

	<b>MODEL RSH/RSV SERIES R-410A WATER SOURCE HEAT PUMP</b>	
<b>INSTALLATION &amp; OPERATION</b>	Supersedes 145.35-NOM1 (110)	Form 145.35-NOM1(210)

**MODEL RSH/RSV SERIES  
R-410A WATER SOURCE HEAT PUMP  
INSTALLATION AND OPERATION INSTRUCTIONS**



# IMPORTANT!

## READ BEFORE PROCEEDING!

### GENERAL SAFETY GUIDELINES

This equipment is a relatively complicated apparatus. During installation, operation, maintenance or service, individuals may be exposed to certain components or conditions including, but not limited to: refrigerants, oils, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in

which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized operating/service personnel. It is expected that this individual possesses independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood this document and any referenced materials. This individual shall also be familiar with and comply with all applicable governmental standards and regulations pertaining to the task in question.

### SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to areas of potential hazard:



**DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



**CAUTION** identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution. Usually an instruction will be given, together with a brief explanation.



**WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



**NOTE** is used to highlight additional information which may be helpful to you.



All wiring must be in accordance with published specifications and must be performed ONLY by qualified Johnson Controls personnel. Johnson Controls will not be responsible for damages/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this will void the manufacturer's warranty and cause serious damage to property or injury to persons.

## CHANGEABILITY OF THIS DOCUMENT

In complying with Johnson Controls policy for continuous product improvement, the information contained in this document is subject to change without notice. While Johnson Controls makes no commitment to update or provide current information automatically to the manual owner, that information, if applicable, can be obtained by contacting the nearest Johnson Controls Service Office.

It is the responsibility of operating/service personnel as to the applicability of these documents to the equipment in question. If there is any question in the mind of operating/service personnel as to the applicability of these documents, then, prior to working on the equipment, they should verify with the owner whether the equipment has been modified and if current literature is available.

## MODEL NUMBER

<b>Horizontal</b>	<b>Vertical</b>	<b>Capacity Tons</b>
RSH007A	RSV007A	1/2
RSH009A	RSV009A	3/4
RSH012A	RSV012A	1
RSH018A	RSV018A	1 1/2
RSH024A	RSV024A	2
RSH030A	RSV030A	2 1/2
RSH036A	RSV036A	3
RSH042A	RSV042A	3 1/2
RSH048A	RSV048A	4
RSH060A	RSV060A	5
RSH070A	RSV070A	6

## PRODUCT NOMENCLATURE

<b>RS</b>  <b>H</b>  <b>018</b>  <b>A</b>  <b>2</b>  <b>E</b>  <b>L</b>  <b>S</b>  <b>A</b>  <b>A</b>  <b>0</b>  <b>A</b>  <b>-</b>  <b>A</b>	<b>Nominal Capacity</b> 007 = .5 ton 009 = .75 ton 012 = 1 ton 018 = 1.5 ton 024 = 2 ton 030 = 2.5 ton 036 = 3 ton 042 = 3.5 ton 048 = 4 ton 060 = 5 ton 070 = 6 ton	<b>Design Series</b> A = Current B = Future	<b>Voltage</b> 1 = 208/230-60-1 2 = 208/230-60-3 4 = 460-60-3 5 = 575-60-3 6 = 265-60-1	<b>Control Options</b> M = Standard Microprocessor Control	<b>Return Air/ Unit Orientation</b> L = Left Hand R = Right Hand	<b>Supply Air Options</b> S = Straight-thru (Horizontal Only) B = Back Discharge (Horizontal Only) T = Top Discharge (Horizontal Only)	<b>Miscellaneous Options</b>	<b>Heating Options</b> 0 = None	<b>Waterside Options</b> A = Std Water Coil B = Std Water Coil with Low-Temp Option N = Cupro-nickel Water Coil R = Cupro-nickel Coil with Low-Temp Option	<b>Airside Options</b> A = Std Air-side Coil C = Corrosion Protective Coating D = Stainless Steel Drain Pan F = Coated Coil w/S-S Drain Pan	<b>Product Identifier</b> V = Vertical Arrangement (Upflow) H = Horizontal Arrangement	<b>Product Category</b> RS = Water Source HP R-410A	<b>Service Digit</b> A = None Future		

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## SECTION 1 – INTRODUCTION

RSH and RSV units are completely self-contained heating and air conditioning units. This equipment employs a water-to-refrigerant heat exchanger to extract (heating cycle) or reject (cooling cycle) heat from/to a circulating water-loop.

All models 1/2 through 6 tons are shipped as factory-charged packages. Horizontal (RSH) units are designed for suspended ceiling mounting, and are constructed with integral hanger channels. Vertical (RSV) units are designed for free-standing floor mounting. All units are shipped completely factory wired and pre-piped. Water supply, water outlet, and condensate drain connections are via female threaded pipe fittings.

Each refrigeration circuit includes an adjustable bi-flow expansion valve, liquid line filter drier, and multiple service gauge ports. External high-pressure and low-pressure protection switches are included in each compressor circuit. A standard suction line freezestat protects against low evaporator temperatures, due to low water supply temperatures. In the case when low water temperature operation is required, freeze stat protection can be disabled. Heat Pump models feature a pilot operated, sliding piston type, 4-way reversing valve with a replaceable magnetic solenoid coil.

The coaxial water-to-refrigerant heat exchanger and all water piping within the unit are rated for water side working pressures up to 400 psig.

All units are completely factory wired with all necessary operating controls, complete with standard microprocessor control. A 24 volt control circuit, with oversize transformer, is provided for field connection. Units are designed to operate with conventional thermostat control interface. The reversing valve solenoid coil shall be energized in cooling mode only.

These units are designed for **indoor** installation only. They are **not** intended or approved for outdoor installation.



**Only qualified personnel should perform installation and service of this equipment**

**CAUTION**

### PRE-INSTALLATION INSPECTION OF EQUIPMENT

All units are factory tested to ensure safe operation and quality assembly. Units are packaged and sealed on shipping skids and shipped in first class condition. Torn and broken packaging, scratched or dented panels should be reported to carrier immediately. Internal inspection of all units should be performed prior to installation. Remove all access doors and check for visual defects that can occur during transport. Any problems found internally should be reported to carrier and manufacturer immediately. Refrigerant circuit should be checked to ensure no leaks have occurred during shipment. Install gauge set to high and low pressure ports to confirm pressure has been maintained and no leaks have occurred during shipment. Repair any damage prior to installation to ensure safe operation.



**Record any unit damage on the Bill of Lading and report to carrier and factory immediately. Shipping and handling damages are not warranty items.**

### RIGGING



**Prior to mounting unit, check individual unit weights and verify lifting capacity of lifting equipment exceeds weight of units by safe margins. Failure to do so may result in unit damage, personal injury or even death.**

To ensure safe installation of the unit when ceiling mount application is specified, estimate the approximate center of gravity of the unit. The configuration of internal components for each unit is different and weight is unevenly distributed.



**Determine the actual center of gravity of the unit by performing a test lift. Lifting an unbalanced unit can cause personal injury or even death.**

**INSTALLATION SITE**

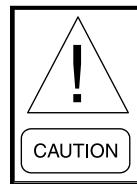
***Lock all electrical power supply switches in the off position before installing the unit. Failure to disconnect power supply may result in electrical shock or even death.***

**Location -** To ensure unit operates at maximum efficiencies, choose a dry indoor area where the temperature is controlled between 40°F and 115°F. Consideration of surrounding areas should be taken when choosing a location to install the unit. Common vibration and sound levels associated with commercial equipment may be objectionable to people or equipment.

