

### ENERGY RECOVERY VENTILATOR

## INSTALLATION INSTRUCTIONS FOR ENERGY RECOVERY VENTILATOR (PIVOTING) USED WITH TRANE ROOFTOP UNIT MODELS YCD/TCD 15 TO 20 TON UNITS



Energy recovery COMPONENT certified to the AHRI Air-to-Air Energy Recovery Ventilation Equipment Certification Program in accordance with AHRI Standard 1060-2000. Actual performance in packaged equipment may vary.



Patent# 5,548,970

ETL Certified per UL 1995 and CSA 22.2

### I - SHIPPING AND PACKING LIST

Package 1 of 1 contains:

- 1 - Energy Recovery Wheel Assembly
  - 1 - Outdoor Fresh Air Hood with Filter
  - 1 - Outdoor Exhaust Hood with Barometric Damper
  - 1 - Platform Support Rail
  - 2 - Side Filler Panels
  - 1 - Top Filler Panel
- 1 - Box Assembly
  - a) Gasketing.
  - b) Wiring harness
  - c) Hardware for attachment to economizer.

### II - SHIPPING DAMAGE

Check unit for shipping damage. Receiving party should contact last carrier immediately if shipping damage is found.

### III - GENERAL

These instructions are intended as a general guide and do not supersede local codes in any way. Authorities having jurisdiction should be consulted before installation.

### IV - REQUIREMENTS

When installed, the unit must be electrically wired and grounded in accordance with local codes or, in the absence of local codes, with the current National Electric Code, ANSI/NFPA No. 70.

### V - APPLICATION

Energy Recovery Ventilators (**ERV**) are used with 15 to 20 ton rooftop units. These wheels conserve energy by mixing warmer air with cooler air in the following manner:

#### Recovery Ventilator Mode

The Recovery Ventilator mode is accomplished by two blowers providing continuous exhaust of stale indoor air and replacement by equal amount of outdoor air. Energy recovery is achieved by slowly rotating the energy recovery wheel within the cassette frame work. In winter, the wheel adsorbs heat and moisture from the exhaust air stream during one half of a complete rotation and gives them back to the cold, drier intake air supply during the other half rotation. In summer, the process is automatically

reversed. Heat and moisture are absorbed from incoming fresh air supply and transferred to the exhaust air stream. This process allows outdoor air ventilation rates to be increased by factors of three or more without additional energy penalty or increase in size of heating or air conditioning systems.

### VI - RIGGING UNIT FOR LIFTING

1. Maximum weight of unit is — 900 Lbs (crated).
2. Remove crating. Then remove access panel to retrieve box assembly. **See Figure 1.** Replace access panel.
3. All panels must be in place for rigging.
4. Lifting lugs are supplied with the unit. Loosen machine bolts and rotate lifting lug as shown in **Figure 1.**

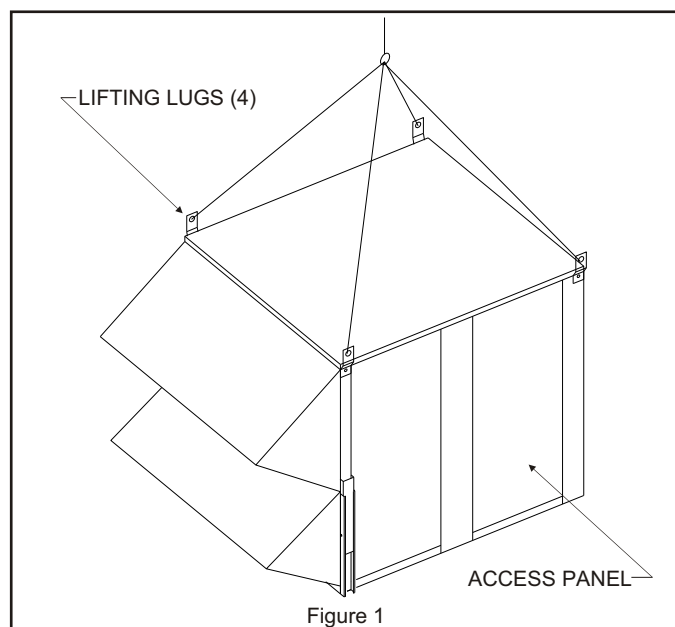


Figure 1

### VII - INSTALLATION

**Note:** The ERV unit is equipped with a support block that must be removed to allow the unit to change operating modes. This block may cause damage to system if not removed.

## ⚠ WARNING



Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch(es). Unit may have multiple power supplies.

1. Disconnect all power to rooftop unit.

## ⚠ CAUTION

Danger of sharp metallic edges. Can cause injury. Take care when servicing unit to avoid accidental contact with sharp edges.

