A baffle is welded into the top of the evaporator to collect oil that falls from the compressor, preventing oil from mixing with the refrigerant charge. The baffle prevents liquid refrigerant from damaging the compressor.

CONDENSING WATER TEMPERATURE

YS Chillers can be operated with entering condensing water temperature that is less than design conditions. The following formula is used to calculate the minimum entering condensing water temperature. Note the minimum entering condensing water temperature is dependant upon the operating load condition.

R-22 Refrigerant

ECW minimum =

$$LCWT+11+\left[\frac{(\%\text{of load})}{100}(15\text{-design condenser deltaT})\right]$$

R-134a REFRIGERANT

ECW minimum =

$$LCWT+16+\left[\frac{(\%\text{of load})}{100}(10\text{ - design condenser deltaT})\right]$$

Where:

ECW minimum =
Minimum Entering Condensing Water Temperature °F

LCWT =
Leaving Chilled Water Temperature °F

Operating below the minimum entering condensing water will not provide energy savings and will result in oil management problems.

Special entering condensing water temperature controls may be required when long condensing water circuits are used and the chiller is being started with minimum load available.

OIL SYSTEM

Refer to the Oil Piping Schematic Drawing, Figure 15 and the Oil Separator Drawing, Figure 20.

Oil flows from the oil separator into the compressor by differential pressure. The oil flows from the oil separator through a 3 micron oil filter (or optional dual oil filters). Filtered oil then flows to a oil manifold that is located at compressor port SB-2, see Figure 15.

