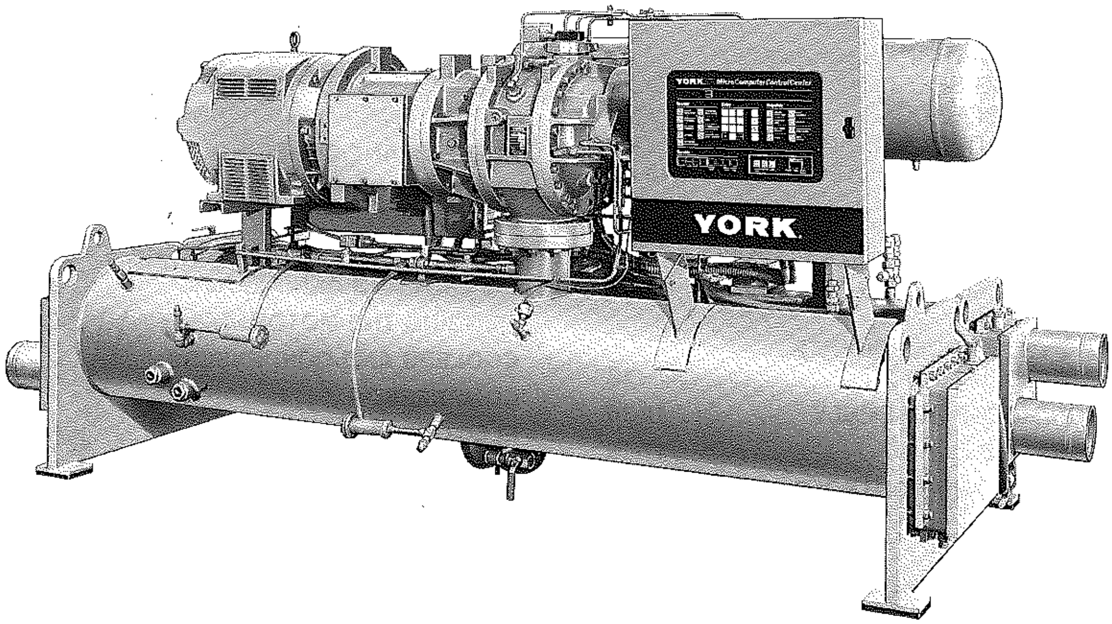
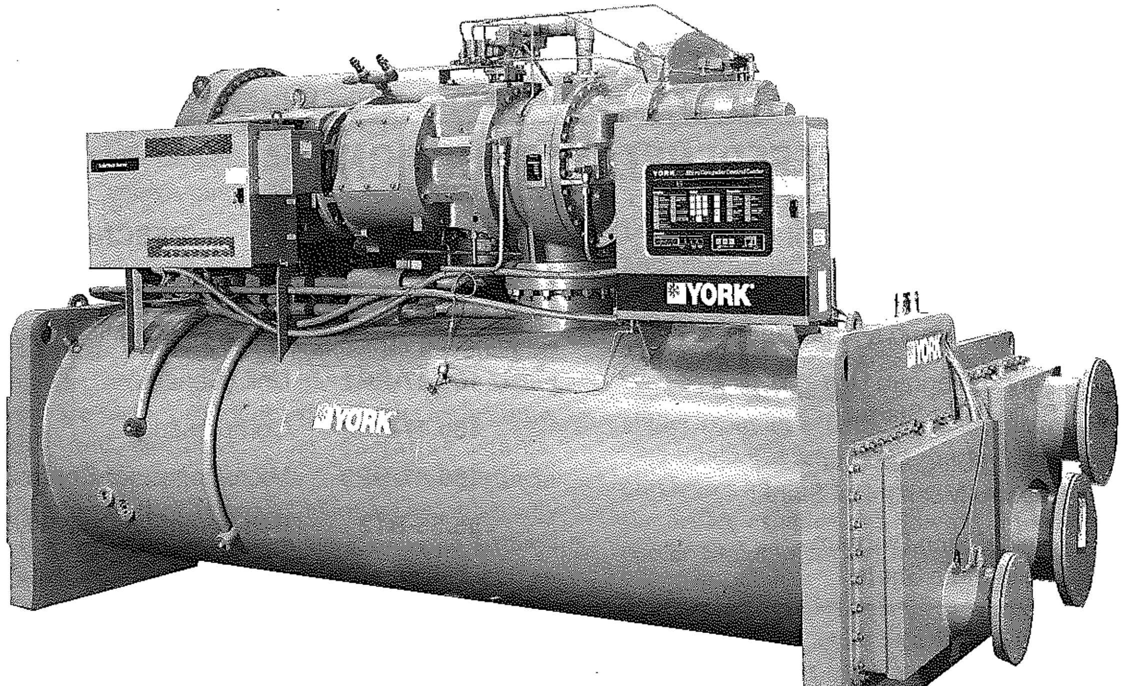
MODEL YS BA BA S0 THRU YS FC FB S5 (STYLES A, B &C) WITH MICROCOMPUTER CONTROL CENTER FOR ELECTRO-MECHANICAL STARTER OR SOLID STATE STARTER COOLING 125 THRU 675 TONS





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160-47-PA9	Field Wiring Diagram - Solid State Starter
160.47-PA10	Field Wiring Diagram - Electro-Mechanical Starter
160.47-RP1	Unit (General)
160.47-RP2	Compressor
160-47-RP3	MicroComputer Control Center
55.55-RT3	Refrigerant-22 Conversion Tables

SECTION 1
DESCRIPTION OF SYSTEM AND OPERATIONAL FUNDAMENTALS

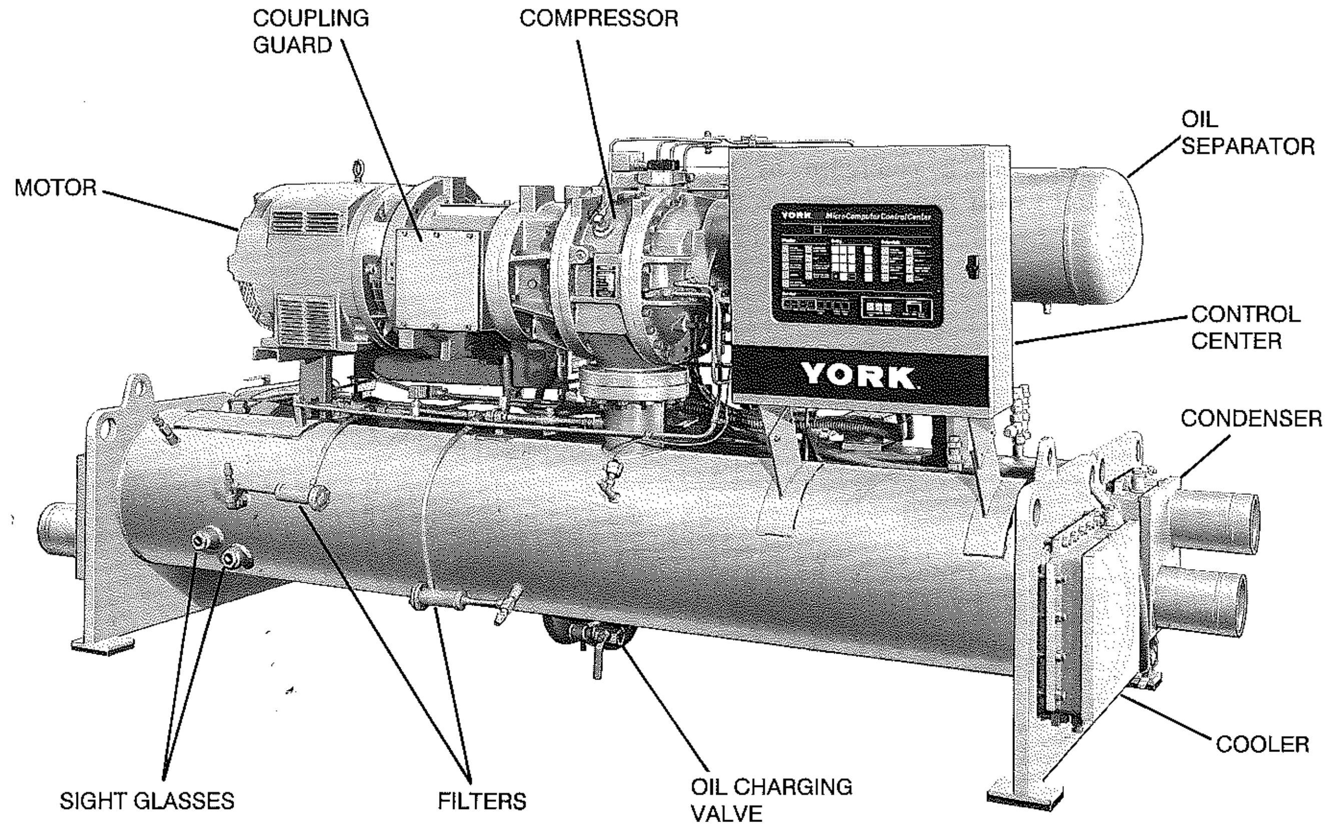


FIG. 1– MODEL YS CODEPAK ROTARY SCREW CHILLER

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 connected to a rotary screw compressor with an adapter support and a coupling, an oil separator, a condenser, a cooler, and a MicroComputer Control Center.

The Codepak is controlled by a modern state-of-the-art MicroComputer Control Center which monitors its' operation. The control center is programmed by the operator to suit job specifications. Automatic timed start-ups and shutdowns are also programmed to suit night time, weekends, and holidays. The operating status, temperatures, pressures, and other information pertinent to the operation of the Codepak Chiller are automatically displayed and read on an alphanumeric message display. The Codepak with the MicroComputer is applied with an electro-mechanical starter, or a factory packaged York Solid State Starter.

In operation, a liquid (water or brine to be chilled) flows through the cooler, where Refrigerant-22, boiling at 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 compressed by the rotary screw compressor and discharged into the oil separator section which removes the oil before the high pressure gas flows into the condenser tube 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 subcooled refrigerant drains from the bottom of the condenser into a pipe connection, where the flow restrictor orifice expands the flow of liquid refrigerant to the cooler to complete the refrigerant cycle.

The major components of a Codepak are selected to handle the refrigerant which is 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.

CAPACITY CONTROL (Refer FIG. 2)

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

The slide valve arrangement is controlled by the MicroComputer Control Center and unit controls that sense the building load conditions. The control center sends signals to the solenoid valve that loads and unloads the slide valve with the use of compressor oil under hydraulic pressure. A cylinder located on the inlet end of the compressor houses a spring loaded shaft and pistons (slide valve) which is fed through its ports by pressurized compressor oil. The flow of the oil is controlled by the equalizing solenoid valve which modulates to load and unload the slide valve that increases or decreases the amount of refrigerant flowing to the compressor, thus controlling the chiller capacity.

