



AUTO-PURGER® PLUS, APP

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 pre-assembled, 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:

5% system water concentration – 3 gallons of water removed per day

10% system water concentration – 5 gallons of water removed per day

20% or more system water concentration – 7 gallons of water removed per day.

The internal surface area and flooded evaporator efficiency gives the AUTO-PURGER Plus two to three times the foul gas condensing capacity of an Armstrong Purger and 10 times the capacity of purgers with small electric hermetic compressors. 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 set to purge for 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.

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

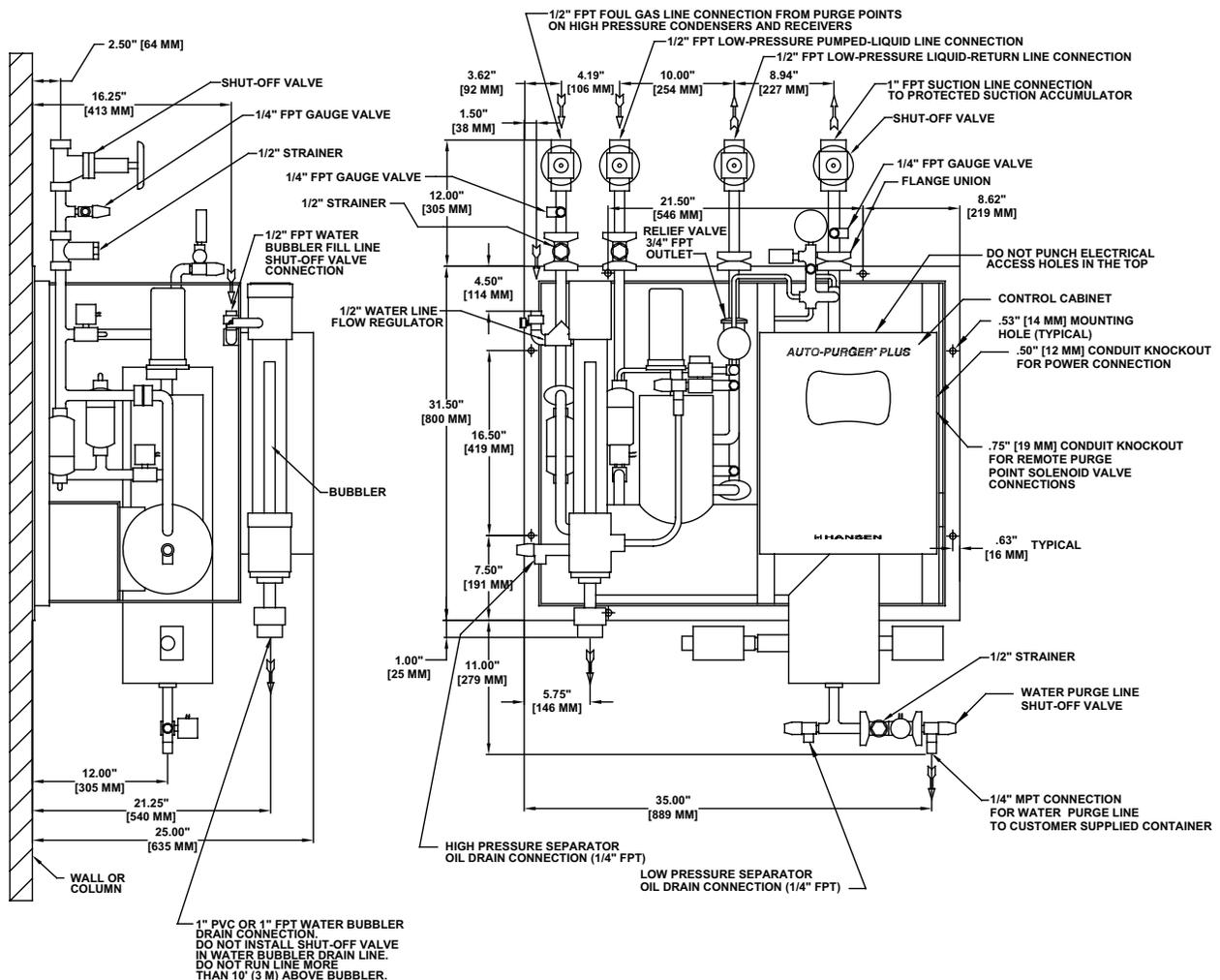
It is nearly impossible to predict where noncondensable gases (air) will accumulate. Therefore, purging at several points on the high-pressure side of the system is the best method for removing air from the system.

