YORK®

CodePak

ROTARY SCREW LIQUID CHILLER

OPERATING AND MAINTENANCE

Supersedes: Nothing | 790 | FORM 160.65-O1

MODEL YS NN NN S7
(STYLE A)

COOLING

1000 THRU 1250 TONS

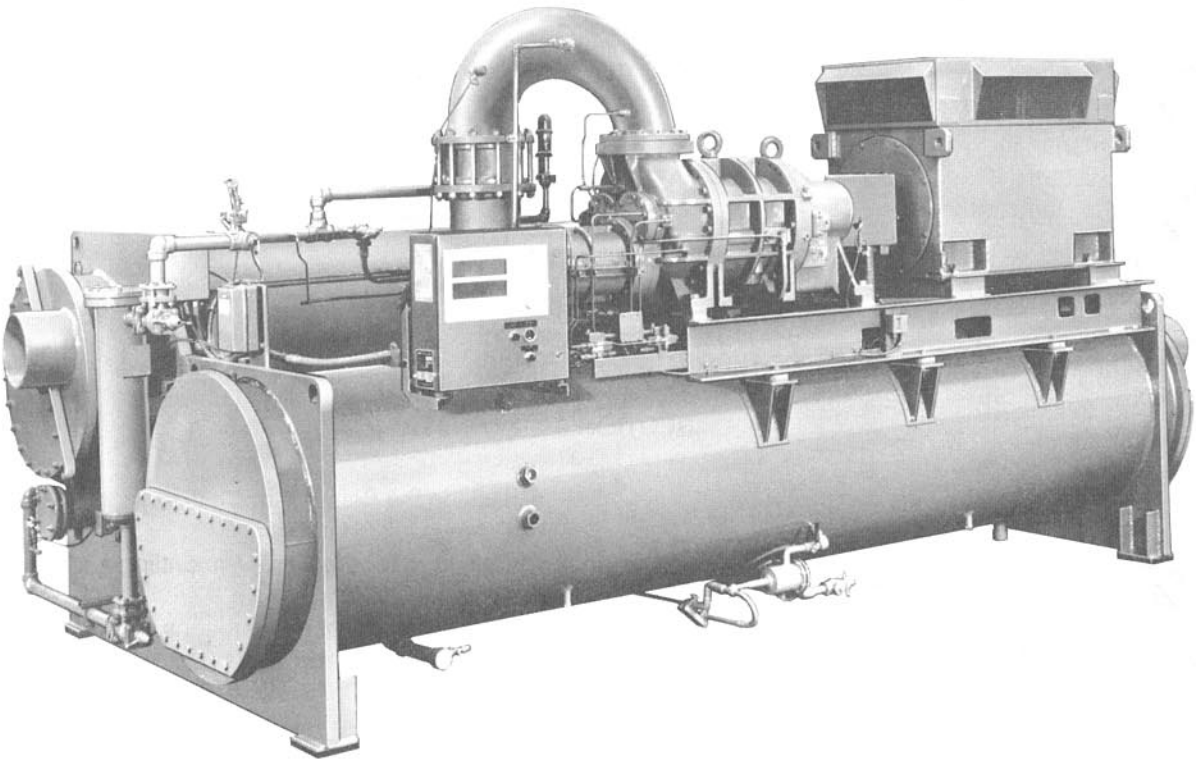
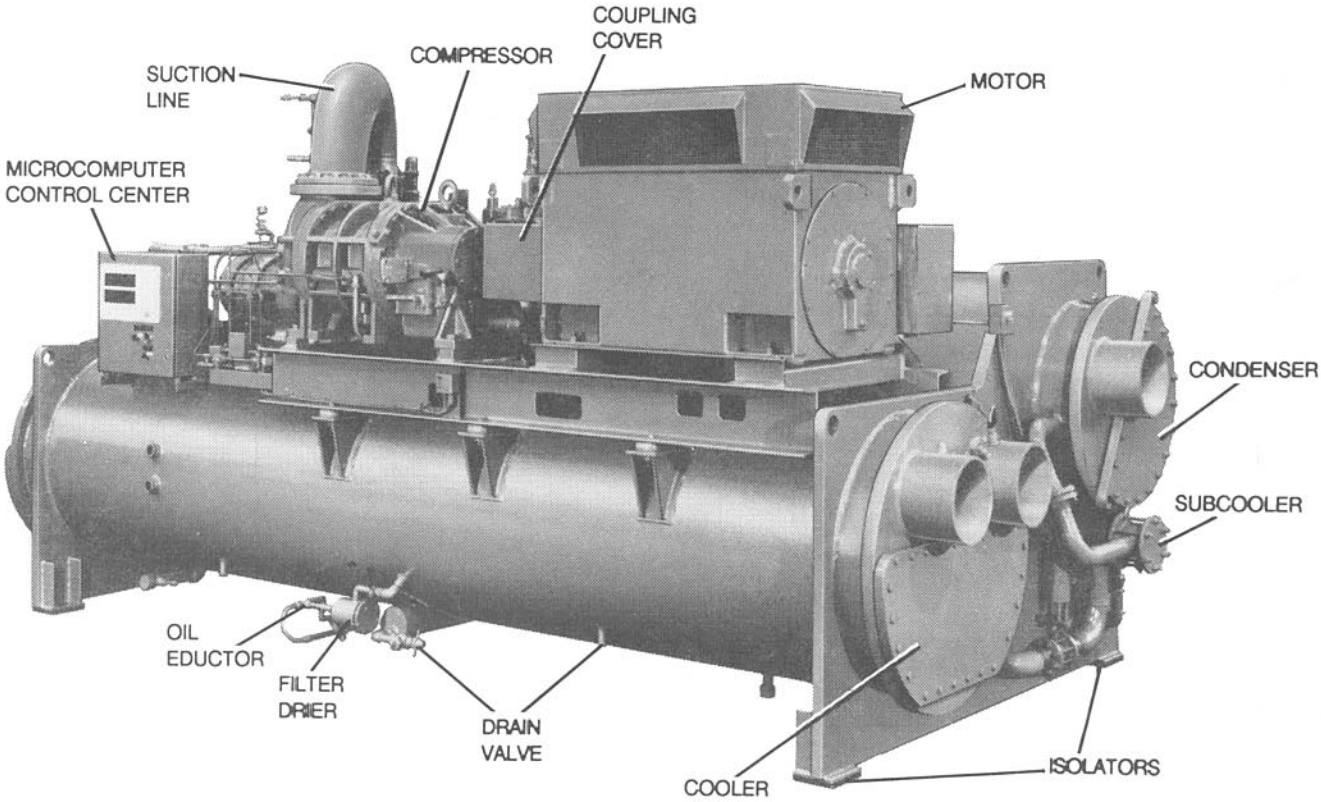


TABLE OF CONTENTS

REFERENCE INSTRUCTIONS

FORM NO.	DESCRIPTION	FORM NO.	DESCRIPTION
160.65-O1.1	MICROCOMPUTER CONTROL CENTER OPERATION AND MAINTENANCE	160.65-RP2	COMPRESSOR
160.65-PA2.1	WIRING DIAGRAM UNIT	160.65-RP3	MICROCOMPUTER CONTROL CENTER
160.65-PA3.2	FIELD WIRING DIAGRAM	160.65-RP4	REFRIGERANT TRANSFER UNIT
160.65-RP1	UNIT (GENERAL)	55.55-RT3	REFRIGERANT-22 CONVERSION TABLES

SECTION 1
DESCRIPTION OF SYSTEM AND OPERATIONAL FUNDAMENTALS



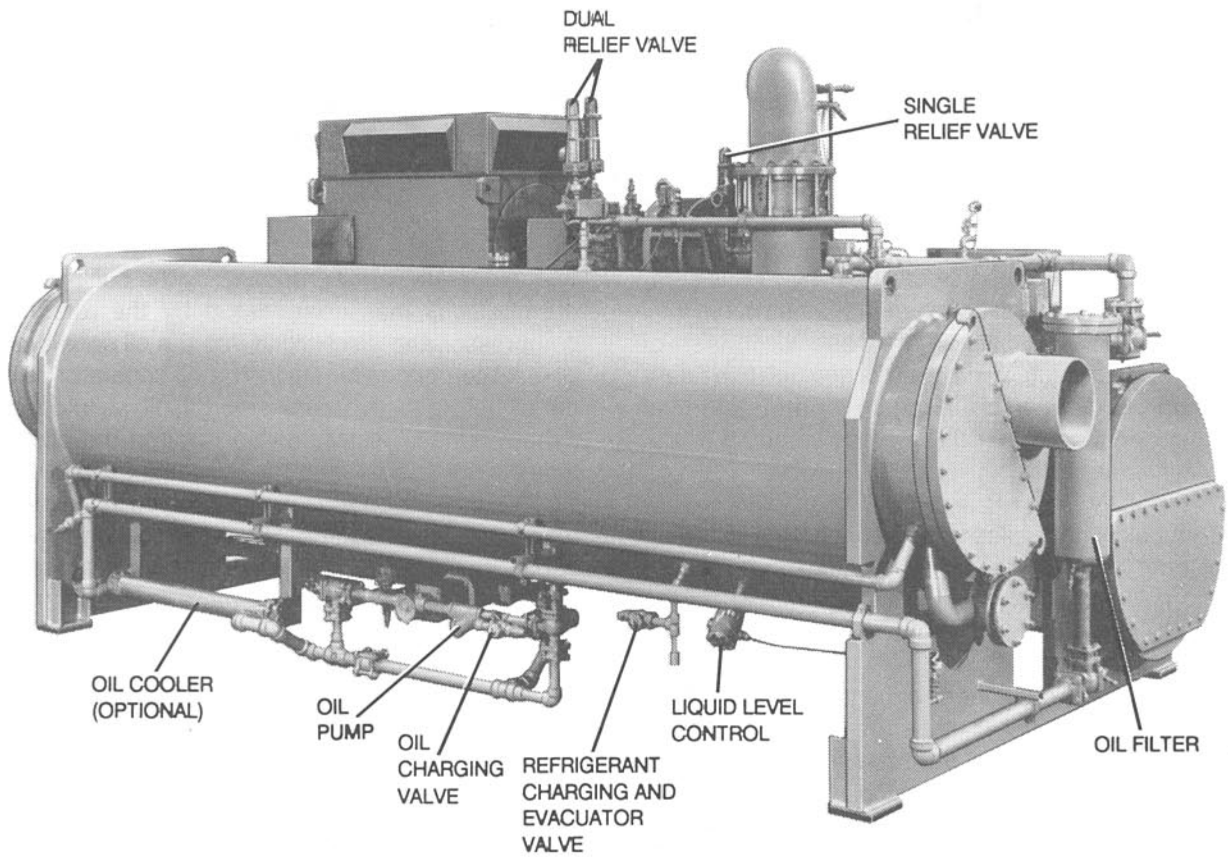


FIG. 1 – MODEL YS NN NN S7 CODEPAK ROTARY SCREW CHILLER FRONT VIEW AND REAR VIEW

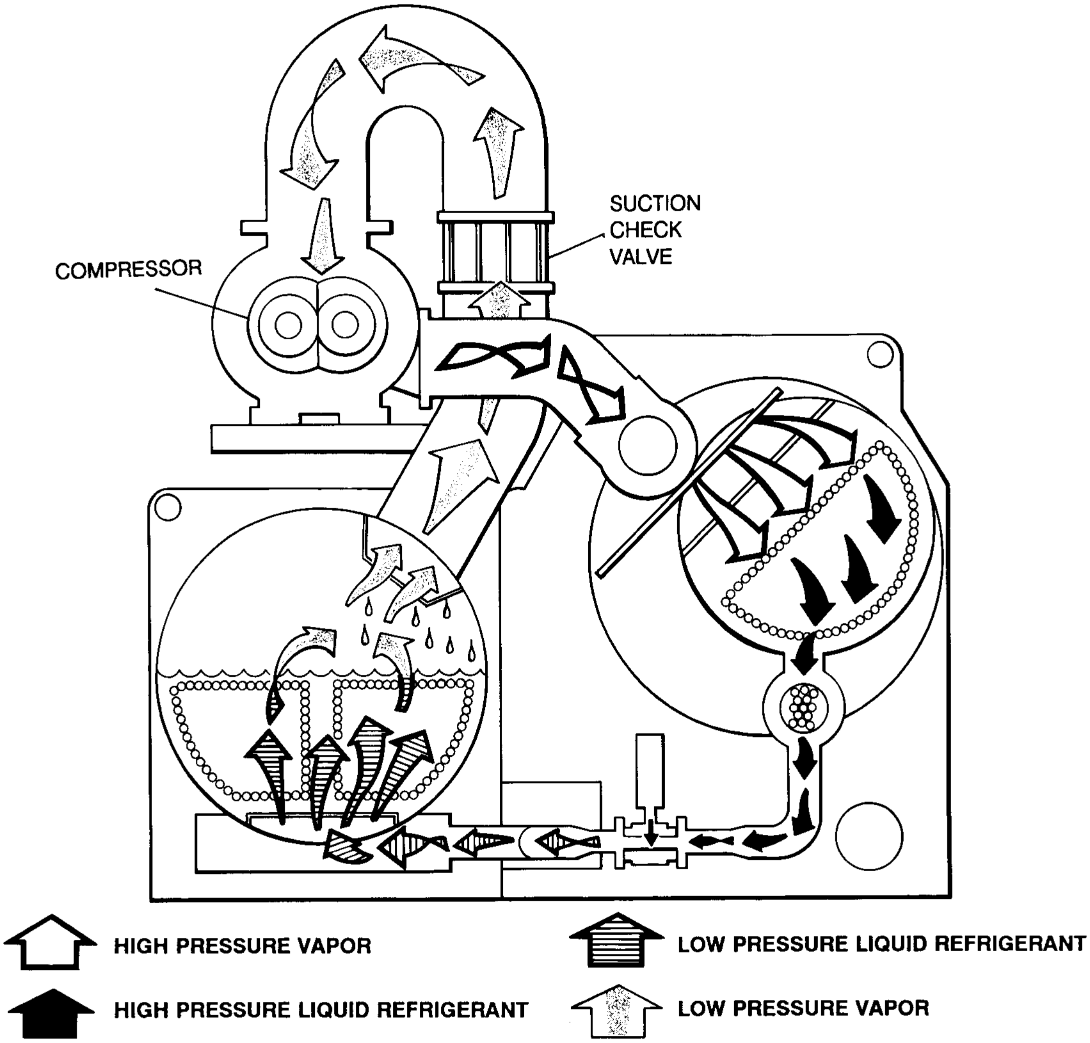


FIG. 2 – YORK SCREW COMPRESSOR REFRIGERANT FLOW

SYSTEM OPERATION DESCRIPTION
(See Fig. 2)

The YORK Codepak Rotary Screw Liquid Chiller is commonly applied to large air conditioning systems, but may be used on other applications. The Codepak consists of an open motor mounted on a base connected to a rotary screw chiller with a coupling, a combination oil separator-condenser-subcooler, a cooler, and a MicroComputer Control Center.

The Codepak is controlled by a modern state-of-the-art MicroComputer Control Center which monitors it's operation. The control center is programmed by the operator to suit job specifications.

In operation, a liquid (water or brine to be chilled) flows through the cooler, where Refrigerant-22, boiling at a low temperature, absorbs heat from the liquid. The chilled liquid flows through pipes to fan coil units or other air conditioning terminal units, where it flows through finned coils, absorbing heat from the air. The warmed liquid is then returned to the cooler to complete the chilled liquid circuit.

