



## Operator Installation & Instruction Manual

### **AUTO-PURGER® PLUS, APP Non-condensable Gas (Air) & Water Purger for Ammonia**

### **Operator Installation & Instruction Manual for Models APP08, APP16, APP24 and APPC**

## SECTION 1 INTRODUCTION

The AUTO-PURGER Plus is a totally automatic, electronically controlled refrigerant noncondensable gas (air) and water purger for reducing the energy costs of operating an ammonia refrigeration system. All models are preassembled, pre-wired, insulated, and include an automatic water bubbler, a relief valve, and an isolation service valve package. Installation requires piping the foul gas line, low-pressure pumped-liquid line, low-pressure liquid return line, suction line, water bubbler fill and drain lines, relief valve vent line, water purge line to a customer supplied container, and power connection, and wiring the remote purge point solenoid valves. Purge point solenoid valves must be purchased separately and must be a minimum of ½" (13 mm) port size.

In addition, a computerized model—APPC—is available where a separate plant computer or programmable logic controller (PLC) is used to independently operate the various remote purge point solenoid valves.

Water contamination in an industrial ammonia refrigeration system can lower system efficiency, and increase the electrical costs required to run the system's refrigeration compressors. Ammonia refrigerant that is contaminated with water requires a lower suction pressure to maintain the same evaporator temperature than would pure ammonia refrigerant. The requirement to maintain a lower suction pressure than would be necessary if the water contamination were removed is a waste of electrical energy.

For water removal, the AUTO-PURGER Plus has the following capacities:

1% system water concentration – ½ gallon of water removed per week,

5% system water concentration – 1 gallon of water removed per day,

10% system water concentration – 3 gallons of water removed per day,

20% or more system water concentration – 5 gallons of water removed per day.

In a system with normal noncondensable loads, all models will handle a 750 ton (2600 kW) ammonia plant at suction pressures below atmospheric pressure or a 1500 ton (5300 kW) ammonia plant at positive suction pressures. The amount of noncondensibles in the system is based on many factors including age, maintenance practices, and operating temperature.

The number of purgers required for a system depends on the number of installed purge points. Twenty-four purge points is the maximum practical number per purger. For example, a system with 24 points at 10 minutes per point requires a 240 minute (4 hour) cycle. Each purge point can be purged 6 times a day. This may, or may not, be adequate. Therefore, a second purger should be used and the purge points divided equally between the two purgers.

The AUTO-PURGER Plus can operate over a wide range of condensing pressures. This is important for refrigeration systems that operate at low condensing pressures during cold ambient conditions.

### **MATERIAL SPECIFICATIONS**

Material of construction: steel, ASTM A53 Grade B, ASTM A106 Grade B, ASTM A234 Grade WPB, ASTM A105.

Maximum allowable working pressure: 400 psig (27 bar).

Minimum design metal temperature: -60F (-50C).

Internal volume: 0.5 cubic feet (14 liters).

Normal refrigerant inventory: 0.27 cubic feet (7.5 liters)

## SECTION 2 INSTALLATION

### MOUNTING INSTRUCTIONS

Mount the AUTO-PURGER Plus securely on a wall or sturdy steel channels capable of supporting 450 lbs (205 Kg). Eight mounting holes in the frame are provided to support the unit. See Figure 1. The unit should be located in an accessible area, but away from moving equipment that could accidentally come in contact with the purger. Elevation with respect to condensers or high-pressure receivers is not critical. Do not punch access holes in the top of the control cabinet. Unused electrical entrances to the enclosure must be sealed to protect the controls from moisture.

The AUTO-PURGER Plus is normally installed in the compressor room where it can be monitored, but also may be installed outdoors where temperatures below freezing are not anticipated. Outdoor use in areas near falling or spraying water, or in constant high humidity areas is not recommended.

Install the float switch assembly on the purger by removing the packaging material and metal shipping tube. Slip the float switch assembly over the enclosing tube being sure the float switch assembly bottoms on the neck on the enclosing tube. Warning: Tighten the retaining screw such that the screw tip is in the groove of the neck assembly. If the float switch assembly is not properly positioned and retained, the switch may not function.

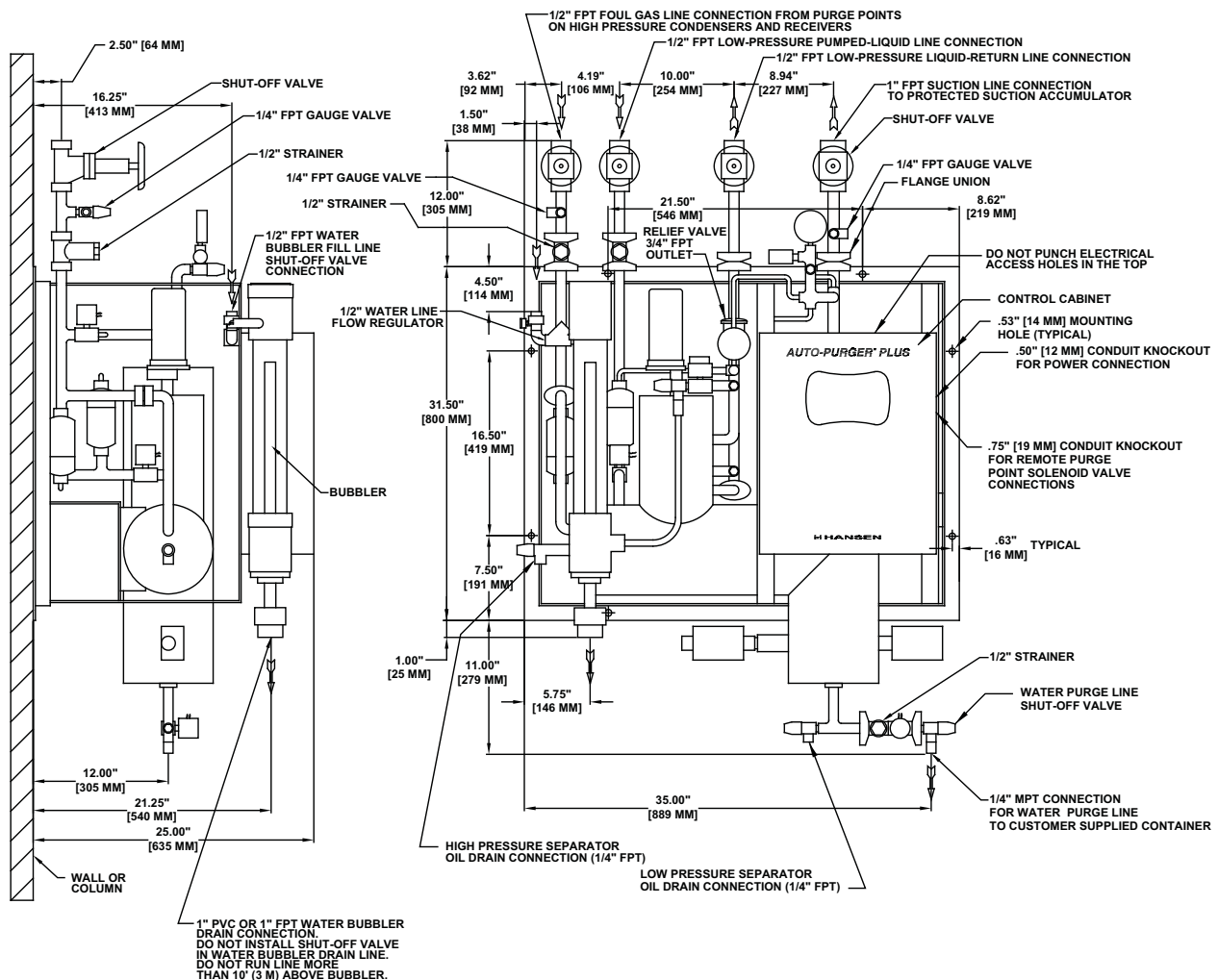
### FOUL GAS PIPING

It is nearly impossible to predict where noncondensable gases (air) will accumulate. Therefore, purging at several points on the high-pressure side of the system is the best method for removing air from the system. For multipoint purgers, the solenoid valves may be manifolded into one line to the purger. However, only one purge point should be purged at a time. Connecting two purge points together may result in gas flowing from one condenser to another due to unequal pressure drop, even though the difference in pressure drops is very small, for example 1/4 psi (0.02 bar). The result is that even in the best of circumstances, only one point is effectively purged. The best practice is to purge each condenser and receiver circuit separately.

It is extremely important to install purge points at locations sure to be liquid free. Also, no liquid traps are desirable either before or after purge point solenoid valves. See Figure 2. The line from the purge point on the condenser to the AUTO-PURGER Plus should not pass through cold areas where further condensing of the saturated gas can occur. If this cannot be avoided, the purge line must be insulated because flooded purge point lines will flood the AUTO-PURGER Plus with liquid, resulting in a temporary halt of noncondensibles being removed.

### AUTO-PURGER PLUS APP INSTALLATION DIMENSIONS

Figure 1



The minimum line size for foul gas piping is 1/2" (13 mm). The line should be pitched down toward the purger to drain any refrigerant that may condense.

It is important that one purge point solenoid valve is open at all times to prevent losing foul gas pressure to the purger. The high side pressure transducer monitors foul gas pressure and the AUTO-PURGER Plus will enter an alarm condition if foul gas pressure is lost.

### EVAPORATIVE CONDENSER PIPING

Typically, ammonia evaporative condenser outlet liquid drain lines on each circuit must drop between 4'-6' (1.2m-1.8m) from the centerline of the condenser outlet to the centerline of highest elevation of the liquid line manifold to receiver. Preferably each circuit should have a P-trap to balance variations in pressure drop in each circuit and to prevent liquid from backing up into one or more condensers, flooding the purge point. A properly-sized equalizer line from the receiver will help drain condenser circuits into the receiver. Refer to ASHRAE guidelines or IAR papers on condenser piping design. Also, consult condenser manufacturer's installation instructions for additional piping and sizing information.

Do not use one purge point solenoid valve to purge two circuits. This negates the P-trap on the condenser drain line and may back liquid up into one circuit.

### PURGE POINT LOCATIONS

Condensers should be purged at points recommended by the condenser manufacturer. This is typically at the top of each circuit's outlet header.

