



Shoffner Kalthoff

Mechanical Electrical Service

Uncompromising Quality. Unwavering Commitment.

Ladd Pump Station

List of Contacts

Air Distribution

Hoffman and Hoffman
408 Erin Dr.
Knoxville, TN 37919
Phone: 865-450-9770

Start Ups

Shoffner Mechanical Services
1010 Wilder Place
Knoxville, TN 37915
Phone: 865-521-6948

Test and Balance

Systems Analysis Inc.
217 Oxmoor Cr.
Birmingham, AL 35209
Phone: 251-442-0800

DATE: 9/9/14

HOFFMAN ° HOFFMAN



INC.

408 Erin Drive
Knoxville, TN 37919

PHONE (865) 450-9770
FAX (865) 450-9353

LETTER OF TRANSMITTAL

TO: SKMES
Skyler Sinclair

JOB: Ladd Pump Station
YOUR ORDER NO:
OUR ORDER NO:
MANUFACTURER:

In connection with the above order, we are enclosing herewith 1 copies of the following:

 Submittal Data for Approval. We would appreciate very much your having two (2) copies of each of these prints marked "Approved" and returned to the above noted office location at your earliest convenience. Upon receipt of each of these prints the order will be entered with the factory for construction and scheduling.

 Submittal Data for Record. These drawings are submitted for record purposes only and give all the physical characteristics and performance data as it applies to the equipment called for on this order.

 Manufacturer's Warranty Statement. The manufacturer's warranty policies as stated herein apply to the equipment furnished on this order.

XX **Operation and Maintenance Instructions.** These instructions are provided for your records.

 Other _____

Remarks: Greenheck and Marley (Berko)

Copy to: file

REPLY TO: Wendell Moore
(Salesperson)
LOCATION: Knoxville, TN

Installation, Operation and Maintenance Manuals

Job Title: Ladd Pump Station

Elevation: (ft) 981

Date: 09/08/14

Submitted By: Wendell Moore

HOFFMAN & HOFFMAN INC

408 ERIN DRIVE

KNOXVILLE, TN 37919

US

Phone: (865)450-9770

Fax: (865)450-9353

Email Address: wendell.moore@hoffman-hoffman.com



P.O. Box 410 Schofield, WI 54476 (715) 359-6171 FAX (715) 355-2399 www.greenheck.com

Ladd Pump Station

Product IOMs

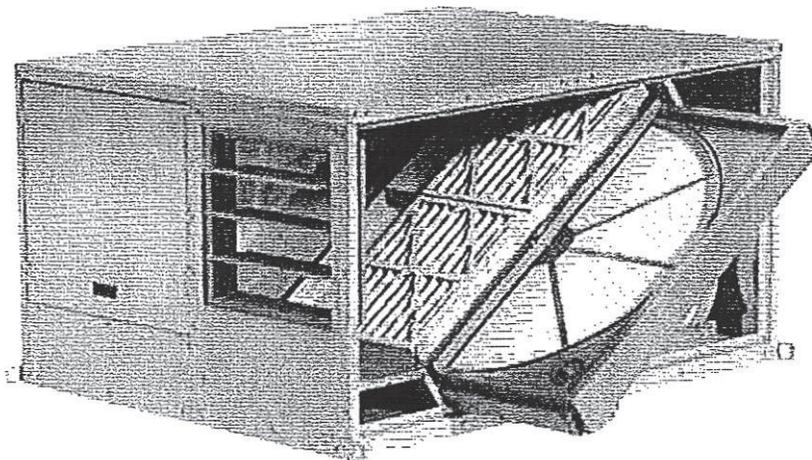
Part Name	Model Name
ERV-1	ERV

Installation, Operation and Maintenance Manual

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage. Retain instructions for future reference.

Models:

ERV-10
ERV-20
ERV-45
ERV-55
ERV-90
ERV-120



General Safety Information

Only qualified personnel should install this system. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

DANGER

Always disconnect power before working on or near this equipment. Lock and tag the disconnect switch or breaker to prevent accidental power up.

CAUTION

When servicing the unit, the internal components may be hot enough to cause pain or injury. Allow time for cooling before servicing.

CAUTION

Precaution should be taken in explosive atmospheres.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. All moving parts must be free to rotate without striking or rubbing any stationary objects.
3. Unit must be securely and adequately grounded.
4. Do not spin fan wheel faster than maximum cataloged fan RPM. Adjustments to fan speed significantly effects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to the unit while it is running.

Receiving

Upon receiving the product, check to make sure all items are accounted for by referencing the bill of lading to ensure all items were received. Inspect each crate for shipping damage before accepting delivery. Notify the carrier if any damage is noticed. The carrier will make notification on the delivery receipt acknowledging any damage to the product. All damage should be noted on all the copies of the bill of lading which is countersigned by the delivering carrier. A Carrier Inspection Report should be filled out by the carrier upon arrival and the Traffic Department. If damaged upon arrival, file claim with carrier. Any physical damage to the unit after acceptance is not the responsibility of Greenheck Fan Corporation.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

Units are to be rigged and moved by the lifting brackets provided or by the skid when a forklift is used. Location of brackets varies by model and size. Handle each piece in such a manner as to keep from scratching or chipping the coating. Damaged finish may reduce ability of the unit to resist corrosion.

Storage

Units are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the unit and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

Inspection and Maintenance during Storage

While in storage, inspect units once per month. Keep a record of inspection and maintenance performed

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate all moving components by hand ten to fifteen revolutions to distribute lubricant on motor and bearings. If paint deterioration begins, consideration should be given to touch-up or repainting. Units with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Wipe clean thoroughly with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive or WD-40® or the equivalent.

Table of Contents

Product Overview	3
Supplemental Installation, Operation and Maintenance Manuals	3
Optional Subassemblies	3
Installation	
Dimensional Data	4-5
Recommended Roof Openings & Weights	6
Service Clearances	7
Access Panel Locations	8-9
Handling	9
Lifting	9
Roof Curb Mounting	10
Curb Outside Dimensions and Weights	10
Ductwork Connections	10
Rail Mounting / Layout	11
Outdoor Air Weatherhood	11
Exhaust Weatherhood	11
Dampers	11
Electrical Information	
General Electrical Information	12
Control Center Components	13
Optional Accessory Wiring Schematics	14
Unit Overview	15
Optional Component Overview	
Economizer	15
Frost Control	16
Variable Frequency Drive	16
CO ₂ Sensor	16
Rotation Sensor	16
Dirty Filter Switch	16
Service Outlet	16
Start-Up	
General	17
Pre Start-Up Checklist	17
Special Tools Required	17
Start-Up Checklist	17
Optional Accessories Checklists	18
Start-Up Components	
Fans	19
Vibration	20
Energy Recovery Wheel	20
Drive Belt	20
Air Seals	20
Optional Start-Up Components	
Dirty Filter Switch	20
Economizer	21
Frost Control	22
Variable Frequency Drives	22-24
Routine Maintenance	25-28
Troubleshooting	
Economizer Alarms	28
Airflow	29
Unit	30-31
Maintenance Log	Backcover
Our Commitment	Backcover

Product Overview

The ERV brings in fresh, outdoor air and removes stale, exhaust air. Prior to discharging the exhaust air, the energy recovery wheel transfers energy from the exhaust air to the outdoor air at an efficiency of 70-80%. Simply put, this unit preconditions the outdoor air to save money on heating and cooling costs.

Supplemental IOMs

Refer to the following Installation, Operation and Maintenance (IOM) Manuals for additional details:

- ERV-90 and ERV-120 Curbs
- ERV Exhaust Weatherhood

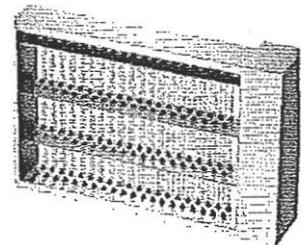
Optional Subassemblies

Electric Heater Application/Operation

Factory installed electric heaters can be provided for preheat frost control. An electric preheater warms the outdoor air prior to the energy recovery wheel to prevent frosting on the wheel. Electric heaters are available in 208, 230, or 460 VAC (refer to heater nameplate for voltage).

Preheaters: Preheaters are standard as single-stage on/off control. Preheaters are single point wired at the factory. A thermodisc temperature sensor (with a 5°F set point) is mounted in the outdoor airstream after the preheater to turn the preheater on. See Frost Control Application/Operation for typical set points. If the temperature falls below the set point and the wheel pressure drop sensor is triggered, the preheater will turn on.

Access to the preheater control panel is through the outdoor air filter door.



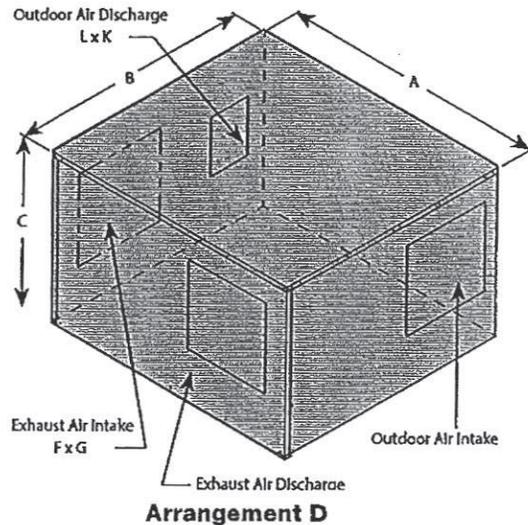
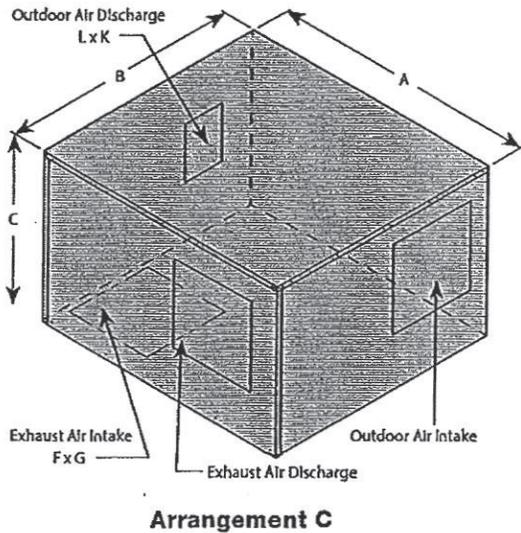
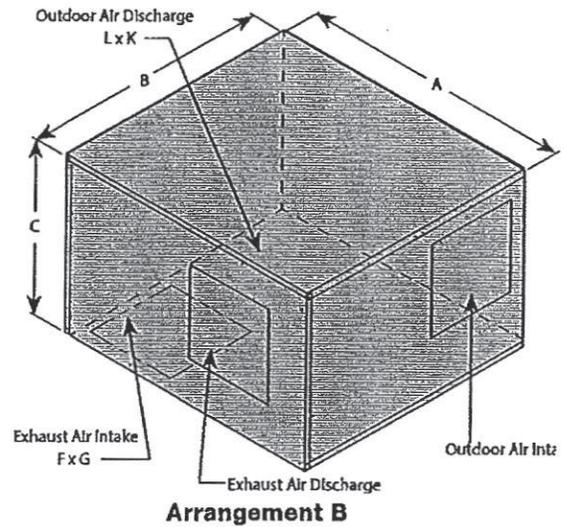
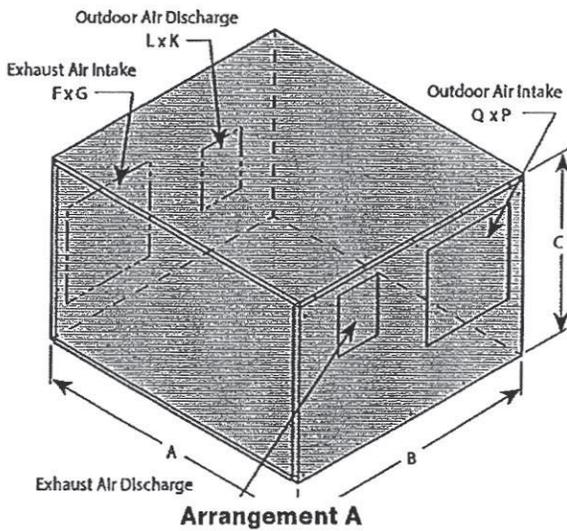
Installation

Dimensional Data

ERV-10, 20, 45 and 55

Unit Size	Exterior Dimensions			Unit Opening Dimensions					
	A	B	C	F	G	K	L	Q	P
ERV-10	46	34	27	10	16	6/	7	10	16
ERV-20	62	51	34	18	18	8/	11/	19	18
ERV-45	67	67	44	24	24	10/	13/	26	26
ERV-55	75	70	67	22	27	16	18/	28	48

All dimensions are in inches.



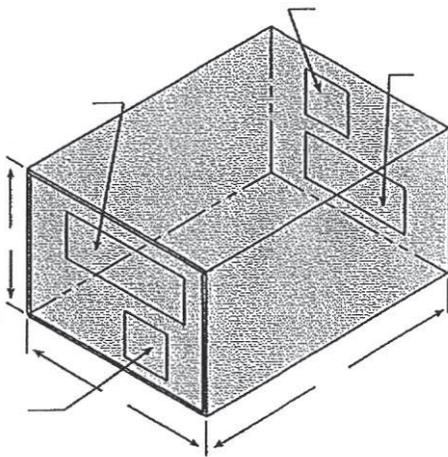
Installation

Dimensional Data

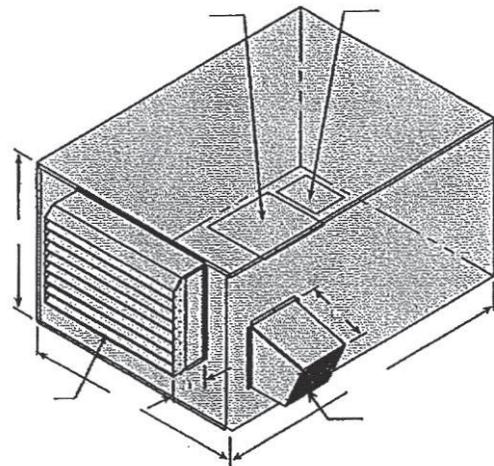
ERV-90 and 120

Unit Size	Exterior Dimensions					Unit Opening Dimensions					
	A	B	C	D	E	F	G	K	L	Q	P
ERV-90L	124	84	64	16	19	48	25	16	18/	60	25
ERV-90H	124	84	64	16	19	48	25	19	22	60	25
ERV-120H	146	97	77	17/	26/	60	28	23	25	70	30

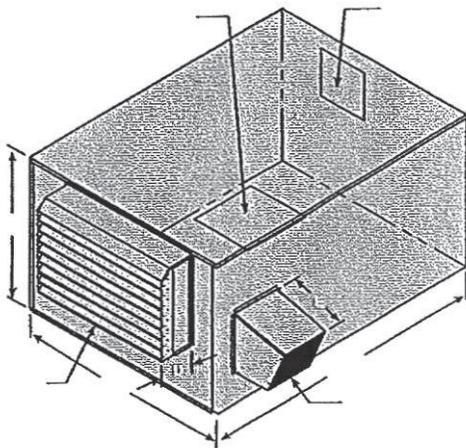
All dimensions are in inches.



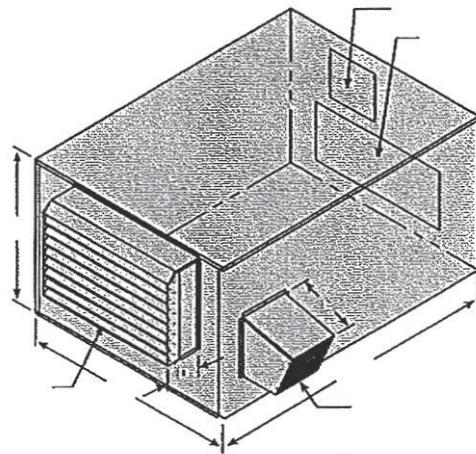
Arrangement A



Arrangement B



Arrangement C



Arrangement D

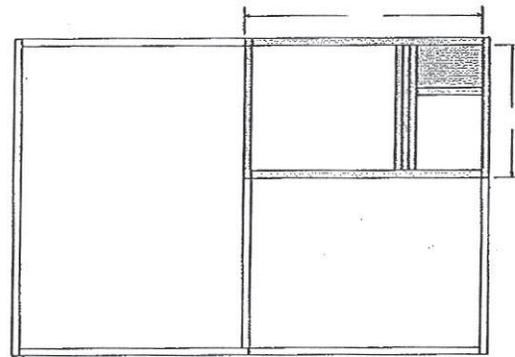
Recommended Roof Openings & Weights

Position the unit roof opening such that the supply discharge and exhaust inlet of the unit will line up with the corresponding ductwork. Be sure to allow for the recommended service clearances when positioning opening (see Service Clearances).

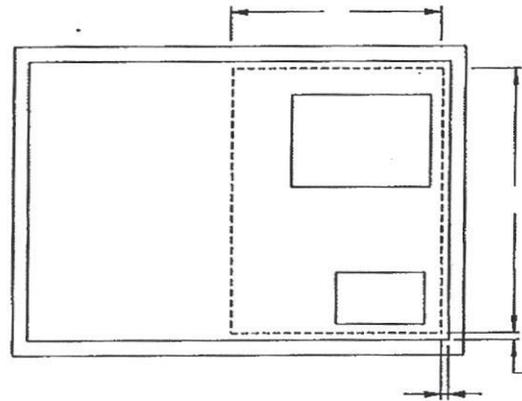
Do not face the outdoor air intake of the unit into prevailing wind and keep the intake away from any other exhaust fans. Likewise, position the exhaust discharge opening away from outdoor air intakes of any other equipment.

When cutting only duct openings, cut opening 1 inch (25 mm) larger than duct size to allow clearance for installation. Area enclosed by roof curb must comply with clearance to combustible materials. If the roof is constructed of combustible materials, area within the roof curb must be ventilated, left open, or covered with non-combustible material which has an "R" value of at least 5. If area within curb is open, higher radiated sound levels may result.

Where the supply or warm air duct passes thru a combustible roof, a clearance of one inch must be maintained between the outside edges of the duct and combustible material in accordance with NFPA Standard 90A.



