

Model APM

Specifications, Applications, Service Instructions & Parts

AUTO-PURGER® M “Energy Saver” Compact, Non-condensable Gas (Air) Purger

For Models APM & APMF



SECTION 1 MOUNTING & PIPING INSTALLATION

INTRODUCTION

The AUTO-PURGER® M is a compact and totally automatic, electronically-controlled, noncondensable gas refrigerant purger for reducing condensing pressure, and thereby saving electrical energy used by the refrigeration system. This deluxe purger is preassembled, prewired, tested, insulated, and includes an automatic water bubbler. Installation requires piping the foul gas line, liquid line, suction line, water line, drain line, and wiring the power connection and the remote ½" (13 mm) port purge point solenoid valves, which must be purchased separately. Up to four (4) purge points can be controlled by this purger. The AUTO-PURGER® M (APM) features welded piping and watertight electrical construction. The APM meets the requirements of the Canadian Standards Association (CSA certified).

A typical APM installed in a plant with normal-entering noncondensable loads will handle up to a 200 ton (700 kW) system. Each purge point will be active between 10 and 30 minutes, depending on the noncondensable gas presence (mostly air) and the purger mode of operation.

Model APMF AUTO-PURGERS are for use in halocarbon refrigeration systems. The installation and operation of these AUTO-PURGERS are similar to that of an ammonia AUTO-PURGER M. See page 13 for additional details.

MOUNTING INSTRUCTIONS

Mount the APM straight and securely on a wall or sturdy steel channels capable of supporting 350 lbs (160 Kg). Eight mounting holes in the frame are provided to support the purger (See Figure 1). The APM should be located in an accessible area, but away from the movement of equipment that could accidentally damage the purger. Elevation with respect to condensers or high-pressure receivers is not critical, however, purge point solenoid valves must be above the purger.

An APM is usually installed in the compressor room where it can be monitored, but also may be installed outdoors where temperatures below freezing are not anticipated. The APM comes standard with a watertight NEMA 13 (IP65, Category 2) control cabinet enclosure with sealed conduit wiring. Any unused electrical entrances to the enclosure must be sealed to protect electronics from moisture. A NEMA 4 cabinet enclosure is available.

An optional valve package (VPM) for purger isolation is available from Hansen. This consists of three welded assemblies which include shut-off valves, gauge valves, and mating flanges. An illustration detailing this optional valve package is on page 12 (Figure 13).

FOUL GAS PIPING

Purging at several points, up to four with the APM, on the high-pressure side of the system is the best method for removing foul gas. Foul gas is refrigerant gas containing some air or other noncondensibles. Several points should be used because it is nearly impossible to predict where noncondensable gas will accumulate in a system.

Even for multipoint purging, only one purge point should be purged at a time. Connecting two purge points from two condensers or receivers may result in gas flowing from one condenser to another. This is due to an unequal pressure drop, even though the differences in pressure drop are very small, for example ¼ psig (0.02 bar). The result would be 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.

When utilizing multipoint purging, the purge point solenoid valves can be manifolded into one foul gas line to the purger. A ½" (13 mm) size line is the minimum and should be pitched toward the purger to drain any condensed liquid. Also, no liquid traps are allowed either before or after the purge point solenoid valves (See Figure 2). The foul gas line should not pass through cold areas where

SECTION 1 MOUNTING & PIPING INSTALLATION

further condensing of the saturated gas can occur. If this cannot be avoided, the line must be insulated because flooded purge point lines result in flooding the APM with liquid, causing a temporary halt of noncondensibles being removed. If flooding can not be avoided, additional condensate drainage may be necessary.

It is important that all purge points be located above any liquid surfaces to avoid drawing liquid refrigerant, rather than vapor, into the APM.

EVAPORATIVE CONDENSER PIPING

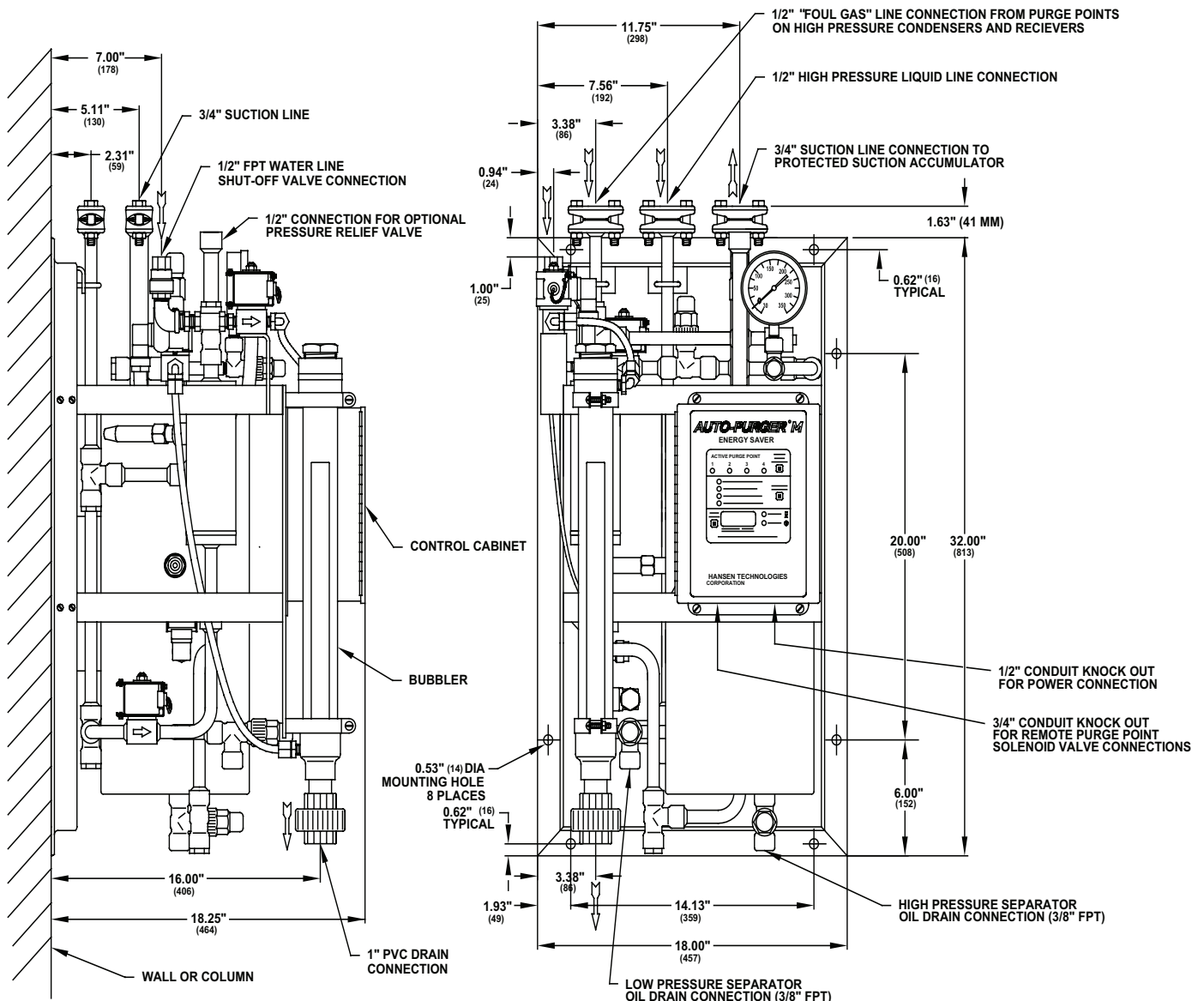
Typically, evaporative condenser outlet liquid drain lines on each circuit must drop a minimum of 4 feet (1.2 m) for ammonia from the centerline of the evaporative condenser outlet to the centerline of highest elevation of the liquid line manifold to receiver. Preferably, each circuit should

have a P trap to balance variations in pressure drop in each circuit to prevent liquid from backing up into one or more condensers, and thereby flooding the purge point. **Most air from the system will normally be trapped between the condenser and the P trap.** Also, a properly-sized equalizer line from the receiver will help drain condenser circuits into the receiver. Refer to ASHRAE GUIDELINES or IIAR Papers on condenser piping design. Hansen Technologies can provide copies of these articles. Also, consult the condenser manufacturers' installation instructions for additional piping and sizing information.

On evaporative condensers, avoid using one purge point solenoid valve to purge two circuits. This practice negates the P-trap on the condenser drain line because of the purge connections of the two circuits and may back liquid up into one circuit.