In some cases a small, high-pressure auxiliary receiver is located at the outlet of one or more condensers. This receiver should have a purge point at the top.

Where a high-pressure float regulator is used to drain one or more condensers, the top of the float valve chamber should be a purge point.

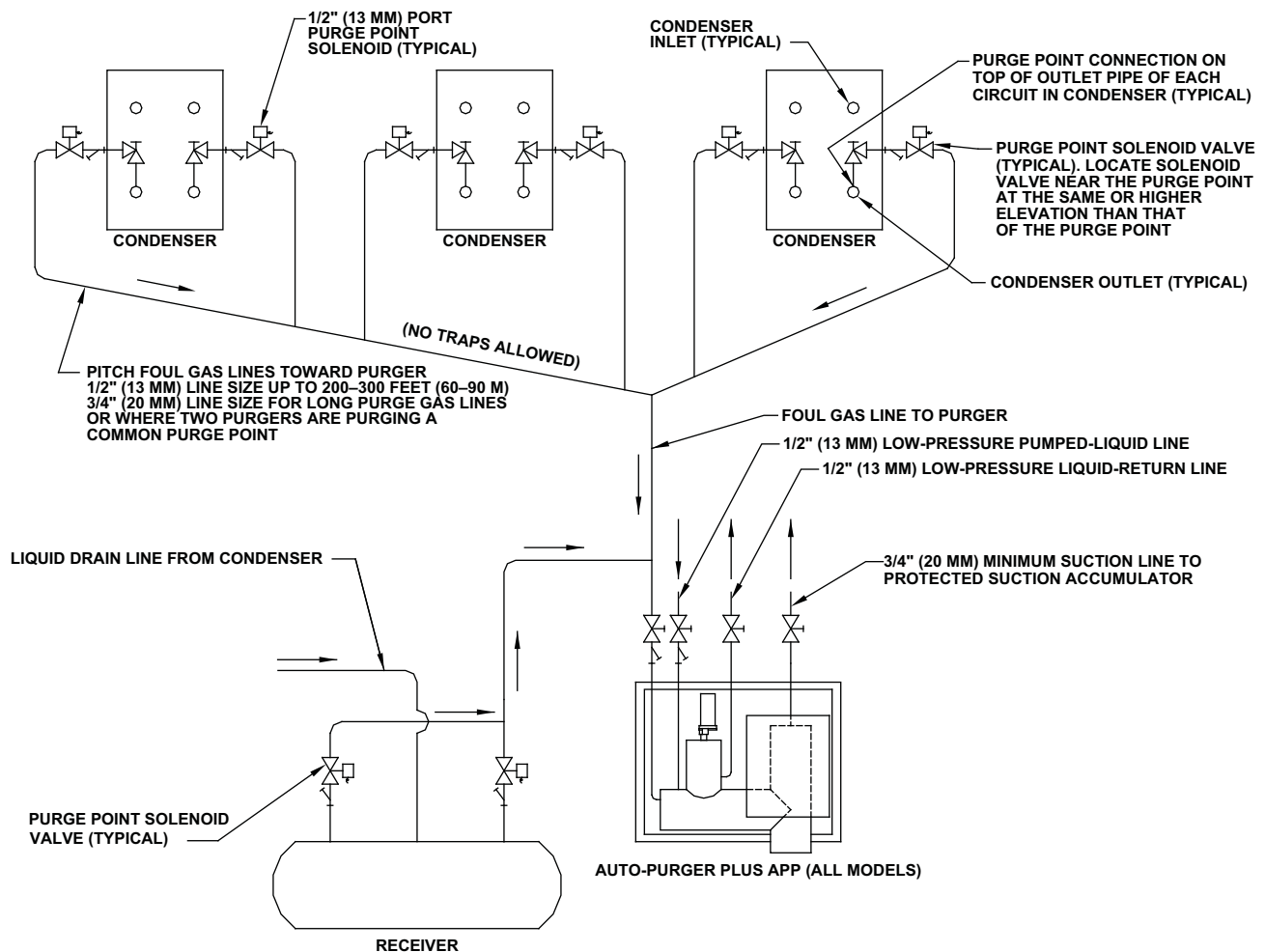
Heat exchangers and horizontal shell and tube watercooled condensers should be purged at the top, usually at the point or points furthest from the compressor discharge main inlet. Vertical condensers should be purged near the top of the vessel if possible.

For certain types of oil separators where very low velocities may exist near the top of the vessel, purging may be advisable from a top fitting.

It is not necessary to purge control pressure receivers, high pressure thermosyphon vessels, or vessels located on the low side of the system.

### TYPICAL PURGE POINT LOCATIONS

Figure 2



## LOW-PRESSURE PUMPED-LIQUID LINE

A 1/2" (13 mm) low-pressure pumped-liquid source is required for the AUTO-PURGER Plus. This connection should be from the pump discharge of the lowest pressure recirculator. See Figure 3. This connection should be at a location where oil will not be directed into the purger. The low-pressure pumped-liquid line feeds makeup liquid as required during purging. The line contains liquid ammonia that typically is also contaminated with water which is to be removed by the AUTO-PURGER Plus. The liquid line solenoid valve (B) on the AUTO-PURGER Plus closes when the AUTO-PURGER Plus is off. See Figure 4.

If the system contains more than one vessel that does not feed liquid to any other lower pressure vessel, then separate pipes may need to be installed, with corresponding shutoff valves, so that liquid can periodically be drawn from each vessel which may contain water. The liquid pressure must be a minimum 15 psi (1.0 bar) higher than the APP suction for the liquid to feed properly.

## LOW-PRESSURE LIQUID RETURN LINE

A 1/2" (13 mm) low-pressure liquid return line is required for the AUTO-PURGER Plus. Ammonia vapor from the foul gas line is condensed to liquid in the air separator chamber. This condensed liquid ammonia flows to the suction accumulator through the low-pressure liquid return line. See Figure 3.

## SUCTION LINE

A 3/4" (20 mm) suction line should be connected to a suction accumulator. See Figure 3. The purger evaporator shell temperature sensor is factory set at 40°F (4°C). To allow for temperature transfer losses between the purger evaporator and the temperature sensor, the suction temperature should be approximately 20°F (-7°C) or below. This then switches the AUTO-PURGER Plus from 3333 EVAP TEMP >40F (4C) to COLLECTING AIR/WATER mode. For higher suction temperatures, consult the factory.

## RELIEF VALVE VENT LINE

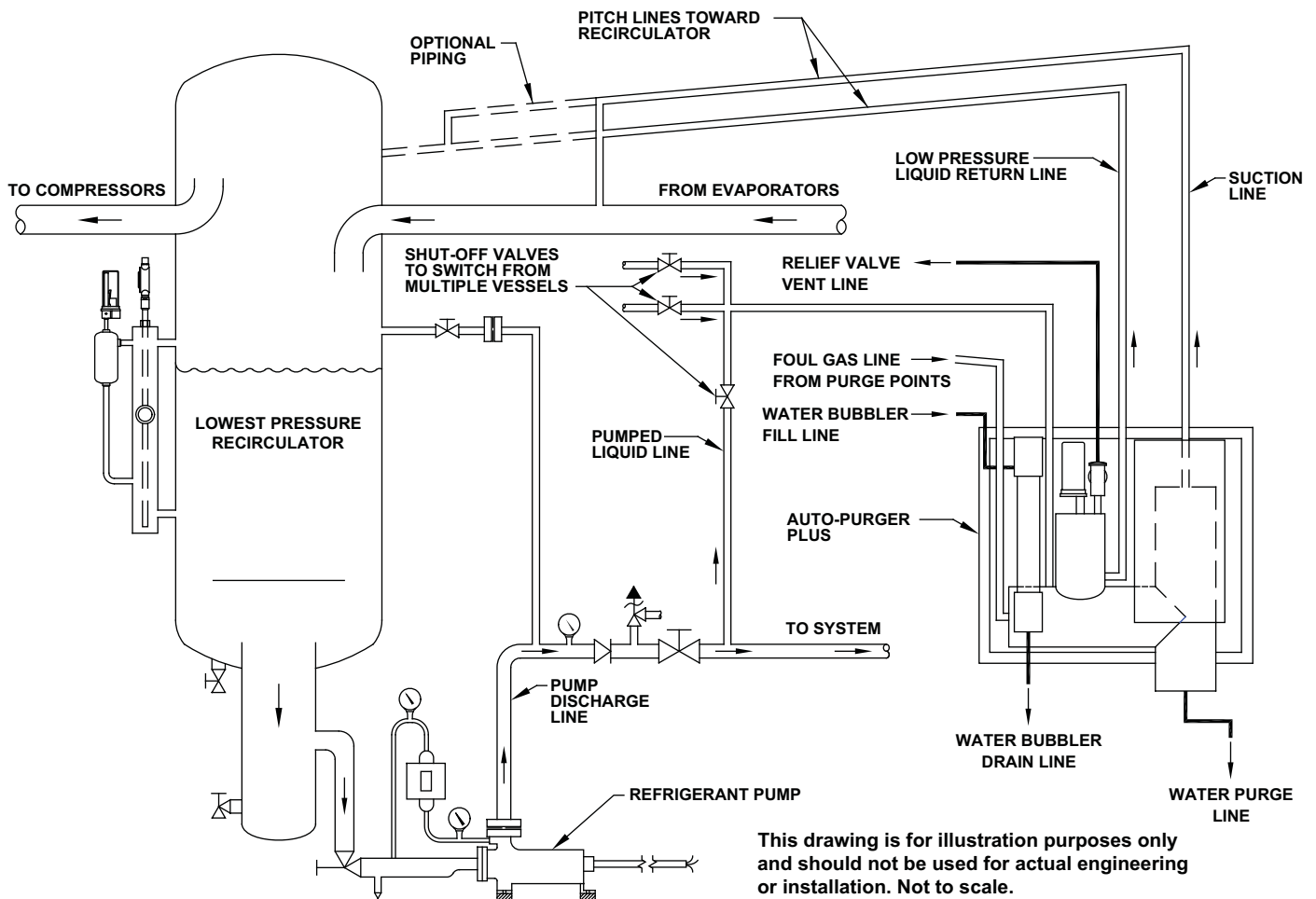
A relief valve vent line should be connected to appropriately vent any potential relief valve discharge in accordance with applicable codes, for example ANSI/ASHRAE Standard 15, Safety Standard for Refrigeration Systems. See Figure 4.

