Industrial
Oil Acid & Moisture Purger[ä]

Installation, Operation & Maintenance Manual

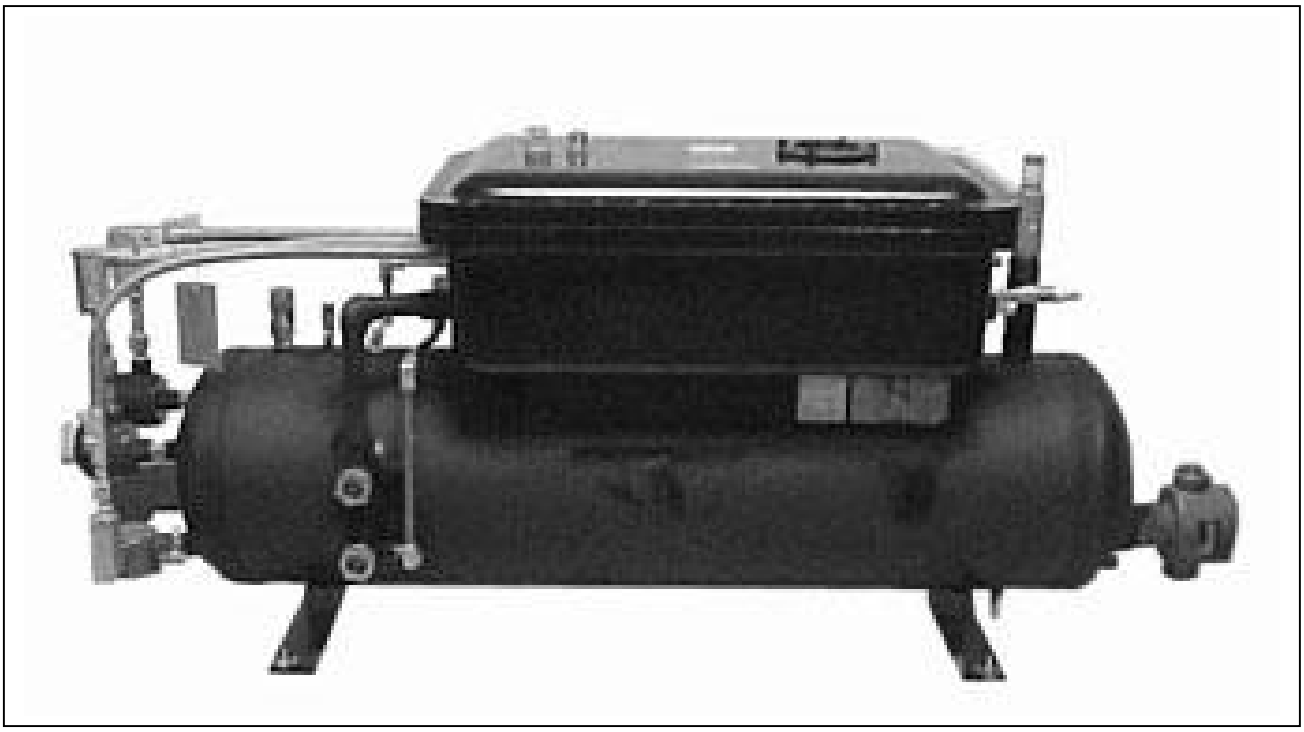
Redi Controls, Inc. Literature File No. 1134-01 Rev 1-27-05

Model: IN-H

for use on

High Pressure Centrifugal Chillers

For use with Refrigerants
R-12, R-22, R-134a, R-500



Patent 6,952,938 B2

Revised Technically as of October 22, 2003
This Copy was Printed on November 8, 2005

GENERAL INFORMATION

YOU ARE URGED TO READ THIS MANUAL COMPLETELY *BEFORE* INSTALLING AND/OR OPERATING THIS UNIT

Upon Receiving Your Unit

Inspect the unit for possible damage caused during shipping. **Contact equipment servicing before attempting to use a damaged unit.**

WARNINGS and Cautions

NOTE: WARNINGS **and** *Cautions* **appear in highlighted boxes as illustrated below at appropriate points throughout this manual. Give special attention to these items.**

WARNINGS: Provided to alert you to special situations that could result in serious personal injury, damage to your equipment, or cause your equipment not to work properly. Warnings may appear in this manual or on the equipment. Heed all Warnings.

Cautions: Designed to alert you to situations that may result in damage to your equipment.

Personal safety and the proper operation of your equipment require strict observance of these precautions.

EQUIPMENT SHOULD BE INSTALLED AND OPERATED ONLY BY QUALIFIED PERSONNEL

WARNING: Certain servicing procedures may expose you to harmful materials and dangerous conditions. To minimize the possibility of injury, follow safety procedures and instructions described in this manual, on product labels and provided in material safety data sheets.

NOTE: *The manufacturer has a continuous equipment improvement policy and reserves the right to change specifications and design of its products without notice*.

Table of Contents

Before You Start…….(MUST READ)

The **OAM Purger** is designed to remove Oil, Acid and Moisture from the refrigerant charge of Centrifugal Chillers and automatically return the oil to the Chiller's oil sump.

This section discusses the proper procedures for installing the OAM Purger.

Warning: You MUST read the INSTALLATION CONSIDERATIONS beginning on page 14 for an understanding of what must be done for the OAM Purger to work.

WARNING: Installing or servicing refrigerant support equipment can be hazardous due to system pressures and dangerous voltages. Only qualified service personnel should work on such equipment.

OAM Purger Specifications

Electrical Power Requirements:……220 / 240 VAC, 60 Hz., 1-Phase, 20 Amp Fused Circuit
Actual current draw Approximately 15 Amps

Dimensions (approximate):…….... 35" height x 77" length x 24" depth

Weight (approximate):…….…….…… 700 pounds

Shipping weight (approximate):…….... 900 pounds

Operating Distillation Temperature:……..…….…. 155 degrees F

Distillation Tank ASME Certified:……..… 400 psig

Average Refrigerant/oil mixture in Purge Tank per distillation cycle:…….…….. 200 lbs.

Average Rate of refrigerant / oil mixture processed per week:……. 10,000 to 12,000 lbs.

Electrical Enclosure Type……..…..Hazardous

Immersion Heater……3.5 Kw with watt density of 5.5 watts per Square Inch

Contents of the OAM Purger Installation Kit

Each "kit" includes: One Installation, Operation and Maintenance Manual.
One (4) core filter-drier shell and cores.
One 3/8" O.D. Inline Oil Filter.
One 1/2" O.D. Refrigerant Strainer
One 3/8" O.D. isolation ball valve
One ½" O.D. isolation ball valve
One ½" O.D. Sight Glass / Moisture Indicator
One Tube of Loctite 567 thread sealant compound
One RED Cylinder Valve with 12 inch dip-tube ***with***
Two 3/8" brass cylinder valve adapter fittings with gasket
Two 5/8' to ½" copper reducers for Refrigeration Filter Drier Shell
One 350 psig Atmospheric Relief Valve (may already be installed)

Field-Provided Items

To be furnished by the installer: OAM Purger mounting hardware.
Hazardous type electrical fittings and conduit materials.
All field piping, connectors and insulation material.
Refrigerant Recovery Cylinder (for collection of excess oil)
7 Gallons of same type oil used in the Chiller
Cylinder of Nitrogen (for leak testing)

Preliminary Inspection

Before installing the OAM Purger, check the data on the Purger nameplate and verify that it is the appropriate model for the application. Make sure the voltage is correct for the application. Visually inspect all components for damage in shipment before installing.

OPERATIONAL OVERVIEW

The ***OAM Purger*** is designed to continually remove ***oil, acid*** and ***moisture*** from a chiller's refrigerant charge and return the oil to the chiller's compressor lubricatio n circuit, ***oil reservoir***, where it belongs. This is accomplished in two phases. The **FIRST Phase** is a ***temporary oil-stripping phase only,*** during which time all excess oil removed from the refrigerant charge is manually disposed of. Depending upon how severe ly the refrigerant charge is contaminated, the initial oil stripping phase can yield many gallons of excess oil, sometimes ranging into ***hundreds of gallons.***

Once the initial ***temporary*** oil-stripping phase is complete the **SECOND Phase**, or ***normalized operation,*** begins. Meaning that from this point on the OAM Purger will automatically maintain the chiller in a state of ***lubrication balance***. Being in lubrication balance is when virtually **100% percent** of the chiller compressor's lubricating oil is maintained within the primary lubrication circuit.

OAM Purger operation is accomplished via a unique ***"Patented"*** process utilizing the properties of ***gravity, heat*** and ***pressure*** exclusively to function. **The OAM Purger does not utilize mechanical pumps of any type.**

The Industrial OAM Purger works by repeatedly extracting from the chiller evaporator (cooler) batches of oil-contaminated refrigerant, ***approximately 200 pounds***, per each cycle. The oil-contaminated refrigerant is then heated via a ***3.5 Kw electric immersion distillation heater***, which causes the liquid refrigerant to vaporize (boil-off) thereby distilling out contaminating oil. When the temperature of the accumulated distilled oil reaches ***155 degrees F*** it is essentially pure oil, wherein it is automatically returned to the chiller's oil reservoir (sump).

The OAM Purger operates around the clock non-stop as long as power is applied, whether or not the chiller is operating, and process between ***10,000*** and ***12,000 pounds of contaminated refrigerant weekly.***

How the OAM Purger Works

OAM Purger operation is ***cyclic*** and ***non-stop*** so long as power is applied. Each complete purge cycle, comprises ***(3) three operational phases***, and takes approximately ***3 to 3 ½ hours to complete.***

The Three Operational Phases:

Phase 1 or **"Fill Phase": *Oil contaminated refrigerant*** flows by ***gravity*** from the chiller evaporator (cooler) into the OAM Purger ***distillation vessel***. This phase is initiated automatically on initial power-up or any time power is interrupted and reapplied. During normal operation, the Fill Phase always follows the Oil Return Phase.

Phase 2 or **"Distillation Phase":** The Distillation Phase always follows the Fill Phase. During the Distillation Phase the ***3.5 Kw immersion distillation heater*** is energized heating the oil contaminated refrigerant causing the liquid refrigerant to vaporize (boil-off) pressurizing the purge vessel. When vessel pressure exceeds the pressure setting of the ***Distillation Pressure Regulator (DPR-1)*** the regulator begins cracking open allowing over pressure to flow from the vessel to the lower pressure chiller evaporator (cooler).

In the process, any entrained oil in the liquid refrigerant is distilled out and accumulated in the purge vessel. When the temperature of the accumulated distilled oil reaches ***155 degrees F*** the distillation phase terminates and the ***"Oil Return Phase"*** is initiated. Duration of a typical Distillation Phase is approximately **1½** to **2½ hours*.***

Phase 3 or **"Oil Return Phase":** During the Oil Return Phase distilled oil accumulated during the Distillation Phase is automatically transferred (pushed by vapor pressure maintained within the Distillation Vessel by the ***Distillation Pressure Regulator DPR-1***) from the purge vessel to the chiller's compressor lubricating circuit (oil reservoir). The Oil Return Phase is a ***27 minute*** timed phase. 27 minutes allows more than ample time for all accumulated oil to be returned to the chiller reservoir. If all of the oil accumulated during the Distillation Phase is returned to the chiller before expiration of the 27 minute timed period, purge vessel pressure simply equalizes through the oil return circuit to chiller oil reservoir pressure then waits until the cycle times out. At the conclusion of the Oil Return Phase ***oil level in the purge vessel will be at about mid-level in the lower sight glass.***

How the OAM Purger returns distilled oil to the Chiller oil reservoir

During the Distillation Phase pressure in the Purge Vessel is maintained by the ***Distillation Pressure Regulator (DPR-1)*** at a pressure approximately **20** to ***25 psig*** higher than the static ***(off-line) pressure corresponding to 90 degrees F temperature for the refrigerant in the chiller***.

Example: Pressure of ***R-134a at 90 degrees F is 104 psig.*** Thus: 104 psig + 20 = ***124 psig***. Therefore, on an R-134a chiller application the ***Distillation Pressure Regulator (DPR-1)*** would be set to maintain ***124 psig*** in the purge vessel during the Distillation Phase. Thus, the pressure maintained in the Distillation Vessel will always be greater than that in the chiller under any circumstance and thereby assuring sufficient pressure to push accumulated oil back to the chiller's oil reservoir.

CAUTION: If Distillation Pressure Regulator DPR-1 is set too low the OAM will not transfer oil back to the chiller's oil sump during the Oil Return Phase and the oil level in the sump will begin to drop because the oil is being trapped in the OAM Vessel. Therefore, if the sump begins to loose oil this is an indication that the OAM Purger may not be functioning. <u>DO NOT ADD OIL</u> until you verify the OAM Purger is functioning properly and that the *Distillation Pressure Regulator DPR-1* is set at the proper pressure.