INSTALLATION DIMENSIONS (MM)

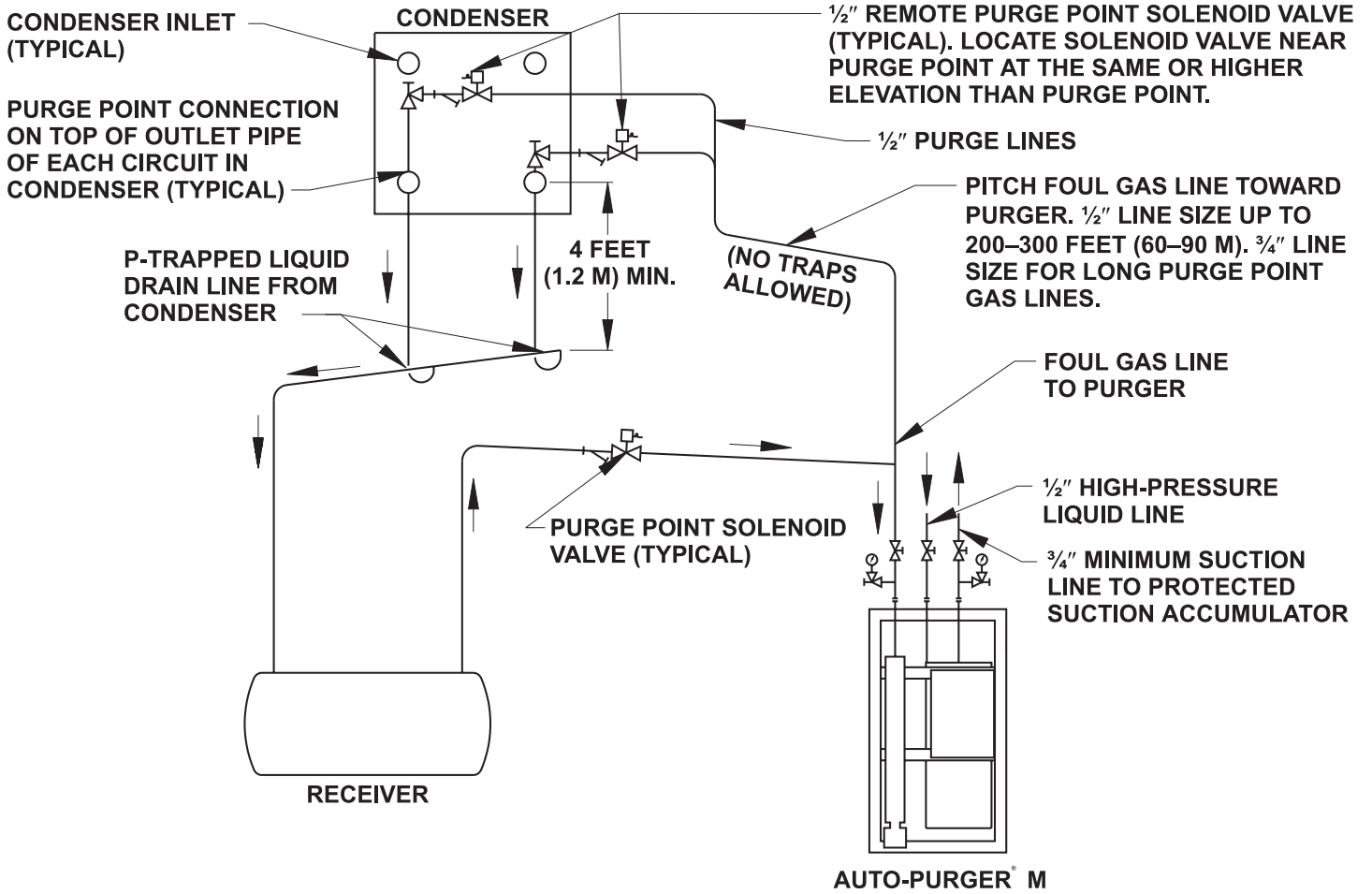
Figure 1



SECTION 1 MOUNTING & PIPING INSTALLATION

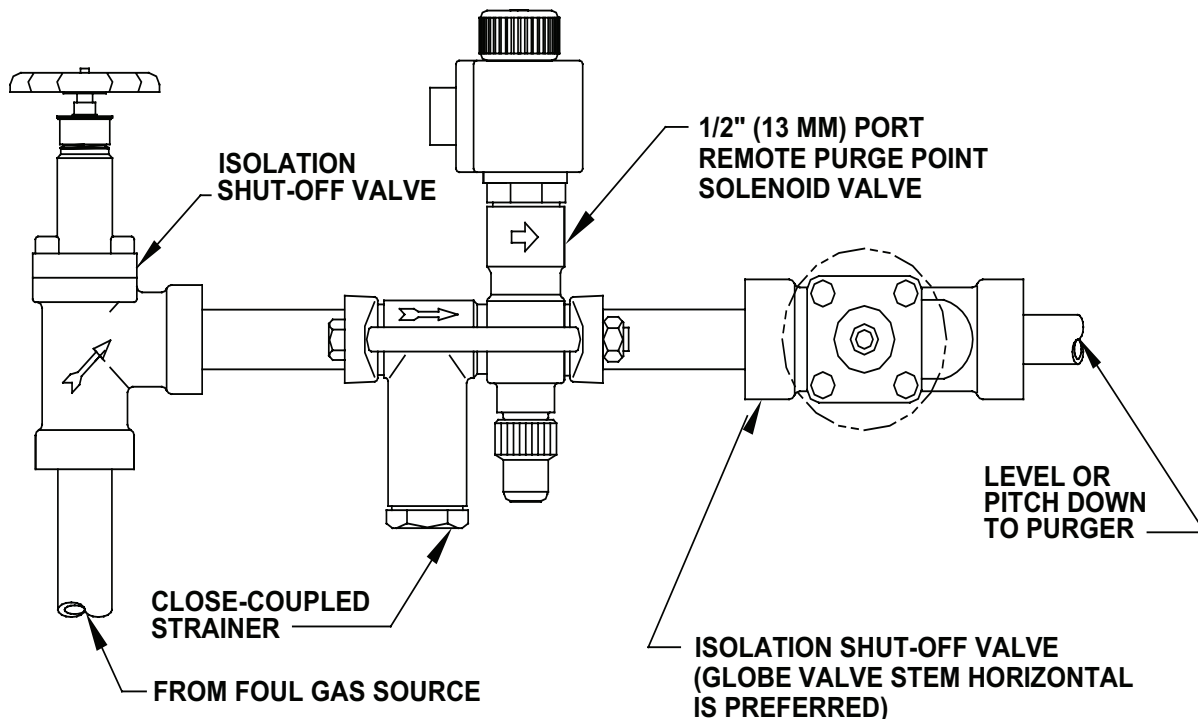
TYPICAL APPLICATION

Figure 2



PURGE POINT VALVE (TYPICAL)

Figure 3



PURGE POINT CONNECTIONS

Foul gas lines from condensers should be purged at points recommended by the condenser manufacturer. Usually, this is at the top of each circuit's outlet header which drains down through a P-trap to the receiver. 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, preferably at a "dead" area away from condenser drain pipes. Below is a typical valve arrangement for a purge point (Figure 3). **Regardless of the purge point location, it is absolutely necessary to ensure that liquid is not drawn into the foul gas line.** Where a high-pressure float regulator is used to drain one or more condensers, the top of the float valve chamber should also be a purge point.

Horizontal shell and tube water-cooled condensers, and heat exchangers should be purged at the top, usually at the point(s) 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 normally not advisable to purge controlled pressure receivers, high-pressure thermosiphon vessels, or vessels located on the low side of the system.

SUCTION LINE

The $\frac{3}{4}$ " suction line from the purger should be connected to a protected main suction line or a suction accumulator. Install a suction line isolation shut-off valve near purger. Excess amounts of liquid from the purger evaporator may occasionally be transmitted through the suction line. The suction temperature must be 40°F (4.4°C) or less to satisfy the APM temperature sensor before purging will occur.

LIQUID LINE

A high-pressure $\frac{1}{2}$ " liquid line is required for the APM. The connection to the high-pressure liquid source should be a location where oil will not be directed into the purger. Install liquid line shut-off valve near the purger. The liquid line supplies refrigerant during start-up and feeds make-up liquid as required. The only requirement is the liquid supply pressure must be sufficiently above the purger evaporator pressure, usually greater than 60 psi (4.1 bar). During operation, only 5% of the liquid refrigerant required for cooling comes from the liquid line. The remainder of the refrigerant is condensate from the foul gas line, which is collected in the drain, condensed in the coil, and into the evaporator.

WATER LINE

The APM has an automatic water bubbler to eliminate any water bottle attention. Connect the water supply to the purger water shut-off valve (See Figure 1). Water pressure should be between 30 and 80 psig (2 and 5 bar). The factory-installed flow controller limits the amount of water going into the bubbler.

