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.

TABLE OF CONTENTS

ABOUT THIS MANUAL

This manual should be used as your main reference for 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.

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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).

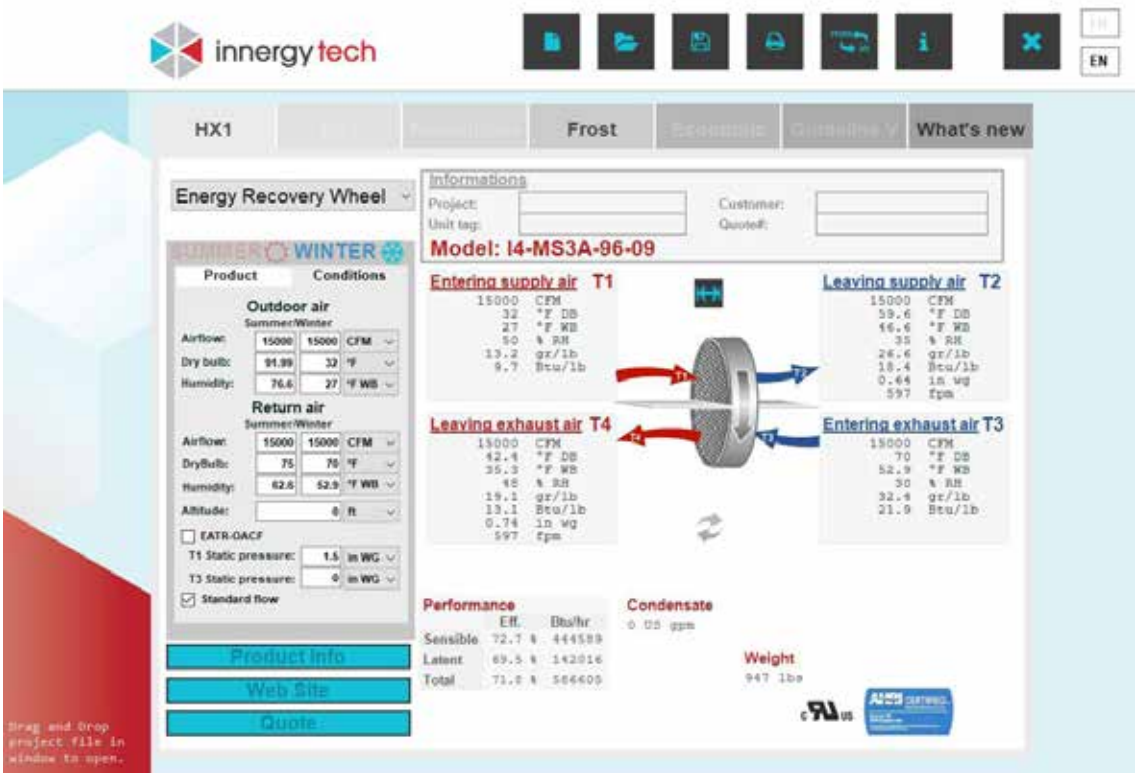


Figure 1.1
Winnergy Pro Selection Software
V3.07, AHRI Certified

THE IMPROVED i4 WHEEL DESIGN

MS3A (ENTHALPY)
Or epoxy coating (sensible)

COMPACT FRAME
Only adds 4" to the diameter dimension

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

Fully installed **TEMPERTURE & ROTATION SENSORS***

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

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

INNOVATIVE DRIVING SYSTEMS
Patented Enclosed Direct Drive or belt driven system

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

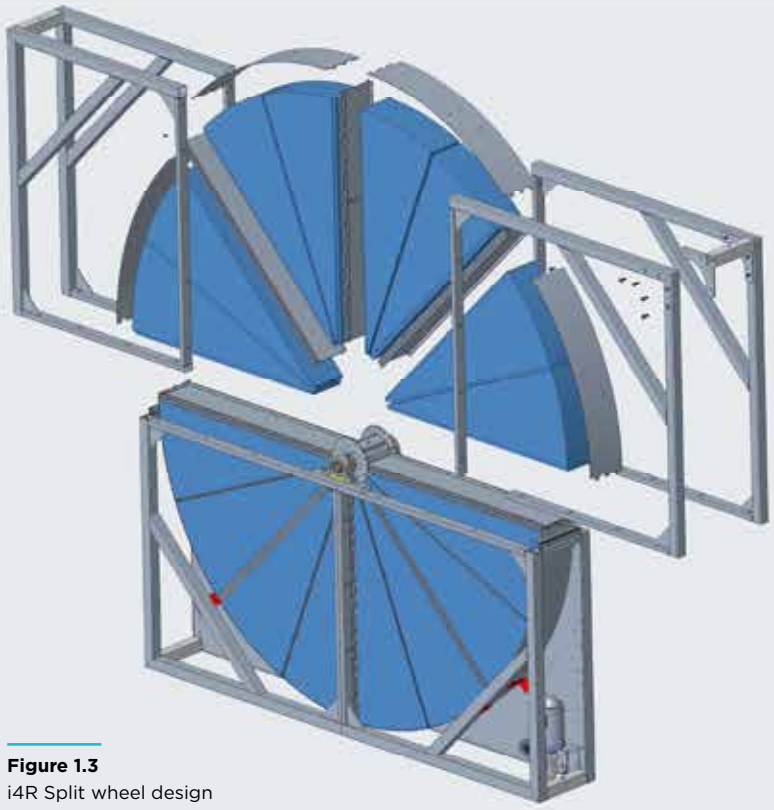


Figure 1.3
i4R Split wheel design

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 132″ 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)
- Aluminum media with MS3A desiccant (Enthalpy) or epoxy coating (Sensible)

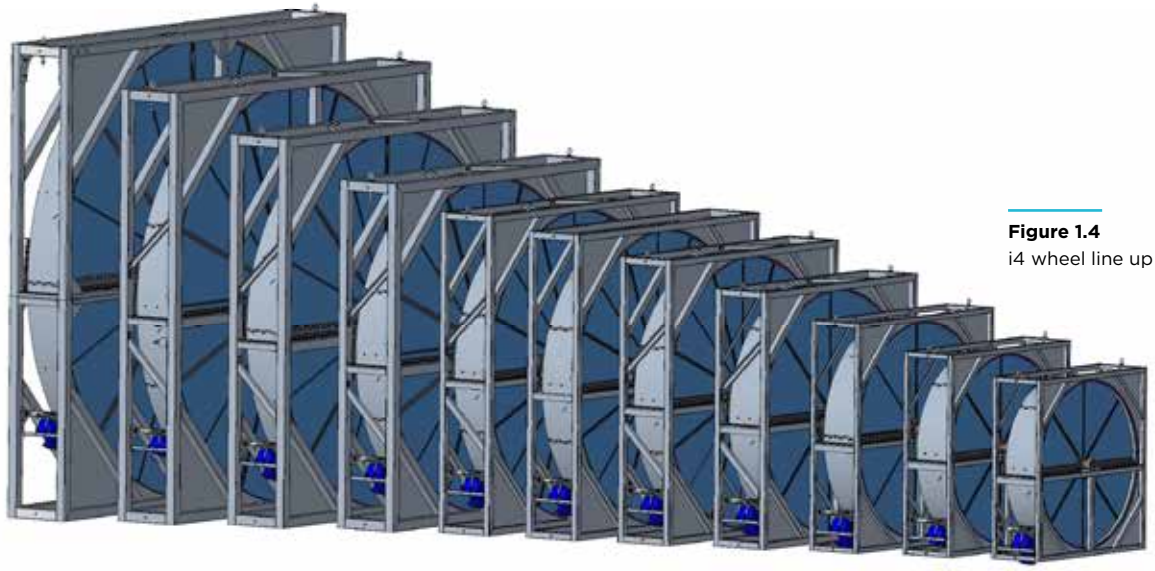


Figure 1.4
i4 wheel line up

Ø132" Ø120" Ø108" Ø96" Ø88" Ø84" Ø78" Ø70" Ø62" Ø54" Ø48"

45000CFM ← → **2000CFM**

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

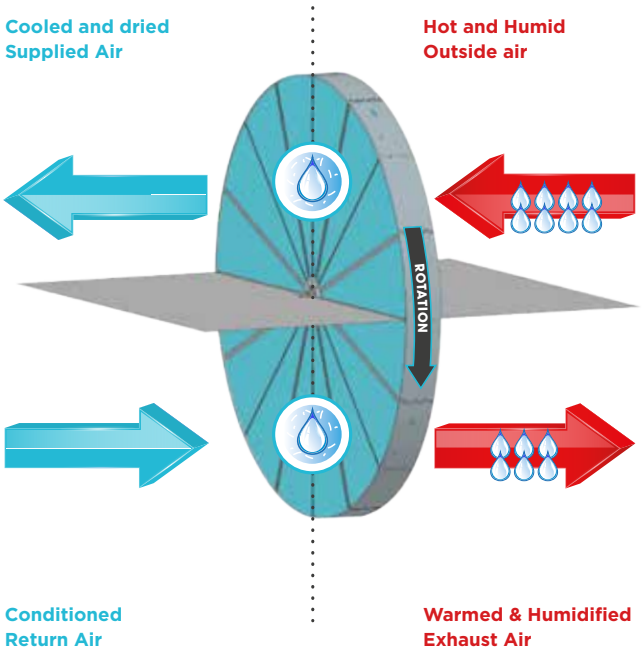


Figure 1.5
Cooling mode (summer)

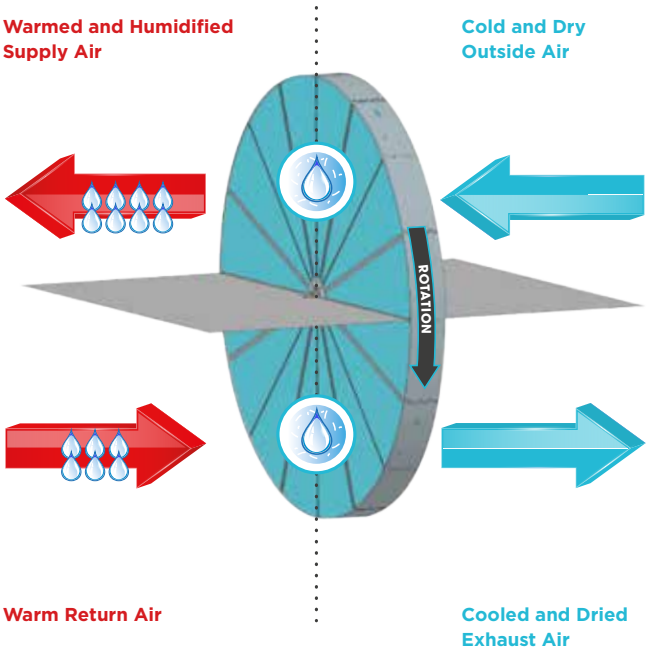


Figure 1.6
Heating mode (winter)

Energy recovery wheels, also known as enthalpy wheels or thermal wheels, are used to condition fresh outside air supplied to the building. The rotor spins between two (2) counterflow[1] airstreams (20 RPM standard) to transfer sensible and latent heat.

In cooling mode (figure 1.5), the wheel will greatly reduce the sensible (heat) and latent (moisture) energies leading to significant cooling and dehumidification cost reductions.

