REFRIGERATING SPECIALTIES RAPID PURGER COMMISSIONING AND TROUBLESHOOTING

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Non-condensable gasses such as air, hydrogen, nitrogen and hydrocarbons reduce the overall efficiency of refrigeration systems. The effects of non-condensable gasses in a refrigeration system increase system operating pressures which in turn negatively effects system performance. Increased compressor discharge temperature, higher energy costs, reduced system efficiency, leaks due to higher pressures and increased wear on mechanical components are all negative consequences of non-condensable gasses in refrigeration systems.

The build-up of non-condensable gasses in the system can be attributed to several factors including inadequate system evacuation during service of system equipment, additions of refrigerant, leaks through external seals on equipment as well as refrigerant and oil decomposition.

Common indicators of non-condensable gasses in the system are excessively high condensing pressure or temperature and deviations in the pressure and temperature relationship at saturation conditions. This can be determined by checking the temperature and pressure relationship at a known point in the system where the refrigerant is saturated, such as the condenser drain legs or high pressure receiver. A higher temperature measured at this point compared to the saturation pressure indicates the presence of non-condensable gasses in the system.

Purging non-condensable gas from a refrigeration system can be accomplished manually, mechanically or automatically. Manual purging generally involves personnel removing air from specified purge “points” within the system through hand shut off valves routed to a portable water reservoir. Mechanical purging is achieved by use of a device which will allow air to escape to a water reservoir when air is present. The last method is automatic purging which is generally achieved by the use of a self-contained system incorporating microprocessor controls designed to sample the non-condensable gasses and refrigerant mixture and purge when non-condensable gasses are present.

Mechanical and automatic air purging units, commonly referred to as "purgers", are manufactured by several companies. Each manufacturer's purger operates in its own unique way. This article will focus specifically on the automatic purgers manufactured by Parker Hannifin Refrigerating Specialties Division.

Introduction

Refrigerating Specialties has manufactured three variations of automatic non-condensable gas purging equipment. The Rapid Purger which was introduced in the year 2000 is a legacy design and will not be specifically addressed. The information pertaining to troubleshooting the current designs detailed in this article may apply to some aspects of the original Rapid Purger. The Rapid Purger V200 was introduced in 2008 as an upgrade to the original Rapid Purger, simplifying the overall design of the unit and reducing the required assembly by the end user. The most recent revision to the Rapid Purger is the V300, which consists of an upgraded control unit reducing the complexity of the controller and adding additional features not found in the V200.

Proper commissioning and problem solving requires understanding the basic function and operating characteristics of the Rapid Purger. The primary function of the purger is to efficiently remove non-condensable gasses from the refrigeration system with minimal loss of refrigerant. This is accomplished by sampling a conditioned mixture of refrigerant and non-condensable gasses and then venting the mixture when the amount of non-condensable gasses reaches a specified concentration.

The first stage in the purge process is filling and pre-cooling the heat exchanger. High pressure liquid is fed to the tube side of the heat exchanger through the liquid feed solenoid, check valve and orifice. The liquid feed solenoid remains energized until the refrigerant level in the heat exchanger reaches the level sensor, fully flooding the tubes. The purger will remain in this mode until the shell side of the heat exchanger reaches 40°F or lower as controlled by the suction pressure that the purger is tied into. Before beginning this stage the water reservoir is also filled with water. See Figure 1 for a graphic representation of this stage.

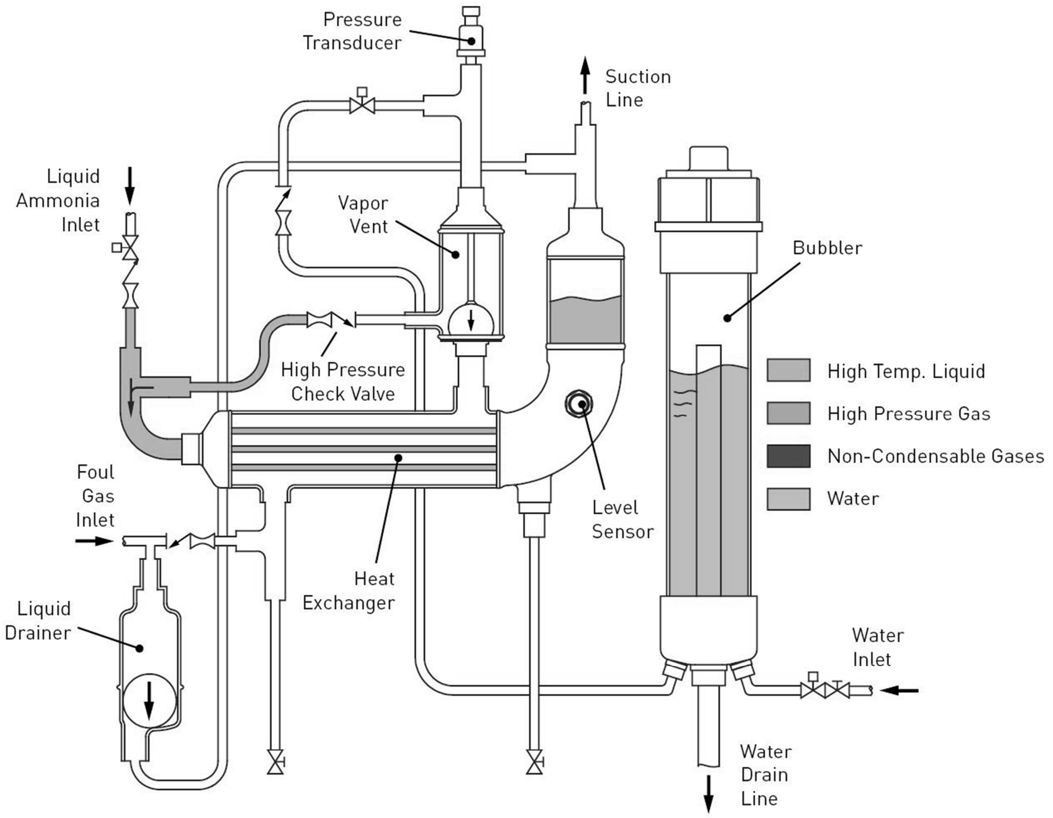

Figure 1: Fill and Pre-Cool stage.

