RL Series

Water Source/Geothermal Heat Pump

- **Commercial**
- **7-25 Tons**

RL Series Engineering Guide

AHRI CERTIFIED™ www.ahridirectory.org Water Source HP ANSI/AHRI/ASHRAE/ISO13256-1

C ETL LISTED US Intertek

Johnson Controls

146.00-EG3A 01/15

Table of Contents

Model Nomenclature

1-3	4	5-7	8	9	10	11	12	13	14	15	16	17	18	19-20	21
RLX	V	120	T	L	3	0	A	C	A	N	N	4	3	SS	*

Model Type
RLL – RL Low Temp
RLX – RL Extended Range

Cabinet Configuration
V – Vertical
H - Horizontal

Unit Capacity (MBTUH)
080, 095, 120, 160
180, 240, 300

Discharge Configuration
T – Top (Vertical)
E – End (Horizontal)
S – Side (Horizontal)

Return Air Configuration
L – Left
R – Right

Voltage
3 – 208-230/60/3
4 – 460/60/3
5 – 575/60/3

Future Option
0 – Future

Blower Options
A – Standard Static, Standard Motor
B – Low Static, Standard Motor[1]
C – High Static, Standard Motor[2]
D – Standard Static, Large Motor[2,3]
E – High Static, Large Motor[3]

Water Coil Option
C – Copper
N – CuproNickel

Sound Kit Option
A – None
B – Sound Kit

Hot Gas Bypass/Reheat Option
N – None
G – Hot Gas Bypass
R – Hot Gas Reheat
B – Hot Gas Bypass w/Hot Gas Reheat

Water Control Option
N – None

Control Option
4 – FX10 Standard without Communication
5 – FX10 with Open N2 Communication
6 – FX10 with Lonworks Communication
7 – FX10 with BacNet Communication
8 – FX10 Standard with User Interface
9 – FX10 with Open N2 & User Interface
0 – FX10 with Lonworks & User Interface
3 – FX10 with BacNet & User Interface

Air Coil/Insulation Option
3 – Uncoated
4 – AlumiSeal™

Non-Standard Options
SS – Standard
QP – 2" MERV 13 Filter
SF – Stainless Steel Drain Pan[4]
SG – 2" MERV 13 Filter, Stainless Steel Drain Pan[4]

Vintage
* - Factory Use Only

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Notes:
1 – Not available on RLXV/RLLV095, 180, RLXH/RLLH080
2 – Not available on RLXV/RLLV080, 160
3 – Not available on RLXH/RLLH120, RLXV/RLLV300
4 – Not available on RLXV/RLLV160-300. Stainless steel is standard on RLXV/RLLV160-300

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All RL Series product is Safety listed under UL1995 thru ETL and performance listed with AHRI in accordance with standard 13256-1.

The RL Series

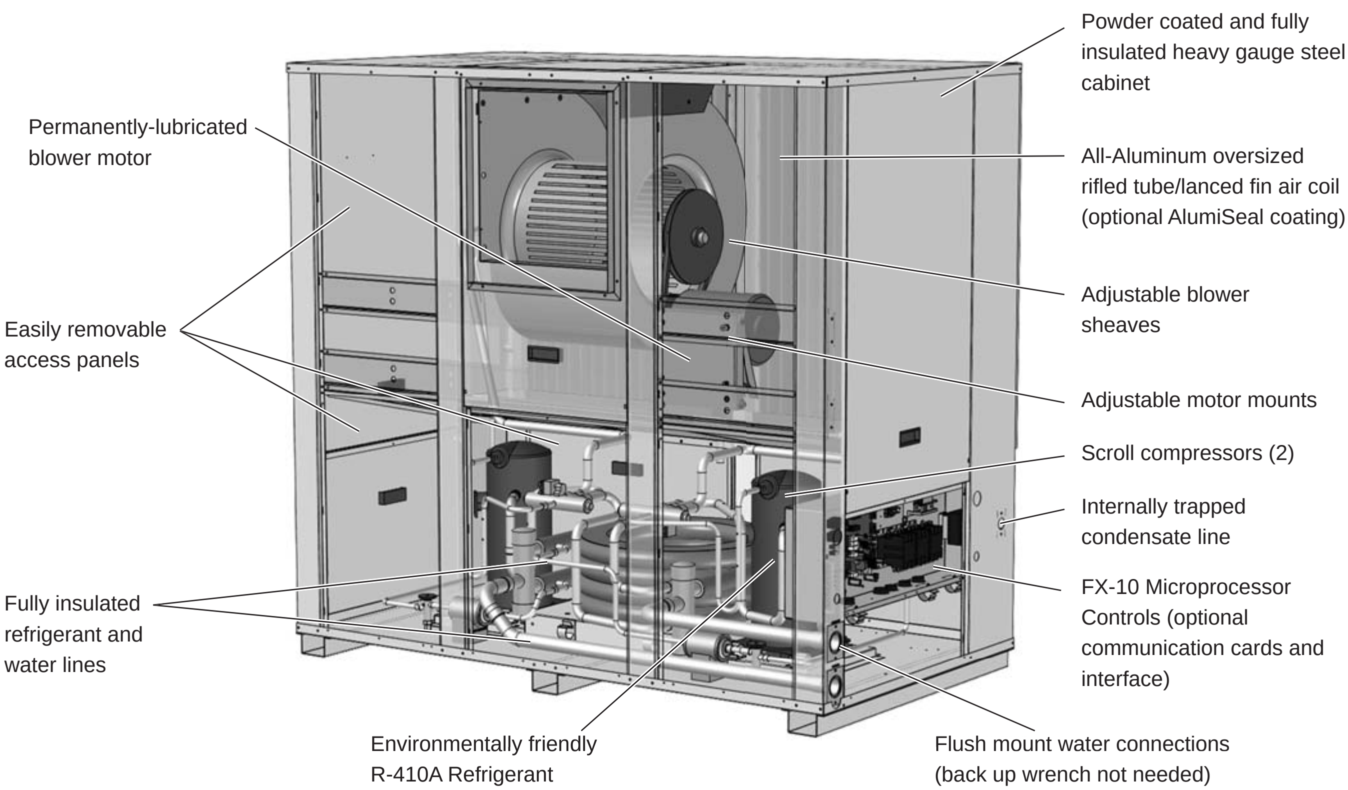
Vertical Models
RLLV080-300 (7-25 tons)
RLXV080-300 (7-25 tons)

Horizontal Models
RLLH080-120 (7-10 tons)
RLXH080-120 (7-10 tons)

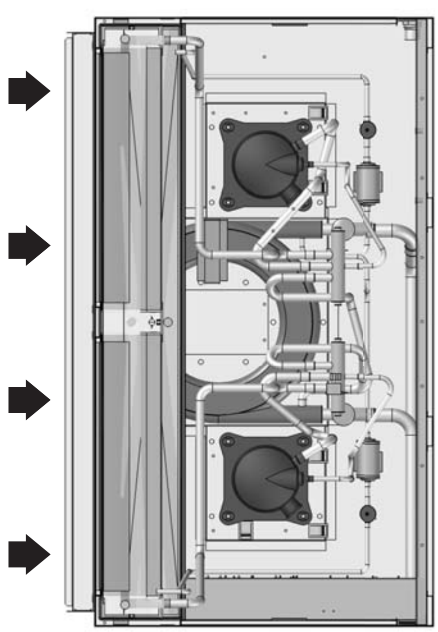
The RL Series cont.

Product Features: Vertical Cabinet

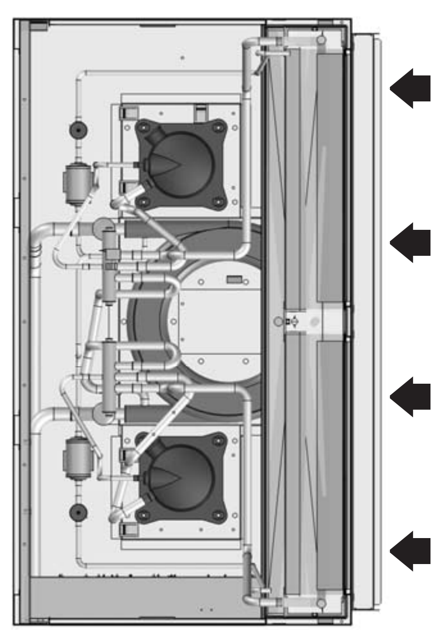
RL Series Vertical units are designed for high efficiency, maximum flexibility and primary servicing from the front and side. These cabinets are field convertible top and side discharge, and are available in two sizes.



A true left and right return option is available.



Left hand return

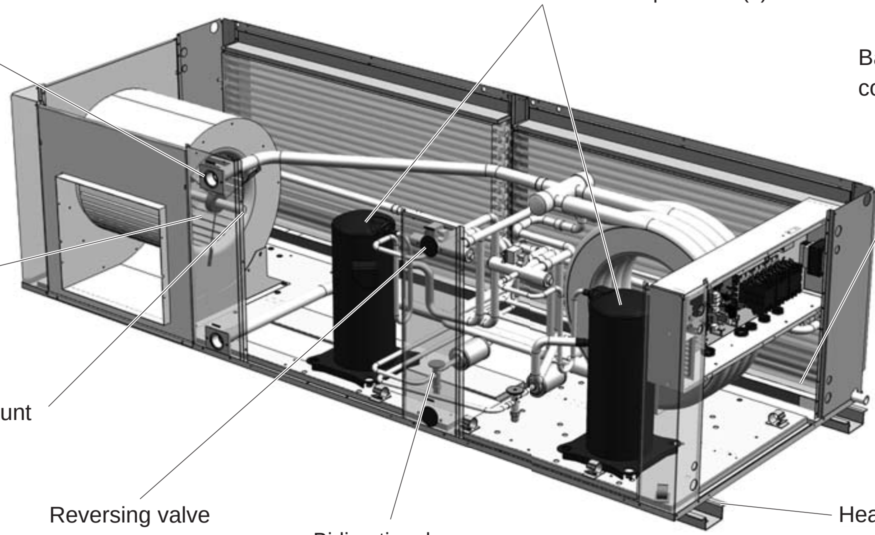


Right hand return

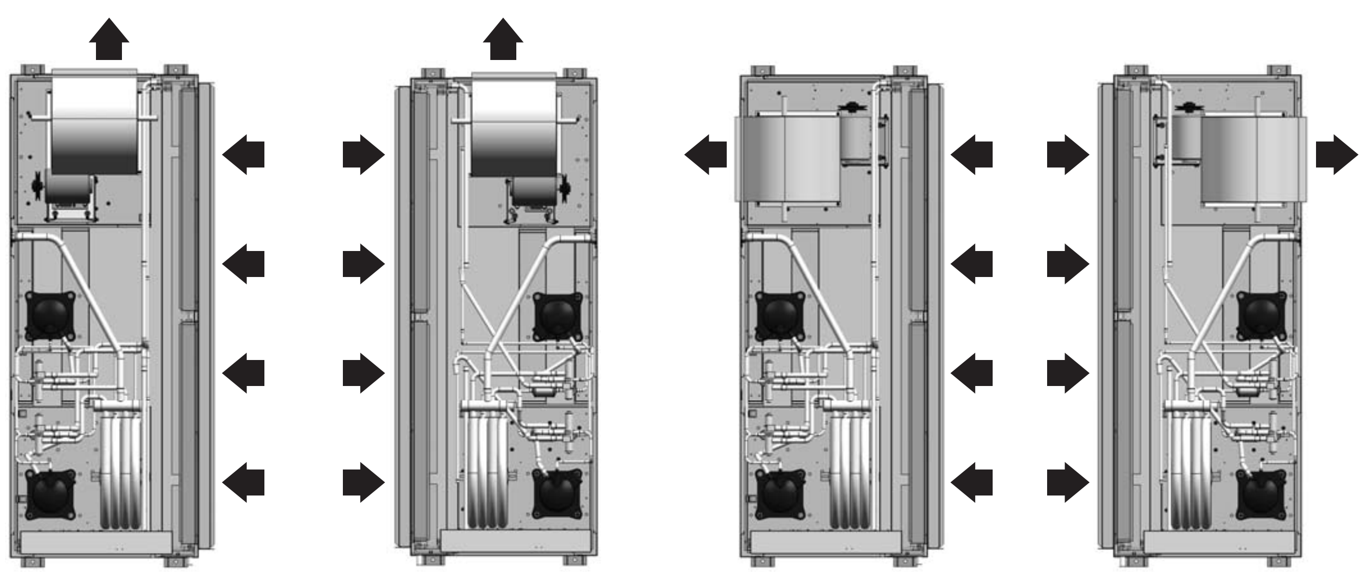
The RL Series cont.

Product Features: Horizontal Cabinet

The RL Series Horizontal units provide high efficiency, maximum flexibility, and primary servicing from the front. These units are available in one cabinet size.



Four blower deck options are available. Factory or field conversion option of end or side discharge using switchable access panels and a factory only option of true left or right return air coil.



Right hand return with end discharge | Left hand return with end discharge | Right hand return with side discharge | Left hand return with side discharge

The RL Series cont.

High Efficiency

RL Series is the highest efficiency units available. Large oversized air coils, water to refrigerant heat exchangers and scroll compressors provide extremely efficient operation. This efficiency means the RL Series requires less loop than any product on the market. This can mean significant savings on commercial projects.

Quiet Operation

All RL Series product is AHRI 260 sound rated using third party sound testing. Room Noise Criteria Curves (NC Curve) may be calculated using data from the AHRI 260 ratings giving the engineer total flexibility in assuring a quiet environment.

Standard Features

- Large low rpm blower.
- Heavy gauge cabinet and rails on horizontals to hang for vibration isolation.
- Quiet scroll compressors in all models
- 2-dimension refrigerant piping vibration loops to isolate the compressor.
- All interior cabinet surfaces including the compressor compartment are insulated with 1/2 in. [12.7 mm] thick 1-1/2lb [681 g] density, surface coated, acoustic type glass fiber insulation.

Super Quiet Option

An optional SuperQuiet Sound Package is also available for a modest cost features:

- Multi-density laminate lined compressor blanket designed to completely surround the compressor on all six sides and suppress low frequency noise.

AlpinePure™ Indoor Air Quality (IAQ)

The RL Series features several IAQ benefits. All units feature:

- Corrosion-free plastic or stainless steel double-sloped drain pan to eliminate standing water and prevent bacterial growth.
- Foil-faced fiber insulation in all air handler compartments to allow cleanability and inhibit bacteria growth. Optional non-fibrous closed cell insulation is also available for more sensitive applications.
- An optional low static high efficiency 2 in. [5.1 cm] MERV 13 filter is also available.

Hot Gas Reheat - Dehumidification

With tighter construction and more and more ventilation air coming into buildings, there is more need now than ever for dehumidification. Ensuring dehumidification can provide; consistent employee comfort, a reduction in mold liability, a reduction in cooling costs. Reduced humidity also provides an improvement in indoor air quality (IAQ) thru lower humidity levels which can reduce allergen levels, inhibit mold and bacterial growth, and provide an improved computer environment. Reheat can be used wherever moisture is a problem. In schools, high latent auditoriums and theaters, makeup air units, computer rooms, and indoor swimming pool rooms are typical applications. The option consists of a reheat air coil located after the evaporator air coil and a reclaim valve that diverts the hot gas into the reheat coil. Neutral air will be provided at typical WLHP loop temperature.

The reheat option is only available with the FX10 control. With this control we have three control schemes available:

Room wall dehumidistat – An optional room wall dehumidistat that controls the reheat mode thru a 24VAC ‘Hum’ input (On or Off). Setpoint and deadband is determined by the dehumidistat.

Duct humidity sensor – An optional duct humidity sensor is installed. The FX10 control reads the humidity from the sensor and determines operation mode. Setpoint and deadband are internally set by the FX10 control and are adjustable. Continuous blower operation is a requirement for this mode to accurately measure relative humidity during the off cycle.

Room wall humidity sensor – An optional wall humidity sensor is installed. The FX10 control reads the humidity from the sensor and determines operation mode. Setpoint and deadband are internally set by the FX10 control and are adjustable. Continuous blower operation is NOT a requirement for this mode.

Hot Gas Bypass

The hot gas bypass (HGB) option is designed to limit the minimum evaporating pressure in the cooling mode to prevent the air coil from icing. The HGB valve senses pressure at the outlet of the evaporator by an external equalizer. If the evaporator pressure decreases to 115 psig the HGB valve will begin to open and bypass hot discharge gas in the inlet of the evaporator. The valve will continue to open as needed until it reaches its maximum capacity. Upon a raising of suction pressure the valve will begin to close back off and normal cooling operation will resume.

Flexible Control Options

The FX10 control provides unmatched capability in several areas including performance monitoring, zoning, humidity, energy management, and service diagnosis, and then communicates it all thru standard DDC protocols like N2, Lon and BACnet (MS/TP @ 19,200 Baud Rate).

The RL Series cont.

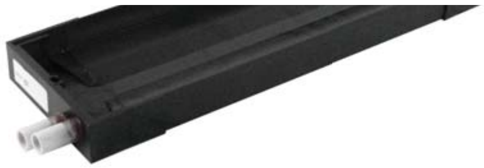
The most unique feature is integrating the FX10 into the RL Series as both the heat pump and DDC controller providing both a cost advantage and features not typically found on WLHP controls. This integration allows heat pump monitoring sensors, status and service diagnosis faults to be communicated thru the DDC direct to the building automation system (BAS), giving building supervisors detailed and accurate information on every piece of equipment without removing an access panel!

Easy Maintenance and Service Advantages

- Removable compressor access panels.
- Separate Air handler and compressor section access panels permit service testing without bypass (Vertical only).
- Removable low voltage connector for easy thermostat wiring.
- Quick attach wiring harnesses are used throughout for fast servicing.
- High and low pressure refrigerant service ports.
- Internal drop out blowers (vertical) and access panel view of all blower motors (horizontal).
- Optional user interface for diagnostics and commissioning of FX controls.

Secondary Drain Option (Special)

Some local building authority's interpretation of codes require more condensate overflow protection than standard microprocessor based condensate sensors offer. In these areas a full secondary drain pan might be required causing both increased cost and unit service access issues. In many of these cases a secondary drain option can be added to the unit to pass this local interpretation of condensate drain redundancy. This option adds a second PVC drain connection to the drain pan at a higher level. This can be ordered as a special and is only availabe in plastic.



Factory Quality

- All refrigerant brazing is performed in a nitrogen environment.
- Computer controlled deep vacuum and refrigerant charging system.
- All joints are leak detected for maximum leak rate of less than 1/4 oz. per year.
- Computer bar code equipped assembly line insures all components are correct.
- All units are computer run-tested with water to verify both function and performance.

Inside the RL Series

Refrigerant

RL Series products all feature zero ozone depletion and low global warming potential R-410A refrigerant.

Cabinet

All vertical units are all constructed of corrosion resistant galvanized sheet metal with optional white polyester powder coat paint rated for more than 1000 hours of salt spray. Large lift-out access panels provide access to the compressor section from four sides. Refrigerant circuit is designed to allow primary serviceability from the front. 1 horizontal and 2 vertical cabinets are provided for application flexibility. Air handler access panels allow servicing of the blower motor, blower, and drain pan. The blower motor and blower can be completely serviced or replaced without removal of the unit. Side or top discharge option is available on vertical units

Flexible configurations include 4 blower deck options for horizontals and a true left and right return on both horizontal and vertical.

Filter Rack

A 2 in. [5.1 cm] disposable filter is standard. An optional 2 in. MERV 13 for high efficiency filtration is available.

Compressors

High efficiency R410A scroll compressors are used on every model. Scrolls provide both the highest efficiency available and great reliability.

Electrical Box

Unit controls feature quick connect wiring harnesses for easy servicing. Separate knockouts for LV, and two for power on two sides allow easy access to the control box. Large 75VA transformer assures adequate controls power for accessories.

Water Connections

Flush mount FPT water connection fittings allow one wrench leak-free connections and do not require a backup wrench.

Drain Pan

Bacteria resistant composite drain pan is sloped to promote complete drainage and will never rust or corrode. Complete drainage helps to inhibit bacterial or microbial growth. Vertical units feature an internally trapped condensate line using clear pvc hose for easy inspection and reduced installation cost. Stainless steel drain pans are available for 7-25 ton units.

Thermostatic Expansion Valve

All RL Series models utilize a balanced port bi-directional thermostatic expansion valve (TXV) for refrigerant metering. This allows precise refrigerant flow in a wide range of entering water variation (20 to 120°F [-7 to 49°C]) found in geothermal systems. The TXV is located in the compressor compartment for easy access.

Inside the RL Series cont.

Water to Refrigerant Coaxial Heat Exchanger Coil

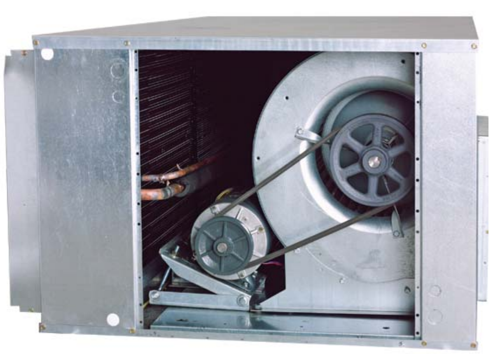
Large oversized coaxial refrigerant to water heat exchangers provide unparalleled efficiency. The coaxes are designed for low pressure drop and low flow rates. All coaxes are pressure rated to 450 psi water side and 600 psi on the refrigerant side. Optional refrigerant and coaxial heat exchanger insulation is available to prevent condensation in low temperature loop operation.

Service Connections and Serviceability

Two Schrader service ports are provided for each circuit on every unit. The suction side and discharge side ports are for field charging and servicing access. All valves are 7/16 in. SAE connections. All water and electrical connections are made from the front of the unit. Unit is designed for front access serviceability.

Blower Motor and Housing

High efficiency low rpm galvanized belt drive blower – reducing air noise. High static options are available in most models. Horizontal units can be field converted from end to side discharge. Vertical units can be field converted from top to side discharge with a few additional parts.



Adjustable Motor Mount

A heavy duty, 16 ga. steel adjustment motor mount is provided to allow easy service of the belt, sheaves, and blower motor. The angle of the plate can be easily adjusted in the field without removal of the blower motor. This prevents the need for the service technician to realign the blower motor after service has been completed.

All-Aluminum Air Coil

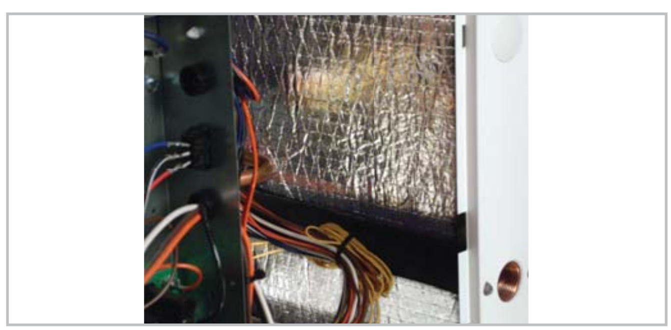
All-aluminum round-tube-and-fin air coil in a packaged water source heat pump. These air coils are constructed of lanced fin and rifled tube aluminum that is not susceptible to formicary corrosion. For additional condensate runoff and meeting project specifications, an optional AlumiSeal e-coating is available.

4-Way Reversing Valve

RL Series units feature a reliable all-brass pilot operated refrigerant reversing valve. The reversing valve operation is limited to change of mode by the control to enhance reliability.

Air Handler Insulation

Foil Faced air handler insulation provides cleanability to further enhance IAQ.



RL Series Controls

FX10 Control

The FX10 control provides unparalleled capability in several areas including performance monitoring, zoning, humidity, energy management, and service diagnosis, and then communicates it all thru standard DDC protocols like N2, Lon and BACnet (MS/TP @ 19,200 Baud Rate).

The most unique feature is integrating the FX10 into the RL Series as both the heat pump and DDC controller providing both a cost advantage and providing features not typically found on WLHP controls. This integration allows heat pump monitoring sensors, status and service diagnosis faults to be communicated thru the DDC direct to the building automation system (BAS), giving building supervisors detailed and accurate information on every piece of equipment without removing an access panel!

Control	General Description	Application	Display/Interface	Protocol
FX10 	The FX10 microprocessor control is self contained control featuring LP, LOC, HP, LWT, and condensate overflow fault modes can be displayed on BAS system. Optional handheld Medium User Interface (MUI) Control can be used for additional setup or servicing. Program customization is possible.	Cannot be integrated with centralized building automation systems. Software can be customized for specific projects.	Optional Medium User Interface (MUI) can be used as a field service tool.	Standalone
FX10 w/N2 	FX10 Control functions as both unitary heat pump control and DDC communication, therefore detail operational and fault information is available to BAS. Other features are same as FX10 with addition of Johnson Controls N2 compatibility.	Same as FX10 with Johnson Controls N2 BAS compatibility.	Optional Medium User Interface (MUI) can be used as a field service tool.	Johnson Controls N2 network
FX10 w/LonWorks 	FX10 Control functions as both unitary heat pump control and DDC communication, therefore detail operational and fault information is available to BAS. Other features are same as FX10 with addition of LonWorks compatibility.	Same as FX10 with LonWorks BAS compatibility.	Optional Medium User Interface (MUI) can be used as a field service tool.	LonWorks
FX10 w/BACnet 	FX10 Control functions as both unitary heat pump control and DDC communication, therefore detail operational and fault information is available to BAS. Other features are same as FX10 with addition of BACnet compatibility.	Same as FX10 with BACnet BAS compatibility. Due to communication speed, no more than 30 units should be connected to a single trunk of the network.	Optional Medium User Interface (MUI) can be mounted or used as field service tool.	BACnet - MS/TP (19,200 Baud Rate)

RL Series Controls - FX10

FX10 Advanced Control Overview

The Johnson Controls FX10 board is specifically designed for commercial heat pumps and provides control of the entire unit as well as input ports for Open N2, LonTalk, BACnet (MS/TP @ 19,200 Baud Rate) communication protocols as well as an input port for a user interface. The user interface is an accessory item that can be used to aid in diagnostics and unit setup. A 16-pin low voltage terminal board provides terminals for common field connections. The FX10 Control provides:

- Operational sequencing
- High and low-pressure switch monitoring
- General lockout
- Freeze Detection
- Condensate overflow sensing
- Lockout mode control
- Emergency shutdown mode
- Random start and short cycle protection

Short Cycle Protection

Allows a minimum compressor “off” time of four minutes and a minimum “on” time of two minutes.

Random Start

A delay of 1 to 120 seconds is generated after each power-up to prevent simultaneous startup of all units within a building after the release from an unoccupied cycle or power loss.

Emergency Shutdown

A field-applied dry contact can be used to place the control into emergency shutdown mode. During this mode, all outputs on the board are disabled.

Freeze Detection

Field selectable for 15° or 30°F (-9° or -1°C)

Installation Options

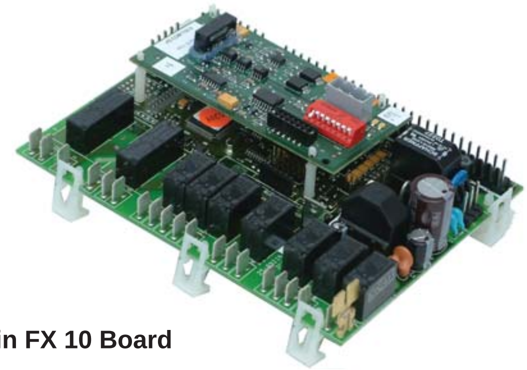
- Standalone controlled by standard room thermostat
- Standalone with a Zone Temperature Sensor (must have user interface to change set points beyond the allowed +/- 5°F)
- Integrated into BAS by adding communication module

Accessory Outputs

Quantity 2. One cycled with blower, other with compressor.

User Interface

4 x 20 backlit LCD.



Main FX 10 Board

Optional Plug-in Communication Modules - (compatible with standard BAS protocols)

- Open N2
- LonTalk
- BACnet (MS/TP @ 19,200 Baud Rate)

Display

Requires DLI Card/Kit. Up to 2 displays, either 1 local and 1 remote, or 2 remote. (A 2-display configuration requires identical displays.) Local display can be up to 3 meters from the controller, power supply, and data communication. Remote display can be up to 300 meters from the controller. Remote display must be independently powered with data communication done via 3 pole shielded cable.