ERV-90 and 120



ERV-10, 20, 45 and 55

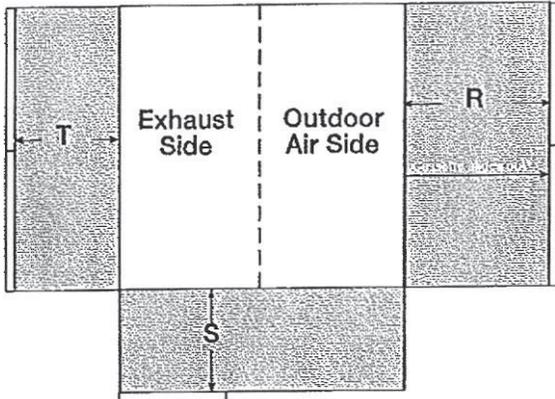
Unit Size	U	V	Approx. Weight (lbs.)
ERV-10	26.5	20	340
ERV-20	43	26	860
ERV-45	58	35	1290
ERV-55	60	30	1470
ERV-90	62	36	3230
ERV-120	77	38	3700

All dimensions are in inches. *Weight assumes outdoor unit with filters, weatherhoods and outdoor air intake damper.

Service Clearances

ERV-10, 20, 45 and 55 units require minimum clearances to perform routine maintenance, such as filter replacement, energy wheel cassette inspection, and fan belt adjustment. Blower and motor assemblies, energy recovery wheel cassette and filter sections are always provided with a service door or panel for proper component access. Clearances for component removal may be greater than the service clearances, refer to drawings below for these dimensions.

ERV-10, ERV-20, ERV-45, ERV-55



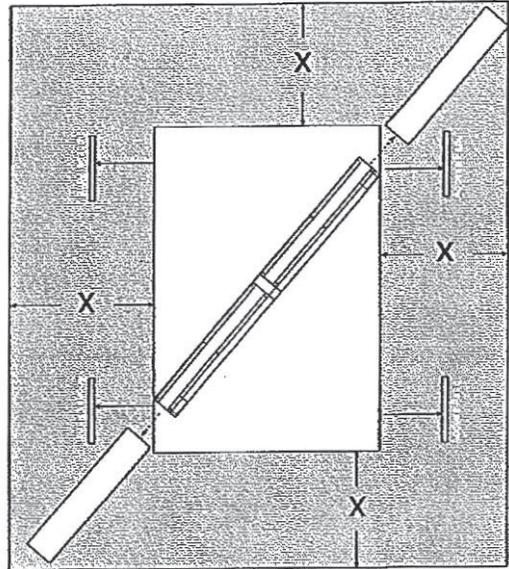
*ERV-10, 20, and 45 only.

Arrangement A

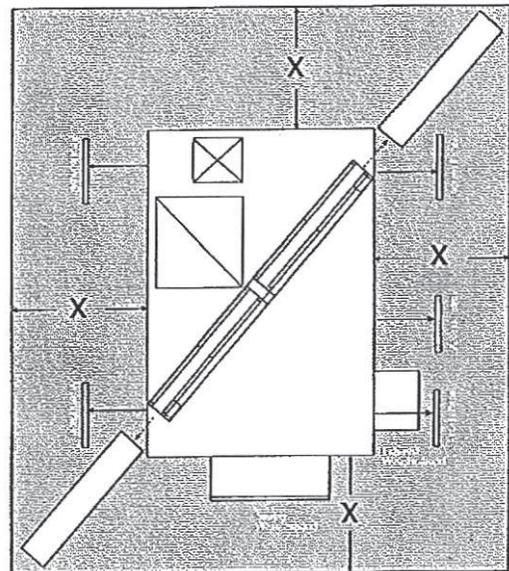
Recommended Service Clearances				
Unit Size	R	S	T	X
ERV-10	32	30	42	
ERV-20	44 (30 for maintenance)	30	42	
ERV-45	60 (39 for maintenance)	40	42	
ERV-55	65 (32 for maintenance)	40	42	
ERV-90				42
ERV-120				42

All dimensions are in inches.

ERV-90, ERV-120



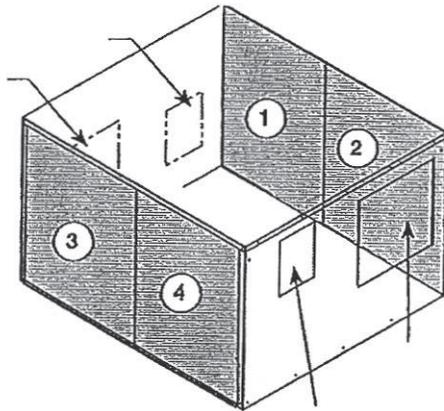
Arrangement A



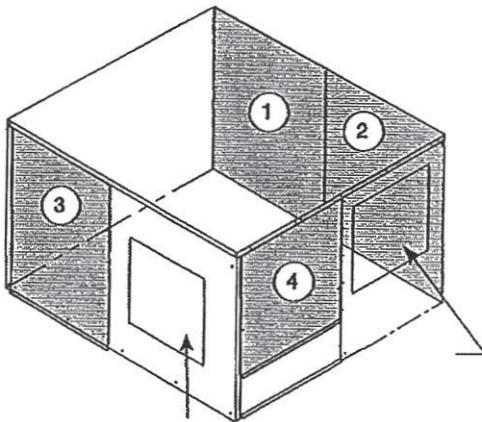
Arrangement B, C or D

Access Panel Locations

ERV-10, ERV-20, ERV-45, ERV-55

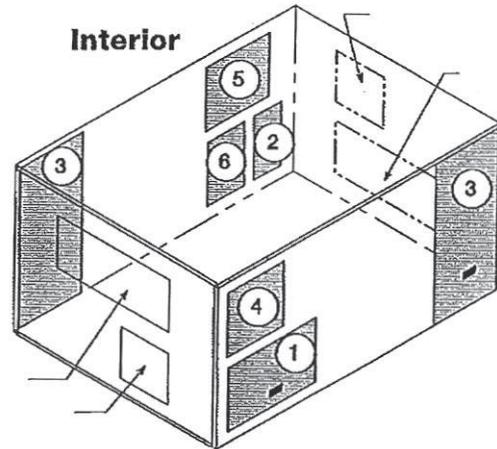


Arrangement A

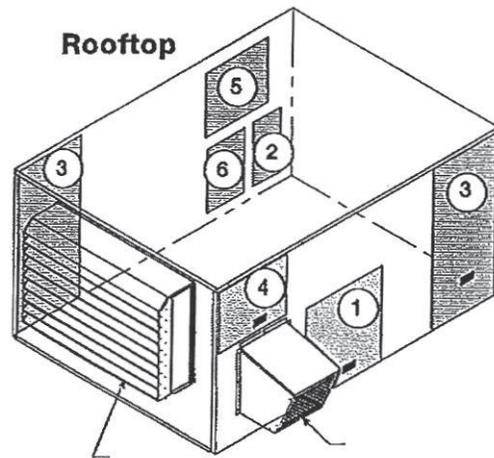


Arrangement B, C or D

ERV-90



Arrangement A



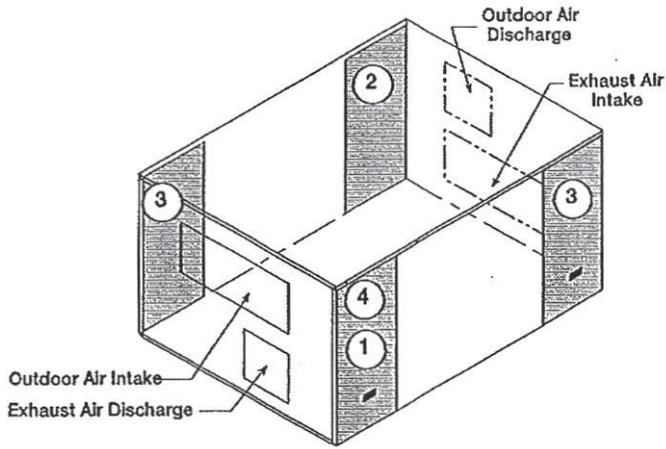
Arrangement B, C or D

①	Outdoor air blower and motor Energy wheel cassette
②	Energy wheel cassette Internal filters Outdoor air intake damper Frost control Outdoor air sensors
③	Main disconnect Electrical control center Internal filters
④	Exhaust air blower and motor

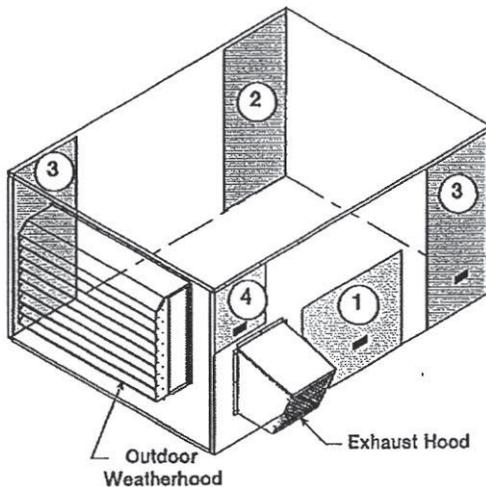
①	Exhaust blower and motor
②	Electric control center Main Disconnect
③	Energy wheel cassette Internal filters Frost control Outdoor air sensors
④	Preheater controls Outdoor air intake damper
⑤	Supply blower and motor
⑥	Exhaust air intake damper

Access Panel Locations continued

ERV-120



Arrangement A



Arrangement B, C or D

①	Exhaust blower and motor
②	Electric control center Main disconnect Supply blower and motor Exhaust air intake damper
③	Energy wheel cassette Internal filters Frost control Outdoor air sensor
④	Preheater controls Outdoor air intake damper

Handling

While this unit was constructed with quality and dependability in mind, damage still may occur during handling of the unit for installation. Exercise extreme caution to prevent any damage from occurring to the refrigerant system.

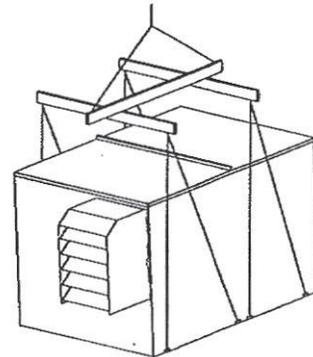
The system design and installation should follow accepted industry practice, such as described in the ASHRAE Handbook. Adequate space should be left around the unit for filter replacement and maintenance. Sufficient space should be provided on the side of the unit for routine service and component removal should that become necessary.

Lifting

WARNING

All factory provided lifting lugs must be used when lifting the unit. Failure to comply with this safety precaution could result in property damage, serious injury or death.

1. Before lifting, be sure that all shipping material has been removed from unit.
2. To assist in determining rigging requirements, weights are shown below.
3. Unit must be lifted by all lifting lugs provided on base structure.
4. Rigger to use suitable mating hardware to attach to unit lifting lugs.
5. Spreader bar(s) must span the unit to prevent damage to the cabinet by the lift cables.



6. Always test-lift the unit to check for proper balance and rigging before hoisting to desired location.
7. Never lift units by weatherhoods.
8. Never lift units in windy conditions.
9. Preparation of curb and roof openings should be completed prior to lifting unit to the roof.
10. Check to be sure that gasketing (supplied by others) has been applied to the curb prior to lifting the unit and setting on curb.
11. Do not use fork lifts for handling unit.

Roof Curb Mounting

Roof curb details including duct location dimensions, are available on ERV-90 & 120 Roof Curb Assembly Instructions.

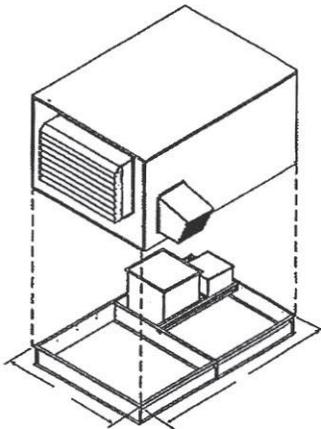
Rooftop units require curbs to be mounted first. The duct connections must be located so they will be clear of structural members of the building.

- 1. Factory Supplied Roof Curbs:** Roof curbs are Model GPI or GPNS for the ERV-10, 20, 45, 55. The GPI or GPNS ships assembled and includes a duct adapter.

Roof curbs are Model GKD for the ERV-90 and 120. The GKD ships in a knockdown kit (includes duct adapter) and requires field assembly (by others). Assembly instructions are included with the GKD curbs.

- 2. Install Curb:** Locate curb over roof opening and fasten in place. (Refer to Recommended Roof Openings). Check that the diagonal dimensions are within $\pm 1/8$ inch of each other and adjust as necessary. For proper unit operation, it is important that the installation be level. Shim as required to level.
- 3. Install Ductwork:** Installation of all ducts should be done in accordance with SMACNA and AMCA guidelines. Duct adapter provided to support ducts prior to setting the unit.
- 4. Set the Unit:** Lift unit to a point directly above the curb and duct openings. Guide unit while lowering to align with duct openings. Roof curbs fit inside the unit base. Make sure the unit is properly seated on the curb and is level.

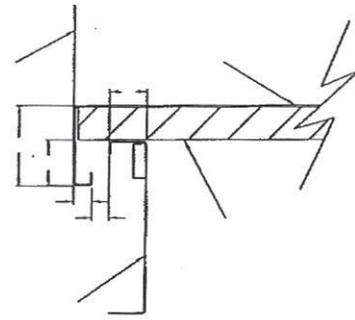
Curb Outside Dimensions and Weights



ERV-90 and 120

Unit Size	L	W	Curb Weight (lbs.)
ERV-10	42.5	30.5	60
ERV-20	58.5	47.5	115
ERV-45	63.5	63.5	160
ERV-55	71.8	66	185
ERV-90	120.5	80.5	520
ERV-120	142.25	93	700

All dimensions are in inches. Weights are for 12-inch high GPI type curbs.



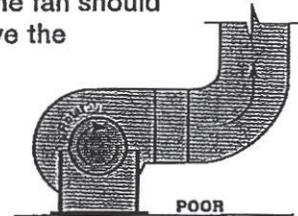
Curb Cap Details for Factory Supplied Roof Curbs

Unit Size	A	B	C	D	E
ERV-10	1.75	2.00	1.00	1.125	0.750
ERV-20	1.75	2.00	1.00	1.200	0.875
ERV-45	1.75	2.00	1.00	0.813	0.875
ERV-55	1.75	2.00	1.00	0.813	0.750
ERV-90	1.813	4.00	1.75	1.000	0.750
ERV-120	1.938	4.125	1.938	1.125	0.625

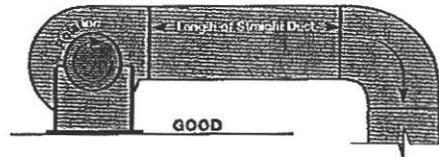
All dimensions are in inches.

Ductwork Connections

Examples of poor and good fan-to-duct connections are shown. Airflow out of the fan should be directed straight or curve the same direction as the fan wheel rotates. Poor duct installation will result in low airflow and other system effects.



POOR



GOOD

Recommended Discharge Duct Size and Length

Model	Blower Size	Duct Size	Straight Duct Length
ERV-10	10	9 x 9	36
ERV-20	10	14 x 14	36
ERV-45	12	20 x 20	36
ERV-55	15	28 x 28	60
ERV-90L	15	28 x 28	60
ERV-90H	18	32 x 32	60
ERV-120	20	34 x 34	72

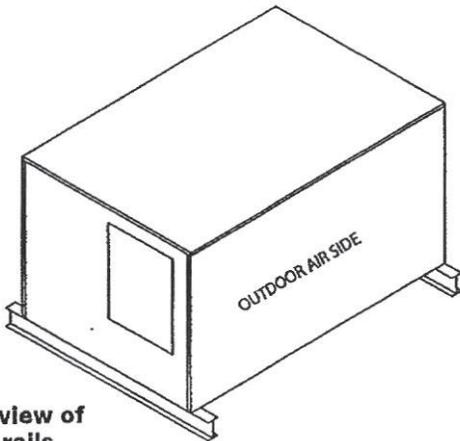
All dimensions shown in inches.

- Recommended duct sizes are based on velocities across the cfm range of each model at approximately 800 feet per minute (FPM) at minimum airflow and up to 1600 fpm at maximum airflow. Recommended duct sizes are only intended to be a guide and may not satisfy the requirements of the project. Refer to plans for appropriate job specific duct size and/or velocity limitations.
- Straight duct lengths were calculated based on 100% effective duct length requirements as prescribed in AMCA Publication 201. Calculated values have been rounded up to nearest foot.

Rail Mounting / Layout

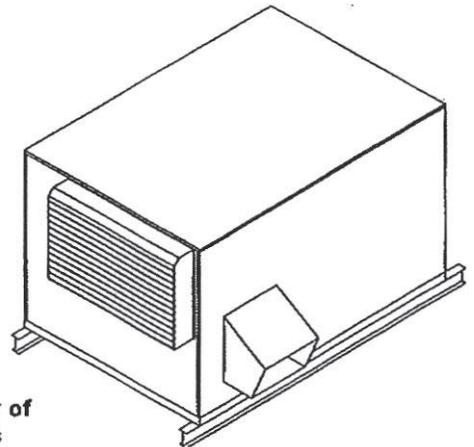
- Rails designed to handle the weight of the ERV should be positioned as shown on the diagram (rails by others).
- Make sure that rail positioning does not interfere with the supply air discharge opening or the exhaust air intake opening on the ERV unit. Avoid area dimensioned "B" below.
- Rails should extend beyond the unit a minimum of 12 inches on each side.
- Set unit on rails.

ERV-10
ERV-20
ERV-45
ERV-55



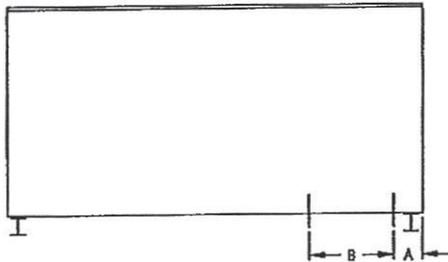
Isometric view of ERV on rails

ERV-90
ERV-120



Isometric view of ERV on rails

Side view of ERV on rails



Side view of ERV on rails



Unit Size	A	B
ERV-10	4.50	16
ERV-20	4.75	18
ERV-45	5.75	24
ERV-55	4.875	22

All dimensions are in inches.

Unit Size	A	B
ERV-90	4.625	32
ERV-120	4.875	33.25

All dimensions are in inches.

Outdoor Air Weatherhood

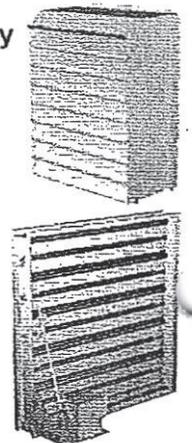
Outdoor air weatherhood will be factory mounted.

Exhaust Weatherhood

The exhaust weatherhood is shipped separately as a kit with its own instructions.

Dampers

Backdraft dampers are always included as an integral part of the exhaust hood assemblies. Motorized outdoor air and exhaust air dampers are optional and are factory mounted (and wired) at the intake.