One way to visually determine if the OAM Purger is returning oil to the chiller is to monitor the two vessel sight glasses during an ***Oil Return Phase.*** The oil level must drop to the ***mid-level of the lower sight glass*** during the Oil Return Phase. Therefore, if the oil level fails to return to the mid-level of the lower sight glass by the end of the Oil Return Phase then there is a problem. You will have to diagnose the problem but the most likely problem is that Distillation Pressure Regulator (DPR-1) is set to too low of a pressure setting. ***Refer to "Initial Start-Up Procedure" page 24 for calibration of Distillation Pressure Regulator DPR-1.***

WARNING: Having to add oil to the chiller's oil sump is an indication that the OAM Purger is probably malfunctioning, and continually adding oil will ultimately result in the OAM Purger becoming completely oil logged (filled to the 70% percent level with oil.) Should this occur you will have to Isolate the OAM Purger from the chiller and manually drain the excess oil from the OAM Vessel down to the mid-level of the lower sight glass. ***NEVER DRAIN BELOW THE MID-LEVEL OF THE LOWER SIGHT GLASS. DOING SO MAY DAMAGE THE DISTILLATION HEATER.***

Operating Parameters

FILL PHASE: The Fill Phase is initiated on initial power-up or any time power is removed and reapplied, and also at the conclusion of each Oil Return Phase. The ***Fill Phase*** is automatically terminated by ***Ultra Sonic Liquid Level Sensor (LLS-1)*** upon liquid level in the distillation vessel rising to the ***70% percent full level.*** Upon activation of LLS-1 the Fill Phase terminates and the Distillation Phase begins.

DISTILLATION PHASE: During the Distillation Phase the ***3.5 Kw electric immersion Distillation Heater*** is energized heating the contaminated refrigerant. In the process the liquid refrigerant vaporizes (boils-off) leaving behind distilled oil.

As the liquid refrigerant boils-off pressure in the purge vessel rises. When vessel pressure exceeds the setting of ***Distillation Pressure Regulator (DPR-1)*** the DPR begins cracking open relieving over pressure to the lower pressure chiller evaporator. Once all refrigerant has completely vaporized off the temperature of the distilled oil begins rising. Upon reaching ***155 degrees F***, as sensed by heater thermostat ***(TS-1)*** and Temperature Sensor ***(TS-2)***, the Distillation Phase is terminated and the Oil Return Phase initiated.

NOTE: Both (TS-1) Heater Thermostat and Temperature Sensor (TS-2) <u>MUST</u> signal the Purgers Solid State Logic Board that the proper oil temperature has been reached before the Oil Return Phase will initiate.

Actual distillation time typically ranges between approximately **1.5** and ***2.5 hours*** depending upon the ***severity of oil contamination, temperature of the liquid refrigerant entering the distillation vessel during the fill phase*** and ***ambient temperature***.

OIL RETURN PHASE: Upon initiation of the Oil Return Phase ***Oil Return Ball Valve (BV-3)*** energizes (opens) allowing pressure in the purge vessel to push any oil accumulated during the Distillation Phase back to the chiller's oil reservoir (sump). The Oil Return Phase is a ***27 minute timed phase.***

OIL DISTILLATION TEMPERATURE: Oil Distillation Temperature is controlled via an integral ***Distillation Heater Thermostat (TS-1)*** which limits distillation temperature to a maximum temperature of ***155 degrees F***.

DISTILLATION PRESSURE: Distillation pressure is regulated by ***Distillation Pressure Regulator (DPR-1).*** The regulator ***must*** be set at a pressure between ***20 to 25 psig*** higher than the chiller's static ***(OFF-Line) pressure corresponding to 90 degrees F temperature.*** Refer to the following settings for various refrigerants.

Typical Distillation Pressure Regulator (DPR-1) Settings:

R-12 ..... 120 ***psig***
R-22 ..... 188 ***psig***
R-134a ..... 124 ***psig***
R-500 ..... 140 ***psig***

REFRIGERANT PROCESSING CAPACITY: The OAM Purger processes approximately ***10,000 to 12,000 pounds*** of refrigerant per week. This means that each week this amount of the chiller's refrigerant charge is made progressively cleaner until virtually pristine. ***To completely clean a chiller's refrigerant charge requires the total charge be processed four to five times.***

Acids and ***moisture*** are also removed in the process of removing oil from the refrigerant. Even after all excess oil has been removed the OAM Purger continues processing the refrigerant. Thus, acids and moisture are continually being removed from the refrigerant even when there may not be any appreciable amount of oil present.

REFRIGERANT-OIL SEPARATION EFFICIENCY: During the ***initial oil-stripping phase*** a certain amount of the chiller's refrigerant charge is unavoidably sacrificed along with the discarded excess oil. Depending upon the refrigerant type the amount of refrigerant that will be sacrificed along with the discarded excess oil will average about ***2% percent by weight***. Thus, approximately ***2 ounces*** **of refrigerant** will typically be **sacrificed with each gallon of oil removed** from the chiller's refrigerant charge.

Example – A chiller with an ***8,000 pound*** refrigerant charge containing ***12.5% percent oil by weight*** will yield approximately ***1000 pounds of excess oil (about 143 gallons).*** Thus, 1,000 pounds (143 gallons) of oil containing 2% percent refrigerant by weight equates to ***20 pounds of refrigerant lost during the initial oil-stripping phase.***

After the initial oil-stripping phase is complete ***only trace amounts*** of refrigerant will be contained in the distilled oil returned to the chiller's oil reservoir. During the normal-operation phase, since the oil is being returned to the oil sump, there will be no loss of refrigerant.

INSTALLATION CONSIDERATIONS..... (MUST READ)

There are too many different types of chillers and specialized one-of-a-kind engineered industrial chillers to possibly formulate a single all encompassing installation manual. However, certain aspects of all chillers are universal, such as they all have an evaporator, condenser, compressor, lubrication system, piping and valves etc.

It is assumed the installer is knowledgeable about the workings of the chiller on which the OAM Purger is to be installed. Therefore, when in this manual the installer is instructed to perform a certain task or to connect to a particular point on the chiller it will be ***entirely up to the installer to evaluate and determine the appropriate action to take or place on the chiller to connect.***

WARNING: It is absolutely imperative that installation of the OAM Purger be done *ONLY* by *personnel qualified* to work on the particular chiller system on which the OAM Purger is to be installed. The installer is *admonished to thoroughly read and understand the entire OAM Purger Manual prior to starting actual installation.* The installer is encouraged to call Redi Controls for technical assistance if there are any doubts or questions regarding installation of the OAM Purger. 1 317-865-4130

NOTICE: The following is a list of criteria that MUST be followed during installation…

1. The OAM Purger Vessel ***must be mounted horizontal.***
2. The vessel's **INSULATION *must*** remain intact at ALL times.
3. The entire **Fill line and all its components including the Fill Port** on the OAM Purge vessel **MUST** all be a minimum of **2 inches below the lowest anticipated liquid refrigerant level in the evaporator** *(cooler).*
4. The entire "FILL" Line and all line components and connections between the OAM Purger and the chiller evaporator ***must*** be thoroughly **insulated** to prevent vapor locking.
5. The vapor return (equalization) line ***must*** connect to the chiller evaporator at a point ***above the liquid level.***
6. Distillation Pressure Regulator (DPR-1) ***must*** be set to the ***appropriate pressure for the refrigerant type in the chiller.***
7. Distillation Heater Thermostat (TS-1) ***must*** be set at ***155 degrees F*** at ***all times.***
8. Before the OAM Purger is put into operation for the first time, the purge vessel ***must*** be pre-charged with the ***same oil as is used in the chiller***. Charge oil to the mid-level of the lower sight glass, approximately ***(7) seven gallons.***
9. There ***must not*** be any ***sagging or traps*** in the Vapor Return (Equalization) line.
10. You may need to add make-up refrigerant to the chiller to compensate for the **volumetric *lost via excess oil removed during the initial oil-stripping phase.***

OAM Purger Placement (Location) & Mounting

Place the OAM Purge vessel horizontally ***direct on the floor*** as close to the chiller evaporator (cooler) as possible. Because **the OAM Purger Model IN-H is top heavy**, it MUST be anchored to the concrete floor using four (4) ½ inch concrete anchor bolts. It must also be mounted in such a way as to allow the enclosure lid to be opened wide enough for safe servicing, but in such a way as to prevent the lid from opening all the way thereby causing the unit to become excessively top heavy. Ideally, the purger should be mounted adjacent to the chiller in such a manor as to allow the enclosure lid to rest against the chiller at about a 20 degree angle when opened.

The OAM Purger ***must be as low as possible*** relative to the liquid refrigerant level in the evaporator, the greater the level differential the better.
In **ALL** instances the liquid refrigerant level in the chiller evaporator **MUST** be a ***minimum of 2 inches above the highest anticipated part of the gravity fed liquid refrigerant "FILL" line and its components.***

Installing the Distillation Heater

The Distillation Heater is shipped uninstalled and separate from the OAM Purge vessel. This is necessary in order to prevent damage to the heater elements during shipment.

1. Uncrate Distillation Heater.
2. From the Installation Kit select the tube of Loctite 567 thread sealant compound and thoroughly **apply to ALL of the heater threads**.
3. Remove 2 ½" shipping plug from distillation vessel
4. Install heater into distillation vessel.
5. **Tighten heater fitting as tight as possible. This and the liberal use of Loctite is necessary to prevent leaks.**
6. Before proceeding to Step 7, and before installing electrical conduit, you MUST first pressurize the purge vessel and leak test the heater threads.
7. Refer to the "***Electrical Connection" section on page 21*** for instructions regarding the ***hazardous rated*** electrical conduit and fittings to be used in the installation of the heater. Then install the appropriate conduit and fittings between the heater and purger enclosures. Pull the six (6) power wires and one (1) ground wire from inside the electrical enclosure. Connect the ground wire to the grounding lug in each enclosure. Wire-nut the six (6) power wires to the six (6) number coded pigtail wires provided in each enclosure.

Plumbing the OAM Purge

WARNING: DO NOT OPEN any chiller valves during installation of the OAM Purger system until instructed to do so.

Plumbing the gravity fed liquid refrigerant "FILL" Line… Refer to Figures 2, 3 & 4 pages 43, 44, 45

Before plumbing the gravity fed liquid refrigerant "FILL" line you must first determine where on the chiller evaporator you will make the connection. Where you connect the "FILL" line will determine how effective the OAM Purger will be. Connecting to the wrong place may render the OAM Purger altogether ineffective.
Most large industrial chillers either have or have had some sort of quasi oil recovery system. Although most of these systems are not very efficient they do usually have a piping connection at the appropriate place on the evaporator shell to access the ***most oil laden refrigerant.***

Whenever possible the OAM "FILL" line must be connected to the same point on the evaporator as was the now defunct oil recovery system.

NOTE: If the installer has any questions regarding where to connect the "FILL" line call Redi Controls for technical assistance. 1 317-865-4130.

NOTE: Before you begin plumbing the "FILL" line remember, the entire Fill line and all its components including the Fill Port on the OAM Purge vessel MUST all be a minimum of 2 inches below the lowest anticipated liquid refrigerant level in the evaporator.

Begin by selecting the following components from the Installation Kit:

1. (4) core filter-drier shell
2. ½" O.D. isolation ball valve
3. ½" O.D. Strainer
4. ½" O.D. Sight Glass / Moisture Indicator
5. Tube of Loctite 567 thread sealant compound

Plumb the "FILL" Line and components as shown in Figure 3 page 44

1. Using ***½" minimum" O.D. copper tubing*** plumb the "FILL" line between the OAM Purger and the chiller evaporator per above guidelines and as illustrated in ***Figures 3 page 44.***
2. ***Insulate entire "FILL" line*** **including the filter-drier shell and all components, fittings and valves in the line**.
3. Install filter cores at this time.
4. **DO NOT** open any valves at this time.

Plumbing the "Vapor Return" (equalization) Line

The Vapor Return (equalization) Line can be connected to any point on the chiller evaporator (cooler) ***above the liquid refrigerant level. See steps below and Figure 2 page 43.***

1. Using ***½" O.D. minimum*** copper tubing, plumb the ***outlet*** of the **Distillation Pressure Regulator (DPR-1)** to an appropriate ½" stop valve on the chiller evaporator.

WARNING: If you are going to install a *temporary oil collection cylinder* you must include an inverted trap in the "Vapor Return" Line where it connects to the chiller, *see figure 2 page 43.*

2. On ***outdoor applications*** or anytime the Vapor Return Line exceeds ***10 feet*** in length ***insulate the entire line.***

WARNING: Avoid *sagging and/or traps in the Vapor Return Line* where refrigerant vapor can condense and accumulate *creating a blockage.* A blockage will prevent the purge vessel from equalizing to evaporator pressure during the "Fill" Phase, thus preventing gravity flow of refrigerant from the evaporator into the purge vessel.

Plumbing "Oil Return" Line for Initial Oil Stripping Phase

(Normally a ***temporary*** connection to a large capacity oil recovery vessel, ***typically a refrigerant recovery cylinder***, will be made)

WARNING: Read and understand the following information about removing excess oil <u>BEFORE</u> plumbing the Oil Return Line.