The transparent 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 brush supplied. A water conditioning filter cartridge and housing are available for abnormally hard water.

DRAIN LINE

A 1" PVC socket water drain connection is located at the bottom of the bubbler (an alternate 1" FPT threaded adapter is also supplied). The water should flow to a suitable drain. Initially, fill the water bubbler with water via the threaded plug located at the top of the bubbler. Keep the plug lubricated and hand tight. A circular, thin, plastic "stick-on" acts as a bubbler relief device in case of water drain plugging. The drain line should be supported to prevent undue stress on the water bubbler.

OIL DRAINS

There are two $\frac{3}{8}$ " valve oil drain connections near the bottom of purger (see Figure 1) from which oil can be drained. These valves are fitted with $\frac{5}{16}$ " (8 mm) hex socket plugs. Before draining oil, first close the liquid and foul gas lines to prevent additional liquid from entering the purger. Wait approximately one half hour and then turn the purger off. Allow the purger to pump out, then close the suction line shut-off valve. Use normal refrigerant oil draining precautions to prevent human or property damage. In general, oil will not be a problem unless the liquid line is connected to a vessel or line where oil can enter the purger. See also the Caution section on page 14. Escaping refrigerant may cause personal injury, particularly to the eyes and lungs.

LEAK TEST

Use standard refrigeration procedures to check the APM for leaks before placing it into service. See also the Caution section on page 14. Manually open one purge point solenoid valve. Open the foul gas line shut-off valve and wait a few moments for the flooded evaporator to pressurize through the metering orifice. Allow pressure to build to condensing pressure, as shown on the high side pressure gauge. Close the foul gas line shut-off valve and check the purger for leaks.

SECTION 2 ELECTRICAL INSTALLATION & OPERATION

ELECTRICAL CONNECTIONS

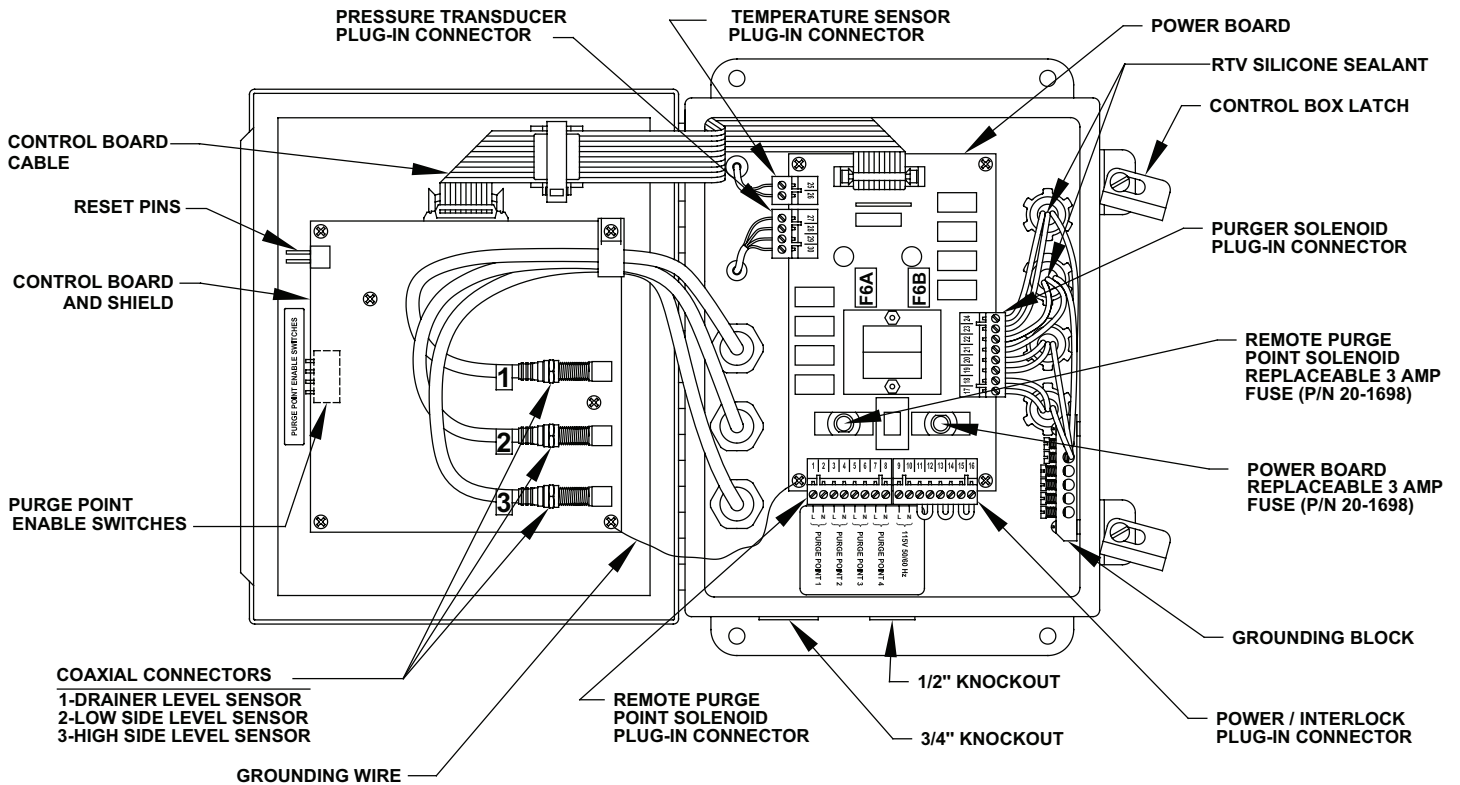
The standard electrical requirement for the APM is 115V 50/60 Hz. Also available is 230V 50/60 Hz. Main supply voltage fluctuations should not to exceed $\pm 10\%$ on nominal voltage. Connect APM to a dual pole external switch or circuit breaker suitable for full disconnection. Locate this switch or circuit breaker nearby. The control cabinet has a bottom 1/2" knockout for power connection and bottom 3/4" knockout for individual purge point solenoid valves (See Figure 4). Any additional knockouts, if necessary, should be made on the bottom of the control cabinet. A grounding block inside the control cabinet is provided for 3

wire purge point solenoid coils. Carefully study the wiring diagram below (Figure 5) to avoid electrical short circuits.

Connect electrical wiring from each purge point solenoid to the remote purge point solenoid plug-in connector screw terminals (1 through 8) plus the grounding block. Normally, the voltage of the remote purge point solenoid valves is the same as the purger. However, if the purge point solenoid valve coil voltage is different, simply remove and discard the factory installed jumpers between terminals 13 & 14 and 15 & 16. Bring the purge point solenoid line (L1) connection to terminal 14 and neutral (L2) to terminal 16.

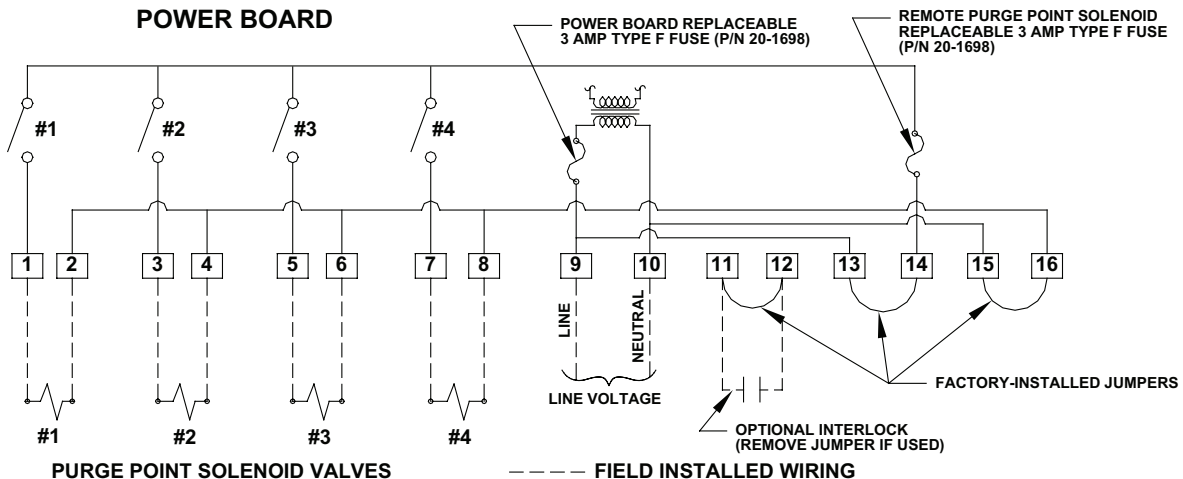
CONTROL CABINET (INSIDE VIEW)

Figure 4



WIRING DIAGRAM

Figure 5



FEATURES OF THE APM

The purger can be set to one of several operating modes to suit the requirement of the system. These include: Automatic Operation, Manual Operation, New System Start-up, and Purger Switched Off. The mode of operation can be selected by repeatedly pushing the program advance button on the front panel until desired purger mode light is on. (See Figure 6).