2. Remove the rooftop return air access panels. Also remove any hoods and/or power exhaust equipment. Discard hoods, power exhaust equipment, and return air access panels.
3. Verify and/or install an economizer. The ERV will **ONLY** work with RSI economizers:
4. Remove the enthalpy control sensor from the economizer. Keep enthalpy control sensor. It will be reinstalled in the ERV.
5. Locate the provided end switch, cam screw, washer, bolts, nuts and bracket in box assembly.
6. Install the cam on the economizer exposed blade pivot with shoulder pointing outward by attaching with provide 10-32 x 1" screw and rubber washer. Position cam and screw, but do not completely tighten screw. Next attach switch bracket to economizer end plate using provided 1/2" self-tapping screws. Then mount switch to bracket using the oblong holes with provided 6-32 x 1" bolts and nuts. **See Figure 2.** This cam will trip the end switch S122 when damper rotates. Set the end switch arm so that it closes when fresh air dampers are open 50% or greater. Tighten screw to secure cam.
7. Locate the provided low voltage field harness. Wire the field harness to the economizer controls per the field wiring harness diagram provided in this installation instructions. Remove the wires that were connecting the enthalpy control of the economizer and replace them with purple and blue wires on the field wiring harness.
8. Clean up wiring around the economizer and neatly route the wires to clear any moving parts.
9. Route the excess wire of the field wiring harness out the return air. Coil the excess wire inside the rooftop unit to clear installation of the ERV.
10. Install side filter panel to RTU. Secure into place with provided screws.
11. Attached platform support rail centered on rooftop unit base rail with channel pointing upward.
12. Locate roll of provided 3/4" and 1/8" gasket material. Apply 3/4" gasket to the middle and bottom decks of the ERV. Also apply 1/8" gasket to perimeter of ERV that contacts RTU.
13. Using lifting lugs, raise ERV unit approximately three (3) feet. Remove nut and bolt assembly to slide

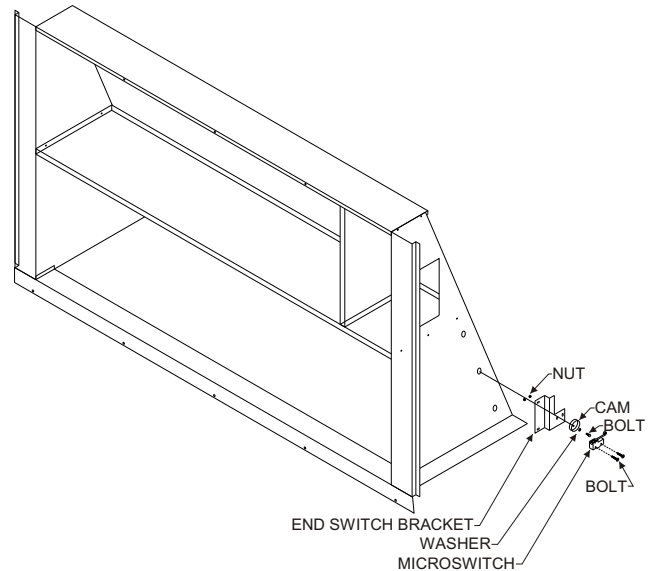


Figure 2

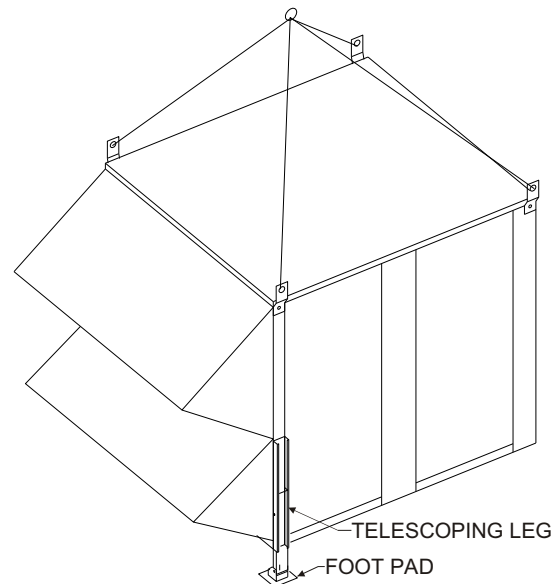


Figure 3

telescoping part of leg half way out of guide and attach flat foot with hardware provided in bag assembly. Position standoff legs so that flat foot is on bottom of stand and reinstall nut and bolt assembly. **DO NOT** fasten tightly, adjustment will need to be made when unit is put into position. **See Figure 3.**

14. Lift and move ERV unit into position with open end in-line with back door panel horizontal openings.

**Note: A treated 2" x 6" x 48" piece of wood or equivalent equipment support should be used to under feet of standoff legs to prevent roof penetration.**

15. Lower ERV into platform support rail catching the front edge of the ERV bottom into the flange. With the ERV in place, adjust the standoff legs to level and support ERV against rooftop unit side filler panels. Use screws to securely fasten ERV to rooftop unit. Tighten securely. Rotate lifting lug to original position and tighten machine bolts.

