



Engineering Bulletin

Energy Wheel Overview for Modular and T-Series Climate Changer™ Air Handlers



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Introduction

Energy wheels (also called “heat wheels,” “enthalpy wheels,” or “passive wheels”) have become more and more popular since the first designs were introduced in the 1950s. Energy wheel technology has evolved through its initial broad application in the 1980s to its widespread acceptance in the 1990s. The substrate and the coating used to effect the energy transfer have been improved, and there have been fundamental enhancements to the components associated with the energy wheels. These improvements have resulted in energy wheels that can be more

specifically targeted to the individual applications of today’s marketplace.

Trane offers an integrated energy wheel module/section, contained within its Modular Climate Changer™ (MCC) and T-Series Climate Changer air handlers, that can economize while recovering energy. Other manufacturers provide a mixing box with an economizer that is ducted to their energy recovery unit.

This engineering bulletin provides an overview of Trane’s

energy wheel module/section for MCC and T-Series air handlers. It describes the features and benefits, construction, operation, and application considerations of Trane’s energy wheel module/section as well as the computerized energy wheel selection program available in the Lexington Custom Toolbox.

For more specific information about Trane’s energy wheel, consult the energy wheel product catalog, CLCH-PRC006-EN.



Features and Benefits

Table 1 describes the features and benefits of Trane’s energy wheel module/section. The primary advantage of a Trane energy wheel is that it is a complete, integrated offering that can economize while recovering energy. Also, Trane’s energy wheel offering allows boiler/chiller equipment

to be downsized, reducing the first cost of the air-handling system as well as the operational costs throughout the life of the air handler.

This equipment can be downsized confidently because Trane energy wheels are

certified to comply with ARI Standard 1060. Modular and T-Series Climate Changer™ air handlers are also certified to use the certified energy wheel, ensuring that cataloged performance data is accurate.

Table 1. Trane’s energy wheel module/section features and benefits

Feature/Benefit	Description
A complete, integrated offering	Trane’s energy wheel offering is contained within one complete package, including pre-mounted, -wired, and -tested controls, starters, and fan variable frequency drives (VFDs) for the entire unit. With components that are designed to work in tandem with each other, Trane’s energy wheel offering eliminates: <ul style="list-style-type: none"> • The need for extra space in the mechanical room (or on the roof) for a separate energy wheel module/section • The ductwork connecting an energy wheel module/section to the main air handler • The coordination efforts between two different manufacturers involving fit, function, and shipping cycles • The concerns about using multiple sources to obtain parts and service for air-handling unit components
Pre-engineered, pre-packaged solution	Trane’s energy wheel offering is engineered specifically for each project. Where other suppliers typically provide just the energy wheel, Trane provides a system solution, including the wheel, optimized for the application.
Flexibility	Trane’s energy wheel can be designed in a wide variety of configurations, consistent with the wide variety of options available in Trane’s MCC and T-Series air handlers.
Confidence	Backed by extensive testing and years of experience, the Trane energy wheel offering can be chosen with utmost confidence.
Accessibility	Wheels that slide out of the air handlers (on MCC sizes 3–8) and wheel sections that are removable (on all other MCC unit sizes and T-Series sizes 8–100) allow for easy service access.
Certification	Trane energy wheel sections are certified by ARI to use an ARI 1060 certified energy wheel. ARI 1060 certification means that the performance of Trane energy wheels has been verified by a reputable organization through independent tests.

Technical Overview

An energy wheel acts as an intermediary device that operates within and between two air streams in the air handler. As the wheel rotates between the outdoor and return air streams, the higher temperature air stream transfers its sensible energy (temperature) to the wheel

media surfaces. This energy is then transferred from the media core to the cooler air stream during the second half of the rotation.

Latent energy (moisture) is transferred via the desiccant coating, which has a strong affinity for water vapor.

Because the opposing air streams have different temperatures and moisture contents, their vapor pressures differ. This vapor pressure differential and temperature change provide the driving force necessary for the transfer of water vapor (see Figure 1 and Figure 2).

Figure 1. Energy transfer in an MCC air handler

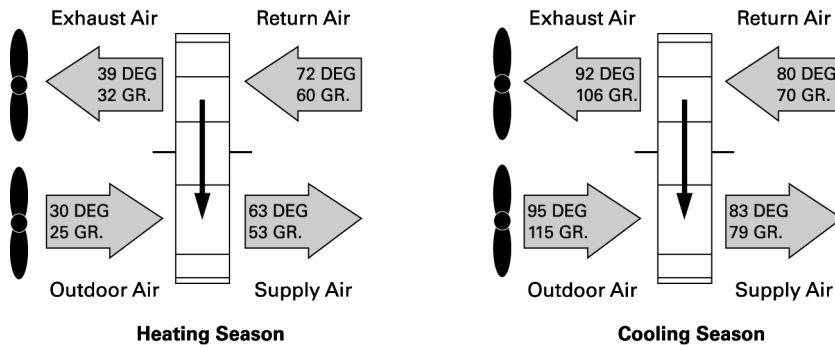
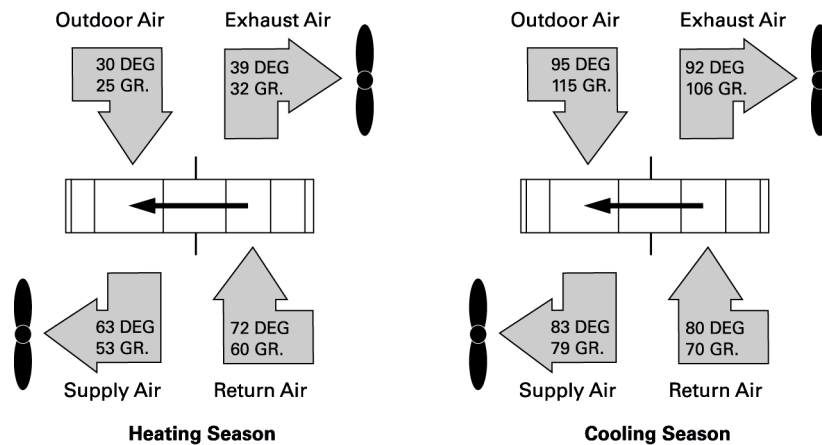


Figure 2. Energy transfer in a T-Series air handler



The ability to recover latent energy is important in both the heating and cooling seasons. During the cooling season, when the latent load can be greater than the sensible load, the outdoor air is dehumidified (see Figure 3). During the heating season, the humidification load is reduced through moisture recovery.

Latent energy recovery allows for sizable reductions in chiller and boiler capacity, which can help offset the initial cost of the energy wheel module/section.

Unit Configuration Using 100 Percent Outside Air

A 100 percent outside air, or dedicated, system gives your customer the opportunity to pre-treat the outside air using recovered sensible and latent energy from the exhaust air stream. A dedicated unit is

typically used with fan coil and water source heat pump systems.

