

GLYCOL CHILLER SYSTEM

TROUBLESHOOTING 101

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There is a good chance your glycol chiller system is often completely forgotten about, until that dreaded day you arrive to find high Fermenter temperatures and your glycol chiller system is not running.

What is the first thing a brewer should do in this situation? Don't panic and don't jump to conclusions. There are several issues or conditions that can cause these alarms. Here we will cover the most common causes and the steps that you can do to remedy, diagnose, and even repair. The goal of this article is not to eliminate the services of a Refrigeration Service Technician, but perhaps minimize these calls to save both you and your service technician's time.

FREEZE, FLOW, OR LOW PRESSURE ALARM

I can almost guarantee, that sometime during the life of your chiller system you will experience a Freeze Alarm. These alarms can not only cause compressor and evaporator failures, but can also cause catastrophic system failures. For example; a ruptured evaporator can not only ruin your entire chiller system, but also contaminate your entire glycol piping loop with refrigerant and oil.

Before we reset a Freeze Alarm, lets first see if we can determine what might have caused this alarm.

- 1) **GLYCOL SOLUTION.** Not only check the glycol percentage but also the level, or volume, of glycol in the storage tank.

You want the freeze point of the solution to be 20-25 F below the thermostat set point- a safe rule of thumb is to operate with 1/3 Propylene Glycol to 2/3 Water mixture, providing a freeze point of approx. +5 F.

The minimum storage tank glycol level varies by manufacturer. You must make sure that when all of the pumps are on, there is enough glycol to prevent pump cavitation (the sucking of air into the pump) which stops the glycol flow and cause an almost immediate freeze up.

I can share too many stories about companies that ignored these alarms and simply reset the controls (sometimes daily), never checking the glycol. Eventually loosing compressors, evaporators, or even pumps. All of this easily preventable with a simple test or check of the glycol tank.

After you have confirmed that your glycol storage tank level and glycol solution concentration are good, reset the Freeze Alarm. The Freeze Control will typically be found near the Chiller Evaporator. On our systems these are marked with a friendly warning encouraging the customer not to modify or change the alarm setpoint with out calling us. The reset is located on the face, or front, of the control.

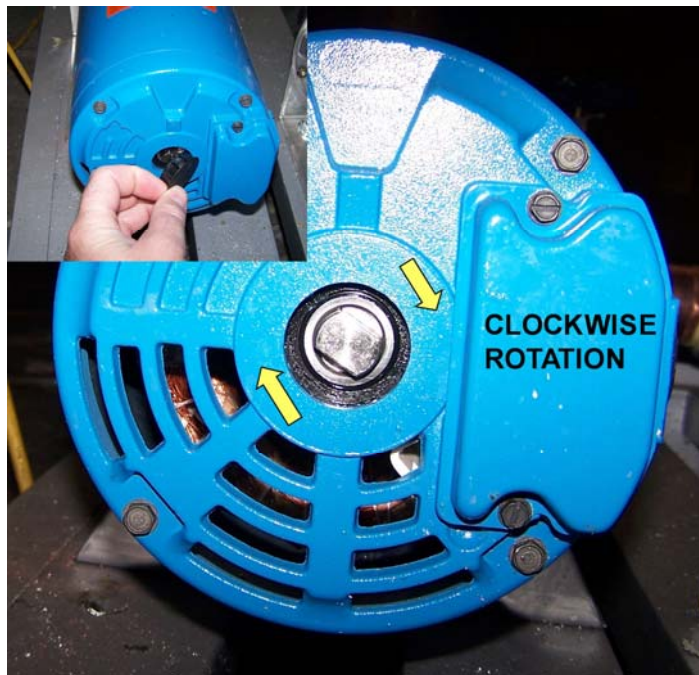


There are many different Freeze or Flow Safety Controls, please refer to the Owner Manual or contact the manufacturer if you are unsure how to reset, or where this control is located.

Now the Freeze Control has been reset and the system begins to run. We can investigate a little further to try and find a cause for the Freeze Alarm.

- 2) **PUMP ROTATION.** A common cause of Freeze Alarms is due to lack of flow. To start, check the rotation of the glycol pump. If a centrifugal pump's rotation is reversed it will still pump glycol, but only a fraction of the design flow. The reduced flow will cause reduced refrigerant temperatures in the evaporator, often causing a system freeze up.