16. Insert and secure top filler panel under top flange of rooftop unit and against top flange of ERV.
17. Seal, if required, along face (top and sides) of ERV unit where it meets rooftop unit to insure no air leakage.
18. Locate the enthalpy control sensor removed earlier from the rooftop unit. Remove the connectors and wires from its terminals.
19. Remove the screws to the top panel of the fresh air hood on the ERV labeled "filter access". Push up the top panel and remove the air filter. Reinstall the enthalpy control sensor with self-tapping screws on the right side panel of the fresh air intake hood.
20. Remove the ERV access panels. Locate the bundle of wires on the top deck. Route the blue and purple wires to the enthalpy control sensor. Connect the purple wire to the "+" terminal on the enthalpy control and the blue wire to the "S" terminal. See field wiring diagram.
21. Remove ERV support block to allow wheel rotation when unit is placed in operation.
22. All electrical connections must conform to any local codes and current National Electric Codes (NEC) and Canadian Electric Codes (CEC). Refer closely to unit wiring diagram in unit and/or in these instructions for proper wiring connections. Refer to the unit nameplate for minimum circuit ampacity and maximum overcurrent protection size. Electrical data is listed on unit rating plate and motor nameplates.
23. Connect line voltage power to ERV from rooftop unit disconnect switch through the knock out. Connect the line voltage to the ERV control box per the wiring diagram.
24. Ground unit with a suitable ground connection either through unit supply wiring or earth ground.

**Note: Unit voltage entries must be sealed weather tight after wiring is complete.**

25. Replace access panels onto the ERV unit and secure.
26. Restore power to unit.
27. Balancing is done by removing the plastic plugs in door panels (4 total).
28. With a manometer measure pressure drop [inches of water column] across the top half of ERV (top holes in door panel). Unit CFM is determined by referring to **Table #1**. If CFM values are not per design, adjust internal damper setting inside rooftop unit. This accomplished by loosening set screw on damper frame of positioning rod or slide damper. The repeat measurement method.
29. Place plastic plugs back into door panels
30. Cleanup once ERV is operating properly. Caulk any open joints, holes or seams to make the unit completely air and water tight.
31. Leave this instruction manual with owner or in an envelope to be kept near the unit.

## VIII - OPERATION

### How It Works

The unit contains an Energy Recovery Wheel (ERW) that is a new concept in rotary air-to-air heat exchanger. Designed as a packaged unit for ease of installation and maintenance, only matching up to rooftop unit with an internal economizer and connection of electrical power is required to make the system operational. The concept consists of a unique rotary energy recovery wheel that rotates in and out of fresh air streams within a heavy duty, permanently installed blower cabinet that provides ready access to all internal components. The media is polymeric material that is coated and permanently bonded with a dry desiccant for total enthalpy recovery. The wheel is belt driven by PSC motor and drive belt.

When slowly rotating through counter flowing exhaust and fresh air streams the ERV adsorbs sensible heat and latent heat from the warmer air stream and transfer this total energy to the cooler air stream during the second half of its rotating cycle. Rotating at 60 revolutions per minute, the wheel provides constant flow of energy from warmer to cooler air stream. The large energy transfer surface and laminar flow through the wheel causes this constant flow of recovered energy to represent up to 85% of the difference in total energy contained within the two air streams.

Sensible and latent heat are the two components of total heat. Sensible heat is energy contained in dry air and latent heat is the energy contained within the moisture of the air. The latent heat load from the outdoor fresh air on an air conditioning system can often be two to three times that of the sensible heat load and in the winter it is a significant part of a humidification heat load.

During both the summer and winter, the ERV transfers moisture entirely in the vapor phase. This eliminates wet surfaces that retain dust and promote fungal growth as well as the need for a condensate pan and drain to carry water.

Because it is constantly rotating when in the air stream, the ERV is always being cleared by air, first in one direction then the other. Because it is always dry, dust or other particles impinging on the surface during one half cycle, are readily removed during the next half cycle.

Low Ambient Kit is appropriate for climates with limited HVAC system operation when outdoor temperatures are below 15°F.

The frost threshold is the outdoor temperature at which frost will begin to form on the ERV wheel. For energy recovery ventilators, the frost threshold is typically below 15°F. Frost threshold is dependent on indoor temperature and humidity. The table shows how the frost threshold temperatures vary depending on indoor conditions.

