Flow Center Installation and Loop Flushing

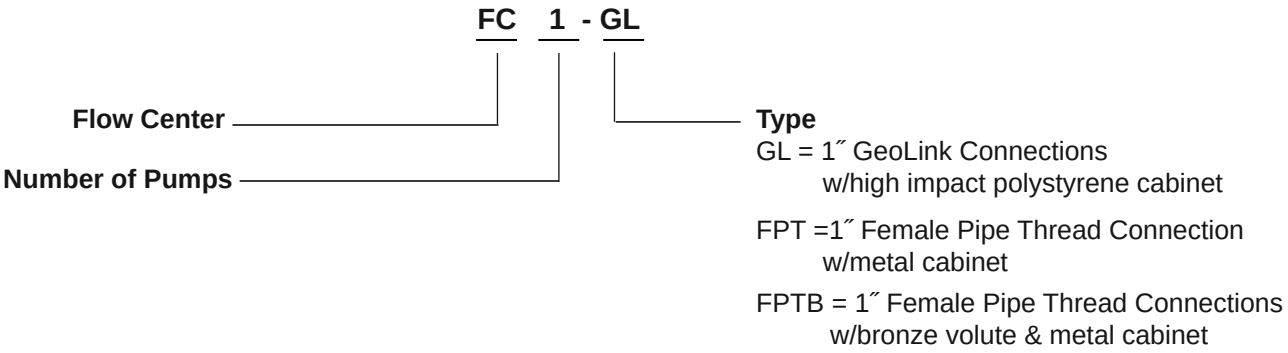
GeoLINK Flow Center

Flow Centers (FC1-GL, FC2-GL, FC1-FPT, FC2-FPT, FC1-FPTB & FC2-FPTB)
Flush Cart (LFC-F)

WaterFurnace
Smarter from the Ground Up™

IM1961 06/08

Flow Center Model Nomenclature



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General Installation Information

Safety Considerations

WARNING: Before performing service or maintenance operations on the system, disconnect all power sources. Electrical shock could cause personal injury. Before applying power, make sure that all covers and screws are in place. Failure to do so could cause risk of electrical shock.

Flow Center Initial Inspection

Please read the complete instructions before starting installation. Carefully follow instructions to ensure optimum and safe operation. Leave the instructions with the owner after installation. The GeoLink® Flow Center and UP Series circulating pumps should be installed according to all applicable codes. Unpack the flow center and any other component kits required and inspect them for shipping damage. Shipping damage claims must be filed promptly by the purchaser with the freight company.

Verify the contents of this package with the following list:

(2) Lag screws 1/4" X 2.5"
(4) Long sheet metal #10 X 3/4" screws (for mounting on unit)
(2) 1" MPT Brass plug (Not included with FPTB or GL series)
(1) Decal
(1) Installation manual
(2) 1-1/4" PE Socket Adapters (GL models only)

Notes: The flow centers are injected with foam for condensation prevention during low temperature operation and for noise attenuation. Pump heads can be field replaced.

Typical Installation

The Flow Centers are insulated and contain all flushing and circulation connections for residential and light commercial earth loops which require a flow rate of no more than 20 gpm. One-inch female pipe thread fittings are furnished with FC1-FPT, FC1-FPTB, FC2-FPT and FC2-FPTB units for loop connections. Various fittings are available for FC1-GL and FC2-GL units for loop connections. See Adapter Sets table below and Connection Options table (page 5) for all adapter fittings.

Typically, one-pump flow centers are used on 3-ton and smaller systems, and two-pump flow centers are used on 3.5-ton to 6-ton systems. However, this is a rule of thumb, and should always be verified by a pressure drop calculation. ***See "Pressure Drop Calculation Manual" or use Pressure Drop software program to determine correct pump selection.***

Adapter Sets (Sets consist of 2 connectors)

PART NO.	DESCRIPTION	CONNECTION USE	FLOW CENTER TYPE
MA4INS	1" MPT to 1" INS (Hose Barb)*	Loop or unit side connection	FPT
MA5INS	1" MPT to 1-1 /4" INS (Hose Barb)*	Loop or unit side connection	FPT
MA5PES	1" MPT to 1-1/4" PE (Socket Fusion)	Loop side connection	FPT
MA4SWV	1” MPT to 1” Swivel Union	Unit side connection	FPT
GL4INS	1" GeoLink fitting x 1" Hose Barb	Unit side connection	GL
GL4PES	1" GeoLink fitting x 1" Socket Fusion	Loop or unit side connection	GL
GL5PES**	1" GeoLink fitting x 1-1/4" Socket Fusion	Loop side connection	GL
GL-FP	1" GeoLink fitting x 1" cam lever elbow (male)	Flushing port connection	GL

Notes: *Hose Clamps included with barbed adapter sets.

General Installation Information (cont.)

Connection Options

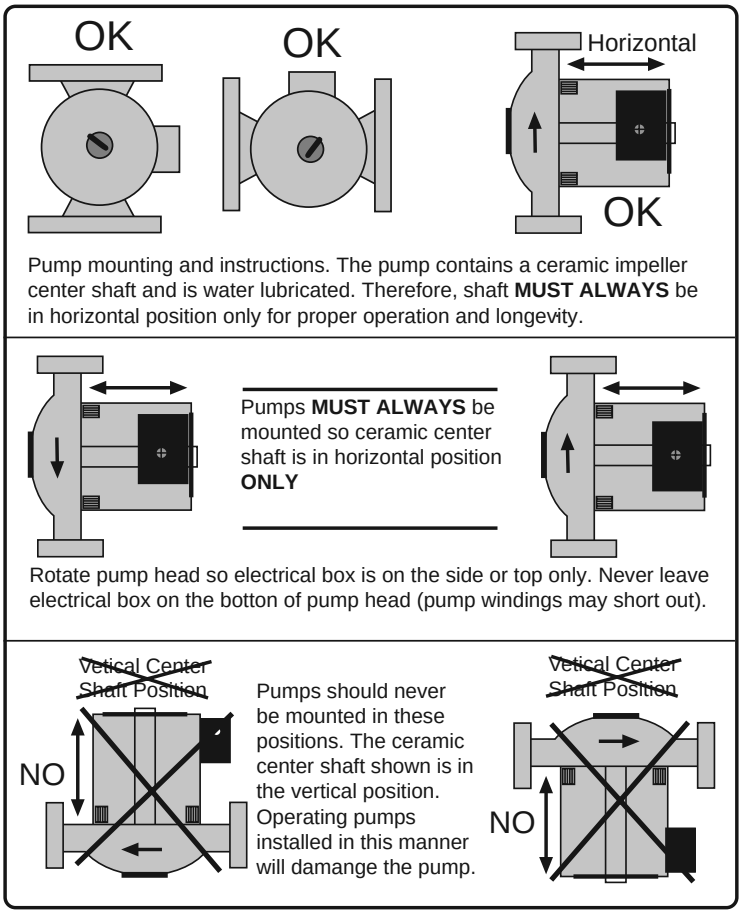
To	Fitting(s)
Rubber Hose Kit	1" MPT to 1" barbed (PVC or brass)
PVC	1" MPT to 1" glue socket or 1" MPT nipple
PE	Use brass barbs and double clamp or PE to brass adapter
Copper	1" MPT x 1" sweat and solder before connecting to FC1S, FC2S or 1" MPT nipple

Mounting

The flow center must be mounted with the pump center shaft in the horizontal position. The only adjustment is that the circulator pump electrical boxes be on the horizontal side of the power head in the mounted position to help prevent moisture from being held inside the box (see Figure 1).

- Side of unit mounting notes:
  The flow center can be mounted by using four sheet metal screws directly into the unit cabinet on the side opposite the air coil. Be careful not to puncture any internal parts of the unit when inserting screws into the cabinet.
- Unfinished wall (bare stud) mounting notes:
  The assembled flow center can be mounted by using four lag screws into two 19-inch (48 cm) cross braces spanning 16 inches (41 cm) on center studs or by using lag bolts through center of brackets into one stud.
- Finished wall (drywall) mounting notes:
  The flow center can be mounted by using two lag screws through drywall into stud through center holes in top and bottom of cabinet.

Figure 1: Pump Mounting



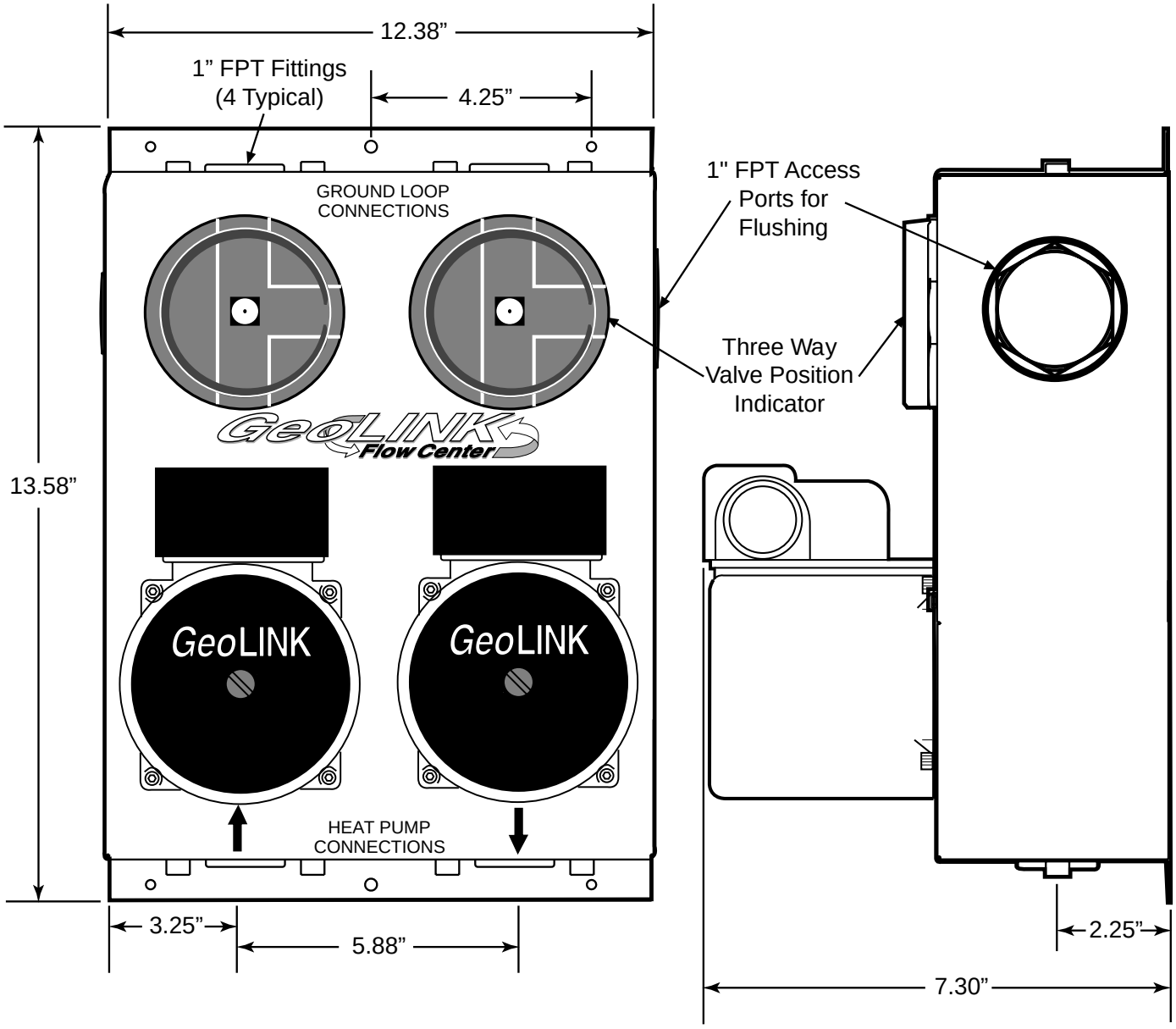
Notes: Insulation should be used on all inside piping when minimum loop temperatures are expected to be less then 50° F (10° C). Use table below for insulation sizes with different piping sizes.