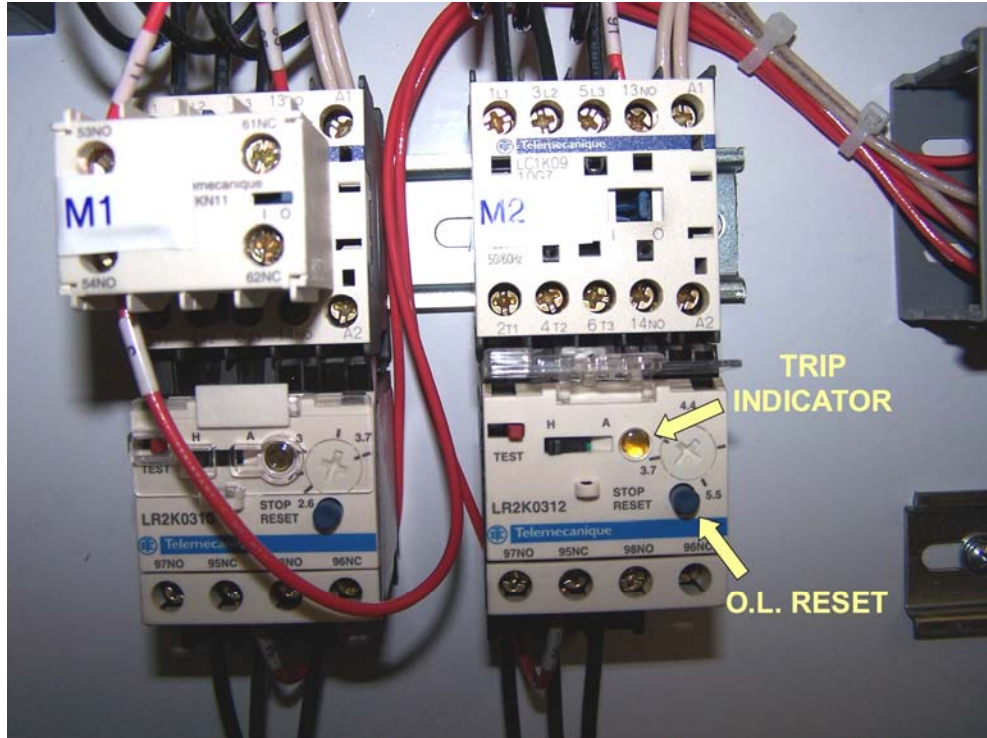
Pump rotations vary, there should be a rotation indicator on the motor. The most common rotation is clockwise when you inspect from the motor end of the pump. If you find the rotation is incorrect, you will need to switch any two motor leads. This should be done with all of the system power off and by a certified technician or electrician.



- 3) **FLOW RESTRICTION.** A flow restriction can also cause a Freeze Alarm. There might be a restriction in the piping, possibly a valve was closed, or your pump has simply failed, or perhaps you recently added Fermenters increasing the load on this pump- all of these can cause flow issues leading to freeze alarms.
- 4) **GLYCOL PUMP.** If you're unable to get the glycol pump to turn on, there is chance that you have tripped the Pump Motor Starter Overload.

Before opening the electrical control panel and checking to see if the pump overload is tripped, please make certain that the electrical power supply is shut off- some panels receive power from multiple sources- make certain that all supplied power is OFF.

With the control panel open, visually locate the motor starter.



Before you reset this overload we need to make sure we have power on all three poles, or legs, of the starter (on 3 phase systems). If you have lost a single leg of power and reset without correcting this fault, permanent motor damage could result. We strongly recommend you consult with a certified technician or electrician to confirm this. Once confirmed, the overload can be reset.

If the overload trips again, shutting the pump motor off, it is likely you have a bigger issue. The cause could be a failed pump motor, loose wire connections, or even a defective overload- this should be left to a service technician to diagnose.

So let's review, we have; checked the Glycol Solution, reset the Freeze Alarm, checked the Glycol Pump, and checked the Pump Motor Starter. We still have a couple more items we can investigate.

- 5) **REFRIGERANT CHARGE.** In addition to an actual freeze situation, a Freeze Alarm can also be the result of low refrigerant charge.

Most Chiller Systems are supplied with Liquid Line Sightglasses, these are located in the liquid refrigerant line that feeds your expansion valve. When the compressor starts you will see bubbles in this Sightglass, the bubbles should quickly disappear and the Sightglass should clear. If after 60-90 seconds you still see bubbles



in this Sightglass, it is a good indication that your system is low on refrigerant.

