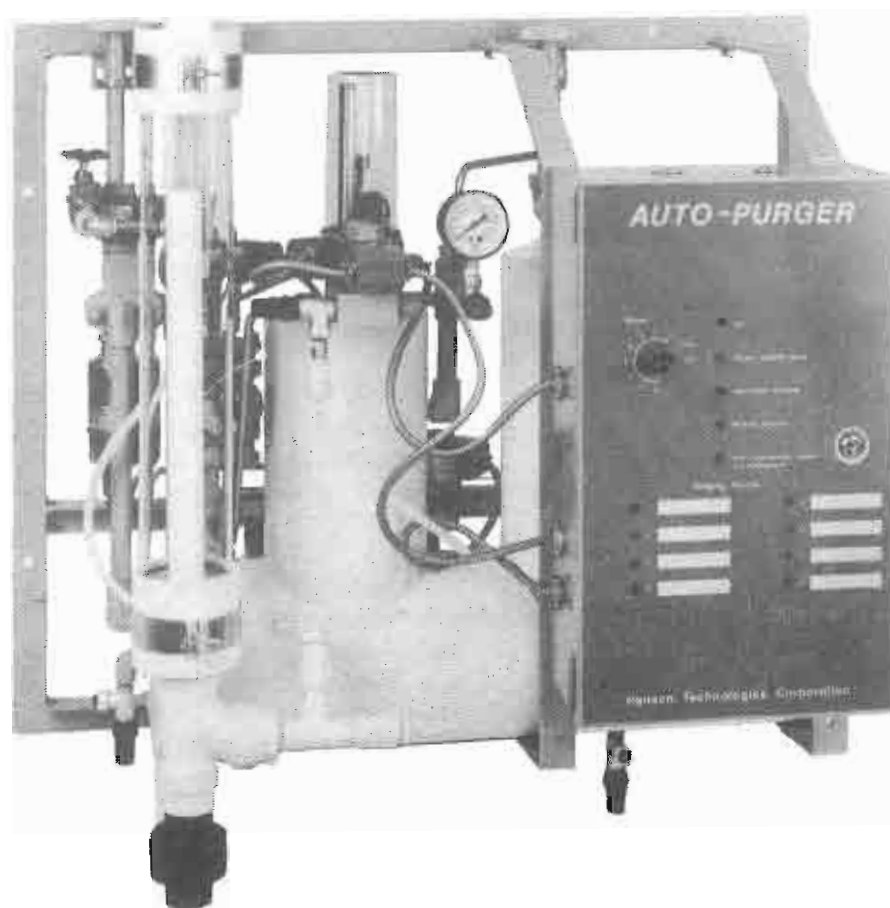


AUTO - PURGER

Non-Condensable Gas Refrigerant Purger



OPERATOR INSTALLATION & INSTRUCTION MANUAL

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INTRODUCTION

The AUTO-PURGER is a totally automatic electronically controlled non-condensable gas purger for reducing condensing pressure and saving power. The Deluxe Models APC, AP08, AP16, and AP24 are pre-packaged, pre-wired, insulated and include an automatic water bubbler. Installation requires piping the "foul gas" line, liquid line, suction line, water line, drain line, 120V/60HZ power connection and wiring the remote 120V purge point solenoid valves. Half inch port purge point solenoid valves and check valves must be purchased separately.

In addition, a "computerized" Model APC is available where a separate plant computer or programmable computer is used to start and stop the AUTO-PURGER and open and close the various remote purge point solenoid valves.

The basic model AUTO-PURGER Model AP01 is the same construction less insulation, automatic water bubbler and water solenoid valve, 7-day time clock and sequence timer for remote multi-point purge solenoid valves. The AP01, like the AP08, AP16 and AP24, includes the automatic fill, cool down and purge features. Insulation and automatic water bubbler may be ordered for the AP01.

Because of its internal surface area and flooded evaporator efficiency, the AUTO-PURGER has two to three times the "Foul Gas" condensing capacity of an Armstrong purger. Model AP01, AP08, AP16 and AP24 for normal non-condensable loads will handle a 750 ton plant at suction pressure below atmospheric pressure or a 1500 ton plant at positive suction pressures. These sizing guidelines are based on previous experience and are conservative. The amount of air in the system is based on many factors including age of the system, maintenance practices, the system operating temperature, etc.,.

Because of its design, the AUTO-PURGER can operate over a wide condensing pressure range. This is especially important for refrigeration systems that operate at low condensing pressures during cold ambient conditions.

MOUNTING INSTRUCTIONS

Mount the AUTO-PURGER securely on a wall or sturdy steel channels. Several 1/2" diameter holes in the frame may be used to bolt the unit to its supports. The unit should be located in an accessible

area but out of the way of the movement of equipment that could accidentally come in contact with the purger. (See Fig. 1)

The AUTO-PURGER is normally installed in the compressor room where it can be monitored, but also may be installed outdoors in temperate climates where temperature below freezing are not anticipated.

For outdoor use or areas where falling water, constant high humidity, or spraying water is possible, an optional NEMA 4 enclosure with sealed conduit wiring is recommended. Unused electrical entrance to the enclosure should be sealed to protect the controls from moisture and environmental gases.

PIPING INSTRUCTIONS"Foul Gas" Lines (Model AP01)

The AUTO-PURGER is available as single point purger (Model AP01), or with an 8, 16 or 24 purge point timer (Models AP08, AP16 and AP24 respectively). For the single point purger, Model AP01, the "Foul Gas" line is brought directly from the purge point on the condenser or receiver to the purger. During operation, the AUTO-PURGER's "Foul Gas" inlet line is opened automatically by the "Foul Gas" solenoid valve (4) located on the purger, when the purger is cooled to approximately 20°F.

"Foul Gas" Piping for Multi-Point Purging (Model AP08, AP16, AP24 and APC)

Purging at several points on the high pressure side of the system is the best method of removing the "Foul Gas" from the system because it is nearly impossible to predict where the non-condensable gas will accumulate.

Even for multi-point 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 due to unequal pressure drop, even though the differences in pressure drop are very small. The result would be that even in the best of circumstances only one point would be effectively purged. The best practice is to purge each condenser and receiver circuit separately.

For multi-point purgers such as AP08, AP16, AP24, APC, the solenoid valves may be manifolded into

