



**GE016-504.2**

5H0835730000

August, 2015

## INSTALLATION AND SERVICE MANUAL hydronic ground source heat pumps models GH and EH



NOTE:  
Energy Star only  
applies to certain  
configurations.

### **⚠ WARNING**

This unit contains R-410A high pressure refrigerant. Hazards exist that could result in personal injury or death. Installation, maintenance, and service must only be performed by an HVAC technician qualified in R-410A refrigerant and using proper tools and equipment. Due to much higher pressure of R-410A refrigerant, **DO NOT USE** service equipment or tools designed for refrigerants other than R-410A.

### **⚠ WARNING**

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death, and could cause exposure to substances which have been determined by various state agencies to cause cancer, birth defects or other reproductive harm. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

### **IMPORTANT**

1. The use of this manual is specifically intended for a qualified installation and service agency. A qualified installation and service agency must perform all installation and service of these appliances.
2. GH/EH units contain the refrigerant R-410A. Review the R-410A Material Safety Data Sheet (MSDS) for hazards and first aid measures.
3. Refrigerant charging should only be carried out by an EPA-certified air conditioning contractor.

#### **Inspection On Arrival**

1. Inspect unit upon arrival. In case of damage, report it immediately to transportation company and your local factory sales representative.
2. Check rating plate on unit to verify that power supply meets available electric power at point of installation.
3. Inspect unit received for conformance with description of product ordered (including specifications where applicable).

THIS MANUAL IS THE PROPERTY OF THE OWNER.  
PLEASE BE SURE TO LEAVE IT WITH THE OWNER WHEN YOU LEAVE THE JOB.

# SPECIAL PRECAUTIONS

## SPECIAL PRECAUTIONS

THE INSTALLATION AND MAINTENANCE INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED TO PROVIDE SAFE, EFFICIENT, AND TROUBLE-FREE OPERATION. IN ADDITION, PARTICULAR CARE MUST BE EXERCISED REGARDING THE SPECIAL PRECAUTIONS LISTED BELOW. FAILURE TO PROPERLY ADDRESS THESE CRITICAL AREAS COULD RESULT IN PROPERTY DAMAGE OR LOSS, PERSONAL INJURY, OR DEATH. THESE INSTRUCTIONS ARE SUBJECT TO ANY MORE RESTRICTIVE LOCAL OR NATIONAL CODES.

## HAZARD INTENSITY LEVELS

1. **DANGER:** Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.
2. **WARNING:** Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.
3. **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.
4. **IMPORTANT:** Indicates a situation which, if not avoided, MAY result in a potential safety concern.

### **DANGER**

1. Appliances must not be installed where they may be exposed to potentially explosive or flammable atmosphere.
2. Water temperatures over 125°F can cause severe burns instantly resulting in severe injury or death. Feel water before showering or bathing. Ensure that the primary water heating source setpoints are higher than the heat pump water discharge temperature of 120°F.

### **WARNING**

1. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
2. All appliances must be wired strictly in accordance with the wiring diagram furnished with the appliance. Any wiring different from the wiring diagram could result in a hazard to persons and property.
3. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.
4. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% greater than rated voltage.
5. This unit contains R-410A high pressure refrigerant. Hazards exist that could result in personal injury or death. Installation, maintenance, and service must only be performed by an HVAC technician qualified in R-410A refrigerant and using proper tools and equipment. Due to much higher pressure of R-410A refrigerant, DO NOT USE service equipment or tools designed for refrigerants other than R-410A.
6. When servicing or repairing this equipment, use only factory-approved service replacement parts. A complete replacement parts list may be obtained by contacting Modine Manufacturing Company. Refer to the rating plate on the appliance for complete appliance model number, serial number, and company address. Any substitution of parts or controls not approved by the factory will be at the owner's risk.

### **CAUTION**

1. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% less than the rated voltage.
2. Do not overcharge the refrigeration system. This can lead to elevated compressor discharge pressure and possibly flooding the compressor with liquid.
3. Do not attempt to reuse any mechanical or electrical component which has been wet. Such component must be replaced.

### **IMPORTANT**

1. Start-up and adjustment procedures must be performed by a qualified service agency.
2. All refrigeration checks must be made by a qualified R-410A refrigeration technician.
3. Do not release refrigerant to the atmosphere. When adding or removing refrigerant, all national, state/province, and local laws must be followed.
4. The ground heat exchanger (open or closed loop or water source to be connected to the unit must be designed, constructed, and prepared in accordance with industry guidelines (IGSHPA, ASHRAE, NGWA, etc.) and best practices, and any more restrictive local codes and regulations by a qualified service agency. Failure to properly, size, install, or prepare the source could result in reduced performance, a reduction in the normal life of the units, and a hazard to persons and property.
5. Units selected for open loop ground source applications should have a cupronickel source coaxial heat exchanger to reduce mineral buildup and scaling. Open loop systems should have the source coaxial coil flushed periodically to maintain peak performance.
6. All piping and connections must be made in accordance with local plumbing codes.
7. To check most of the Possible Remedies in the troubleshooting guide listed in Tables 20.1-22.1, refer to the applicable sections of the manual.

## Table of Contents

General Information . . . . .	1
Inspection on Arrival . . . . .	1
Special Precautions . . . . .	2
Model/Serial Number Designations . . . . .	3
Unit Dimensions . . . . .	4
SI (Metric) Conversion Factors . . . . .	6
Unit Location . . . . .	6
Installation . . . . .	6
Water Connections . . . . .	7
Hot Water Generator . . . . .	8
Wiring . . . . .	9
Electrical Specifications . . . . .	11
Start-Up Procedure . . . . .	12
Physical Data . . . . .	15
Maintenance . . . . .	16
Replacement Parts . . . . .	17
Serial Plate – Example . . . . .	17
Troubleshooting . . . . .	19
Start Up/Troubleshooting Form . . . . .	23
Warranty . . . . .	Back Page

# MODEL NOMENCLATURE

**Figure 3.1 - Model Number Designations**

1,2	3	4,5,6	7	8	9,10	11	12	13	14	15	16	17	18
MT	UC	MBH	DS	CC	SV	CT	AC	GM	HM	HWG	MT	SA	RA

**1,2 - Model Type (MT)**

GH - Residential Hydronic (Water to Water)  
 EH - Commercial Hydronic (Water to Water)

**3 - Unit Configuration (UC)**

R - Reversible  
 W - Non-Reversible

**4,5,6 - Nominal Cooling Capacity (MBH)**

036 - 36,000 Btu/hr  
 048 - 48,000 Btu/hr  
 060 - 60,000 Btu/hr  
 066 - 66,000 Btu/hr  
 096 - 96,000 Btu/hr  
 120 - 120,000 Btu/hr  
 132 - 132,000 Btu/hr