Electrical Information

The unit must be electrically grounded in accordance with the current National Electrical Code, ANSI/NFPA 70. In Canada, use current CSA Standard C22.1, Canadian Electrical Code, Part 1. In addition, the installer should be aware of any local ordinances or electrical company requirements that might apply. System power wiring must be properly fused and conform to the local and national electrical codes. System power wiring is to the unit main disconnect (door interlocking disconnect switch standard on most units) or distribution block and must be compatible with the ratings on the nameplate: supply power voltage, phase, and amperage (Minimum Circuit Amps - MCA, Maximum Overcurrent Protection - MOP). All wiring beyond this point has been done by the manufacturer and cannot be modified without affecting the unit's agency / safety certification.

If field installing an additional disconnect switch, it is recommended that there is at least four feet of service room between the switch and system access panels. When providing or replacing fuses in a fusible disconnect, use dual element time delay fuses and size according to the rating plate.

If power supply is desired through bottom of unit, run the wiring through the curb, cut a hole in the cabinet bottom, and wire to the disconnect switch. Seal penetration in cabinet bottom to prevent leakage.

The electric supply to the unit must meet stringent requirements for the system to operate properly. Voltage supply and voltage imbalance between phases should be within the following tolerances. If the power is not within these voltage tolerances, contact the power company prior to operating the system.

Voltage Supply: See voltage use range on the rating plate. Measure and record each supply leg voltage at all line disconnect switches. Readings must fall within the allowable range on the rating plate.

Voltage Imbalance: In a 3-phase system, excessive voltage imbalance between phases will cause motors to overheat and eventually fail. Maximum allowable imbalance is 2%. To determine voltage imbalance, use recorded voltage measurements in this formula.

Key: V1, V2, V3 = line voltages as measured
 VA (average) = $(V1 + V2 + V3) / 3$
VD = Line voltage (V1, V2 or V3) that deviates farthest from average (VA)

Formula: % Voltage Imbalance = $[100 \times (VA - VD)] / VA$

WARNING

To prevent injury or death due to electrocution or contact with moving parts, lock disconnect switch open.

Most factory supplied electrical components are prewired. To determine what electrical accessories require additional field wiring, refer to the unit specific wiring diagram located on the inside of the unit control center access door. The low voltage control circuit is 24 VAC and control wiring should not exceed 0.75 ohms.

Refer to Field Control Wiring Length/Gauge table for wire length maximums for a given wire gauge.

Field Control Wiring Length/Gauge	
Total Wire Length	Minimum Wire Gauge
125 ft.	18
200 ft.	16
300 ft.	14
450 ft.	12

Control wires should not be run inside the same conduit as that carrying the supply power. Make sure that field supplied conduit does not interfere with access panel operation.

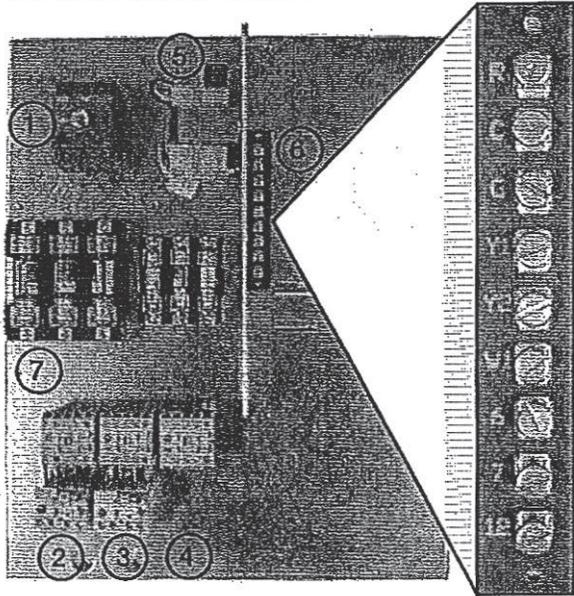
If wire resistance exceeds 0.75 ohms, an industrial-style, plug-in relay should be added to the unit control center and wired in place of the remote switch (typically between terminal blocks R and G on the terminal strip (refer to Typical Control Center Components). The relay must be rated for at least 5 amps and have a 24 VAC coil. Failure to comply with these guidelines may cause motor starters to "chatter" or not pull in which can cause contactor failures and/or motor failures.

CAUTION

If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105°C.

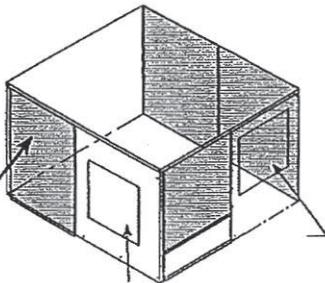
Typical Control Center Components

1. Main Disconnect (non-fusible, lockable)
2. Motor Starter – Exhaust Air Fan
3. Motor Starter – Outdoor Air Fan
4. Motor Contactor – Energy Wheel
5. 24 VAC Control Transformer
6. 24 VAC Terminal strip
7. Fuses for blower motors



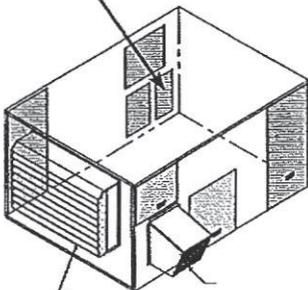
Exploded Detail
of Terminal Strip

ERV-10, 20, 45, 55

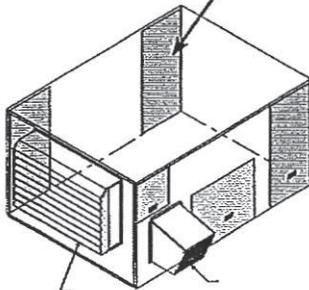


Access to Control Center Components
is gained through the access panel indicated.

ERV-90



ERV-120



Optional Accessory Wiring Schematics Remote Panel

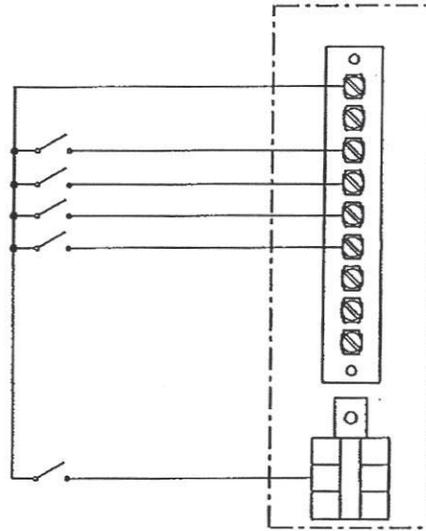
The remote panel is available with a number of different alarm lights and switches to control the unit. The remote panel ships loose and requires mounting and wiring in the field. The remote panel is available with the following options:

- Unit on/off switch
- Unit on/off light
- 7-day time clock
- Hand/off/auto switch
- Dirty filter light
- Economizer light
- Frost control light
- Wheel rotation sensor light

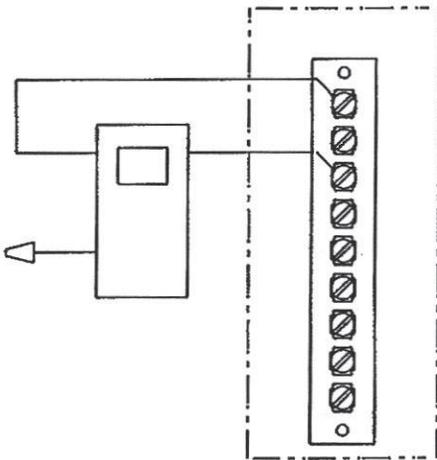


Unit Interfacing Terminals

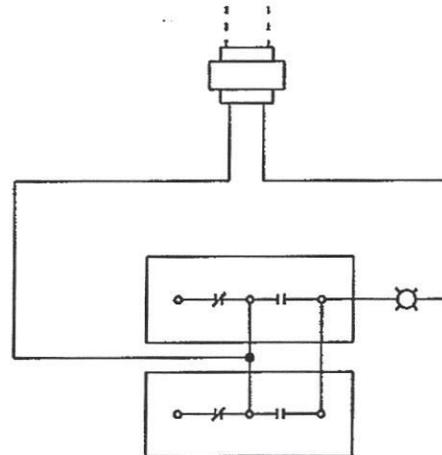
Heating/Cooling Switches & Night Setback Switch/Timer



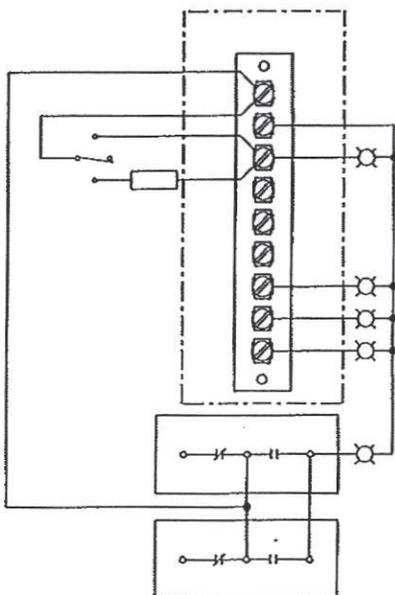
7-Day Timer



Dirty Filter Indicator (powered by others)



On/Off/Auto Switch & Indicator Light Wiring



Unit Overview

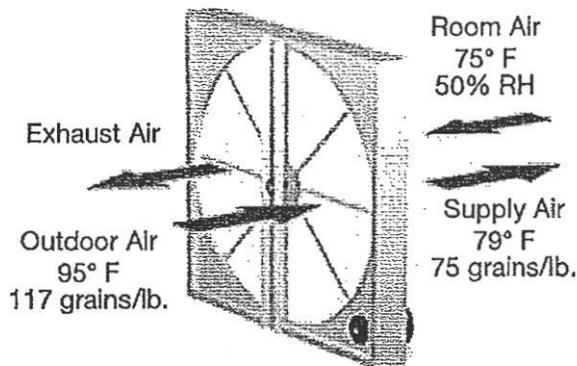
Basic Unit

The unit is pre-wired such that when a call for outside air is made (via field-supplied 24 VAC control signal wired to unit control center), the supply fan, exhaust fan, and energy wheel are energized and optional motorized dampers open.

The unit can be supplied with or without heating and cooling coils. For units with coils, controls can be supplied by manufacturer or by the controls contractor. If supplied by the controls contractor, they would provide, mount, and wire any temperature controllers and temperature or relative humidity sensors required for the unit to discharge air at the desired conditions. However, temperature, pressure, and current sensors can be provided by manufacturer for purposes of monitoring via the BMS.

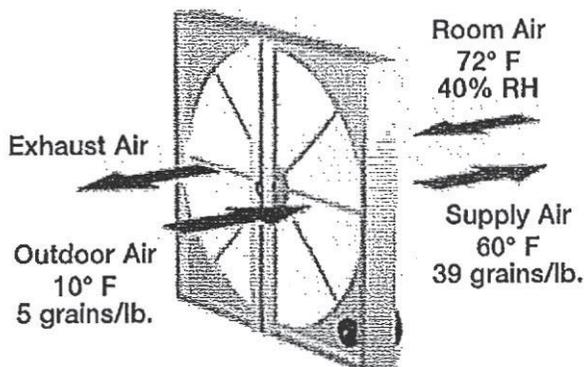
Summer Operation

Outdoor air is preconditioned (temperature and moisture levels are decreased) by the transfer of energy from the cooler, drier exhaust air via the energy recovery wheel. The preconditioned air is typically mixed with return air going back to the air handler for final conditioning.



Winter Operation

Outdoor air is preconditioned (temperature and moisture levels are increased) by the transfer of energy from the warmer, more humid exhaust air via the energy recovery wheel. The preconditioned air is typically mixed with return air going back to the air handler for final conditioning.



Optional Component Overview

Economizer

The energy wheel operation can be altered to take advantage of economizer operation (free cooling). Two modes are available:

1. Stopping the wheel
2. Modulating the wheel

Stopping the wheel: A field-supplied call for cool (Y1) is required. De-energizing the wheel is accomplished one of three ways:

1. The outdoor air temperature is less than the outdoor drybulb set point (DRYBLB SET)
2. The outdoor air temperature is less than the return air temperature
3. The outdoor air enthalpy is within the preset enthalpy curve

A low temperature lock out (LOW T LOCK) is also set to deactivate mechanical cooling when it exceeds the outdoor air temperature (factory default 32°F). Effectively, the two sensors create a deadband where the energy recovery wheel will not operate and free cooling from outside can be brought into the building unconditioned.

Modulating the wheel (factory): A variable frequency drive is fully programmed at the factory. A "call for cool" must be field wired to the unit (terminals provided in unit-refer to wiring diagram in unit control center) to allow for initiation of economizer mode. The unit recognizes economizer conditions based one of the previously mention sensors and set points. The unit will then modulate the wheel speed to maintain the mixed air temperature set point (MAT SET).

Modulating the wheel (by others): A variable frequency drive is fully programmed at the factory. A field-supplied 0-10 VDC signal will be required for operation of the energy wheel. The field will be required to have full control of the energy wheel speed at all times. If no 0-10 VDC signal is provided, the energy wheel will run at the factory default of 3 Hz and no energy transfer will be captured.

Frost Control

Extremely cold outdoor air temperatures can cause moisture condensation and frosting on the energy recovery wheel. Frost control is an optional feature that will prevent/control wheel frosting. Three options are available:

1. Timed exhaust frost control
2. Electric preheat frost control
3. Modulating wheel frost control

All of these options are provided with a thermdisc mounted in the outdoor air intake compartment and a pressure sensor to monitor pressure drop across the energy wheel.

An outdoor air temperature of below 5°F and an increase in pressure drop would indicate that frost is occurring. Both the pressure sensor and the outdoor air thermdisc must trigger in order to initiate frost control. The two sensors together ensure that frost control is only initiated during a real frost condition.

Timed exhaust frost control includes a timer in addition to the thermdisc and wheel pressure sensor. When timed exhaust frost control is initiated, the timer will turn the supply blower off. Time exhaust using default timer setting will shut down the supply fan for 5 minutes every 30 minutes to allow exhaust to defrost energy wheel. Use the test procedure in the Optional Start-Up Accessories section for troubleshooting.

Electric preheat frost control includes an electric heater (at outdoor air intake) in addition to the thermdisc and pressure sensor on wheel. When electric preheat frost control is initiated, the electric preheater will turn on and warm the air entering the energy wheel to avoid frosting. Use the test procedure in the Optional Start-Up Accessories section for troubleshooting.

Modulating wheel frost control includes a variable frequency drive (VFD) in addition to the thermdisc and pressure sensor. When modulating wheel frost control is initiated, the VFD will reduce the speed of the wheel. Reducing the speed of the energy wheel reduces its effectiveness, which keeps the exhaust air condition from reaching saturation, thus, eliminating condensation and frosting. If the outdoor air temperature is greater than the frost threshold temperature OR the pressure differential is less than the set point, the wheel will run at full speed. If the outdoor air temperature is less than 5°F AND the pressure differential is greater than the set point, the wheel will run at reduced speed until the pressure differential falls below the set point. The VFD will be fully programmed at the factory.

Variable Frequency Drives (VFD)

VFDs are used to control the speed of the fan as either multi-speed or modulating control. Multi-speed VFDs reference a contact which can be made by a switch or a sensor with a satisfied set point. Modulating control references a 2-10 VDC signal to the VFD which will vary the fan speed from a minimum 50% to full 100% rpm. An optional CO₂ sensor is available to provide both a set point contact or a modulating 2-10 VDC signal.

CO₂ Sensor

This accessory is often used in Demand Control Ventilation (VDC) applications. The factory provided sensors can either be set to reference a set point for multi-speed operation, or output a 2-10 VDC signal to modulate the fan speed. These can either be shipped loose to mount in the ductwork, or can be factory mounted in the return air intake. Follow instructions supplied with sensor for installation and wiring details.

Rotation Sensor

The rotation sensor monitors energy wheel rotation. If the wheel should stop rotating, the sensor will close a set of contacts in the unit control center. Field-wiring of a light (or other alarm) between terminals R and 12 in the unit control center will notify maintenance personnel when a failure has occurred.

Dirty Filter Sensor

Dirty filter sensors monitor pressure drop across the outdoor air filters, exhaust air filters, or both. If the pressure drop across the filters exceeds the set point, the sensor will close a set of contacts in the unit control center. Field-wiring of a light (or other alarm) to these contacts will notify maintenance personnel when filters need to be replaced. The switch has not been set at the factory due to external system losses that will affect the switch. This switch will need minor field adjustments after the unit has been installed with all ductwork complete. The dirty filter switch is mounted in the exhaust inlet compartment next to the unit control center or in unit control center.

Service Outlet

120 VAC GFCI service outlet ships loose for field installation. Requires separate power source so power is available when unit main disconnect is turned off for servicing.

Start-Up

DANGER

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

WARNING

Use caution when removing access panels or other unit components, especially while standing on a ladder or other potentially unsteady base. Access panels and unit components can be heavy and serious injury may occur.

Do not operate energy recovery ventilator without the filters and birdscreens installed. They prevent the entry of foreign objects such as leaves, birds, etc.

CAUTION

Do not run unit during construction phase. Damage to internal components may result and void warranty.

General Start-Up Information

Every installation requires a comprehensive start-up to ensure proper operation of the unit. As part of that process, the following checklist must be completed and information recorded. Starting up the unit in accordance with this checklist will not only ensure proper operation, but will also provide valuable information to personnel performing future maintenance. Should an issue arise which requires factory assistance, this completed document will allow unit experts to provide quicker resolve. Qualified personnel should perform start-up to ensure safe and proper practices are followed.

Unit Model Number _____
(e.g. ERV-20)

Unit Serial Number _____
(e.g. 04C99999 or 10111000)

Energy Wheel Date Code _____
(e.g. 0450)

Start-Up Date _____

Start-Up Personnel Name _____

Start-Up Company _____

Phone Number _____

Pre Start-Up Checklist – check as items are completed.

- Disconnect and lock-out all power switches
- Remove any foreign objects that are located in the energy recovery unit.
- Check all fasteners, set-screws, and locking collars on the fans, bearings, drives, motor bases and accessories for tightness.

- Rotate the fan wheels and energy recovery wheels by hand and ensure no parts are rubbing. If rubbing occurs, refer to Start-Up section for more information.
- Check the fan belt drives for proper alignment and tension (refer to Start-Up section for more information).
- Filters can load up with dirt during building construction. Replace any dirty pleated filters and clean the aluminum mesh filters in the intake hood (refer to Routine Maintenance section).
- Verify that non-motorized dampers open and close properly.
- Check the tightness of all factory wiring connections.
- Verify control wire gauge (refer to the Electrical Connections section).
- Verify diameter seal settings on the energy recovery wheel (refer to Start-Up section for more information).