In heating mode (figure 1.6), 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. 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). 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. 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 decreases 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. The aluminum matrix, used by Innergy tech, represents the industry standard for high performance commercial wheels due to its outstanding durability and fire resistance.

i4 CONSTRUCTION/PARTS

2.1 Construction details

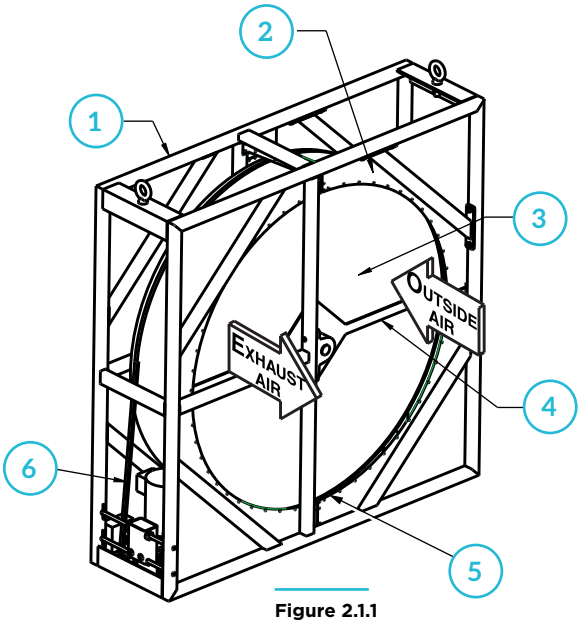


Figure 2.1.1
Outside air side

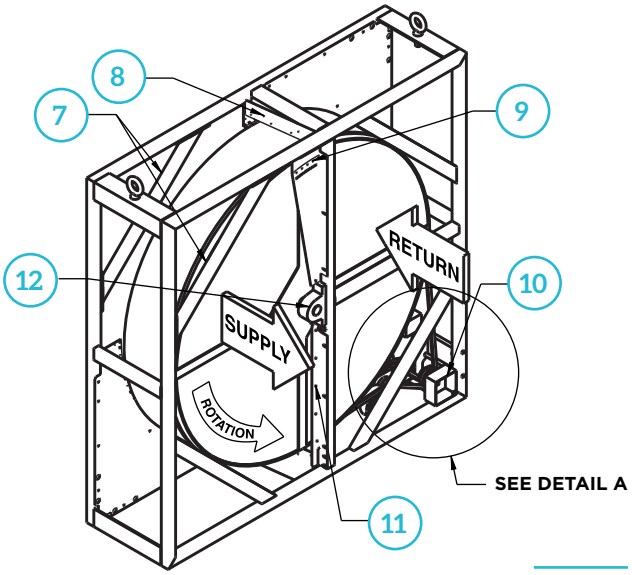
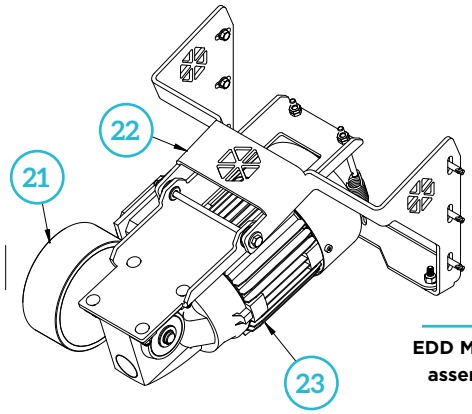


Figure 2.1.2
Return air side

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
10	Electrical Box
11	Airloop™ labyrinth Seal

Enclosed Direct Drive (EDD) Option:



EDD Motor assembly

Belt Driven Option:

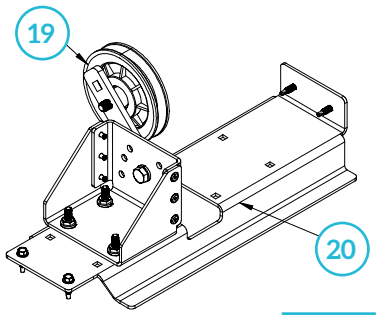


Figure 2.1.3.a
Tensioner assembly (48"-70")

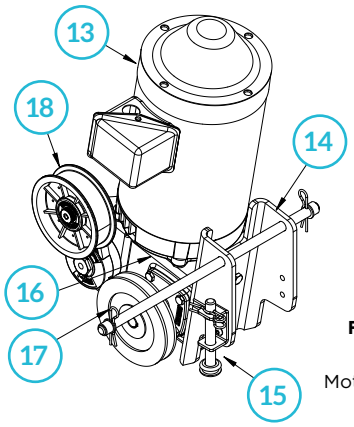


Figure 2.1.3.c
Belt Driven Motor assembly (78"-120")

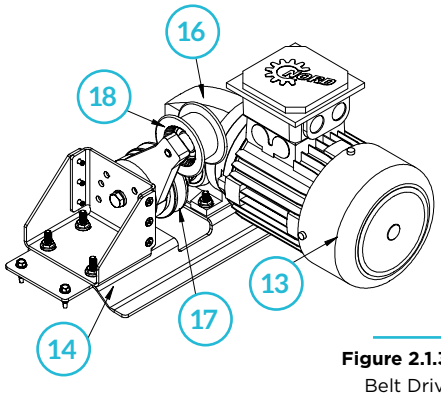


Figure 2.1.3.b
Belt Driven Motor assembly (48"-70")

No.	Description
12	Pillow Block Bearing
13	Motor
14	Motor Base Holder
15	Locking pin
16	Gear Box
17	Idler Sheave
18	Variable tensioner
19	Constant tensioner
20	Tensioner Base Holder
21	Drive wheel
22	Enclose Direct Drive (EDD) Complete assembly
23	Motor and gear reducer assembly

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.

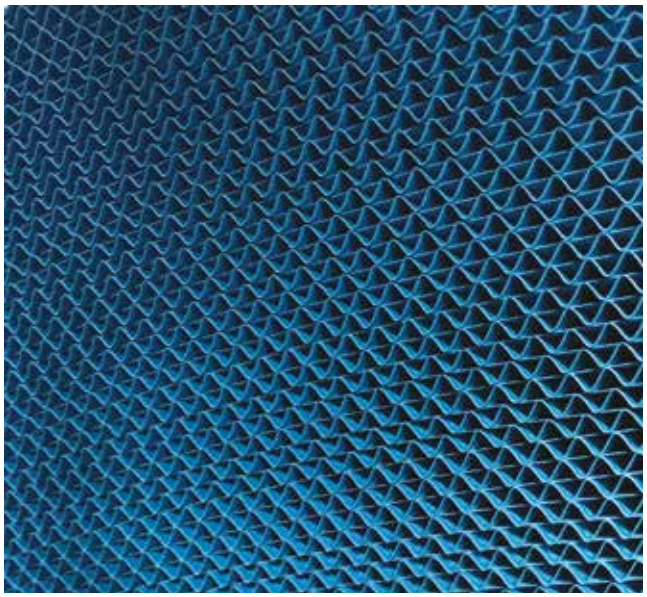
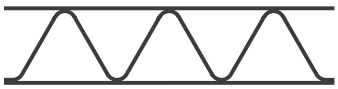


Figure 2.2
Wheel Matrix



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 the wheel media. 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 2.3
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 2.4
Wheel media cleaning – Flat Nozzle blowgun

Figure 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, 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.

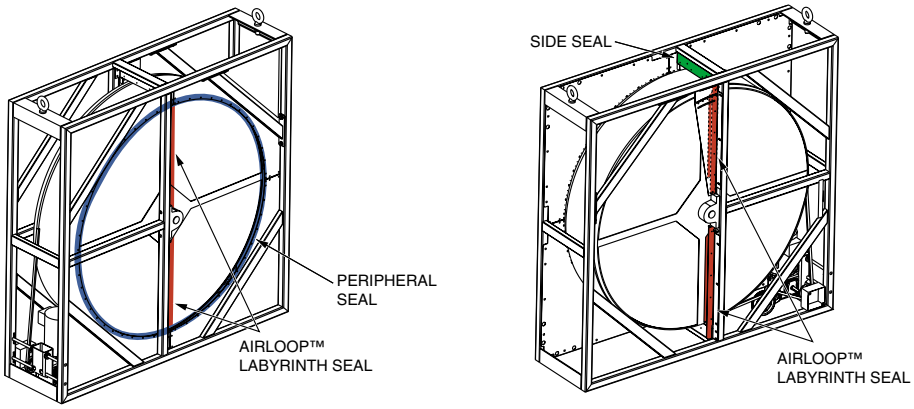


Figure 2.6
i4 seal locations

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.

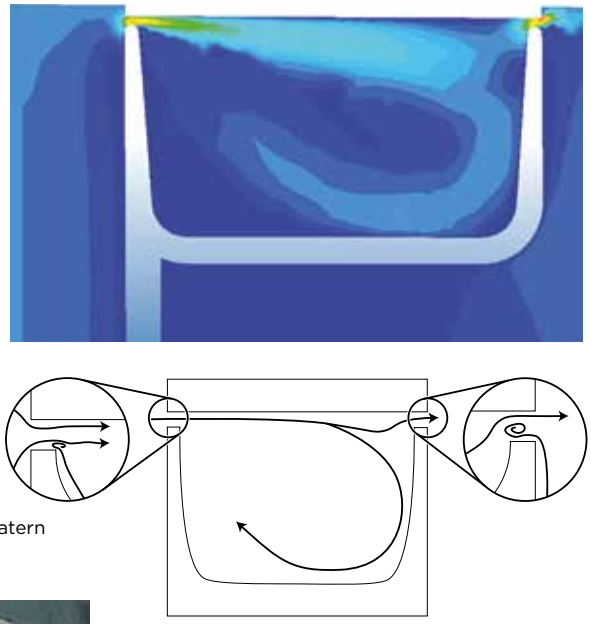


Figure 2.7
Airloop™ flow patern

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.

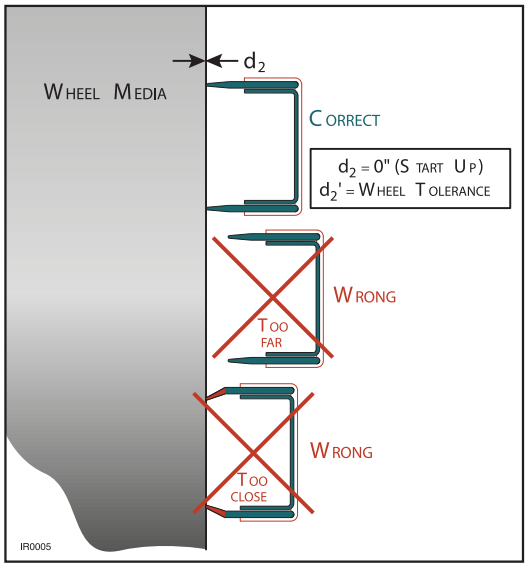


Figure 2.9
Airloop™ seal adjustement

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 2.11
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

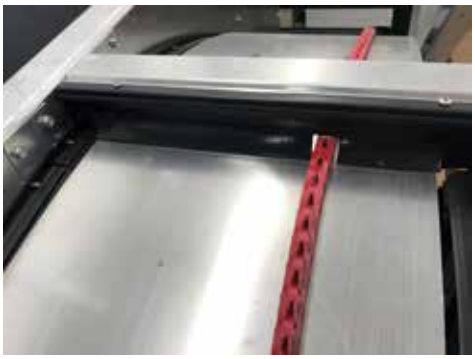


Figure 2.13
Side seal typical installation

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).

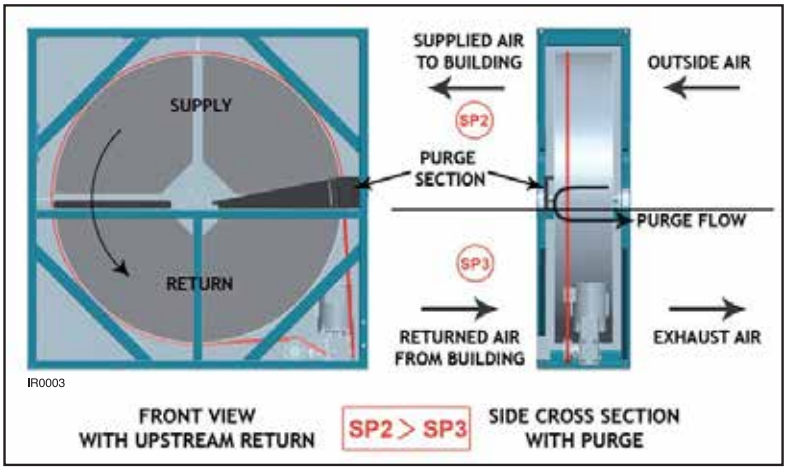


Figure 2.14
Purge section

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. On more demanding projects, 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).