FROST THRESHOLD TEMPERATURE	
INDOOR RH AT 70°F	FROST THRESHOLD TEMPERATURE
20%	0°F
30%	5°F
40%	10°F

Because Energy Recovery Ventilators have a low frost threshold, frost control options are not necessary in many climates. Where outdoor temperatures may drop below the frost threshold during the ERV operational hours, exhaust only frost control option is available.

## Low Ambient Kit

Low Ambient Kit turns off the supply blower when outdoor temperatures fall below the frost threshold. Exhaust Only set points are field adjustable with a factory supplied thermostat. Supply fan operation is automatically restored when the exhaust air temperature rises above the thermostat set point. Provisions for introducing make-up air into the building when the supply blower is off to avoid depressurization should be considered.

## Recovery Wheel Mode

On a thermostat call for blower operation in heating, cooling or continuous blower, the ERV media will rotate between fresh air and exhaust air streams. Both the fresh air blower and exhaust air blower will be operating to overcome the air resistance of the ERV media. The ERV unit will operate in this mode until economizer mode is activated.

## Economizer/Power Exhaust Mode

On the activation of the economizer mode [closure of damper switch], the ERV unit will shutdown for approximately 60 seconds to allow the ERV media to pivot out of the air stream. After the delay timer has been satisfied, the exhaust air blower will operate. The ERV unit will act as a power exhaust unit.

This mode will continue until economizer has been deactivated. The exhaust air blower will shut down and the delay timer will be activated. During this time period the ERV media will pivot back into the air stream. When timing is complete the unit will operate in the Recovery Wheel Mode.

## IX - SYSTEM CHECK

1. Disconnect ERV main power.
2. Remove ERV control access panel and install jumper at low voltage terminal strip between "TB37-1 and TB37-2". Wheel should pivot out of air stream.

**Note - If optional Low ambient kit is used the jumper between TB37-5 & TB37-6 should be removed. Also if system check out is being conducted at low ambient temperatures, technician should be aware that this kit can cause system not to operate.**

3. Turn thermostat to "Cont" for blower operation.
4. Restore power to unit. Observe ERV drive motors (damper motor) for wheel and dampers, it should pivot wheel out of air stream, opening fresh air dampers and a delayed exhaust blower will operate.
5. Remove jumper(s) from low voltage terminal block (TB37). View pivoting of media back into air stream and closing of fresh air dampers. After delay timer has cycled then both fresh air blower and one exhaust air blower will operate.
6. Disconnect main power to unit before making adjustment to economizer and/or ERV unit.
7. Replace ERV control access panel.
8. Set thermostat to normal operating position.
9. Restore power to unit.

## A - Economizer Settings

Refer to economizer instructions for minimum air flow requirement. The damper end switch setting on the internal economizer damper assembly is field adjustable to any position above minimum air flow for fresh air requirements at the customers specified conditions.

## B - Blower Speed Adjustment

Blower speed selection is accomplished by changing the sheave setting on both fresh air and exhaust air blowers. Both blowers are factory set at "closed" for maximum airflow. To determine air flow setting, external static pressure readings will need to be read across the ERV. **See Figure 4** for location to take pressure readings.

1. Disconnect main power to unit before making adjustment to economizer and/or ERV unit.
2. Replace ERV control access cover.
3. Set thermostat to normal operating position.
4. Restore power to unit.

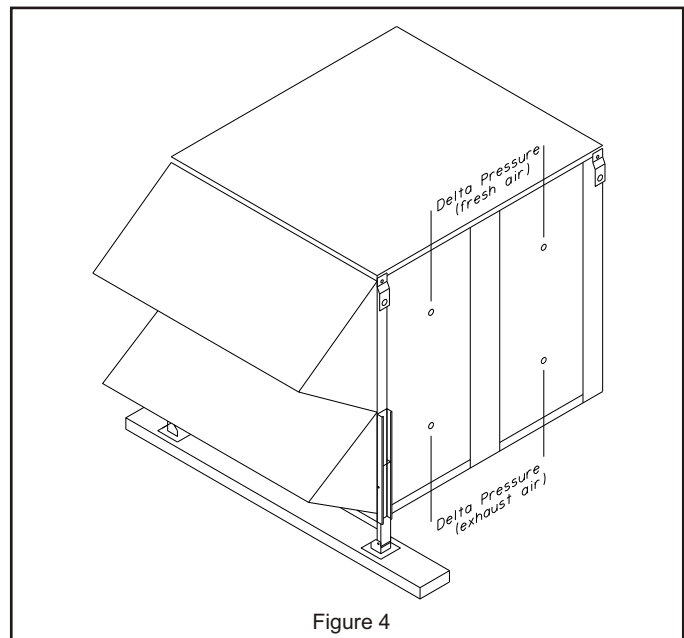


Figure 4

## C - Air Balancing Adjustment

1. Remove plastic plugs in door panels (4 total).
2. With a manometer measure pressure drop [inches of water column] across top half of ERV (top holes in door panel). Unit CFM is determined then by referring to **Table #1**. If CFM values are not per design, adjust damper in fresh air hood and repeat measure method.
3. Repeat the same process for the bottom half of ERV. If CFM values are not per design, adjust internal dampers inside the ERV. This is accomplished by removing door panel at the return air opening, loosening screw in center of damper, then slide damper rod up or down in the return airstream and re-tighten screw. Replace door panel and repeat measurement method.
4. Place plastic plugs back in to door panels.