Once the heat exchanger reaches the required temperature, the purger will enter active mode. The non-condensable gasses and refrigerant mixture, also called foul gas, is fed into the shell side of the heat exchanger through one of the foul gas solenoids, liquid drainer, check valve and orifice. Some of the refrigerant in the foul gas will condense in the purge line. The condensed refrigerant will enter the liquid drainer and is return directly to suction. The remaining foul gas passes over the tubes in the heat exchanger and residual refrigerant is condensed. Liquid accumulation in the shell side of the heat exchanger continues until the level reaches the differential check valve, where the liquid is the recycled to the tube side and back to suction. See Figure 2 for a graphic representation of this stage.

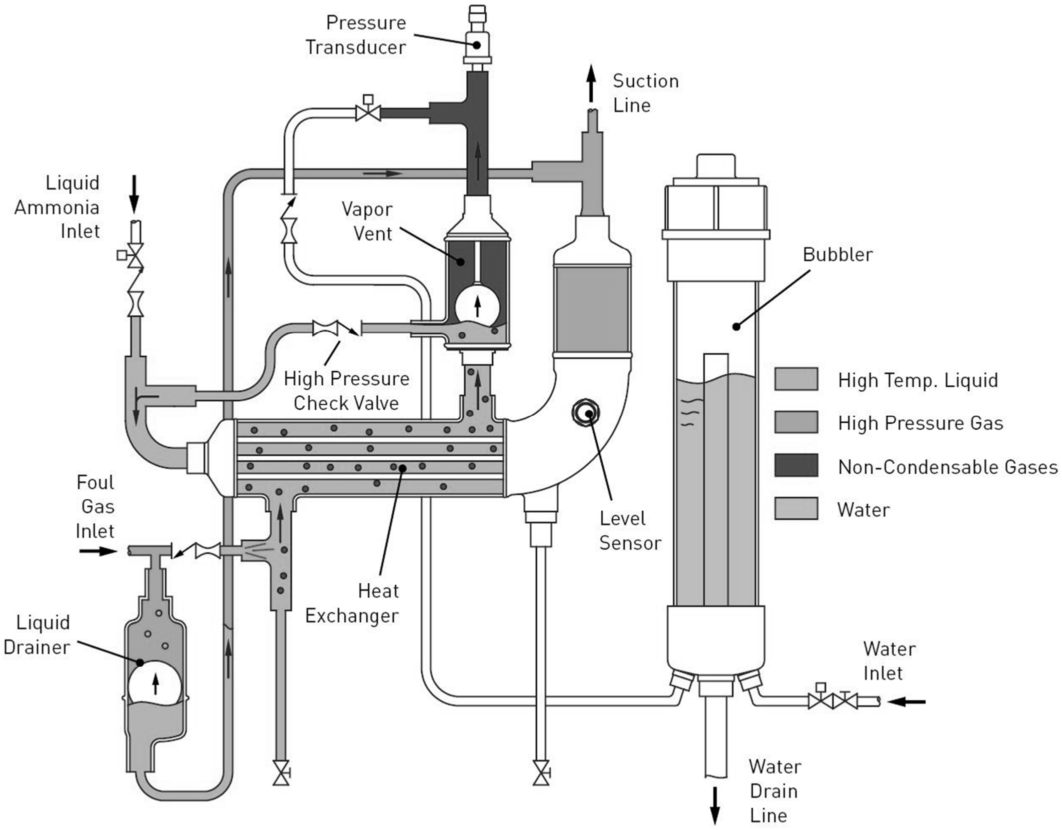

Figure 2: Separation of non-condensable gasses from the refrigerant.

Non-condensable gasses will continue to accumulate in the vapor vent chamber as it is separated from the refrigerant. The controller actively senses the temperature and pressure of the foul gas to determine adequate removal of refrigerant. Once the target pressure is reached based on the sampled temperature, the vent and water feed solenoids are energized and the non-condensable gas is released into the water reservoir. See Figure 3 for a graphic representation of this stage.

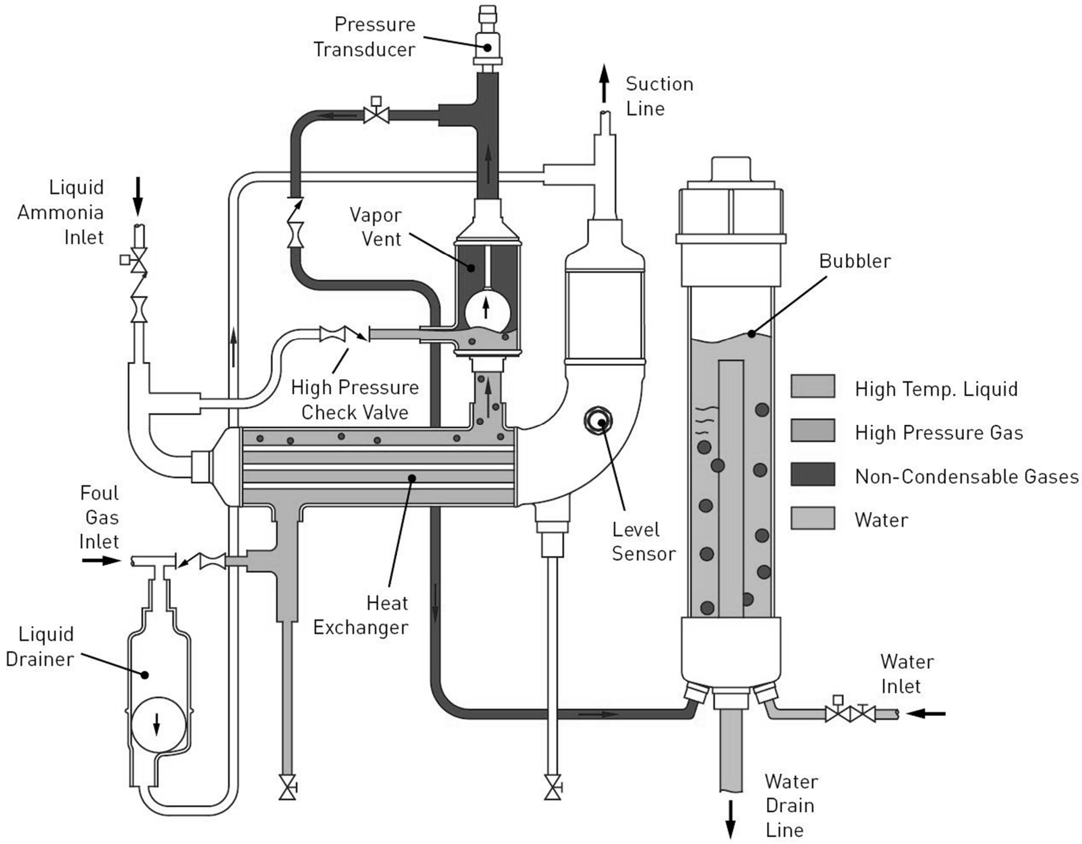

Figure 3: Release of non-condensable Gasses.