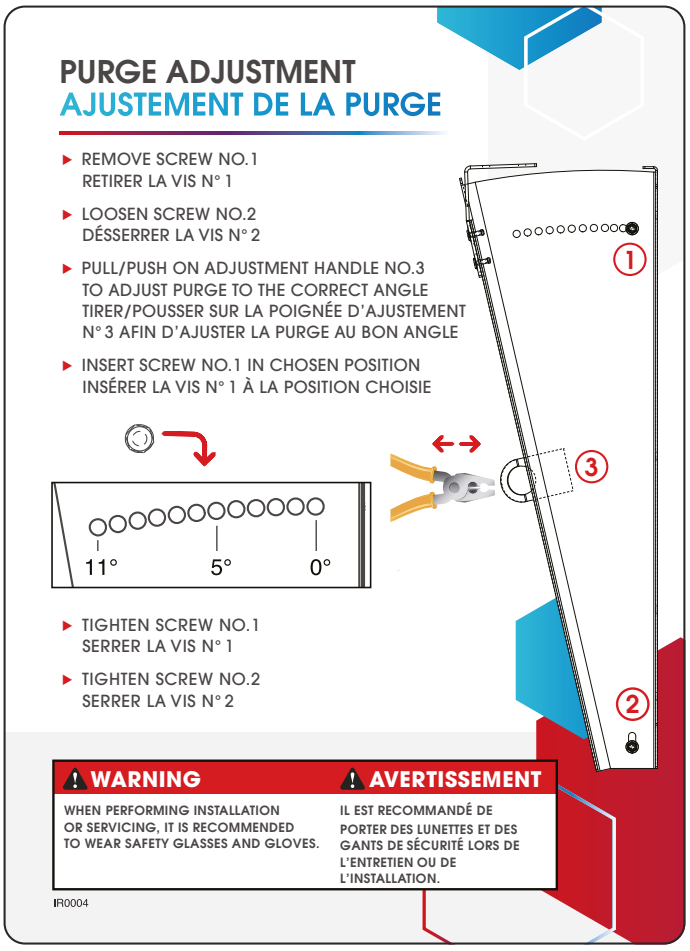


Figure 2.15
Purge adjustment

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 575 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	MTR VOLT	HERTZ	Full Load Amps (FLA)	POWER FACTOR	INS CLASS	DRIVE SYSTEM	48	54	62	70	78	84	88	96	108	120	132
0,5	208-230-460	60	2.06 (208 volts) 1.90 (230 volts) 0.95 (460 volts)	0,69	F	Belt Driven & Enclosed Direct Drive	▪	▪	▪	▪							
0,5	575	60	0.80 (575 volts)	0,69	F	Belt Driven & Enclosed Direct Drive	▪	▪	▪	▪							
0,5	208-230-460	60	1.7 (208 volts) 1.5 (230 volts) 0.8 (460 volts)	0,74	F	Belt Driven					▪	▪	▪				
0,5	575	60	0.6 (575 volts)	0,74	F	Belt Driven					▪	▪	▪				
0,5	208-230-460	60	2.06 (208 volts) 1.90 (230 volts) 0.85 (460 volts)	0,69	F	Enclosed Direct Drive					▪	▪	▪				
0,5	575	60	0.8 (575 volts)	0,69	F	Enclosed Direct Drive					▪	▪	▪				
1	208-230-460	60	3.4 (208 volts) 3.2 (230 volts) 1.6 (460 volts)	0,693	F	Belt Driven								▪	▪	▪	▪
1	575	60	1.3 (575 volts)	0,698	F	Belt Driven								▪	▪	▪	▪
0,5	208-230-460	60	2.06 (208 volts) 1.90 (230 volts) 0.95 (460 volts)3	0,69	F	Enclosed Direct Drive								▪	▪	▪	▪
0,5	575	60	0.8 (575 volts)	0,69	F	Enclosed Direct Drive								▪	▪	▪	▪

For 1 phase motor applications, 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

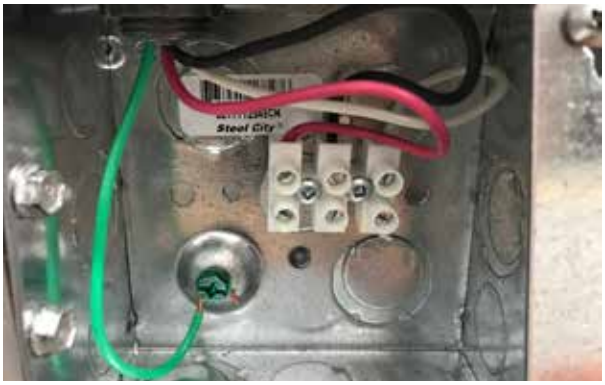


Figure 2.17
Motor wiring

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

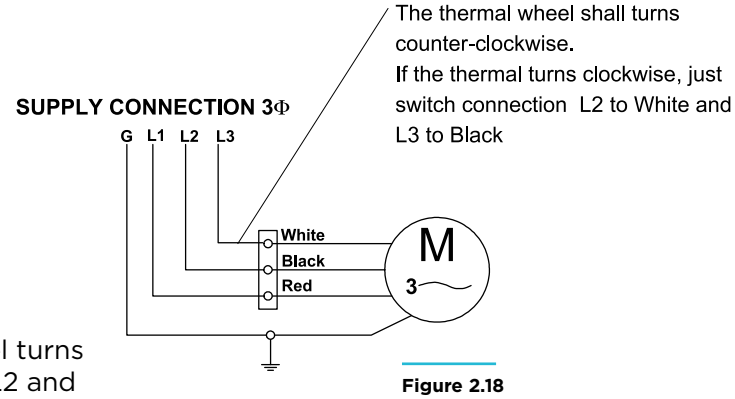
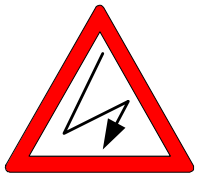


Figure 2.18
Wiring diagram thermal wheel

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).

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.

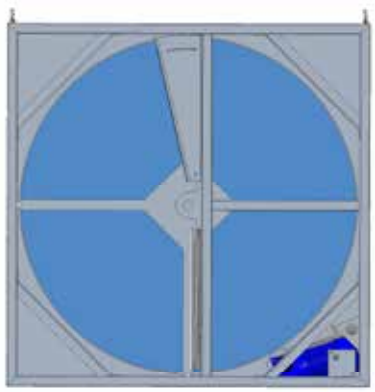
Please contact Innergy tech service team if you have any questions or concerns (1-800-203-9015 or service@innergytech.com).

Figure 2.21
Gear reducer

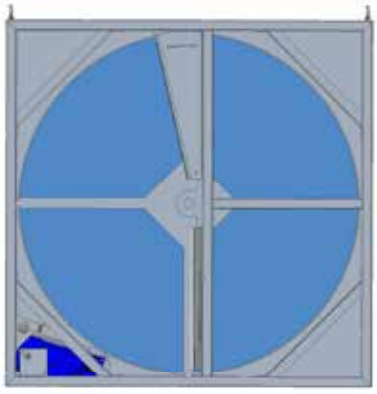
2.5.5 ENCLOSED DIRECT DRIVE (EDD)

All i4 wheels now comes standard with our patented Enclosed Direct Drive(EDD) assembly. This innovative technology eliminates the need of a driving belt entirely, improves reliability and reduces noise, potential leakage and the power draw of the motor.

The EDD Technology is very compact and will fit entirely within the i4 frames. Its location depends on the configuration selected:

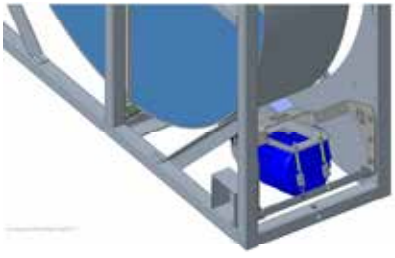


EDD Motor location
for configuration 1 to 4

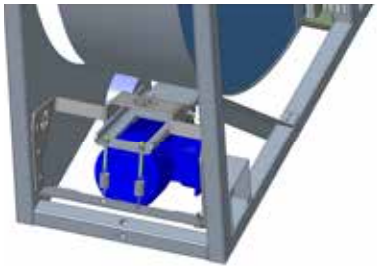


EDD Motor location
for configuration 5 to 8

Initial tension of the EDD is made possible by its dual rear springs. A special, wear resistant material is used at its contact wheel and ensures an excellent grip. In fact, the grip is so good that we recommend acceleration/deceleration times of at least 30 seconds to eliminates any possible ‘’jumps’’ of the driving mechanism at start up.



EDD Motor assembly details
configuration 1 to 4



EDD Motor assembly details
configuration 5 to 8

2.5.6 BELT TENSIONER (BELT DRIVEN WHEELS ONLY)

A belt tensioner is factory installed on the wheel casing to ensure proper tension of the driving belt. No adjustment is required on the tensioner after shipping. Below images indicate the location of the tensioners and motor assembly for wheel sizes 48″ to 70″ diameter.

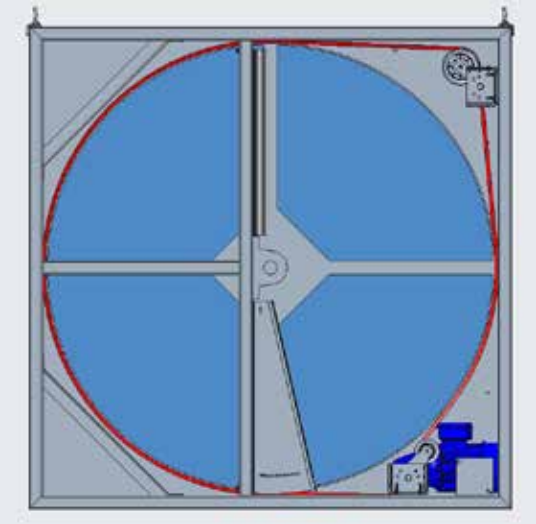


Figure 2.22.a
Size 48” to 70” diameter, configuration 1 & 2*

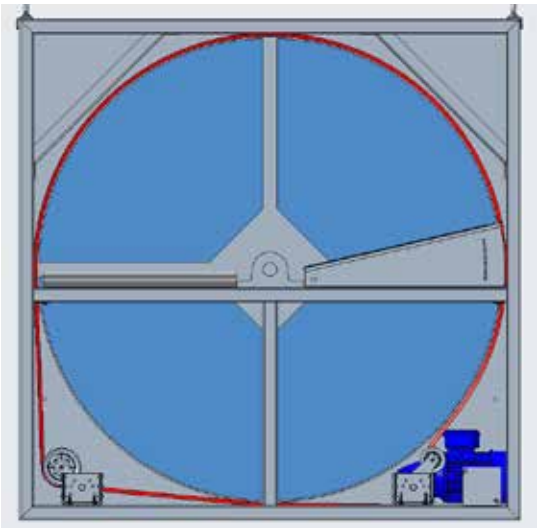


Figure 2.22.b
Size 48” to 70” diameter, configuration 3* & 4

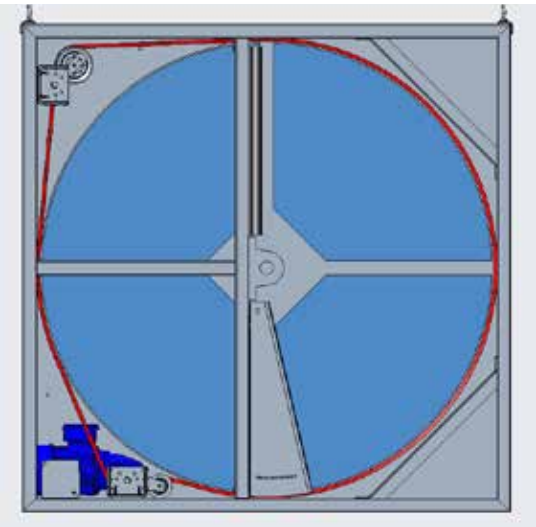


Figure 2.22.c
Size 48” to 70” diameter, configuration 5 & 6*

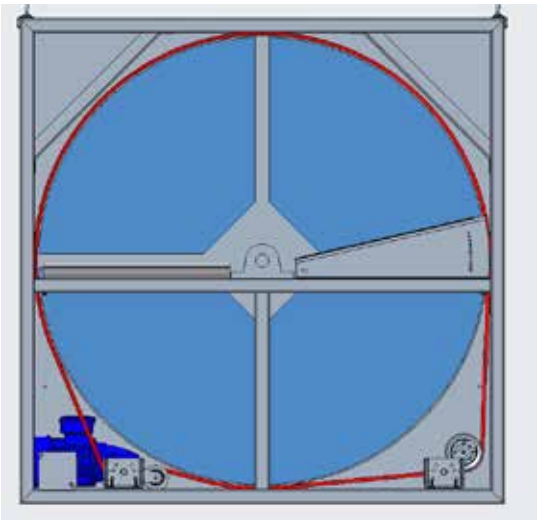


Figure 2.22.d
Size 48” to 70” diameter, configuration 7* & 8

*Configuration shown as example

The variable tensioner is located on the motor base holder and the fixed tensioner is located on the tensioner holder in the opposite corner of the wheel frame. Both motor and belt tensioners are always situated in the same airflow duct (supply or exhaust) for easier maintenance.