Recommended Insulation

Piping	Description
1" IPS Rubber Hose	1-3/8" ID - 1/2" Wall
1-1/4" IPS PE	1-5/8" ID - 1/2" Wall
2" IPS PE	2-1/8" ID - 1/2" Wall

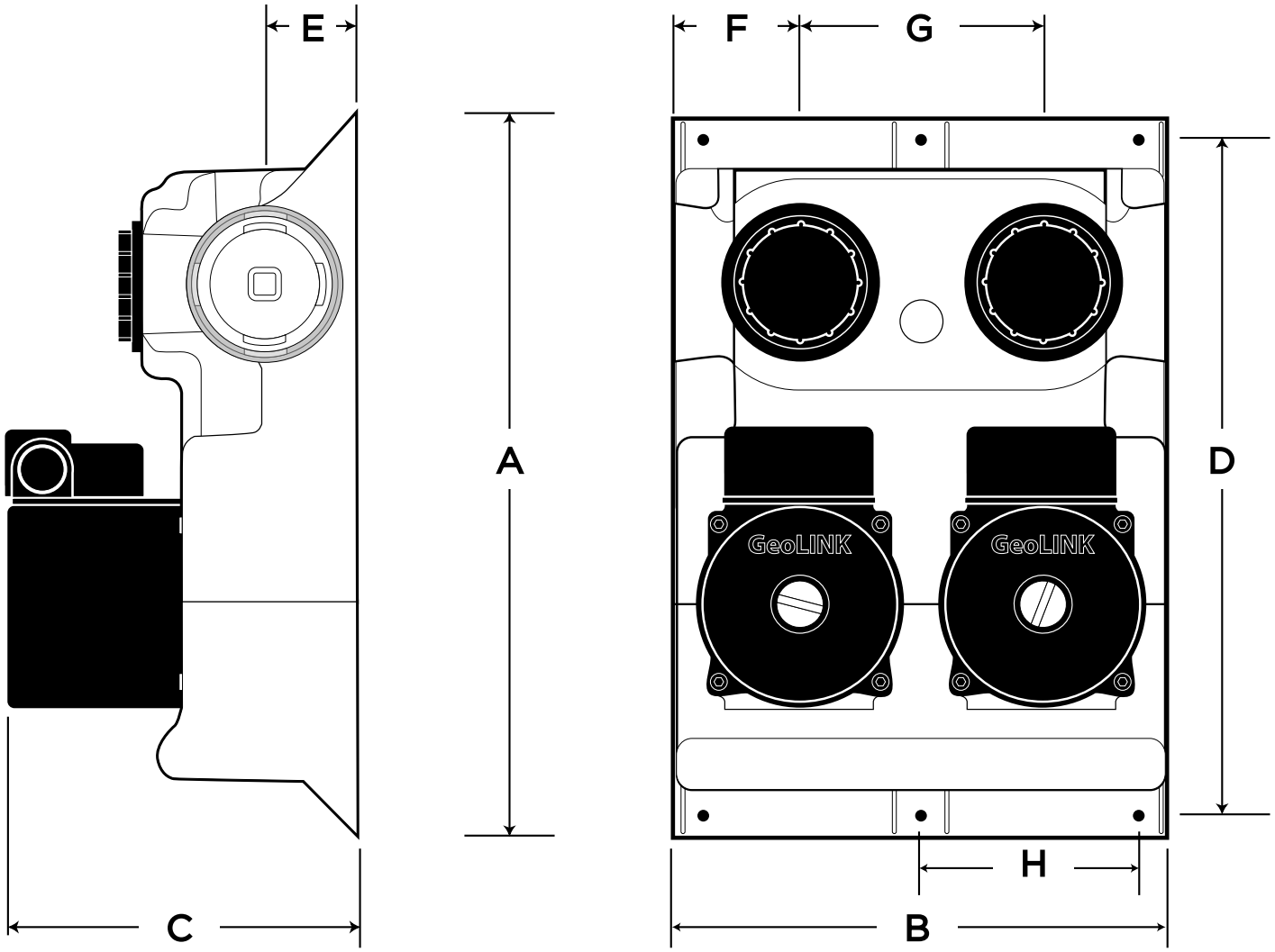
General Installation Information (cont.)

Figure 2a: FPT Style Flow Center



General Installation Information (cont.)

Figure 2b: GL Style Flow Center



	A	B	C	D	E	F	G	H
INCHES	15.0	10.3	7.0	14.0	2.0	2.6	5.0	4.5
[CM]	[38.1]	[26.0]	[17.8]	[35.6]	[5.1]	[6.7]	[12.7]	[11.4]

TYPE	SHIPPING WEIGHT
FC1-GL	26 LBS
FC2-GL	31 LBS

Electrical Information

Single-Speed Units

If a single-speed unit is to be used, the pump(s) will be connected to the terminals on PB1 in the unit electrical box as shown in Figure 3. The pumps will automatically be cycled as required by the unit or by a signal from another unit sharing the flow center (See Figures 5 and 6). Pumps are fused through the PCB (Printed Circuit Board).

Dual Capacity

If a two-speed or dual capacity unit is used, the pumps will be connected to the pump power block (PB1) as shown in Figure 4. The pumps will automatically be cycled as required either by the unit or by a signal from another unit sharing the same flow center.

Figure 3: Single Speed Field Unit Wiring for Loop Pumps

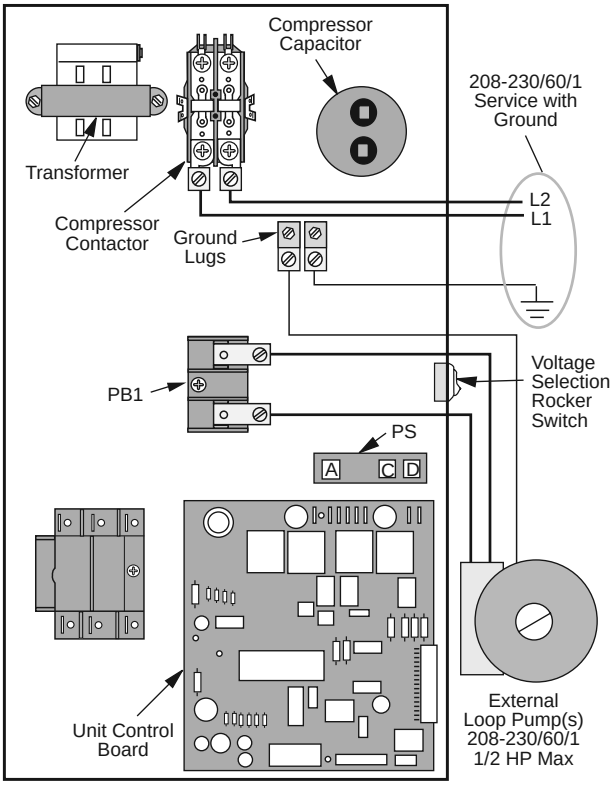
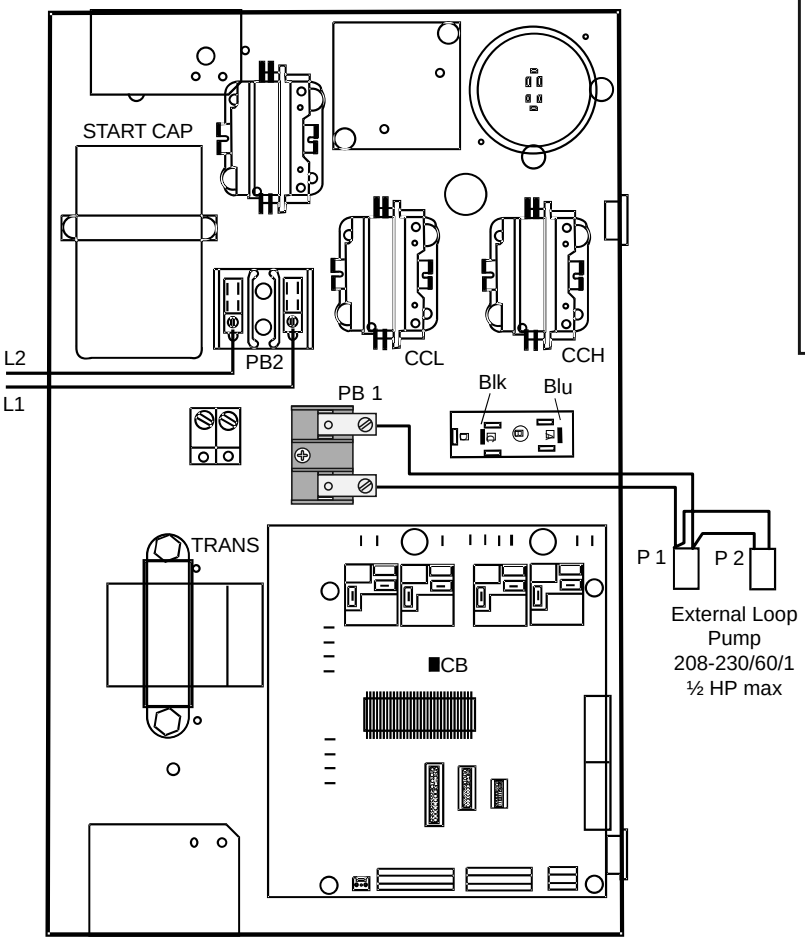


Figure 4: Dual Capacity Unit Wiring for Loop Pumps



Notes: For closed loop systems with antifreeze protection, set SW2 DIP Switch #2 to the "Loop" position on units.

Electrical Information (cont.)

Multiple Units On One Flow Center

When two units are connected to one loop pumping system, pump control is automatically achieved by connecting the SL terminals in both units with 18-gauge 2-wire thermostat wire. These terminals are polarity conscious (see Figures 5 and 6 for proper loop pump SL wiring). The loop pump(s) may be powered from either unit, whichever is more convenient. If either unit calls, the loop pump(s) will automatically start.