## X - MAINTENANCE

### **Motor Maintenance**

All motors use prelubricated sealed bearings; no further lubrication is necessary.

### **Mechanical Inspection**

Make visual inspection of dampers, linkage assemblies and ERV rotating bearings during routine maintenance. Filters should be checked periodically and cleaned when necessary. Filter is located in fresh air hoods. **DO NOT** replace permanent filters with throwaway type filters.

### **Belt Alignment**

Proper alignment is essential to maintain long V-Belt life. Belt alignment should be checked every time belt maintenance is performed, each time the belt is replaced, and whenever sheaves are removed or installed.

### **Belt Installation**

Always move the drive unit forward so the belt can be easily slipped into the groove without forcing them. Never force the belt into a sheave with a screw driver or wedge. You will damage the fabric and break the cords. It is recommended that the pulley center distances be offset by  $\frac{3}{4}$ " for proper length. This will allow the motor assembly to slide forward to remove belt and backward for belt tension.

### **Belt Tension**

Measure the span length (center distance between pulleys when belt is snug). Mark center of span, then apply a force (6 to 9 Lbs on new belts) perpendicular to the span large enough to deflect the belt  $\frac{1}{64}$ " for every inch in span length.

### **Energy Recovery Wheel Maintenance**

Eight pie-shaped ERW segments, are seated on stops between the segment retainer which pivots on the wheel rim and secured to the hub and rim of wheel. Annual inspection of the self cleaning wheel is recommended. With power disconnected, remove ERV access panels (rear) and unplug [J150 and P150] (**Refer to wiring diagrams in this instruction manual**). Remove segment and wash with water and/or mild detergent.

To install wheel segments follow steps A through E . **See Figure 5.** Reverse procedure for segment removal.

- A. Unlock two segment retainers (one on each side of the selected segment opening).
- B. With the embedded stiffener facing the motor side, insert the nose of the segment between the hub plates.
- C. Holding segment by the two outer corners, press the segment towards the center of the wheel and inwards against the spoke flanges. If hand pressure does not fully seat the segment, insert the flat tip of a screw driver between the wheel rim and outer corners of the segment and apply downward force while guiding the segment into place.
- D. Close and latch each segment retainer under segment retaining catch.
- E. Slowly rotate the wheel 180°. Install the second segment opposite the first for counterbalance. Rotate the two installed segment 90° to balance the wheel while the third segment is installed. Rotate the wheel 180° again to install the fourth segment. Repeat this sequence with the remaining four segments.

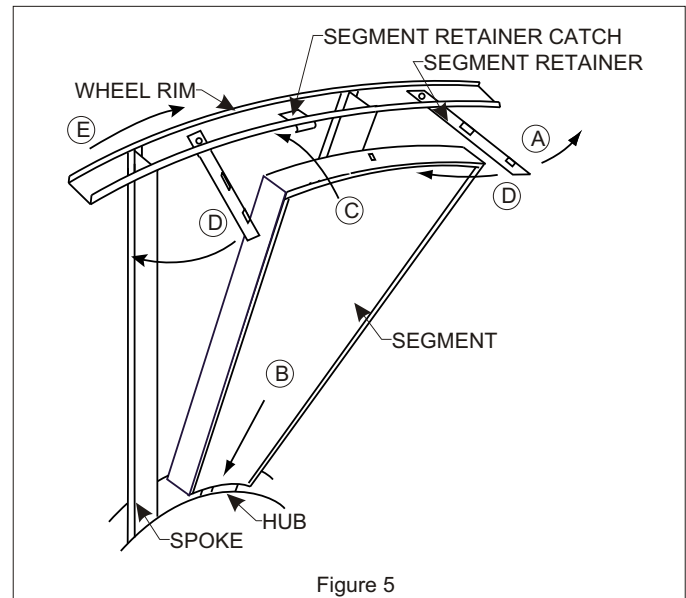


Figure 5

## XI - WARRANTY

### **RSI Manufactured Parts**

In the event that defects in workmanship or materials originate in any part manufactured by RSI, FOB point of manufacture, we guarantee to repair or replace that part, within three (3) months of the shipment date.