The refrigerant vapor produced by the boiling action in the cooler is then compressed by the rotary screw compressor and discharged into the oil separator section of the condenser shell. The oil separator removes the oil before the high pressure gas flows into the condenser bundle. Water flowing through the condenser tubes absorbs heat from the refrigerant vapor, causing it to condense. Condenser water is supplied to the chiller from an external source, usually a cooling tower. The condensed refrigerant flows from the condenser into a subcooler where it's temperature is further reduced before entering the cooler. A liquid level control valve in the liquid feed line meters the flow of the refrigerant to the cooler to complete the refrigerant circuit.

The major components of a Codepak are selected to handle the refrigerant which would be evaporated at full load design conditions. However most systems will be called upon to deliver full load capacity for only part of the time the unit is in operation.

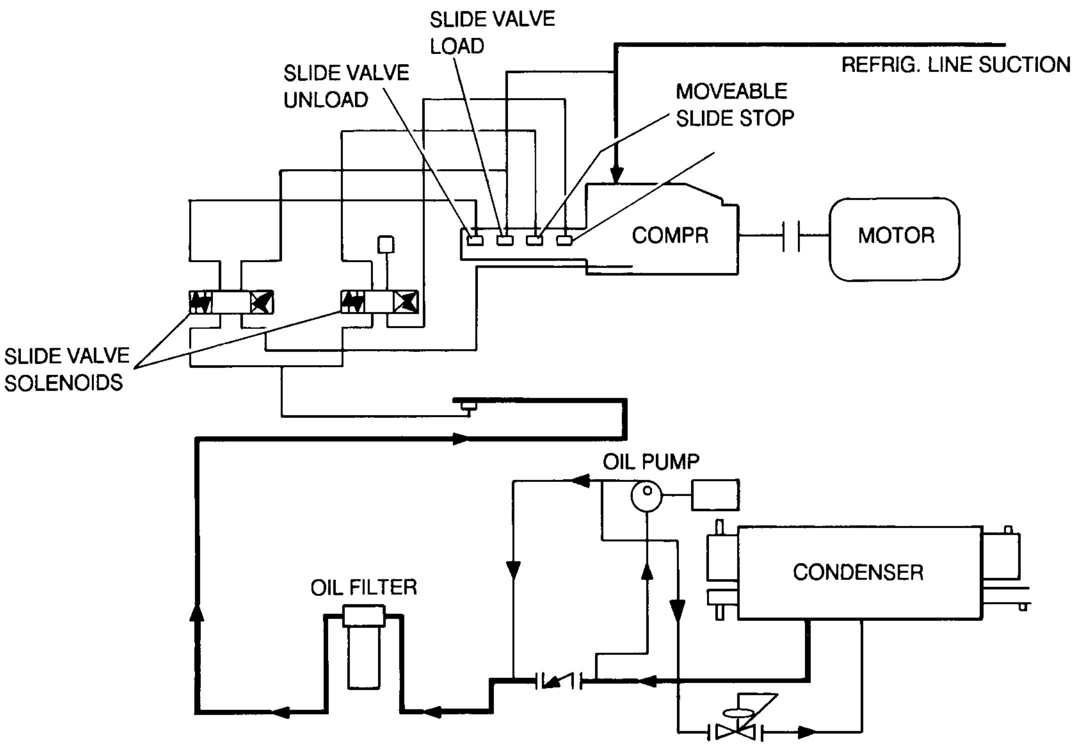


FIG. 3 – YORK SCREW CHILLER CAPACITY CONTROL

CAPACITY CONTROL
(See Fig. 3)

The major components are selected for full load requirements, and therefore must be controlled to maintain a constant chilled liquid termperature leaving the cooler at part load conditions. A slide valve arrangement located on the rotary screw compressor compensates for the variation in load.

The slide valve arrangement is controlled by the Micro-Computer Control Center, which senses the building load and sends signals to solenoid valves which load and unload the compressor and vary the compressor's volume ratio with the use of compressor oil under pressure (hydraulically), thus controlling the chiller capacity. A cylinder located on the inlet end of the compressor houses a spring loaded shaft and pistons which is fed by compressor oil. The flow of the oil is controlled by the MSV solenoid valve which loads and unloads the compressor, and the MSS solenoid valve which varies the internal compressor volume ratio to match varying system pressures.

SECTION 2
SYSTEM OPERATING PROCEDURES

INITIAL START-UP

PRESTART CHECKLIST

All check points in the following list must be completed before placing the Rotary Screw Liquid Chiller in operation. Only when the checklist is completed will the unit be ready for initial start-up.

	CHECKPOINT
	Pressure test introducing pressure to unit and check for leaks.
	Confirm motor disconnect is open.
	With compressor coupling center removed confirm the motor will drive the compressor CLOCKWISE when facing the compressor shaft end. (NOTE: Directional arrow on shaft seal cover?)
	Confirm proper coupling alignment and replace coupling center.
	Confirm oil level is between the two sight glasses on the oil separator.
	Confirm all field wiring connections have been made.
	Turn oil pump switch to OFF position on microprocessor junction box.
	Confirm emergency stop switch is not pushed in. Release by gently twisting to the left.
	Confirm microcomputer control center display is operating.
	Confirm microcomputer pressure and temperatures are consistent within anticipated ranges. HTR on message should be present. Confirm heaters are operating.
	Rotate displays to SETPOINT DISPLAY. Enter variable setpoints. Rotate displays and return to SETPOINT DISPLAY to confirm entry.
	Rotate displays to ANNUNCIATOR DISPLAY. Confirm all setpoints are normal and no alrm or cutout indications are present.
	Rotate displays to OPERATING DISPLAY. Open all oil system service valves and start oil pump by turning the oil pump switch to HAND.
	Confirm oil pressure buildup and pump rotation. Oil level may drop as oil filters and oil coolers fill up. Add oil as required.
	Allow oil pump to operate 10 minutes to flush lubricating circuit.
	Shut down oil pump.
	Place oil pump switch in the AUTO mode.
	Open discharge service valve.
	Confirm all unloader and slide stop service valves are open.
	Confirm all oil return system service valves are open.
	Confirm oil injection service valves are open.
	Close motor main disconnect.

START-UP PROCEDURE

PRE-STARTING

1. Oil Heaters – The oil heaters should be energized for 12 hours prior to starting the chiller. The unit will not start if the oil is less than 50°F.
2. Oil Pump – Place oil pump switch in Auto Mode.
3. Slide Valve – Slide valve and slide stop potentiometers should be checked for proper adjustment. Refer to MicroComputer Control Center instruction. Form 160.65-OM1.
4. Current Limit – Refer to MicroComputer Control Center instruction, Form 160.65-OM1 for adjustment of current limit prior to starting.
5. Adjustable Set Points – All MicroComputer Control Center adjustable setpoints should be programmed prior to starting. (Refer to MicroComputer Control Center instruction Form 160.65-OM1). If not programmed the "default" value setpoints are as follows:

ADJUSTABLE SETPOINTS: ID = [ØØ] [ØØ-ØØ-ØØ]
PAGE #1 Wed [ØØ-ØØ-ØØ]
Lo Suct Cutout - [55. Ø g] Baud - - - - [19 2ØØ]
Lo Suct Alarm - - [55. Ø g]

Hi Disch Cutout - [27 Ø g] Flow [Shutd] [NC]
Hi Disch Alarm - - [26 Ø g]
MLC1 Stop Load - - - [1 ØØ%] CT Factor - [ØØØ]
MLC2 Force Unload - [1 Ø5%] Recy. Delay - [3 Ø]

ADJUSTABLE SETPOINTS:
PAGE #2

Liquid Setpoints: Liquid Control Setpoints:

Cap. Control - - [+ØØØ°F] Position - [Ø5Ø%]
Lo Liq Temp Cut [+ØØØ°F] Dead Band [Ø1%]
Lo Liq Temp Alr [+ØØØ°F] Pro. Band [1ØØ%]
D.B. - [Ø1°F] P.B. - [1Ø%]

* Display for illustrative purposes only.

START-UP

1. If the chilled water pump is manually operated, start the pump. The control center will not allow the chiller to start unless the chilled liquid flow is established through the unit. (A field supplied chiller water flow switch is required).

2. To start chiller, press compressor RUN key on key pad. The oil pump will start and establish oil pressure (greater than 10 lbs. over discharge pressure). The MicroComputer Control Center will unload the slide valve allowing compressor motor to start.

NOTE: *If any malfunctions occur, the alarm or cutout will flash on display screen and will be recorded on Annunciator screen until cleared. Message will also be recorded on Shutdown Record screen with date and time of shutdown.*

CODEPAK OPERATION

After the compressor reaches its operating speed the slide valve will begin to open under the control of the MicroComputer Control Center which senses the leaving chilled liquid temperature. The unit capacity will vary to maintain the leaving chilled liquid temperature setpoint. A drop in chilled liquid temperature below set point will cause the slide valve to close, decreasing CodePak capacity. When the chilled liquid temperature rises the slide valve opens increasing capacity. However, the current draw (amperes) by the compressor motor cannot exceed the setting of the "% FLA" at any time during operation. The MicroComputer Control Center will prevent the slide valve from loading the machine above the full load amp setpoint.

CHECKING OPERATION

A permanent daily record of system operating conditions (temperatures and pressures) at regular intervals throughout each 24 hour operating period should be kept. An accurate record of readings serves as a valuable reference for operating the system. Readings taken when a system in newly installed will establish normal conditions with which to compare later readings. For example, dirty condenser tubes may be indicated by higher than normal temperature differences between leaving condenser water and refrigerant leaving the condenser.

OPERATING LOG SHEET
(See Fig. 4)

A permanent record of system operating conditions (temperatures and conditions) recorded at regular intervals thoughout each 24 hour operating period should be kept.

YORK
INTERNATIONAL

ROTARY SCREW
LIQUID CHILLER LOG SHEET
1000 – 1250 TONS

Chiller Location

System No.

Date												
Time												
Hour Meter Reading												
O.A. Temperature D.B./W.B.			/	/	/	/	/	/	/	/	/	/
Compressor		Oil Level										
		Oil Pressure										
		Oil Temperature										
		Suction Temperature										
		Discharge Temperature										
		Filter PSID										
		Slide Valve Position %										
		V Ratio										
		Oil Added (gals.)										
Motor		Volts										
		Amps										
Cooler	Refrig.	Suction Pressure										
	Liquid	Inlet Temperature										
		Inlet Pressure										
		Outlet Temperature										
		Outlet Pressure										
		Flow Rate — GPM										
Condenser	Refrig.	Discharge Pressure										
		Corresponding Temperature										
		High Pressure Liquid Temperature										
		System Air — Degrees										
	Water	Inlet Temperature										
		Inlet Pressure										
		Outlet Temperature										
		Outlet Pressure										
		Flow Rate — GPM										

(390) FORM 160.65-F2

FIG. 4 – LIQUID CHILLER LOG SHEET

An optional status printer is available for this purpose or Fig. 4 shows a log sheet used by YORK Personnel for recording test data on Codepak systems. It is available from the factory in pads of 50 sheets each under Form 160.65-F2 and may be obtained through the nearest YORK office.

OPERATING INSPECTIONS

By following a regular inspection using the display readings of the MicroComputer Control Center, and maintenance procedure, the operator will avoid serious operating difficulty. The following list of inspections and procedures should be used as a guide.

DAILY

1. Check MicroComputer Control Center displays.
2. When the compressor is in operation, check oil pressure by reading the display on the control center. Also check the oil level in the oil separator. Add oil if necessary.
3. Check oil filter differential pressure.
4. Check entering and leaving condenser water pressure and temperatures for comparison with job design conditions.
5. Check the entering and leaving chilled liquid temperatures and evaporator pressure for comparison with job design conditions.
6. Check the condenser saturation temperature based upon condenser pressure sensed by the condenser transducer.
7. Check compressor discharge temperature.
8. Check motor voltage and current (AMPS) at starter.
9. Check for any signs of dirty or fouled condenser tubes. (The temperature difference between water leaving condenser and liquid refrigerant leaving the condenser should not exceed the difference recorded for a new unit by more than 4°F).
10. Verify proper water treatment.

MAINTENANCE SCHEDULE

The following maintenance schedule should be followed to assure trouble-free operation of CodePak.

NEED FOR MAINTENANCE OR SERVICE

If the system is malfunctioning in any manner or the unit is shutdown by one of the safety controls, consult the troubleshooting section of the MicroComputer Control Center Instruction (Form 160.65-OM1). After consulting the instruction if the proper repairs can not be made, or adjustments to start the compressor, or the particular trouble continues to hinder performance of the unit, please contact the nearest YORK District Office. Failure to report constant troubles could damage the unit and increase the cost of repairs considerably.

NORMAL AND SAFETY SYSTEM SHUTDOWNS

Normal and safety system shutdowns have been built into the CodePak to protect it from damage during certain operating conditions. Therefore, it should be understood that at certain pressures and temperatures the system will be stopped automatically by controls that

TABLE 1 – MAINTENANCE SCHEDULE

MAINTENANCE	HOURS OF OPERATION (MAXIMUM)																					
	200	1000	5000	8000	10000	15000	20000	25000	30000	35000	40000	45000	50000	55000	60000	65000	70000	75000	80000	85000	90000	95000
CHANGE OIL			X						X						X						X	
CHANGE FILTER	X		X		X		X		X		X		X		X		X		X		X	
CHANGE FILTER DRIER	X		X		X		X		X		X		X		X		X		X		X	
OIL ANALYSIS	X		X		X		X		X		X		X		X		X		X		X	
CHECK ALIGNMENT	X		X		X		X		X		X		X		X		X		X		X	
CHECK COUPLING	X		X		X		X		X		X		X		X		X		X		X	
CHECK TEMP AND PRESS. CALIBRATION	X	X	X		X		X		X		X		X		X		X		X		X	
REPLACE OIL SEAL									X													
VIBRATION ANALYSIS	X				X				X				X				X				X	
INSPECT COMPRESSOR													X									

respond to high temperatures, low temperatures, and low and high pressures, etc. If the CodePak shuts down on a "Safety" shutdown, the operating display will flash the word "Cutout". Conditions at time of the most recent cutout will be retained on Freeze Display Screen. Safety shutdowns are also recorded and retained on the shutdown record screen where the cutout, date and time of shutdown are recorded for the past six shutdowns. To clear "Cutout" scroll display to annunciator screen and press "Clear".

STOPPING THE SYSTEM

1. Push compressor stop. The Operating Display will show compressor in the "OFF" mode.

2. Stop the chilled water pump (if not wired into the MicroComputer Control Center in which case it will shut off automatically).

3. Open the switch to the cooling tower fan motors, if used.

4. The oil separator heaters (thermostatically controlled) are energized when the unit is stopped.

PROLONGED SHUTDOWN

If the CodePak is to be shut down for an extended period of time (for example, over the winter season), the following paragraphs outline the procedure to be followed:

1. Leak check all system joints for refrigerant leaks with a leak detector. During long idle periods, the tightness of the system should be checked periodically.

2. Inspect and replace oil filter element. At the same time take an oil sample and have a chemical analysis performed. If the analysis indicates the oil should be changed, oil charge should be drained and replaced before next start-up.

3. If freezing temperatures are encountered while the system is idle, carefully drain the cooling water from the cooling tower, condenser pump, oil cooler, condenser, and chilled water system-chilled water pump and coils. Open the drains on the cooler and condenser liquid heads to assure complete drainage.

4. If power is disconnected, remove battery backup jumper in MicroComputer Control Center to conserve the battery. Refer to MicroComputer Control Center instruction.