Figure 5: Pump Connection Option

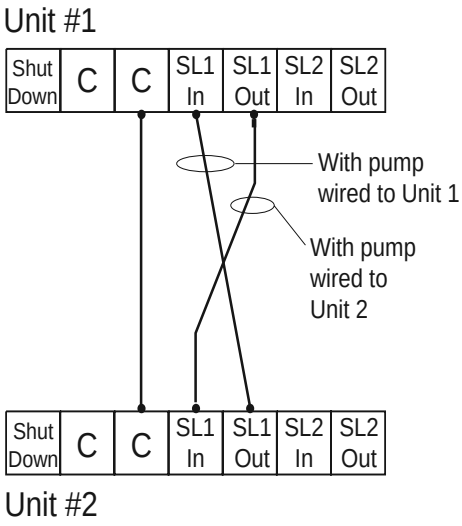
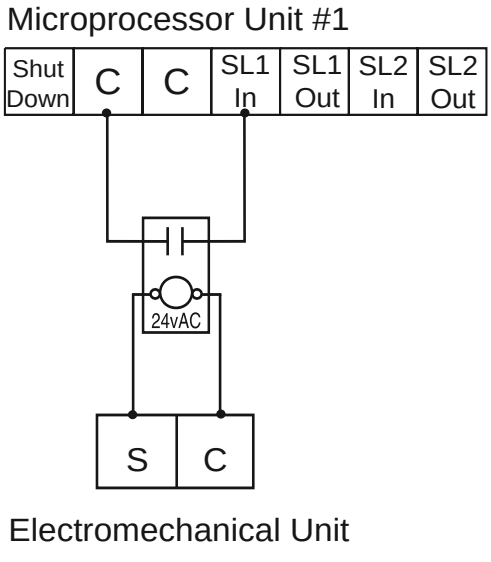


Figure 6: Pump Connection Option

Microprocessor Unit to Electromechanical Unit

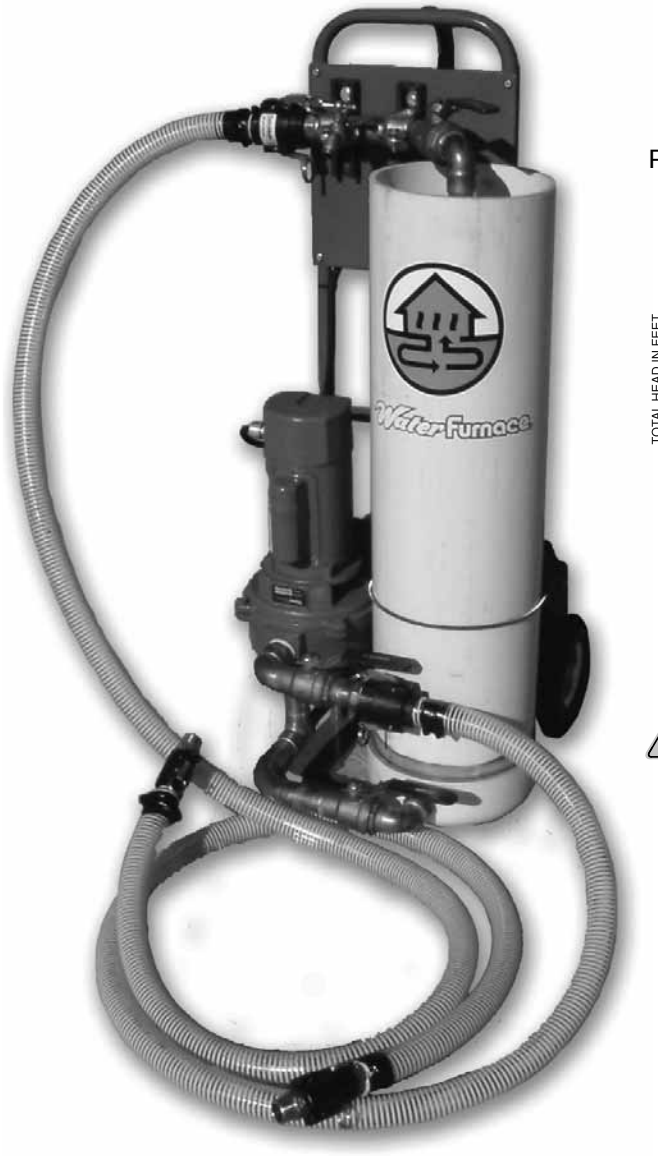


Flush Cart Information

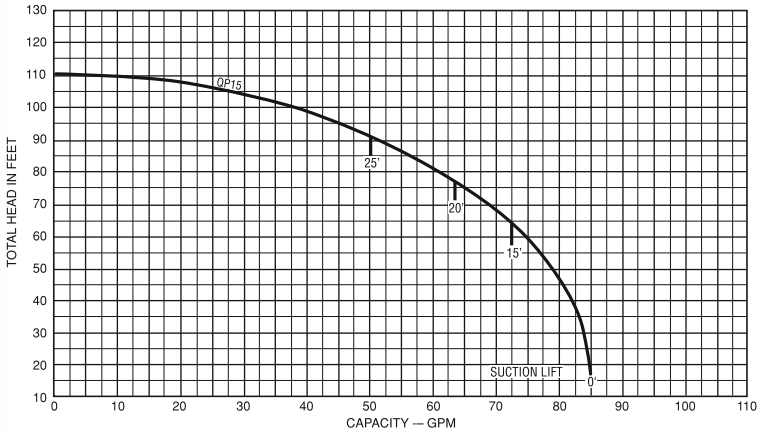
The WFI Flush Cart has been designed to effectively and efficiently flush geothermal earth loops and to facilitate mixing and injection of antifreeze. The single most important element in flow center pump reliability is the ability to remove all the air from the earth loop and provide the proper working pressure.

Features of Flush Cart (part number LFC-F) include:

- Cylinder: Schedule 40, 10” diameter
- Pump: Myers Quick Prime 15, 1½ hp, high head, 115 volt
- Hose Connections: 1½” PVC braid
- Valves: 1½” high flow ball valves
- Pump Drain: Integral petcock valve
- Priming: Drilled into pump volute housing, integral petcock valve to bleed air
- Tubing: 1½” Copper type L
- Hand Truck: Industrial P loop handle, 600 lb. rating, fully pneumatic 10”x 3½” tires
- Wiring: 15’ SJO 12 AWG with 15A male plug
- Power Switch: Liquid tight metal ON/OFF switch with box, switch rated at 20A 120V



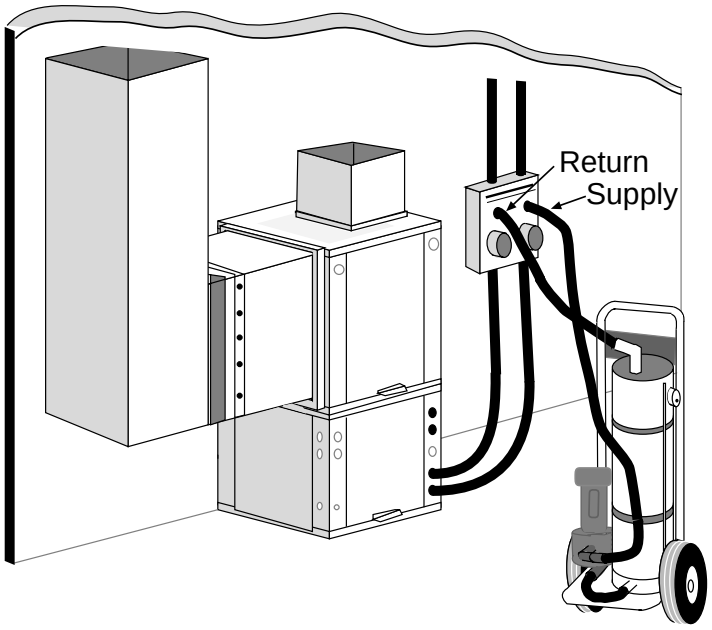
Pump Curve for Flush Cart



Caution: Use extreme care when opening, pouring and mixing flammable antifreeze solutions. Remote flames or electrical sparks can ingnite undiluted antifreezes and vapors. Use only in a well-ventilated area. Do not smoke when handling flammable antifreezes. Failure to observe safety precautions may result in fire, injury or death.

Flushing & Charging

Figure 8: Loop and Unit Flushing



All flushing of earth loops should be performed using a 1.5 hp (1.1 kW) or larger pump. The manufacturer markets a flush cart designed specifically for earth loops. Flushing can be accomplished using three different methods. The first flushing method applies a one-step installation of the loop, unit, and inside piping. The second method allows a Loop Contractor to use a flush cart when installing the loop; and, at a later date, the dealer can install the unit to the loop using only domestic water to flush the unit. The third procedure shown is used when replacing pump, coax or unit. The following are step-by-step procedures. Be careful not to rotate the three-way valve into a position where air can be introduced into the loop. Reflushing will be needed if this occurs. Valve position can be verified by looking on the end of the valve stem for the pattern position. Consult the Piping Design Manual for more complete flushing and antifreeze instructions. See the following sections for flushing and antifreeze charging specifics.

A minimum time of two hours of continuous flushing is recommended to remove all air from the loop. Flush in one direction only. Do not reverse flow.

The presence of air can be detected by “dead heading” the pump. To dead head the pump, close off the return to the pump and watch the water level in the flush tank reservoir. A drop of more than 2 inches indicates that there is air in the loop.

Power flushing can be achieved using the home’s city water supply (or well water) connected to the flush cart. This uses the combined pressure of the flush cart pump and the home’s water system for faster flushing.

After flushing is complete, but prior to unit start-up, remove the large screw from the center of the flow center pump to allow air to escape (water will drip out). Replace the screw after pump has filled with fluid.

For final pressurization, run the unit in heating or cooling for a period of 20 minutes. This time can be used to clean tools and workspace. After 20 minutes, pressurize the loop using the flush cart to 50-75 psi in winter, or 40-50 psi in summer.

In areas where entering loop temperature drop below 40º F (5º C) or where piping will be routed through areas subject to freezing, antifreeze is needed to prevent the loop water from freezing inside the pipe or heat exchanger. Alcohols and glycols are commonly used as antifreeze; however, you should consult with your representative (or distributor) for assistance on selecting the antifreeze best suited for your region.

Procedure for adding antifreeze:

a) Flush cart should be 1/2 full of water.
b) Add measured amount of antifreeze through hose below the water level.
c) Add antifreeze to loop side only (see flow center valve positions in Figures10a & 10b).
d) Pump and dump (discharge).
e) Turn off pump, close discharge valve.
f) Repeat the procedure to add remaining antifreeze to loop.

Flushing & Charging (cont.)

Flushing and Filling Earth Loop and Unit(s) Together

All air and debris must be removed from the earth loop piping system before operation. Flush the loop with a high volume of water at a high velocity (.6 m/s) (2 fps in all piping). The manufacturer has a flush cart available which performs this function. The steps below must be followed for proper flushing.

1. Connect the unit and loop to the flow center.
2. Assemble and attach the pressure measurement adapters to the access ports located on the flow center.
3. Connect the flush cart hoses to the adapters on the flow center.
4. Fill closed loop (outside) evenly with domestic water and discharge the return water by adding water to the flush cart until water returns to the reservoir. The return water should be filtered or discharged to remove debris.
5. Fill the cart 2/3 full for initial flushing.
6. Flush in one direction only.
7. Flush the lowest portion of the system first. Depending upon the individual layout, this could be the loop or the unit.
8. Restart pump. Once you have a steady flow of water on the return side from the system, deadhead the pump by closing the ball valve on the hose returning to the reservoir. This will generate maximum pressure on the system. While the return ball valve is closed, note the fluid level in the reservoir. If all the air is purged from the system, the level will drop only 1-2 inches in a flush cart with an 8-inch PCV reservoir (about 1/2 gallon), since water is not compressible. **This is the only way to tell if the air is purged from the system.** Open valve quickly. Wait one minute, then deadhead again. Repeat this process until all air is purged from the system.
9. Repeat step 8 for the higher elevation side of the system.
10. After flushing both sides of the system, reset flow control valves to flush the entire system. Repeat Step 8.