SPECIAL TOOLS REQUIRED

- Voltage Meter (with wire probes)
- Amperage Meter
- Thermometer
- Tachometer
- Incline manometer or equivalent

Start-Up Checklist

The unit will be in operational mode during start-up. Use necessary precautions to avoid injury. All data must be collected while the unit is running. In order to measure volts & amps, the control center door must be open, and the unit energized using a crescent wrench to turn the disconnect handle.

Check line voltage at unit disconnect

_____ L1-L2 volts
_____ L2-L3 volts
_____ L1-L3 volts

Motor Amp Draw

• Supply Fan	_____	• Exhaust Fan	_____
	L1 amps		L1 amps
	L2 amps		L2 amps
	L3 amps		L3 amps

• Energy Wheel

_____ L1 amps
_____ L2 amps
_____ L3 amps

Fan RPM

_____ Supply Fan _____ Exhaust Fan

Correct fan rotation direction

Supply Fan	Yes / No
Exhaust Fan	Yes / No

Optional Accessories Checklist

Refer to the respective sections in this Installation, Operation and Maintenance Manual for detailed information.

Refer to wiring diagram in unit control center to determine what electrical accessories were provided.

provided with Unit?

Frost Control Application / Operation section:

			Setting	Factory Default
Yes	No	Frost Control set point		5°F
		Differential		2°F
		Timer		Refer to IOM
Yes	No	Frost Control Modulating		Refer to IOM

Economizer Application / Operation section:

Yes	No	Economizer (temperature)		
		Set point		65°F
		Offset		20°F
		Differential		2°F
Yes	No	Economizer (enthalpy)		
		Set point		D
Yes	No	Economizer (modulating)		Refer to IOM

Optional Accessories section:

Operational

Yes	No	Wheel Rotation Sensor	Yes	No	N/A
Yes	No	OA Dirty Filter Sensor	Yes	No	N/A
Yes	No	EA Dirty Filter Sensor	Yes	No	N/A
Yes	No	CO ₂ Sensor	Yes	No	N/A
Yes	No	Service Outlet	Yes	No	N/A
Yes	No	Remote Control Panel	Yes	No	N/A

Variable Frequency Drives section:

Operational

Yes	No	Blower VFDs	Yes	No	N/A
Yes	No	Wheel VFD	Yes	No	N/A

Damper section:

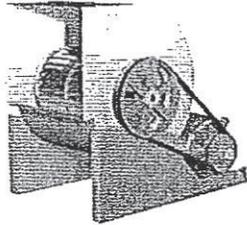
Operational

Yes	No	Outdoor Air Damper	Yes	No	N/A
Yes	No	Exhaust Air Damper	Yes	No	N/A

Start-Up Components

Fans

The ERV models contain two forward curved (supply and exhaust) fans. These forward curved fans should be checked for free rotation. If any binding occurs, check for concealed damage and foreign objects in the fan housing. Be sure to check the belt drives per the start-up recommendations in the following section.



Forward Curved Exhaust Fan

CAUTION

When operating conditions of the fan are to be changed (speed, pressure, temperature, etc.), consult Greenheck to determine if the unit can operate safely at the new conditions.

Fan Performance Modifications

Due to job specification revisions, it may be necessary to adjust or change the sheave or pulley to obtain the desired airflow at the time of installation. Start-up technician must check blower amperage to ensure that the amperage listed on the motor nameplate is not exceeded. Amperage to be tested with access doors closed and ductwork installed.

Fan Belt Drives

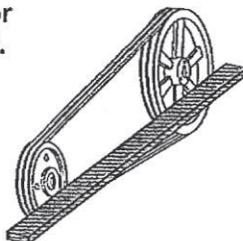
The fan belt drive components, when supplied by Greenheck, have been carefully selected for the unit's specific operating condition. Utilizing different components than those supplied could result in unsafe operating conditions which may cause personal injury or failure of the following components:

- Fan Shaft
- Bearings
- Motor
- Fan Wheel
- Belt

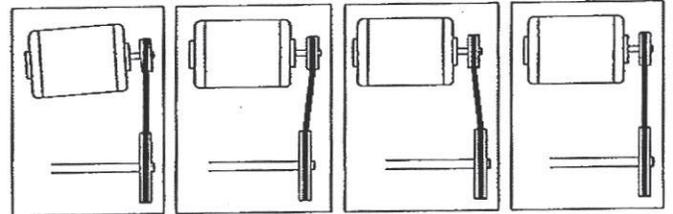
Tighten all fasteners and set screws securely and realign drive pulleys after adjustment. Check pulleys and belts for proper alignment to avoid unnecessary belt wear, noise, vibration and power loss. Motor and drive shafts must be parallel and pulleys in line (see diagrams in this section).

Belt Drive Installation

1. Remove the protective coating from the end of the fan shaft and assure that it is free of nicks and burrs.
2. Check fan and motor shafts for parallel and angular alignment.
3. Slide sheaves on shafts. Do not drive sheaves on as this may result in bearing damage.

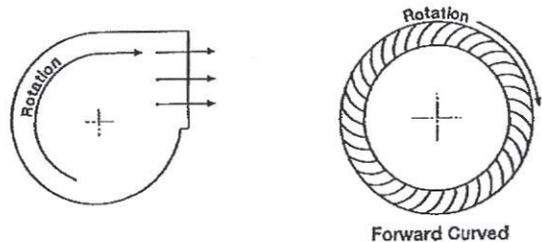


4. Align fan and motor sheaves with a straight-edge or string and tighten.
5. Place belts over sheaves. Do not pry or force belts, as this could result in damage to the cords in the belts.
6. With the fan off, adjust the belt tension by moving the motor base. (See belt tensioning procedures in the Routine Maintenance section of this manual). When in operation, the tight side of the belts should be in a straight line from sheave to sheave with a slight bow on the slack side.



Direction of Fan Wheel Rotation

Blower access is labeled on unit. Check for proper wheel rotation by momentarily energizing the fan. Rotation is determined by viewing the wheel from the drive side and should match the rotation decal affixed to the fan housing (see Rotation Direction figures). If the wheel is rotating the wrong way, direction can be reversed by interchanging any two of the three electrical leads. Check for unusual noise, vibration, or overheating of bearings. Refer to the Troubleshooting section of this manual if a problem develops.



Fan RPM

Supply fan and exhaust fan will have an adjustable motor pulley (on 15 HP and below) preset at the factory to the customer specified RPM. Fan speed can be increased or decreased by adjusting the pitch diameter of the motor pulley. Multi-groove variable pitch pulleys must be adjusted an equal number of turns open or closed. Any increase in fan speed represents a substantial increase in load on the motor. Always check the motor amperage reading and compare it to the amperage rating shown on the motor nameplate when changing fan RPM. All access doors must be installed except the control center door. Do not operate units with access doors open or without proper ductwork in place as the fan motors will overload.

Vibration

Excessive vibration may be experienced during initial start-up. Left unchecked, excessive vibration can use a multitude of problems, including structural and/or component failure. The most common sources of vibration are listed.

Wheel Unbalance
Drive Pulley Misalignment
Incorrect Belt Tension
Bearing Misalignment
Mechanical Looseness
Faulty Belts
Drive Component Unbalance
Poor Inlet/Outlet Conditions
Foundation Stiffness

Many of these conditions can be discovered by careful observation. Refer to the Troubleshooting section of this manual for corrective actions. If observation cannot locate the source of vibration, a qualified

technician using vibration analysis equipment should be consulted. If the problem is wheel unbalance, in-place balancing can be done.

Generally, fan vibration and noise is transmitted to other parts of the building by the ductwork. To eliminate this undesirable effect, the use of heavy canvas connectors is recommended.

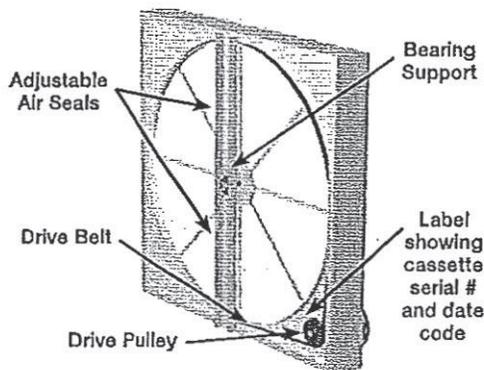
Energy Recovery Wheel

The ERV models contain a total energy recovery wheel. The wheels are inspected for proper mechanical operation at the factory. However, during shipping and handling, shifting can occur that may affect wheel operation. The wheel is accessible through the access door marked "Energy Wheel Cassette Access". For the ERV-10, 20, 45, and 90, the wheel cassette(s) slide out. Due to the size and weight of the ERV-55 and 120 wheels, they remain stationary and all maintenance is performed in place. There is room inside the unit to perform energy recovery wheel servicing.

Turn the energy recovery wheels by hand to verify free operation. The wheel should rotate smoothly and should not wobble.

Drive Belt

Inspect the drive belt. Make sure the belt rides smoothly through the pulley and over the wheel rim.



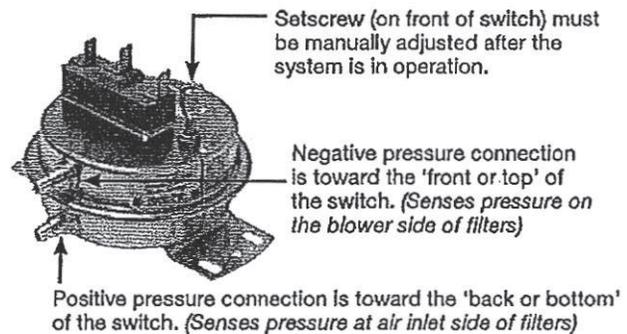
Air Seals

Check that the air seals located around the outside of the wheel and across the center (both sides of wheel) are secure and in good condition. Air seal clearance is determined by placing a sheet of paper, to act as a feeler gauge, against the wheel face. To access seals, enter the unit for the ERV-55 and 120, or pull out the cassette for the ERV-10, 20, 45, and 90, following the instructions in the Energy Recovery Wheel Maintenance section. To adjust the air seals, loosen all eight seal retaining screws. These screws are located on the bearing support that spans the length of the cassette through the wheel center. Tighten the screws so the air seals tug slightly on the sheet of paper.

Replace cassette into unit, plug in wheel drive, replace access door and apply power. Observe by opening door slightly (remove filters if necessary to view wheel) the wheel should rotate freely at about 50-60 RPM.

Optional Start-Up Components

Dirty Filter Switch



To adjust the switch, the unit must be running with all of the access doors in place, except for the compartment where the switch is located (exhaust intake compartment). The adjusting screw is located on the top of the switch.

1. Open the filter compartment and place a sheet of plastic or cardboard over 50% of the filter media.
2. Replace the filter compartment door.
3. Check to see if there is power at the alert signal leads (refer to electrical diagram).
4. Whether there is power or not, turn the adjustment screw on the dirty filter gauge (clockwise if you did not have power, counter-clockwise if you did have power) until the power comes on or just before the power goes off.
5. Open the filter compartment and remove the obstructing material.
6. Replace the door and check to make sure that you do **not** have power at the alert signal leads.

The unit is now ready for operation.

Economizer

Relevant Set Points

1. **MAT SET** The mixed air temperature set point after the energy wheel. The control will modulate the energy wheel to maintain temperature as best as it can. (Set point menu, default 53°F)
2. **LOW T LOCK** The set point for the low temperature mechanical cooling lockout. (Set point menu, default 32°F)
3. **DRYBLB SET** The outdoor air set point to call for economizer. (Set point menu, default 63°F)
4. **MIN POS** The minimum signal voltage sent to the energy wheel. This must be set to 2 VDC. (Set point menu, default 2.8 VDC)
5. **AUX1 O** The controllers operating sequence structure. (Set point menu, default 'None')
6. **ERV OAT SP** The set point for low temperature economizer lockout. This is the low temperature set point when AUX1 O is set to ERV. (Set point menu, default 32°F)
7. **STG3 DLY** Time delay after second cooling stage is enabled (Advanced setup menu, default 2 hrs.)

Using the Keypad with Settings and Parameters

To use the keypad when working with Set points, System and Advanced Settings, Checkout tests, and Alarms:

1. Navigate to the desired menu.
2. Press **↵** (enter) to display the first item in the currently displayed menu.
3. Use the **▲** and **▼** buttons to scroll to the desired parameter.
4. Press **↵** (enter) to display the value of the currently displayed item.
5. Press the **▲** button to increase (change) the displayed parameter value.^a
6. Press the **▼** button to increase (change) the displayed parameter value.^a
7. Press **↵** (enter) to accept the displayed value and store it in non-volatile RAM.
8. CHANGE STORED displays.
9. Press **↵** (enter) to return the current menu parameter.
10. Press **⏏** (escape) to return to the current menu parameter.

^a When values are displayed, pressing and holding the **▲** or **▼** button causes the display to automatically increment.

The table shows which set points are relevant to the given sequences. Refer to the wiring diagram for the units's sequence.

	MODULATE WHEEL			STOP WHEEL		
	OA Temp	OA Enthalpy	OA/RA Temp Differential	OA Temp	OA Enthalpy	OA/RA Temp Differential
DRYBLB SET	X			X		
MAT SET	X	X	X	X	X	X
LOW T LOCK	X	X	X	X	X	X
ERV OAT SP				X	X	X
MIN POS	X	X	X			
AUX1 OUT				ERV	ERV	ERV
STG3 DLY	X	X	X	X	X	X

Stop Wheel

1. Navigate to the Checkout menu and press **↵** (enter).
2. The energy wheel and cooling should stop.
3. Navigate to Connect ERV and press **↵** (enter) twice to run the test.
4. Voltage between AUX1-O and C should be 24 VAC. The energy wheel should activate.

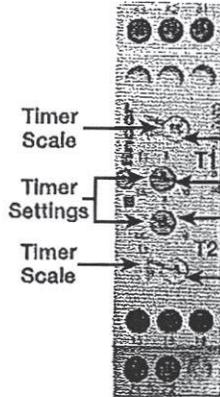
Modulate Wheel

1. Navigate to the Checkout menu and press **↵** (Enter).
2. The cooling should turn off and the wheel should be rotating at full speed.
3. Navigate to Damper Open and press **↵** (enter) twice to run the test.
4. Voltage between terminals ACT 2-10 and ACT COM should be 10 VDC. This will slow the wheel down to minimum speed.
5. Press **⏏** (escape), navigate to Damper Close and press **↵** (enter) twice to run the test.
6. Voltage between terminal ACT 2-10 and ACT COM should be 2 VDC. This will speed the wheel up to maximum speed.

Frost Control

Timed Exhaust

- Remove power from unit.
- Jumper the frost indicating wheel pressure switch in the unit control center.
- Jumper the temperature indicating thermodisc in the unit control center. Thermodisc has a pre-set temperature of 5°F.
- Set the frost control timer scale for T1 and T2 to 1m. Set the timer settings for T1 and T2 to 10.
- Add power to the unit. Blower should cycle on for one minute, then turn off for one minute.
- Remove power from unit and remove jumpers that were placed. Re-set timer settings.
 - T1 timer setting set to 5 and timer scale set to 10m for 5 minutes of wheel off time.
 - T2 timer setting set to 5 and timer scale set to 1h for 30 minutes of wheel on time.



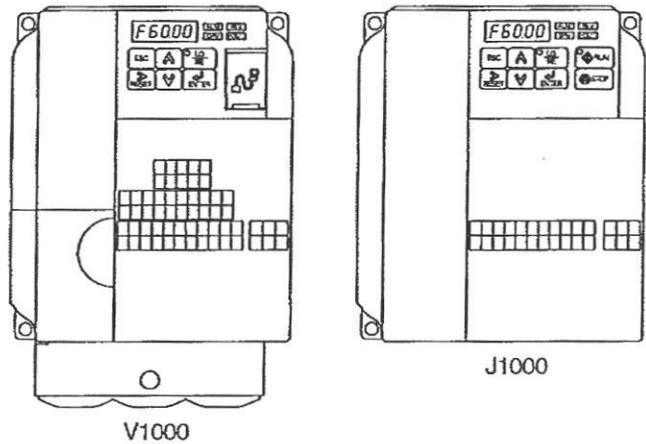
Electric Preheat

- Remove power from unit.
- Jumper the frost indicating wheel pressure switch in the preheat control center.
- Jumper the temperature indicating thermodisc in the preheat control center. Thermodisc has a pre-set temperature of 5° F.
- Apply power to unit. Preheater should turn on.

Variable Frequency Drives

Optional factory installed, wired, and programmed variable frequency drives (VFDs) may have been provided for modulating or multi-speed control of the blowers and energy recovery wheel for economizer and frost control modes. One VFD, either Yaskawa model V1000 or J1000, is provided for each blower (supply air and exhaust) and one Yaskawa model J1000 is provided for the energy recovery wheel.

Refer to the tables in this section for factory settings and field wiring requirements. Refer to the unit control center for unit specific wiring diagram. When making adjustments outside of the factory set points, refer to Yaskawa VFD instruction manual, which can be found online at www.drives.com. For technical support, contact Yaskawa direct at 1-800-927-5292.



OPTION 1 - 0-10 VDC CONTROL

USER TO PROVIDE ISOLATION AS REQUIRED

A1	AC
----	----

 0-10 VDC CONTROL SIGNAL (BY OTHERS)
 WIRED TO A1 (+) AND AC (COMMON)
 0 VDC = 30 Hz
 10 VDC = 60 Hz
 FOR ONE 0-10 SIGNAL, WIRE TO DRIVES IN PARALLEL

SEE VFD INSTALLATION MANUAL FOR MORE DETAIL

OPTION 2 - MULTI SPEED CONTROL

USER TO PROVIDE CONTACTS AND ISOLATION AS REQUIRED

S4	S5	SC
----	----	----

 NEITHER S4 OR S5 CONTACT CLOSED
 DRIVE SPEED = 60 Hz.
 S4 TO SC CONTACT CLOSED (BY OTHERS)
 DRIVE SPEED = 40 Hz.
 S5 TO SC CONTACT CLOSED (BY OTHERS)
 DRIVE SPEED = 30 Hz.

SEE VFD INSTALLATION MANUAL FOR MORE DETAIL

Factory Set Points

Variable frequency drives (VFDs) for the blowers are factory setup to operate in one of the three following modes:

- **Modulating:** 0-10 VDC signal wired in the field by others varies the speed of the blower between 30 and 60 Hz
- **Multi-speed:** Digital contact closures by others command the VFD to run at multiple speed settings:
 - Open - Drive runs at 60 Hz
 - SC to S4 - Drive runs at 40 Hz
 - SC to S5 - Drive runs at 30 Hz
- **CO₂ Sensor:**
 - **Set Point Control:** A carbon dioxide sensor is provided from the factory for field mounting OR unit mounting in the space(s) being served by the energy recovery unit. The CO₂ sensors are wired to the unit VFD's with two preset speeds of 700 PPM or less CO₂ = 50% fan speed and 800 PPM or greater CO₂ = 100% fan speed.
 - **Proportional Control:** A carbon dioxide sensor is provided from the factory for field mounting OR unit mounting in the space(s) being served by the energy recovery unit. The CO₂ sensors are wired to the unit VFD's with default factory settings of 500 PPM or less CO₂ = 50% fan speed and 1000 PPM or greater CO₂ = 100% fan speed. Modulation of VFD occurs proportional to CO₂ between 500 and 1000 PPM.