AUTOMATIC OPERATION

The Automatic Operation mode is where the purger should be set when normal levels of noncondensibles are in the refrigeration system. The microprocessor-based electronics of the APM uses its “logic” to locate noncondensibles and spend more time purging those points. The purger will energize the first enabled purge point solenoid (see page 7, Purge Point Enable Switches). If after 10 minutes noncondensibles are not released, the purger then will advance to the next enabled purge point. If noncondensibles are released at any purge point within the first 10 minutes, then the purger will continue to process gas and remain at that purge point for increments of 10 minutes as long as noncondensibles are released during the 10 minute time period. This “smart” feature will continue for a maximum of 30 minutes. After 30 minutes, the purger will go on to the next active purge point regardless if noncondensibles are released. Once noncondensibles have been minimized, and enabled purge points cycle without releasing noncondensibles, the purger will go into “Standby” mode for two hours (the Standby purger status light will be on). After two hours on Standby, the purger will then resume operation to seek out noncondensibles gases that may have collected.

MANUAL OPERATION

Manual Operation mode allows the operator to select one purge point continuously. This is usually the case if a large volume of noncondensibles gas is suspected to be at a particular point. To select this mode, push the program advance button until the Manual Operation purger mode light is on. Then, push the purge point advance button to select the purge point. In this mode, the purger will purge this point only. However, noncondensibles must be present for the purger to release gas from the purger. If not, the purger will go into Standby mode.

NEW SYSTEM STARTUP

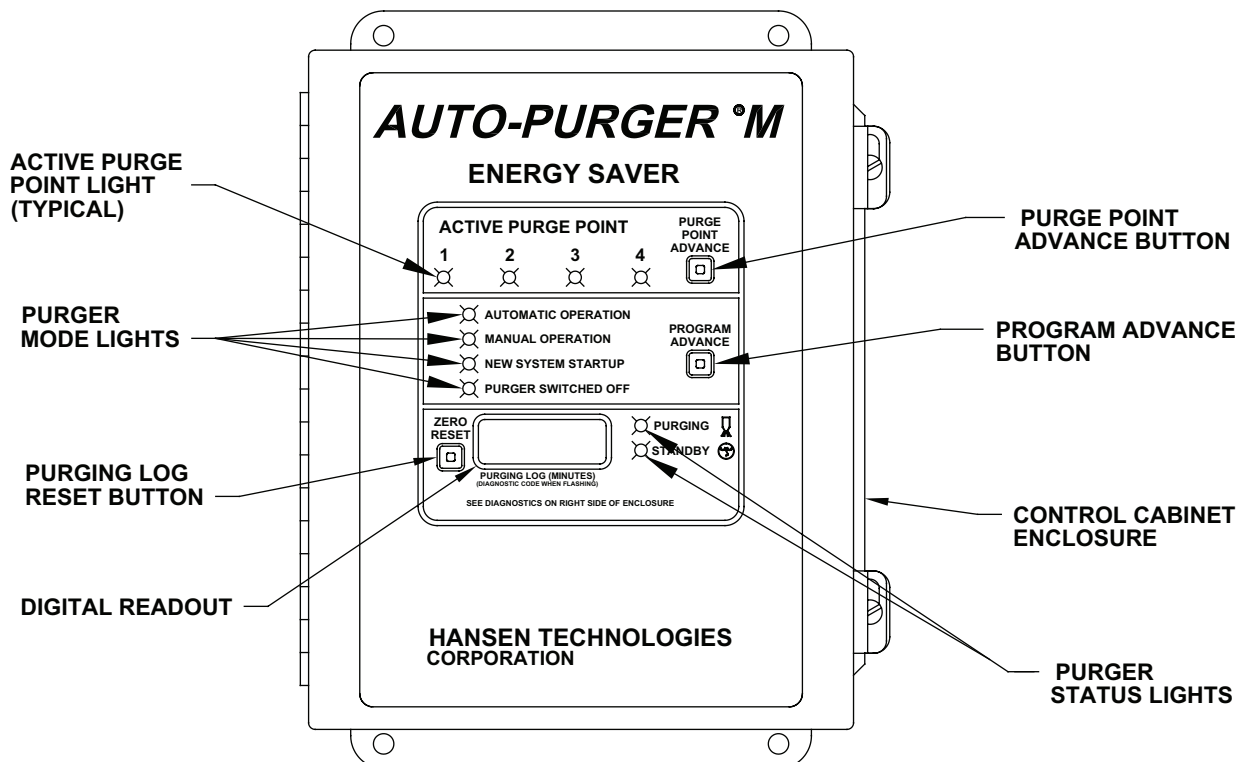
The New System Startup mode is to be used when the refrigeration system is known to contain large amounts of noncondensibles gas. This may be due to new system startup, extensive repairs to a system, or the presence of an abnormal vacuum leak on the low side of the system. The APM automatically sequences the purge point solenoid valves for a fixed period of 10 minutes each to remove air from each of the enabled purge points. The purger will not go into Standby mode while in New System Startup mode.

PURGER SWITCHED OFF

When the purger is in this position, all solenoid valves close and the purger will pump out if the suction valve is open.

CONTROL CABINET (FRONT VIEW)

Figure 6



ACTIVE PURGE POINT

The front of the control cabinet has lights which indicate the active purge point. The active purge point can be manually advanced in any operational mode by pushing the purge point advance button.

PURGER STATUS LIGHTS

There are two purger status lights on the front of the control cabinet next to the digital readout. These are the Purging status light and Standby status light which indicate when noncondensable gas (air) is being released from the purger (Purging), or when the purger is in a waiting mode (Standby).

PURGING LOG

The purging log is displayed on the digital readout. It displays the number of minutes the purge gas solenoid valve (C) (see Figure 11) has been open to release noncondensibles into the water bubbler.

The purger log can be used to track the release of noncondensable gas. If a daily or weekly record is kept, then any abnormal increases in the amount of noncondensable gases can be noted, and corrective measures can be taken. Little or no activity compared to normal operation may indicate noncondensibles have been thoroughly removed or a problem with the purger. Frequent activity beyond normal could mean excessive new leakage of air into the system. To reset the purge log, push the zero reset button next to the digital readout on the front panel.

DIAGNOSTIC FEATURES

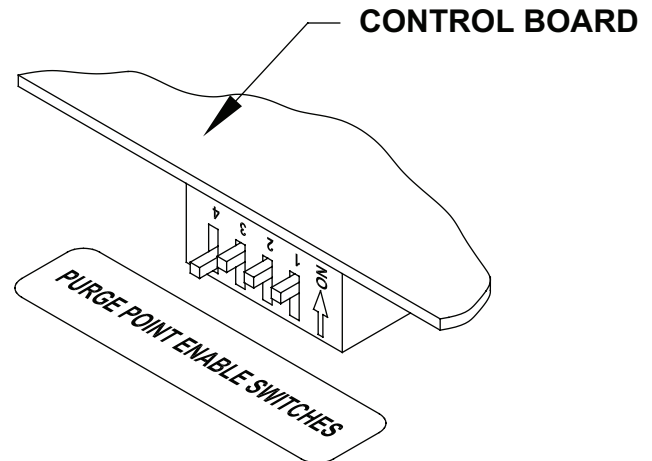
Although the APM is very reliable, after an extended operation or under severe conditions, problems may occur or be suspected. Under these conditions, due to the importance of the purging functions, restoration to normal operation is desired as quickly as possible. The APM features diagnostic codes which are displayed on the digital readout when abnormal operation of the refrigeration system or the APM is detected. These flashing numbers help to identify the problem area. Below is a quick reference to these diagnostic codes. The digital readout will display the diagnostic code related to the occurrence which first put the APM into this mode; exception, 6666 will override 7777. Also see the troubleshooting guide on page 10 for detailed explanation.

- Flashing 2222 LOSS OF FOUL GAS PRESSURE.
- Flashing 3333 PURGER TOO WARM.
- Flashing 4444 PURGED OVER 60 MINUTE TIME LIMIT.
- Flashing 5555 PURGER SHUT-OFF REMOTELY.
- Flashing 6666 LEVEL CONTROL OUT OF RANGE.
- Flashing 7777 LOSS OF HIGH-PRESSURE LIQUID.

PURGE POINT ENABLE SWITCHES

These switches are located on the control board and are all factory-set to the ON position. They control whether or not a purge point can become active. If for example, only three purge points are being utilized, the number 4 purge point enable switch should be in the downward off position (see Figure 7). By doing this, the unused purge point is disabled and purger time is not wasted.

