Bulletin 061013
TCR-104 & 109
Filling and adding to the Glycol pressure system

1. Glycol System and air

On this model the glycol system is a closed system, the glycol is not exposed to the air. No external air should get into the system. A small amount of gas will be in the system in the form of small air bubbles, but most will reabsorb as it passes though the pressurized pipe work.

Air in the system at colder temperatures causes the glycol to become thicker and the air could collect into a large bubble at high spots in the glycol system and block the glycol flow.

When the heater is used and there is a low glycol level in the system containing a small amount of air in the system, it could occur that the air collects at the pump inlet causing the pump to cavitate. The glycol may not circulate and this could cause the glycol probe to not read correctly. Should the heater continue to heat in this condition it will cause excess heat and pressure; this will cause components to fail.

The main part of the system is the pump, chiller, air separator, air vent, relief valve, fill valve and the expansion tank (which accommodates the glycol which will expand and contract as the temperature changes) plus the piping system around the tank.

Note: The thermostat has 2 probes. The cargo probe controls the cooling and/or heating. The thermostat also monitors the glycol probe, limit setting and the set point. This will temporally turn off the cooling or heating to prevent over cooling or heating. This requires that the pump inlet has enough glycol to allow glycol circulation through out the system.

2. Air trap and vent

The air trap is located on top of the air separator which is back of the control box. There is a Schrader (tire type valve) vent back of the control box on the top of the air separator. This provides a port to expel air but it has to be operated manually.

Venting at this point should be done at each pre trip.

Depending on the tank's cooling system there should be 2 additional vent points in the upper part of the tanks piping, 1 each side to allow for air venting.

3. The glycol

The circulating system is simple in design and in operation. Since the pipe work is a closed system there is no requirement for an inline filter. Should the system become contaminated with solid matter, it may collect at the chiller and restrict the flow. This could affect the capacity of the system. If this happens the chiller may be reverse flushed with high pressure, high volume liquid such as wet steam.

Caution: Only clean glycol should be added to the glycol system. The glycol should be checked and compatible glycol added.

Invariably the volume of the cooling system is not known to Klinge Corporation. However, generally the volume of glycol for these units, when fitted on a 20,000 liter ISO tank would be 30 ~ 35 or more US gallons. We recommend that for a new installation or a repair after a catastrophic loss that a 40 US gallon barrel of pre diluted glycol be used to fill the system.

Usually the coolant is an ethylene glycol based industrial or propylene glycol a food grade heat transfer fluid (Caution: the different glycols should not be mix). It is water-soluble, and has built in corrosion inhibitors and is compatible with other glycol fluids of the same type. The combination of a closed system and corrosion inhibitors in the glycol permit a longer glycol life.

The condition of the glycol is also important, it is suggested that each year the pH (acid level) should be checked (a pH of 7 or above is recommended). The ratio of glycol to water is to 50-50 or 60 glycol to 40 water. This should be checked with a refractometer or a less accurate hydrometer.

4. Initial filling

Adding glycol to a tank container that has no cargo in will be faster and easier.

It may be expedient to break the pipe work at one or two points to add the initial charge of glycol by gravity and allow the air to escape at another point.

After the filling operation is complete the pump (only) should be allowed to run. Set the unit set point the same as the cargo temperature and allow the unit to operate (the compressor should not run). Observe the glycol through the translucent hose at the pump suction inlet. The inlet sight tube should be full of glycol and there should be very few air bubbles in the system. When the system appears to be full, (no bubbles) continue to run the pump for approximately 15 minutes longer. Observe the glycol flow during this period, it should be steady, with no air bubbles.

There is a venting port above the air separator on the suction side of the pump, this small air tank has a Schrader valve located on top and the valve may be removed to aid filling and venting (see attached sketch for a fill tool). The unit can be filled through this pipe. Adjust the set point to be the same as the cargo temperature. This will allow the pump (only) to be run at this time to aid the charging of glycol and removing air. Allow this fill tool to remain open to the atmosphere allowing the air to escape. This pipe on the fill tool should always contain glycol to prevent air from being pulled back into the system.

The pump is not self-priming and relies on the coolant as a lubricant, so it should not be run dry.

If glycol is added at the fill valve, a pressure of 20 psig [1.4 Bars] is required.

If glycol is added at another spot, then the air vent on top of the air separator will manually need to be purged by depressing the Schrader valve often or remove the Schrader valve and use a fill tool.