On the larger wheel sizes (78”-132”), the variable belt tensioner is also located on the motor base holder. However, the fixed tensioner is not required for these wheel sizes because the motor base holder pivots to add the final tension on the driving belt (see section 2.5.7 for details).

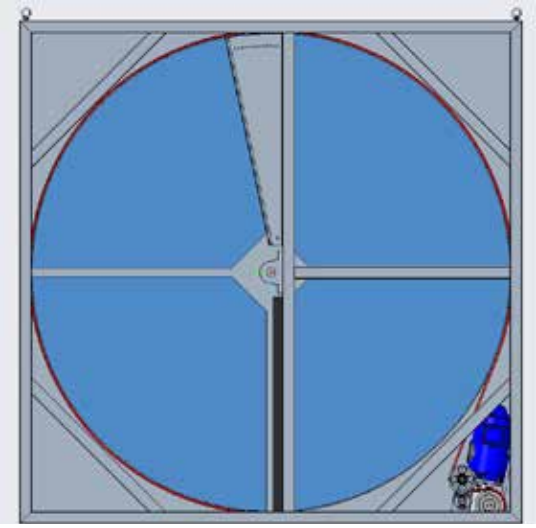


Figure 2.22.e
Size 78” to 132” diameter, configuration 1* to 4

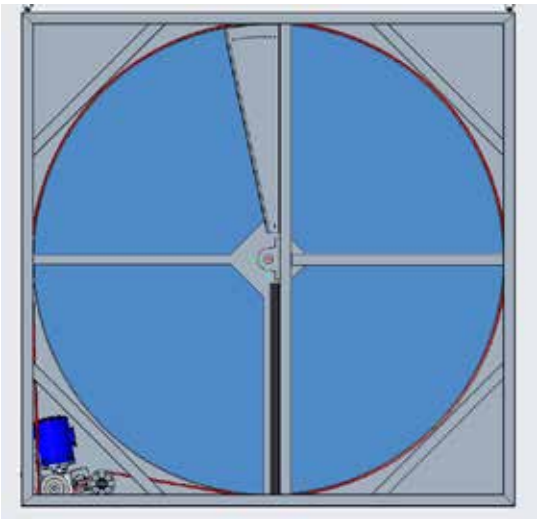


Figure 2.22.f
Size 78” to 132” diameter, configuration 5* to 8

*Configuration shown as example

On all wheel sizes and configuration, the diving belt first passes around the idler sheave of the motor gear box and then against the variable tensioner pulley for the pre-tension of the belt. The final belt tension is added with either the constant tensioner (size 48”-70”) or with the pivoting motor base holder (size 78”-132”).

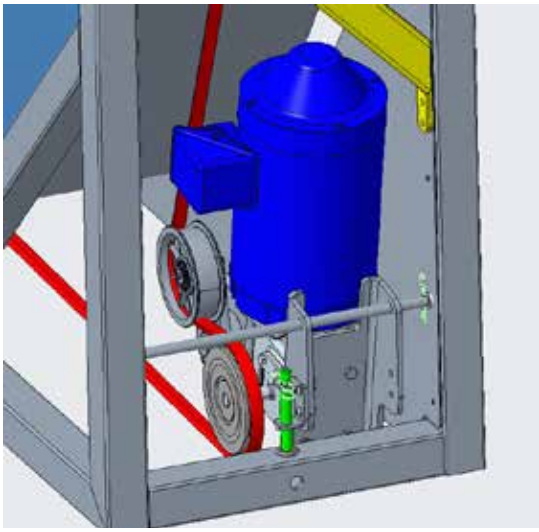


Figure 2.23.a
Motor base holder details*, configuration 1 to 4

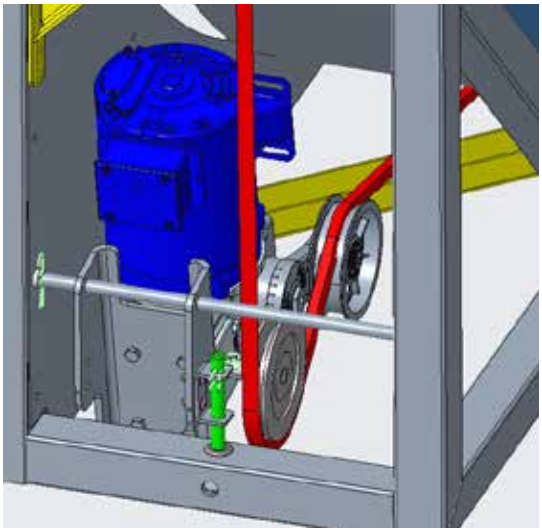


Figure 2.23.b
Motor base holder details*, configuration 5 to 8

Note: Wheel size 78” diameter shown as example.

2.5.7 MULTI-LINK BELT (BELT DRIVEN WHEELS ONLY)

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.

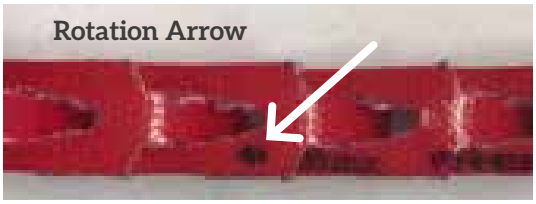


Figure 2.24
Innergy tech multi-link belt

Belt installation
To install a spare belt or modify the length of the current belt, follow the steps below:

1. Release the tension in the belt: size 48” to 70”

   a. While holding the constant tensioner with a 3/8” ratchet, unscrew and loosen the tensioner from its base holder (socket size 9/16”).

   b. If required, loosen the variable tensioner at the motor base holder to further release the tension in the driving belt (socket size 9/16”).

   c. Release the belt around the tensioners and motor idler sheave.

   With the tension in the belt released, both tensioner should point approximately towards the middle of the rotor.

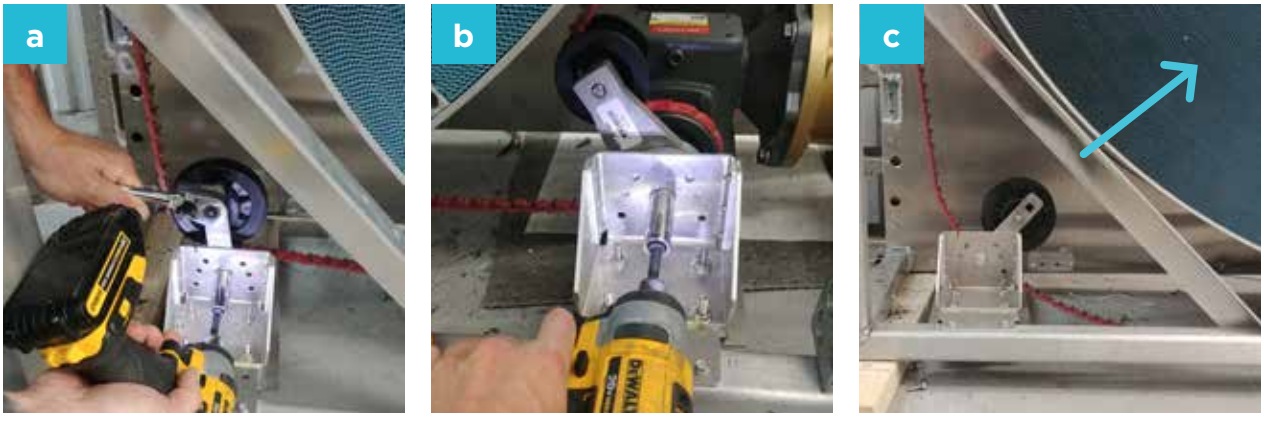


Figure 2.25
Steps to release the belt tension for wheel sizes 48” to 70” diameter

2. Release the tension in the belt: size 78” to 132”

   a. While pressing down on the motor, lift the locking pin of the motor base.

   b. Rotate the motor base to release the tension in the driving belt.

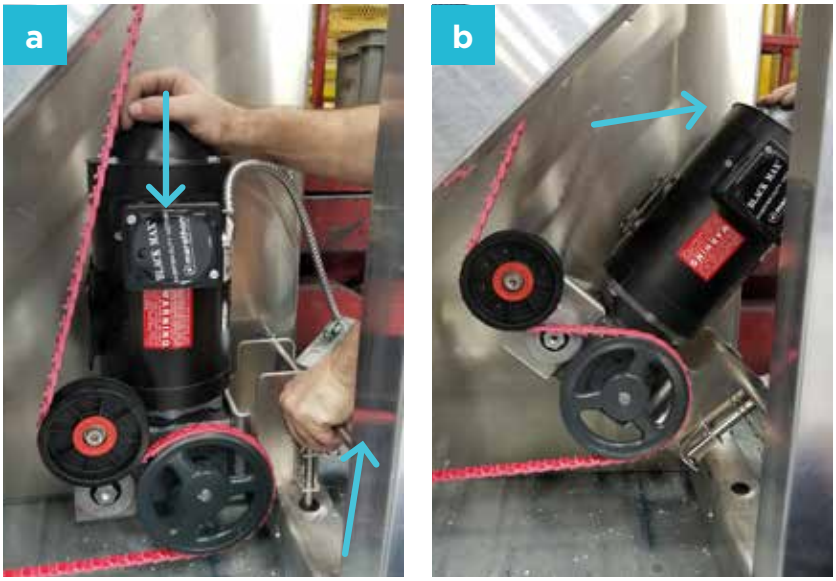


Figure 2.26
Steps to release the belt tension for wheel sizes 78” to 120” diameter

3. Adjust the belt:
   Open/separate the belt by twisting the link tabs sideways and pulling the surplus out of the belt (see figure 2.27).

   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 2.27
Mutli-link belt adjustment instructions

4. Install the belt around the wheel:

   a. Tape one end of the belt on the perimeter of the wheel (Figure 2.28).

   b. Turn the wheel by hand for one complete revolution.

   c. Ensure that the belt tabs are against the perimeter of the wheel and that the belt passes through the side seal opening (see side seals on figure 2.13, section 2.3.3)

Figure 2.28
Belt installation

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.

5. Closing the driving belt:

   a. Remove the tape and pull the belt tightly around the wheel, the tensioner(s) and the motor idler sheave.

   b. Connect both ends of the belt as shown in step 3.
   See section 2.5.6 for the belt position with tensioner(s).

6. Add final tension to the driving belt: See step 1 or 2.

Visually inspect that the belt is not twisted around the rotors and is properly located through the side seals. Note, the belt tabs should me against the perimeter of the wheel for optimal grip.

2.6 Pillow block bearing

2.6.1 STANDARD BEARING

Wheel bearings are greased before shipping. Additional grease is not required 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 4 to 10 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)**. Grease quantities added should not exceed 0.09oz for rotor sizes 48''-88'' and 0.35oz for sizes 96''-132'' during maintenance check-up.

The pillow block bolts should be inspected where a special seal lacquer has been factory applied **(2)** to ensure proper bolt torque. 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 a visual indicator that the bolts and screws have not loosen. An inspection is required at the unit start-up and every 6 months.

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

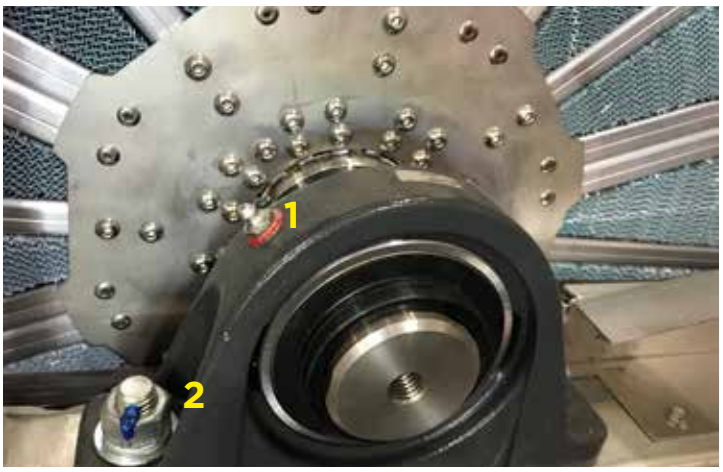


Figure 2.29.a
i4 wheel Pillow block

Figure 2.29.b
Damaged seal bearing (over greased)

CAUTION: No grease should be added to the wheel bearings at the product start-up. Over greasing the bearing can damage the seals and reduce its lifetime expectancy.