NOTE: Before starting, oil heaters should be energized at least 24 hours.

START-UP AFTER PROLONGED SHUTDOWN

To start-up after a prolonged shutdown the following procedure should be followed:

1. Any water necessary for the operation of the system that may have been drained or shut off should be restored and turned on. If oil cooler heads were removed, reinstall and remove tags.

2. Close disconnect switches for compressor, motor and oil pump starters.

3. Turn Main Disconnect to energize oil heater circuit breaker.

4. Perform checkpoints on prestart check list, then start unit.

PUMPDOWN AND REFRIGERANT ISOLATION PROCEDURE

CAUTION: The procedure to be followed and technique used to pump down large tonnage ref. systems utilizing flooded coolers requires the services of a trained technician. Failure to observe and understand the system conditions during pump-out may result in extensive damage to system components.

1. Shutdown unit and isolate main power.

2. Close following valves to isolate condenser.
   a. Compressor discharge valve.
   b. Oil supply at valve downstream of oil filter.
   c. Oil eductor return line at suction line.
   d. Gas supply at discharge connection.
   e. Liquid valve between cooler and condenser if liquid control valve is installed, utilize manual feature on others. Close manual ball valve.

3. Stop condenser water flow and chiller liquid flow.

4. Referring to pump-out schematic valve arrangement outlined above, set up pump-out manifold and unit valves as follows:
   a. Close pump-out manifold valve "A".
   b. Open pump-out manifold valve "B".
   c. Close pump-out manifold valve "C".
   d. Open pump-out manifold valve "D".
   e. Open condenser vapor valve "E".
   f. Open cooler vapor valve "F".

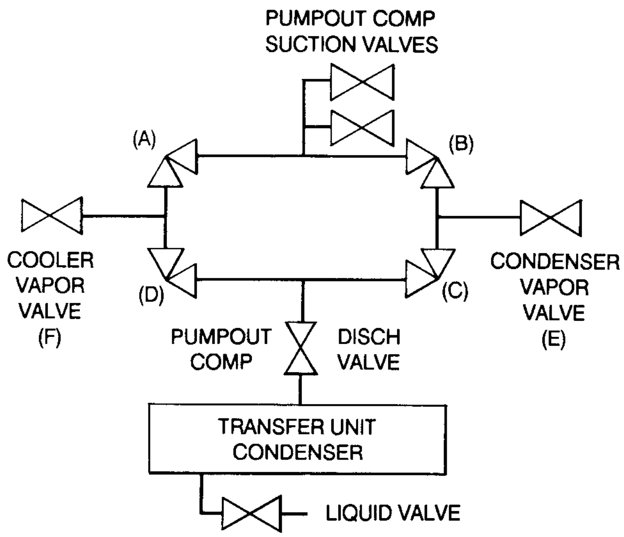


FIG. 5 – PUMPOUT VALVE SCHEMATIC

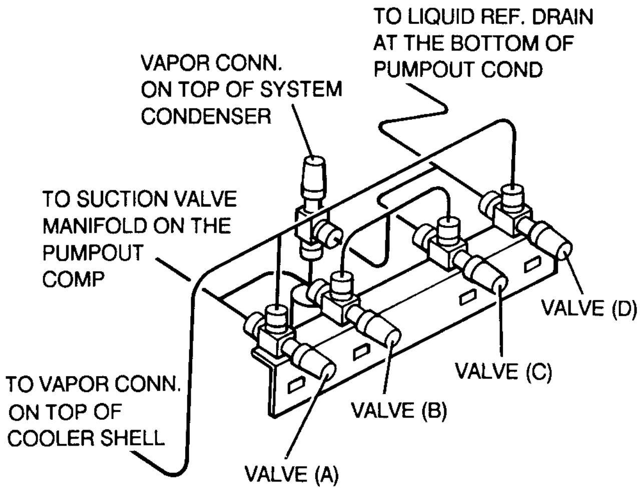


FIG. 6 – REFRIGERANT TRANSFER UNIT VALVES

5. Check transfer unit compressor for oil level and crankcase heat, should be hot to touch.

NOTE: *This compressor is directional, be sure rotation corresponds to arrow cast in compressor housing on oil pump end. Open suction and discharge valves of transfer unit compressor.*

NOTE: *This compressor utilizes dual suction valves at compressor. Both valves must be open. Connect suitable gauges to transfer unit compressor suction discharge valve ports. Isolate water flow to refrigerant transfer unit condenser. After completing above, refrigerant transfer unit compressor will be in stand-by condition.*

6. Start transfer unit compressor. Observe transfer unit compressor gauges. When differential between cooler and condenser is 30 psig or more, manually open liquid line valve approximately 25%. Observe condenser side of liquid line. When a gas flow is sensed, manually close liquid line valve. Stop transfer unit compressor.

At this point, establish water flow through cooler and open water valves to the transfer unit condenser receiver. Re-arrange pump out valve manifold as follows:

1. Open manifold valve "A".

2. Close manifold valve "B".

3. Throttle manifold valve "C" to obtain approximately 215 psig. discharge at transfer unit compressor during operation.

4. Close manifold valve "D".

5. Allow condenser valve "E" and cooler valve "F" to remain open.

6. Start transfer unit compressor again and monitor gauges at compressor until suction pressure of the cooler indicates 60 psig. Stop transfer unit and observe compressor suction pressure. Any rapid rise in suction pressure would indicate residual liquid remaining in the cooler. Allow 5 to 10 minutes of transfer unit compressor down time and then re-start.

Watch rate of pull down at transfer unit. Suction slow pulldown is another indication of residual liquid. Repeat pulling down to 60 psig as outlined above until complete cycle indicates slow rise in suction after shutdown and rapid decrease upon re-start.

At this point, carefully pull down to 50 psig and stop transfer unit compressor. Wait 10 minutes and observe suction pressure. If a substantial rise is noted repeat pull down to 50 psig again.

When suction pressure rise above 50 psig stabilizes at 65 psig or less after 10 minutes of pump out down time, allow transfer unit to pull down to 40 psig during next re-start. After manual shutdown observe rise in suction pressure. If slow to increase and less than 60 psig, decrease minimum suction pressure to 30 psig during next pump down cycle. Repeat pump down cycles as outlined above progressively lowering cooler pressure as observed at transfer unit suction gauge unitl cooler pressure is equalized to atmosphere during transfer unit down time.

Depending on the extent of work to be done and the length of down time expected, the next step would be to go ahead with the job "as is" or else to purge cooler with only nitrogen.

Upon completion of service and prior to putting the unit back in operation, the non-condensables must be removed from the system. After completing the tightness test, blow down to atmosphere and evacuate as follows.

1. Start the condenser and chilled water pumps.

2. Utilizing a good vacuum pump suitable for refrigeration service, evacuate to 2.0 mm (Hg) or less. After satisfactory evacuation, arrange the pump out manifold valves and system shell connection valves as follows.

   a. Close all valves.

   b. Open condenser vapor valve "E" approximately 1 turn.

   c. Open pump out manifold valve "C".

   d. Open pump out manifold valve "D".

   e. Open pump out manifold valve "A".

   f. Slowly open cooler vapor valve "F".

Observe suction pressure gauges at transfer unit. When this gauge indicates 60 psig or above, slowly close condenser vapor valve "E". When the cooler pressure shows 60 pgig or above with the condenser valve "E" closed, proceed as follows.

3. Open valve in liquid line between condenser cooler approximately 25%, allow refrigerant to transfer to cooler until equalized. At this point, arrange pump out until system valves as follows.

   a. Close valve in refrigerant liquid line.

   b. Close manifold valve "A".

   c. Open manifold valve "B".

   d. Close manifold valve "C".

   e. Open manifold valve "D".

   f. Open cooler vapor valve "F".

   g. Check to be sure pump out compressor stop valves are open.

5. Start transfer unit compressor, this will allow the pulling of residual liquid from the condenser in vapor form and also to de-gas the oil in the oil separator.

Observe the level showing in the oil separator sight glasses until a level shows in the top sight glass.

NOTE: Watch the transfer unit pump out compressor sution pressure gauge. It it falls below 60 psig, throttle the suction suction to keep it at 60 psig. Establish control power and be sure oil separator heaters are energized. When the oil level in the sight glass and the oil separator temperature is above 50°F, secure the transfer unit and close off the system and manifold lines. The chiller back in "stand-by" condition from a system charge balance aspect, ready for start-up.

SECTION 3
SYSTEM COMPONENTS DESCRIPTION

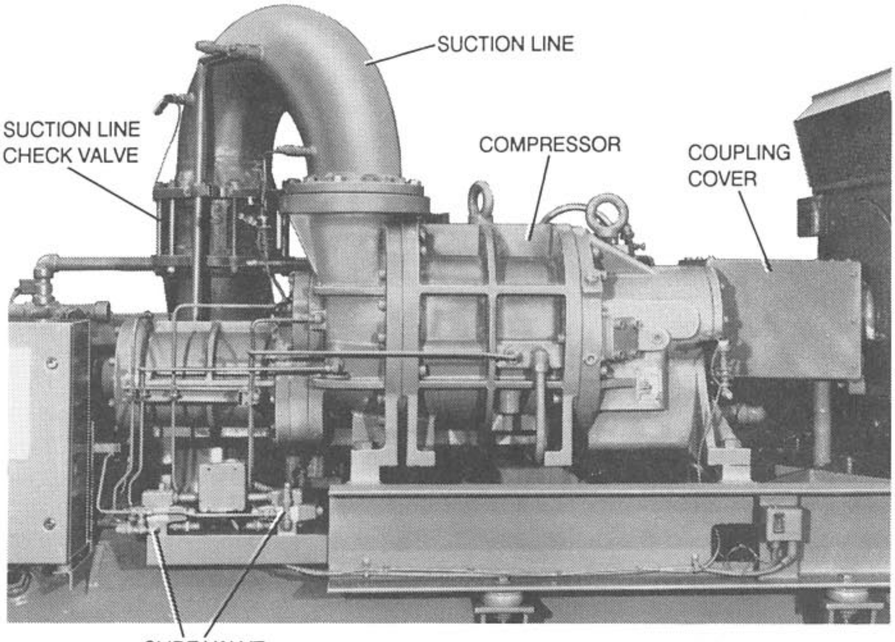


FIG. 7 – ROTARY SCREW COMPRESSOR – MODEL T DSH-283-L AC

COMPRESSOR

The YORK rotary twin screw compressor is engineered and constructed to meet the exacting requirements of the industrial refrigeration market. It utilizes state-of-the-art technology to provide the most reliable and energy efficient compressor available at all operating conditions. The compressor operates at 3570 RPM (60 hertz).

The compressor housing is made of cast iron, precision machined to provide minimal clearance for the rotors. A 2" bursting disc is provided to meet the requirements of the ANSI/ASHRAE 15 Safety Code for Mechanical Refrigeration.

The rotors are manufactured from forged steel and use asymmetric profiles.

The compressor incorporates a complete anti-friction bearing design for reduced power and increased reliability. Four separate cylindrical roller bearings handle radial loads. Two 4-point angular contact ball bearings handle axial loads. Together they maintain accurate rotor positioning at all pressure ratios thereby minimizing blow-by and maintaining efficiency.

CAPACITY CONTROL

Capacity control is achieved by use of a slide valve which provides fully modulating capacity control from 100% to 10% of full load. The slide valve is actuated by oil pressure controlled by external solenoid valves via the MicroComputer Control Center.

VARIABLE VOLUME RATIO CONTROL

The compressor includes a patented movable slide valve stop which optimizes the discharge port location. The internal compressor volume ratio is automatically changed to match the varying system pressure ratios which naturally occur at lower loads and lower entering condenser water temperatures. This eliminates the energy waste associated with over and under compression inherent in conventional screw compressors.

Volume ratio is controlled based on system suction and discharge pressure measured via the MicroComputer Control Center.

MOTOR DRIVELINE

The compressor motor is an open drip proof, squirrel cage, induction type contructed to YORK design specifications. 60 hertz motors operate at 3570 rpm. A large, 14 gauge (minimum) steel terminal box with gasketed front access cover is provided for field connected conduit.

Motor drive shaft is directly connected to the compressor shaft with a flexible disc coupling. Coupling is designed to accommodate the slight shaft misalignments which can develop in service; all metal construction with no wearing parts assure long life; and no lubrication requirement provides low maintenance.

Coupling guard is a fabricated, heavy gauge, steel enclosure. It must be in place during unit operation.

The driveline is mounted on a fabricated structural steel base fully supporting the compressor and motor. The base is mounted on top of the evaporator shell and isolated from the shell by rubber mounts. This ensures controlled alignment of the entire compressor/motor assembly.

OIL MANAGEMENT SYSTEM

The condenser shell houses an integral condenser/subcooler/oil separator/oil reservoir. Combining all functions provides an efficient, yet compact, oil management system to separate oil before the refrigerant enters the heat exchangers.

OIL SEPARATOR

The oil separator is a horizontal design with no moving parts. Effective oil separation is achieved by a combination of methods:

1. Gravity dropout of oil from the refrigerant gas as velocity decreases upon entering the separator.
2. 180° change of gas direction in the separator.
3. Dual density mesh pads provide final gas/oil separation before gas enters the condenser.

LUBRICATION

The oil reservoir is located at the base of the oil separator.

A 3 HP oil pump (460V/3/60) is supplied for pre-lube operation to ensure compressor bearings are fully lubricated and the slide valves are in the proper location before the compressor starts. Compressor can not start until proper oil pressure is achieved. Operation of the pump is controlled by MicroComputer Control Center measurement of system oil pressure differential. A unit mounted oil pump starter is supplied for field connection to a separate power source.

During operation the system pressure differential is generally sufficient to provide proper oil flow without operation of the oil pump. This minimizes system energy consumption during chiller operation. The compressor has an oil reservoir to assure a supply of oil to the bearings during coast down, and in the event of a power failure.

(2) 500 watt (120 volt / 1 phase / 60 HZ) immersion oil heaters are provided, temperature actuated to effectively remove refrigerant from the oil.

An external, replaceable cartridge, 15 micron oil filter is provided. Manual isolation stop valves and drain connections are provided for ease of servicing.

An oil eductor automatically removes oil which may accumulate in the evaporator and returns it to the compressor.

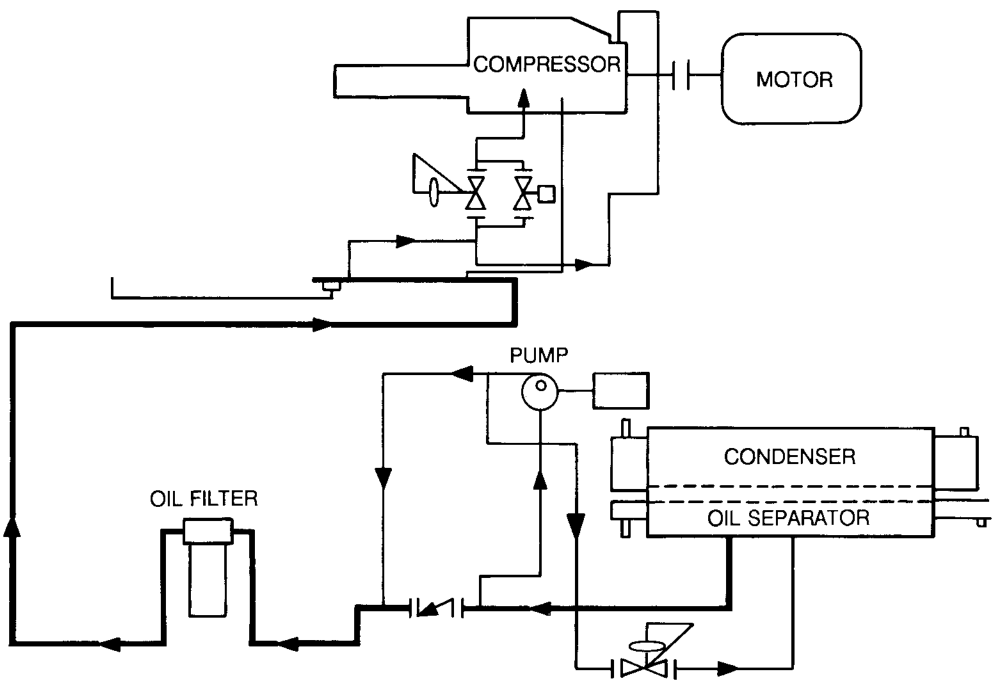


FIG. 8 – YORK SCREW CHILLER OIL FLOW

OIL COOLER

A water cooled oil cooler is provided, with water piping factory connected to the condenser water boxes. Manual shut off valves allow isolation for service and tube cleaning.