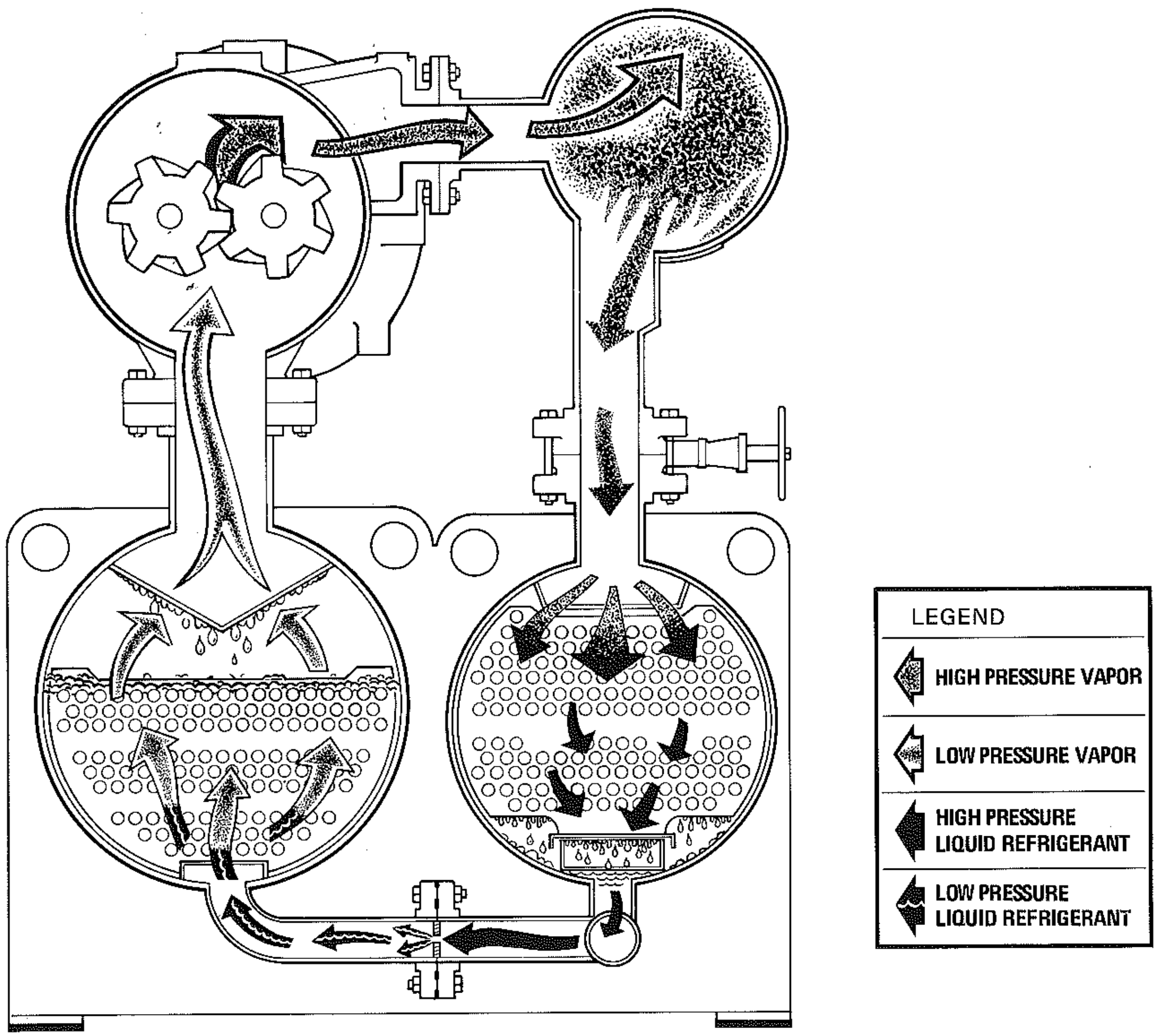


FIG. 2 – REFRIGERANT FLOW THROUGH CODEPAK

YS OPEN MOTORS

The YS motor is air cooled which requires ventilation in the equipment room as predetermined by the building design.

SECTION 2
SYSTEM OPERATING PROCEDURES

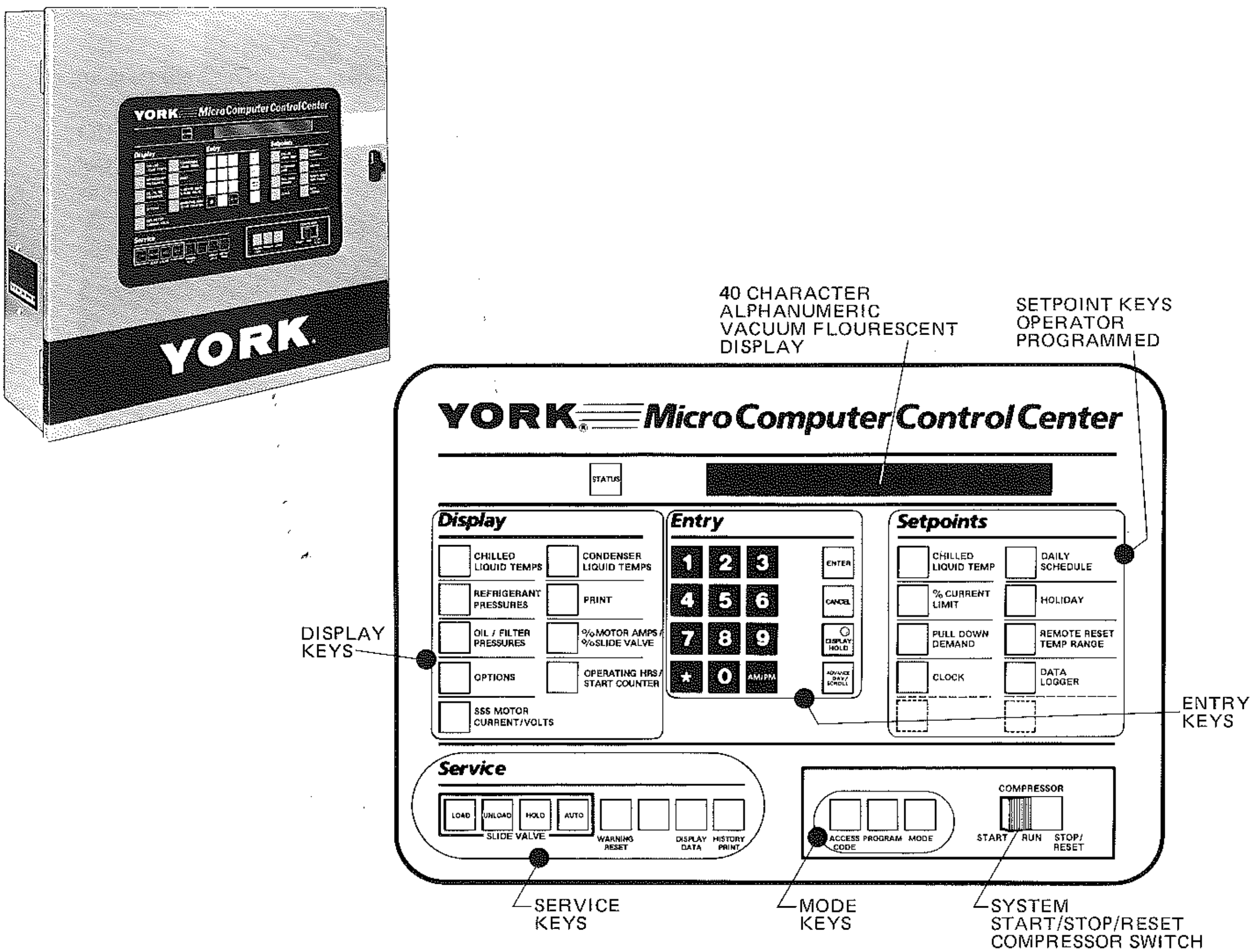


FIG. 3 – MICROCOMPUTER CONTROL CENTER AND KEYPAD

WARNING

OIL HEATER

If the oil heater is de-energized during a shutdown period, it may have to be energized prior to starting compressor, or remove all oil and recharge compressor with new oil. (See CHARGING UNIT WITH OIL page 21.)

NOTE: The oil heater is thermostatically controlled and remains energized as long as the fused disconnect switch to the starter is energized.

CHECKING THE OIL LEVEL IN THE OIL RESERVOIR

Proper operating oil level – the middle of the upper sight glass.

If the oil is excessively high after start-up, the excess oil may be drained from the oil filter drain valve while the compressor is running.

If oil level is low, oil should be added to the compressor. (See CHARGING UNIT WITH OIL page 21.)

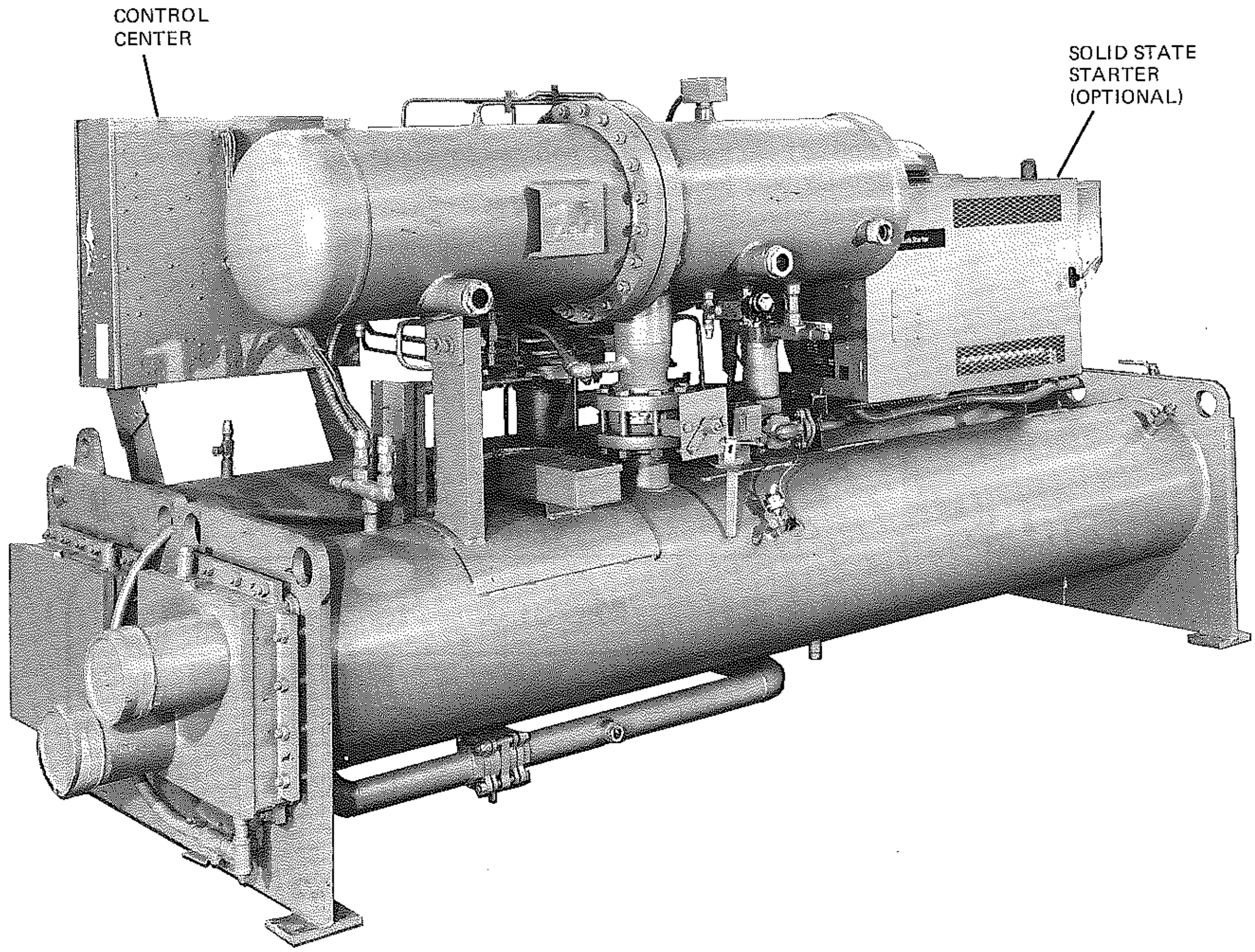


FIG. 4 – UNIT WITH MICROCOMPUTER CONTROL CENTER AND SOLID STATE STARTER (OPTIONAL)

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 be 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.
	Confirm MicroComputer Control Center display is operating.
	Confirm MicroComputer pressure and temperatures are consistent within anticipated ranges. Confirm heater is operating.
	Open discharge service valve.
	Confirm all unloader and slide stop service valves are open.
	Confirm all oil return system service valves are open.
	Confirm liquid injection service valves are open.
	Close motor main disconnect.