## WATER BUBBLER FILL LINE

An automatic water bubbler flush system is provided with the purger. A water line must be connected to the water bubbler fill line solenoid valve (D). See Figure 4. The connection is 1/2" FPT. The water supply pressure should be 30–80 psig (2.1–5.5 barg).

## AUTO-PURGER PLUS APP PIPING DIAGRAM

Figure 3



The clear tube of the water bubbler may become coated with mineral deposits after a period of time. These deposits can be removed by adding a cup of vinegar to the water in the bubbler and cleaning the clear tube through the top plastic fitting with the supplied brush. A water conditioning filter housing and cartridge are available for abnormally hard water.

## **WATER BUBBLER DRAIN LINE**

A 1" (25 mm) PVC socket/1" FPT water drain connection is located at the bottom of the bubbler. The water bubbler drain line should flow to a suitable drain or container. See Figure 4. If the drain line is run overhead, the fitting on the top of the water bubbler must be sealed, including the ¼" NPT vent connection in the fitting, and a protective mesh installed around the clear tube. Do not run the line more than 10' (3 m) above the height of the bubbler because the pressure on the water bubbler could be excessive. Support the drain line to prevent undue stress on the water bubbler. Also, do not install a shutoff valve in this line.

Initially, fill the water bubbler with water through the 3" (80 mm) plug located on top of the tube. Keep the plug lubricated and hand tight. Check for leaks at the hose fittings.

## **WATER PURGE LINE**

Water removed from the refrigeration system by the AUTO-PURGER Plus flows out the water purge line. This line should be directed to a customer supplied container, such as a 55 gallon drum for example. See Figure 4. It is recommended to use rigid metal tubing or to secure the line. Commonly, when draining water, initially all the water is released, then any oil is released, and then a small quantity of ammonia vapor may be released. A loose hose may whip around when the last of the liquid slugs come out of the hose and is therefore not recommended. The customer supplied container may be partially filled with water, and the end of the water purge line submerged in this water so that any small amount of ammonia vapor that may be released is dissolved in this water.

## **OIL DRAINS**

Excess oil can reduce the purger capacity by lowering the evaporating or condensing rate. Oil is not typically a problem. Oil in the evaporator chamber is typically released with the water that is released out the water purge line. However, any oil that may collect in the purger can be drained off through the two capped ¼" valves on the purger. See Figure 1. Before draining oil, close the purge gas gauge valve to the water bubbler, the low-pressure pumped-liquid line shut-off valve, the foul gas line shut-off valve, and the water bubbler fill line valve. Allow the purger to pump out, then close the low-pressure liquid return and suction line valves. Use normal oil draining precautions to prevent injury or property damage.

## **ELECTRICAL CONNECTIONS**

The standard AUTO-PURGER Plus requires a 115V 50/60Hz 17 amp electrical supply on a 20 amp circuit breaker; models for 220V 50/60Hz, 11 amps electrical supply on a 15 amp circuit breaker are available. All models have a ½" (13 mm) knockout on the side of the control cabinet to access the power connection terminal strip. Any unused knockout holes must be sealed to prevent splashing water, dust, and debris from entering the control cabinet.

AUTO-PURGER Plus models APP08, APP16, and APP24 have an additional ¾" (20 mm) knockout for individual purge point solenoid valves. Wires from each purge point solenoid valve should be brought to the purger control cabinet. Any additional access holes should be made on the side of the control cabinet. All access holes into the control cabinet must be sealed to prevent moisture, dust, and debris entering the cabinet.

From each purge point solenoid, one wire is connected to the corresponding screw terminal for the purge point inside the control cabinet on the terminal strip. For 115V models, the other wire from the purge point solenoid is connected together for all the purge points and tied to the available neutral position on the top terminal strip. For the 220V models, the other wire from the purge point solenoid is connected together for all the purge points and tied to the top terminal strip labeled PP\_COM. Both 115V and 220V models APP08, APP16, and APP24 supply 115V to the purge points.

All APP models have a relay available which energizes whenever action is required by plant personnel. The normally open contacts will close when action is required. If desired, the contacts may be connected to a light, an audible alarm, or to a plant computer, to notify plant personnel to attend to the purger. The contacts are rated for 10 amps. Connection to the relay is made at the top terminal strip labeled REMOTE RELAY.

The purger should not be operated when the refrigeration compressors are stopped. It is recommended to install a customer supplied, externally mounted, power relay to de-energize the purger when the refrigeration compressors are stopped.

After completing all electrical connections inside the cabinet, connect the cable from the PLC Control Console to the PLC. Connect the cable plug to the socket and tighten the hand screws. Refer to the wiring tag inside unit.

## **LEAK TEST**

Use standard refrigeration procedures to check the AUTO-PURGER Plus for leaks before placing it in service. To confirm a leak-free AUTO-PURGER Plus, manually open one remote purge point solenoid valve, if there is one. Manually open the foul gas shut-off valve and allow pressure inside the purger to build to condensing pressure, as shown on the high side pressure gauge. Then, manually open the high side to low side bypass valve to pressurize the evaporator section of the purger, as shown on the low side pressure gauge. See Figure 4. Check for leaks. Close the high side to low side bypass valve.

## SECTION 3 AUTO-PURGER PLUS OPERATION

The AUTO-PURGER Plus is designed to automatically startup and operate without the assistance of plant personnel. Beginning at start-up, the following is a description of the refrigerant flow through a purger when all connecting shut-off valves are open. See Figure 4.

### START-UP

Make sure all piping, electrical connections, and settings are complete as described in this bulletin.

Models APP08, APP16, and APP24, should have unused purge points disabled before start-up. For example, an APP08 that will only use 6 of the possible 8 purge points, should have purge points 7 and 8 disabled in the purger software. To do so, first energize the purger. Press the ESC button on the Control Console until the PLC MESSAGE light is off, indicating the Control Console is in the MENU mode. Use the  $\wedge$  or  $\vee$  buttons to highlight the +PURGE POINT ENABLE menu item and press the ENTER button. All purge points are enabled when shipped from the factory. To disable a particular purge point in the software, use the  $\vee$  or  $\wedge$  buttons to highlight the particular purge point and press the ENTER button. Use the  $\vee$  or  $\wedge$  buttons to change the status from 1 to 0, and press the ENTER button. This tells the purger software to skip this particular purge point when sequencing through the purge points.

To start-up the APP, open the foul gas, low-pressure pumped-liquid, low-pressure liquid return, and suction line shut-off valves. Open the purge gas valve. The water purge line shut-off valve should remain closed at this time (open only while draining water). See Figure 4. On start-up, the AUTO-PURGER Plus enters a cooling down stage. The display indicates 3333 EVAP TEMP >40F (4C). In this stage, liquid refrigerant fills and cools the purger. The low-pressure pumped-liquid line solenoid valve (B) energizes to feed refrigerant to the low-pressure flooded evaporator. The liquid make-up level sensor, located in the evaporator chamber, senses when the flooded evaporator is full and closes the low-pressure pumped-liquid line solenoid valve (B).

At the same time the flooded evaporator is cooling, the control software energizes the first purge point solenoid valve. Foul gas enters the high-pressure air separator chamber and condenses to fill the high-pressure air separator chamber with liquid ammonia. When the float switch chamber fills with liquid refrigerant, the float ball rises and pulls in the float switch magnet. (If this chamber is already full of air, the float switch magnet will not pull-in until later when this air is released to the bubbler.)

At approximately 20°F (-7°C) evaporator temperature, the evaporator shell temperature sensor switches the purger from the cooling down stage to STARTUP DELAY MODE for 10 minutes, as indicated by the Control Console no longer displaying 3333 EVAP TEMP>40F (4C), but instead displaying STARTUP DELAY MODE. The control software will not allow any noncondensibles to be released into the water bubbler until the 10 minute STARTUP DELAY MODE is complete. This 10 minute delay is necessary to give the purger time to condense enough foul gas to fill the high pressure air separator chamber with liquid ammonia.

### OPERATION

After the 10 minute STARTUP DELAY MODE is complete, the purger will enter its normal mode of COLLECTING AIR/WATER.

The foul gas that flows into the purger may carry a certain amount of condensed refrigerant, which is captured by the liquid drainer before it enters the purger's condenser coil. From the liquid drainer, the liquid is fed directly into the low-pressure liquid return line. If this separation does not occur, liquid refrigerant will fill the purger's condenser and limit the condensing capacity of the purger.

The liquid-free foul gas enters the purger condensing coil, which is submerged in the flooded evaporator. The refrigerant condenses inside the coil. The condensed refrigerant and noncondensable gas then flow through a check valve and into the air separator chamber. The condensed liquid refrigerant is removed from the high-pressure air separator chamber through the liquid metering valve and to the low-pressure liquid return line.