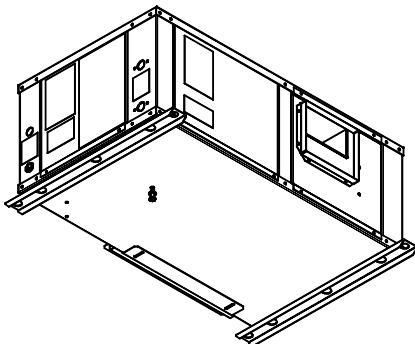


***Failure to allow adequate space between units may result in poor unit performance and possible unit failure.***

Install thermostats, supply air ductwork, and return air ductwork (if applicable) so that each unit will operate only in a single cooling or heating zone. In order to assure proper drainage of condensate, both horizontal and vertical units have sloped (self-draining) drain pan.



***Failure to remove shipping bolts on RSH units may result in piping damage and/or poor sound performance.***



**FIGURE 1 - SHIPPING BOLT REMOVAL**

**TABLE 1 - RSH/RSV SERIES - PHYSICAL DATA**

Model Series	007	009	012	018	024	030	036	042	048	060	070
Nominal Cooling (Ton) <sup>1</sup>	0.5	0.75	1.0	1.5	2.0	2.5	3	3.5	4	5	6
<b>Compressor-Type</b>	Rotary			Reciprocating					Scroll		
<b>Air Coil-Type</b>	Enhanced Copper tubes, Enhanced Aluminum Fins										
Face Area(sq ft)	1.17	1.17	1.33	2.56	2.88	2.88	3.47	4.44	4.44	6.11	6.11
Rows/FPI	3/13	3/13	3/15	3/15	3/15	3/15	3/15	3/15	3/15	3/15	3/15
<b>Water Coil-Type</b>	Enhanced Surface Co-Axial										
Water Connection (FPT)	1/2"	1/2"	1/2"	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"	1"	1"
Drain Connection (FPT)	3/4"										
<b>Standard Blower / Motor</b>	DWDI Forward-Curved Centrifugal / PSC Direct-Drive										
Diameter x Width (in)	6x5	6x5	6x6	9x7	9x7	10x7T	10x7T	11x8T	11x8T	11x10T	11x10T
Motor HP	0.10/3	0.10/3	0.13/3	0.17/3	0.25/3	0.33/3	0.50/3	0.50/3	0.75/3	1.0/3	1.0/3
<b>RSH Filter Quantity-Size(in)</b>	1-12x16	1-12x16	1-12x20	1-18x24	1-18x24	1-18x24	2-14x20	2-18x20	2-18x20	2-22x22	2-22x22
<b>RSV Filter Quantity-Size(in)</b>	1-12x20	1-12x20	1-12x20	1-18x24	1-20x25	1-20x25	1-24x24	2-14x25	2-14x25	2-16x30	2-16x30
<b>RSH Cabinet Weight (lb)</b>	130	135	145	195	210	215	240	310	320	370	385
<b>RSV Cabinet Weight (lb)</b>	120	125	135	185	200	210	230	305	315	375	390

**NOTE:**

1) Nominal Capacity calculated in accordance with AHRI / ISO Standard 13256-1 for Water Loop Application

**OPERATING LIMITS\***

	COOLING	HEATING
Min. Entering Water	30°F	20°F
Max. Entering Water	110°F	90°F

*\* Units are capable of operation with an entering fluid temperature range of 20° F to 110° F*

## CLEARANCES REQUIRED

For all units allow sufficient clearance for filter replacement and adequately connecting all duct, electrical, and piping connections, as well as service access to key components. Flex duct collars and quick disconnect hoses are recommended for ease of servicing.

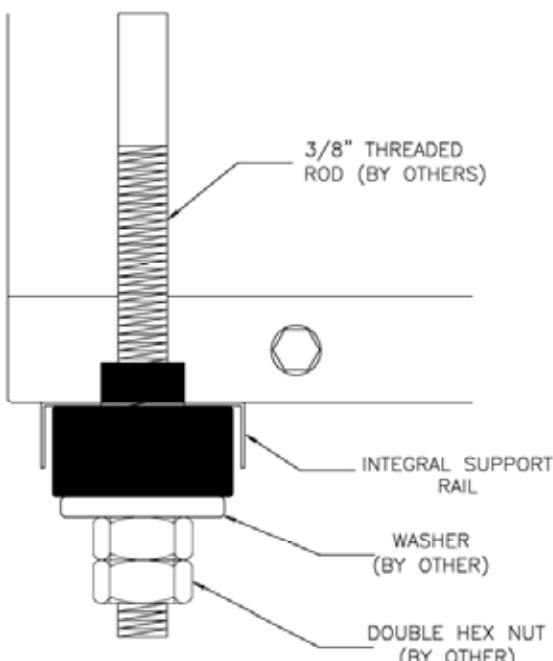
On Horizontal Units, service doors are located on all sides of the unit to allow easy servicing of all components.

On Vertical Units allow for sufficient clearance at the designated service panels.

## UNIT MOUNTING

Vertical units should be mounted level on a vibration absorbing pad(s) to minimize vibration transmission through the floor structure. It is not necessary to anchor the unit to the floor.

Horizontal units are typically suspended above a ceiling by threaded steel rods, securely anchored to the building structure. Units should be supported from the holes in the rail extensions at the four corners, using steel threaded rods having a minimum diameter of 3/8 inch. Four rubber bushings are supplied with the unit to be placed between the unit and the supporting rods to absorb vibration.



**FIG. 2 - UNIT MOUNTING**

## DUCT CONNECTIONS

Canvas or other types of flexible collars are recommended for connecting the air ducts to the unit. The supply air duct collar can be connected directly to the blower outlet flange. Allowance must be made in the supply duct for removal of the first duct section adjacent to the unit, for the servicing of the blower and motor assembly. Return air may be ducted to the unit or drawn directly from the ceiling space into the filter.

Supply ducts should be sized for an air velocity of not more than 1000 feet per minute. Return ducts should be sized for a velocity of not more than 700 feet per minute. When the sound level is critical, it is recommended that both the supply and return ducts be lined with acoustic insulation for the first ten feet closest to the unit. The supply duct should also have at least one elbow or tee upstream of the first outlet connection for good sound attenuation.

## LOOP WATER SUPPLY AND PIPING CONNECTIONS

The recommended circulating water supply for heat pump systems is a closed-water loop, utilizing a cooling tower and boiler to maintain the loop temperature within acceptable temperature limits. Typically, the closed loop temperature is maintained above 60 F and below 90 F. All units function independently, either adding heat to the loop (cooling mode) or removing heat from the loop (heating mode).

For applications where heating is required when circulating water temperatures are below 35F and contain antifreeze solution, please refer to the Operations section under Freezestat Switch for information on configuring the unit.

When utilizing an open cooling tower (evaporative type), chemical treatment is mandatory to ensure that the loop water is free of corrosive minerals. A secondary heat exchanger between the open cooling tower and the closed water loop may also be used. It is imperative that all air is purged from the closed loop side to prevent condenser fouling.

Dual acting water regulating valves should be used when there is potential for low fluid flow and/or low fluid temperature or when high fluid temperature conditions exist. These water regulating valve assemblies consist of a direct acting valve parallel coupled to a reverse acting valve. The direct acting valve opens in response to an increase in discharge pressure during cooling mode. The

reverse acting valve opens in response to a decrease in suction pressure during heating mode.

## SUPPLY/RETURN PIPING

Supply and return piping should be as large as the unit connection sizes (larger on long pipe runs). Never use flexible hoses of a smaller inside diameter than that of the nominal water pipe size. Both supply and return water lines will sweat if subjected to low water temperatures. Insulate these lines as necessary to prevent condensation damage.

Flexible hoses should be used between the unit and rigidly mounted piping to avoid vibration transmission. Teflon tape thread sealant is recommended. Do not overtighten threaded connections. Ball valves should be installed in the supply and return lines for unit isolation and water flow balancing. Before final connection to the unit, the supply and return hoses should be connected together and the piping system flushed to remove any dirt or foreign material.

Pressure and temperature ports are recommended in both the supply and return lines for system flow balancing. The water flow can be accurately set by measuring the water-side pressure drop through the unit. See the flow versus pressure drop specification table for application information.