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 IIR 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.

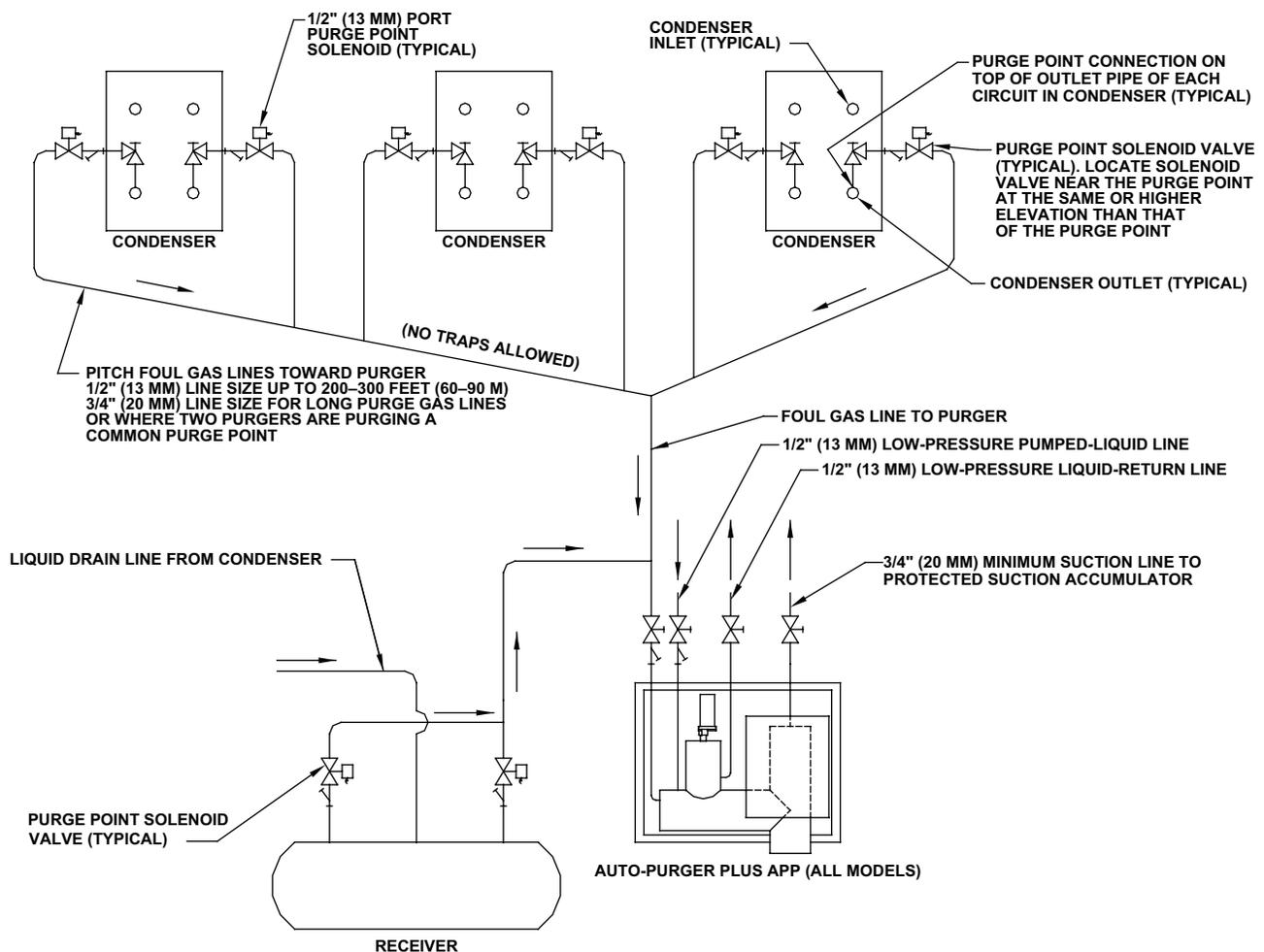
Heat exchangers and horizontal shell and tube water-cooled condensers should be purged at the top, usually at the point or points furthest from the compressor discharge main inlet. Vertical condensers should be purged near the top of the vessel if possible.

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 shut-off valves, so that liquid can periodically be drawn from each vessel which may contain water. The liquid pressure must be a minimum 15 psi 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 its PURGER COOLING DOWN mode to its COLLECTING AIR AND WATER mode. For higher suction temperatures, consult the factory.