For normal air conditioning applications oil cooling is only required at low loads, typically well under 20% load. For those applications where a chiller will not operate in this region, the oil cooler may be omitted.

COMPRESSOR

The rotary screw compressor utilizes mating asymmetrical profile helical rotors to provide a continuous flow of refrigerant vapor and is designed for both high pressure and low pressure applications. The compressor incorporates the following features:

1. High capacity roller bearings to carry radial loads at both the inlet and outlet ends of the compressor.
2. Heavy-duty four point angular contact ball bearings to carry axial loads are mounted at the discharge end of compressor.
3. Balance pistons located in the inlet end of the compressor to reduce axial loads on the thrust bearings and increase bearing life.
4. Moveable slide valve to provide infinite step capacity control from 100 to 10%.
5. VOLUMIZER volume ratio control to allow infinitely variable volume ratio from 1.7 to 2.5 during compressor operation.
6. A hydraulic unloader cylinder to operate the slide stop and slide valve.
7. Bearing and casing design for 350 PSI discharge pressure.
8. All bearing and control oil vented to closed thread in the compressor instead of suction port to avoid performance penalties from superheating suction gas.
9. Shaft seal designed to maintain operating pressure on seal well below discharge pressure for increased seal life.
10. Oil injected into the rotors to maintain good volumetric and adiabatic efficiency even at very high compression ratios.
11. Shaft rotation clockwise facing compressor, suitable for all types of drives.
12. Dual compressor casing design for very low airborne noise transmission.

NOTE: Compressor rotation is clockwise when facing the compressor drive shaft. The compressor should never be operated in reverse rotation as bearing damage could result.

COMPRESSOR LUBRICATION SYSTEM

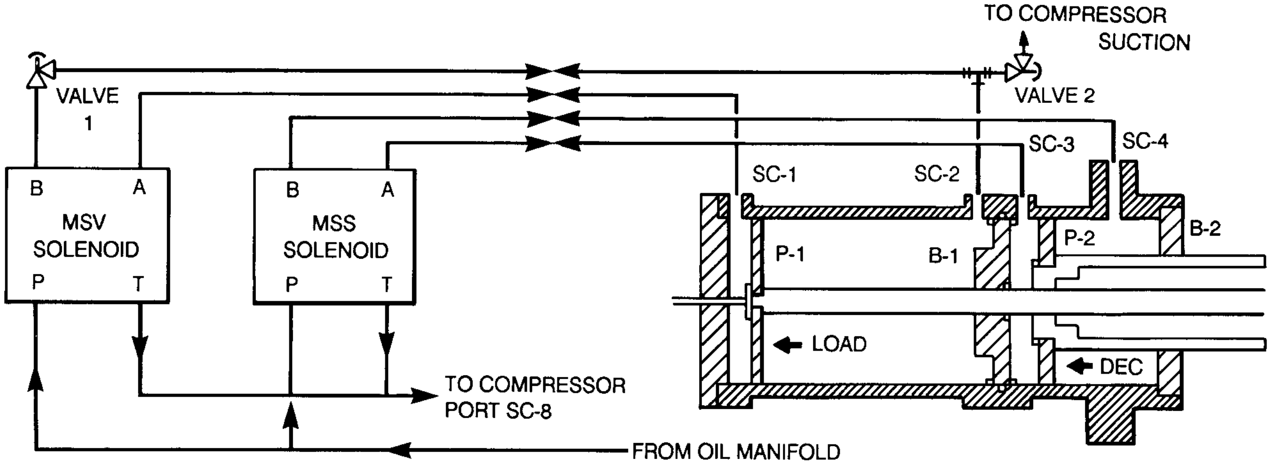
The lubrication system on screw compressor unit performs several functions:

1. Provides lubrication to bearings and seal.
2. Provides a cushion between the rotors to minimize noise and vibrations.
3. Helps keep the compressor cool and prevents overheating.
4. Provides an oil supply to hydraulically actuate the slide valve and slide stop.
5. Provides oil pressure to the balance pistons to help increase bearing life.
6. Provides an oil seal between the rotors to prevent rotor contact or gas bypassing.

CYCLING FULL LUBE OIL SYSTEM

This system is designed to provide those applications that operate with normal to low differential pressure across the compressor suction and discharge with adequate compressor lubrication.

During the period from start-up to normal operation the oil pressure alarm and oil pressure cutout setpoints will vary according to formulas built into the microprocessor control program. On start-up the oil pump has 30 seconds to produce over five pounds of oil pressure above registered discharge pressure or a cutout will occur. After the compressor starts and the pressure is between 5 PSI and 10 PSI differential the prealarm signal



SC-1	SLIDE VALVE UNLOAD PORT	P-1	SLIDE VALVE-PISTON
SC-2	SLIDE VALVE LOAD PORT	P-2	VOLUME RATIO PISTON
SC-3	VOLUME RATIO INCREASE PORT	B-1	FIXED BULKHEAD
SC-4	VOLUME RATION DECREASE PORT	B-2	FIXED BULKHEAD

FIG. 9 – DOUBLE PURPOSE HYDRAULIC CYLINDER

is activated. If the oil pressure is above 10 PSI the alarm will go off. The pump will continue to run until 85 PSI discharge pressure over suction pressure is obtained. At 85 PSI the pump will shut down, to start again when discharge pressure over suction pressure falls below 75 PSI.

COMPRESSOR HYDRAULIC SYSTEM

The compressor hydraulic system moves the movable slide valve (MSV) to load and unload the compressor. It also moves the movable slide stop (MSS) to increase or decrease the compressor's volume ratio (Vi).

The hydraulic cylinder located at the inlet end of the TDS compressor serves a dual purpose. It is separated by a fixed bulkhead into two sections. The movable slide valve (MSV) section is to the left of the bulkhead and the movable slide stop (MSS) to the right. Both sections are considered double acting hydraulic cylinders as oil pressure moves the pistons in either direction.

Both sections are controlled by double-acting four-way solenoid valves which are activated when a signal from the appropriate microprocessor output energizes the solenoid valve.

Compressor Loading

The compressor loads when MSV solenoid SV2 is energized and oil flows from the oil manifold thru valve ports P and B to cylinder port SC-2 and enters the load side of the cylinder. Simultaneously, oil contained in the unload side of the cylinder flows out cylinder port SC-1 thru valve ports A and T to compressor closed thread port.

Compressor Unloading

The compressor unloads when MSV solenoid SV1 is energized and oil flows from the oil manifold thru valve ports P and A to cylinder port SC-1 and enters the unload side of the cylinder. Simultaneously, oil contained in the load side of the cylinder flows out compressor port SC-2 thru valve ports B and T to compressor closed thread port.

SHELL ASSEMBLIES

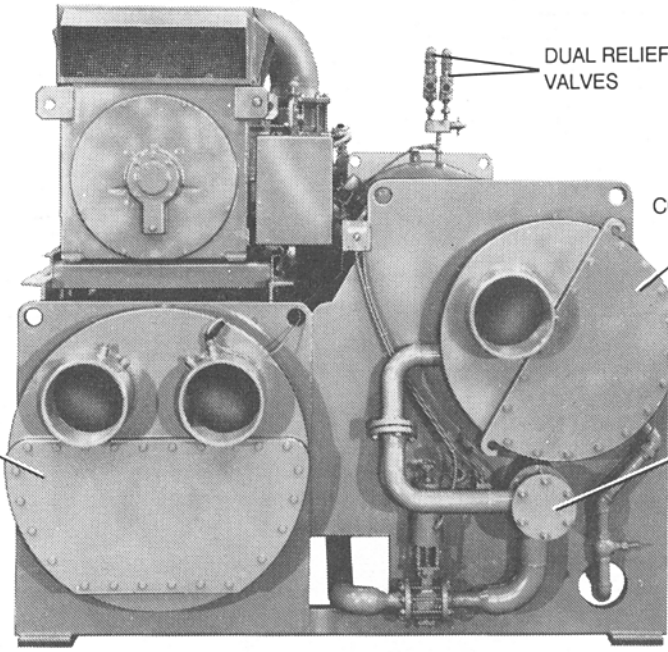


FIG. 10 – SHELL ASSEMBLY

SHELLS

Cooler and integral condenser/subcooler/oil separator shells are fabricated from rolled carbon steel plate with fusion welded seams. Carbon steel tube sheets, drilled and reamed to accommodate the tubes, are welded to the end of each shell. Intermediate tube supports are fabricated of carbon steel plate, spaced no more than four feet apart.

The refrigerant side of each shell is designed, tested and stamped in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII - Division 1.

TUBES

Tubes are state-of-the-art, high efficiency, internally enhanced type to provide optimum performance. Each tube is roller expanded into the tube sheets providing a leak-proof seal, and are individually replaceable. Tubes are 3/4" OD, 22 BWG, copper alloy.

COOLER

Cooler (Evaporator) is a shell and tube, flooded type designed for 225 psig design working pressure on the refrigerant side, and tested at 338 psig. A distributor trough provides uniform distribution of refrigerant over the entire shell length to yield optimum heat transfer. A 4" liquid level sight glass is conveniently located on the side of the shell to aid in determining proper refrigerant charge. A 3/4" refrigerant charging valve is provided.

A 3/4" x 1-1/2" NPT single refrigerant relief device set at 225 psig is located on the suction connection at the top of the shell.

CONDENSER

Integral condenser/subcooler/oil separator is a shell and tube type designed for 300 psig design working pressure on the refrigerant side, and tested at 450 psig.

A 3/4" x 1-1/2" NPT dual refrigerant relief device set at 300 psig is located at the top of the shell.

The subcooler is located in the bottom of the condenser section providing highly effective liquid refrigerant subcooling to improve cycle efficiency.

MARINE WATER BOXES

Marine water boxes are standard on the cooler, condenser and subcooler. Bolted on water box covers allow access to all tubes for cleaning without disturbing water piping.

All water connections are made to the ends of the unit which saves valuable aisle space at the front and rear of the unit. Cooler and condenser water connections are 12" pipe with welded closures. Connections are suitable for Victaulic, welding or flanged connections.

Water boxes are designed for 150 psig design working pressure and tested at 225 psig.

3/4" NPT vent and drain connections with plugs are provided on each water box.

MICROCOMPUTER CONTROL CENTER

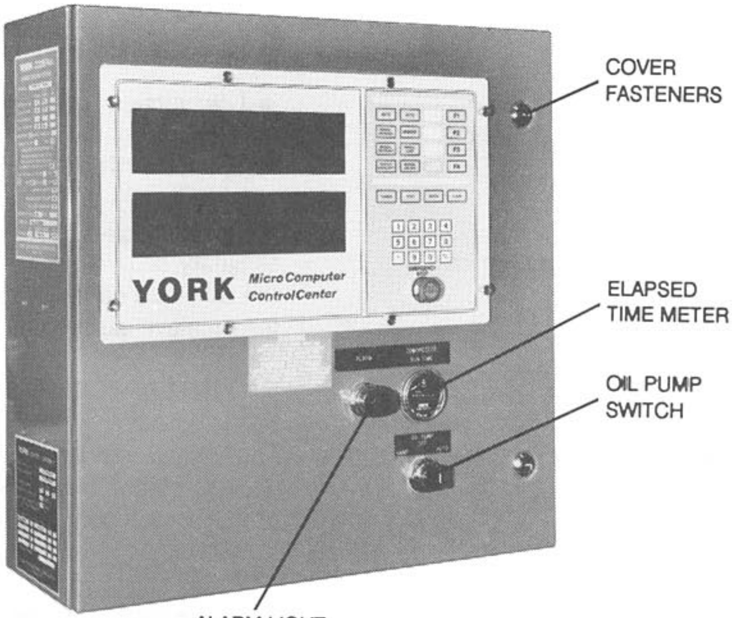


FIG. 11 – MICROCOMPUTER CONTROL CENTER

MICROCOMPUTER CONTROL CENTER

The MicroComputer Control Center is factory mounted, wired and tested. It is housed in a steel, Nema 4 enclosure supplied with a hinged, gasketed front access cover having screw latches.

The control center automatically controls and monitors the operation of the chiller in meeting system cooling requirements while minimizing energy usage.

All operating conditions, control septoints, safety controls and pre-alarm messages are displayed on a large 320 character liquid crystal display (LCD). The display is provided with backlighting for ease of reading. A time clock displays the date and time.

Chiller operating parameters are sensed by either temperature transmitters or pressure transducers and are continually updated on the display. Temperatures are displayed in °F and pressures in psig and inches of mercury.

The keyboard consists of 32 membrane type keys for input of data and controlling of the chiller. A five digit, changeable, security access code prevents unauthorized changing of setpoints. Battery backup with low battery warning maintains program memory.

Also provided on the front of the control center:

- Large emergency stop push button
- Elapsed compressor running time meter
- Oil pump auto-manual-off switch.

The control center can provide either manual or automatic restart after power failure. Automatic restart requires a field installed jumper wire.

ADJUSTABLE SETPOINT CONTROL

Operating controls, programmed from the keypad include:

- Leaving chilled liquid temperature
- % motor current

OPERATING DATA DISPLAYED

- Leaving chilled liquid temperature and setpoint
- Evaporator refrigerant pressure and temperature (suction)
- Condenser refrigerant pressure and temperature (discharge)

- Oil temperature and pressure
- Oil filter pressure differential
- % motor current and setpoint*
- Volume ratio*
- Oil separator temperature
- Subcooler refrigerant liquid level
- Compressor status (manual, auto or remote)
  Oil pump status
- Oil heater status

* Includes indication of manual or auto mode and if loading, unloading or hold

SAFETY CUTOUTS DISPLAYED

- Low chilled liquid temperature)
- Low oil pressure and temperature
- High oil temperature (high discharge temperature)
- High condenser pressure
- Low evaporator pressure
- Under voltage
- Flow switch (evaporator and/or condenser)
- Anti-recycle (30 minutes between restarts)
- Over current/motor control failure
- Oil pump motor overload
- Oil level switch in oil sump

PRE-ALARM SETPOINTS

The MicroComputer Control Center is provided with anticipatory safeties to warn of potential shutdown conditions. A red light on the front of the Control Center alerts the operator of a problem. The display shows which pre-alarm tripped and the time of occurence. (Two) 100V terminals are provided for field connection to a remote alarm.