**7 - Development Sequence Designation (DS)**

C - Current

**8 - Compressor Configuration (CC)**

1 - Single Stage  
 3 - Single Stage with Soft Start

**9,10 - Supply Voltage (SV)**

02 - 208/60/1  
 03 - 208-230/60/1  
 04 - 208/60/3  
 05 - 208-230/60/3

**11 - Controls Type (CT)**

4 - Modine Controls System

**12 - Air Coil (AC)**

N - None

**13 - Geo (Source) Coaxial Coil Material (GM)**

C - Copper  
 N - Cupronickel

**14 - Hydronic (Load) Coaxial Coil Material (HM)**

C - Copper  
 N - Cupronickel

**15 - Hot Water Generator or Desuperheater (HWG)**

0 - None  
 1 - HWG with Factory Installed Pump

**16 - Motor Type (MT)**

N - None

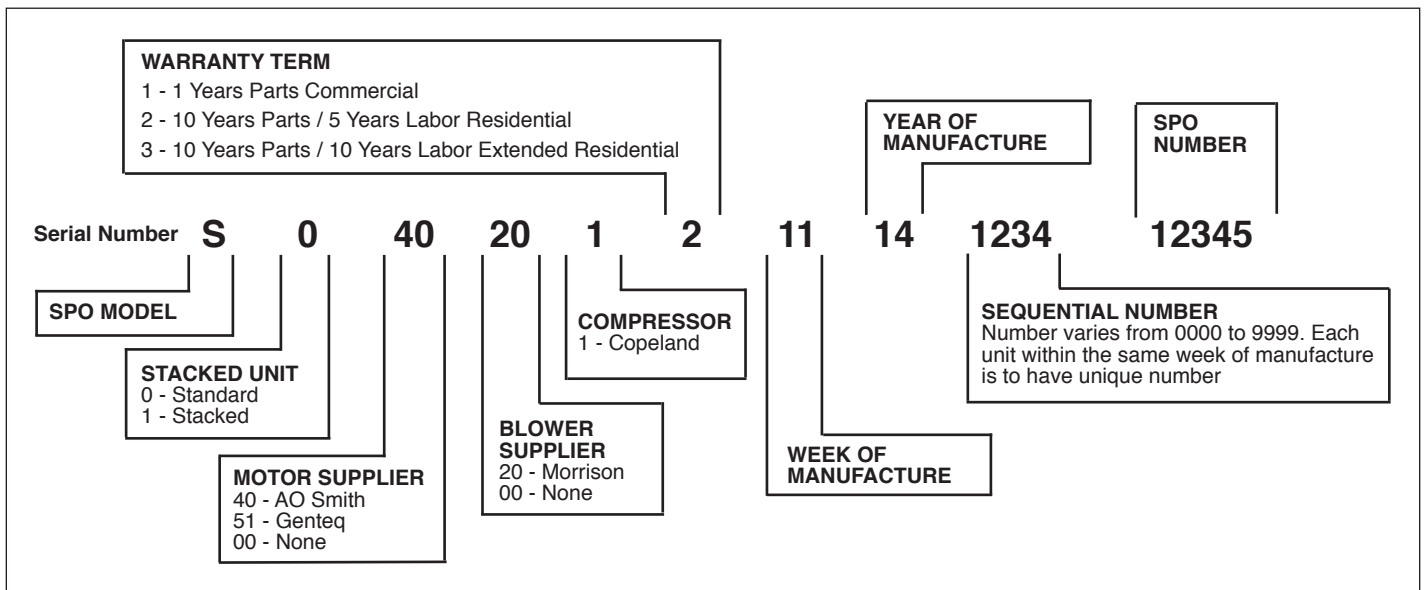
**17 - Supply Air Configuration (SA)**

N - None

**18 - Return Air Configuration (RA)**

N - None

**Figure 3.2 - Serial Number Designations**



# UNIT DIMENSIONS

Figure 4.1 - Dimensional Drawings - Models 036-066

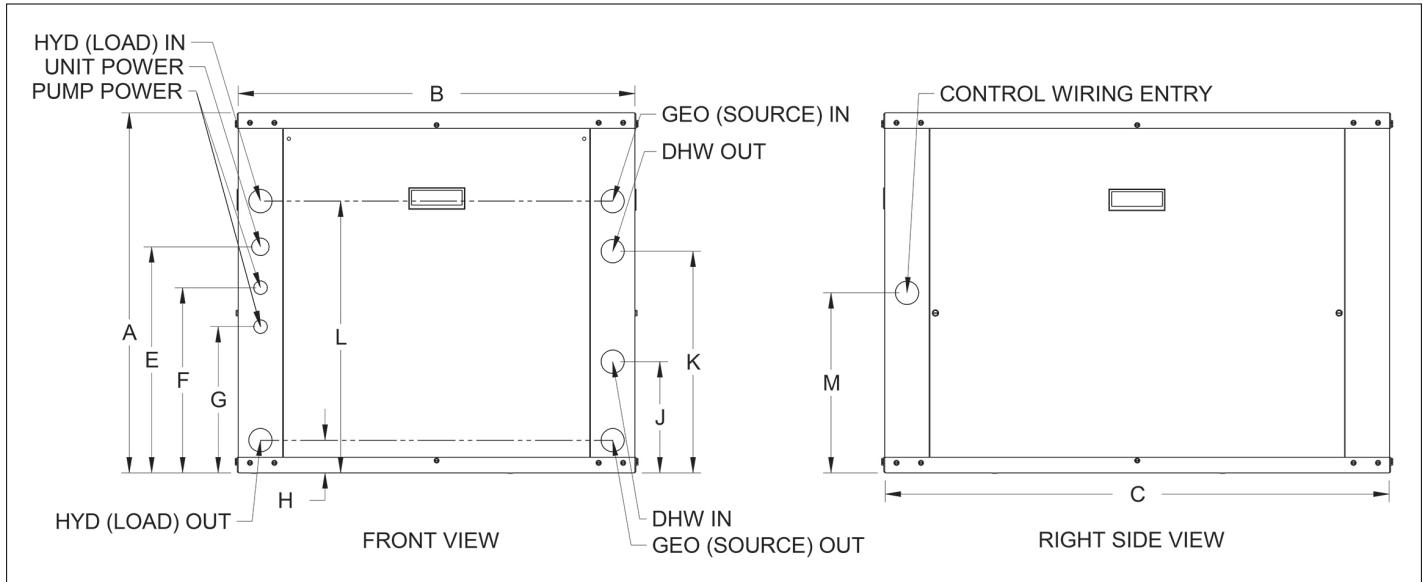


Table 4.1 - Dimensions (inches) - Models 036-066

Models		036	048	060	066
Overall Cabinet	A	23.13	23.13	23.13	23.13
	B	25.65	25.65	25.65	25.65
	C	32.63	32.63	32.63	32.63
Electrical	E	15.44	17.07	15.44	15.44
	F	12.82	14.26	12.82	12.82
	G	10.32	11.76	10.32	10.32
Geo, Hyd, & DHW	H	2.00	2.00	2.00	2.00
	J	7.14	7.14	7.14	7.14
	K	14.24	14.24	14.24	14.24
	L	18.62	20.32	18.62	18.62
Control	M	11.57	11.57	11.57	11.57
Approx. Shipping Weight (lbs.)		240	327	442	443
Coil Connection Size (Female Swivel)		1" NPT	1" NPT	1" NPT	1" NPT

# UNIT DIMENSIONS

Figure 5.1 - Dimensional Drawings - Models 096-132

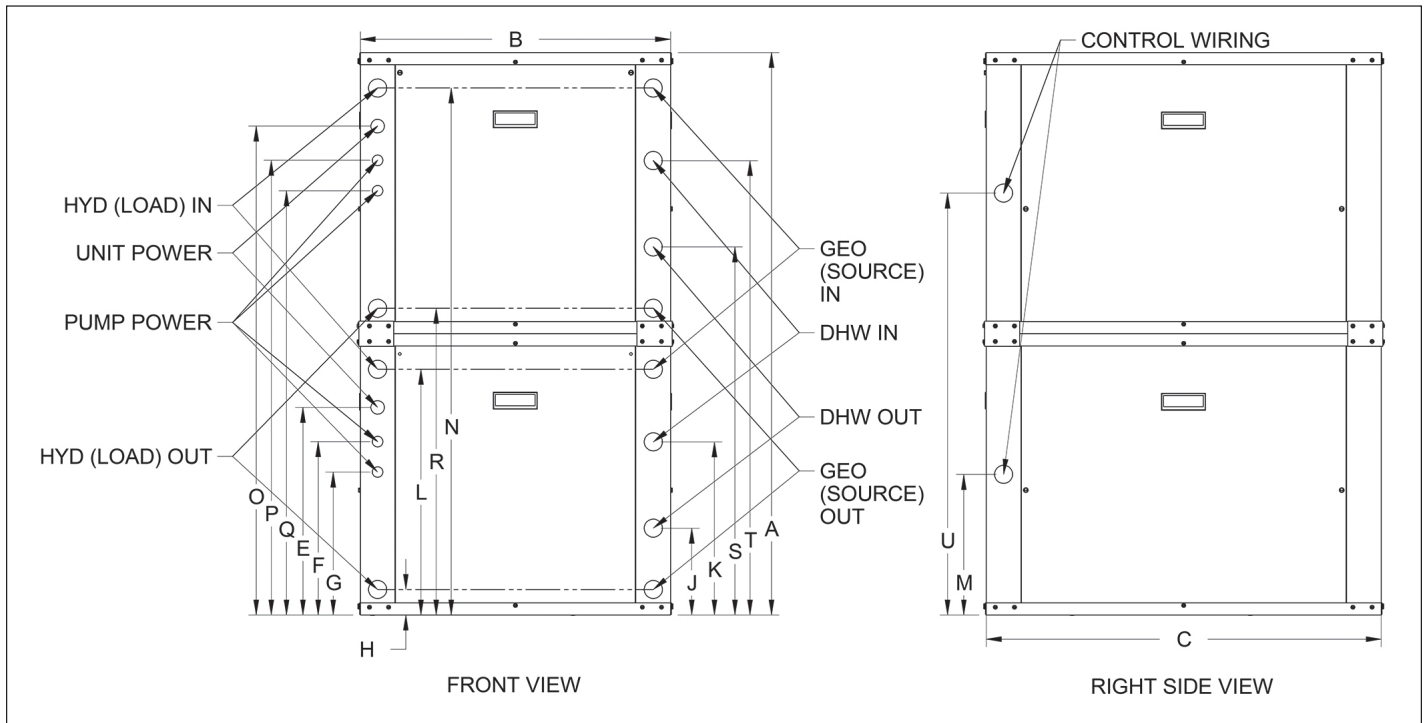


Table 5.1 - Dimensions (inches) - Models 096-132

Models			096	120	132
Overall Cabinet		A	46.26	46.26	46.26
		B	25.65	25.65	25.65
		C	32.63	32.63	32.63
Bottom Unit	Electrical	E	17.07	15.44	15.44
		F	14.26	12.82	12.82
		G	11.76	10.32	10.32
	Geo, Hyd, & DHW	H	2.00	2.00	2.00
		J	7.14	7.14	7.14
		K	14.24	14.24	14.24
		L	20.32	18.62	18.62
Control	M	11.57	11.57	11.57	
Top Unit	Electrical	O	40.20	38.57	38.57
		P	37.39	35.95	35.95
		Q	34.89	33.45	33.45
	Geo, Hyd, & DHW	N	43.42	41.72	41.72
		R	25.10	25.10	25.10
		S	30.28	30.28	30.28
		T	37.37	37.37	37.37
Control	U	34.70	34.70	34.70	
Approx. Shipping Weight (lbs.)			655	884	885
Coil Connection Size (Female Swivel)			1" NPT	1" NPT	1" NPT

# UNIT LOCATION / INSTALLATION

**Table 6.1 - SI (Metric) Conversion Factors**

To Convert	Multiply By	To Obtain	To Convert	Multiply By	To Obtain
"W.C.	0.24	kPa	CFH	1.699	m <sup>3</sup> /min
psig	6.893	kPa	Btu/ft <sup>3</sup>	0.0374	mJ/m <sup>3</sup>
°F	(°F-32) x 0.555	°C	pound	0.453	kg
inches	25.4	mm	Btu/hr	0.000293	kW/hr
feet	0.305	meters	gallons	3.785	liters
CFM	0.028	m <sup>3</sup> /min	psig	27.7	"W.C.

## UNIT LOCATION



Appliances must not be installed where they may be exposed to potentially explosive or flammable atmosphere.

## Handling

Each unit will be shipped to the site on a wood skid. Whenever possible, all lifting and handling of the unit should be done with the packing and skid in position.

When slinging or using a forklift to lift the unit, the support points should be sufficiently apart to give stability when lifting. Unless otherwise noted, the lifting points should be equidistant from the centerline. Extreme care should be taken not to drop the unit.

Considerable damage can occur to the unit during positioning, in particular, to the paneling and exterior paint. Use an adequate number of personnel and the correct tools when moving the unit. The unit is designed to remain upright so care should be taken when lifting the unit up steps.

The use of torque screwdrivers on panel, cover or component mounting screws is not recommended. Hand-start all screws. If electric drills are used – set at the lowest possible torque.

## Storage

Equipment should be stored in clean, dry area and in its original packaging.

Do not store or install units in corrosive environments or in locations subject to temperature or humidity extremes. Performance, reliability, and service life can be significantly reduced. Transport and store units in an upright position. Tilting units greater than 60° beyond horizontal may result in damage to the compressor. If the unit is tilted past 60°, do not energize the compressor until the unit has been upright for a minimum of 6 hours to prevent compressor damage.

## Unit Protection

To prevent damage, keep the unit in its original packaging or cover with an equivalent protective covering while on the job site. Cover open water connections to prevent debris from entering the system. Take extra precautions to protect the unit from damage or contamination when in an area where spraying, plastering and / or painting has not been completed. Physical damage or contamination from foreign debris may prevent proper start-up and costly equipment clean-up. Examine all fittings, valves, or pipes and remove all dirt or debris before installing unit.

## Preparation

1. Before installation, ensure that the correct electrical power supplies are available for the unit.
2. Each unit requires an independently fused and isolated power supply.
3. Check to make sure that the units will have adequate installation clearance for easy access to remove all panels and access all internal components. Provide ample area to access external components in and around the unit and system including water valves, fittings, and all electrical connections.
4. Remove any accessory kits and shipping support material from the mechanical compartment.
5. Check refrigerant piping for dents or kinks.
6. Inspect all electrical connections. Connections must be clean and tight at the terminal.

## Electrical

Electrical wiring should be done in accordance with all applicable national and local codes. It is the responsibility of the electrical contractor to adhere to such codes. The warranty will be voided if wiring is not in accordance with the specifications of the unit. Modine recommends using copper conductors only.

All power supply wiring must be capable of carrying the maximum current load under no fault conditions at the stipulated voltages. Care should be taken to avoid significant voltage drops.

A knockout for power connection is provided on the access side of the unit. See unit dimensions.