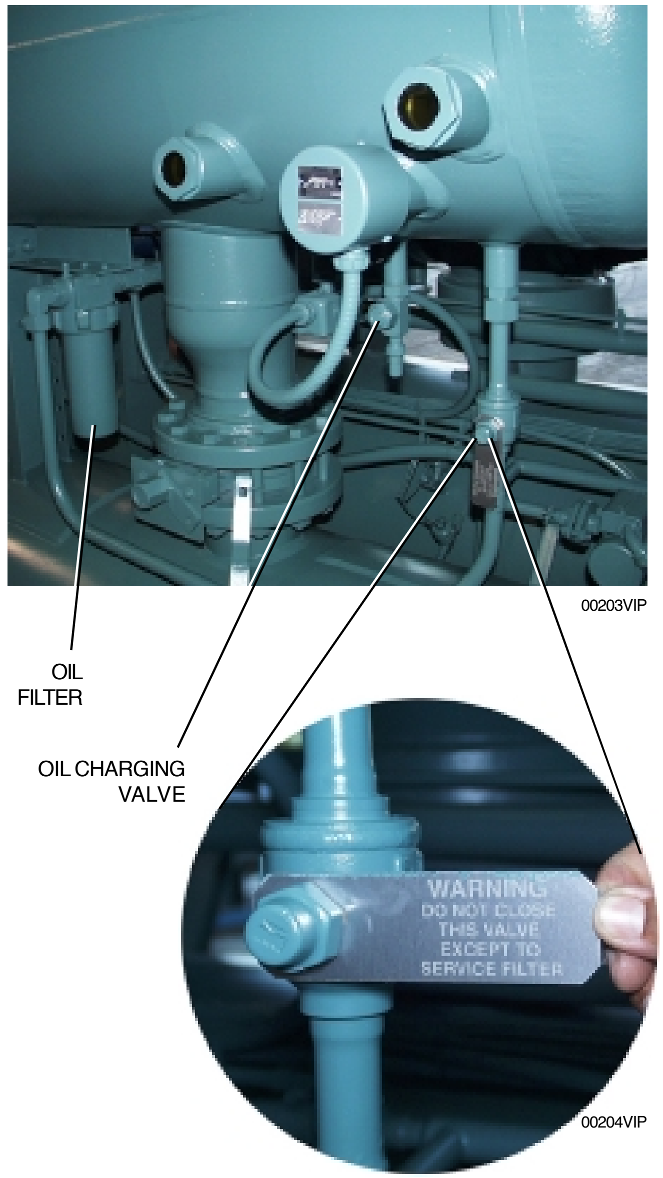

FIG. 17 – OIL FILTER LOCATION

The oil pressure transducer is located at the SB-2 manifold. The differential pressure is measured as the difference between the Oil Pressure Transducer at SB-2 and the Filter Pressure Transducer located in the oil separator. This value is compared to the limits in the control panel logic. If the oil filter differential reaches 20 PSID, a warning message is displayed by the control panel display. If the oil filter reaches 25 PSID, a safety shutdown is initiated. See Figure 18.

FIG. 18 – OIL AND FILTER PRESSURE TRANSDUCERS

An oil supply line from the manifold at SB-2 is piped to the capacity control directional valve at Port P. The 4-way capacity control solenoid (directional) valve directs oil pressure against one side or the other of the slide valve piston. The opposite side of the slide valve is relieved to suction pressure at compressor port SC-11. The differential pressure between the P port and the suction pressure at Compressor Port SC-11 is what provides the force to load or unload the slide valve and provide capacity control. Refer to Fig. 26, Capacity Control Schematic Diagram.

Oil flows from the oil manifold at SB-2 to the brazed plate, refrigerant cooled oil cooler. Cool oil leaving the brazed plate heat exchanger flows to the eductor block manifold. The oil circuit is separate from the eductor oil management system. See Figure 19.

The eductor block manifold oil circuit contains the Seal Oil Pressure Transducer and a High Oil Temperature

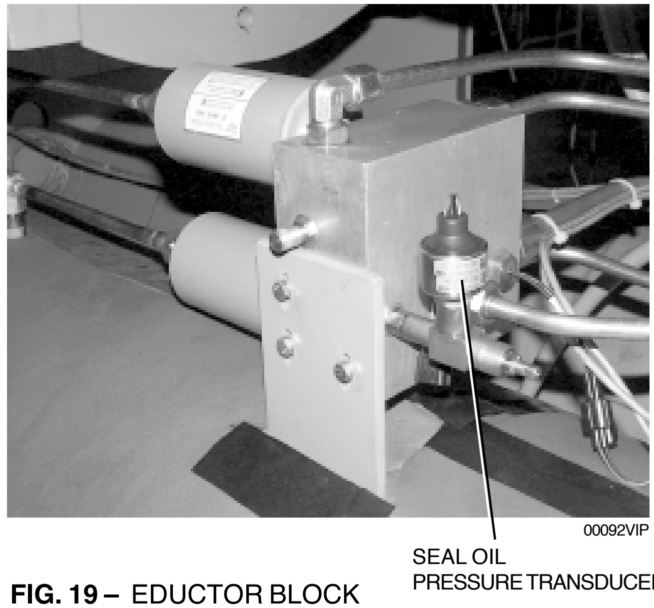

FIG. 19 – EDUCTOR BLOCK

Safety sensor. The Seal Oil Pressure is monitored by the control panel. The differential pressure between the Seal Oil Pressure and the Evaporator Pressure Transducer is calculated and compared to the control panel logic. If the differential reaches the set point (30 PSID for R-22 and 20 PSID for R-134a, the control panel will initiate a safety shutdown. A high oil temperature safety shutdown will be initiated at 170ºF (77ºC).

The oil leaving the oil eductor manifold block flows into the compressor at compressor port SB-3 to lubricate the compressor bearings and shaft seal. All of the oil that is injected into the compressor mixes with refrigerant gas during compression. The oil and refrigerant gas is discharged into the oil separator, where it is separated and returned to the oil sump. A high discharge temperature safety is located in the discharge line, between the compressor and oil separator. This safety will initiate a safety shutdown at 210ºF (99ºC).

Oil is separated from the refrigerant gas in the oil separator in a three step process.