***Do not exceed the recommended water flow rates. Damage due to erosion of the water-to-refrigerant heat exchanger could occur.***

## CONDENSATE DRAIN PIPING

Horizontal Units - The 3/4 FPT drain connection on the unit is NOT internally trapped. The cooling coil compartment and drain pan are under negative pressure when the blower is running; therefore a P trap MUST be used in the drain line.

It is recommended that a 3/4 inch drain line be sloped (1/4 inch/foot) all the way to an open drain. Each unit must be installed with its own individual trap, and have the means to flush out the condensate line if necessary. If it is not possible to reach an open drain by gravity flow, a pump kit, which is available as an accessory, can be mounted close to the unit.

Vertical Units - Each unit utilizes a flexible hose inside the cabinet as a trapping loop. An external P-trap is not necessary.

## ELECTRICAL POWER SUPPLY AND CONNECTIONS

Before installing the unit, make sure that the voltage and number of phases on the unit data plate are the same as the available power supply. All wiring and switchgear installed external to the unit must conform to all applicable local codes. The maximum allowable size of fuses or circuit breaker required is shown on the unit data label. Fuses must be of the time delay type.

The power supply wiring is to be connected directly to the line side of compressor contactor as shown on the connection wiring diagram. A ground wire must be connected to the ground lug marked GND in the electrical control box.

## ROOM THERMOSTAT AND CONTROL WIRING

RSH and RSV Heat Pump models require the installation of conventional heating and cooling thermostat with a dedicated "W" and "Y" terminals for activating heating or cooling mode. Wiring between the thermostat and the unit should be 18 Ga. minimum. Appropriate room thermostats can be ordered as an optional accessory for delivery with the units if desired.

## COAXIAL FREEZE PROTECTION SET POINT

The unit allows for field selection of the coaxial freeze protection set point. Unit utilizes a Freezestat sensor factory set for compressor lock-out when water supply temperature drops below 35F. To lower the set point for low temp heating applications with an adequate water-antifreeze solution, jumper at P6 on the microprocessor control board should be removed. By removing the jumper at P6, the freezestat switch is bypassed allowing for heating operation with supply water temperatures below 35F. Only in low water applications with adequate antifreeze should the P6 jumper be removed, otherwise damage can occur. Additionally it is recommended the unit comes equipped with the optional low temperature insulation package to prevent the formation of condensate.



***Modification of the set point without adequate freeze protection in the water loop may result in damage to unit, or property.***

## UNIT CONTROLS

The control system microprocessor board is specifically designed for water source heat pump operation. The control system interfaces with a conventional type thermostat.

- Unit shall be complete with self-contained low-voltage control circuit
- Unit shall incorporate a lockout circuit which provides reset capability at the space thermostat or base unit, should any of the following standard safety devices trip and shut off compressor.
  - Loss-of-charge/Low-pressure switch
  - High-pressure switch
  - Freeze-protection thermostat, unit shutdown on low water temperature.
  - Condensate Overflow protection switch
- Unit shall operate with conventional thermostat designs and have a low voltage terminal strip for easy hook-up.
- Unit control board shall have on-board diagnostics and fault code display.
- Standard controls shall include anti-short cycle and low voltage protection
- Control board shall monitor each refrigerant safety switch independently.
- Control board shall have random start feature
- Control board shall retain last 5 fault codes in non volatile memory which will not be lost in the event of a power loss.

### Operation

For cooling the room t-stat energizes the low-voltage circuit between "R" & "Y1".

The call is passed to the unit microprocessor control, which then determines whether the requested operation is available and, if so, which components to energize.

For the heating, the room t-stat energizes the circuit between "R" & "W1". The microprocessor control energizes the compressor and fan allowing the unit to run in heating mode.

If at any time a call for both heating and cooling are present, the heating operation will be performed. If operating, the cooling system is halted as with a completion of a call for cooling. Heating always takes priority.

### Continuous Blower

By setting the room t-stat fan switch set to "ON", the supply air blower will operate continuously. With the room t-stat fan switch set to "AUTO" or "HEAT" settings, the blower is energized whenever a cooling or heating operation is requested. The blower is energized after any specified delay associated with the operation.

When energized, the indoor blower has a minimum run time of 30 seconds. Additionally, the indoor blower has a delay of 10 seconds between operations.

When the room t-stat calls for cooling, the low-voltage control circuit from "R" to "Y1" and "G" is completed. The compressor and fan motor are energized. After completing the specified fan on delay for cooling, the microprocessor control will energize the blower motor.

Once the room t-stat has been satisfied, it will de-energize "Y1". If the compressor has satisfied its minimum run time, the compressor and fan de-energize. Otherwise, the unit operates the cooling system until the minimum run time for the compressor has been completed. After the compressor de-energizes, the blower is stopped following the elapse of the fan-off delay for cooling.

To be available, a compressor must not be locked-out due to a high-pressure switch, low-pressure switch, condensate overflow switch, freezestat trip, and the anti-short cycle delay (ASCD) must have elapsed.

### SAFETY SWITCHES

Each refrigerant system is monitored to ensure it does not operate outside of its intended operating parameters. Safety switches are handled as described below. All system errors override minimum run times for compressors.

#### High-Pressure Limit Switch

If a high-pressure limit switch opens, the microprocessor control de-energizes the compressor, initiates the ASCD, and stops the fan. If a call for cooling or heating is still present at the conclusion of the ASCD, the microprocessor control will re-energize the compressor and unit fan.

Should a high-pressure switch open three times within two hours of operation, the microprocessor control will permanently lock-out the compressor. The system must be manually reset by de-energizing the 24 volt power to unit, or turning the room t-stat to the "OFF" position

then back to either heating or cooling as required. The microprocessor control will flash a fault code indicating a high-pressure lock-out.

### **Low-Pressure Limit Switch**

The low-pressure limit switch is not monitored during the initial 30 seconds of compressor operation. After the initial 30 seconds have passed, the microprocessor control will monitor the low-pressure switch for another 30 seconds. If the low-pressure switch fails to close after the 30 second monitoring phase, the microprocessor control will de-energize the compressor, initiate the ASCD, and stop the fan.

Once the low-pressure switch has been proven (closed during the 30-second monitoring period as described above), the microprocessor control board will continue to monitor the low-pressure limit switch for any openings. If the low-pressure switch opens for greater than 5 seconds, the microprocessor control board will de-energize the compressor, initiate the ASCD, and stop the fan.

If the call for cooling is still present at the conclusion of the ASCD, the microprocessor control will re-energize the compressor.

Should a low-pressure switch fault three times within one hour of operation, the microprocessor control board will lock-out the compressor and flash a fault code indicating a low-pressure lock-out.

### **Freezestat Switch**

If the Freezestat switch opens, indicating below threshold supply water temperature, the microprocessor control will de-energize the compressor, and initiate the ASCD. If a call for cooling or heating is still present at the conclusion of the ASCD, the microprocessor control will re-energize the halted compressor.

The microprocessor control board logs the first incident per compressor request. If the compressor request is removed, the fault occurrence counter is reset to zero. Should the Freezestat switch open twice within a compressor request cycle, the microprocessor control board will lock-out the compressor and flash a fault code indicating a Freezestat lock-out.

### **Condensate Overflow Switch**

A Condensate Overflow fault occurs if the Condensate Overflow switch was open continuously for 30 seconds. The compressor is shutdown regardless of Minimum

Run Time, ASCD is initiated, and alarm 15 is tripped. The fan continues operating in its current state. Compressor will re-energize once the Condensate Overflow switch closes, and ASCD has been satisfied and a call for cooling is still present.

The microprocessor control board logs the first incident per compressor request. If the compressor request is removed, the fault occurrence counter is reset to zero. Should the Condensate Overflow switch open twice within a compressor request cycle, the microprocessor control board will lock-out the compressor and flash a fault code indicating a Condensate Overflow lock-out.