In a dedicated MCC unit (see Figure 4), return air enters on the top deck through the filter module, passes through the wheel, and is exhausted from the air handler by the exhaust fan. Outside air enters the bottom deck through the mixing box, passes through the wheel, and is drawn through the unit by the supply fan.

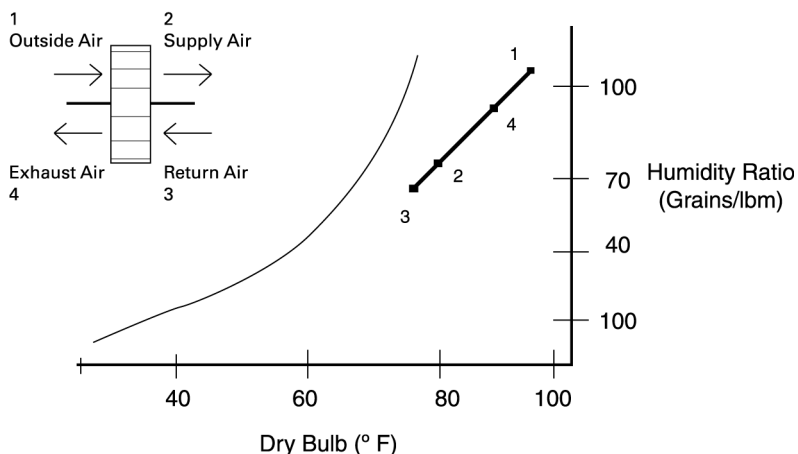
In a dedicated T-Series unit (see Figure 5), return air enters the bottom of the energy wheel section, passes through the wheel, and is exhausted from the air handler by the exhaust fan. Outside air enters the wheel section from both the left and right sides of the air handler, passes through the wheel, and is drawn through the unit by the supply fan.

Unit Configuration Using Partial Flow Outside Air

A partial flow outside air, or recirculating, system is typically used when the required outside air is less than 100 percent, such as in a recirculating constant-volume (CV) or variable-air-volume (VAV) air handler. In this configuration, the exhaust air bypass damper can also be used to control capacity through variable effectiveness.

Wheel sizes are chosen for the outdoor air ventilation requirement. In recirculating systems, an optimal-sized wheel is installed in the module/section and dampers are used to bypass excess air around the wheel, varying wheel capacity. In recirculating MCC units (see Figure 6), an optional damper can be installed in the return air

Figure 3. Typical psychrometrics in cooling season



bulkhead to bypass return air around the wheel to vary wheel capacity. In recirculating T-Series units (see Figure 7), the energy wheel section has a return air damper between the exhaust and outside air sections. Exhaust air bypass dampers can also be used in T-Series recirculating units to vary wheel capacity.

When conditions are not favorable for energy recovery, the wheel module/section

doubles as an economizer. The wheel is turned off and the outside air and return air bypass dampers modulate to maintain the desired discharge air temperature, similar to a conventional exhaust fan economizer unit.

For recirculating recovery applications where there is a minimum outside air ventilation requirement of less than or equal to 50 percent of nominal flow, an airflow

monitoring station, such as Trane Traq™ dampers, is recommended to control the system properly.

Table 2 gives an overview of energy wheel module/section operation in various modes. For a full sequence of operation and control information on recirculating energy recovery units, see the energy wheel controls engineering bulletin, CLCH-PRB009-EN.