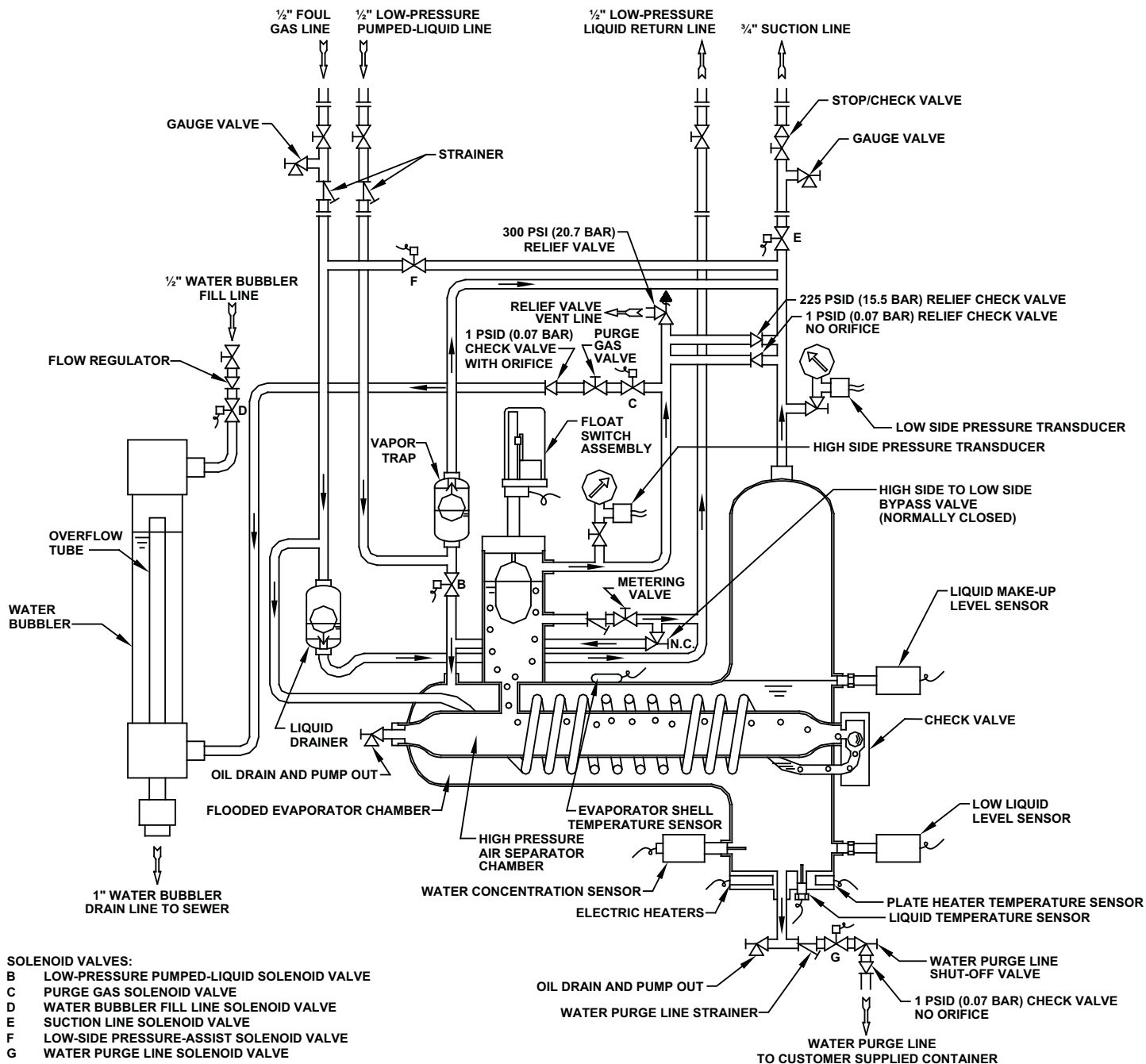
Meanwhile, the noncondensable gas travels along the top of the air separator chamber and into the float ball chamber where it collects. As more noncondensable gases collect, the liquid level gradually falls, causing the float ball to fall. This changes the SPDT switch position of the liquid level float switch and energizes the purge gas solenoid valve (C) and the water bubbler fill line solenoid valve (D), allowing noncondensable gas to bleed through the orifice plate into the water bubbler. The Control Console Display indicates RELEASING AIR. As air is released into the water bubbler, the liquid refrigerant level in the purger float ball chamber rises.

The control software operates each enabled remote purge point solenoid valve in sequence. The control software energizes each purge point for 10 minutes. If noncondensibles are released during this 10 minute period, then the control software will remain on that particular purge point for 10 additional minutes, for a total of 20 minutes. If noncondensibles are released during this second 10 minute period, then the control software will remain on that particular purge point for another 10 minutes, for a total of 30 minutes. After a total of 30 minutes on one particular purge point, the control software will move to the next purge point, regardless of whether noncondensibles were released in the third 10 minute period.

The make-up liquid from the low-pressure pumped liquid line typically contains a small percentage of water dissolved in the liquid ammonia. This is the water the AUTO-PURGER Plus will remove from the refrigeration system. Liquid ammonia and water are brought into the evaporator chamber of the purger, where the ammonia is evaporated and the water remains. Gradually the concentration of water in the evaporator chamber increases with time. When the concentration of water in the evaporator chamber reaches about 25% water / 75% ammonia, as detected by the water concentration sensor, the AUTO-PURGER Plus switches to the CONCENTRATING WATER mode. The purger stops collecting air, isolates the mixture of water and ammonia, and energizes the two electric heaters. About half the energy to concentrate the water comes from the two electric heaters, and the other half comes from the foul gas that continues to flow through the purger. For positive suction pressures, the ammonia/water solution is heated

# AUTO-PURGER PLUS APP FLOW DIAGRAM

Figure 4



to 185°F (85°C). This corresponds to a concentration of about 10% to 20% ammonia and about 80% to 90% water. In a vacuum, water boils at lower temperatures, so the set point to which the ammonia/water solution is heated is reduced to an appropriately lower temperature depending on the suction pressure as detected by the low side pressure transducer.

The AUTO-PURGER Plus will prepare the concentrated water for draining, but the computer software will not allow draining until an operator presses a button to permit draining. When the purger finishes heating the water and the water has been concentrated, the suction line solenoid valve (E) shuts. The Control Console indicates

READY TO DRAIN. OPEN WATER PURGE SHUT-OFF VALVE THEN PRESS "OK" BUTTON. The system remains in this condition until an operator opens the water purge line shut-off valve and presses the OK button on the Control Console. See Figure 5.

After the operator opens the water purge line shut-off valve and presses the OK button, the water purge line solenoid valve (G) energizes to drain the concentrated water. The Control Console Display indicates DRAINING WATER. If the pressure in the evaporator chamber is less than 10 psig (0.7 bar) as detected by the low side pressure transducer, the low-side pressure assist solenoid valve (F) modulates to maintain 10 psig (0.7 bar) in the evaporator chamber.

The concentrated water continues to drain until the level reaches the low-liquid level sensor. After the liquid level passes this sensor, the water purge line solenoid valve (G) remains energized for an additional 10 seconds, and then shuts.

After the water is drained, the low-side pressure-assist solenoid valve F closes, the suction line solenoid valve E opens, and the Control Console indicates, DRAINING IS COMPLETE. CLOSE WATER PURGE SHUT-OFF VALVE THEN PRESS "OK" BUTTON.

After the operator closes the water purge line shut-off valve and presses the OK button, the AUTO-PURGER Plus goes back to 3333 EVAP TEMP>40F (4C) cooling down mode, then the 10 minute STARTUP DELAY mode, and then COLLECTING AIR AND WATER mode. If no air or water is present, there are no releases to atmosphere.

## SECTION 4 CONTROL CONSOLE OPERATION

### CONTROL CONSOLE

The Control Console is the operator's interface with the APP software, see Figure 5. The Control Console Display Window has two display modes. The first display mode alerts the operator to operating conditions and status, and the PLC Message LED illuminates to indicate that it is in the PLC MESSAGE display mode. The APP normally operates in this PLC MESSAGE display mode. The second display mode consists of the menu hierarchy, which allows the operator to verify, and in certain cases change, various system parameters. The PLC Message LED is off when it is in this MENU display mode. To switch between the two display modes press the "esc" key. The PLC Message LED turns on or off to indicate the display mode.

On the Control Console, four Control Pushbuttons allow navigation through the menu hierarchy. See Figure 5.

ESC – Switches between the PLC MESSAGE display mode and the MENU display mode. It is also used to exit when navigating through the menu system.

/ \ – Navigate UP.

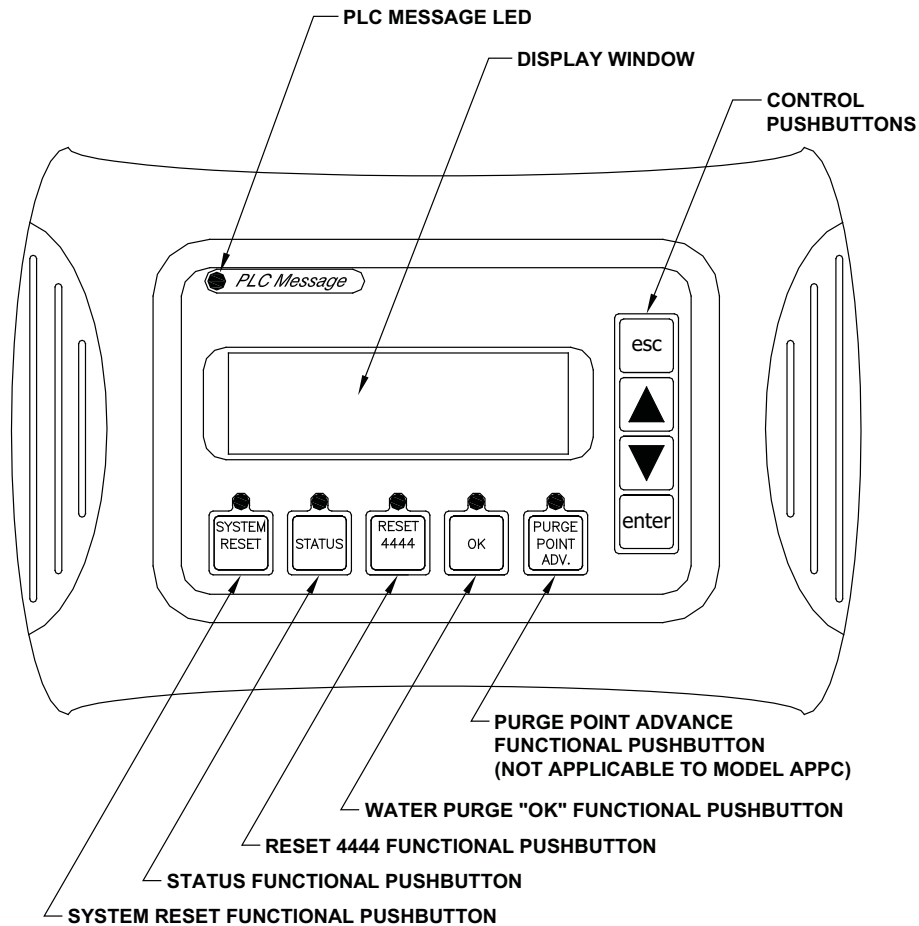
\ / – Navigate DOWN.

ENTER – To enter a specific menu hierarchy or enter a parameter change.