Pre-alarm safeties include:

- High discharge temperature
- Low chilled liquid termperature
- Low oil temperature
- Low oil pressure
- Dirty oil filter
- High discharge pressure
- Low suction pressure

FIRST-OUT AND SHUTDOWN MEMORY

A first-out display "freezes" all readings that existed prior to safety shutdown. A shutdown record display stores the time and cause of the last six shutdowns for maintenance evaluation.

BAS INTERFACE

The MicroComputer Control Center is provided with an RS-422 communications terminal, through which the chiller can be controlled and monitored from a remote location.

Available commands from a remote location are:

- Chiller start and stop
- Compressor slide valve control
- Chilled liquid setpoint change

Available information from a remote location are:

- Compressor status
- Each individual (or all) temperature readings
- Each individual (or all) pressure readings
- % current information
- Each individual (or all) display screens

REFRIGERANT SYSTEM

Refrigerant Flow Control

Refrigerant flow to the evaporator is controlled by a motorized expansion valve. A liquid level sensor in the subcooler automatically modulates the valve to attain optimum part load performance. All parts are externally accessible for service.

Suction Check Valve

A check valve is installed in the suction line to prevent compressor rotor backspin due to system refrigerant pressure gradients during shutdown.

SECTION 4
OPERATIONAL MAINTENANCE

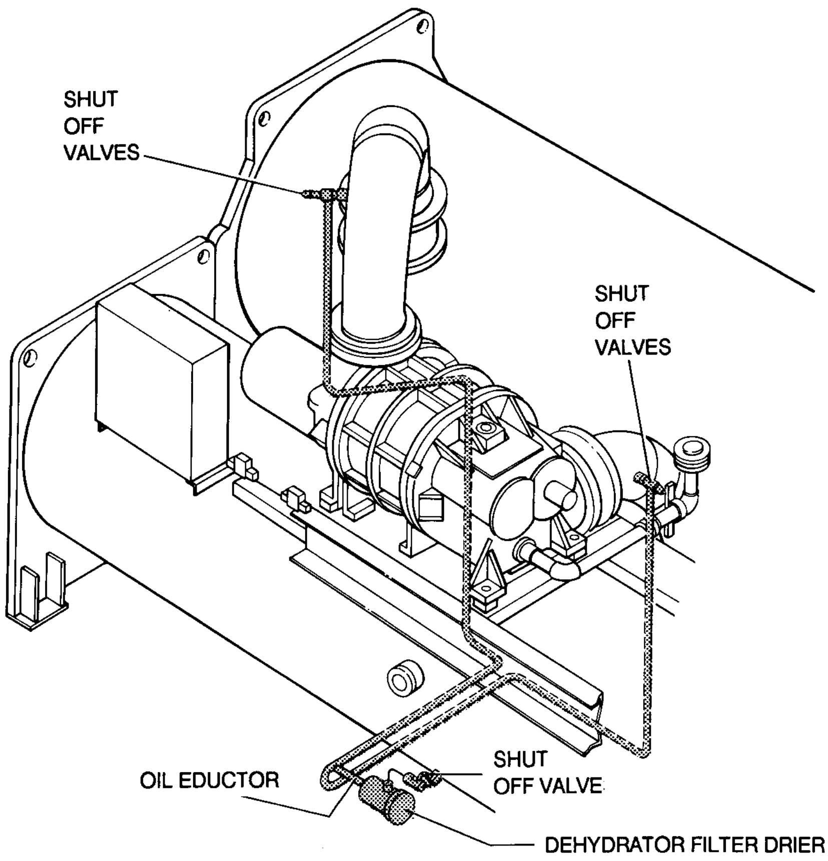


FIG. 12 – OIL RETURN SYSTEM

OIL RETURN SYSTEM

The oil return system continuously maintains the proper oil level in the oil separator.

High pressure condenser gas flows continuously through the eductor inducing the low pressure, oil rich liquid to flow from the evaporator, through the dehydrator to the compressor suction.

Changing The Dehydrator Filter

To change the dehydrator filter drier use the following procedure:

1. Shut the stop valves on the condenser gas line, oil return line to rotor support and inlet end of the dehydrator.

2. Remove the dehydrator filter drier as follows: Refer to Fig. 12.

   To remove the head of connection dehydrator filter. Removing the cap screws first then remove the filter, clean inside of filter.

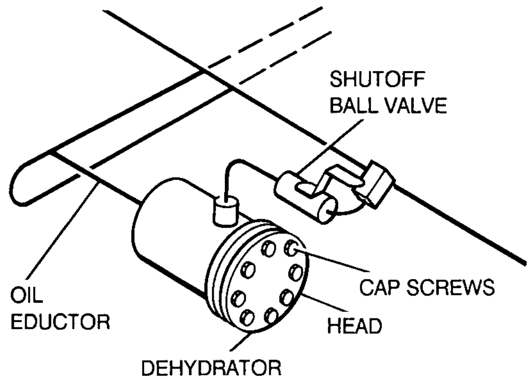
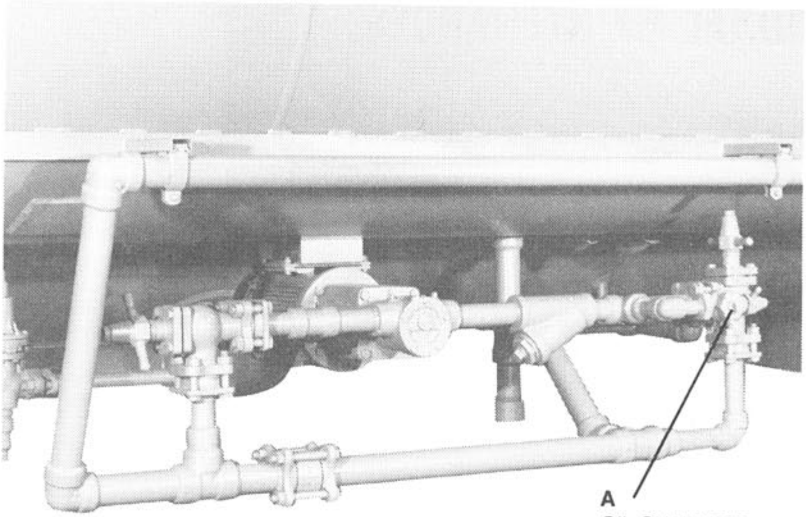


FIG. 13 – ASSEMBLY OR DEHYDRATOR

3. Place the new filter-drier inside of the filter drier casing. Then replace head and the cap screw. Tighten the screws.

4. Open condenser stop valve and check dehydrator connections for refrigerant leaks.

5. Open all the dehydrator stop valves to allow the liquid refrigerant to flow through the dehydrator and condenser-gas through the eductor.



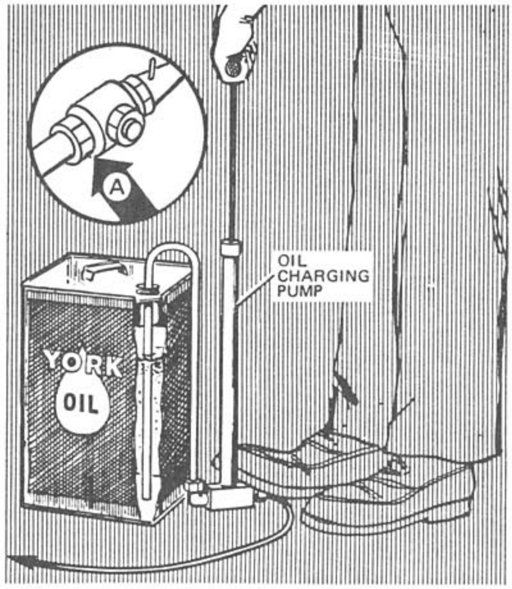


FIG. 14 – CHARGING OIL RESERVOIR WITH OIL

THE OIL CHARGE

The nominal oil charge for the compressor is: 110 gal.

New oil YORK Refrigeration Type "C", must be used in the Rotary Screw compressor. Since oil absorbs moisture when exposed to the atmosphere it should be kept tightly capped until used.

OIL CHARGING PROCEDURE

The oil should be charged into the oil reservoir using the YORK Oil Charging Pump-YORK Part No. 070-10654. To charge oil into the oil reservoir proceed as follows:

1. The unit should be shut down.

NOTE: If charging oil to restore the correct level – the unit may be kept in operation.

2. Immerse the suction connection of the oil charging pump in a clean container of new oil and connect the pump discharge connection to the oil charging valve (A) located on the remote oil reservoir cover plate. (See Fig. 15). Do not tighten the connection at the charging valve until after the air is forced out by pumping a few strodes of the oil pump. This fills the lines with oil and prevents air from being pumped into the system.

3. Open the oil charging valve and pump oil into the system until oil level in the oil separator is about midway in the upper sight glass. Then close the charging valve and disconnect the hand oil pump.

4. As soon as oil charging is complete, close the power supply to the starter to energize the oil heater. (See System Operating Procedures, page 6). This will keep the concentration of refrigerant in the oil to a minimum.

When the oil separator is initially charged with oil, the oil pump should manually be started to fill the lines, passages, oil cooler and oil filter. This will lower the oil level in the oil separator. It will then be necessary to add oil to bring the level back to the center of the upper sight glass.

MOTOR BEARINGS

Follow motor manufacturer's maintenance recommendations.

CAUTION: Make sure motor bearings are properly lubricated before start-up. If required by motor manufacturer.

OIL QUALITY AND ANALYSIS

High quality refrigeration oil is necessary to insure compressor longevity and reliability. Oil quality will rapidly deteriorate in refrigeration systems containing moisture and air or other contaminants. In order to insure the quality of the refrigeration oil in the compressor unit follow these recommendations:

1. Only use YORK C oil.

2. Participation in a regular, periodic oil analysis program may be helpful in maintenance of oil and system integrity.

SECTION 5
TROUBLESHOOTING

TROUBLESHOOTING GUIDE

Successful problem solving requires an organized approach to define the problem, identify the cause, and make the proper correction. Sometimes it is possible that two relatively obvious problems combine to provide a set of symptoms that can mislead the troubleshooter. Be aware of this possibility and avoid solving the "wrong problem".

ABNORMAL OPERATION ANALYSIS AND CORRECTION

Four logical steps are required to analyze an operational problem effectively and make the necessary corrections:

1. Define the problem and its limits.
2. Identify all possible causes.
3. Test each cause until the source of the problem is found.
4. Make the necessary corrections.

When an operating problem develops compare all operating information on the OPERATING DISPLAY with normal operating conditions. If an Operating Log has been maintained the log can help determine what constitues normal operation for the compressor unit in that particular system.

PRESSURE – TEMPERATURE CHART

DEVICE	UNITS	OPERATING POINT	
		ON RISE	ON FALL
* HIGH CONDENSER PRESSURE (HCP)	PSIG	270	269
HIGH DISCHARGE TEMPERATURE (HDT)	DEG.F/DEG.C	212/100	211/99.4
HIGH PRESSURE CUTOUT (HP)	PSIG	270	210
* LOW EVAPORATOR PRESSURE (LEP)	PSIG	52.8	52.7
LOW OIL PRESSURE (LOP)	PSIG	(**) + 1	(**)
LOW OIL TEMPERATURE (LOT)	DEG.F/DEG.C	50/10	49/9.4
* LOW WATER TEMPERATURE (LWT)	DEG.F/DEG.C	42/5.5	41/5.0

* Adjustable setpoints. Default values shown.

(**) Low oil pressure cutout (PSIG) = (.39) (Suction Press. in PSIG) + (.61)) (Discharge Press. in PSIG)

TROUBLESHOOTING THE ROTARY SCREW COMPRESSOR

Troubleshooting the compressor is limited to identifying the probable cause. If a mechanical problem is suspected contact the Service Department, YORK INTERNATIONAL. DO NOT DISASSEMBLE COMPRESSOR.

SYMPTOM	PROBABLE CAUSES AND CORRECTIONS
EXCESSIVE NOISE AND VIBRATION	Main oil injection valve may be closed. Open valve. Bearing damage or excessive wear. Coupling loose on shaft. Tighten coupling. Replace if damaged. Misalignment between motor and compressor. Realign motor and compressor. Refrigerant flood back. Correct system problem.

TROUBLESHOOTING THE OIL SEPARATION SYSTEM

SYMPTOM	PROBABLE CAUSES AND CORRECTIONS
GRADUAL OIL LOSS WITH AN OIL LEVEL IN THE SEPARATOR SECTION SIGHT GLASS	Maintaining too high an oil level, lower level. Refrigerant carryover or liquid injection overfeeding, correct operation. Loss of suction superheat.

TROUBLESHOOTING THE HYDRAULIC SYSTEM

SYMPTOM	PROBABLE CAUSES AND CORRECTIONS
SLIDE VALVE AND/OR SLIDE STOP WILL NOT MOVE	Slipper seals worn out or damaged. Unloader spindle or slide valve jammed. Slide stop indicator rod jammed.
SLIDE VALVE WILL NOT LOAD OR UNLOAD	Solenoid coils may be burned out, replace. Valve may be closed. Open hydraulic service valves. Solenoid spool may be stuck or centering spring broken, replace. Check outputs 9 and 14 and fuses. Solenoid may be mechanically actuated by inserting a piece of 3/16" rod against armature pin and pushing spool to opposite end. Push a side to confirm unload capability. If valve works, problem is electrical.
SLIDE VALVE WILL LOAD BUT WILL NOT UNLOAD	A side solenoid coil may be burned out, replace. Dirt inside solenoid valve preventing valve from operating both ways, clean. Check output 14, replace if necessary. Solenoid may be mechanically actuated by inserting a piece of 3/16" rod against armature pin and pushing spool to opposite end. Push a side to confirm unload Capability. If valve works, problem is electrical.
SLIDE VALVE WILL UNLOAD BUT WILL NOT LOAD	A side solenoid coil may be burned out, replace. Dirt inside solenoid valve preventing valve from operating both ways, clean. Check output 9, replace if necessary. Solenoid may be mechanically actuated by inserting a piece of 3/16" rod against armature pin and pushing spool to opposite end. If valve works, problem is electrical.
SLIDE STOP WILL NOT FUNCTION EITHER DIRECTION	Solenoid coils may be burned out, replace. Solenoid service valves may be closed, open. Check outputs 13 and 15, replace if necessary. Manually actuate solenoid. If slide stop will not move, mechanical problems are indicated. Consult YORK, District Service Department.

TABLE 2 – OPERATING ANALYSIS CHART

RESULTS	POSSIBLE CAUSE	REMEDY
1. SYMPTOM ABNORMALLY HIGH DISCHARGE PRESSURE		
Temperature difference between liquid refrigerant out and water off condenser higher than normal.	Air in condenser.	Purge condenser.
High discharge pressure.	Condenser tubes dirty or scaled.	Clean condenser tubes. Check water conditioning.
	High condenser water temperature.	Reduce condenser water inlet temperature. (Check cooling tower and water circulation).
Temperature difference between condenser water on and water off higher than normal, with normal cooler pressure.	Insufficient condensing water flow.	Increase the quantity of water through the condenser to proper value.