Figure 4. A dedicated MCC unit

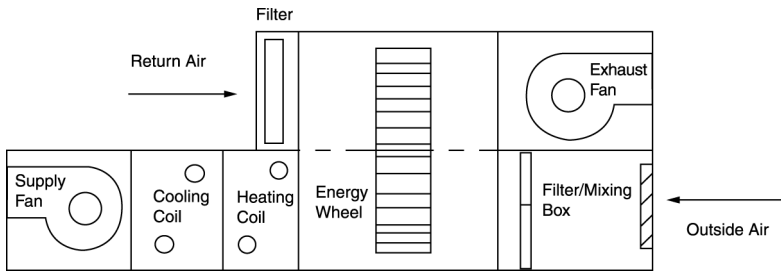


Figure 5. A dedicated T-Series unit

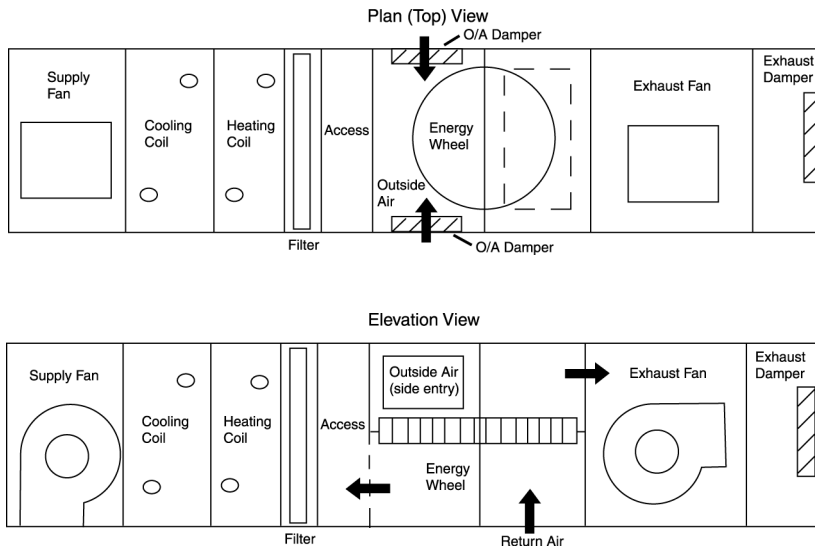


Figure 6. A recirculating MCC unit

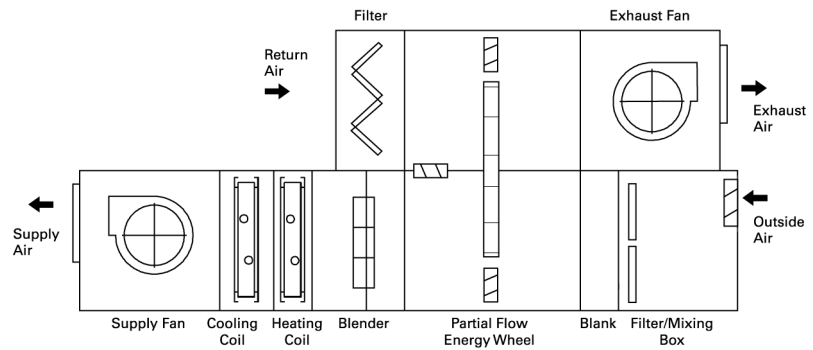


Figure 7. A recirculating T-Series unit

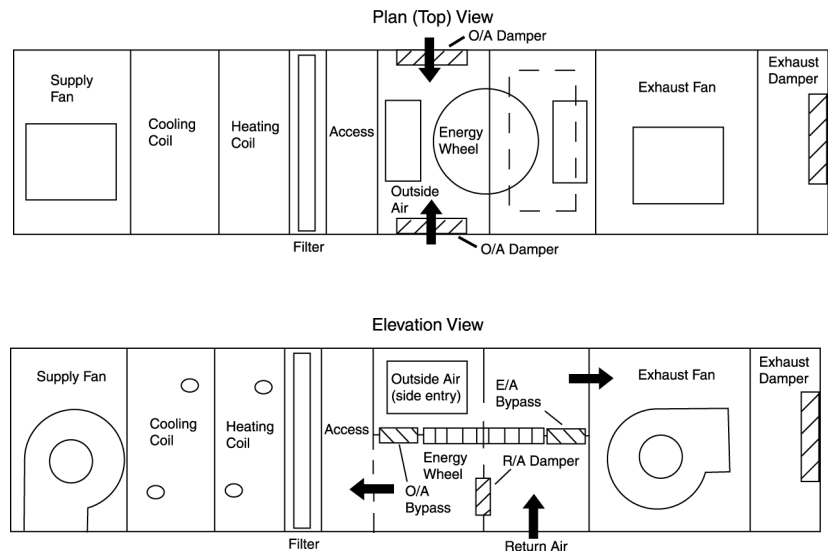


Table 2. Energy wheel operation in various modes

Mode of Operation	Energy Wheel	Exhaust Air Bypass	Outside Air Bypass	Outside Air Damper
Cooling Recovery	On	Closed	Closed	Minimum
Economizing	Off	Open	Open	Minimum-100%
Free Heat/Partial Recovery	On	Modulating	Closed	Minimum
Heating Recovery	On	Closed	Closed	Minimum



Module/Section Construction

The construction of the energy wheel module/section is consistent with that of the MCC and T-Series air-handling units, respectively, including pressure ratings and panel deflections. The module/section also ships fully assembled. Installation guidelines can be found in the appropriate IOM: CLCH-SVX01A-EN for T-Series air handlers and

CLCH-SVX02A-EN for MCC air handlers.

MCC energy wheel modules are not weatherproof and are designed for indoor use only.

NOTE: Outside and exhaust/return air dampers are standard on recirculating MCC and T-Series units.

MCC Energy Wheel Module Construction

- Sizes 3–8 have one access door, which permits slide-out removal of the energy wheel cassette.
- Sizes 10–50 have four access doors for accessibility.
- Outside air bypass dampers are not provided on dedicated MCC units.

Figure 8. MCC energy wheel module



T-Series Energy Wheel Section Construction

- All sizes have an exterior access door for service accessibility to the return air/exhaust air section.
- Internal access doors provide access to the outside air section.
- Access to internal doors is through a downstream access section.
- Airflow monitoring damper/station or parallel blade dampers are available on the outside air intake.
- Exhaust air bypass dampers are optional on dedicated T-Series units.

Figure 9. T-Series energy wheel section





Application Considerations

Typical Applications

- Schools, universities, dormitories
- Offices, condominiums, apartments
- Smoking lounges, casinos
- Nursing homes, day care centers
- Hotels, motels, department stores
- Breweries
- Swimming pools, sports arenas
- Convention centers, airports, prisons
- Bus and train maintenance facilities
- Welding, foundry, casting areas
- Printing operations
- Product drying operations

Inappropriate Applications

⚠ WARNING

TOXIC HAZARDS! Do not use an energy wheel in an application where the exhaust air is contaminated with harmful toxins or biohazards, which could result in death or serious injury.

Although cross leakage between air streams in an air handler with an energy wheel is minimal, there are some applications where cross leakage poses a significant health risk

to the building occupants. These applications are not appropriate for energy wheel technology. For example:

- Specialized hospital treatment wings, such as tuberculosis units
- Some retail establishments, such as restaurants, whose menus include grease- or smoke-producing selections
- Some industrial applications, such as concentrated smoke from welding operations
- Laboratories where hood exhaust fumes are involved in the project analysis

For applications where the air streams within the air handler must be isolated, consider using alternative technologies, such as coil loops, that guarantee separation of the air streams. Do *not* use energy wheels in applications where even a minor mixing of the air streams presents a health risk.

Filtration Requirements

Debris screens are provided in the outside air hoods for T-Series units; therefore, additional filtration is generally not required. For MCC units, minimal filtration should be provided prior to the energy wheel. Small size particles pass through the heat exchange matrix due to the laminar flow of air within the wheel. If larger particles do impact on to the wheel, they are generally blown off by the reversing

airflow as the wheel passes into the opposing air stream. Downstream supply air filters can catch any particulate “self-cleaned” in this manner.

Though return air filtration is not generally required, in an industrial application or in applications where the exhaust air is contaminated with large particles such as lint, the air should be filtered upstream of the energy wheel.

Component Spacing Requirements

In MCC units, no additional access modules are required for proper spacing with adjoining air handler components. Coil, fan, and filter modules may be installed immediately upstream or downstream of the energy wheel module.

In T-Series units, an access section is required on the supply air outlet side of the energy wheel section prior to other air handler components. This section must be equipped with at least one access door for servicing the energy wheel section. See Table 3 for the required minimum access module/section sizes.

Table 3. Required minimum access module/section sizes

Unit Size	Required Access Module/Section
8	Medium
10–100	Medium-large

An access section is required on the exhaust air side of the T-Series energy wheel section *only* if a plenum fan is used as the exhaust fan. A housed exhaust fan does not require the access section.

Capacity Control: Variable Effectiveness

Variable effectiveness is a means to control the capacity of an energy wheel. Normal wheel sizing is for worst case winter/summer load; therefore, at part load the wheel may be

oversized and variable effectiveness is justifiable.

Variable effectiveness control can be used in any application where the outdoor air temperature may fall between the discharge air set point and the temperature at which heating is required. For example, a job may have a required supply air set point of 55°F. A typical return air temperature may be 70°F and the outside air temperature 40°F. The energy wheel could heat the supply air to over 60°F, but by employing variable effectiveness, the

energy wheel's capacity can be modulated to exactly match the required supply air temperature without using additional heating or cooling. Therefore, variable effectiveness control can significantly add to the amount of energy saved in a year.