Traces of refrigerant oil on the copper pipes is an obvious indication of a leak. Please remember that refrigerant can be harmful if ingested and even cause death, especially inside an enclosed area. Do not attempt to repair a refrigerant leak yourself, this is not only potentially dangerous to you but can also cause additional damage to the system.

Your refrigerant technician will utilize an electronic leak detector and/or opt to coat all accessible weld and flare fittings with soap bubbles (a mixture of detergent and water)- the leaking refrigerant is then detected by the soap bubbles that are created. If the technician is unable to find a leak, he will need to reclaim the remaining refrigerant from the system and charge the system up with Nitrogen, isolating parts of the system to pinpoint the leak source eventually finding the leak.

- 6) **THERMOSTAT.** With the system running, check the setpoint of your thermostat. It should read somewhere in the 26-30 F range. There is a chance the T-Stat may be defective and not shutting the system down at setpoint (this issue can occur intermittently too, making it a challenge to diagnose). Manually adjust the setpoint of the T-Stat up to the current operating temperature. Did the system shut down when you raised the setpoint? Repeat this test several times.
- 7) **DEFECTIVE SOLENOID VALVE.** The thermostat typically opens and closes the liquid line solenoid valve. Just like your glycol solenoid valve on your Fermenters, these valves can occasionally hang open. Like your Fermenters, when this happens you over cool your system, eventually shutting down your chiller on the freeze alarm. If you can see that your T-Stat is satisfied, but your solenoid is still open and your compressor is still running, your solenoid valve is likely faulty and you will need to have a technician come out and replace it.

If none of these identified a potential cause, it may have just been a one time deal. Monitor the system closely and keep your eye out for any other indicators.

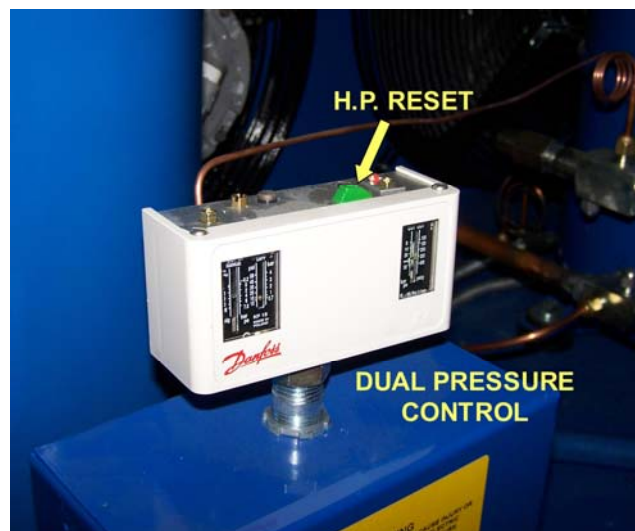
You could also call a technician out to take a look. They will obviously be equipped to go over the system much more extensively. At least you can review with him what you have already checked and probably reduce their valuable, and expensive, time onsite.

HIGH HEAD PRESSURE ALARM

A common fault that often appears during peak load periods and when the ambient temperature is very high is a High Head Pressure Alarm. Often there will not be an indicator light for this alarm and the only way to determine is to reset the control.

The High Pressure control will typically be found at the compressor. The reset is located on top of the control or sometimes on the face of the control. Upon pressing the reset, the compressor and fans should come on immediately.

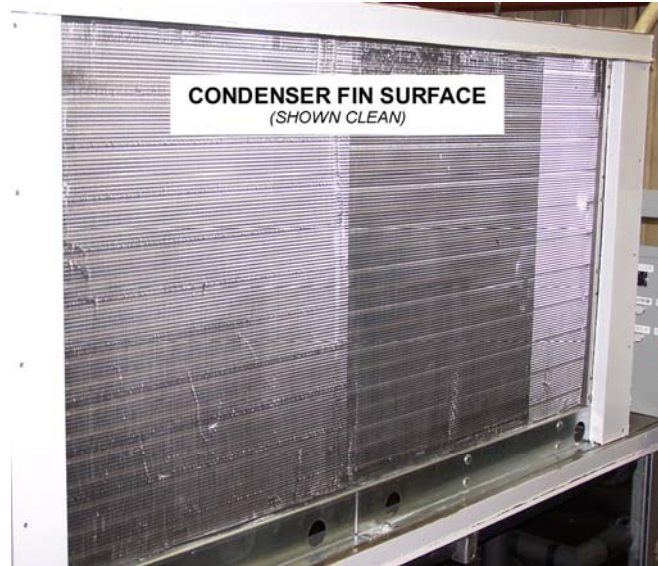
The system will likely trip off again after resetting. This is because the glycol temperature has probably increased while the compressor was off (because the pumps likely remained on). As the glycol temperature increased, your