## **SAFETY CONTROLS**

The microprocessor control monitors the following inputs:

1. A suction line freezestat to protect against low evaporator temperatures due to low water supply temperatures opens at 35F leaving water temperature.
2. A high-pressure switch to protect against excessive discharge pressures.
3. A low-pressure switch to protect against loss of refrigerant charge.
4. A Condensate Overflow Switch to protect against condensate overflow.

### **Random Start**

Random start function, upon power up, will impose time delay of 4 minutes plus a random delay of 1 to 64 seconds. The random number generator seed is determined by a fixed seed programmed at the factory combined with the serial number, model number, and the hours of compressor run time of the unit.

### **Compressor Protection**

In addition to the external pressure switches, the compressor also has inherent (internal) protection. If there is an abnormal temperature rise in a compressor, the internal protection will immediately shut down the compressor. The microprocessor control incorporates features to minimize compressor wear and damage. An anti-short cycle delay (ASCD) is utilized to prevent short cycling of the compressor. Additionally, a minimum run time is imposed any time a compressor is energized. The ASCD is initiated on unit start-up and on any compressor reset or lockout.

**TABLE 2 RSH/RSV ELECTRICAL DATA**

Unit Size	SUPPLY VOLTAGE	COMPRESSOR			BLOWER		MIN. CCT. AMPACITY	MAX FUSE / CCT. BKR. AMP
		QTY	RLA	LRA	HP	FLA		
007	208-230/1/60	1 @	3.0	14.0	0.10	0.8	4.55	15
009	208-230/1/60	1 @	3.7	22.0	0.10	0.8	5.43	15
012	208-230/1/60	1 @	4.7	25.0	0.10	0.8	6.68	15
	265/1/60	1 @	4.2	22.0	0.10	0.8	6.05	15
018	208-230/1/60	1 @	6.5	43.0	0.17	1.4	9.53	15
	265/1/60	1 @	5.8	46.0	0.17	0.8	8.05	15
024	208-230/1/60	1 @	7.4	43.0	0.25	1.5	10.75	15
	265/1/60	1 @	6.7	46.0	0.25	1.3	9.68	15
	208-230/3/60	1 @	5.9	63.0	0.25	1.3	8.68	15
030	208-230/1/60	1 @	9.9	54.0	0.33	2.6	14.98	20
	265/1/60	1 @	8.5	46.0	0.33	1.9	12.53	20
	208-230/3/60	1 @	6.9	63.0	0.33	2.6	11.23	15
	460/3/60	1 @	3.6	30.0	0.33	1.6	6.10	15
036	208-230/1/60	1 @	13.0	74.0	0.50	3.2	19.45	30
	265/1/60	1 @	10.6	66.0	0.50	2.2	15.45	25
	208-230/3/60	1 @	7.8	68.0	0.50	3.2	12.95	20
	460/3/60	1 @	3.7	34.0	0.50	2.5	7.13	15
042	208-230/1/60	1 @	19.9	109.0	0.50	3.2	28.08	45
	208-230/3/60	1 @	13.1	83.1	0.50	3.2	19.58	30
	460/3/60	1 @	6.1	41.0	0.50	2.5	10.13	15
	575/3/60	1 @	4.2	33.0	0.50	1.8	7.05	15
048	208-230/1/60	1 @	23.1	144.0	0.75	4.9	33.78	50
	208-230/3/60	1 @	16.0	91.0	0.75	4.9	24.90	40
	460/3/60	1 @	7.1	46.0	0.75	2.2	11.08	15
	575/3/60	1 @	5.6	37.0	0.75	1.8	8.80	15
060	208-230/1/60	1 @	26.3	134.0	1.00	5.1	37.98	60
	208-230/3/60	1 @	15.6	110.0	1.00	5.1	24.60	40
	460/3/60	1 @	7.8	52.0	1.00	3.2	12.95	20
	575/3/60	1 @	5.8	38.9	1.00	2.6	9.85	15
070	208-230/3/60	1 @	19.0	123.0	1.00	5.1	28.85	45
	460/3/60	1 @	9.7	62.0	1.00	3.2	15.33	25
	575/3/60	1 @	7.4	50.0	1.00	2.6	11.85	15

**TABLE 3 RSH/RSV BLOWER PERFORMANCE**

Unit Size	Rated CFM	Min. CFM	Motor Speed	Lead Wire Color	External Static Pressure (in w.g.)								
					0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
<b>007</b>	260	180	Med	<b>BLU</b>	260	250	235	205	185	160	130	-	-
<b>009</b>	320	220	High	<b>BLK</b>	385	375	360	335	295	260	220	-	-
<b>012</b>	425	300	High	<b>BLK</b>	430	420	400	385	370	350	315	280	-
<b>018</b>	640	445	High	<b>BLK</b>	-	-	860	850	820	775	705	600	465
			Med	<b>BLU</b>	745	735	710	685	655	615	560	500	-
			Low	<b>RED</b>	540	535	525	495	460	420	380	335	-
<b>024</b>	800	560	High	<b>BLK</b>	-	1060	1010	955	905	830	755	660	540
			Med	<b>BLU</b>	900	870	840	800	760	705	650	560	-
			Low	<b>RED</b>	805	775	745	705	670	625	570	490	-
<b>030</b>	1000	700	High	<b>BLK</b>	-	1170	1120	1075	1020	965	900	835	760
			Med	<b>BLU</b>	1000	970	945	905	860	820	780	725	655
			Low	<b>RED</b>	855	820	785	750	710	670	630	590	-
<b>036</b>	1200	840	High	<b>BLK</b>	-	-	1540	1490	1435	1365	1285	1210	1110
			Med	<b>BLU</b>	1295	1275	1255	1240	1205	1160	1115	1060	990
			Low	<b>RED</b>	1190	1160	1145	1115	1085	1045	1000	940	850
<b>042</b>	1400	980	High	<b>BLK</b>	-	-	1710	1695	1675	1655	1610	1560	1505
			Med	<b>BLU</b>	1400	1380	1355	1335	1305	1270	1245	1210	1170
			Low	<b>RED</b>	1165	1155	1140	1110	1080	1050	1010	965	930
<b>048</b>	1600	1120	High	<b>BLK</b>	-	-	-	-	2000	1955	1900	1845	1780
			Med	<b>BLU</b>	1755	1745	1720	1690	1660	1630	1600	1555	1500
			Low	<b>RED</b>	1505	1490	1465	1435	1400	1365	1325	1280	1230
<b>060</b>	2000	1400	High	<b>BLK</b>	-	-	2560	2530	2490	2440	2370	2300	2220
			Med	<b>BLU</b>	-	2100	2085	2060	2035	2000	1960	1910	1870
			Low	<b>RED</b>	1905	1885	1860	1835	1805	1770	1730	1680	1620
<b>070</b>	2200	1400	High	<b>BLK</b>	-	-	2560	2530	2490	2440	2370	2300	2220
			Med	<b>BLU</b>	-	2100	2085	2060	2035	2000	1960	1910	1870
			Low	<b>RED</b>	1905	1885	1860	1835	1805	1770	1730	1680	1620

Units are shipped pre-wired for Medium speed.

All airflow ratings are at lowest voltage rating of dual rating (ie. 208 volt)

Airflow ratings include resistance of wet coil and clean air filters.

## MICROPROCESSOR CONTROL UNIT FLASH CODES

Various flash codes are utilized by the microprocessor control to aid in troubleshooting. Flash codes are distinguished by the short on and off cycle used (approximately 200ms on and 200ms off). To show normal operation, the control boards flash a 1 second on, 1 second off “heart beat” during normal operation. This is to verify that the microprocessor is functioning correctly. Do not confuse this with an error flash code. To avoid confusion the 1-flash, fault code is not used.

Current alarms or active restrictions are flashed on the microprocessor control LED.