Variable effectiveness can be accomplished by varying the wheel's rotational speed or by bypassing a portion of the exhaust air around the wheel matrix. Varying the wheel's rotational speed is usually

Figure 10. MCC energy wheel with air bypass damper

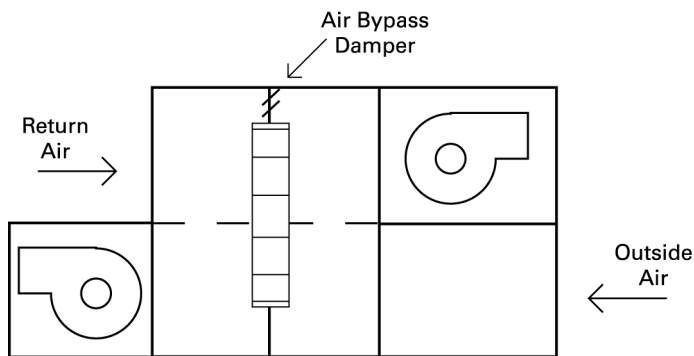
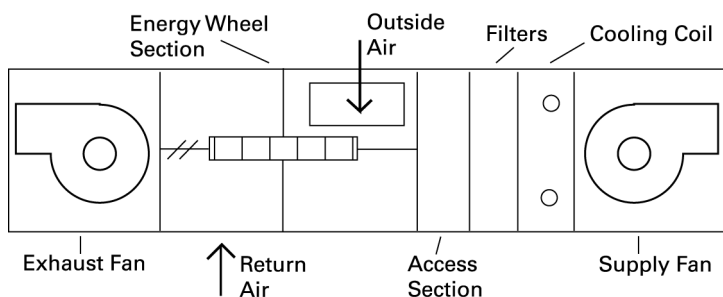


Figure 11. T-Series energy wheel with air bypass damper



accomplished using a variable frequency drive (VFD) connected to the motor that rotates the wheel. Slowing the wheel's rotational speed reduces effectiveness. Air bypass is accomplished using a conventional damper and actuator in parallel with the energy wheel (see Figure 10 and Figure 11).

Air Bypass Versus VFD Capacity Control

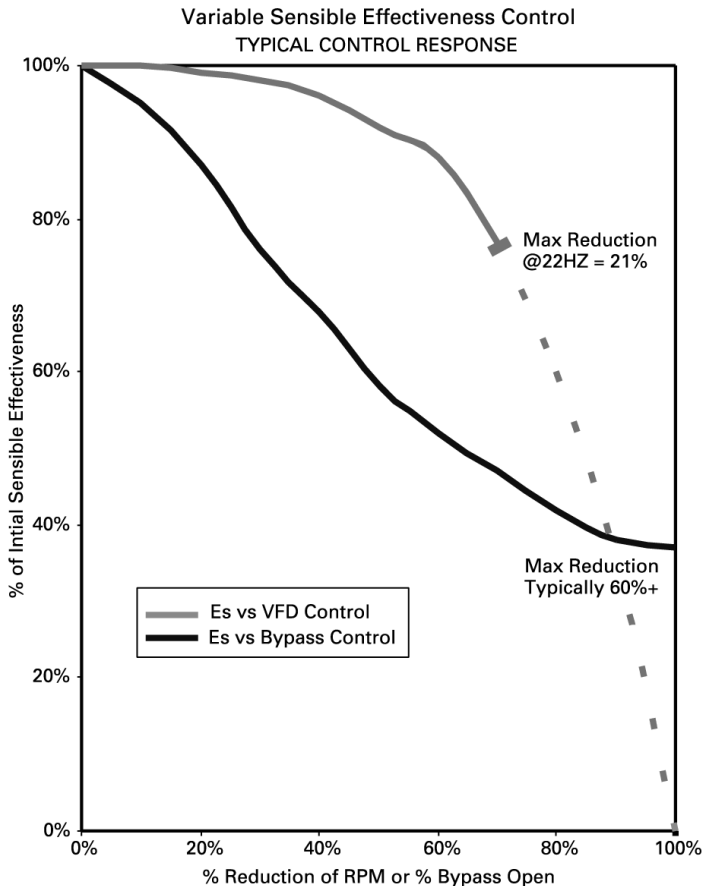
When comparing costs, reliability, and control stability, variable effectiveness using air bypass is the recommended method of capacity control.

Cost. The material costs of a VFD, its installation, and other related costs are more than that of an actuator and damper. Also, if a recirculating wheel is being considered, there is no additional cost for a bypass

damper. The recirculating energy wheel has the damper already installed for economizer control.

Reliability. The simplicity of an actuator and damper translates to a more reliable system with fewer components to fail. Also, variable effectiveness is only needed in part load conditions, so a VFD would operate at constant full speed for the majority of the system operating hours. Most of the

Figure 12. Air bypass vs. VFD capacity control



reduction in sensible effectiveness occurs below 33 percent of nominal speed, which increases the likelihood of the motor overheating and burning out.

Controllability. Air bypass is a better means of controlling the supply air temperature. Wheel speed is reduced to decrease sensible effectiveness. However, as speed is decreased, effectiveness drops off rapidly, which could lead to control instability. Air bypass generates a more linear control response. See Figure 12 for a comparison of the two methods. The air bypass method more accurately maintain the discharge set point and has a quicker response after a system change.

Flexibility. The air bypass method can be used, and is economically advantageous, for all energy wheel sizes. VFDs are limited to larger wheels with three-phase motors. A reliable automatic single-phase speed controller that reduces speed well below 33 percent is a less plausible option even than a VFD.

Installation and Maintenance. Installing an actuator and relay is no different here than on a mixing box and less complicated than a VFD.

Frost Prevention. Trane does not recommend VFD control for frost control, but air bypass can be used in non-extreme climates.

Because of the limited controllability issues and the risk of motor burnout, VFD control is

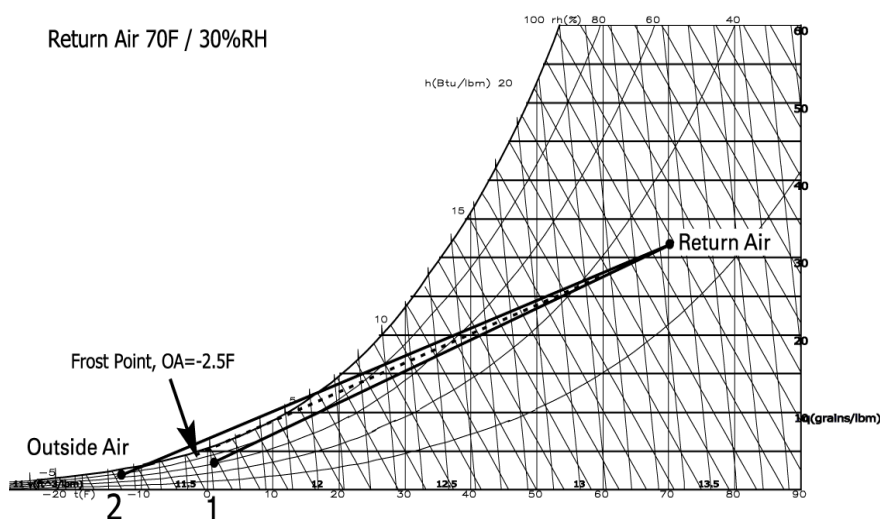
not available on Trane energy wheels.

Frost Prevention

Moisture condenses on an energy wheel when its surface temperature is below the air stream dew point temperature. Due to cold outdoor air temperatures during winter, the surface temperatures of an energy wheel can be below freezing. Frost forms on the energy wheel because it is cooled below its dew point. The contributors to frost formation are the winter return air relative humidity, return air dry bulb temperature, and outdoor air temperature, with the main contributor being return air relative humidity.