The terminal locations for modulating and multi-speed are shown on the previous page. Most of the set points in the VFDs are Yaskawa factory defaults. However, a few set points are changed at Greenheck and are shown in the tables. These settings are based on the VFD mode selected.

Change Set Points

To gain access to change set points on the V1000 and J1000 drives, parameter A1-01 needs to be set at "2". To prevent access or tampering with drive settings on either drive, change parameter A1-01 to "0".

- **Drive Operation**
 - SC to S1 contact for On/Off
 - A1 (0-10 VDC) referenced to AC.
Can use +15 VDC from +V.

Resetting the V1000 drive to factory defaults

To reset the V1000 drive back to Greenheck factory defaults, go to parameter A1-01 and set it to "2". Then go to A1-03 and change it to "1110" and press enter. The drive is now reset back to the settings programmed at Greenheck. This option is not available on the J1000.

MODULATING CONTROL FOR FAN SPEED (0-10 VDC)			
Parameter		Setting	
		V1000	J1000
A1-01	Access Level	2	2
B1-17	VFD Start-Up Setting	1	1
C6-02	Carrier Frequency	1	1
D2-02	Ref Lower Limit	50%	50%
E2-01	Motor Rated FLA	Motor FLA	Motor FLA
H2-01	Terminal MA, MC Function	5	5
H3-04	Terminal A1 Bias	50%	50%
L4-01	H2-01 Frequency Detection	15	15
L5-01	Auto Restart Attempt	5	5
A1-01	Access Level	0	0

CO ₂ SENSOR CONTROL FOR FAN SPEED (1/2 SPEED WHEN CO ₂ DROPS BELOW 700 PPM) (FULL SPEED WHEN CO ₂ RISES ABOVE 800 PPM)			
MULTI-SPEED CONTROL FOR FAN SPEED (1/3 OR 1/2 SPEED REDUCTION)			
Parameter		Setting	
		V1000	J1000
A1-01	Access Level	2	2
B1-01	Reference Source (Frequency)	0	0
B1-17	VFD Start-Up Setting	1	1
C6-02	Carrier Frequency	1	1
D1-01	Frequency Reference 1	60 Hz	60 Hz
D1-02	Frequency Reference 2	40 Hz	40 Hz
D1-03	Frequency Reference 3	30 Hz	30 Hz
D1-04	Frequency Reference 4	60 Hz	60 Hz
D2-02	Ref Lower Limit	50%	50%
E2-01	Motor Rated FLA	Motor FLA	Motor FLA
H1-04	Multi-Function Input Sel 4 (Terminal S4)	3	3
H1-05	Multi-Function Input Sel 5 (Terminal S5)	4	4
H1-06	Multi-Function Input Sel 6 (Terminal S6)	5	NA
H2-01	Terminal MA, MC Function	5	5
H3-10	A2 Not Used	F	NA
L4-01	H2-01 Frequency Detection	15	15
L5-01	Auto Restart Attempt	5	5
A1-01	Access Level	0	0

CO ₂ PROPORTIONAL CONTROL			
Parameter		Setting	
		V1000	J1000
B1-17	VFD Start-Up Setting	1	1
C6-02	Carrier Frequency	1	1
D2-02	Ref Lower Limit	50%	50%
E2-01	Motor Rated FLA	FLA	FLA
H3-03	Analog Frequency Reference (Gain)	150%	150%
H3-04	Analog Frequency Reference (Bias)	25%	25%
L2-01	Ride Thru Power Loss	2	2
L4-05	Frequency Ref Loss	0	NA
L5-01	Auto Restart Attempt	5	5
A1-01	Access Level	0	0

VARIABLE-FREQUENCY DRIVES FOR ENERGY RECOVERY WHEEL			
Parameter		Setting - J1000	
A1-01	Access Level	2	
B1-17	VFD Auto Start	1	
C1-04	Decel Time	600	
*C4-01	Torque Gain	0.6	
C6-02	Carrier Frequency	2	
D2-01	Ref Upper Limit	40 or 50*	
D2-02	Ref Lower Limit	5%	
E2-01	Motor Rated FLA	Motor FLA	
E2-03	Motor No-Load Current	Must be less than FLA	
H1-02	Multi-Function Input (Terminal S2)	6	
H2-01	Multi-Function Output (MA, MB, MC)	4	
H1-04	Multi-Function Input Sel 4 (Terminal S4)	7	
Economizer Signal Source (0-10 VDC)		Setting	
		Honeywell Module	Carel Controller
H3-03	Analog Frequency Reference (Gain)	0	40 or 50*
H3-04	Analog Frequency Reference (Bias)	40 or 50**	0
L1-01	Elect Thermal Overload	2	
L2-01	Ride Thru Power Loss	2	
L4-01	Frequency Detection Level	15	
L5-01	Auto Restart Attempt	5	
A1-01	Access Level	0	

* 208/230 volt only

**36 through 52 inch wheels are 40 (24 Hz)

58 or 74 inch wheel is 50 (30 Hz)

Routine Maintenance

DANGER

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

CAUTION

Use caution when removing access panels or other unit components, especially while standing on a ladder or other potentially unsteady base. Access panels and unit components can be heavy and serious injury may occur.

Once the unit has been put into operation, a routine maintenance program should be set up to preserve reliability and performance. Items to be included in this program are:

Lubrication

Apply lubrication where required

Dampers

Check for unobstructed operation

Fan Belts

Check for wear, tension, alignment

Motors

Check for cleanliness

Blower Wheel & Fasteners

Check for cleanliness

Check all fasteners for tightness

Check for fatigue, corrosion, wear

Bearings

Check for cleanliness

Check set screws for tightness

Lubricate as required

External Filter

Check for cleanliness - clean if required

Internal Filter

Check for cleanliness - replace if required

Door Seal

Check if intact and pliable

Energy Recovery Wheel

Check for cleanliness - clean if required

Check belt for wear

Check pulley, bearings, and motor

Maintenance Procedures:

Lubrication

Check all moving components for proper lubrication. Apply lubrication where required. Any components showing excessive wear should be replaced to maintain the integrity of the unit and ensure proper operation.

Dampers

Check all dampers to ensure they open and close properly and without binding. Backdraft dampers can be checked by hand to determine if blades open and close freely. Apply power to motorized dampers to ensure the actuator opens and closes the damper as designed.

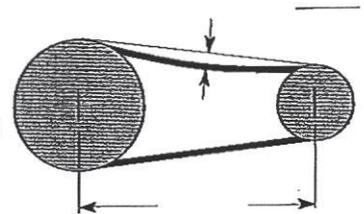
Fan Belts

Belts must be checked on a regular basis for wear, tension, alignment, and dirt accumulation. Premature or frequent belt failures can be caused by improper belt tension (either too loose or too tight) or misaligned sheaves. Abnormally high belt tension or drive misalignment will cause excessive bearing loads and may result in failure of the fan and/or motor bearings. Conversely, loose belts will cause squealing on start-up, excessive belt flutter, slippage, and overheated sheaves. Both loose and tight belts can cause fan vibration.

When replacing belts on multiple groove drives, all belts should be changed to provide uniform drive loading. Do not pry belts on or off the sheave. Loosen belt tension until belts can be removed by simply lifting the belts off the sheaves. After replacing belts, insure that slack in each belt is on the same side of the drive. Belt dressing should never be used.

Do not install new belts on worn sheaves. If the sheaves have grooves worn in them, they must be replaced before new belts are installed.

The proper belt setting is the lowest tension at which the belts will not slip under peak load operation. For initial tensioning, set the belt deflection at $\frac{1}{4}$ inch for each inch of belt span (measured half-way between sheave centers). For example, if the belt span is 64 inches, the belt deflection should be one inch (using moderate thumb pressure at mid-point of the drive). Check belt tension two times during the first 24 hours of operation and periodically thereafter.

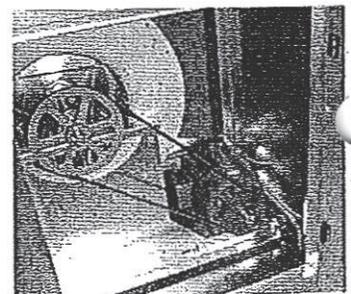


Fan Motors

Motor maintenance is generally limited to cleaning and lubrication. Cleaning should be limited to exterior surfaces only. Removing dust and grease buildup on the motor housing assists proper motor cooling.

Never wash-down motor with high pressure spray.

Greasing of motors is only intended when fittings are provided. Many fractional motors are permanently lubricated for life and require no further lubrication.



Fan Wheel & Fasteners

Wheels require very little attention when moving clean air. Occasionally oil and dust may accumulate on the wheel causing imbalance. When this occurs the wheel and housing should be cleaned to assure smooth and safe operation. Inspect fan impeller and housing for fatigue, corrosion or wear.

Routinely check all fasteners, set screws and locking collars on the fan, bearings, drive, motor base and accessories for tightness. A proper maintenance program will help preserve the performance and reliability designed into the fan.

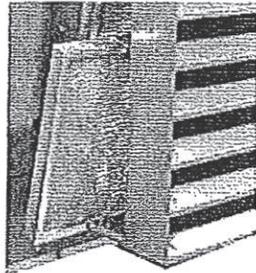
Bearings

Most bearings are permanently lubricated and require no further lubrication under normal use. Normal use being considered -20°F to 120°F and in a relatively clean environment. Some bearings are relubricatable and will need to be regreased depending on fan use. Check your bearings for grease zerk fittings to find out what type of bearing you have. If your fan is not being operated under normal use, bearings should be checked monthly for lubrication.

External Filter Maintenance

Aluminum mesh, 2-inch deep filters are located in the supply weatherhood (if the weatherhood option was purchased). Filters should be checked and cleaned on a regular basis for best efficiency. The frequency of cleaning depends upon the cleanliness of the incoming air. These filters should be cleaned prior to start-up.

To access these filters, remove bottom bolt in the access door on the side of the weatherhood. Slide the access door up and then pull bottom out to remove door. Then, slide the filters out (see picture at right).



Outdoor air Intake hood mesh filter access

Clean filters by rinsing with a mild detergent in warm water.

Internal Filter Maintenance

The ERV units will typically be provided with 2-inch, pleated filters in the outdoor air and exhaust airstreams. These filters should be checked per a routine maintenance schedule and replaced as necessary to ensure proper airflow through the unit. See table for pleated filter size and quantity for each unit. Replacement filters shall be of same performance and quality as factory installed filters. Filter type must be pleated design with integral metal frame. Two acceptable filter replacements are Aerostar Series 400 or Farr 30/30®.

Pleated Filter Size and Quantities			
Unit Size	Size	Supply Qty.	Exhaust Qty.
ERV-10	16 x 25	1	1
ERV-20	16 x 20	2	2
ERV-45	16 x 25	3	3
ERV-55	16 x 20	6	6
ERV-90	16 x 25	7	7
ERV-120	20 x 25	6	6

All dimensions in inches.

Outdoor Air Filters: Access to the outdoor air filters is through the door labeled as "Filter Access" on the outdoor air side of the unit.

Exhaust Air Filters: Access to the exhaust air filters is through the door labeled as "Filter Access" on the exhaust air side of the unit.

Refer to Access Door Descriptions section for additional information on filter locations.

Door Seal Maintenance

ERV-10, 20, 45, and 55: Closed cell foam tape is installed on the perimeter of the door. Inspect at least annually to ensure that the seal is still intact.

ERV-90 & 120: Slip-on type vinyl seal is installed on the perimeter of the door openings. Inspect at least annually to ensure that seal is still pliable and intact.



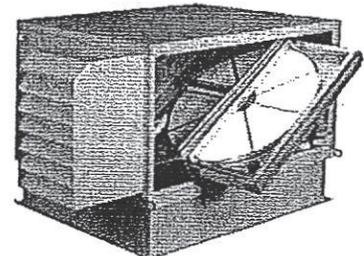
Energy Recovery Wheel Maintenance

Annual inspection of the energy recovery wheel is recommended. Units ventilating smoking lounges and other non-clean air spaces should have energy recovery wheel inspections more often based upon need. Inspections for smoke ventilation applications are recommended bimonthly to quarterly until a regular schedule can be established.

Accessing the Energy Recovery Wheel in Models ERV-10, 20, 45 and 55

Disconnect power to the ERV. Remove access panel(s) labeled "Energy Wheel Cassette Access".

Unplug the wheel drive motor. The center channel must be removed to access the energy wheel cassette. Use a 7/8 inch open or closed wrench to remove the three (3) fasteners that hold the center channel in place.



Access to wheel through outdoor air filter door

Pull the cassette halfway out as shown. (Except on ERV-55, wheel is stationary).

When service is complete, reattach the center channel before putting access panels back in place.

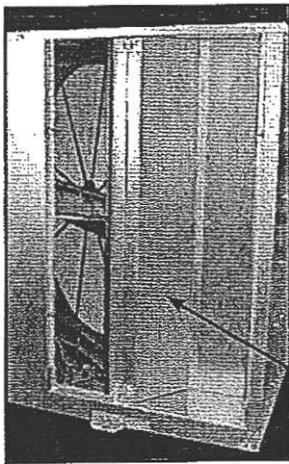
Accessing the Energy Recovery Wheel in Models ERV-90 and 120

Disconnect power to the ERV. Remove access panel(s) labeled "Energy Wheel Cassette Access", which reveals the energy wheel cassette. There are additional panels that must be removed in order to slide out the cassettes. (See pictures providing additional visual information).

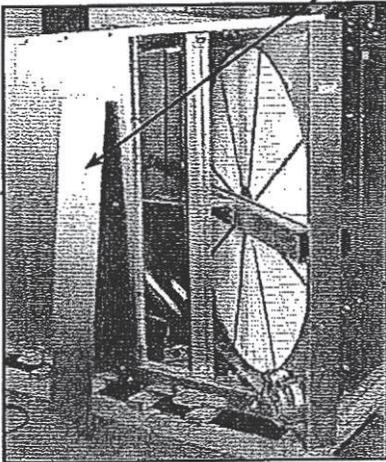
Unplug the wheel drive motor and pull the cassette halfway out as shown.

NOTE: ERV-90 has two energy wheels with access panels for both wheels. Wheels slide out on opposite corners.

Energy recovery wheels for ERV-120 are hard-wired and not designed to slide out.

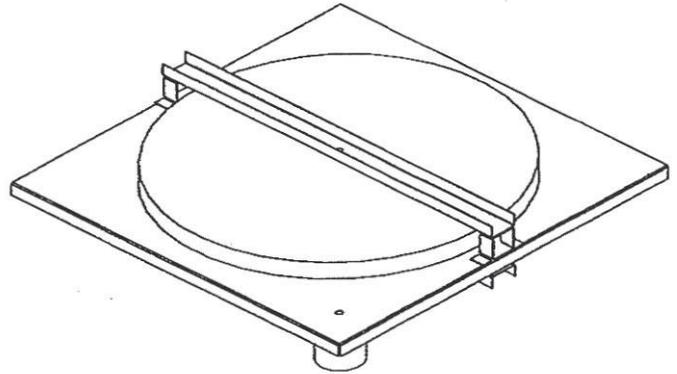


This panel must be removed before the energy wheel can slide out. (ERV-90 only)



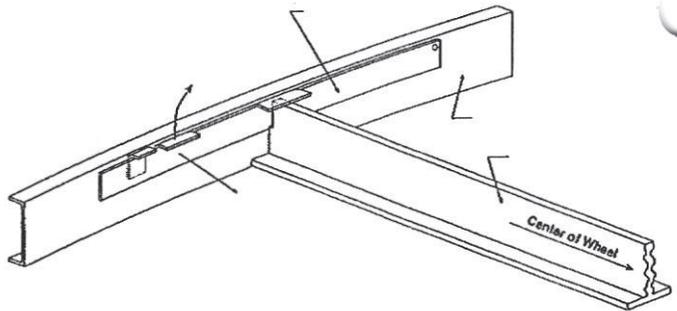
Removing the Energy Recovery Wheel in ERV-10

First, remove the drive belts and the collars in both bearings. On the pulley side of the cassette, remove the four (4) fasteners that hold the bearing support channel in place. Once the bearing support is removed the wheel can be pulled from the cassette. To replace the wheel, reverse this procedure.



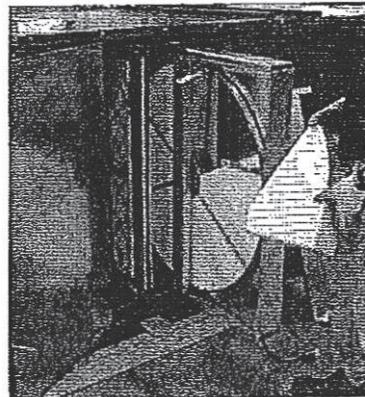
Removing the Energy Recovery Wheel Segments ERV-20, 45, 55, 90 and 120 (stainless steel rim)

Steel retainers are located on the inside of the wheel rim. Push the retainer towards the center of the wheel, then lift up and away to release segments.



IMPORTANT

Place retainers back in the original position before rotating the energy recovery wheel, otherwise damage to retainer will occur.



Wheel segment removed

Cleaning the Energy Recovery Wheel

If the wheel appears excessively dirty, it should be cleaned to ensure maximum operating efficiency. Only excessive buildup of foreign material needs to be removed. Discoloration and staining of energy recovery wheel does not affect its performance.

Thoroughly spray wheel matrix with household cleaner such as Fantastik® or equivalent. Gently rinse with warm water and using a soft brush remove any heavier accumulation. A detergent/water solution can also be used. Avoid aggressive organic solvents, such as acetone. The energy recovery wheel segments can be soaked in the above solution overnight for stubborn dirt or accumulation.

After cleaning is complete, shake the excess water from the wheel or segments. Dry wheel or segments before placing them back into the cassette. Place wheel or segments back into cassette by reversing removal procedures.

CAUTION

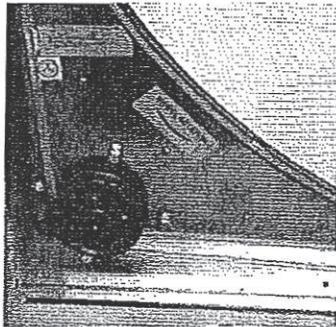
Do not clean energy recovery wheel segments with water in excess of 140°F (60°C).

Do not dry energy recovery wheel segments in air in excess of 140°F (60°C).