CAUTION: Maximum torque on bearing bolts is 60 lbf-ft on 48''-88'' diameter wheels and 70 lbf-ft on 96''-132'' diameter wheels. IMPORTANT: Do not overtighten the bolts.

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.

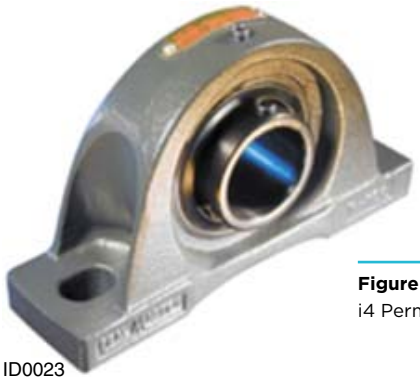


Figure 2.30
i4 Permanently seal bearing

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 reduce 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%.

2.7.2 SIDE PLATES

As an option, top, bottom and side aluminum plates can be added around the wheel frame. The side plates are required if the blank off is located on the back of the wheel frame in the HVAC unit. In that case, the side plates enclose the frame along its depth which prevents air from passing around the wheel rotor.

If the blankoff is located at the front of the frame (around the face plate), the side plates are not required.

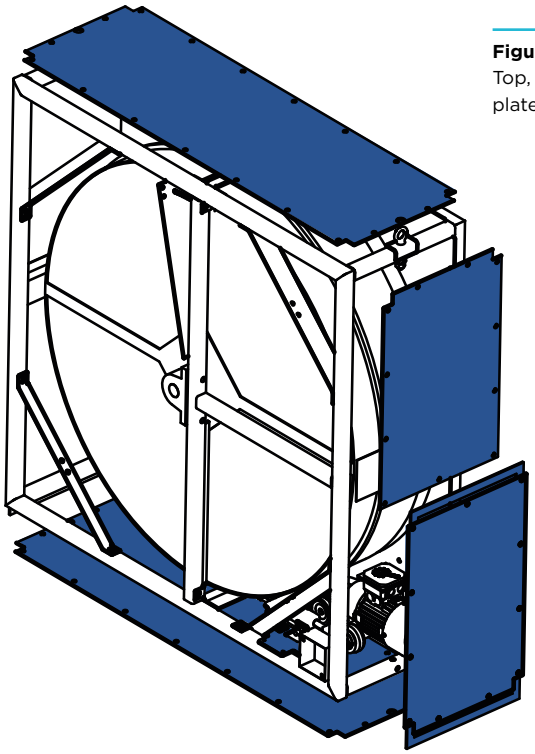


Figure 2.31
Top, bottom and side aluminum plate option

2.8 Wheel Dimensions

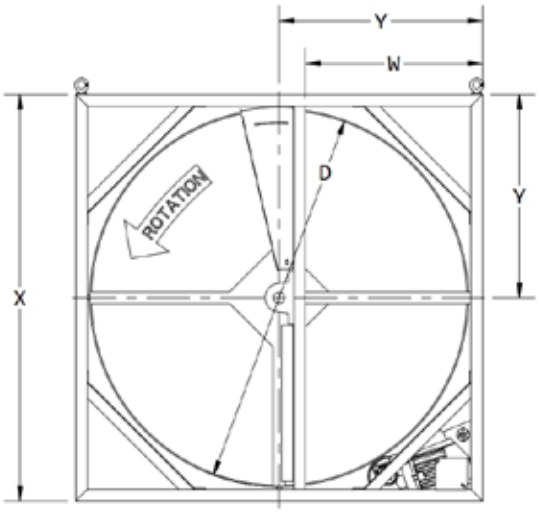


Figure 2.32.a
i4 dimensions, front vue

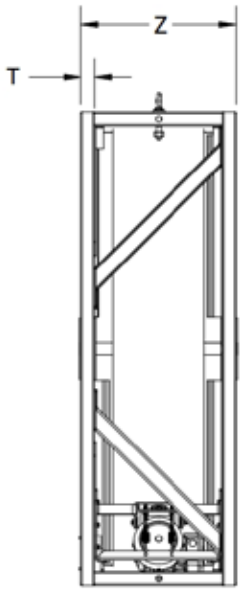


Figure 2.32.b
i4 dimensions, side vue

	OVERALL DIMENSIONS OF ENERGY RECOVERY WHEEL							
	Dimensions in INCHES (MM)						LB (KG)	CFM*
Model	D	W	X	Y	Z	T	AV. Weight	
i4-XX-48-13	48 (1219)	22-5/8 (575)	52 (1321)	26 (661)	17 (432)	1-1/2 (38.1)	250 (114)	-
i4-XX-48-09							300 (136)	4850
i4-XX-48-07							350 (159)	-
i4-XX-54-13	54 (1372)	25-5/8 (651)	58 (1473)	29 (737)	17 (432)	1-1/2 (38.1)	300 (136)	-
i4-XX-54-09							350 (159)	6200
i4-XX-54-07							400 (181)	-
i4-XX-62-13	62 (1575)	29-5/8 (752)	66 (1676)	33 (838)	17 (432)	1-1/2 (38.1)	350 (159)	-
i4-XX-62-09							400 (181)	8300
i4-XX-62-07							450 (204)	-
i4-XX-70-13	70 (1778)	33-1/8 (841)	74 (1880)	37 (940)	18 (457)	2 (51)	450 (204)	-
i4-XX-70-09							500 (227)	10600
i4-XX-70-07							575 (261)	-
i4-XX-78-13	78 (1981)	37-1/8 (943)	82 (2083)	41 (1041)	18 (457)	2 (51)	550 (250)	-
i4-XX-78-09							650 (295)	12500
i4-XX-78-07							750 (340)	-
i4-XX-84-13	84 (2134)	40-1/8 (1019)	88 (2235)	44 (1118)	18 (457)	2 (51)	575 (262)	-
i4-XX-84-09							685 (312)	14750
i4-XX-84-07							775 (353)	-
i4-XX-88-13	88 (2235)	42-1/8 (1070)	92 (2337)	46 (1168)	18 (457)	2 (51)	650 (295)	-
i4-XX-88-09							750 (340)	16500
i4-XX-88-07							850 (386)	-
i4-XX-96-13	96 (2438)	44-1/16 (1119)	100 (2540)	50 (1270)	20 (508)	3 (76.2)	850 (386)	-
i4-XX-96-09							1050 (454)	19300
i4-XX-96-07							1150 (522)	-
i4-XX-108-13	108 (2743)	50-1/16 (1272)	112 (2845)	56 (1423)	20 (508)	3 (76.2)	1050 (476)	-
i4-XX-108-09							1200 (544)	25000
i4-XX-108-07							1350 (612)	-
i4-XX-120-13	120 (3048)	56-1/16 (1424)	124 (3150)	62 (1575)	20 (508)	3 (76.2)	1200 (544)	-
i4-XX-120-09							1400 (635)	30500
i4-XX-120-07							1600 (726)	-
I4-XX-132-13	132 (3353)	62-1/16 (1576)	136 (3454)	68 (1727)	20 (508)	3 (76.2)	1050 (680)	-
I4-XX-132-09							1750 (794)	36750
I4-XX-132-07							2000 (907)	-

*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.

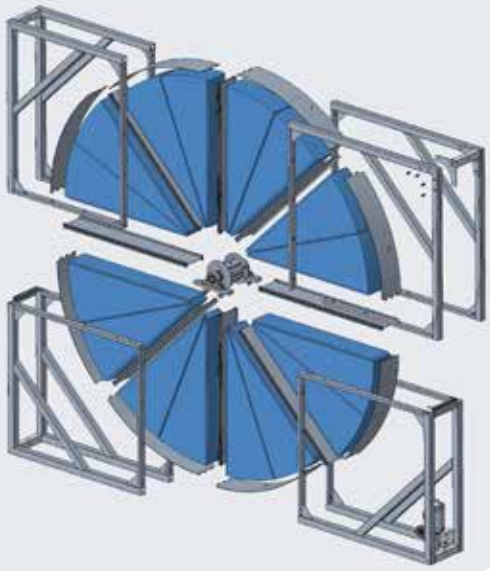


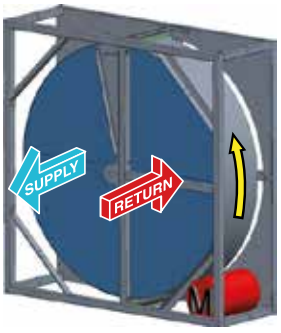
Figure 2.33
i4R wheel

2.10 i4 Wheel Terminology

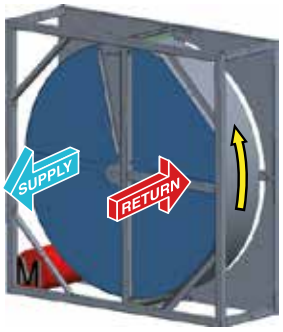
		I4	-	MS3A	-	48	-	07	-	P1	-	C1	-	460	-	OPTIONS
Wheel type																
Factory assembled	I4															
Field installed (frame in 4 sections)	I4R															
Desiccant type																
Molecular Sieve 3A (Enthalpy wheel)	MS3A															
Epoxy coated Aluminum (Sensible wheel)	S															
Wheel Diameter (inches)																
	48															
	54															
	62															
	70															
	78															
	84															
	88															
	96															
	108															
	120															
Matrix type																
High Performance Matrix	07															
Optimized Standard Matrix	09															
Low Pressure Matrix	13															
Purge Setup																
With purge plate *(Digit represents the angle from 0° to 1*	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)																
Aluminum sheet metal top, bottom and sides plates	SM															
Epoxy coating on Media	EM															
Permanently Sealed Bearings	PB															
Parallel Airflow arrangement	PF															

Figure 2.34
i4 Wheel configurations

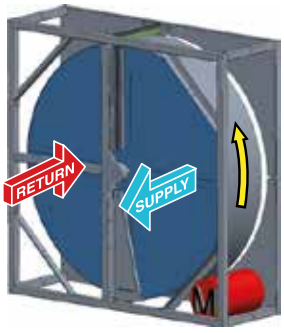
SIDE - BY - SIDE AIRFLOWS



NO. 1



NO. 5



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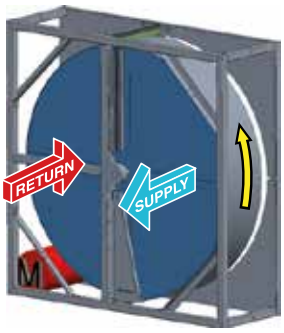
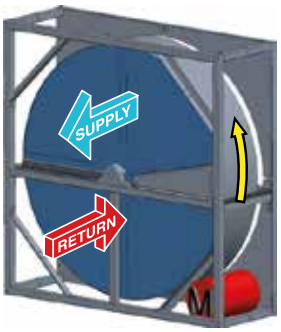
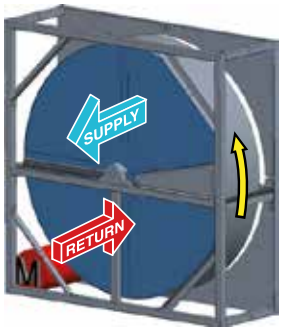


NO. 6

TOP AND BOTTOM AIRFLOWS



NO. 3



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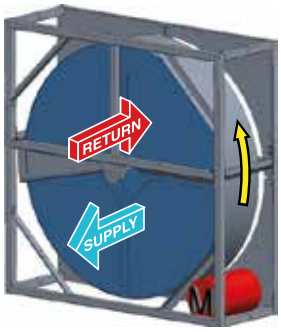

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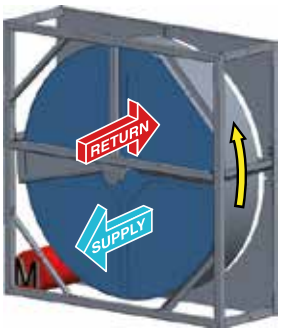

NO. 8

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 (parallel flow).