1. LAST ERROR – When this button is pressed and released, it flashes the last five (5) flash codes on the board’s LED. The most recent alarm is shown first and the oldest alarm is shown last.
2. TEST RESET – When this button is pressed and released, any anti-short cycle delays (ASCD) are bypassed for one cycle. When pressed twice, any active lockouts are reset.
3. COMM SETUP – If the board is to be networked with other units, this button is used to set the network address. Press the button once and it scans the bus, then assigns itself the first available address, (starts at 2). It then flashes that address one time. Pressing the button twice causes the control to flash the address.

## BLOWER PERFORMANCE

All units employ direct-drive blower motors with multiple speed taps available. The motors have been selected to deliver the nominal air volume against varying external static pressures when necessary. After

**TABLE 4 MICROPROCESSOR FLASH CODES**

Flash Codes	Description
On Steady	Control Failure – Replace Control
Heart Beat	Normal Operation
2 Flashes	Control Waiting on ASCD <sup>1</sup> (Anti-Short Cycle Delay)
3 Flashes	HPS1 – Compressor Lock out
5 Flashes	LPS1 – Compressor Lock out
13 Flashes	Compressor Held OFF due to Low Voltage <sup>1</sup>
14 Flashes	EEPROM Storage Failure (Control Failure)
15 Flashes	Condensate Overflow Switch – Compressor Lock out
16 Flashes	Coaxial Freeze Thermostat – Compressor Lock out

<sup>1</sup> These flash codes do not represent alarms.

installation of the unit, it will be necessary to check the air volume and change the motor speed connection accordingly. All units are factory-wired with the medium speed winding connected.

A simple method for approximating sufficient air volume is to measure the difference between the supply and return air temperatures. In Heating mode, the air temperature rise should be in the range of 20°F to 30°F. In Cooling mode, the temperature drop should be between 15°F to 25°F. If the values are outside the appropriate range, increase or reduce the motor speed as necessary.

## START-UP AND OPERATION

NOTE: The services of a qualified Refrigeration Service Mechanic should be employed in the start-up and commissioning of these systems.



***Lock all electrical power supply switches in the off position before installing the unit. Failure to disconnect power supply may result in electrical shock or even death.***

After completing the installation, and before energizing the power supply to the unit, the following checks should be made.

- Verify that the electrical supply to the unit is of the correct voltage, and rated for sufficient amperage in accordance with the nameplate values.
- Verify that the low voltage wiring between the unit and the thermostat is correct.
- Confirm that the water piping is complete and free of leaks
- Check that the water flow rate is correct, and adjust as necessary
- Confirm that the blower wheel rotates freely
- All service access panels are in place and properly secured

A room thermostat should be used to cycle the unit on and off automatically as required to maintain the room temperature at the set point of the thermostat. The air circulating fan will cycle on and off with the compressor. If desired, the air circulating fan can be run continuously.

The units have a lock out relay that will prevent the unit from cycling on the low pressure cut out or the high pressure cut out. If either of these safety devices open, the compressor will not restart when the safety device resets. To restart the compressor after a safety lock out, it will be necessary to interrupt the power to the control circuit. This can be done at the thermostat or at the disconnect switch.

## START-UP

1. Set the thermostat to the highest setting.
2. Set the fan switch to the 'AUTO' position, and the thermostat system switch to 'COOL'.
3. Reduce the thermostat setting to approximately 5 degrees below room temperature.
4. The compressor, and the supply air blower, will start. Simultaneously the reversing valve will be energized.
5. After five minutes, verify cooling mode operation by checking for cool air discharge at the supply air outlet.
6. Set the thermostat system switch to the 'OFF' position. The unit will stop running, and the reversing valve will deenergize.
7. Allow approximately five minutes to allow for system pressures to equalize.
8. Set the thermostat to its lowest temperature setting.
9. Move the thermostat system switch to 'HEAT'.
10. Increase the thermostat setting approximately 5 degrees above room temperature.
11. After five minutes, verify heating mode operation by checking for warm air discharge at the supply air outlet.
12. Adjust the thermostat to maintain the desired space temperature.
13. Check the unit for unusual vibrations, noises, leaks, etc.

## MAINTENANCE

The air circulating fan motor has bearings that are factory lubricated and sealed for long life. No further lubrication is required. The compressor is part of a sealed refrigeration system that does not require any additional lubrication.

Filter changes are required at regular intervals. It is suggested that the filter be checked at 60-day intervals for the first year of operation, until field experience is acquired. If light cannot be seen through the filter, it should be changed. Always replace the filter with the same size of 1-inch thick disposable type of fiberglass filter. (See General Data for listing of required filter sizes.)

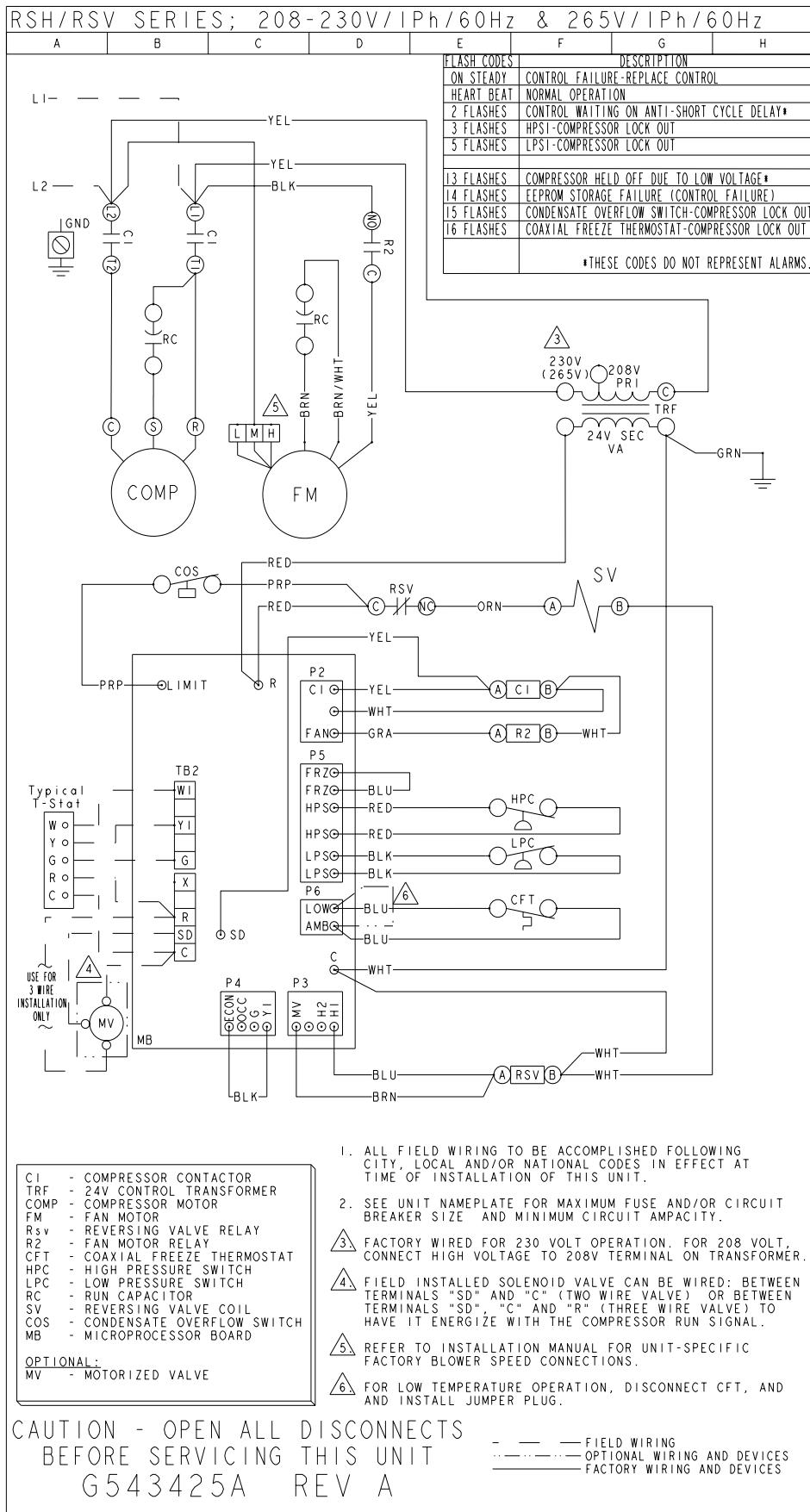
The condensate drain pan should be checked annually, and cleaned and flushed as required.