CODEPAK START-UP PROCEDURE

PRE-STARTING

Prior to starting the CODEPAK observe the MicroComputer Control Center. Make sure the display reads SYSTEM READY TO START

To pre-start the CODEPAK use the following procedure:

1. OIL HEATER - The unit will not start if the oil is less than 49°F. If not possible the compressor oil should be drained and new oil must be charged into the oil sump. (See CHARGING UNIT WITH OIL Page 21.)
2. All control center setpoints should be programmed before the Codepak is started. (Refer to Form 160.47-O1.1 pages 14 thru 17.) Prior to start, the clock must be programmed for the proper day and time. Place the clock jumper in the "CLK ON" position and program the date and time. Any setpoints which are desired to be changed may be programmed. If not programmed the "default" value setpoints are as follows:

   LCWT = 45°F
   % Current Limit = 100% FLA
   Pulldown Demand = None
   Clock = Sun 12:00 A.M.
   Daily Schedule = None
   Holiday = None
   Remote Reset Temp. Range = 20°F
   Data Logger = No operation

START-UP

1. If the chilled water pump is manually operated, start the pump, the control center will not allow the Codepak to start unless chilled liquid flow is established through the unit. (A field installed chilled water flow switch is required.) If the chilled liquid pump is wired to the MicroComputer Control Center the pump will automatically start, therefore, this step is not necessary.

2. To start the Codepak, press the COMPRESSOR START switch. This switch will automatically spring return to the RUN position. (If the unit was previously started press the STOP/RESET side of the COMPRESSOR switch and then press the START side of the switch to start the Codepak.) When the start switch is energized the control center is placed in an operating mode and any malfunction will be noted by messages on the 40 character alphanumeric display. (See Fig. 3.)

   Note: Any malfunctions which occur during STOP/RESET are also displayed.

   When the Codepak is shutdown, the slide valve will close automatically to prevent loading the compressor on start-up. When the Codepak is shutdown, the "Display" reads "2.0 MIN. LOCKOUT DELAY" to allow system pressure equalization.

When the Codepak starts to operate the following automatic sequences are initiated: (Refer to page 8 Fig. 5 - Chiller Starting & Shutdown Sequence Chart.)

1. The MicroComputer Control Center alphanumeric display message will read:
   START SEQUENCE INITATED
   for the first 30 seconds of the starting sequence.

2. The oil and oil filter, plus oil and evaporator pressure transducer differential are compared during system equalization so that any offset is stored for use in calculating deferential trip points during compressor operation.

3. Make sure the proper oil pressure is supplied to the compressor.

4. The oil, oil filter, and evaporator pressure transducers and the oil temperature sensor (RT3) will sense any malfunction in the lubrication system and activate one of the following display messages:

   DAY 10:30 AM - LOW OIL PRESSURE

   DAY 10:30 AM - HIGH OIL TEMPERATURE

   DAY 10:30 AM - CLOGGED OIL FILTER

   WARNING: DIRTY OIL FILTER

   DAY 11:30 AM - OIL PRESSURE TRANSDUCER

   DAY 11:30 AM - LOW SEPARATOR OIL LEVEL

   DAY 11:30 AM - FAULTY OIL OR CONDENSER TRANSDUCER

5. The anti-recycle timer software function will operate after the 30 seconds of pre-run time. At this time the timer will be initiated and will run for 30 minutes after the compressor starts. If the Codepak shuts down during this period of time it cannot be started until the timer completes the 30 minute cycle.

SECTION 2

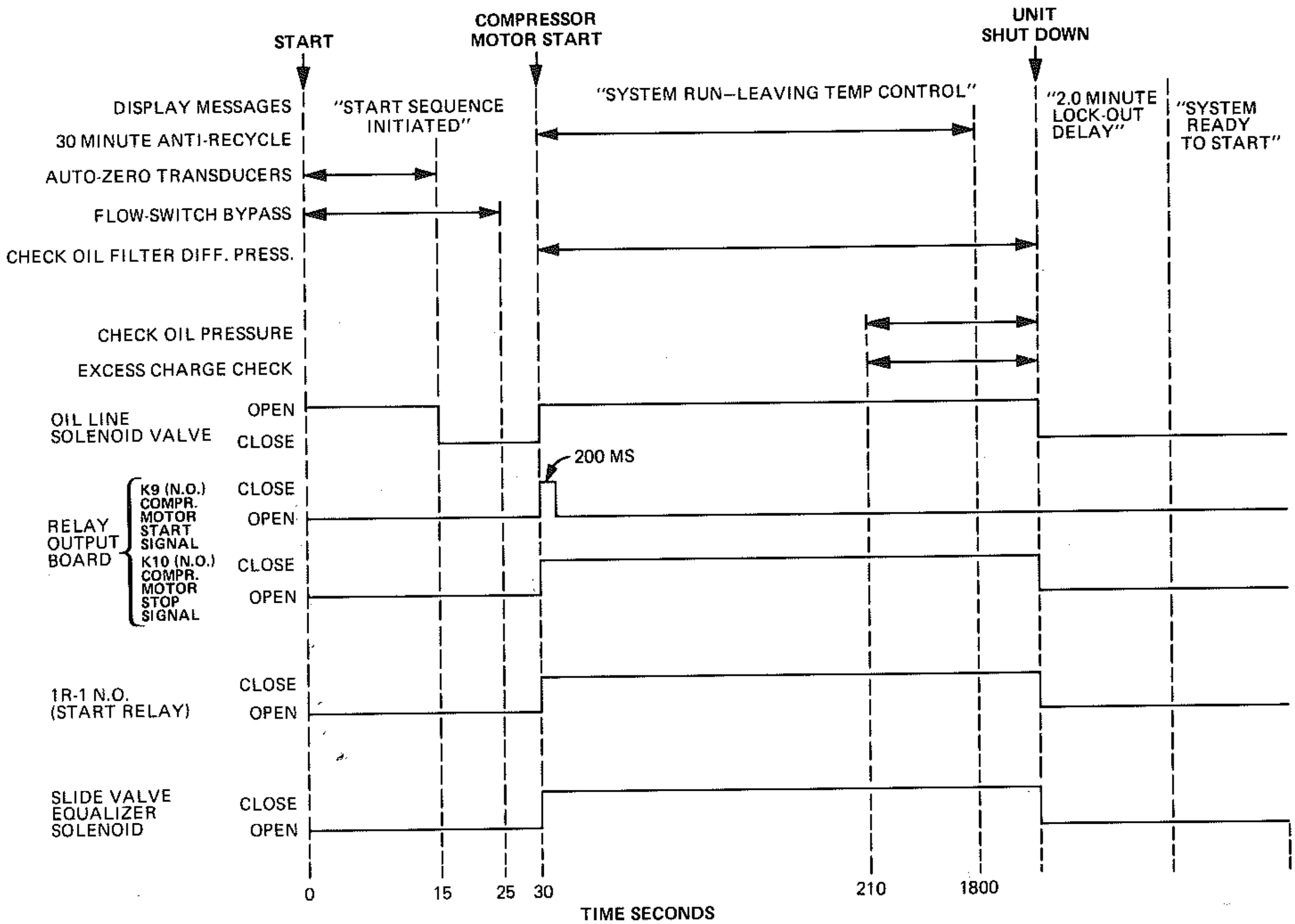


FIG. 5 – CODEPAK CHILLER STARTING SEQUENCE & SHUTDOWN SEQUENCE

6. The chilled liquid pump contacts will close starting the chilled liquid pump to allow liquid flow through the cooler when the "COMPRESSOR" start switch is energized.

7. After first 30 seconds of start sequence operation, the compressor will start and the control center display message will read:
   SYSTEM RUN – CURRENT LIMIT IN EFFECT
   while the motor is accelerating to full speed. When the motor reaches full speed and the current falls below 100% FLA the message will read:
   SYSTEM RUN – LEAVING TEMP. CONTROL

8. For additional display messages and information pertaining to the operation of the MicroComputer Control Center refer to Form 160.47-O1.1 and page 21 of this instruction.

CODEPAK OPERATION

After the compressor reaches its operating speed the slide valve will begin to load under the control of the Microprocessor board which senses the leaving chilled liquid temperature. The unit capacity will vary to maintain the leaving chilled liquid temperature setpoint. The slide valve loads and unloads under the control of the Microprocessor board. The slide valve control routine employs proportional plus derivative (rate) control action. A drop in chilled liquid temperature will cause the slide valve to unload to decrease Codepak capacity. When the chilled liquid temperature rises, the slide valve loads the compressor and increases the capacity of the Codepak.

However, the current draw (amperes) by the compressor motor cannot exceed the setting of the "% CURRENT LIMIT" at any time during the unit operation, since the

Micro Computer Control Center 40 to 100% three phase peak current limit software function, plus the 3 phase 100% solid state overload current limiter (CM-2A) on Electro-Mechanical Starter applications or the solid state starter current limit function will override the temperature control function and prevent the slide valve from loading beyond the "% CURRENT LIMIT" setting.

If the load continues to decrease, after the slide valve unloads the compressor completely, the Codepak will be shut down by the Low Water Temperature control (LWT) function which is displayed on the Control Center as:

MON 10:30 AM-LOW WATER TEMPERATURE-AUTOSTART

This occurs when the leaving water temperature falls to 4°F below setpoint or 36°F, whichever is higher. The LWT is part of the Micro-Board.

NOTE: If the temperature setpoint has been reprogrammed within the last 10 minutes, the LWT cutout is 36°F for 10 minutes.

CHECKING OPERATION

During operation, the following conditions should be periodically checked:

1. On starting, the slide valve should remain unloaded until the compressor motor is up to speed on the run winding; then the slide valve solenoid valve causes the slide valve to load and unload the compressor as required to maintain the leaving the chilled water temperature equal to the leaving water temperature setpoint.
2. Check Oil Pressure Display. The oil and oil filter transducers are compared during compressor operation. If the differential filter pressure exceeds 20 psi for 5 seconds, the message "WARNING — DIRTY OIL FILTER" is displayed. If the differential filter pressure exceeds 25 psi for 5 seconds, the unit shuts down and the displayed message is "CLOGGED OIL FILTER". A gradual decrease in bearing pressure of 5 to 10 psi (with constant suction and discharge pressures) may be an indication of a dirty filter. The filter should be replaced when pressure loss is 30% of the original pressure. The actual bearing oil pressure will vary with compressor suction and discharge pressures. When a new system is first operated under normal full load conditions, the bearing oil pressure should be recorded as a reference point with which to compare subsequent readings.

OPERATING LOG SHEET

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

An optional status printer is available for this purpose or Fig. 6 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 No. 160.47-F6 and may be obtained through the nearest York office. Automatic data logging is possible by connecting the optional printer and programming the DATA LOGGER function (Ref. Form 160.47-NO1.2).