On the Control Console, five Functional Pushbuttons perform specific tasks when depressed. Each has an LED above it which illuminates when the button is operational. See Figure 5. The specific functions are as follows:

### AUTO-PURGER PLUS CONTROL CONSOLE

Figure 5



**SYSTEM RESET** – Resets the system similar to rebooting a computer. Actions performed by pressing this key consist of clearing any error code(s), clearing air purge log minutes, clearing air purge log cycles, clearing water drain log minutes, clearing water drain cycles, and stopping air and water purging processes if active. The number of purge points, the 60 MINUTE AIR PURGE LIMIT setting, and the DISPLAY UNITS will not be changed.

**STATUS** – Pressing this key once displays the total time that air has been released in minutes, the number of cycles that air has been released, the total time that water has been released in minutes, and the number of cycles that water has been released. Pressing this key again displays the water concentration in the purger evaporator (except the water concentration is not displayed during CONCENTRATING WATER mode, because the concentration in this mode often exceeds the range of the water concentration sensor). Pressing the key again displays the temperature of the evaporator shell, the temperature of the liquid inside the purger evaporator, and the temperature of the plate heaters (see figure 4). Another press of this key displays the pressures in the low side and the high side of the purger. A final press of this key returns the display to its normal messages. If this key is not pressed a sufficient number of times to return to the normal messages, it will automatically return to the normal messages after 2 minutes.

**RESET 4444** – Resets a 4444 alarm condition. See Section 7, Troubleshooting for an explanation of this alarm.

**OK** – This key will become active and its LED will illuminate when the purger is ready to drain water to the customer supplied container. The display window will also indicate READY TO DRAIN. OPEN WATER PURGE SHUT-OFF VALVE THEN PRESS “OK” BUTTON. When the operator opens the water purge line shut-off valve and presses this key, the purger will drain the accumulated water. When draining is complete, the display window will indicate DRAINING IS COMPLETE. CLOSE WATER PURGE SHUT-OFF VALVE THEN PRESS “OK” BUTTON. When the operator closes the water purge line shut-off valve and presses this key, the LED will turn off and the purger will return to its normal mode of collecting air and water.

**PURGE POINT ADV.** – Press this key to manually advance to the next purge point. (This key is not applicable to model APPC.)

## PLC MESSAGES WHEN IN THE PLC MESSAGE DISPLAY MODE

The following is a list of messages that may appear in the Control Console Display Window during purger operation:

“Active Purge Pnt ##” indicates which purge point is energized.

“Startup Delay Mode” appears for 10 minutes after the APP evaporator shell cools to colder than 40 °F (4 °C) and the foul gas pressure exceeds 80 psig (5.5 barg).

“Releasing Air” appears when the APP is releasing noncondensable gas.

“Collecting Air/Water” appears when the APP is in its normal operation of collecting noncondensable gas and water.

“Concentrating Water” appears during the process of heating the ammonia/water solution to remove as much ammonia from the water as possible before releasing the water.

“Liquid Temp: ### F” appears during the CONCENTRATING WATER process to indicate the temperature of the ammonia/water solution, when the display units are set to US.

“Liquid Temp: ### C” appears during the CONCENTRATING WATER process to indicate the temperature of the ammonia/water solution, when the display units are set to SI/metric.

“READY TO DRAIN. OPEN WATER PURGE SHUT-OFF VALVE THEN PRESS “OK” BUTTON.” appears when the process of CONCENTRATING WATER is complete and the water is ready to be drained.

“Draining Water” appears when concentrated water is draining from the APP.

“DRAINING COMPLETE. CLOSE WATER PURGE SHUT-OFF VALVE THEN PRESS “OK” BUTTON.” appears when the APP is done draining and is ready to go back to its normal mode of COLLECTING AIR/WATER.

When the STATUS functional pushbutton is pressed once,  
“air purge= ## minute”  
“air purge= ## cycles”  
“H2O purge= ## minute”  
“H2O purge= ## cycles”  
appears to display the purge logs.

When the STATUS functional pushbutton is pressed again, “water solution= ##%” appears to give the water concentration. (This value is not displayed when in CONCENTRATING WATER mode because the concentration typically exceeds the range of the sensor in this mode.)

When the STATUS functional pushbutton is pressed again,  
“evap. shell = ##F”  
“evap. liquid= ##F”  
“evap. plate = ##F”  
appears to display the purger temperatures, when the display units are set to US.

Alternatively,  
“evap. shell = ##C”  
“evap. liquid= ##C”  
“evap. plate = ##C”  
appears to display the purger temperatures, when the display units are set to SI/metric.

When the STATUS functional pushbutton is pressed again,  
“low side= ### psig” (in-Hg, for vacuum)  
“high side= ### psig”  
appears to display the purger pressures, when the display units are set to US.

Alternatively,  
“low side= ### bar” (negative bar, for vacuum)  
“high side= ### bar”  
appears to display the purger pressures, when the display units are set to SI/metric.

“2222 foul gas<80 psi” appears when foul gas pressure is lost and the display units are set to US.

“2222 foul gas< 5 bar” appears when foul gas pressure is lost and the display units are set to SI/metric.

“3333 evap temp>40 F” appears when the evaporator temperature is too warm for effective air purging and the display units are set to US.

“3333 evap temp> 4 C” appears when the evaporator temperature is too warm for effective air purging and the display units are set to SI/metric.

“4444 air purge>60min, Push RESET 4s to CLR” appears when noncondensibles have been released for 60 minutes continuously and the air purge limit is set to normal.

“7777 loss of lp liq” appears when the liquid makeup solenoid valve has been energized for 30 minutes continuously.

ERROR HEATER FAULT appears if the heaters are on longer than 5 hours. This error can only be cleared by depressing the “SYSTEM RESET” key.

“System Reset” appears for 5 seconds after the System Reset key has been pressed. Also, the APP will reset any time power is cycled.

“System Initializing” appears after “System Reset” and before the Liquid Make-up Level Sensor goes dry and then wet one time. “System Initializing” prevents the heaters from turning-on until the evaporator shell has filled with liquid.

See Section 7, Troubleshooting for additional information.

## MENU HIERARCHY WHEN IN THE MENU DISPLAY MODE

The control console menu is as follows:

### +air purge limit

60 minute limit: #  
(normal=0, 60 min)  
(startup=1, nolimit)

When set to normal, the purge gas solenoid is limited to being continuously energized for no longer than one hour. However if large amounts of noncondensibles are expected, for example on new system startup, this limit can be disabled by setting this parameter to startup. To change the air purge limit, move the cursor with the  $\wedge$  and  $\vee$  keys to the 60 minute limit: # line and press enter. Change the value with the  $\wedge$  or  $\vee$  keys, and press enter again. Press esc to return to the menu.

### +purge point enable

01:# 1=enable,0=skip  
02:# 1=enable,0=skip  
03:# 1=enable,0=skip  
04:# 1=enable,0=skip  
05:# 1=enable,0=skip  
06:# 1=enable,0=skip  
07:# 1=enable,0=skip  
08:# 1=enable,0=skip

Model APP08 has purge points 01-08 as shown here, model APP16 has purge points 01-16, model APP24 has purge points 01-24. Model APPC does not have this menu item. To enable or disable individual purge points, move the

cursor with the  $\wedge$  and  $\vee$  keys to the desired purge point and press enter. Change the value with the  $\wedge$  or  $\vee$  keys, and press enter again. Press esc to return to the menu. At system start-up, when a purger is initially installed in a system that has fewer purge points than are available on the purger (e.g., an APP08 used on system that has 5 purge points), the unused purge points must be set to 0.

### +water collection

counts= # (600)  
drain mode: 0

The water collection parameters can not be changed and are for information only. The counts indicate the time in seconds that the water concentration as measured by the water concentration sensor exceeds the concentration set point. The concentration of water in the purger evaporator must exceed 25% for 10 minutes (600 seconds) continuously before the purger will enter CONCENTRATING WATER mode. This is available for information only, and no action is required by the operator related to the counts. The drain mode is always set to 0, and can not be changed.

### +display units

units: #  
(1=US)  
(0=SI/metric)

To change the display units, move the cursor with the  $\wedge$  and  $\vee$  keys to the units: # line and press enter. Change the value with the  $\wedge$  or  $\vee$  keys, and press enter again. Press esc to return to the menu.

### +version

keypad FW= ####  
plc FW= ####

The version menu item displays the software revisions for the purger’s display keypad and for the purger’s plc.

## SECTION 5 COMPONENT DESCRIPTIONS

### WATER BUBBLER

Noncondensable gas released from the AUTO-PURGER Plus flows through the water bubbler where residual ammonia is absorbed into the water. Large, 1" (25 mm) diameter bubbles in the water bubbler indicate proper operation. The water, with absorbed ammonia, flows to a drain. The water bubbler fill line solenoid valve (D) opens to automatically replenish water to the bubbler each time the purge gas solenoid valve (C) energizes. The water bubbler fill line solenoid valve (D) remains energized for 30 seconds after the purge gas solenoid valve (C) de-energizes (float switch magnet pulls in). This fills the water bubbler with fresh water for the next purge cycle.

### LIQUID DRAINER

The liquid drainer separates any liquid condensed in the purge point piping. This liquid is fed to the low-pressure liquid return line. Therefore, only foul gas—no liquid—enters the condensing section of the purger. However, if too much liquid comes down the foul gas line due to improper piping, corrective action must be taken.

### VAPOR TRAP

The vapor trap separates any vapor that flashes in the low-pressure pumped liquid line piping. This vapor is fed to the suction line. Therefore, only liquid—no vapor—flows through the liquid make-up solenoid valve (B) to the evaporator chamber of the purger.

### CHECK VALVES

There are five check valves on the purger.

- a) A 1 psid (.07 bar) check valve with a 1/32" (.8 mm) diameter metering orifice is installed on the purge gas line to prevent reverse flow of water into the purger from the water bubbler.
- b) A 225 psid (15.5 bar) relief check valve from the float chamber to suction line.
- c) A 1 psid (.07 bar) relief check valve from the suction line to the float chamber.
- d) A 1 psid (.07 bar) check valve in the water purge line to prevent reverse flow of water into the purger from the customer supplied container.
- e) The water bubbler fill line has a 1/2" check valve.