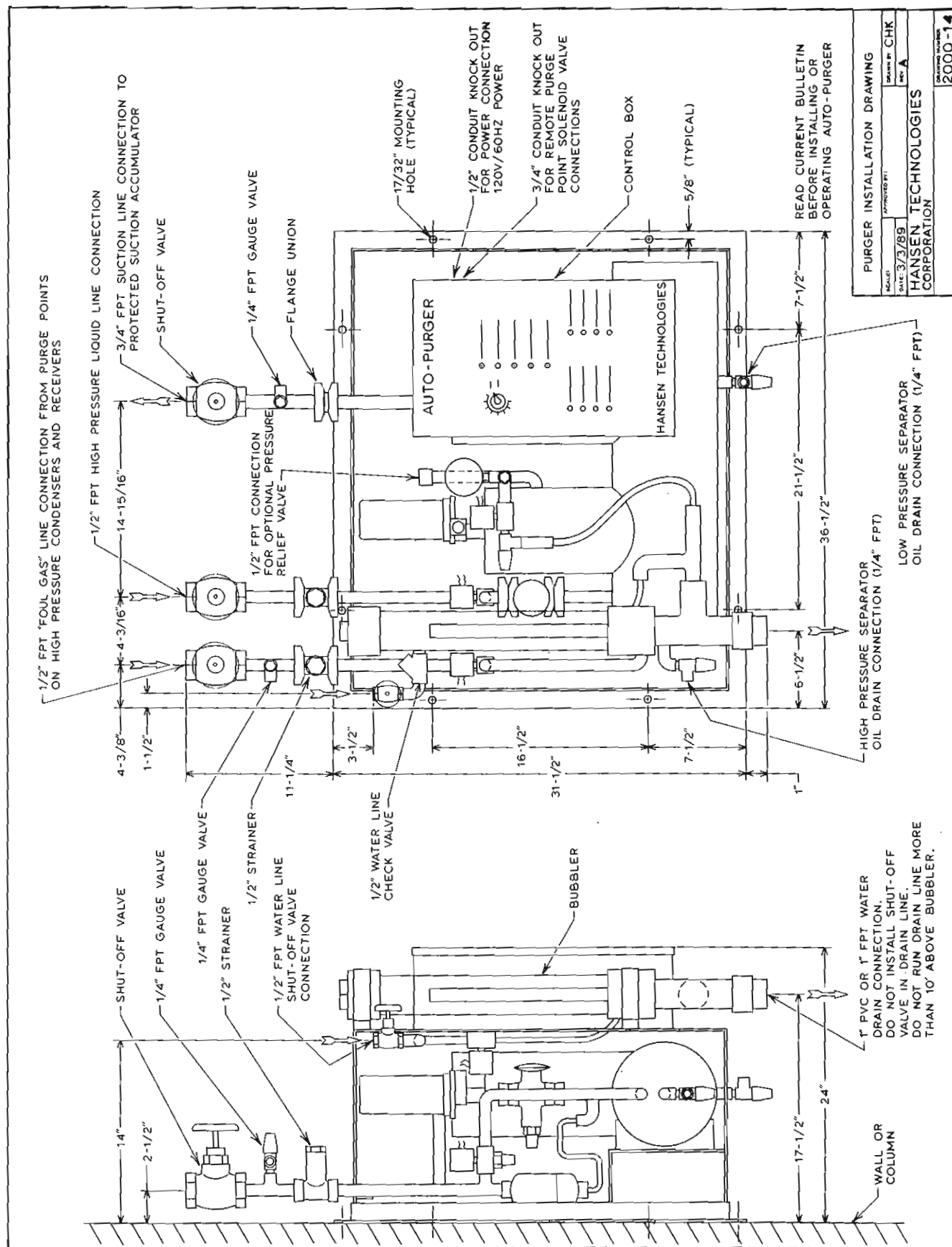


FIG. 1

one line leading to the purger. A 1/2" size line is the minimum size. A low pressure drop check valve should be installed on each purge line leading from any condenser or receiver where the pressure is 5 psi or more lower than other condensers or receivers on the same circuit. This is to prevent possible backflow of gas through the solenoid valve of the lower pressure purge point. (See Fig. 2) The line from the purge point on the condenser to the AUTO-PURGER should not pass through cold areas where further condensing of the saturated gas can occur.

Place remote purge point solenoid valves at purge points to avoid condensing in purge lines during off time. Manifold outlets of purge point solenoid valves and run one line to purger. Pitch line toward purger to drain any condensed liquid. No liquid traps are desirable either before or after purge point solenoid valves.

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 and may back liquid up into one circuit.

Condenser Piping Design

Condenser outlet liquid drain lines on each circuit must drop a minimum of 4' for ammonia (8' for freon) from 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 condenser and flooding the purge point. Also, a properly sized equalizer line from the receiver will help gravity drain condenser circuits into receiver. Refer to ASHRAE GUIDELINES or recent IIAR Papers on condenser piping design. Hansen Technologies can provide copies of these articles. Also consult condenser manufacturers installation instructions.

Liquid Drainer

Each purger is equipped with a liquid drainer, located on the "foul gas" line. Small amounts of liquid refrigerant, present in nearly all purge lines, are directed into the liquid drainer. From there, the liquid is released into the evaporator by-passing the condenser. Only "Foul Gas" flows

to the condensing coil. This prevents filling the AUTO-PURGER with liquid resulting in a halt in purging for many hours.

Where to Connect Purge Points

"Foul Gas" lines from condenser should be purged at points recommended by the condenser manufacturer. Usually, this is at the top of each circuit's outlet header.

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

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

Horizontal shell and tube water-cooled condensers should be purged at the top, usually at the point or points the furthest from the inlet from the compressor discharge main.

Vertical condensers should be purged at the top of the outlet drain line or from a connection in the condenser just above the outlet drain line connection.

"Foul Gas" from Oil Separator

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

Liquid Line

One high pressure 1/2" liquid line is required to the AUTO-PURGER. The connection to the high pressure liquid source should be a location where oil would not be directed into the purger. The liquid line supplies refrigerant during start-up and feeds make-up liquid as required during purging. A solenoid valve (1) in the AUTO-PURGER closes the liquid line when the AUTO-PURGER is off. The exact supply pressure is not critical to the proper operation of the purger. The only requirement is that the pressure be sufficiently above the evaporator pressure to insure proper operation of the Level Master Control. Except for start-up, the Level Master supplies only 5% of the liquid refrigerant. The