An accurate record of readings serves as a valuable reference for operating the system. Readings taken when a system is 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 INSPECTIONS

By following a regular inspection using the display readings of the Micro-Computer 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 Micro-Computer control center displays.
2. If the compressor is in operation, check the bearing oil pressure by pressing "**DISPLAY DATA**" key to read the display on the control center. Also check the oil level in the oil reservoir. Drain or add oil if necessary.
3. Check entering and leaving condenser water pressure and temperatures for comparison with job design conditions. Condenser water temperatures can be checked by pressing "**CONDENSER LIQUID TEMPERATURES**" display key if the optional condenser water temperature sensor kit has been installed on the condenser entering and leaving water piping connections. If not, then conventional methods may be used.

YORK

ROTARY SCREW
LIQUID CHILLER LOG SHEET
125 - 400 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 %										
		Oil Added (gallons)										
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										

FORM 160.47-F6

*NOTE: These items can be printed by an electronic printer connected to J11 of the Micro Board and pressing the PRINT key on the Micro Board or automatically using the Data Logger feature.

FIG. 6 – LIQUID CHILLER LOG SHEETS – FORM 160.47-F6

4. Check the entering and leaving chilled liquid temperatures and evaporator pressure for comparison with job design conditions. This can be accomplished by pressing the "**CHILLED LIQUID TEMPS**" key and the "Refrigerant Pressures" key (see Form 160-47-NO1 page 11.)

5. Check the condenser saturation temperature (based upon condenser pressure sensed by the condenser transducer). Press the "**DISPLAY DATA**" key (see Form 160.47-NO1). This key may be depressed repeatedly after depressing the "**DISPLAY HOLD**" key to display three different parameters.

6. Check the compressor discharge temperature. Press "**DATA DISPLAY**" key (see Form 160.47-NO1). During normal operation discharge temperature should not exceed 212°F.

7. Check the compressor motor voltage and current (amps) at E-M starter or on the Control Center display for Solid State Starter Units.

8. 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.)

9. Verify proper water treatment.

10. Press the "STATUS" key whenever the display indicates so. This allows any warning messages to be displayed.

Weekly

1. Check the refrigerant charge (See CHECKING THE REFRIGERANT CHARGE, page 33).

Quarterly

1. Perform chemical analysis of oil.

Semi-Annually (or more often as required.)

1. Change and inspect compressor oil filter element.

2. Oil return system

   a. Clean strainer.

   b. Check nozzle of eductor for foreign particles.

3. Check controls and safety cutouts.

Annually (more often if necessary)

1. Drain and replace the oil in the separator oil sump (See CHARGING THE UNIT WITH OIL, Page 21).

2. Cooler and Condenser.

   a. Inspect and clean water strainers.

   b. Inspect and clean tubes as required.

   c. Inspect end sheets.

3. Compressor Drive Motor (See motor manufacturers maintenance and service instruction supplied with unit)

   a. Clean air passages and windings per manufacturers instructions.

   b. Meg motor windings - See Figure 18 for details.

   c. Re-lubricate ball bearings.

4. Inspect and service electrical components as necessary.

5. Perform chemical analysis of system.

NEED FOR MAINTENANCE OR SERVICE

If the system is malfunctioning in any manner or the unit is stopped by one of the safety controls, consult the OPERATION ANALYSIS CHART pages 26 and 27 of this instruction. After consulting this chart, if you are unable to make the proper repairs or adjustments to start the compressor or the particular trouble continues to hinder the performance of the unit, please call 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 respond to high temperatures, low temperatures, or low and high pressures, etc. Table 1, pages 23-25, is an explanation of each specific shutdown. If the Codepak shuts down on a "Safety" shutdown, the display will read: SYSTEM SHUTDOWN - PRESS STATUS. Upon pressing the "STATUS" key, the day-of-week, time-of-day and cause of shutdown is displayed. Safety shutdowns require the operator to manually reset the control center prior to restarting the Codepak. When the display reads "Start Sequence Initiated" the cause of the safety shutdown is automatically cleared from memory.

SAFETY SHUTDOWNS

- Power Failure
  (If auto restart programming jumper is not installed on the Micro Board)
- Low Evaporator Pressure
- Low Oil Pressure
- High Condenser Pressure
- Evaporator Transducer or Probe Error
- High Discharge Temp
- High Oil Temp
- Faulty Oil or Condenser Transducer
- Starter Malfunction Detected
- Faulty Discharge Temp Sensor
- Aux. Safety Shutdown
- Motor Phase Current Unbalance (Solid State Starter Unit only)
- Low Separator Oil Level
- Clogged Oil Filter
- Oil Pressure Transducer

If the Codepak shuts down on a "Cycling" shutdown the display will read SYSTEM SHUTDOWN - PRESS STATUS. Upon pressing the "STATUS" key the day-of-week, time-of-day and cause of shutdown are displayed. These shutdowns do not require the operator to manually reset the control center prior to re-starting the Codepak. The Codepak will automatically restart when the cycling condition is removed.

CYCLING SHUTDOWNS

- Power Failure
  (If auto re-start programming jumper is installed on the Micro Board).
- Low Water Temp
- Flow Switch
- System Cycling
- Multi-Unit Cycling
- Internal Clock
- Anti-Recycle
- Motor Controller
  (manual reset of the CM-2 module on E-M starter units or the logic board of the SSS may be required)
- Power Fault
- Program Initiated Reset
- AC Undervoltage
- Low Line Voltage (Solid State Starter Units only)
- High Line Voltage (Solid State Starter Units only)

STOPPING THE SYSTEM (See Fig. 3 page 5).

The Codepak Microcomputer Controls Center can be programmed to start and stop automatically (maximum, once each day) whenever desired. Refer to Form 160.47-O1.1. To stop the Codepak proceed as follows:

1. Push the COMPRESSOR "STOP/RESET" switch. The control center display will show: 2.0 MIN. LOCKOUT DELAY.
   This prevents compressor restart until system equilization is achieved.

2. Stop the chilled water pump (if not wired into the Microcomputer Control Center, in which case it will shut off automatically.) (The actual water pump contact operation is dependent upon the position of Micro Board Jumper J54)

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

4. The compressor sump oil heater (thermostatically controlled) is 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. During long idle periods, the tightness of the system should be checked periodically.

2. If freezing temperatures are encountered while the system is idle, carefully drain the cooling water from the cooling tower, condenser, condenser pump, and the chilled water system-chilled water pump and coils.

   Open the drains on the cooler and condenser liquid heads to assure complete drainage. (If Solid State Starter, drain water from starter cooling loop.

3. Move jumper J-57 on the micro board from CLOCK ON position (CLKON) to CLOCK OFF position (CLKOFF) while 115VAC control power is applied. This conserves the battery.

4. Open the main disconnect switches to the compressor motor, condenser water pump and the chilled water pump. Open the 115 volt circuit to the control center.

START UP AFTER PROLONGED SHUTDOWN

1. When putting the system into operation after prolonged shutdown (during the winter), remove all oil from the separator. Install a new filter element and charge separator with fresh oil. Move jumper J-57 on the micro board from CLOCK OFF Position (CLKOFF) to CLOCK ON Position (CLKON) and reset the clock. Energize the 115 volt circuit to the control center to energize the separator sump oil heater for at least 12 hours.

2. If the water systems were drained, fill the condenser water circuit and chilled liquid circuit.

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.	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									

SECTION 3
SYSTEM COMPONENTS DESCRIPTION
COMPRESSOR/MOTOR ASSEMBLY

(SEE FIG. 7)

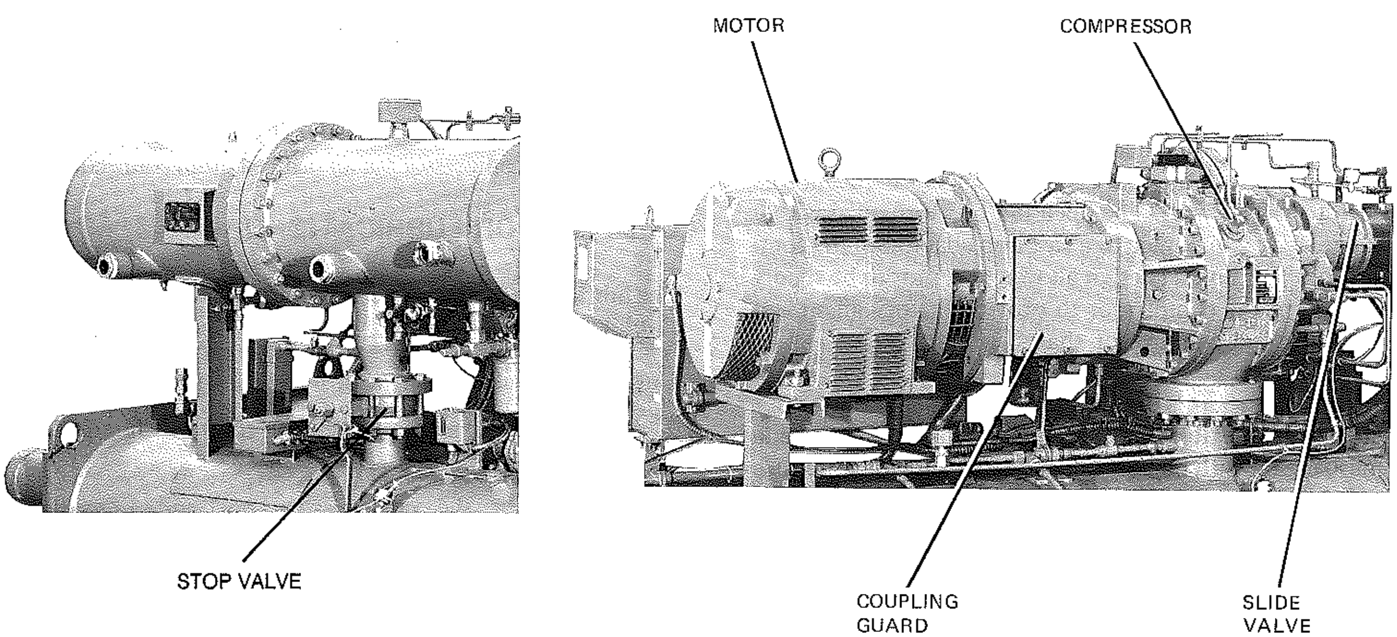


FIG. 7 – COMPRESSOR ASSEMBLY

Compressor

The Frick rotary twin screw compressor is engineered and constructed to meet the exacting requirements of the industrial refrigerant 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 for 60 Hertz and 2975 RPM for 50 Hertz. The compressor housing is made of cast iron, precision machined to provide minimal clearance for the rotors.

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 axial loads. Two 4-point angular contract ball bearings handle axial loads. Together they maintain accurate rotor positioning at all pressure ratios thereby minimizing blow-by and maintaining efficiency.

The open-drive compressor shaft seal consists of a spring-loaded, precision carbon ring, high temperature elastomer "O" ring static seal, and stress-relieved, precision lapped collars. The entire shaft seal cavity is at low pressure, being vented to the oil drain from the compressor. Combining low pressure with direct oil cooling provides long seal life.

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.

Motor Driveline

The compressor motor is an open drip proof, squirrel cage, induction type constructed to York design specifications. 60 hertz motors operate at 3570 rpm. 50 hertz motors operate at 2975 rpm. The open motor is provided with a flange, factory mounted to a cast iron adaptor on the compressor. This unique design allows the motor to be rigidly coupled to the compressor to provide factory alignment of motor and compressor shafts.