Control Timing and Fault Recognition Delays

Lead compressor “ON” delay ....90 seconds
(not applicable for single compressor models)
Minimum compressor “ON” time...2 minutes
(except for fault condition)
Short cycle delay ....5 minutes
Random start delay ....0-120 seconds
High pressure fault .... <1 second
Low pressure fault ....30 seconds
Freeze detection fault..30 seconds
Condensate overflow fault...30 seconds
Low pressure fault bypass..2 minutes
Freeze detection fault bypass...2 minutes

RL Series Controls - FX10 cont.

FX10 Microprocessor and BAS System

The FX10 is a microprocessor based control that not only monitors and controls the heat pump but also can communicate any of this information back to the building automation system (BAS). This means that not only does the control monitor the heat pump at the unit you can also monitor and control many of the features over the BAS. This clearly puts the FX10 in a class of its own.

The control will enumerate all fault conditions (HP, LP, CO, LOC, and Freeze Detection) over a BAS as well as display them on a medium user interface (MUI). HP, LP, CO and Freeze Detection faults can all be reset over a BAS. A Loss Of Charge fault can not be reset or bypassed until the problem has been corrected. A MUI is invaluable as a service tool for the building service team.

The unit can be commanded to run by a typical heat pump thermostat or run based on heating and cooling set points supplied by a BAS. The control board is wired with quick connect harnesses for easy field change out of a bad control board. The control has an input programmed to enable field installed emergency heat in the event that the compressor is locked out. This input can also be commanded on from a BAS as needed. An alarm history can be viewed through the MUI and will be held in memory until the unit is power cycled. Relative humidity can be read by a 0-5VDC humidity sensor that is displayed over the network. Because the FX10 is not factory configured to read CO^2 levels, contact the factory for application assistance.

The FX10 control has unused analog and digital inputs for field installed items such as air temperature, water temperature, CO^2 or current status switches. The control has unused binary and PWM outputs that can be commanded over the BAS for field use.

An optional Medium User Interface (MUI) for control setup and advanced diagnostics is available with some mounting kits, MUIK1 - Panel mount version and the MUIK2-Wall mount version.

Zone Sensors

There are two options for zone sensors that can be used with the FX10 control. Both sensors use a Johnson controls A99 positive temperature coefficient type sensor. The TAXXJ02 has a set point adjustment now which will give the end user a +/- 5°F adjustment from the set point as well as a push button that can be used for temporary occupancy. The control leaves the factory set to operate with a TAXXJ02 sensor and can be changed to read the TAXXA04 sensor through a building automation system or with a user interface.

Standard Features

- Anti Short Cycle
- High Pressure Protection
- Low Pressure Protection
- Freeze Detection
- Loss Of Charge Detection
- Random Start
- Display for diagnostics
- Reset Lockout at disconnect or through BAS
- 2 Accessory outputs
- Optional BAS add-on controls
- Compressor Lead/Lag

DDC Operation & Connection

Other optional network protocol boards that can be added to the FX10 are:

- Johnson Control N2
- LonWorks
- BACnet
  - MS/TP @ 19,200 Baud rate
  - Limit devices to 30 on a single trunk line.

Control and Safety Feature Details

Emergency Shutdown

The emergency shutdown mode can be activated by a command from a facility management system or a closed contact on BI-2. The default state for the emergency shutdown data point is off. When the emergency shutdown mode is activated, all outputs will be turned off immediately and will remain off until the emergency shutdown mode is de-activated. The first time the compressor starts after the emergency shutdown mode has been de-activated, there will be a random start delay present.

Lockout Mode

Lockout mode can be activated by any of the following fault signals: refrigerant system high pressure, refrigerant system low pressure, freeze detection, and condensate overflow. When any valid fault signal remains continuously active for the length of its recognition delay, the controller will go into fault retry mode, which will turn off the compressor. After the Compressor short cycle delay, the compressor will attempt to operate once again. If three consecutive faults occur in 60 minutes during a single heating or cooling demand, the unit will go into lockout mode, turning off the compressor, enabling the alarm output, and setting the blower back to low speed operation until the controller is reset. If the control faults due to the low pressure input (BI-3) being open during the pre-compressor startup check, the control will go into lockout mode immediately, disabling the compressor from starting

RL Series Controls - FX10 cont.

and enabling the alarm output (BO-6). The lockout condition can be reset by powering down the controller, by a command from the BAS, or by the holding the ESC and Return keys on the MUI for 5 seconds.

Freeze Detection (AI-5)

The freeze detection sensor will monitor the liquid refrigerant temperature entering the water coil in the heating mode. If the temperature drops below the freeze detection trip point for the recognition delay period, the condition will be recognized as a fault. The freeze detectopm trip point will be factory set for 30°F and will be field selectable for 15°F by removing a jumper wire on BI-5. The freeze detection fault condition will be bypassed 2 minutes at normal compressor startup, to allow the refrigeration circuit to stabilize. If the freeze detection sensor becomes unreliable at any time compressor operation will immediately be suspended until the problem is corrected. This should be displayed as an alarm on the BAS and the MUI. This alarm will be reported a “Water Low Temp Limit” fault.

High Pressure (BI-11)

The high-pressure switch shall be a normally closed (NC) switch that monitors the systems refrigerant pressure If the input senses the high-pressure switch is open it must disable the compressor output immediately and count the fault. The compressor minimum on time does not apply if the high-pressure switch opens. The compressor will not restart until the compressor short cycle time delay has been satisfied.

Low Pressure (BI-3)

The low-pressure switch shall be a normally closed (NC) switch that monitors the systems refrigerant pressure. The input shall be checked 15 seconds before compressor start up to be sure the pressure switch is closed and then ignored for the first 2 minutes after the compressor output (BO-2) is enabled. If the switch is open continuously for (30) seconds during compressor operation the compressor output (BO-2) will be disabled. The compressor will not restart until the compressor short cycle time delay has been satisfied.

Condensate Overflow

The condensate overflow sensing circuit will monitor the condensate level as a resistance input to AI-3. If the condensate water level rises resulting in the input resistance rising above the set point for the recognition delay period, the condition will be recognized as a fault. The condensate will be subjected to a (30) second lockout delay which requires that the fault be sensed for a continuous (30) seconds before suspending unit operation.

Alarm Output (BO-6)

The alarm output will be enabled when the control is in the lockout mode and will be disabled when the lockout is reset.

Test Mode

Raising the zone temperature input (AI-1) reading to 180–220°F or by holding the ESC and down arrow keys on the MUI for 5 seconds will put the control into test mode. In test mode the random start delay and the compressor fixed on delay time will both be shortened to 5 seconds and the reversing valve will be allowed to cycle with out shutting down the compressor. If an MUI is connected to the control LED 8 will flash and the words “Test Mode Enabled” will be shown on the LCD display when the control is in test mode. Test mode will be disabled after a power cycle, 30 minute timeout, or by holding the ESC and Up arrow keys on the MUI.

Sequence of Operation

Power Fail Restart

When the controller is first powered up, the outputs will be disabled for a random start delay. The delay is provided to prevent simultaneous starting of multiple heat pumps. Once the timer expires, the controller will operate normally.

Random Start Delay

This delay will be used after every power failure, as well as the first time the compressor is started after the control exits the unoccupied mode or the emergency shutdown mode. The delay should not be less than 1 second and not longer than 120 seconds. If the control is in test mode the random start delay will be shortened to 5 seconds.

Compressor Fixed On Delay Time

The Compressor Fixed On Delay Time will ensure that the compressor output (B02) is not enabled for (90) seconds after the control receives a call to start the compressor. This delay is adjustable from 30 – 300 seconds over a BAS or a MUI. If the control is in test mode the Compressor Fixed On Delay Timer will be shortened to 5 seconds.

Compressor Minimum On Delay

The compressor minimum on delay will ensure that the compressor output is enabled for a minimum of (2) minute each time the compressor output is enabled. This will apply in every instance except in the event the high pressure switch is tripped or emergency shutdown then the compressor output will be disable immediately.

RL Series Controls - FX10 cont.

Compressor Short Cycle Delay Time

The compressor short cycle time delay will ensure that the compressor output will not be enabled for a minimum of (5) minutes after it is disabled. This allows for the system refrigerant pressures to equalize after the compressor is disabled.

Compressor Lead/Lag

Compressor lead/lag is a standard part of the FX10 control system. The unit is shipped from the factory with lead/lag disabled. Lead/lag can be activated through the unit mounted user interface. The default lead/lag time is 24 hours, but can be adjusted through the user interface.

Heating Cycle

On a call for heating, the blower enable output and accessory output 2 will turn on immediately after the random start delay timer has been satisfied. If the compressor short cycle time delay has been satisfied, the compressor will turn on after the blower enable and accessory output 2 are on and the fixed compressor start delay timers have been satisfied.

Auxiliary heat output can be controlled over the BAS.

Set Point Control Mode

In set point control mode the reversing valve output will be disabled. As the temperature drops below the heating set point and begins to operate in the heating proportional band, the low capacity compressor output (BO-2) will be enabled. A PI loop in the programming of the control will determine when the full capacity compressor output (BO-4) is to be enabled. The compressor must be operating in low capacity for a minimum of 30 seconds before the full capacity compressor output can be enabled. During low capacity compressor operation the ECM2.3 blower will operate in medium speed and will operate in high speed when the compressor is operating at full capacity.

Thermostat Control Mode

In thermostat mode the compressor will be cycled based on Y1 and Y2 calls from a room thermostat. When the control receives a Y1 command (BI-7) from the thermostat the low capacity compressor output (BO2) will be enabled and the ECM2.3 blower will operate in medium speed. When the control receives a Y2 command (BI-8) from the thermostat the full capacity compressor output will be enabled and the ECM2.3 blower will operate in high speed. During the heating cycle the reversing valve will be commanded into the off position.

Cooling Cycle

On a call for cooling, the blower enable output and accessory output 2 will turn on immediately after the random start delay timer has been satisfied. If the compressor short cycle time delay has been satisfied, the compressor will turn on after the blower enable and accessory output 2 are on and the fixed compressor start delay timers have been satisfied.

Set Point Control Mode

In set point control mode the reversing valve output will be enabled. As the temperature falls below the cooling set point and begins to operate in the cooling proportional band, the low capacity compressor output (BO-2) will be enabled. A PI loop in the programming of the control will determine when the full capacity compressor output (BO-4) is to be enabled. The compressor must be operating in low capacity for a minimum of 30 seconds before the full capacity compressor output can be enabled. During low capacity compressor operation the ECM2.3 blower will operate in medium speed and will operate in high speed when the compressor is operating at full capacity.

Thermostat Control Mode

In thermostat mode the compressor will be cycled based on Y1 and Y2 calls from a room thermostat. When the control receives a Y1 command (BI-7) from the thermostat the low capacity compressor output (BO2) will be enabled and the ECM2.3 blower will operate in medium speed. When the control receives a Y2 command (BI-8) from the thermostat the full capacity compressor output will be enabled and the ECM2.3 blower will operate in high speed. During the cooling cycle the reversing valve will be commanded into the “ON” position.

Emergency Heat/Network Enabled Output (BO5)

This output is set from the factory to enable/disable emergency heat. If a problem occurs with the unit resulting in the compressor being locked out in heating mode, the control will automatically enable this output to turn on field installed electric heat. This output is interlocked with the blower proving input BI-6 (Blower proving sensors must be field supplied and installed). BI-6 must be connected to PB2 position 3 (see unit schematic) in the field if no blower proving sensor is desired. There is a configurable parameter available through a BAS network that must be enabled if this output is to be commanded over the BAS network.

MUI Alarm History Reporting

If a fault occurs the fault will be recorded in history for display on the medium user interface in the History Menu. Each fault type will be displayed in the history menu with a number between 0 and 3. A reading of 3+ will mean that fault has occurred more than three times in the past. The history menu can be cleared with a power cycle only. Alarm date and time are not included in the history.

RL Series Controls - FX10 cont.

Inputs and Outputs Configuration

Field Selectable Options

Water Coil Low Temperature Limit Set Point (BI-5)

The water coil low temperature limit set point input allows you to adjust the water coil low temperature limit set point (AI-5). When the jumper is installed on BI-5 (Wire #24) the water coil low temperature limit set point is factory set for 30°F. When the jumper on BI-5 (Wire #24) is removed the water coil low temperature limit set point will be 15°F.

Accessory Outputs (BO-7 and BO-8)

Accessory Output 1 will be energized 90 seconds prior to the compressor output being energized. Accessory Output 2 will be energized with the blower output (BO-1). When the corresponding compressor output is turned off the accessory output will be deactivated immediately. These outputs are selectable for normally open or normally closed operation through the Medium User interface or through the Building Automation System.

SINGLE and DUAL STAGE WATER-TO-AIR			
Input Name	**Input**	**Output Name**	**Output**
Zone Temp 1	AI 1	Fan Enable	BO1
Relative Humidity Input	AI 2	Comp – Low Capacity	BO2
Condensate Level	AI 3	Reversing Valve	BO3
Universal Temp Input	AI 4	Comp – Full Capacity	BO4
Water Coil Low Temperature Limit	AI 5	Network Output/EH Output	BO5
Warm/Cool Adjust and Temp Occ	AI 6	Alarm	BO6
		Accessory 1 Output	BO7
Occupied	BI 1	Accessory 2 Output	BO8
Emergency Shutdown	BI 2	Network Controlled Output	B09
Stage 1 Low Pressure	BI 3		
Network Viewable Input 1	BI 4	Variable Speed ECM Blower	PWM1
Water Coil Low Temp Limit Set Point	BI 5	Network Controlled Output	PWM2
Network Viewable Input 2	BI 6		
Thermostat Y1	BI 7		
Thermostat Y2	BI 8		
Thermostat O	BI 9		
Thermostat G	B10		
Stage 1 High Pressure	BI11		
Compressor Proving	BI12		
XP10 Expansion Card			
Input Name	**Input**	**Output Name**	**Output**
Unused	AI 1	Unused	BO 1
Unused	AI 2	Unused	BO 2
Unused	AI 3	Unused	BO 3
Unused	AI 4	Unused	BO 4

Control Accessories

Zone Sensors

- TAXXJ02 Room Command Module
- TAXXA04 LCD Room Command Module
- A99 Sensor

MUI (LCD User interface) for diagnostics and commissioning.

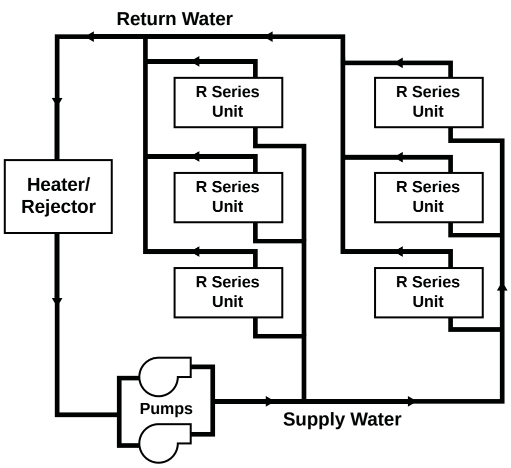
- MUIK1 - Panel Mount, Portable
- MUIK2 - Wall Mount

RL Series Application Notes

The Closed Loop Heat Pump Concept

The basic principle of a water source heat pump is the transfer of heat into water from the space during cooling, or the transfer of heat from water into the space during heating. Extremely high levels of energy efficiency are achieved as electricity is used only to move heat, not to produce it. Using a typical RL Series, one unit of electricity will move four to five units of heat.

When multiple water source heat pumps are combined on a common circulating loop, the ultimate in energy efficiency is created: The units on cooling mode are adding heat to the loop which the units in heating mode can absorb, thus removing heat from the area where cooling is needed, recovering and redistributing that heat for possible utilization elsewhere in the system. In modern commercial structures, this characteristic of heat recovery from core area heat generated by lighting, office equipment, computers, solar radiation, people or other sources, is an important factor in the high efficiency and low operating costs of closed source heat pump systems.



In the event that a building's net heating and cooling requirements create loop temperature extremes, RL Series units have the extended range capacity and versatility to maintain a comfortable environment for all building areas. Excess heat can be stored for later utilization or be added or removed in one of three ways; by ground-source heat exchanger loops: plate heat exchangers connected to other water sources, or conventional cooler/boiler configurations. Your sales representative has the expertise and computer software to assist in determining optimum system type for specific applications.

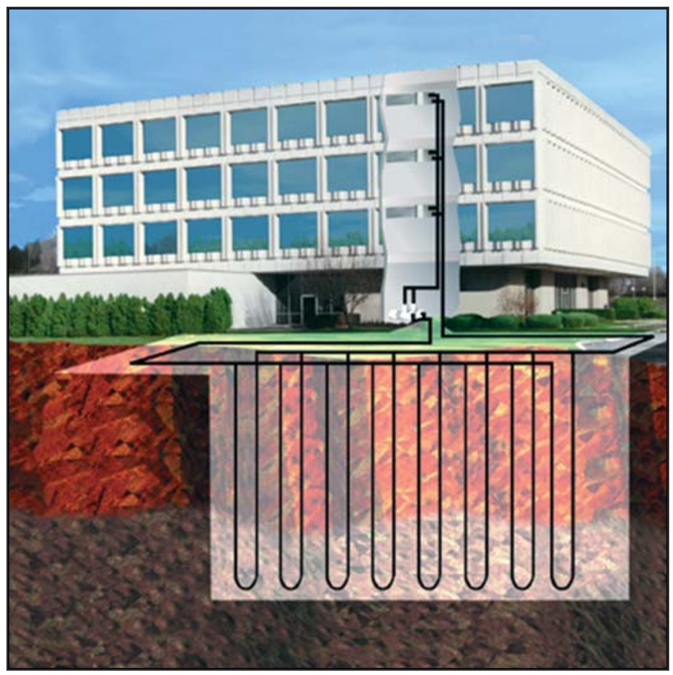
The Closed Loop Advantage

A properly applied water source heat pump system offers many advantages over other systems. First costs are low because units can be added to the loop on an "as needed basis"- perfect for speculative buildings. Installed costs are low since units are self-contained and can be located adjacent to the occupied space, requiring minimal ductwork. Maintenance can be done on individual units without system shut-down. Conditions remain comfortable since each unit operates separately, allowing cooling in one area and heating in another. Tenant spaces can be finished and added as needed. Power billing to tenants is also convenient since each unit can be individually metered: each pays for what each uses. Nighttime and/or weekend uses of certain areas are possible without heating or cooling the entire facility. A decentralized system also means if one unit should fault, the rest of the system will continue to operate normally, as well as eliminating air cross-contamination problems and expensive high pressure duct systems requiring an inefficient electric resistance reheat mode.

The RL Series Approach

There are a number of proven choices in the type of RL Series system which would be best for any given application. Most often considered are:

Closed Loop/Ground Source
Vertical



• ***Closed Loop/Ground-Source Systems*** utilize the stable temperatures of the earth to maintain proper water source temperatures (via vertical or horizontal closed loop heat exchangers) for RL Series extended range heat pump system. Sizes range from a single unit through many hundreds of units. When net cooling requirements cause closed loop water temperatures to rise, heat is dissipated into the cooler earth through buried high strength plastic pipe "heat exchangers." Conversely if net space heating demands cause loop heat absorption beyond that heat recovered from building core areas, the loop temperature will fall causing heat to be extracted from the earth. Due to the extended loop temperatures, AHRI/ISO 13256-1 Ground Loop Heat Pumps are required for this application.

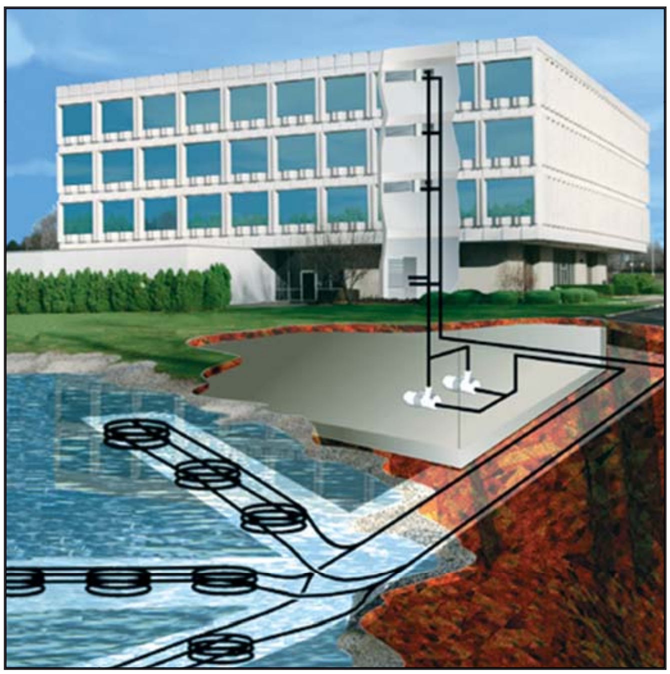
RL Series Application Notes cont.

Because auxiliary equipment such as a fossil fuel boiler and cooling tower are not required to maintain the loop temperature, operating and maintenance costs are very low.

Ground-source systems are most applicable in residential and light commercial buildings where both heating and cooling are desired, and on larger envelope dominated structures where core heat recovery will not meet overall heating loads. Both vertical and horizontally installed closed-loops can be used. The land space required for the "heat exchangers" is 100-250 sq. ft./ ton on vertical (drilled) installations and 750-1500 sq. ft./ton for horizontal (trenched) installations. Closed loop heat exchangers can be located under parking areas or even under the building itself.

On large multi-unit systems, sizing the closed loop heat exchanger to meet only the net heating loads and assisting in the summer with a closed circuit cooling tower may be the most cost effective choice.

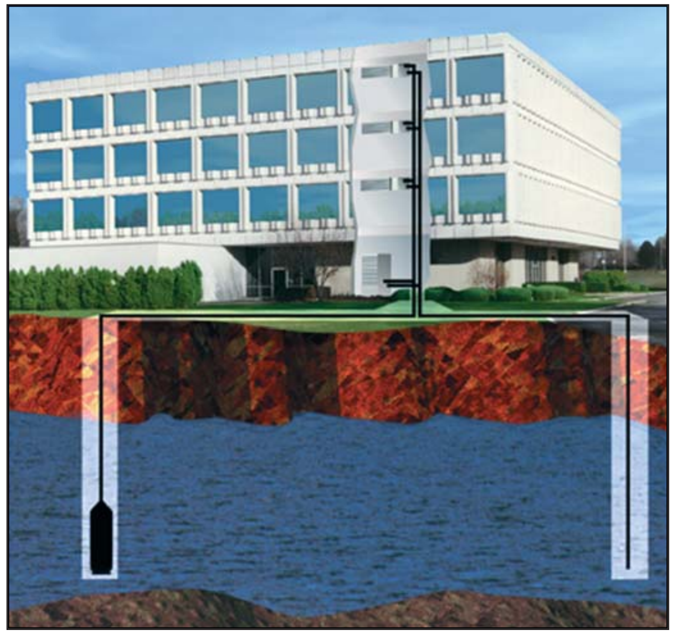
Closed Loop/Ground Source Surface Water



• ***Closed Loop/Ground-Source Surface Water Systems*** also utilize the stable temperatures of Surface Water to maintain proper water source temperatures for RL Series extended range heat pump systems. These systems have all of the advantages of horizontal and vertical closed loop systems. Due to the extended loop temperatures, AHRI/ISO 13256-1 Ground Water or Ground Loop Heat Pumps are required for this application.

In cooling dominated structures, the ground-source surface water systems can be very cost effective especially where local building codes require water retention ponds for short term storage of surface run-off. Sizing requirements for the surface water is a minimum of 500 sq. ft./ton of surface area at a minimum depth of 8 feet. Your sales representative should be contacted when designs for heating dominated structures are required.

Closed Loop/Ground Water Plate Heat Exchanger



• ***Closed Loop/Ground Water Plate Heat Exchanger Systems*** utilize lake, ocean, well water or other water sources to maintain closed loop water temperatures in multi-unit RL Series systems. A plate frame heal exchanger isolates the units from any contaminating effects of the water source, and allows periodic cleaning of the heat exchanger during off peak hours.

Operation and benefits are similar to those for ground-source systems. Due to the extended loop temperatures, AHRI/ ISO 13256-1 Ground Loop Heat Pumps are required for this application. Closed loop plate heat exchanger systems are applicable in commercial, marine, or industrial structures where the many benefits of a water source heat pump system are desired, regardless of whether the load is heating or cooling dominated.

RL Series Application Notes cont.

Closed Loop Cooler - Boiler

• ***Closed Loop /Cooler-Boiler Systems*** utilize a closed heat recovering loop with multiple water source heat pumps in the more conventional manner. Typically a boiler is employed to maintain closed loop temperatures above 60°F and a cooling tower to maintain loop temperatures below 90°F. These systems are applicable in medium to large buildings regardless of whether the load is heating or cooling dominated. Due to the moderate loop temperatures, AHRI/ISO 13256-1 Water Loop Heat Pumps are required for this application.

Water Quality

In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, a closed loop system is recommended. The heat exchanger coils in ground water systems may, over a period of time, lose heat exchange capabilities due to a buildup of mineral deposits inside. These can be cleaned, but only by a qualified service mechanic, as special solutions and pumping equipment are required. Hot water generator coils can likewise become scaled and possibly plugged. In areas with extremely hard water, the owner should be informed that the heat exchanger may require occasional flushing.

Units with cupronickel heat exchangers are recommended for open loop applications due to the increased resistance to build-up and corrosion, along with reduced wear caused by acid cleaning.