Because of the extraordinary size of refrigerant inventories generally associated with most large tonnage industrial chillers the potential volume of excess oil that may be recovered during the initial oil-stripping phase can be significant, often measured in hundreds of gallons.

Therefore, you **<u>MUST</u>** plan ahead and make provisions for how you intend to deal with the potentially large volume of excess waste oil involved.

The best and least troublesome way to deal with the problem is to ***temporarily*** connect a large capacity recovery vessel (typically a refrigerant recovery cylinder) to the Oil Return port on the OAM Purger to collect the excess distilled oil. Then, once ***all*** excess oil has been stripped from the refrigerant charge to then remove the temporary cylinder and permanently plumb the OAM Purger to the chiller. The least troublesome way to deal with the problem is to select a recovery cylinder of sufficient capacity to contain **<u>all</u>** of the anticipated excess oil.

Estimating potential amount of excess oil that will be recovered during the initial oil-stripping phase

It is possible to make a rough estimate of how much excess oil will be recovered during the initial oil-stripping phase. To do this you need to know the approximate percentage by weight

of oil in the refrigerant. Refer to the latest refrigerant analysis for the chiller involved to find this information. **Then refer to "Refrigerant-Oil Contamination Chart 1" (See Page 49)**.

On "**Chart 1"** plot a line, ***representing the oil percentage indicated in the oil analysis,*** horizontally intersecting the column that approximates the pounds of refrigerant in the chiller. The number given is the approximate pounds of excess oil that will be recovered during the initial oil-stripping phase. ***To convert pounds of oil into gallons of oil divide by (7) seven.***

The **following example** is given to illustrate how significant the volume of excess oil can be:

A ***15,000 pound*** refrigerant charge contaminated with ***20% percent oil by weight*** will yield about ***3,000 pounds*** or ***428 gallons*** of excess oil. Once you know approximately how much excess oil to expect you can better select an appropriate capacity recovery cylinder.

When choosing a recovery cylinder you have ***two choices.*** You can either select a single cylinder of sufficient capacity to contain **ALL** anticipated waste oil, or a smaller cylinder, emptying it several times. ***A choice you <u>DO NOT</u> have is using multiple recovery cylinders.***

WARNING: UNDER NO CIRCUMSTANCE SHOULD YOU CONNECT MULTIPLE CYLINDERS IN EITHER SERIES OR IN PARALLEL TO GAIN CAPACITY!

When selecting the appropriate recovery cylinder it is important to understand that a refrigerant recovery cylinder ***<u>will not</u>*** hold the same weight in oil as its stated capacity for refrigerant. Oil weighs less than refrigerant, therefore it is necessary to compensate accordingly. To calculate a refrigerant recovery cylinders oil capacity ***multiply its stated capacity in pounds of refrigerant times 0.46 to find its capacity in pounds of oil.***

For instance… in the example given above, a 1,000 pound refrigerant recovery cylinder will hold 460 pounds or 65 gallons of oil. Therefore a 1,000 pound capacity refrigerant recovery cylinder will have to be emptied (7) seven or more times.

IMPORTANT NOTE: ***It is also important to understand*** **that since typical refrigeration oil weighs about one half that of liquid refrigerant means that removing** ***3,000 pounds of excess oil*** **from a chiller will reduce the total volume of liquid content in the evaporator equivalent to about** ***6,000 pounds of refrigerant,*** **so it will likely be necessary to add refrigerant.**
However, this does not necessarily mean that you will have to add 6,000 pounds of refrigerant. The evaporator will likely already be overfilled because of the excess oil. Removing the excess oil will likely bring the liquid level in the evaporator to a more normal level. Nevertheless, ***be prepared to add a significant amount of refrigerant both during and at the conclusion of the initial oil-stripping process.***

Oil Recovery Cylinder Preparation & Configuration.
Refer to Figures 2 page 43

Excess Oil Recovery Cylinder Preparation: (In preparation for Temporary hook-up for initial oil stripping.)

1. Calculate required capacity and then select the appropriate recovery cylinder. (See topic immediately before this one for procedure on estimating excess oil in chiller.)

2. From the Installation Kit select the ***RED Cylinder Valve with 12 inch dip tube.***

3. Remove the existing ***red*** cylinder valve from the recovery cylinder and in its place, using the Loctite 567 thread sealant compound provided, ***install the Red cylinder valve from the Installation Kit.***

4. Now, from the Installation Kit select the two 3/8" brass cylinder valve adapter fittings with gasket and install one on each of the two cylinder valves.

Plumbing the "Oil Recovery" cylinder

1. Place the recovery cylinder near the OAM Purger, preferably on the right-hand side.

2. Using 3/8" O.D. copper tubing connect the ***Oil Return*** fitting on the OAM Purger to the ***BLUE*** cylinder valve on the recovery cylinder.

3. Using 3/8" O.D. copper tubing run a line from the ***RED*** cylinder valve on the recovery cylinder to any point on the chiller evaporator ***above the liquid refrigerant level***, and construct an inverted trap in the "Vapor Return" Line and tee in as illustrated in ***figure 2***. **page 43.**

DO NOT OPEN any valves at this time.

How the temporary Oil Recovery Cylinder works… Refer to figure 2 page 43.

The dip-tube of the **"RED"** valve limits oil filling of the cylinder to about ***80% percent full.*** This dip-tube and the initial plumbing of the oil return line to the chiller evaporator is a ***safety feature to prevent overfilling of the recovery cylinder.*** As oil accumulates in the oil recovery cylinder it rises to the level of the bottom end of the 12" dip-tube that is protruding into the cylinder. Once oil rises above the end of the dip-tube, vessel vapor pressure pushes any overage from the cylinder over to the chiller evaporator. No harm done since this is where the oil came from in the first place.

NOTE: the above safety feature of plumbing the oil return line to the chiller evaporator during the initial oil stripping process was designed into the system because of the possibility of the oil collection cylinder not being emptied before it overfilled.

Once the oil level reaches the dip-tube in the recovery cylinder the ***OAM Purger will simply return any further recovered oil from the refrigerant charge to the chiller evaporator until the recovery cylinder is emptied.***

Re-plumbing the "Oil Return" line for Normal Operation following the Initial Oil-stripping Phase Refer to Figure 3 page 44.

Once the initial oil-stripping phase has been completed you **MUST** remove the temporary oil recovery cylinder and ***permanently plumb the OAM Purger to the chiller as follows:***

1. Terminate electrical power to the OAM Purge system.
2. Close both valves on the recovery cylinder.
3. Isolate the recovery cylinder by closing appropriate chiller valve.
4. Disconnect and remove recovery cylinder. Dispose of waste excess oil in an appropriate manor.
5. Remove all ***temporary piping. (The inverted trap is no longer necessary, it can be eliminated.)***
6. Using 3/8" O.D. copper tubing re-plumb a new ***permanent oil return line*** **from the OAM Purger to the chiller's oil reservoir (sump)**. The oil return line may be connected to any point (stop valve) open to the chiller's oil reservoir (sump).

Electrical Connection

WARNING: Be sure to open and lockout all electrical disconnects during installation to prevent injury or death caused by electrical shock.

WARNING: Use Class 1, 10 AGW copper wire and conduit in compliance with the NEMA Rating of the OAM Purger being installed. Further, all field-installed wiring, conduit and electrical fixtures must comply with *all applicable NEC and local electrical codes*.

See below and refer to electrical wiring diagram, **Figure 7 page 48,** for wiring connections to OAM Purger.

Power Requirement: 220 / 240 VAC, 60 Hz., 1-Phase, 20 ampere fused circuit

1. For entry of electrical power into Hazardous Electrical Enclosure see Figure 4 page 45.
2. Use appropriate hazardous rated electrical fittings and conduit when connecting the heater and electrical wiring to the Hazardous Enclosure. Install and electrically connect the heater as explained in step 7 of the "Installing the Distillation Heater" section on page 15. (**See warning below**.)

WARNING: When installing the heater you should utilize an appropriate hazardous rated union joint in the electrical conduit in case the heater should ever have to be replaced.

PRE-START-UP PROCEDURE

Preliminary Electrical System Check.

For purposes of testing and system evacuation you will be instructed (via certain DIP Switch settings) to manually open and close the OAM Purge electric motor actuated ball valves during the pre-start-up procedure. Therefore, before getting started it will be necessary to verify that the OAM Purger be properly wired and that the control system is functioning properly.

WARNING: During this procedure the installer will be required to perform certain manual operations within the electrically alive controls enclosure. Therefore, these procedures MUST only be performed by personnel qualified to work on live electrical systems and equipment.

IMPORTANT NOTE: Before you begin you MUST thoroughly understand the operational mode of the three electric motor actuated ball valves located in the OAM Purger control enclosure.

Electric motor actuated Ball Valves **BV-1** and **BV-3** drive **OPEN when energized** and **spring-return CLOSED when de-energized.** Electric motor actuated Ball Valve **BV-2 drives CLOSED when energized** and **spring-returns OPEN when de-energized.**
Any time power is removed from the OAM Purger, such as during a power outage, all three ball valves spring-return to their normal de-energized position.

1. With the OAM Purger enclosure cover open, apply main power to unit.
2. Observe the **LED indicator lights** on the Logic Controller Board, **GREEN LED D1** should be **"ON" and blinking**.
3. Because the OAM always starts in the **"FILL" Phase** on power-up you should be able to hear and observe **"FILL" Ball Valve (BV-1)** driving to the **OPEN** position**.**
4. The **Vapor Return** (equalization) Ball Valve **(BV-2)** should be **de-energized** and therefore remain in its normal **spring-returned OPEN** position.

5. The **Oil Return** Ball Valve **BV-3** should also be **de-energized** and remain in its normal **spring-returned CLOSED** position.

6. Distillation Heater contactor **"HC-1"** should remain de-energized and the ***distillation heater*** should be **"OFF"**.

7. If all of the above are functioning properly ***Turn OFF Power*** to unit.

WARNING: ALL chiller stop valves to the OAM Purger MUST remain CLOSED during the following Pre-start-up Procedure except when otherwise instructed to open a particular valve.

Pre-charging OAM Purger with oil… Refer to Figure 1.

In this procedure you will be pre-charging the OAM Purge vessel with approximately ***(7) seven gallons*** of oil, the ***same type oil as used in the chiller***. This is absolutely necessary in order to fully submerse the distillation heater in oil. ***Failure to properly pre-charge the purge vessel with oil can result in damage to the heater.***

1. Remove the 1" NPT shipping plug from the threaded port identified in **Figure 1** on page 42 as the ***Atmospheric Relief Valve Port.*** Using a funnel, pour approximately ***7 to 7.5 gallons*** of oil into vessel, stopping when the oil level rises to ***mid level of the lower sight glass.***

2. Select the Atmospheric Relief Valve and the tube of Loctite 567 thread sealant compound from the Installation Kit.

3. Apply ample thread sealant to all of the relief valve's threads and install valve into vessels 1.0" NPT relief valve port.

4. Using the appropriate wrench, tighten relief valve.

Leak Testing the OAM Purge System, temporary oil recovery cylinder and interconnecting piping…Refer to Figure 2 page 43.

To perform this procedure you will need the following materials and equipment.

1. Refrigeration gauge manifold set
2. Tank of dry nitrogen with regulator
3. Refrigerant leak detector

Begin Leak Test…

1. Connect a refrigeration compound gauge to the ¼" angle valve on top of the OAM Purge vessel.

2. **Leaving the "FILL" LINE <u>STOP VALVE ON THE CHILLER</u> CLOSED**, **OPEN** the manual "Fill" line ball valve between the filter-drier and the OAM Purge vessel.

3. **LEAVE THE STOP VALVE CLOSED WHERE THE 3/8" O.D. LINE FROM THE RED VALVE ON THE OIL RECOVERY CYLINDER <u>CONNECTS TO THE CHILLER</u>** and **OPEN both recovery cylinder valves.**

4. On the Logic Control Board locate **DIP Switches (S1) and (S2).** (**See Fig 6 on page 47) First**, **on Switch (S1)** ***flip dip switches 1, 3,*** and **6** to the **"ON"** position. **Then on Switch (S2)** ***flip dip switches 4, 6*** and ***8*** to the **"ON"** position. This will energize and **OPEN** the **Fill Ball Valve BV-1 and Oil Return Ball Valve BV-3.** This will allow the Fill line and the oil recovery cylinder and lines to become pressurized along with the purge vessel when power is re-applied. (Double check before applying power that you have the flipped the correct dip switches on the appropriate Switch.)

5. Re-apply main power to OAM Purger.

6. Using a refrigeration manifold gauge set connect a cylinder of refrigerant to the ¼" angle valve on top of OAM Vessel. You will use the refrigerant to provide the ***trace refrigerant*** needed to perform the leak test. Pressurize the OAM Vessel to approximately 1 to 2 psig.