## INSTALLATION

### IMPORTANT

1. The ground heat exchanger (open or closed loop) or water source to be connected to the unit must be designed, constructed, and prepared in accordance with industry guidelines (IGSHPA, ASHRAE, NGWA, etc.) and best practices, and any more restrictive local codes and regulations by a qualified service agency. Failure to properly, size, install, or prepare the source could result in reduced performance, a reduction in the normal life of the units, and a hazard to persons and property.
2. Units selected for open loop ground source applications should have a cupronickel source coaxial heat exchanger to reduce mineral buildup and scaling. Open loop systems should have the source coaxial coil flushed periodically to maintain peak performance.

Installation of these units is to be INDOORS only. The instructions detailed below are for the Installation of a "Standard" unit. Accommodations and adjustments will be required for the usage of additional unit accessories. Should assistance be required for the installation of these additional items, consult Modine at the phone number listed on the back cover of this manual.

# INSTALLATION

## Unit Installation

1. Units should be mounted on a vibration-absorbing pad slightly larger than the base of the unit. See Table 7.1 below for Modine vibration pad part numbers. If the unit isn't mounted on a vibration-absorbing pad, it must be raised off the floor to prevent damage due to accidental flooding. It is not necessary to anchor the unit to the floor.

**Table 7.1 - Vibration Absorbing Pads - High Density Plastic**

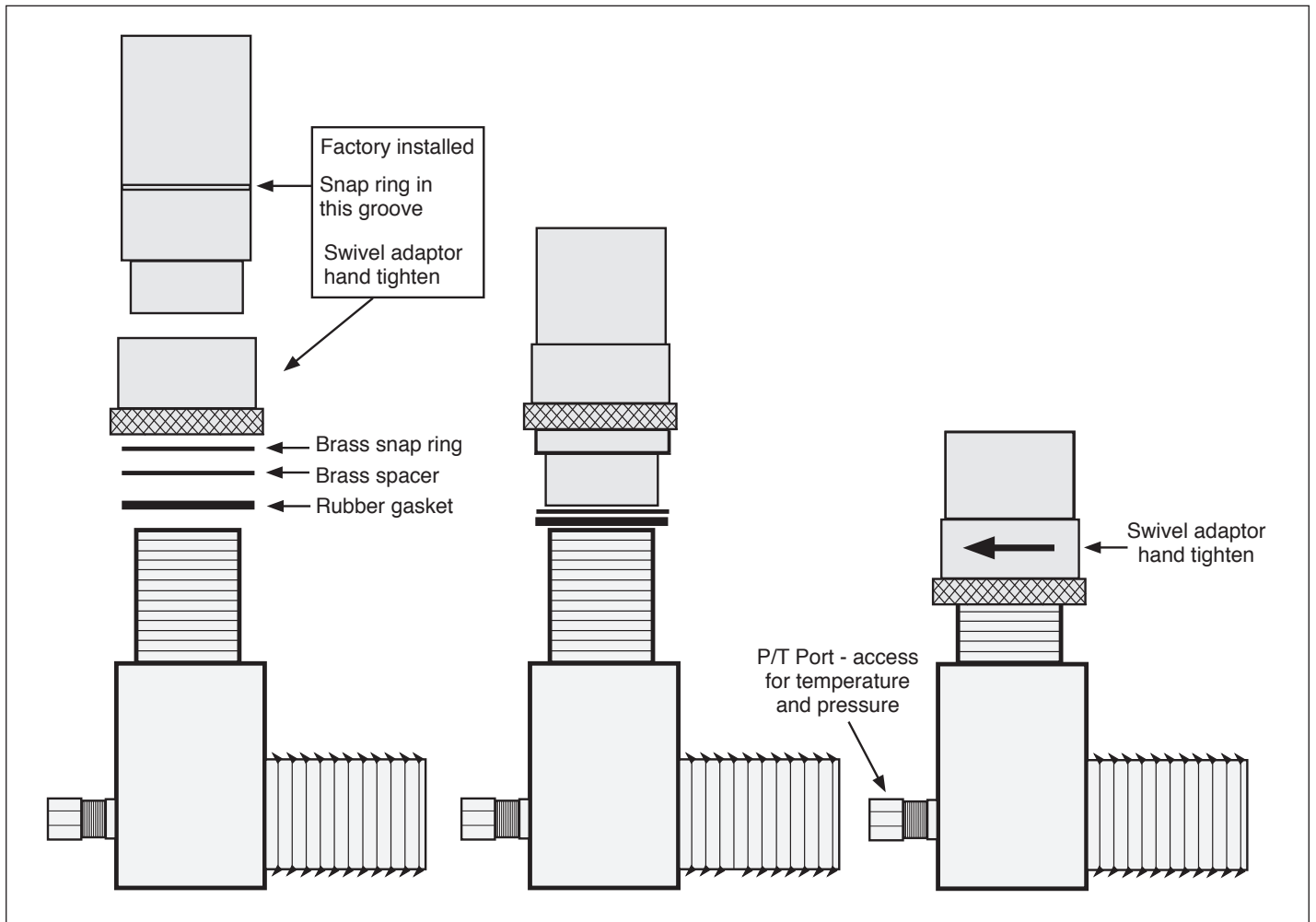
Pad Size	Part Number	Models
32" X 32"	5H0835220000	036
36" X 36"	5H0835230000	048-132

2. Check to ensure that the unit is level in both directions and also plumb. If adjustment is necessary, Modine recommends the placement of metal shims in the outermost corners of the base.
3. Provide adequate clearance for all access panels.
4. Provide easy access for servicing water valves, fittings and compressor.
5. Provide access to the controller and all electrical connections.
6. Provide a clear physical path to the unit. Adequate space should be provided to allow removal of the unit, if necessary.

## Water Connections

1. All units utilize swivel pipe fittings for water connections that are rated for 150 psi.
2. The connections have a rubber gasket seal similar to a garden hose gasket, which, when mated to the flush end of most 1" threaded male pipe fittings (MPT), provides a leak-free seal without the need for thread sealing tape or joint compound.
3. The water piping system should include pressure/temperature taps for serviceability.
4. Install the brass spacer and rubber gasket in swivel connector prior to attempting any connection, as shown in Figure 7.1 (rubber gasket and brass spacer kits are shipped with unit). To make the connection, mate the field supplied male pipe thread fitting against the rubber gasket in the swivel connector and thread the female locking ring onto the pipe threads, while maintaining the brass elbow in the desired direction. Tighten the connectors by hand, and then gently snug the fitting with pliers to provide a leak-proof joint.
5. **DO NOT OVERTIGHTEN**, as leaks may occur.
6. **NOTE:** Never use flexible hose smaller than 1" inside diameter on the unit. Limit the length to 10' per connection in one direction. Check carefully for leaks.

**Figure 7.1 - Water Connection Breakdown**



# INSTALLATION

## Hot Water Generator (Desuperheater) Installation (If Equipped)

### **⚠ DANGER**

Water temperatures over 125°F can cause severe burns instantly resulting in severe injury or death. Feel water before showering or bathing. Ensure that the primary water heating source setpoints are higher than the heat pump water discharge temperature of 120°F.

### **IMPORTANT**

All piping and connections must be made in accordance with local plumbing codes.

A minimum 50 gallon water heater is recommended with the Desuperheater (DHW) option. Higher demand applications may use either one 80 gallon water heater or two 50 gallon water heaters piped in series. The hot water tank should be allowed to stratify by lowering the bottom element setpoint to 100°F and setting the top element setpoint to 125°F. Operation of the DHW is controlled by a sensor located on the domestic water in line, which must not be removed. Hot water will only be produced when the unit is running a conditioning cycle.

The desuperheater pump is disabled on delivery from the factory. It must be enabled by wiring the pump in the unit control panel after the DHW piping has been completed and purged. This is to prevent the domestic hot water pump from running before the DHW tank is piped to the heat pump. DHW option must not be enabled until all piping is complete and the DHW loop has been purged and bled or damage can occur.

Poor domestic water quality may result in debris buildup in the system. A water softener is recommended with hard water (greater than 10 grains or 170 total hardness). Extreme hard water will require additional maintenance and should be considered with the DHW option, as maintenance costs may outweigh potential savings.

Make sure all local electrical and plumbing codes are met for installing a hot water generator. The installing contractor is responsible for performing the installation accordingly.

Water piping lengths must be kept at a minimum. DO NOT use a one way length greater than 50'.

Coaxial drain tees that provide an inlet and outlet to the heat pump from the drain connection are not recommended. The decreased diameter of the inlet and outlet pipes to the heat pump make it possible for debris build up and completely stop the flow of water to and from the desuperheater.

All components should be located in a conditioned space that is maintained above 50°F at all times.

1. Turn off power or fuel supply to the water heater.
2. Close cold water supply valve to heater.
3. Drain and flush the tank, then remove the drain valve.
4. Inspect the water heater cold water inlet pipe for a check valve and remove if present. Failure to do so will result in damage to the unit.
5. Use a tee to connect the cold water supply pipe to the DHW in connection on the unit. Be sure to install a check valve rated for at least 1/2" PSI and a shutoff valve on the cold water inlet pipe. Also install a shutoff valve on the supply line to the unit, as well as an air vent at the highest point of the system.
6. Run DHW piping using a minimum of 1/2" OD copper tubing. See Table 8.1 for recommended line sizes.
7. Use a tee to connect the unit DHW out connection to the water heater drain connection. Be sure to install a shutoff valve on the pipe as near to the water heater as possible.
8. Reinstall the drain valve on one side of the tee.

Figure 8.1 - Typical DHW Piping Diagram

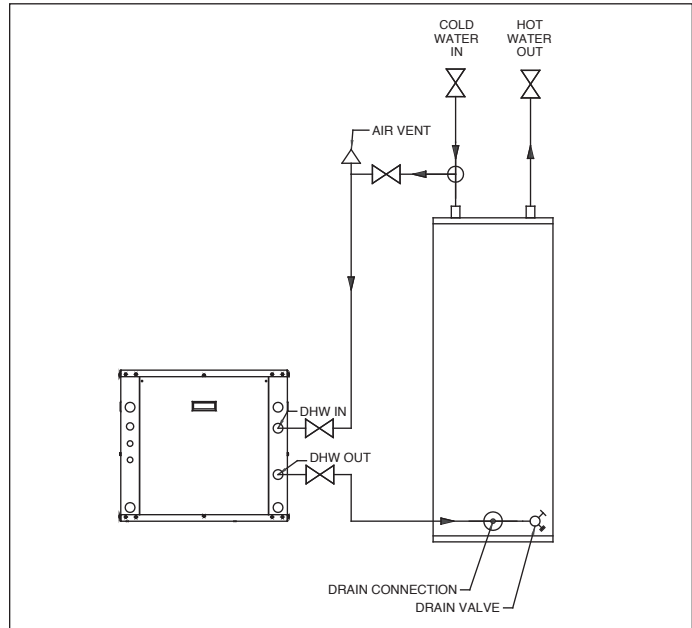


Figure 8.2 - Typical DHW Piping Diagram with Two Tanks

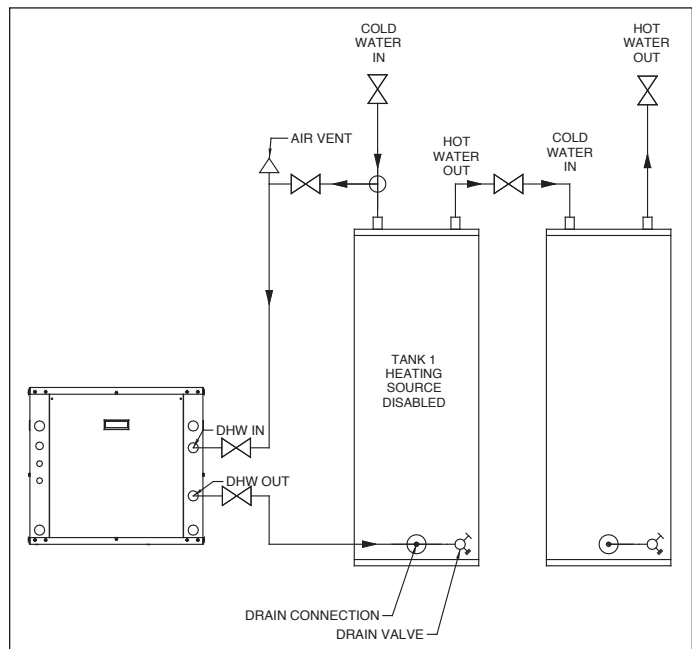


Table 8.1 - DHW Pipe Sizes ①

Maximum pipe length (one way) to achieve optimum flow			
Models	DHW Flow (gpm)	1/2" Copper	3/4" Copper
036	1.2	50	-
048 & 096 ①	1.6	45	50
060 & 120 ①	2.0	25	50
066 & 132 ①	2.4	10	50