Valve Positioning

Figure 9a: FPT Style

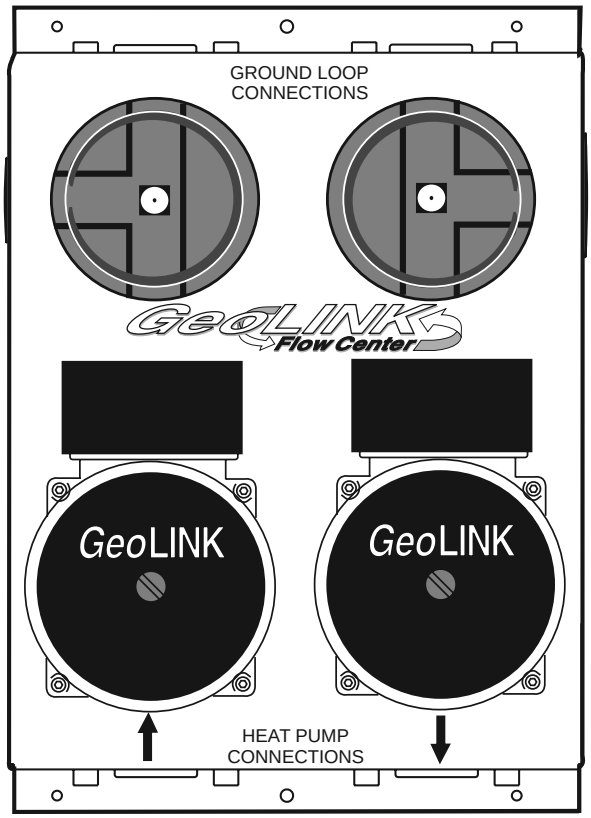
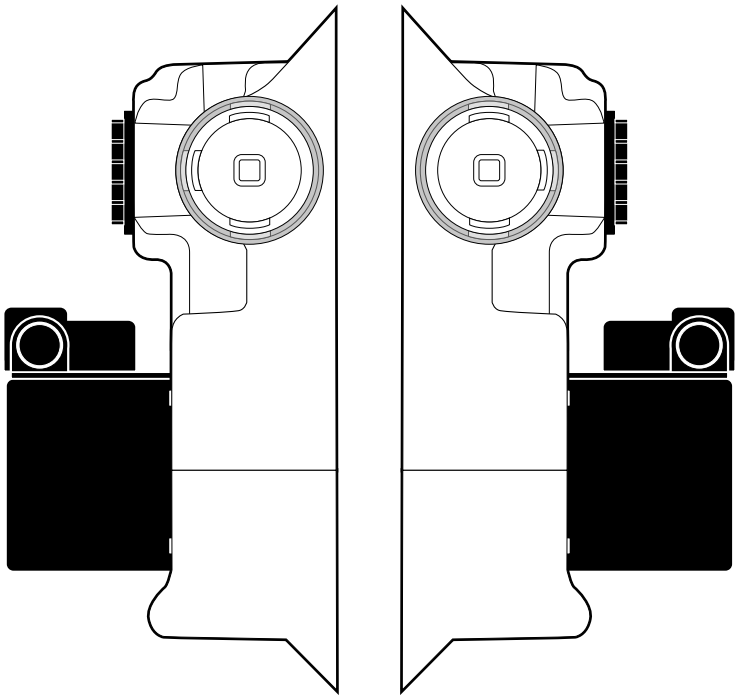


Figure 9b: GL Style



Flushing & Charging (cont.)

To Flush Loop Only

1. Connect loop to flow center.
2. Connect the unit side connections of the flow center together with a jumper.
3. Remove caps from flow center access ports.
4. Connect flush cart hoses to access ports.
5. Position valve stems as shown below.
6. Proceed with steps 4 through 8 on page 12.
7. Rotate the flow center valves to isolate the flush cart from the rest of the system.
8. Turn off flush cart pump, relieve the pressure on the hoses, and remove them.
9. Replace caps in access ports.
10. Remove jumper between unit connections.

Note: If antifreeze is to be added to the loop, follow procedure listed previously (page 11).

Valve Positioning

Figure 10a: FPT Style

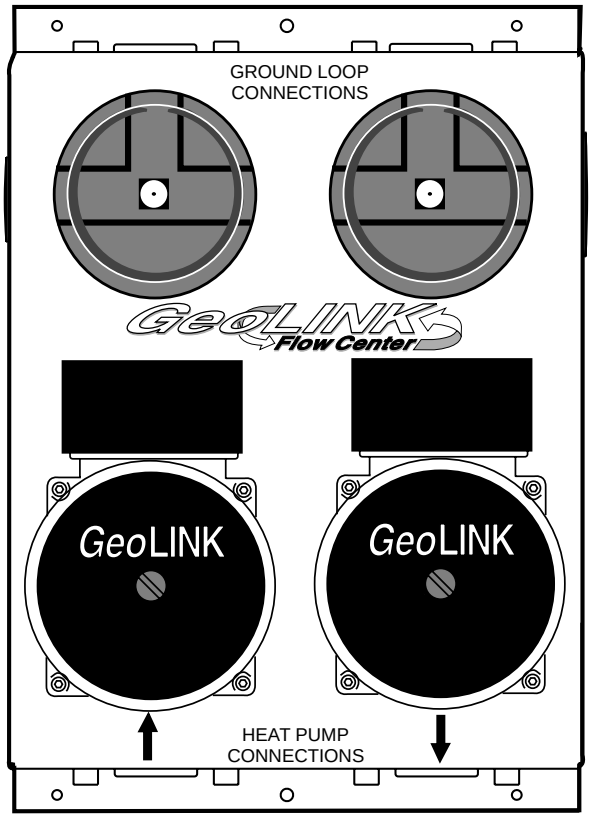
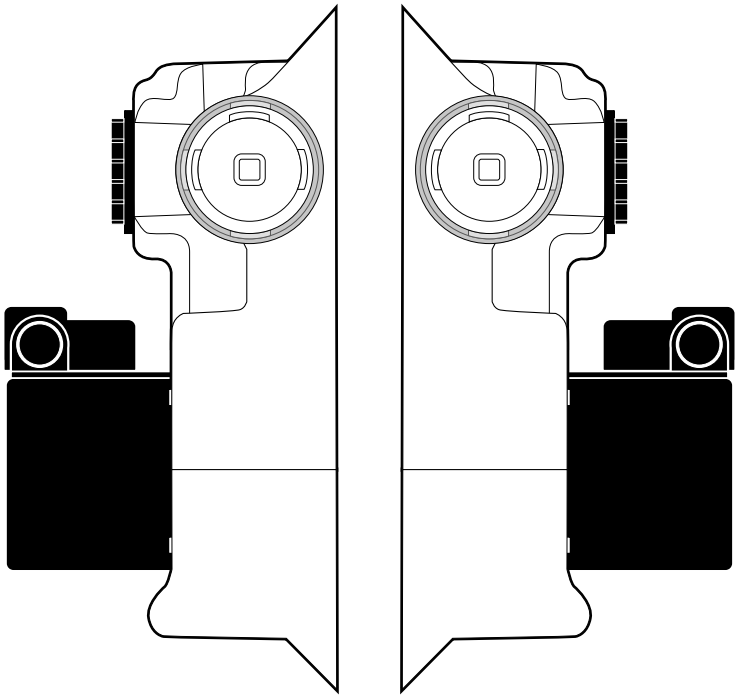


Figure 10b: GL Style



Flushing & Charging (cont.)

To Flush Unit Only: (Used When Replacing Unit, Coax, Hose Kit or Pump)

1. Connect unit to flow center.
2. Rotate 3-way valves to isolate ground loop and gain access to unit side only as shown in Figures 11a and 11b.
3. Remove access port caps/plugs and install boiler drain adapters for garden hose connection to the flow center.
4. Attach garden hose to domestic water supply.
5. Purge air from garden hose before connecting to port in flow center.
6. Attach another length of garden hose to the other port in the flow center, leading to drain.
7. Flush flow center and unit with domestic water until all air is removed.
8. Close boiler drain valve on discharge hose and pressurize system to domestic water pressure, approx. 40-75 psi (276-517 kPa).
9. Remove bleed screw(s) from loop pumps to purge air from them.
10. Close boiler drain valve on supply hose to trap pressure in the system.
11. Rotate 3-way valves back to the normal operating position (see Figures 12a and 12b).
12. Turn off water supply, disconnect hoses, remove flush adapters, and replace access port caps/plugs.

Valve Positioning

Figure 11a: FPT Style

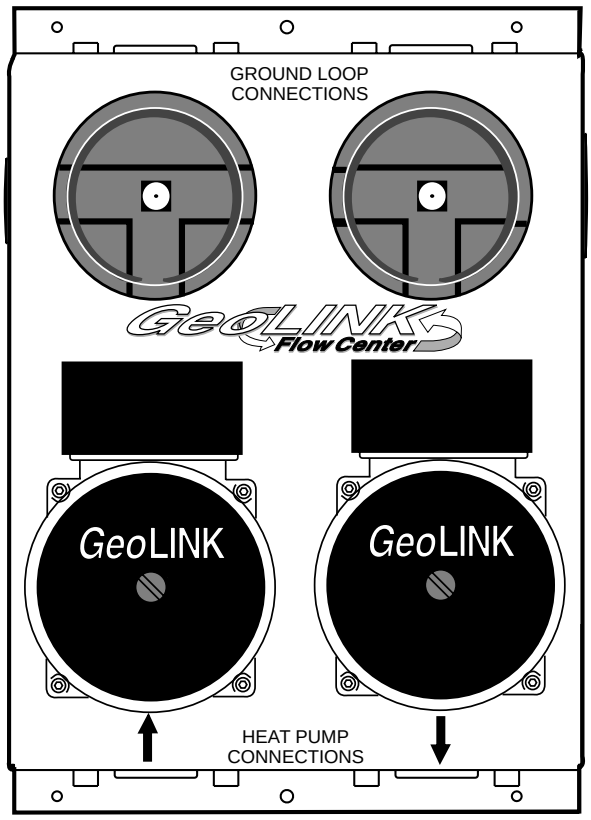
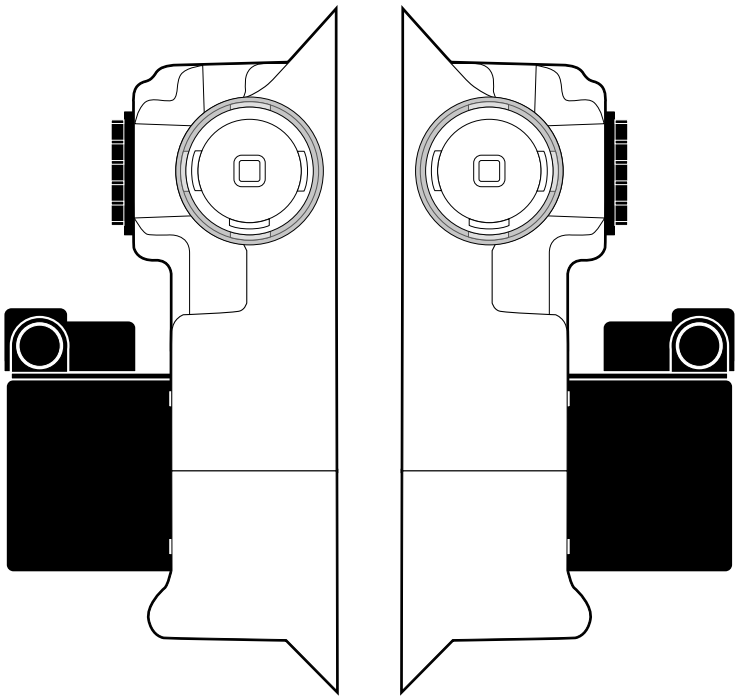


Figure 11b: GL Style



Flow Center Initial Startup

Startup of Flow Center

1. Check to make sure that the loop and unit isolation valves are completely open and the flush ports are closed and sealed.
2. Check and record the earth loop pressure: Loop Pressure = In _____ Out _____
3. Check and record the flow rate: Flow Rate = _____ GPM (L/S)
4. Check performance of unit. Refer to unit specification catalog.