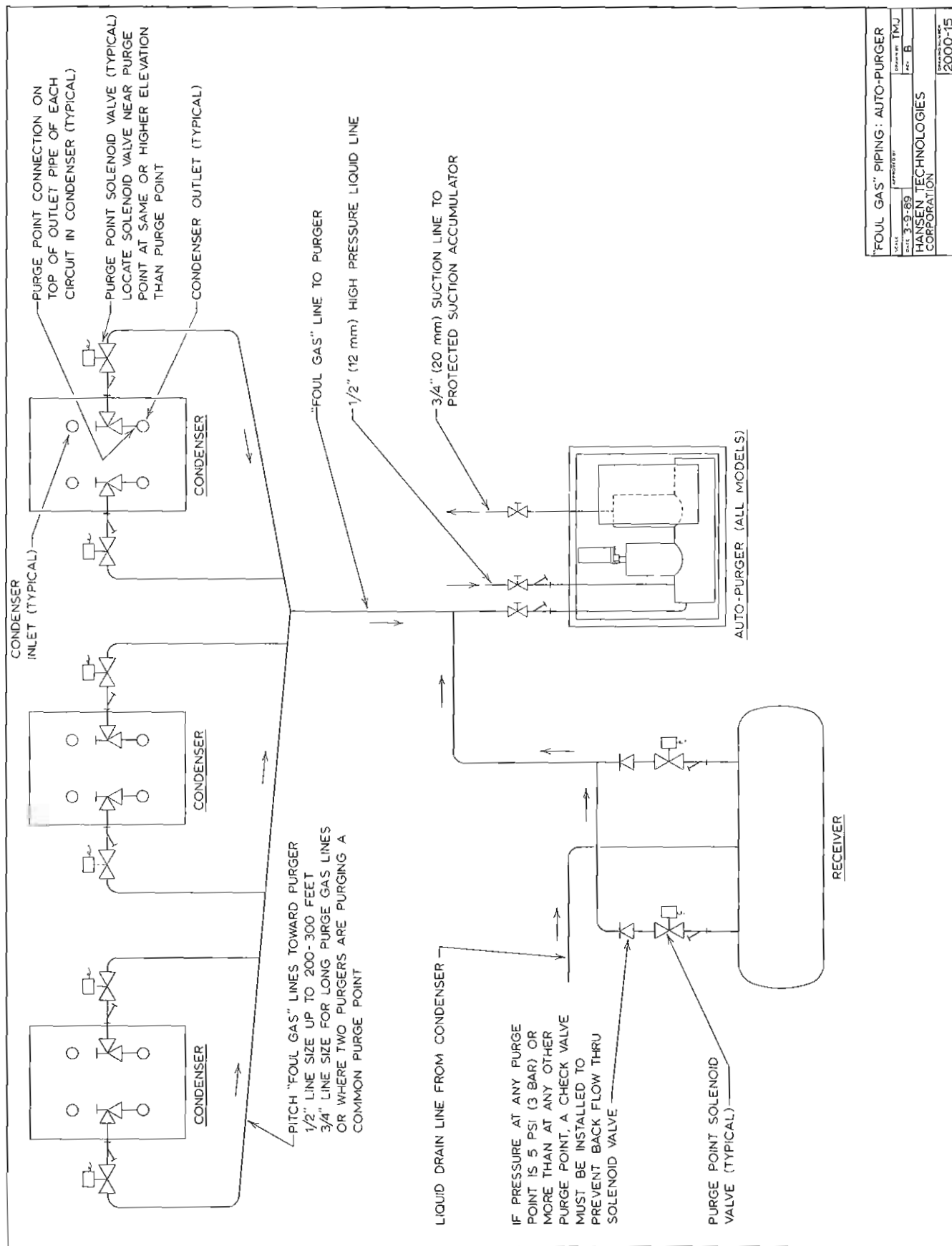


FIG. 2

remainder of the refrigerant is condensed from the foul gas line. It is fed to the evaporator through the metering valve.

Suction Line

A 3/4" suction line is connected to a protected main suction line or can be piped to a suction accumulator. Excess amounts of liquid from the liquid drainer may occasionally be transmitted through the suction line. The suction temperature must be 20°F or less to close the thermostat which switches the AUTO-PURGER from its PURGER COOLING DOWN mode to its AUTOMATIC mode. The purger thermostat is factory set at 30°F. For higher suction pressures, consult factory.

Water Line

Purger Models APC, AP08, AP16, and AP24 are provided with an automatic water bubbler. A water line must be connected to the water solenoid valve. The connection is 1/2" FPT. The water supply pressure should be between 30 and 80 psi.

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 bottle brush supplied. A water conditioning filter is available for abnormally hard water supply.

For basic Model AP01, a plastic hose and fitting is supplied for top entry to the bottom of a one gallon or larger glass or plastic jug (not supplied). This jug must be refilled with fresh cold water when it will hold no more ammonia. The automatic water bubbler may be added to the Model AP01.

Drain Line

A 1" PVC socket/1" FPT threaded water drain connection is located at the bottom of the bubbler. The water and small amount of dissolved ammonia should be run to a suitable drain or container. Do not install a shut-off valve in this line. Do not run the line over 10' above the height of the bubbler because the pressure in the plastic bubbler housing could be excessive. For AP01, no drain is necessary.

Oil Drains

The purger has two connections for draining oil from the purger. Excess oil could reduce the purger capacity by lowering the evaporating or condensing rate. (See Fig. 1)

Any oil that collects in the purger can be drained off through the two capped 1/4" valves installed on the purger. Before starting to drain, shut-off the purger and its 3 hand valves to liquid, foul gas and suction. Allow it to warm up to reduce the oil viscosity for easier removal. Use normal oil draining precautions to prevent human or property damage since ammonia might escape with the oil. Generally, oil is not a problem unless the liquid line is connected to a vessel or line where oil can drain into the purger.

Check Valves

There are three steel check valves installed on the purger. One 1 psi differential check valve is installed on the purge gas line to prevent reverse flow of water into the purger. A second 30 psi differential check valve is installed in the liquid line to the float chamber. It limits liquid line pressure at the purger to 30 psi less than the condenser pressure.

The third check valve is a 200 psi differential relief check valve to suction.

The water line also has a check valve to prevent reverse flow.

SECTION II ELECTRICAL INSTALLATION & OPERATION

Electrical Connections

The standard electrical requirement for the single point purger is a 120V/60HZ supply. The circuit should be fused at 15 amperes. A 1/2" knockout on the side of the control cabinet provides access to the power connection terminal strip.

The multi-point purger (Models APC, AP08, AP16 and AP24), in addition to the electrical connection above, provides a 3/4" knockout for individual purge point solenoid valves. Wires from each purge point solenoid valve should be brought to the purger control box.

One line from each purge point solenoid is connected to a numbered screw terminal located inside the control box near the top. The numbers on the terminal strip correspond to the numbers on the lights located on the door of the control cabinet. The voltage of the remote purge point solenoid valve is 120V/60HZ. The electronic control circuits as well as the door panel wiring is 12V D.C. This 12V circuit is internally wired to a transformer from the power source and normally does not need to be serviced.

Setting the Grasslin Timeclock

The timeclock used in the AUTO-PURGER Control Box is a Grasslin 7-Day Timeclock. To set the time of day, rotate the minute hand until the correct time and day is shown on the circular dial. Once the correct day and time of day are set, the amount of purging per day must be determined and set. Quite often the purger is run 24 hours per day so no settings are required. Just pull all the red pins from the circular dial to leave the time clock on continuously. A small knob in the upper right hand corner of the timeclock can be turned manually to turn the purger on and off.

If the purger is to run on an intermittent basis, then set the "ON" time using the green tabs and the "OFF" time using the red tabs. Use a green tab and red tab for each day of the week. If very little air is being removed during a week, the purger can be operated fewer hours.

Setting Purge Point Timer

Each timer board contains eight relays which power the remote purge point solenoid valves. These relays operate in sequence as long as the AUTO-PURGER is set on "AUTOMATIC". The time each purge

point relay operates is adjustable. A small screwdriver is used to adjust the "timers" anywhere from one minute to sixty minutes. The screwdriver slot in the form of an arrow on top of the "timer" can rotate approximately 270° with linear increase in time in a clockwise rotation. (See Fig. 5)

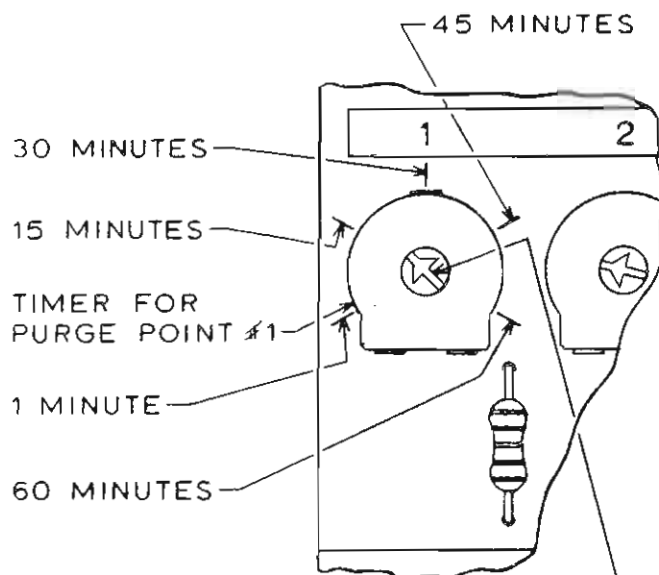
When on "AUTOMATIC", the sequence will always start with purge point #1. After purge point #1 has timed out, purge point #2 will start and so on.

After purge point #8 is finished, the timer circuit will jump back to purge point #1 and repeat the sequence. This will continue as long as the purger front panel switch is set to "AUTOMATIC" position. When less than eight purge points are used, "jumper select connector" (See Fig. 5) is installed on the two pins corresponding to the number of purge points used. (In the illustration six purge points are used.) This "jumper select connector" will bring the sequence back to purge point #1 and skip those points not used. In the illustration, the sequence timer will jump from purge point #6 to purge point #1 and repeat the cycle. Purge points #7 and #8 are skipped. If it is not desired to use this jumper, merely set unused timers to minimum position (counter-clockwise). Each unused purge point would then result in one minute of unused purging time. For models AP16 and AP24, jumpers "A" and "B" are used to tie the timer boards together. Note the locations of the jumpers for AP16 and AP24. (See Fig. 5a, 5b) If a timer board is temporarily not used, the "A" jumper and "jumper select connector" are moved to the next timer board. (i.e. AP24 becomes an AP16 (Fig. 5a), AP16 becomes an AP08 (Fig. 5b))

Manual Operation for Purge Points

The purger switch located on the front panel of the AP08, AP16 and AP24 AUTO-PURGERS can be used to manually select the purge point location as well as turn the purger to "AUTOMATIC" and "OFF". If it is desired to purge only one location continuously, turn the purger switch to that position number (1 through 8 points on AP08, 1 through 16 points on AP16 and 1 through 24 points on AP24).