Installation and commissioning of the Rapid Purger models V200 and V300 should be completed as directed in Bulletin 75-00 and 76-00 published by Parker Hannifin Refrigerating Specialties Division.

Once the unit is mounted, properly connected to the associated piping and all power connections are securely established, it may be commissioned. Supplying power to the unit will cause the controller to power on. The initial startup screen will display showing the required steps to follow to properly set the unit up. At this screen, the first step is to press the designated key to fill the water reservoir. Note that on V300 models, the water solenoid valve is automatically energized for 15 seconds. This is an added safety feature to ensure that filling the water reservoir is not skipped.

After filling the water reservoir, the startup screen can be exited upon reviewing the remaining instructions. The main operating screen is entered and the unit will begin pre-cooling. From this screen, the settings menu can be entered. The required number of points for the system can be defined with the required sample time for each point. The purge mode can also be set allowing either automatic, time based or manual purging. More details regarding setup and information about each of the purge modes can be found in the installation bulletin.

Now that the purger is properly installed and commissioned, the process for removing non-condensable gasses has started. The negative effects from the presence of non-condensable gasses should dissipate over a period of time once the purger is active. Operational difficulties or poor performance will require troubleshooting to alleviate any observed symptoms.

Troubleshooting

The Rapid Purger assembly consists of five main functional component groups which include: valves, sensors, piping, a heat exchanger and a controller. A problem with any component in the assembly can lead to a variety of functional or performance issues. Attempting to problem solve a poor performing or non-functioning purger by an operator not trained in the functional aspects of the purger can be time consuming and labor intensive. However, an operator trained on the purger operation can methodically diagnose problems and expect to quickly identify and resolve any issues.

Problems can occur as early as the initial supply of power to the purger. Each identified symptom may only be related to one cause; however, it is not unlikely that there could be multiple causes for each symptom. It is also possible that resolution of one problem may lead to the discovery of another.

Stage 1: Power On and Pre-Cool

The ideal approach to effectively identify specific problems and resolutions is to follow the three main operating stages of the purger. Below are some of the potential problems which may occur at the initial commissioning:

- Power is supplied to the unit but the unit does not turn on.
- The unit is powered but the water reservoir cannot be filled with water.
- The unit is powered but the liquid feed solenoid is not energized.
- The unit is powered and the liquid feed solenoid is energized, but the unit is not filling with refrigerant.
- The unit is powered on filled with refrigerant but the unit will not exit pre-cool mode.

There are several areas where the disruption of power may occur to prevent the unit from responding. Working from the source to the purger, first ensure that power is properly supplied. Check the live and neutral leads in the main junction box of the purger to ensure power is present at the leads. The terminal blocks in the main junction box have test ports for inserting leads from a voltmeter shown in Figure 4. Note that the fuse holder will need to be removed to reach the test port on terminal block for the live connection. If power is present at the leads, next check the fuse to make sure the fuse is intact. If the fuse is blown replace it with a standard 5x20 glass fuse rated for 3.15 amps at 250 volts. Figure 5 shows the fuse holder with the side door open where the fuse is contained.

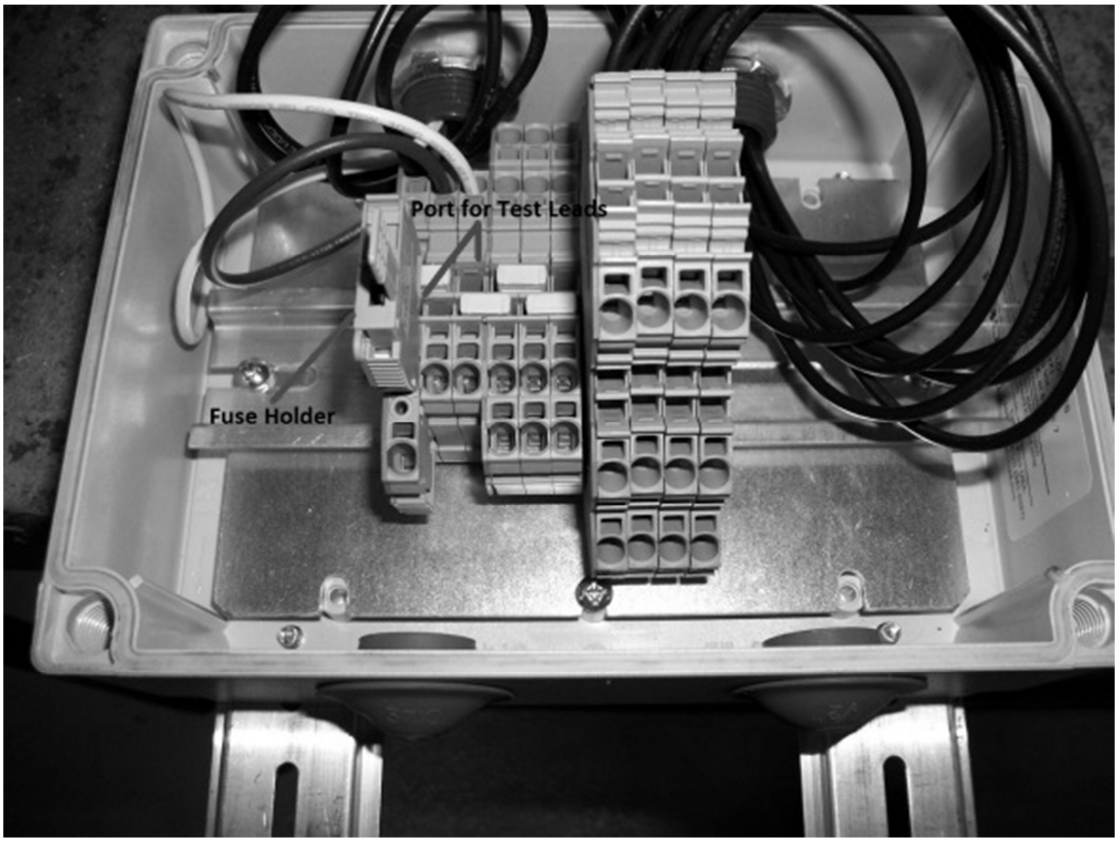

Figure 4: Fuse Holder and Test Lead Port

Please note that the lower junction box shown in Figure 4 is only correct for Rapid Purgers built after August, 2011. Rapid Purgers built prior to this have a terminal strip without an integral factory provided fuse terminal.