P Series/E Series equipment includes freeze protection thermistors to protect the water-to-refrigerant heat exchanger (coax) from damage caused by freezing liquid. Be sure the “Loop/Well” DIP switch is in the “Loop” position if antifreeze is used and in the “Well” position if plain water is used in the loop.

Valve Positioning - Operational Mode

Figure 12a: FPT Style

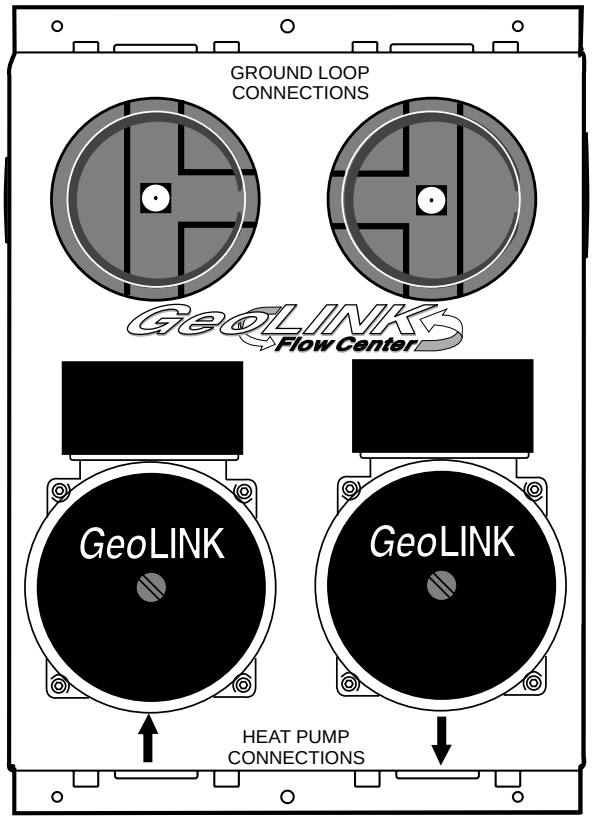
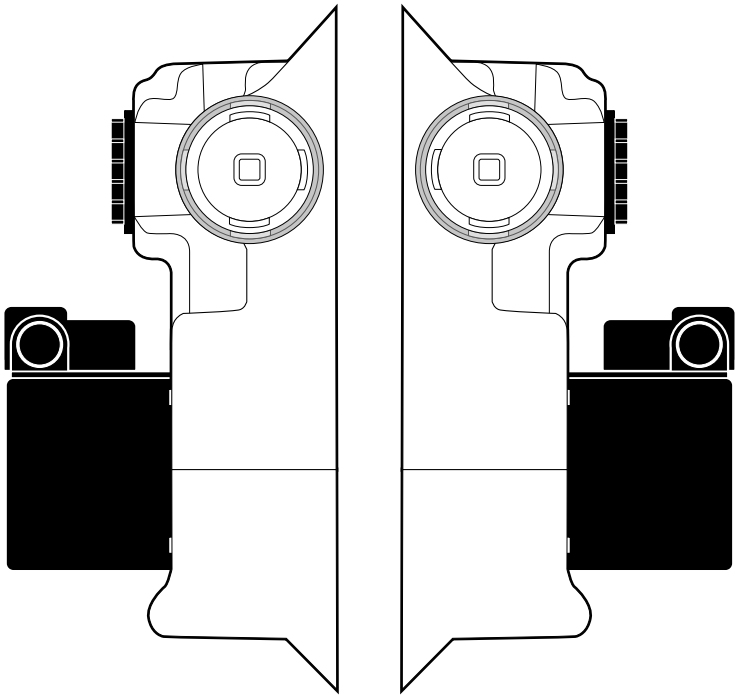


Figure 12b: GL Style



Procedure for Pressurizing System

1. Once the system is completely flushed and antifreeze added, it can then be pressurized. Perform this by deadheading the pump by closing the return hose ball valve. This will increase the pressure on the loop via the flush cart pump. As the pressure will fluctuate with the seasons (higher in winter, lower in summer), it is suggested that the initial loop pressure be 50-75 psi in winter, 40-50 psi in summer. If you cannot reach these pressures with the flush cart pump alone, turn on the fresh water feed to the cart while still deadheading the pump. The potable water pressure along with the pump will increase the amount of pressure in the loop.
2. Rotate the flow center valves to isolate the flush cart from the rest of the system.
3. Turn off flush cart pump, relieve the pressure on the hoses, and remove them.
4. Replace caps in access ports.
5. Before starting loop pump(s), be sure to bleed any air from the inside of the pump. This can be done by removing the bleed screw from the center of the pump head, allowing a small amount of fluid to drip out. Replace the bleed screw.

Note: If the flow center is mounted in the horizontal position, the supply hose during the last flush must be connected to the lower flush port to allow air to pass out of the upper port.

Flow Center Initial Startup (cont.)

Pressure/Temperature Plugs

The pressure/temperature plugs (P/T plugs) supplied with the earth loop connector kit are provided as a means of measuring flow and temperature. The water flow (GPM or L/S) through the unit can be checked by measuring the incoming water pressure at the supply water P/T plug and subtracting the leaving water pressure at the return water P/T plug. Comparing the pressure differential to the pressure drop/flow chart on pages 17 and 18 will determine the flow rate through the unit.

Example: An E035 with a 5.4 psi (37.2 kPa) pressure drop would be equivalent to 9 GPM on the chart. More flow will not hurt the performance. However, insufficient flow can significantly reduce capacity and possibly even damage the heat pump in extreme conditions.

Notes: Pressure/temperature gauges should be lubricated with a water-based lubricant and pushed gently into P/T ports to prevent internal damage to ports. Digital thermometers and pressure gauges needed for the P/T plugs are available from the manufacturer.

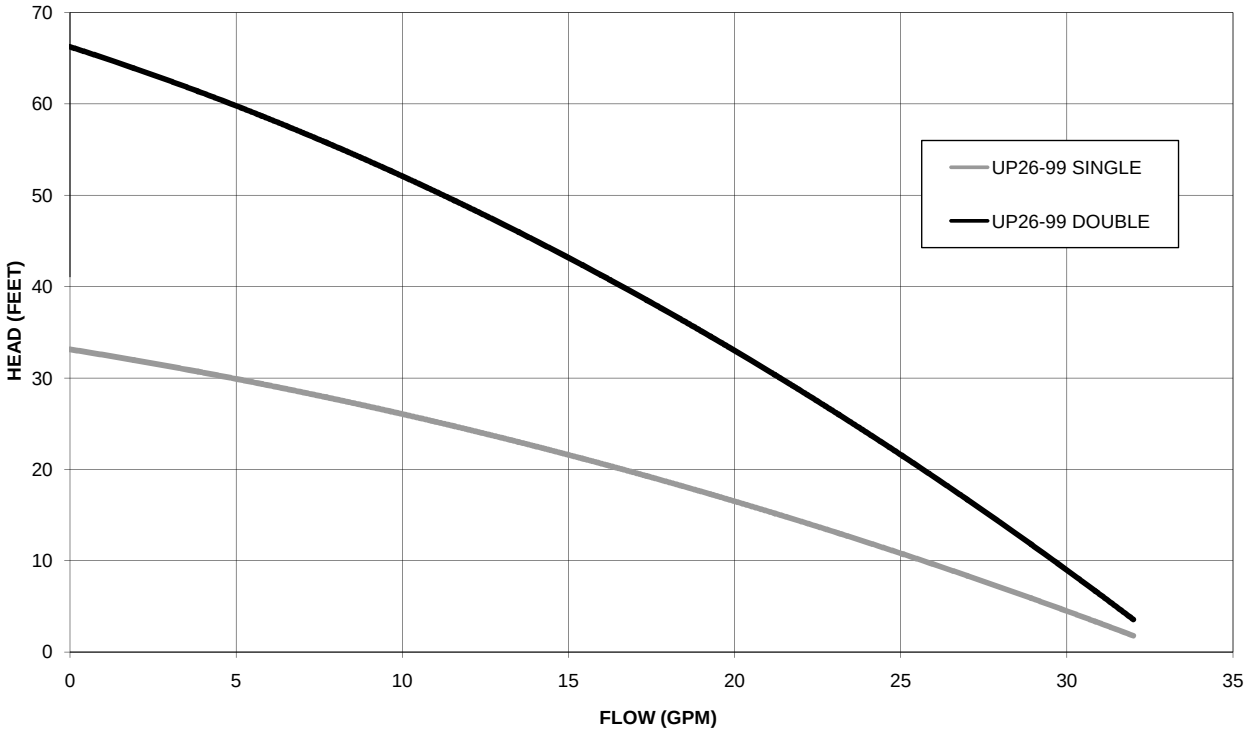
Earth Loop Flow Rate

Units require 2.25-3 GPM (0.14-0.19 L/S) per nominal cooling ton when installed in conjunction with an earth loop. Flow rates can be determined by measuring the pressure drop across the heat exchanger and comparing it against the pressure drop table on pages 17 and 18.

Note: Do not go below 2.25 GPM (0.14 L/S)/ton.