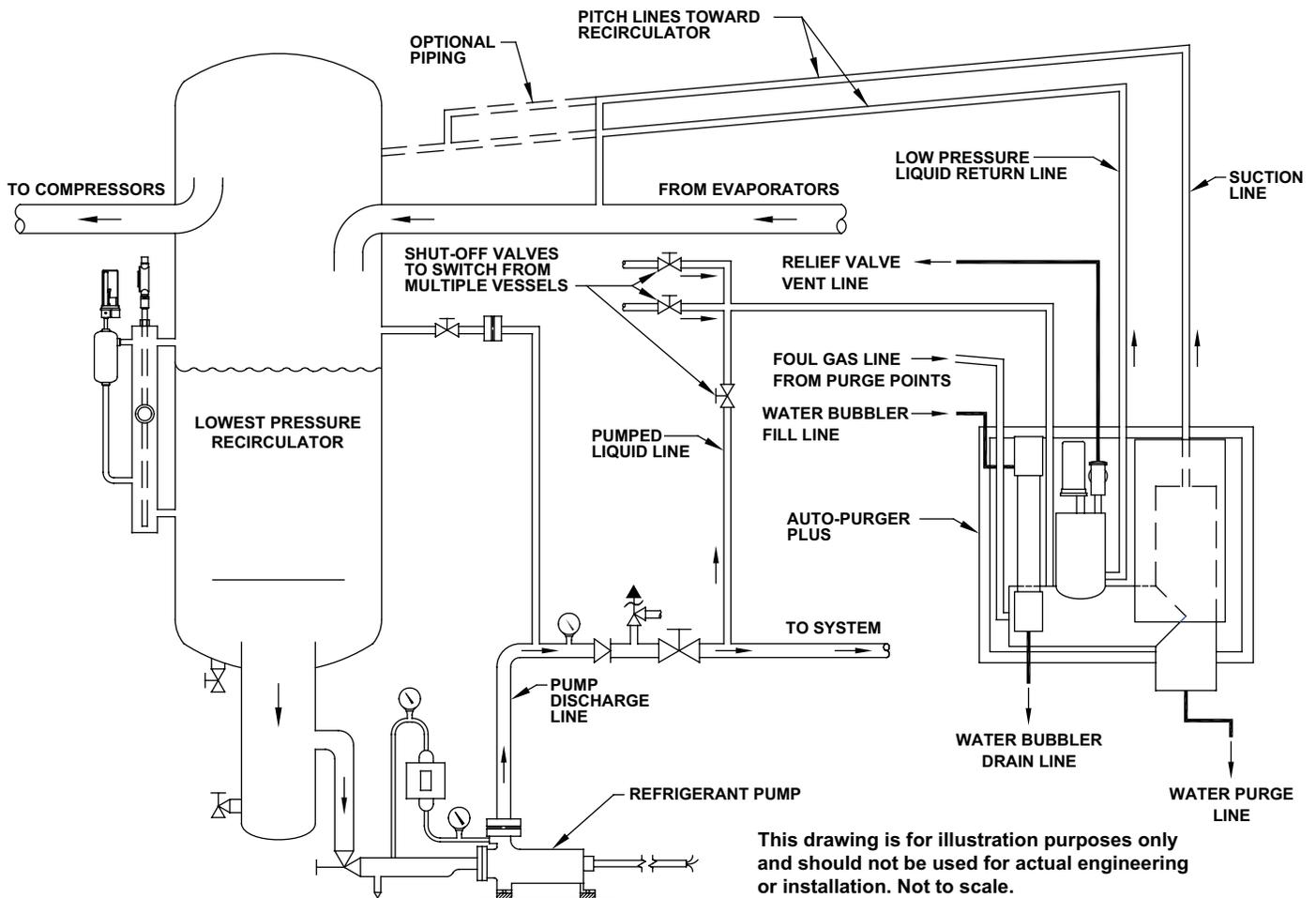
WATER BUBBLER FILL LINE

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).

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.

AUTO-PURGER PLUS APP PIPING DIAGRAM

Figure 3



This drawing is for illustration purposes only and should not be used for actual engineering or installation. Not to scale.

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 foul gas and low-pressure pumped-liquid valves. 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. 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.

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.

Connect one line from each purge point solenoid to the corresponding screw terminal located near the top inside the control cabinet. The numbers on the terminal strip correspond to the numbers in the control software. Connect the remaining wire from each purge point solenoid to the ground terminal inside the control cabinet.