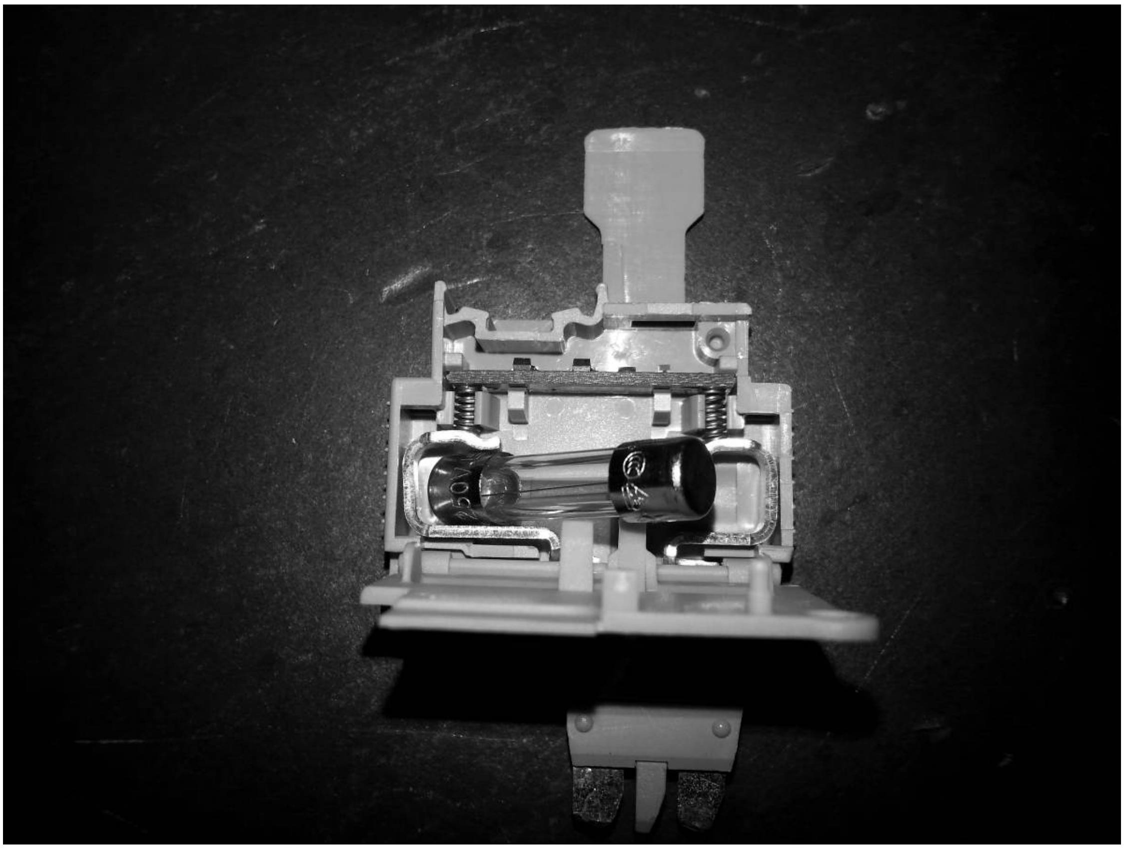

Figure 5: Fuse holder.

Should any of the above solutions not resolve the symptom, it is possible that the cause could be located inside the controller assembly. Each Rapid Purger is factory wired, calibrated and tested prior to shipment to the customer. While it is unlikely that the cause would be located in factory wired part of the controller, it is not impossible for this to occur. Problem solving the controller assembly requires patience and attention to detail.

First, check the live and neutral leads on the factory wired side of the terminal blocks shown in Figure 4 to verify the integrity of the terminal block and fuse holder. If power is present, remove the cover from controller. On the V200, the cover is held on by four Phillips head screws. The cover is not tethered, so care should be taken to adequately support the cover during service. The V300 has a hinged cover with latches and no additional support is required during maintenance. The V300 is outfit with a security cover which will require removal to access the terminal strips used for the factory wiring.

Check the live and neutral leads on the terminal strip in the controller shown in Figure 6 using a voltmeter. If voltage is not present, check the integrity of the wiring at the terminal blocks in the main junction box. If voltage is present, look for a green light blinking on the main PCB (V300 models only). If the green status light is not on, check the fuse on the main PCB near the live and neutral wiring on the terminal strip. If the fuse is blown, replace with a standard 5x20 glass fuse rated for 3.15 amps at 250 volts AC for the V200, 1 amp at 250 volts AC for the V300. If the fuses are good, the wiring to the controller terminal strip is correct and the controller does not respond; there is likely a problem with the main PCB and the unit will require replacement.