Caution: **This air purging has to be done properly. There may be a lot of air in the form of small bubbles that will need to be removed. Air removal may take some time and should be done as completely as possible, because air in the system could cause the pump to cavitate (air at the inlet) and not push the liquid through the system.**

Caution: **The systems that have heaters require extra attention to the quantity of glycol in the system. If the level is low an air pocket could form at the pump inlet. At this time the pump will not pull glycol through a heater that may be operating. This would create excess heat and pressure and could cause damage to the system**

When it has been determined that most of the air is out of the system the glycol system can be closed.

5. <u>The glycol fill valve</u>

The fill valve is located between the air separator and the expansion tank. When the system is closed glycol is added through this fill valve which has a connection with 5/8 SAE x 45 degree male flare fitting with 7/8”- 14 threads/inch.

The fill valve will require 20 psig [1.4 Bars] or more pressure to open the valve to allow glycol to be added to the closed system. The fill valve has a check valve and only allows filling at this location.

Note: The fill valve will only allow glycol to be added to the system not the expansion tank.

6. <u>Adding glycol to the closed system</u>

Note: Some type of pumping device will be required for this charging operation.
For proper filling of glycol there should be no cargo in the tank.

The fill hose should be connected and under pressure during the charging process.

Turn the unit on and set the temperature set point to -20°F or [-30°C].

As the temperature falls the glycol will contract and allow more glycol to be pushed into the system. When it nears the set point, check the translucent hose for bubbles.

Run the unit on cooling for over 1 hour – the glycol pipe from the chiller outlet should be noticeably cooler. The refrigeration pipe at the expansion valve may frost up. This is normal – however, excessive icing indicates either a blockage in the chiller (see section 3) or if there is no glycol flow (see section 9)

The tank system has numerous vent points that can be used to remove air from the glycol system.

If the tank is loaded with a product, it may not be possible to pull the glycol down to –20°F. In this case, pull the unit down until the pull-down rate slows down. Replace the vent cap.

Note: If the fill valve will not allow the glycol to be added. See section 10 or a refrigerant hose with valve depressor can be used on the Schrader valve fitting on top of the vent

reservoir. CAUTION only a small amount of glycol 1/2 gal max. [2 Liter] should be added when the glycol is cold; when the system becomes warm excess glycol may exceed the capacity of the expansion tank and will be relieved through the relief valve.

7. The expansion tank

The expansion tank contains a flexible bladder and is used to contain the greater volume of glycol as the temperature rises.
The bladder in the expansion tank has air or nitrogen (N_2) on one side and system glycol on the other side. The pressure is checked at the Schrader valve on the bottom of the tank. This gas side is to be adjusted to 12 psig (0.8 Bar). This maintains a system pressure of 12 psig. And is a pre set charge and is not normally adjusted.

This tank contains a plate on the top side of the bladder with a valve stem that protrudes past the mounting threads. This presses on valve in the fill valve controlling the flow in the fill valve.

Only gas should be in the tank, if glycol comes out of this valve it indicates the bladder has failed and the gas charge has been lost. Running the unit in this condition could cause a failure. Contact Klinge Corporation or e-mail engineering@klingecorp.com for specific directions and reeferparts.com for spare parts.

8. The safety valve

The system also has a safety pressure relief valve, which is 50 psig (3.5 Bar)

9. The pump

The pump is not self-priming and relies on the coolant as a lubricant, so should not be run dry. However, it may be run intermittently in the initial filling stage to assist in venting the system. The pump, being a moving part has a service life estimated at 4 to 5 years of regular service. There is a replacement seal kit for in-service replacement.
Quote the serial number of the unit when ordering the in-service kit.