refrigerant pressures have also increased forcing the compressor to operate, momentarily, outside the design envelope. After resetting this control, do not load the system up immediately. It is important that you first drop the glycol temperature in the storage tank to within the design range of the system, before you try to bring your Fermenters back online. When the glycol tank reaches 27 to 35 F, go ahead and start bringing the Fermenters online slowly so as not to overload the system.

Here are a couple possible causes for this alarm:

- 1) **DIRTY CONDENSER.** Check the finned surface on the condenser, is it plugged with dirt and hard to see through? Take a fine brush and gently try to clean away any obstruction to this coil, be very careful to not bend the fin surface, as this will restrict the airflow and cause more harm than good. With the system off you can also try to spray this coil down, being careful not to get water into the fan motors. If the condenser is severely plugged up, you should contact a service technician and ask him to come out and clean professionally. There is specially formulated coil cleaning detergent and tools that the professionals will use, do not use any solvents or acid cleaners that are not designed for this purpose. A clean condenser will not only prevent HP Alarms, but provide increased operating efficiency and cooling capacity.



- 2) **FAILED FAN MOTOR.** As most condensers will have at least two fan motors, a failed motor can go weeks, even months, without being detected. During the hot summer months, a faulty fan motor will quickly become evident as the unit will likely shut off on the High Head Pressure Alarm.
- 3) **AIRFLOW.** I was once called to a winery whose system was repeatedly tripping out on High Head Pressure. I arrived to find the customer had stacked large apple crates around the chiller system to shade the system from the direct sun. In reality, these apple crates were preventing any fresh air from reaching the chiller system. Instead they were simply re-circulating the same air through the condenser. On this day the ambient was 85 F, but we had air temperatures well over 120 F at the chiller system. Refrigeration systems need fresh air much more than they need shade from the sun.

You will find similar issues when air cooled chiller systems are placed indoors. If the chiller system is indoors, you need an exhaust system and make up air vent equal in CFM capacity as your condenser fans.

COMPONENT FAILURE

If you suspect that you have a failed component, your next step is to contact your service technician. A competent service technician will listen closely to the customer to minimize the troubleshooting and repair time. Believe it or not, a service technician doesn't enjoy charging you for a service call, travel time, and truck stock fee, etc. to simply reset an alarm.

Share what steps you have taken, make sure he (or she) understands the system completely. If you know it is the first time they have worked on or seen your chiller system, ask if they would be willing to contact the manufacturer to have them explain how the system is controlled. Often 10 minutes on the phone with the manufacturer can greatly reduce the service and repair time. Remember that this technician might service 5 to 10 different refrigeration systems by 5 to 10 different manufactures each day, and there is a very good chance that none of these systems were glycol chiller systems.

If you need to find a new service technician, take the time to call around and talk to several of them. We have had the best success with contractors that specialize in commercial refrigeration, instead of specializing in Heating and Air Conditioning. Although the same refrigeration theory is applicable to both Air Conditioning and Medium Temperature Refrigeration, there are some definite differences and you want a contractor comfortable with working on this equipment.

Explain that you have a "Medium Temperature Glycol Chiller System" that operates at 27 F with a 33% Glycol Mixture. The contractors that are not familiar with or comfortable with servicing this equipment will probably let you know right then. Another great referral source would be other breweries or wineries in your area. Often the manufacturer will also have a contractor in the area they can recommend.

Many manufacturers will also provide replacement parts to their existing customers, often for significantly less than these can be purchased locally. Encourage your service technician to contact them, in addition to the local wholesale suppliers if replacement parts are needed.

Hopefully with some of the advise listed here you can eliminate, or at least reduce, the number of service calls on your chiller system. Do you have a story, or input, advise, questions? I would love to hear them, please contact me at jimvgjr@prorefrigeration.com.

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