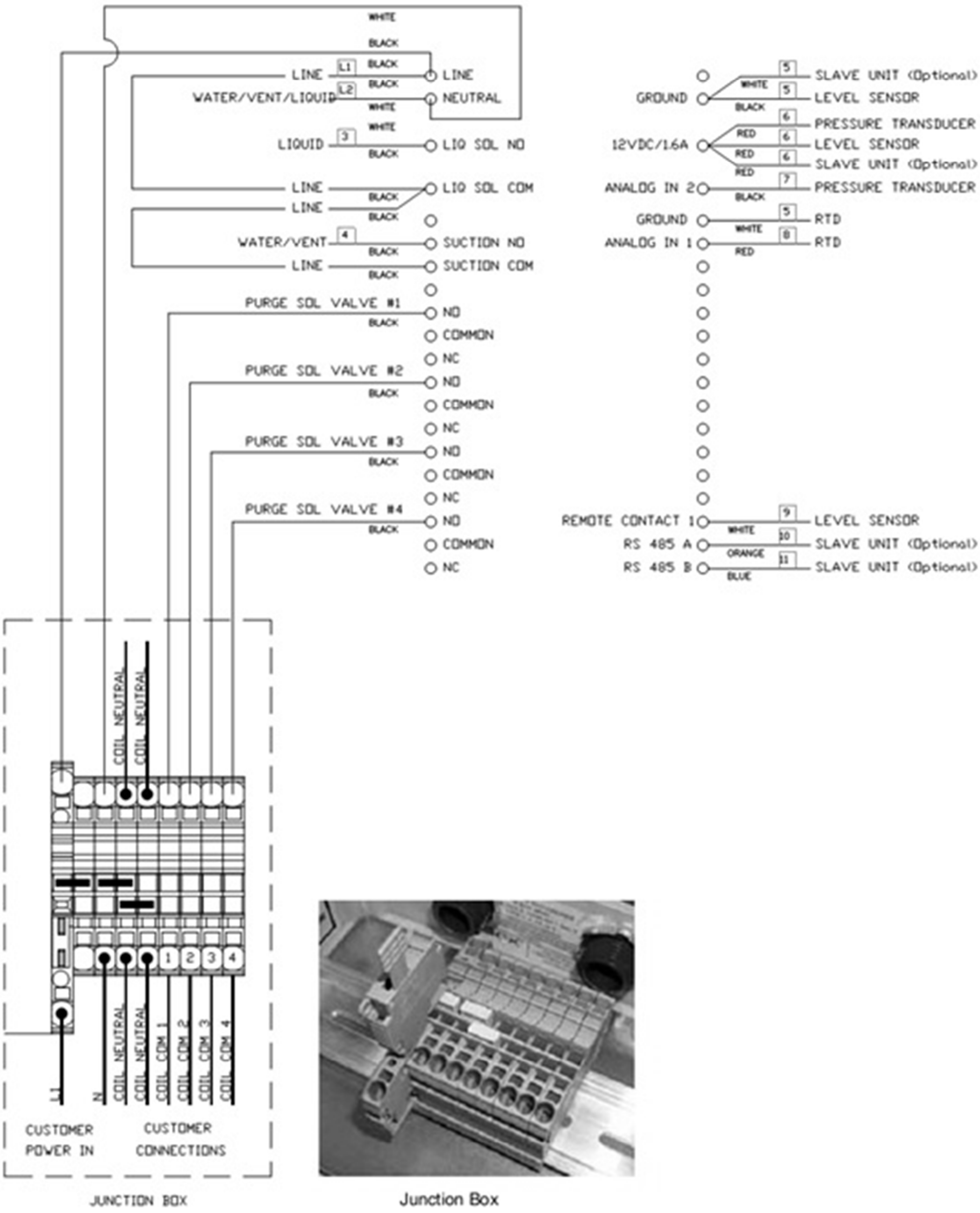

Figure 6: Factory Wiring Diagram

The next scenario involves the purger powering on correctly and booting to the “startup” screen. Following the directions displayed on the screen, press the designated key to fill the water reservoir. If pressing the designated key does not cause water to fill the reservoir, the plumbing and associated valves will require inspection. Please note that on the V300, the water reservoir will automatically fill for 15 seconds prior to unlocking the keypad. First, ensure that the water supply is open and there are no blockages in the piping. Next, while pressing the designated key to fill the water reservoir, check to make sure that the coil is energized on the water feed solenoid valve. If the coil does not energize, check the wiring integrity in the coil splice box and the controller. If the wiring is correct and intact, replace the vent/water relay in the controller and the solenoid coil with the appropriate replacement.

If the coil energizes appropriately, check the water solenoid valve for blocks in the orifice and plunger assembly. If the valve assembly is clean, the blockage is located in either the flow switch or the outlet line to the water reservoir.

The Rapid Purger is equipped with a flow switch on the outlet of the water solenoid valve. This flow switch is connected in series with the vent solenoid valve. This safety feature prevents venting of non-condensable gas and ammonia into the water reservoir without an adequate supply of water to the unit. The flow switch, shown in Figure 7, is a plunger style which is easily disassembled and cleaned. Carefully remove the water lines from the flow switch and remove the NPT to straight thread adapter from the inlet. The plunger is located inside the body behind the NPT adapter and it is spring loaded. Clean the components and reassemble the flow switch to the water solenoid valve. Check the water line from the flow switch outlet to the water reservoir and remove any blockages present. Reassemble the water line and fill the water reservoir with water.

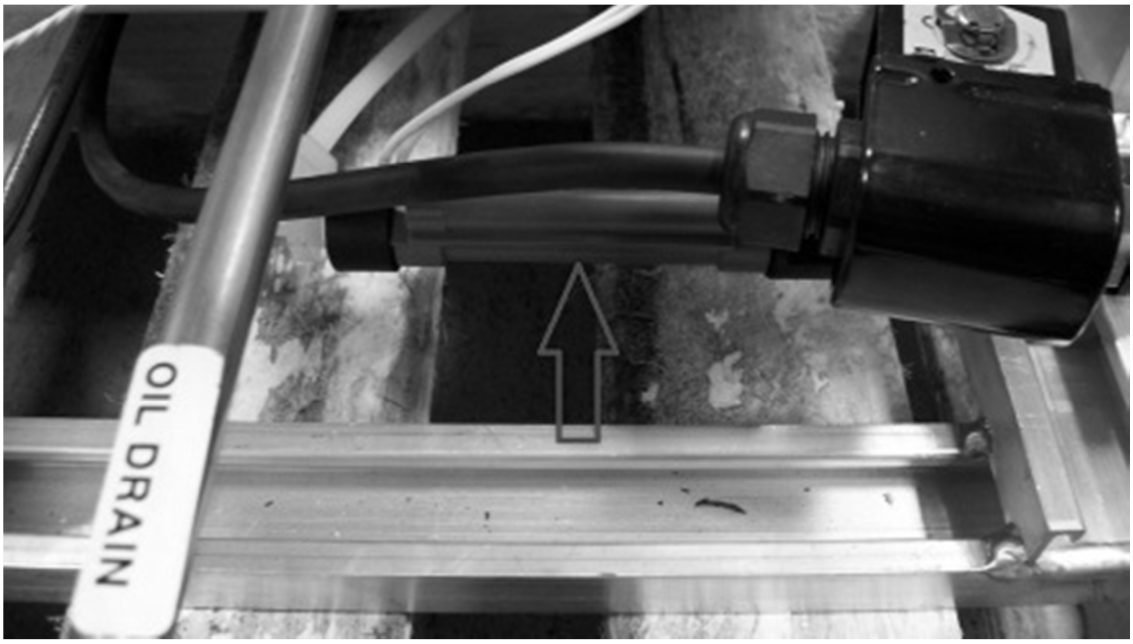

Figure 7: Water Feed Flow Switch

After filling the water reservoir, the operator will leave the startup screen and the purger controller will enter the main operation screen. When this occurs, the purger energizes the liquid feed solenoid and allows high pressure liquid to enter the heat exchanger. If the liquid feed solenoid does not engage the symptom can be traced back to the solenoid coil wiring, the liquid feed relay, the level switch or the level switch wiring.