Figure 7



PUMP OUT PROCEDURE

Performing certain types of service on the APM may first require the purger to be pumped-out (drained of liquid refrigerant). To begin pump-out, shut off the foul gas and high-pressure liquid lines. Wait for all refrigerant to evaporate to suction; this usually takes several hours to complete. Using safe refrigeration practices, reduce the pressure to zero. In addition to following these procedures, check the lower portion of drainer and the APM piping for signs of frost. If there is no frost, pump-out is probably complete. If there is frost, this means excess refrigerant is still in the drainer and/or piping. To drain, energize the drainer solenoid valve.

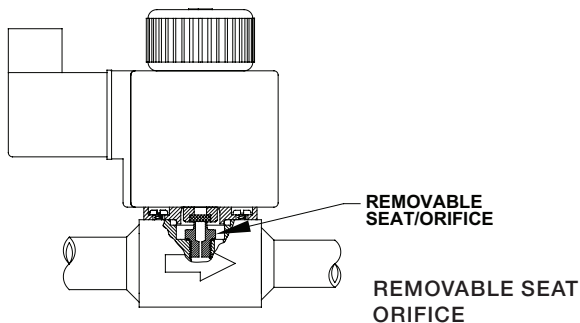
To accelerate the pump out process, attach ammonia hoses to the oil drain valves. Close the main suction line to the purger. Using the oil drain valves, pump out to a lower suction pressure than the main purger suction line. When pumped out, close the oil drain valves and leave the main suction line closed to isolate the purger. With electricity on, the pressure in the purger should remain at zero. This process should be completed only by knowledgeable refrigeration technicians.

SECTION 2 ELECTRICAL INSTALLATION & OPERATION

SOLENOID VALVES

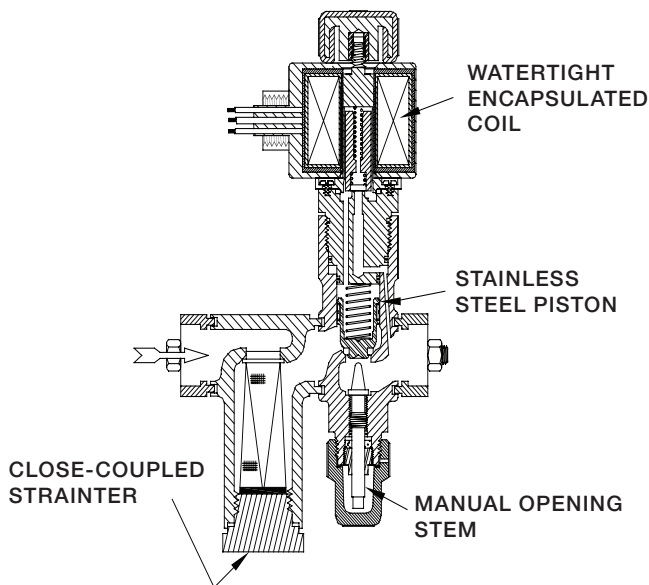
The APM is equipped with four solenoid valves. These are: the liquid drainer solenoid valve (A), the liquid line solenoid valve (B), the purge gas solenoid valve (C), and the water solenoid valve (D). See Figure 11. With the exception of the water solenoid valve, each is directly welded in-line and has a stainless steel removable seat/orifice (see Figure 8). The removable seat/orifice facilitates easy access to the orifice for inspection or replacement. If necessary, the water solenoid valve (D), whose brass body has threaded ends, can easily be replaced or parts thereof changed.

Figure 8



In addition, separate remote point solenoid valves are required, one for each enabled purge point. These are not included with the APM. The Hansen type HS8 solenoid valve having a 1/2" (13mm) port and a stainless steel piston is recommended. Below is a typical purge point solenoid valve with close-coupled strainer (Figure 9).

Figure 9



CHECK VALVES

There are three check valves on the purger. An 80 psid (5.5 bar) differential check valve is installed on the purge gas line to prevent any possibility of reverse flow of water into the purger. A 225 psid (15.5 bar) differential relief check valve leads from the condensing coil inlet to the suction line; this prevents excessive purger pressure. A third check valve is installed from the liquid drainer to the evaporator coil to prevent reverse flow with a temporary loss of foul gas pressure.

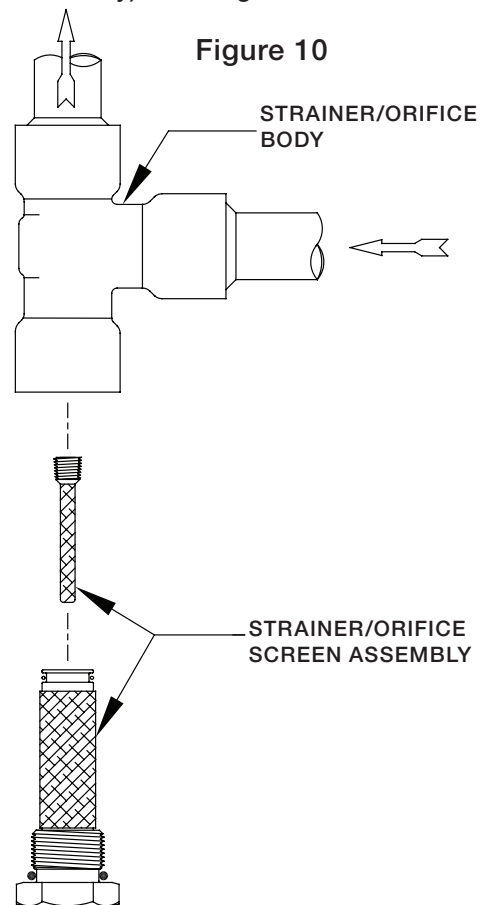
LIQUID DRAINER

The liquid drainer removes any condensed liquid that trickles from the foul gas line into the purger. This enables the purger to always be condensing gas, rather than having liquid entering the condensing section of the purger and limiting proper operation. The drainer solenoid valve (A) will open to empty a reasonable amount of excess liquid directly to the flooded evaporator. However, if too much liquid comes down the foul gas line, due to improperly piped condensers, corrective action must be taken. See the Foul gas piping section on page 3.

STRAINER/ORIFICE

The strainer/orifice meters condensed liquid refrigerant from the high-pressure side of the purger into its flooded evaporator. It features a dual filter arrangement to reduce potential orifice blockage. This dual filter (strainer) removes particles and houses the integral orifice (strainer/orifice screen assembly). See Figure 10.

Figure 10



WATER BUBBLER

The APM is equipped with a water bubbler which eliminates any water bottle attention. Purge gas (noncondensibles) from the purger flows into the bottom of the water bubbler where residual ammonia can be absorbed into the water. The water with absorbed ammonia flows to a drain. The water solenoid valve (D) opens to automatically replenish water to the bubbler each time the purge gas solenoid valve (C) energizes. A 30-second delay keeps the water solenoid valve (D) open after the purge gas solenoid valve (C) de-energizes to refill water bubbler. Proper release of noncondensibles through the bubbler is usually indicated by large, 1/2" (13mm) diameter bubbles.

SECTION 3 APM OPERATION

The APM 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.

Keep the control cabinet door closed at all times to prevent water damage and tampering.

PURGER START-UP SEQUENCE

On start-up, liquid refrigerant fills and begins to cool the purger. The liquid line solenoid valve (B) energizes to feed refrigerant to the flooded evaporator. The low side level sensor, located on the side of the flooded evaporator, senses when liquid reaches the proper level. The display should show 3333.

At the same time the flooded evaporator is filling, foul gas enters the flooded evaporator condensing coil and the refrigerant gas contained therein changes state to a liquid. The liquid and noncondensable gas gradually fill the air separator chamber.

As the purger continues to cool down, a temperature sensor attached to the flooded evaporator senses temperature. At approximately 40°F (4.4°C) evaporator temperature, the readout will no longer display 3333 and the purger will enter the mode selected.

Foul gas is continually processed as long as a remote purge point solenoid is energized. It is important that one, but only one, remote purge point solenoid valve is open at all times to prevent losing foul gas pressure to the purger. If foul gas pressure is lost (as sensed by pressure transducer), diagnostic code 2222 flashes on the APM digital readout. No purging of air will occur until foul gas pressure is restored.