7. Next, remove the refrigerant cylinder and connect a cylinder of dry nitrogen to the gauge set. Adjust the nitrogen cylinder pressure regulator to ***75 psig.***

8. Open manifold gauge valve and the ¼" angle valve and pressurize the OAM Vessel to approximately ***50 psig***

9. Close gauge manifold valve, ¼" angle valve and nitrogen cylinder valve.

10. Using a dependable refrigerant leak detector, ***leak test the entire OAM Purge system, including the temporary oil recovery cylinder and all piping & fittings, etc.***

11. Repair any leaks found in system and retest.

12. Remove nitrogen cylinder.

13. Bleed-off pressure from purge vessel.

14. Leave main power **"ON"** for Evacuation Procedure.

15. Install Filter-Drier cores in filter shell.

Evacuating OAM Purger, Oil Recovery Cylinder and piping.

1. With gauge manifold set still connected to the ¼" purge vessel angle, connect service vacuum pump to gauge manifold.
2. Open ¼" angle valve.
3. Verify that main power is **"ON"** to OAM Purger.
4. Turn **"ON"** vacuum pump and OPEN gauge manifold valve.
5. Evacuate OAM Purge system until appropriate vacuum level has been reached.
6. Close ¼" angle valve on purge vessel, turn off and remove vacuum pump.
7. Turn **"OFF"** main power to OAM Purger.
8. On **DIP Switches (S1) and (S2)** turn all dip switches **(S1) 1**, **3**, **6** and **(S2) 4, 6** and **8** back to the **"OFF"** position.

NOTE: Installation of the OAM Purger is now complete. However remember, once the initial oil-stripping phase or process is complete the temporary oil recovery cylinder MUST be removed and the Oil Return permanently plumbed to the chiller oil reservoir (sump).

INITIAL START-UP PROCEDURE

CAUTION: Once the Initial Start-up Procedure is begun you MUST NOT leave the Purger unattended until ALL STEPS of the procedure have been completed.

1. **OPEN** the **"FILL"** line stop valve on chiller.
2. **OPEN** the **"Vapor Return"** line stop valve on chiller.
3. **OPEN** the **"Oil Return"** stop valve on chiller where the temporary cylinder is connected, or if direct to the oil reservoir, that stop valve.
4. Connect compound gauge of refrigeration gauge manifold set to the ¼" angle valve on the distillation vessel, **OPEN** angle valve.
5. Remove cap from top of the **Distillation Pressure Regulator (DPR-1).** Have a ***5/16" hex wrench*** ready to adjust the DPR valve in ***step 12***.
6. Refer to **a refrigerant *pressure – temperature (PT) Chart*** and determine the pressure

corresponding to ***90 degrees F*** for the type refrigerant in the chiller. Record this pressure. You will need this data in ***step 11***.

7. Turn **"ON"** main power to OAM Purger.

8. The Purger is now in the **"FILL" Phase** and **"FILL"** ball valve **BV-1** should be energized and driving to the **OPEN** position.

9. The OAM vessel should now be filling with refrigerant from the chiller. You can observe refrigerant flowing into the vessel by looking into the upper sight glass. It typically takes approximately **25 to 35 *minutes*** for the purge vessel to fill to the ***70% percent full level.***

10. Once the vessel is filled to the ***70% percent level,*** as sensed by ***Ultra Sonic liquid level sensor (LLS-1),*** the OAM Purger enters the **Distillation Phase**. Fill Valve **BV-1 *de-energizes*** and ***spring-returns*** **CLOSED.** Vapor Return ball valve **BV-2 *energizes*** and drives **CLOSED**. Distillation Heater **(HTR-1)** energizes and distillation begins.

NOTE: Ultra Sonic liquid level sensors LLS-1 and LLS-2 are active <u>ONLY</u> *during the "FILL" Phase.* The instant liquid level sensor *LLS-1* triggers the Distillation Phase the Logic Board Controller de-energizes both LLS-1 and LLS-2.

11. Now, add ***20 psig*** to the pressure recorded in Step 6. In the next step you will adjust **Distillation Pressure Regulator (DPR-1)** to maintain this pressure in the purge vessel during the Distillation Phase. Turning the hex wrench in ***clockwise rotation increases*** purge vessel pressure, ***counter- clockwise rotation decrease*** purge vessel pressure.

12. Monitor vessel pressure. The pressure will begin rising slowly. ***Adjust the DPR valve as necessary to maintain the pressure calculated in Step 11***, when done, replace cap on DPR.

13. Continue monitoring the OAM Purge operation until the ***Oil Return Phase*** is initiated. This will take approximately ***2 to 2.5 hours.*** Should a problem arise or should the OAM Purger shut-down on a Purge Fault condition during the initial purge cycle refer to the ***Trouble-Shooting Section of manual for diagnostic assistance.***

POST START-UP PROCEDURE

Regularly monitor the temporary excess oil collection cylinder, emptying as necessary. Continue the monitoring and emptying process until it is certain that **ALL** excess oil has been stripped from the refrigerant charge. This process can be several weeks. The time required will depend on factors such as the size of the refrigerant charge, the oil contamination level and the size of the oil recovery collection canister. ***Remember, the entire charge must be distilled four to five times to remove all the excess oil and the OAM Purger only distills 10,000 to 12000 lbs per week. Other factors will include how diligently the oil collection canister is emptied because there may be several hundreds of gallons of oil to be removed.***

Once ***all*** excess oil has been stripped from the refrigerant charge the ***temporary collection cylinder MUST be removed from the system and a permanent Oil Return line installed between the OAM Purger and the chiller's oil reservoir***.

PLUMBING PERMANENT OIL RETURN LINE

1. Turn OFF power to OAM Purger. Wait for all motorized ball valves to spring-return to their normal de-energized positions.

2. Close stop-valve on chiller evaporator where temporary cylinder is connected.

3. Close both valves on temporary recovery cylinder.

4. Remove the temporary cylinder from service.

5. Disconnect and remove temporary Oil Return line.

NOTE: For step 6 below, a 3/8" manual ball valve has been included in the Installation Kit, in the event one is needed.

6. **(See NOTE above)** ***Using 3/8" O.D. Copper tubing,*** re-plumb a ***permanent*** Oil Return line from the OAM Purger to the chiller's oil reservoir (sump). The line can connect to any convenient location on the oil reservoir. If there is not already a stop valve available on the reservoir to which the Oil Return line can be connected a ball valve must be installed in the oil return line between the OAM Purger and the chiller oil reservoir.

7. From the Installation Kit select the 3/8" O.D. in-line oil filter/drier and install in Oil Return Line.

OAM PURGER COMPONENT DESCRIPTION

Distillation Vessel

The main OAM Purge Vessel where liquid refrigerant is vaporized (boiled-off) during the Distillation Phase distilling out lubricating oil.

Distillation Pressure Regulator (DPR-1)

Regulates vessel pressure during the distillation phase.

Distillation Heater (HTR-1)

Distillation Heater HTR-1 is a 3.5 Kw Incoloy blade type low watt density electric immersion heater used to distill liquid refrigerant during the Distillation Phase.

Distillation Heater Contactor (HC-1)

Controls line voltage to Distillation Heater and is controlled via Relay RLY-4 on the Logic Board controller and Distillation Thermostat (TS-1).

Distillation Heater Thermostat (TS-1)

TS-1 is an integral part of the distillation heater and controls operation of Distillation Heater via Distillation Heater Contactor (HC-1). TS-1 is set to limit distilled oil temperature to ***155 degrees F***.

WARNING: Distillation Heater Thermostat (TS-1) MUST *remain set at 155 degrees F.* Setting TS-1 to a higher temperature can result in oil carbonization and setting to a lower temperature will allow excessive liquid refrigerant to be returned to the chiller's oil reservoir along with distilled oil during the Oil Return Phase.

Enclosure Heater (HTR-2) (outdoor application only)

HTR-2 Heater provides sufficient heating to maintain temperature in controls enclosure above freezing on outdoor applications. The Heater activates at 40 degrees and de-activates at 55 degrees.

FAULT Light Indicator

The FAULT Light indicates that the purge unit is locked-out in a Purge Fault condition.

“FILL” Ball Valve (BV-1)

BV-1 is an electric motor actuated ***normally closed*** spring-returned ball valve. BV-1 is ***ENERGIZED opened*** during the “FILL” Phase via Logic Board relay “RLY-1”. On removal of power the valve spring returns to the ***CLOSED position.***

High Pressure Cut-Out Switch (HPC-1)

Limits purge vessel pressure to a maximum 250 psig. When actuated HPC-1 de-energizes the Distillation Heater until the pressure drops below the cut-in setting. HPC-1 is automatic reset.

High Temperature Limit Switch (TS-3)

TS-3 is an integral part of the Distillation Heater and limits distilled oil temperature to a maximum of ***170 degrees F.*** TS-3 is manual reset.

Liquid Level Sensor (LLS-1)

LLS-1 is an Ultra Sonic liquid level sensor that signals the Logic Board when the liquid level in the distillation vessel has reached the 70% full level during the “FILL” Phase.

Liquid Level Sensor (LLS-2)

LLS-2 is an Ultra Sonic liquid level sensor that signals the Logic Board when liquid level in the distillation vessel has overfilled beyond the 70% level to the 80% level during the “Fill” Phase. This indicates that level sensor LLS-1 has failed.

Oil Flow Switch (FS-1)

FS-1 monitors the outlet of the Oil Return Ball Valve (BV-3) for the purpose of verifying proper valve re-closure at the conclusion of the Oil Return Phase. If improper oil flow is detected FS-1 signals the Logic Board and purge operation is locked-out on purge FAULT.

“Oil Return” Ball Valve (BV-3)

BV-3 is an electric motor actuated ***normally closed*** spring return ball valve. BV-3 is ***ENERGIZED opened*** during the Oil Return Phase via Logic Board relay RLY-3. On removal of power BV-3 spring returns to the ***CLOSED position.***

“Oil Return” Ball Valve BV-3 Auxiliary Switch

BV-3 valve Auxiliary Switch contacts ***close*** when BV-3 ball valve is in the-***closed*** position, thus at the end of an Oil Return Phase the Auxiliary Switch proves that the valve has fully closed.

Oil Temperature Verification Temperature Sensor (TS-2)

TS-2 Thermostat verifies that a minimum allowable oil temperature of ***125 degrees F*** has been reached during the Distillation Phase. TS-2 must actuate before the Oil Return Phase can be initiated.

Reset Switch

The Reset Switch is used to reset purge operation following lock-out on Purge Fault. The purge can also be reset by removing and reapplying main power to the purge unit.

Sight Glass (Lower)

The lower sight glass Indicates minimum oil level in purge vessel.

Sight Glass (Upper)

The upper sight glass indicates maximum 70% percent “Fill” level in purge vessel.

Solid State Controller Logic Board

The Solid State Controller Logic Board controls: Timing functions, Input and Output functions, and the LEDs used for display indications in the operational and fault modes. The controller board sequences the operations of the OAM Purger.

“Vapor Return” (Equalization) Ball Valve (BV-2)

BV-2 is an electric motor actuated ***normally open*** spring-return ball valve. BV-2 is ***ENERGIZED closed*** during both the distillation and oil return phases via Logic Board relay RLY-2. On removal of power the valve spring returns to the ***OPEN position.***

350 PSIG Atmospheric Relief Valve

This is a standard atmospheric pressure relief set to limit Distillation Vessel pressure to a maximum 350 psig.

OAM PURGER SAFETY FEATURES

Protecting the Purge Vessel from over-pressurization

The OAM Purge vessel is protected from over-pressurization in the follow ways:

1. **Distillation Pressure Regulator (DPR-1)** is a spring loaded pressure relieving device that is not affected by down stream pressure and therefore functions like a pressure relief valve, the difference being that the DPR relieves over pressure back to the low side of the chiller rather than to the atmosphere.
2. **High Pressure Cut-Out Switch (HPC-1)** limits purge vessel pressure by de-energizing the Distillation Heater on pressure rise to 250 psig. Since the Distillation Heater is the only element in the purge system that can generate pressure, over-pressurization is thus prevented.
3. **Atmospheric Relief Valve** ultimately limits distillation vessel pressure to 350 psig.

Protection against vessel overfilling

The OAM Purger incorporates two Ultra Sonic liquid level sensors LLS-1 and LLS-2. Level sensor LLS-1 limits the liquid level in the distillation vessel to ***70 percent full***. If LLS-1 should fail level sensor LLS-2 will lock-out purge operation on ***"Overfill Fault"*** at the ***80 percent full*** level***.*** When this happens all three motorized ball valves are ***de-energized*** and ***automatically return to their respective spring-return positions.*** Thus, the "FILL" valve automatically ***spring-returns*** to the ***CLOSED*** position preventing further filling of vessel.

Protecting against inadvertent closing of one or more chiller valves to purger

Should any of the chiller valves to the OAM Purger be inadvertently closed while the purger is in operation the purger Logic Board will detect this condition and automatically lock-out the unit on ***"Purge Fault"*** until the problem has been corrected.