First check the liquid feed solenoid wiring. If the wiring is correct and intact, replace the solenoid coil with the appropriate replacement and the liquid feed relay in the controller. Next, check the wiring for the level switch in the electrical connector on the switch. Using a voltmeter, check across the black and orange wire for 24 volts DC. If power is not present at these terminals, check the wiring integrity back to the controller. If power is present, but measuring greater than 24 VDC ± 5%, a voltage clamping diode will need to be inserted into the level sensor electrical connector across the black and orange wires. Intact wiring and correct voltages will require replacing the electrical head on the level switch with the appropriate replacement part. Should the level sensor still fail to send the appropriate signal to the controller; check the grounding for the switch and apply an external earth ground if required.

During the pre-cool phase, the high pressure liquid will generally fill the heat exchanger in a couple of minutes if everything if functioning properly. If the liquid feed solenoid is energized, but there is no flow of refrigerant to the heat exchanger, first ensure that the liquid feed hand shut off valve is open. Next, manually open the SV2 liquid feed valve (if equipped) to check the valve for functionality. Flowing refrigerant when the valve is manually opened but not when the valve is energized will require the valve to be disassembled and cleaned or replaced. Continually blocked refrigerant flow will required the orifice at the outlet of the liquid feed valve in the pipe flange to be cleaned. It is important to note that the purger will not properly function without an adequate supply of liquid.

After the unit has filled with refrigerant, the liquid feed solenoid will de-energize and the flow switch with light up with red glow, indicating that the vessel is charged with refrigerant. Please note that early versions of the V200 were equipped with an optical level sensor which did not have any visual indication of sensed liquid. The temperature reading on the screen in the actual column should slowly decrease to eventually stabilize within a few degrees of the corresponding suction temperature. Once the temperature falls below 40°F, the purger will exit pre-cool mode and enter active mode.

The transition to this point may take a few hours depending on suction pressure. It is important that the suction pressure at the purger be below 58.4 psig for proper function. Ideally, the lowest possible suction pressure down to 3 psig is recommended for optimal performance. If the suction pressure is correct, but the purger cannot reach the required temperature for operation, check the hand shut off valve on the suction line and ensure that it is fully open. The A2B regulator setting and the accuracy of the attached gauge should also be verified.

If these items are functioning properly, the RTD will require inspection. The RTD directly controls the logic of the controller by monitoring the temperature of the heat exchanger shell. The temperature reading is displayed on the main operating screen of the controller in the column designated “actual”. The displayed reading on the screen should make sense based on the observed conditions of the system. For example, if there is frost on the liquid feed line into the purger and liquid return line from the 50 psi differential check valve, but the temperature reading is stable at 60°F, there is likely a problem with either the calibration or the RTD itself. On V200 models, if there is no reading, and the controller simply displays “---“ indicating the RTD is faulty or the wiring is compromised. The V300 model is programmed with error status readout to display which sensor has a fault.

Check the integrity of the wiring from the RTD to the controller. If the wiring is correct then check the calibration. To calibrate the RTD, remove the silicone seal from the insulation jacket and pull the RTD out of the insulation. Immerse a few inches of the RTD into a container of ice water and verify the temperature reading. The temperature should read 32°F. A deviation in the reading can be corrected by changing the temperature offset in the settings menu. If the RTD cannot be calibrated it should be replaced. Return the RTD to the well and seal the insulation with silicone sealant.

Stages 2 and 3: Sampling and Venting Non-Condensable Gas

Now that the purger is pre-cooled and actively sampling the specified purge points, foul gas will begin to accumulate within the purger until the criteria is met for the purger to release the non-condensable gasses. Releasing the non-condensable gasses may require significant time depending upon air concentration in the system, plumbing of foul gas lines, ambient conditions as well as other factors.

Over a period of a few hours and possibly up to a couple of days, the purger should be releasing non-condensable gasses from the system if there a measureable quantity is present. Poor non-condensable gas rejection performance from the purger can be attributed to a few a factors. Some of the potential symptoms of a poorly performing purger are:

- The foul gas pressure never reaches the target pressure.
- Strong ammonia smell coming from the water reservoir.
- Short vent cycles.
- The vent solenoid valve does not open when the foul gas pressure reaches the target.
- Purging performance has decreased since the initial start of the purger.

Some of the above symptoms will have causes related to the system which may not be directly associated with the purger. For example, if the foul gas pressure never reaches the target pressure, the cause could be associated with the piping of the foul gas line. Due to the unique nature of every refrigeration system, only general guidelines for installation of the purger can be made. Recommended installation guidelines can be found in the installation bulletin provided by Refrigerating Specialties.

The non-condensable gasses which accumulate in the purger are not released until the pressure satisfies the requirements programmed in the controller to vent. If the actual measured pressure in the purger does not reach the target pressure, it could simply be that there are not enough non-condensable gasses present at that point.

The known presence of non-condensable gasses and exhibition of this symptom can be related to several causes. First, increase the purge point sample time to 20 minutes, the maximum allowed setting. This will allow the purge solenoid to remain open longer and allow any non-condensable gas to accumulate for a longer duration at the purger. Observe the actual pressure reading on the controller. A constant reading of 0.0 indicates that the pressure transducer is either disconnected or faulty. On the V200 model, the only indication of disconnected or damaged pressure transducer is the pressure reading. V300 models will display and error message if there is no signal being received from the pressure transducer.

If the symptom persists, the 50 psi differential check valve may be stuck open allowing the foul gas to recirculate back to suction. Pump down the unit and clean the 50 psi differential check valve. Restart the system and allow the purger to fully cool and begin sampling the purge points.