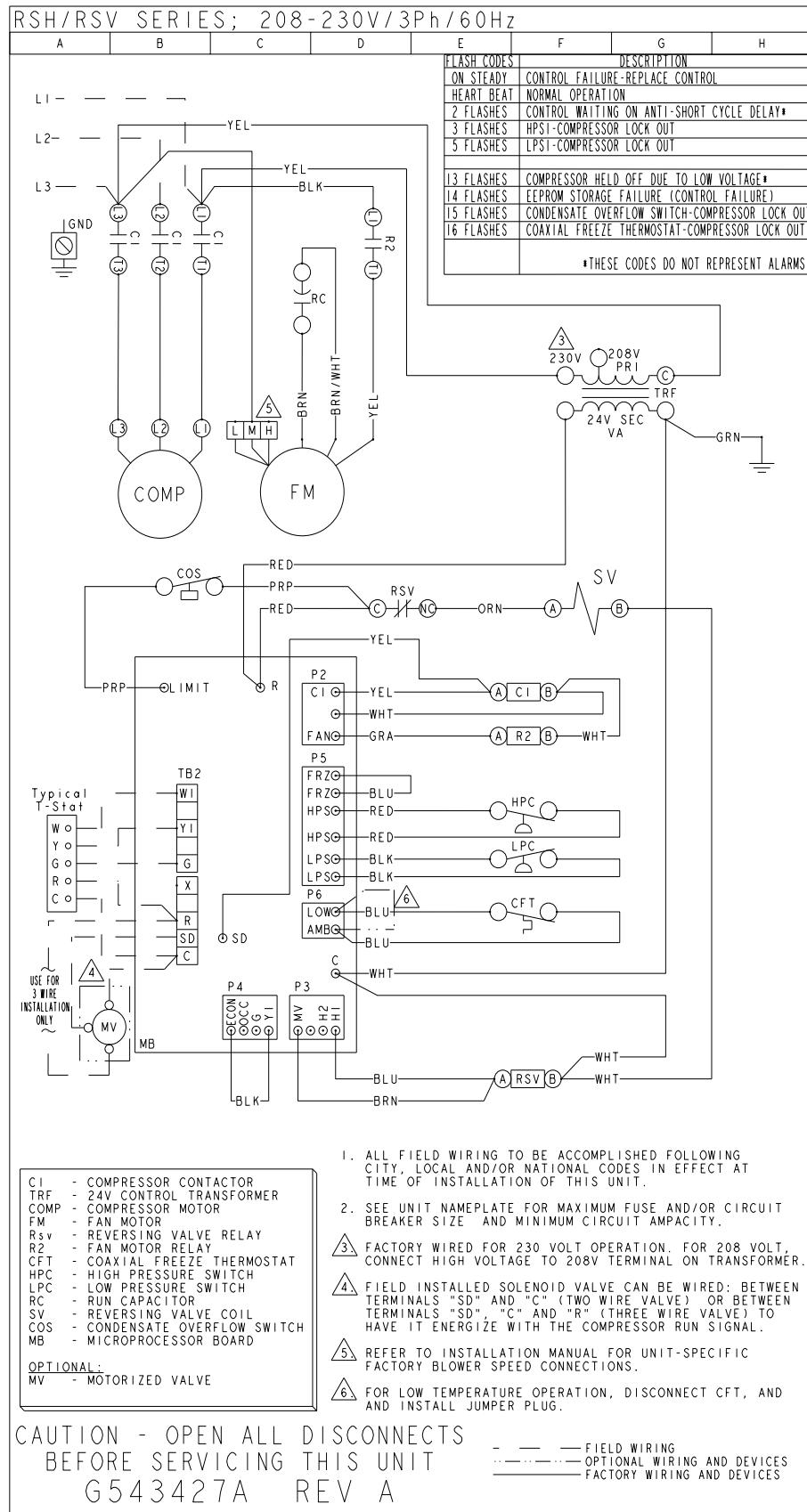
Recording of reference operating parameters is recommended (volts, amp draw, water temperature differences, etc.). A comparison of logged data with start-up and annual data is useful as an indicator of general equipment condition.

Periodic lockouts are almost always caused by air or water problems. The lockout of the compressor is a normal protective result of insufficient heat transfer. Check for dirt in the water system, insufficient water flow rates, excessive water temperatures, air flow rates (dirty filters), and air temperatures.

**TABLE 5 R-410A REFRIGERANT CHARGE**

UNIT SIZE	CAPACITY TONS	RS*
070	6.0	6 lbs - 15 oz
060	5.0	6 lbs - 10 oz
048	4.0	4 lbs - 7 oz
042	3.5	4 lbs - 3 oz
036	3.0	3 lbs - 7 oz
030	2.5	3 lbs - 2 oz
024	2.0	2 lbs - 13 oz
018	1.5	2 lbs - 9 oz
012	1.0	1 lbs - 8.5 oz
009	0.75	1 lbs - 5 oz
007	0.50	1 lbs - 3.5 oz