Material		Copper	90/10 Cupronickel	316 Stainless Steel
pH	Acidity/Alkalinity	7 - 9	7 - 9	7 - 9
Scaling	Calcium and Magnesium Carbonate	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm	(Total Hardness) less than 350 ppm
Corrosion	Hydrogen Sulfide	Less than 0.5 ppm (rotten egg smell appears at 0.5 ppm)	10 - 50 ppm	Less than 1 ppm
	Sulfates	Less than 125 ppm	Less than 125 ppm	Less than 200 ppm
	Chlorine	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Chlorides	Less than 20 ppm	Less than 125 ppm	Less than 300 ppm
	Carbon Dioxide	Less than 50 ppm	10 - 50 ppm	10 - 50 ppm
	Ammonia	Less than 2 ppm	Less than 2 ppm	Less than 20 ppm
	Ammonia Chloride	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Nitrate	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Hydroxide	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Ammonia Sulfate	Less than 0.5 ppm	Less than 0.5 ppm	Less than 0.5 ppm
	Total Dissolved Solids (TDS)	Less than 1000 ppm	1000 - 1500 ppm	1000 - 1500 ppm
	LSI Index	+0.5 to -0.5	+0.5 to -0.5	+0.5 to -0.5
Iron Fouling (Biological Growth)	Iron, $FE^{2}+$ (Ferrous) Bacterial Iron Potential	< 0.2 ppm	< 0.2 ppm	< 0.2 ppm
	Iron Oxide	Less than 1 ppm, above this level deposition will occur	Less than 1 ppm, above this level deposition will occur	Less than 1 ppm, above this level deposition will occur
Erosion	Suspended Solids	Less than 10 ppm and filtered for max. of 600 micron size	Less than 10 ppm and filtered for max. of 600 micron size	Less than 10 ppm and filtered for max. of 600 micron size
	Threshold Velocity (Fresh Water)	< 6 ft/sec	< 6 ft/sec	< 6 ft/sec

Installation Notes

Typical Unit Installation

Unit Location

Locate the unit in an indoor area that allows for easy removal of the filter and access panels. Location should have enough space for service personnel to perform maintenance or repair. Provide sufficient room to make water, electrical and duct connection(s). If the unit is located in a confined space, such as a closet, provisions must be made for return air to freely enter the space by means of a louvered door, etc. Any access panel screws that would be difficult to remove after the unit is installed should be removed prior to setting the unit. On horizontal units, allow adequate room below the unit for a condensate drain trap and do not locate the unit above supply piping. **Care should be taken when units are located in unconditioned spaces to prevent damage from frozen water lines and excessive heat that could damage electrical components.**

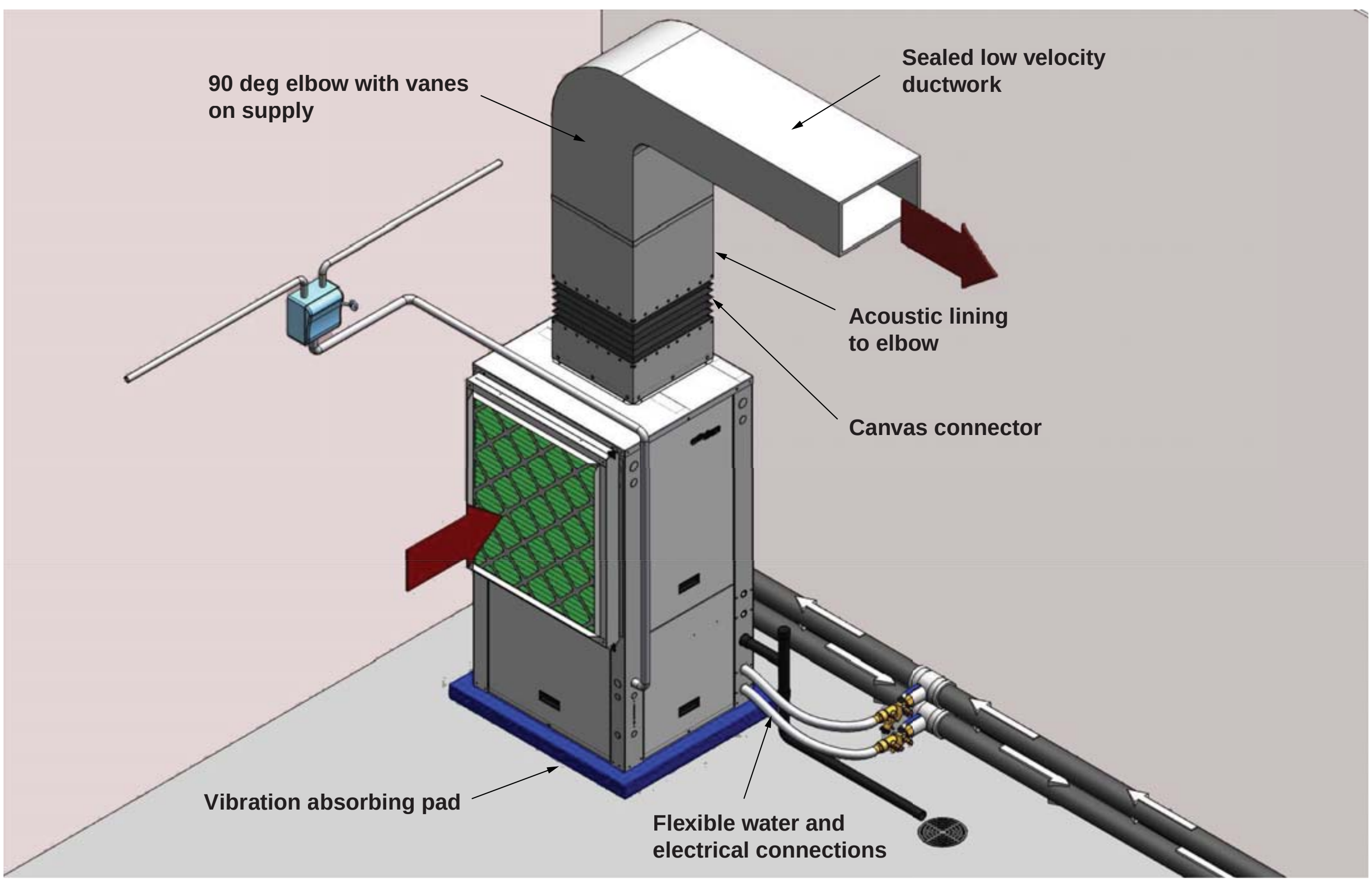
Installing Vertical Units

Vertical units are available in left or right air return configurations. Top flow vertical units should be mounted level on a vibration absorbing pad slightly larger than the base to provide isolation between the unit and the floor. It is not necessary to anchor the unit to the floor.

WARNING: Before performing service or maintenance operations on a system, turn off main power switches to the indoor unit. If applicable, turn off the accessory heater power switch. Electrical shock could cause personal injury.

Installing and servicing heating and air conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair or service heating and air conditioning equipment. Untrained personnel can perform the basic maintenance functions of cleaning coils and cleaning and replacing filters.

All other operations should be performed by trained service personnel. When working on heating and air conditioning equipment, observe precautions in the literature, tags and labels attached to the unit and other safety precautions that may apply. Follow all safety codes. Wear safety glasses and work gloves. Use a quenching cloth for brazing operations and have a fire extinguisher available.



Installation Notes cont.

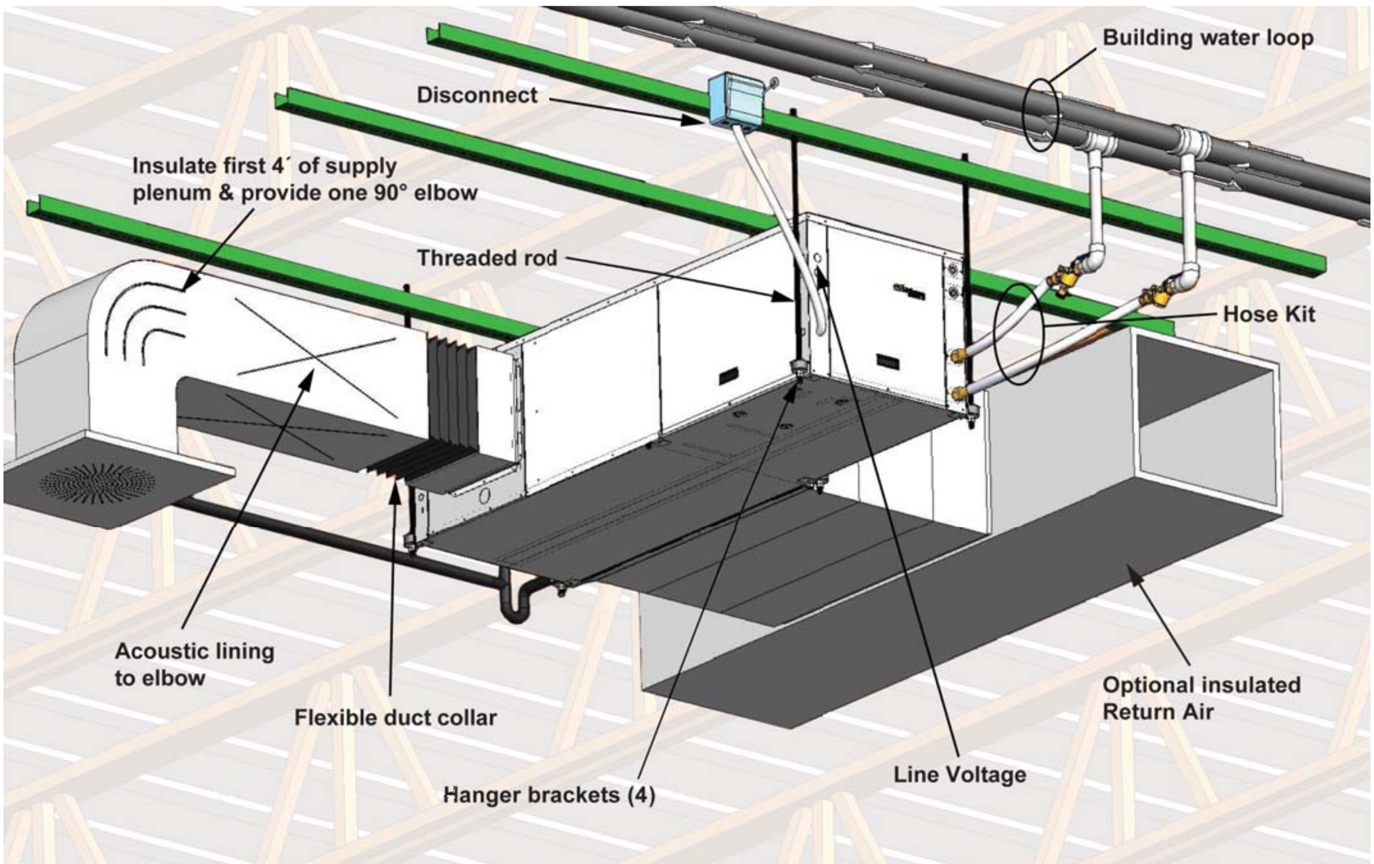
Installing Horizontal Units

Horizontal units are available with side or end discharge and may be field converted from one to the other. Horizontal units are normally suspended from a ceiling by four 1/2 in. diameter threaded rods. The rods are usually attached to the unit by hanger bracket kits furnished with each unit. Lay out the threaded rods per the dimensions below. Assemble the hangers to the unit as shown. When attaching the hanger rods to the bracket, a double nut is required since vibration could loosen a single nut.

NOTE: The unit should be pitched approximately 1/4-inch towards the drain in both directions to facilitate the removal of condensate.

Some installations requIre placing a horizontal unit on an attic floor. In this case, the unit should be set in a full size secondary drain pan on top of a vibration absorbing pad. The secondary drain pan prevents possible condensate overflow or water leakage damage to the ceiling. The secondary drain pan is usually placed on a plywood base isolated from the ceiling joists by additional layers of vibration absorbing material. Insulate supply plenum and use at least one 90° elbow to reduce noise.

CAUTION: Do not use rods smaller than 1/2-inch diameter since they may not be strong enough to support the unit. The rods must be securely anchored to the ceiling.



Installation Notes cont.

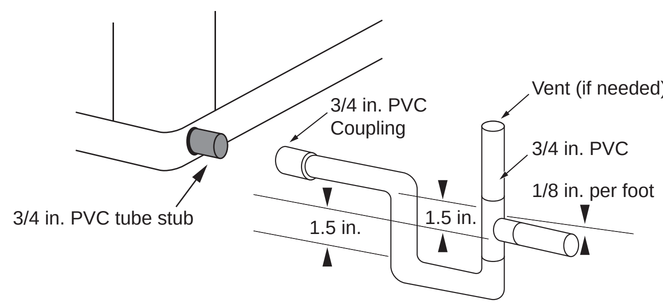
Water Piping

Piping is usually designed as 'reverse return' to equalize flow paths through each unit. A short flexible pressure rated hose is used to make connection to the fixed building piping system. This hose is typically stainless steel braid and includes a swivel fitting on one end for easy removal and is flexible to help isolate the unit for quieter operation . Isolation valves for servicing, y-strainers for filtering and memory-stop flow valve or a balancing valve can be provided for consistent water flow through the unit.

All unit source water connections are fittings that accept a male pipe thread (MPT). Insert the connectors by hand, then tighten the fitting with a wrench to provide a leakproof joint. The open and closed loop piping system should include pressure/temperature ports for serviceability. The proper water flow must be provided to each unit whenever the unit operates. To assure proper flow, use pressure/temperature ports to determine the flow rate. These ports should be located at the supply and return water connections on the unit. The proper flow rate cannot be accurately set without measuring the water pressure drop through the refrigerant-to-water heat exchanger. Limit hose length to 10 feet per connection.Check carefully for water leaks.

Condensate Drain

On vertical units, the internal condensate drain assembly consists of a drain tube which is connected to the drain pan, a 3/4 in. or 1 in. copper female adapter and a flexible connecting hose. On vertical upflow units, a condensate hose is inside all cabinets as a trapping loop; therefore, an external trap is not necessary. On horizontal units, a PVC stub is provided for condensate drain piping connection. An external trap is required (see below). If a vent is necessary, an open stand pipe may be applied to a tee in the field-installed condensate piping. In order to work properly, the vent must be after the trap and away from the unit.



Installation Notes cont.

Acoustical Considerations and Equipment Sound Performance

Sound Performance

The RL Series is third party sound rated in accordance with AHRI 260.

Recommendations for Noise Reduction

Horizontal Unit Location

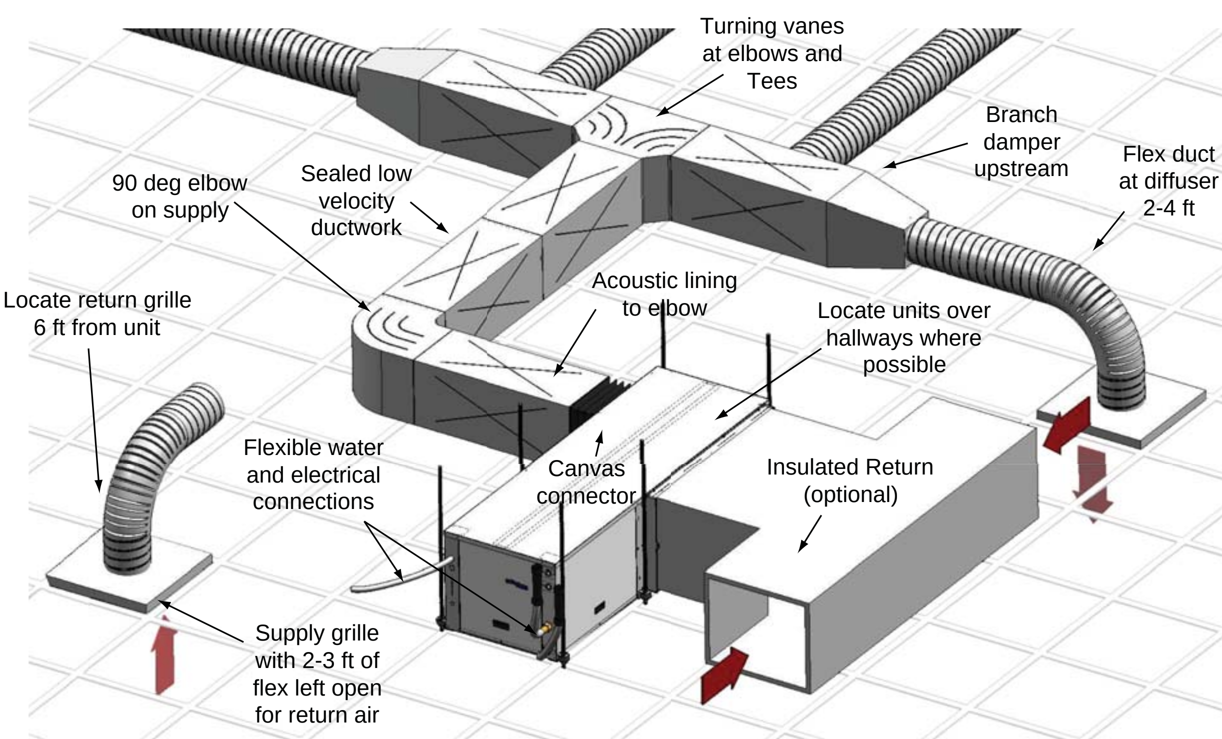
- Specify equipment with quietest sound power ratings
- Do not locate units above areas with a required NC 40 or less
- Space WSHP at least 10 ft (3m) apart to avoid noise summing of multiple units in a space.
- Maximize the height of the unit above the ceiling (horizontal).
- Suspend unit with isolation grommets that are appropriately rated to reduce vibrations (horizontal).

Vertical Unit Location

- Specify equipment with quietest sound power ratings
- Space WSHP at least 10 ft (3m) apart to avoid noise summing of multiple units in a space.
- Acoustic ceiling coatings can greatly reduce noise levels in mechanical rooms.
- Mount unit on a sound absorbing pad, extruded polystyrene, rubber or cork pad.

Ductwork

- Ensure return air grilles will not allow line of site noise to transfer to adjacent space. Use a sound barrier or some other material to isolate the grille from the unit. A supply grille, boot and short piece of flex duct pointed away from the unit can greatly attenuate equipment noise.
- Use a canvas isolation duct connector at the supply and return duct connection of the unit.
- Internally line the discharge and return duct within the first 4-8 feet of unit with acoustic insulation. Install an internally lined 'L' shaped return duct elbow at return grille. Face the elbow away from adjacent units.
- Always install at least one 90° elbow in the discharge duct to eliminate line of sight noise transmission of the blower.
- Use turning vanes at all elbows and tees to reduce turbulence.
- Limit supply duct velocities to less than 1000 fpm
- Design and install ductwork as stiff as possible
- Allow 3 duct diameters both up and down stream of the unit before any fittings or transitions are installed.
- Use duct sealant on all duct joints.
- Install a short (2-4') of flex duct on all branch ducts just prior to discharge boot or diffuser to reduce vibration and duct sound prior to delivery in the room.
- Locate the branch duct balancing damper as far away from the diffuser as possible.
- In ceiling plenum systems, install an internally lined 'L' shaped return duct elbow at unit. Face the elbow away from adjacent units (horizontal).



Performance Standard (AHRI/ISO/ASHRAE 13256-1)

The performance standard AHRI/ASHRAE/ISO 13256-1 became effective January 1, 2000 and replaces ARI Standards 320, 325, and 330. This new standard has three major categories: Water Loop (comparable to ARI 320), Ground Water (ARI 325), and Ground Loop (ARI 330). Although these standards are similar there are some differences:

Unit of Measure: The Cooling COP

The cooling efficiency is measured in EER (US version measured in Btuh per Watt. The Metric version is measured in a cooling COP (Watt per Watt) similar to the traditional COP measurement.

Water Conditions Differences

Entering water temperatures have changed to reflect the centigrade temperature scale. For instance the water loop heating test is performed with 68°F (20°C) water rounded down from the old 70°F (21.1°C).

Air Conditions Differences

Entering air temperatures have also changed (rounded down) to reflect the centigrade temperature scale. For instance the cooling tests are performed with 80.6°F (27°C) dry bulb and 66.2°F (19°C) wet bulb entering air instead of the traditional 80°F (26.7°C) DB and 67°F (19.4°C) WB entering air temperatures. 80.6/66.2 data may be converted to 80/67 using the entering air correction table. This represents a significantly lower relative humidity than the old 80/67 of 50% and will result in lower latent capacities.

Pump Power Correction Calculation

Within each model, only one water flow rate is specified for all three groups and pumping Watts are calculated using the following formula. This additional power is added onto the existing power consumption.

- Pump power correction = (gpm x 0.0631) x (Press Drop x 2990) / 300

Where 'gpm' is waterflow in gpm and 'Press Drop' is the pressure drop through the unit heat exchanger at rated water flow in feet of head.

Blower Power Correction Calculation

Blower power is corrected to zero external static pressure using the following equation. The nominal airflow is rated at a specific external static pressure. This effectively reduces the power consumption of the unit and increases cooling capacity but decreases heating capacity. These Watts are significant enough in most cases to increase EER and COPs fairly dramatically over ARI 320, 325, and 330 ratings.

- Blower Power Correction = (cfm x 0.472) x (esp x 249) / 300

Where 'cfm' is airflow in cfm and 'esp' is the external static pressure at rated airflow in inches of water gauge.

ISO Capacity and Efficiency Calculations

The following equations illustrate cooling calculations:

- ISO Cooling Capacity = Cooling Capacity (Btuh) + (Blower Power Correction (Watts) x 3.412)
- ISO EER Efficiency (W/W) = ISO Cooling Capacity (Btuh) x 3.412 / [Power Input (Watts) - Blower Power Correction (Watts) + Pump Power Correction (Watt)]

The following equations illustrate heating calculations:

- ISO Heating Capacity = Heating Capacity (Btuh) - (Blower Power Correction (Watts) x 3.412)
- ISO COP Efficiency (W/W) = ISO Heating Capacity (Btuh) x 3.412 / [Power Input (Watts) - Blower Power Correction (Watts) + Pump Power Correction (Watt)]

Comparison of Test Conditions

	ARI 320	ISO/AHRI 13256-1 WLHP	ARI 325	ISO/AHRI 13256-1 GWHP	ARI 330	ISO/AHRI 13256-1 GLHP
Cooling						
Entering Air - DB/WB °F	80/67	80.6/66.2	80/67	80.6/66.2	80/67	80.6/66.2
Entering Water - °F	85	86	50/70	59	77	77
Fluid Flow Rate	*	**	**	**	**	**
Heating						
Entering Air - DB/WB °F	70	68	70	68	70	68
Entering Water - °F	70	68	50/70	50	32	32
Fluid Flow Rate	*	**	**	**	**	**

Note *: Flow rate is set by 10°F rise in standard cooling test   Note **: Flow rate is specified by the manufacturer

Part load entering water conditions not shown.

WLHP = Water Loop Heat Pump; GWHP = Ground Water Heat Pump; GLHP = Ground Loop Heat Pump

Conversions:

Airflow (lps) = CFM x 0.472;
ESP (Pascals) = ESP (in wg) x 249;
WaterFlow (lps) = GPM x 0.0631;
Press Drop (Pascals) = Press Drop (ft hd) x 2990

AHRI/ISO 13256-1 Performance Ratings

English (IP) Units

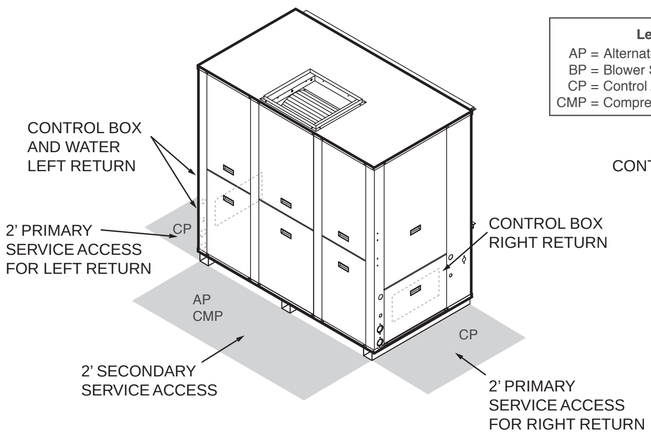
Model	Flow Rate		Water Loop Heat Pump				Ground Water Heat Pump				Ground Loop Heat Pump			
			Cooling EWT 86°F		Heating EWT 68°F		Cooling EWT 59°F		Heating EWT 50°F		Cooling EWT 77°F		Heating EWT 32°F	
	gpm	cfm	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP
RLLH080	22.0	2600	73,000	15.5	77,700	4.7	79,000	22.5	65,800	4.2	76,000	17.7	51,300	3.5
RLLH095	24.0	3200	85,500	15.6	91,000	4.8	95,000	23.0	78,000	4.3	91,200	18.1	61,600	3.5
RLLH120	28.0	3600	113,000	13.8	140,600	4.6	129,000	21.9	115,000	4.1	119,500	16.2	89,000	3.4
RLLV080	22.0	2600	76,000	16.5	85,000	5.0	84,000	24.2	71,000	4.4	83,000	19.7	55,000	3.7
RLLV095	24.0	2800	91,000	17.2	100,000	5.2	101,000	25.7	83,000	4.6	95,000	19.6	65,000	3.8
RLLV120	28.0	3600	115,000	15.5	136,000	5.1	135,000	24.3	107,500	4.4	122,000	18.0	83,000	3.6
RLLV160*	35.0	5000	166,000	18.9	154,000	5.1	178,000	25.3	130,000	4.6	171,000	21.0	97,000	3.7
RLLV180*	45.0	5600	180,000	17.1	190,000	5.0	187,000	22.2	149,000	4.3	185,000	18.5	109,000	3.4
RLLV240*	60.0	7600	240,000	16.3	296,000	5.2	264,000	22.5	237,000	4.6	246,000	17.4	184,000	3.8
RLLV300*	75.0	9500	284,000	17.3	353,000	5.4	314,000	24.5	286,000	4.8	291,000	19.0	224,000	4.2

Cooling capacities based upon 80.6°F DB, 66.2°F WB entering air temperature 12/9/08
Heating capacities based upon 68°F DB, 59°F WB entering air temperature
All ratings based upon 208V operation.
* Ratings for models RLLV/RLXV160-300 are outside the scope of the AHRI Water to Air/Brine to Air Heat Pumps Certification Program.