Models APP08, APP16, and APP24 supply 115VAC to the purge points regardless of whether 115VAC or 230VAC is supplied to the control cabinet.

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 start-up 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. 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). On start-up, the AUTO-PURGER Plus enters a COOLING DOWN stage. (The display indicates 3333.) 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. When the float switch chamber fills with liquid refrigerant, the float ball rises and pulls in the float switch magnet.

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. The control software will not allow any noncondensibles into the water bubbler until 10 minutes after the Control Console discontinues indicating 3333.

OPERATION

When the purger is in COLLECTING AIR AND WATER mode, a mixture of noncondensable gas and refrigerant flows into the purger. The evaporator shell temperature sensor also allows solenoid valves (C) and (D) to open when the float ball is down (magnet away from tube).

The foul gas 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 back 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. As air is released into the water bubbler, the liquid refrigerant level in the purger float ball chamber rises.

The control software operates each specified remote purge point solenoid valve in sequence.

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, but only ammonia vapor can exit through the suction line. Gradually the concentration of water in the evaporator chamber increases with time. When the concentration of water in the evaporator chamber reaches about 20% water / 80% 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. The heaters remain energized until the ammonia water solution is heated to 185°F (85°C), except for suction pressures in a vacuum. 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. 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 presses the OK button on the Control Console. See Figure 5.

SECTION 4 CONTROL CONSOLE OPERATION

CONTROL CONSOLE

The Control Console allows the operator to interface with the purger's control software. Messages are displayed in the Control Console Display Window. See Figure 5. The Control Console Display Window supports four lines of twenty characters each. Two types of messages can be displayed by the Control Console Display Window. The first type of message alerts the operator to specific important conditions or status. The PLC Message LED illuminates when one of these messages from the PLC is being displayed by the Control Console. Pushbuttons are disabled for 3 seconds after a message is displayed to ensure that the operator sees the message. The second type of message consists of the normal Control Console menu hierarchy, which allows the operator to verify, and in certain cases change, various system parameters. The operator can switch between the two message types by pressing the "esc" key.

Control Console Specifications:

Display Type: Character LCD, 4 lines by 20 characters w/LED backlight.

Enclosure: NEMA 4, 4x(indoor)

Humidity: 10-95% (non-condensing)

LED/LCD Life: 100,000 hours

The four Control Pushbuttons allow navigation through the menu hierarchy. See Figure 5.

ESC – Switches between PLC messages and the Control Console menu system. It is also used to exit when navigating through the menu system.

∧ – Navigate UP.

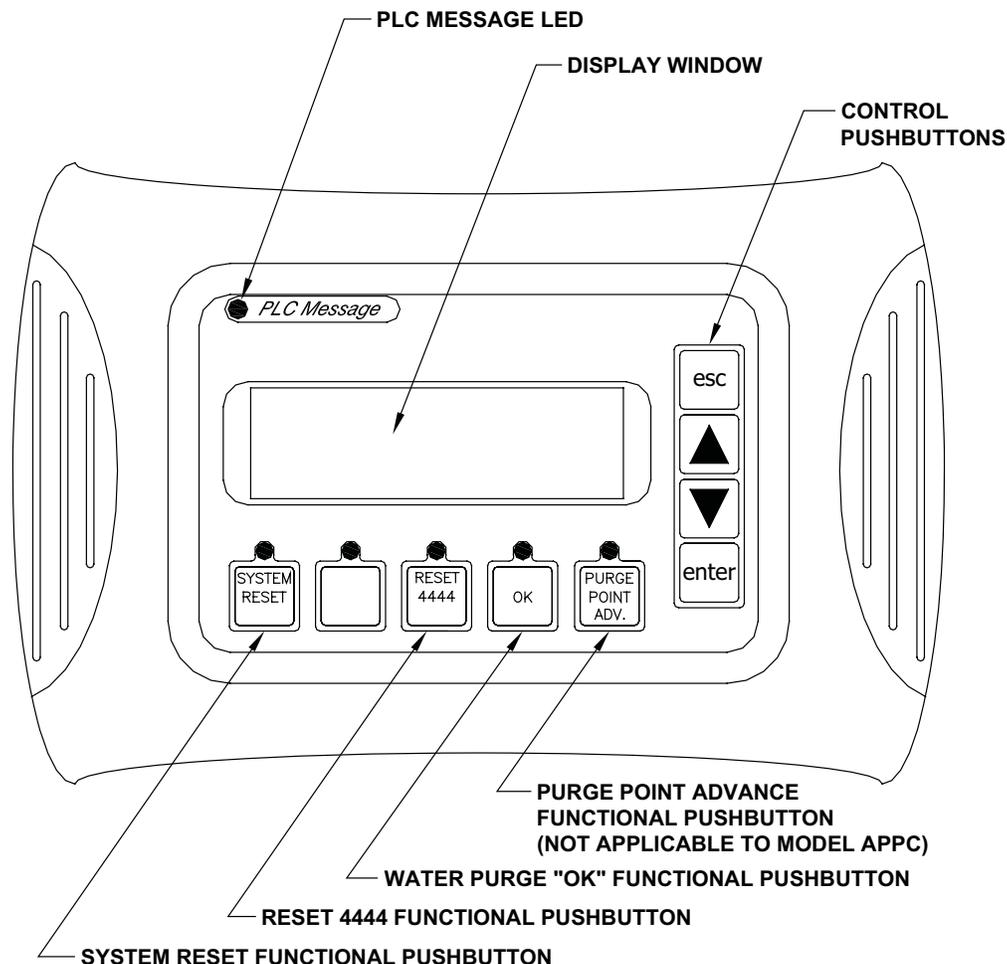
∨ – Navigate DOWN.