Flow Center Pump Performance

Figure 13: Performance Pump Curve (FPT & GL Flow Centers)



Unit Pressure Drop Tables

Residential Unit Pressure Drop

Series	Model & Size	Closed Loop (minimum)			Closed Loop (optimum)		
		Flow Rate	Pressure Drop*		Flow Rate	Pressure Drop*	
		GPM	PSI	Ft. Head	GPM	PSI	Ft. Head
Envision Single Speed	NS022	4.5	1.6	3.8	6.0	2.7	6.2
	NS030	6.0	2.8	6.6	8.0	4.8	11.1
	NS036	7.0	1.9	4.5	9.0	3.3	7.5
	NS042	8.0	2.1	4.8	11.0	4.1	9.4
	NS048	9.0	2.1	4.9	12.0	3.7	8.4
	NS060	12.0	3.6	8.4	15.0	5.3	12.3
	NS070	15.0	4.0	9.3	18.0	5.5	12.7
Envision Dual Capacity	ND026 Low	5.0	1.8	4.3	7.0	3.4	7.9
	ND026 High	6.0	2.6	6.0	8.0	4.4	10.1
	ND038 Low	6.0	1.6	3.7	8.0	2.6	6.1
	ND038 High	7.0	2.1	4.8	9.0	3.2	7.4
	ND049 Low	8.0	1.8	4.2	11.0	3.1	7.2
	ND049 High	9.0	2.2	5.2	12.0	3.6	8.4
	ND064 Low	10.0	2.5	5.7	14.0	4.7	10.8
	ND064 High	12.0	3.5	8.1	16.0	6.0	13.8
	ND072 Low	13.0	3.3	7.5	16.0	4.6	10.6
	ND072 High	15.0	4.2	9.8	18.0	5.7	13.1
E & EZ Single Speed	E024	4.5	1.4	3.2	6.0	2.4	5.6
	E030	5.5	2.0	4.7	7.0	3.1	7.2
	E035	7.0	3.4	7.9	9.0	5.4	12.4
	E040	8.0	3.3	7.7	11.0	4.7	10.9
	E047	9.0	3.5	8.2	12.0	5.6	12.9
	E058	11.0	2.9	6.7	14.0	4.6	10.6
	E066	13.0	4.1	9.5	16.0	5.8	13.4
E & EZ Dual Capacity	E036 Low	4.0	1.0	2.2	5.0	1.5	3.4
	E036 High	7.0	2.8	6.5	9.0	4.5	10.4
	E048 Low	6.0	1.9	4.4	9.0	3.5	8.1
	E048 High	9.0	3.5	8.1	12.0	5.6	12.9
	E060 Low	8.0	2.0	4.6	11.0	2.9	6.7
	E060 High	11.0	2.9	6.7	14.0	4.6	10.6
	E072 Low	10.0	2.6	6.0	13.0	4.1	9.5
	E072 High	13.0	4.1	9.5	16.0	5.8	13.4
ES Single Speed	ES024	4.5	1.8	4.2	6.0	2.7	6.2
	ES030	6.0	2.7	6.3	8.0	4.4	10.2
ES Dual Capacity	ES036 Low	4.0	1.2	2.7	5.0	1.7	3.9
	ES036 High	7.0	2.9	6.7	9.0	4.7	10.9
	ES048 Low	6.0	1.9	4.4	9.0	3.5	8.1
	ES048 High	9.0	3.5	8.2	12.0	5.6	12.9
	ES060 Low	8.0	2.0	4.6	11.0	2.9	6.7
	ES060 High	11.0	2.9	6.7	14.0	4.6	10.6
	ES072 Low	10.0	2.6	6.0	13.0	4.1	9.5
	ES072 High	13.0	4.1	9.5	16.0	5.8	13.4
Synergy3	RT046	9.0	5.2	12.0	12.0	8.3	19.2
	RT056	11.0	5.4	12.5	14.0	7.7	17.8
	RT066	13.0	6.7	15.5	16.0	10.3	23.8
Premier	P010	2.0	3.2	7.4	2.5	4.9	11.4
	P013	2.5	4.4	10.1	3.5	7.7	17.8
	P019	4.0	2.0	4.6	5.0	3.3	7.7
	P022	4.5	3.1	7.2	6.0	5.8	13.3
	P028	5.5	2.0	4.7	7.0	3.1	7.2
	P034	7.0	3.7	8.7	9.0	5.9	13.6
	P040	8.0	4.5	10.4	11.0	9.0	20.8
	P046	9.0	5.2	12.0	12.0	8.3	19.2
	P056	11.0	5.2	12.0	14.0	7.2	16.6
	P066	13.0	6.7	15.5	16.0	10.3	23.8

*** Pressure Drops shown at 50º F EWT. For Pressure Drops at other EWTs, use table below.**

Ent. Water Temp.		Correction Factor
ºF	ºC	
30	-1	1.08
70	21	0.93
90	32	0.88
110	43	0.83

Unit Pressure Drop Tables (cont.)

Residential Unit Pressure Drop (cont.)

Series	Model & Size	Closed Loop (minimum)			Closed Loop (optimum)		
		Flow Rate	Pressure Drop*		Flow Rate	Pressure Drop*	
		GPM	PSI	Ft. Head	GPM	PSI	Ft. Head
Versatec Vertical	V(L/X)009	2.0	2.5	5.8	2.5	4.0	9.2
	V(L/X)012	2.3	3.8	8.8	3.0	6.1	14.1
	V(L/X)015	3.0	1.6	3.6	4.0	2.1	4.9
	V(L/X)018	4.0	2.1	4.9	5.0	3.0	6.9
	V(L/X)024	4.5	2.6	6.0	6.0	4.1	9.5
	V(L/X)030	6.0	5.9	13.6	8.0	10.1	23.3
	V(L/X)036	7.0	3.1	7.2	9.0	5.2	12.0
	V(L/X)042	8.0	4.4	10.2	11.0	8.0	18.5
	V(L/X)048	9.0	4.5	10.4	12.0	7.4	17.1
	V(L/X)058	11.0	5.4	12.5	14.0	7.7	17.8
Versatec Horizontal	V(L/X)009	2.0	3.2	7.4	2.5	4.6	10.6
	V(L/X)012	2.3	3.6	8.3	3.0	6.2	14.3
	V(L/X)015	3.0	1.6	3.6	4.0	2.1	4.9
	V(L/X)018	4.0	2.0	4.7	5.0	3.4	7.9
	V(L/X)024	4.5	3.1	7.2	6.0	6.0	13.9
	V(L/X)030	6.0	2.4	5.4	8.0	3.8	8.8
	V(L/X)036	7.0	3.6	8.3	9.0	5.3	12.2
	V(L/X)042	8.0	4.7	10.9	11.0	8.6	19.9
	V(L/X)048	9.0	4.4	10.2	12.0	7.3	16.9
	V(L/X)058	11.0	4.7	10.9	14.0	7.2	16.6
	V(L/X)070	13.0	5.5	12.7	16.0	8.1	18.7
EW Water-to-water	EW020	6.0	4.6	10.7	9.0	10.0	23.2
	EW030	8.0	2.6	6.1	12.0	5.6	12.9
	EW042	11.0	2.9	6.6	16.5	6.2	14.4
	EW060	14.0	2.9	6.8	21.0	5.2	12.0
Premier Water-to-water	P034	7.0	3.4	7.9	9.0	5.2	12.0
	P056	11.0	5.9	13.7	14.0	8.5	19.7
Versatec Water-to-water	V036W	7.0	3.3	7.6	9.0	5.0	11.6
	V060W	11.0	4.1	9.5	14.0	5.8	13.4
Console	C07	1.5	1.3	3.0	2.0	2.1	4.9
	C09	1.8	1.9	4.5	2.5	3.2	7.4
	C12	2.3	2.1	4.9	3.0	3.4	7.9
	C15	3.0	3.8	8.8	4.0	6.4	14.8
	C18	4.0	3.3	7.6	5.0	5.5	12.7

Troubleshooting

PROBLEM	POSSIBLE CAUSE	CHECKS AND CORRECTIONS
Water drips out	Condensation	Insulate piping.
	Water leak	Tighten connections.
Low flow / No flow	No power	Check power supply from the unit.
	Blow fuse	Replace fuse - check for cause.
	Broken or loose wires	Replace or tighten wires.
	Pump shaft stuck	Remove the indicator plug and ensure that shaft is rotating.
	Air lock	Flush the loop to eliminate the air.
	Improperly sized pump	Add pump capacity.
	Defective pump	Replace.
	No positive pressure	Check for leaks; add fluid; flush loop in the earth loop (need more than 3 psi).
	Viscous solution	Change type of antifreeze.
	Loop fluid freezing or frozen	Switch Thermostat to air conditioning to see if flow improves at warmer temperature; add antifreeze and measure freeze protection.
	Kink in loop	Straighten or replace.
Noisy	Defective pump	Replace.
	Air in loop	Flush loop again.
	Vibration	Check mounting.
Pressure loss	Leak	Repair.
	Temperature change	Not a problem, pressure should vary as temperature changes (30 - 50 psi, 206 - 345 kPa).
	Pipe expansion	Not a problem, plastic pipe relaxing.
Unit trips out on water flow, low pressure, or high pressure	Low Flow / No Flow	See Low flow / No flow.

Antifreeze Selection And Use

"P" Series/"E" Series equipment includes freeze protection thermistors to protect the water-to-refrigerant heat exchanger (coax) from damage caused by freezing liquid. Be sure the "Loop/Well" DIP switch is in the "Loop" position if antifreeze is used and in the "Well" position if plain water is used in the loop.

Selection of the antifreeze solution for closed loop earth coupled systems requires the consideration of many important factors which have long-term implications on the performance and life of the equipment. Each area of concern leads to a different "best choice" of antifreeze. The fact is that there is no "ideal" antifreeze and any choice will require compromises in one area or another. Some of the factors to consider are:

Safety—The toxicity and flammability of the brine (antifreeze solution of any type).
Thermal performance—The heat transfer and viscosity effects of the brine.
Cost—The prices vary widely.
Corrosiveness—System materials must be compatible with the brine.
Stability—Will the brine require periodic change out or maintenance?
Convenience—Is the brine available and easy to transport and install?
Codes—Will the brine meet local and national regulatory standards?

Caution: Use extreme care when opening, pouring and mixing flammable antifreeze solutions. Remote flames or electrical sparks can ingnite undiluted antifreezes and vapors. Use only in a well-ventilated area. Do not smoke when handling flammable antifreezes. Failure to observe safety precautions may result in fire, injury or death.

The following are some general observations about the types of brine presently being used:

Methanol—Considered toxic in pure form, good heat transfer, low to mid price, flammable in concentrations greater than 25%, non-corrosive, low viscosity.

Ethanol (Environol 1000 and 2000)—Good heat transfer (slightly less than methanol), high price, flammable in concentrations greater than 25%, non-corrosive and low viscosity.

Propylene glycol—Nontoxic-noncorrosive, expensive, hard to handle when cold, poorest heat transfer, has formed "slime-type" coatings inside pipe. Poor heat transfer has required its removal in some systems.

GS4 (Potassium acetate)—Due to its low surface tension, GS4 is known to leak through mechanical fittings and most thread sealants. It is corrosive when exposed to air. The manufacturer does not recommend use of GS4 with its products.

Note: Consult with your representative or distributor if you have any questions regarding antifreeze selection, or any comments to report about problems or success with any particular methods.

Approximate Fluid Volume per 100' of Pipe

Type	Size	Volume (U.S. Gal/100' Pipe)	Volume (Liters/10 Meters)
Copper	1" CTS	4.1	15.5
Copper	1.25" CTS	6.4	24.2
Copper	1.5" CTS	9.2	34.8
Polyethylene	.75" - IPS SDR 11	3.0	11.4
Polyethylene	1" - IPS SDR 11	4.7	17.8
Polyethylene	1.25" - IPS SDR 11	7.5	28.4
Polyethylene	1.50" - IPS SDR 11	9.8	37.1
Polyethylene	2" - IPS SDR 11	15.4	58.3

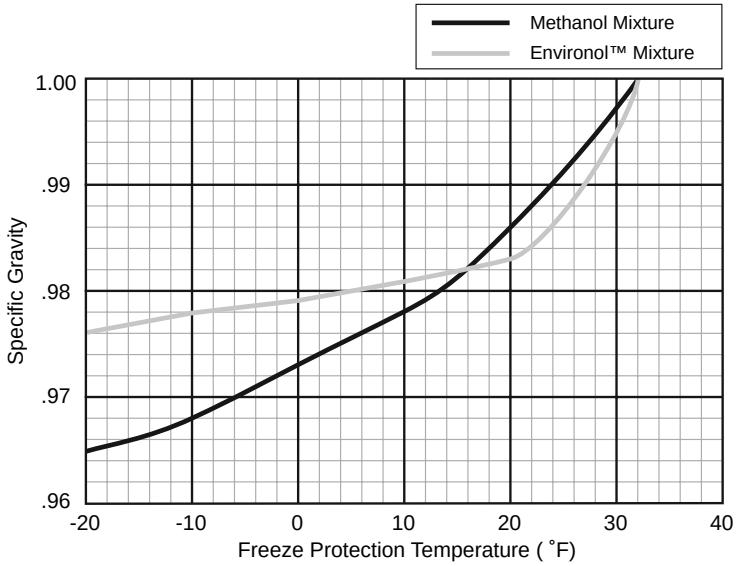
Antifreeze Requirements

Type	Minimum Temperature for Freeze Protection			
	10° F (-12.2° C)	15° F (-9.4° C)	20° F (-6.7° C)	25° F (-3.9° C)
Methanol*	25%	21%	16%	10%
Environol™ 1000* (premix)	100%	87%	72%	48%
Environol™ 2000* (pure)	27%	24%	20%	13%

Notes: Not all currently available in all areas. All % are by volume.