Motor drive shaft is directly connected to the compressor shaft with a flexible disc coupling. Coupling has all metal construction with no wearing parts to assure long life with no lubrication requirements to provide low maintenance.

For units utilizing remote electro-mechanical starters, a large, 14 gauge (minimum) steel terminal box with gasketed front access cover is provided for field connected conduit. There are six terminals (three for high voltage) brought through the motor casing into the terminal box. Jumpers are furnished for three-lead types of starting. Motor terminal lugs are not furnished. Overload/overcurrent transformers are furnished with all units.

Oil Separator

The oil separator is a horizontal design with no moving parts. Effective oil separation is achieved by gravity dropout of oil from the refrigerant gas as velocity decreases upon entering the separator, and by impinging on mesh pads in the first stage of the separator. Final separation is accomplished when the gas passes through coalescer elements in the second stage.

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

Lubrication

The oil reservoir is located in the first stage of the oil separator. The compressor also has an oil reservoir located at the rotor bearings to provide lubrication during startup, coastdown and in the event of a power failure. During operation, system pressure differential provides proper oil flow without the need of an oil pump. This minimizes system energy consumption.

A 500 watt (115 volt-1 phase-60/50 Hz) immersion oil heater is located in the oil separator reservoir, temperature actuated to effectively remove refrigerant from the oil. Power wiring is provided to the control center. A refrigerant cooled oil cooler is provided, factory piped to the system. An external, replaceable cartridge, 15 micron oil filter is provided with manual isolation stop valves for ease of servicing. An oil eductor automatically removes oil which may have migrated to the evaporator and returns it to the compressor. A second oil eductor system returns oil to the compressor which may accumulate in the evaporator suction baffle during low load/head operation. It is activated only at slide valve positions less than 17%.

Oil collected in the second stage of the separator is returned directly to the compressor via an orificed drain connection.

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.

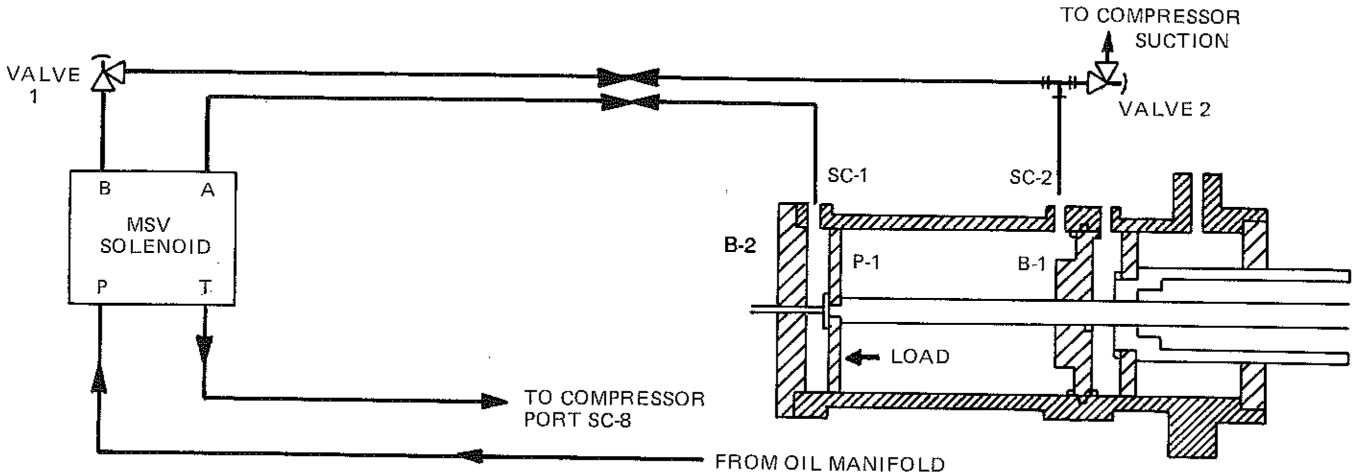


FIG. 8 — DOUBLE PURPOSE HYDRAULIC CYLINDER

Solenoid Operation

1 SOL – Closes on shutdown to prevent oil from draining from the separator. Also prevents flow of oil to Movable Slide Valve (MSV)

2 SOL – Opens on shutdown to equalize oil pressure on both sides of slide valve unloader piston. Slide valve then assumes unloaded position.

3 SOL – At low load condition (approximately 10% slide valve position) 3 SOL opens. This allows high pressure condenser gas to flow to eductor B, drawing oil from the bottom of the cooler suction baffle, and returning it to the separator sump.

PRELUBE OIL SYSTEM

The rotary screw compressor is designed to be self-lubricating. Oil being supplied to the compressor from the oil separator is at system head pressure. Within the compressor, oil porting to all parts of the compressor is vented back to a point in the compressor's body that is at a pressure lower than compressor discharge pressure. The compressor's normal operation makes the compressor unit operate essentially as its own oil pump. All oil entering the compressor is moved by the compressor rotors out the compressor outlet and back to the oil separator.

COMPRESSOR HYDRAULIC SYSTEM (See Fig. 8)

The compressor hydraulic system moves the movable slide valve (MSV) to load and unload the compressor.

The slide valve is controlled by a double-acting four-way solenoid valve which is activated from a signal from the appropriate microprocessor output.

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 port SC-8.

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.

OIL HEATER

The oil heater is thermostatically controlled at times during compressor shutdown to maintain the sump oil at 90°F to 105°F.

SHELLS – The cooler and condenser shells are rolled carbon steel plate with fusion welded seams. A tube sheet is welded to each end of the shell and is drilled and reamed to accommodate the tubes.

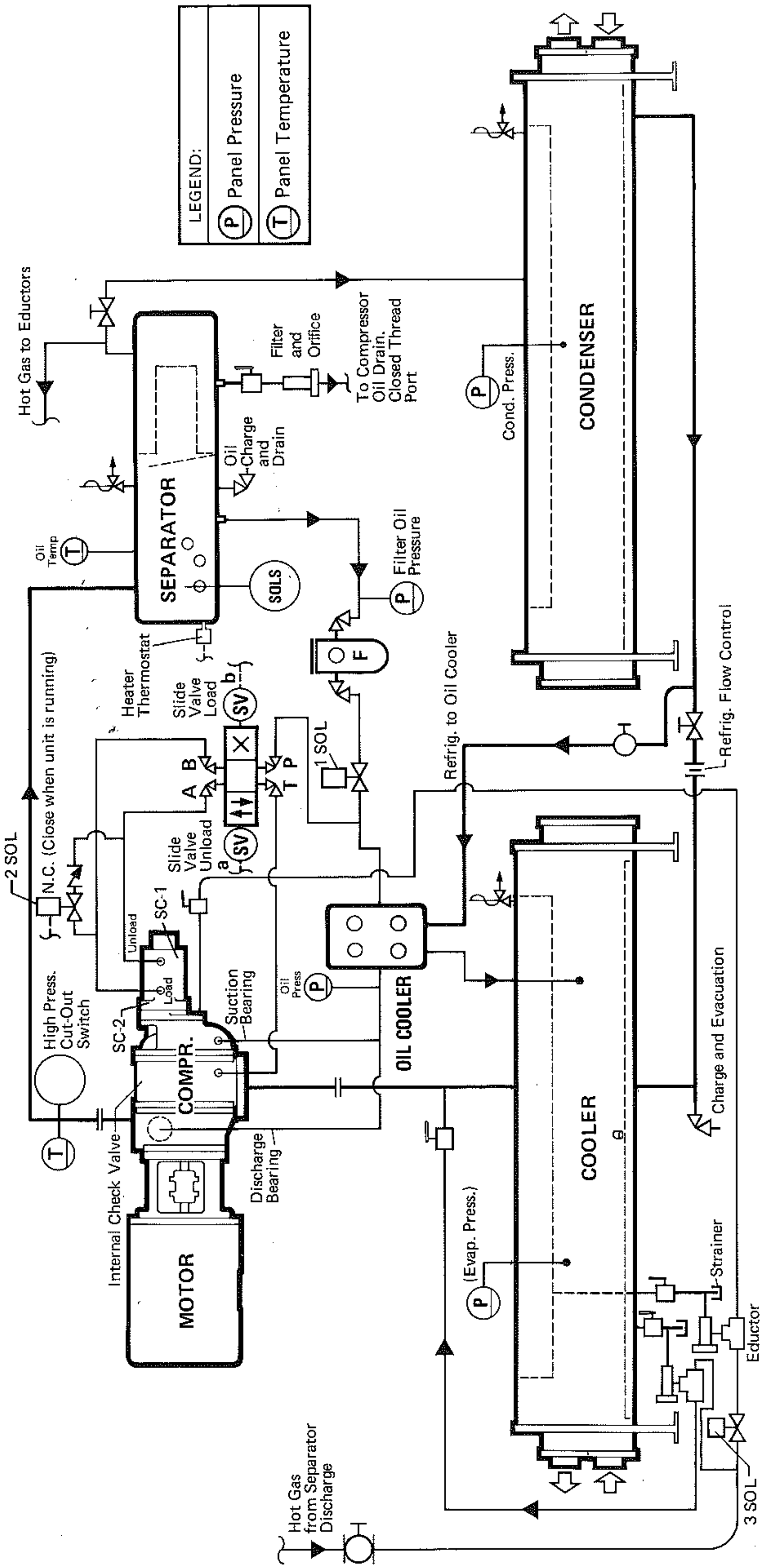
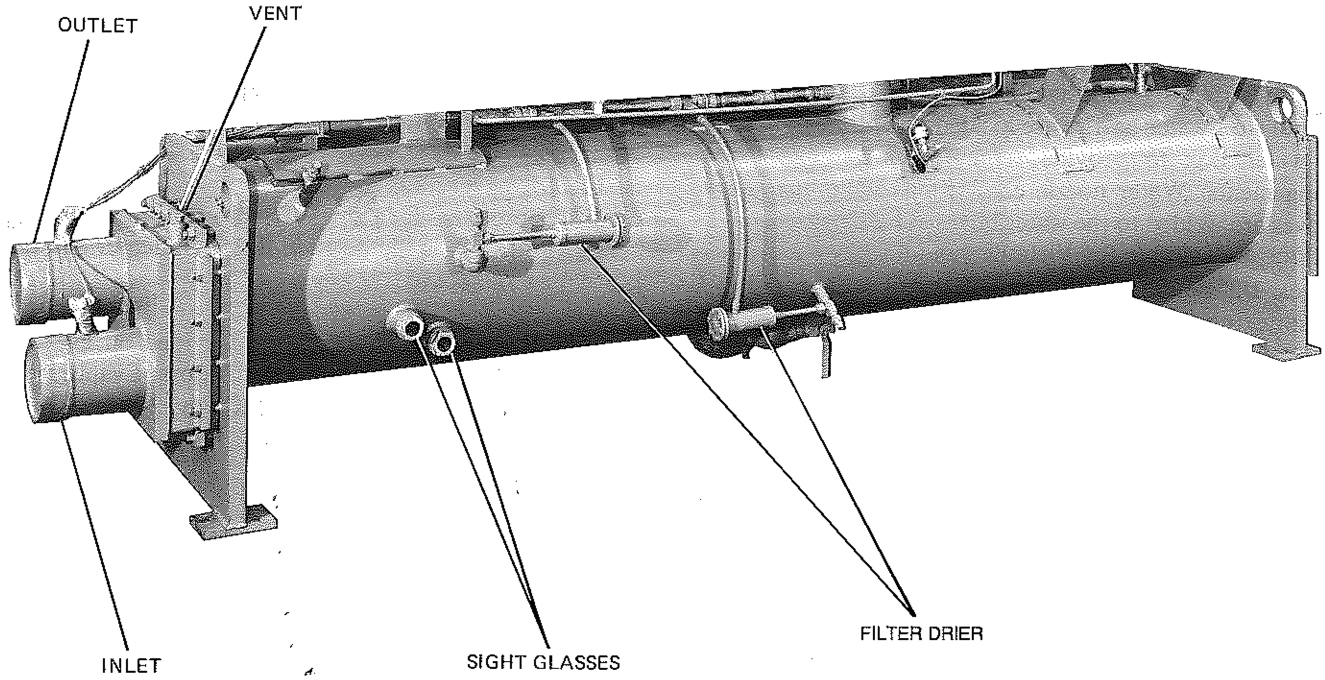
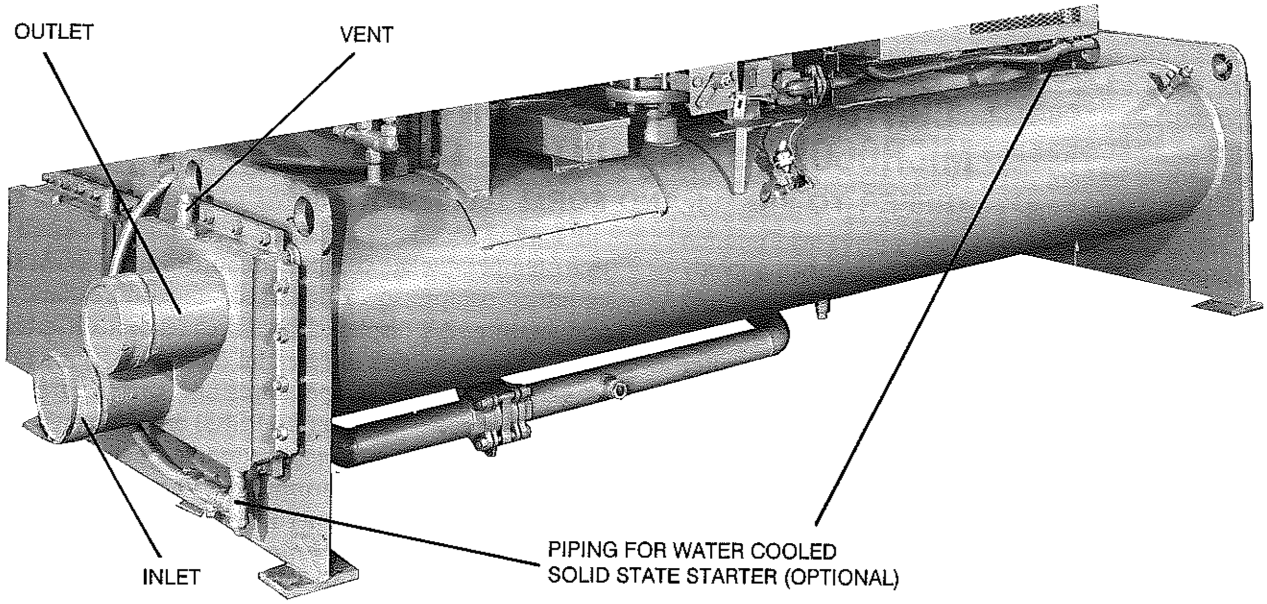