Top and bottom or side by side airflow configuration are both acceptable designs. 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 is 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 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 THROUGH (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).

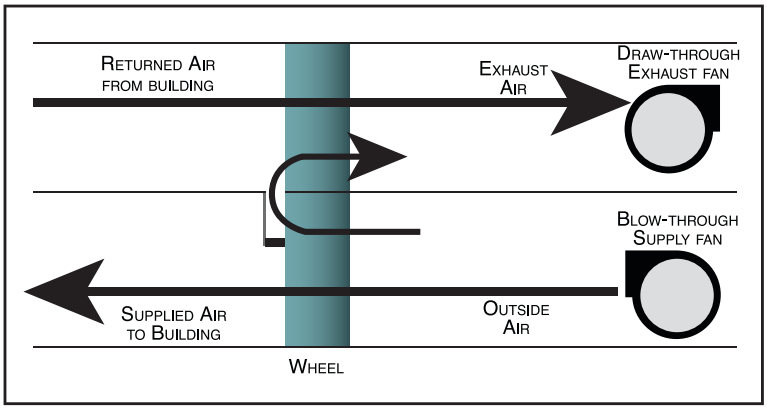

Figure 3.1.1
Fan configurations

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 throughout the AHU, no cross leakage (EATR = 0) as well as low fan operating costs (OACF).

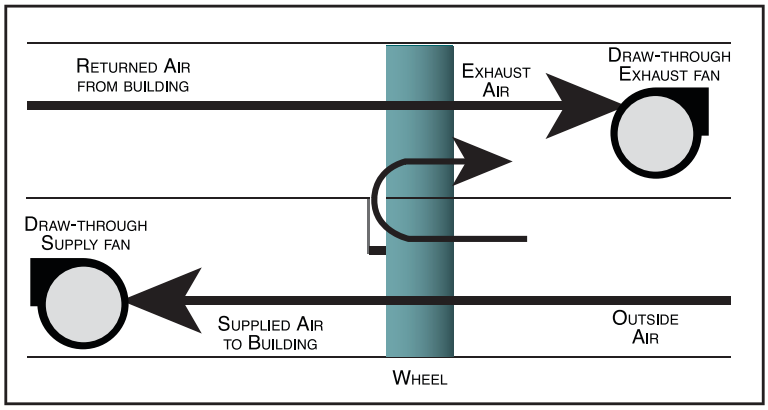

Figure 3.1.2
Fan configurations

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).

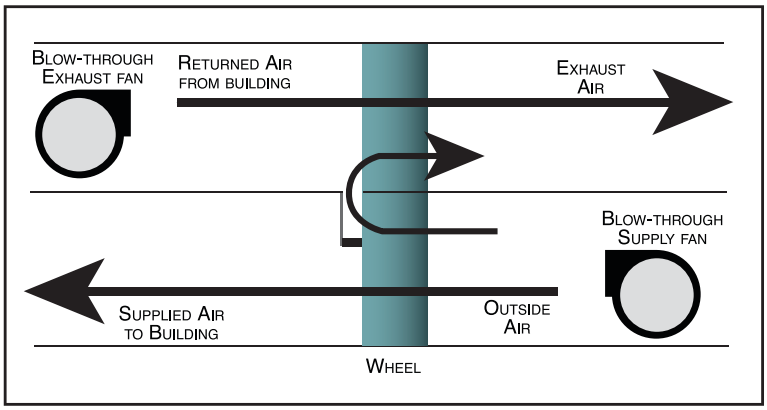

Figure 3.1.3
Fan configurations

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.

Note, if the HVAC unit is designed to allow air recirculation, this fan configuration may be acceptable.

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

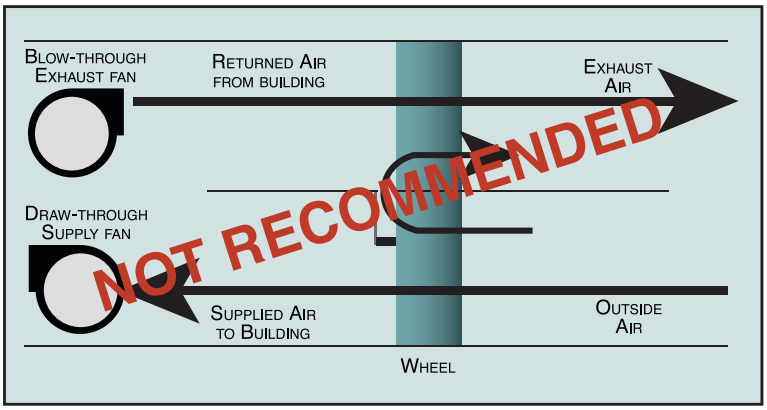

Figure 3.1.4
Fan configurations

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.

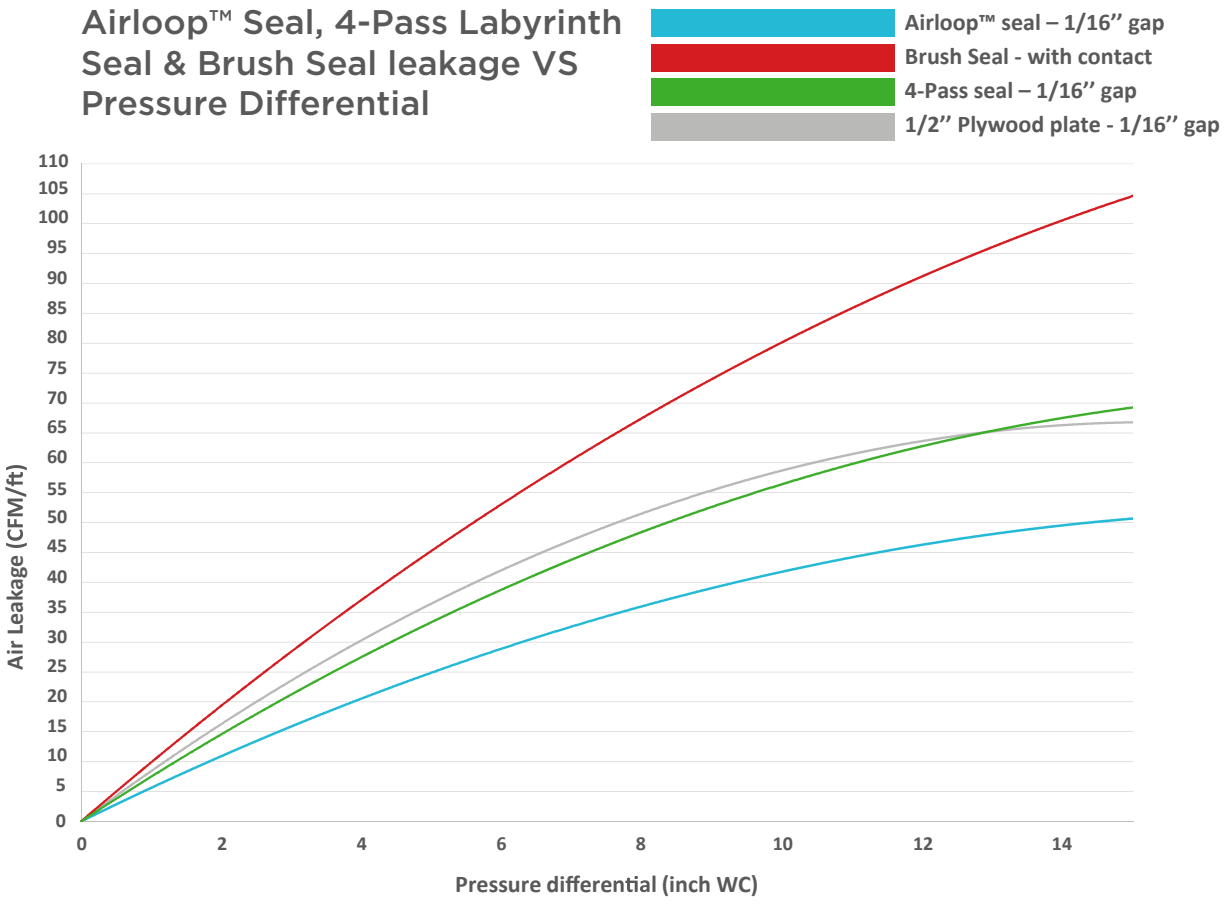

Figure 3.2
Airloop™ Seal, 4-Pass Labyrinth Seal & Brush Seal leakage chart

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).

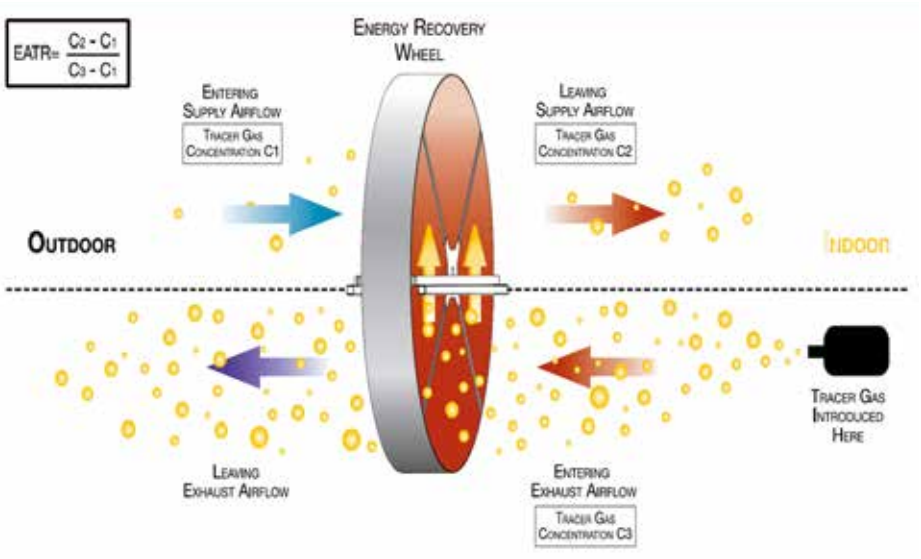

Figure 3.3
EATR measuring test

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 indicator. 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.

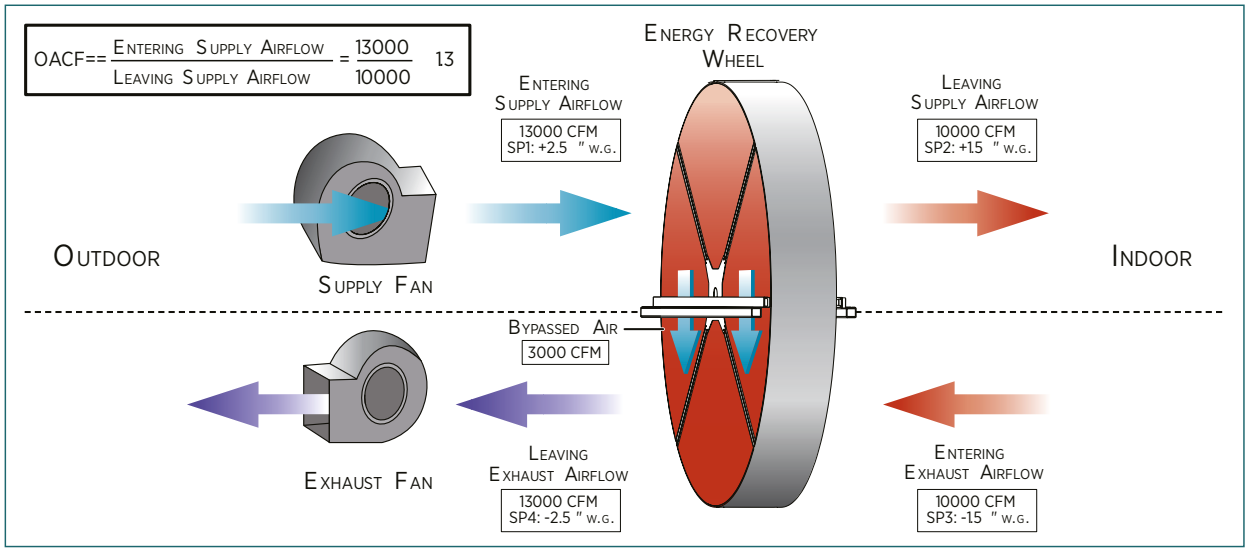

Figure 3.4
OACF created by seal leaks or wheel purge

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 increased. Finally, the work resulting from the wheels synergy can represent an increase of up to 70% compared to a single wheel system.