The use of a pressure washer to clean segments is not recommended. Damage could result.

Energy Recovery Wheel Belt

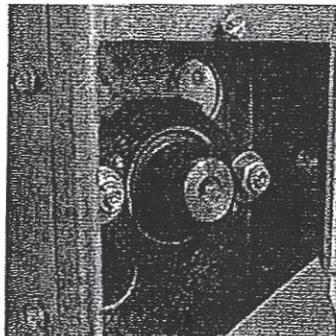
Inspect belts each time filters are replaced. Belts that look chewed up or are leaving belt dust near the motor pulley may indicate a problem with the wheel. Be sure to inspect wheel for smooth and unrestricted rotation. If a belt requires replacement, contact the local Greenheck representative. Instructions for replacement will ship with the new belt.



Wheel Belt & Pulley

Energy Recovery Wheel Bearing

In the unlikely event that a wheel bearing fails, the bearing is behind a removable plate on the wheel support beam which is accessible through the outdoor air filter door (and exhaust filter door on the ERV-90 and 120). Contact the local Greenheck representative for detailed instructions on how to replace the bearing.



Wheel Bearing

Troubleshooting - Economizer Alarms

Addressing Alarms

Alarms will signify a faulty sensor. When this occurs, verify all connections to the sensor and controller are secure. Press enter twice to clear the alarm. If the issue persists, consult the factory.

Clearing Alarms

Once the alarm has been identified and the cause has been removed (e.g. replaced faulty sensor), the alarm can be cleared from the display.

To clear an alarm, perform the following:

1. Navigate to the desired alarm.
2. Press the **↵** (enter).
3. ERASE? displays.
4. Press **↵** (enter).
5. ALARM ERASED displays.
6. Press **⏏** (escape) to complete the action and return to the previous menu.

NOTE

If an alarm still exists after you clear it, it redisplay within 5 seconds.

Troubleshooting – Airflow

Test and Balance Report

The Test and Balance Report (TAB) is utilized to determine whether the appropriate amount of outdoor air and exhaust air is being supplied and removed from a building, respectively. There are no set rules on what information must be included in a TAB report. As such, if a TAB report indicates that the airflow on a unit is low, prior to contacting the factory, please determine the following information:

	Unit #1	Unit #2	Unit #3	Unit #4
Model Number				
Serial Number				
Nameplate Information				
Voltage				
Hertz				
Phase				
Outdoor Air Fan Amps				
Exhaust Fan Amps				
Outdoor Air Fan Horsepower				
Exhaust Fan Horsepower				
Design Airflow				
Outdoor Air				
Exhaust				
Measured Airflow				
Outdoor Air				
Exhaust				
Measured Data				
Blower Rotation				
Outdoor Air Fan RPM				
Exhaust Fan RPM				
Outdoor Air Fan Amp Draw				
Exhaust Fan Amp Draw				
Pressure Drop Across Energy Recovery Wheel				
Outdoor Air Side				
Exhaust Air Side				

Airflow problems can often be tied back to improper ductwork installation. Be sure to install ductwork in accordance with SMACNA and AMCA guidelines.

Troubleshooting – Unit

Symptom	Possible Cause	Corrective Action
Blower fails to operate	Blown fuse or open circuit breaker.	Replace fuse or reset circuit breaker and check amps.
	Defective motor or capacitor.	Replace.
	Motor starter overloaded.	Reset starter and check amps.
	Electrical.	Check for On/Off switches. Check for correct supply voltage.
	Drive.	Check for broken or loose belts. Tighten loose pulleys.
Motor starters "chatter" or do not pull in	Control power (24 VAC) wiring run is too long (resistance should not exceed 0.75 ohms).	Shorten wiring run to mechanical room or install a relay which will turn unit on/off. Consult Factory for relay information.
	Incoming supply power is less than anticipated. Voltage supplied to starter coil must be within +10% / -15% of nominal voltage stated on the coil.	Need to increase supply power or use a special control transformer which is sized for the actual supply power.
Motor over amps	CFM too high.	Check cfm and adjust drives if needed.
	Static pressures are higher or lower than design.	If higher, ductwork should be improved. If lower, fan rpm should be lower.
	Blower rotation is incorrect.	Check rotation and reverse if necessary.
	Motor voltage incorrect.	Check motor nameplate versus supplied voltage.
	Motor horsepower too low.	See specifications and catalog for fan curves to determine if horsepower is sufficient.
	Shorted windings in motor.	Replace motor.
Low airflow (cfm)	Unit damper not fully open.	Adjust damper linkage or replace damper motor.
	System static pressure too high.	Improve ductwork to eliminate losses using good duct practices.
	Blower speed too low.	Check for correct drives and rpm with catalog data.
	Fan wheels are operating backwards.	For 3-phase, see Direction of Fan Wheel Rotation under Unit Start-Up section.
	Dirty filter or energy wheel.	Follow cleaning procedures in Routine Maintenance section.
	Leaks in ductwork.	Repair.
	Elbows or other obstructions may be obstructing fan outlet.	Correct or improve ductwork.
	Belt slippage.	Adjust belt tension.
High airflow (cfm)	Blower fan speed too high.	Check for correct fan rpm. Decrease fan speed if necessary.
	Filter(s) not in place.	Install filters.
	Insufficient static pressure (Ps) (airflow resistance).	Induce Ps into system ductwork. Make sure grilles and access doors are installed. Decrease fan speed if necessary.

Always have a completed Pre Start-Up Checklist, unit Start-Up Checklist, and Optional Accessories Checklist prior to requesting parts or service information.

Troubleshooting – Unit

Symptom	Possible Cause	Corrective Action
One or both blowers turn off intermittently and back on after about 2 minutes	Exhaust Only frost control sensors are tripping.	Adjust frost temperature sensor set point as needed.
Energy wheel does NOT turn	Air seals are too tight.	See Energy Recovery Wheel under Unit Start-Up section.
	“Economizer” sensors are operating.	Adjust temperature or enthalpy set points as needed.
	No power to wheel motor.	Make sure wheel drive is plugged in. Verify power is available.
	Wheel drive belt.	Check for loose or broken belts. Replace belts (consult factory).
	VFD overload. (OL1 on readout)	Refer to VFD section. Compare motor amp rating to setting in VFD. Adjust accordingly.
Energy wheel runs Intermittently	Wheel motor overloads are tripping, due to rubbing between wheel and air seals.	Recheck air seals, make sure they are not too tight. See Energy Recovery Wheel under Unit Start-Up Section.
Excessive noise or vibration	Fan wheel rubbing on inlet.	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	Bearings.	Replace defective bearing(s). Lubricate bearings. Tighten collars and fasteners.
	Wheel out of balance.	Replace or rebalance.
	Loose wheel on shaft.	Tighten wheel setscrew.
	Loose motor or blower sheave.	Tighten sheave setscrew.
	Belts too loose.	Adjust belt tension after 24 hours of operation.
	Belts too tight.	Loosen to maintain a 3/8 inch deflection per foot of span between sheaves.
	Worn belt.	Replace.
	Motor base or blower loose.	Tighten mounting bolts.
	Buildup of material on wheel.	Clean wheel and housing.
	Bearing and drive misaligned.	Realign.
Noise being transmitted by duct.	Make sure ductwork is supported properly. Make sure ductwork metal thickness is sized for proper stiffness. Check duct size at discharge to ensure that air velocities are not too high.	

Always have a completed Pre Start-Up Checklist, unit Start-Up Checklist, and Optional Accessories Checklist prior to requesting parts or service information.

Maintenance Log

Date _____ Time _____ AM/PM

Notes: _____

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Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

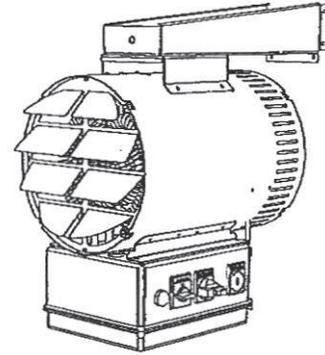
Greenheck catalog, Energy Recovery Ventilators, Model MiniVent, ERV, ERVe and ERM, provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.





WD Series Corrosion Resistant Heater



Installation, Operation & Maintenance Instructions

Specifications

Model Number	KW	Volts	Phase	Output BTU/HR	Heater Amps	Motor Volts	Motor Phase	Motor Amps	Temp Rise	CFM	Ship Weight lbs (kg)
WD02112A	2	120	1	6,824	16.7	120	1	1.554	9	700	60 (27.2)
WD02812A	2	208	1	6,824	9.6	208	1	0.896	9	700	60 (27.2)
WD02212A	2	240	1	6,824	8.3	240	1	0.777	9	700	60 (27.2)
WD03112A	3	120	1	10,236	25.0	120	1	1.554	14	700	60 (27.2)
WD03812A	3	208	1	10,236	14.4	208	1	0.896	14	700	60 (27.2)
WD03212A	3	240	1	10,236	12.5	240	1	0.777	14	700	60 (27.2)
WD03712A	3	277	1	10,236	10.8	277	1	0.673	14	700	60 (27.2)
WD03832A	3	208	3	10,236	8.3	208	1	0.896	14	700	60 (27.2)
WD03232A	3	240	3	10,236	7.2	240	1	0.777	14	700	60 (27.2)
WD03432A	3	480	3	10,236	3.6	480	1	0.388	14	700	60 (27.2)
WD05812A	5	208	1	17,060	24.0	208	1	0.896	23	700	60 (27.2)
WD05212A	5	240	1	17,060	20.8	240	1	0.777	23	700	60 (27.2)
WD05712A	5	277	1	17,060	18.1	277	1	0.673	23	700	60 (27.2)
WD05412A	5	480	1	17,060	10.4	480	1	0.388	23	700	60 (27.2)
WD05832A	5	208	3	17,060	13.9	208	1	0.896	23	700	60 (27.2)
WD05232A	5	240	3	17,060	12.0	240	1	0.777	23	700	60 (27.2)
WD05432A	5	480	3	17,060	6.0	480	1	0.388	23	700	60 (27.2)
WD07812A	7.5	208	1	25,590	38.1	208	1	0.896	34	700	60 (27.2)
WD07212A	7.5	240	1	25,590	31.3	240	1	0.777	34	700	60 (27.2)
WD07712A	7.5	277	1	25,590	27.1	277	1	0.673	34	700	60 (27.2)
WD07412A	7.5	480	1	25,590	15.6	480	1	0.388	34	700	60 (27.2)
WD07832A	7.5	208	3	25,590	20.8	208	1	0.896	34	700	60 (27.2)
WD07232A	7.5	240	3	25,590	18.0	240	1	0.777	34	700	60 (27.2)
WD07432A	7.5	480	3	25,590	9.0	480	1	0.388	34	700	60 (27.2)
WD10212A	10	240	1	34,120	41.7	240	1	0.777	22	1450	60 (27.2)
WD10712A	10	277	1	34,120	36.1	277	1	0.673	22	1450	60 (27.2)
WD10412A	10	480	1	34,120	20.8	480	1	0.388	22	1450	60 (27.2)
WD10832A	10	208	3	34,120	27.8	208	1	0.896	22	1450	60 (27.2)
WD10232A	10	240	3	34,120	24.1	240	1	0.777	22	1450	60 (27.2)
WD10432A	10	480	3	34,120	12.0	480	1	0.388	22	1450	60 (27.2)
WD12812A	12.5	208	1	42,650	60.1	208	1	1.793	27	1450	60 (27.2)
WD12212A	12.5	240	1	42,650	52.1	240	1	1.554	27	1450	60 (27.2)
WD12832A	12.5	208	3	42,650	34.7	208	1	1.793	27	1450	60 (27.2)
WD12232A	12.5	240	3	42,650	30.1	240	1	1.554	27	1450	60 (27.2)
WD12432A	12.5	480	3	42,650	15.0	480	1	0.777	27	1450	60 (27.2)
WD15812A	15	208	1	51,180	72.1	208	1	1.793	20	2400	110 (49.9)
WD15212A	15	240	1	51,180	62.5	240	1	1.554	20	2400	110 (49.9)
WD15412A	15	480	1	51,180	31.3	480	1	0.777	20	2400	110 (49.9)
WD15832A	15	208	3	51,180	41.6	208	1	1.793	20	2400	110 (49.9)
WD15232A	15	240	3	51,180	36.1	240	1	1.554	20	2400	110 (49.9)
WD15432A	15	480	3	51,180	18.0	480	1	0.777	20	2400	110 (49.9)
WD20412A	20	480	1	68,240	41.7	480	1	0.777	26	2400	120 (54.4)
WD20232A	20	240	3	68,240	48.1	240	1	1.554	26	2400	120 (54.4)
WD20432A	20	480	3	68,240	24.1	480	1	0.777	26	2400	120 (54.4)
WD25832A	25	208	3	85,300	69.4	208	1	1.793	33	2400	120 (54.4)
WD25232A	25	240	3	85,300	60.1	240	1	1.554	33	2400	120 (54.4)
WD25432A	25	480	3	85,300	30.1	480	1	0.777	33	2400	120 (54.4)
WD30832A	30	208	3	102,360	83.3	208	1	1.793	39	2400	120 (54.4)
WD30232A	30	240	3	102,360	72.2	240	1	1.554	39	2400	120 (54.4)
WD30432A	30	480	3	102,360	36.1	480	1	0.777	39	2400	120 (54.4)
WD39432A	39	480	3	133,068	46.9	480	1	0.777	51	2400	120 (54.4)

NOTE: Heaters over 48 amps require supplemental fusing.

SAVE THESE INSTRUCTIONS

IMPORTANT INSTRUCTIONS

WARNING

WHEN USING ELECTRIC APPLIANCES, BASIC PRECAUTIONS SHOULD ALWAYS BE FOLLOWED TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, AND INJURY TO PERSONS, INCLUDING THE FOLLOWING:

1. Read all instructions before installing or using this heater.
2. This heater is a commercial/industrial product not intended for use in a residential setting.
3. This heater has hot and arcing or sparking parts inside and is not intended for use in hazardous atmospheres where flammable vapors, gases, liquids or other combustible atmospheres as defined in the National Electrical Code are used or stored. Failure to comply can result in explosion or fire.
4. This heater is hot when in use. To avoid burns, do not let bare skin touch hot surfaces. Keep combustible materials, such as furniture, pillows, bedding, papers, clothes, etc. and curtains at least 3 feet (0.9 m) from the front of the heater.
5. Extreme caution is necessary when any heater is used by or near children or invalids and whenever the heater is left operating and unattended.
6. Do not operate any heater after it malfunctions. Disconnect power at service panel and have heater inspected by a reputable electrician before using.
7. Do not use outdoors.
8. To disconnect heater, turn controls to OFF, and turn OFF power to heater circuit at main disconnect panel.
9. Do not insert or allow foreign objects to enter any ventilation or exhaust opening as this may cause an electric shock, fire, or damage to the heater.
10. To prevent a possible fire, do not block air intake or exhaust in any manner.
11. Use this heater only as described in this manual. Any other use not recommended by the manufacturer may cause fire, electric shock, or injury to persons.
12. When installing, see INSTALLATION INSTRUCTIONS for additional warnings and precautions.
13. For safe and efficient operation, and to extend the life of your heater, keep your heater clean - See MAINTENANCE INSTRUCTIONS.

NOT FOR RESIDENTIAL USE.

WARNING

To prevent a possible fire, injury to persons or damage to the heater, adhere to the following:

Important Note: This heater must be installed by a qualified person.

1. Disconnect all power coming to heater at main service panel before wiring or servicing.
2. All wiring procedures and connections must be in accordance with the National and Local Codes having jurisdiction and the heater must be grounded.

CAUTION: All electrical conduit and fittings must be Listed for watertight applications to maintain the NEMA 4X enclosure classification to prevent hose-directed water from entering electrical box.

3. Verify the power supply voltage coming to heater matches the ratings as shown on the heater nameplate.

CAUTION: ENERGIZING HEATER AT A VOLTAGE GREATER THAN THE VOLTAGE PRINTED ON THE NAMEPLATE WILL DAMAGE THE HEATER AND VOID THE WARRANTY AND COULD CAUSE A FIRE.

4. To reduce the risk of fire, do not store or use gasoline or other flammable vapors and liquids in the vicinity of the heater.
5. The ceiling or wall mounting structure and the anchoring provisions must be of sufficient strength to support the combined weight of the heater and mounting bracket. See Specifications for total weight.
6. Heater must be mounted for horizontal air flow only. The heater must be mounted at least 7' (2134 mm) above the floor to avoid accidental contact with the fan blade which could cause injury.
7. Keep at least 5' (1524 mm) clearance in front of the heater. Refer to Figure 2 for side, top and back clearance requirements.
8. Do not mount mercury type thermostat directly on unit. Vibration could cause heater to malfunction.
9. Outlet grille is factory formed with louvers set at a 45° angle. This is the minimum angle allowable to avoid potential overheating. Louvers may be opened up to 90° if desired to allow for better air throw by bending each louver outward. See Figure 3.

- D. Are directed along the windward side when installed in a building exposed to a prevailing wind.

Locate thermostat on interior partition walls or posts away from cold drafts, internal heat sources and away from heater discharge air streams.

INSTALLATION INSTRUCTIONS

General

Heater Location Instructions:

Arrange units so their discharge air streams:

- A. Are subjected to minimum interference from columns, machinery and partitions.
- B. Wipe exposed walls without blowing directly at them.
- C. Are directed away from room occupants in comfort heating.

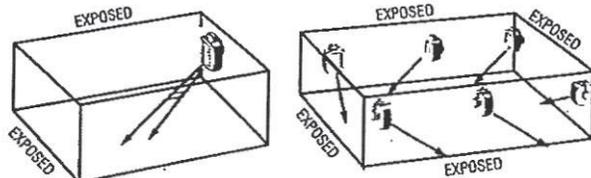


Figure 1

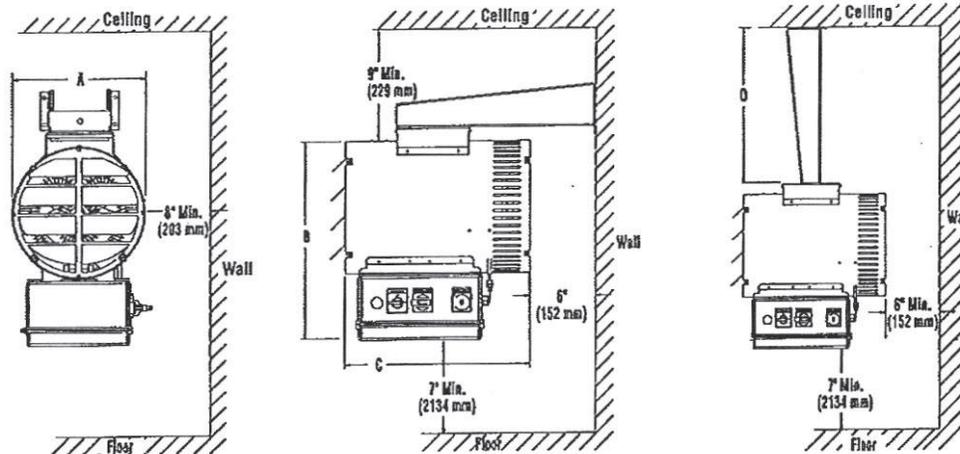


Figure 2

kW	Dimensions: Inches (mm)			
	A	B	C	D
2-10	13 (330)	19.5 (495)	18 (457)	19.5 (495)
12.5-39.0	20 (508)	31 (787)	27 (686)	24.2 (615)

Small rooms can be heated by one unit heater. Where two walls are exposed, the heater should be mounted as shown in Figure 1.