### PURGE GAS ORIFICE

A metering orifice disc is installed inside the 1 psid (0.07 bar) check valve in the purge gas line to the water bubbler. See Figure 6. This 1/32" (0.8 mm) diameter orifice meters the noncondensable gas into the water bubbler to prevent over or under feeding. The 1/4" NPT gauge valve should be fully open during operation and closed for pump out or maintenance.

### METERING VALVE

The metering valve meters condensed liquid refrigerant from the high-pressure float switch chamber of the purger into the low-pressure liquid-return line. The refrigerant is filtered through a small flanged strainer prior to the metering valve, which removes any particles that might block the orifice.

An indication of proper operation of the metering valve is a frosted liquid feed line from the metering valve to the low-pressure liquid-return line. If the line is not frosted when the purger is in COLLECTING AIR/WATER mode, then the flow of refrigerant through the line may be blocked due to dirt in the metering valve or strainer.

The metering valve is set and held in place by a locking knob. Unlock this knob using the .035" hex key wrench provided inside the purger control cabinet. To clean the orifice of the metering valve, fully open the metering valve to flush out any particles. Then, close the valve and reopen two turns.

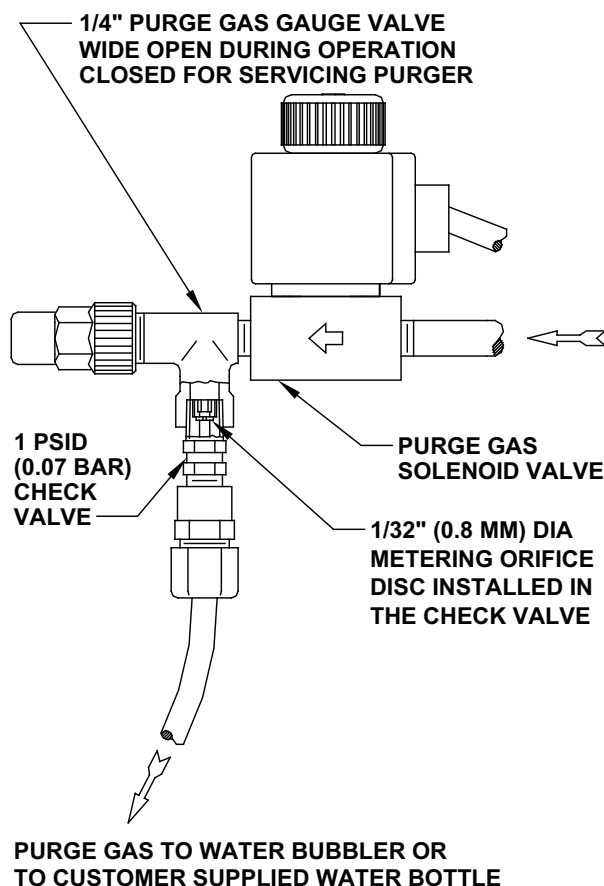
If the line still does not frost, then pump out the purger and inspect the strainer and metering valve.

### HIGH SIDE TO LOW SIDE BYPASS VALVE

The High Side To Low Side Bypass Valve is normally closed. The AUTO-PURGER Plus has portions that normally contain high pressure, and portions that normally contain low pressure. The two portions are separate and isolated from each other. For some maintenance and testing purposes, it may be desirable to connect the two together so that the pressure in both is the same. The High Side To Low Side Bypass Valve may be opened for these purposes. Return this valve to its closed position for normal operation. See Figure 4.

### PURGE GAS SOLENOID VALVE

Figure 6



## TEMPERATURE SENSORS

There are three temperature sensors on the purger. All three temperature sensors are type J thermocouples.

- a) The evaporator shell temperature sensor is mounted to the outside of the evaporator shell, and controls the 3333 EVAP TEMP > 40F (4C) indication. It may be replaced without pumping-out the purger.
- b) The plate heater temperature sensor is mounted in the bottom plate of the evaporator shell, between the two electric heaters. It is used to control the heaters to maintain adequate temperature of the plate when CONCENTRATING WATER. It may be replaced without pumping-out the purger, but may be very hot if the heaters are energized.
- c) The liquid temperature sensor measures the temperature of the liquid inside the evaporator. It is used to indicate liquid temperature when CONCENTRATING WATER. It also is used to end the CONCENTRATING WATER cycle and indicate READY TO DRAIN when the water has reached the desired temperature. The purger must be pumped-out to replace it because it is in direct contact with the ammonia/water solution.

## PRESSURE TRANSDUCERS

There are two pressure transducers on the purger. Each provides a 4-20 mA output proportional to pressure from 29 in-Hg to 285 psig (-1.0 bar to +19.7 bar).

- a) The low side pressure transducer measures the pressure in the evaporator shell. It is used to adjust the set point temperature to which the ammonia/water solution is heated if the suction is operating in a vacuum, which prevents boiling off the water. It also controls the low-side pressure-assist solenoid valve (F) to maintain positive pressure for draining water if the suction is in a vacuum.
- b) The high side pressure transducer measures the pressure in the air separator chamber. It controls the 2222 FOUL GAS < 80 PSI (5 BAR) indication, which prevents the purge gas solenoid valve (C) from energizing if the purger has insufficient pressure.

## SINGLE POINT LEVEL SENSORS

There are two single point level sensors on the purger, which operate on the principle of capacitance to determine whether liquid or gas is present. The level sensor has a relay contact which is open when the sensor is in gas, and which closes when the sensor is in liquid ammonia. Further information may be found in bulletin P105.

- a) The liquid make-up level sensor controls the low-pressure pumped-liquid solenoid valve (B) to maintain the ammonia level in the evaporator shell.
- b) The low liquid level sensor prevents the electric heaters from energizing if no liquid is present, which protects the heaters from damage. It also controls the water purge line solenoid valve (G) while draining water. While water is draining, the water purge line solenoid valve (G) will remain energized for 10 seconds after the low liquid level sensor goes dry, and then will shut.

## WATER CONCENTRATION SENSOR

The water concentration sensor measures temperature and pressure in a single sensor, compares the two, and outputs a 4-20 mA signal of the water concentration. A current of 12 mA or less indicates no water. Each mA above 12 mA is equivalent to 7.5% water concentration. For example, 13 mA indicates 7.5% water, 14 mA indicates 15% water, and 15 mA indicates 22.5% water.

The maximum range for the water concentration sensor is 20 mA which indicates 60% water. Any water concentration above 60% is out of range. The APP display will only indicate a maximum of 60% water, even if the concentration is greater than 60%.

The water concentration sensor will only provide an accurate reading when immersed in liquid. For example, when the APP is pumped-out, the water concentration sensor will indicate 60%, because it senses low pressure (1 atmosphere) and warm temperature (room temperature), which would mean a high concentration of water if it were sensing a liquid ammonia/water solution.

## ELECTRIC HEATERS

The APP has two electric heaters, which are used during the CONCENTRATING WATER mode. When the purger is CONCENTRATING WATER, the ammonia/water solution is heated to evaporate as much ammonia as possible, so that when the water is released it has as little ammonia as possible. Each heater is 750 W.

## PURGE POINT SOLENOID VALVES

For the customer-supplied purge point solenoid valves, Hansen recommends our HS8A with close-coupled strainer. This is a 1/2" port, heavy-duty, pilot-operated solenoid valve with stainless steel piston. The purge point solenoid valve must be a minimum of 1/2" port size to avoid excess pressure drop across the valve.

The standard molded coil is for 115V, (208/230V or 24V are available). Flange connections available are 1/2", 3/4", and 3/8" FPT, socket weld, and weld neck. To order, specify catalog number HS8AST, required connection style and size, and volts. Specify DIN plug solenoid connection if needed.

Both 115V and 220V models APP08, APP16, and APP24 supply 115V to the purge points.

### **PURGER PUMP OUT PROCEDURE**

- 1) Close the purge gas gauge valve to the water bubbler.
- 2) Close the low-pressure pumped-liquid line shut-off valve.
- 3) Close the foul gas line shut-off valve.
- 4) Close the water bubbler fill line valve.

The purger will pump down in several hours. To accelerate the process, attach ammonia hoses to the oil drain valves and pump out into a suction line. After all liquid is removed, close the low-pressure liquid return line shut-off valve and the suction line stop/check valve to isolate the purger. With electricity on, the pressure in the purger, as indicated by both the high side pressure gauge and the low side pressure gauge, should remain at zero. After the purger is completely pumped-out, turn off electricity to the purger. This process should be completed only by knowledgeable refrigeration technicians.

### **REPLACEMENT OF THE PLC BACKUP BATTERY**

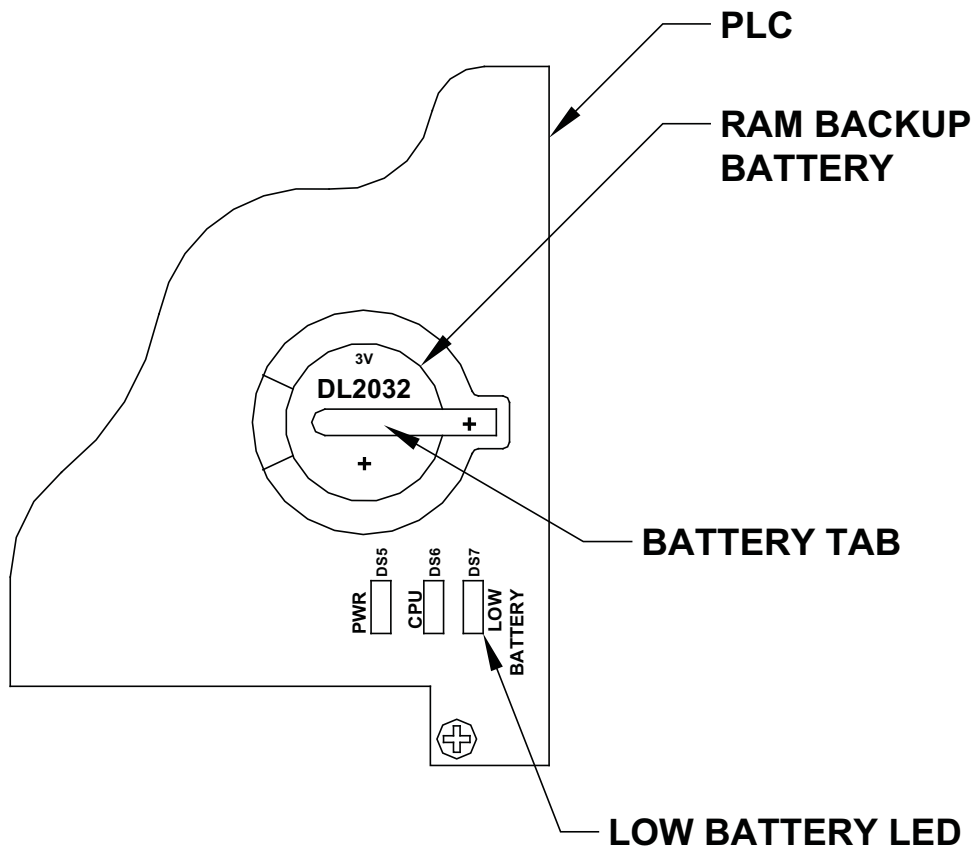
The replacement battery is DURACELL DL2032 or RAYOVAC CR2032.