OPERATION

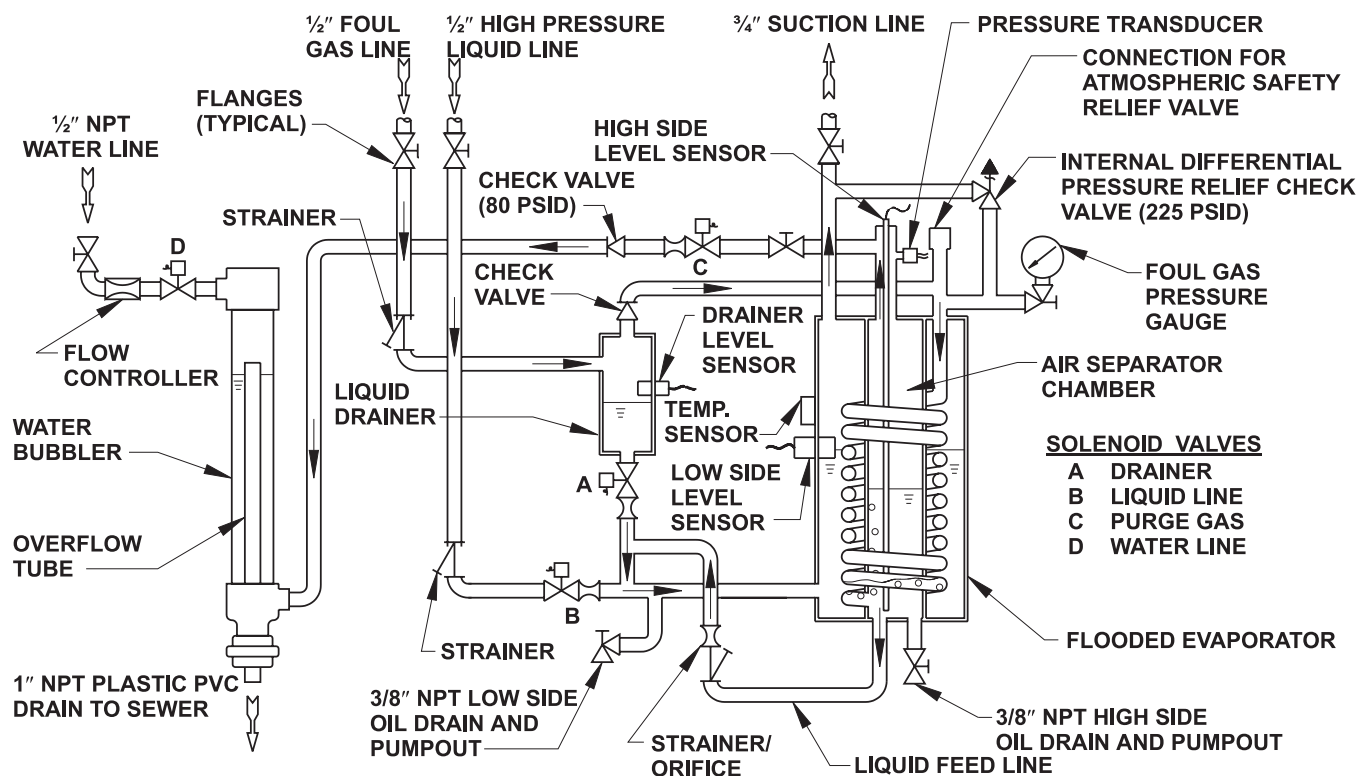
The foul gas may carry a certain amount of condensed refrigerant which is captured by the liquid drainer before it enters the flooded evaporator coil of the purger. The drainer level sensor operates solenoid valve (A) to drain the liquid directly into the low-pressure flooded evaporator. This separation step enables the liquid refrigerant to bypass the purger's flooded evaporator condensing coil.

The liquid-free foul gas enters the condensing coil, which is submerged in the cold liquid refrigerant of the flooded evaporator. The refrigerant gas condenses while the noncondensable gas passes into the air separator chamber. The condensed liquid refrigerant is removed from the air separator chamber through the strainer with integral orifice, and passed into the low-pressure side of the flooded evaporator.

Meanwhile, the noncondensable gas collects in the air separator chamber. The collected noncondensable gas gradually depresses the liquid level causing the high side level sensor to open both the purge gas solenoid valve (C) and water solenoid valve (D). Inside the water bubbler, noncondensable gas and water mix so that residual amounts of ammonia can be absorbed. The waste water is flushed to the drain through the overflow tube.

The purger will cycle each enabled remote purge point solenoid valve in sequence, when the purger is on Automatic Operation or New System Start-up. The Purger will remain at the selected purge point when in Manual Operation.

Figure 11



SECTION 4 TROUBLE SHOOTING PURGER OPERATION

DIGITAL READOUT FLASHING 2222

LOSS OF FOUL GAS PRESSURE. This usually means the pressure in the air separator chamber is below 80 psig (5.5 bar). 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 remote purge point solenoid 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 digital readout again flashes 2222. The faulty coil or wiring is now pinpointed.

Action: Replace the coil or repair the wire, and replace the 3 amp fuse (p/n 20-1698).

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 14.

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 14.

REASON 4: Faulty pressure transducer.

Check: With the purger in any operational mode, check the pressure gauge reading. If it is above 80 psig, check pressure transducer plug-in connector terminals 27 & 30 for 10 volts DC. Then check terminals 28 & 29 for at least 13 mV.

Action: If terminals 27 & 30 do not have 10 volts DC, check for faulty wiring. If terminals 28 & 29 do not have at least 13 mV, replace the pressure transducer (p/n 20-1857) with the purger at zero pressure. See also the Caution section on page 14.

DIGITAL READOUT FLASHING 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 14.

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.

Check: With the temperature sensor plug-in connector disconnected from power board (see Figure 4), check the electrical resistance of the sensor across the wire leads.

Action: If the resistance is not between 30 K ohms and 486 K ohms, replace the temperature sensor (p/n 20-2303). See also Caution section on page 14.

DIGITAL READOUT FLASHING 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 momentarily turning the APM to Purger Switched Off and back to the desired operation mode. 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 removable seat/orifice inside the solenoid valve body. See also the Caution section on page 13.

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.

SECTION 4 TROUBLE SHOOTING PURGER OPERATION

DIGITAL READOUT FLASHING 5555

PURGER SHUT-OFF REMOTELY. This code indicates that the optional interlock remote relay contacts are open. These contacts are connected to the purger via the power/interlock plug-in connector terminals 11 and 12.

REASON 1: The purger is temporarily shut-off due to the interlocked compressor (or other device) being shut down by temperature controls or safety devices.

Check: Wait until the interlocked compressor (or other device) begins to operate. If digital readout does not stop flashing diagnostic code 5555, then check the interlock relay for proper operation.

DIGITAL READOUT FLASHING 6666

LEVEL CONTROL OUT OF RANGE. This Flashing 6666 code will alternate with either a 6661, 6662, or 6663 code. The second code indicates which level sensor is out of the normal sensing range. This may indicate a mechanical or electrical problem with the drainer level sensor (6661), the low side level sensor (6662), or the high side level sensor (6663).

REASON 1: One or more level sensors are out of calibration.

Action: Recalibrate the level sensors as follows:

- A) First, all refrigerant and oil must be removed from the APM and the pressure must be zero (atmospheric pressure)
- B) Remove power to purger.
- C) install the supplied "jumper" (small white chip) to the Reset Pins located on the side of the Control Board, wait 5 minutes. See figure 4. Note: A small alligator clip can be substituted for "jumper".
- D) Apply power to the APM. The display on the front of the APM should read "CAL". With power still applied, remove "jumper" from the Reset Pins.
- E) Recalibration is complete.

REASON 2: Discontinuity in the coaxial wire from the probe to the control board.

Check: Verify that the level sensor coaxial connectors at the control board are tight.

Action: If the connections appear proper, replace the suspected level sensor, with the purger isolated from the system and pressure at zero. See also the Caution section on page 14.

DIGITAL READOUT FLASHING 7777

LOSS OF HIGH PRESSURE LIQUID. If the liquid line solenoid valve remains energized for more than 30 minutes, it indicates there is insufficient high-pressure 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 removable 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 removable seat/orifice inside the solenoid valve body. See also the Caution section on page 14.

REASON 2: Liquid line restricted.

Check: Look for closed shut-off valves in the 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 14.

REASON 3: Flooded evaporator is full of oil.

Check: Look for oil at the drain valves.

Action: Drain the oil according to safe refrigeration practices.

PURGER NOT OPERATING AND THE DIGITAL READOUT BLANK

REASON 1: One or both of the replaceable 3 amp fuses is blown. (APM's shipped before January 1997 have circuit breakers instead of fuses.)

Check: Check for a blown fuse.

Action: Replace the blown fuse.

REASON 2: Condensation inside the flexible electric conduit is causing a short in the DIN plug connector. Note: This only applies to APM purgers shipped before December 9, 1996.

Check: Remove the DIN plug connector from the solenoid valve and inspect for moisture or condensation.