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

The five Functional Pushbuttons perform specific tasks when depressed. Each has an LED above it which illuminates when the button is operational. See Figure 5.

AUTO-PURGER PLUS CONTROL CONSOLE

Figure 5



SYSTEM RESET – Resets the system to its pre-startup settings. 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, stopping air and water purging processes if active. The number of purge points will not be changed.

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.)

PROCEDURE FOR ENABLING OR DISABLING INDIVIDUAL PURGE POINTS

Verify the active purge points. This can be checked by going to “# OF PURGE POINTS” and pressing “ENTER” key. Scroll down by pressing the “V” key. Purge points set to 1 are active. To set a purge point, move to the purge point to be changed, press the “ENTER” key, this will move the cursor to the parameter position. To change from 0 to 1, press the “/\” key to set it to 1. Use the “V” key to set the purge point parameter to 0. If you attempt to enter a number other than 0 or 1 you will get an “OUT OF RANGE” error. Wait until the error clears before proceeding, approximately two seconds. When done, press the “ENTER” key. Press the “ESC” key to return to the main system menu.

CONTROL PANEL MESSAGES

Menu hierarchy.

+ Temperature Units

UNITS: #(0:C/1:F)

+ Mode of Operation

Auto Operation: 0

New Sys Startup: 1

Mode: # (User definable)

+ # OF PURGE POINTS

PP TIME: 10 MIN. (Not user configurable)

PP1: # (1/0) (User definable, 1 ACTIVE)

PP2: # (1/0) (User definable, 1 ACTIVE)

PP3: # (1/0) (User definable, 1 ACTIVE)

PP4: # (1/0) (User definable, 1 ACTIVE)

PP5: # (1/0) (User definable, 1 ACTIVE)

PP6: # (1/0) (User definable, 1 ACTIVE)

PP7: # (1/0) (User definable, 1 ACTIVE)

PP8: # (1/0) (User definable, 1 ACTIVE)

Models APP08 Purger Points (PP1 - PP8), APP16 Purge Points (PP1 - PP16) and APP24 Purge Points (PP1 - PP24)

+ SYSTEM PARAMETERS

DRAIN MODE: 0 (Internal Parameter)

LEVEL LOW: # (0:LOW)

HEATER: # (1:ON) (Heater ON/OFF)

FOUL GAS: ### Psig (FOUL gas pressure)

COUNTS: ### (600) (Internal parameter)

SHS: ##.## Ma (Ma reading from Water Concentration Sensor)

+THERMOCOUPLES (Reference Only)

LTS: #### (Liquid Temp. Sensor)

PHTS: #### (Plate Heater Temp. Sensor)

ESTS: #### (Evaporator Shell Temp. Sensor)

+Ma INPUTS (Reference Only)

LSPS: #### (Low Side Pressure Transducer)

HSPS: #### (High Side Pressure Transducer)

+SOLENOIDS (Reference Only)

Sol. B: # (1:ON)

Sol. C: # (1:ON)

Sol. D : # (1:ON)

Sol. E: # (1:ON)

Sol. F: # (1:ON)

Sol. G: # (1:ON)

+LOG (Reference Only)

Purger Log: ### min (Accumulated minutes releasing air, max. 999)

Air Cycles: ### cnt (Accumulated air release cycles, max. 999)

Water Drain: ### min. (Accumulated water drain minutes, max. 999)

Water Cycles: ### cnt (Accumulated water release cycles, max. 999)

+ERRORCODES (Reference only)

2222 Foul Gas < 80 psig

3333 EVAP temp > 40 F

4444 C open > 60 min. when Mode of Operation=0 the continuous release of air is limited to 60 minutes. When Mode of Operation=1 this alarm is disabled.