### **Other Supplied Parts**

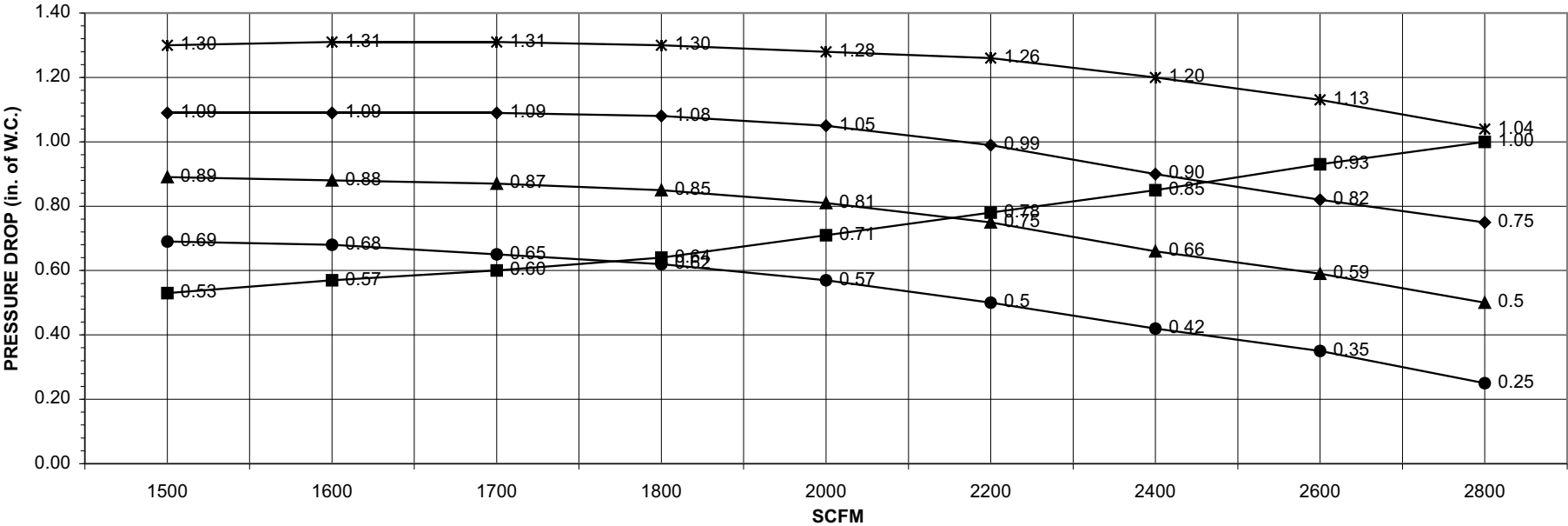
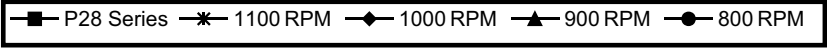
Additionally, RSI guarantees to replace standard components purchased new from a RSI vendor, (motors, controls, etc.) that may be found defective, within twelve (12) months of the installation date. The components warranty, however, excludes service call charges and labor cost for replacing or adjusting the defective part.

### **Limitation of Warranties**

Misapplication, destruction, negligence or alteration constitute the warranty and/or the components warranty of RSI products and/or parts, null and void. This warranty is provided in lieu of all other written, stated or implied warranties.