Trane energy wheels are total energy wheels, meaning that at the nominal speed of the

Figure 13. Determining frost conditions



wheel, sensible and latent effectiveness is close to equal. On the psychrometric chart, each air stream follows a straight line path between the outside air and return air. When this line crosses the saturation line, condensate or frost occurs. In Figure 13, frost does not occur at condition 1, but does at condition 2.

To determine the minimum outside air temperature where frosting will not occur:

- 1 Plot the return air dry bulb and percent RH on a psychrometric chart.
- 2 Draw a line from this return air point to the tangent on the saturation line. (This point is shown as the "Frost Point" in the example in Figure 13.)
- 3 Drop straight down from the tangent intersection point to find the minimum outside air dry bulb temperature.

Note that just because the outdoor air temperature is below freezing doesn't necessarily mean frost will form on the energy wheel. This example shows that frost control is not needed if the winter design condition for the outdoor air temperature does not drop below 0°F and the indoor relative humidity does not exceed 30 percent at 70°F.

Frost Prevention Methods

If frost prevention is necessary, Trane recommends four possible methods:

- 1 Preheat the outside air.
- 2 Preheat the return air.
- 3 Reduce the effectiveness of the wheel using bypass control.
- 4 Turn the wheel off and on.

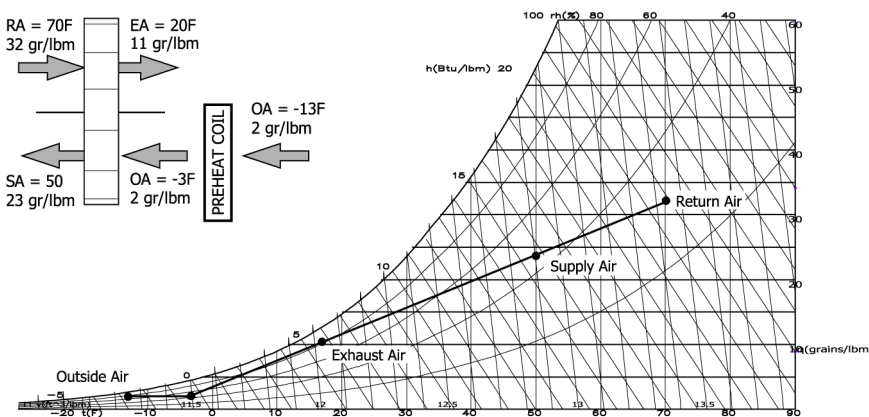
Preheat the Outside Air

Preheating the outside air produces the best result and allows for the most energy to

be recovered. It prevents the exhaust air stream from reaching frost conditions by raising the outdoor air temperature above the frost point temperature. Trane's energy wheel selection program calculates the minimum outdoor air temperature for the given extreme return air conditions and outputs the set-point temperature for preheat. It also calculates the required coil capacity. See Figure 14 for an example of the psychrometrics of preheat.

For continuous operation below the frost threshold temperature, the preheat coil (electric, hot water/glycol, or steam) should be installed in the outdoor air stream before the outside air enters the energy wheel. When using electric preheat coils, adhere to manufacturers' published guidelines for coil installation and placement to ensure

Figure 14. Frost prevention using outside air preheat



proper airflow across the heating elements and to minimize temperature stratification in the supply air.

The preheat coil should be automatically controlled to maintain a predetermined inlet air temperature. The required preheat temperature at design is always *below* the initial frosting threshold temperature for a given indoor condition because preheating lowers the relative humidity of the outside air entering the wheel, effectively lowering the frosting threshold as outdoor temperature drops.

Preheat the Return Air

Return air can be preheated to raise the exhaust air temperature above the frost point temperature, preventing the exhaust air stream from reaching frost conditions. The Trane energy wheel performance program can calculate the return air preheat required temperature for the given

minimum outdoor air temperature and return air relative humidity. See Figure 15 for an example of the psychrometrics of preheat.

The primary advantage of return air preheat is that a hydronic coil can be used for preheat without the need to add glycol. Return air preheat also allows slightly more energy to be recovered than outside air preheat. Preheating the return air further increases the temperature differential between air streams and increases the amount of energy transferable to the supply air.

Although preheating the outside air adds the new energy directly to the supply air, it decreases the temperature differences between air streams and the amount of energy available for transfer. In some cases, the return air coil may be the only heating coil needed in the air handler.

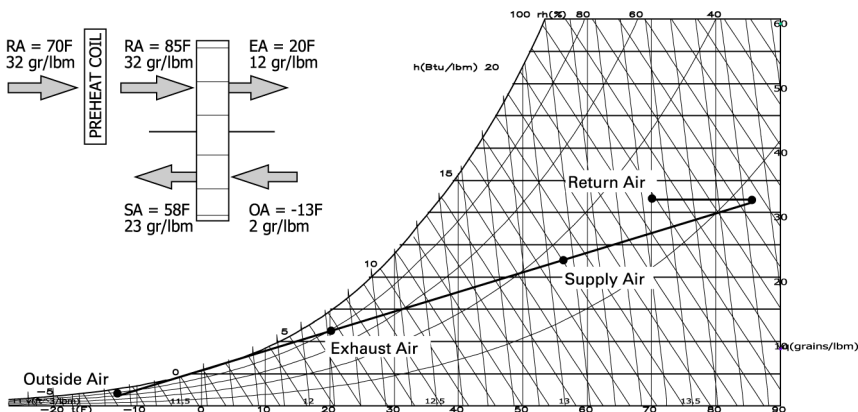
For continuous operation below the frost threshold temperature, the preheat coil (hot water or steam) should be installed in the return air stream prior to the return air entering the energy wheel. This coil should also be placed before the recirculation damper so that the coil can be used during morning warm up.

The preheat coil should be automatically controlled to maintain a predetermined minimum inlet air temperature when the outside air temperature drops below the frost temperature. Both of these set points are given in the Trane energy wheel performance software. Note that the coil may be activated before this point if it is also being used as the primary heating coil.

Reduce the Effectiveness of the Wheel Using Bypass Control

Variable effectiveness is best used in cases where frosting

Figure 15. Frost prevention using return air preheat



conditions exist only at the extreme winter design conditions. It prevents the exhaust air from being cooled down below saturation.

To reduce the amount of energy recovered from the exhaust air stream, outside air is bypassed

around the wheel. Frosting conditions are avoided by preventing the energy wheel temperature to drop below the exhaust air dew point temperature. Trane's energy wheel selection program calculates the required exhaust air set-point temperatures based on

the winter design conditions given. The exhaust set-point temperature is maintained by modulating the outside air bypass damper. Figure 16 represents this process. The indoor air humidity has the greatest effect on the exhaust air set-point temperature.