Protecting against overheating of oil due to defective Thermostat (TS-1) or welded Heater Contactor (HC-1) contacts

Distillation Heater (HTR-1) is protected against oil overheating via High Temperature Limit Switch (TS-3). TS-3 is integral to the Distillation Heater and limits oil temperature to a maximum temperature of ***170 degrees F.*** The TS-3 Limit Switch is manual reset. Should this condition occur the OAM Purger will shut-down on ***"Purge Fault".***

Protection against Thermostat Sensor (TS-1) and/or Temperature Sensor (TS-2) failure

The OAM Purger Logic Board is programmed to detect this condition and when detected will lock-out purge operation on ***"Purge Fault".***

Protection against Motorized Ball Valve failure

The OAM Purger Logic Board is programmed to detect this condition and when detected will lock-out purge operation on ***"Purge Fault.***

Protection against inadvertent transfer of *non-distilled refrigerant* to the chiller oil reservoir

An Oil Return Phase cannot be in initiated until both thermostats TS-1 and TS-2 sense proper oil temperature. When proper oil temperature is reached there cannot be any raw liquid refrigerant present in the oil.

Should Oil Return Ball Valve BV-3 fail to re-close following oil return cycle, an auxiliary switch contact, integral to Ball Valve BV-3, will remain open preventing further purge operation until either the valve re-closes or the problem is rectified.

Should Oil Flow Switch FS-1 sense any oil flow during the fill or distillation phase (indicating a transfer of un-distilled refrigerant oil mixture) the OAM Purger will shut down in a fault until the problem is rectified.

LOGIC BOARD COMPONENT DESCRIPTION

Refer to Figure 6 page 47 for picture of Logic Board

Output Control Relays:

Relay (RLY-1) Controls motorized "FILL" Ball Valve BV-1
Relay (RLY-2) Controls motorized "Vapor Return" (Equalization) Ball Valve BV-2
Relay (RLY-3) Controls motorized "Oil Return" Ball Valve BV-3
Relay (RLY-4) Controls Distillation Heater Contactor HC-1
Relay (RLY-5) Controls Level Sensor LLS-1 and LLS-2 Power
Relay (RLY-6) Controls the "FAULT" indicator light

Logic Board Input Signals IN1 through IN6

The six voltage signal inputs on the Logic Board are interfaced with the various system controls for the purpose of tracking operational status. These terminals are factory wired and **MUST NOT** be changed.

IN1…….. Input from Thermostat TS-1
IN2…….. Input from Thermostat TS-2
IN3…….. Input from 70 Percent Level Sensor LLS-1
IN4…….. Input from Oil Flow Switch FS-1
IN5…….. Input from "Oil Return" Ball Valve BV-3 Auxiliary Switch
IN6…….. Input from the 80 Percent Level Sensor LLS-2

Dip Switches S1 & S2 Used Only For Diagnostic Mode

All **DIP SWITCHES ARE TO BE IN *OFF* POSITION DURING NORMAL OPERATION**

WARNING: You will be given instructions on the individual dip switches on Switches (S1) and (S2) to be used in the Diagnostic Mode. Regardless of whether you are in the normal, or diagnostic mode NEVER UNDER ANY CIRCUMSTANCES TURN ON (S1) SWITCH 8, or (S2) SWITCHES 1, 2, or 3.
These switches are used at the factory for overriding or shortening the times of certain functions for testing. If used in the field damage may occur to your chiller.

DIP Switch (S1): Used to enter Code Setting for diagnostic Mode

DIP Switch (S1) is **used to enter a code setting *(S1) dip switches 1,3,6 ON*** this **allows activation of the diagnostic Mode.** (Then the Diagnostic Mode utilizes (S2) dip switches for activation of specific components.**)**
When not in the Diagnostic Mode, all (S1) dip switches MUST be in the OFF position.
(**See Warning above and *ABSOLUTELY NEVER TURN ON* (S1) Dip Switch 8)**

DIP Switch (S2)….Used For Diagnostic Mode and individual component activation.

Switch **(S2) dip s*witch 8 ON <u>in conjunction with</u> (S1) switches 1,3,6 ON places the Purger in the DIAGNOSTIC MODE)*** then **(S2) switches 4, 5, 6, 7** may be used to manually activate various system components during system start-up procedure. (**See Warning above**.)

S2 DIP Switch component activation when in the ON position during the Diagnostic Mode: (Again see procedure immediately above for following switches to function in diagnostic mode).

S2-1… <u>Warning</u> Unit Manufacturer's use only <u>absolutely never</u> place in the on position.
S2-2… <u>Warning</u> Unit Manufacturer's use only <u>absolutely never</u> place in the on position.
S2-3… <u>Warning</u> Unit Manufacturer's use only <u>absolutely never</u> place in the on position.
S2-4… Manually actuates ***Oil Transfer*** Ball Valve BV-3
S2-5… Manually actuates ***Vapor Return*** Ball Valve BV-2
S2-6… Manually actuates ***Fill*** Ball Valve BV-1
S2-7… Manually energizes **Distillation Heater** HTR-1
S2-8… Places the Purger in the Diagnostic Mode when (S1) dip switches 1, 3, 6 are ON.

WARNING: <u>ALL</u> DIP switches on both (S1) and (S2) <u>MUST</u> be in the <u>OFF</u> position during normal purge operation.

LED Indicators

The Logic Board has five green LED's and one red LED and numbered ***D1 through D6.*** The six LED's provide visual indication of current purge operational status as well as FAULT status. The LED's also are used to assist in system diagnosis.

LED Indication "Normal Operational" status:

D1 Green LED "ON" and Blinking… Indicates purger is in the ***"FILL" Phase.***

D2 Green LED "ON" and Blinking… Indicates purger is in the ***"Distillation" Phase.***

D3 Green LED "ON" and Blinking… Indicates purger is in the ***"Oil Return" Phase.***

D4 Green LED… Not used during normal purge operating mode.

D5 Green LED "ON" Solid Indicates ***"Distillation Heater"*** is energized.

LED Indication “FAULT” Status:

The same LED’s that indicate operational status also indicate ***“FAULT”*** status during a ***Fault lock-out condition.*** Refer to the **“Troubleshooting”** Section of manual for details on each of the FAULT conditions below.

When the Purge unit is locked-out in any of the various “**FAULT”** conditions **Red LED D6** will be ***“ON” Blinking*** along with one of the following **Green LED’s *“ON” Solid***.

D1 Green LED… Indicates purge vessel has ***overfilled*** with liquid refrigerant during the Fill Phase.

D2 Green LED… Indicates purge vessel failed to fill within 8 hours of start of the “Fill” Phase.

D3 Green LED… Oil temperature failed to reach 155 degrees F within 9 hours after the beginning of a “Distillation” Phase.

D4 Green LED… “Oil Return” Ball Valve BV-3 ***Auxiliary Switch failed to CLOSE*** at end of Oil Return Phase.

D5 Green LED… Oil flow detected after start of “Fill” Phase or during distillation phase.

Using the LED Indicators as a FAULT diagnostic tool

When the OAM Purger shuts-down in one of the above **“FAULT”** conditions the associated LED indicator provides valuable information necessary to quickly troubleshoot the cause.

NOTE: When the unit is reset or if the power is removed, this valuable information will be lost. Therefore, before resetting or turning off power to purger always <u>FIRST</u> observe and record status of the LED indicators.

MAINTENANCE

This section discusses recommended OAM Purger maintenance and troubleshooting. Although the OAM Purger requires minimal preventive maintenance there are certain aspects of purger operation that require attention in order to maintain its maximum effectiveness.

WARNING: Certain servicing procedures may expose you to harmful materials and dangerous conditions. To minimize the possibility of injury when performing maintenance on this equipment, follow all safety procedures and instructions given in this manual, on product labels and applicable materials handling safety data sheets.

Replacing Filter-Drier Cores (Recommendation ONLY)

For maximum moisture and acid removal from the chiller's refrigerant charge the filter-drier cores should be replace frequently. How frequently depends upon many factors and varies from chiller to chiller. The in-line ***moisture indicator*** will give some indication of filter-core condition. However, **it is <u>recommended</u>** that at the very least, the cores should be replaced every ***800 hours of OAM Purge operation. (Remember this is a recommendation only.)***

While ***800 hours*** seem fairly often, considering that the OAM Purger process ***10,000 to 12,000 pounds of refrigerant weekly*** it really isn't. During an 800 hour period (about a month) the purger will have processed ***40,000 to 50,000 pounds of contaminated refrigerant.***

Filter Drier Supplied with the Industrial OAM Purger is a Parker Hannifin 4 Core Shell that receives Core Model # PCX-48.

Periodic Maintenance

Monthly:

1. **Recommended:** Replacement of filter-drier cores. **(Filter Drier Supplied with the Industrial OAM Purger is a Parker Hannifin 4 Core Shell that receives Core Model # PCX-48.)**
2. Visually inspect entire OAM Purge system, piping and insulation. Correct any problems found during inspection. (pay particular attention to the condition of all insulated areas, **<u>the insulation must remain intact for the Purger to function</u>**.
3. Verify Purger for proper operation.

Annually:

1. Perform scheduled monthly maintenance.
2. Verify ***Distillation Pressure Regulator (DPR-1)*** is properly calibrated. To re-calibrate the DPR, follow calibration procedures given in ***Steps 11 and 12*** in the **Initial Start-up Procedure** section.
3. Replace Oil Filter. (Type supplied with OAM Purger, (**Sporlan OF-303** 3/8" SAE Flare)

Trouble Shooting

Trouble Shooting Chart

Should the OAM Purger malfunction the following Trouble Shooting Chart will help diagnose the cause and determine corrective action to be taken. The Trouble Shooting Chart itemizes ***"Symptoms", "Possible Cause"*** and ***"Solution"*** for a wide range of potential problem scenarios.

IMPORTANT: **If the OAM Purger shuts-down on a** PURGE FAULT **condition,** before turning OFF power **to purger note which of the** *Logic Board LED's are lit***. This information is vital in diagnosing purger problems.** *Once power to the purger is turned OFF this information is lost.*

Trouble Shooting Chart (continued)

Symptom	Possible Cause	Solution
Power Switch ON but all Logic Board LED's are all OFF	Main power to unit Off. Blown Logic Board fuse. Switch defective Logic Board defective. Wiring disconnected. If OAM Purger is installed outside and the temperature is extremely cold, the Solid State Logic board May be affected by defective enclosure heater (HTR-2).	Restore main power Replace fuse. Replace Switch. Replace Logic Board. Repair as necessary. Replace Enclosure Heater.
Red **FAULT** LED **D6** ON blinking **WITH** Green LED **D1** ON solid Indicates distillation vessel overfilled and Ultra Sonic level sensor LLS-2 has activated.	Ultra Sonic level sensor LLS-1 Logic Board defective and failed to respond to LLS-1 signal.	Replace defective LLS-1 See "Troubleshooting the OAM following an "Overfill Fault" page 40. See "Troubleshooting the OAM Purger following an "Overfill Fault" page 40.

Trouble-shooting Chart (continued)

Symptom	Possible Cause	Solution
Red **FAULT** LED **D6** ON blinking **WITH** Green LED **D2** ON solid Indicates (LLS-1), 70% level sensor did not sense a liquid level within 8 hours from start of fill phase.	Chiller "FILL" stop valve to OAM Purger closed.	Open stop valve
	Chiller "Vapor Return" stop valve on chiller closed.	Open stop valve
	Defective RLY-1 and/or RLY-2 relay on Logic Board.	Replace Logic Board
	Normally closed motorized "Fill" Ball Valve BV-1 is energized but failed closed.	Repair or replace BV-1 ball valve
	Normally open motorized" Vapor Return" Ball Valve BV-2 is de-energized but failed closed.	Repair or replace BV-2 ball valve
	Purger may be mounted in a position that precludes it from filling to the 70% fill level.	See OAM Purger Placement Page 15
	Fill line and/or components vapor locked.	See instructions discussing insulating purger and lines, etc.
	Chiller may be low on refrigerant and the level is too low to properly fill the purger.	Check refrigerant charge. Add refrigerant if low
	Fill line filter/drier clogged, or if outdoor installation, moisture accumulation in filter may be frozen	Replace drier cores
	Fill line strainer clogged.	Replace strainer
	Logic Board DIP Switches set improperly.	See pages 32 and 33 for DIP Switch settings
	Defective Logic Board	Replace Logic Board
Red **FAULT** LED **D6** ON blinking **WITH** Green LED **D3** ON solid Indicates thermostats TS-1 and temperature Sensor TS-2 did not sense proper oil temperature within 9 hours of start of last Fill Phase. Distillation Heater off on TS-3 high limit……..TS-3 is a manual reset switch.	Distillation Heater Thermostat TS-1 set too low.	Re-set TS-1 to 155 degrees F.
	Distillation Heater Thermostat TS-1 defective.	Replace Distillation Heater HTR-1
	Oil temperature thermostat TS-2 defective.	Replace TS-2
	Distillation Heater relay RLY 4 defective	Replace Logic Board
	Insulation on Distillation Vessel not intact.	Repair insulation
	If the OAM Purger is located outside where the ambient temperature can drop below 40 degree F this Fault may occur.	Turn OFF purger until ambient temperature is warmer.
	Defective Logic Board	Replace Logic Board
	Distillation Heater Contactor HC-1 defective	Replace heater contactor HC-1
	Defective Heater Thermostat TS-1	Replace Distillation Heater