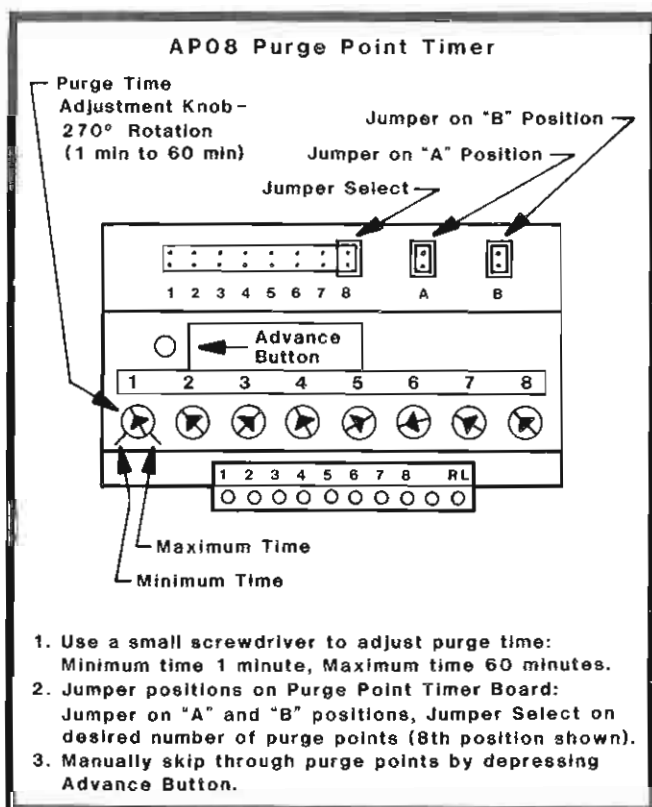
The AUTO-PURGER will go through automatic start-up with the switch in either the "AUTOMATIC" or "MANUAL" position.



SCREWDRIVER SLOT TO ADJUST PURGE POINT TIME FROM 1 MINUTE TO 60 MINUTES (270° ROTATION)

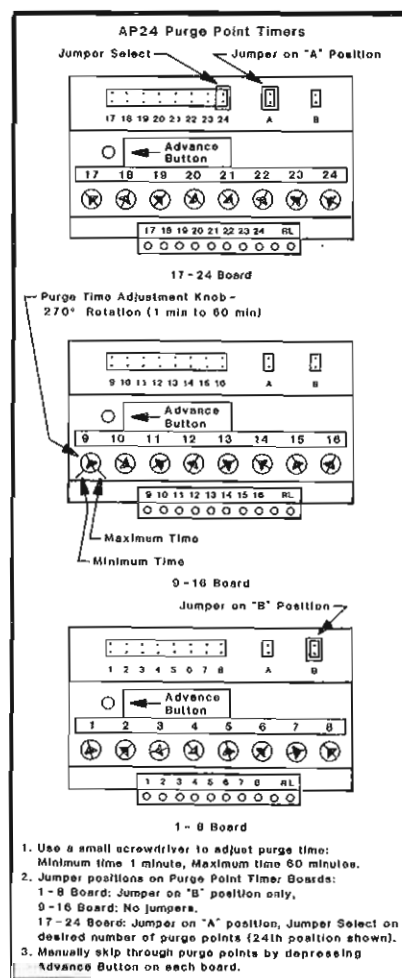
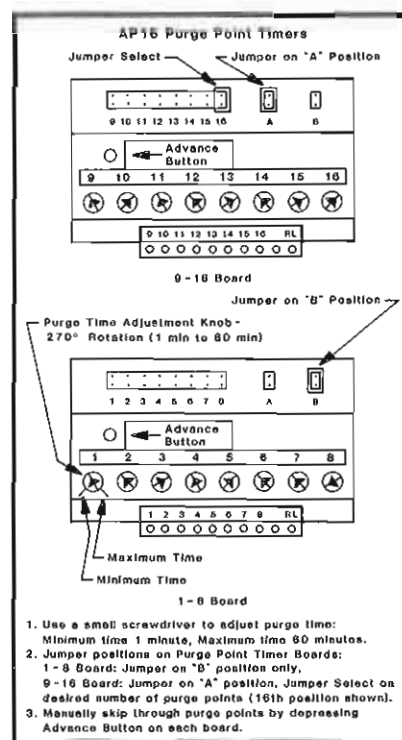
DETAIL SHOWING ADJUSTMENT OF PURGE POINT TIMER

FIG. 4



TIMER BOARD

FIG. 5



Purge Gas Solenoid Valve Time-Delay Cutout

The AUTO-PURGER is equipped with a one hour fixed time-delay relay in the control box which is connected to the purge gas solenoid valve that meters the air to the water bubbler when the purger is operating. This relay prevents the air or refrigerant from feeding into the water bubbler for more than one hour of continuous operation. This is to prevent excess amounts of refrigerant from being released due to a float switch mechanical malfunction or electrical fault. However, during start-up of a new purger or under high air removal conditions, it is sometimes advantageous for the purge gas solenoid valve to remain open continuously due to the large amount of non-condensable gas in the system. The delay relay is equipped with a fixed 1 hour time delay with an on/off switch to by-pass the time delay function. Simply turn relay to "OFF" until the initial volume of air is removed when commissioning a new plant, and later, when air is being removed at short intervals of time, the time delay relay should then be switched to the "ON" position for normal operation.

If during normal operation the delay relay time is exceeded, the magnet will be away from the float switch tube but no gas will be escaping into the water bubbler. To reset the time delay relay, momentarily turn the delay relay switch to "OFF" and back to "ON". This will reset the time delay relay for another hour of continuous bleeding of air into the water bubbler.

Operation of Metering Valve

The operation of the metering valve is to meter condensed liquid refrigerant from the high pressure side of the purger into the flooded evaporator of the purger. The flow to the metering valve is controlled by a 1/4" liquid line solenoid valve (#3) which is open when the purger is in "AUTOMATIC" or "MANUAL" operation. The refrigerant is filtered by a small flanged filter. This filter removes any particles that might block the orifice.

The proper operation of the metering valve can be determined by a frosted line after the orifice. If the stainless steel line is not frosted when the purger is in the "AUTOMATIC" or "MANUAL" operation, then the flow of refrigerant through the line is blocked due to dirt in the orifice, filter or solenoid valve.

If the line still does not frost, check the metering line solenoid valve for operation. If solenoid valve appears to be operating normally then pump out the purger and inspect the filter and solenoid valve and metering valve for proper operation.

To clean the orifice of the metering valve, open the metering valve fully (about two turns from the set position) to flush out any dirt particles. Close valve and re-open six turns. This is the proper operating setting for the meter valve for ammonia. On freon, the proper setting is two turns.

The metering valve is set and held in place by a locking knob. The knob may be unlocked by using a small Allen wrench provided. It is taped inside the control box. Unlock the knob before making adjustments.

Operation of Counter

The purpose of the counter is to count the number of times the purge gas solenoid (#5) opens to feed air into the water bubbler. It does not monitor the duration of the purge time but just the number of times the solenoid valve is operated. To reset the counter to zero, push the knob on the face of the counter. The orifice is sized to remove approximately 2 cubic feet of non-condensable gas per minute.