RESULTS	POSSIBLE CAUSE	REMEDY
2. SYMPTOM: ABNORMALLY LOW SUCTION PRESSURE		
Temperature difference between leaving chilled water and refrigerant in cooler greater than normal with high discharge temperature.	Insufficient charge of refrigerant.	Check for leaks and charge refrigerant into system.
Temperature difference between leaving chilled water and refrigerant in the cooler greater than normal with normal discharge temperature.	Cooler tubes dirty or restricted.	Clean cooler tubes.
Temperature of chilled water too low with low motor amperes.	Insufficient load for system capacity.	Check slide valve operation and setting of low water temperature cutout.
3. SYMPTOM: NO OIL PRESSURE WHEN SYSTEM START BUTTON PUSHED		
Low oil pressure displayed on control center; compressor will not start.	Oil pump running in wrong direction.	Check rotation of oil pump (Elec. Conns.)
	Oil pump not running.	Check electrical connections to oil pump and press manual reset on oil pump starter mounted on condenser shell in front of purge unit.
4. SYMPTOM: UNUSUALLY HIGH OIL PRESSURE DEVELOPS WHEN OIL PUMP RUNS		
Unusually high oil pressure is displayed when the oil pressure display key is pressed when the oil pump is running.	High oil pressure. Transducer defective. Relief valve is misadjusted.	Replace oil pressure transducer. Adjust external relief valve.
5. SYMPTOM: OIL PUMP VIBRATES OR IS NOISY		
Oil pump vibrates or is extremely noisy with some oil pressure when pressing "Oil Pressure" display key.	Misalignment of pump or piping.	Correct condition or replace faulty part.
	Mounting bolts loose.	
	Bent shaft.	
Note: When oil pump is run without an oil supply it will vibrate and become extremely noisy.	Worn pump parts.	
	Oil not reaching pump suction inlet in sufficient quantity.	Check oil supply and oil piping.
6. SYMPTOM: OIL RETURN SYSTEM CEASES TO RETURN AN OIL/REFRIGERANT SAMPLE		
Oil refrigerant return not functioning.	Filter-drier in oil return system dirty.	Replace old filter-drier with new.
	Jet or orifice of oil return jet clogged.	Remove jet, inspect for dirt. Remove dirt using solvent and replace.
7. SYMPTOM: OIL PUMP FAILS TO DELIVER OIL PRESSURE		
No oil pressure registers "Oil Pressure" display key when oil pump runs.	Faulty oil pressure transducer. Faulty wiring/connectors.	Replace oil pressure transducer.

SECTION 6
MAINTENANCE

RENEWAL PARTS

For any required Renewal Parts Model YS refer to Form 160.65-RP1, 160.65-RP2, 160.65-RP3, and 160.65-RP4.

CHECKING SYSTEM FOR LEAKS

LEAK TESTING DURING OPERATION

The refrigerant side of the system is carefully pressure tested and evacuated at the factory.

After the system is in operation under load, the high pressure components should be carefully leak tested with a leak detector to be sure all joints are tight.

If any leaks are indicated, they must be repaired immediately. Usually, leaks can be stopped by tightening flare nuts or flange bolts. However, if it is necessary to repair a welded joint, the refrigerant charge must be removed (See HANDLING REFRIGERANT FOR DISMANTLING AND REPAIR, page 37).

CONDUCTING INITIAL R-22 PRESSURE TEST

With the R-22 charge removed and all known leaks repaired, the system should be charged with a small amount of R-22 mixed with dry nitrogen so that a halide torch or electronic leak detector can be used to detect any leaks too small to be found by the soap test.

To test with R-22 proceed as follows:

1. With no pressure in the system charge R-22 gas into the system through the charging valve to a pressure of 2 psig.
2. Build up the system pressure with dry nitrogen to approximately 100 psig. To be sure that the concentration of refrigerant has reached all parts of the system, slightly open the oil charging valve and test for the presence of refrigerant with a leak detector.
3. Test around each joint and factory weld. It is important that this test be thoroughly and carefully done, spending as much time as necessary and using a good leak detector.
4. To check for refrigerant leaks in the cooler and condenser, open the vents in the cooler and condenser heads and test for the presence of refrigerant. If no refrigerant is present, the tubes and tube sheets may be considered tight. If refrigerant is detected at the vents, the heads must be removed, the leak located (by means of soap test or leak detector) and repaired.
5. When absolute tightness of the system has been established, blow the mixture of nitrogen and refrigerant thru the charging valve.

EVACUATION AND DEHYDRATION OF UNIT

VACUUM TESTING

After the pressure test has been completed the vacuum test should be conducted as follows:

1. Connect a high capacity vacuum pump, with indicator, to the system charging valve as shown in Fig. 15 and start the pump (See VACUUM DEHYDRATION).
2. Open wide all system valves, including the gauge valves. Be sure all valves to the atomsphere are closed.
3. Operate the vacuum pump in accordance with VACUUM DEHYDRATION until a wet bulb temperature of +32°F or a pressure of 5 mm Hg is reached. See Table 3 for corresponding values of pressure.
4. To improve evacuation, circulate hot water (not to exceed 125°F) through the cooler and condenser tubes to thoroughly dehydrate the shells. If a source of hot water is not readily available, a portable water heater should be employed. DO NOT USE STEAM. A suggested method is to connect a hose between the source of hot water under pressure and the cooler head drain connection, out the cooler vent connection, into the condenser head drain and out the condenser vent. To avoid the possibility of causing leaks, the temperature should be brought up slowly so that the tubes and shell are heated evenly.

5. Close the system charging valve and the stop valve between the vacuum indicator and the vacuum pump (See Fig. 15). Then disconnect the vacuum pump leaving the vacuum indicator in place.

6. Hold the vacuum obtained in Step 3 in the system for 8 hours; the slightest rise in pressure indicates a leak or the presence of moisture, or both. If, after 8 hours the wet bulb temperature in the vacuum indicator has not risen above 40°F or a pressure of 6.3 mm Hg, the system may be considered tight.

NOTE: A minimum ambient temperature of 55°F should be maintained during evacuatioin. Be sure the vacuum indicator is valved off while holding the system vacuum and be sure to open the valve

TABLE 3 – SYSTEM PRESSURES*

	GAUGE	ABSOLUTE				Boiling Temperatures of Water		
	Psig.	Psia.	kPa	Millimeters of Mercury (Hg)	Microns	°F	°C	
	250	264.7	1823					
	200	214.7	1479					
	100	114.7	790					
Atmospheric Pressure At Sea Level – 14.696 psia.	0	14.696	101.3	760	760,000	212	100	
Inches Mercury (Hg) below one atmosphere (gauge)	10.24"	9.629	66.3	500	500,000	192	86.9	
	22.05"	3.865	26.6	200	200,000	151	66.1	
	25.98"	1.935	13.3	100	100,000	124	51.1	
	27.95"	.968	6.7	50	50,000	101	38.3	
	28.94"	.481	3.3	25	25,000	78	25.6	
	29.53"	.192	1.3	10	10,000	52	11.1	
	29.72"	.099	.68	5	5,000	35	1.7	Water Freezes
	29.842"	.039	.27	2	2,000	15	-9.4	
	29.882"	.019	.13	1.0	1,000	+1	-17.2	Recommended Field Evacuation Conditions
	29.901"	.010	.069	.5	500	-11	-23.9	
	29.917"	.002	.014	.1	100	-38	-38.9	
	29.919"	.001	.0069	.05	50	-50	45.5	
	29.9206"	.0002	.0014	.01	10	-70	-56.6	
	29.921"	0	0	0	0			

*Based Upon Standard Atmosphere
Standard Atmosphere = 14.696 psia.
= Atmospheric Pressure at Sea Level
= 760 Mm Hg. Absolute Pressure at 32°F
= 29.921 inches Hg.

Notes:
psig. = lbs. per sq. in. gauge pressure
psig. = Pressure above atmospheric
psia. = lbs. per sq. in. Absolute Pressure
psia. = Sum of Gauge plus Atmospheric Pressure
Hg. = Mercury
kPa = kilopascals

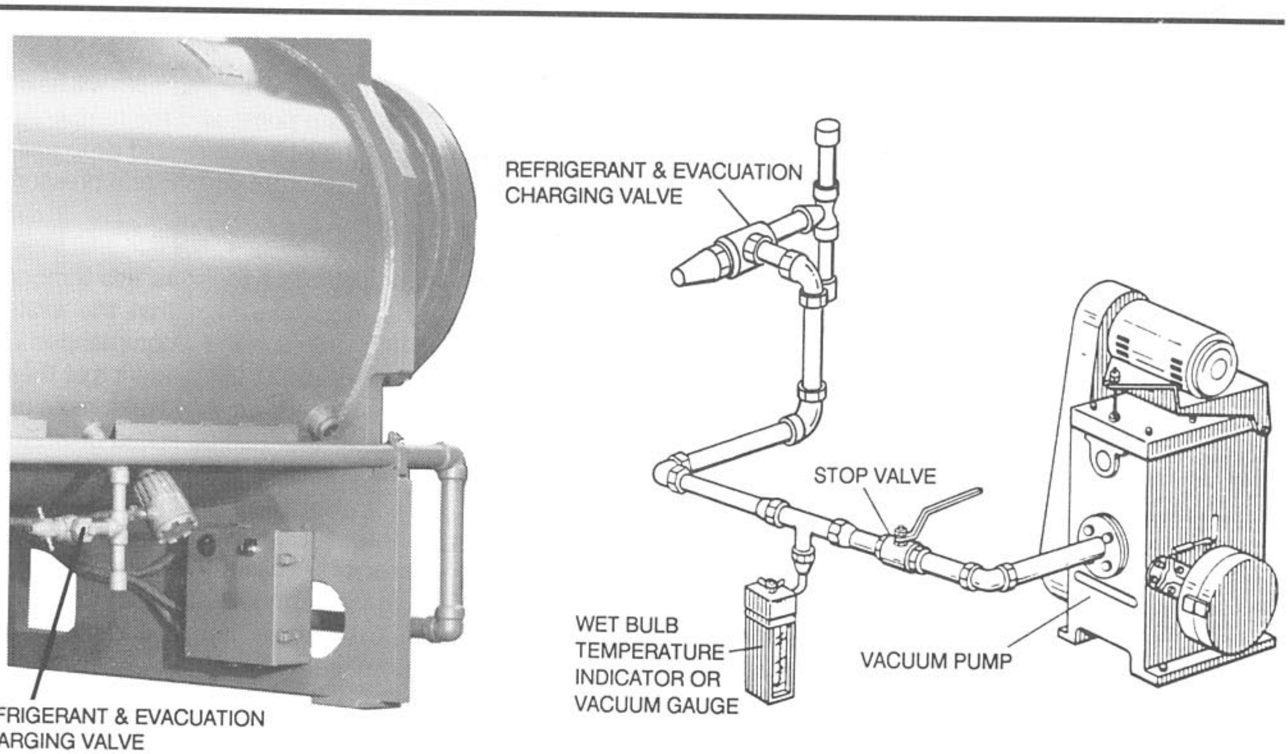


FIG. 15 – EVACUATION OF CODEPAK

between the vacuum indicator and the system when checking the vacuum after the 8 hour period.

7. If the vacuum does not hold for 8 hours within the limits specified in Step 6, the leak must be found and repaired.

VACUUM DEHYDRATION

To obtain a sufficiently dry system, the following instructions have been assembled to provide an effective method for evacuating and dehydrating a system in the field. Although there are several methods of dehydrating a system, we are recommending the following, as it produces one of the best results, and affords a means of obtaining accurate readings as to the extent of dehydration.

The equipment required to follow this method of dehydration consists of a wet bulb indicator or vacuum gauge, a chart showing the relation between dew point temperature and pressure in inches of mercury (vacuum), (See Table 3) and a vacuum pump capable of pumping a suitable vacuum on the system.

OPERATION

Dehydration of a refrigeration system can be obatined by this method because the water present in the system reacts much as a refrigerant would. By pulling down the pressure in the system to a point where its sautration temperature is considerably below that of room temperature, (55°F) heat will flow from the room through the walls of the system and vaporize the water, allowing a large percentage of it to be removed by the vacuum pump. The length of time necessary for the dehydration of a system is dependent on the size or volume of the system, the capacity and efficiency of the vacuum pump, the room temperature and the quantity of water present in the system. By the use of the vacuum indicator as suggested, the test tube will be evacuated to the same pressure as the system, and the distilled water will be maintained at the same saturation temperature as any free water in the system, and this temperature can be observed on the thermometer.

If the system has been pressure tested and found to be tight prior to evacuation, then the saturation temperature recordings should follow a curve similar to the typical saturation curve shown as Fig. 16.

The temperature of the water in the test tube will drop as the pressure decreases, until the boiling point is reached, at which point the temperature will level off and

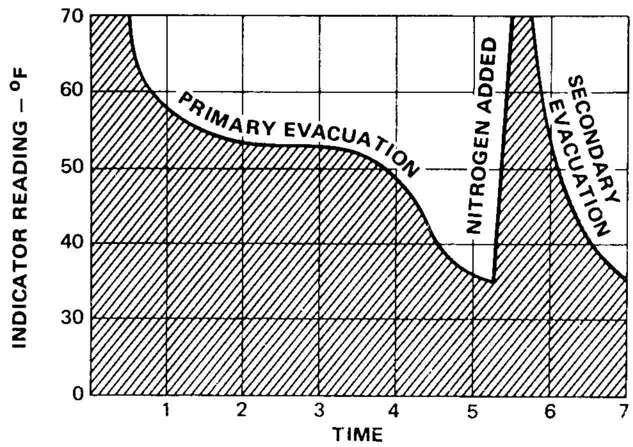


FIG. 16 – SATURATION CURVE

remain at this level until all of the water in the shell is vaporized. When this final vaporization has taken place the pressure and temperature will continue to drop until eventually a temperature of 35°F or a pressure of 5 mm Hg. is reached.

When this point is reached, practically all of the air has been evacuated from the system, but there is still a small amount of moisture left. In order to provide a medium for carrying this residual moisture to the vacuum pump, nitrogen should be introduced into the system to bring it to atmospheric pressure and the indicator temperature will return to approximately ambient temperature. Close off the system again, and start the second evacuation.

The relatively small amount of moisture left will be carried out through the vacuum pump and the temperature or pressure shown by the indicator should drop uniformly until it reaches a temperature of 35°F or a pressure of 5 mm Hg.

When the vacuum indicator registers this temperature or pressure it is a positive sign that the system is evacuated and dehydrated to the recommended limit. If this level cannot be reached, it is evident that there is a leak somewhere in the system. Any leaks must be corrected before the indicator can be pulled down to 35°F or 5 mm Hg. in the primary evacuation.

During the primary pulldown keep a careful watch on the wet bulb indicator temperature, and do not let it fall below 35°F. If the temperature is allowed to fall to 32°F the water in the test tube will freeze, and the result will be a faulty temperature reading.