Vertical Dimensional Data

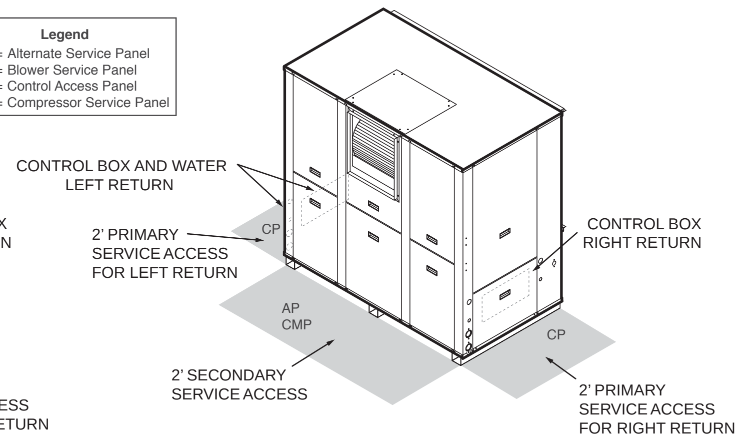
7-10 Tons

TOP DISCHARGE

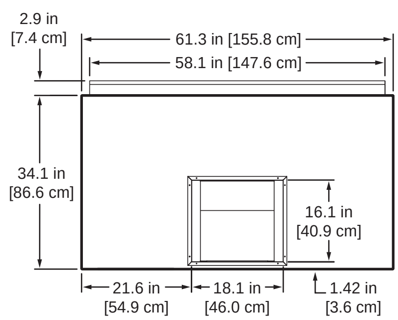


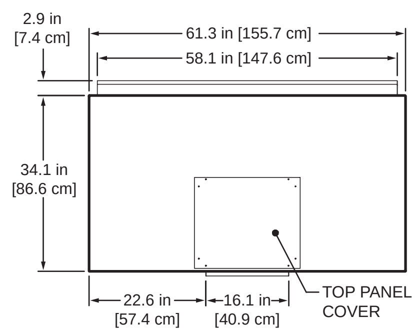
Legend
AP = Alternate Service Panel
BP = Blower Service Panel
CP = Control Access Panel
CMP = Compressor Service Panel

SIDE DISCHARGE

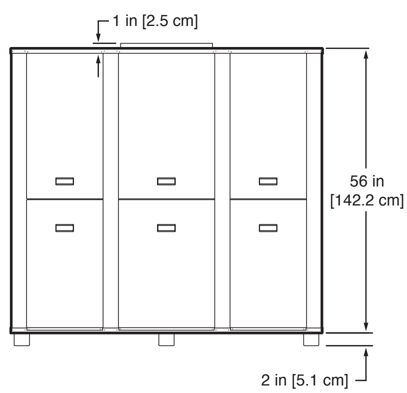


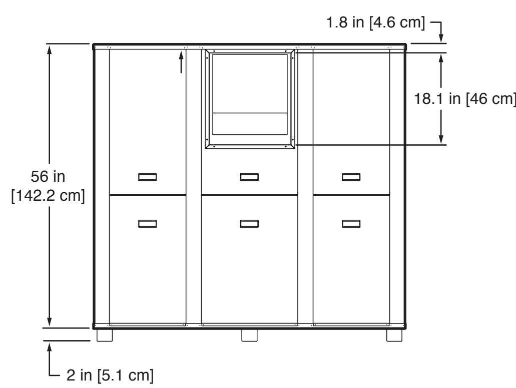
TOP VIEW
Left or Right Return



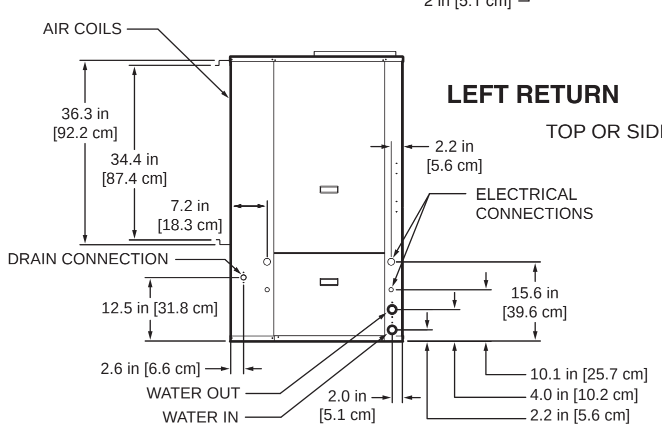


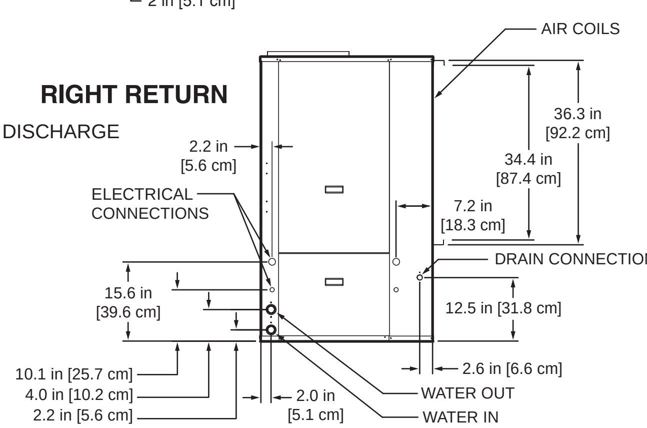
SIDE VIEW
Left or Right Return





LEFT RETURN **RIGHT RETURN**
TOP OR SIDE DISCHARGE

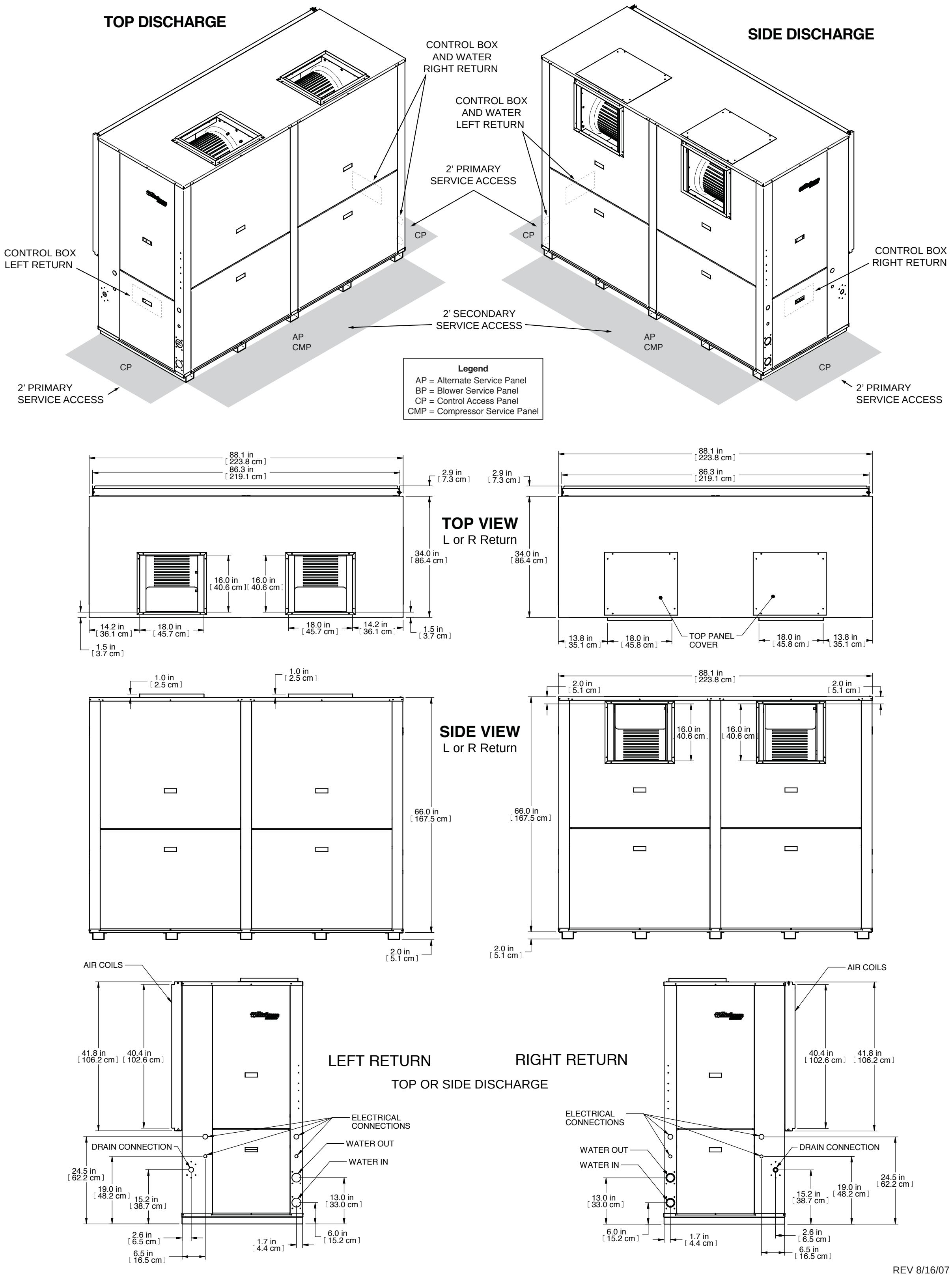




REV 2/11/08

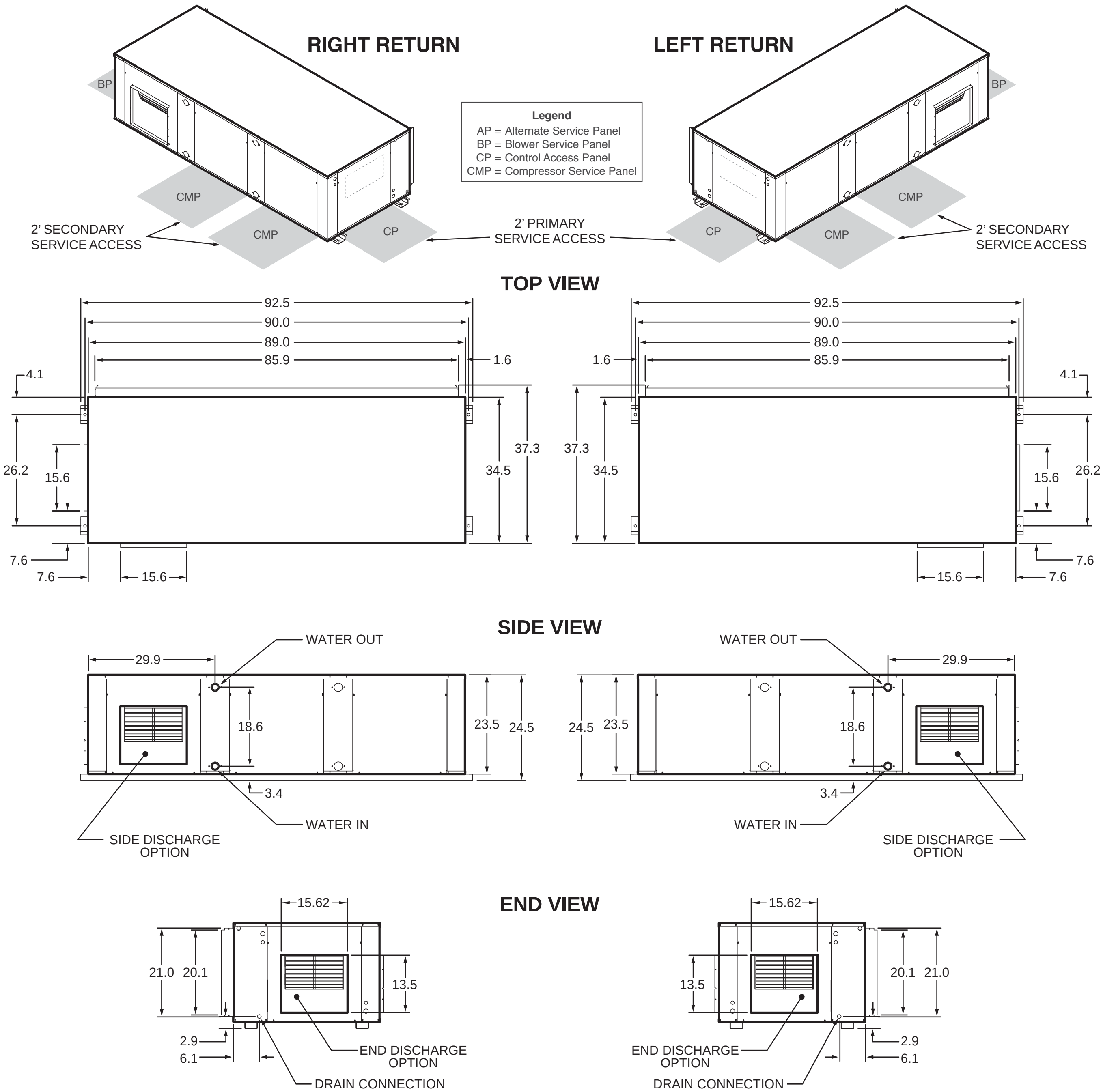
Vertical Dimensional Data cont.

13-25 Tons



Horizontal Dimensional Data

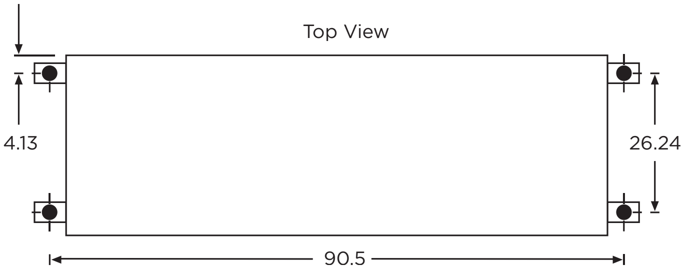
7-10 Tons



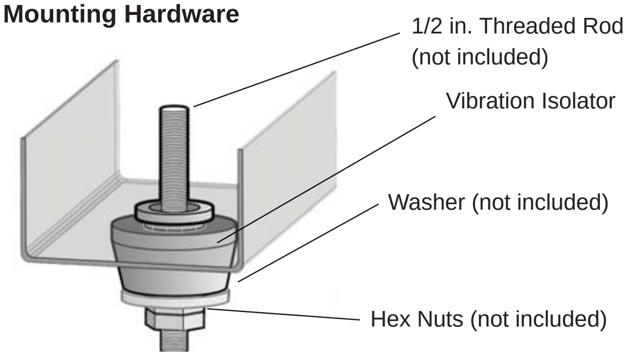
REV 4/28/08

Hanger Bracket Locations

Mounting Rod Layout - Left or Right Return



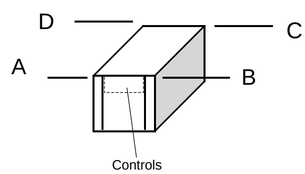
Mounting Hardware



Horizontal Unit Corner Weight Distribution

Model	Return / Discharge	A Front Left	B Front Right	C Back Right	D Back Left
080 - 120	Left / Side or End	30%	26%	22%	22%
	Right / Side or End	26%	30%	22%	22%

Approximate



Physical Data

	Horizontal			Vertical						
Model	**080**	**095**	**120**	**080**	**095**	**120**	**160**	**180**	**240**	**300**
Compressor (2 each)	Copeland Scroll			Copeland Scroll						
Factory Charge R410A, oz [kg] (per circuit)	74 [2.10]	84 [2.38]	92 [2.61]	78 [2.21]	86 [2.44]	100 [2.83]	176 [4.99]	178 [5.05]	236 [6.69]	240 [6.80]
PSC Fan Motor & Blower										
Fan Motor- hp [W]	1.5 [1120]	2.0 [1492]	3.0 [2238]	1.0 (746)	1.5 (1120)	2.0 (1492)	1.0 (746)	1.5 (1120)	2.0 (1492)	3.0 (2238)
Blower Wheel Size (Dia x W), in. [mm]	12 x 12 [305 x 305]	12 x 12 [305 x 305]	12 x 12 [305 x 305]	15 x 11 [381 x 280]	15 x 11 [381 x 280]	15 x 11 [381 x 280]	15 x 11 (2) [381 x 280]	15 x 11 (2) [381 x 280]	15 x 11 (2) [381 x 280]	15 x 11 (2) [381 x 280]
Coax and Water Piping										
Water Connections Size - FPT - in [mm]	1 1/4 [31.75]	1 1/4 [31.75]	1 1/4 [31.75]	1 1/4 [31.75]	1 1/4 [31.75]	1 1/4 [31.75]	2 [50.8]	2 [50.8]	2 [50.8]	2 [50.8]
HWG Connection Size - FPT - in [mm]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Coax & Piping Water Volume - gal [l]	2.87 [10.85]	3.20 [12.13]	3.46 [13.11]	2.87 [10.85]	3.20 [12.13]	3.46 [13.11]	6.50 [24.61]	6.50 [24.61]	7.00 [26.50]	7.00 [26.50]
Air Coil & Filters										
Air Coil Dimensions (H x W), in. [mm]	20 x 35 [508 x 889]	20 x 40 [508 x 1016]	20 x 40 [508 x 1016]	28 x 25 (711 x 635)	32 x 25 (813 x 635)	36 x 25 (915 x 635)	40 x 40 (2) [1016 x 1016]	40 x 40 (2) [1016 x 1016]	40 x 40 (2) [1016 x 1016]	40 x 40 (2) [1016 x 1016]
Air Coil Total Face Area, ft2 [m2]	9.74 [0.91]	11.11 [1.03]	11.11 [1.03]	9.72 (0.90]	11.10 (1.03)	12.50 (1.16)	22.22 [2.06]	22.22 [2.06]	22.22 [2.06]	22.22 [2.06]
Air Coil Tube Size, in [mm]	3/8 (9.52)	3/8 (9.52)	3/8 (9.52)	3/8 (9.52)	3/8 (9.52)	3/8 (9.52)	3/8 (9.52)	3/8 (9.52)	3/8 (9.52)	3/8 (9.52)
Air Coil Number of rows	3	3	3	3	3	4	3	3	3	3
Filter Standard - 2” [50.8], in [mm]	20 x 20 (3) [508 x 508] 20 x 25 (1) [508 x 635]	20 x 20 (3) [508 x 508] 20 x 25 (1) [508 x 635]	20 x 20 (3) [508 x 508] 20 x 25 (1) [508 x 635]	28 x 36 (1) (711 x 914) 30 x 36 (1) (762 x 914)	28 x 36 (1) (711 x 914) 30 x 36 (1) (762 x 914)	28 x 36 (1) (711 x 914) 30 x 36 (1) (762 x 914)	40 x 42 (2) (1016 x 1067)	40 x 42 (2) (1016 x 1067)	40 x 42 (2) (1016 x 1067)	40 x 42 (2) (1016 x 1067)
Weight - Operating, lb [kg]	700 [318]	796 [361]	843 [382]	644 [292]	762 [346]	849 [385]	1175 [533]	1195 [542]	1350 [612]	1400 [635]
Weight - Packaged, lb [kg]	690 [313]	785 [356]	830 [376]	620 [281]	735 [333]	820 [372]	1180 [535]	1200 [544]	1355 [614]	1405 [637]

11/10/2014

Electrical Data

Model	Rated Voltage	Voltage Min/Max	Compressor*			Blower Motor FLA***	Blower HP ***	Total Unit FLA	Min Circ Amp	Max Fuse/ HACR
			MCC	RLA	LRA					
Horizontal										
080	208-230/60/3	187/253	16.3	10.4	88.0	4.8	1.5	25.7	28.3	35.0
	460/60/3	414/506	9.0	5.8	38.0	2.4	1.5	13.9	15.4	20.0
	575/60/3	518/632	5.9	3.8	36.5	1.9	1.5	9.5	10.4	10.0
080**	208-230/60/3	187/253	16.3	10.4	88.0	6.2	2.0	27.1	29.7	40.0
	460/60/3	414/506	9.0	5.8	38.0	3.1	2.0	14.6	16.1	20.0
	575/60/3	518/632	5.9	3.8	36.5	2.5	2.0	10.1	11.0	10.0
095	208-230/60/3	187/253	21.2	13.6	83.1	6.2	2.0	33.3	36.7	50.0
	460/60/3	414/506	9.5	6.1	41.0	3.1	2.0	15.3	16.8	20.0
	575/60/3	518/632	7.8	5.0	34.0	2.5	2.0	12.5	13.7	15.0
095**	208-230/60/3	187/253	21.2	13.6	83.1	9.2	3.0	36.3	39.7	50.0
	460/60/3	414/506	9.5	6.1	41.0	4.3	3.0	16.5	18.0	20.0
	575/60/3	518/632	7.8	5.0	34.0	3.4	3.0	13.4	14.6	15.0
120	208-230/60/3	187/253	24.9	15.9	110.0	9.2	3.0	41.1	45.1	60.0
	460/60/3	414/506	12.1	7.7	52.0	4.3	3.0	19.8	21.7	25.0
	575/60/3	518/632	8.9	5.7	38.9	3.4	3.0	14.8	16.2	20.0
Vertical										
080	208-230/60/3	187/253	16.3	10.4	88.0	3.6	1.0	24.5	27.1	35.0
	460/60/3	414/506	9.0	5.8	38.0	1.8	1.0	13.3	14.8	20.0
	575/60/3	518/632	5.9	3.8	36.5	1.5	1.0	9.0	9.9	10.0
080**	208-230/60/3	187/253	16.3	10.4	88.0	4.8	1.5	25.7	28.3	35.0
	460/60/3	414/506	9.0	5.8	38.0	2.4	1.5	13.9	15.4	20.0
	575/60/3	518/632	5.9	3.8	36.5	1.9	1.5	9.5	10.4	10.0
095	208-230/60/3	187/253	21.2	13.6	83.1	4.8	1.5	31.9	35.3	45.0
	460/60/3	414/506	9.5	6.1	41.0	2.4	1.5	14.6	16.1	20.0
	575/60/3	518/632	7.8	5.0	34.0	1.9	1.5	11.9	13.1	15.0
095**	208-230/60/3	187/253	21.2	13.6	83.1	6.2	2.0	33.3	36.7	50.0
	460/60/3	414/506	9.5	6.1	41.0	3.1	2.0	15.3	16.8	20.0
	575/60/3	518/632	7.8	5.0	34.0	2.5	2.0	12.5	13.7	15.0
120	208-230/60/3	187/253	24.9	15.9	110.0	6.2	2.0	38.1	42.1	50.0
	460/60/3	414/506	12.1	7.7	52.0	3.1	2.0	18.6	20.5	25.0
	575/60/3	518/632	8.9	5.7	38.9	2.5	2.0	13.9	15.3	20.0
120**	208-230/60/3	187/253	24.9	15.9	110.0	9.2	3.0	41.1	45.1	60.0
	460/60/3	414/506	12.1	7.7	52.0	4.3	3.0	19.8	21.7	25.0
	575/60/3	518/632	8.9	5.7	38.9	3.4	3.0	14.8	16.2	20.0
160	208-230/60/3	187/253	35.0	22.4	149.0	3.6	1.0	52.0	57.6	80.0
	460/60/3	414/506	16.5	10.6	75.0	1.8	1.0	24.8	54.0	35.0
	575/60/3	518/632	12.0	7.7	54.0	1.5	1.0	18.4	20.3	25.0
160**	208-230/60/3	187/253	35.0	22.4	149.0	4.8	1.5	54.4	60.0	80.0
	460/60/3	414/506	16.5	10.6	75.0	2.4	1.5	26.0	28.7	35.0
	575/60/3	518/632	12.0	7.7	54.0	1.9	1.5	19.2	21.1	25.0
180	208-230/60/3	187/253	36.2	23.2	164.0	4.8	1.5	56.0	61.8	80.0
	460/60/3	414/506	17.5	11.2	75.0	2.4	1.5	27.2	30.0	40.0
	575/60/3	518/632	12.3	7.9	54.0	1.9	1.5	19.6	21.6	25.0
180**	208-230/60/3	187/253	36.2	23.2	164.0	6.2	2.0	58.8	64.6	80.0
	460/60/3	414/506	17.5	11.2	75.0	3.1	2.0	28.6	31.4	40.0
	575/60/3	518/632	12.3	7.9	54.0	2.5	2.0	20.8	22.8	30.0
240	208-230/60/3	187/253	47.0	30.1	225.0	6.2	2.0	72.6	80.1	110.0
	460/60/3	414/506	26.0	16.6	114.0	3.1	2.0	39.5	43.6	60.0
	575/60/3	518/632	19.0	12.2	80.0	2.5	2.0	29.3	32.4	40.0
240**	208-230/60/3	187/253	47.0	30.1	225.0	9.2	3.0	78.6	86.1	110.0
	460/60/3	414/506	26.0	16.6	114.0	4.3	3.0	41.9	46.0	60.0
	575/60/3	518/632	19.0	12.2	80.0	3.4	3.0	31.1	34.2	45.0
300	208-230/60/3	187/253	52.0	33.3	239.0	9.2	3.0	85.0	93.3	125.0
	460/60/3	414/506	28.0	17.9	125.0	4.3	3.0	44.4	48.9	60.0
	575/60/3	518/632	20.0	12.8	80.0	3.4	3.0	32.4	35.6	45.0

*Ratings per each compressor - unit supplied with two 9/10/07
**With optional motor
***Ratings per each blower motor - Vertical models 160-300 supplied with two.

HACR circuit breaker in USA only
All fuses Class RK-5

RLLH080 - Blower Performance Data

Belt Drive

Airflow in CFM with dry coil and clean air filter.

Rated CFM		External Static Pressure (in. w.g.)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
2200	MTR/SHEAVE				1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**	**4.0**	**4.0**	**5.0**	**5.0**	**5.0**	**5.0**
	BHP				0.37	0.40	0.43	0.47	0.52	**0.59**	**0.65**	**0.71**	**0.75**	**0.78**	**0.81**	**0.86**	**0.90**
	RPM				583	624	665	706	747	**770**	**791**	**821**	**865**	**911**	**957**	**986**	**1015**
	TURNS OPEN				5.0	4.0	3.0	2.0	1.0	**3.0**	**2.0**	**1.0**	**0.0**	**3.5**	**3.0**	**2.5**	**2.0**
2400	MTR/SHEAVE			1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**	**4.0**	**4.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	BHP			0.45	0.49	0.53	0.59	0.62	**0.67**	**0.70**	**0.74**	**0.79**	**0.85**	**0.88**	**0.91**	**0.95**	**1.08**
	RPM			582	623	664	705	746	**765**	**790**	**820**	**861**	**906**	**938**	**970**	**1004**	**1030**
	TURNS OPEN			5.0	4.0	3.0	2.0	1.0	**3.0**	**2.0**	**1.0**	**0.0**	**4.0**	**3.0**	**2.5**	**2.0**	**1.5**
2600	MTR/SHEAVE			1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	BHP			0.51	0.56	0.62	0.66	0.69	0.73	0.76	0.84	0.90	**0.93**	**0.96**	**1.04**	**1.12**	**1.17**
	RPM			602	643	684	726	760	783	805	853	877	**916**	**954**	**988**	**1021**	**1051**
	TURNS OPEN			4.5	3.5	2.5	1.5	4.0	3.5	2.5	2.0	1.5	**3.5**	**3.0**	**2.5**	**1.5**	**1.0**
2800	MTR/SHEAVE		1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	**5.0**	**5.0**	
	BHP		0.53	0.58	0.64	0.69	0.76	0.79	0.80	0.94	0.99	1.03	**1.15**	**1.16**	**1.17**	**1.27**	
	RPM		581	622	663	704	744	776	802	851	876	900	**951**	**976**	**1001**	**1033**	
	TURNS OPEN		5.0	4.0	3.0	2.0	1.0	3.5	3.0	2.0	1.5	1.0	**3.0**	**2.5**	**2.0**	**1.5**	
3000	MTR/SHEAVE	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	
	BHP	0.59	0.66	0.73	0.80	0.87	0.90	0.92	1.07	1.08	1.10	**1.30**	**1.33**	**1.35**	**1.40**	**1.44**	
	RPM	580	621	662	702	743	775	801	848	873	898	**949**	**973**	**997**	**1022**	**1046**	
	TURNS OPEN	5.0	4.0	3.0	2.0	1.0	3.5	3.0	2.0	1.5	1.0	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**	
3200	MTR/SHEAVE	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**		
	BHP	0.72	0.81	0.90	0.98	1.02	1.04	1.19	1.21	1.23	**1.44**	**1.47**	**1.51**	**1.54**	**1.57**		
	RPM	620	661	701	741	773	799	846	871	895	**946**	**970**	**994**	**1019**	**1043**		
	TURNS OPEN	4.0	3.0	2.0	1.0	3.5	3.0	2.0	1.5	1.0	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**		
3400	MTR/SHEAVE	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**			
	BHP	0.87	0.98	1.08	1.12	1.16	1.31	1.34	1.36	**1.58**	**1.62**	**1.65**	**1.69**	**1.73**			
	RPM	660	700	740	772	797	844	869	893	**944**	**968**	**992**	**1016**	**1040**			
	TURNS OPEN	3.0	2.0	1.0	3.5	3.0	2.0	1.5	1.0	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**			

07/25/07

Bold Face Requires Larger 2 HP Motor

A=Std Static/Std Mtr;B=Low Static/Std. Mtr;C=High Static/Std. Mtr;D=Std Static/Large Mtr;E=High Static/Large Mtr

Units factory shipped with standard static sheave and drive at 2.5 turns open (2600 cfm @ 0.4 in. ESP). Other speeds require field selection.

ISO/AHRI rating point with standard static sheave and drive at 1.5 turns open (2600 cfm @ 0.5 in. ESP). Other speeds require field selection.

For applications requiring higher static pressures, contact your local representative.

Performance data does not include drive losses and is based on sea level conditions.

Do not operate in gray region. "na" = information not available at time of printing.

All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, and 400 fpm by 0.12in. wg.

RLLH095 - Blower Performance Data

Belt Drive

Airflow in CFM with dry coil and clean air filter.