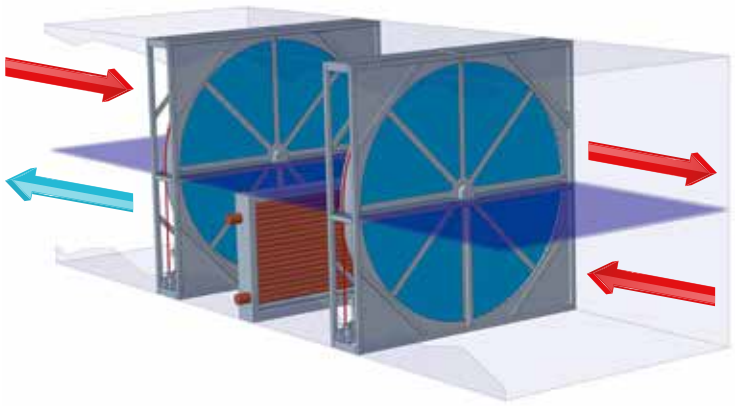

Figure 3.5
Dual wheel configuration

3.8.1 FEATURES AND BENEFITS

- 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.

3.8.2 OPTIMIZED DESIGN WITH ACTIVE MATRIX TECHNOLOGY

While it's a fact that dual wheel configurations lead to 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.

3.8.3 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).

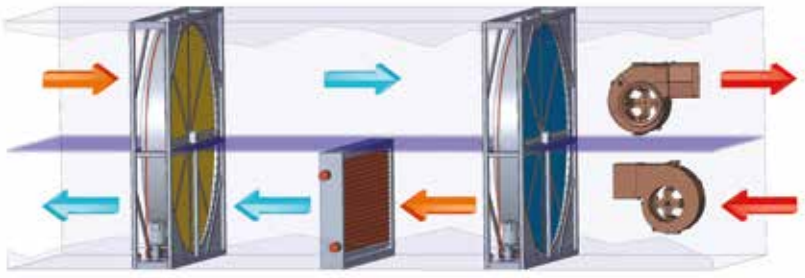

Figure 3.6.1
Fan configurations

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).

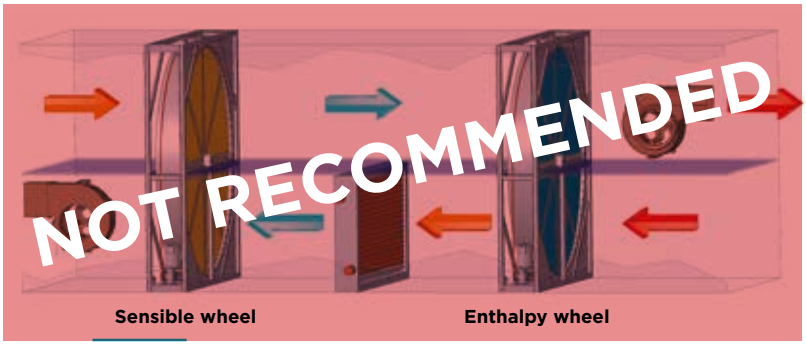

Figure 3.6.2
Fan configurations

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.

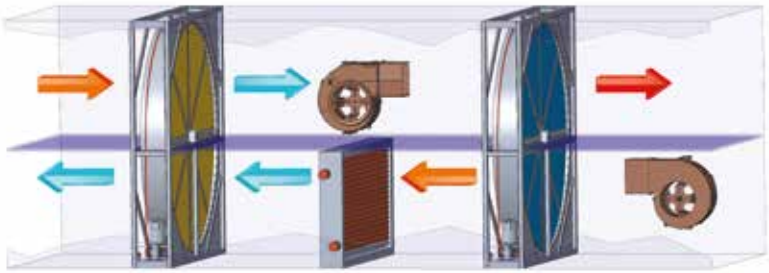

Figure 3.6.3
Fan configurations

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.

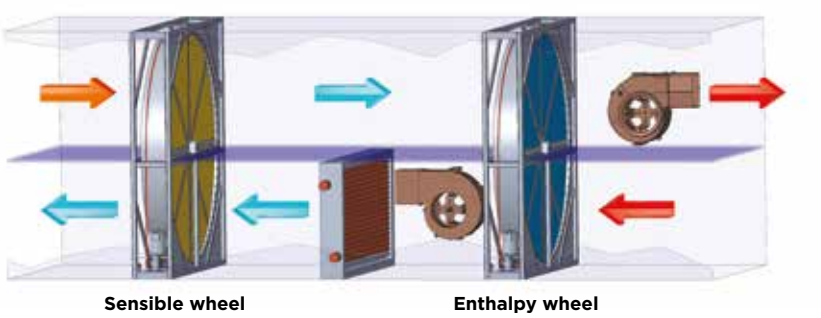

Figure 3.6.4
Fan configurations

3.9 Energy recovery wheel control strategies

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.

3.9.1 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 in colder climates.

3.9.2 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).

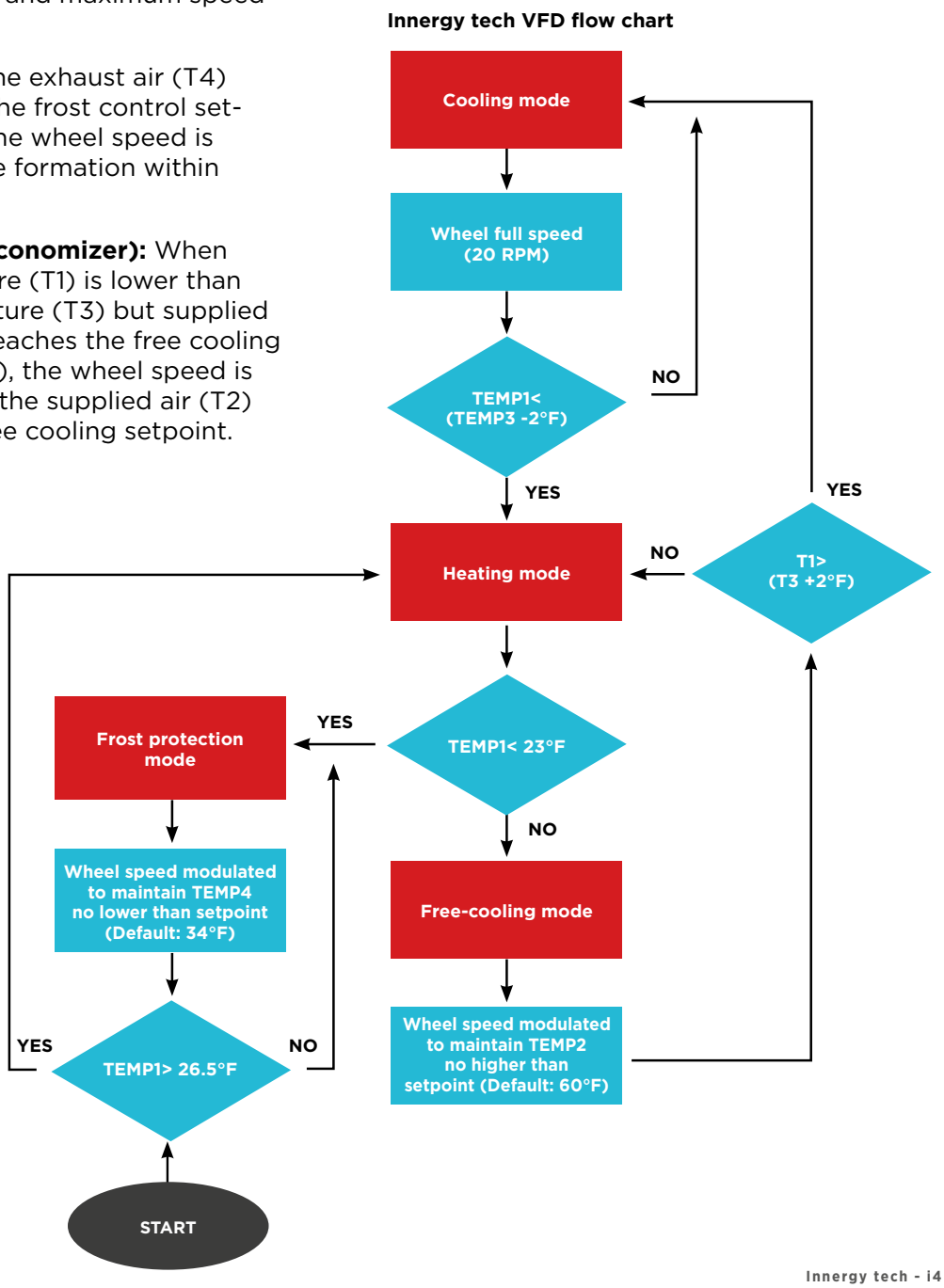

Figure 3.7
Innergy tech VFD Flow Chart

3.9.3 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.

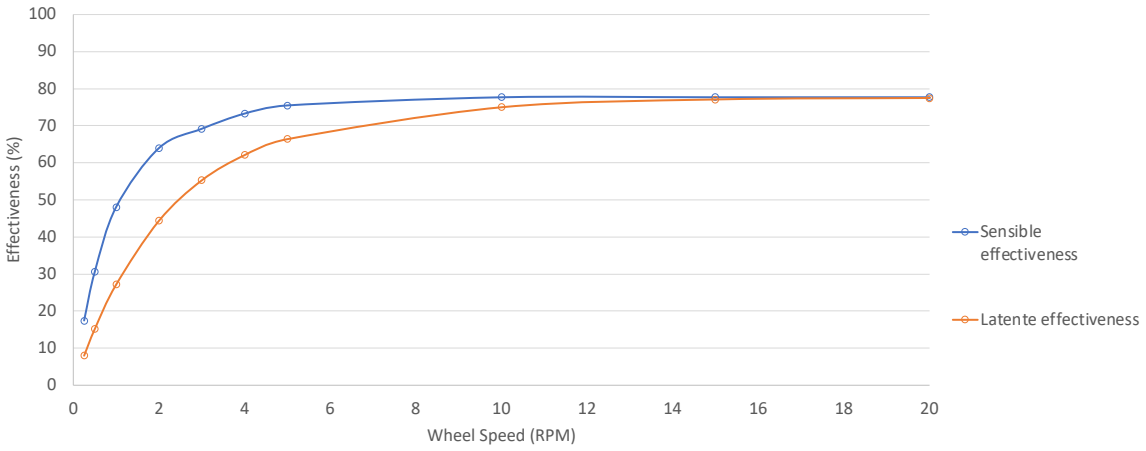

Figure 3.8
Effectiveness VS Wheel speed

3.9.4 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.

3.9.5 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.

3.9.6 INNERGY TECH CONTROL PACKAGE OPTION

The Innergy tech ACH 580 VFD controller package is designed to provide complete control support for all i4 wheel products.

Unlike other controllers which rely on a variable frequency drive as well as a separate controller, the Innergy tech ACH580 VFD controller package benefits from the extensive VFD programming capacity to eliminate the need of a separate controller entirely. The drive and controller are therefore united to form an "intelligent" drive system.

Proprietary Innergy tech programming optimisations result in full implementation of all analog inputs for smooth free-cooling (with summer changeover) and frost control modulations.

In addition, VFD mode (heating, cooling, frost control or free-cooling) as well as wheel temperature efficiency status are available in real time through the large VFD LCD screen or remote through your preferred communication protocol (S-422/485 Modbus or BACnet).

The kit comes complete with four (4) 4-20mA IP67 pre-installed temperature sensors located in the outside air (TEMP1), supplied air (TEMP2), return air (TEMP3) and exhaust air (TEMP4) streams. A magnetic rotation sensor also come standard with all VFD kits to monitor wheel rotation speed and warn the BMS in case of rotor failure.

When ordered with an i4 wheel, all sensors will not only be pre-installed on your wheel but will also be fully wired to a sensor terminal box with a quick connector junction. The matching male quick connector with 50ft of wire means the only field connection required is at the VFD main terminal board.