TABLE 5 – TEMPERATURE CONVERSION TABLE

Temperature			Temperature			Temperature			Temperature		
°C	°C or °F	°F	°C	°C or °F	°F	°C	°C or °F	°F	°C	°C or °F	°F
-40.0	**-40**	-40.0	-6.7	**+20**	+68.0	+26.7	**+80**	+176.0	+60.0	**+140**	+284.0
-39.4	**-39**	-38.2	-6.1	**+21**	+69.8	+27.2	**+81**	+177.8	+60.6	**+141**	+285.8
-38.9	**-38**	-36.4	-5.5	**+22**	+71.6	+27.8	**+82**	+179.6	+61.1	**+142**	+287.6
-38.3	**-37**	-34.6	5.0	**+23**	+73.4	+28.3	**+83**	+181.4	+61.7	**+143**	+289.4
-37.8	**-36**	-32.8	-4.4	**+24**	+75.2	+28.9	**+84**	+183.2	+62.2	**+144**	+291.2
-37.2	**-35**	-31.0	-3.9	**+25**	+77.0	+29.4	**+85**	+185.0	+62.8	**+145**	+293.0
-36.7	**-34**	-29.2	-3.3	**+26**	+78.8	+30.0	**+86**	+186.8	+63.3	**+146**	+294.8
-36.1	**-33**	-27.4	-2.8	**+27**	+80.6	+30.6	**+87**	+188.6	+63.9	**+147**	+296.6
-35.6	**-32**	-25.6	-2.2	**+28**	+82.4	+31.1	**+88**	+190.4	+64.4	**+148**	+298.4
-35.0	**-31**	-23.8	-1.7	**+29**	+84.2	+31.7	**+89**	+192.2	+65.0	**+149**	+300.2
-34.4	**-30**	-22.0	-1.1	**+30**	+86.0	+32.2	**+90**	+194.0	+65.6	**+150**	+302.0
-33.9	**-29**	-20.2	-0.6	**+31**	+87.8	+32.8	**+91**	+195.8	+66.1	**+151**	+303.8
-33.3	**-28**	-18.4	.0	**+32**	+89.6	+33.3	**+92**	+197.6	+66.7	**+152**	+305.6
-32.8	**-27**	-16.6	+0.6	**+33**	+91.4	+33.9	**+93**	+199.4	+67.2	**+153**	+307.4
-32.2	**-26**	-14.8	+1.1	**+34**	+93.2	+34.4	**+94**	+201.2	+67.8	**+154**	+309.2
-31.7	**-25**	-13.0	+1.7	**+35**	+95.0	+35.0	**+95**	+203.0	+68.3	**+155**	+311.0
-31.1	**-24**	-11.2	+2.2	**+36**	+96.8	+35.6	**+96**	+204.8	+68.9	**+156**	+312.8
-30.6	**-23**	-9.4	+2.8	**+37**	+98.6	+36.1	**+97**	+206.6	+69.4	**+157**	+314.6
-30.0	**-22**	-7.6	+3.3	**+38**	+100.4	+36.7	**+98**	+208.4	+70.0	**+158**	+316.4
-29.4	**-21**	-5.8	+3.9	**+39**	+102.2	+37.2	**+99**	+210.2	+70.6	**+159**	+318.2
-28.9	**-20**	-4.0	+4.4	**+40**	+104.0	+37.8	**+100**	+212.0	+71.1	**+160**	+320.0
-28.3	**-19**	-2.2	+5.0	**+41**	+105.8	+38.3	**+101**	+213.8	+71.7	**+161**	+321.8
-27.8	**-18**	-0.4	+5.5	**+42**	+107.6	+38.9	**+102**	+215.6	+72.2	**+162**	+323.6
-27.2	**-17**	+1.4	+6.1	**+43**	+109.4	+39.4	**+103**	+217.4	+72.8	**+163**	+325.4
-26.7	**-16**	+3.2	+6.7	**+44**	+111.2	+40.0	**+104**	+219.2	+73.3	**+164**	+327.2
-26.1	**-15**	+5.0	+7.2	**+45**	+113.0	+40.6	**+105**	+221.0	+73.9	**+165**	+329.0
-25.6	**-14**	+6.8	+7.8	**+46**	+114.8	+41.1	**+106**	+222.8	+74.4	**+166**	+330.8
-25.0	**-13**	+8.6	+8.3	**+47**	+116.6	+41.7	**+107**	+224.6	+75.0	**+167**	+332.6
-24.4	**-12**	+10.4	+8.9	**+48**	+118.4	+42.2	**+108**	+226.4	+75.6	**+168**	+334.4
-23.9	**-11**	+12.2	+9.4	**+49**	+120.2	+42.8	**+109**	+228.2	+76.1	**+169**	+336.2
-23.3	**-10**	+14.0	+10.0	**+50**	+122.0	+43.3	**+110**	+230.0	+76.7	**+170**	+338.0
-22.8	**-9**	+15.8	+10.6	**+51**	+123.8	+43.9	**+111**	+231.8	+77.2	**+171**	+339.8
-22.2	**-8**	+17.6	+11.1	**+52**	+125.6	+44.4	**+112**	+233.6	+77.8	**+172**	+341.6
-21.7	**-7**	+19.4	+11.7	**+53**	+127.4	+45.0	**+113**	+235.4	+78.3	**+173**	+343.4
-21.1	**-6**	+21.2	+12.2	**+54**	+129.2	+45.6	**+114**	+237.2	+78.9	**+174**	+345.2
-20.6	**-5**	+23.0	+12.8	**+55**	+131.0	+46.1	**+115**	+239.0	+79.4	**+175**	+347.0
-20.0	**-4**	+24.8	+13.3	**+56**	+132.8	+46.7	**+116**	+240.8	+80.0	**+176**	+348.8
-19.4	**-3**	+26.6	+13.9	**+57**	+134.6	+47.2	**+117**	+242.6	+80.6	**+177**	+350.6
-18.9	**-2**	+28.4	+14.4	**+58**	+136.4	+47.8	**+118**	+244.4	+81.1	**+178**	+352.4
-18.3	**-1**	+30.2	+15.0	**+59**	+138.2	+48.3	**+119**	+246.2	+81.7	**+179**	+354.2
-17.8	**0**	+32.0	+15.6	**+60**	+140.0	+48.9	**+120**	+248.0	+82.2	**+180**	+356.0
-17.2	**+1**	+33.8	+16.1	**+61**	+141.8	+49.4	**+121**	+249.8	+82.8	**+181**	+357.8
-16.7	**+2**	+35.6	+16.7	**+62**	+143.6	+50.0	**+122**	+251.6	+83.3	**+182**	+359.6
-16.1	**+3**	+37.4	+17.2	**+63**	+145.4	+50.6	**+123**	+253.4	+83.9	**+183**	+361.4
-15.6	**+4**	+39.2	+17.8	**+64**	+147.2	+51.1	**+124**	+255.2	+84.4	**+184**	+363.2
-15.0	**+5**	+41.0	+18.3	**+65**	+149.0	+51.7	**+125**	+257.0	+85.0	**+185**	+365.0
-14.4	**+6**	+42.8	+18.9	**+66**	+150.8	+52.2	**+126**	+258.8	+85.6	**+186**	+366.8
-13.9	**+7**	+44.6	+19.4	**+67**	+152.6	+52.8	**+127**	+260.6	+86.1	**+187**	+368.6
-13.3	**+8**	+46.4	+20.0	**+68**	+154.4	+53.3	**+128**	+262.4	+86.7	**+188**	+370.4
-12.8	**+9**	+48.2	+20.6	**+69**	+156.2	+53.9	**+129**	+264.2	+87.2	**+189**	+372.2
-12.2	**+10**	+50.0	+21.1	**+70**	+158.0	+54.4	**+130**	+266.0	+87.8	**+190**	+374.0
-11.7	**+11**	+51.8	+21.7	**+71**	+159.8	+55.0	**+131**	+267.8	+88.3	**+191**	+375.8
-11.1	**+12**	+53.6	+22.2	**+72**	+161.6	+55.6	**+132**	+269.6	+86.9	**+192**	+377.6
-10.6	**+13**	+55.4	+22.8	**+73**	+163.4	+56.1	**+133**	+271.4	+89.4	**+193**	+379.4
-10.0	**+14**	+57.2	+23.3	**+74**	+165.2	+56.7	**+134**	+273.2	+90.0	**+194**	+381.2
-9.4	**+15**	+59.0	+23.9	**+75**	+167.0	+57.2	**+135**	+275.0	+90.6	**+195**	+383.0
-8.9	**+16**	+60.8	+24.4	**+76**	+168.8	+57.8	**+136**	+276.8	+91.1	**+196**	+384.8
-8.3	**+17**	+62.6	+25.0	**+77**	+170.6	+58.3	**+137**	+278.6	+91.7	**+197**	+386.6
-7.8	**+18**	+64.4	+25.6	**+78**	+172.4	+58.9	**+138**	+280.4	+92.2	**+198**	+388.4
-7.2	**+19**	+66.2	+26.1	**+79**	+174.2	+59.4	**+139**	+282.2	+92.8	**+199**	+390.2

The number in bold-face type in the center column refer to the temperature, either in Centigrade or Fahrenheit, which is to be converted to the other scale. Converting Fahrenheit to Centigrade, the equivalent temperature will be found in the left column. If converting Centigrade to Fahrenheit, the equivalent temperature will be ofund in the column on the right.

REFRIGERANT CHARGING

REFRIGERANT CHARGING

To avoid the possibility of freezing the liquid within the cooler tubes when charging an evacuated system, only refrigerant vapor from the top of the drum or cylinder must be admitted to the system until the system pressure is raised above the point corresponding to the freezing point of the cooler liquid. For water, the pressure corresponding to the freezing point is 58 psig R-22. (At sea level)

While charging, every precaution must be taken to prevent moisture laden air from entering the system. Make up a suitable charging connection from new copper tubing to fit between the system charging valve and the fitting on the charging drum. This connection should be as short as possible but long enough to permit sufficient flexibility for changing drums. The charging connection should be purged each time a full container of refrigerant is connected and changing containers should be done as quickly as possible to minimize the loss of refrigerant.

Refrigerant-22 may be furnished in cylinders containing either 125 lbs. or 1750 lbs. or refrigerant.

After the condenser, receiver and associated piping have been installed, tested and dehydrated as previously described, the system may be charged with refrigerant as follows:

1. With a positive Refrigerant-22 pressure on the system, connect a charging cylinder with a known weight of Refrigerant-22 by means of a suitable charging connection to the charging port on the refrigerant liquid stop valve as explained in CHARGING CONNECTIONS.
2. Close refrigerant liquid stop valve. (This opens the charging port).
3. Open the refrigerant charging cylinder valve and allow the system to accept as much refrigerant as it will. If additional refrigerant is required to fully charge the system, the refrigerant charge for the unit is 4375 lbs.

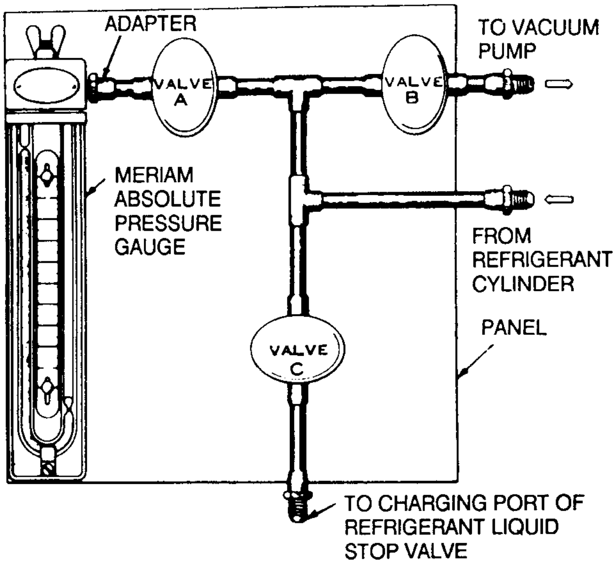


FIG. 17 – TYPICAL ABSOLUTE PRESSURE GAUGE AND CHARGING PANEL

CONDENSERS AND COOLERS

GENERAL

Maintenance of condenser and cooler shells is important to provide trouble free operation of the Codepak unit. The water side of the tubes in the shell must be kept clean and free from scale. Proper maintenance such as tube cleaning and testing for leaks, is covered on the following pages.

CHEMICAL WATER TREATMENT

Since the mineral content of the water circulated through coolers and condensers varies with almost every source of supply, it is possible that the water being used may corrode the tubes or deposit heat resistant scale in them. Reliable water treatment companies are available in most larger cities to supply a water treating process which will greatly reduce the corrosive and scale forming properties of almost any type of water.

As a preventive measure against scale and corrosion and to prolong the life of cooler and condenser tubes, a chemical analysis of the water should be made preferably before the system is installed. A reliable water treatment company can be consulted to determine whether water trreatment is necessary, and if so, to furnish the proper treatment for the particular water condition.

CLEANING COOLER AND CONDENSER TUBES

Cooler

It is difficult to determine by any particular test whether possible lack of performance of the water cooler is due to fouled tubes alone or due to a combination of troubles. Trouble which may be due to fouled tubes is indicated when, over a period of time, the cooling capacity decreases and the split (temperature difference between water leaving the cooler and the refrigerant temperature in cooler) increases. A gradual drop-off in cooling capacity can also be caused by a gradual leak of refrigerant from the system or by a combination of fouled tubes and shortage of refrigerant charge. An excessive quantity of oil in the cooler can also contribute to erratic performance.

Condenser

In a condenser, trouble due to fouled tubes is usually indicated by a steady rise in head pressure, over a period of time, accompanied by a steady rise in condensing temperature, and noisy operation. These symptoms may also be due to foul gas buildup. Purging will remove the foul gas revealing the effect of fouling.

TUBE FOULING

Fouling of the tubes can be due to deposits of two types as follows:

1. Rust or sludge – which finds its way into the tubes and accumulates there. This material usually does not build up on the inner tube surfaces as scale, but does interfere with heat transfer. Rust or sludge can generally be removed from the tubes by a thorough brushing process.

2. Scale – due to mineral deposits. These deposits, even though very thin and scarcely detectable upon physical inspection, are highly resistant to heat transfer. They can be removed most effectively by circulating an acid solution through the tubes.

TUBE CLEANING PROCEDURES

Brush Cleaning Of Tubes

If the tube fouling consists of dirt and sludge, it can usually be removed by means of the brushing process. Drain the water sides of the circuit to be cleaned (cooling water or chilled water) remove the heads and thoroughly clean each tube with a soft bristle bronze brush. DO NOT USE A STEEL BRISTLE BRUSH. A steel brush may damage the tubes.

Improved results can be obtained by admitting water into the tube during the cleaning process. This can be done by mounting the brush on a suitable length of 1/8 pipe with a few small holes at the brush end and connecting the other end by means of a hose to the water supply.

The tubes should always be brush cleaned before acid cleaning.

Acid Cleaning Of Tubes

If the tubes are fouled with a hard scale deposit, they must be acid cleaned. It is important that before acid cleaning, the tubes be cleaned by the brushing process described above. If the relatively loose foriegn material is removed before the acid cleaning, the acid solution will have less material to dissolve and flush from the tubes with the result that a more satisfactory cleaning job will be accomplished with a probable saving of time.

COMMERCIAL ACID CLEANING

In many major cities, commercial organizations now offer a specialized service of acid cleaning coolers and condensers. If acid cleaning is required, YORK recommends the use of the type organization. These organizations will analyze the type of dirt or scale to be removed and then use the proper cleaning solution for the individual job.

TESTING FOR COOLER AND CONDENSER TUBE LEAKS

Cooler and condenser tube leaks in R-22 systems may result in refrigerant leaking into the water circuit, or water leaking into the shell depending on the pressure levels. If refrigerant is leaking into the water it can be detected at the liquid head vents after a period of shutdown. If water is leaking into the refrigerant, frequent purging will be necessary and system capacity and efficiency will drop off sharply. If a tube is leaking and water has entered the system, the cooler and condenser should be valved off from the rest of the water circuit and drained immediately to prevent severe rusting and corrosion. If a tube leak is indicated, the exact location of the leak may be determined as follows:

1. Allow the system to warm up until a substantial pressure is reached for testing. Dry nitrogen (pressure not to exceed 225 psig) may be admitted to the unit to increase pressure in the shell. Remove the heads and listen at each section of tubes for a hissing sound that would indicate gas leakage. This will assist in locating the section of tubes to be further investigated. If the probable location of the leaky tubes has been determined, treat that section in the following manner (if the location is not definite, all the tubes will require investigation).

2. Wash off both tube heads and the ends of all tubes with water.

   NOTE: Do not use carbon tetrachloride for this purpose since its fumes give the same flame discoloration that the refrigerant does.