# ENERGY RECOVERY VENTILATOR

SCFM vs. PRESSURE DROP

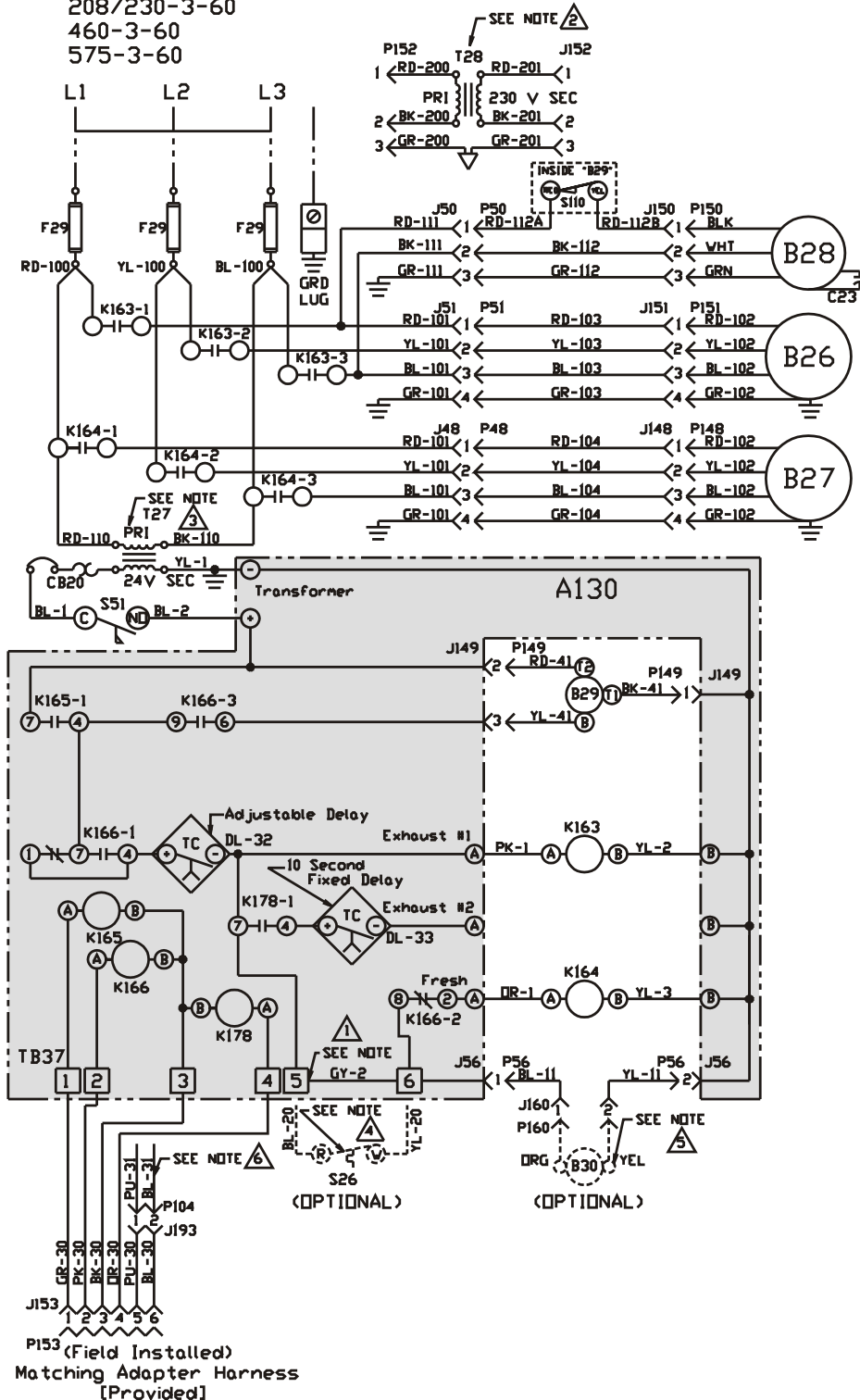


Equation of line:  $SCFM = (PD + 0.01) / 0.00036$

TABLE #1

# ERV UNIT SCHEMATIC DIAGRAM

POWER SUPPLY  
208/230-3-60  
460-3-60  
575-3-60

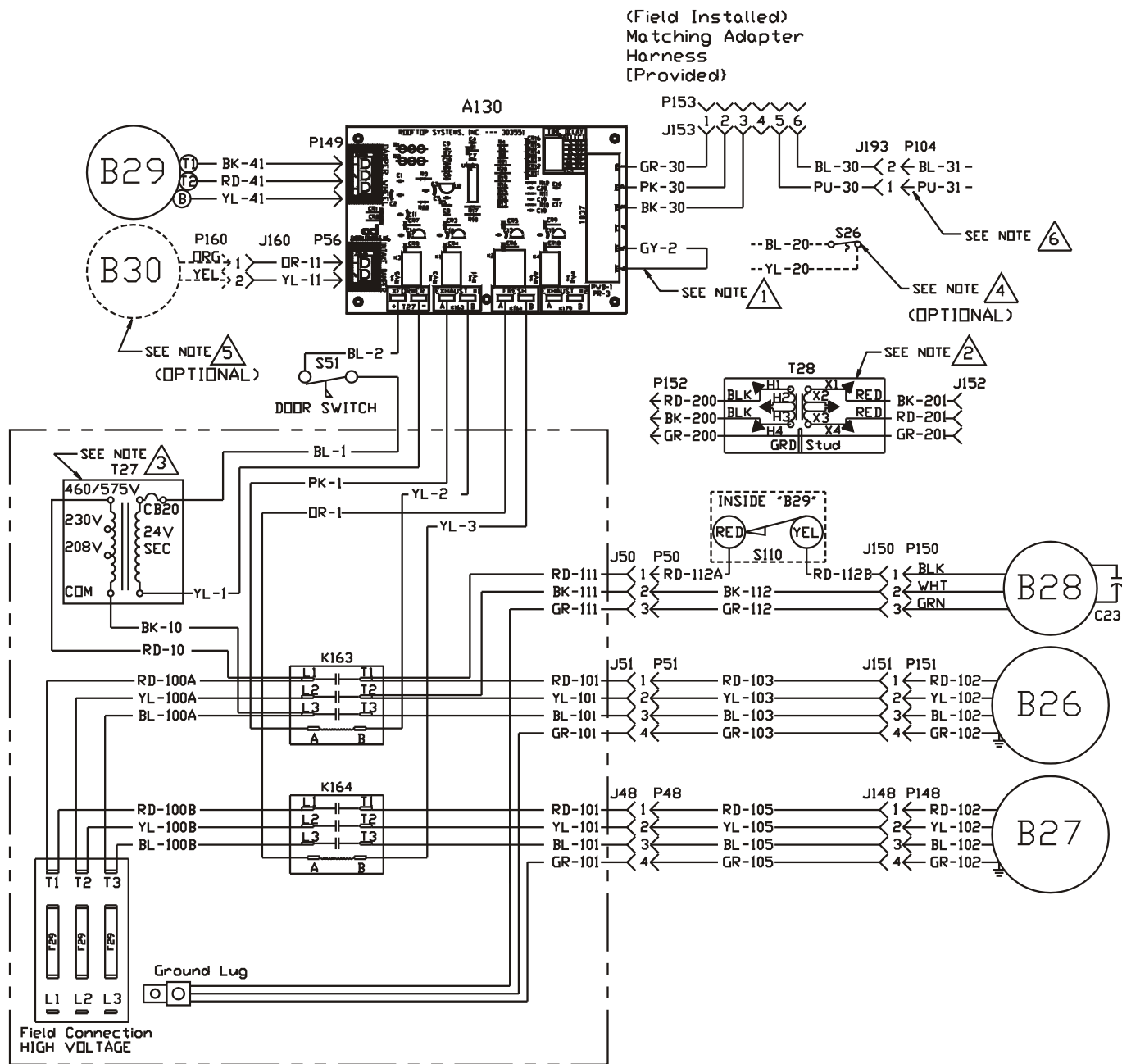


COMPONENT CODE	
A130	Pivot Wheel Board
B26	Motor, Exhaust Air
B27	Motor, Fresh Air
B28	Desiccant Wheel
B29	Motor, Wheel & Damper
B30	Motor, Damper (Optional)
C23	Capacitor, Wheel Motor
F29	Fuse
J48	Jack, Control Box (Fresh Air)
J50	Jack, Control Box (Wheel)
J51	Jack, Control Box (Exhaust Air)
J56	Jack, Control Box (Damper)
J148	Jack, Fresh Air Motor Harness
J150	Jack, Wheel Motor Harness
J151	Jack, Exhaust Air Motor Harness
J152	Jack, Transformer (High Voltage)
J153	Jack, Field Harness
J160	Jack, Damper Motor
J193	Jack, Enthalpy Sensor
K163	Contactor, Exhaust Air Motor
K164	Contactor, Fresh Air Motor
P48	Plug, Fresh Air Motor Harness
P50	Plug, Wheel Motor Harness
P51	Plug, Exhaust Air Motor Harness
P56	Plug, Damper Motor Harness
P104	Plug, Outdoor Enthalpy Sensor
P148	Plug, Fresh Air Motor
P149	Plug, Wheel & Damper Motor
P150	Plug, Wheel Motor
P151	Plug, Exhaust Air Motor
P152	Plug, Transformer (High Voltage)