Following these steps should resolve the issue if the symptom is caused by the purger. Repeated observation of this problem could potentially be related to the system. Ensure that the foul gas line is not trapped before entering the purger. This can cause the foul gas to be recycled back to the suction line through the liquid drainer. Ensure that only one purge point is active at any given time while the purger is sampling. If more than one purge point is open, it is possible that the foul gas will migrate from one point to the other instead of moving to the purger. These are only a couple of the potential system related causes that may be encountered.

Ammonia concentrations in the waste water stream generated by the purger are low under normal operation. High concentrations of ammonia present in the waste water are not normal and can be attributed to changes in the water supply or conditions under which the purger will vent. Check the water supply line for blockages and ensure that the water can freely flow to the water reservoir. Make sure that the drain lines are free flowing and that the waste water is properly draining from the water reservoir. If the concentration remains high, the sensors may need to be recalibrated on the purger.

First, check the calibration of the RTD and the pressure transducer. The RTD off set is generally 0°F with a range of approximately ±3 degrees which will vary based on the factory calibration. If the RTD is outside of this range, recalibrate the RTD using the procedure detailed on page 16. The pressure transducer calibration should be approximately 0-15 psig for the low setting and 495-525 psig for the high setting. These values will vary based on the factory calibration. If these values are significantly different than what is listed above, return to the setting to the nominal values for the pressure transducer which are 0 psig and 500 psig.

The pressure transducer can be calibrated by first pumping down the unit and then removing the transducer from the purger. Install the transducer into a manifold outfit with a calibrated gauge. Supply air or nitrogen to the manifold and compare the reading on the screen with the reading on the gauge. Adjust the low and high settings so that readings taken from 0 psig to 100 psig do not vary more than 1 psig from the transducer to the calibrated gauge. The pressure transducer is now calibrated properly.

Should venting occur while the vent solenoid is not energized, it is possible that the vent solenoid valve seat is dirty or damaged causing foul gas to leak to the water reservoir. The water solenoid valve will not energize in the case of a leaking valve and the leak should be repaired quickly to prevent excessive ammonia losses and high concentrations in the water reservoir.

Another common symptom related to poor purging performance is short vent cycles. Occasionally vent cycles lasting less than a second can be observed depending on the system conditions. If this only occurs at certain times of the day or at certain points, it is likely that non-condensable gasses are not prevalent at the point being sampled. The occurrence of this symptom during sampling of a point which is known to contain non-condensable gasses can be attributed to excessive liquid in the vapor vent chamber on the purger. The vapor vent chamber is equipped with a float which will prevent the release of liquid refrigerant to the water reservoir.

To test this theory, first reduce the setting on the suction regulator down to 3 psig and disconnect the connector on the level switch. With the switch disconnected, the liquid feed solenoid valve will stop functioning and the refrigerant in the heat exchanger will return to the system. After a period of time the purger vent duration should increase and the frost on the liquid return line from the 50 psi differential check valve should fade, depending on the amount of ice present. The liquid level switch can be reconnected and the suction regulator returned to the desired setting once the liquid levels return to normal.

If performing the above operation does not resolve the problem, pump down the purger and remove the liquid return line from the 50 psi differential check valve and the pipe Tee assembly on the liquid feed line. Inside the pipe Tee assembly is an orifice which may need to be cleaned along with the 50 psi differential check valve. After performing this sequence, reinstall all parts and allow the purger to cool and begin sampling the purge points again.

After performing the above two procedures, should the problem persist, it may be that the foul gas lines are returning a significant amount of liquid causing the shell side of the heat exchanger to fill with liquid faster than it can be returned to suction. Consult Refrigerating Specialties for a custom sized orifice in the liquid return line if this is believed to be the source of the problem.

The vent solenoid valve is wired in series to the water solenoid valve and the water flow switch. Problems associated with the vent solenoid valve not opening can be attributed to either the wiring, the relay inside the controller, the flow switch or the vent solenoid coil. Check each of these areas carefully and determine which component is the causing the symptom. Details for diagnosing the water solenoid valve are covered on pages 13-14.

The presence of oil in the heat exchanger reduces the performance of the unit by fouling the tube surfaces and reducing the thermal conductivity over heat exchange area. In an ammonia refrigeration system, oil accumulates in low spots which make these areas conducive for oil draining. The Rapid Purger is equipped with two oil drains, one for each the shell side and tube side of the heat exchanger. A small amount of oil in the purger's heat exchanger can significantly affect the heat transfer effectiveness due to the small heat exchange area. A schedule for oil draining should be part of every purger maintenance plan and diligently followed to keep the purger operating at peak efficiency.

Many problems associated with oil are due to the nature of plumbing the liquid feed line to the purger. All liquid feed lines should be taken from either the side or the top of the pipe or vessel (within the liquid level) and never from the bottom. This will assist in preventing oil from being transferred to the purger.

Conclusion

The Rapid Purger manufactured by Refrigerating Specialties is a system comprised of valves, piping, sensors, a heat exchanger and a controller designed to efficiently and effectively remove air from refrigeration system. A general understanding of the operational characteristic of the Rapid Purger will aid in effective problem solving. This article details problem solving several functional issues which may be observed in operation. Problems not detailed in this document can be discussed with the staff at Refrigerating Specialties to determine the appropriate resolution.