Wheel rotation speed will vary proportionally with the VFD's frequency variation from its maximum speed of 20 RPM (60 Hz input) to its minimum speed of 1/4 RPM (0.75 Hz input). This 80:1 speed ratio results in total capacity control (0 to 100%) of the energy recovery wheel.

Figure 3.9
ACH580 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 unless the wheel is carefully strapped onto its skid. Lifting eye bolts are located on top of unit casing. When lifting and handling the unit, be sure that lifting forces are applied uniformly to all lifting points. Please review section 4.3 of this manual carefully before attempting to lift your new wheel.

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 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

4.3.1 USING A LIFTING CRANE:

- 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.

* If assembling he eye bolts is necessary, follow the the eyebots assembly details (figure 4.3). Make sure to align the eye bolts parallel to the diameter dimension (per figure 4.1).

- Before lifting, always ensure the chains or slings are vertical (see figure 4.1 and 4.2).
- 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).

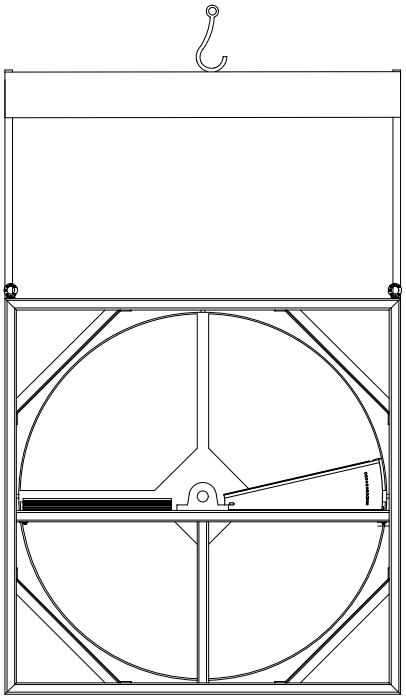

Figure 4.1
Recommended lifting method

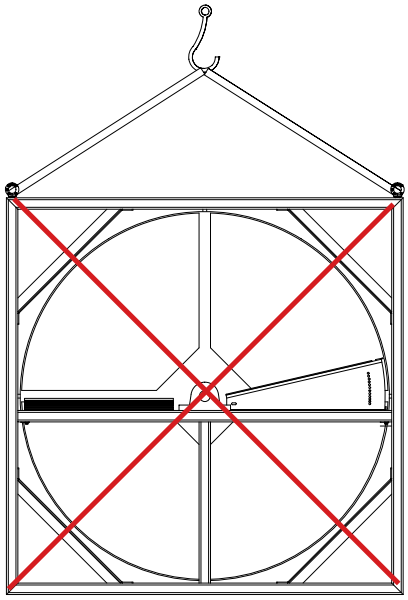

Figure 4.2
Incorrect lifting method

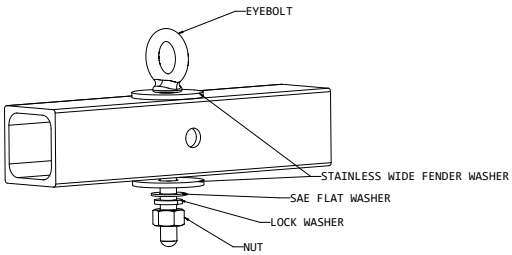

Figure 4.3
Eye bolt assembly details

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

4.3.2 USING A FORK LIFT:

- Fork lifts may only be used if your wheel is still fully strapped onto its skid. For our larger models (96″ to 132″ diameters), extended forks are required.

Figure 4.4
Extended Forks

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 (max 1/8″ level difference).

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

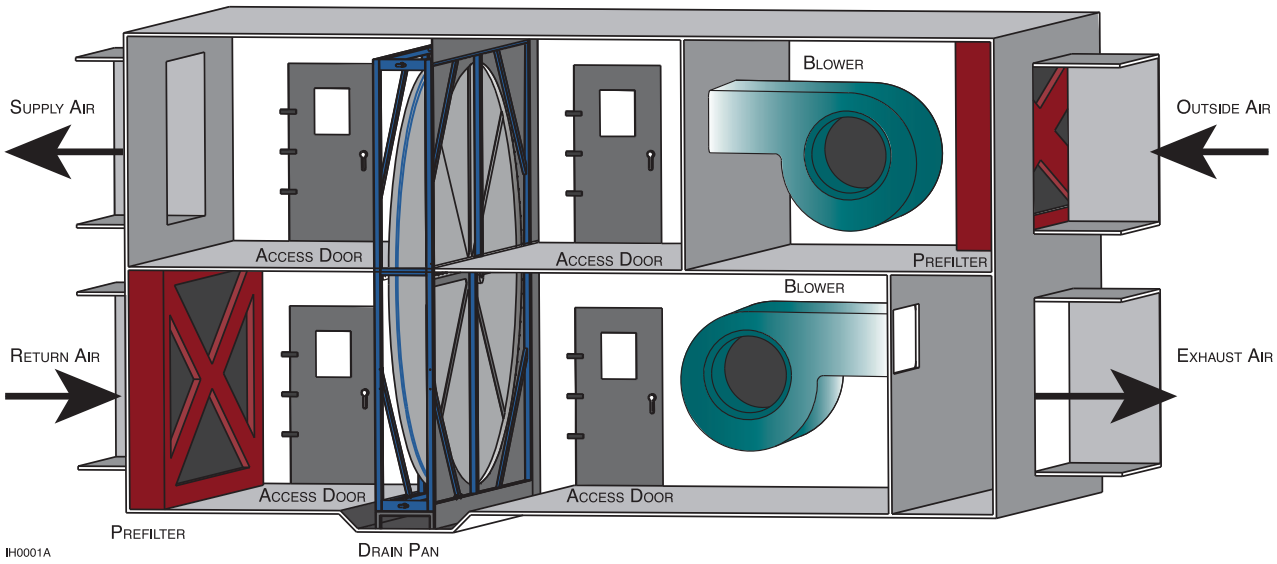

Figure 4.3
Typical energy recovery wheel installation

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 square aluminum tubings
- As shown on figure 4.3, the wheels blank offs should be aligned with the face plate (side facing the outside air). If not, the top, bottom and side aluminum 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

- 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 with the correct belt tension (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, tabs against the perimeter, 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 energy to 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: Never 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**	**84**	**88**	**96**	**108**	**120**
1	Driving Belt	12’	14’	18’	20’	23’	24’	25’	27’	30’	34’

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.

Enclosed Direct Drive: Beltless driving mechanism totally enclosed withing the wheel frame.

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 Specifications Energy Recovery Wheel

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 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-year 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 2.5" 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 1M 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 1/16".

4.4.2. The framing shall be made of 6000 series aluminum for increased corrosion resistance and high strength.

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 use an Enclosed Direct Drive system for beltless operation, lower noise production, less power draw and increased reliability. No part of the direct drive system shall exceed from the cassette.

4.6.2. 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.

4.6.3. Speed reducer shall be permanently lubricated and maintenance free.

4.6.4. The drive system's motor shall be compatible with major VFD brands and shall allow a turn down ratio of at least 80:1.

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 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 to prevent the supply temperature from exceeding set point (default: 60°F, adjustable).

4.7.4. All sensors (4X temperature sensors & 1X rotation sensor) 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 1/4 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: BACnetTM & S-422/485 MEMOBUS/Modbus at 115.2 kbps (LonworksTM & others 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 & rotation sensor pre-installed on wheel.

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

4.8.3. Permanently greased bearings.

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

4.8.5. Multilink V-belt made of high-tech polyurethane/polyester composite material & tensioner drive systems.

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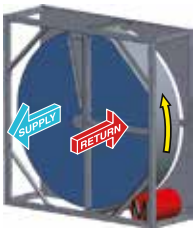
SELECTION FORM
i4 ENERGY RECOVERY WHEEL

CONFIGURATIONS

SIDE - BY - SIDE AIRFLOWS



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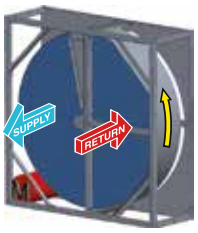

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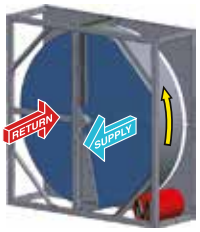

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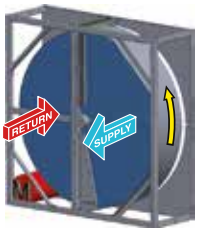

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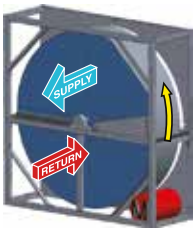
TOP AND BOTTOM AIRFLOWS



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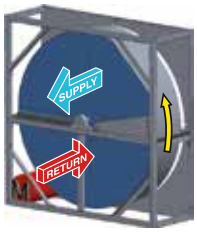

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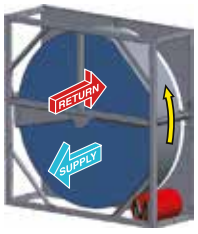

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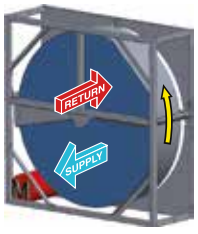


☐ NO. 8

COMPANY NAME: _____

PROJECT NAME: _____

UNIT (AHU) NUMBER: _____

QUOTE NUMBER: _____

NOTE:

Wheel Sizes

☐ 48 ☐ 54 ☐ 62 ☐ 70 ☐ 78 ☐ 84

☐ 88 ☐ 96 ☐ 108 ☐ 120 ☐ 132

Installation Type

☐ i4 Factory Assembled (std)

☐ i4R 100% Field Installed

☐ i4R 50% Field Installed*

*Bottom Half Factory Assembled (Conf. 3, 4, 7 & 8 Only)

Rotor Type

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

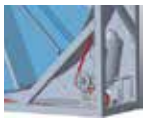
Matrix

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

Drive Mechanism

☐ Enclosed Direct Drive (Standard)

☐ Belt Driven



Motor Characteristics

☐ 208/3/60 ☐ 460/3/60 (std) 120/1/60*

*For 120V/1Ph current, select 208/3/60 motor with drive kit 1Ph/120V to 3Ph/208V (see options)

☐ 230/3/60 ☐ 575/3/60

Purge Angle

☐ 0° ☐ 1° ☐ 2° ☐ 3° ☐ 4° ☐ 5° ☐ 6° ☐ 7°

☐ 8° ☐ 9° ☐ 10° ☐ 11° For no purge effect 0° should be selected.

= Supply Air = Wheel Rotation

= Return Air = Motor Location

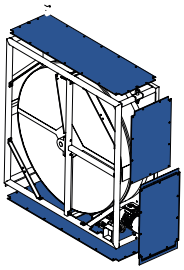
To select among available options, go to page 2

Flow Directions

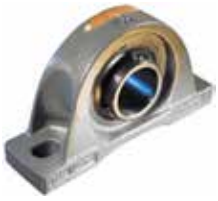
☐ **Counterflow (Standard)** ☐ **Parallel Flow**

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.

WHEEL OPTIONS



☐ **Aluminum Sheet Metal Top Bottom And Sides Plates**



☐ **Permanently Sealed Bearings**

☐ **Two-Part Epoxy Coating (Media)**

☐ **Rotation Sensor only (no controls or wiring)**

NEMA1 120V DRIVE KIT

☐ **1Ph to 3Ph Drive Kit (120V 1Ph to 208V 3Ph Drive Kit)**
(controller and temperature sensors by others)

NEMA1 DRIVE-CONTROLLER KIT

☐ **Drive/Controller Kit (208V, 230V, 460V or 575V 3Ph Drive Kit)**
(C/W Frost control & free cooling logics. Four (4) temperature sensors & rotation sensor pre-installed on wheel)

COMMUNICATION PROTOCOL:

☐ **None (std)**

☐ **BACnet MS/TP (std)**

☐ **Modbus RTU (std)**

☐ **Other (please specify):** _____

CONTROL OPTIONS

Casing According to Usage Temperature and Environment

☐ **Nema 1 (std)** . . . . . 14°F (-10°C) Indoors

☐ **Nema 12** . . . . . 14°F (-10°C) Indoors

☐ **Nema 3r + Heater**. . . For Outdoors installation down to -40°F (-40°C)

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WHEELS • CORES

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21 December 2022 10:05