Large rooms require multi-unit installations. Number and capacity of units will be determined by volume of building and square feet of floor area to be heated. Arrange units to provide perimeter air circulation where each unit supports the air stream from another.

Mounting Heaters with supplied Universal Mounting Bracket

NOTICE — These heaters are designed for wall and ceiling mounting with horizontal air discharge only. Other modes of mounting voids factory warranty.

- Height above floor
 - In areas where ceiling height is more than 12 feet (3658 mm), recommended mounting height is approximately 10 feet (3048 mm) to underside of heater.
 - For ceiling heights of 12 feet (3658 mm) or less, maximum mounting height is determined by use of the mounting bracket offered for these heaters. Minimum spacing to ceiling is 9" (229 mm). (See Figure 2.)
 - In either case the minimum mounting height is 7 feet (2134 mm) from floor to bottom of heater. (Figure 2)
- Spacing to adjacent walls (See Figure 2).
 - Rear of case to back wall 6" (152mm) minimum.
 - Side of case to side wall 8" (203 mm) minimum.

NOTE: If two or more units are operated in the same enclosed air space, their discharges should be directed to aid in development of mass air movement for uniform heat dispersal.

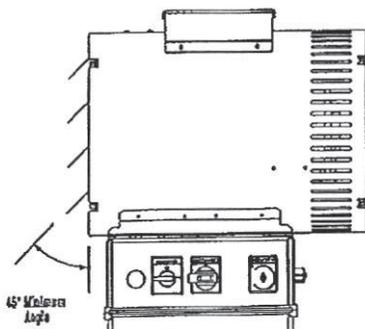


Figure 3 - Louver Adjustment

Wiring

Refer to wiring diagram included with the unit.

The wiring diagram can be found on the inside of the door to the wiring compartment. Should you have any questions, please contact Technical Service at 800-642-4328. Have your model number found on the name plate for reference.

CAUTION ⚠

ALL ELECTRICAL CONDUIT AND FITTINGS MUST BE LISTED FOR WATERTIGHT APPLICATIONS TO MAINTAIN THE NEMA 4X ENCLOSURE CLASSIFICATION TO PREVENT HOSE DIRECTED WATER FROM ENTERING ELECTRICAL BOX.

NOTE: All electrical wiring must be done according to National Electrical and local codes by a qualified person.

IMPORTANT NOTE - Installation Screw Lug Torque: During transportation it is possible screw lug connections can loosen. After installation, before power is turned on to the heater, check all screw lug connections for tightness to a recommended minimum torque of 35 in-lbs. (3.9 N-m). A tool is included for tightening lugs in hard to reach locations

⚠ WARNING ⚠

ELECTRIC SHOCK HAZARD. ANY INSTALLATION INVOLVING ELECTRIC HEATERS MUST BE PERFORMED BY A QUALIFIED PERSON AND MUST BE EFFECTIVELY GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE TO ELIMINATE SHOCK HAZARD.

- Connect heater according to the voltage and frequency specified on the nameplate.
- All units are provided with control and power terminal blocks for customer's connection.
- Protection against overheating is provided by an internal automatic thermal cutout (manual reset cutout optional) which opens the electric circuit if the normal air-flow is restricted or stopped. Cutout automatically energizes heater on removal of the obstruction. If optional manual reset is tripped, determine cause before re-energizing.

⚠ WARNING ⚠

THE SYSTEM DESIGNER IS RESPONSIBLE FOR THE SAFETY OF THIS EQUIPMENT AND SHOULD INSTALL ADEQUATE BACK-UP CONTROLS AND SAFETY DEVICES WITH THEIR ELECTRIC HEATING EQUIPMENT. WHERE THE CONSEQUENCES OF FAILURE COULD RESULT IN PERSONAL INJURY OR PROPERTY DAMAGE, BACK-UP CONTROLS ARE ESSENTIAL.

4. Heaters are equipped with fan delay control. This control continues fan operation for a short time after elements are de-energized to dissipate residual heat.

⚠ WARNING ⚠

FAN BLADE ROTATION MUST BE CHECKED. IF AIRFLOW IS NOT MOVING OUT THROUGH THE OUTLET GRILLE, INTERCHANGE ANY TWO OF THE THREE INCOMING SUPPLY POWER LEADS ON THREE-PHASE UNITS ONLY.

Optional Equipment

- **Built-in Thermostat** (bulb and capillary type) for automatic temperature control. The thermostat controls the heating elements and fan simultaneously to achieve set temperature. The Lo setting of the thermostat is approximately 40°F and the Hi setting is approximately 90°F.
- **Mode Switch** (heater on, heater off, fan only) to permit air flow with or without energizing the heating elements. The switch is accessible from outside the NEMA 4X enclosure.
- **Pilot Light** to indicate when heating elements are energized.
- **Internal Fusing**
- **Manual Reset Limit**
- **ON/OFF Switch**
- For wiring diagram containing options, see label on inside cover of terminal box

OPERATING INSTRUCTIONS

1. Heater must be properly installed before operation.
2. To check out the installation, turn the Mode Switch to the OFF position. Turn power ON to the heater at the main disconnect panel and check to see that the heater is not operating. If it is operating, disconnect power and check wiring.
3. Rotate thermostat clockwise to the highest heat setting. With Heat-Cool Switch in OFF position, heater should not operate.
4. Turn Heat-Cool Selector Switch to the Fan Only position. The fan should come on and operate with no heat.
5. Turn Heat-Cool Selector Switch to the Heat position. The fan and heater should come on producing heat.
6. The heater should be allowed to operate with the thermostat at max or high heat until room temperature reaches the desired level. The thermostat should then be rotated counter-clockwise until the heater elements turn off (an audible click). This should set the thermostat to cycle the heater on and off to maintain the ambient temperature. Fine adjustments may need to be made to obtain the desired room ambient. Slight rotating of the thermostat in the clockwise direction will increase the room ambient while rotation in the counter-clockwise direction will lower the room ambient.

NOTE: A built in fan delay will cause the fan to run after the elements turn off to dissipate residual heat.

NOTE: If a Disconnect Switch option is provided, this switch will be accessible from the outside of the control box and will be marked ON and OFF accordingly. In the OFF position, the heater will not operate.

NOTE: If a Manual-Reset Cutout option is provided, the RESET button will be marked and accessible on the control panel. This safety control will operate only if the heater overheats.

⚠ WARNING ⚠

DO NOT TAMPER WITH OR BYPASS ANY SAFETY LIMITS INSIDE HEATER.

MAINTENANCE INSTRUCTIONS

It is important to keep this heater clean. Your heater will give you years of service and comfort with only minimum care. To assure efficient operation follow the simple instructions below.

⚠ WARNING ⚠

ALL SERVICING BEYOND SIMPLE CLEANING THAT REQUIRES DISASSEMBLY SHOULD BE PERFORMED BY QUALIFIED SERVICE PERSONNEL.

⚠ WARNING ⚠

TO REDUCE RISK OF FIRE AND ELECTRIC SHOCK OR INJURY, DISCONNECT ALL POWER COMING TO HEATER AT MAIN SERVICE PANEL AND CHECK THAT THE ELEMENT IS COOL BEFORE SERVICING OR PERFORMING MAINTENANCE.

User Cleaning Instructions:

1. Turn off power to heater and allow elements to cool.
2. Vacuum or hose off heater with water (at city pressure) before activating for next heating season to remove accumulated dust or lint which otherwise may smoke or incinerate on initial heat up.
3. Return power to heater and check to make sure it is operating properly.

Maintenance Cleaning Instructions:

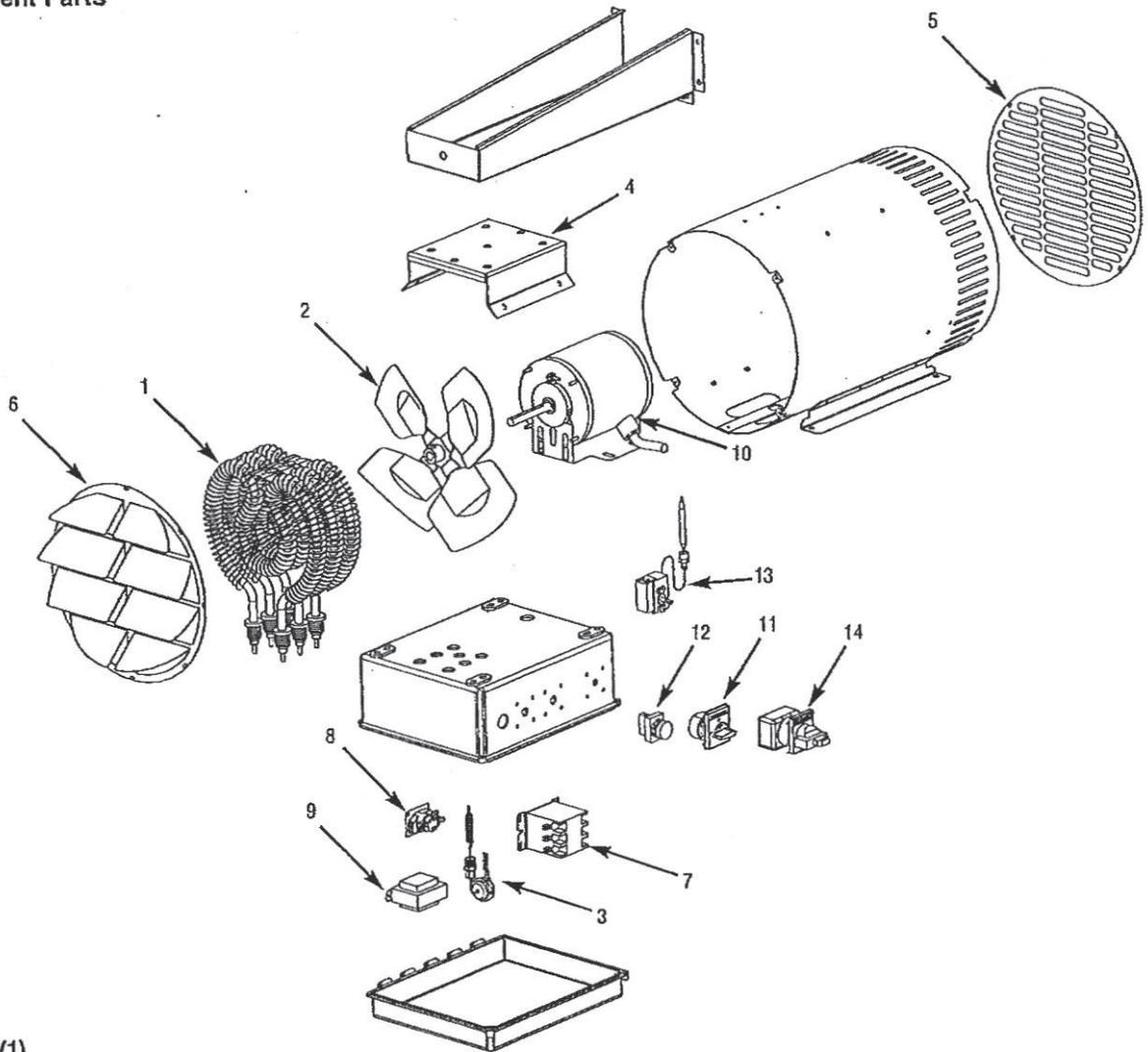
(To be performed only by Qualified Service Personnel)

At least annually, the heater should be cleaned and serviced by a qualified service person to assure safe and efficient operation. This should include as necessary, vacuuming dust and debris from the elements and fan, and check all screw lug connections for tightness to a recommended minimum torque of 35 in-lbs. (3.9 N-m) using the included tool(s) for hard to reach lugs if necessary. After completing the cleaning and servicing, the heater should be fully reassembled and checked for proper operation.

IMPORTANT NOTE: For heaters used in a hose down application, it is recommended that periodically after the heater has been hosed down (with power off at panel) the wiring enclosure cover be opened and the interior inspected for water penetration. If water is discovered, the heater must be repaired by a qualified electrician to assure the seals are properly installed.

During each cleaning, all seals should be inspected for damage as it is critical that they maintain a water tight seal. If damage is discovered (such as tears or cracking), they should be replaced or repaired with an appropriate silicone sealant.

Replacement Parts



Elements (1)

Heater KW	120 V	208 V	240 V	277 V	480 V
2	1802-11012-001	1802-11012-002	1802-11012-003	-	-
3	1802-11012-001	1802-11012-002	1802-11012-003	1802-11012-004	1802-11012-004
5	-	1802-11012-005	1802-11012-006	1802-11012-007	1802-11012-008 1PH 1802-11012-007 3 PH
7.5	-	1802-11012-011	1802-11012-012	1802-11012-009	1802-11012-008
10	-	1802-11012-010	1802-11012-011	1802-11012-012	1802-11012-013
12.5	-	1802-11013-001	1802-11013-002	-	1802-11013-003
15	-	1802-11013-004	1802-11013-005	-	1802-11013-006
20	-	-	1802-11013-007	-	1802-11013-008
25	-	1802-11013-001	1802-11013-002	-	1802-11013-003
30	-	1802-11013-004	1802-11013-005	-	1802-11013-006
39	-	-	-	-	1802-11013-009

Mechanical Parts and Cutout - KW Dependent

Heater KW	Fan Blade (2)	Limit (3)	Mounting Bracket(4)	Inlet Grill (5)	Outlet Grill (6)
2kw, 3kw, 5kw, 7.5kw	1210-11007-003	4520-11013-000	1215-11081-000	2504-11018-000	2504-11019-001
10kw	1210-11007-002				
12.5kw	1210-11008-000	4520-11013-001	1215-11081-001	2504-11020-000	2504-11021-001
15kw, 20kw, 25kw, 30kw, 39kw	1210-11008-001				

Electrical Parts

Heater KW	Heater Line Voltage	Heater Control Voltage	Heater Phase	Contactor (7)	Fan Delay Relay(8)	Transformer (9)	Terminal Block (Not Shown)
2kw, 3kw, 5kw, 7.5kw, 10kw	120	24	1	5018-0006-000	5018-11005-000	5814-0003-006	5823-0004-002 (480V also req 2900-0030-000)
	208	24	1 or 3			5814-0003-000	
	240	24				5814-0003-000	
	277	24	1			5814-0003-001	
	480	24	1 or 3			5814-0003-002	
2kw, 3kw, 5kw, 7.5kw, 10kw	120	120	1	5018-0006-001	5018-11005-001	N/A	
	208	120	1 or 3			5814-0003-003	
	240	120				5814-0003-003	
	277	120	1			5814-0003-004	
	480	120	1 or 3			5814-0003-005	
Unfused large units 12.5kw, 15kw,	208	24	3	5018-0006-000	5018-11005-000	5814-0003-000	
	240	24				5814-0003-000	
	480	24				5814-0003-002	
	208	120	3	5018-0006-001	5018-11005-001	5814-0003-003	
	240	120				5814-0003-003	
	480	120				5814-0003-005	
Fused large units	208	24	1	5018-0006-000	5018-11005-000	5814-0003-000	480034002
	240	24				5814-0003-000	
	480	24				5814-0003-002	
	208	120	1	5018-0006-001	5018-11005-001	5814-0003-003	
	240	120				5814-0003-003	
	480	120				5814-0003-005	

Electrical Parts (Continued)

Heater KW	Heater Line Voltage	Heater Control Voltage	Heater Phase	Motor (10)	Mode Switch (11) (Accy)	Pilot Light Green (12) (Accy)
2kw, 3kw, 5kw, 7.5kw, 10kw	120	24	1	3900-11029-002	5216-11016-000	3510-11009-000
	208	24	1 or 3	3900-11029-000		
	240	24				
	277	24	1	3900-11029-001		
	480	24	1 or 3	3900-11029-000		
2kw, 3kw, 5kw, 7.5kw, 10kw	120	120	1	3900-11029-002	5216-11016-000	3510-11009-001
	208	120	1 or 3	3900-11029-000		
	240	120				
	277	120	1	3900-11029-001		
	480	120	1 or 3	3900-11029-000		
Unfused large units 12.5kw, 15kw	208	24	3	3900-11031-000	5216-11016-000	3510-11009-000
	240	24				
	480	24				
	208	120	3	3900-11031-000		
	240	120				
	480	120				
Fused large units	208	24	1	3900-11031-000	5216-11016-000	3510-11009-000
	240	24				
	480	24				
	208	120	1	3900-11031-000		
	240	120				
	480	120				

Disconnect Switch (14)

Size Amps	Part Number
40	4529-11009-031
60	4529-11009-032
100	4529-11009-033
125	4529-11009-034

Miscellaneous

Description	Part Number
Thermostat (13)	5813-11010-000
Gasket (Not Shown)	5206-11009-000

LIMITED WARRANTY

All products manufactured by Marley Engineered Products are warranted against defects in workmanship and materials for one year from date of installation. This warranty does not apply to damage from accident, misuse, or alteration; nor where the connected voltage is more than 5% above the nameplate voltage; nor to equipment improperly installed or wired or maintained in violation of the product's installation instructions. All claims for warranty work must be accompanied by proof of the date of installation.

The customer shall be responsible for all costs incurred in the removal or reinstallation of products, including labor costs, and shipping costs incurred to return products to Marley Engineered Products Service Center. Within the limitations of this warranty, inoperative units should be returned to the nearest Marley authorized service center or the Marley Engineered Products Service Center, and we will repair or replace, at our option, at no charge to you with return freight paid by Marley. It is agreed that such repair or replacement is the exclusive remedy available from Marley Engineered Products.

THE ABOVE WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEED THE AFORESAID EXPRESSED WARRANTIES ARE HEREBY DISCLAIMED AND EXCLUDED FROM THIS AGREEMENT. MARLEY ENGINEERED PRODUCTS SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES ARISING WITH RESPECT TO THE PRODUCT, WHETHER BASED UPON NEGLIGENCE, TORT, STRICT LIABILITY, OR CONTRACT.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion or limitation may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

For the address of your nearest authorized service center, contact Marley Engineered Products in Bennettsville, SC, at 1-800-642-4328. Merchandise returned to the factory must be accompanied by a return authorization and service identification tag, both available from Marley Engineered Products. When requesting return authorization, include all catalog numbers shown on the products.