Appendix

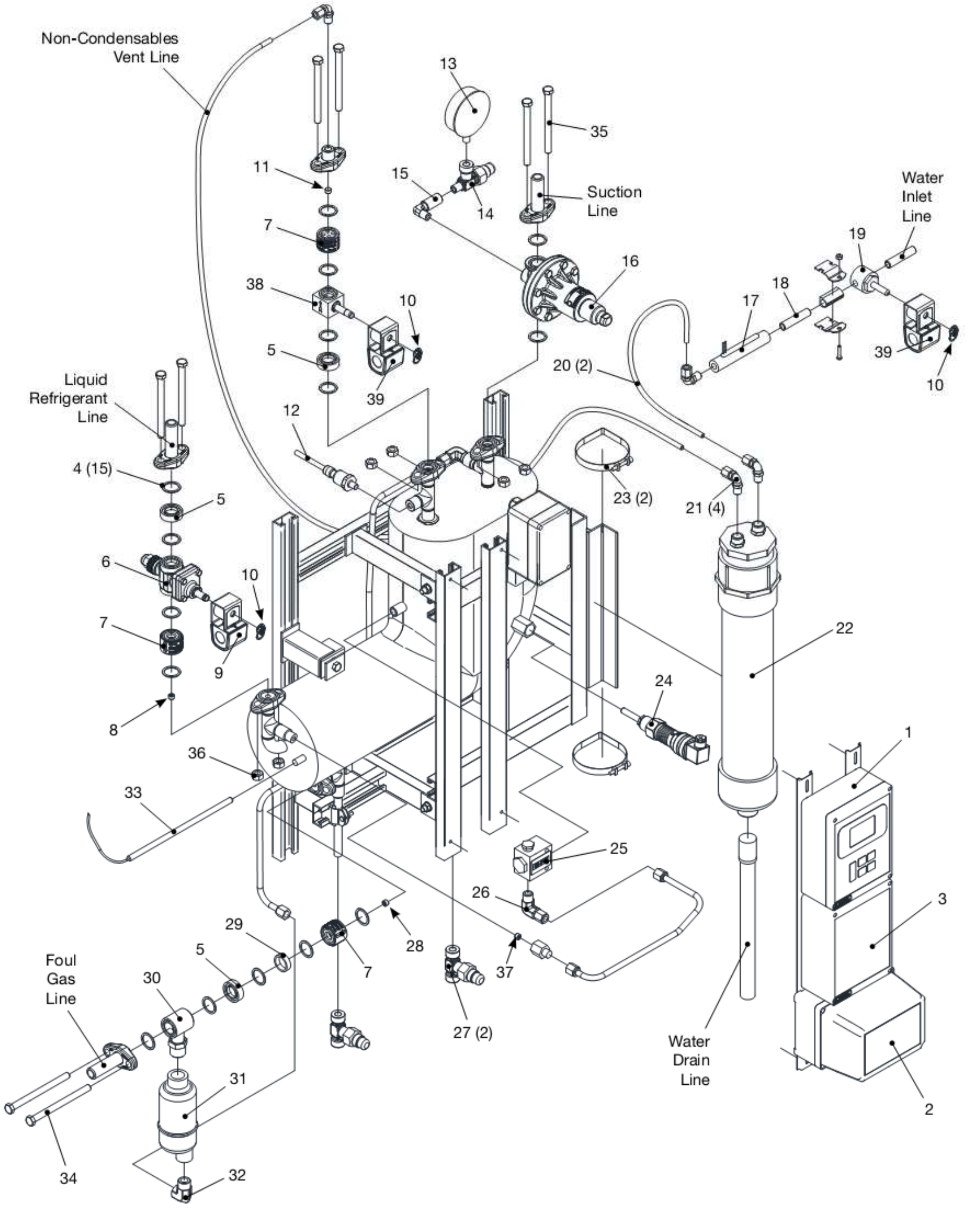

Figure 8: V200 Exploded View

Item	Description	Kit Description	Kit
1 2 3	Purger Controller Juction Box Slave Controller Unit	4 Point Purger 8 Point Purger 12 PointPurger 16 Point Purger 20 Point Purger	209308 209309 209310 209311 209312
–	Fuse, Glass Tube	Fuse Pkg	209313
–	Pin Connectors	Purger Spare Parts	209317
–	Pin Connectors	Solenoid 4 Point	209318
– (4)	Relays, Controller	Relay Pkg	208785
4(12)	Gasket, 1.25 OD x 1.00 ID x 0.063	Gasket Pkg, Flange	208785
4(2) 5	Gasket, 1.25 OD x 1.00 ID x 0.063 ½" Disc Strainer	Strainer Assembly, Disc	200912
4(2) 6	Gasket, 1.25 OD x 1.00 ID x 0.063 SV2 Solenoid Valve	Liquid Solenoid Valve Assembly	209369
7	½" CK4A-2 Check Valve	Check Valve Assembly	101047
8	Orifice 0.040", ⅛" NPT	Plug Pkg, Orifice 0.040	208667
9 10	Coil, 110-120V 50-60Hz/220-240V 50-60Hz 10.5W Retaining Clip, Coil	SV2 Coil, 110-120V 50-60Hz SV2 Coil, 220-240V 50-60Hz	202951 202952
10(12)	Retaining Clip, Coil	Retaining Clip Pkg	206516
11	Orifice 0.026", ⅛" NPT	Plug Pkg, Orifice 0.026	208665
12	Pressure Transducer, 0-500 psi, 4-20MA, ⅛" NPT	Pressure Transducer	209292
13	Pressure Gage	Gage, 30" - 150 psig (R717) Gage, 760mm - 10.5 bar (R717)	309401 309403
14	Unibody, ¼" Angle	Unibody, 1/4" Angle	106630
16	Pressure Regulator, A2B Range A	Pressure Regulator, A2B	209290
17	Switch, Flow 0.1 GPM, ¼" FPT	Switch, Flow	209324
18 19 21	Pipe, Threaded 316 SS ¼" x 2-½" LG Solenoid Valve, Water Nylon Connector, Elbow ⅜" MPT 316 SS	Solenoid Valve, Water	208787
20(6) 21(4)	Tubing Connector, Elbow	Tubing, Bubbler Nylon	208668
22	Water Bubbler	Water Bubbler	208789
24	Level Switch, HBSR	Level Switch	208790
25	Differential Check Valve (50 psig)	Differential Check Valve (50 psig)	309657
27	Unibody, ¼" Globe	Unibody, 1/4" Globe	106621
28	Orifice 0.032, ⅛" NPT	Plug Pkg, Orifice 0.032	208666
4(2) 29	Gasket, 1.25 OD x 1.00 ID x 0.063 Ring, Adaptor 13mm (½") Male	Ring, Adaptor	200095
31	Liquid Drainer	Liquid Drainer	309625
33	Temperature Probe, E4 Temp Controller	Temperature Probe, Sensor	209075
37	Orifice 0.028", 1/8" NPT		
38	Solenoid Valve, S6P	Solenoid Valve Assembly, S6P	208982
39 10	Coil, 110-120V 50-60Hz/220-240V 50-60Hz 10.5W Clip, Coil	S66 Coil, 110-120V 50-60Hz S6P Coil, 220-240V 50-60Hz	209073 209074

Figure 9: V200 Table of Components