7777 B open > 30 min.

9990 TC Plate open

9991 TC Liquid open

+VERSION (Reference Only)

Keypad FW: #### (Keypad code version)

PLC FW: #### (PLC code version)

+TEMP TP SETTINGS

LQD TP ### (Internal parameter)

Plate LTP ### (Internal parameter)

Plate UTP ### (Internal parameter)

PLC MESSAGES

Line 1 Messages:

“Active Purge Point ##” were ## indicates the active purge point.

For 115VAC models, “Liquid Temp: ### °F” will appear during the CONCENTRATING WATER process when the liquid temperature is above 32°F.

For 220VAC models, “Liquid Temp: ### °C” will appear during the CONCENTRATING WATER process when the liquid temperature is above 0°C.

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

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

Line 2 Messages:

“Releasing Air” will appear when the APP is releasing air.

“Concentrating Water” will appear during the process of heating the ammonia/water solution.

“Draining Water” will appear when removed water is draining from the APP.

“Collecting Air/Water” will appear when the APP is operating normally.

“Startup Delay Mode” will appear for 10 minutes after the APP evaporator shell cools to less than 40°F and the foul gas pressure exceeds 80 psig.

Line 3 Messages:

“Error #####” during normal operation and when a fault occurs an error code will display on line 3 of the LCD.

ERROR 2222 LOSS OF “FOUL GAS” PRESSURE.

ERROR 3333 PURGER TOO WARM.

ERROR 4444 PURGED AIR OVER 60 MINUTE TIME LIMIT.

ERROR 7777 LOSS OF HIGH PRESSURE LIQUID.

ERROR 9990 PLATE THERMOCOUPLE OPEN.

ERROR 9991 LIQUID THERMOCOUPLE OPEN.

ERROR HEATER FAULT will be displayed if the heaters are on longer than 4 hours. This ERROR can only be cleared by depressing the “SYSTEM RESET” key.

See Section 7, Troubleshooting for additional information.

Line 4 Messages:

“System Reset” will appear for 5 seconds after the System Reset key has been depressed.

“Push RESET 4s to CLR” will appear if Mode of Operation= 0 and the purger releases air for a continuous 60 minutes.

MAINTENANCE ITEM, RTC BACKUP BATTERY

Replacement Battery:

DURACELL DL2032 or RAYOVAC CR2032

The coin cell battery, 3.0V Lithium, is used to provide backup power to the real time clock. The battery and battery low indicator are located in the lower right corner of the PLC, see Figure 6. 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.

Battery Replacement Procedure

The power to the AP Purger must be OFF.

Lift the battery tab and press the battery out with your finger or non-metallic tool.

To install 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. Procedure is complete.

OPERATION OF TIMER

The timer in the control software records both the minutes and number of times the purge gas solenoid valve (C) is open. This valve bleeds noncondensibles into the water bubbler.

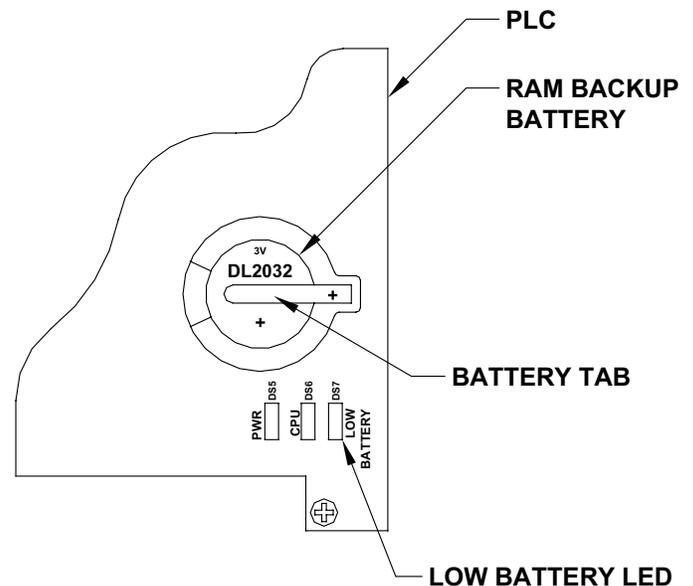
These can be used to measure noncondensable gas activity. If a daily or weekly record is logged, any abnormal changes in the purge gas solenoid valve (C) operation can be noted. This directly relates to the amount of noncondensable gases released. An abnormal increase may indicate a problem with the system, such as a leak. An abnormal decrease in the operation of the purge gas solenoid valve (C) may indicate a problem with the purger. In either case, action can be taken to correct the problem.