FIG. 9 – SCHEMATIC DRAWING – (YS) COMPRESSOR LUBRICATION SYSTEM

SHELL ASSEMBLIES
(REFER TO FIG. 10)



COOLER



CONDENSER

FIG. 10 – SHELL ASSEMBLIES

TUBES - Individually-replaceable, 3/4″ O.D., integral-finned copper heat exchanger tubes are used in the cooler and condenser. The tubes are roller-expanded into the tube sheets, providing a leak-proof seal.

COMPACT WATER BOXES - Removable water boxes are fabricated of steel. The standard design working pressure is 150 psig and the boxes are tested at 225 psig. Integral steel water baffles are located and welded within the water box to provide required 1, 2, or 3-pass arrangements. Water nozzle connections with Victaulic grooves are welded to the water boxes. These nozzle connections are suitable for Victaulic couplings, welding or flanges. 1/2" coupling and separable well are located in the entering and leaving chilled liquid nozzles for temperature sensing elements. Plugged drain and vent connections are provided in each water box.

COOLER - The cooler is a horizontal, flooded, shell-and-tube type, with a distribution system consisting of a distributor trough to give uniform distribution throughout the shell length and a perforated distributor plate, located under the entire tube bundle, to equally distributor refrigerant. Intermediate steel tube supports 1/2″ thick, are spaced at intervals of less than four feet.

A liquid level sight glass is conveniently located on the side of the cooler to aid in determining proper refrigerant charge.

CONDENSER - The condenser is a horizontal, shell-and-tube type, with a discharge gas baffle to prevent direct high velocity impingement on the tubes. This baffle is also used to distribute the refrigerant gas flow properly for most efficient heat transfer. A purge connection is located in the condenser for elimination of noncondensibles. Intermediate, 1/4″ thick, steel tube supports are spaced at intervals of less than four feet. A liquid subcooler section is provided in the bottom segment of the condenser.

REFRIGERANT FLOW CONTROL - Refrigerant flow control is provided by a single fixed orifice in the piping connection between the bottom of the condenser and the bottom of the cooler.

DUAL RELIEF VALVES - Are provided on all condensers and on 22″ diameter oil separators. Evaporators will be provided with a **single** relief valve.

An additional large capacity relief valve will be provided on **all** separators to provide compressor over-pressure protection.

CONTROL CENTER AND CONTROLS
MICROCOMPUTER CONTROL CENTER
(REFER TO FIG. 11 AND FORM 160.47-O1.1)

A microprocessor based control center is factory mounted, wired and tested on each Codepak chiller. The control center enclosure is a Nema Type 1 and is provided with a hinged door with lock and key. The Microcomputer Control Center automatically controls the operation of the unit in meeting system cooling requirements while minimizing energy usage.

Analog chiller operating parameters are sensed by either thermistors or transducers and displayed on the keypad. Available parameters include: return/leaving chilled water temperatures, return/leaving condenser water temperatures (field installed option), evaporator/condenser refrigerant pressures, oil pressure, filter oil pressure, differential oil filter pressure, motor current in % full load amps, slide valve position in %, 3 phase compressor motor current and voltage (SSS units only) evaporator/condenser saturation temperatures, compressor operating hours/start counter, compressor discharge temperature, and oil temperature. All displayed pressures (except differential oil filter pressure and differential oil pressure,) are taken as gauge pressure. Temperatures and pressures can be displayed in either English (°F, PSIG) or metric (°C, KPa) units depending on the application. A factory installed jumper on the micro board provides English units to be displayed. When the jumper is removed metric units are displayed. Complete calibration and testing of all sensors is done at the factory.

SAFETY CONTROLS

The control center includes unique safety logic to protect the Codepak from any damaging malfunctions. Complete

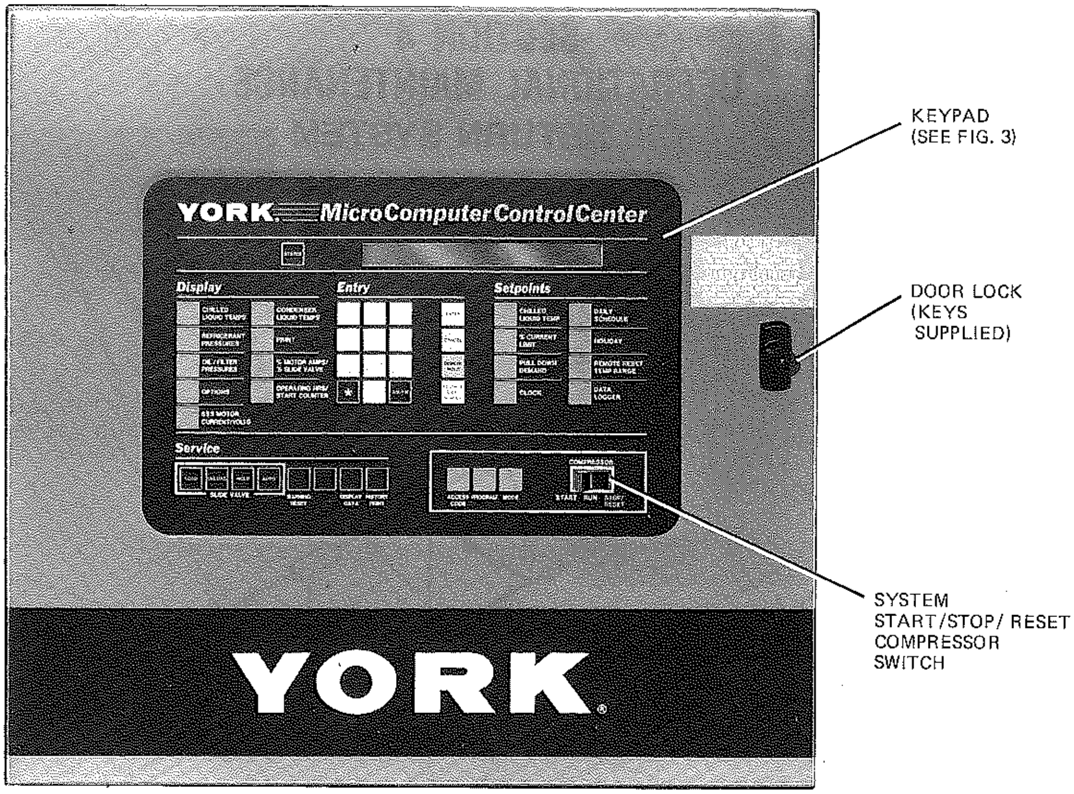


FIG. 11 – MICROCOMPUTER CONTROL CENTER

safety annunication is displayed for each shutdown by pressing the "**STATUS**" key. This information includes day, time, and reason for shutdown. These include high condenser pressure, low oil pressure, high oil temperature, high compressor discharge temperature, low evaporator pressure, low separator oil level, clogged oil filter, starter malfunction, undervoltage, power failure and sensor malfunction. The control center is fed from a 1½ KVA transformer on the compressor motor starter.

SOLID STATE STARTER (OPTIONAL)

The optional Solid State Starter is a reduced-voltage liquid cooled starter that controls and maintains a constant current flow to the motor during start-up. The starter is mounted on the Codepak. The power wiring from the starter to the motor and from the starter control transformer to the control center is factory wired and tested. Available for 200-600V-3Ph-60/50Hz power; 2 or 3 barrel lug connections per phase are provided on the starter. The starter enclosure is NEMA Type 1 and is provided with a hinged door with lock and key.

OPERATING CONTROLS

The unit operating controls are also centered around a 40 character alphanumeric display on the panel keypad. Foreground messages are displayed while the unit is running to signal the operator of controlling conditions such as: SYSTEM RUN - CURRENT LIMIT IN EFFECT , SYSTEM RUN - LEAVING TEMPERATURE CONTROL , SYSTEM RUN - PRESS STATUS

Background messages can be viewed by pressing the "**STATUS**" key. Examples of messages are as follows: dirty oil filter, excess refrigerant charge, and non-critical sensor error. System cycling messages are displayed in regard to day, time, cause of cycling shutdown, and auto start indication. These include low water temperature, cooler water flow interruption, power fault, internal time clock, anti-recycle, slide valve loaded >10%, low oil temperature, power failure in autostart mode, and remote/local cycling input, multi-unit cycling, AC undervoltage, low line voltage (Solid State Starter units only), high line voltage (Solid State Starter units only), motor controller and power faults.