The counter can be used to measure non-condensable gas activity. If daily or weekly record is logged, then any abnormal increases in the amount of non-condensable gases can be noted and corrective measures can be taken to determine the source of the air leak.

Operation of Purge Gas Orifice

All purgers shipped after January 3, 1989 incorporate a metering orifice disc in the purge gas line to the water bubbler, located inside of the inline 30 PSID check valve. This 1/32 dia orifice meters the non-condensable gas into the water bubbler to prevent over or under feeding. The 1/4" NPT gage valve should be opened fully during operation and closed for pump out or when service work is performed. (Purgers shipped prior to 1989 use the gage valve as an orifice and the valve was set at 1/8 turn open, which bleeds adequate air to the bubbler; more than 1/8 turn open causes excess water bubble action.) See illus. 6 on page 12.

Operation of Level Master Control

The purpose of the Level Master Control is to maintain the liquid level in the flooded evaporator. During start-up, the liquid line opens to feed liquid refrigerant to the Level Master. The Level Master will feed liquid until the level in the flooded evaporator reaches the level of the sensor. During operation of the purger, the Level Master acts as a make-up device to maintain the liquid level. However, approximately 95% of the liquid used in the evaporator is from the condensed liquid that is fed through the liquid metering valve.

Liquid Drainer

The liquid drainer is used to remove any condensed liquid that trickles down the purge lines into the purger. In this way the purger is always condensing gas rather than having liquid entering the condensing section of the purger and preventing proper operation. (Liquid Bound) However, if too much liquid comes down the "Foul Gas" line due to improperly piped condensers, corrections must be taken to eliminate the problem. Too much liquid can be determined by noting the condition of the stainless steel line running from the outlet of the liquid drainer to the inlet feed. The stainless steel line will frost and defrost as small amounts of liquid are released into the flooded evaporator. If the line is continuously frosted, then it is an indication one or more purge points are flooded with liquid.

Leak Test

Use standard refrigeration procedures to check AUTO-PURGER for leaks before placing it in service. To confirm a leak-free AUTO-PURGER, manually open the "Foul Gas" solenoid valve (HS8) on the purger by removing the lower seal cap and turning in the stem. Next, manually open one remote purge point solenoid valve, if there is one. Manually open the "Foul Gas" hand shut-off valve and allow pressure to build to 60 psig as shown on the pressure gauge, then turn this valve off. Turn purger switch on front panel to "AUTO". This will open the "VENT" solenoid valve on the purger and pressurize the evaporator section of the purger. Check for leaks. Return all solenoid manual opening stems to the automatic position.

Water Bubbler

The AP08, AP16, AP24 and APC AUTO-PURGERS are equipped with a Water Bubbler. Non-condensable gas from the AUTO-PURGER flows through the Water Bubbler where the residual ammonia is absorbed into the water. The water, with absorbed ammonia flows to a drain. A water solenoid valve opens each time the non-condensable gas solenoid opens to automatically replenish water to the bubbler. A 30 second time delay permits the water solenoid valve to remain open after the purge gas solenoid closes (float switch magnet pulls in).

Install a 1" PVC or 1" galvanized steel Drain Line. Do not use copper for Drain Line. Do not install any shut-off valves in Drain Line. Water should free drain to sewer, or may be piped up to 10' above Water Bubbler if line is kept free of accumulation of dirt and mineral deposits and a protective wire mesh is installed around clear tube. Support the Drain Line to prevent undue stress on Water Bubbler. Initially, fill Water Bubbler with water through the 3" threaded plug located on top. Keep plug threads lubricated and tighten hand tight. Check for leaks at hose fittings.

Start-Up

Models AP01, AP08, AP16, AP24 and APC

Check piping and electrical connections. (Read sections on "Piping Instructions" and "Electrical Connections" in this bulletin.) Open "Foul Gas", liquid and suction line shut-off valves. Open purge gas gage valve. On Models AP08, AP16 and AP24 open water shut-off valve. Turn the purger switch for Models AP08, AP16 and AP24 located on the front panel of the control cabinet to the "AUTO" position. Be sure 7-day time clock in "ON".

The AUTO-PURGER will begin a "COOL DOWN" stage of operation. A "PURGER COOLING DOWN" light on the front panel will indicate this stage. This stage of operation is necessary to allow the purger to cool to a temperature where good separation of non-condensable gas and ammonia will occur. The AUTO-PURGER will not condense any "Foul Gas" nor allow non-condensable gas into the Water Bubbler until the temperature of the evaporator reaches approximately 20°F. It should take 5 to 15 minutes depending on suction line temperature to reach 20°F.

Operation

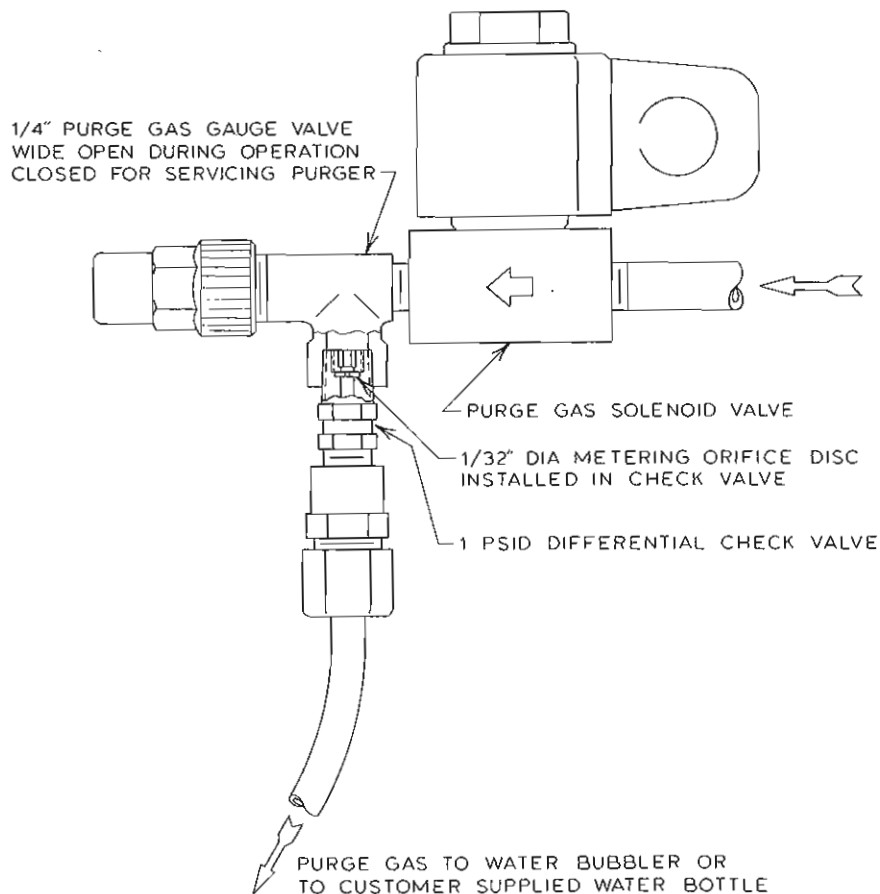
A thermostat with a sensor located on the horizontal portion of the purger will actuate when temperature reaches 20°F and condensing of "Foul Gas" will begin. This is indicated by the "AUTOMATIC" light located on the front panel of the control panel. This also energizes the timer board to operate the first purge point solenoid valve. If the front panel knob is set to one of the "MANUAL" purge point positions that purge point solenoid valve will open. The purger will purge only from that position as long as the knob is positioned at that purge point.