A 3.0V lithium coin cell battery is used to provide backup power to the real time clock of the plc. The battery and battery low indicator are located in the lower right corner of the plc, see Figure 7. On certain models, the battery is located underneath a control module. The battery should be replaced every 5 years or when the LOW BATTERY LED is illuminated.

To replace the battery, the power to the APP must be ON. Lift the battery tab and press the battery out with your finger or a non-metallic tool. When installing a new battery, the battery polarity “+” must be to the top side. Lift the battery tab and slide the battery into place. Verify the LOW BATTERY LED is not illuminated.

# BATTERY REPLACEMENT

Figure 7



## PARTS LIST

<b>MECHANICAL</b>	
HLLSW	Float Switch Assembly
20-1772	Water Bubbler Assembly, antisiphon (w/end connections)
20-1186	Metering Valve
20-1198	Metering Valve Seal Kit
20-1648	Metering Valve Strainer
20-1737	Screen Assembly Replacement Kit for above strainer, includes: 20-1535 Screen Assembly 78-0016 Strainer Cap Gasket
ST050	Water Purge Line Strainer
78-1001	Screen Assembly Replacement Kit for above strainer, includes: 78-0005 Screen Assembly 78-0016 Strainer Cap Gasket
70-1059	Plunger Kit for all purger solenoid valves
20-1183	Check Valve, 1 psid (.07 bar) with orifice
20-2489	Check Valve, 1 psid (.07 bar) no orifice
20-1185	Check Valve, 225 psid (15.5 bar)
20-1214	Check Valve Seal Kit for 1 psid and 225 psid check valves
20-1311	Liquid Drainer
20-2432	Vapor Trap
H5600R	Relief Valve, 300 psi
<b>ELECTRICAL</b>	
70-1088	Solenoid Coil, DIN plug - 115V, 50/60 Hz, 16 Watt
20-2428	Electric Heater, 115V, 50/60 Hz, 750 Watt
20-2477	Electric Heater, 230V, 50/60 Hz, 750 Watt
20-1279	Fuse, 2 amp, 115V purger
20-2402	Fuse, 15 amp, 115V purger
20-1695	Fuse, 3 amp, 220V purger
20-2463	Fuse, 8 amp, 220V purger
20-2403	PLC, 12 position (APP08, APP16, APP24)
20-2416	PLC, 6 position (APPC, APPC-2, APP08-2, APP16-2, APP24-2)
20-2405	PLC module, thermocouple input
20-2406	PLC module, current input
20-2407	PLC module, AC output
20-2408	PLC module, AC input/output
20-2409	PLC control console display
20-2410	Heater Contactor
20-2411	Cable, PLC to Control Console
PSU	100-240VAC:24VDC Power Supply
HPT717	Water Concentration Sensor
SPSN-1	Liquid Make-up Level Sensor
SPSN-1	Low Liquid Level Sensor
20-2429	Plate Heater Temperature Sensor
20-2430	Liquid Temperature Sensor
20-2431	Evaporator Shell Temperature Sensor
75-3002	Pressure Transducer
20-2404	PLC module, AC input
20-2413	PLC module, DC input/relay output
20-2464	Transformer 220/115V

## SECTION 7 TROUBLESHOOTING

### CONTROL CONSOLE DISPLAYS 2222

**LOSS OF “FOUL GAS” PRESSURE.** This usually means the pressure in the air separator chamber is below 80 psig (5.5 barg). The high side pressure gauge on the purger reads near suction pressure. The purger will not allow noncondensable gases to be released from the purger.

**REASON 1:** A remote purge point solenoid valve is jammed closed.

**Check:** Advance purge points one at a time with the purge point advance button, waiting approximately 2 minutes before advancing again. Wait until the Control Console again displays 2222. The faulty coil or wiring is now pinpointed. Inspect the remote purge point solenoid valve which caused the diagnostic code to appear. Manually open the solenoid valve and recheck the pressure.

**Action:** If the coil is energized, clean and replace any solenoid valve parts as necessary. See also the Caution section on page 20.

**REASON 2:** “Foul gas” line restricted.

**Check:** Inspect the “Foul gas” line for a closed shut-off valve(s) or the plastic shipping cap still in “foul gas” line flange.

**Action:** Open shut-off valves and/or remove the shipping cap. See also Caution section, page 20.

**REASON 3:** Faulty pressure transducer.

**Check:** With the purger in any operational mode, check the high-side pressure gauge reading. If it is above 80 psig, press the STATUS functional pushbutton several times until the pressures are displayed. Verify that the high side pressure is greater than 80 psig (5.5 barg).

**Action:** If the high side pressure displayed is less than 80 psig (5.5 barg), replace the high side pressure transducer (p/n 75-3002) with the purger at zero pressure. See also the Caution section on page 20.

### CONTROL CONSOLE DISPLAYS 3333

**PURGER TOO WARM.** If the purger evaporator temperature is 40°F (4°C) or warmer, the purger will not release noncondensable gas from the purger because excessive refrigerant would also escape. This code is also displayed during initial start-up until the purger flooded evaporator is cooled down.

**REASON 1:** Suction temperature too high.

**Check:** Verify the pressure at the purger suction line connection. To allow for temperature transfer losses between the purger evaporator and the temperature sensor, the suction temperature should be approximately 20°F (-7°C) or colder. For higher suction temperatures, consult the factory.

**Action:** Connect to a lower-temperature suction.

**REASON 2:** Restriction in the suction line.

**Check:** Inspect the suction line and shut-off valves. These should be a minimum size of ¾". On new installations, also make sure the plastic shipping cap in suction line flange is removed.

**Action:** Eliminate the restriction. See also the Caution section on page 20.

**REASON 3:** The flooded evaporator inside the purger is not filled with refrigerant.

**Check:** Look for a closed liquid line shut-off valve. Also, check that the liquid line solenoid valve (B) is energized.

**Action:** Open the liquid line shut-off valve. If not energized, check for voltage at the liquid line solenoid valve coil. Replace the coil if it is burned-out.

**REASON 4:** Faulty liquid make-up level sensor providing a “false wet” indication.

**Check:** Remove the cover of the electrical enclosure on the liquid make-up level sensor. The red LED inside will be on if it senses liquid, and off if it senses gas. If the sensor has no frost where the sensor enters the vessel, but the red LED is on, the sensor may be defective.

**Action:** Replace the liquid make-up level sensor if defective. See also Caution section, page 20.

**REASON 5:** Faulty temperature sensor.

**Check:** Press the STATUS button to display the evaporator shell temperature.

**Action:** Replace the evaporator shell temperature sensor (p/n 20-2431) if defective.

**REASON 6:** Purger is in CONCENTRATING WATER mode.

**Check:** Display Window states CONCENTRATING WATER.

**Action:** No action is required. It is normal for the evaporator to heat to warmer than 40°F (4°C) in this mode.

### CONTROL CONSOLE DISPLAYS 4444

**PURGED OVER 60 MINUTE TIME LIMIT.** If noncondensibles are released from the purger for 60 minutes continuously, a time delay will close the purge gas solenoid valve (C). This limits the possibility of a substantial amount of refrigerant inadvertently being released into the water bubbler in the unlikely event of purger malfunction.

**REASON 1:** A large volume of noncondensibles is continuously being removed from system.

**Action:** Reset the time delay by pressing the RESET 4444 functional pushbutton on the Control Console. See Figure 5. The delay is now reset for up to another hour of continuous purging. Otherwise, change the AIR PURGE LIMIT to STARTUP for continuous purging without the 60 minute time limit.

**REASON 2:** Purge gas solenoid valve (C) is not opening or the seat/orifice is blocked.

**Check:** Make sure purge gas solenoid valve (C) is energized. If not, check for voltage at solenoid coil.

**Action:** Replace the coil if it is burned-out, otherwise clean or replace the valve. See also the Caution section on page 20.

**REASON 3:** The shut-off valve located after the purge gas solenoid valve (C) is closed.

**Check:** Verify that purge gas is not being sent to the bubbler.

**Action:** Open the valve.

## CONTROL CONSOLE DISPLAYS 7777

**LOSS OF LOW-PRESSURE PUMPED-LIQUID.** If the liquid line solenoid valve remains energized for more than 30 minutes, it indicates there is insufficient low-pressure pumped-liquid available to maintain an adequate level in the flooded evaporator of the purger. The purger will not purge air until this is corrected.

**REASON 1:** Liquid line solenoid valve (B) is not opening or the seat/orifice is blocked.

**Check:** Make sure the liquid line solenoid valve (B) is energized. If not, check for voltage at the solenoid coil.

**Action:** Replace the coil if it is burned-out, otherwise clean or replace the valve. See also the Caution section on page 20.

**REASON 2:** Liquid line restricted.

**Check:** Look for closed shut-off valves in the pumped-liquid line, plugged strainers, or the plastic shipping cap still in the liquid line flange.

**Action:** Inspect piping for a closed shut-off valve. Open the shut-off valves, clean the strainer, or remove the shipping cap. See also the Caution section on page 20.

## NONCONDENSIBLES ARE NOT BEING RELEASED.

(See also page 17; **Control Console displays 3333**)

**REASON 1:** Noncondensibles not present in system.

**Check:** Compare the refrigerant liquid temperature from condenser exit with the condensing pressure. The pressure/temperature relationship should be within 2 or 3 psig (0.14 to 0.21 bar).