In the first stage of oil separation, high velocity oil and refrigerant gas in the compressor discharge line under goes a rapid reduction in velocity as it enters the large diameter oil separator. Most of the oil drops out of the refrigerant gas stream due to the reduction in velocity. The oil falls by gravity into the oil reservoir located in the bottom of the oil separator.

The second stage of oil separation is accomplished by directing the refrigerant gas through mesh pads that have an extended surface area. Smaller liquid oil droplets are collected on the extended surface area of the wire mesh pads where the oil falls by gravity into the oil reservoir.

The third and final stage of oil separation is achieved in the oil coalescing element section of the oil separator. The oil mixed with the refrigerant entering the coalescer element is a very fine aerosol mist about the size of cigarette smoke particles. These small aerosol mist particles wet the coalescer element media and form larger oil droplets which fall by gravity to the bottom of the coalescer element section. The oil collected in the coalescer section is drained from the oil separator with a small amount of refrigerant gas. This provides the high pressure "gas drive" for the eductors to return oil from the evaporator. Refer to section titled "Oil Eductor Circuit", page 41.

Three sight glasses are provided in the oil separator for monitoring the oil level and verifying performance of the coalescer element. Liquid oil should be visible in the top glass of the oil separator when the chiller is off. During operation, oil may be higher or lower due to system load and operating conditions.

A low oil level safety switch is provided in the bottom of the oil separator. A safety shutdown will be initiated if the oil level is below the switch setting for 30 continuous seconds after the chiller has been running for 3 minutes.

An oil drain and charging valve is located on the bottom of the oil separator. A 5/8 inch male flare connection is provided for ease of connecting a hose to quickly drain used oil into a EPA approved recovery cylinder or tank. Oil can be added into the oil reservoir with the chiller in service.

CAUTION

Do not add oil. YORK YS Chiller packages are pre-charged with the correct amount of YORK oil during functional testing after manufacture. Refer to the Table 6, YORK Oil Types, in the Maintenance Section.

Oil loss is most often the result of operating conditions at loads under 10% of the chillers rated capacity and with condensing water that is too cold for load and operating condition.

The oil is not "lost" but has migrated into the refrigerant charge and is most likely in the evaporator. Excessive amounts of oil in the evaporator will result in operational problems.

Oil management problems result if the compressor discharge superheat is not maintained at the values listed in Table 9. Compressor discharge superheat is the difference between the compressor discharge temperature and the saturated condenser temperature. Compressor discharge superheat is used in conjunction with the evaporator approach to determine the most efficient refrigerant charge.

WARNING

Should the control panel display EXCESS CHARGE WARNING this is most likely the result of excessive amounts of oil in the evaporator. Excess amounts of oil in the refrigerant will cause foaming. The oil foam carries liquid refrigerant into the compressor. This results in lowering the compressor discharge superheat to low levels. If the compressor discharge superheat falls to within 10ºF of the saturated condensing temperature the control panel will display EXCESS CHARGE WARNING. Compressor loading will be inhibited while the EXCESS CHARGE WARNING is displayed. The inhibit loading will remain in effect until the compressor discharge superheat increases to 15ºF. Refer to "Oil Recovery Procedure" in the Maintenance section on page 56.

OIL EDUCTOR CIRCUIT

An oil eductor circuit is provided to properly manage the amount of oil in the refrigerant charge. A small amount of oil is normal in the refrigerant charge and will be found in the evaporator. If not properly managed the oil will accumulate and have adverse consequences regarding chiller performance.

The oil eductor circuit consists of three refrigerant and oil filter driers, two "jet pump" eductors and the interconnecting piping. Refer to Figures 21 and 22.