For Model AP01 AUTO-PURGER, the "Foul Gas" solenoid valve located on the purger will open and "Foul Gas" from a single purge point will flow to the purger. If several points are purged, then the plant operator must, from time to time, manually open and close the hand shut-off valve for each purge point. One point should be open at any time.

Purger Pump-Out Procedure, With Purger On

1. Close purge gas gage valve to Water Bubbler
2. Close liquid line hand shut-off valve
3. Close "Foul Gas" line hand shut-off valve
4. Close water line valve

Purger will pump down in several hours. To speed procedure up, attach ammonia hoses to oil drain valves and drain into suction line. Close suction line to isolate purger. With electrical on, pressure gage should remain at zero psi.



SECTION III SPARE PARTS

SPARE PARTS LIST

Electrical

<u>Part No.</u>	<u>Description</u>
20-1202	LED Light - Red
20-1203	LED Light - Yellow
20-1204	LED Light - Green
1827512	Solenoid Coil - 120V/60HZ/14 Watt
20-1424	7-Day Time Clock
20-1130	Purger Control Board Less Plug-In Connector
20-1536	Purger Control Board (Same as 20-1130 but 220 Volt)
20-1499	Purger Control Board w/Plug-In Connectors (Replaces Older Boards with Screw Terminals)
20-1131	8-Point Timer Board, Less Plug-In Conn.
20-1500	8-Point Timer Board w/Plug-In Conn. (Replaces Older Boards with Screw Terminals)
20-1205	Transformer - 115V/60HZ - 24V/60HZ
20-1307	Thermostat
20-1498	Time Delay Relay, 1 Hour Fixed with Off Switch
20-1280	4-Digit Counter with Reset, 120 Volt
70-0100	HS2 (Brass) Water Solenoid Valve Only-Less Coil, 1/4" FPT (6)
70-1013	HS2 Solenoid Valve Only-Less Coil, 1/4" FPT (2 and 3)
70-1015	HS2 Solenoid Valve Only-Less Coil, 1/2" FPT (1)
70-0153	HS2 (Purge Gas Solenoid) with Neoprene Seat 1/4" (5)
70-1016	HS8 Solenoid Valve Only - Less Coil (4)
20-1182	Asco Solenoid #8262C80N, 1/4" Connection 120 Volt (Old Model)
20-1538	Repair Kit for Asco Solenoid, Asco Part #302-020 (Old Model)

Mechanical

<u>Part No.</u>	<u>Description</u>
20-1179	Level Control Valve
20-1441	Power Element, Level Control Valve
HLLSW	Float Switch Assembly
20-1142	Float Ball Assembly
20-1396	Water Bubbler Assembly (w/End Conn.)
20-1212	Gasket - Top Adapter
20-1186	Metering Valve
20-1198	Metering Valve Seal Kit
20-1214	Check Valve Seal Kit
78-1002	1/2" Strainer
70-1010	Plunger Kit - Teflon Seat (Solenoids 1,2,3,4)
3.2F0226	Plunger Kit - Neoprene Seat (Solenoids 5 & 6)

SECTION IV AUTO-PURGER OPERATION

The AUTO-PURGER 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 the purger.

Start-Up

On start-up, the AUTO-PURGER first enters a "COOLING DOWN" step. In this step, refrigerant fills the purger and cools the purger down to temperature. Both the flooded evaporator and high pressure air separator chamber are filled at the same time. The liquid line solenoid (#1) opens to feed refrigerant to the liquid Level Master control valve. The liquid Level Master control valve opens to fill the low pressure flooded evaporator. The liquid level sensor located in the suction separator chamber senses when the flooded evaporator is full and closes the liquid level control valve. The flooded evaporator is cooled to the suction temperature.

At the same time the flooded evaporator is filling, liquid refrigerant fills the float ball chamber and the air separator chamber through the fill line and 30 psi differential check valve. The refrigerant gas that is formed is vented to suction through the vent solenoid (#2).

As the float ball chamber is filled with liquid refrigerant, the float ball moves up, pulling in the magnet of the liquid level float switch to activate the electrical switch and turn off the vent solenoid valve (#2).

The purger continues to cool down. A thermostat with sensor bulb attached to the flooded evaporator senses temperature. At approximately 20°F evaporator temperature the factory set the thermostat switches from "COOLING DOWN" to "AUTOMATIC" (OR "MANUAL").

Operation

The thermostat switches the AUTO-PURGER to "AUTOMATIC" when the evaporator temperature reaches 20°F. This opens the "Foul Gas" solenoid valve (#4) and allows the non-condensable gas and refrigerant mixture into the purger.

The "Foul Gas" carries with it a certain amount of condensed refrigerant which is captured by the liquid drainer before it enters the purger's con-

denser coil and is by-passed directly to the flooded evaporator. Otherwise, the liquid refrigerant could fill the purger's condenser and limit the condensing capacity of the Purger.

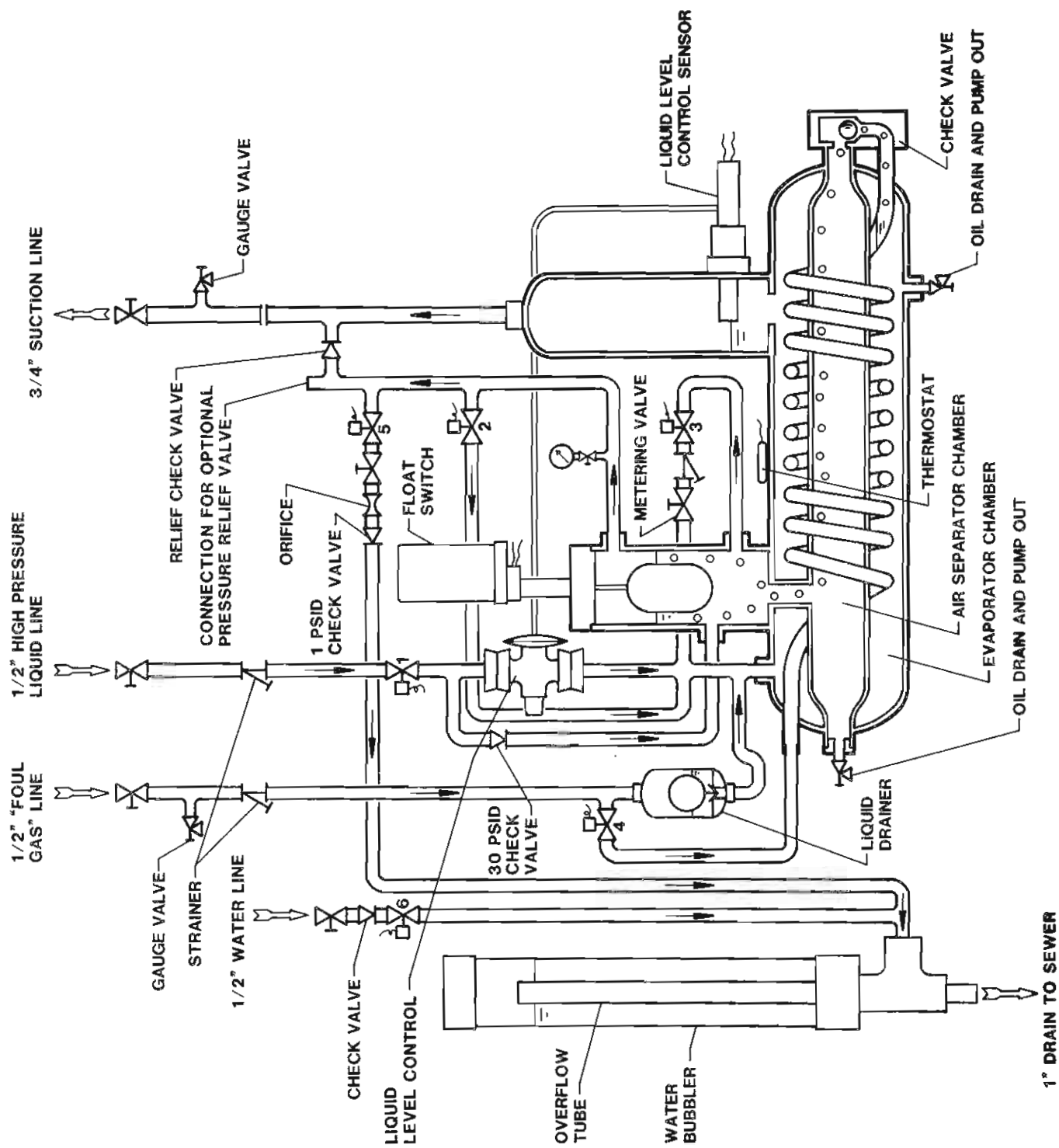
The liquid-free "Foul Gas" enters the purger condensing coil which is submerged in the flooded evaporator. The refrigerant condenses inside the coil as it proceeds to the other end. The now condensed refrigerant and non-condensable gas pass through a check valve and back into the air separator chamber. The condensed liquid refrigerant is removed from the high pressure air separator chamber through the liquid metering solenoid valve (#3) and through a metering valve and into the flooded evaporator.