**FIGURE 3 - RSH/RSV SERIES 208-230V/265**

**FIGURE 4 - RSH/RSV SERIES 208-230V**

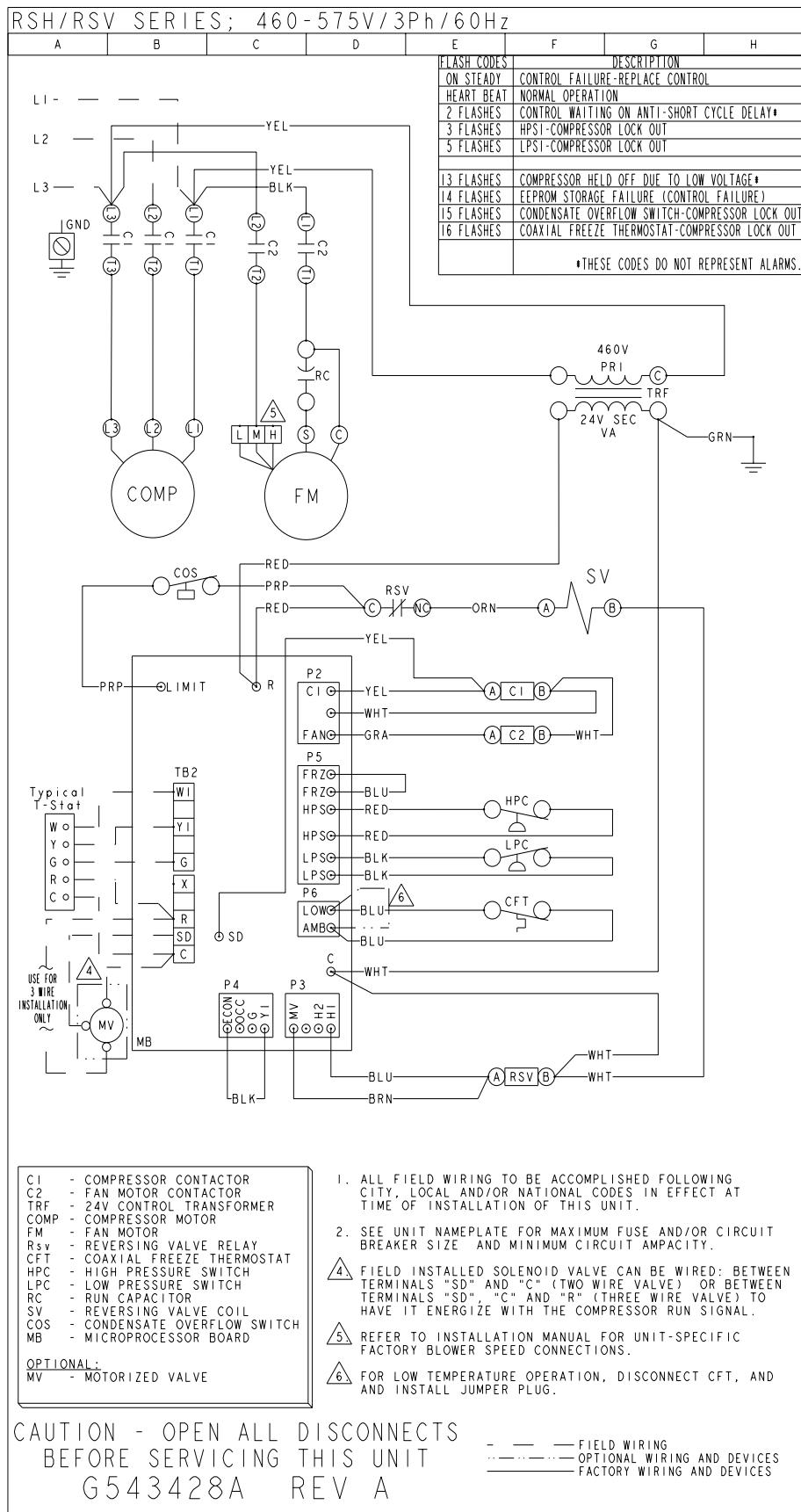
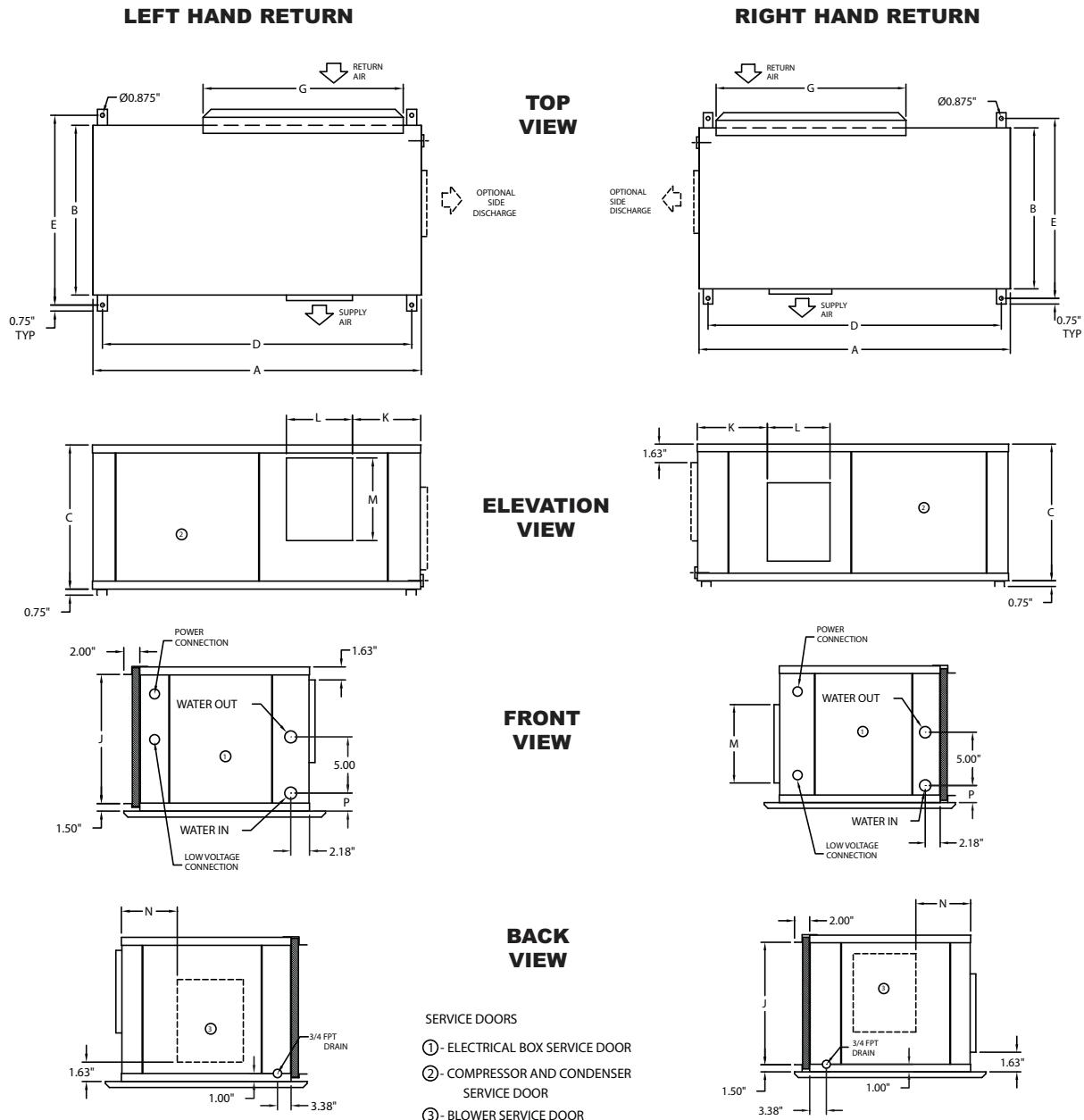
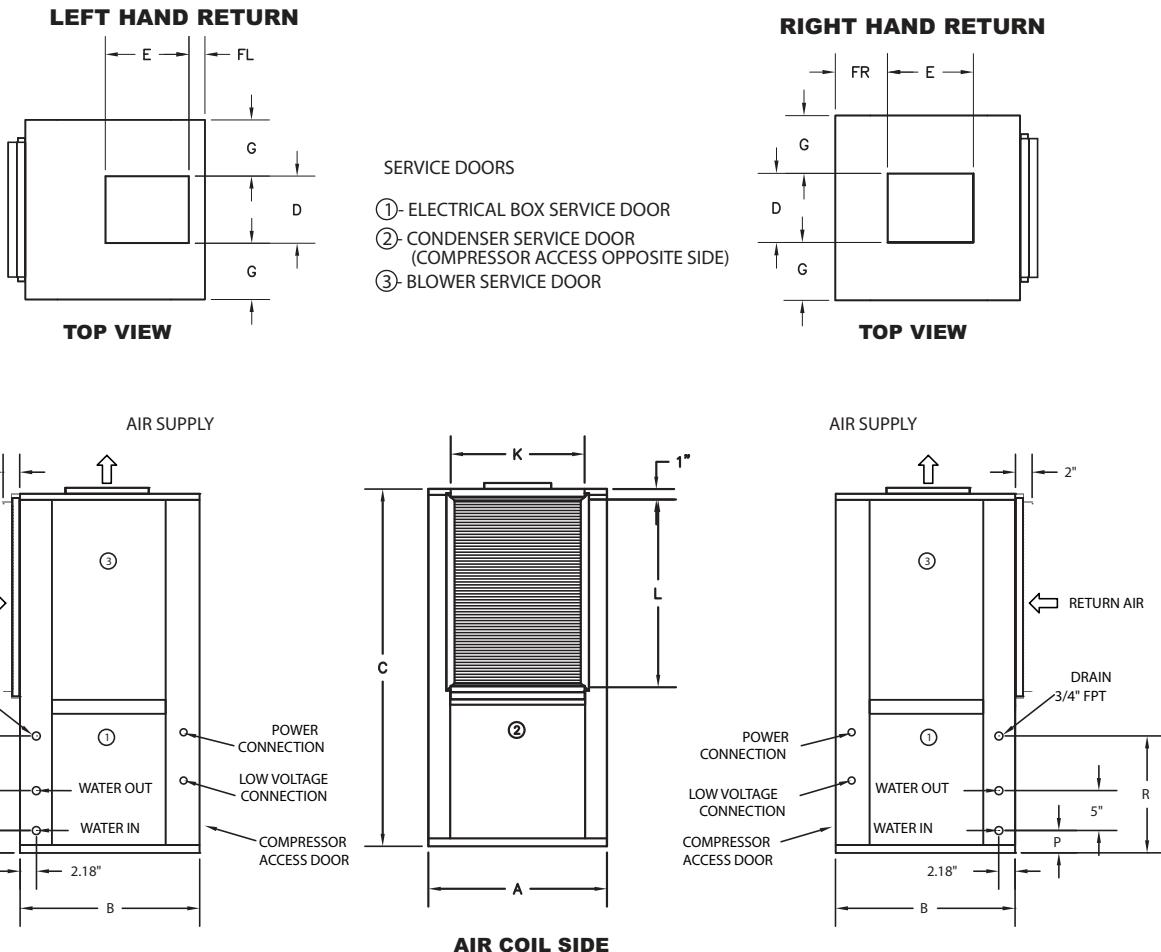