RESETTING THE TIMER TO ZERO

To reset the timer press the “SYSTEM RESET” key on the Control Console.

BATTERY REPLACEMENT

Figure 6



SECTION 5 COMPONENT DESCRIPTIONS

WATER BUBBLER

Noncondensable gas from the AUTO-PURGER Plus flows through the water bubbler where residual ammonia is absorbed into the water. 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). Large, 1" (25 mm) diameter bubbles in the water bubbler indicate proper operation.

The water bubbler flush system consists of the water bubbler, water bubbler fill line solenoid valve (D), water check valve, and shut-off valve. Water is automatically fed to the water bubbler through the water bubbler fill line solenoid valve (D). Noncondensable gas and water mix, absorbing residual amounts of ammonia into the water. The ammonia-laden water is flushed to the water bubbler drain through the overflow tube. The water bubbler fill line solenoid valve (D) remains energized an additional 30 seconds after the 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 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. A 225 psid (15.5 bar) relief check valve from the float chamber to suction line. A 1 psid (.07 bar) relief check valve from the suction line to the float chamber. 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. The water bubbler fill line has a 1/2" check valve.

OPERATION OF 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 7. 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.

OPERATION OF THE METERING VALVE

The metering valve meters condensed liquid refrigerant from the high-pressure side of the purger into 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 float switch chamber through the solenoid valve, strainer and metering valve to the low-pressure liquid-return line. If the line is not frosted when the purger is in COLLECTING AIR AND WATER mode, then the flow of refrigerant through the line may be blocked due to dirt in the metering valve, strainer, or solenoid valve.

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.

PURGE POINT SOLENOID VALVES

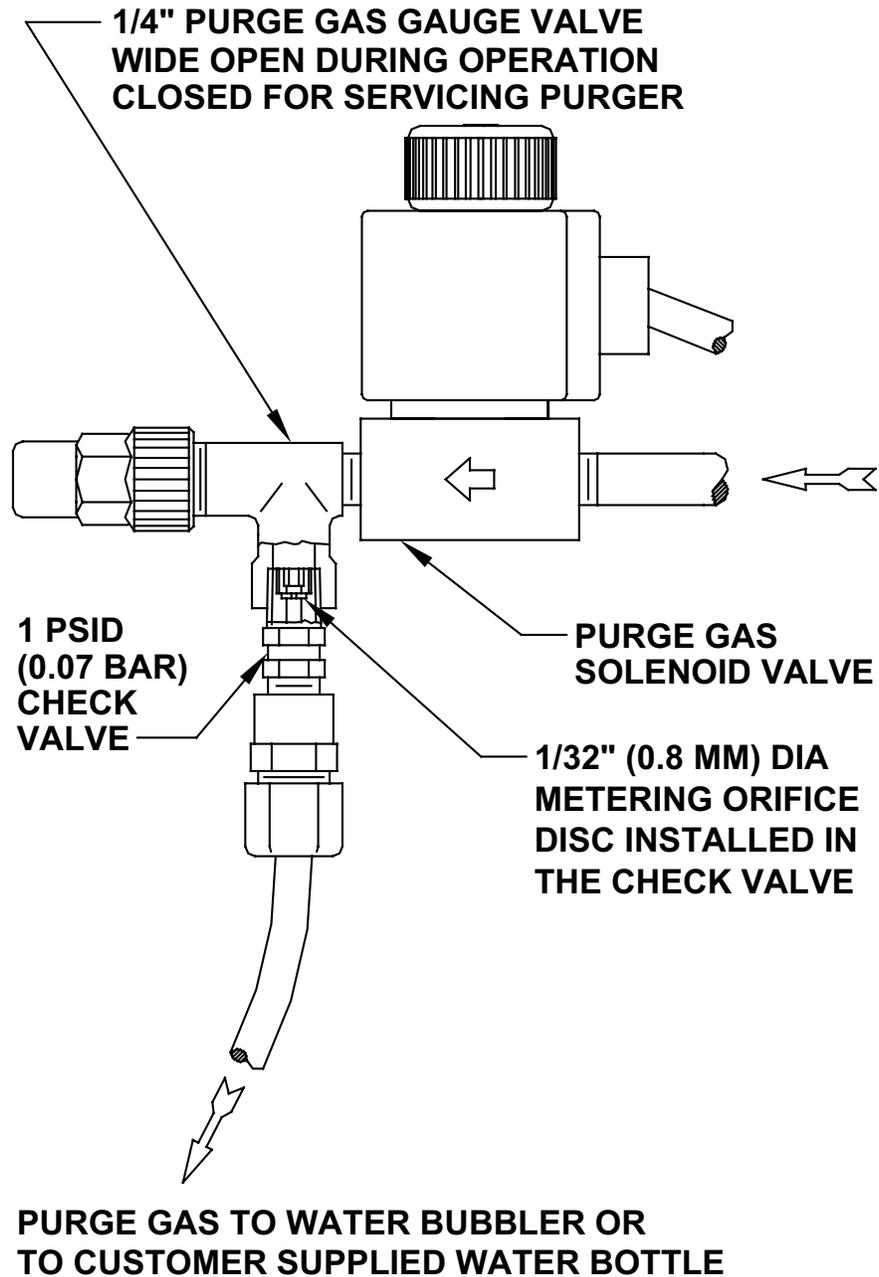
For the customer-supplied purge point solenoid valves, Hansen recommends our HS8A with close-coupled strainer. This is a 1/2" port, heavy-duty, pilot-operated solenoid valve with stainless steel piston. The purge point solenoid valve must be a minimum of 1/2" port size to avoid excess pressure drop across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