Digital programming of operating setpoints from the keypad include leaving chilled water temperature, 40-100% current limiting, pulldown demand limiting, daily start/stop scheduling of chiller, and pumps, and separate holiday schedule, clock, remote reset temp range and data logger.

Individual display readings highlight operation of compressor slide valve load/unload/hold/auto control in "**SERVICE**" mode. Four operator selectable modes of operation are Local, Remote, Program, or Service.

SECTION 4
OPERATIONAL MAINTENANCE
OIL RETURN SYSTEM

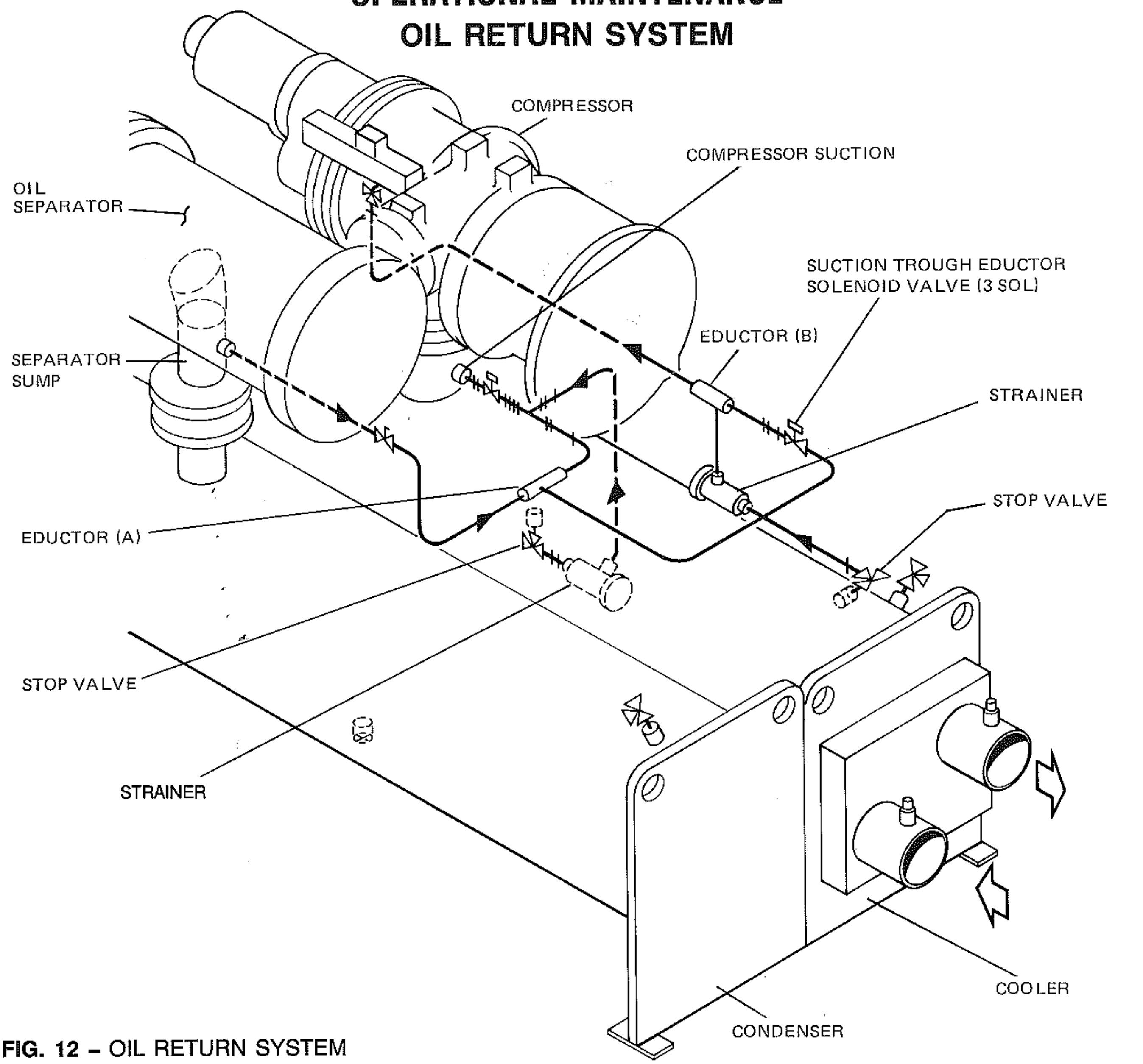


FIG. 12 – OIL RETURN SYSTEM

GENERAL

The oil return system continuously maintains the proper oil level in the separator oil sump. (See Fig. 12.)

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

At low load conditions (approximately 10% slide valve position) solenoid valve (3SOL) opens. This allows high pressure condenser gas to flow to eductor B, drawing oil from the bottom of the cooler suction trough, and returning it to the compressor suction.

CLEANING THE STRAINER

To clean the strainer use the following procedure: Refer to Fig. 13.

1. Close all stop valves on both sides of the strainer.
2. Slowly (to relieve pressure) loosen the cap screws holding the cover plate to the strainer body. Provide some means to catch the oil remainig in the strainer body.
3. Remove and clean the strainer cartridge.
4. Insert the strainer & re-install the cover plate.

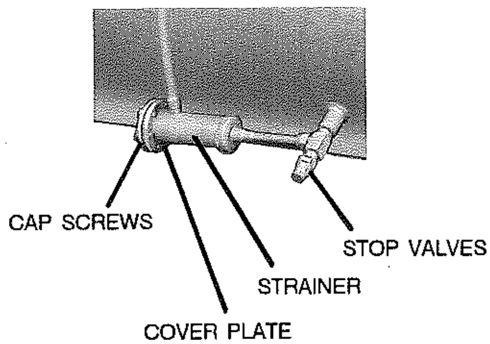


FIG. 13 – ASSEMBLY OF STRAINER

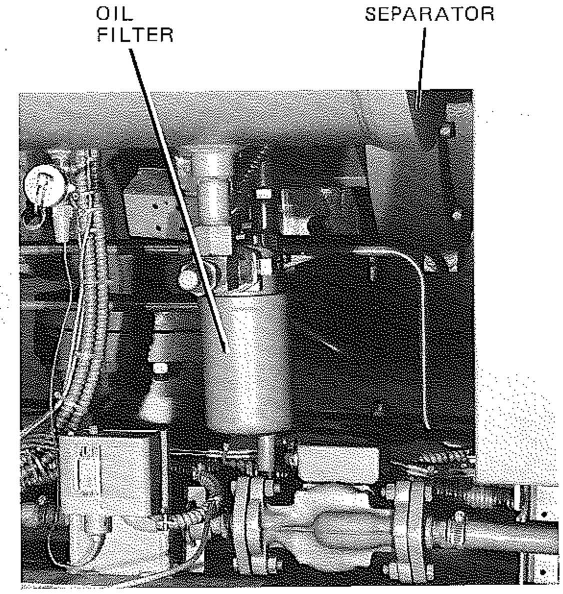


FIG. 14 – OIL FILTER

5. Open the stop valves on both sides of the strainer & check for refrigerant leaks.

OIL FILTER

Each unit is equipped with an oil filter located on the bottom of the oil separators. (See Fig. 14) Filters are of 2 designs. (1) Earliest design included a spin-on canister type oil filter, or (2) Later design included a filter with replaceable element.

To replace the filter proceed as follows:

1. Close the stop valves on both sides of the filter.
2. Each filter is equipped with a small valve which can be used to relieve the pressure within the filter. Relieve the pressure slowly and carefully.
3. If unit is equipped with the spin-on canister type filter, use a strap wrench or similar tool to remove the filter. Discard the filter & install a new one.
4. If unit is equipped with a filter with replaceable cartridge, a wrench can be used on the hex boss on the bottom of the housing to remove the filter. Remove & discard the filter element. Clean the inside of the housing and install a new filter element. Re-install the filter on the unit.
5. Open the stop valves on both sides of the filter. Open the small valve on the filter to vent the air from the filter.
6. Check for refrigerant leaks.

CHARGING UNIT WITH OIL

THE OIL CHARGE

The proper amount of oil is approximately 10 gallons for S0, S1, S2, and S3 compressors or 15 gallons for S4 and S5 compressors, depending on the actual compressor/separator combination and the condition of the refrigerant. The actual operating level in the separator should be kept from exceeding the top of the highest sight port shown in Fig. 15.

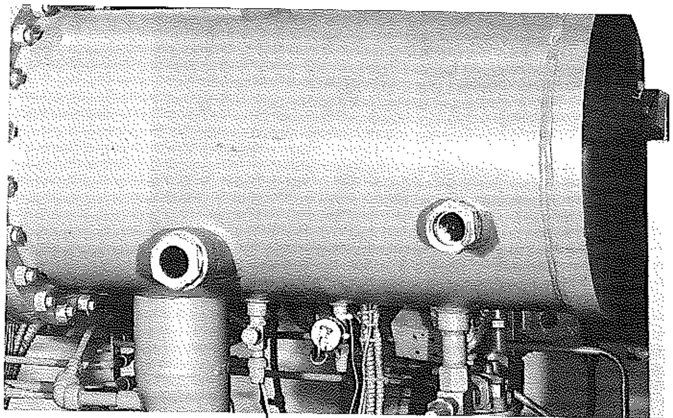
OIL CHARGING PROCEDURE

NOTE: YORK C oil is used in S0, S1, and S2 units – YORK G oil is used in S3, S4, and S5 units.

The oil should be charged into the oil separator using the YORK Oil Charging Pump - YORK Part No. 070-10654. To charge oil 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.



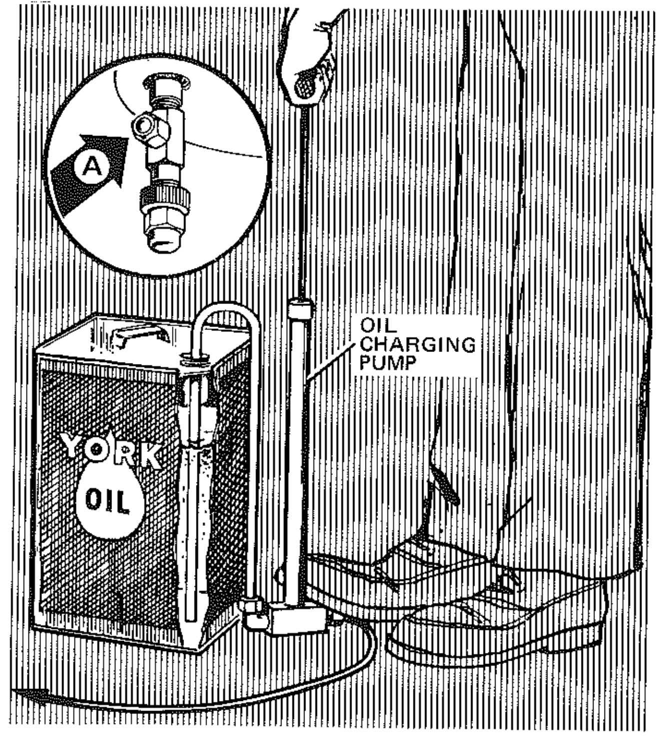


FIG. 15 – CHARGING OIL

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. (See Fig. 15.) Do not tighten the connection at the charging valve until after the air is forced out by pumping a few strokes 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 5). This will keep the concentration of refrigerant in the oil to a minimum.