Figure 16. Frost prevention using air bypass

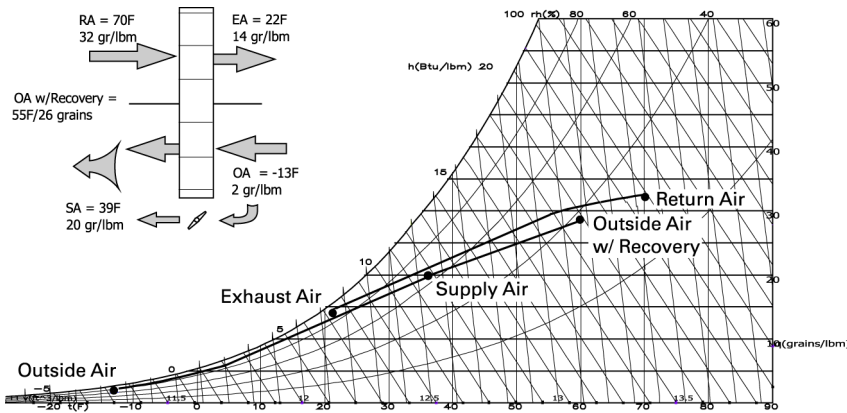
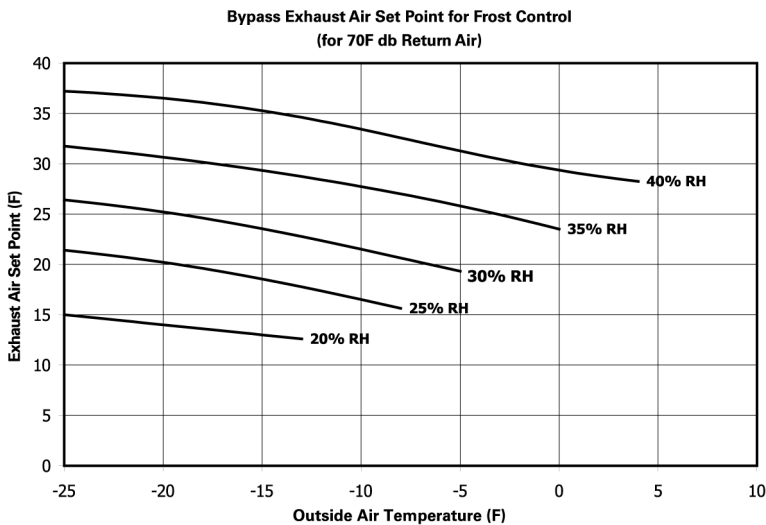


Figure 17. Exhaust air set point temperatures



Note that only one air bypass damper on a dedicated recovery module/section is available as standard.

Figure 17 gives the exhaust air set-point temperature for 70°F return air at various percents of relative humidity.

On T-Series units, if air bypass is to be used for frost control on the energy wheel, freeze protection of the downstream coils is required. This protection could include electric, steam, or glycol/hot water coils and related peripheral components. Do not rely on a low temperature switch as the only means of frost prevention. This switch could lead to nuisance control trip-outs or freezing of the downstream coils.

Another way to vary the effectiveness of the wheel is to adjust the wheel's rotational speed by means of a variable frequency drive; however, Trane does not recommend this method of frost prevention.

As an energy wheel's speed is reduced, the latent and sensible effectiveness decrease. However, latent effectiveness decreases faster than sensible effectiveness.

When the wheel speed is initially reduced the probability of frost actually increases because the ability of the wheel to remove moisture from the air stream decreases faster than

the ability to raise the dry bulb exhaust temperature.

For example, decreasing the wheel speed by 50 percent may raise the exhaust air temperature by several degrees; however, the wheel becomes close to a sensible-only recovery device and has a temperature below the dew point temperature of the exhaust air. Setting the exhaust air temperature above freezing can keep ice from forming on the wheel; however, it is likely that condensate will form to further reduce wheel performance.

The overall energy recovered using this method is minimal and the supply air temperature is often well below freezing. Also, the air temperatures leaving the wheel are more extreme with a VFD, so freeze protection for the coils is almost always required.

Turn the Wheel Off and On

For intermittent ventilation below the frost threshold temperature, a temperature control can be provided to shut off the energy wheel and ventilation fans when outdoor temperature drops to the control set point (as determined by the frost threshold temperature). Operation may be automatically restored when the outdoor air temperature rises above the thermostat set point. The thermostat should be located in the outdoor air intake hood or outdoor air intake duct as close as practical

to the intake hood. On/off frost control should only be used if:

- The temperature falls below the frost threshold for a limited number of hours, resulting in a building's highest natural ventilation rate because of the maximum indoor/outdoor temperature differential.
- Temperatures below the winter design temperature usually occur during periods of darkness lasting one to six hours. Depending on the application, these low temperatures may only occur during unoccupied periods when ventilation is not required.

On T-Series units, an air pressure differential switch can be installed in the section as a further safety for frost buildup. As frost forms on the wheel, air pressure drop increases. The differential pressure switch is used to stop the wheel's rotation.

Turning the wheel off during frost conditions is a reliable method of preventing the wheel from frosting; however, it does not allow for any reduction in the heating equipment.

Method Comparison and Recommendation

The Trane Company recommends using outside air preheat or air bypass as a means of frost prevention depending on the system and



the climate. Indoor relative humidity and the outdoor air temperature at extreme winter conditions are the main factors in determining what method to use (see Figure 18).

Preheating the air allows more energy to be recovered at peak winter conditions than the other two methods. Table 4 was derived considering a 10,000

cfm unit with a heating coil set point of 90°F.

Air bypass is a reliable method to use in mild winter climates where frosting conditions occur only at the extreme winter conditions, though proper freeze protection is needed for downstream coils. Air bypass is not recommended for use in systems that use a

humidifier. If humidification is used, or in cases where the return air relative humidity is high, return or outside air preheat is recommended.

Trane does not recommend using a VFD for frost prevention because of reliability and performance issues.