**ACTION:** None at this time.

**REASON 2:** Metering valve plugged.

**Symptom:** The purger appears to be operating properly, however, the low-pressure liquid-return line is not frosted.

**Action:** Fully open the metering valve to flush out any particles. Then, close the valve and reopen two turns.

**REASON 3:** “Foul gas” line is flooded with liquid.

**Symptom:** The bottom of the liquid drainer often remains frosted.

**Check:** Inspect condenser and “foul gas” piping. In many cases, the problem is liquid refrigerant being drawn from the purge point. To prevent this from happening, select purge point locations above liquid surfaces and make sure purge point lines are installed so that only vapor, and not liquid, can be drawn in. Refer to Piping Instructions in Section 2 of this bulletin.

**Action:** Correct condenser and “foul gas” piping.

## AMMONIA INSTEAD OF NONCONDENSIBLES RELEASED FROM PURGER.

**REASON 1:** Purge gas solenoid valve (C) leaking at seat.

**Symptom:** A slow leak of noncondensibles to the bubbler.

**Check:** Look for dirt or a worn seat in the purge gas solenoid valve (C).

**Action:** Remove, clean, or replace the solenoid tube plunger or valve. See also the Caution section on page 20.

**REASON 2:** Oil in purger.

**Symptom:** No frost around the low side oil drain valve.

**Action:** Remove oil through both the low side and high side drain valves (See Figure 1) per safe refrigeration procedures. See also the Caution section on page 20.

**REASON 3:** Refrigeration compressors are stopped.

**Symptom:** After the refrigeration compressors are stopped, the purger releases ammonia into the water bubbler for about 1/2 hour until either the 2222 alarm or the 3333 alarm is displayed.

**Action:** The purger should not be operated when the refrigeration compressors are stopped. It is recommended to install a customer supplied, externally mounted, power relay to de-energize the purger when the refrigeration compressors are stopped.

## WATER IS NOT BEING RELEASED

**REASON 1:** Water not present in system.

**Check:** Perform a water analysis of the vessel from which the low-pressure pumped liquid is supplied. Divide ppm by 10,000 to convert to percent.

**Action:** None at this time.

**REASON 2:** The water concentration sensor is defective.

**Check:** Press the STATUS button on the Control Console and record the water solution percentage, the evaporator liquid temperature, and the low side pressure readings. Compare the evaporator liquid temperature with the low side pressure reading. The water concentration sensor should read approximately 2% water for every 1 °F (0.6 °C) that the evaporator liquid temperature is warmer than the temperature of pure saturated ammonia corresponding to the low side pressure reading. The evaporator liquid temperature must be 12 °F (7 °C) warmer than the temperature of pure saturated ammonia corresponding to the low side pressure reading before the APP will enter CONCENTRATING WATER mode.

**Action:** Replace the water concentration sensor if defective. See also Caution section, page 20.

**REASON 3:** The low liquid level sensor is defective.

**Check:** The heaters will not energize, and the APP will not release water, if the low liquid level sensor indicates no liquid is present. Remove the cover of the electrical enclosure on the low liquid level sensor. The red LED inside will be on if it senses liquid, and off if it senses gas. If the sensor has frost where the sensor enters the vessel, but the red LED is off, the sensor may be defective. If there is no frost, either no liquid is present, or the sensor is logged with oil and the oil must be drained.

**Action:** Replace the low liquid level sensor if defective. See also Caution section, page 20.

## EZ PLC TIMEOUT

This message means that the APP Control Console is not communicating with the APP PLC.

**REASON 1:** The cable from the display is not connected to the plc. The cable is shipped disconnected to make it easier to wire the purge points during initial installation. After the purge points are wired, the cable should be connected to the plc.

**Action:** Connect the cable if disconnected.

**REASON 2:** DIP switches on the plc are in the wrong positions.

**Check:** The four DIP switches on the plc should be: 1-on, 2-off, 3-on, 4-off.

**Action:** Move the switches to the correct positions.

**REASON 3:** The plc is defective.

**Check:** On the PLC, lower right corner, there are 3 LEDs, PWR/CPU/LOW BATTERY. Check that the PWR and CPU LEDs are ON.

**Action:** If these lights are not on, try turning the purger off then back on. If this does not restart the plc, replace the plc.

## PURGER TURNS-OFF DUE TO BLOWN FUSE

This is the result of a short circuit either on the purger itself, or from a shorted purge point solenoid. To isolate the short circuit, turn off power to the APP, disconnect all modules on the plc, replace the 2A or 3A fuse if necessary, and perform the following.

**REASON 1:** A short circuit on the APP sensors.

**Check:** Reconnect the plc module for temperature, and verify the fuse does not blow. Reconnect the plc module for the milliamp circuits, and verify the fuse does not blow. Reconnect the plc module for the level sensors, and verify the fuse does not blow. If the fuse does blow, the location of the short circuit is located.

**Action:** Replace the shorted sensor. See also Caution section, page 20.

**REASON 2:** A short circuit on the APP solenoid coils.

**Check:** Reconnect the plc module for the APP solenoid coils, and verify the fuse does not blow. If the fuse does blow, one of the solenoid coils on the purger, or the heater relay is shorted.

**Action:** Replace the shorted solenoid coil or relay.

**REASON 3:** A shorted purge point solenoid coil.

*(This step is not applicable to model APPC.)*

**Check:** Reconnect the plc module(s) for the purge point solenoid coils. Press the PURGE POINT ADV button to sequence through each purge point, and verify the fuse does not blow. If the fuse does blow, that purge point solenoid coil is shorted.

**Action:** Replace the shorted purge point solenoid coil.

## HEATER FAULT

The APP display will indicate HEATER FAULT if the APP is in CONCENTRATING WATER mode for 5 hours continuously. This alarm condition can only be cleared by pressing the SYSTEM RESET functional pushbutton.

**REASON 1:** The capacitors on the pressure transducer milliamp circuitry are missing. These capacitors dampen electrical noise on the pressure transducer signals. The heater temperature set-points change depending on the low-side pressure transducer signal to avoid boiling the water when operating in a vacuum. Electrical noise can cause the heater set points to change rapidly resulting in the water never reaching the desired temperature.

**Check:** Verify the capacitors are installed across the 24 VDC power supply terminals 7 and 8, and the plc mA input module terminals 50 to 51 and 48 to 51.

**Action:** Install correct capacitors if missing.

**REASON 2:** A burned-out 15A fuse (8A fuse for 220V models).

**Check:** Check the 15 or 8 amp fuse for continuity.

**Action:** If necessary, replace the 15 or 8 amp fuse (p/n 20-2402 or p/n 20-2463).

**REASON 3:** One or both heaters do not have electrical continuity.

**Check:** De-energize the APP, and measure the heater resistance across the output terminals of the heater contactor in the bottom left corner of the APP electrical enclosure. For 115V models, the combined resistance of the two heaters in parallel should be about 9 to 10 ohms. For 220V models, the combined resistance of the two heaters in parallel should be about 35 to 40 ohms.

**Action:** Replace the one defective heater if the measured resistance is double the value expected. Replace both defective heaters if the measured resistance is an open circuit.

**REASON 4:** The heater contactor is defective.

**Action:** Replace the heater contactor.

## DISPLAY CONTINUOUSLY INDICATES “SYSTEM INITIALIZING”.

The display will indicate SYSTEM INITIALIZING if the system is restarting and the purger is already cooled down. One example of when this might occur is immediately after pressing the SYSTEM RESET button. The display will continue to indicate SYSTEM INITIALIZING until the liquid make-up level sensor cycles dry then wet one time, at which time it will change to STARTUP DELAY MODE. The purpose of SYSTEM INITIALIZING is to ensure the heaters will not energize until the purger evaporator has been filled with liquid at least one time. If SYSTEM INITIALIZING appears for only a few minutes this is normal. If SYSTEM INITIALIZING appears for longer than 30 minutes, then the reason should be investigated.

**REASON 1:** The liquid make-up level sensor is defective

**Check:** Remove the cover of the electrical enclosure on the liquid make-up level sensor. The red LED inside will be on if it senses liquid, and off if it senses gas. If the red LED is either always on or always off, and does not change state, the sensor may be defective.

**Action:** Replace the liquid make-up level sensor if defective. See also Caution section, page 20.

## **WATER BUBBLER DEVELOPS EXCESSIVE MINERAL COATING.**

**REASON 1:** Hard water.

**Action:** Add vinegar to the bubbler water. Then, clean with the supplied brush. Use a water conditioning housing and cartridge in the water supply line to the purger.

## **ORDERING INFORMATION**

**To Order:** Specify catalog number and voltage. 115V 50/60Hz 17A is standard. 220V 50/60Hz 11A is available. All models are suitable for ammonia only.

<b>Cat. No.</b>	<b>Description</b>
APP08	AUTO-PURGER Plus, 8 points
APP16	AUTO-PURGER Plus, 16 points
APP24	AUTO-PURGER Plus, 24 points
APPC	AUTO-PURGER Plus for Plant Computer

## **CAUTION**

Hansen purgers are for refrigeration systems only. These instructions and related safety precautions must be read completely and understood before selecting, using, or servicing these purgers. Only knowledgeable, trained refrigeration technicians should install, operate, or service these purgers. Stated temperature and pressure limits should not be exceeded. Purger components should not be removed from the purger unless the system has been evacuated to zero pressure. See also the Safety Precautions in the current List Price schedule and the Safety Precautions Sheet supplied with this product. Escaping refrigerant can cause injury, especially to the eyes and lungs.

## **WARRANTY**

All Hansen products, except electronics, are guaranteed against defective materials or workmanship for one year F.O.B. factory. Electronics are guaranteed against defective materials or workmanship for 90 days F.O.B. factory. No consequential damages or field labor is included.

# **H HANSEN**

Hansen Technologies Corporation

6827 High Grove Boulevard

Burr Ridge, Illinois 60527 USA

Tel: 630.325.1565 Fax: 630.325.1572 Toll: 800.426.7368

Email: info@hantech.com Web: www.hantech.com

**USA · Asia · Europe · India · Latin America · Middle East**

© 2008 Hansen Technologies Corporation