The standard molded coil is for 115V, 208/230V, or 24V. 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.

Models APP08, APP16, and APP24 supply 115VAC to the purge points regardless of whether 115VAC or 220VAC is supplied to the control cabinet.

PURGE GAS SOLENOID VALVE

Figure 7



**PURGER PUMP OUT PROCEDURE, WITH
AUTO-PURGER ON**

- 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. Close the low-pressure liquid return line and the suction line 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. This process should be completed only by knowledgeable refrigeration technicians.

PARTS LIST

MECHANICAL	
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
ELECTRICAL	
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
20-2416	PLC, 6 position
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
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 bar). 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. However, the purger will continue to operate normally in all other functions.

REASON 1: A burned-out purge point solenoid coil.

Check: Check the 2 or 3 amp fuse for continuity. Replace if necessary. Advance purge points one at a time with the purge point advance button, waiting approximately 2 minutes before advancing again. Wait until the fuse opens or the Control Console again displays 2222. The faulty coil or wiring is now pinpointed.

Action: Replace the coil or repair the wire, and replace the 2 or 3 amp fuse (p/n 20-1279 or p/n 20-1695).

REASON 2: A remote purge point solenoid valve is jammed closed.

Check: 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 19.

REASON 3: "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 19.

REASON 4: Faulty pressure transducer.

Check: With the purger in any operational mode, check the pressure gauge reading. If it is above 80 psig, scroll through the menu hierarchy to verify HSPS is greater than 1300.

Action: If HSPS is less than 1300 replace the high side pressure transducer (p/n 75-3002) with the purger at zero pressure. See also the Caution section on page 19.

CONTROL CONSOLE DISPLAYS 3333

PURGER TOO WARM. If the purger evaporator temperature is 40°F (4.4°C) or warmer, the purger will not release noncondensable gas from the purger because excessive refrigerant would also escape. The purger will continue to operate normally in all other functions. 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.

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 3/4". 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 19.

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 temperature sensor.

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

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. Delay is now reset for up to another hour of continuous purging. Otherwise, put the purger in New System Start-up mode for continuous purging without the 60 minute time limit.

REASON 2: Purge gas solenoid valve (C) is not opening or the removable 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 19.

REASON 3: The shut-off valve located before 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 19.

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 19.

NONCONDENSIBLES ARE NOT BEING RELEASED.

(See also page 16; 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.

Check: 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 line from 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.

(See also page 16; Control Console displays 3333)

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 19.

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 19.

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.

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ORDERING INFORMATION

Cat. No.	Description
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

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.

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.

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