Figure 18. Frost threshold based on 70°F return air

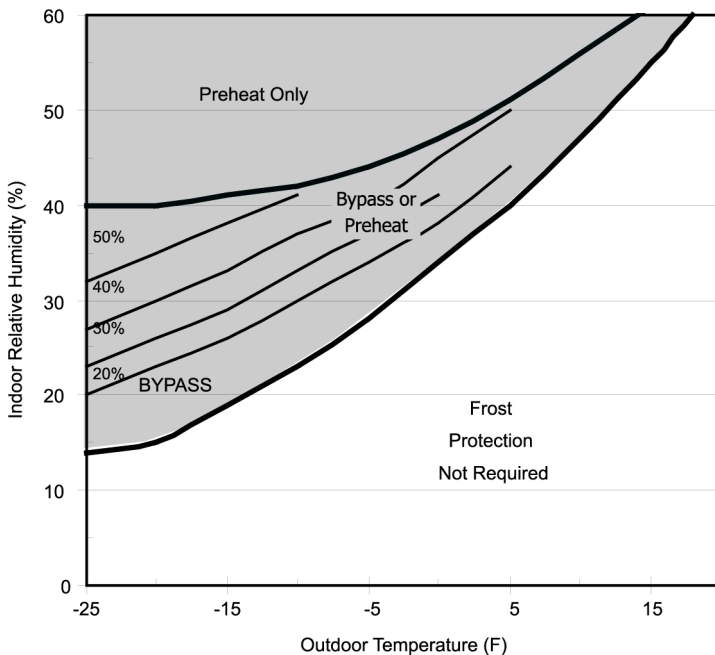


Table 4. Frost prevention method comparisons

Method of Energy Wheel Frost Protection	Energy Recovered (BTUH*)	Preheat Required (BTUH*)	Heating Coil (BTUH*)	Reduction of Winter Peak Heat Load (%)
With return air preheat	785,000	155,500	327,000	54
With outside air preheat	591,500	120,000	408,500	50
With air bypass	576,000	0	521,000	50
With VFD	387,500	0	695,500	34
Energy wheel off/on	0	0	1,052,000	0

* Sensible energy

Supply and Exhaust Fan Orientation

Supply and exhaust air fans must be arranged to provide counterflow airflow through the energy wheel. Fan placement, which can affect the pressurization of the two air streams, can be used to direct seal-related cross leakage. The pressurization controls the direction that the seal-related leakage moves.

MCC Energy Wheel Fan Orientation

In MCC units, exhaust and supply fans must be arranged to provide counterflow airflow through the energy wheel. The MCC unit can be arranged in the following fan arrangements; however, the best fan arrangement is dependent on each system's pressure differential between the supply and exhaust air streams:

- Draw-thru exhaust and blow-thru supply
- Draw-thru exhaust and supply
- Blow-thru exhaust and supply

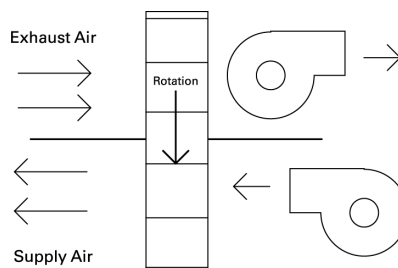
Trane does not recommend a blow-thru exhaust, draw-thru supply fan arrangement. It would have negative implications for exhaust air transfer as well as fan energy.

Draw-thru exhaust, blow-thru supply

This orientation is the best application to minimize air cross leakage through the seals from the exhaust air chamber

to the supply air chamber. In this orientation, air cross leakage is from the supply air chamber to the exhaust air chamber because the supply air chamber is usually at a higher static pressure. For this system to function as described, the static pressure in the supply air chamber must be higher than the static pressure in the exhaust air chamber. However, the higher the pressure differential, the higher the purge volume.

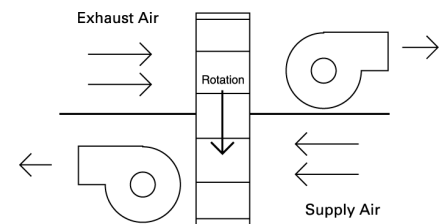
Figure 19. Draw-thru exhaust, blow-thru supply



Draw-thru exhaust and supply

This orientation promotes good airflow distribution across the energy wheel and minimal cross leakage through the seals. Air cross-leakage direction past the seals is dependent on static pressure differences in the exhaust and supply air chambers. Also, designing the system so that the static pressure in the exhaust air chamber is nearly equal to that in the supply air chamber can minimize air transfer through the seals.

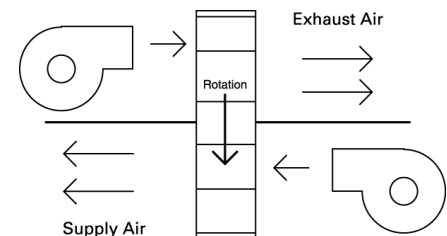
Figure 20. Draw-thru exhaust and supply



Blow-thru exhaust and supply

In this orientation, minimal cross leakage occurs due to seal designs. Air cross-leakage direction past the seals is dependent on static pressure differences in the exhaust and supply air chambers. Designing the system so that the static pressure in the exhaust air chamber is nearly equal to that in the supply air chamber can minimize air transfer through the seals.

Figure 21. Blow-thru exhaust and supply



Use the examples in Figure 22, Figure 23, and Figure 24 for ideas on component placement and air handler layouts in MCC energy wheel units. Keep in mind that the lower deck must be as long as, and must fully support, the upper deck modules. The upper deck

modules should not overhang the lower deck.

Figure 22. Draw-thru exhaust and blow-thru supply: 100% outside air, cold air supply (with optional variable effectiveness air damper)

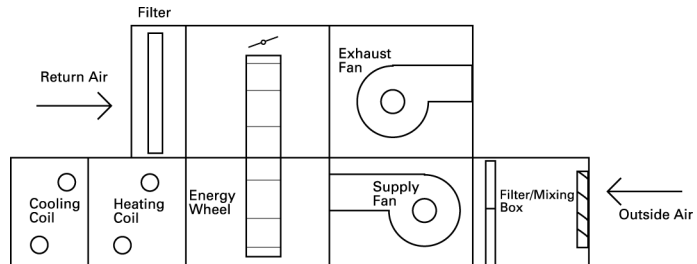


Figure 23. Blow-thru exhaust and supply: 100% outside air, room neutral air

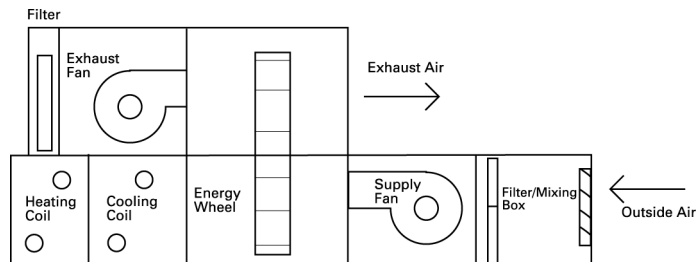
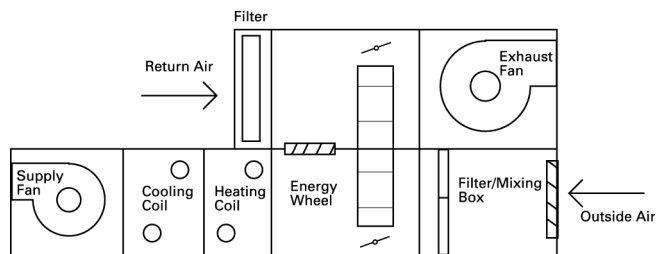


Figure 24. Draw-thru exhaust and supply: Partial outside air, cold air supply (with standard recirculating air damper)



T-Series Energy Wheel Fan Orientation

The T-Series energy wheel section is designed for draw-thru exhaust air, draw-thru supply air orientation only (see Figure 25 and Figure 26). This orientation promotes good airflow distribution across the energy wheel and minimal cross leakage through the seals. Air cross-leakage

direction past the seals is dependent on static pressure differences in the exhaust and supply air chambers. This cross leakage is usually not significant, for example, less than three percent of nominal flow. Designing the system so the static pressure in the exhaust air chamber is nearly equal to that in the supply air chamber can minimize air transfer through the seals because of

the return duct static pressure. If cross leakage is a concern, a fixed position damper can be placed in the return air intake or return air ductwork to reduce the pressure differential. This orientation represents the most energy efficient use of the supply and exhaust fans. See CLCH-PRC006-EN to determine the cross leakage in a T-Series energy wheel section.