P153	Plug, Field Harness
P160	Plug, Damper Motor
S26	Switch, Low Ambient (Optional)
S51	Switch, Door
S110	Switch, Tip
T27	Transformer Control
T28	Transformer, Step-down (Optional)
TB37	Terminal Block (Low Voltage)
WIRE COLOR CODE	
BK	Black
BL	Blue
GR	Green
GY	Gray
OR	Orange
PK	Pink
RD	Red
WH	White
YL	Yellow

## Notes:

1. Remove jumper to install field optional low ambient switch.
2. Step-down transformer assembly for 460/575 volt units (only) connect between J50 and P50.
3. Move wire for different input voltage
4. Optional low ambient switch.
5. Optional motorized intake damper.
6. Reposition enthalpy control into intake hood of ERV from rooftop unit economizer.

# ERV UNIT WIRING DIAGRAM



## Notes:

1. Remove jumper to install field optional low ambient switch.
2. Step-down transformer assembly for 460/575 volt units (only) connect between J50 and P50.
3. Move wire for different input voltage.
4. Optional low ambient switch.
5. Optional motorized intake damper.
6. Reposition enthalpy control into intake hood of ERV from rooftop unit.

Desiccant Wheel for Rooftop Unit  
208-230/460V/575V (3 PH)

Unit#: 01-P28-01XX-23/-33/-43



# Field Wiring Harness

Trane  
Rooftop  
Unit  
YCD/TCD