① 096, 120, and 132 are stacked units, data is for individual unit.

9. Open all valves, except the system drain valve, and fill the system with water. Bleed all air and check for leaks.
10. Insulate all piping with 3/8" closed cell insulation.
11. Refer to "Start Up Procedure" for DHW setup and start up.



# INSTALLATION

## Wiring

### **⚠ WARNING**

1. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
2. All appliances must be wired strictly in accordance with the wiring diagram furnished with the appliance. Any wiring different from the wiring diagram could result in a hazard to persons and property.
3. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.
4. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% greater than rated voltage.

### **⚠ CAUTION**

Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% less than the rated voltage.

Installation of wiring must conform with local building codes, or in the absence of local codes, with the National Electric Code ANSI/NFPA 70 - Latest Edition. Unit must be electrically grounded in conformance to this code. In Canada, wiring must comply with CSA C22.1, Part 1, Electrical Code.

Electric wiring must be sized to carry the full load amp draw of the motor, starter and any controls that are used with the unit. See Table 11.1 for electrical data.

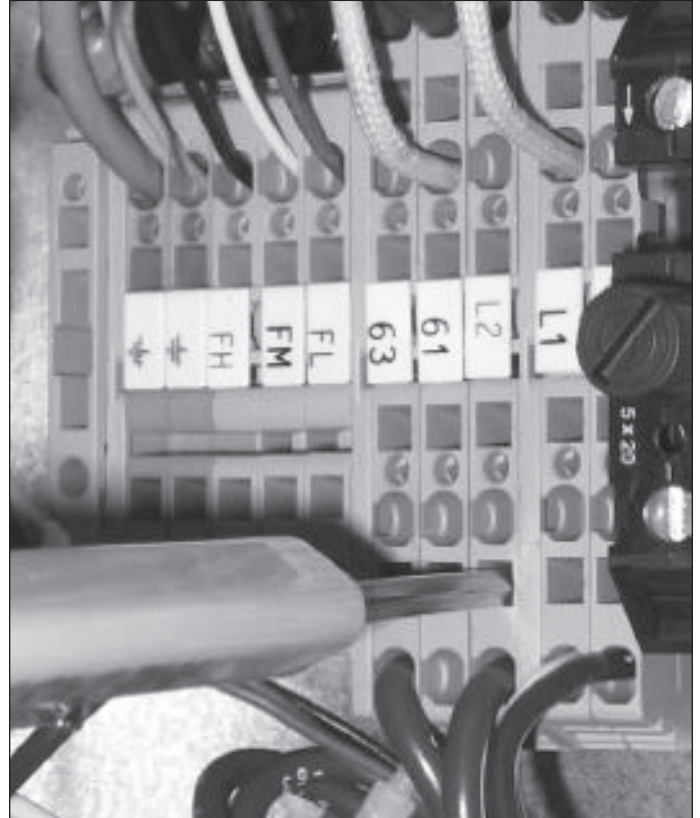
Any damage to or failure of units caused by incorrect wiring of the units is not covered by warranty.

## Terminal Strip Connections

The terminal strip connections are designed to clamp down on the wires. To properly connect the wires to the terminal strip:

1. Push a small flat-head screwdriver into the square hole on the terminal. Press firmly until the screwdriver hits the back stop and opens the terminal (see Figure 9.1).
2. Remove approximately 3/8" of insulation from the end of the wire and push the stripped wire into the oval hole in the terminal.
3. Remove the screwdriver. Pull on the wire to make sure that it is securely clamped in the terminal.
4. Make sure that the terminal clamp is in contact with bare wire (insulation removed).

Figure 9.1 - Terminal Strip



## Unit Power Connection

Refer to the unit serial plate for unit voltage and phase. Available power must be the same as indicated on serial plate.

Remove access panel and electrical box cover. Using unit power knockout, route power lines through unit and into main electrical panel. Connect line voltage wires to the L1 and L2 (& L3, if three phase voltage) lugs of the contactor. Consult the unit electrical data on the serial plate for correct overcurrent protection sizing. Connect ground wire to ground lug in electrical panel. Replace electrical box cover and access panel prior to unit startup.

## Hot Water Generator Pump Wiring

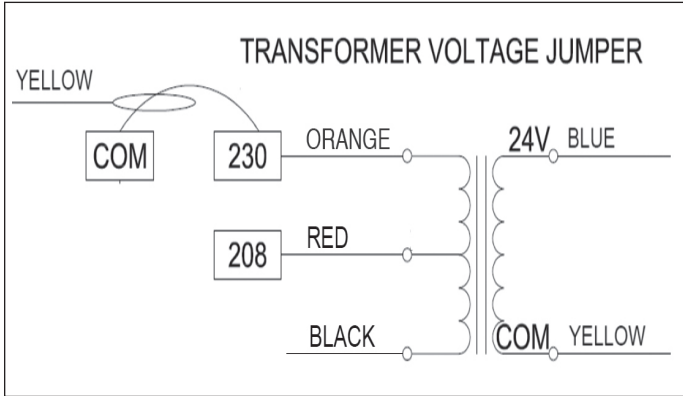
The domestic hot water pump is not wired in the factory to prevent pump burnout in case the unit is powered before the domestic hot water tank is plumbed or full of water. Refer to the control manual for instructions on enabling the pump.

## Transformer Wiring

The system supplies the power to the controller via a 24V transformer. On 208V systems, the transformer is factory wired and is ready for operation. On 208-230V systems, the transformer comes factory wired for 230V operation. If the unit is to be powered with 208V, the transformer must be wired for 208V. A terminal strip with a jumper is provided for easy field configuration (see Figure 10.1). Refer to the wiring diagram provided with the unit for details.

# INSTALLATION

**Figure 10.1 - 208-230V Transformer Wiring**



## Hydronic Pump Wiring

The hydronic pump must be connected to the terminal blocks in the electrical box. The pumps will automatically be cycled as required by the unit. Be sure to wire the pump prior to turning the system on.

## Aquastat Wiring

The aquastat wires are connected directly to the terminal blocks in the electrical box.

## Flow Center Wiring

The flow center must be connected to the terminal blocks in the electrical box. The pumps will automatically be cycled as required by the unit. Be sure to wire the flow center prior to turning the system on.

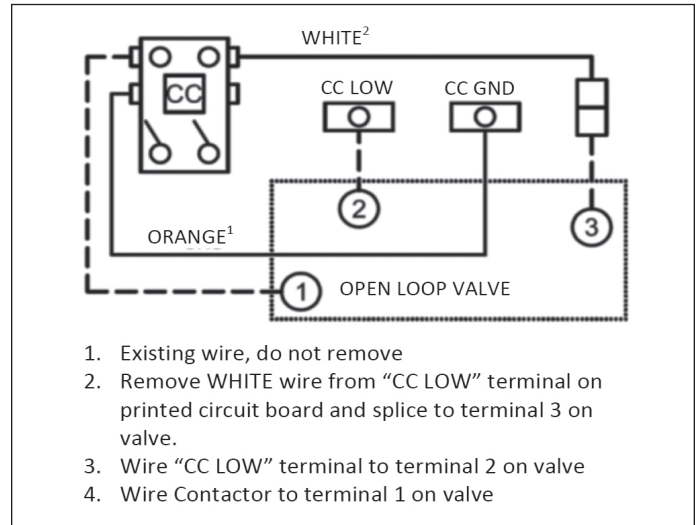
## Sensor Wiring

All sensors are factory wired and installed.

## Open Loop Control Valve Wiring

Always maintain water pressure in the heat exchanger by placing water control valves at the outlet of the unit to prevent mineral precipitation during the off cycle. Pilot operated slow closing valves are recommended to reduce water hammer. If water hammer persists, an expansion tank can be mounted on the piping to help absorb the excess hammer shock. Slow closing valve must have an end switch that enables/disables the compressor. See Figure 10.2 for proper wiring.

**Figure 10.2 - Optional Open Loop Valve Wiring**



# ELECTRICAL SPECIFICATIONS

Table 11.1 - Electrical Ratings

Models	Digits 9 & 10 Power Code	Rated Voltage	Voltage (min/max)	Compressor		Pumps			Control	Total Unit FLA	MCA	MAX FUSE
				RLA	LRA	Load	FLC	DHW				
036	02,03	208-230/1/60	197 / 253	20.0	112.0	1.8	1.8	0.4	0.5	24.5	29.5	30.0
	04,05	208-230/3/60	197 / 253	14.3	95.0	1.8	1.8	0.4	0.5	18.8	22.4	30.0
048	02,03	208-230/1/60	197 / 253	29.4	134.0	1.8	3.6	0.4	0.5	35.7	43.1	50.0
	04,05	208-230/3/60	197 / 253	17.1	110.0	1.8	3.6	0.4	0.5	23.4	27.7	30.0
060	02,03	208-230/1/60	197 / 253	31.6	178.0	1.8	3.6	0.4	0.5	37.9	45.8	50.0
	04,05	208-230/3/60	197 / 253	21.0	146.0	1.8	3.6	0.4	0.5	27.3	32.6	40.0
066	02,03	208-230/1/60	197 / 253	41.1	185.0	1.8	3.6	0.4	0.5	47.4	57.7	60.0
	04,05	208-230/3/60	197 / 253	24.2	179.0	1.8	3.6	0.4	0.5	30.5	36.6	40.0
096 ①	02,03	208-230/1/60	197 / 253	29.4	134.0	1.8	3.6	0.4	0.5	35.7	43.1	50.0
	04,05	208-230/3/60	197 / 253	17.1	110.0	1.8	3.6	0.4	0.5	23.4	27.7	30.0
120 ①	02,03	208-230/1/60	197 / 253	31.6	178.0	1.8	3.6	0.4	0.5	37.9	45.8	50.0
	04,05	208-230/3/60	197 / 253	21.0	146.0	1.8	3.6	0.4	0.5	27.3	32.6	40.0
132 ①	02,03	208-230/1/60	197 / 253	41.1	185.0	1.8	3.6	0.4	0.5	47.4	57.7	60.0
	04,05	208-230/3/60	197 / 253	24.2	179.0	1.8	3.6	0.4	0.5	30.5	36.6	40.0

① Stacked unit, electrical data is for individual unit.

## START-UP PROCEDURE

### START-UP PROCEDURE

# IMPORTANT

Start-up and adjustment procedures must be performed by a qualified service agency.

The unit has been factory tested and set for proper operation, but a full unit start-up is recommended.

**NOTE:** If any abnormal operation occurs during the startup procedure, refer to the troubleshooting section.

**NOTE:** Always start the system in heating mode.

### Pre-Start Checks

Before applying power to heat pump, use the following checklist to ensure a complete and proper installation.

- Check that the supply voltage matches the unit supply voltage listed on the unit serial plate.
- Verify that all wiring is secure and properly protected.
- All high voltage wiring is correct including, fuses, breakers and wire sizes.
- Trace circuits to insure that the unit has been wired according to the wiring diagram.
- Check that the unit has no visible damage and that all the components are secure.
- Check that all field electrical and mechanical work has been performed according to all applicable Federal, State, and Local codes.
- Check the supply voltage to the unit is within +/- 5% of the voltage on the unit serial plate.
- Low voltage wiring for aquastat, control wiring and the freeze protection setpoint completed.
- Transformer wiring is correct.
- Water supply to and load piping from heat pump is completed.
- Piping completed, water system cleaned and flushed of debris.
- Air and debris are purged from ground and load loops.
- Antifreeze added to ground and load loops, as required.
- Isolation valves are open, water control valves or loop pumps wired.
- DHW piping is complete, all air purged from system and charged with water.
- **IMPORTANT:** Ensure all valves in the DHW circuit are fully open and pump is wired correctly.
- Service/access panels are in place.
- Entering water temperatures are within operating limits in Table 14.1.

# CAUTION

Verify that ALL water control valves are open and allow water flow prior to engaging the compressor. Freezing of the coax or water lines can permanently damage the heat pump.

# CAUTION

To avoid equipment damage, DO NOT leave system filled in a building without heat during the winter unless antifreeze is added to the water loop. Heat exchangers never fully drain by themselves and will freeze unless winterized with antifreeze.

### Controller Setup

GH/EH systems are pre-programmed from the factory for easy installation, no installer setup is required for the unit to function.

The DHW pump is not wired from the factory on all units. This is done to protect the pump during installation and startup. If a DHW pump is in the system, it must be wired.

# IMPORTANT

Ensure that the freeze protection setpoint is properly set (approximately 10°F above the fluid freeze point) for the type and percentage of fluid used in the ground loop.

**Table 12.1 - Freeze Point of Pure Antifreeze Solutions, °F** ①

% Vol.	Methanol	Ethanol	Propylene Glycol
5.0	26.2	29.5	29.3
7.5	23.0	28.1	27.7
10.0	19.7	26.4	26.1
12.5	16.2	24.6	24.4
15.0	12.6	22.6	22.5
17.5	8.8	20.4	20.5
20.0	4.9	18.1	18.4
22.5	—	15.6	16.1
25.0	—	12.9	13.8
27.5	—	10.0	11.3
30.0	—	7.0	8.8

① All values are typical, refer to antifreeze manufacturer data sheets for actual values.

# START-UP PROCEDURE

## Unit Startup Procedure

The Startup / Troubleshooting form found on page 23 of this manual may be used to assist during unit startup.

1. Put aquastat in standby or off mode.
2. Turn on line power to heat pump.
3. Slowly raise the aquastat set-point until a heating call is generated and the compressor energizes.
4. After a few minutes, check the load out temperature and verify warm water delivery.
5. Verify water flow by comparing pressure drop across the coaxial coil to values in Table 13.1.
6. Monitor ground water supply (GWI) and return (GWO) temperatures. If temperature drop is within expected operating range as shown in Table 14.1, continue with testing.
7. If temperature drop is outside of expected operating range, check refrigerant pressures and compare to values in Table 14.1.
8. Check for vibration, noise and leaks.
9. Lower aquastat set point below tank temperature and verify that compressor and flow center deactivate.
10. Initiate a control signal to place the unit in the cooling mode. Cooling set point must be set below room temperature.
11. Cooling will energize after a time delay.
12. Be sure that the compressor and flow center are activated.
13. Monitor ground water supply (GWI) and return (GWO) temperatures. If temperature rise is within expected operating range in Table 14.1, continue with testing.
14. If temperature drop is outside of expected operating range, check refrigerant pressures and compare to Table 14.1.
15. Check for vibration, noise and leaks.
16. Adjust the cooling set point above the tank temperature and verify that the compressor and flow center deactivate.
17. If unit fails to operate as described, see troubleshooting section. If the unit still does not operate properly, contact Modine at the number listed on the back of this manual.
18. When testing is complete, set system to normal operating mode.

## DHW Startup Procedure

1. If the DHW was wired, the DHW pump will run whenever the heat pump is running and the DHW Supply temperature is below 120°F and the discharge temperature is above 100°F.
2. To verify operation of the DHW pump, ensure that the heat pump is running and the DHW temperature is below 120°F and the discharge temperature is above 100°F.
3. The temperature rise across the desuperheater should be 5-10°F.

## Sequence of Operation

The unit's controller will monitor calls for heat or cooling by aquastat.

**Cool:** When the temperature increases above the cooling aquastat's set point and the dead band, the compressor and reversing valve will be energized. The compressor will be limited by a timer that will provide anti-cycle protection.

**Heat:** When the temperature falls below the heating aquastat's set point and the dead band, the compressor will be energized and the reversing valve de-energized. The compressor will be limited by a timer that will provide short-cycle protection.

**Open Loop Systems:** An optional valve can be fitted to stop water flow when the compressor is not energized. This allows the variable pumping system to work more efficiently.

**Table 13.1 - Water Pressure Drop, psi  
(Based on Entering Water Temperature)**

Models	GPM	30°F	40°F	60°F	90°F	110°F
036	6.0	1.9	1.8	1.6	1.4	1.3
	8.0	2.9	2.8	2.5	2.1	2.0
	9.0	3.5	3.4	3.0	2.6	2.4
	10.0	4.1	4.0	3.5	3.0	2.8
	12.0	5.5	5.4	4.7	4.1	3.7
048	6.0	1.4	1.4	1.2	1.1	1.0
	8.0	2.2	2.1	1.9	1.7	1.6
	10.0	3.0	3.0	2.6	2.4	2.2
	12.0	4.0	4.0	3.5	3.2	3.0
	14.0	5.1	5.1	4.5	4.1	3.9
060 & 066	9.0	1.5	1.5	1.4	1.3	1.2
	12.0	2.4	2.3	2.2	2.0	1.9
	15.0	3.5	3.4	3.2	2.9	2.7
	18.0	4.7	4.6	4.3	3.9	3.7
	21.0	6.2	6.1	5.6	5.1	4.8
096 ①	6.0	1.4	1.4	1.2	1.1	1.0
	8.0	2.2	2.1	1.9	1.7	1.6
	10.0	3.0	3.0	2.6	2.4	2.2
	12.0	4.0	4.0	3.5	3.2	3.0
	14.0	5.1	5.1	4.5	4.1	3.9
120 ① & 132 ①	9.0	1.5	1.5	1.4	1.3	1.2
	12.0	2.4	2.3	2.2	2.0	1.9
	15.0	3.5	3.4	3.2	2.9	2.7
	18.0	4.7	4.6	4.3	3.9	3.7
	21.0	6.2	6.1	5.6	5.1	4.8
	24.0	7.9	7.7	7.1	6.4	6.0

① Pressure drop is for individual unit.

**Table 13.2 - Antifreeze Pressure Drop Corrections**

Antifreeze Type	Antifreeze Solution Percent by Weight	Correction Factor
Ethylene Glycol	15%	1.12
	20%	1.16
	30%	1.22
Propylene Glycol	15%	1.20
	20%	1.27
	30%	1.43
Ethanol	38%	1.55
	14%	1.29
	20%	1.34
Methanol	29%	1.43
	10%	1.12
	15%	1.16
	20%	1.19
	25%	1.21

**Equation 13.1 - Coaxial Coil Pressure Drop Antifreeze Correction**

To find actual pressure drop through either coaxial coil when the unit is operated with an antifreeze solution, rather than water:

$$WPD_A = WPD_S \times ACF$$

Where:

$WPD_A$  = Water Pressure Drop at Actual Conditions

$WPD_S$  = Water Pressure Drop at Standard Conditions (water) from Table 18.1

$ACF$  = Antifreeze Correction Factor from Table 18.2

# START-UP PROCEDURE

**Table 14.1 - Typical Operating Conditions**

Heating - No Desuperheater						
Entering Water Temperature (°F)	Water Flow (gpm/ton)	Suction Pressure (psig)	Discharge Pressure (psig)	Superheat (°F)	Subcool (°F)	Source Water Temperature Drop (°F)
30	1.5	68-76	285-310	8-12	3-9	5-7
	3	72-80	290-315	8-12	3-9	3-5
50	1.5	100-110	315-345	9-13	5-11	7-9
	3	104-114	320-350	9-13	5-11	5-7
70	1.5	134-144	355-395	10-14	6-12	9-11
	3	138-148	360-390	10-14	6-12	7-9

Cooling - No Desuperheater						
Entering Water Temperature (°F)	Water Flow (gpm/ton)	Suction Pressure (psig)	Discharge Pressure (psig)	Superheat (°F)	Subcool (°F)	Source Water Temperature Rise (°F)
50	1.5	122-130	220-235	13-19	10-16	19-23
	3	120-128	190-210	13-19	10-16	7-12
70	1.5	127-136	280-210	11-15	8-14	19-23
	3	125-134	250-270	11-15	8-14	7-12
90	1.5	132-144	360-380	10-14	8-14	18-22
	3	130-142	330-350	10-14	8-14	7-12

**Table 14.2 - Operating Limits**

Operating Limits		Cooling (°F)	Heating (°F)
SOURCE	Min. Entering Water	30	20
	Normal Entering Water	85	60
	Max. Entering Water	110	90
LOAD	Min. Entering Water	50	60
	Normal Entering Water	60	100
	Max. Entering Water	90	120

**NOTE:** Limits are acceptable for start-up conditions only. Min / max limits are intended for bringing the space up / down to normal temperatures. Units are not designed to operate at the min / max conditions on a continual or regular basis. The operating limits are dependent upon three primary factors: 1) entering source temperature, 2) entering load temperature, and 3) flow rate (gpm). 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.

**Table 14.3 - Compressor Winding Resistance**

Compressor	C to S	C to R	S to R
ZP16K5E-PFV	2.30	1.53	3.83
ZP21K5E-PFV	1.64	1.30	2.94
ZP25K5E-PFV	1.91	1.02	2.93
ZP29K5E-PFV	1.44	0.90	2.34
ZP34K5E-PFV	1.25	0.56	1.81
ZP36K5E-PFV	1.25	0.56	1.81
ZP39K5E-PFV	1.22	0.55	1.77
ZP51K5E-PFV	0.79	0.45	1.25
ZP57K5E-PFV	0.97	0.37	1.34
ZP72KCE-PFV	0.85	0.32	1.17

# START-UP PROCEDURE / PHYSICAL DATA

**Table 15.1 - Refrigerant Circuit Malfunctions and Probable Causes** ①

The following chart will assist in troubleshooting and diagnosing causes of a problematic unit. The chart provides general guidance for system measurements relative to typical operating conditions.

Cause	Symptom						
	Head Press.	Suct. Press.	Comp Amp Draw	Superheat	Subcool	Load Temp Diff.	Water (Source) Temp Diff
Undercharged System	Low	Low	Low	High	Low	Low	Low
Overcharged System	High	High	High	Normal	High	Normal	Normal
Low Load Water Flow - Heating	High	High	High	High	Low	High	Low
Low Load Water Flow - Cooling	Low	Low	Low	Low / Normal	High	High	Low
Low Source Water Flow - Heating	Low	Low	Low	Low	High	Low	High
Low Source Water Flow - Cooling	High	High	High	High	Low	Low	High
High Load Water Flow - Heating	Low	Low	Low	Low	High	Low	Normal / High
High Load Water Flow - Cooling	Normal / High	High	Normal / High	High	Low	Low	Normal / High
High Source Water Flow - Heating	Normal / High	High	Normal / High	High	Low / Normal	High	Low
High Source Water Flow - Cooling	Low	Low	Low	Low	High	High	Low
Low Load Water Temp - Heating	Low	Low	Low	Low / Normal	High	High	Normal / High
Low Load Water Temp - Cooling	Low	Low	Low	Low / Normal	High	Low	Low
High Load Water Temp - Heating	High	High	High	Normal / High	Low / Normal	Low	Low
High Load Water Temp - Cooling	High	High	High	High	Low	Low	High
Restricted TXV	High	Low	Low / Normal	High	High	Low	Low
TXV Bulb Failure (Loss of Charge)	High	Low	Low	High	High	Low	Low
Restricted Filter/Drier ①	High	Low	Low / Normal	High	High	Low	Low
Inefficient Compressor	Low	High	Low	High	High	Low	Low
Scaled / Fouled Load Heat Exchanger - Heating	High	High	High	High	Low	Low	Low
Scaled / Fouled Load Heat Exchanger - Cooling	Low	Low	Low	Low / Normal	High	Low	Low
Scaled / Fouled Source Heat Exchanger - Heating	Low	Low	Low	Low / Normal	High	Low	Low
Scaled / Fouled Source Heat Exchanger - Cooling	High	High	High	High	Low	Low	Low

① Restricted filter / drier will have symptoms similar to restricted TXV. Check temperature drop across filter driver to verify a restriction.

## PHYSICAL DATA

**Table 15.2 - Physical Data**

Models	036		048		060		066		096		120		132	
Reversible (H), Non-Reversible (W)	H	W	H	W	H	W	H	W	H	W	H	W	H	W
Factory Charge, R-410A, oz (per Unit)	53	51	70	67	101	100	112	112	70	67	101	100	112	112
Factory Charge, R-410A, oz (per Unit) - w/HWG	56	55	74	71	104	104	115	115	74	71	104	104	115	115
Unit Style	Single Unit								Stacked Unit					
Compressor	Copeland Scroll													

## MAINTENANCE

### MAINTENANCE

#### **WARNING**

When servicing or repairing this equipment, use only factory-approved service replacement parts. A complete replacement parts list may be obtained by contacting Modine Manufacturing Company. Refer to the rating plate on the appliance for complete appliance model number, serial number, and company address. Any substitution of parts or controls not approved by the factory will be at the owner's risk.

#### **CAUTION**

Do not attempt to reuse any mechanical or electrical component which has been wet. Such component must be replaced.

#### **IMPORTANT**

To check most of the possible remedies in the troubleshooting guide listed in Tables 20.1-22.1, refer to the applicable sections of the manual.

The routine care and maintenance of this unit will increase longevity, provide for the proper operational performance, and reduce the probability of failure.

Once the unit is operational, it will be necessary to perform certain routine maintenance/service checks. Following is a maintenance schedule with the recommended checks. If your unit is equipped with special features, there may be additional checks that are required. Consult Modine for assistance.

The use of torque screwdrivers on panel, cover or component mounting screws is not recommended. Hand-start all screws. If electric drills are used – set at the lowest possible torque.

### Coaxial Coil Maintenance - Ground Water Applications

If the system is installed in an area with a known high mineral content (125 P.P.M. or greater), best practice is to establish a periodic maintenance schedule with the owner so the coil can be checked on a regular basis. Should periodic coil cleaning be necessary, use coil cleaning procedures that are compatible with the heat exchanger material and copper water lines.

Generally, with greater water flow rates, the likelihood of scaling reduces. Therefore, the recommended minimum water flow is 1.5 gpm per ton. Recommended minimum flow rate for entering water temperatures below 50°F is 2.0 gpm per ton.

Keep all air out of the water. An open loop system should be checked to ensure that the well head is not allowing air to infiltrate the water line. Lines should always be airtight. Keep the system under pressure at all times. It is recommended in open loop systems that the water control valve be placed in the discharge line to prevent loss of pressure during off cycles. Closed loop systems must have positive static pressure.

### Coaxial Coil Maintenance - Ground Loop Applications

Generally coaxial coil maintenance is not needed for closed loop systems. However, if the piping is known to have high dirt or debris content, best practice is to establish a periodic maintenance schedule with the owner so the coil can be checked on a regular basis. Dirty installations are typically the result of deterioration of iron or galvanized piping or components in the system.

Open cooling towers requiring heavy chemical treatment and mineral buildup through water use can also contribute to higher maintenance. Should periodic coil cleaning be necessary, use standard coil cleaning procedures that are compatible with the heat exchanger material and copper water lines.

Generally, with greater water flow rates, the likelihood of scaling reduces. However, flow rates over 3 gpm per ton can produce water (or debris) velocities that can erode the heat exchanger wall and ultimately produce leaks.

### Desuperheater Coils

If potable water is hard or not chemically softened, the high temperature of the desuperheater can lead to scaling. This results in more scheduled maintenance. A buffer tank may be installed to help prevent scaling. Extreme hard water conditions should not use the desuperheater option. Should periodic coil cleaning be necessary, use coil cleaning procedures that are compatible with the heat exchanger material and copper water lines.

### Compressor

Conduct annual amperage checks to insure that amp draw is no more than 10% greater than indicated on the operating data.



# MAINTENANCE

## Cabinet

If a flood occurs, try to expel water as soon as possible. Water contact for any duration will cause corrosion on the cabinet finish. All units mounted on the ground should be installed on an absorption pad. This also helps prevent water from entering the cabinet. If the cabinet is dirty, do not spray with water, use a damp rag with mild detergent, and wipe the system clean.

## Refrigerant System

The refrigerant circuit is sealed; service gauges should not be used unless the system is not operating correctly. The operational charts show correct pressures, flow and temperature. Before servicing the refrigerant circuit, ensure that the water flows are correct.

## Replacement Parts



For ease of identification when ordering replacement parts or contacting the factory about your unit, please provide the complete model number and unit serial number. This information can be found on the serial plate attached to your unit (see Figure 17.1).

When a component part fails, a replacement part should be obtained by contacting your local distributor or Modine Sales Representative. Your sales representative can assist with Return Material Authorizations (RMAs) and potential warranty claims. The following details are required to process parts orders and warranty claims:

1. Full description of part required, including unit's model number.
2. The complete unit's serial number.
3. Completed Return Material Authorization (RMA)
4. An appropriate purchase order number.

For further information email [modinegeothermal@ccsportal.com](mailto:modinegeothermal@ccsportal.com) or call 1-877-679-4436 (4GEO).

Figure 17.1 - Serial Plate EXAMPLE

Modine 1500 DeKoven Avenue Racine, WI 53403-2552 Phone: 1-866-823-1631		 MADE IN U.S.A	
Serial Number: <b>111111 04020114212-1234</b>			
Model Number: <b>GFV018B1023RNX1ETL</b>			
Power Supply: <b>208V/10/60Hz</b>		Compressor Amps: <b>10 RLA      48 LRA</b>	
Supply Motor: <b>4.2 FLA    1/2 HP</b>		FLC Amps: <b>1.8 FLA</b>	
Refrigerant: <b>R-410</b>		Factory Charge: <b>3.1 Lbs / 1.4 Kg</b>	
Design Pressure: <b>High: 450psi / Low: 150psi</b>			
Unit FLA: <b>17 A</b>	Unit MCA: <b>19 A</b>	Unit MOP: <b>29 A</b>	
<b>COMMON REPLACEMENT PARTS:</b> Compressor: 5H102804-1611 Supply Motor: 9F050090 Supply Blower: 5H0834250001 Air Coil: 5H0834010006 Source Coil: 5H0834080016 Control Board: 5H0835950001 Control Display: 5H0835950002 DHW Pump: 5H0834230001 Wiring Diagram: 5H0834743001			
		CONFORMS TO UL STD 1995 CERTIFIED TO CAN/CSA STD C22.2 NO. 236	

# REPLACEMENT PARTS

Table 18.1 - Common Replacement Parts

Part Description		036	048	060	066	098	120	132			
		<b>Compressor Code</b>									
Power Code	02,03	01,03	Compressor	5H1028043611	5H1028045111	5H1028045711	5H1028047211	5H1028045111	5H1028045711	5H1028047211	
			Compressor Run Capacitor	5H1036890003	5H1036890007	5H1036890008	5H1036890010	5H1036890007	5H1036890008	5H1036890010	
		3	Soft Start	5H0834140002							
		<b>Hot Water Generator</b>									
	1	Desuperheater (DHW) Pump	5H0834230001								
	All	Control Transformer	5H0749490001								
	All	Contactactor	5H0834310001								
04,05	<b>Compressor Code</b>										
	01,03	Compressor	5H1028043612	5H1028045112	5H1028045712	5H1028047212	5H1028045112	5H1028045712	5H1028047212		
	All	Control Transformer	5H0749490001								
	All	Contactactor	5H0834310003								
All Models	Expansion Valve	5H0834040004	5H0834040005	5H0834040006	5H0834040006	5H0834040005	5H0834040006	5H0834040006	5H0834040006		
	Filter / Drier	5H0834050002	5H0834050002	5H0834050003	5H0834050003	5H0834050002	5H0834050003	5H0834050003	5H0834050003		
	Reversing Valve	5H1028300001	5H1028300001	5H1028300005	5H1028300005	5H1028300001	5H1028300005	5H1028300005	5H1028300005		
	Water Line Fitting Gasket / Spacer Set	3H0387930000									
	High Pressure Switch	5H0834070001									
	Low Pressure Switch	5H0834070002									

# TROUBLESHOOTING

## General

When encountering a unit with operational faults, complete these preliminary system checks before utilizing the troubleshooting charts.

In order to maintain system integrity, performance and efficiency, do not install service gauges unless unit operation appears abnormal and all other diagnostic checks are normal. Verify water source and load side temperatures changes against typical operating data. If the performance is within the ranges in the table and the water flows have been verified, then gauges may be installed in order to check subcooling and superheat.

1. Verify that the unit and flow center power supplies are on.
2. Verify that all fuses or disconnects switches are intact.
3. Inspect unit for obvious defects (e.g., leaking connections, loose or damaged wiring, etc.).
4. Verify field inputs and outputs (refer to wiring diagram).
  - a. **Aquastat inputs** – Aquastat inputs are 24VAC signals and can be verified using a volt meter.
  - b. **Outputs** – Compressor and reversing valve output relays are 24VAC and can be verified using a voltmeter. The flow center and DHW pump are powered through 240V relays. Operation can be verified using a voltmeter or clamp-on ammeter.
5. After completing these checks, refer to the troubleshooting tables on the next pages.

# TROUBLESHOOTING

Table 20.1 - Troubleshooting

Fault	Mode		Possible Cause	Verify	Action
	Htg	Clg			
No power to unit	X	X	Power Failure	No voltage at line side of compressor contactor.	Check disconnect switch and power distribution panel.
	X	X	Open disconnect switch	At heat pump disconnect, voltmeter shows voltage on the line side but not on the load side.	Determine why the disconnect switch was opened. Close disconnect if safe to do so.
	X	X	Blown fuse / circuit breaker tripped	Check fuses and circuit breaker.	Reset circuit breaker or replace fuses with proper size and type. Verify total load on system and proper fuse / circuit breaker sizing.
	X	X	Low supply voltage	Voltmeter shows abnormally low voltage at heat pump disconnect switch (below 95% of serial plate voltage).	Call power company.
Compressor not operating	X	X	Aquastat wiring	Verify wiring at unit and signals at unit.	Repair wiring, if needed.
	X	X	Transformer	Check primary and secondary transformer voltages.	If no primary, verify wiring. If no, or low secondary, check transformer wiring. If wiring ok, replace transformer.
				Check transformer secondary voltage circuit breaker.	Reset breaker if tripped.
	X	X	Power wiring defect	Check for loose or broken wires at compressor, contactor and capacitor.	Repair wiring, if needed.
	X	X	Locked out on safety controls	Check for fault.	Address lockout and cycle power to unit to reset controller.
	X	X	Defective compressor overload	Ensure that compressor is cool and overload has had sufficient time to reset. Ohmmeter shows a resistance across R & S terminals and OPEN or infinite resistance between C & R or C & S terminals.	If windings are open or overload is faulty, replace compressor.
	X	X	Compressor motor burn out or open windings	Ohmmeter shows no resistance or OPEN between common and run terminals. <b>*NOTE: Make sure the compressor is rested.</b>	Troubleshoot cause and replace motor.
	X	X	Defective compressor contactor	Voltage on line side and contactor pulled in, but no voltage on one or both terminals on the load side.	Points damaged. Replace contactor.
				Voltage on line side, 24VAC across contactor coil and no voltage on load side.	Bad coil, replace contactor.
	X	X	Loss of compressor run signal	Voltage on line side of contactor verified and contactor won't pull in. No 24VAC on compressor contactor coil when 24VAC is present at controller and controller fuse is intact.	Replace controller.
X	X	Defective run capacitor	Measure resistance across capacitor terminals. If shorts exist, capacitor is defective.	Replace, if faulty.	
Unit "short cycles"	X	X	Unit is oversized	Verify load calculations and unit selection.	
	X	X	Defective compressor overloads	Ensure that compressor is cool and overload has had sufficient time to reset. Ohmmeter shows a resistance across R & S terminals and OPEN or infinite resistance between C & R or C & S terminals.	If windings are open or overload is faulty, replace compressor.
	X	X	Wiring and controls	Examine all wiring points.	Tighten all wiring points.

# TROUBLESHOOTING

**Table 21.1 - Troubleshooting**

Fault	Mode		Possible Cause	Verify	Action
	Htg	Clg			
Low pressure cutout	X		Reduced water flow	Check flow center operation.	Troubleshoot flow center.
				Manually open water valve and measure water flow.	Adjust to proper flow rate.
				Plugged water strainer or filter.	Replace or clean, if dirty.
	X		Scaled or plugged coaxial coil	Check temperature drop across coaxial coil.	Clean, if necessary.
	X		Water supply too cold	Verify GEO IN with temperature probe.	Verify loop sizing; verify that all air has been purged from ground heat exchanger; bring water temperature within design parameters.
		X	Entering water too cold	Measure return water temperature, should be above 50°F.	Bring return water temperature within design parameters.
		X	Reduced water flow	Verify hydronic pump operation.	Troubleshoot pump.
				Manually open water valve and measure water flow.	Adjust to proper flow rate.
				Plugged water strainer or filter.	Replace or clean, if dirty.
	X	X	Low refrigerant charge	Check for refrigerant leaks.	If leaks found, evacuate, repair and recharge to factory recommended charge.
X		Plugged bi-flow filter / drier	Verify that low pressure cut-out occurs in heating mode and not in cooling mode.	Replace filter if necessary.	
X	X	Restricted TXV	Verify superheat and subcooling values.	Replace, if necessary.	
X	X	Defective low pressure switch	Monitor suction pressure while operating, verify low pressure cut-out pressure (25 +/- 5 psig).	Replace, if defective.	
High pressure cutout		X	Reduced water flow	Check flow center operation.	Troubleshoot flow center.
				Manually open water valve and measure water flow.	Adjust to proper flow rate.
				Plugged water strainer or filter.	Clean or replace.
		X	Water supply too hot	Verify GEO IN with temperature probe.	Verify loop sizing; bring water temperature within design parameters.
		X	Scaled or plugged coaxial coil	Check temperature drop across coaxial coil.	Clean, if necessary.
	X		Reduced water low	Verify hydronic pump operation.	Troubleshoot pump operation.
				Manually open water valve and measure water flow.	Adjust to proper flow rate.
				Plugged water strainer or filter.	Replace or clean, if dirty.
	X		Water temperature out of range	Measure return water temperature, should be below 90°F.	Bring return water temperature within design parameters.
	X	X	Defective high pressure switch	Monitor discharge pressure while operating, verify high pressure cut-out pressure (600 +/- 25 psig).	Replace, if defective.
X	X	Overcharged with refrigerant	Verify superheat and subcooling values.	Evacuate and recharge to factory recommended charge.	
X	X	Restricted TXV	Verify superheat and subcooling values.	Replace, if necessary.	
X	X	Non-condensables in system	Verify superheat and subcooling values.	Evacuate and recharge to factory recommended charge.	

# TROUBLESHOOTING

Table 22.1 - Troubleshooting

Fault	Mode		Possible Cause	Verify	Action
	Htg	Clg			
Unit will not operate in cooling mode		X	Loss of control signal	In cooling mode, verify 24VAC at RV coil and at REV terminals.	If 24VAC exists, troubleshoot RV and coil. If no control signal, troubleshoot aquastat signals.
		X	Defective reversing valve	Verify operation of reversing valve and solenoid coil.	Replace, if defective. When it is necessary to replace the reversing valve, wrap it with a wet cloth and direct the heat away. Excessive heat can damage the valve.
		X	Aquastat setup / wiring	Verify aquastat setup and wiring.	Repair wiring, if needed.
		X	Aquastat operation	Verify proper aquastat signals to unit.	Replace, if necessary.
		X	No water flow, high pressure cutout	Check flow with flow meter.	Check pump operation.
Insufficient cooling or heating	X	X	Unit undersized	Verify load calculations and unit selection.	If excessive, it may possible to rectify with shading and insulation.
		X	Defective reversing valve	Verify operation of reversing valve and solenoid coil. Defective reversing valve creating bypass of refrigerant from discharge to suction side of compressor.	Replace, if defective. When it is necessary to replace the reversing valve, wrap it with a wet cloth and direct the heat away. Excessive heat can damage the valve.
	X	X	Reduced water flow	Verify hydronic pump operation.	Troubleshoot pump operation.
				Manually open water valve and measure water flow.	Replace or clean if dirty.
				Plugged water strainer or filter.	Replace or clean, if dirty.
	X	X	Ambient losses	Check for losses / gains due to ambient air infiltration through doors and windows.	Address issue.
	X	X	Low refrigerant charge	Check superheat and subcooling values. Check for refrigerant leaks.	If leaks found, evacuate, repair and recharge to factory recommended charge.
	X	X	Scaled or plugged coaxial coil	Check temperature drop across coaxial coil.	Clean, if necessary.
	X	X	Reduced water flow	Check flow center operation.	Troubleshoot flow center.
				Manually open water valve and measure water flow.	Adjust to proper flow rate.
				Plugged water strainer or filter.	Replace or clean, if dirty.
		X	Water supply too hot	Verify GEO IN with temperature probe.	Verify loop sizing; bring water temperature within design parameters.
	X		Water supply too cold	Verify GEO IN with temperature probe.	Verify loop sizing; bring water temperature within design parameters.
	X	X	Restricted TXV	Verify superheat and subcooling values.	Replace, if necessary.
X	X	Compressor	Troubleshoot compressor operation.	If discharge pressure is too low and suction pressure too high, compressor is not pumping properly. Replace compressor.	
X	X	Non-condensables in system	Verify superheat and subcooling values.	Evacuate and recharge to factory recommended charge.	
Noisy unit	X	X	Compressor	Make sure the compressor is not in direct contact with the base or sides of the cabinet. Cold surroundings can cause liquid slugging, increase ambient temperature.	
	X	X		Remove compressor mounting bolts.	
	X	X	Rattles and vibrates	Check for loose screws, panels, or internal components. Tighten and secure. Piping could be hitting the metal surfaces. Add insulation between the contact.	
	X	X	Pump cavitation	Purge air from closed loop system.	

# START UP / TROUBLESHOOTING FORM

Customer Name \_\_\_\_\_

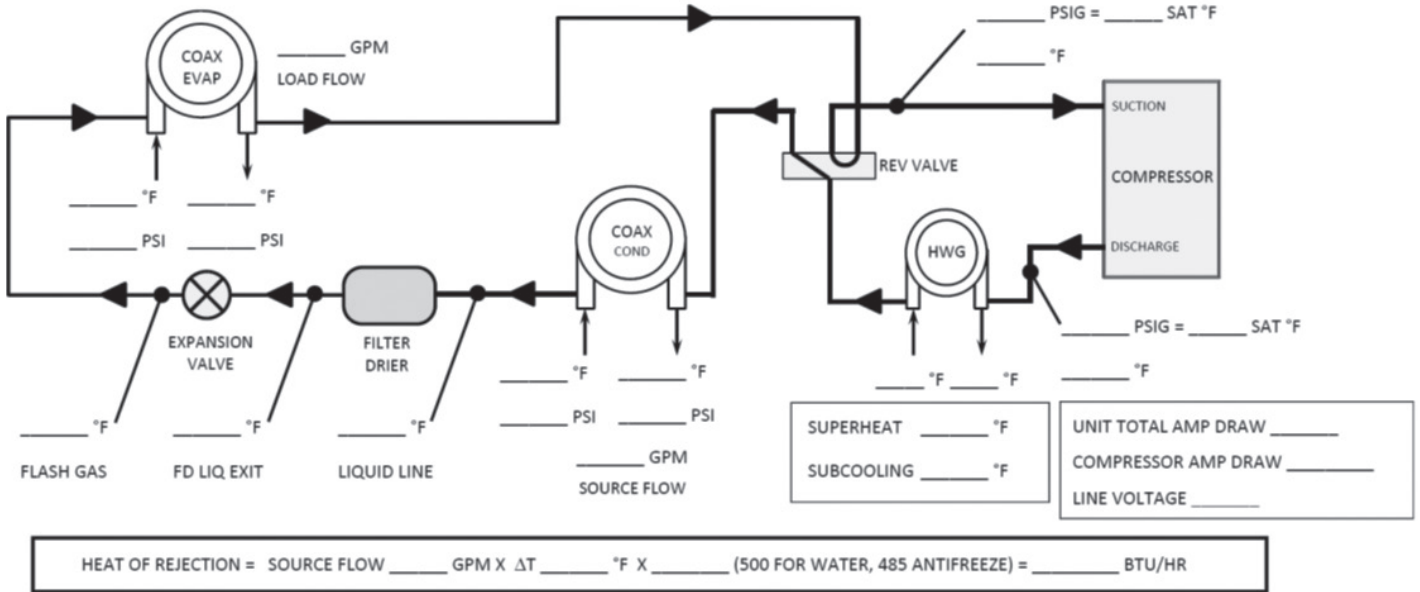
Date \_\_\_\_\_

Address \_\_\_\_\_ Loop Type \_\_\_\_\_

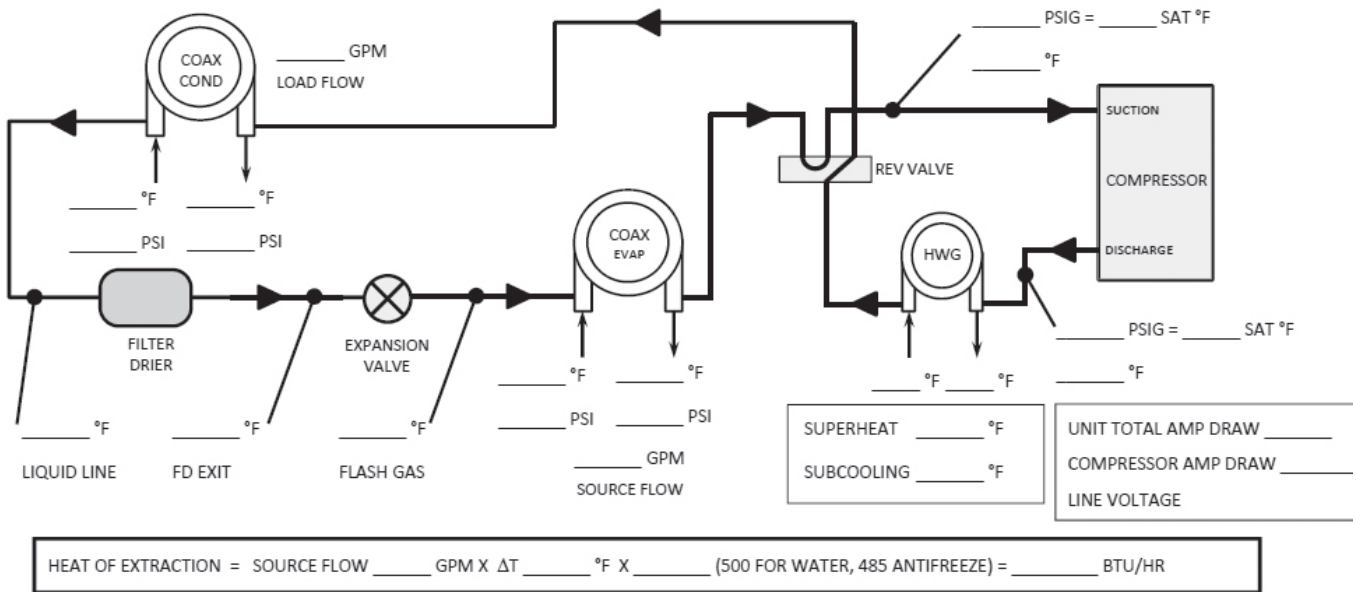
Model # \_\_\_\_\_ Serial # \_\_\_\_\_ Antifreeze \_\_\_\_\_

\_\_\_ Startup \_\_\_ Troubleshooting, Complaint \_\_\_\_\_

## COOLING CYCLE ANALYSIS



## HEATING CYCLE ANALYSIS



**Note:** In order to maintain optimal performance, DO NOT hook up pressure gauges during start up procedures. When troubleshooting, conduct water side analysis first. If water side performance is poor, use of pressure gauge and refrigerant side analysis may be required.

### Technician Notes

# COMMERCIAL WARRANTY (For Residential Warranty, see GEO16-510)

Seller warrants its products to be free from defects in material and workmanship, EXCLUSIVE, HOWEVER, of failures attributable to the use of materials substituted under emergency conditions for materials normally employed. This warranty covers replacement of any parts furnished from the factory of Seller, but does not cover labor of any kind and materials not furnished by Seller, or any charges for any such labor or materials, whether such labor, materials or charges thereon are due to replacement of parts, adjustments, repairs, or any other work done. This warranty does not apply to any equipment which shall have been repaired or altered outside the factory of Seller in any way so as, in the judgment of Seller, to affect its stability, nor which has been subjected to misuse, negligence, or operating conditions in excess of those for which such equipment was designed. This warranty does not cover the effects of physical or chemical properties of water or steam or other liquids or gases used in the equipment.

BUYER AGREES THAT SELLER'S WARRANTY OF ITS PRODUCTS TO BE FREE FROM DEFECT IN MATERIAL AND WORKMANSHIP, AS LIMITED HEREIN, SHALL BE IN LIEU OF AND EXCLUSIVE OF ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, WHETHER ARISING FROM LAW, COURSE OF DEALING, USAGE OF TRADE, OR OTHERWISE, **THERE ARE NO OTHER WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE, WHICH EXTEND BEYOND THE PRODUCT DESCRIPTION CONFIRMED BY BUYER AND SELLER AS OF THE DATE OF FINAL AGREEMENT.**

This warranty is void if the input to the product exceeds the rated input as indicated on the product serial plate by more than 5% on gas-fired and oil-fired units, or if the product in the judgment of SELLER has been installed in a corrosive atmosphere, or subjected to corrosive fluids or gases, been subjected to misuse, negligence, accident, excessive thermal shock, excessive humidity, physical damage, impact, abrasion, unauthorized alterations, or operation contrary to SELLER'S printed instructions, or if the serial number has been altered, defaced or removed.

BUYER AGREES THAT IN NO EVENT WILL SELLER BE LIABLE FOR COSTS OF PROCESSING, LOST PROFITS, INJURY TO GOODWILL, OR ANY OTHER CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY KIND RESULTING FROM THE ORDER OR USE OF ITS PRODUCT, WHETHER ARISING FROM BREACH OF WARRANTY, NONCONFORMITY TO ORDERED SPECIFICATIONS, DELAY IN DELIVERY, OR ANY LOSS SUSTAINED BY THE BUYER.

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY COMPONENT WHICH SHALL, WITHIN THE APPLICABLE WARRANTY PERIOD DEFINED HEREIN AND UPON PRIOR WRITTEN APPROVAL, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER. FOR GAS-FIRED PRODUCTS INSTALLED IN HIGH HUMIDITY APPLICATIONS AND UTILIZING STAINLESS STEEL HEAT EXCHANGERS, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO TEN YEARS FROM DATE OF SHIPMENT FROM SELLER.

These warranties are issued only to the original owner-user and cannot be transferred or assigned. No provision is made in these warranties for any labor allowance or field labor participation. Seller will not honor any expenses incurred in its behalf with regard to repairs to any of Seller's products. No credit shall be issued for any defective part returned without proper written authorization (including, but not limited to, model number, serial number, date of failure, etc.) and freight prepaid.

### OPTIONAL SUPPLEMENTAL WARRANTY

Provided a supplemental warranty has been purchased, Seller extends the warranty herein for an additional four (4) years on certain compressors. Provided a supplemental warranty has been purchased, Seller extends the warranty herein for an additional four (4) years or nine (9) years on certain heat exchangers.

### EXCLUSION OF CONSUMABLES & CONDITIONS BEYOND SELLER'S CONTROL

This warranty shall not be applicable to any of the following items: refrigerant gas, belts, filters, fuses and other items consumed or worn out by normal wear and tear or conditions beyond Seller's control, including (without limitation as to generality) polluted or contaminated or foreign matter contained in the air or water utilized for heat exchanger (condenser) cooling or if the failure of the part is caused by improper air or water supply, or improper or incorrect sizing of power supply.

<b>Component</b> Applicable Models	<b>"APPLICABLE WARRANTY PERIOD"</b>
<b>Heat Exchangers</b> Gas-Fired Units	TEN YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN ONE HUNDRED TWENTY-SIX MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST
<b>Heat Exchangers</b> Low Intensity Infrared Units  <b>Compressors</b> Condensing Units for Cassettes	FIVE YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN SIXTY-SIX MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST
<b>Burners</b> Low Intensity Infrared Units  <b>Other</b> Components excluding Heat Exchangers, Coils, Condensers, Burners, Sheet Metal	TWO YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TWO YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN THIRTY MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST
<b>Heat Exchangers/Coils</b> Indoor and Outdoor Duct Furnaces and System Units, Steam/Hot Water Units, Oil-Fired Units, Electric Units, Cassettes, Vertical Unit Ventilators, Geothermal Units  <b>Compressors</b> Vertical Unit Ventilators, Geothermal Units  <b>Burners</b> High Intensity Infrared Units  <b>Sheet Metal Parts</b> All Products	ONE YEAR FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN ONE YEAR FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN EIGHTEEN MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST

As Modine Manufacturing Company has a continuous product improvement program, it reserves the right to change design and specifications without notice.



**Modine Manufacturing Company**  
 1500 DeKoven Avenue  
 Racine, WI 53403  
 Phone: 1.877.679.4436 (4GEO)  
 www.modinevac.com