Rated CFM		External Static Pressure (in. w.g.)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0
2600	MTR/SHEAVE			2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**	**4.0**	**4.0**	**5.0**
	BHP			0.44	0.47	0.52	0.57	0.66	0.78	0.79	0.80	0.92	**0.97**	**1.08**	**1.18**	**1.37**	**1.56**
	RPM			584	625	667	708	757	806	831	856	905	**960**	**1021**	**1082**	**1142**	**1202**
	TURNS OPEN			5.0	4.0	3.0	2.0	4.0	3.0	2.5	2.0	1.0	**3.0**	**2.0**	**1.0**	**0.0**	**3.0**
2800	MTR/SHEAVE		2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**	**4.0**	**4.0**	**5.0**	**5.0**
	BHP		0.51	0.56	0.61	0.67	0.77	0.89	0.90	0.91	1.06	**1.11**	**1.14**	**1.38**	**1.44**	**1.59**	**1.73**
	RPM		583	625	665	707	756	804	829	854	902	**933**	**982**	**1055**	**1100**	**1156**	**1212**
	TURNS OPEN		5.0	4.0	3.0	2.0	4.0	3.0	2.5	2.0	1.0	**3.5**	**2.5**	**1.5**	**0.5**	**3.5**	**2.5**
3000	MTR/SHEAVE	2.0	2.0	2.0 B	2.0	1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**	**4.0** D	**4.0**	**4.0**	**5.0**	**5.0**
	BHP	0.57	0.64	0.70	0.76	0.87	1.00	1.01	1.03	1.19	**1.25**	**1.28**	**1.33**	**1.59**	**1.64**	**1.68**	**1.91**
	RPM	582	624	665	705	754	802	827	852	900	**930**	**955**	**1005**	**1078**	**1110**	**1169**	**1228**
	TURNS OPEN	5.0	4.0	3.0	2.0	4.0	3.0	2.5	2.0	1.0	**3.5**	**3.0**	**2.0**	**0.5**	**0.0**	**3.0**	**2.0**
3200	MTR/SHEAVE	2.0	2.0	2.0	1.0	1.0	1.0 A	1.0	1.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	
	BHP	0.70	0.78	0.86	0.97	1.11	1.13	1.15	1.31	1.31	1.38	1.44	1.61	1.69	**1.80**	**2.02**	
	RPM	623	664	704	753	801	826	851	899	919	949	978	1036	1086	**1137**	**1196**	
	TURNS OPEN	4.0	3.0	2.0	4.0	3.0	2.5	2.0	1.0	4.0	3.5	3.0	2.5	1.5	**3.5**	**2.5**	
3400	MTR/SHEAVE	2.0	2.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0 C	3.0	3.0	3.0	**5.0** E	**5.0**	
	BHP	0.85	0.94	1.07	1.21	1.24	1.26	1.42	1.43	1.50	1.57	1.65	1.71	1.76	**2.10**	**2.35**	
	RPM	663	703	752	800	825	849	896	917	947	976	1020	1057	1094	**1164**	**1223**	
	TURNS OPEN	3.0	2.0	4.0	3.0	2.5	2.0	1.0	4.0	3.5	3.0	2.5	1.8	1.0	**3.0**	**2.0**	
3600	MTR/SHEAVE	2.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**		
	BHP	1.01	1.16	1.31	1.34	1.37	1.54	1.55	1.63	1.70	1.78	1.87	2.06	**2.15**	**2.40**		
	RPM	702	751	798	823	848	894	915	945	974	1003	1031	1088	**1133**	**1191**		
	TURNS OPEN	2.0	4.0	3.0	2.5	2.0	1.0	4.0	3.5	3.0	2.5	2.0	1.5	**3.5**	**2.5**		
3800	MTR/SHEAVE	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**			
	BHP	1.23	1.40	1.44	1.48	1.66	1.67	1.75	1.83	1.91	2.00	2.10	**2.19**	**2.44**			
	RPM	750	797	821	845	893	913	942	971	1000	1029	1086	**1102**	**1160**			
	TURNS OPEN	4.0	3.0	2.5	2.0	1.0	4.0	3.5	3.0	2.5	2.0	1.5	**4.0**	**3.0**			

07/25/07

Bold Face Requires Larger 2 HP Motor

A=Std Static/Std Mtr;B=Low Static/Std. Mtr;C=High Static/Std. Mtr;D=Std Static/Large Mtr;E=High Static/Large Mtr

Units factory shipped with standard static sheave and drive at 2 turns open (3200 cfm @ 0.6 in. ESP). Other speeds require field selection.

ISO/AHRI rating point with standard static sheave and drive at 2 turns open (3200 cfm @ 0.6 in. ESP). Other speeds require field selection.

For applications requiring higher static pressures, contact your local representative.

Performance data does not include drive losses and is based on sea level conditions.

Do not operate in gray region. "na" = information not available at time of printing.

All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, and 400 fpm by 0.12in. wg.

RLLH120 - Blower Performance Data

Belt Drive

Airflow in CFM with dry coil and clean air filter.

Rated CFM		External Static Pressure (in. w.g.)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0
3000	MTR/SHEAVE					2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0
	BHP					0.80	0.88	0.96	1.07	1.09	1.11	1.13	1.28	1.36	1.48	1.67	1.86
	RPM					707	748	789	830	857	882	907	931	956	1032	1115	1198
	TURNS OPEN					5.0	4.0	3.0	2.0	5.0	4.5	4.0	3.5	2.5	1.0	4.5	3.5
3200	MTR/SHEAVE				2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0
	BHP				0.90	0.99	1.09	1.16	1.22	1.25	1.27	1.34	1.49	1.63	1.77	1.98	2.08
	RPM				707	747	788	830	855	880	905	930	955	1031	1107	1166	1210
	TURNS OPEN				5.0	4.0	3.0	2.0	5.0	4.5	4.0	3.5	2.5	1.0	4.0	3.0	2.5
3400	MTR/SHEAVE			2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0
	BHP			0.99	1.09	1.20	1.19	1.35	1.38	1.41	1.44	1.47	1.55	1.76	2.06	2.15	2.24
	RPM			706	747	787	829	854	879	904	929	954	1004	1070	1137	1180	1224
	TURNS OPEN			5.0	4.0	3.0	2.0	5.0	4.5	4.0	3.5	3.0	2.0	4.5	3.5	2.5	2.0
3600	MTR/SHEAVE		2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0
	BHP		1.05	1.18	1.30	1.32	1.47	1.51	1.54	1.58	1.61	1.85	1.90	2.12	2.22	2.32	2.51
	RPM		706	746	787	828	853	878	903	928	953	1001	1044	1103	1134	1184	1233
	TURNS OPEN		5.0	4.0	3.0	2.0	5.0	4.5	4.0	3.5	3.0	2.0	5.0	4.0	3.5	2.5	1.5
3800	MTR/SHEAVE	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0
	BHP	1.11	1.25	1.39	1.53	1.59	1.63	1.67	1.71	1.75	1.99	2.08	2.16	2.27	2.37	2.64	2.75
	RPM	705	756	786	827	853	878	902	927	951	999	1037	1075	1118	1161	1219	1255
	TURNS OPEN	5.0	4.0	3.0	2.0	5.0	4.5	4.0	3.5	3.0	2.0	1.0	4.5	3.5	3.0	2.0	1.5
4000	MTR/SHEAVE	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	3.0
	BHP	1.31	1.46	1.61	1.68	1.74	1.79	1.84	1.89	2.13	2.17	2.20	2.43	2.68	2.76	2.84	2.94
	RPM	745	786	826	852	877	901	926	950	998	1023	1047	1100	1157	1188	1231	1275
	TURNS OPEN	4.0	3.0	2.0	5.0	4.5	4.0	3.5	3.0	2.0	1.0	5.0	4.0	3.0	2.5	1.5	1.0
4200	MTR/SHEAVE	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	3.0	
	BHP	1.52	1.69	1.85	1.88	1.90	1.96	2.02	2.26	2.30	2.34	2.57	2.84	2.91	2.97	3.28	
	RPM	785	825	851	876	900	925	949	997	1018	1039	1098	1155	1184	1214	1270	
	TURNS OPEN	3.0	2.0	5.0	4.5	4.0	3.5	3.0	2.0	1.0	5.0	4.5	3.5	2.5	2.0	1.0	

07/23/07

A=Std Static/Std Mtr;B=Low Static/Std. Mtr;C=High Static/Std. Mtr;D=Std Static/Large Mtr;E=High Static/Large Mtr

Units factory shipped with standard static sheave and drive at 3.0 turns open (3600 cfm @ 0.9 in. ESP). Other speeds require field selection.

ISO/AHRI rating point with standard static sheave and drive at 2.0 turns open (3600 cfm @ 1.0 in. ESP). Other speeds require field selection.

For applications requiring higher static pressures, contact your local representative.

Performance data does not include drive losses and is based on sea level conditions.

Do not operate in gray region. "na" = information not available at time of printing.

All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, and 400 fpm by 0.12in. wg.

RLLV080 - Blower Performance Data

Belt Drive

Airflow in CFM with dry coil and clean air filter.

Rated CFM		External Static Pressure (in. w.g.)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
2200	MTR/SHEAVE	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	BHP	0.29	0.33	0.38	0.37	0.45	0.47	0.50	0.54	0.58	0.64	0.69	**0.71**	**0.73**	**0.84**	**0.95**	**1.05**
	RPM	437	478	518	539	586	617	647	677	707	736	765	**775**	**809**	**843**	**876**	**909**
	TURNS OPEN	4.0	3.0	2.0	1.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**
2400	MTR/SHEAVE	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	BHP	0.38	0.44	0.43	0.52	0.56	0.59	0.63	0.68	0.73	0.78	**0.81**	**0.83**	**0.94**	**1.05**	**1.13**	**1.20**
	RPM	477	517	538	585	615	645	675	704	734	763	**774**	**807**	**841**	**874**	**907**	**940**
	TURNS OPEN	3.0	2.0	1.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**
2600	MTR/SHEAVE	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	
	BHP	0.49	0.50	0.59	0.63	0.67	0.72	0.77	0.83	0.89	**0.91**	**0.94**	**1.05**	**1.17**	**1.24**	**1.32**	
	RPM	516	537	584	614	643	673	702	732	761	**772**	**806**	**839**	**871**	**905**	**938**	
	TURNS OPEN	2.0	1.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**	
2800	MTR/SHEAVE	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**		
	BHP	0.56	0.66	0.71	0.75	0.81	0.86	0.92	0.99	**1.02**	**1.05**	**1.17**	**1.29**	**1.37**	**1.44**		
	RPM	536	582	612	642	671	700	729	758	**770**	**804**	**837**	**869**	**903**	**936**		
	TURNS OPEN	1.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**		
3000	MTR/SHEAVE	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**			
	BHP	0.72	0.78	0.83	0.89	0.95	1.02	1.09	**1.12**	**1.16**	**1.29**	**1.41**	**1.49**	**1.57**			
	RPM	581	611	640	669	698	727	756	**768**	**802**	**835**	**867**	**900**	**933**			
	TURNS OPEN	5.0	4.5	4.0	3.5	3.0	2.5	2.0	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**			
3200	MTR/SHEAVE	1.0	1.0	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**				
	BHP	0.83	0.90	0.97	1.03	1.11	1.18	**1.14**	**1.27**	**1.40**	**1.53**	**1.61**	**1.70**				
	RPM	610	639	668	697	726	754	**767**	**800**	**833**	**865**	**898**	**930**				
	TURNS OPEN	4.5	4.0	3.5	3.0	2.5	2.0	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**				
3400	MTR/SHEAVE	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**					
	BHP	0.97	1.04	1.11	1.19	**1.23**	**1.30**	**1.37**	**1.51**	**1.64**	**1.73**	**1.82**					
	RPM	637	666	695	725	**731**	**765**	**798**	**830**	**862**	**895**	**927**					
	TURNS OPEN	4.0	3.5	3.0	2.5	**4.0**	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**					

07/25/07

Bold Face Requires 1.5 HP Motor

A=Std Static/Std Mtr;B=Low Static/Std. Mtr;C=High Static/Std. Mtr;D=Std Static/Large Mtr;E=High Static/Large Mtr

Units factory shipped with standard static sheave and drive at 3 turns open (2600 cfm @ 0.6 in. ESP). Other speeds require field selection.

ISO/AHRI rating point with standard static sheave and drive at 3 turns open (2600 cfm @ 0.6 in. ESP). Other speeds require field selection.

For applications requiring higher static pressures, contact your local representative.

Performance data does not include drive losses and is based on sea level conditions.

Do not operate in gray region. "na" = information not available at time of printing.

All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, and 400 fpm by 0.12in. wg.

RLLV095 - Blower Performance Data

Belt Drive

Airflow in CFM with dry coil and clean air filter.

Rated CFM		External Static Pressure (in. w.g.)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0
2600	MTR/SHEAVE				1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**			
	BHP				0.61	0.64	0.66	0.68	0.76	0.81	0.87	0.89	**0.94**	**1.05**			
	RPM				581	601	621	663	703	739	774	784	**827**	**867**			
	TURNS OPEN				5.0	4.5	4.0	3.0	2.0	1.5	1.0	0.0	**2.0**	**1.0**			
2800	MTR/SHEAVE			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**	**4.0**			
	BHP			0.65	0.66	0.68	0.75	0.86	0.87	0.88	1.02	**1.05**	**1.14**	**1.23**			
	RPM			580	600	621	662	701	722	742	782	**805**	**855**	**905**			
	TURNS OPEN			5.0	4.5	4.0	3.0	2.0	1.5	1.0	0.0	**2.5**	**1.5**	**0.0**			
3000	MTR/SHEAVE		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**
	BHP		0.72	0.73	0.74	0.84	0.96	0.98	0.99	1.13	1.14	1.17	1.23	1.36	1.48	**1.59**	**1.69**
	RPM		579	600	620	660	700	721	741	780	797	813	845	890	940	**960**	**991**
	TURNS OPEN		5.0	4.5	4.0	3.0	2.0	1.5	1.0	0.0	3.0	2.5	2.0	1.0	0.0	**3.0**	**2.5**
3200	MTR/SHEAVE	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	**5.0**
	BHP	0.79	0.80	0.82	0.93	1.06	1.08	1.10	1.25	1.26	1.31	1.36	1.49	1.62	**1.67**	**1.85**	**2.03**
	RPM	578	599	619	659	699	719	739	778	795	819	843	890	937	**942**	**967**	**991**
	TURNS OPEN	5.0	4.5	4.0	3.0	2.0	1.5	1.0	0.0	3.0	2.5	2.0	1.0	0.0	**3.0**	**2.5**	**2.0**
3400	MTR/SHEAVE	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	**5.0**	**5.0**
	BHP	0.84	0.89	1.01	1.15	1.17	1.20	1.35	1.36	1.42	1.48	1.52	1.61	**1.82**	**1.90**	**1.99**	**2.03**
	RPM	597	619	658	697	718	738	776	794	818	841	857	888	**940**	**963**	**986**	**1034**
	TURNS OPEN	4.5	4.0	3.0	2.0	1.5	1.0	0.0	3.0	2.5	2.0	1.5	1.0	**3.0**	**2.5**	**2.0**	**1.0**
3600	MTR/SHEAVE	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	BHP	0.97	1.09	1.23	1.26	1.29	1.45	1.47	1.53	1.60	1.67	1.74	**1.95**	**2.05**	**2.14**	**2.19**	**2.41**
	RPM	618	657	696	716	736	775	792	815	838	862	885	**937**	**960**	**983**	**1031**	**1077**
	TURNS OPEN	4.0	3.0	2.0	1.5	1.0	0.0	3.0	2.5	2.0	1.5	1.0	**3.0**	**2.5**	**2.0**	**1.0**	**0.0**
3800	MTR/SHEAVE	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	
	BHP	1.17	1.32	1.35	1.38	1.55	1.57	1.64	1.71	1.78	1.86	**2.09**	**2.18**	**2.28**	**2.34**	**2.57**	
	RPM	656	695	715	735	773	790	814	837	860	883	**935**	**958**	**981**	**1029**	**1074**	
	TURNS OPEN	3.0	2.0	1.5	1.0	0.0	3.0	2.5	2.0	1.5	1.0	**3.0**	**2.5**	**2.0**	**1.0**	**0.0**	

7/25/07

Bold Face Requires Larger 2 HP Motor

A=Std Static/Std Mtr;B=Low Static/Std. Mtr;C=High Static/Std. Mtr;D=Std Static/Large Mtr;E=High Static/Large Mtr

Units factory shipped with standard static sheave and drive at 2 turns open (2800 cfm @ 0.6 in. ESP). Other speeds require field selection.

ISO/AHRI rating point with standard static sheave and drive at 1 turns open (2800 cfm @ 0.7 in. ESP). Other speeds require field selection.

For applications requiring higher static pressures, contact your local representative.

Performance data does not include drive losses and is based on sea level conditions.

Do not operate in gray region. "na" = information not available at time of printing.

All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, and 400 fpm by 0.12in. wg.

RLLV120 - Blower Performance Data

Belt Drive

Airflow in CFM with dry coil and clean air filter.

Rated CFM		External Static Pressure (in. w.g.)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0
3200	MTR/SHEAVE	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	
	BHP	0.50	0.51	0.59	0.68	0.68	0.79	0.92	0.92	0.92	1.08	1.16	1.30	1.31	1.41	1.59	
	RPM	418	438	480	521	541	582	623	644	665	705	732	787	826	867	932	
	TURNS OPEN	4.5	4.0	3.0	2.0	1.0	5.0	4.0	3.5	3.0	2.0	1.5	0.5	2.0	1.0	0.0	
3400	MTR/SHEAVE	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0		
	BHP	0.58	0.67	0.77	0.78	0.90	1.04	1.05	1.07	1.16	1.26	1.28	1.37	1.47	1.65		
	RPM	438	480	520	541	582	622	643	664	694	724	746	795	843	888		
	TURNS OPEN	4.0	3.0	2.0	1.0	5.0	4.0	3.5	3.0	2.5	1.5	1.0	3.0	1.5	0.5		
3600	MTR/SHEAVE	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0		
	BHP	0.74	0.86	0.88	1.00	1.02	1.17	1.20	1.22	1.24	1.44	1.47	1.52	1.82	1.90		
	RPM	479	519	540	581	602	643	663	684	704	745	765	806	866	906		
	TURNS OPEN	3.0	2.0	1.0	5.0	4.5	3.5	3.0	2.5	2.0	1.0	3.5	2.5	1.0	0.0		
3800	MTR/SHEAVE	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0			
	BHP	0.94	0.96	1.10	1.15	1.24	1.32	1.35	1.38	1.41	1.62	1.66	1.91	2.06			
	RPM	519	539	581	622	642	662	683	704	723	764	784	823	884			
	TURNS OPEN	2.0	1.0	5.0	4.0	3.5	3.0	2.5	2.0	1.5	3.5	3.0	2.0	0.5			
4000	MTR/SHEAVE	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	**5.0**
	BHP	1.04	1.20	1.26	1.35	1.44	1.47	1.51	1.55	1.58	1.81	1.86	1.96	2.17	**2.25**	**2.39**	**2.66**
	RPM	539	580	621	641	661	682	703	724	744	783	803	843	893	**933**	**970**	**1017**
	TURNS OPEN	1.0	5.0	4.0	3.5	3.0	2.5	2.0	1.5	1.0	3.0	2.5	1.5	0.0	**3.5**	**2.5**	**1.5**
4200	MTR/SHEAVE	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**5.0**	**5.0**	**5.0**
	BHP	1.28	1.36	1.45	1.54	1.59	1.63	1.67	1.72	**1.95**	**2.01**	**2.06**	**2.19**	**2.31**	**2.48**	**2.75**	**3.03**
	RPM	580	620	641	661	682	702	722	742	**782**	**802**	**822**	**863**	**902**	**944**	**991**	**1037**
	TURNS OPEN	5.0	4.0	3.5	3.0	2.5	2.0	1.5	1.0	**3.0**	**2.5**	**2.0**	**1.0**	**0.0**	**3.0**	**2.0**	**1.0**
4400	MTR/SHEAVE	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**5.0**	**5.0**	**5.0**	
	BHP	1.46	1.55	1.65	1.70	1.75	1.80	1.85	**2.09**	**2.15**	**2.21**	**2.28**	**2.41**	**2.54**	**2.80**	**3.08**	
	RPM	620	640	660	681	701	722	742	**781**	**801**	**821**	**841**	**881**	**919**	**965**	**1012**	
	TURNS OPEN	4.0	3.5	3.0	2.5	2.0	1.5	1.0	**3.0**	**2.5**	**2.0**	**1.5**	**0.5**	**3.5**	**2.5**	**1.5**	

07/25/07

Bold Face Requires Larger 3 HP Motor

A=Std Static/Std Mtr;B=Low Static/Std. Mtr;C=High Static/Std. Mtr;D=Std Static/Large Mtr;E=High Static/Large Mtr

Units factory shipped with standard static sheave and drive at 3 turns open (3600 cfm @ 0.6 in. ESP). Other speeds require field selection.

ISO/AHRI rating point with standard static sheave and drive at 1 turns open (3600 cfm @ 0.9 in. ESP). Other speeds require field selection.

For applications requiring higher static pressures, contact your local representative.

Performance data does not include drive losses and is based on sea level conditions.

Do not operate in gray region. "na" = information not available at time of printing.

All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, and 400 fpm by 0.12 in. wg.

RLLV160 - Blower Performance Data

Belt Drive

Airflow in CFM with dry coil and clean air filter.

Rated CFM		External Static Pressure (in. w.g.)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
4400	MTR/SHEAVE	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	BHP	0.29	0.33	0.38	0.37	0.45	0.47	0.50	0.54	0.58	0.64	0.69	**0.71**	**0.73**	**0.84**	**0.95**	**1.05**
	RPM	437	478	518	539	586	617	647	677	707	736	765	**775**	**809**	**843**	**876**	**909**
	TURNS OPEN	4.0	3.0	2.0	1.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**
4600	MTR/SHEAVE	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	BHP	0.33	0.38	0.41	0.44	0.50	0.53	0.57	0.61	0.66	0.71	0.75	**0.77**	**0.84**	**0.95**	**1.04**	**1.13**
	RPM	457	498	528	562	601	631	661	691	720	750	770	**791**	**825**	**858**	**892**	**925**
	TURNS OPEN	3.5	2.5	1.5	0.5	4.5	4.0	3.5	3.0	2.5	2.0	1.0	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**
4800	MTR/SHEAVE	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	BHP	0.38	0.44	0.43	0.52	0.56	0.59	0.63	0.68	0.73	0.78	**0.81**	**0.83**	**0.94**	**1.05**	**1.13**	**1.20**
	RPM	477	517	538	585	615	645	675	704	734	763	**774**	**807**	**841**	**874**	**907**	**940**
	TURNS OPEN	3.0	2.0	1.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**
5000	MTR/SHEAVE	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	BHP	0.44	0.47	0.51	0.58	0.62	0.66	0.70	0.75	0.81	0.85	**0.87**	**0.94**	**1.05**	**1.15**	**1.22**	**0.60**
	RPM	497	527	561	599	629	659	688	718	747	768	**790**	**823**	**856**	**889**	**923**	**470**
	TURNS OPEN	2.5	1.5	1.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**	**0.5**
5200	MTR/SHEAVE	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	
	BHP	0.49	0.50	0.59	0.63	0.67	0.72	0.77	0.83	0.89	**0.91**	**0.94**	**1.05**	**1.17**	**1.24**	**1.32**	
	RPM	516	537	584	614	643	673	702	732	761	**772**	**806**	**839**	**871**	**905**	**938**	
	TURNS OPEN	2.0	1.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**	
5400	MTR/SHEAVE	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	
	BHP	0.53	0.58	0.65	0.69	0.74	0.79	0.85	0.91	0.95	**0.98**	**1.05**	**1.17**	**1.27**	**1.34**	**0.66**	
	RPM	526	560	598	628	657	686	716	745	766	**788**	**821**	**854**	**887**	**920**	**469**	
	TURNS OPEN	1.5	1.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**	**0.5**	
5600	MTR/SHEAVE	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**		
	BHP	0.56	0.66	0.71	0.75	0.81	0.86	0.92	0.99	**1.02**	**1.05**	**1.17**	**1.29**	**1.37**	**1.44**		
	RPM	536	582	612	642	671	700	729	758	**770**	**804**	**837**	**869**	**903**	**936**		
	TURNS OPEN	1.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	**3.5**	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**		

7/25/07

Bold Face Requires Larger 1.5 HP Motor

A=Std Static/Std Mtr;B=Low Static/Std. Mtr;C=High Static/Std. Mtr;D=Std Static/Large Mtr;E=High Static/Large Mtr

Units factory shipped with standard static sheave and drive at 3 turns open (5000 cfm @ 0.6 in. ESP). Other speeds require field selection.

ISO/AHRI rating point with standard static sheave and drive at 2.0 turns open (5000 cfm @ 0.7 in. ESP). Other speeds require field selection.

For applications requiring higher static pressures, contact your local representative.

Performance data does not include drive losses and is based on sea level conditions.

Do not operate in gray region. "na" = information not available at time of printing.

All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, and 400 fpm by 0.12 in. wg.

BHP is given for each blower. Multiply BHP x 2 for unit BHP.

RLLV180 - Blower Performance Data

Belt Drive

Airflow in CFM with dry coil and clean air filter.

Rated CFM		External Static Pressure (in. w.g.)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0
5200	MTR/SHEAVE				1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**			
	BHP				0.61	0.64	0.66	0.68	0.76	0.81	0.87	0.89	**0.94**	**1.05**			
	RPM				581	601	621	663	703	739	774	784	**827**	**867**			
	TURNS OPEN				5.0	4.5	4.0	3.0	2.0	1.5	1.0	0.5	**2.0**	**1.0**			
5400	MTR/SHEAVE				1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**			
	BHP				0.64	0.66	0.71	0.77	0.82	0.85	0.94	0.97	**1.04**	**1.14**			
	RPM				591	611	642	682	712	740	778	795	**841**	**886**			
	TURNS OPEN				4.5	4.0	3.5 A	2.5	1.5	1.0	0.5	0.0	**1.5** D	**0.5**			
5600	MTR/SHEAVE			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**	**4.0**			
	BHP			0.65	0.66	0.68	0.75	0.86	0.87	0.88	1.02	**1.05**	**1.14**	**1.23**			
	RPM			580	600	621	662	701	722	742	782	**805**	**855**	**905**			
	TURNS OPEN			5.0	4.5	4.0	3.0	2.0	1.5	1.0	0.0	**2.5**	**1.5**	**0.0**			
5800	MTR/SHEAVE			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**
	BHP			0.69	0.70	0.76	0.86	0.92	0.93	1.01	1.08	1.11	1.19	1.30	0.74	**0.80**	**0.85**
	RPM			590	610	641	681	711	731	761	790	809	850	898	470	**480**	**496**
	TURNS OPEN			4.5	4.0	3.5	2.5	1.5	1.0	0.5	0.0	3.0	2.5 C	2.0	1.0	**3.0**	**2.5**
6000	MTR/SHEAVE		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**
	BHP		0.72	0.73	0.74	0.84	0.96	0.98	0.99	1.13	1.14	1.17	1.23	1.36	1.48	**1.59**	**1.69**
	RPM		579	600	620	660	700	721	741	780	797	813	845	890	940	**960**	**991**
	TURNS OPEN		5.0	4.5	4.0	3.0	2.0	1.5	1.0	0.0	3.0	2.5	2.0	1.0	0.0	**3.0** E	**2.5**
6200	MTR/SHEAVE		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	**5.0**
	BHP		0.76	0.77	0.84	0.95	1.02	1.04	1.12	1.20	1.23	1.27	1.36	1.49	**1.58**	**1.72**	**1.86**
	RPM		589	609	640	680	710	730	760	788	808	828	868	914	**941**	**963**	**991**
	TURNS OPEN		4.5	4.0	3.5	2.5	1.5	1.0	0.5	0.0	2.5	2.0	1.5	0.5	**3.5**	**2.5**	**2.0**
6400	MTR/SHEAVE	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	**5.0**
	BHP	0.79	0.80	0.82	0.93	1.06	1.08	1.10	1.25	1.26	1.31	1.36	1.49	1.62	**1.67**	**1.85**	**2.03**
	RPM	578	599	619	659	699	719	739	778	795	819	843	890	937	**942**	**967**	**991**
	TURNS OPEN	5.0	4.5	4.0	3.0	2.0	1.5	1.0	0.0	3.0	2.5	2.0	1.0	0.0	**3.0**	**2.5**	**2.0**

7/25/07

Bold Face Requires Larger 2.0 HP Motor

A=Std Static/Std Mtr;B=Low Static/Std. Mtr;C=High Static/Std. Mtr;D=Std Static/Large Mtr;E=High Static/Large Mtr

Units factory shipped with standard static sheave and drive at 3 turns open (5600 cfm @ 0.6 in. ESP). Other speeds require field selection.

ISO/AHRI rating point with standard static sheave and drive at 1.5 turns open (5600 cfm @ 0.7 in. ESP). Other speeds require field selection.

For applications requiring higher static pressures, contact your local representative.

Performance data does not include drive losses and is based on sea level conditions.

Do not operate in gray region. "na" = information not available at time of printing.

All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, and 400 fpm by 0.12 in. wg.

BHP is given for each blower. Multiply BHP x 2 for unit BHP.

RLLV240 - Blower Performance Data

Belt Drive

Airflow in CFM with dry coil and clean air filter.