Meanwhile, the air bounces along the top of the chamber and then into the float ball chamber where it is collected. The collected air gradually depresses the liquid level causing the float ball to fall. This changes the SPDT switch position of the liquid level float switch and opens the non-condensable purge gas solenoid valve (#5) to bleed through the orifice plate into the Water Bubbler (except AP01).

For Models AP08, AP16 and AP24, in addition to the above, the Purger Timer Board will open the remote solenoid valve for purge point #1. (See "Purger Timer Board" section for details.) The Purger Timer Board will operate each remote purge point solenoid in valve sequence, as long as the purger switch on the front panel of the control cabinet is on "AUTOMATIC" and the 7-day time clock is "ON".

Water Flush System

The water flush system consists of the factory mounted water bubbler and water solenoid valve (#6) with water check valve and shut-off valve. Non-condensable gas and water mix in the water bubbler where the residual amounts of ammonia are absorbed. The water is automatically fed to the Water Bubbler through the water solenoid valve (#6). This valve is energized at the same time the non-condensable gas solenoid valve (#5) is energized. (It works off the liquid level float switch.) The ammonia laden water and air are flushed to the drain through the overflow tube. The water solenoid valve remains open an additional 30 seconds after the float switch magnet pulls in. This fills the water bubbler with fresh water, ready for the next purge cycle.



Installation and Operation of APF AUTO-PURGER for fluorocarbon refrigeration systems.

The installation and operation of the AUTO-PURGER for removing air from fluorocarbon systems is very similar to that for an ammonia system.

Piping APF AUTO-PURGERS for Fluorocarbon.

The fluorocarbon refrigerant piping details and sizing are the same as for ammonia. Please note the drain lines on evaporative condensers must be trapped and drop vertically 8' for fluorocarbon condenser per manufacturers recommendation to prevent possible back-up of liquid into one or more condenser circuit resulting in a flooded purge point. While the air indicating column (water bubbler) is included, the water line and drain line are not required. Purge points are at the same locations as for ammonia. (See Page 2 and Fig. 2) On evaporative condensers, the purge point is on the top of the outlet drain line. Although air is lighter than fluorocarbon gas, the air still collects at or near the outlet.

Filter Dryer Conditioning System

The special construction features for the APF series purger include a filter dryer conditioning system for the foul gas line and liquid line. (See Fig. below) Water vapor as well as non-condensable gas is present at the purge point. The filter dryer removes this moisture prior to entering the purger. A filter dryer is also located on the

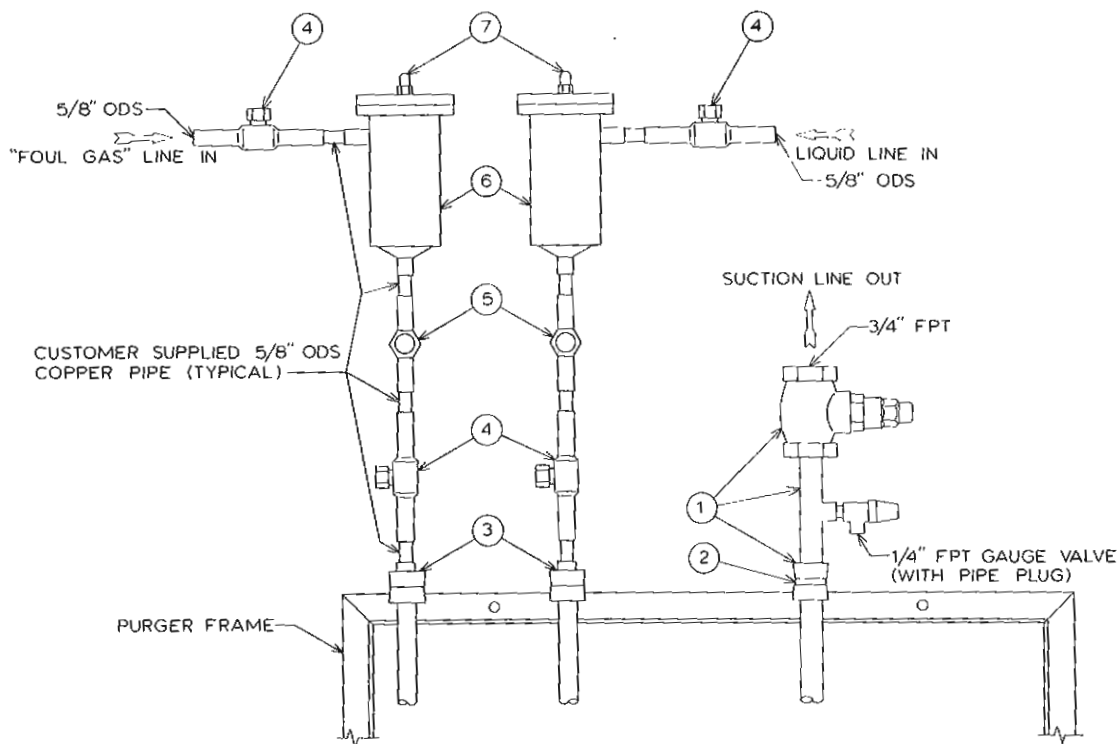
liquid line. Both dryers are used to protect the purger from water freezing stoppage but they also act as a supplemental water removal method to the primary system liquid line dryers. Sight glasses located downstream of the dryer indicate when the dryers are saturated with water and require new filter dryer cores.

Another feature is a small dryer in place of the strainer and prior to the metering valve to filter small particles and capture residual moisture present in the purger.

The metering valve is sized for fluorocarbon. The normal setting is two turns open as compared to 6 turns open for the smaller orificed ammonia metering valve.

Air indicating column for Fluorocarbon.

The APF series purger is equipped with an air indicating column which replaces the ammonia absorption water bubbler. The clear tube is manually filled to the marked line with a light weight clear oil or water. Air expelled from the purger bubbles up through the column as an indication to the operator of proper operation of the purger. Additionally, a counter keeps a record of how many times the purge gas solenoid valve opens to release air into the column.