Trouble-shooting Chart (continued)

Symptom	Possible Cause	Solution
Red **FAULT** LED **D6** ON blinking **WITH** Green LED **D4** ON solid Indicates Logic Board failed to detect re-closure of Oil Return ball valve BV-3 following termination of the Oil Return Phase.	Defective RLY-3 relay of Logic Board. Defective motorized Oil Return ball valve BV-3. Defective BV-3 auxiliary switch Defective Logic Board	Replace Logic Board Replace BV-3 ball valve Replace BV-3 ball valve Replace Logic Board
Red **FAULT** LED **D6** ON blinking **WITH** Green LED **D5** ON solid. ındicates oil flow detected during the Fill Phase.	Motorized Oil Return valve BV-3 either leaking or not closed. Defective FS-1 Oil Flow switch. Defective Logic Board	Replace BV-3 ball valve Replace FS-1 switch Replace Logic Board
Purger will not go into “Oil Return” Phase	Defective heater contactor HC-1 Defective TS-1 thermostat Defective TS-2 Temperature Sensor Defective Logic Board Defective Distillation Heater HTR-1	Replace contactor HC-1 Replace Distillation Heater HTR-1 Replace TS-2 Temperature Sensor Replace Logic Board Replace HTR-1

Trouble-shooting Chart (continued)

Symptom	Possible Cause	Solution
Oil fails to transfer to oil sump during the Oil Return Phase.	Distillation Pressure Regulator DPR-1 set to too low of pressure.	Refer to “Initial Start-up Procedure” Page 24 and recalibrate DPR-1 and refer to “How the OAM Purger returns distilled oil to the Chiller oil reservoir pages 10 and 11 for information on how to adjust oil to proper level in the OAM vessel after a problem with a DPR.
	Oil Sump stop valve closed.	Open oil sump stop valve
	Oil Return line kinked or blocked.	Correct as necessary
	Return Oil line Filter/Drier blocked.	Replace Filter/Dried
	Normally closed motorized “Oil Return” ball valve BV-3 energized but failed to open.	Repair or replace BV-3 valve
	Normally open motorize “Vapor Return” ball valve BV-2 energized but failed to close.	Repair or replace BV-2
	Defective RLY-2 and/or RLY-3 relay on Logic Board.	Replace Logic Board

Troubleshooting the OAM Purger following an "Overfill Fault"

If the OAM Purger shuts-down on "Overfill Fault" it means the Distillation Vessel has filled beyond the normal 70% full level to the 80% full level. This usually indicates that the 70% Ultra Sonic liquid level sensor LLS-1 has failed. Although the liquid level sensor failure is the most likely cause of an overfill fault, there are other possible causes, such as a defective Logic Board. In any case, you must first determine the cause of the overfill fault and correct it before the purger can be placed back into service.

Troubleshooting Ultra Sonic Level Sensor LLS-1 circuit

The following test procedure will determine if the problem is with the ***Ultra Sonic circuit*** or with the controller ***Logic Board***.
(Refer to Figures 5, 6, and 7 on pages 46, 47, 48 for pictures of components and wiring schematic.)

1. Close the chiller **"FILL"** valve to OAM Purger. ***Leave ALL other valves open.***

2. Turn OFF power to OAM Purger.

3. Locate and remove ***Yellow wire #6*** from input terminal ***IN6*** on the OAM Logic Board.

4. Locate and remove ***Yellow wire #3*** from input terminal ***IN3*** on the OAM Logic Board.

5. Turn power back on to the OAM Purger and then using a volt meter, check for 230/240 volts between ***yellow wire # 3*** and any ***L2*** terminal on ***terminal block TB1***.
   (A) If there is voltage between yellow wire #3 and L2 then LLS-1 is okay, therefore, the problem is probably with the Logic Board. ***Proceed to step 6.***
   (B) If there is NO voltage between yellow wire #3 and L2 then LLS-1 is probably defective and will have to be replaced. **Proceed to next procedure** ***"Replacing LLS-1 Sensor".***

6. Turn **OFF** power to OAM purger and ***replace the Logic Board with a new Board.***

7. Reattach ***yellow wire #3*** to input terminal ***IN3*** on the Logic Board. **Leave yellow wire #6 off for now**.

8. Turn power back on to the OAM Purger and then allow the purger to operate in the Distillation Phase until the liquid level in the Distillation Vessel drops below the upper sight glass, then turn OFF power to purger and reconnect ***yellow wire #6*** to input terminal ***IN6*** on the Logic Board.

9. **Turn Power back ON to purger.** The purger should now come on in the "Fill" Phase, if so **open the chiller Fill Valve**. *Logic Board replacement is now complete and Purger should be functioning normally.*

Replacing the Liquid Level Sensor LLS-1

1. Turn OFF power to purger.

2. Close the chiller ***"Fill"*** Valve to OAM Purger.

3. Remove ***yellow wires #3 & #6*** from input terminals ***IN3 & IN6*** on the Logic Board.

4. Temporarily connect ***yellow wire #6*** to input terminal ***IN3***. This will trick the OAM Purger into the Distillation Phase when power is reapplied.

5. Turn power to purger back ON.

6. Allow the purger to operate in the Distillation Phase until it goes into the Oil Return Phase. At this point all of the liquid refrigerant will have been completely vaporized from the vessel back to the chiller.

7. Turn OFF power to purger.

8. **Completely isolate** the OAM Purger by ***closing all chiller valves to purger.***

9. Using an appropriate refrigerant recovery unit, recover the remaining refrigerant vapor from the distillation vessel leaving about ½ psig residual pressure in the vessel. The residual pressure will allow slight out-gassing when replacing the LLS-1 Sensor, therefore it will not be necessary to evacuate the vessel once procedure is complete.

10. Replace the defective ***LLS-1 sensor*** with a new sensor.

11. Reconnect ***yellow wire #3*** to input terminal ***IN3*** on the Logic Board.

12. Reconnect ***yellow wire #6*** to input terminal ***IN6*** on the Logic Board.

13. **Open all chiller valves to OAM Purger.**

14. Turn ON power to purger. The purger should now come on in the ***"Fill"*** Phase.

LLS-1 liquid Level Sensor replacement is now complete.

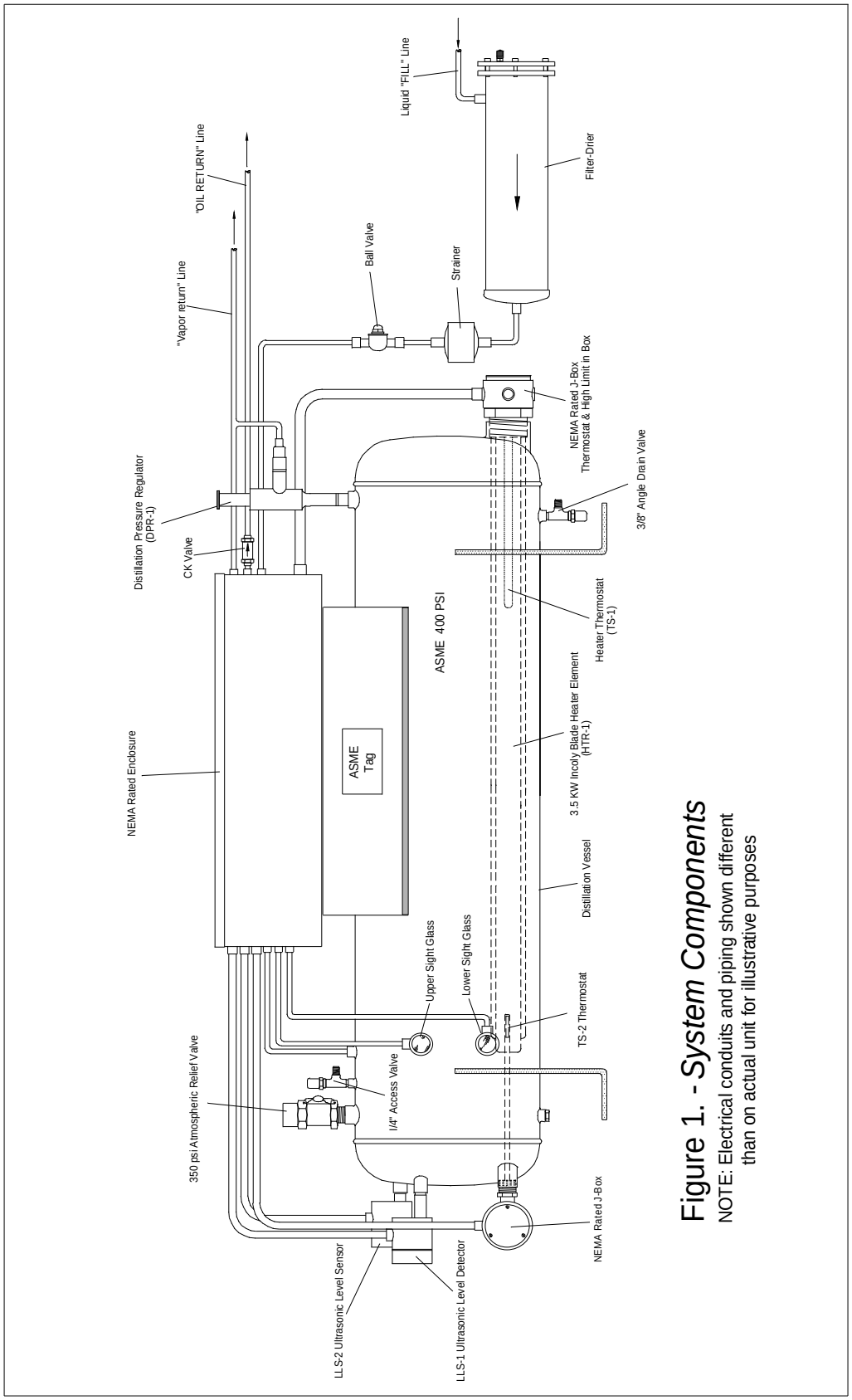


Figure 1. - *System Components*
NOTE: Electrical conduits and piping shown different than on actual unit for illustrative purposes