Rated CFM		External Static Pressure (in. w.g.)															
		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0
6400	MTR/SHEAVE	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	
	BHP	0.50	0.51	0.59	0.68	0.68	0.79	0.92	0.92	0.92	1.08	1.16	1.30	1.31	1.41	1.59	
	RPM	418	438	480	521	541	582	623	644	665	705	732	787	826	867	932	
	TURNS OPEN	4.5	4.0 B	3.0	2.0	1.0	5.0	4.0	3.5	3.0	2.0	1.5	0.5	2.0	1.0	0.0	
6800	MTR/SHEAVE	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0		
	BHP	0.58	0.67	0.77	0.78	0.90	1.04	1.05	1.07	1.16	1.26	1.28	1.37	1.47	1.65		
	RPM	438	480	520	541	582	622	643	664	694	724	746	795	843	888		
	TURNS OPEN	4.0	3.0	2.0	1.0	5.0	4.0	3.5	3.0	2.5	1.5	1.0	3.0	1.5	0.5		
7200	MTR/SHEAVE	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0		
	BHP	0.74	0.86	0.88	1.00	1.02	1.17	1.20	1.22	1.24	1.44	1.47	1.52	1.82	1.90		
	RPM	479	519	540	581	602	643	663	684	704	745	765	806	866	906		
	TURNS OPEN	3.0	2.0	1.0	5.0	4.5	3.5 A	3.0	2.5	2.0	1.0	3.5	2.5 C	1.0	0.0		
7600	MTR/SHEAVE	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0			
	BHP	0.94	0.96	1.10	1.15	1.24	1.32	1.35	1.38	1.41	1.62	1.66	1.91	2.06			
	RPM	519	539	581	622	642	662	683	704	723	764	784	823	884			
	TURNS OPEN	2.0	1.0	5.0	4.0	3.5	3.0	2.5	2.0	1.5	3.5	3.0	2.0	0.5			
8000	MTR/SHEAVE	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0	**5.0**	**5.0**	**5.0**
	BHP	1.04	1.20	1.26	1.35	1.44	1.47	1.51	1.55	1.58	1.81	1.86	1.96	2.17	**2.25**	**2.39**	**2.66**
	RPM	539	580	621	641	661	682	703	724	744	783	803	843	893	**933**	**970**	**1017**
	TURNS OPEN	1.0	5.0	4.0	3.5	3.0	2.5	2.0	1.5	1.0	3.0	2.5	1.5	0.0	**3.5** E	**2.5**	**1.5**
8400	MTR/SHEAVE	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**5.0**	**5.0**	**5.0**
	BHP	1.28	1.36	1.45	1.54	1.59	1.63	1.67	1.72	**1.95**	**2.01**	**2.06**	**2.19**	**2.31**	**2.48**	**2.75**	**3.03**
	RPM	580	620	641	661	682	702	722	742	**782**	**802**	**822**	**863**	**902**	**944**	**991**	**1037**
	TURNS OPEN	5.0	4.0	3.5	3.0	2.5	2.0	1.5	1.0	**3.0**	**2.5** D	**2.0**	**1.0**	**0.0**	**3.0**	**2.0**	**1.0**
8800	MTR/SHEAVE	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**5.0**	**5.0**	**5.0**	
	BHP	1.46	1.55	1.65	1.70	1.75	1.80	1.85	**2.09**	**2.15**	**2.21**	**2.28**	**2.41**	**2.54**	**2.80**	**3.08**	
	RPM	620	640	660	681	701	722	742	**781**	**801**	**821**	**841**	**881**	**919**	**965**	**1012**	
	TURNS OPEN	4.0	3.5	3.0	2.5	2.0	1.5	1.0	**3.0**	**2.5**	**2.0**	**1.5**	**0.5**	**3.5**	**2.5**	**1.5**	

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Bold Face Requires Larger 3.0 HP Motor

A=Std Static/Std Mtr;B=Low Static/Std. Mtr;C=High Static/Std. Mtr;D=Std Static/Large Mtr;E=High Static/Large Mtr

Units factory shipped with standard static sheave and drive at 2.5 turns open (7600 cfm @ 0.6 in. ESP). Other speeds require field selection.

ISO/AHRI rating point with standard static sheave and drive at 2 turns open (7600 cfm @ 0.7 in. ESP). Other speeds require field selection.

For applications requiring higher static pressures, contact your local representative.

Performance data does not include drive losses and is based on sea level conditions.

Do not operate in gray region. "na" = information not available at time of printing.

All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, and 400 fpm by 0.12 in. wg.

BHP is given for each blower. Multiply BHP x 2 for unit BHP.

RLLV300 - Blower Performance Data

Belt Drive

Airflow in CFM with dry coil and clean air filter.

Rated CFM		External Static Pressure (in. w.g.)															
		0.0	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**	**1.0**	**1.2**	**1.4**	**1.6**	**1.8**	**2.0**
8400	MTR/SHEAVE				2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	
	BHP				1.46	1.49	1.77	1.94	2.11	2.29	2.32	2.39	2.65	2.72	2.80	2.36	
	RPM				677	696	745	778	810	841	858	878	912	932	951	994	
	TURNS OPEN				5.0	4.0	3.0	2.0	1.0	4.0	3.5	3.0	2.0	1.5	1.0	4.5	
8800	MTR/SHEAVE			2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	
	BHP			1.55	1.70	1.86	2.03	2.21	2.39	2.42	2.50	2.75	2.83	2.91	2.63	2.61	
	RPM			674	708	742	774	806	837	853	873	907	926	945	981	1010	
	TURNS OPEN			5.0	4.0	3.0	2.0	1.0	4.0	3.5	3.0	2.0	1.5	1.0	4.5	4.0	
9200	MTR/SHEAVE		2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	
	BHP		1.63	1.79	1.96	2.13	2.31	2.49	2.52	2.60	2.85	2.93	3.01	2.87	2.87	2.86	
	RPM		671	705	738	771	802	833	849	869	903	922	940	969	997	1025	
	TURNS OPEN		5.0	4.0 B	3.0	2.0	1.0	4.0	3.5 A	3.0	2.0	1.5	1.0	4.5	4.0	3.5	
9600	MTR/SHEAVE	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0		
	BHP	1.72	1.88	2.04	2.22	2.40	2.58	2.62	2.70	2.95	3.03	3.11	3.09	3.10	3.11		
	RPM	668	702	735	767	799	829	845	864	898	917	935	959	985	1012		
	TURNS OPEN	5.0	4.0	3.0	2.0	1.0	4.0	3.5	3.0	2.0	1.5	1.0	4.5 C	4.0	3.5		
10000	MTR/SHEAVE	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0			
	BHP	1.96	2.13	2.31	2.49	2.68	2.71	2.79	3.05	3.13	3.21	3.29	3.31	3.33			
	RPM	699	732	764	795	825	841	860	894	912	931	949	975	1001			
	TURNS OPEN	4.0	3.0	2.0	1.0	4.0	3.5	3.0	2.0	1.5	1.0	4.5	4.0	3.5			
10400	MTR/SHEAVE	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0			
	BHP	2.21	2.39	2.58	2.77	2.81	2.89	3.13	3.22	3.31	3.39	3.51	3.54	3.56			
	RPM	729	761	792	821	837	856	890	908	926	944	965	990	1016			
	TURNS OPEN	3.0	2.0	1.0	4.0	3.5	3.0	2.0	1.5	1.0	4.5	4.0	3.5	3.0			
10800	MTR/SHEAVE	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0	3.0				
	BHP	2.48	2.66	2.85	2.90	2.98	3.23	3.32	3.40	3.48	3.61	3.73	3.76				
	RPM	758	788	818	833	852	885	904	922	939	960	980	1005				
	TURNS OPEN	2.0	1.0	4.0	3.5	3.0	2.0	1.5	1.0	4.5	4.0	3.5	3.0				

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ISO/AHRI rating point with standard static sheave and drive at 3.0 turns open (9500 cfm @ 0.7 in. ESP). Other speeds require field selection.

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For wet coil performance first calculate the face velocity of the air coil (Face Velocity [fpm] = Airflow [cfm] / Face Area [sq ft]).

Then for velocities of 200 fpm reduce the static capability by 0.03 in. wg, 300 fpm by 0.08 in. wg, and 400 fpm by 0.12 in. wg.

BHP is given for each blower. Multiply BHP x 2 for unit BHP.

Selection Example

To achieve optimal performance, proper selection of each heat pump is essential. A building load program should be used to determine the heating and cooling load of each zone. A computer software selection program can then be used to develop an accurate and complete heat pump schedule. Software can be obtained from your local sales representative.

While software is the easiest and most accurate method to size and select equipment, however, selection can still be accomplished manually using this manual and the following selection procedure. Sizing so that the actual sensible capacity of the equipment will satisfy the sensible capacity of the zone is the recommended method for best results.

Boiler/Tower Application

Typical boiler/tower application will result in entering water temperatures of 60-90°F with 70°F for heating and 90°F for cooling. Water to refrigerant insulation option would not be required. Flow rates are 2.5 to 3 gpm per ton with 2.5 gpm per ton often representing an economical design point.

Geothermal Application

Typical geothermal application can result in a wide entering water temperature range of 30-100°F. Typically minimum heating entering water temperatures can range from 30 to 50°F depending upon loop type and geographical location. Cooling performance should be calculated using a maximum loop temperature of 100°F in most loop applications. Water flow is typically 2.5 to 3 gpm per ton with 3 gpm per ton recommended with the more extreme loop temperatures. **PLEASE NOTE THAT WATER COIL INSULATION OPTION SHOULD BE SELECTED WHEN ENTERING WATER TEMPERATURES ARE EXPECTED TO BE BELOW 45-50°F.**

Geothermal Selection Example

Unit Model Number Designation
RLLH/RLXH = Horizontal Heat Pump
RLLV/RLXV = Vertical Heat Pump

Capacity Tables
RLL/RLX H/V 080-300

Selection Procedure
I. Determine Unit Requirements

Zone Design Conditions:

Total Cooling Load .... 82,000 BTUH
Sensible Cooling Load .... 63,800 BTUH
Total Heating Load .... 91,000 BTUH
Required Airflow .... 2700 cfm
Required External Static .... 0.60 in wg

System Design Conditions:

Entering water conditions will vary depending upon system type. A boiler/tower system will typically have different entering water conditions then a closed loop system. Refer to the performance data tables for maximum and minimum entering water temperatures. Contact your technical representative if you have questions regarding a specific application. The following design example is for a commercial ground source vertical closed loop.

Unit Selection Parameters:

Ent Water Temperature (EWT) – Max Clg .... 95°F
Ent Water Temperature (EWT) – Min Htg .... 45°F
Ent Air Temperature Dry-Bulb (Summer) .... 75°F
Ent Air Temperature Wet-Bulb (Summer) .... 63°F
Ent Air Temperature Dry-Bulb (Winter) .... 65°F
Water Flow Per Ton .... 3.0 gpm
Unit Electrical 460/60/3

II. Initial Selection

Refer to performance data table, and pick a unit that has a capacity rating close to the design total cooling load and sensible cooling load. Multiple units may need selected in order to find the best match.

Unit Possibility #1
RLLV080, 7 ton unit
@ 90°F EWT, 22.0 gpm and 80/67 EA conditions
TC = 78,000 BTUH and SC = 57,800 BTUH
This unit does not meet required capacity.

Unit Possibility #2
RLLV095, 8 ton unit
@ 90°F EWT, 24.0 gpm and 80/67 EA conditions
TC = 90,800 BTUH and SC = 66,600 BTUH
This unit is within 10% of needed total cooling performance and of sensible cooling performance.

III. Correction Factors:

After the initial selection has been made we must determine our correction factors for entering water temperature, water flow, entering air, and airflow.

A. Entering Water Corrections:
Corrections for capacity based on different entering water temperatures can be made by interpolation of the performance table. The following interpolation will be used to find the capacity of an RLLV095 at 95°F EWT. Extrapolation of the performance table is not permitted.

$$TC \ @\ 95°F = 90{,}800 + \frac{(95-90)}{(100-90)} \times (86{,}300 - 90{,}800)$$

TC @ 95°F = 88,550 BTUH

Using the same methodology for sensible cooling.

SC @ 95°F = 66,600 BTUH

B. Water flow Corrections:
Water flow corrections for capacity can be made by

Selection Example cont.

interpolation of the performance table. In this example, we are using a flow rate that is listed in the table, therefore interpolation is not necessary.

C. Entering Air (EA) and Airflow (AF) Corrections:
The capacity is corrected using the equations below. It might be necessary to use interpolation in the tables to find the right correction factor. Once the correct factor is determined, use the equations below to find the final capacity of the unit at the design conditions.

CORRECTED TC = TC x EA x AF

CORRECTED SC = SC x EA x AF

The nominal cfm per ton of cooling can be determined by the following equation:

1 ton = BTUH ÷ 12,000 BTUH/ton
Tons of cooling = 88,550 ÷ 12,000 = 7.38 tons
cfm = 2700
cfm/ton of clg = 2700 ÷ 7.38
nominal cfm/ton of clg = 365

For an RLLV095 at 75°F DB/ 63°F WB and 2700 cfm:

CORRECTED TC = 88,550 x 0.937 x 0.998
CORRECTED TC = 82,105 BTUH

CORRECTED SC = 66,600 x 0.958 x 0.992
CORRECTED SC = 63,290 BTUH

IV. Blower Performance

Refer to blower performance data table to determine cfm capability at required external static pressure. Different blower packages are available to offer a large range of static capabilities. Sheave adjustments maybe necessary to get the desired airflow at the external static pressure level.

For an RLLV095 with Package A:

At 2.0 turns open, the unit is capable of 2800 cfm at 0.60 in. w.g. This is within 5% of the design airflow. The drive sheave can be adjusted in 0.5 turn increments.

V. Cooling Ratings

A. General ratings:
It is important to note that both the total cooling and sensible load must be met for the zone by the equipment. The actual unit capacity is within 5% of the design load which is acceptable.

VI. Heating Ratings

A. General ratings:
Refer to heating capacity table and interpolate the capacity at 45°F EWT, 24.0 gpm and 2800 cfm at 70°F entering air conditions.

Total Heating Capacity = 83,100 BTUH

B. Dry Bulb and Airflow Corrections:
Find entering air dry bulb values in Entering Air Correction table. The correction factor for a dry bulb of 65°F is shown to be 1.011. In order to determine the correction factor for airflow, one must use the value based on nominal cfm/ton of cooling. It was determined in a previous step that the nominal cfm was approximately 365 cfm/ton of cooling. The correction factor for this was found to be 0.996. The total corrected heating capacity can be determined by the following equation:

CORRECTED HC = HC x EA x AF

For an RLLV095 at 65°F DB and 2700 cfm:

CORRECTED HC = 83,100 x 1.011 x 0.996

CORRECTED HC = 83,700 BTUH

The design heating load was 91,000 BTUH and the actual capacity of the unit is only 83,700 BTUH. This unit will require a source of auxiliary heat to make up for the 7,300 BTUH that will be needed at the heating design point. Typically, a small 5 kW electric heat strip would be used to supplement the unit at this condition.

VII. Final Results

RLLV095 (refer to model nomenclature):

Total Cooling Capacity = 82,105 Btu/hr
Sensible Cooling Capacity = 63,290 Btu/hr

Total Heating Capacity = 83,700 Btu/hr

Antifreeze Correction

Catalog performance can be corrected for antifreeze use. Please use the following table and note the example given.

Antifreeze Type	Antifreeze % by wt	Cooling Capacity	Heating Capacity	Pressure Drop
EWT - degF [DegC]		**90 [32.2]**	**30 [-1.1]**	**30 [-1.1]**
Water	0	1.000	1.000	1.000
Ethylene Glycol	10	0.991	0.973	1.075
	20	0.979	0.943	1.163
	30	0.965	0.917	1.225
	40	0.955	0.890	1.324
	50	0.943	0.865	1.419
Propylene Glycol	10	0.981	0.958	1.130
	20	0.969	0.913	1.270
	30	0.950	0.854	1.433
	40	0.937	0.813	1.614
	50	0.922	0.770	1.816
Ethanol	10	0.991	0.927	1.242
	20	0.972	0.887	1.343
	30	0.947	0.856	1.383
	40	0.930	0.815	1.523
	50	0.911	0.779	1.639
Methanol	10	0.986	0.957	1.127
	20	0.970	0.924	1.197
	30	0.951	0.895	1.235
	40	0.936	0.863	1.323
	50	0.920	0.833	1.399

Warning:
Gray area represents antifreeze concentrations greater than 35% by weight and should be avoided due to the extreme performance penalty they represent.

Antifreeze Correction Example

Antifreeze solution is Propylene Glycol 20% by weight. Determine the corrected heating and cooling performance at 30°F and 90°F respectively as well as pressure drop at 30°F for an RL Series RLLV080.

The corrected cooling capacity at 90°F would be:
78,000 MBtuh x 0.969 = 75,582 MBtuh
The corrected heating capacity at 30°F would be:
60,300 MBtuh x 0.913 = 55,054 MBtuh
The corrected pressure drop at 30°F and 22 GPM would be:
23.1 feet of head x 1.433 = 33.10 feet of head

Reference Calculations

Heating Calculations:

$$LWT = EWT - \frac{HE}{GPM \times 500}$$

$$LAT = EAT + \frac{HC}{CFM \times 1.08}$$

$$TH = HC + HWC$$

Cooling Calculations:

$$LWT = EWT + \frac{HR}{GPM \times 500}$$

$$LAT (DB) = EAT (DB) - \frac{SC}{CFM \times 1.08}$$

$$LC = TC - SC$$

$$S/T = \frac{SC}{TC}$$

Legend and Notes

ABBREVIATIONS AND DEFINITIONS:

CFM = airflow, cubic feet/minute
EWT = entering water temperature, Fahrenheit
GPM = water flow in gallons/minute
WPD = water pressure drop, PSI and feet of water
EAT = entering air temperature, Fahrenheit (dry bulb/wet bulb)
HC = air heating capacity, MBTUH
TC = total cooling capacity, MBTUH
SC = sensible cooling capacity, MBTUH
KW = total power unit input, kilowatts
HR = total heat of rejection, MBTUH
HE = total heat of extraction, MBTUH
HWC = hot water generator capacity, MBTUH
EER = Energy Efficient Ratio
= BTU output/Watt input
COP = Coefficient of Performance
= BTU output/BTU input
LWT = leaving water temperature, °F
LAT = leaving air temperature, °F
TH = total heating capacity, MBTUH
LC = latent cooling capacity, MBTUH
S/T = sensible to total cooling ratio

Notes to Performance Data Tables

The following notes apply to all capacity data tables:

- Performance ratings are based on 80ºF DB / 67ºF WB EAT for cooling and 70ºF DB EAT for heating.
- Three flow rates are shown for each unit. The lowest flow rate shown is used for geothermal open loop/well water systems with a minimum of 50ºF EWT. The middle flow rate shown is the minimum geothermal closed loop flow rate. The highest flow rate shown is optimum for geothermal closed loop systems and the suggested flow rate for boiler/tower applications.
- The hot water generator numbers are based on a flow rate of 0.4 GPM/ton of rated capacity with an EWT of 90ºF.
- Entering water temperatures below 40ºF assumes 15% antifreeze solution.
- For non-standard EAT conditions, apply the appropriate correction factors from the Correction Factor Tables.
- Interpolation between EWT, GPM and CFM data is permissible.

Correction Factor Tables

Air Flow Corrections (Dual Circuit)

Airflow		Cooling				Heating		
CFM Per Ton of Clg	% of Nominal	Total Cap	Sens Cap	Power	Heat of Rej	Htg Cap	Power	Heat of Ext
281	75%	0.981	0.910	0.956	0.976	0.956	1.049	0.947
299	80%	0.985	0.928	0.965	0.981	0.970	1.034	0.959
318	85%	0.988	0.947	0.975	0.986	0.977	1.027	0.968
337	90%	0.990	0.965	0.990	0.990	0.985	1.021	0.977
355	95%	0.996	0.985	0.995	0.997	0.992	1.014	0.986
374	**100%**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
393	105%	1.005	1.030	1.012	1.014	1.010	0.993	1.005
412	110%	1.007	1.044	1.025	1.013	1.014	0.991	1.014
430	115%	1.010	1.065	1.035	1.018	1.021	0.987	1.024
449	120%	1.014	1.086	1.046	1.024	1.029	0.981	1.033
468	125%	1.017	1.106	1.059	1.027	1.040	0.980	1.039

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EA Corrections
Cooling Capacity Corrections

Entering Air WB ºF	Total Clg Cap	Sensible Cooling Capacity Multipliers - Entering DB ºF										Power Input	Heat of Rejection
		60	65	70	75	80	80.6	85	90	95	100		
55	0.898	0.723	0.866	1.048	1.185	*	*	*	*	*	*	0.985	0.913
60	0.912		0.632	0.880	1.078	1.244	1.260	*	*	*	*	0.994	0.927
65	0.967			0.694	0.881	1.079	1.085	1.270	*	*	*	0.997	0.972
66.2	0.983			0.655	0.842	1.040	1.060	1.232	*	*	*	0.999	0.986
67	1.000			0.616	0.806	1.000	1.023	1.193	1.330	*	*	1.000	1.000
70	1.053				0.693	0.879	0.900	1.075	1.250	1.404	*	1.003	1.044
75	1.168					0.687	0.715	0.875	1.040	1.261	1.476	1.007	1.141

11/10/09

NOTE: * Sensible capacity equals total capacity at conditions shown.

Heating Capacity Corrections

Ent Air DB °F	Heating Corrections		
	Htg Cap	Power	Heat of Ext
45	1.062	0.739	1.158
50	1.050	0.790	1.130
55	1.037	0.842	1.096
60	1.025	0.893	1.064
65	1.012	0.945	1.030
68	1.005	0.976	1.012
70	1.000	1.000	1.000
75	0.987	1.048	0.970
80	0.975	1.099	0.930

11/10/09

Operating Limits

Operating Limits	Cooling		Heating	
	(°F)	(°C)	(°F)	(°C)
Air Limits				
Min. Ambient Air	45	7.2	45	7.2
Rated Ambient Air	80	26.7	70	21.1
Max. Ambient Air	100	37.8	85	29.4
Min. Entering Air	50	10.0	40	4.4
Rated Entering Air db/wb	80.6/66.2	27/19	68	20.0
Max. Entering Air db/wb	110/83	43/28.3	80	26.7
Water Limits				
Min. Entering Water	30	-1.1	20	-6.7
Normal Entering Water	50-110	10-43.3	30-70	-1.1
Max. Entering Water	120	48.9	90	32.2

NOTE: Minimum/maximum limits are only for start-up conditions, and are meant for bringing the space up to occupancy temperature. Units are not designed to operate at the minimum/maximum conditions on a regular basis. The operating limits are dependant upon three primary factors: 1) water temperature, 2) return air temperature, and 3) ambient temperature. When any of the factors are at the minimum or maximum levels, the other two factors must be at the normal level for proper and reliable unit operation.

Pressure Drop

Model	GPM	Pressure Drop (psi)				
		30°F	50°F	70°F	90°F	110°F
080	10.0	2.48	2.36	2.29	2.21	2.14
	16.0	5.96	5.62	5.22	4.89	4.69
	22.0	10.91	10.38	9.73	9.12	8.50
095	12.0	2.22	2.00	1.92	1.83	1.67
	18.0	4.62	4.02	3.80	3.75	3.65
	24.0	7.31	6.81	5.80	5.60	5.19
120	16.0	2.03	1.93	1.88	1.80	1.50
	22.0	3.69	3.58	3.40	3.19	2.99
	28.0	5.58	5.50	5.32	5.00	4.84
160	20.0	1.20	1.19	1.18	1.17	1.16
	28.0	2.64	2.50	2.37	2.24	2.12
	35.0	3.72	3.65	3.41	3.36	3.21
180	22.0	1.50	1.50	1.50	1.50	1.50
	34.0	3.95	3.90	3.85	3.80	3.75
	45.0	6.40	6.10	6.00	5.80	5.70
240	30.0	0.90	0.82	0.75	0.69	0.63
	45.0	2.22	2.06	1.91	1.77	1.64
	60.0	3.47	3.29	3.06	2.88	2.40
300	35.0	1.84	1.60	1.39	1.21	1.05
	56.0	4.09	3.88	3.69	3.51	3.33
	75.0	6.10	5.95	5.77	5.45	5.10

RLLH080 - Performance Data

Belt Drive - Dual Circuit - 2600 CFM

EWT	WATER FLOW	WPD		HEATING - EAT 70 °F					COOLING - EAT 80/67 °F					
°F	GPM	PSI	FT	HC	KW	HE	LAT	COP	TC	SC	S/T	KW	HR	EER
20	10.0	2.5	5.8	Operation not recommended					Operation not recommended					
	16.0	6.1	14.0	46.9	4.43	31.8	84.7	3.10						
	22.0	11.1	25.6	48.0	4.45	32.8	85.1	3.16						
30	10.0	2.5	5.8	Operation not recommended										
	16.0	6.0	13.8	54.9	4.53	39.4	87.5	3.55						
	22.0	10.9	25.2	55.9	4.56	40.3	87.9	3.59						
40	10.0	2.4	5.5	60.2	4.61	44.5	89.4	3.83	85.6	61.0	0.71	3.36	97.1	25.5
	16.0	5.8	13.4	62.8	4.66	47.0	90.4	3.96	79.6	58.0	0.73	3.15	90.4	25.2
	22.0	10.7	24.6	64.0	4.69	48.0	90.8	4.00	76.1	57.0	0.75	3.07	86.6	24.8
50	10.0	2.4	5.4	66.1	4.75	49.9	91.5	4.08	85.5	61.9	0.72	3.71	98.1	23.0
	16.0	5.6	13.0	70.6	4.80	54.2	93.1	4.31	82.5	60.8	0.74	3.53	94.6	23.4
	22.0	10.4	24.0	72.1	4.83	55.6	93.7	4.37	81.2	60.7	0.75	3.45	93.0	23.5
60	10.0	2.3	5.4	73.9	4.90	57.2	94.3	4.42	83.8	61.6	0.73	4.13	97.9	20.3
	16.0	5.4	12.5	78.0	4.94	61.1	95.8	4.62	83.3	61.9	0.74	3.91	96.6	21.3
	22.0	10.1	23.2	79.7	4.98	62.7	96.4	4.69	83.2	62.4	0.75	3.82	96.2	21.8
70	10.0	2.3	5.3	82.0	5.02	64.8	97.2	4.78	81.1	60.5	0.75	4.60	96.8	17.6
	16.0	5.2	12.1	84.7	5.08	67.4	98.2	4.89	82.2	61.5	0.75	4.31	96.9	19.1
	22.0	9.7	22.5	86.5	5.12	69.1	98.8	4.95	82.6	62.0	0.75	4.20	97.0	19.7
80	10.0	2.3	5.2	88.6	5.10	71.2	99.6	5.09	77.6	58.9	0.76	5.10	95.0	15.2
	16.0	5.0	11.6	90.5	5.19	72.8	100.2	5.12	79.6	60.1	0.76	4.75	95.8	16.7
	22.0	9.4	21.7	92.3	5.25	74.3	100.9	5.15	80.0	61.2	0.76	4.61	95.7	17.3
90	10.0	2.2	5.1	92.2	5.10	74.8	100.8	5.30	73.8	57.0	0.77	5.60	92.9	13.2
	16.0	4.9	11.3	95.3	5.26	77.4	102.0	5.31	75.6	58.0	0.77	5.26	93.5	14.4
	22.0	9.1	21.1	96.5	5.34	78.2	102.3	5.29	75.8	59.0	0.78	5.09	93.2	14.9
100	10.0	2.2	5.0	Operation not recommended					Operation not recommended					
	16.0	4.8	11.0						70.7	55.7	0.79	5.84	90.6	12.1
	22.0	8.8	20.2						70.6	56.2	0.80	5.65	89.9	12.5
110	10.0	2.1	4.9						Operation not recommended					
	16.0	4.7	10.8						65.0	53.4	0.82	6.51	87.2	10.0
	22.0	8.5	19.6						64.8	53.3	0.82	6.32	86.4	10.2
120	10.0	2.1	4.9						Operation not recommended					
	16.0	4.7	10.9						59.0	51.5	0.87	7.29	83.8	8.1
	22.0	8.3	19.1						58.9	52.3	0.89	7.13	83.3	8.3