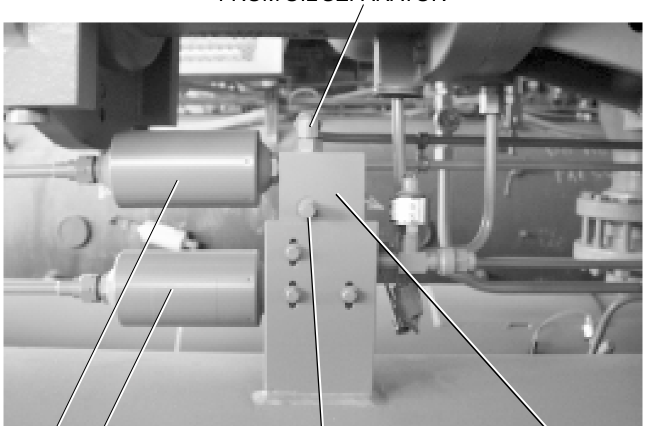

FIG. 21 – FILTER DRIERS AND OIL EDUCTOR

The eductors operate using the "jet pump" principle. Discharge pressure gas and oil flows through a filter dryer located at the bottom of the oil separator. YS Chillers are supplied with a variable orifice arrangement. The reduced pressure (pumping action) is created by the velocity of the discharge pressure gas and oil flowing through the orifice and nozzle. This creates a reduced pressure area that allows the oil-rich refrigerant and oil to flow from the evaporator into the compressor.

Oil-rich refrigerant flows into the eductor block through the filter drier from the evaporator. The oil rich refrigerant mixes with the discharge pressure gas and flows into the compressor suction line.

A second eductor flows oil, which may have collected in the evaporator trough through the second filter drier located on the eductor block. This oil mixes with the discharge gas in the eductor block and flows to the compressor at port SC-5.

The filter driers should be changed annually or when excessive amount of oil is indicated in the refrigerant charge.

LIQUID REFRIGERANT CIRCUIT

Liquid refrigerant flows from the condenser into the evaporator by differential pressure. Sub-cooled liquid refrigerant flows out of the condenser into the liquid line. A metering orifice is installed in the liquid line to control the rate liquid refrigerant flows into the evaporator. The orifice is selected based upon the operating conditions of the chiller. Refer to Figure 23.

YS Chillers are supplied with a variable orifice arrangement. In parallel with the metering orifice is a solenoid valve and hand-throttling valve. The solenoid is energized open by the DIFFERENTIAL PRESSURE set point that is field programmable from the panel. The differential pressure between condensing pressure and evaporating pressure is compared to the set point value. When the differential pressure is at or less than the setpoint, the solenoid valve is energized open. The solenoid valve is de-energized closed when the differential pressure is equal to or greater than the setpoint plus 10 PSIG. A hand-throttling valve is provided to adjust the refrigerant flow rate through the solenoid valve to match the system operating conditions.

Dual Service Chillers – Ice duty and comfort cooling air conditioning applications will require the solenoid valve to be energized open in the air conditioning mode of operation since this represents the low differential pressure mode of operation.

The differential pressure setpoint is field programmable within the ranges specified in Table 5 for different refrigerants and EPROM version S.01F.17 and later. See YORK Service Bulletin 160.47-M2 (SB18) for programming instructions.

TABLE 5 – VARIABLE ORIFICE PRESSURE DIFFERENTIAL SETPOINTS

REFRIGERANT	DIFFERENTIAL PRESSURE RANGE
R-22	25 - 150 PSID
R-134A	15 - 110 PSID

A liquid line hand-isolation valve is located between the condenser and the metering orifice plate. This valve, in combination with the hand isolation valve between the oil separator and the condenser, allows all of the refrigerant charge to be stored in the condenser.

A ½ inch liquid refrigerant supply is piped from the bottom of the liquid line to the refrigerant cooled oil cooler. The refrigerant gas from the oil cooler is piped directly into the evaporator.

A liquid refrigerant-charging valve is piped into the liquid line between the evaporator and the metering orifice. A ¾ inch male flare connection is provided for connecting hoses or transfer lines.

CAPACITY CONTROL

Refer to the Capacity Control Piping Schematic piping, Fig. 26.