Figure 1. – System Components

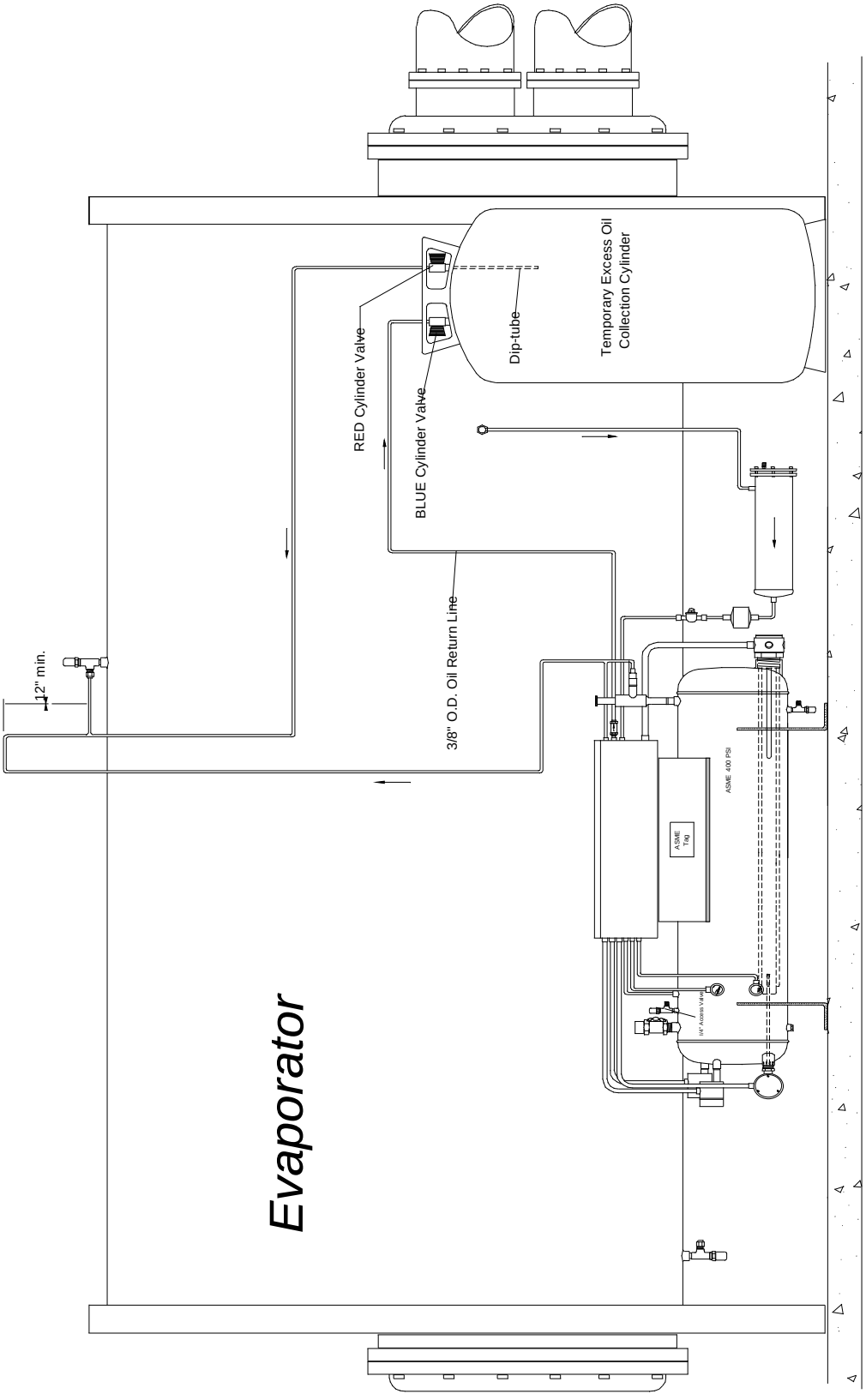


Figure 2 *Temporary Excess Oil Collection Cylinder Hook-up*

Figure 2. – Temporary Oil Collection Cylinder Hook-up

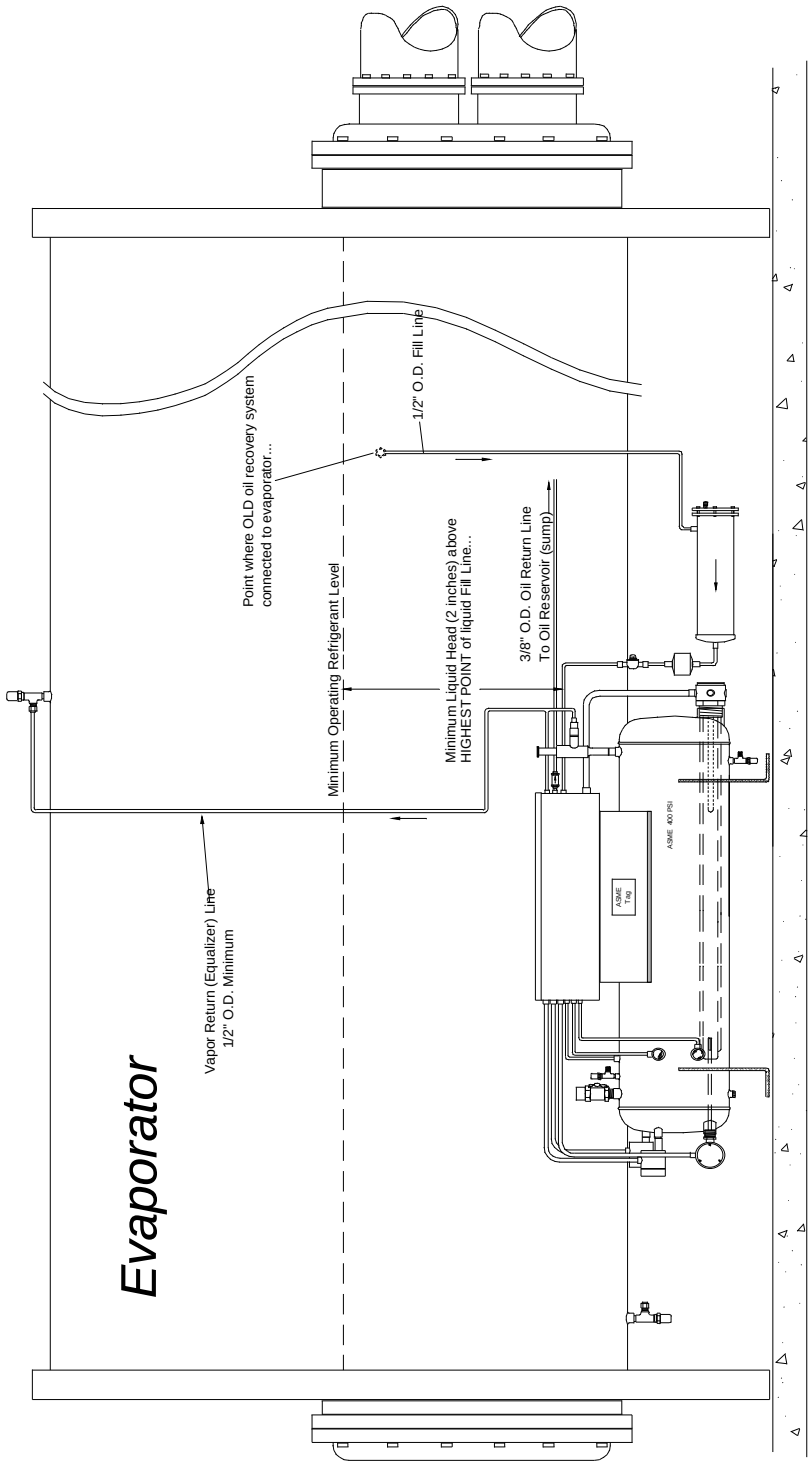


Figure 3 -*Final Piping Hook-up*

Figure 3. – Final Piping Hook-up

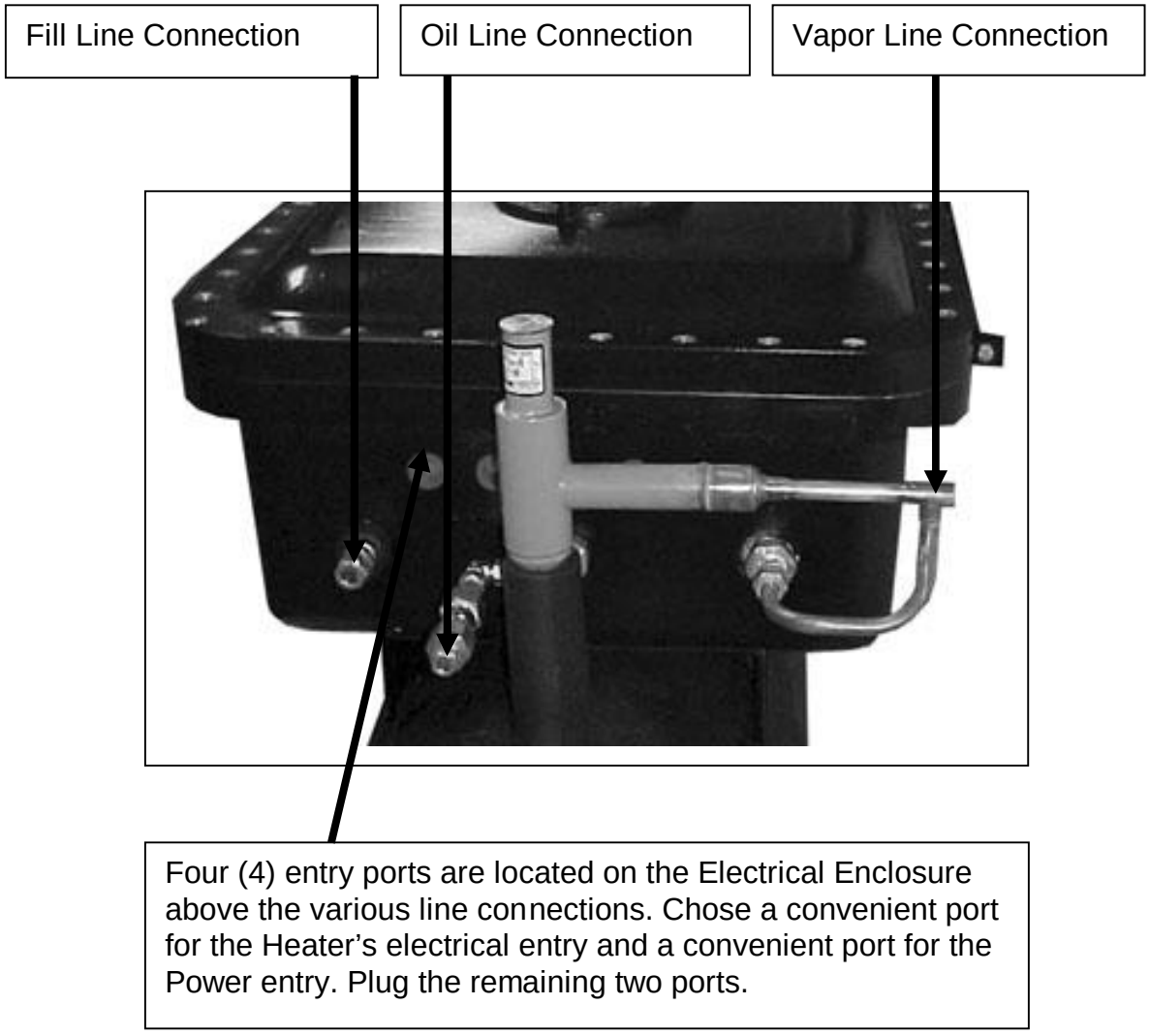


Figure 4. – Purger Connections….Picture View

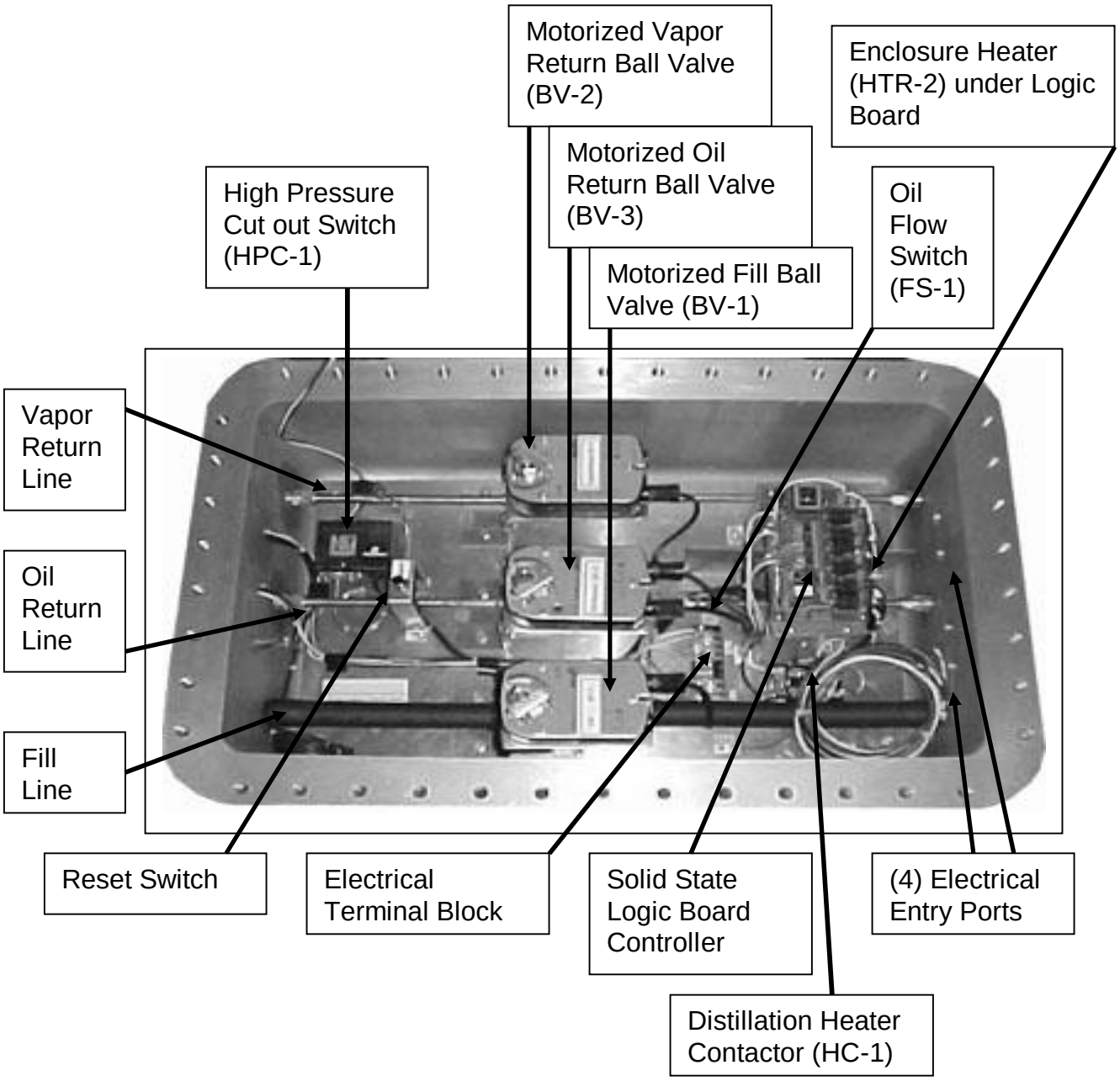


Figure 5. – Electrical Enclosure Box Components

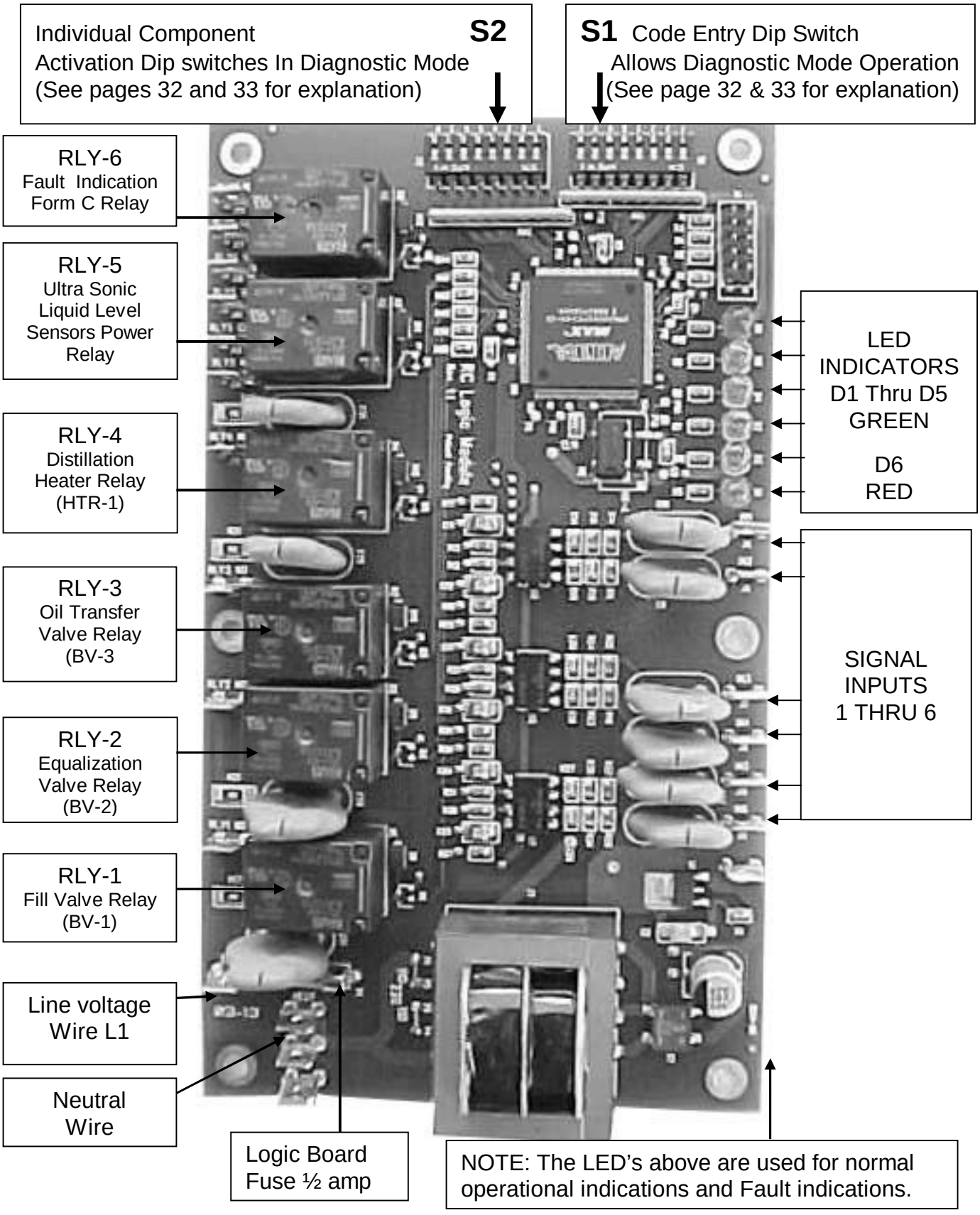


Figure 6. – Solid State Logic Board Description

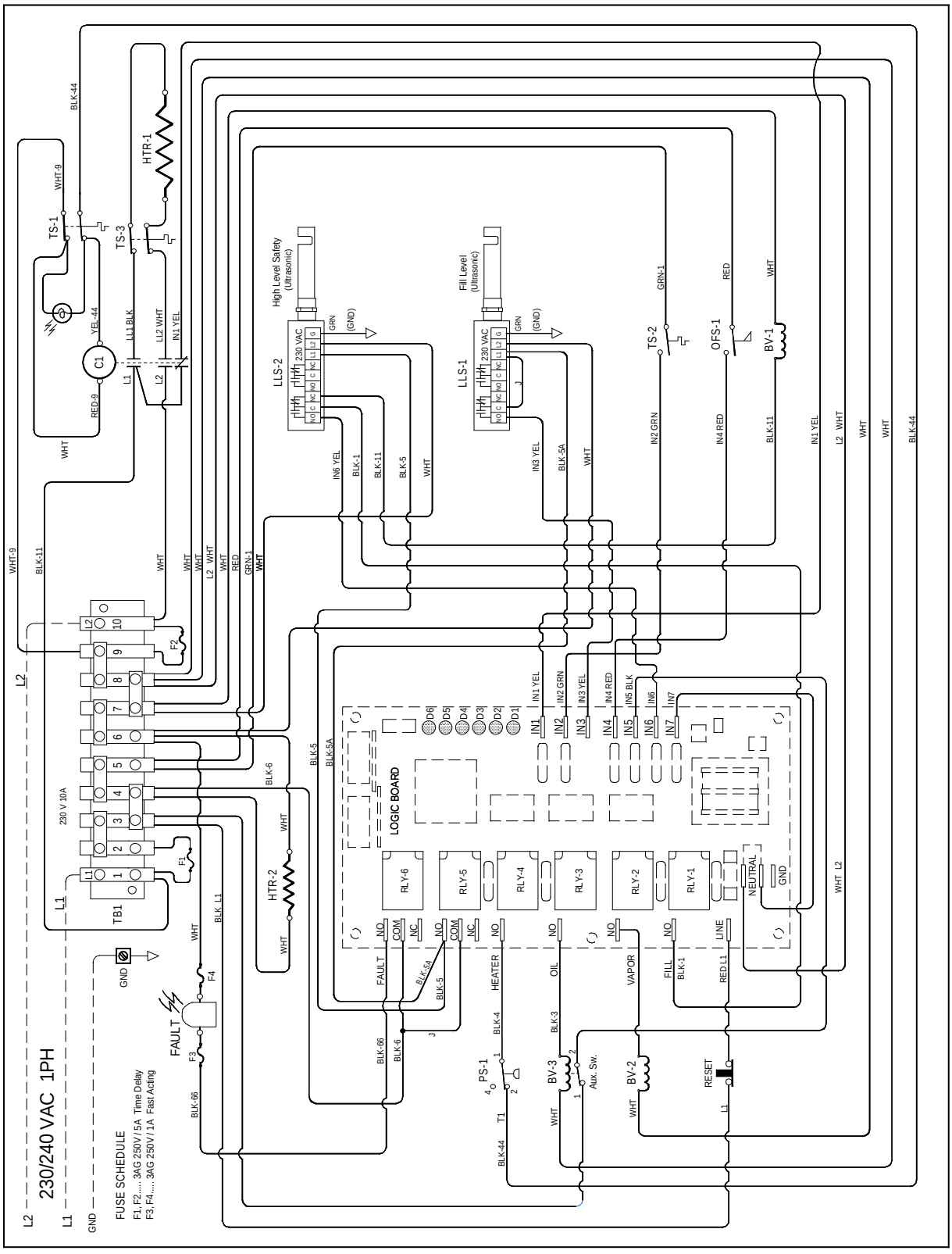


Figure 7. – Electrical wiring diagram

Use this chart to estimate the amount of excess oil in the Chiller's Refrigerant Charge. According to ASHRAE study 601-TRP, the Average Chiller has 12 % oil by weight in its Refrigerant Charge. A 500 lb. Refrigerant Charge at 12% by weight contains 60 lbs., or 8.5 gallons of oil.

For Larger Capacities Multiply All Numbers By 10 or 100

	CHILLER REFRIGERANT CHARGE BY WEIGHT IN lbs.											
	100	200	300	400	500	600	700	800	900	1000	1100	1200
% OIL		lbs. of Oil in Refrigerant Charge based on % by weight										
1%	1	2	3	4	5	6	7	8	9	10	11	12
2%	2	4	6	8	10	12	14	16	18	20	22	24
3%	3	6	9	12	15	18	21	24	27	30	33	36
4%	4	8	12	16	20	24	28	32	36	40	44	48
5%	5	10	15	20	25	30	35	40	45	50	55	60
6%	6	12	18	24	30	36	42	48	54	60	66	72
7%	7	14	21	28	35	42	49	56	63	70	77	84
8%	8	16	24	32	40	48	56	64	72	80	88	96
9%	9	18	27	36	45	54	63	72	81	90	99	108
10%	10	20	30	40	50	60	70	80	90	100	110	120
11%	11	22	33	44	55	66	77	88	99	110	121	132
12%	12	24	36	48	60	72	84	96	108	120	132	144
13%	13	26	39	52	65	78	91	104	117	130	143	156
14%	14	28	42	56	70	84	98	112	126	140	154	168
15%	15	30	45	60	75	90	105	120	135	150	165	180
16%	16	32	48	64	80	96	112	128	144	160	176	192
17%	17	34	51	68	85	102	119	136	153	170	187	204
18%	18	36	54	72	90	108	126	144	162	180	198	216
19%	19	38	57	76	95	114	133	152	171	190	209	228
20%	20	40	60	80	100	120	140	160	180	200	220	240
21%	21	42	63	84	105	126	147	168	189	210	231	252
22%	22	44	66	88	110	132	154	176	198	220	242	264
23%	23	46	69	92	115	138	161	184	207	230	253	276
24%	24	48	72	96	120	144	168	192	216	240	264	288
25%	25	50	75	100	125	150	175	200	225	250	275	300
		OIL WEIGHS APPROXIMATELY 7 Lbs. PER GALLON										
				60 Lbs = approximately 8.5 Gallons								

Chart 1. – Refrigerant-Oil Contamination Chart

Parts List

Note: Parts List does not include minor components such as Brackets, Nuts, Bolts, Normal Fittings, Tubing, Etc.

1.	Spring Actuated Fill / Equalization Motor (BV-1, BV-2) ……	IN-H-1001 *
2.	Spring Actuated Oil Transfer Motor w/Switch (BV-3) ……	IN-H-1002 *