Figure 25. Draw-thru exhaust and supply (dedicated recovery)

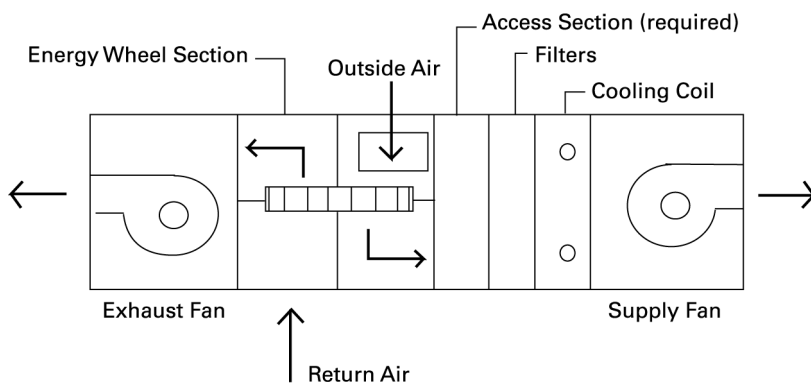
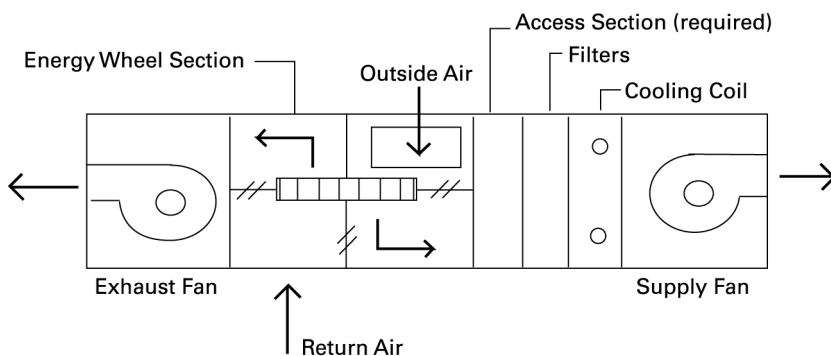


Figure 26. Draw-thru exhaust and supply (economizer)





Trane Energy Wheel Selection Program

To aid the designer in selecting an energy wheel module/section, Trane developed a computerized selection program. This selection program quickly and accurately displays new supply air conditions useful for calculating cooling and heating loads. For energy wheel selections using this selection program, contact the local Trane sales engineer.

The Trane energy recovery selection program, a performance-only program, is currently available to all Trane commercial sales offices. The user must input the energy

wheel size (by nominal CFM) and the summer and winter conditions.

The Trane energy recovery selection program includes exhaust air energy recovery using total energy wheels. The software predicts the performance characteristics as defined in ARI Standard 1060. This includes net latent effectiveness, net sensible effectiveness and net total effectiveness, cross flow characteristics EATR and OACF, leaving air conditions and energy saved.

The software also alerts the user if winter frost control is needed and what methods can be used. This information includes the preheat set points and the exhaust air set point for bypass frost control. The user has to enter the unit type, air flows, psychrometric conditions, and wheel size based on the minimum ventilation air. The section pressure drops are also outputs. Figure 28 shows the main user interface for the MCC energy wheel portion of the Trane energy recovery selection program.

Figure 27. Trane energy recovery selection program

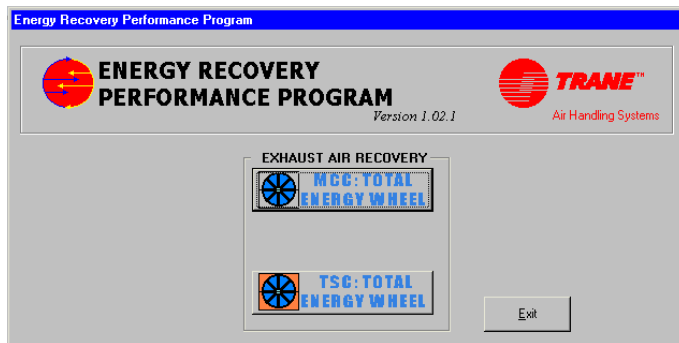
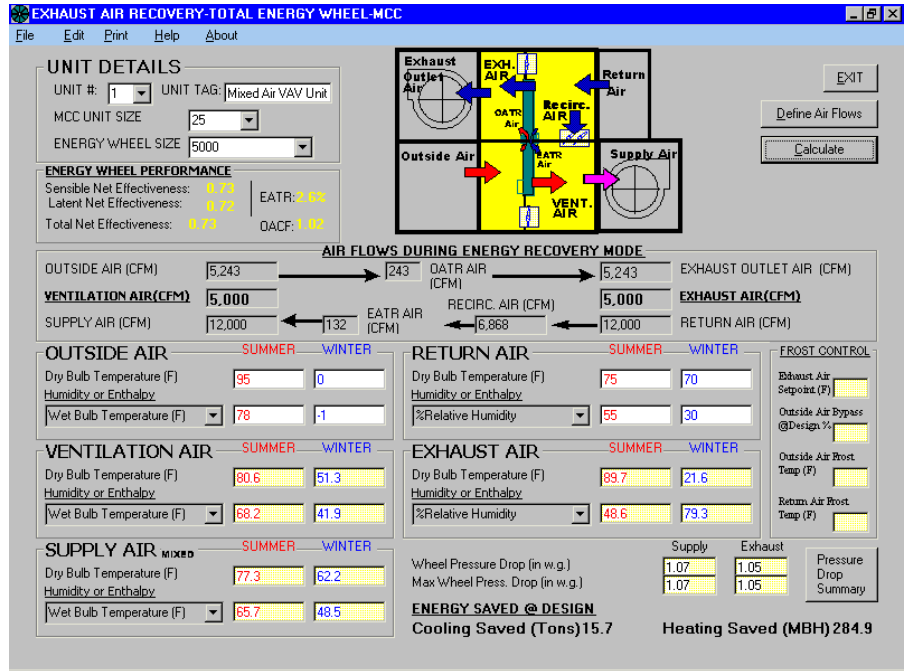


Figure 28. Main user interface





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