Action: Replace the solenoid, flexible conduit, and (if necessary) the power board. Contact the factory for an upgrade kit including the solenoid and flexible conduit. The power board must be ordered separately. Refer to drawing 2001-80 for power board replacement procedures.

REASON 3: A short or open on the low voltage side of the power board.

Check: With power to the APM use a voltmeter to check for approximately 10V DC across terminals 27 and 30.

Action: If there is no voltage across the terminals, replace the power board. Refer to drawing 2001-80 for power board replacement procedures.

REASON 4: One or both solid state fuses (F6A and F6B) are blown.

Action: Disconnect power and verify continuity across the fuses. Replace board if no continuity.

SECTION 4 TROUBLE SHOOTING PURGER OPERATION

NONCONDENSIBLES ARE NOT BEING RELEASED.

(See also page 10; Digital Readout Flashing 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: Strainer/orifice plugged.

Symptom: The purger appears to be operating properly, however, the liquid feed line is not frosted.

Check: Look for a restriction in the strainer/orifice.

REASON 3: foul gas line is flooded with liquid.

Symptom: The line from the bottom of the liquid drainer solenoid valve (A) to the inlet of the purger evaporator 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 I of this bulletin.

Action: Correct condenser and foul gas piping.

REASON 4: High side level sensor not detecting drop in liquid level due to oil.

Action: Run recalibration procedure per recalibration instruction on page 11.

AMMONIA INSTEAD OF NONCONDENSIBLES RELEASED FROM PURGER.

(See also page 10; Digital Readout Flashing 3333)

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

Symptom: A slow leak of noncondensibles to the bubbler when the Purging status light is off.

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

Action: Remove, clean, or replace the seat/orifice and solenoid tube plunger. See also the Caution section on page 14.

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 and suggested oil removal instructions describe in the Oil Drains section, page 4.

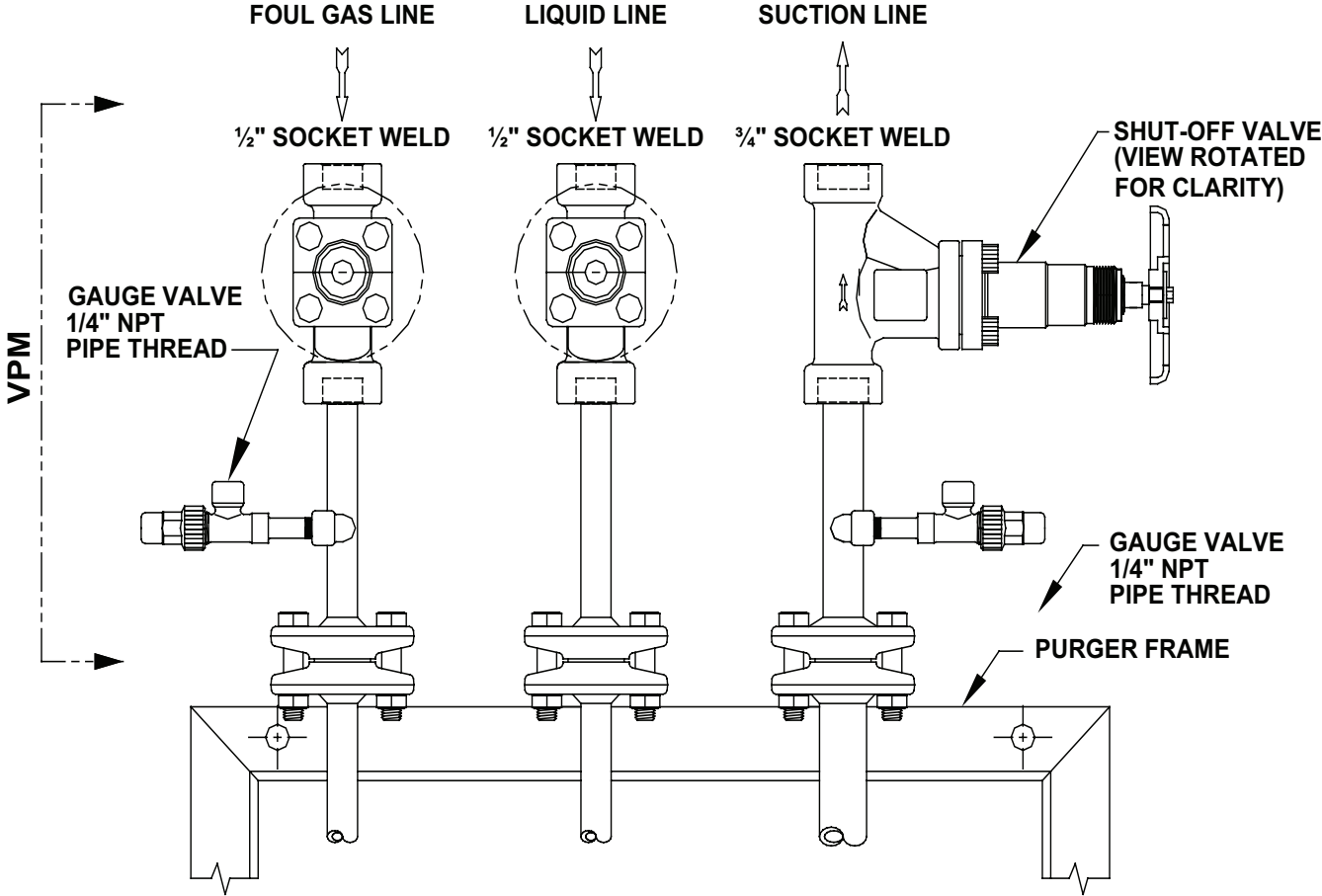
WATER BUBBLER DEVELOPS EXCESSIVE MINERAL COATING.

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.

OPTIONAL VALVE PACKAGE FOR AMMONIA SYSTEMS (VPM)

Figure 13



SECTION 5 APMF AUTO-PURGER M FOR HALOCARBON SYSTEMS

INTRODUCTION

Model APMF AUTO-PURGERs are for use in halocarbon refrigeration systems. The installation and operation of these AUTO-PURGERs are similar to that of an ammonia AUTO-PURGER M.

PIPING HALOCARBON AUTO-PURGERs

The halocarbon liquid line and foul gas line piping and sizing details are the same as for an ammonia AUTO-PURGER M. However, the suction line size for halocarbon purgers should be 3/4" (20mm) for suction temperatures down to -20°F (-29°C) to -60°F (-51°C) suction temperatures. Condenser drain lines on halocarbon evaporative condensers must be trapped and drop vertically 8' - 12' (2.5m - 3.7m), or per manufacturer recommendations. This is to prevent possible backflow of liquid into one or more condenser circuits resulting in a flooded purge point.

Purge points are at the same locations as for an ammonia purger. For evaporative condensers, the purge points are on the top of the outlet drain line. Although noncondensibles gases are lighter than halocarbon gas, they still collect at, or near, the outlet.