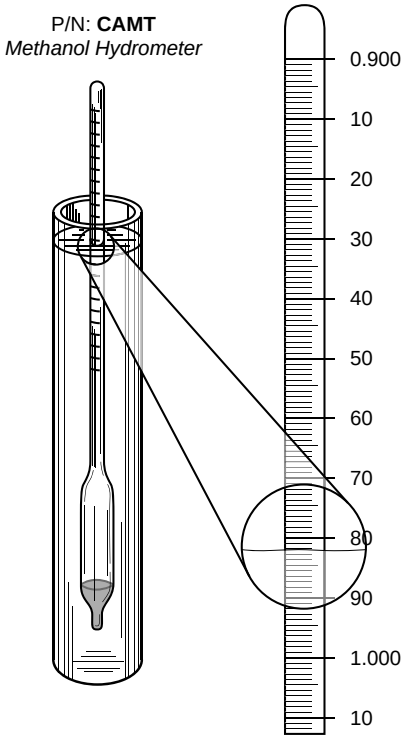
Antifreeze Selection and Use (cont.)

Figure 14: Freeze Protection Curves



* With reference to 60°F water courtesy of Carbide and Carbon Chemicals Corporation

P/N: **CAMT**
Methanol Hydrometer



0.982 = 15°

Figure 15: Environol™ 1000 Freeze Protection

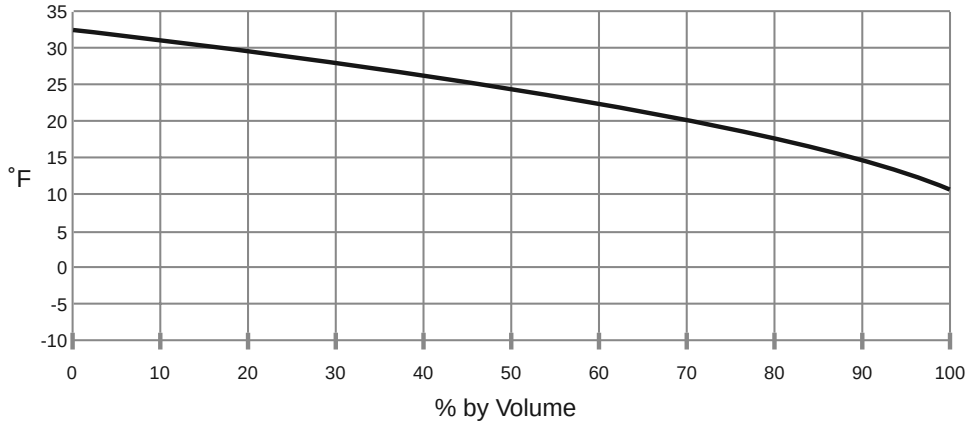
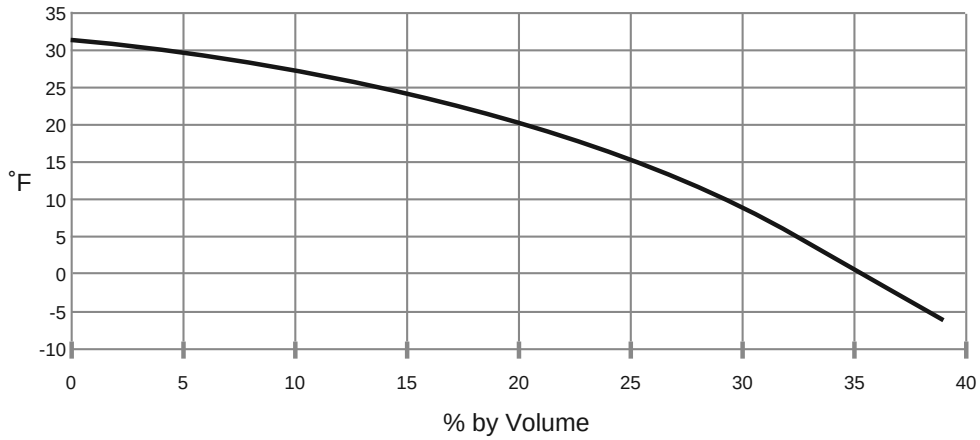


Figure 16: Environol™ 2000 Freeze Protection



Pipe Pressure Drop

WATERFURNACE POLYETHYLENE PRESSURE DROP
PER 100 FT OF PIPE IN FEET OF HEAD
ALL SIZES SDR 11

BRINE 8 25% ETHANOL @ 30°F
Viscosity 0.004 lbm/ft sec Darcy-Weisbach Method
Density 61.30 lb/ft3

FLOW RATE	3/4" IPS SDR 11			1" IPS SDR 11			1 1/4" IPS SDR 11			1 1/2" IPS SDR 11			2" IPS SDR 11		
	PD (ft)	Vel ft/s	Re	PD (ft)	Vel ft/s	Re	PD (ft)	Vel ft/s	Re	PD (ft)	Vel ft/s	Re	PD (ft)	Vel ft/s	Re
1	0.41	0.55	676	0.14	0.35	541	0.05	0.22	428	0.02	0.17	374	0.01	0.11	299
2	1.39	1.11	1352	0.48	0.71	1081	0.16	0.44	856	0.08	0.34	748	0.03	0.22	598
3	2.83	1.66	2028	0.98	1.06	1622	0.32	0.66	1284	0.17	0.51	1122	0.06	0.32	898
4	4.68	2.21	2704	1.62	1.41	2162	0.53	0.89	1712	0.28	0.68	1496	0.10	0.43	1197
5	6.91	2.76	3379	2.39	1.77	2703	0.79	1.11	2140	0.42	0.85	1870	0.14	0.54	1496
6	9.51	3.32	4055	3.29	2.12	3244	1.09	1.33	2568	0.57	1.02	2244	0.20	0.65	1795
7	12.45	3.87	4731	4.31	2.48	3784	1.42	1.55	2996	0.75	1.19	2618	0.26	0.76	2094
8	15.73	4.42	5407	5.45	2.83	4325	1.80	1.77	3424	0.95	1.35	2992	0.33	0.87	2394
9	19.33	4.98	6083	6.69	3.18	4866	2.21	1.99	3852	1.16	1.52	3366	0.40	0.97	2693
10	23.25	5.53	6759	8.05	3.54	5406	2.65	2.22	4280	1.40	1.69	3741	0.48	1.08	2992
11	27.47	6.08	7435	9.51	3.89	5947	3.14	2.44	4708	1.65	1.86	4115	0.57	1.19	3291
12	31.99	6.63	8111	11.07	4.24	6487	3.65	2.66	5136	1.93	2.03	4489	0.67	1.30	3590
13	36.79	7.19	8787	12.74	4.60	7028	4.20	2.88	5564	2.21	2.20	4863	0.77	1.41	3890
14				14.50	4.95	7569	4.78	3.10	5993	2.52	2.37	5237	0.87	1.52	4189
15				16.36	5.30	8109	5.40	3.32	6421	2.84	2.54	5611	0.98	1.62	4488
16				18.32	5.66	8650	6.04	3.55	6849	3.18	2.71	5985	1.10	1.73	4787
17				20.37	6.01	9191	6.72	3.77	7277	3.54	2.88	6359	1.23	1.84	5086
18				22.51	6.37	9731	7.43	3.99	7705	3.91	3.05	6733	1.36	1.95	5386
19				24.75	6.72	10272	8.16	4.21	8133	4.30	3.22	7107	1.49	2.06	5685
20				27.07	7.07	10812	8.93	4.43	8561	4.71	3.39	7481	1.63	2.17	5984
21				29.48	7.43	11353	9.72	4.65	8989	5.13	3.56	7855	1.77	2.27	6283
22				31.98	7.78	11894	10.55	4.87	9417	5.56	3.72	8229	1.93	2.38	6582
23				34.57	8.13	12434	11.40	5.10	9845	6.01	3.89	8603	2.08	2.49	6881
24							12.28	5.32	10273	6.47	4.06	8977	2.24	2.60	7181
25							13.19	5.54	10701	6.95	4.23	9351	2.41	2.71	7480
26							14.13	5.76	11129	7.45	4.40	9725	2.58	2.82	7779
28							16.09	6.20	11985	8.48	4.74	10473	2.94	3.03	8377
30							18.15	6.65	12841	9.57	5.08	11222	3.31	3.25	8976
32							20.32	7.09	13697	10.71	5.42	11970	3.71	3.47	9574
34							22.60	7.53	14553	11.91	5.76	12718	4.12	3.68	10173
36							24.98	7.98	15409	13.16	6.09	13466	4.56	3.90	10771
38							27.45	8.42	16265	14.47	6.43	14214	5.01	4.12	11369
40							30.03	8.86	17121	15.83	6.77	14962	5.48	4.33	11968
42							32.71	9.31	17978	17.24	7.11	15710	5.97	4.55	12566
44							35.48	9.75	18834	18.70	7.45	16458	6.48	4.77	13165
46							38.35	10.19	19690	20.22	7.79	17206	7.00	4.98	13763
48										21.78	8.13	17954	7.54	5.20	14361
50										23.39	8.47	18703	8.10	5.42	14960

Rev. 1/6/06

BRINE 4 20% METHANOL @ 30°F
Viscosity 0.002 lbm/ft sec Darcy-Weisbach Method
Density 60.80 lb/ft3