FIGURE 5 - RSH/RSV SERIES 460-575V



Model	A	B	C	D	E	RETURN AIR		K	SUPPLY AIR		N	P
						G	J		L	M		
RSH007	34.00	19.00	13.00	31.75	21.50	16.50	10.50	6.75	7.25	6.00	6.07	2.50
RSH009	34.00	19.00	13.00	31.75	21.50	16.50	10.50	6.75	7.25	6.00	6.07	2.50
RSH012	34.00	19.00	13.00	31.75	21.50	18.50	10.50	6.75	7.25	6.00	6.07	2.50
RSH018	40.00	21.00	19.00	37.75	23.50	23.00	16.50	6.50	9.19	10.31	3.75	2.80
RSH024	44.00	21.00	19.00	41.75	23.50	24.50	16.50	6.50	9.19	10.31	4.81	2.80
RSH030	44.00	21.00	19.00	41.75	23.50	24.50	16.50	6.50	9.69	11.38	4.81	2.80
RSH036	48.00	22.00	21.00	45.75	24.50	27.50	18.50	6.50	9.69	11.38	5.88	2.80
RSH042	52.00	26.00	21.00	49.75	28.50	35.50	18.50	6.50	10.50	13.63	5.88	2.80
RSH048	52.00	26.00	21.00	49.75	28.50	35.50	18.50	6.50	10.50	13.63	5.13	2.80
RSH060	56.00	26.00	23.00	53.75	28.50	43.50	20.50	6.00	13.12	13.63	5.13	3.06
RSH070	56.00	26.00	23.00	53.75	28.50	43.50	20.50	6.00	13.12	13.63	5.13	3.06

FIGURE 6 - RSH VIEWS - SUPPLY AND RETURN AIR



Model	A	B	C	SUPPLY AIR		FL	FR	G	RETURN AIR		P	R
				D	E				K	L		
<b>RSV007</b>	21.50	21.50	31.50	7.25	6.00	2.00	8.56	7.13	20.00	10.50	2.50	16.25
<b>RSV009</b>	21.50	21.50	31.50	7.25	6.00	2.00	8.56	7.13	20.00	10.50	2.50	16.25
<b>RSV012</b>	21.50	21.50	31.50	7.25	6.00	2.00	8.56	7.13	20.00	10.50	2.50	16.12
<b>RSV018</b>	25.50	23.00	40.00	9.19	10.31	2.00	6.00	8.16	25.00	16.50	2.75	18.56
<b>RSV024</b>	25.50	23.00	40.00	9.19	10.31	2.00	6.00	8.16	25.00	18.50	2.75	17.12
<b>RSV030</b>	25.50	23.00	40.00	9.69	11.38	2.00	5.00	7.91	25.00	18.50	2.75	17.12
<b>RSV036</b>	25.50	23.00	44.00	9.69	11.38	2.00	5.00	7.91	25.00	22.50	2.75	17.00
<b>RSV042</b>	28.00	25.50	46.00	10.50	13.63	2.00	5.00	8.75	23.00	26.00	2.75	15.25
<b>RSV048</b>	28.00	25.50	46.00	10.50	13.63	2.00	5.00	8.75	23.00	26.00	2.75	15.25
<b>RSV060</b>	32.50	27.50	50.00	13.12	13.63	3.00	6.00	9.69	28.00	30.00	3.06	15.00
<b>RSV070</b>	32.50	27.50	50.00	13.12	13.63	3.00	6.00	9.69	28.00	30.00	3.06	15.00

ALL DIMENSIONS IN INCHES

**FIGURE 7 - RSH VIEWS - SUPPLY AND RETURN AIR (AIR COOL SIDE)**

## **LIMITED WARRANTY**

Johnson Controls warrants this product to be free from defects in workmanship or material for a period of one year from date of original installation or 18 months from date of shipment, whichever comes first.

Johnson Controls obligation under this Warranty is LIMITED to repairing or replacing at our sole option, at our factory, any part thereof which shall be returned to our factory, transportation charges prepaid and which on examination proves to have been thus defective under normal domestic use not exceeding the fuel rating. The defective part should be returned through a qualified servicing dealer. Upon warranty determination, the replacement part will be shipped freight collect and assumes the unexpired portion of this Limited Warranty.

When a defective part can be repaired or replaced, Johnson Controls shall not be obligated to repair the entire unit or any part thereof other than the defective part.

This warranty applies only to the original homeowner, and is subject to the terms and conditions hereof.

## **COMPRESSOR – FIVE YEAR LIMITED WARRANTY**

In addition to the One Year Limited Warranty, Johnson Controls warrants the compressor to be free from defects in workmanship or material for a period of five (5) years from the date of original installation. If a compressor fails during this five year period, a new compressor will be supplied. The customer will be responsible for freight costs from our factory for delivery of the replacement compressor and also for the return of the defective compressor which may be required under the terms of the Warranty. Labor and any other expense involved in replacing the compressor is not covered by this Warranty.

## **LABOR AND COST NOT COVERED**

This Warranty provides only replacement parts or credits, and does not provide for or cover any labor, shipping, handling or other costs for service travel, servicing, removing, or installing any parts.

## **EXCLUSIONS**

This Warranty shall be void if:

1. The unit is not installed by a licensed or otherwise qualified or contractor and in compliance with the Installation Manual, applicable installation and good trade practices.
2. The defect or damage is caused by accident, abuse, negligence of any person or company, misuse, riot, flood, fire or Acts of God.
3. The unit is not operated and regularly serviced and maintained as called for in the Users' Manual.
4. Damages are caused by operating the unit in a commercial or corrosive atmosphere containing any damaging or dangerous chemicals.
5. The unit is modified or services in a manner not in accordance with the Installation Manual and Users' Manual.
6. Components, replacement parts, or other accessories not compatible with the unit or not approved by Johnson Controls have been used with or attached to the unit.
7. The defect or damage is not caused by Johnson Controls, or it arises from circumstances beyond the control of Johnson Controls.
8. The unit is installed outside the United States or Canada, or has been removed from the place where it was originally installed.

**THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, OBLIGATIONS OR LIABILITIES, EXPRESSED OR IMPLIED BY EMPLOYEES OR REPRESENTATIVES OF JOHNSON CONTROLS. ALL STATUTORY, EXPRESSED OR IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY NEGATED AND EXCLUDED. ANY CLAIMS FOR INCIDENTAL AND CONSEQUENTIAL DAMAGES, OR ANY OTHER DAMAGES OR EXPENSES BEYOND THE TERMS OF THIS LIMITED WARRANTY ARE HEREBY EXPRESSLY NEGATED AND EXCLUDED.**