OPTIONAL VALVE PACKAGE, VPMF

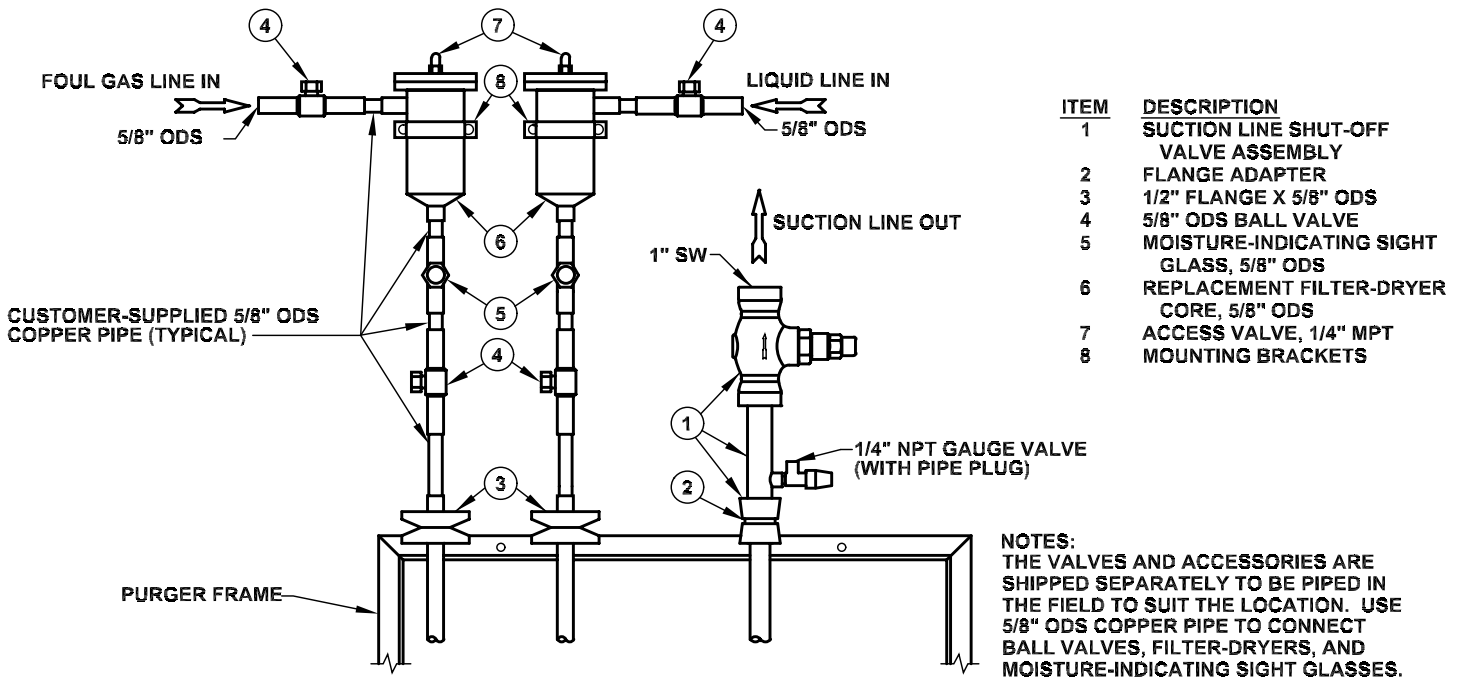
The special construction for APMF AUTO-PURGERs includes a filter-dryer conditioning system for the foul gas and liquid line. Water vapor, as well as noncondensable gas, may be present at each purge point. The filter-dryers remove this moisture before it can enter the purger. Both dryers are used to protect the purger internally from freezing water, but they also supplement water removal of the primary refrigeration system liquid line dryers. Moisture indicating sight glasses located downstream of the filter-dryers indicate when the filter-dryer cores are saturated with water and must be replaced. Isolation shut-off valves are included for change out of the filter-dryer cores, and access valves allow evacuation of the refrigerant from the filter-dryer shell.

AIR INDICATING COLUMN

While the air indicating column (water bubbler flush system) is included, the water line and drain line are not required. Fill the clear tube to the marked line with a lightweight, clear refrigeration oil. Noncondensibles released from the purger bubble up through the column, indicating proper operation.

OPTIONAL VALVE PACKAGE FOR HALOCARBON SYSTEMS (VPMF)

Figure 14



PARTS LIST FOR APM (AMMONIA)

ELECTRICAL	
Control Board	20-1836
Shield for above	20-2271
Ground Wire for above	20-2270
Power Board	20-1845
3A (amp) fuse (5mm x 20mm) Type F for Power Board	20-1698
Cable, Control Board	20-1837
Pressure Transducer	20-1857
Temperature Sensor	20-2303
High Side Level Sensor	77-0796
Drainer & Low Side Level Sensor	77-0535
Solenoid Coil Kit, 230V for DIN plug	70-1093
Solenoid Coil Kit, 115V for DIN plug	70-1092
MECHANICAL	
Solenoid Tube/Plunger Kit	70-1059
Water Solenoid Valve (D), Less Coil	HS2B/1
APM Bubbler	20-1959
Strainer/Orifice Screen Assembly Kit includes Strainer/Orifice Screen Assembly and necessary O-Rings	20-2177
Water Flow Controller	20-1985
Removable Seat/Orifice Kits	
For Solenoid Valve (B) or (C)	70-1068
For Solenoid Valve (A)	70-1069
80 psid Check Valve	20-2379
Foul Gas/Liquid Line Strainer Kits include Strainer Basket and O-Ring	78-1010

ORDERING INFORMATION, PURGER

Cat. No.	Description
APM	Auto-Purger M, 4 points, for ammonia systems
APMF	Auto-Purger M, 4 points, for halocarbon systems

To Order: Specify catalog number, refrigerant and voltage. Standard voltage is 115V 50/60Hz; 230V 50/60Hz, is available. CSA and CE mark available.

PARTS LIST FOR APMF (HALOCARBON)

ELECTRICAL	
Control board	20-1836
Shield for above	20-2271
Ground Wire for above	20-2270
Power board	20-1845
3 amp fuse (5mm x 20mm) Fast-Acting for Power board	20-1698
Cable, control board	20-1837
Pressure transducer	20-1857
Temperature sensor	20-2303
High side level sensor	77-0796
Drainer and low side level sensor	77-0794
Solenoid coil kit, 230V with DIN plug	70-1093
Solenoid coil kit, 115V with DIN plug	70-1092
MECHANICAL	
Solenoid tube/plunger kit	70-1059
APMF bubbler	20-2282
Strainer/orifice screen assembly kit includes strainer/orifice screen assembly and necessary o-rings	20-2285
Removable seat/orifice kits	
For solenoid valve (C)	70-1068
For solenoid valve (A) or (B)	70-1069
80 psid check valve	20-1949
Foul gas/liquid line strainer kit Includes strainer basket and o-ring	78-1010

ORDERING INFORMATION, OPTIONAL VALVE PACKAGE

Cat. No.	Description
VPM	Valve Package for ammonia systems
VPMF	Valve Package for halocarbon systems

To Order: Specify catalog number and refrigerant. The VPM optional isolation valve package consists of three flanged welded assemblies which include the necessary shut-off valves and gauge valves for the foul gas line, suction line, and liquid line. The VPMF for halocarbons also includes filter dryers and moisture indication sight glasses.

SELECTING AN AUTO-PURGER®

In addition to the AUTO-PURGER® AP, Hansen Technologies offers three other versions—the compact AUTO-PURGER® APM, the gas (air) and water AUTO-PURGER® APP, and the Nonelectrical AUTO-PURGER® (NEAP). Use the following descriptions to help select the best AUTO-PURGER for your needs. For additional assistance, contact the factory.

AUTO-PURGER AP

This is the original AUTO-PURGER. It has solid-state control and is ideal for larger systems, up to 1500 tons (5300 kW) ammonia. This is two to three times the air removal capacity of the Armstrong purger. With models available to purge up to 24 points, the AP features automatic start-up with electronic control. The purge cycles can be individually adjusted to meet system requirements. The AP includes an automatic water bubbler. An optional NEMA 4 rated enclosure is available.



AUTO-PURGER APM

A more compact version of the original AP, the AUTO-PURGER APM is ideal for medium-size systems, up to 200 tons (700 kW). Like the AP, the APM features automatic start-up with electronic control. Designed for up to four purge points, an electronic “brain” searches for noncondensable gases in the system and purges at those points when air is present. The APM includes an automatic water bubbler and comes standard with a NEMA 12,13 control cabinet. For use with ammonia refrigeration systems. Assembled, tested, and ready to run.



Nonelectrical AUTO-PURGER (NEAP)

The nonelectrical AUTO-PURGER (NEAP) is ideal for small systems, up to 100 tons (350 kW). The nonelectrical design also makes the NEAP ideal for explosion proof applications. The simple design of the NEAP features easy start-up and is generally used to purge a single point. For use with ammonia refrigeration systems. Assembled, tested, and ready to run.



AUTO-PURGER APP

AUTO-PURGER PLUS is a totally automatic, electronically controlled non-condensable gas (air) and water purger for reducing the energy costs of operating an ammonia refrigeration system. Shipped preassembled, prewired, insulated, and includes an automatic water bubbler, a relief valve, and an isolation service valve package. One AUTO-PURGER PLUS is typically sufficient for a 1500 ton (5275 kW) system (or a 750 ton (2638 kW) system operating below 0 psig (0bar g). All models suitable for ammonia only.



Hansen Auto-Purger Specifications				
Model	AP	APP	APM	NEAP
Pressure Rating	400 psig	400 psig	400 psig	400 psig
Test Pressure	450 psig	450 psig	450 psig	450 psig
Min. Operating Temp.	-60°F	-60°F	-60°F	-60°F
Max Operating Temp.	240°F	240°F	240°F	240°F
Ammonia Charge	11 lb	14 lb	7 lb	7lb
Cubic Volume	0.5 ft ³	0.7 ft ³	0.3 ft ³	0.2 ft ³
Refr. Capacity (tons)	1 TR	1 TR	0.5 TR	0.5 TR
Certification Type (std)	CRN, CSA	CRN, CSA	CRN, CSA	CRN
HEX Length x Width (to calculate relief size)	48" x 5"	48" x 5"	18" x 5"	14" x 5"
Bulletin number	AP003	APP001	APM001	NEAP001

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

Electrical and electronic components are guaranteed against defective materials and workmanship for 90 days F.O.B. our plant. All other components are guaranteed against defective materials or workmanship for one year F.O.B. our plant. No consequential damages or field labor is included.

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