Capacity control is accomplished by using differential pressure to move the slide valve. As the slide valve is moved axially between the compressor rotors the volume of gas pumped by the compressor is changed to match the system requirements.

Leaving evaporator fluid temperature is continuously monitored by the microprocessor. The Leaving Evaporator fluid temperature is compared to the Leaving Evaporator fluid Set Point. When the leaving evaporator fluid temperature is beyond the range of the set point value a signal is sent to the relay output board. A signal is sent from the relay output board to energize the 4-way valve directional solenoid valves.

When Solenoid Valve B is energized the slide valve begins to move in the load direction. The 4-way directional valve opens Port P to Port B and Port A to Port T. Oil pressure from the oil circuit flows into the 4-way solenoid valve sub-plate manifold at Port P. Oil pressure flows through the sub-plate manifold block and out Port B to Compressor Port SC-2. Simultaneously, oil flows out of Compressor Port SC-1 into Port A on the sub-plate manifold, through the sub-plate manifold block and out of the sub-plate manifold block at Port T to suction pressure.

When the Solenoid Valve A is energized, the slide valve will move in the unload direction. The 4-way directional valve opens Port P to Port A and Port B to Port T. See Figure 24. High pressure oil flows into Compressor Port SC-1 and oil is relieved out of Compressor Port SC-2 to suction pressure.

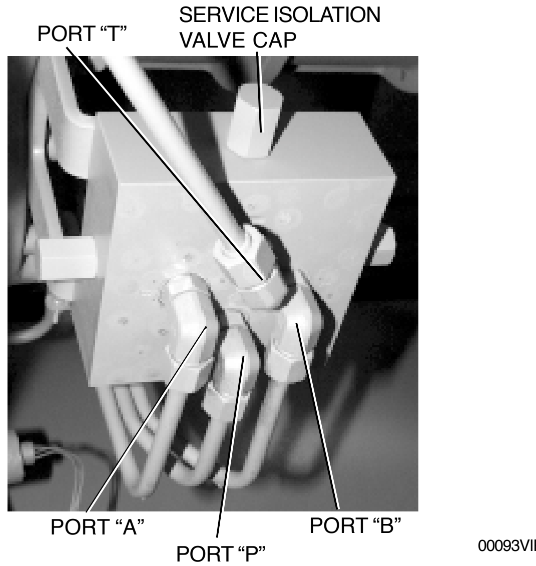

FIG. 24 – 4-WAY DIRECTIONAL VALVE SUBPLATE

A slide valve potentiometer is used to provide feedback to the microprocessor to display slide valve position as a percentage of full load. See Fig. 25.

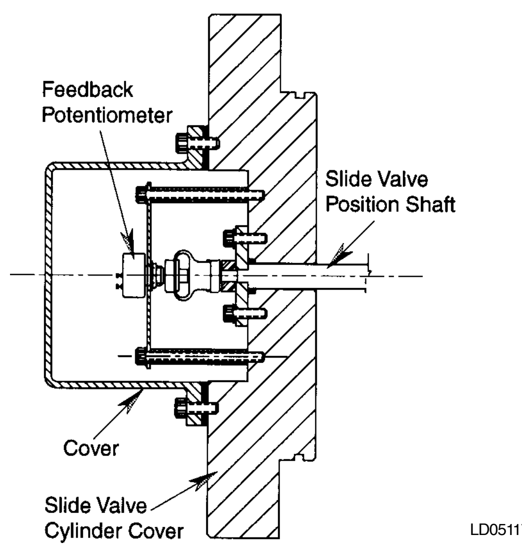

FIG. 25 – SLIDE VALVE POTENTIOMETER

Four manual isolation valves are incorporated into the 4-way solenoid sub-plate to isolate the 4-way directional valve for service. Remove the steel hexagonal caps to gain access to the service valve stem. Use a refrigeration service valve wrench to close or open the valves.