RLLH095 - Performance Data

Belt Drive - Dual Circuit - 3200 CFM

EWT	WATER FLOW	WPD		HEATING - EAT 70 °F					COOLING - EAT 80/67 °F					
°F	GPM	PSI	FT	HC	KW	HE	LAT	COP	TC	SC	S/T	KW	HR	EER
20	12.0	2.1	4.9	Operation not recommended					Operation not recommended					
	18.0	5.1	11.9	55.2	5.46	36.6	84.0	2.96						
	24.0	7.2	16.6	56.8	5.52	38.0	84.4	3.02						
30	12.0	2.1	4.9	Operation not recommended										
	18.0	4.6	10.7	71.6	5.57	52.6	88.7	3.77						
	24.0	7.1	16.5	73.3	5.66	54.0	89.2	3.79						
40	12.0	2.0	4.7	74.5	5.57	55.5	89.6	3.92	97.0	74.0	0.76	4.33	111.8	22.4
	18.0	4.3	9.8	82.6	5.70	63.2	91.9	4.25	93.5	72.5	0.78	4.05	107.3	23.1
	24.0	7.0	16.2	84.3	5.81	64.5	92.4	4.25	90.0	71.4	0.79	3.87	103.2	23.3
50	12.0	2.0	4.7	79.5	5.71	60.0	91.0	4.08	98.7	73.5	0.74	4.63	114.5	21.3
	18.0	4.0	9.3	89.6	5.83	69.7	93.9	4.50	99.6	71.1	0.71	4.27	114.2	23.3
	24.0	6.8	15.6	91.3	5.96	71.0	94.4	4.49	94.3	70.4	0.75	4.28	108.9	22.0
60	12.0	2.0	4.5	85.6	5.84	65.7	92.8	4.30	97.8	72.5	0.74	5.05	90.8	19.4
	18.0	3.9	9.0	94.1	5.97	73.8	95.2	4.62	101.3	70.0	0.69	4.64	117.1	21.8
	24.0	6.5	14.9	95.9	6.09	75.1	95.7	4.61	95.8	69.7	0.73	4.71	111.9	20.3
70	12.0	1.9	4.4	92.3	5.96	72.0	94.7	4.54	94.9	71.2	0.75	5.56	113.9	17.1
	18.0	3.8	8.8	97.7	6.09	77.0	96.3	4.71	99.5	69.0	0.69	5.14	117.1	19.4
	24.0	6.1	14.2	99.5	6.21	78.3	96.8	4.70	94.9	69.3	0.73	5.18	112.6	18.3
80	12.0	1.8	4.2	98.7	6.06	78.0	96.6	4.78	90.7	69.6	0.77	6.12	111.5	14.8
	18.0	3.8	8.7	102.0	6.19	80.8	97.5	4.83	95.1	68.0	0.72	5.75	114.7	16.6
	24.0	5.8	13.4	103.7	6.31	82.2	98.0	4.82	92.1	68.5	0.74	5.69	111.5	16.2
90	12.0	1.7	4.0	104.0	6.12	83.1	98.1	4.98	85.8	68.0	0.79	6.70	108.6	12.8
	18.0	3.8	8.7	108.3	6.26	87.0	99.3	5.07	88.9	67.0	0.75	6.43	110.9	13.8
	24.0	5.5	12.7	110.0	6.37	88.3	99.8	5.06	87.7	67.8	0.77	6.26	109.1	14.0
100	12.0	1.7	3.9	Operation not recommended					Operation not recommended					
	18.0	3.7	8.6						81.9	65.8	0.80	7.16	106.3	11.4
	24.0	5.3	12.3						82.2	67.0	0.81	6.91	105.7	11.9
110	12.0	1.7	3.9						Operation not recommended					
	18.0	3.6	8.4						74.9	64.4	0.86	7.93	101.9	9.4
	24.0	5.2	12.0						75.9	65.9	0.87	7.65	102.0	9.9
120	12.0	1.7	3.9						Operation not recommended					
	18.0	3.5	8.1						68.8	62.6	0.91	8.69	98.4	7.9
	24.0	5.2	12.0						69.2	63.3	0.91	8.49	98.2	8.2

RLLH120 - Performance Data

Belt Drive - Dual Circuit - 3600 CFM

EWT	WATER FLOW	WPD		HEATING - EAT 70 °F					COOLING - EAT 80/67 °F					
°F	GPM	PSI	FT	HC	KW	HE	LAT	COP	TC	SC	S/T	KW	HR	EER
20	16.0	2.7	6.2	Operation not recommended					Operation not recommended					
	22.0	4.2	9.7	74.2	6.13	53.3	87.1	3.55						
	28.0	6.4	14.8	75.7	6.13	54.8	87.5	3.62						
30	16.0	2.6	6.0	Operation not recommended										
	22.0	4.1	9.4	88.0	6.25	66.7	90.6	4.13						
	28.0	6.2	14.3	90.1	6.21	68.9	91.2	4.25						
40	16.0	2.5	5.7	97.5	6.41	75.6	93.1	4.46	136.3	85.6	0.63	5.50	155.1	24.8
	22.0	4.0	9.1	100.9	6.39	79.0	93.9	4.62	131.8	84.8	0.64	5.74	151.4	23.0
	28.0	6.0	13.8	102.8	6.39	81.0	94.4	4.72	129.7	84.0	0.65	5.82	149.6	22.3
50	16.0	2.4	5.6	106.7	6.55	84.4	95.5	4.78	133.6	84.0	0.63	6.36	155.3	21.0
	22.0	3.9	8.9	113.2	6.56	90.9	97.1	5.06	133.0	83.7	0.63	6.34	154.6	21.0
	28.0	5.8	13.4	114.8	6.62	92.3	97.5	5.08	133.4	83.9	0.63	6.29	154.8	21.2
60	16.0	2.3	5.3	119.6	6.69	96.8	98.8	5.24	129.0	82.1	0.64	7.22	153.6	17.9
	22.0	3.8	8.7	125.8	6.73	102.8	100.4	5.48	130.9	82.5	0.63	6.97	154.7	18.8
	28.0	5.7	13.1	127.2	6.86	103.7	100.7	5.43	132.0	83.3	0.63	6.84	155.3	19.3
70	16.0	2.2	5.0	134.2	6.82	111.0	102.5	5.77	123.3	80.0	0.65	8.07	150.8	15.3
	22.0	3.7	8.5	139.0	6.88	115.6	103.8	5.92	126.4	81.0	0.64	7.66	152.5	16.5
	28.0	5.5	12.7	140.8	7.07	116.7	104.2	5.84	126.9	82.0	0.65	7.48	152.4	17.0
80	16.0	2.0	4.6	148.8	6.94	125.1	106.3	6.28	117.0	77.7	0.66	8.90	147.4	13.1
	22.0	3.5	8.2	153.6	7.01	129.7	107.5	6.43	120.0	79.2	0.66	8.43	148.8	14.2
	28.0	5.4	12.4	156.7	7.20	132.2	108.3	6.38	119.4	80.3	0.67	8.22	147.4	14.5
90	16.0	1.8	4.2	161.5	7.07	137.4	109.5	6.70	110.8	75.5	0.68	9.71	143.9	11.4
	22.0	3.4	7.8	170.0	7.09	145.8	111.7	7.03	112.6	77.0	0.68	9.29	144.3	12.1
	28.0	5.2	12.0	176.0	7.20	151.4	113.3	7.16	110.8	78.0	0.70	9.06	141.7	12.2
100	16.0	1.6	3.8	Operation not recommended					Operation not recommended					
	22.0	3.2	7.4						104.9	74.4	0.71	10.25	139.8	10.2
	28.0	5.0	11.6						102.5	75.2	0.73	10.02	136.7	10.2
110	16.0	1.5	3.5						Operation not recommended					
	22.0	3.0	6.9						97.5	71.2	0.73	11.34	136.2	8.6
	28.0	4.8	11.2						95.8	71.8	0.75	11.10	133.7	8.6
120	16.0	1.5	3.5						Operation not recommended					
	22.0	2.7	6.3						91.3	67.5	0.74	12.56	134.2	7.3
	28.0	4.6	10.6						92.0	68.2	0.74	12.31	134.0	7.5

RLLV080 - Performance Data

Belt Drive - Dual Circuit - 2600 CFM

EWT	WATER FLOW	WPD		HEATING - EAT 70 °F					COOLING - EAT 80/67 °F					
°F	GPM	PSI	FT	HC	KW	HE	LAT	COP	TC	SC	S/T	KW	HR	EER
20	10.0	2.2	5.1	Operation not recommended					Operation not recommended					
	16.0	5.6	12.9	51.8	4.67	35.9	86.4	3.25						
	22.0	10.3	23.7	52.1	4.85	35.6	86.6	3.15						
30	10.0	2.2	5.1	Operation not recommended										
	16.0	5.5	12.7	59.8	4.85	43.3	89.3	3.62						
	22.0	10.0	23.1	60.3	4.92	43.5	89.5	3.59						
40	10.0	2.1	5.0	65.3	4.95	48.4	91.3	3.87	84.2	58.9	0.70	3.65	96.7	23.1
	16.0	5.3	12.3	68.0	5.01	50.9	92.2	3.98	78.1	55.1	0.71	3.35	89.5	23.3
	22.0	9.7	22.3	68.8	5.03	51.7	92.5	4.01	72.7	51.7	0.71	3.28	83.9	22.2
50	10.0	2.1	4.8	71.2	5.09	53.8	93.4	4.10	87.5	59.7	0.68	3.94	100.9	22.2
	16.0	5.2	12.0	76.0	5.16	58.4	95.1	4.32	84.0	59.3	0.71	3.67	96.5	22.9
	22.0	9.4	21.6	77.4	5.18	59.8	95.6	4.38	81.8	57.2	0.70	3.63	94.2	22.5
60	10.0	2.0	4.6	79.0	5.23	61.2	96.1	4.43	87.6	59.7	0.68	4.34	102.4	20.2
	16.0	5.0	11.6	83.7	5.31	65.6	97.8	4.63	86.2	61.0	0.71	4.04	100.0	21.3
	22.0	9.0	20.9	85.7	5.34	67.4	98.5	4.70	85.9	60.2	0.70	4.01	99.6	21.4
70	10.0	1.9	4.4	87.4	5.37	69.1	99.1	4.77	85.3	59.2	0.69	4.83	101.8	17.7
	16.0	4.9	11.2	91.0	5.45	72.4	100.4	4.89	85.3	60.8	0.71	4.48	100.6	19.1
	22.0	8.7	20.1	93.2	5.51	74.4	101.2	4.96	85.9	60.5	0.70	4.43	101.0	19.4
80	10.0	1.8	4.2	95.0	5.51	76.2	101.8	5.06	81.6	58.2	0.71	5.37	99.9	15.2
	16.0	4.7	10.8	97.5	5.60	78.4	102.7	5.10	82.2	59.3	0.72	4.97	99.2	16.5
	22.0	8.4	19.4	99.7	5.66	80.3	103.5	5.16	83.0	60.1	0.72	4.88	99.6	17.0
90	10.0	1.8	4.1	100.4	5.62	81.3	103.8	5.24	77.0	56.9	0.74	5.91	97.2	13.0
	16.0	4.5	10.5	103.2	5.77	83.5	104.7	5.25	77.6	56.9	0.73	5.53	96.5	14.0
	22.0	8.2	18.8	104.7	5.80	84.9	105.3	5.30	78.0	57.8	0.74	5.40	96.4	14.4
100	10.0	1.8	4.1	Operation not recommended					Operation not recommended					
	16.0	4.4	10.2						72.3	54.4	0.75	6.16	93.3	11.7
	22.0	7.9	18.2						72.0	54.4	0.76	5.98	92.4	12.0
110	10.0	1.8	4.1						Operation not recommended					
	16.0	4.3	9.9						67.0	52.2	0.78	6.86	90.4	9.8
	22.0	7.7	17.8						66.0	50.2	0.76	6.64	88.7	9.9
120	10.0	1.8	4.1						Operation not recommended					
	16.0	4.2	9.7						62.6	50.8	0.81	7.63	88.6	8.2
	22.0	7.5	17.4						61.0	48.0	0.79	7.40	86.3	8.2

RLLV095 - Performance Data

Belt Drive - Dual Circuit - 2800 CFM

EWT	WATER FLOW	WPD		HEATING - EAT 70 °F					COOLING - EAT 80/67 °F					
°F	GPM	PSI	FT	HC	KW	HE	LAT	COP	TC	SC	S/T	KW	HR	EER
20	12.0	2.2	5.1	Operation not recommended					Operation not recommended					
	18.0	4.7	10.9	56.8	5.42	38.3	86.8	3.07						
	24.0	8.0	18.6	57.8	5.47	39.1	87.1	3.10						
30	12.0	2.1	4.9	Operation not recommended										
	18.0	4.7	10.9	66.4	5.60	47.3	89.9	3.47						
	24.0	8.0	18.5	67.5	5.61	48.4	90.3	3.53						
40	12.0	2.0	4.6	73.5	5.72	54.0	92.3	3.77	101.6	70.9	0.70	4.14	115.8	24.5
	18.0	4.6	10.7	76.4	5.78	56.7	93.3	3.88	97.5	66.1	0.68	3.80	110.4	25.7
	24.0	7.8	18.1	77.9	5.77	58.2	93.8	3.96	93.6	62.7	0.67	3.71	106.3	25.2
50	12.0	2.0	4.7	80.9	5.88	60.9	94.8	4.03	101.1	70.5	0.70	4.44	116.2	22.8
	18.0	4.4	10.3	86.5	5.95	66.2	96.6	4.26	98.6	68.1	0.69	4.19	112.9	23.5
	24.0	7.6	17.6	88.3	5.95	68.0	97.2	4.35	96.2	65.6	0.68	4.06	110.1	23.7
60	12.0	2.0	4.6	91.0	6.06	70.3	98.1	4.40	98.8	69.8	0.71	4.89	115.5	20.2
	18.0	4.2	9.8	96.4	6.13	75.5	99.9	4.61	97.8	68.8	0.70	4.62	113.6	21.2
	24.0	7.3	16.9	98.5	6.14	77.5	100.6	4.70	97.1	67.5	0.69	4.48	112.4	21.7
70	12.0	1.9	4.5	101.7	6.24	80.4	101.6	4.78	95.2	68.8	0.72	5.46	113.8	17.4
	18.0	4.0	9.3	105.7	6.30	84.2	102.9	4.91	95.4	68.4	0.72	5.10	112.8	18.7
	24.0	7.0	16.2	107.9	6.33	86.3	103.7	4.99	96.4	68.1	0.71	4.96	113.3	19.4
80	12.0	1.9	4.3	111.4	6.41	89.5	104.8	5.10	90.8	67.6	0.74	6.08	111.6	14.9
	18.0	3.8	8.9	114.0	6.48	91.9	105.7	5.16	91.9	67.3	0.73	5.65	111.1	16.3
	24.0	6.7	15.5	116.1	6.52	93.9	106.4	5.22	94.2	68.3	0.72	5.50	113.0	17.1
90	12.0	1.8	4.1	118.0	6.56	95.6	107.0	5.28	86.2	66.2	0.77	6.69	109.0	12.9
	18.0	3.7	8.5	121.0	6.65	98.3	108.0	5.33	87.5	65.5	0.75	6.26	108.9	14.0
	24.0	6.5	15.0	122.7	6.69	99.9	108.6	5.38	90.8	67.4	0.74	6.10	111.6	14.9
100	12.0	1.7	4.0	**Operation not recommended**					Operation not recommended					
	18.0	3.6	8.3						82.8	63.4	0.77	6.95	106.5	11.9
	24.0	6.3	14.5						86.3	65.8	0.76	6.76	109.4	12.8
110	12.0	1.7	3.8						Operation not recommended					
	18.0	3.6	8.3						78.0	61.3	0.79	7.73	104.4	10.1
	24.0	6.2	14.2						80.8	63.5	0.79	7.48	106.4	10.8
120	12.0	1.6	3.7						Operation not recommended					
	18.0	3.7	8.5						73.6	59.4	0.81	8.60	103.0	8.6
	24.0	6.2	14.3						74.6	61.4	0.82	8.26	102.8	9.0

RLLV120 - Performance Data

Belt Drive - Dual Circuit - 3600 CFM

EWT	WATER FLOW	WPD		HEATING - EAT 70 °F					COOLING - EAT 80/67 °F					
°F	GPM	PSI	FT	HC	KW	HE	LAT	COP	TC	SC	S/T	KW	HR	EER
20	16.0	2.1	4.9	Operation not recommended					Operation not recommended					
	22.0	4.0	9.2	69.6	7.41	44.3	85.9	2.75						
	28.0	5.8	13.4	72.1	7.42	46.8	86.5	2.85						
30	16.0	2.1	4.9	Operation not recommended										
	22.0	3.8	8.8	82.3	7.60	56.4	89.2	3.17						
	28.0	5.7	13.1	84.2	7.61	58.3	89.7	3.24						
40	16.0	2.0	4.7	92.6	7.69	66.4	91.8	3.53	140.9	100.0	0.71	6.04	161.5	23.3
	22.0	3.7	8.5	96.3	7.83	69.5	92.8	3.60	138.5	99.0	0.71	5.75	158.1	24.1
	28.0	5.6	12.9	98.0	7.86	71.2	93.2	3.66	137.2	98.0	0.71	5.59	156.3	24.5
50	16.0	1.9	4.5	103.4	7.94	76.3	94.6	3.82	136.9	97.3	0.71	6.47	158.9	21.2
	22.0	3.6	8.3	110.8	8.10	83.2	96.5	4.01	137.0	97.8	0.71	6.24	158.3	22.0
	28.0	5.5	12.7	112.8	8.14	85.0	97.0	4.06	135.5	97.1	0.72	6.07	156.2	22.3
60	16.0	1.9	4.4	118.3	8.24	90.1	98.4	4.21	130.9	94.2	0.72	7.08	155.1	18.5
	22.0	3.5	8.1	125.4	8.39	96.8	100.3	4.38	132.8	95.6	0.72	6.81	156.0	19.5
	28.0	5.4	12.5	128.0	8.45	99.2	100.9	4.44	131.6	95.5	0.73	6.63	154.2	19.9
70	16.0	1.9	4.3	134.2	8.58	104.9	102.5	4.58	123.7	90.8	0.73	7.83	150.4	15.8
	22.0	3.4	7.9	139.6	8.71	109.8	103.9	4.70	126.6	92.5	0.73	7.47	152.1	16.9
	28.0	5.3	12.3	142.9	8.78	113.0	104.8	4.77	126.1	93.0	0.74	7.27	150.8	17.3
80	16.0	1.9	4.3	148.2	8.95	117.6	106.1	4.85	116.1	87.3	0.75	8.65	145.6	13.4
	22.0	3.3	7.6	152.6	9.05	121.7	107.2	4.94	119.1	88.9	0.75	8.22	147.1	14.5
	28.0	5.2	12.0	157.0	9.12	125.9	108.4	5.04	119.3	90.4	0.76	8.00	146.6	14.9
90	16.0	1.8	4.2	157.2	9.36	125.3	108.4	4.92	108.7	83.9	0.77	9.48	141.1	11.5
	22.0	3.2	7.4	164.0	9.41	131.9	110.2	5.11	111.0	85.0	0.77	9.07	142.0	12.2
	28.0	5.0	11.6	169.5	9.47	137.2	111.6	5.25	112.0	87.0	0.78	8.83	142.1	12.7
100	16.0	1.7	3.9	Operation not recommended					Operation not recommended					
	22.0	3.1	7.1						103.1	81.1	0.79	10.02	137.2	10.3
	28.0	4.8	11.1						104.5	83.1	0.79	9.77	137.9	10.7
110	16.0	1.4	3.3						Operation not recommended					
	22.0	2.9	6.7						95.9	77.3	0.81	11.07	133.7	8.7
	28.0	4.5	10.4						97.5	78.7	0.81	10.81	134.4	9.0
120	16.0	1.4	3.3						Operation not recommended					
	22.0	2.7	6.2						90.4	74.1	0.82	12.23	132.1	7.4
	28.0	4.1	9.5						91.3	75.0	0.82	11.98	132.2	7.6

RLLV160 - Performance Data

Belt Drive - Dual Circuit - 5000 CFM

EWT	WATER FLOW	WPD		HEATING - EAT 70 °F					COOLING - EAT 80/67 °F					
°F	GPM	PSI	FT	HC	KW	HE	LAT	COP	TC	SC	S/T	KW	HR	EER
20	20.0	1.2	2.8	Operation not recommended					Operation not recommended					
	28.0	2.7	6.3											
	35.0	3.9	8.9											
30	20.0	1.2	2.8	Operation not recommended										
	28.0	2.6	6.1	87.3	8.70	57.6	84.2	2.94						
	35.0	3.7	8.6	89.1	8.87	58.8	84.5	2.94						
40	20.0	1.2	2.8	98.2	8.91	67.8	86.2	3.23	168.0	119.0	0.71	7.66	194.1	21.9
	28.0	2.6	5.9	101.2	8.97	70.6	86.7	3.31	171.0	120.2	0.70	7.40	196.3	23.1
	35.0	3.7	8.5	103.6	9.10	72.5	87.2	3.34	174.0	122.0	0.70	7.27	198.8	23.9
50	20.0	1.2	2.7	111.9	9.19	80.6	88.7	3.57	163.5	117.8	0.72	8.22	191.5	19.9
	28.0	2.5	5.8	115.2	9.26	83.6	89.3	3.65	167.1	119.3	0.71	7.93	194.2	21.1
	35.0	3.7	8.4	118.1	9.32	86.2	89.9	3.71	170.3	120.6	0.71	7.68	196.5	22.2
60	20.0	1.2	2.7	124.1	9.48	91.8	91.0	3.84	159.3	114.3	0.72	8.84	189.4	18.0
	28.0	2.4	5.6	127.8	9.56	95.1	91.7	3.92	162.0	115.8	0.72	8.54	191.1	19.0
	35.0	3.5	8.2	130.9	9.64	98.0	92.2	3.98	164.4	117.2	0.71	8.27	192.6	19.9
70	20.0	1.2	2.7	136.4	9.77	103.0	93.3	4.09	155.0	110.8	0.71	9.46	187.3	16.4
	28.0	2.4	5.5	140.3	9.86	106.7	94.0	4.17	156.8	112.4	0.72	9.14	188.0	17.2
	35.0	3.4	7.9	143.8	9.95	109.8	94.6	4.23	158.4	113.8	0.72	8.86	188.6	17.9
80	20.0	1.2	2.7	148.6	10.07	114.2	95.5	4.33	149.2	106.9	0.72	10.30	184.4	14.5
	28.0	2.3	5.3	151.4	10.11	116.9	96.0	4.39	151.0	108.5	0.72	9.98	185.1	15.1
	35.0	3.4	7.8	154.8	10.21	119.9	96.7	4.44	152.6	109.9	0.72	9.70	185.7	15.7
90	20.0	1.2	2.7	160.8	10.31	125.6	97.8	4.57	141.7	101.8	0.72	10.90	178.9	13.0
	28.0	2.2	5.2	162.5	10.37	127.1	98.1	4.59	144.8	103.4	0.71	10.71	181.3	13.5
	35.0	3.4	7.8	165.8	10.47	130.0	98.7	4.64	146.8	106.0	0.72	10.54	182.8	13.9
100	20.0	1.2	2.7	Operation not recommended					Operation not recommended					
	28.0	2.2	5.0						136.7	101.3	0.74	11.80	176.9	11.6
	35.0	3.2	7.5						138.7	103.5	0.75	11.62	178.4	11.9
110	20.0	1.2	2.7						Operation not recommended					
	28.0	2.1	4.9						128.4	99.0	0.77	12.90	172.4	10.0
	35.0	3.2	7.4						130.7	101.1	0.77	12.71	174.0	10.3
120	20.0	1.2	2.7						Operation not recommended					
	28.0	2.1	4.8						118.0	95.2	0.81	14.27	166.7	8.3
	35.0	3.0	6.9						120.4	97.0	0.81	13.99	168.2	8.6

RLLV180 - Performance Data

Belt Drive - Dual Circuit - 5600 CFM

EWT	WATER FLOW	WPD		HEATING - EAT 70 °F					COOLING - EAT 80/67 °F					
°F	GPM	PSI	FT	HC	KW	HE	LAT	COP	TC	SC	S/T	KW	HR	EER
20	22.0	1.5	3.5	Operation not recommended					Operation not recommended					
	34.0	4.0	9.2											
	45.0	6.4	14.9											
30	22.0	1.5	3.5	Operation not recommended										
	34.0	4.0	9.1	119.7	10.20	84.9	87.8	3.44						
	45.0	6.4	14.8	123.0	10.33	87.8	88.3	3.49						
40	22.0	1.5	3.5	129.6	10.43	94.1	89.4	3.64	176.8	122.3	0.69	8.78	206.8	20.1
	34.0	3.9	9.1	134.9	10.64	98.6	90.3	3.72	179.7	127.8	0.71	8.42	208.4	21.3
	45.0	6.3	14.4	140.0	10.82	103.1	91.1	3.79	182.8	129.7	0.71	8.03	210.2	22.8
50	22.0	1.5	3.5	146.0	10.89	108.8	92.1	3.93	172.5	121.3	0.70	9.49	204.9	18.2
	34.0	3.9	9.0	151.7	11.10	113.9	93.1	4.01	175.7	124.7	0.71	9.11	206.8	19.3
	45.0	6.1	14.1	157.0	11.30	118.4	94.0	4.07	178.7	127.8	0.72	8.77	208.6	20.4
60	22.0	1.5	3.5	166.1	11.39	127.2	95.5	4.27	168.4	120.3	0.71	10.30	203.5	16.3
	34.0	3.9	8.9	172.3	11.60	132.7	96.5	4.35	172.1	123.2	0.72	9.91	205.9	17.4
	45.0	6.1	14.0	178.0	11.79	137.8	97.4	4.42	175.4	125.8	0.72	9.55	208.0	18.4
70	22.0	1.5	3.5	186.1	11.89	145.5	98.8	4.59	164.3	119.3	0.73	11.11	202.2	14.8
	34.0	3.8	8.9	192.8	12.09	151.6	99.9	4.67	168.4	121.6	0.72	10.70	204.9	15.7
	45.0	6.0	13.9	199.0	12.28	157.1	100.9	4.75	172.1	123.8	0.72	10.33	207.3	16.7
80	22.0	1.5	3.5	210.6	12.43	168.2	102.8	4.97	161.0	117.6	0.73	11.98	201.9	13.4
	34.0	3.8	8.8	217.9	12.62	174.8	104.0	5.06	165.1	119.9	0.73	11.57	204.5	14.3
	45.0	5.9	13.6	224.0	12.79	180.4	105.0	5.13	168.8	122.1	0.72	11.20	207.0	15.1
90	22.0	1.5	3.5	237.8	12.99	193.5	107.3	5.37	159.7	115.5	0.72	13.02	204.1	12.3
	34.0	3.8	8.8	245.6	13.18	200.7	108.6	5.46	163.2	117.3	0.72	12.54	206.0	13.0
	45.0	5.8	13.4	249.0	13.30	203.6	109.2	5.49	165.5	120.3	0.73	12.06	206.6	13.7
100	22.0	1.5	3.5	Operation not recommended					Operation not recommended					
	34.0	3.8	8.7						159.2	115.7	0.73	13.63	205.7	11.7
	45.0	5.7	13.2						161.7	118.4	0.73	13.23	206.8	12.2
110	22.0	1.5	3.5						Operation not recommended					
	34.0	3.7	8.7						155.1	114.0	0.73	14.78	205.5	10.5
	45.0	5.7	13.2						157.8	116.4	0.74	14.40	206.9	11.0
120	22.0	1.5	3.5						Operation not recommended					
	34.0	3.7	8.6						151.9	112.8	0.74	16.01	206.5	9.5
	45.0	5.6	12.9						155.0	115.0	0.74	15.75	208.7	9.8