SECTION VI TROUBLE SHOOTING PURGER OPERATION

Purger does not operate when switch is turned on.
("AUTOMATIC" or "MANUAL" selection)

1. REASON: No power to purger
SYMPTOM: "ON" and "PURGER COOLING DOWN" lights off
CHECK: 120 volts at "LINE" and "NEUTRAL" terminal in control box
ACTION: Check voltage source

2. REASON: No power to purger board 20-1130
SYMPTOM: Red LED light on purger board not lit
CHECK: VOLTAGE TO BOARD
Voltage between terminal "RL" and "COMMON" should be 120V/60HZ

3. REASON: 7-Day Timer not "ON"
CHECK: Time setting on timer
ACTION: Set time per instructions

4. REASON: Fault in wiring to purger board
CHECK: Leads 36, 37, 38 and 46 for continuity
ACTION: Repair if defective

5. REASON: Transformer faulty
SYMPTOM: Red LED light off but power at terminal "RL"
CHECK: 24V between lines 43 and 44
ACTION: No voltage: replace transformer
If voltage okay go to 6

6. REASON: Short in 12V DC circuit
SYMPTOM: Red LED light on purger board 20-1130 will go out if there is a short. Purger board has built-in safety circuit to turn itself off if overload occurs. Purgers shipped beginning January 1989 have a 1 amp fuse mounted on purger board 20-1130. If fuse blown, replace fuse after completing following "CHECK" step
CHECK: Disconnect purger cables 20-1195, 20-1197 and terminal plug connections 22 through 26. Red LED light on purger board now lights
ACTION: Plug in each cable separately to determine which circuit has ground short. (Red LED light will go out) Repair short. If LED does not light replace circuit board

7. REASON: Fault in purger cable 20-1195
SYMPTOM: "ON" light off but red LED light on purger board on

CHECK: Voltage at terminal 1 should be 12V DC

ACTION: No voltage - check continuity of cable 20-1195 and repair
If voltage - go to step 8

8. REASON: Faulty rotary switch
SYMPTOM: No voltage at terminal 2 when rotary set to "AUTOMATIC" position
ACTION: No voltage - check wiring on Leads 1 and 2 and rotary switch
If voltage - go to step 9

9. REASON: Fault in purger cable 20-1195
SYMPTOM: "ON" light and LED light are on but purger not operating
CHECK: Continuity of line 2 on purger cable 20-1195
ACTION: Fix fault
If voltage to purger board through line 2 is 12V DC, then fault on purger board. Replace purger board 20-1130

Trouble Shooting Timer Board Operation.

1. REASON: No voltage to Timer Board
SYMPTOM: Red LED light not on
CHECK: Voltage on cable 20-1197 leading from purger board. White wire is neutral and black and gray wires are 12V DC when purger is in "AUTOMATIC" position
ACTION: Repair discontinuity
CHECK: If cable 20-1197 is okay, check for 12V DC at terminal 4 on door panel
ACTION: If no voltage, check wire 4 for continuity

2. In "AUTOMATIC" purge point lights do not operate
REASON: Fault in timer board cable 20-1196
SYMPTOM: Purge point solenoids operate but lights do not light
CHECK: Continuity of each line
ACTION: Repair fault

3. In "AUTOMATIC" all purge point lights on
REASON: Fault in purger board to timer board cable 20-1197
CHECK: Continuity of each line
ACTION: Repair fault

4. REASON: Purge point solenoid valve does not operate

CHECK: Two amp fuse for fault
ACTION: If faulty, replace
CHECK: Voltage at terminal "RL". Voltage should be 120V/60HZ
If no voltage, check continuity of Leads 42

CHECK: One hour time delay limit powering purge gas solenoid valve exceeded

ACTION: Turn delay relay off momentarily to reset one hour time delay. For more information see Section II, Purge Gas Solenoid Valve Time-Delay Cutout

Purger does not switch from "PURGER COOLING DOWN" to "AUTOMATIC" or "MANUAL OPERATION"

1. REASON: Suction temperature too high
CHECK: Suction pressure at purge suction line connection
ACTION: Move suction line to lower temp suction, or reset thermostat to higher temperature. (Call factory before changing thermostat setting.)
2. REASON: Restriction in suction pressure
CHECK: Line size and hand valves. Suction line should be a minimum of 3/4" size
ACTION: Remove restriction
3. REASON: Evaporator not filled with refrigerant. Liquid line blocked
CHECK: Float switch magnet should pull in within 5 minutes after turning purger on
ACTION: If magnet does not pull in, check liquid line shut-off valve; liquid line solenoid valve voltage (120V at terminal 28); continuity of liquid line solenoid coil; liquid line strainer; plastic shipping cap left in line
4. REASON: Evaporator not filled with refrigerant - Sporlan line level control not working
CHECK: Frost at outlet of valve. If no frost, check for 120V at terminal 35. Check continuity of heater. Check for broken or pinched capillary tube
ACTION: Replace power element 20-1441

2. REASON: Liquid feed line plugged
SYMPTOM: Purger appears to be operating properly. Liquid feed line not frosted
CHECK: Metering valve 20-1186 for restriction
ACTION: Unlock metering valve knob using small Allen wrench taped inside control box and open wide to clear any dirt plugging orifice. Close metering valve and re-open to 6 turns open.
CHECK: Liquid Feed Solenoid Valve
ACTION: Check liquid feed solenoid to see if it is energized. If feed line does not frost, strainer or line is plugged and must be disassembled to find cause of blockage. See Pump-Out Procedure Section IV
3. REASON: "Foul Gas" line is flooded with liquid
SYMPTOM: Stainless steel line from bottom of liquid drainer to inlet of evaporator is always frosted. During proper operation, line should frost and defrost periodically
CHECK: Refer to Section I for condenser piping recommendations
4. REASON: "Foul Gas" line not open
SYMPTOM: Pressure gauge on purger reading 20-30 psi below liquid line pressure
CHECK: Close "Foul Gas" hand shut-off valve. If pressure falls 20-30 psi at pressure gauge located on purger, "Foul Gas" line is open. If pressure remains the same, then:
ACTION: Check for purge point solenoid not electrically energized or stuck closed. Check for hand valves not open. Check foul gas solenoid valve on purger for proper operation. To check for sticking solenoid valve, use manual opening stem to open valve. Observe if pressure increases
5. REASON: Liquid line pressure at purger 20 psi or higher than condensing pressure

Air is not released from purger

1. REASON: Time delay relay 20-1328 time limit exceeded
SYMPTOM: Magnet on float switch away from steel tube, water solenoid on and non-condensable gas to atmosphere light is on

SYMPTOM: Liquid line pressure at purger higher than condenser pressure

CHECK: Put pressure gauges at liquid line and "Foul Gas" line to check pressures. Check for high static head of liquid and/or pump boosted liquid line pressure

ACTION: For high static head, install a pressure reducing HAZBL - Differential Pressure Regulator in the liquid line. For boosted pump liquid problem, take liquid line from location before pump

6. REASON: Purge point solenoid coil burned out

SYMPTOM: 2 Amp fuse blown (do not increase ampacity of fuse)

CHECK: Coil resistance in each coil for shorted coil

QUICK CHECK: Replace blown 2 amp fuse with another 2 amp fuse. Advance purge points with advance button unit fuse blows. Faulty coil or wiring is now pinpointed

ACTION: Replace coil and 2 amp fuse

Ammonia released from purger.

1. REASON: Purge gas solenoid valve seat leaking

SYMPTOM: Slow leak of gas, non-condensable to atmosphere light is not on. Magnet is pulled in against tube

CHECK: Solenoid valve for dirt or worn seat

ACTION: Lift float switch assembly momentarily to open valve to clear dirt on seat. If this fails, pump out purger and repair valve

2. REASON: Purge gas line not open

SYMPTOM: Pressure gage on purger does not indicate a drop of 20 - 30 psi when foul gas shut-off valve is closed

ACTION: Check for blown 2 amp fuse in control box. This indicates a burned out purge point solenoid coil. Next, check for valve closed in "Foul Gas" line. Strainer plugged