3. With nitrogen or dry air blow out the tubes to clear them of traces of refrigerant laden moisture from the circulation water. As soon as the tubes are clear, a cork should be driven into each end of the tube. Repeat this with all of the other tubes in the suspected section or if necessary, with all the tubes in the cooler or condenser. Allow the cooler or condenser to remain corked up to 12 to 24 hours before proceeding. Depending upon the amount of leakage, the corks may blow from the end of a tube, indicating the location of the leakage. If not, it will be necessary to make a very thorough test with the halide torch.

4. After the tubes have been corked for 12 to 24 hours, it is recommended that two men working at both ends of the cooler carefully test each tube - one man removing corks at one end and the other at the opposite end to remove corks and handle the test torch. Start with the top row of tubes in the section being investigated, remove the corks at the ends of one tube simultaneously and insert the exploring tube for 5 seconds - this should be long enough to draw into the detector any refrigerant gas that might have leaked through the tube walls. A fan placed at the end of the cooler opposite the torch will assure that any leakage will travel through the tube to the torch.

5. Mark any leaking tubes for later identification.

6. If any of the tube sheet joints are leaking, the leak should be detected by the test torch. If a tube sheet leak is suspected, its exact location may be found by using a soap solution. A continuous buildup of bubbles around a tube indicates a tube sheet leak.

COMPRESSOR

Maintenance for the compressor assembly consists of checking the operation of the oil return system and changing the dehydrator, checking and changing the oil, checking and changing the oil filters, checking the operation of the oil heater, checking the operation of the oil pump, and observing the operation of the compressor.

Internal wearing of compressor parts could be a serious problem caused by improper lubrication, brought about by restricted oil lines, passengers, or dirty oil filters. If the unit is shutting down on (HOT) High Oil Temperature or Low Oil Pressure (OP), change the oil filter element. Examine the oil filter element for the presence of metal particles. If metal particles are noticeable and the same conditions continue to stop the unit operation after a new filter element is installed, notify the nearest YORK office to request the presence of a YORK Service man.

ELECTRICAL CONTROLS

For information covering the MicroComputer Control Center operation, refer to Instruction 160.65-O1.1 and Wiring Diagrams, Form 160.65-PA2.1.

The operating points of the pressure and temperature cutouts are shown in the Wiring Diagrams. These diagrams also contain a starting and stopping sequence and timing sequence diagram.

CHECKING THE REFRIGERANT CHARGE DURING UNIT SHUTDOWN

The refrigerant charge specified for Codepak model YS NN NN S7 is 4375 lbs. Charge the correct amount of refrigerant and record the level in the cooler sight glass. The refrigerant charge should always be checked and trimmed when the system is shutdown.

The refrigerant charge level must be checked after the pressure and temperature has equalized between the condenser and cooler. This would be expected to be 4 hours or more after the compressor and water pumps are stopped. The level should be at the center of the sight glass ± 1/4 inch.

Charge the refrigerant in accordance with the method shown under REFRIGERANT CHARGING, page 29. The refrigerant level should be observed and the level recorded after initial charging.

HANDLING REFRIGERANT FOR DISMANTLING AND REPAIRS

If it becomes necessary to open any part of the refrigerant system for repairs, it will be necessary to remove the charge before opening any part of the unit.

Under atmospheric pressure, Refrigerant-22 boils at -41°F. Use caution so that freeze-burn to the skin or eyes does not occur.

MEGGING THE MOTOR

While the main disconnect switch and compressor motor starter are both open, meg the motor as follows:

1. Using a megohm meter (megger), meg between phases and each phase to ground (See Fig. 18); these readings are to be interpreted using the graph shown in Fig. 19, page 32.
2. If readings fall below shaded area, remove external leads from motor and repeat test.

NOTE: Motor is to be megged with the starter at ambient temperature after 24 hours of idle standby.

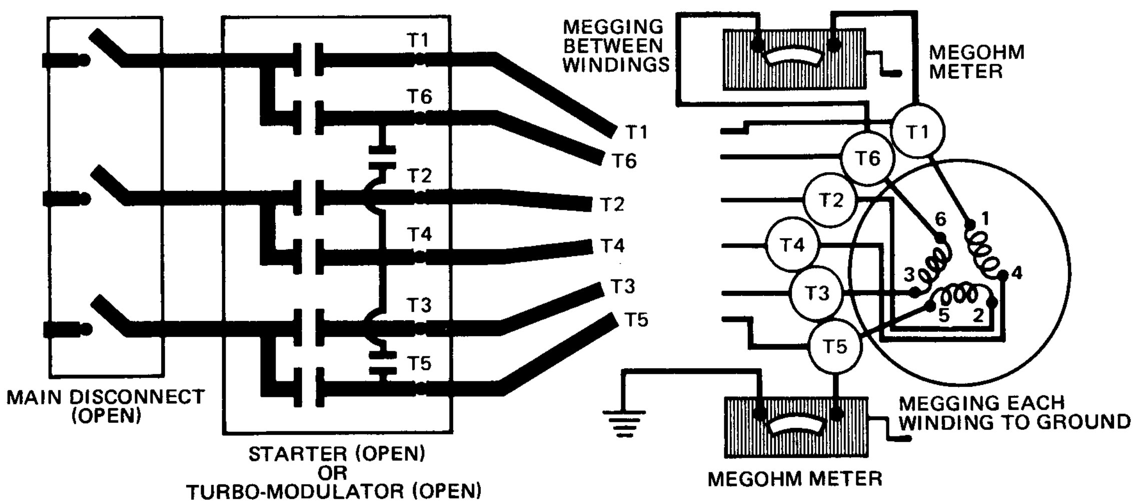


FIG. 18 – DIAGRAM, MEGGING THE MOTOR WINDINGS

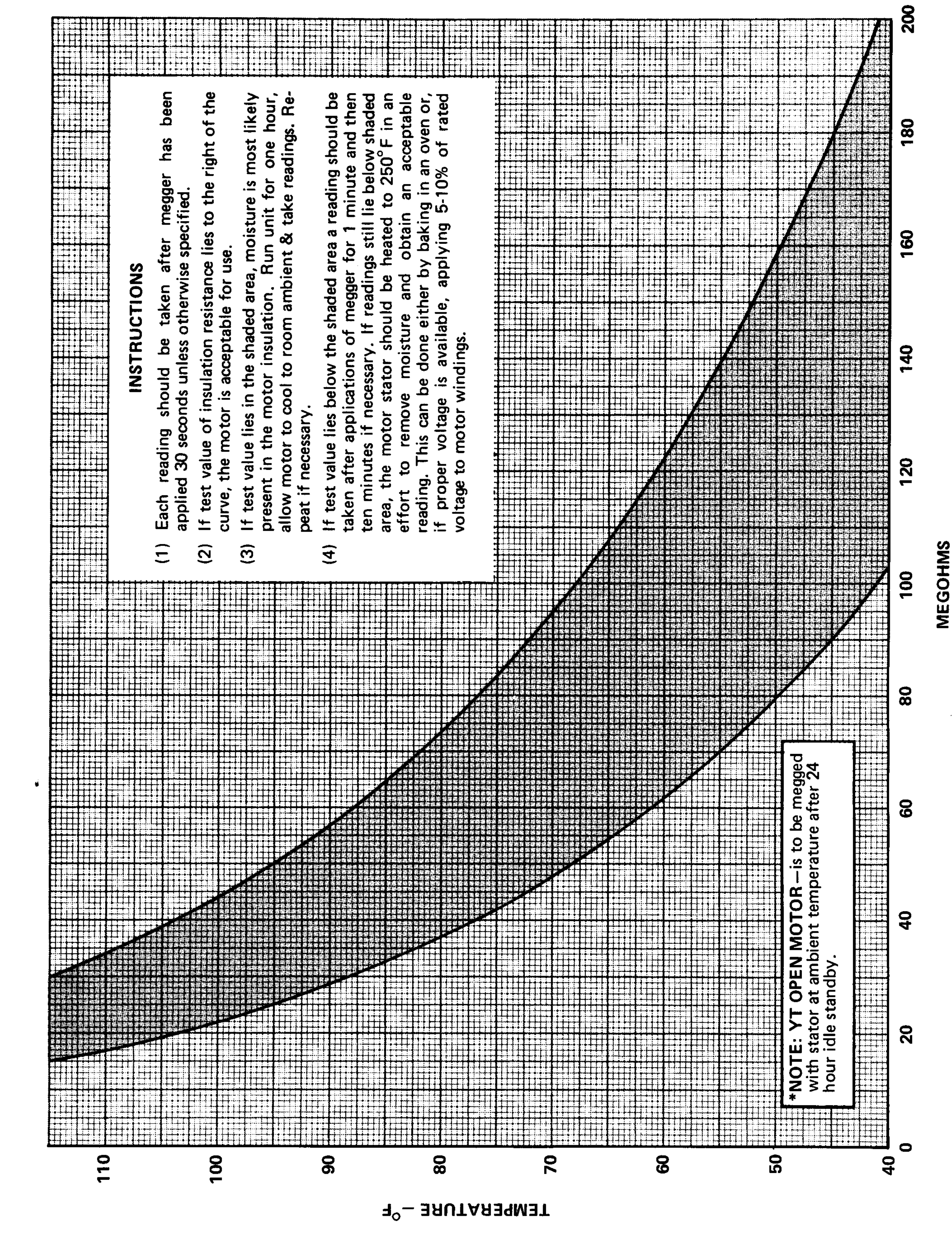


FIG. 19 – MOTOR STATOR TEMPERATURE AND INSULATION RESISTANCES

NORMAL MAINTENANCE OPERATIONS

When performing maintenance you must take several precautions to insure your safety:

CAUTION

1. *IF UNIT IS RUNNING, PRESS STOP KEY.*
2. *DISCONNECT POWER FROM UNIT BEFORE PERFORMING ANY MAINTENANCE.*
3. *WEAR PROPER SAFETY EQUIPMENT WHEN COMPRESSOR UNIT IS OPENED TO ATMOSPHERE.*
4. *INSURE ADEQUATE VENTILATION.*
5. *TAKE NECESSARY SAFETY PRECAUTIONS REQUIRED FOR THE REFRIGERANT BEING USED.*

GENERAL INSTRUCTIONS FOR REPLACING COMPRESSOR COMPONENTS

When replacing or repairing the shaft seal or potentiometers which are exposed to refrigerant pressure proceed as follows:

1. Push STOP key on control panel to shutdown unit.
2. Open disconnect switches for compressor and pump motor starters. Be sure starters are locked out.
3. Make sure unit is pumped down with all refrigerant stored in condenser.
4. Make replacement or repair.
5. Pressurize unit and leak test.
6. Evacuate unit.
7. Open discharge service valves, also liquid injection and economizer service valves, if applicable.
8. Close disconnect switches for unit and oil pump motor starters.
9. Unit is ready to put into operation.
10. Perform checkpoints on prestart check list, then start unit.

OIL FILTER

YORK Rotary Screw Chiller units are furnished with one (1) main oil filter container which contains two (2) cartridges.

The procedure to change filter cartridges is as follows:

1. Push STOP key on MicroProcessor panel to shutdown unit, then lock out the disconnect switches for compressor and oil pump motor starters.
2. Close outlet then inlet service valves of filter.
3. Attach a suitable holes to the drain valve. Slowly open the drain valve and drain oil into a container. Use caution as oil will be under pressure. Then open bleed valve to assure complete drainage.
4. Remove cover plate and gasket, pull filter assembly from canister. Discard cartridge(s).
5. Flush filter body with clean refrigeration oil and wipe dry with a clean lint free cloth. Close drain valve or reinstall drain plug.
6. Place new cartridges in filter assembly, insert filter assembly with new gasket, then fill with new refrigeration oil. Open bleed valve to be sure all air is removed from canister.

SECTION 7
PREVENTIVE MAINTENANCE

It is the responsibility of the owner to provide the necessary daily, monthly and yearly maintenance requirements of the system.

> **IMPORTANT**
>
> *If a unit failure occurs due to improper maintenance during the warranty period; YORK will not be liable for costs incurred to return the system to satisfactory operation.*
>
> *In any operating system it is most important to provide a planned maintenance and inspection of its functioning parts to keep it operating at its peak efficiency. Therefore, the following maintenance should be performed when prescribed.*

COMPRESSOR
(See Maintenance Schedule page 24)

In order to obtain maximum compressor unit performance and insure reliable operation a regular maintenance program should be followed.

The compressor unit should be checked daily for leaks, abnormal vibration, noise, proper operation and a log maintained. There should be a continuing monitoring of oil quality and oil analysis testing. In addition, an analysis of the unit's vibration should be periodically made.

1. Oil Filter – The oil filter must be changed as listed in Table 1, page 8.

   When the oil filter is changed it should be inspected thoroughly for any metalic particles which would indicate possible bearing wear. If metal is found this should be brought to the attention of the nearest YORK office for their further investigation and recommendations.

2. Oil Changing – The oil should be changed per the maintenance schedule page 8 unless oil analysis indicates a problem that would require changing earlier.

COMPRESSOR MOTOR

1. Check motor mounting screws frequently to insure tightness.

2. Meg motor windings annually to check for deterioration of windings.

3. Perform maintenance procedures recommended by the motor manufacturer.

PRESSURE TESTING

The unit should be leak tested. Any leaks found must be repaired immediately.

COOLER AND CONDENSER

The major portion of maintenance on the condenser and cooler will deal with the maintaining of the water side of the condenser and cooler in a clean condition. The use of untreated water in cooling towers, closed water systems, etc. frequently results in one or more of the following:

1. Scale Formation.

2. Corrosion or Rusting.

3. Slime and Algae Formation.

It is therefore to the benefit of the user to provide for proper water treatment to provide for a longer and more economical life of the equipment. The following recommendation should be followed in determining the condition of the water side of the condenser and cooler tubes.

1. The condenser tubes should be cleaned annually or earlier if conditions warrant. If the temperature difference between the water off the condenser and the condenser liquid temperature is more than 4°greater than the difference recorded on a new unit it is a good indication that the condenser tubes require cleaning. They should be cleaned as instructed on pages 28 - 29 of this manual.

2. The cooler tubes under normal circumstances will not require cleaning. If however the temperature difference between the refrigerant and the chilled water increases slowly over the operating season, it is an indication that the cooler tubes may be fouling or that there may be a water by-pass in the water box requiring gasket replacement.

VIBRATION ANALYSIS

Periodic vibration analysis can be useful in detecting bearing wear and other mechanical failures. If vibration analysis is used as a part of your preventive maintenance program, take the following guidelines into consideration.

1. Always take vibration readings from exactly the same places, at exactly the same percent of load.

2. Use vibration readings taken from the new unit at start-up as the base line reference.

3. Evaluate vibration readings carefully as the instrument range and function used can vary. Findings can be easily misinterpreted.

4. Vibration readings can be influenced by other equipment operating in the vicinity or connected to the same piping as the unit.

TRANSFER UNIT

Clean and inspect the transfer unit valves. Drain, flush and replace compressor oil. Use YORK "C" oil. This maintenance should be performed at least once a year or more often.

OIL RETURN SYSTEM

1. Change the filter on the filter-drier in the oil return system semi-annually or earlier if the oil return system fails to operate.

2. When the dehydrator is changed the nozzle of the eductor should be checked for any foreign particles that may be obstructing the jet.

ELECTRICAL CONTROLS

1. All electrical controls should be inspected for obvious malfunctions.

2. It is important that the factory settings of controls (operation and safety) not be changed. If the settings are changed without YORK's approval the warranty will be jeopardized.

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