FLOW RATE	3/4" IPS SDR 11			1" IPS SDR 11			1 1/4" IPS SDR 11			1 1/2" IPS SDR 11			2" IPS SDR 11		
	PD (ft)	Vel ft/s	Re	PD (ft)	Vel ft/s	Re	PD (ft)	Vel ft/s	Re	PD (ft)	Vel ft/s	Re	PD (ft)	Vel ft/s	Re
1	0.36	0.55	1162	0.12	0.35	930	0.04	0.22	736	0.02	0.17	643	0.01	0.11	515
2	1.21	1.11	2325	0.42	0.71	1860	0.14	0.44	1472	0.07	0.34	1287	0.03	0.22	1029
3	2.47	1.66	3487	0.85	1.06	2789	0.28	0.66	2209	0.15	0.51	1930	0.05	0.32	1544
4	4.08	2.21	4650	1.41	1.41	3719	0.47	0.89	2945	0.25	0.68	2573	0.09	0.43	2058
5	6.04	2.76	5812	2.09	1.77	4649	0.69	1.11	3681	0.36	0.85	3217	0.13	0.54	2573
6	8.30	3.32	6975	2.87	2.12	5579	0.95	1.33	4417	0.50	1.02	3860	0.17	0.65	3088
7	10.87	3.87	8137	3.76	2.48	6509	1.24	1.55	5153	0.65	1.19	4503	0.23	0.76	3602
8	13.74	4.42	9300	4.76	2.83	7439	1.57	1.77	5890	0.83	1.35	5147	0.29	0.87	4117
9	16.88	4.98	10462	5.84	3.18	8368	1.93	1.99	6626	1.02	1.52	5790	0.35	0.97	4631
10	20.30	5.53	11625	7.03	3.54	9298	2.32	2.22	7362	1.22	1.69	6433	0.42	1.08	5146
11	23.99	6.08	12787	8.30	3.89	10228	2.74	2.44	8098	1.44	1.86	7077	0.50	1.19	5661
12	27.93	6.63	13950	9.67	4.24	11158	3.19	2.66	8834	1.68	2.03	7720	0.58	1.30	6175
13	32.13	7.19	15112	11.12	4.60	12088	3.67	2.88	9571	1.93	2.20	8363	0.67	1.41	6690
14				12.66	4.95	13018	4.18	3.10	10307	2.20	2.37	9007	0.76	1.52	7204
15				14.29	5.30	13947	4.71	3.32	11043	2.48	2.54	9650	0.86	1.62	7719
16				16.00	5.66	14877	5.28	3.55	11779	2.78	2.71	10293	0.96	1.73	8233
17				17.79	6.01	15807	5.87	3.77	12515	3.09	2.88	10937	1.07	1.84	8748
18				19.66	6.37	16737	6.48	3.99	13251	3.42	3.05	11580	1.18	1.95	9263
19				21.61	6.72	17667	7.13	4.21	13988	3.76	3.22	12223	1.30	2.06	9777
20				23.64	7.07	18597	7.80	4.43	14724	4.11	3.39	12867	1.42	2.17	10292
21				25.75	7.43	19526	8.49	4.65	15460	4.48	3.56	13510	1.55	2.27	10806
22				27.93	7.78	20456	9.21	4.87	16196	4.86	3.72	14154	1.68	2.38	11321
23				30.19	8.13	21386	9.96	5.10	16932	5.25	3.89	14797	1.82	2.49	11836
24							10.73	5.32	17669	5.65	4.06	15440	1.96	2.60	12350
25							11.52	5.54	18405	6.07	4.23	16084	2.10	2.71	12865
26							12.34	5.76	19141	6.50	4.40	16727	2.25	2.82	13379
28							14.05	6.20	20613	7.40	4.74	18014	2.56	3.03	14409
30							15.85	6.65	22086	8.36	5.08	19300	2.89	3.25	15438
32							17.75	7.09	23558	9.35	5.42	20587	3.24	3.47	16467
34							19.73	7.53	25031	10.40	5.76	21874	3.60	3.68	17496
36							21.81	7.98	26503	11.50	6.09	23160	3.98	3.90	18525
38							23.97	8.42	27975	12.64	6.43	24447	4.37	4.12	19555
40							26.22	8.86	29448	13.82	6.77	25734	4.79	4.33	20584
42							28.56	9.31	30920	15.05	7.11	27020	5.21	4.55	21613
44							30.98	9.75	32392	16.33	7.45	28307	5.65	4.77	22642
46							33.49	10.19	33865	17.65	7.79	29594	6.11	4.98	23671
48										19.02	8.13	30880	6.58	5.20	24700
50										20.43	8.47	32167	7.07	5.42	25730

Rev. 1/6/06

Pipe Pressure Drop (cont.)

WATERFURNACE PRESSURE DROP
PER 100 FT. OF PIPE IN FEET OF HEAD
CSA 100 and 160 SERIES PE PIPE

BRINE 4 **20% METHANOL @ 30°F**
Viscosity 0.002 lbm/ft sec Darcy-Weisbach Method
Density 60.80 lb/ft3

FLOW RATE	3/4" IPS CSA 160			1" IPS CSA 160			1 1/4" IPS CSA 100			1 1/2" IPS CSA 100			2" IPS CSA 100		
	PD (ft)	Vel ft/s	Re	PD (ft)	Vel ft/s	Re	PD (ft)	Vel ft/s	Re	PD (ft)	Vel ft/s	Re	PD (ft)	Vel ft/s	Re
1	0.49	0.63	1242	0.17	0.41	996	0.04	0.21	713	0.02	0.16	623	0.01	0.10	498
2	1.66	1.26	2484	0.58	0.81	1992	0.12	0.42	1425	0.06	0.32	1245	0.02	0.20	995
3	3.38	1.89	3726	1.18	1.22	2987	0.24	0.62	2138	0.13	0.48	1868	0.04	0.30	1493
4	5.59	2.52	4968	1.96	1.62	3983	0.40	0.83	2850	0.21	0.63	2490	0.07	0.41	1991
5	8.26	3.15	6210	2.89	2.03	4979	0.59	1.04	3563	0.31	0.79	3113	0.11	0.51	2488
6	11.37	3.79	7452	3.98	2.43	5975	0.81	1.25	4275	0.43	0.95	3735	0.15	0.61	2986
7	14.89	4.42	8694	5.21	2.84	6970	1.06	1.45	4988	0.56	1.11	4358	0.19	0.71	3483
8	18.80	5.05	9935	6.58	3.24	7966	1.34	1.66	5701	0.71	1.27	4980	0.24	0.81	3981
9	23.11	5.68	11177	8.09	3.65	8962	1.65	1.87	6413	0.87	1.43	5603	0.30	0.91	4479
10	27.79	6.31	12419	9.73	4.06	9958	1.99	2.08	7126	1.04	1.59	6225	0.36	1.01	4976
11	32.83	6.94	13661	11.50	4.46	10953	2.35	2.28	7838	1.23	1.74	6848	0.43	1.11	5474
12	38.23	7.57	14903	13.39	4.87	11949	2.73	2.49	8551	1.44	1.90	7470	0.50	1.22	5972
13	43.98	8.20	16145	15.40	5.27	12945	3.14	2.70	9264	1.65	2.06	8093	0.57	1.32	6469
14				17.53	5.68	13941	3.58	2.91	9976	1.88	2.22	8715	0.65	1.42	6967
15				19.78	6.08	14936	4.04	3.12	10689	2.12	2.38	9338	0.73	1.52	7465
16				22.15	6.49	15932	4.52	3.32	11401	2.38	2.54	9960	0.82	1.62	7962
17				24.63	6.90	16928	5.03	3.53	12114	2.64	2.69	10583	0.91	1.72	8460
18				27.22	7.30	17924	5.55	3.74	12826	2.92	2.85	11205	1.01	1.82	8957
19				29.92	7.71	18920	6.10	3.95	13539	3.21	3.01	11828	1.11	1.92	9455
20				32.73	8.11	19915	6.68	4.15	14252	3.51	3.17	12450	1.21	2.03	9953
21				35.65	8.52	20911	7.27	4.36	14964	3.83	3.33	13073	1.32	2.13	10450
22				38.67	8.92	21907	7.89	4.57	15677	4.15	3.49	13695	1.43	2.23	10948
23				41.80	9.33	22903	8.53	4.78	16389	4.49	3.65	14318	1.55	2.33	11446
24				45.03	9.73	23898	9.19	4.98	17102	4.84	3.80	14940	1.67	2.43	11943
25							9.87	5.19	17814	5.19	3.96	15563	1.79	2.53	12441
26							10.57	5.40	18527	5.56	4.12	16185	1.92	2.63	12939
28							12.03	5.82	19952	6.33	4.44	17430	2.19	2.84	13934
30							13.58	6.23	21377	7.15	4.76	18675	2.47	3.04	14929
32							15.20	6.65	22803	8.00	5.07	19920	2.76	3.24	15924
34							16.90	7.06	24228	8.90	5.39	21165	3.07	3.44	16920
36							18.68	7.48	25653	9.83	5.71	22410	3.39	3.65	17915
38							20.53	7.89	27078	10.81	6.02	23655	3.73	3.85	18910
40							22.46	8.31	28503	11.82	6.34	24900	4.08	4.05	19905
42							24.46	8.72	29928	12.88	6.66	26146	4.45	4.25	20901
44							26.54	9.14	31354	13.97	6.97	27391	4.82	4.46	21896
46							28.69	9.55	32779	15.10	7.29	28636	5.21	4.66	22891
48										16.27	7.61	29881	5.62	4.86	23887
50										17.47	7.93	31126	6.03	5.06	24882

Rev. 1/6/06

PRESSURE DROP
PER 100 FT OF HOSE IN FEET OF HEAD
Darcy-Weisbach Method

BRINE 4 **20% METHANOL @ 30°F**
Viscosity 0.002 lbm/ft sec
Density 60.80 lb/ft3

FLOW RATE	1" IPS RUBBER HOSE		
	PD (ft)	Vel ft/s	Re
1	0.18	0.41	1000
2	0.59	0.82	2000
3	1.21	1.23	2999
4	2.00	1.64	3999
5	2.95	2.04	4999
6	4.06	2.45	5999
7	5.31	2.86	6998
8	6.71	3.27	7998
9	8.25	3.68	8998
10	9.92	4.09	9998
11	11.72	4.50	10997
12	13.64	4.91	11997
13	15.70	5.31	12997
14	17.87	5.72	13997
15	20.16	6.13	14996
16	22.57	6.54	15996
17	25.10	6.95	16996
18	27.74	7.36	17996
19	30.49	7.77	18995
20	33.36	8.18	19995

Rev. 1/6/06

Note: For additional tables and information on calculating Pressure Drop, refer to document WF310.

Loop Pressurizer (LP1)

The Loop Pressurizer device (LP1) has been designed to facilitate the adding of water and pressure to the earth loop using the home's water system. The device includes the following components, (shipped unassembled):

- Pressure/Temperature port adapter (part number GA125)
- Brass nipple, ¼" x 1" long
- Brass insert bushing, ¼" x ¾"
- Brass ball valve
- Garden hose adapter x ¾" MPT

Figure 17: Loop Pressurizer

To add fluid and pressure to the loop, attach the LP1 to a garden hose, attached to the home's water system. Attach pressure gauge with port adapter into P/T plug on the leaving water side of the coax. Open the valve on the LP1 and place it in a bucket to bleed the air. Turn on water to hose and bleed off all air, until water coming from the LP1 flows freely without air. Keeping water pressure on, turn off valve on LP1 and insert it into the P/T plug on the entering water side of the coax. Open valve on LP1. Observe pressure gauge to ensure added pressurization.

Note: The LP1 is not designed to remove air from the loop. It is designed to add water and pressure to the loop. This device is not a substitute for proper flushing. Failure to eliminate air during flushing, or when using the LP1, may cause pump failure.

Manufactured by:
WaterFurnace Renewable Energy
9000 Conservation Way
Fort Wayne, IN 46809

Product:	Flow Center Installation and Loop Flushing
Type:	FC1-GL, FC2-GL, FC1-FPT, FC2-FPT, FC1-FPTB and FC2-FPTB. LFC-1

Document Type:	Installation Manual
Part Number:	IM1961
Release Date:	05/07
Supercedes:	IM1961 (11/06)