10. Air blockage at colder temperatures

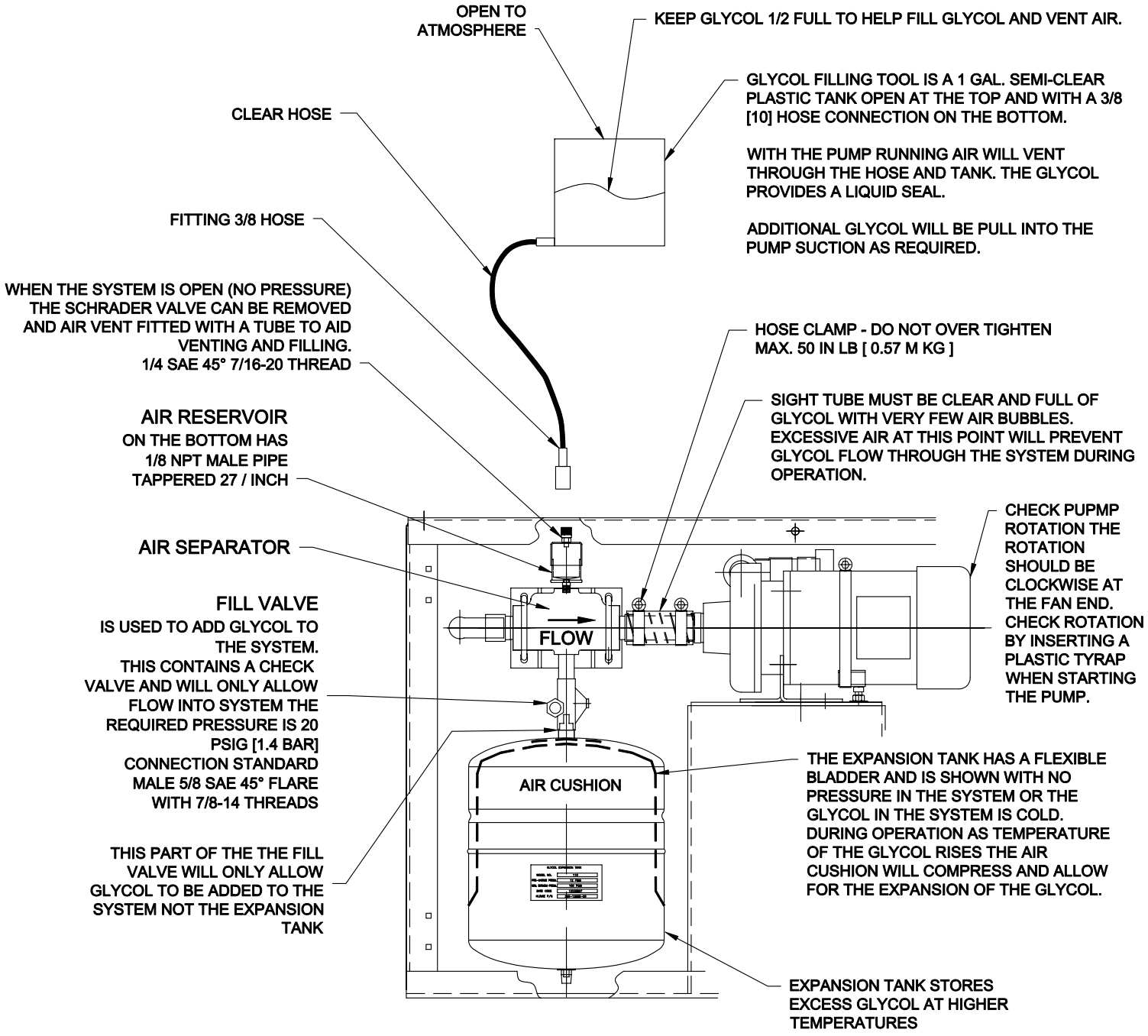
At ambient temperatures and with 12 psig of pressures, a small amount of air trapped in the system may freely flow around the system in a pattern of small bubbles. These will be visible at the sight-glass. These bubbles will tend to be trapped in the air vent cavity on top of the air separator. They can be released by removing the cap and depressing the pin on the (car tire like) valve. Always remember to replace the valve cap.

Venting of this type should be done at each pre trip.

As the glycol becomes colder it becomes denser and more viscous and the entrapped air bubbles will tend to reduce in size. As the glycol temperature falls, the bubbles will come out of suspension and have a tendency to collect and combine into one larger bubble. This will tend to happen normally at the highest point in the pipe run or place where the pipe size changes and causes a pressure drop. Once the large bubble begins it will tend to accumulate more of the air in the system. When the volume of the air bubble exceeds the cross section of the pipe, it will tend

to act as plug slowing the flow of liquid to the suction side of the pump and stall the pump - resulting in no flow of liquid. Obviously, this large bubble cannot be seen from the outside of the system and the small bubbles seen in the sight glass may give the impression of liquid flow. The refrigeration unit will give the impression of working but the cargo temperature will rise. If this happens, there may be a frost build up on the expansion valve at the chiller.

To free the system of the residual bubbles the temperature of the glycol may have to be increased. Because of the comparative large mass of the cargo compared to the mass of the glycol it may be possible to lift the temperature of the glycol without affecting the cargo temperature. If this is done, vent the air trap frequently. On completion, do not forget to replace the valve cap.



ADDING GLYCOL SYSTEM AND VENTING AIR WITH NO PRESSURE IN THE SYSTEM MODEL TCR-104-04 THRU 09