RLLV240 - Performance Data

Belt Drive - Dual Circuit - 7600 CFM

EWT	WATER FLOW	WPD		HEATING - EAT 70 °F					COOLING - EAT 80/67 °F					
°F	GPM	PSI	FT	HC	KW	HE	LAT	COP	TC	SC	S/T	KW	HR	EER
20	30.0	0.9	2.2	Operation not recommended					Operation not recommended					
	45.0	2.3	5.3											
	60.0	3.7	8.6											
30	30.0	0.9	2.1	Operation not recommended										
	45.0	2.2	5.1	178.9	10.81	142.0	89.8	4.85						
	60.0	3.5	8.0	192.0	10.93	154.7	91.4	5.15						
40	30.0	0.9	2.0	192.4	11.12	154.5	91.4	5.07	267.0	178.0	0.67	9.13	298.1	29.3
	45.0	2.1	4.9	200.6	11.22	162.3	92.4	5.24	268.7	182.7	0.68	8.82	298.8	30.5
	60.0	3.4	7.8	212.9	11.35	174.1	93.9	5.50	273.3	185.5	0.68	8.73	303.1	31.3
50	30.0	0.8	1.9	215.1	11.51	175.9	94.2	5.48	266.3	180.4	0.68	9.69	299.4	27.5
	45.0	2.1	4.7	224.4	11.64	184.7	95.3	5.65	268.2	182.2	0.68	9.39	300.2	28.6
	60.0	3.3	7.6	233.7	11.78	193.5	96.5	5.82	270.0	184.0	0.68	9.08	301.0	29.7
60	30.0	0.8	1.8	242.6	11.92	201.9	97.6	5.96	258.2	175.7	0.68	10.32	293.4	25.0
	45.0	2.0	4.6	253.3	12.10	212.0	98.9	6.14	260.3	177.8	0.68	10.02	294.5	26.0
	60.0	3.2	7.3	264.0	12.27	222.1	100.2	6.31	262.4	180.0	0.69	9.72	295.5	27.0
70	30.0	0.8	1.7	270.1	12.34	228.0	100.9	6.42	250.2	171.0	0.68	10.94	287.5	22.9
	45.0	1.9	4.4	282.2	12.55	239.4	102.4	6.59	252.4	173.5	0.69	10.65	288.8	23.7
	60.0	3.1	7.1	294.3	12.77	250.8	103.9	6.76	254.7	175.9	0.69	10.35	290.0	24.6
80	30.0	0.7	1.7	303.3	12.77	259.7	104.9	6.96	235.4	168.2	0.71	11.67	275.3	20.2
	45.0	1.8	4.2	317.2	13.03	272.7	106.6	7.13	237.7	170.7	0.72	11.38	276.5	20.9
	60.0	3.0	6.9	327.2	13.22	282.0	107.9	7.25	240.0	173.2	0.72	11.08	277.8	21.7
90	30.0	0.7	1.6	339.8	13.22	294.7	109.4	7.53	217.3	163.6	0.75	12.36	259.5	17.6
	45.0	1.8	4.1	355.6	13.53	309.5	111.3	7.70	222.0	166.1	0.75	12.12	263.4	18.3
	60.0	2.9	6.7	360.0	13.68	313.3	111.9	7.71	225.2	170.4	0.76	11.81	265.5	19.1
100	30.0	0.7	1.5	Operation not recommended					Operation not recommended					
	45.0	1.7	3.9						209.2	160.0	0.76	12.87	253.1	16.3
	60.0	2.7	6.3						212.4	163.6	0.77	12.84	256.2	16.5
110	30.0	0.6	1.4						Operation not recommended					
	45.0	1.6	3.8						196.1	153.4	0.78	13.70	242.9	14.3
	60.0	2.4	5.5						199.5	156.7	0.79	13.86	246.8	14.4
120	30.0	0.6	1.4						Operation not recommended					
	45.0	1.6	3.6						182.1	147.2	0.81	14.59	231.9	12.5
	60.0	2.4	5.5						185.9	150.0	0.81	14.91	236.7	12.5

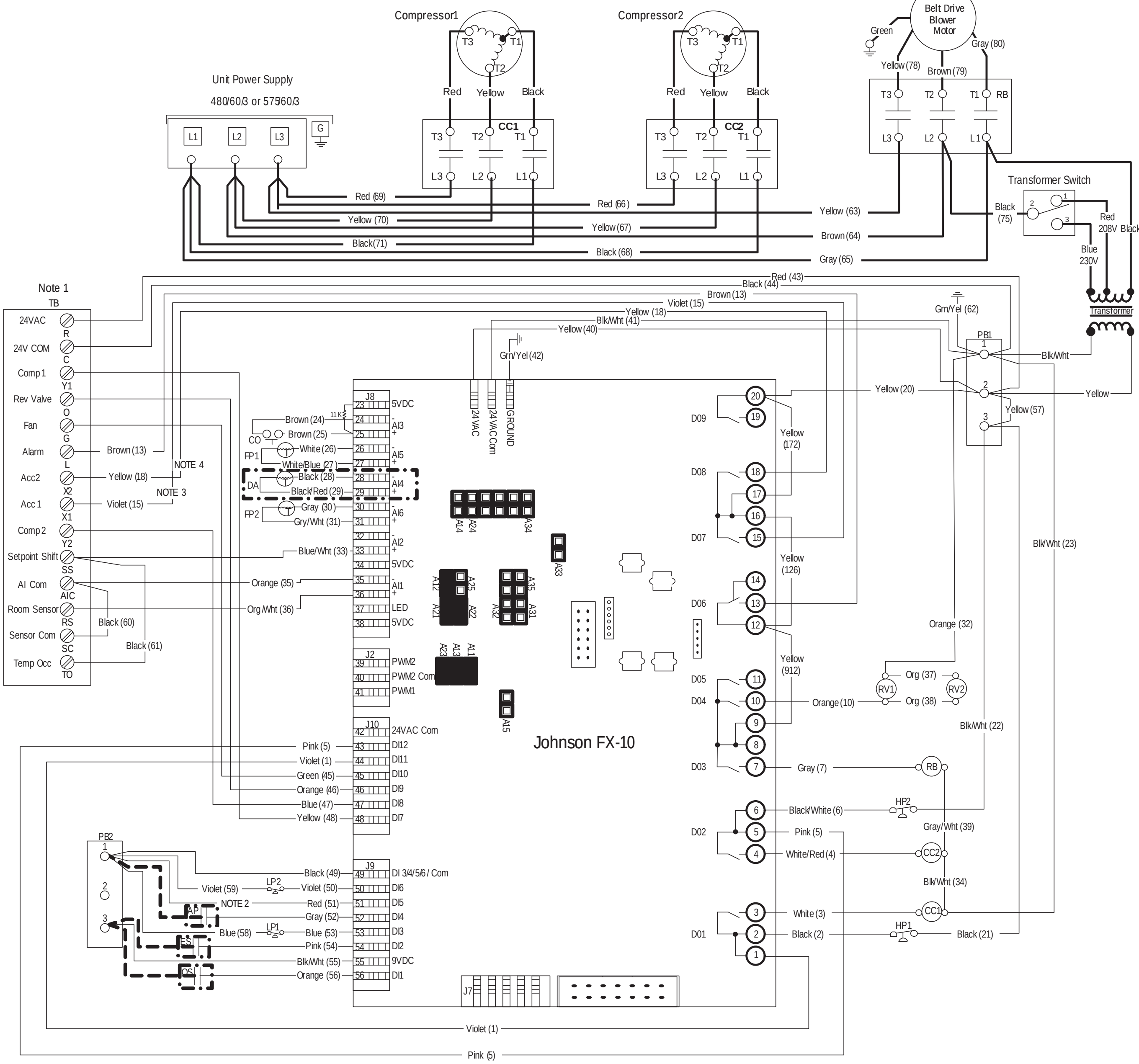
RLLV300 - Performance Data

Belt Drive - Dual Circuit - 9500 CFM

EWT	WATER FLOW	WPD		HEATING - EAT 70 °F					COOLING - EAT 80/67 °F					
°F	GPM	PSI	FT	HC	KW	HE	LAT	COP	TC	SC	S/T	KW	HR	EER
20	35.0	2.0	4.6	Operation not recommended					Operation not recommended					
	56.0	4.2	9.7											
	75.0	6.3	14.7											
30	35.0	1.8	4.3	Operation not recommended										
	56.0	4.1	9.4	218.4	17.07	160.2	89.3	3.75						
	75.0	6.1	14.1	225.0	17.15	166.5	89.9	3.85						
40	35.0	1.7	4.0	233.3	17.71	172.9	90.7	3.86	305.4	209.0	0.68	12.95	349.6	23.6
	56.0	4.0	9.2	244.1	17.74	183.6	91.8	4.03	314.6	211.1	0.67	12.36	356.7	25.4
	75.0	6.0	13.9	254.7	17.87	193.7	92.8	4.18	320.0	214.3	0.67	11.84	360.4	27.0
50	35.0	1.6	3.7	259.0	18.25	196.7	93.2	4.16	297.0	207.8	0.70	14.25	345.6	20.8
	56.0	3.9	9.0	272.3	18.42	209.5	94.5	4.33	303.8	210.5	0.69	13.60	350.2	22.3
	75.0	6.0	13.7	284.4	18.58	221.0	95.7	4.49	310.0	213.0	0.69	13.02	354.4	23.8
60	35.0	1.5	3.5	289.6	18.82	225.4	96.2	4.51	289.4	206.6	0.71	15.77	343.2	18.3
	56.0	3.8	8.7	306.3	19.16	240.9	97.9	4.68	296.6	209.2	0.71	15.06	348.0	19.7
	75.0	5.9	13.5	321.4	19.47	255.0	99.3	4.84	303.1	211.5	0.70	14.41	352.3	21.0
70	35.0	1.4	3.2	320.2	19.39	254.0	99.2	4.84	281.7	205.4	0.73	17.30	340.7	16.3
	56.0	3.7	8.5	340.2	19.90	272.3	101.2	5.01	289.3	207.8	0.72	16.51	345.7	17.5
	75.0	5.8	13.3	358.4	20.36	288.9	102.9	5.16	296.3	210.0	0.71	15.80	350.2	18.7
80	35.0	1.3	3.0	356.7	19.98	288.5	102.8	5.23	274.6	204.5	0.74	18.82	338.8	14.6
	56.0	3.6	8.3	381.1	20.68	310.5	105.1	5.40	282.2	206.9	0.73	18.03	343.7	15.7
	75.0	5.6	13.0	399.2	21.18	326.9	106.9	5.52	289.1	209.1	0.72	17.32	348.2	16.7
90	35.0	1.2	2.8	396.7	20.59	326.4	106.7	5.65	267.4	199.9	0.75	21.03	339.2	12.7
	56.0	3.5	8.1	426.0	21.49	352.6	109.5	5.81	275.4	202.9	0.74	19.87	343.2	13.9
	75.0	5.5	12.6	440.0	22.00	364.9	110.9	5.86	282.0	208.1	0.74	18.84	346.3	15.0
100	35.0	1.1	2.6	Operation not recommended					Operation not recommended					
	56.0	3.4	7.9						268.7	199.5	0.74	22.12	344.2	12.1
	75.0	5.3	12.2						275.0	204.0	0.74	20.85	346.2	13.2
110	35.0	1.0	2.4						Operation not recommended					
	56.0	3.3	7.7						263.4	195.6	0.74	24.38	346.6	10.8
	75.0	5.1	11.8						268.0	199.8	0.75	22.87	346.0	11.7
120	35.0	1.0	2.3						Operation not recommended					
	56.0	3.2	7.5						252.8	193.6	0.77	26.86	344.5	9.4
	75.0	5.0	11.6						258.0	197.3	0.76	25.33	344.4	10.2

Wiring Schematic - FX10 Control

208-230/60/3



Legend

Factory low voltage wiring	
Factory line voltage wiring	
Field low voltage wiring	
Field line voltage wiring	
Optional block	
Internal junction	
Quick connect terminal	
Wire nut	
L1	Field wire lug
Ground	

Relay Contacts- N.O., N.C.

Thermistor - Johnson Control

Relay coil

Switch - High pressure

Switch - Low pressure

Polarized connector

Condensate Overflow

AP - Air Proving
CC1 - Compressor contactor 1
CC2 - Compressor contactor 2
CO - Condensate overflow
CPM1 - Compressor Protection Module 1
CPM2 - Compressor Protection Module 2
DA - Discharge Air Temperature
ES - Emergency Shutdown
FP1 - Freeze protection sensor 1
FP2 - Freeze protection sensor 2

HP1 - Stage 1 High Pressure
HP2 - Stage 2 High Pressure
LP1 - Stage 1 Low Pressure
LP2 - Stage 2 Low Pressure
OS - Occupied Switch
RB - Blower power relay
RV1 - Reversing Valve coil 1
RV2 - Reversing Valve coil 2

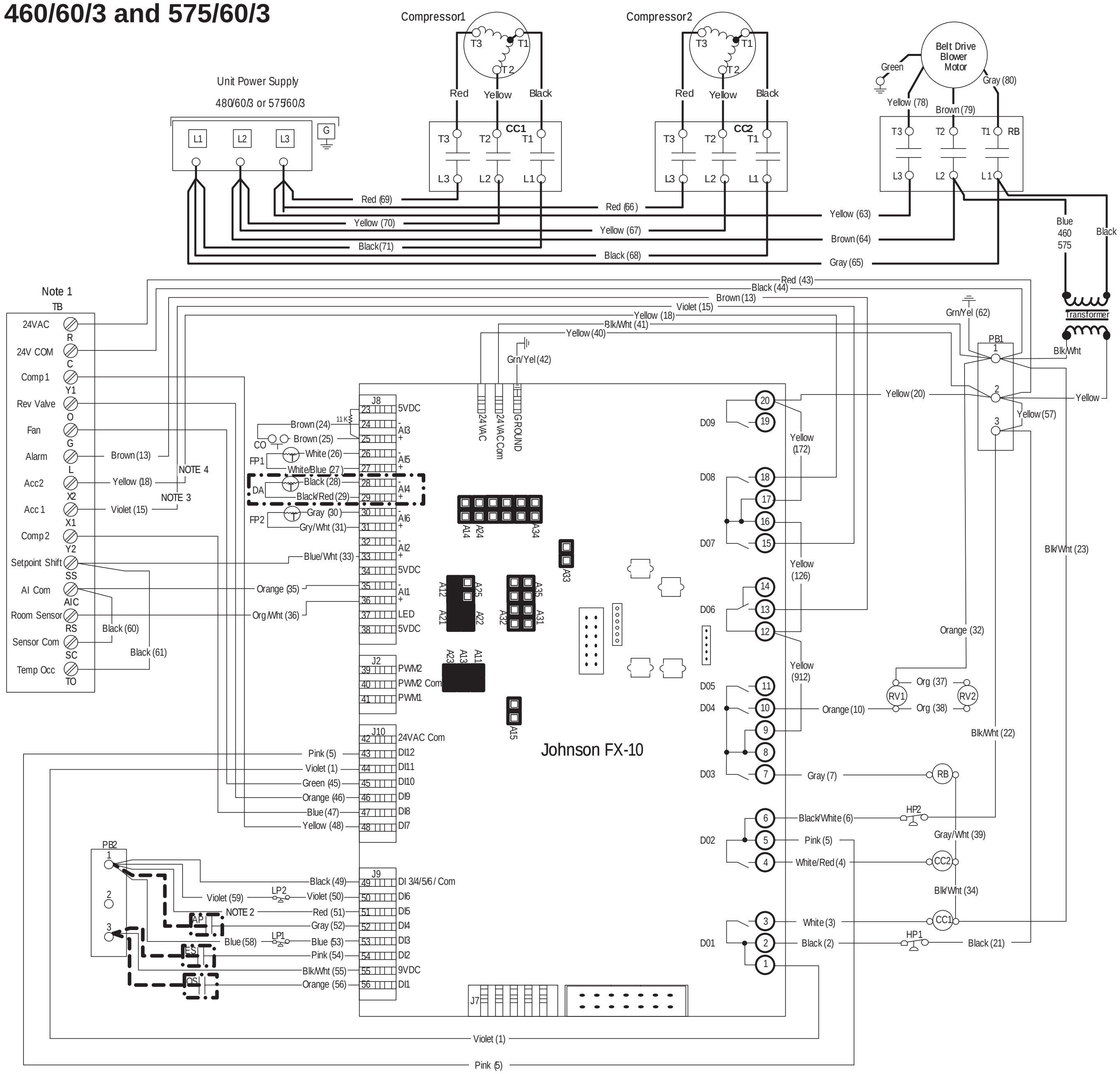
Notes:

1 - R, C, Y1, Y2, O, and G are for use with a wall mounted thermostat
2 - Disconnect for 15 degree freeze protection
3 - Acc 1 output is cycled with the compressor
4 - Acc 2 output is cycled with the fan

97P699-01 5/17/06

Wiring Schematic - FX10 Control cont.

460/60/3 and 575/60/3



Legend

Factory low voltage wiring Factory line voltage wiring Field low voltage wiring Field line voltage wiring Optional block Internal junction Quick connect terminal Wire nut Field wire lug Ground	Relay Contacts- N.O., N.C. Thermistor - Johnson Control Relay coil	Switch - High pressure Switch - Low pressure Polarized connector Condensate Overflow	AP - Air Proving CC1 - Compressor contactor 1 CC2 - Compressor contactor 2 CO - Condensate overflow CPM1 - Compressor Protection Module 1 CPM2 - Compressor Protection Module 2 DA - Discharge Air Temperature ES - Emergency Shutdown FP1 - Freeze protection sensor 1 FP2 - Freeze protection sensor 2	HP1 - Stage 1 High Pressure HP2 - Stage 2 High Pressure LP1 - Stage 1 Low Pressure LP2 - Stage 2 Low Pressure OS - Occupied Switch RB - Blower power relay RV1 - Reversing Valve coil 1 RV2 - Reversing Valve coil 2

Notes:
1 - R, C, Y1, Y2, O, and G are for use with a wall mounted thermostat
2 - Disconnect for 15 degree freeze protection
3 - Acc 1 output is cycled with the compressor
4 - Acc 2 output is cycled with the fan

97P699-02 5/17/06

Engineering Guide Specifications

General

Furnish and install Water Source Heat Pumps, as indicated on the plans. Equipment shall be completely assembled, piped and internally wired. Capacities and characteristics as listed in the schedule and the specifications that follow. The reverse cycle heating/cooling units shall be either suspended type with horizontal air inlet and discharge or floor mounted type with horizontal air inlet and vertical upflow/side air discharge. Units shall be AHRI/ISO 13256-1 certified (080-120) and listed by a nationally recognized safety-testing laboratory or agency, such as ETL Testing Laboratory. Each unit shall be computer run-tested at the factory with conditioned water and operation verified to catalog data. The units shall be designed to operate with entering liquid temperature between 20°F and 120°F [-6.7°C and 48.9°C]. Refer to the performance data tables actual operating range.

Casing and Cabinet

The cabinet shall be fabricated from heavy-gauge galvanized steel and finished with corrosion-resistant powder coating (vertical units). This corrosion protection system shall meet the stringent 1000 hour salt spray test per ASTM B117. The interior shall be insulated with 1/2-inch thick, multi-density, Cleanable aluminum foil coated glass fiber with edges sealed or tucked under flanges to prevent the introduction of glass fibers into the discharge air. Standard cabinet panel insulation must meet NFPA 90A requirements, air erosion and mold growth limits of UL-181, stringent fungal resistance test per ASTM-C1071 and ASTM G21, and shall meet zero level bacteria growth per ASTM G22. Unit insulation must meet these stringent requirements or unit(s) will not be accepted.

Blower and compressor compartment access panels shall be ‘lift-out’ removable with supply and return ductwork in place.

A duct collar shall be provided on the supply air opening. Standard size 2 in. [5.1 cm] disposable filters shall be provided with each unit. The upflow vertical units shall have a removable insulated divider panel between the air handling section and the compressor section to minimize the transmission of compressor noise and to permit operational service testing without air bypass. Vertical units shall be supplied with left or right horizontal air inlet and top or side air discharge. Horizontal units shall be supplied with left or right air inlet and end or side air discharge.

Option: A 2 in. [5.1 cm] wide MERV 13 filter shall be installed In filter rack for high efficiency filter applications.

The compressor shall be double isolation mounted (160-300) using selected durometer grommets to provide vibration free compressor mounting. The compressor mounting bracket shall be acoustically deadened galvanized steel to prevent vibration transmission to the cabinet.

Option: A Super Quiet Sound package shall include multi-density full coverage compressor blanket.

The drain pan shall be of plastic (080-120) or stainless steel (080-300) construction to inhibit corrosion inhibit bacterial growth. Drain outlet shall be located on pan as to allow complete and unobstructed drainage of condensate. The unit as standard will be supplied with solid-state electronic condensate overflow protection. Mechanical float switches WILL NOT be accepted. Vertical units shall be furnished with a copper FPT condensate drain connection and an internal factory installed condensate trap. Horizontal units shall have a pipe drain connection suitable for standard 3/4 in. PVC glue fittings.

Refrigerant Circuit

All units shall utilize the non-ozone depleting and low global warming potential refrigerant R-410A. All units shall contain a sealed refrigerant circuit including a hermetic motor-compressor, bidirectional thermostatic expansion valve, finned tube air-to-refrigerant heat exchanger, reversing valve, coaxial tube water-to-refrigerant heat exchanger, optional hot water generator coil, and service ports.

Compressors shall be high-efficiency single scroll type designed for heat pump duty and mounted on vibration isolators.

The air coil shall be sized for low-face velocity and constructed of lanced aluminum fins bonded to rifled copper tubes in a staggered pattern not less than three rows deep for enhanced performance. FormiShield™ electro-coated air coil for maximum protection against formicary corrosion.

The coaxial water-to-refrigerant heat exchanger shall be designed for low water pressure drop and constructed of a convoluted copper inner tube and a steel outer tube. Refrigerant to air heat exchangers shall utilize enhanced corrugated lanced aluminum fins and rifled copper tube construction rated to withstand 600 PSIG (4135 kPa) refrigerant working pressure. Refrigerant to water heat exchangers shall be of copper inner water tube and steel refrigerant outer tube design, rated to withstand 600 PSIG (4135 kPa) working refrigerant pressure and 450 PSIG (3101 kPa) working water pressure. The thermostatic expansion valve shall provide proper superheat over the entire liquid temperature range with minimal “hunting.” The valve shall operate bi-directionally without the use of check valves.

Option: Cupronickel refrigerant to water heat exchangers shall be of copper-nickel inner water tube and steel refrigerant outer tube design, rated to withstand 600 PSIG (4135 kPa) working refrigerant pressure and 450 PSIG (3101 kPa) working water pressure. Water lines shall also be of cupronickel construction.

Option: Insulated water-to-refrigerant heat exchanger and refrigerant suction lines shall be insulated to prevent condensation at low liquid temperatures.

Engineering Guide Specifications cont.

Option: Insulated water-to-refrigerant heat exchanger, water lines and refrigerant suction lines shall be insulated to prevent condensation at low liquid temperatures below 50 °F.

Blower and Motor Assembly

All units shall have belt-driven centrifugal blowers. Blower motors shall be permanently lubricated with thermal overload protection. Units supplied without permanently lubricated motors must provide external oilers for easy service. The blower shall be double-width double inlet forward curved with dynamically balanced wheels. Blower motors shall be 1725 rpm, 56 frame sealed ball bearing type. The drive shall include fixed pitch blower sheave and variable pitch motor sheave sized for 115% of the blower brake horsepower. The blower and motor assembly must be capable of overcoming the external static pressures as shown on the schedule. Airflow / Static pressure rating of the unit shall be based on a wet coil and a clean filter in place. Ratings based on a dry coil and/or no filter, or on an ESP less than 0.25 in. (6.35 mm w.g.) shall NOT be acceptable.

Option: Various blower drive packages for selectable static pressure/airflow.

Option: High static blower motors available on select models.

Electrical

A control box shall be located within the unit compressor compartment and shall contain a 75VA transformer, 24 Volt activated, 2 pole compressor contactor, terminal block for thermostat wiring and solid-state controller for complete unit operation. Electro-mechanical operation WILL NOT be accepted. Units shall be name-plated for use with time delay fuses or HACR circuit breakers. Unit controls shall be 24 Volt and provide heating or cooling as required by the remote thermostat/sensor.

An FX10 microprocessor-based controller that interfaces with a multi-stage electronic thermostat to monitor and control unit operation shall be provided. The control shall provide operational sequencing, blower speed control, high, low and loss of charge pressure monitoring, freeze detection, condensate overflow sensing, lockout mode control, hot water and loop pump control, LED status and fault indicators, fault memory, field selectable options and accessory output. The control shall coomunicate all mode, status, fault and lockout codes to the front end system for fast and accurate equipment diagnosis. The control shall provide fault retry three times before locking out to limit nuisance trips.

Option: FX10 microprocessor control with N2 communication protocol Option: FX10 microprocessor control with LonWorks communication protocol

Option: FX10 microprocessor control with BACnet (MS/TP @ 19,200 Baud Rate) communication protocol

Piping

Supply and return water connections shall be copper fittings which eliminate the need for backup wrenches when making field connections. Optionally, all water piping shall be insulated to prevent condensation at low liquid temperatures.

FX10 Controller

A standalone mounted Johnson Controls FX10 controller that will monitor and control unit operation shall be provided. The control shall be capable of integration into a Building Automation System with Open N2, LonTalk or BACnet (MS/TP 19,200 Baud Rate) protocols. The control shall provide operational sequencing, short cycle protection, random start, emergency shutdown, high- and low-pressure switch monitoring, general lockout, freeze detectiont, fault retry, and condensate overflow protection. A terminal block with screw terminals, and a 75VA low voltage transformer shall be provided. The control shall be factory mounted and tested. An optional communication module shall be provided for interface to the building automation system.

Options and Accessories

Hot Gas Reheat

An optional hot gas reheat coil shall be available to allow dehumidification only operation. The internal reheat system shall be factory installed and include a high efficiency reheat coil located downstream of the evaporator coil, a reclaim valve and integral controls to allow heating, cooling and reheat/dehumidification modes. The reheat coil shall be sized so that during reheat/dehumidification mode the unit will produce neutral air (78 ±3°F DB @ 50-58% relative humidity) with typical 80 DB/67 WB°F entering air and 90°F entering water temperature. The reheat coil shall be sized to restrict airflow by no more than 0.17 in wg at 350 feet per minute airflow velocity.

The FX10 control shall have three control options available:

- ***Room wall dehumidistat –*** An optional room wall dehumidistat shall control the reheat mode thru a 24VAC ‘Hum’input (On or Off). Setpoint and deadband shall be determined by the dehumidistat.
- ***Duct humidity sensor –*** An optional duct humidity sensor shall be installed. The FX10 control reads the humidity from the sensor and determines operation mode. Setpoint and deadband are internally set by the FX10 control and shall be are adjustable. Continuous blower operation is a requirement for this mode to accurately measure relative humidity during the off cycle.
- ***Room wall humidity sensor –*** An optional wall humidity sensor is installed. The FX10 control reads the humidity from the sensor and determines operation mode. Setpoint and dead band are internally set by the FX10 control and are adjustable. Continuous blower operation is NOT requirement for this mode.
- ***Dehumidification Set Point (used only with a humidity sensor) –*** The factory default set point for dehumidification

Engineering Guide Specifications cont.

is 52% this is field adjustable from 30% to 60%. In addition there shall be a factory default differential of 5% field adjustable from 5% to 15%. The control will enable re-heat when the space humidity rises above the set point plus the differential.

- ***Reheat operation during periods of vacancy –*** The control logic contains an unoccupied set point that can be used for periods of vacancy if desired. The factory default for the setpoint is 60% and is adjustable from 30% to 60%. The unoccupied setback must be enabled either through a building automation system or with a user interface. Factory default for unoccupied setback is off.
- ***Space Humidity High and Low Alarm Limits (building automation system only) –*** The control has a high and low alarm limit that can be enumerated over a building automation system. The factory default setpoint for these alarm limits is 0% for the low alarm and 100% for the high alarm limit. These limits can be adjusted through a building automation system.

Hot Gas Bypass

The hot gas bypass (HGB) option is designed to limit the minimum evaporating pressure in the cooling mode to prevent the air coil from icing. The option shall consist of a hot gas bypass valve installed in the discharge side of the compressor. The refrigerant control shall proportionately bypass hot gas refrigerant to the air coil when suction pressure falls below 115 psig thus limiting air coil freeze-up.

Product:	**RL Series Commercial**
Type:	Water Source/Geothermal Heat Pump
Size:	7-25 Tons
Document Type:	Engineering Guide
Part Number:	146.00-EG3
Release Date:	01/15