3.	High Pressure Cut Out Switch (HPC-1) ……	IN-H-1003 *
4.	Reset Switch ……	IN-H-1004 *
5.	Heater Contactor (HC-1) ……	IN-H-1005 *
6.	3500 W Distillation Heater (HTR-1) ……	IN-H-1006
7.	Oil Flow Switch (FS-1) ……	IN-H-1007 *
8.	Enclosure Heater (HTR-2) ……	IN-H-1008 *
9.	125 degree Thermostat (TS-2) ……	IN-H-1009 *
10.	Ultrasonic Liquid Level Sensor (LLS-1/LLS-2)……	IN-H-1010 *
11.	Hazardous Type Enclosure ……	IN-H-1011
12.	Hazardous Type Enclosure Vent ……	IN-H-1012
13.	Fault Indicator Receptacle……	IN-H-1013
14.	Fault Indicator Bulb 240V ……	IN-H-1014 *
15.	Solid State Logic Board ……	IN-H-1015 *
16.	Sight Glass w/Reflector and Float Ball ……	IN-H-1016 *
17.	Check Valve ……	IN-H-1017 *
18.	Distillation Pressure Regulator (DPR-1) ……	IN-H-1018 *
19.	350 # Relief Valve ……	IN-H-1019
20.	Filter Drier Cores ……	IN-H-1020 *
21.	Inlet Strainer ……	IN-H-1021 *
22.	Oil Filter ……	IN-H-1022 *
23.	Moisture Indicator ……	IN-H-1023 *
24.	Thread Sealant ……	IN-H-1024 *
25.	Four Core Filter Housing ……	IN-H-1025

* Recommended Items for Spare Parts

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Equipment Warranty

Subject to the terms below, **REDI CONTROLS** will, within one year after date of purchase, repair any **REDI CONTROLS'** product being used by the original purchaser, which is defective due to faulty materials or workmanship. **REDI CONTROLS** has the right to repair or replace a defective part or replace the entire product.

To file a Warranty claim on any system or component, return the defective unit to the address below, or other location as REDI CONTROLS directs, freight prepaid.

This Warranty <u>does not</u> apply to or cover:

- Damages beyond **REDI CONTROLS'** control.
- Malfunctions that result from failure to properly install, operate or maintain a product in accordance with instructions provided by **REDI CONTROLS**.
- Failures of equipment due to abuse, accident or negligence.
- Damages from, or part failures due to equipment not being installed per **REDI CONTROLS'** instructions, per applicable codes or ordinances, or in accordance with good trade practices.
- Labor or other charges incurred in removing or reinstalling any **REDI CONTROLS** product or part.
- Damages resulting from use of a **REDI CONTROLS** product for any purpose other than for which it was designed and manufactured.
- Any implied warranty of merchantability or fitness for any particular purpose, occurring after the Warranty Period.
- Loss of use, loss of time, inconvenience, rental for substitute products, loss of business, loss of income, or any other consequential damages resulting from use or failure of any **REDI CONTROLS** product.

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