HOW TO OBTAIN WARRANTY SERVICE AND WARRANTY PARTS PLUS GENERAL INFORMATION

- | | |
|--------------------------------|--|
| 1. Warranty Service or Parts | 1-800-642-4328 |
| 2. Purchase Replacement Parts | 1-800-654-3545 |
| 3. General Product Information | www.marleymep.com |

Note: When obtaining service always have the following:

1. Model number of the product
2. Date of manufacture
3. Part number or description



Marley
Engineered Products

470 Beauty Spot Rd. East
Bennettsville, SC 29512 USA



Shoffner Mechanical Services

PO Box 10048
 Knoxville, TN 37939-0048
 865-521-6948 865-524-7673

Work Order:	B40821004
Date:	09/03/2014

Customer	
SHOFFNER KALTHOFF SKMES 3600 PAPERMILL DRIVE DRAWER #10048 KNOXVILLE TN 37939 000-000-0000	
Customer No:	SHOF06

Location	
LADD PUMP STATION 715 EAST EMORY RD	
Contact:	SKYLER SINCLAIR
Caller:	SKYLER SINCLAIR

Work Requested: ERV AND UNIT HEATER START UP

Work Performed: 09/03/14 9-3-14 Picked up the switch from Skyler's office & drove to location. I called Titus 931-319-1335 & he sent another person to the startup location to unlock the door. I ran a new stat wire from the switch to the ERV & started up the ERV. Electricians do not have power to the hanging heater closest to the door. I completed the startup on the ERV & the one heater furthest from the door. As of right now I am waiting to return until the electricians order a "bucket" ??? The following Monday is when the "bucket" is set to arrive & be installed by the electricians. Incomplete

09/03/14 9-9-14 I completed the startup on the last hanging heater. I sent the startups to Skyler Sinclair. Startup complete

Material / Other

Item Number	Description	Quantity
18/2 WIRE	18/2 TSTAT WIRE (15ft)	15.00 FT
	none used	EA

Labor

Name	Work Date	Time (in Hours)
MATTHEW S PIENTA	09/03/14	7.00
MATTHEW S PIENTA	09/09/14	2.50
Total Labor		9.50

I reviewed the above information and acknowledge the work has been completed and/or the problem corrected to my satisfaction at this time.

X 



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PO Box 10048
 Knoxville, TN 37939-0048
 865-521-6948 865-524-7673

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09/03/14 9-9-14 I completed the startup on the last hanging heater. I sent the startups to Skyler Sinclair. Startup complete

Material / Other

Item Number	Description	Quantity
18/2 WIRE	18/2 TSTAT WIRE (15ft)	15.00 FT
	none used	EA

Labor

Name	Work Date	Time (in Hours)
MATTHEW S PIENTA	09/03/14	7.00
MATTHEW S PIENTA	09/09/14	2.50
Total Labor		9.50

I have reviewed the above information and acknowledge the work has been completed and/or the problem corrected to my satisfaction at this time.

SKMES Startup

X _____



EQUIPMENT START UP SHEET

Job #	SMS B40821004	Job Name	Ladd Pump Station	Job Location	Harriman
Job Foreman		Start Up Technician	Matthew Pienta	Project Manager	Skyler Sinclair
Equipment ID #		Equipment Location	Inside Pump Station closest to door		
Equipment Manufacturer	Marley	Shipping Supports & Packaging Removed	Yes		
Equipment Type	Electric hanging heater				
Equipment Model #	WD10432ATSD	Equipment Serial #	4104-11089-346		
Power Connected	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Power On Equipment	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Gas Connected	<input type="checkbox"/> Yes <input type="checkbox"/> No
Ductwork Connected	<input type="checkbox"/> Yes <input type="checkbox"/> No	Unit Ready for Start Up	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Gas Purged	<input type="checkbox"/> Yes <input type="checkbox"/> No

TO BE FILLED OUT BY JOB FOREMAN PRIOR TO TECHNICIAN'S ARRIVAL

Belt Size:	DD	Filter Sizes and Quantity	NA
Air Filters Installed	<input type="checkbox"/> Yes <input type="checkbox"/> No	Motor Rotation Correct	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Coils in Good Condition	<input type="checkbox"/> Yes <input type="checkbox"/> No	Condensate Drain Connected	<input type="checkbox"/> Yes <input type="checkbox"/> No
Refrigerant Charged	<input type="checkbox"/> Yes <input type="checkbox"/> No	Suction Pressure	NA
Voltage	480	Discharge Pressure	NA
Sub cool temp	NA	F.L. Amp	12
Compressor R.L.A.	A	Phase A	480
Condenser Fan Check Amps: A	NA	Phase B	482
Supply Air Temp	125	Phase C	481
Heating Operation Checked	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Delta T Temperature	NA
Economizer Operation Checked	<input type="checkbox"/> Yes <input type="checkbox"/> No	Compressor R.L.A.	B
Unit Controls Checked & Operational	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Condenser Fan Check Amps: B	B
Outdoor Temperature:	75	Supply Air Temp	125
		Heating Operation Checked	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
		Economizer Operation Checked	<input type="checkbox"/> Yes <input type="checkbox"/> No
		Unit Controls Checked & Operational	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
		Outdoor Temperature:	75
		Actual Gas Pressure	6.8,6.6,6.9
		Economizer TSTAT Setting	NA
		Central Control System	Unit mounted stat set at 55
		Outdoor Humidity:	100
		Safety Controls Checked	Yes
		Blower Fans Checked Amps: A	5.1
		Checked for Leaks	yes

Start Up Date (completed) 9/9/2014

Notes: The electricians do not have power to one of the heaters as of 9-3-14. The electricians corrected power & startup was finalized as of 9-9-14



EQUIPMENT START UP SHEET

Job #	SMS B40821004	Job Name	Ladd Pump Station	Job Location	Harriman
Job Foreman		Start Up Technician	Matthew Pienta	Project Manager	Skyler Sinclair
Equipment ID #		Equipment Location	Inside Pump Station furthest from door		
Equipment Manufacturer	Marley	Shipping Supports & Packaging Removed	Yes		
Equipment Type	Electric hanging heater				
Equipment Model #	WD07432ATSD	Equipment Serial #	4104-11089-347		
Power Connected	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Power On Equipment	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Gas Connected	<input type="checkbox"/> Yes <input type="checkbox"/> No
Ductwork Connected	<input type="checkbox"/> Yes <input type="checkbox"/> No	Unit Ready for Start Up	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Gas Purged	<input type="checkbox"/> Yes <input type="checkbox"/> No

TO BE FILLED OUT BY JOB FOREMAN PRIOR TO TECHNICIAN'S ARRIVAL

Belt Size:	DD	Filter Sizes and Quantity	NA
Air Filters Installed	<input type="checkbox"/> Yes <input type="checkbox"/> No	Motor Rotation Correct	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Coils in Good Condition	<input type="checkbox"/> Yes <input type="checkbox"/> No	Condensate Drain Connected	<input type="checkbox"/> Yes <input type="checkbox"/> No
Refrigerant Charged	<input type="checkbox"/> Yes <input type="checkbox"/> No	Suction Pressure	NA
Voltage	480	F.L. Amp	9
Sub cool temp	NA	Delta T Temperature	NA
Compressor R.L.A.	A		Phase A
Condenser Fan Check Amps: A	NA		480
Supply Air Temp	115	Discharge Temp	NA
Heating Operation Checked	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Actual Gas Pressure	4.8,4.7,4.9
Economizer Operation Checked	<input type="checkbox"/> Yes <input type="checkbox"/> No	Economizer TSTAT Setting	NA
Unit Controls Checked & Operational	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Central Control System	Unit mounted stat set at 55
Outdoor Temperature:	80	Outdoor Humidity:	95

Start Up Date (completed)	9/3/2014
Notes:	



EQUIPMENT START UP SHEET

Job #	SMS B40821004	Job Name	Ladd Pump Station	Job Location	Harriman
Job Foreman		Start Up Technician	Matthew Pienta	Project Manager	Skyler Sinclair
Equipment ID #	ERV1	Equipment Location	Inside Pump Station		
Equipment Manufacturer	Greenheck	Shipping Supports & Packaging Removed	Yes		
Equipment Type	ERV				
Equipment Model #	ERV-20-15L-A	Equipment Serial #	13776556		
Power Connected	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Power On Equipment	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Gas Connected	<input type="checkbox"/> Yes <input type="checkbox"/> No
Ductwork Connected	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Unit Ready for Start Up	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Gas Purged	<input type="checkbox"/> Yes <input type="checkbox"/> No

TO BE FILLED OUT BY JOB FOREMAN PRIOR TO TECHNICIAN'S ARRIVAL

Belt Size:	2-4L440 belts	Filter Sizes and Quantity	4-16x20x2 pleated
Air Filters Installed	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
Coils in Good Condition	<input type="checkbox"/> Yes <input type="checkbox"/> No	Motor Rotation Correct	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Refrigerant Charged	<input type="checkbox"/> Yes <input type="checkbox"/> No	Suction Pressure	NA
Voltage	208	F.L. Amp	8.6
Sub cool temp	NA	Delta T Temperature	NA
Compressor R.L.A.	A		C
Exhaust Fan Check Amps: A	3.6	B	B
Supply Air Temp	80	Discharge Temp	80
Heating Operation Checked	<input type="checkbox"/> Yes <input type="checkbox"/> No	Actual Gas Pressure	NA
Economizer Operation Checked	<input type="checkbox"/> Yes <input type="checkbox"/> No	Economizer TSTAT Setting	NA
Unit Controls Checked & Operational	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Central Control System	Switch on wall
Outdoor Temperature:	80	Outdoor Humidity:	95

Start Up Date (completed)

Notes: This unit is continuous use. I mounted the on/off switch on 9-3-14. The electricians do not have power to one of the heaters as of 9-3-14

LADD PUMP STATION

HARRIMAN, TN
Test & Balance Report
September 08, 2014

S.A.I. PROJECT No. 408256

CONTRACTOR

SHOFFNER/KALTHOFF MECHANICAL



SYSTEMS ANALYSIS INCORPORATED



Table of Contents
Job Number: 408256
LADD PUMP STATION

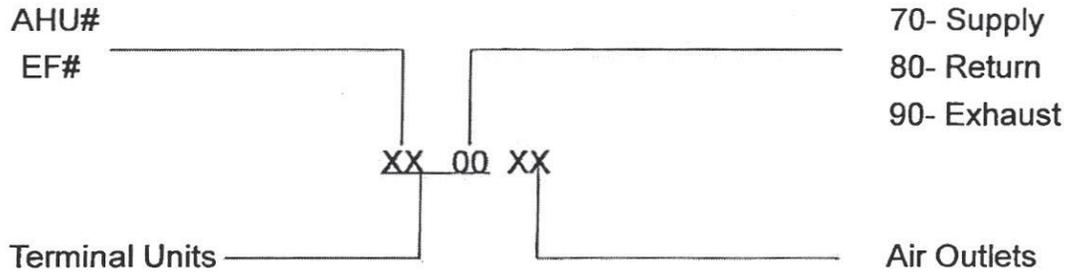
Table of Contents	2
System Identification & Code	3
Test Summary	4
Air Apparatus Test Report	5-8

SYSTEM IDENTIFICATION & CODE

LADD PUMP STATION

Job Number: 408256

HARRIMAN, TN



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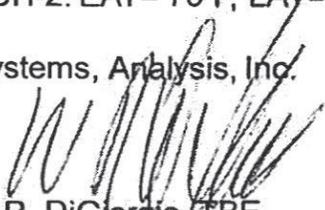
Test Summary
Job Number: 408256
LADD PUMP STATION

All tests were performed in accordance with the plans and specifications of this project and in accordance with AABC National Standards Sixth Edition, 2002.

Electric Unit Heaters were tested and are operating.

EUH-1: EAT= 83 F, LAT= 131 F
EUH-2: EAT= 75 F, LAT= 132 F

Systems, Analysis, Inc.


W.R. DiGiorgio, TBE





Associated Air Balance Council

Annual Certificate

Awarded to

W.R. DiGiorgio
Systems Analysis, Inc.

In recognition of his qualifications as a

Certified Test and Balance Engineer

under the rules, regulations, and requirements of the Associated Air Balance Council. The above named is fully authorized to perform total system balance in accordance with the standards as established by the AABC and as a member of the Associated Air Balance Council for the year

2014

This registration number 92-05-31 is fully recognized by the bylaws and charter of this professional association. Certification is renewable on an annual basis after examination of the agency's record for the preceding year. This certificate expires December 31, 2014.



Jay A. Johnson
Jay A. Johnson, President

Kenneth M. Sufka
Kenneth M. Sufka, Executive Director

SAI

SYSTEMS ANALYSIS INCORPORATED



INSTRUMENT LIST

INSTRUMENT	MANUFACTURER	MODEL	SERIAL NO.	RANGE	CALIBRATION DATE
HYDRODATA	SHORTRIDGE	HDM-250	W-13040		03/04/2014
FLOWHOOD	SHORTRIDGE	8400			
MULTIMETER	SHORTRIDGE	ADM-860C	M-91346		02/14/2014
MAGNEHELIC	DWYER			0-2"	FIELD CALIBRATED
MAGNEHELIC	DWYER			0-1"	FIELD CALIBRATED
MAGNEHELIC	DWYER				
MAGNEHELIC	DWYER				
VANE/ ANEMOMETER	DAVIS				
PITOT TUBE	DWYER	18"			
PITOT TUBE	DWYER	3'			
PITOT TUBE	DWYER	5"			
TACHMETER	SHIMPO	MT-200	BB5B9008		
VOLT METER	FLUKE	336	83706361		
TEMP METER	FLUKE	52 II	10730224		
LAP TOP	DELL	D520	G6N3DD1		
SOUND METER	QUEST	1800	HP2070001		FIELD CALIBRATED

AIR APPARATUS TEST REPORT LADD PUMP STATION

Job Number: 408256
SYSTEM/UNIT: ERV-01-EXH

Code:

UNIT DATA	
MANUFACTURER:	GREENHECK
MODEL NUMBER:	ERV-20-15L
SERIAL NUMBER:	13776556
TYPE:	
SHEAVE TYPE:	
SHEAVE SIZE:	5.0
SHEAVE BORE SIZE:	0.75
NO. BELTS & SIZE:	(1)4L440R

MOTOR DATA	
MAKE & FRAME:	MARATHON/48Y
MOTOR HORSEPOWER:	0.50
VOLTS/PHASE:	208/1/60
FULL LOAD AMPS:	3.5
SHEAVE TYPE:	1VP34
SHEAVE SIZE:	2.9
SHEAVE BORE SIZE:	0.5
SHEAVE CENTER DST:	15.5

TEST DATA	DESIGN	ACTUAL
N RPM	1099	1078
MOTOR RPM	1725	1725
MOTOR BHP	0.4	0.4
MOTOR VOLTS 1	208	211
MOTOR VOLTS 2	----	----
MOTOR VOLTS 3	----	----
MOTOR AMPS 1	3.5	3.2
MOTOR AMPS 2	----	----
MOTOR AMPS 3	----	----

TEST DATA	DESIGN	ACTUAL
OUTSIDE AIR CFM		
RETURN AIR CFM	1080	1121
TOTAL AIR CFM	1080	1121
FAN TOTAL SP	0.61	1.27
FAN DISCHARGE SP	----	0.37
FAN INLET SP	----	-0.90
UNIT DISCHARGE SP	----	0.37
UNIT RETURN SP	----	-0.27
UNIT EXTERNAL SP	0.50	0.64

DATE:09/04/14

TEST BY:JP

NOTES:

Notes



TRAVERSE TEST REPORT LADD PUMP STATION

Job Number: 408256
SYSTEM: ERV-01-EXH

Traverse No:	01	Air Station Monitor	
Type:	EXHAUST	Air Density:	0.075
Date:	9/4/2014	Net Area:	1.069
Width:	14	Vel (fpm):	1049
Height:	0	CFM:	1121
Insul Thick:	0		

	Velocity Profile									
Dim	0.70	2.10	3.50	4.90	6.30	7.70	9.10	10.50	11.90	13.30
	601	1040	1238	1097	728	1050	1641	1101	1210	782

Notes:

AIR APPARATUS TEST REPORT LADD PUMP STATION

Job Number: 408256
SYSTEM/UNIT: ERV-01-SUP

Code:

UNIT DATA	
MANUFACTURER:	GREENHECK
MODEL NUMBER:	ERV-20-15L
SERIAL NUMBER:	13776556
TYPE:	
SHEAVE TYPE:	AK51
SHEAVE SIZE:	
SHEAVE BORE SIZE:	0.5
NO. BELTS & SIZE:	(1)4L440R

MOTOR DATA	
MAKE & FRAME:	MARATHON/48Y
MOTOR HORSEPOWER:	0.50
VOLTS/PHASE:	208/1/60
FULL LOAD AMPS:	3.5
SHEAVE TYPE:	1VP34
SHEAVE SIZE:	
SHEAVE BORE SIZE:	0.75
SHEAVE CENTER DST:	15.5

TEST DATA	DESIGN	ACTUAL
FAN RPM	1111	1139
MOTOR RPM	1725	1725
MOTOR BHP	0.4	0.5
MOTOR VOLTS 1	208	211
MOTOR VOLTS 2	----	----
MOTOR VOLTS 3	----	----
MOTOR AMPS 1	3.5	3.4
MOTOR AMPS 2	----	----
MOTOR AMPS 3	----	----

TEST DATA	DESIGN	ACTUAL
OUTSIDE AIR CFM	1080	1091
RETURN AIR CFM		
TOTAL AIR CFM	1080	1091
FAN TOTAL SP	0.61	1.27
FAN DISCHARGE SP	----	0.34
FAN INLET SP	----	-0.93
UNIT DISCHARGE SP	----	0.34
UNIT RETURN SP	----	-0.18
UNIT EXTERNAL SP	0.50	0.52

DATE:09/04/14

TEST BY:JP

NOTES:

Notes

Page:7



SYSTEMS ANALYSIS INCORPORATED



TRAVERSE TEST REPORT
LADD PUMP STATION

Job Number: 408256
SYSTEM: ERV-01-SUP

Traverse No:	01	Rectangular Duct	
Type:	SUPPLY	Air Density:	0.075
Date:	9/4/2014	Net Area:	1.250
Width:	10	Vel (fpm):	873
Height:	18	CFM:	1091
Insul Thick:	0		

Velocity Profile

Dim	5.00
	873

Notes: