MODINE

GEO16-500.3
5H0835710000

August, 2015

INSTALLATION AND SERVICE MANUAL
forced air ground source heat pumps
models GF and EF

C ETL LISTED US
Intertek

ENERGY STAR

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.

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. GF/EF 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.

⚠ 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.

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).

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 use these units to heat or cool the building during construction. Mechanical components can quickly become clogged with debris. System damage may result.
3. Do not overcharge the refrigeration system. This can lead to elevated compressor discharge pressure and possibly flooding the compressor with liquid.
4. 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 26.1-28.1, refer to the applicable sections of the manual.

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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)
GF - Residential Forced Air Unit
EF - Commercial Forced Air Unit

3 - Unit Configuration (UC)
V - Vertical
H - Horizontal

4,5,6 - Nominal Cooling Capacity (MBH)
018 - 18,000 Btu/hr
024 - 24,000 Btu/hr
036 - 36,000 Btu/hr
048 - 48,000 Btu/hr
060 - 60,000 Btu/hr
066 - 66,000 Btu/hr

7 - Development Sequence Designation (DS)
C - Current

8 - Compressor Configuration (CC)
1 - Single Stage
2 - Two Stage
3 - Single Stage with Soft Start
4 - Two 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)
R - Round Tube Plate Fin (RTPF) R-410A

13 - Geo (Source) Coaxial Coil Material (GM)
C - Copper
N - Cupronickel

14 - Hydronic (Load) Coaxial Coil Material (HM)
X - None

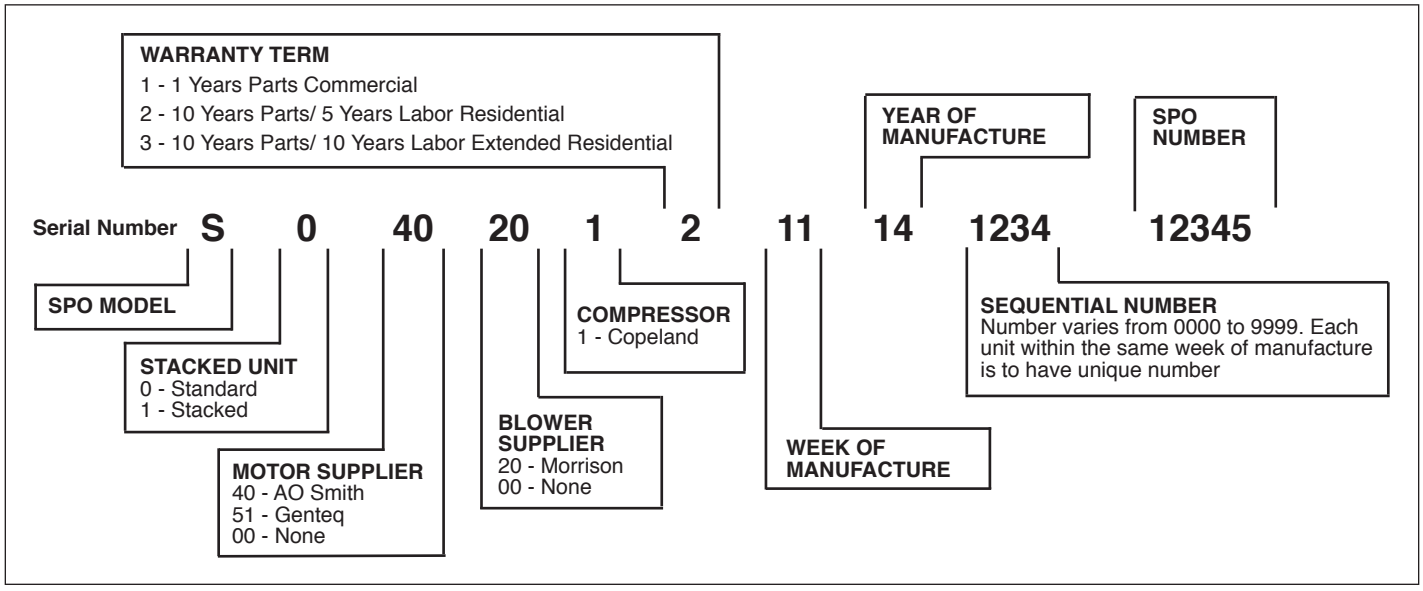
15 - Hot Water Generator or Desuperheater (HWG)
0 - None
1 - HWG with Factory Installed Pump

16 - Motor Type (MT)
E - ECM

17 - Supply Air Configuration (SA)
T - Top
B - Bottom
S - Side
E - End

18 - Return Air Configuration (RA)
L - Left
R - Right

Figure 3.2 - Serial Number Designations



UNIT DIMENSIONS

Figure 4.1 - Dimensional Drawings - Vertical Top Discharge

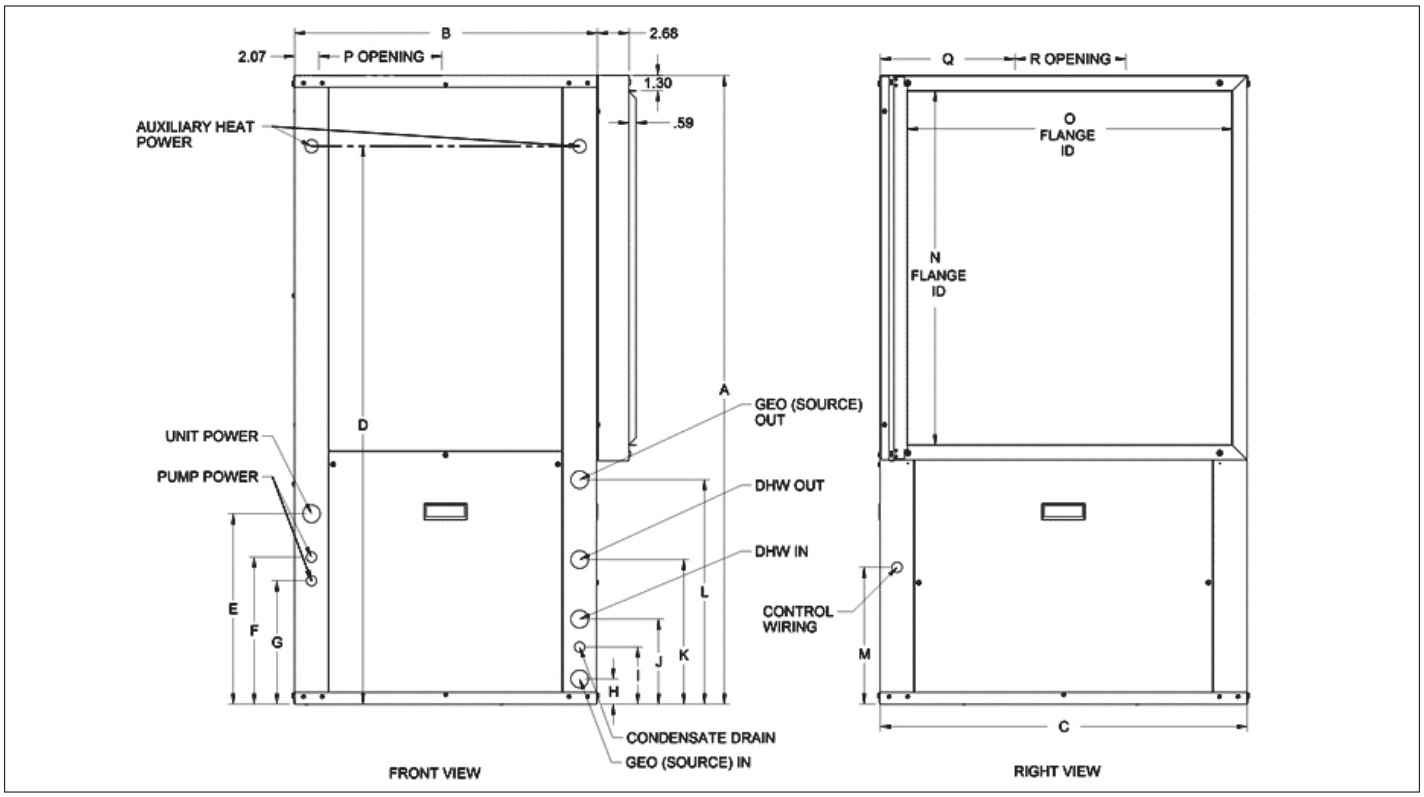


Table 4.1 - Dimensions (inches) - Vertical Top Discharge

Models	018	024	036	048	060	066
A	48.50	48.50	53.20	54.61	61.14	61.14
B	25.65	25.65	25.65	25.65	25.65	25.65
C	27.79	27.79	31.14	32.62	32.62	32.62
D	42.60	42.60	47.20	48.66	55.21	55.21
E	16.09	16.09	16.11	14.52	12.27	12.27
F	13.73	13.73	12.43	11.90	14.66	14.66
G	11.76	11.76	10.43	9.40	12.16	12.16
H	2.12	2.12	2.14	2.14	2.14	2.14
I	4.87	4.87	4.82	4.63	7.27	7.27
J	7.24	7.24	7.19	7.15	9.96	9.96
K	11.12	11.12	12.23	14.23	14.35	14.35
L	17.08	17.08	18.99	17.49	20.25	20.25
M	4.87	4.87	11.59	11.67	16.00	16.00
N	27.54	27.54	29.92	31.83	35.57	35.57
O	24.63	24.63	27.43	29.39	29.39	29.39
P	10.39	10.39	10.39	13.82	13.82	13.82
Q	9.21	9.21	10.89	9.69	9.69	9.69
R	9.37	9.37	9.37	13.24	13.24	13.24
Filter Size	27.0x29.5x2.0	27.0x29.5x2.0	27.0x29.5x2.0	27.0x29.5x2.0	31.5x33.8x2.0	27.0x29.5x2.0
Approx. Shipping Weight (lbs.)	324	329	388	465	544	546
Coil Connection Size (Female Swivel)	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT

NOTE: Right Return shown, Left Return is mirror image.

UNIT DIMENSIONS

Figure 5.1 - Dimensional Drawings - Vertical Bottom Discharge

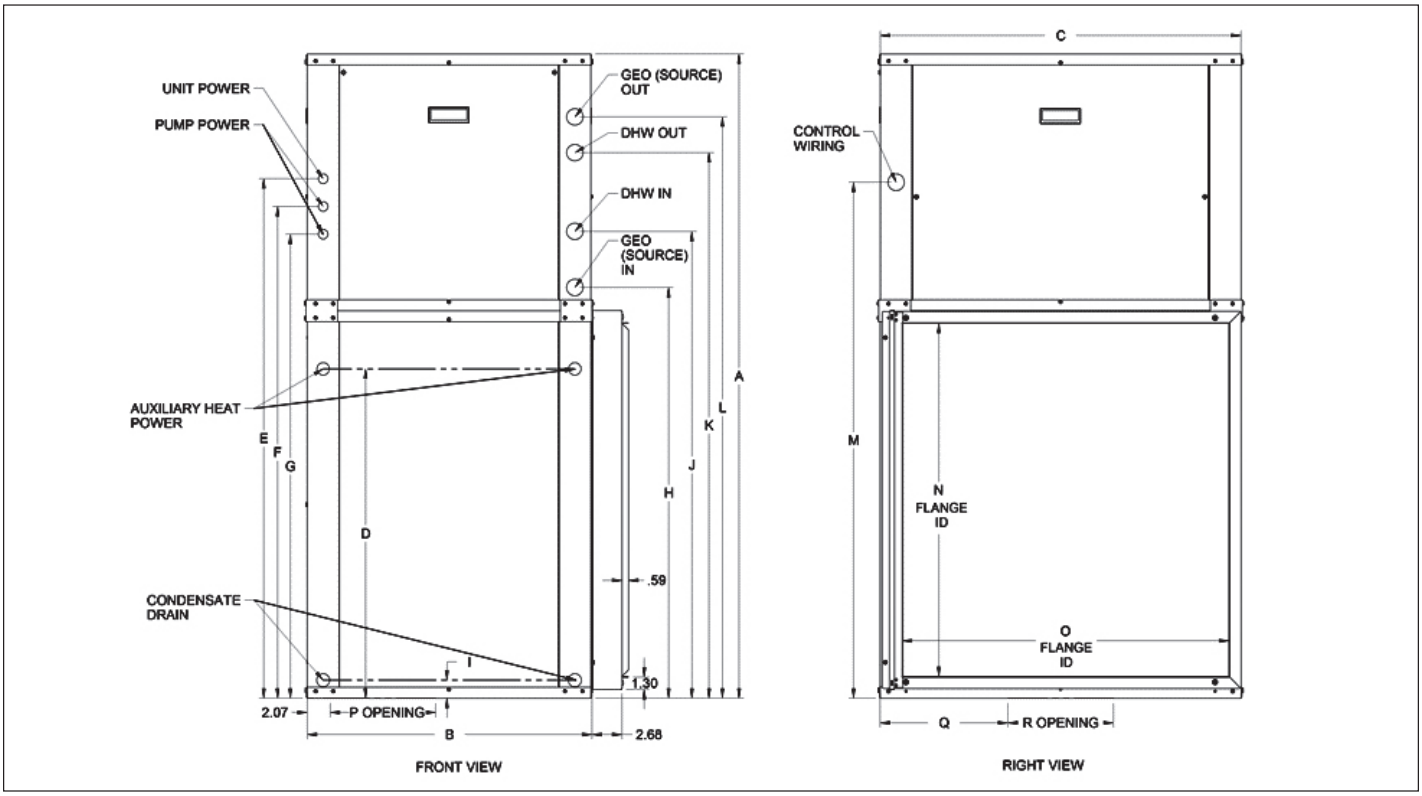


Table 5.1 - Dimensions (inches) - Vertical Bottom Discharge

Models	018	024	036	048	060	066
A	53.89	53.89	56.04	58.04	62.04	62.04
B	25.65	25.65	25.65	25.65	25.65	25.65
C	27.79	27.79	31.14	32.62	32.62	32.62
D	25.66	25.66	27.66	29.67	33.67	33.67
E	47.40	47.40	48.34	49.43	55.98	55.98
F	45.04	45.04	45.72	46.80	53.17	53.17
G	43.07	43.07	43.22	44.30	50.67	50.67
H	32.88	32.88	34.87	37.01	40.87	40.87
I	1.62	1.62	1.62	1.62	1.71	1.71
J	37.99	37.99	40.05	42.05	46.05	46.05
K	41.88	41.88	47.14	49.15	53.15	53.15
L	47.84	47.84	51.49	52.37	60.12	60.12
M	42.32	42.32	44.47	46.48	50.48	50.48
N	27.54	27.54	29.92	31.83	35.57	35.57
O	24.63	24.63	27.43	29.39	29.39	29.39
P	10.39	10.39	10.39	13.82	13.82	13.82
Q	9.21	9.21	10.89	9.69	9.69	9.69
R	9.37	9.37	9.37	13.27	13.24	13.24
Filter Size	27.0x29.5x2.0	27.0x29.5x2.0	30.0x32.0x2.0	31.5x33.8x2.0	31.5x33.8x2.0	31.5x33.8x2.0
Approx. Shipping Weight (lbs.)	324	329	388	465	544	546
Coil Connection Size (Female Swivel)	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT

NOTE: Right Return shown, Left Return is mirror image.

UNIT DIMENSIONS

Figure 6.1 - Dimensional Drawings - Horizontal End Discharge

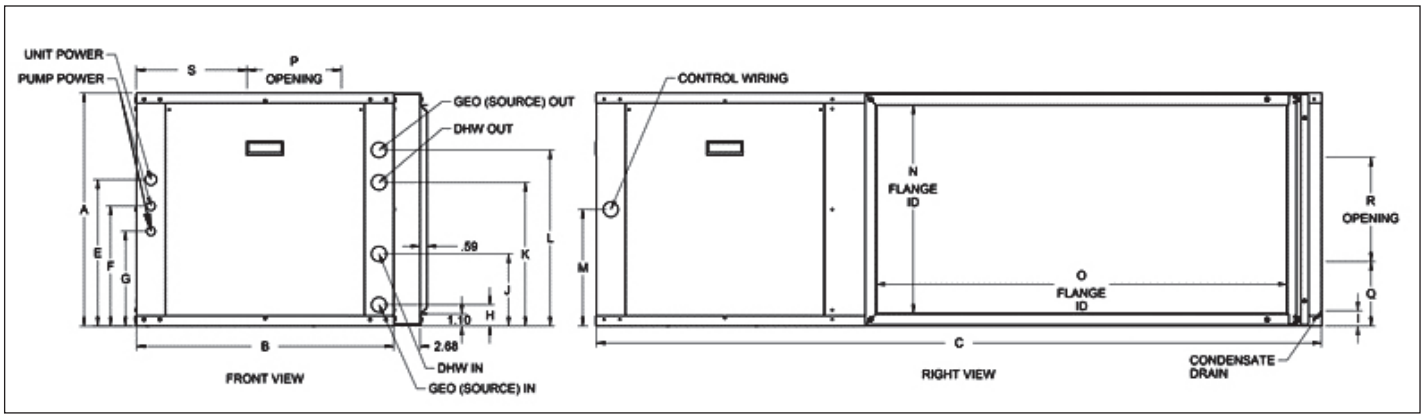


Table 6.1 - Dimensions (inches) - Horizontal End Discharge

Models	018	024	036	048	060	066
A	23.13	23.13	23.13	23.13	23.13	23.13
B	25.65	25.65	25.65	25.65	25.65	25.65
C	61.80	61.80	67.50	72.11	79.91	79.91
D	NA	NA	NA	NA	NA	NA
E	17.08	17.08	15.45	14.52	17.08	17.08
F	14.26	14.26	12.82	11.90	14.26	14.26
G	11.76	11.76	10.32	9.40	11.76	11.76
H	1.97	1.97	1.97	2.10	1.97	1.97
I	1.46	1.46	1.46	1.46	1.46	1.46
J	7.15	7.15	7.15	7.15	7.15	7.15
K	14.24	14.24	14.24	14.24	14.24	14.24
L	21.21	21.21	18.59	17.46	21.21	21.21
M	11.57	11.57	11.57	11.57	11.57	11.57
N	20.65	20.65	20.65	20.65	20.65	20.65
O	30.42	30.42	36.12	40.73	45.53	45.53
P	9.38	9.38	9.38	13.24	13.24	13.24
Q	6.39	6.39	6.39	4.28	4.28	4.28
R	10.36	10.36	10.36	13.82	13.82	13.82
S	11.02	11.02	11.02	7.16	7.16	7.16
Filter Size	22.5x32.5x2.0	22.5x32.5x2.0	22.5x38.5x2.0	22.5x42.5x2.0	22.5x48.0x2.0	22.5x48.0x2.0
Approx. Shipping Weight (lbs.)	324	329	388	465	544	546
Coil Connection Size (Female Swivel)	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT

NOTE: Right Return shown, Left Return is mirror image.

UNIT DIMENSIONS

Figure 7.1 - Dimensional Drawings - Horizontal Side Discharge

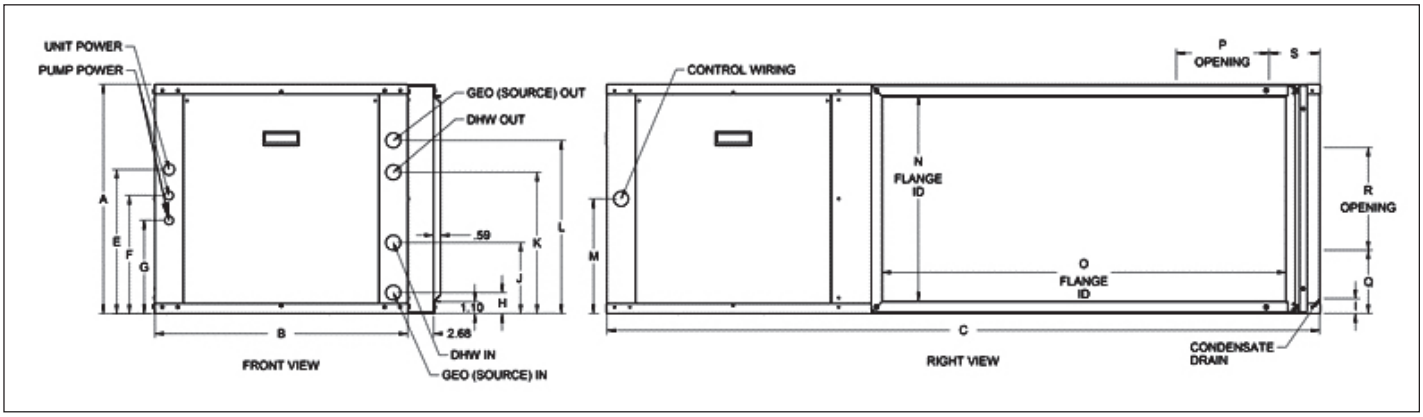


Table 7.1 - Dimensions (inches) - Horizontal Side Discharge

Models	018	024	036	048	060	066
A	23.13	23.13	23.13	23.13	23.13	23.13
B	25.65	25.65	25.65	25.65	25.65	25.65
C	61.80	61.80	67.50	72.11	76.91	76.91
D	NA	NA	NA	NA	NA	NA
E	17.08	17.08	15.45	14.52	17.08	17.08
F	14.26	14.26	12.82	11.90	14.26	14.26
G	11.76	11.76	10.32	9.40	11.76	11.76
H	1.97	1.97	1.97	2.10	1.97	1.97
I	1.46	1.46	1.46	1.46	1.46	1.46
J	7.15	7.15	7.15	7.15	7.15	7.15
K	14.24	14.24	14.24	14.24	14.24	14.24
L	21.21	21.21	18.59	17.46	21.21	21.21
M	11.57	11.57	11.57	11.57	11.57	11.57
N	20.65	20.65	20.65	20.65	20.65	20.65
O	30.42	30.42	36.12	40.73	45.53	45.53
P	9.38	9.38	9.38	13.24	13.24	13.24
Q	6.39	6.39	6.39	4.28	4.28	4.28
R	10.36	10.36	10.36	13.82	13.82	13.82
S	11.02	11.02	11.02	7.16	7.16	7.16
Filter Size	22.5x32.5x2.0	22.5x32.5x2.0	22.5x38.5x2.0	22.5x42.5x2.0	22.5x48.0x2.0	22.5x48.0x2.0
Approx. Shipping Weight (lbs.)	324	329	388	465	544	546
Coil Connection Size (Female Swivel)	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT

NOTE: Right Return shown, Left Return is mirror image.

UNIT LOCATION / INSTALLATION

Table 8.1 - SI (Metric) Conversion Factors

To Convert	Multiply By	To Obtain
"W.C.	0.24	kPa
psig	6.893	kPa
°F	(°F-32) x 0.555	°C
inches	25.4	mm
feet	0.305	meters
CFM	0.028	m^3/min

To Convert	Multiply By	To Obtain
CFH	1.699	m^3/min
Btu/ft^3	0.0374	mJ/m^3
pound	0.453	kg
Btu/hr	0.000293	kW/hr
gallons	3.785	liters
psig	27.7	"W.C.

UNIT LOCATION

⚠ DANGER

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 and fan blower compartments..
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

Vertical Unit Installation

Vertical units are available in top or bottom discharge with left or right hand return air configurations.

1. Top discharge units should be mounted on a vibration-absorbing pad slightly larger than the base of the unit. See Table 9.1 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 9.1 - Vibration Absorbing Pads - High Density Plastic

Pad Size	Part Number	Models
32" X 32"	5H0835220000	018-036
36" X 36"	5H0835230000	048-066

2. Bottom discharge units should be mounted level and sealed well to the floor to prevent air leakage. Bottom discharge units require the supply air opening to be cut at least 1/2" larger than the unit's air outlet. Protect the edges of combustible flooring with sheet metal or other non-combustible materials.
3. 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.
4. Provide adequate clearance for all access panels.
5. Provide easy access for air filter replacement, drain pan cleaning, fan and fan motor maintenance, and for servicing water valves, fittings, compressor and air coil.
6. Provide access to the controller and all electrical connections.
7. Do not block air filter access with piping, conduit or other materials.
8. Provide a clear physical path to the unit. Adequate space should be provided to allow removal of the unit, if necessary.

Horizontal Unit Field Discharge Air Conversion

Horizontal units can be field converted from a side to end supply (discharge) and vice-versa.

NOTE: Horizontal units can not be converted from left to right hand return or vice-versa.

NOTE: Unit conversion must take place on the ground and prior to hanging.

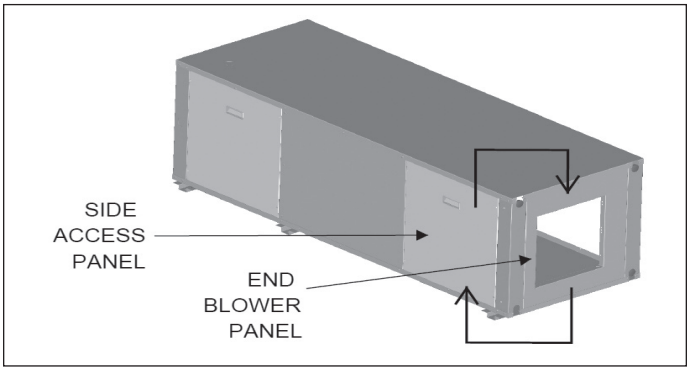
End to Side Supply Conversion (see Figure 9.1)

1. Remove side access panel.
2. Disconnect blower wiring.
3. Remove end blower panel fasteners.
4. Carefully install blower panel in side supply position.
5. Reconnect blower wiring.
6. Check blower wiring routing and connections for tension and contact with sheet metal edges. Reroute wiring as required.
7. Manually rotate the blower wheel to verify that the wheel is not obstructed.
8. Reinstall access panel.

Side to End Supply Conversion

The process is the same as above with the exception of the location of the blower and access panels. Note that the blower panel may need to be rotated 180° in order to prevent interference with condensate pan when installed in the end position.

Figure 9.1 - End to Side Discharge Conversion

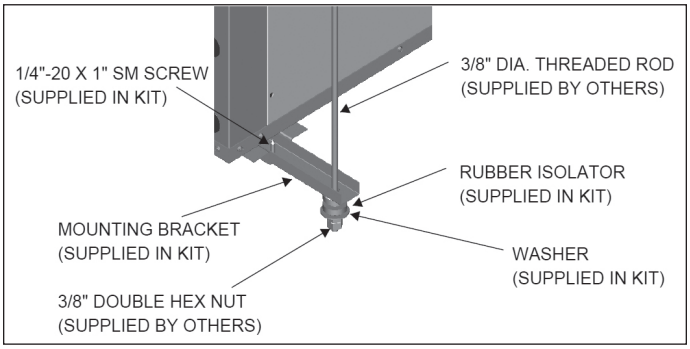


Horizontal Unit Installation

Horizontal units are available in side or end discharge with left or right hand return air configurations.

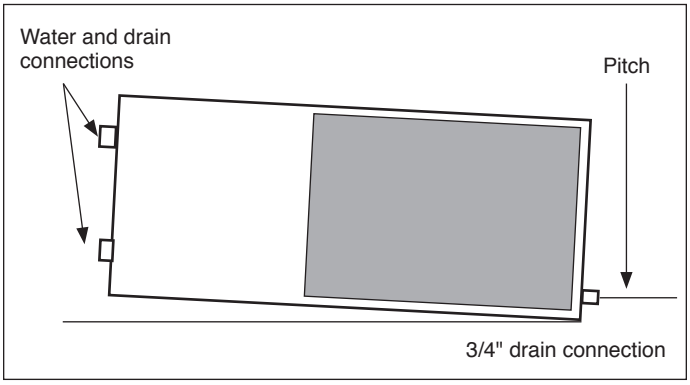
1. Horizontal units may be installed on any level surface that is capable of supporting the weight of the unit(s).
2. Horizontal units are typically installed above false ceilings and are normally suspended from a ceiling by 3/8" diameter thread rod (see Figure 9.2). Rods are usually attached to units by hanger brackets furnished with each unit. Accessory bracket kits to allow for horizontal suspension of units are available from Modine, model sizes 018-036 use part number 3H0388190001 and model sizes 042-066 use 3H0388190002.

Figure 9.2 - Horizontal Hanger Kit



3. Pitch the unit toward the drain connection as shown in Figure 9.3.

Figure 9.3 - Horizontal Pitch for Condensate Drain



4. Provide adequate clearance for all access panels.
5. Provide easy access for air filter replacement, drain pan cleaning, fan and fan motor maintenance, and for servicing hanger hardware, water valves, fittings, compressor and air coil.
6. Provide access to the controller and all electrical connections.
7. Do not block air filter access with piping, conduit or other materials.
8. If the unit is installed in a crawl space, the bottom of the unit must be at least 4" above grade to prevent flooding during heavy rainfalls.
9. Provide a clear physical path to the unit. Adequate space should be provided to allow removal of the unit, if necessary.
10. Some residential applications require the installation of horizontal units on an attic floor. In this case, the unit should be set in a full size secondary drain pan on top of a vibration absorbing pad. The secondary drain pan prevents possible condensate overflow or water leakage damage to the ceiling. The secondary drain pan is usually placed on top of plywood resting on the ceiling joists. The use of a secondary drain pan overflow switch is recommended. The switch should be tied into the overflow alarm switch circuit in the unit control panel. Terminals are provided in the control panel for easy tie in of secondary overflow switch. Refer to unit wiring diagram.

Ducting

IMPORTANT

In order to ensure efficient operation of system, the ductwork should be designed and installed per current industry guidelines and procedures.

1. A flexible connector is recommended for discharge and return air duct connections on metal duct systems to eliminate the transfer of vibration to the duct system.
2. Duct should be insulated with a minimum of 1" duct insulation. Uninsulated duct work in an unconditioned space is not recommended, as unit performance will be adversely affected.
3. If the unit is connected to existing duct work, check the duct system to ensure that it has the capacity to accommodate the air flow (cfm) required for the unit application. If the duct is too small, as in the replacement of heating only systems, larger duct work should be installed. All existing duct work should be checked for leaks and repaired if necessary.
4. The duct system should be sized to handle the design airflow quietly and efficiently. To maximize sound attenuation of the unit blower, the supply and return plenums should include an internal duct liner of fiberglass or constructed of ductboard for the first few feet.
5. When fitting the supply ducting to the unit, be sure to use screws that are no longer than ½".
6. Long radius return transitions are recommended.

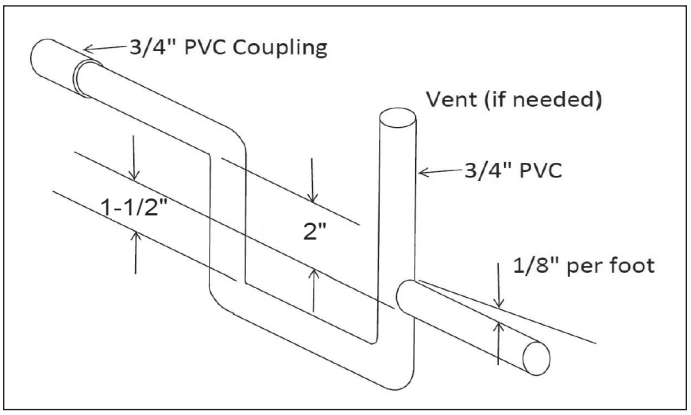
Condensate Piping - Vertical Top Discharge Units

1. On vertical top discharge units the condensate drain is internally trapped (external P trap is not required) and consists of a flexible drain tube connected to the pan and a 3/4" PVC female adapter. The female adapter exits the front of the unit and should be glued to the field-installed PVC condensate piping. The condensate pan is slightly tilted for proper drainage. Ensure level mounting of the system for proper drainage.
2. Each unit must be installed with its own individual vent (where necessary) and a means to flush or blow out the condensate drain line. Do not install units with a common trap and/or vent.
3. All connections must be made in accordance with local plumbing codes.

Condensate Piping - Vertical Bottom Discharge Units and Horizontal Units

1. On vertical bottom discharge and horizontal units, a stainless steel 3/4" FPT fitting is provided for condensate drain piping connection.
2. An external trap is required (see Figure 10.1). As a general rule, the minimum trap depth is 1-1/2".

Figure 10.1 - Bottom Discharge and Horizontal Condensate Piping



3. If a vent is necessary, an open pipe stand may be applied to a tee in the field-installed condensate piping.
4. Each unit must be installed with its own individual trap and connection to the condensate line or riser. Provide a means to flush or blow out the condensate line. DO NOT install units with a common trap and/or vent.
5. Always vent the condensate line when dirt or air can collect in the line or a long horizontal drain line is required. Also vent when large units are working against higher external static pressure than other units connected to the same condensate main, since this may cause poor drainage for all units on the line. When a vent is installed in the drain line, it must be located after the trap in the direction of the condensate flow.
6. All connections must be made in accordance with local plumbing codes.

INSTALLATION

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 11.1 (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.

Air Coil

To ensure maximum performance, it is recommended that the air coil be cleaned before startup. A solution of 10% dishwasher detergent and water is recommended. Spray both sides of the coil followed by a thorough clean water rinse.

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.

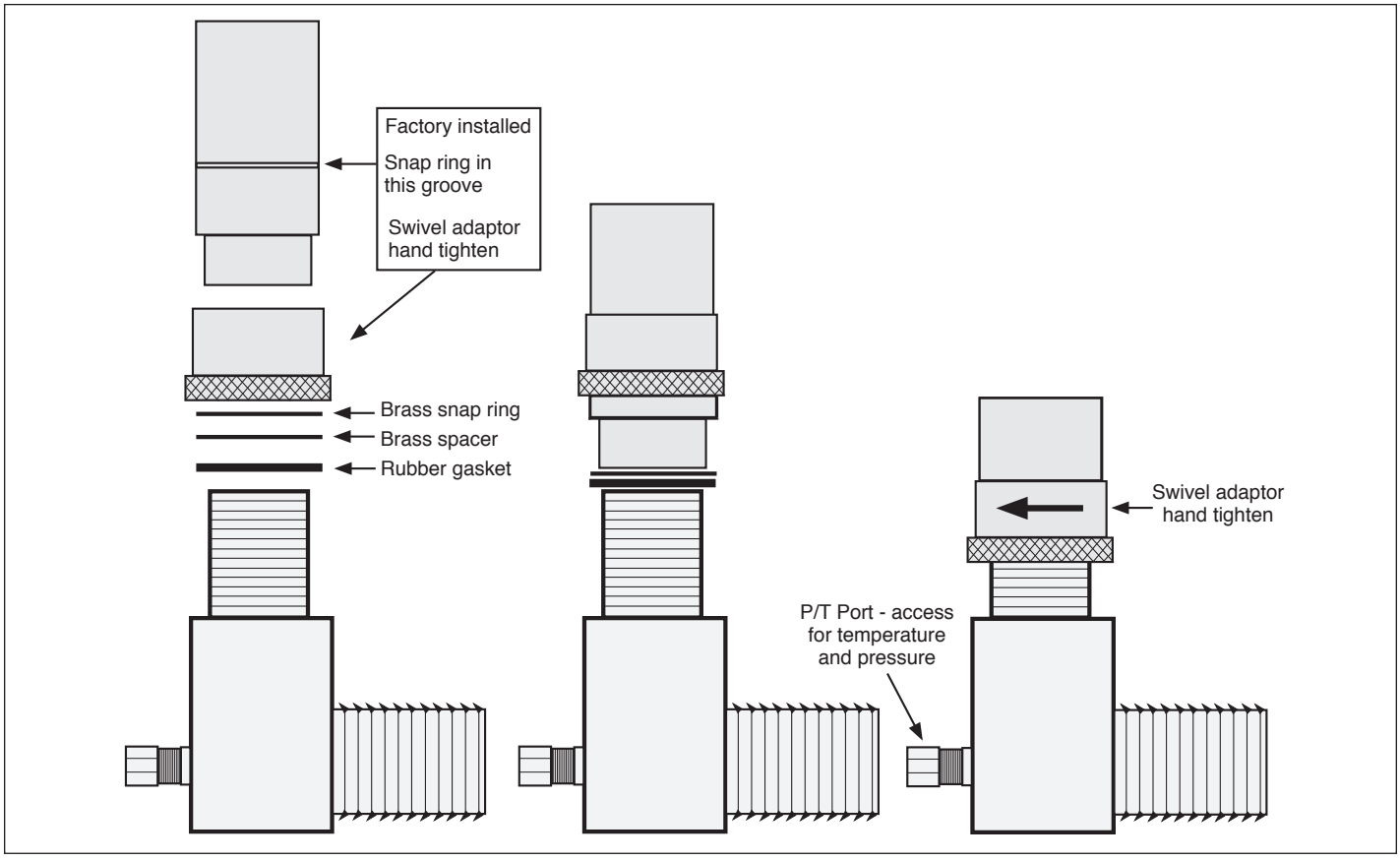
IMPORTANT

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. Control of the DHW pump is via electro-mechanical temperature switches. The pump is energized whenever the unit is running a conditioning cycle, the DWH supply temperature (water leaving the desuperheater coil) is < = 120°F and the compressor discharge temperature is > = 100°F.

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 a safety feature 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.

Figure 11.1 - Water Connection Breakdown

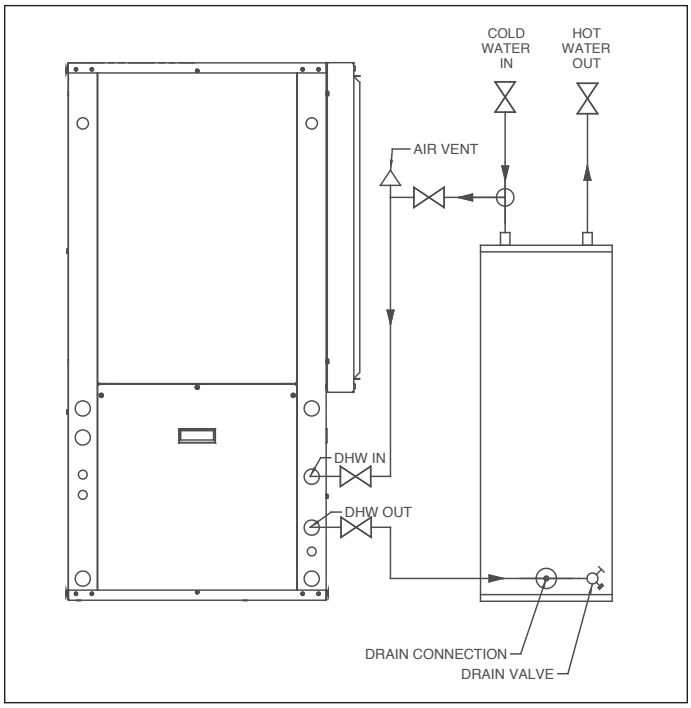


INSTALLATION

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.

Figure 12.1 - Typical DHW Piping Diagram with One Tank



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 12.1 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.
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.

Figure 12.2 - Typical DHW Piping Diagram with Two Tanks

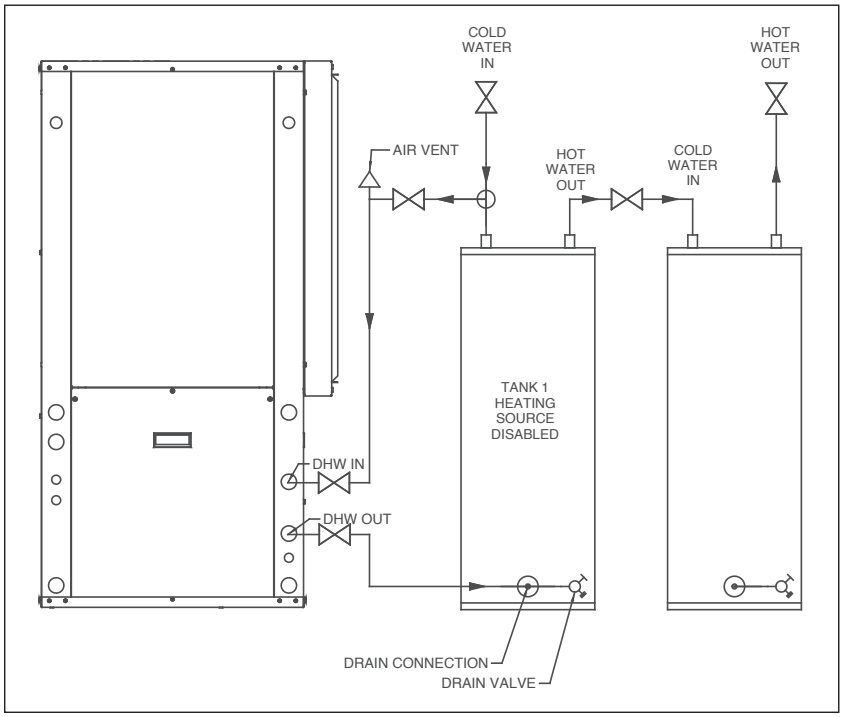


Table 12.1 - DHW Pipe Sizes

Maximum pipe length (one way) to achieve optimum flow			
Models	**DHW Flow (gpm)**	**1/2" Copper**	**3/4" Copper**
018	0.6	50	-
024	0.8	50	-
036	1.2	50	-
048	1.6	45	50
060	2.0	25	50
066	2.4	10	50

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 Tables 15.1 - 16.1 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 13.1).
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 13.1 - 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

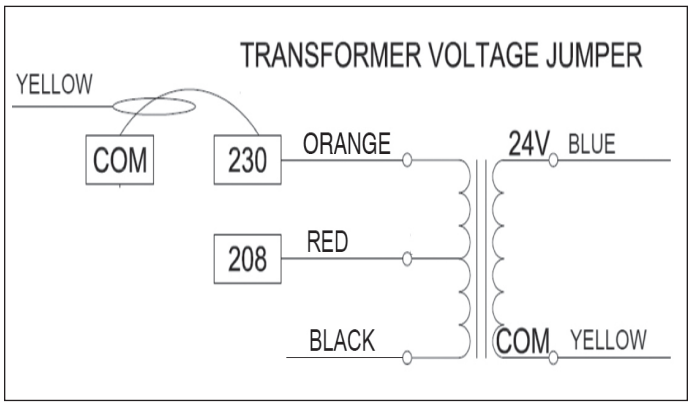
The domestic hot water pump is not wired in the factory to prevent pump burnout in case the unit is powered before the domestic hot water tank is plumbed or full of water. Refer to the control manual and wiring diagram for instructions on enabling the pump.

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 14.1). Refer to the wiring diagram provided with the unit for details.

INSTALLATION

Figure 14.1 - 208-230V Transformer Wiring



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.

Thermostat Wiring

The thermostat wires must be connected to the appropriate terminal blocks in the electrical box. Refer to the the unit wiring diagram or control manual for details.

Thermostat Installation

The thermostat should be located on an interior wall in a larger room approximately 54" off the floor and away from supply duct drafts. DO NOT locate the thermostat in areas subject to sunlight, drafts or on external walls.

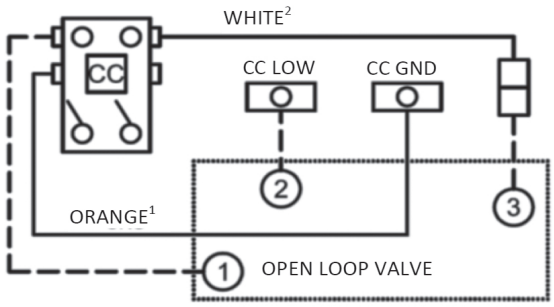
Auxiliary Heat Wiring

Refer to the auxiliary heat installation manual, provided with auxiliary heat assembly, and the wiring diagram for details. The auxiliary heat assembly is mounted internally on vertical units and externally on horizontal units. The auxiliary heat assembly is powered separately from the unit.

Open Loop Control Valve Wiring

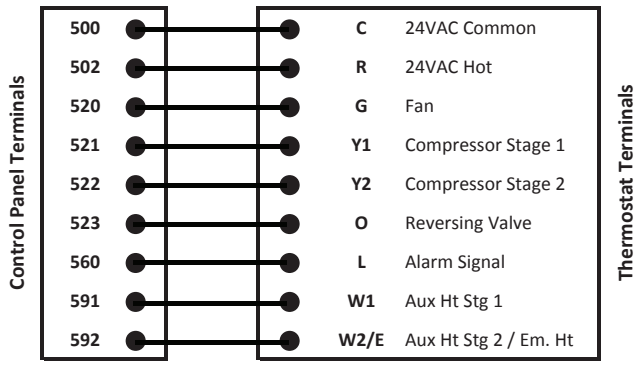
Always maintain water pressure in the heat exchanger by placing water control valves at the outlet of the unit to prevent mineral precipitation during the off cycle. Pilot operated slow closing valves are recommended to reduce water hammer. If water hammer persists, an expansion tank can be mounted on the piping to help absorb the excess hammer shock. Slow closing valve must have an end switch that enables/disables the compressor. See Figure 14.2 for proper wiring.

Figure 14.2 - Optional Open Loop Valve Wiring



1. Existing wire, do not remove
2. Remove WHITE wire from “CC LOW” terminal on printed circuit board and splice to terminal 3 on valve.
3. Wire “CC LOW” terminal to terminal 2 on valve
4. Wire Contactor to terminal 1 on valve

Figure 14.3 - Thermostat Terminals



ELECTRICAL SPECIFICATIONS

Table 15.1 - Electrical Ratings

	Digits 9 & 10 Power Code	Rated Voltage	Voltage (min/max)	Digit 8 Compressor Code	Compressor		Fan		FLC Pump	Control FLA	DHW Pump	Total Unit		
					RLA	LRA	FLA	HP	FLA		FLA	FLA	MCA	MOP
018	02,03	208-230/60/1	197 / 253	1,3	10.0	48.0	4.2	1/2	1.8	0.5	0.4	16.9	19.4	25.0
024	02,03	208-230/60/1	197 / 253	1,3	14.3	58.3	4.2	1/2	1.8	0.5	0.4	21.2	24.8	35.0
				2,4	13.0	58.3	4.2	1/2	1.8	0.5	0.4	19.9	23.2	35.0
	04,05	208-230/60/3	197 / 253	1,3	8.5	57.0	4.2	1/2	1.8	0.5	0.4	15.4	17.5	25.0
				2,4	7.2	57.0	4.2	1/2	1.8	0.5	0.4	14.1	15.9	20.0
036	02,03	208-230/60/1	197 / 253	1,3	15.7	77.0	4.2	1/2	1.8	0.5	0.4	22.6	26.5	40.0
				2,4	17.0	83.0	4.2	1/2	1.8	0.5	0.4	23.9	28.2	45.0
	04,05	208-230/60/3	197 / 253	1,3	10.0	71.0	4.2	1/2	1.8	0.5	0.4	16.9	19.4	25.0
				2,4	12.9	73.0	4.2	1/2	1.8	0.5	0.4	19.8	23.0	35.0
048	02,03	208-230/60/1	197 / 253	1,3	22.1	109.0	4.2	1/2	3.6	0.5	0.4	30.8	36.3	50.0
				2,4	23.6	104.0	4.2	1/2	3.6	0.5	0.4	32.3	38.2	60.0
	04,05	208-230/60/3	197 / 253	1,3	14.6	83.1	4.2	1/2	3.6	0.5	0.4	23.3	27.0	40.0
				2,4	15.6	83.1	4.2	1/2	3.6	0.5	0.4	24.3	28.2	40.0
060	02,03	208-230/60/1	197 / 253	1,3	29.4	134.0	7.8	1	3.6	0.5	0.4	41.7	49.1	70.0
				2,4	30.2	152.9	7.8	1	3.6	0.5	0.4	42.5	50.1	80.0
	04,05	208-230/60/3	197 / 253	1,3	14.6	83.1	7.8	1	3.6	0.5	0.4	26.9	30.6	45.0
				2,4	18.1	110.0	7.8	1	3.6	0.5	0.4	30.4	34.9	50.0
066	02,03	208-230/60/1	197 / 253	1,3	31.6	178.0	7.8	1	3.6	0.5	0.4	43.9	51.8	80.0
				2,4	33.1	179.2	7.8	1	3.6	0.5	0.4	45.4	53.7	80.0
	04,05	208-230/60/3	197 / 253	1,3	17.8	110.0	7.8	1	3.6	0.5	0.4	30.1	34.6	50.0
				2,4	19.6	136.0	7.8	1	3.6	0.5	0.4	31.9	36.8	50.0

ELECTRICAL SPECIFICATIONS

Table 16.1 - Auxiliary Heater Ratings - Vertical

Part Number	Nominal Rating (kW)	Actual Rating (kW)		Circuits	Actual Rating (Btu/Hr)		Minimum Airflow (CFM)	Models					
		208V	240V		208V	240V		018	024	036	048	060	066
5H0835040000	5	3.6	4.8	1	12,300	16,300	450	•	•	•			
5H0835050000	10	7.2	9.6	2	24,600	32,700	650	•	•	•			
5H0835060000	10	7.2	9.6	2	24,600	32,700	1,150				•	•	•
5H0835070000	15	10.8	14.4	3	36,900	49,100	1,250				•	•	•
5H0835080000	20	14.4	19.2	4	49,200	65,500	1,500				•	•	•

Table 16.2 - Auxiliary Heater Ratings - Horizontal

Part Number	Nominal Rating (kW)	Actual Rating (kW)		Circuits	Actual Rating (Btu/Hr)		Minimum Airflow (CFM)	Models					
		208V	240V		208V	240V		018	024	036	048	060	066
5H0835090000	5	3.6	4.8	1	12,300	16,300	450	•	•	•			
5H0835100000	10	7.2	9.6	2	24,600	32,700	650	•	•	•			
5H0835110000	10	7.2	9.6	2	24,600	32,700	1,150				•	•	•
5H0835120000	15	10.8	14.4	3	36,900	49,100	1,250				•	•	•
5H0835130000	20	14.4	19.2	4	49,200	65,500	1,500				•	•	•

Table 16.3 - Auxiliary Heater Data - Vertical

Part Number	Nominal Rating (kW)	FLA		MCA		MOP	
		208V	240V	208V	240V	208V	240V
5H0835040000	5.0	17.3	20.0	17.3	20.0	25.0	25.0
5H0835050000	10.0	34.6	40.0	34.6	40.0	45.0	50.0
5H0835060000	10.0	34.6	40.0	34.6	40.0	45.0	50.0
5H0835070000	15.0	51.9	60.0	51.9	60.0	70.0	80.0
5H0835080000	20.0	69.2	80.0	69.2	80.0	90.0	100.0

Table 16.4 - Auxiliary Heater Data - Horizontal

Part Number	Nominal Rating (kW)	FLA		MCA		MOP	
		208V	240V	208V	240V	208V	240V
5H0835090000	5.0	18.0	20.8	18.0	20.8	30.0	30.0
5H0835100000	10.0	36.1	41.7	36.1	41.7	60.0	60.0
5H0835110000	10.0	36.1	41.7	36.1	41.7	60.0	60.0
5H0835120000	15.0	54.1	62.5	54.1	62.5	80.0	80.0
5H0835130000	20.0	72.1	83.3	72.1	83.3	110.0	110.0

NOTE: refer to Auxilliary Heat Installation Manual for installation instructions.

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 thermostat, control wiring and the freeze protection setpoint completed.
- Transformer wiring is correct.
- Water supply to heat pump is completed.
- Piping completed, water system cleaned and flushed of debris.
- Air and debris are purged from a ground loop.
- Antifreeze added to ground loop, 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.
- Condensate line is open, condensate drain line is correctly pitched.
- Blower rotates freely.
- Check air coil for cleanliness.
- Filter is clean and in position.
- Clean all debris from the ducting system.
- Service/access panels are in place.
- Entering air and water temperatures are within operating limits in Table 19.1.

⚠ 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

GF/EF systems are pre-programed 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 17.1 - 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 29 of this manual may be used to assist during unit startup.

1. Put thermostat in standby or off mode.
2. Turn on line power to heat pump.
3. Turn thermostat fan position to “ON” and verify blower operation.
4. Put thermostat in heating mode.
5. Slowly raise the thermostat set-point until a heating call is generated and the compressor energizes.
6. After a few minutes, check the supply air and verify warm air delivery.
7. Verify water flow by comparing pressure drop across the coaxial coil to values in Table 18.1.
8. Monitor ground water supply (GWI) and return (GWO) temperatures. If temperature drop is within expected operating range as shown in Table 19.1, continue with testing.
9. If temperature drop is outside of expected operating range, check refrigerant pressures and compare to values in Table 19.1.
10. Check air temperature rise across the coil. Air temperature rise should be between 20°F and 30°F.
11. Check for vibration, noise and leaks.
12. Lower thermostat set point below room temperature and verify that compressor and flow center deactivate.
13. Initiate a control signal to place the unit in the cooling mode. Cooling set point must be set below room temperature.
14. Cooling will energize after a time delay.
15. Be sure that the compressor and flow center are activated.
16. Monitor ground water supply (GWI) and return (GWO) temperatures. If temperature rise is within expected operating range in Table 19.1, continue with testing.
17. If temperature drop is outside of expected operating range, check refrigerant pressures and compare to Table 19.1.
18. Check for an air temperature drop of 15°F to 25°F across the air coil.
19. Check for vibration, noise and leaks.
20. Adjust the cooling set point above the room temperature and verify that the compressor and flow center deactivate.
21. 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.
22. 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 thermostat.

Blower: The blower will cycle with a call for cooling or heating.

Cool: Upon receiving a G, Y1, and O signal from the thermostat, the compressor and reversing valve will be energized. On two stage units with ECM, the first stage of the compressor will be energized and the blower will provide the first stage airflow. The compressor will be limited by a timer that will provide anti-cycle protection. When a subsequent Y2 signal is received, the second stage of the compressor will be energized and the blower will provide the second stage airflow (two stage units with ECM only).

Heat: Upon receiving a G and Y1 signal from the thermostat, the compressor will be energized and the reversing valve de-energized. On two stage units with ECM, the first stage of the compressor will be energized and the blower will provide the first stage airflow. The compressor will be limited by a timer that will provide short-cycle protection. When a subsequent Y2 signal is received, the second stage of the compressor will be energized and the blower will provide the second stage airflow (two stage units with ECM only).

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.

Supplemental Electric Heat (Field Installed Accessory): Upon receiving a W1 signal from the thermostat, the first stage of the auxiliary electric heat is energized. Upon receiving a W2/E signal from the thermostat, the second stage of auxiliary electric heat is energized.

Table 18.1 - Water Pressure Drop, psi (Based on Entering Water Temperature)

Models	GPM	30°F	40°F	60°F	90°F	110°F
018	2.0	0.3	0.3	0.3	0.3	0.3
	3.0	0.5	0.5	0.5	0.4	0.4
	4.0	0.7	0.7	0.7	0.6	0.6
	5.0	1.0	0.9	1.0	0.8	0.8
	6.0	1.3	1.2	1.2	1.0	1.0
024	4.0	0.8	0.8	0.7	0.6	0.6
	5.0	1.1	1.1	0.9	0.8	0.8
	6.0	1.4	1.4	1.2	1.1	1.0
	7.0	1.8	1.8	1.5	1.4	1.3
	8.0	2.2	2.1	1.9	1.7	1.6
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	0.6	0.6	0.5	0.5	0.4
	8.0	0.9	0.9	0.8	0.7	0.7
	10.0	1.3	1.3	1.1	1.0	1.0
	12.0	1.7	1.7	1.5	1.4	1.3
	14.0	2.2	2.2	2.0	1.8	1.7
060 & 066	9.0	1.1	1.2	1.0	0.9	1.0
	12.0	1.8	1.9	1.7	1.5	1.6
	15.0	2.7	2.7	2.5	2.2	2.3
	18.0	3.8	3.7	3.4	3.1	3.0
	21.0	5.0	4.9	4.5	4.1	3.9
	24.0	6.3	6.2	5.8	5.3	4.9

Table 18.2 - 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
	38%	1.55
Ethanol	14%	1.29
	20%	1.34
	29%	1.43
Methanol	10%	1.12
	15%	1.16
	20%	1.19
	25%	1.21

START-UP PROCEDURE

Equation 19.1 - 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

Table 19.1 - Typical Operating Conditions

Heating - No Desuperheater							
Entering Water Temperature (°F)	**Water Flow (gpm/ton)**	**Suction Pressure (psig)**	**Discharge Pressure (psig)**	**Superheat (°F)**	**Subcool (°F)**	**Water Temperature Drop (°F)**	**Air Temperature Rise (°F)**
30	1.5	68-76	285-310	8-12	3-9	5-7	15-21
	3.0	72-80	290-315	8-12	3-9	3-5	17-23
50	1.5	100-110	315-345	9-13	5-11	7-9	22-28
	3.0	104-114	320-350	9-13	5-11	5-7	24-30
70	1.5	134-144	355-395	10-14	6-12	9-11	30-36
	3.0	138-148	360-390	10-14	6-12	7-9	32-38
Heating - No Desuperheater							
Entering Water Temperature (°F)	**Water Flow (gpm/ton)**	**Suction Pressure (psig)**	**Discharge Pressure (psig)**	**Superheat (°F)**	**Subcool (°F)**	**Water Temperature Drop (°F)**	**Air Temperature Rise (°F)**
50	1.5	122-130	220-235	13-19	10-16	19-23	21-25
	3.0	120-128	190-210	13-19	10-16	9-12	21-25
70	1.5	127-136	210-280	11-15	8-14	19-23	20-24
	3.0	125-134	250-270	11-15	8-14	9-12	20-24
90	1.5	132-144	360-380	10-14	8-14	18-22	18-22
	3.0	130-142	330-350	10-14	8-14	9-12	18-22

Table 19.2 - Operating Limits

Operating Limits	Cooling (°F)	Heating (°F)
Min. Ambient	45	45
Rated Ambient	80	70
Max Ambient	100	85
Min. Entering Air	50	40
Rated Entering Air, db/wb	80.6/66.2	68
Max. Entering Air, db/wb	110/83	80
Min. Entering Water	30	20
Normal Entering Water	50-110	30-70
Max. Entering Water	120	90

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 dependant upon three primary factors: 1) water temperature, 2) return air temperature, and 3) ambient temperature. When any of the factors are at the minimum or maximum levels, the other two factors must be at the normal level for proper and reliable unit operation.

START-UP PROCEDURE

Table 20.1 - Compressor Winding Resistance

Compressor	C to S	C to R	S to R
ZP16K5E-PFV	2.30	1.53	3.83
ZPS20K5E-PFV	1.64	1.30	2.94
ZPS26K5E -PFV	1.91	1.02	2.93
ZPS35K5E -PFV	1.55	0.62	2.17
ZPS49K5E-PFV	1.67	0.42	2.09
ZPS51K5E-PFV	1.67	0.42	2.09
ZPS60K5E-PFV	1.91	0.36	2.27

Table 20.2 - 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	Air 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 Air Flow / Load Water Flow - Heating	High	High	High	High	Low	High	Low
Low Air Flow / 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 Air Flow / Load Water Flow - Heating	Low	Low	Low	Low	High	Low	Normal / High
High Air Flow / 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 Indoor Air / Load Water Temp - Heating	Low	Low	Low	Low / Normal	High	High	Normal / High
Low Indoor Air /Load Water Temp - Cooling	Low	Low	Low	Low / Normal	High	Low	Low
High Indoor Air / Load Water Temp - Heating	High	High	High	Normal / High	Low / Normal	Low	Low
High Indoor Air / 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 21.1 - Physical Data

Model	018	024	036	048	060	066
	Single Stage	Two Stage	Two Stage	Two Stage	Two Stage	Two Stage
Compressor	Copeland Scroll	Copeland Ultratech	Copeland Ultratech	Copeland Ultratech	Copeland Ultratech	Copeland Ultratech
Factory Charge, R-410A, oz - No HWG	46	67	73	97	140	140
Factory Charge, R-410A, oz - w/HWG	49	71	76	101	144	144
Blower Motor Type, Speeds	ECM, Variable Speed	ECM, Variable Speed	ECM, Variable Speed	ECM, Variable Speed	ECM, Variable Speed	ECM, Variable Speed
Blower Motor (hp)	1/3	1/2	1/2	1/2	1	1
Blower Wheel Size (in)	9-7	9-7	9-7	11-10	11-10	11-10
Max ESP (in-W.C.)	0.75	0.75	0.75	0.50	0.75	0.75
Vertical Air Coil Dims, HxW (in)	28x20	28x20	30x23.5	32x25	36x25	36x25
Vertical Air Coil Face Area (ft^2)	3.9	3.9	4.9	5.6	6.3	6.3
Horizontal Air Coil Dims, HxW (in)	20x30	20x30	20x36	20x40	20x45	20x45
Horizontal Air Coil Face Area (ft^2)	4.2	4.2	5.0	5.6	6.3	6.3
Air Coil Tube Diameter (in)	3/8	3/8	3/8	3/8	3/8	3/8
Air Coil Number of Rows	2	3	3	3	4	4

Table 21.2 - Blower Data (CFM)

Model		Blower Motor Type	Max ESP (in. W.C.)	Fan Only	Cooling / Heating Mode		Aux / Emerg. Mode
					Stage 1	Stage 2	
018	Single Capacity	ECM, Var Speed	0.75	250	–	720	800
024	Dual Capacity	ECM, Var Speed	0.75	250	540	720	800
036	Dual Capacity	ECM, Var Speed	0.75	370	820	1,080	1,200
048	Dual Capacity	ECM, Var Speed	0.5	500	1,090	1,440	1,600
060	Dual Capacity	ECM, Var Speed	0.75	620	1,360	1,800	2,000
066	Dual Capacity	ECM, Var Speed	0.75	680	1,500	1,980	2,200

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

1. Do not attempt to reuse any mechanical or electrical component which has been wet. Such component must be replaced.
2. Air coil fin edges are sharp, take necessary precautions.

IMPORTANT

To check most of the Possible Remedies in the troubleshooting guide listed in Tables 26.1-28.1, 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 the 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 the 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.

Air Filters

Filters must be clean to obtain maximum performance. They should be inspected monthly under normal operating conditions and be replaced when necessary. Units should never be operated without a filter.

Condensate Drain

In areas where airborne bacteria produce slime in the drain pan, it may be necessary to treat chemically with an algaecide approximately every three months to minimize the problem. It may be necessary to clean the condensate pan periodically to insure indoor air quality. The condensate drain can pick up lint and dirt, especially with dirty filters. Inspect twice a year to avoid the possibility of overflow.

Compressor

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

Blower Motors

All units have lubricated fan motors. Do not lubricate unless obvious, dry operation is inspected. Periodic oiling is not required (may lead to excessive dirt buildup & motor failure). Check the operation amperage annually to ensure the amp draw is not greater than 10% of data indicated on the name plate. ECM fan motors need NO oiling.

MAINTENANCE

Air Coil

The air coil should be cleaned annually to retain maximum performance. Inspect once a year under normal operating conditions. If the air coil shows dirt or debris, use a vacuum with a gentle end or a rag to clean the debris from the air coil. The fins are easily damaged, so take care when cleaning.

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 and air flow are correct.

Replacement Parts

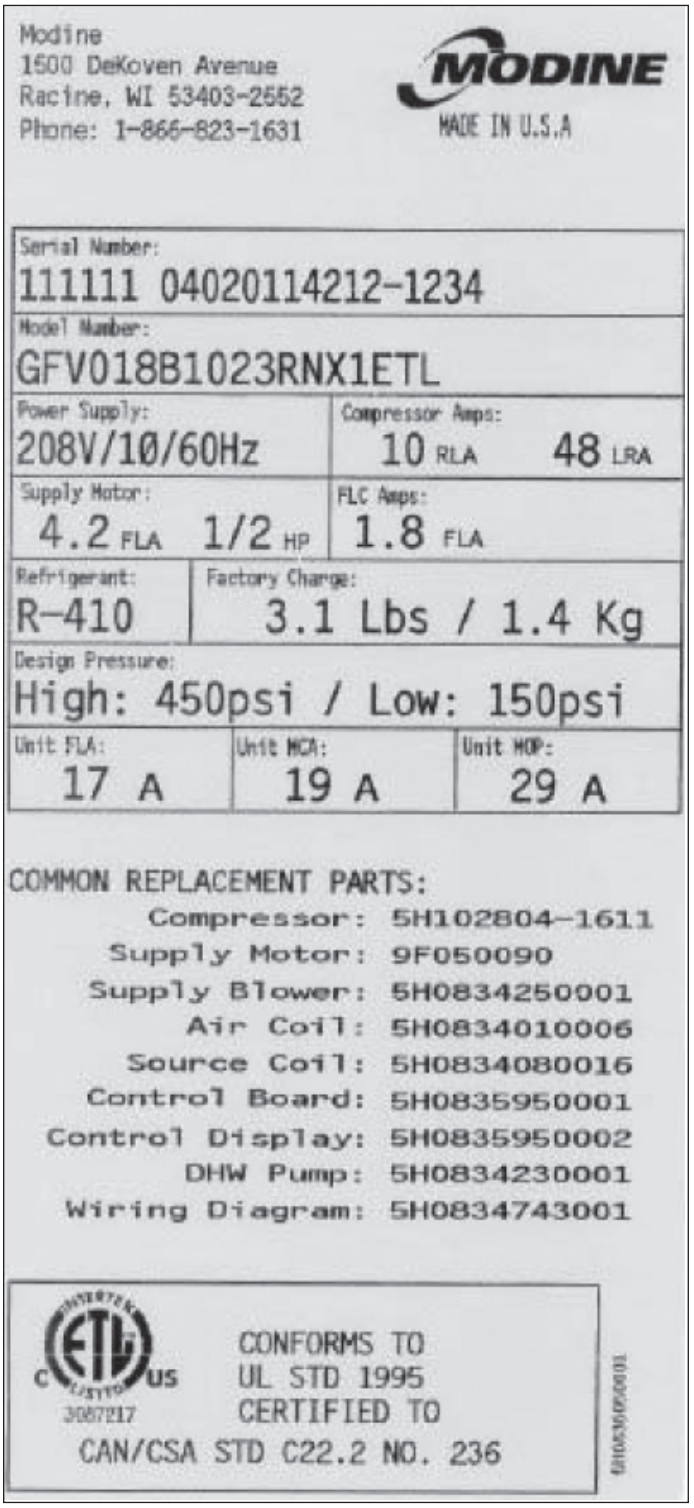
For ease of identification when ordering replacement parts or contacting the factory about your unit, please provide the complete model number and unit serial number. This information can be found on the serial plate attached to your unit (see Figure 23.1).

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** or call **1-877-679-4436 (4GEO).**

Figure 23.1 - Serial Plate EXAMPLE



REPLACEMENT PARTS

Table 24.1 - Common Replacement Parts

Part Description			Models					
			018	024	036	048	060	066
Unit Configuration	V	MERV 13 Pleated Air Filter	5H1042680007	5H1042680007	5H1042680008	5H1042680009	5H1042680010	5H1042680010
		Electrostatic Air Filter	5H0835140000	5H0835140000	5H0835150000	5H0835160000	5H0835170000	5H0835170000
	H	MERV 13 Pleated Air Filter	5H1042680003	5H1042680003	5H1042680004	5H1042680005	5H1042680006	5H1042680006j1
		Electrostatic Air Filter	5H0835180000	5H0835180000	5H0835190000	5H0835200000	5H0835210000	5H0835210000
Power Code	02,03	Compressor Code						
		01,03	Compressor	5H1028041611	–	–	–	–	–
			Compressor Run Capacitor	5H1036890009	–	–	–	–	–
		02,04	Compressor	–	5H1038032021	5H1038033021	5H1038034021	5H1038035121	5H1038036021
			Compressor Run Capacitor	–	5H1036890001	5H1036890002	5H1036890009	5H1036890012	5H1036890012
		03,04	Soft Start	5H0834140002					
		Motor Type							
		E	Blower Motor	5H1006770006	5H1006770006	5H1006770006	5H1006770006	5H1006770008	5H1006770008
		Hot Water Generator							
		1	Desuperheater (DHW) Pump	5H0834230001					
		ALL	Control Transformer	5H0749490001					
		ALL	Contactor	5H0834310001					
	04,05	Compressor Code							
		01,03	Compressor	5H1028041611	–	–	–	–	–
		02,04	Compressor	-	5H1038032022	5H1038033022	5H1038034022	5H1038035122	5H1038036022
		Motor Type							
		E	Blower Motor	5H1006770006	5H1006770006	5H1006770006	5H1006770006	5H1006770008	5H1006770008
		ALL	Control Transformer	5H0749490001					
		ALL	Contactor	5H0834310003					
All Models		Expansion Valve		5H0834040003	5H0834040003	5H0834040004	5H0834040005	5H0834040006	5H0834040006
		Filter / Drier		5H0834050001	5H0834050001	5H0834050002	5H0834050002	5H0834050003	5H0834050003
		Reversing Valve		5H1028300006	5H1028300006	5H1028300001	5H1028300001	5H1028300005	5H1028300005
		Water Line Fitting Gasket / Spacer Kit		3H0387930000					
		Condensate Overflow Switch		5H1011780000					
		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 and air side temperatures changes against Typical Operating Data. If the performance is within the ranges in the table and the air and 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. **Thermostat inputs** – Thermostat inputs are 24VAC signals and can be verified using a volt meter between C and Y, G, O, W.
   b. **Outputs** – Compressor and reversing valve output relays are 24VAC and can be verified using a voltmeter. The fan, 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 26.1 - 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	Thermostat position	Verify that thermostat is in heating or cooling position.	Test operation of thermostat.
	X	X	Defective thermostat	Verify operation of thermostat; verify thermostat signals at unit.	Replace if defective.
	X	X	Thermostat wiring	Verify thermostat 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. ***NOTE: Make sure the compressor is rested.**	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 resitance across capacitor terminals. If shorts exist, capacitor is defective.	Replace, if faulty.
Blower does not run	X	X	Defective thermostat	Verify operation of thermostat.	Replace, if defective.
	X	X	Thermostat wiring	Verify thermostat wiring at unit.	Repair wiring, if needed.
	X	X	Loss of power to motor (208/240V units)	Verify voltage across 240VAC L1 IN & L2 IN.	If no voltage, on L1 and L2, check wiring; repair wiring as needed.
	X	X	Defective ECM motor	Verify line voltage at motor.	If power at motor, verify control signals from thermostat.

TROUBLESHOOTING

Table 27.1 - Troubleshooting

Fault	Mode		Possible Cause	Verify	Action
	Htg	Clg			
Unit "short cycles"	X	X	Unit is oversized	Verify load calculations and unit selection.	
	X	X	Dirty Air Filter	Check air filter.	Replace, if necessary.
	X	X	Thermostat location	Check to see if thermostat is installed near a supply air grill.	Relocate, if necessary.
	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.
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 air too cold	Measure return air, should be above 60ºF.	Bring return air temperature within design parameters.
		X	Reduced air flow	Verify blower operation.	Troubleshoot blower operation.
				Check air filter.	Replace or clean, if dirty.
				Check for airflow restrictions in ducting system.	Address any ductwork airflow restrictions.
				Check external static.	Check external static against blower table.
	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 or no air flow in heating	Verify blower operation.	Troubleshoot blower operation.
				Check air filter.	Replace or clean, if dirty.
				Check for airflow restrictions in ducting system.	Address any ductwork airflow restrictions.
				Check external static.	Check external static against blower table.
	X		Air temperature out of range	Measure return air, should be below 95ºF.	Bring return air 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 28.1 - 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 contrrol signal, troubleshoot thermostat 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	Thermostat setup / wiring	Verify thermostat setup and wiring.	Repair wiring, if needed.
		X	Thermostat operation	Verify proper thermostat 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	Dirty Air Filter	Check air filter.	Replace or clean if dirty.
	X	X	Unit undersized	Verify load calculations and unit selection.	If excessive, it may possible to rectify with shading and insulation.
	X	X	Thermostat location	Check to see if thermostat is installed near a supply air grill.	Relocate, if necessary.
		X	Defective lreversing 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		Reduced or no air flow in heating	Verify blower operation.	Troubleshoot blower operation.
				Check air filter.	Replace or clean if dirty.
				Check for airflow restrictions in ducting system.	Address any ductwork airflow restrictions.
				Check external static.	Check external static against blower table.
		X	Reduced air flow in cooling	Verify blower operation.	Troubleshoot blower operation.
				Check air filter.	Replace or clean if dirty.
				Check for airflow restrictions in ducting system.	Address any ductwork airflow restrictions.
				Check external static.	Check external static against blower table.
	X	X	Duct losses	Check supply and return air temperatures at heat pump and at furthest registers. If difference is significant, duct losses are occuring.	Repair duct losses.
	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	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		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 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.
Condensate overflow		X	Blocked drain	Check for blockage and clean drain.	
		X	Improper trap	Check trap dimensions and location.	
		X	Poor drainage	Check piping slope, away from unit and toward outlet. Check venting.	
Auxiliary heater is always "ON"	X		Defective auxiliary heater PCB	Cycle power to system, using an amp meter verify amperage draw.	Replace printed circuit board.
				Check 24VAC voltage signals to the auxiliary heater printed circuit board.	Replace printed circuit board.
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	Air flow is noisy	Undersized duct work will cause high airflow velocities and noisy operation.	
	X	X	Pump cavitation	Purge air from closed loop system.	

START UP / TROUBLESHOOTING FORM

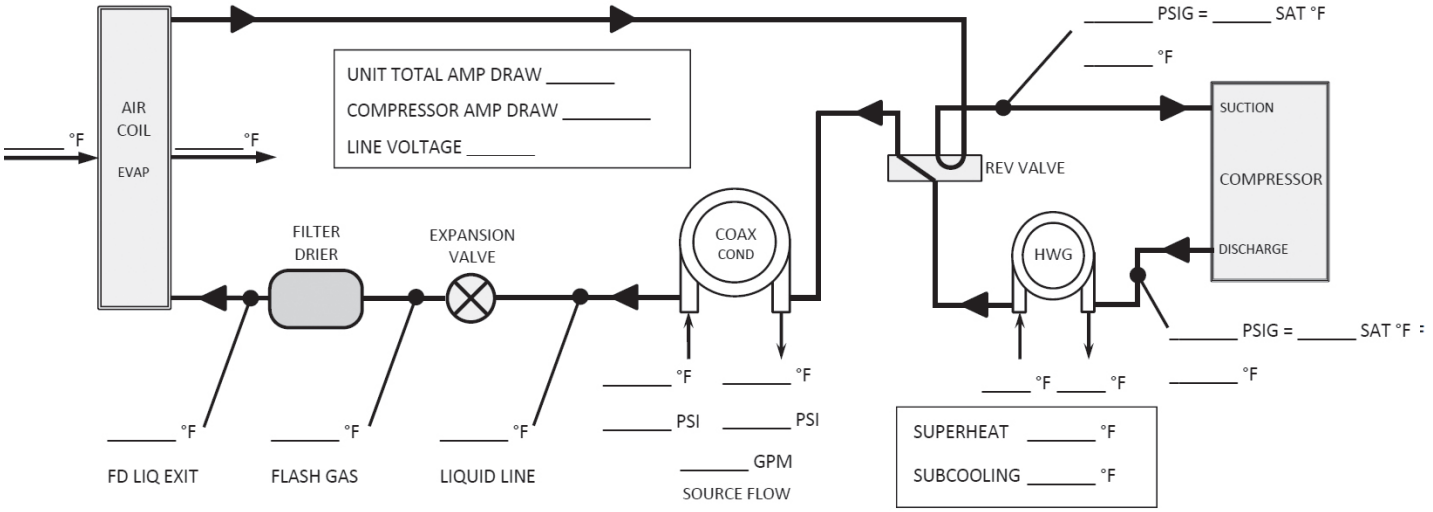
Customer Name _____ Date _____

Address _____ Loop Type _____

Model # _____ Serial # _____ Antifreeze _____

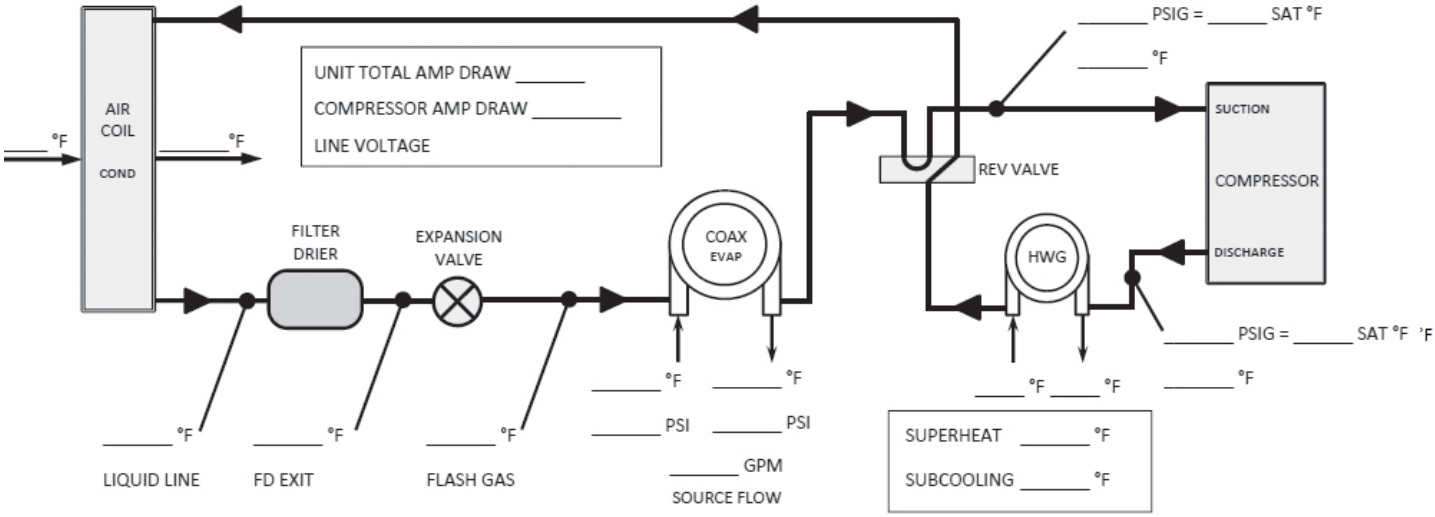
__ Startup __Troubleshooting, Complaint _____

COOLING CYCLE ANALYSIS



HEAT OF REJECTION = SOURCE FLOW _____ GPM X ΔT _____ °F X _____ (500 FOR WATER, 485 ANTIFREEZE) = _____ BTU/HR

HEATING CYCLE ANALYSIS



HEAT OF EXTRACTION = SOURCE FLOW _____ GPM X ΔT _____ °F X _____ (500 FOR WATER, 485 ANTIFREEZE) = _____ BTU/HR

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

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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.

Component Applicable Models	**"APPLICABLE WARRANTY PERIOD"**
Heat Exchangers 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
Heat Exchangers Low Intensity Infrared Units **Compressors** 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
Burners Low Intensity Infrared Units **Other** 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
Heat Exchangers/Coils Indoor and Outdoor Duct Furnaces and System Units, Steam/Hot Water Units, Oil-Fired Units, Electric Units, Cassettes, Vertical Unit Ventilators, Geothermal Units **Compressors** Vertical Unit Ventilators, Geothermal Units **Burners** High Intensity Infrared Units **Sheet Metal Parts** 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.

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