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 constitutes normal operation for the compressor unit in that particular system.

TABLE 1 – CAUSES OF NORMAL AND SAFETY SYSTEM SHUTDOWNS IN ACCORDANCE WITH THE MICROCOMPUTER CONTROL, CENTER DISPLAY, REFER TO FORM 160.47-O1.1 CONTROL CENTER INSTALLATION & OPERATION INSTRUCTIONS

SHUTDOWN CAUSE CONTROL CENTER DISPLAY				GOVERNING CONTROL FUNCTION			PROGRAMMED SETPOINTS BY OPERATOR	START-UP OF SYSTEM AFTER SHUTDOWN	PROBABLE CAUSE AND SERVICE REQUIRED
					OPERATING POINT				
DAY OF WEEK	TIME OF DAY	CAUSE OF SHUTDOWN	METHOD OF RESTART	DESCRIPTION	ON RISE	ON FALL			
MON.	10:00 AM	Low Water Temp.	Autostart	Low Water (LWT)	Chilled water setpoint	4°F below chilled water setpoint	4°F below chilled water setpoint (If set to 40°F would be 36°F) (36°F minimum)	Automatic Restart when water reaches setpoint; if system is running and setpoint is increased 4°F, system will continue to run, as LWT cutout shifts to a fixed 36°F for 10 minutes.	System load is less than minimum capacity
MON.	10:00 AM	Flow Switch	Autostart	Flow Switch				Automatic Restart when water flow is restored to close flow switch.	Lack of water flow. Check operation of chilled water pump.
MON.	10:00 AM	System Cycling	Autostart	A remote command (computer relay contact or manual switch.)				Automatic Restart upon remote command.	Contact-connected to the Remote/Local cycling input of the Digital input board.
MON.	10:00 AM	Multi-Unit Cycling	Autostart	(Optional) Lead-Lag Sequence Control				Automatic Restart upon remote command.	Contact-connected to the Multi-Unit cycling input of the Digital input board.
MON.	10:00 AM	Internal Clock	Autostart	Internal Clock			Daily Schedule Programmed to shut down Unit	Will automatically restart when programmed schedule permits.	Pressing Compressor Start Switch overrides the program.
MON.	10:00 AM	AC Undervoltage	Autostart	<15% FLA for 25 continuous seconds					Cycling shutdown occurs when motor current is <15% FLA for 25 seconds during chiller operation
MON.	10:00 AM	Power Fault	Autostart	CM-2 Current Module or Solid State Starter				Will start automatically following coastdown.	Motor Controller contacts opening and closing in less than 3 seconds due to a power fault condition.
		Remote Stop		Energy Management System				Start up by start signal from remote start switch.	Remote Stop Contact Closure.
MON.		Anti-Recycle, 20 Min. Left		Anti-recycle timer			Will not start until 30 Min. timer is timed out.	Will restart when time left = 00 Min.	Min. time between successive compr. starts is 30 min.
MON.	10:00 AM	Low Evap. Pressure		Low Evap. Pressure Transducer	52.8 PSIG	52.7 PSIG		To restart press compressor switch from STOP/RESET to START position.	See OPERATION ANALYSIS TABLE 2 Symptom 2.
MON.	10:00 AM	Low Evap. Pressure Brine		1 LEP external control (Brine units only).	Set To Job Spec.	Set To Job Spec.		To restart press compressor switch from STOP/RESET to START position.	See OPERATION ANALYSIS TABLE 2 Symptom 2.

TABLE 1 – CAUSES OF NORMAL AND SAFETY SYSTEM SHUTDOWNS IN ACCORDANCE WITH THE MICROCOMPUTER CONTROL, CENTER DISPLAY, REFER TO FORM 160.47-O1.1 CONTROL CENTER INSTALLATION & OPERATION INSTRUCTIONS (Continued)

SHUTDOWN CAUSE CONTROL CENTER DISPLAY				GOVERNING CONTROL FUNCTION					
					OPERATING POINT				
DAY OF WEEK	TIME OF DAY	CAUSE OF SHUTDOWN	METHOD OF RESTART	DESCRIPTION	ON RISE	ON FALL	PROGRAMMED SETPOINTS BY OPERATOR	START-UP OF SYSTEM AFTER SHUTDOWN	PROBABLE CAUSE AND SERVICE REQUIRED
MON.	10:00 AM	Oil Pressure		Low Oil Pressure Transducer Evap. Pressure Transducer	>15 PSID Oil Pressure minus evap. pressure	<15 PSID Oil Pressure minus evap pressure	Check is by-passed for 90 seconds at compressor start.	To restart press compressor switch from STOP/RESET to START position.	Refer to OPERATIONAL ANALYSIS TABLE 2 Symptoms 4, 5, 6, 7, 9, 10, 11.
MON.	10:00 AM	High Pressure		High Pressure Safety Control	270 PSIG	210 PSIG		Will restart when Pressure falls to 210 PSIG. To restart press compressor switch from STOP/RESET to START position.	See Operational Analysis Table 2 Symptom 1 High Discharge Pressure.
MON.	10:00 AM	Evap. Trans. or Probe Error		Evap. Pressure Transducer or Leaving Chilled Water Thermistor				To restart press compressor switch from STOP/RESET to START position.	Defective Evap. Pressure Transducer or Leaving Chilled Water thermister (RT1). LCWT minus saturation temperature is less than −2.5F or greater than 25F. Checked every 10 minutes following a 10 min. bypass at start-up.
MON.	10:00 AM	Motor Controller — Ext. Reset		CM2 or Solid State Starter				Reset the device that caused the shutdown. Chiller will start automatically.	CM2, or Solid State Starter has shutdown chiller.
MON.	10:00 AM	High Discharge Temp.		Discharge Temp. Thermistor	212F	211F		To restart press compressor switch from STOP/RESET to START position.	Condenser tubes dirty or scaled or high condenser water temperature. (See Symptom 1 – TABLE 1).
MON.	10:00 AM	High Oil Temp.		Oil Temperature Thermistor	170F	169F		To restart press compressor switch from STOP/RESET to START position.	Dirty oil filter or restricted oil cooler line. Change oil filter. Refer to OPERATIONAL ANALYSIS TABLE 2, Sympton 9.
MON.	10:00 AM	Power Failure – Autostart	Auto-Restart	Micro board undervoltage circuit on 5V unregulated supply.	8.29VDC	7.84VDC	Optional AUTO Restart Plug is installed on Micro board.	Will restart automatically when voltage reaches 8.29VDC An undervoltage circuit on the micro board monitors the 5VDC unregulated supply for an undervoltage condition.	Power Failure.
MON.	10:00 AM	Power Failure		Micro Board undervoltage circuit on 5V unregulated supply.	8.29VDC	7.84VDC	Auto restart plug is removed on Micro Board.	To restart, press compressor switch to **STOP-RESET** position and then to **START** position	Power Failure.

MON.	10:00 AM	Oil Pressure Transducer Error		Oil Press. Transducer	300 PSIG	299 PSIG		Will start at 299 PSIG when compr. switch is placed to STOP/RESET and then START.	This Shutdown is provided to check on Oil Pressure Transducers.
MON.	10:00 AM	Slide Valve above 10%	Autostart					System will automatically restart when slide valve position is <10%.	Slide valve did not unload at <10% after chiller shutdown.
MON.	10:00 AM	Starter Malfunction Detected		Motor Current >15% for 10 sec. with control center not calling for motor to run.				Press compressor STOP/RESET Switch & then Switch.	Check motor starter operation. Motor current value greater than 15% FLA.
MON.	10:00 AM	Program Initiated Reset	Autostart	Micro Board.					Watchdog timer circuit has reset software program — Chiller will automatically restart.
		Replace RTC IC chip Reprogram Setpoints		RTC-IC chip				Reprogram the Control Center Setpoints & proceed with Normal Start-up.	Weak battery Replace RTC-IC chip U16
MON.	10:00 AM	Faulty Discharge Temp. Sensor		Discharge Temp. Thermistor (RT2) disconnected or faulty (min.) system operating temp. = 32ºF)	30.0ºF	29.9ºF		Press STOP/START Switch & then START Switch.	Faulty Discharge Temp. Thermistor (RT2) or disconnected from Micro Board. Connect or replace open sensor.
MON.	10:00 AM	Low Line Voltage (SSS Units only)	Autostart	SSS Logic Board	See legend on wiring diagram.			Chiller will automatically restart when all phases of line voltage increase to the minimum required starting level.	Low AC Line Voltage
MON.	10:00 AM	High Line Voltage (SSS Units only)	Autostart	SSS Logic Board	See Legend on wiring diagram.				High AC Line Voltage
MON.	10:00 AM	MTR Phase Current unbalance (SSS Units only)		SSS Logic Board	See Form 160.46-O1.1 Operations Manual.			Press STOP/START switch then Start Switch	Motor Phase Current Unbalance
MON.	10:00 AM	Clogged Oil Filter		Oil Press. and Oil Filter Press. Transducers	Oil Filter Diff. Press. ≥25 PSIG	<25 PSIG		Press STOP/START	Replace Oil Filter

TABLE 2 – OPERATING ANALYSIS CHART

1. SYMPTOM: ABNORMALLY HIGH DISCHARGE PRESSURE

RESULTS	POSSIBLE CAUSE	REMEDY
Temperature difference between liquid refrigerant out and water off condenser higher than normal.	Air in 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.

2. SYMPTOM: ABNORMALLY LOW SUCTION PRESSURE

RESULTS	POSSIBLE CAUSE	REMEDY
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.
	Flow orifice blocked.	Remove obstruction.
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: HIGH COOLER PRESSURE

RESULTS	POSSIBLE CAUSE	REMEDY
High chilled water temperature.	Slide valves fail to open.	Check the slide valve solenoid valve.
	System overloaded.	Be sure the slide valves are loaded (without overloading the motor) until the load decreases.

4. SYMPTOM: COMPRESSOR STARTS, NORMAL OIL PRESSURE DEVELOPS, FLUCTUATES FOR SHORT WHILE, THEN COMPRESSOR STOPS ON OIL PRESSURE CUTOUT

RESULTS	POSSIBLE CAUSE	REMEDY
Oil pressure normal, fluctuates then compressor stops on Oil Pressure Cutout. Display reading LOW OIL PRESSURE.	Unusual starting conditions exist, i.e. oil foaming in reservoir and piping due to lowered system pressure.	Drain the oil from the oil separator and compressor and charge new oil into the oil separator. (Refer to Charging The System With Oil, page 21.)
	Burned out oil heater.	Replace oil heater.

5. SYMPTOM: OIL PRESSURE GRADUALLY DECREASES (NOTED BY OBSERVATION OF DAILY LOG SHEETS)

RESULTS	POSSIBLE CAUSE	REMEDY
Oil pressure (noted when pressing "Oil Pressure" display key) drops to 70% of oil pressure when compressor was originally started.	Oil filter is dirty.	Change oil filter.
	Extreme bearing wear.	Inspect compressor.

(Continued)

TABLE 2 – OPERATING ANALYSIS CHART (Continued)

6. SYMPTOM: OIL RETURN SYSTEM CEASES TO RETURN AN OIL/REFRIGERANT SAMPLE

RESULTS	POSSIBLE CAUSE	REMEDY
Oil refrigerant return not functioning.	Strainer in oil return system dirty.	Replace old strainer with new.
	Jet or orifice of oil return jet clogged.	Remove jet, inspect for dirt. Remove dirt using solvent and replace.

7. SYMPTOM: FAILS TO DELIVER OIL PRESSURE

RESULTS	POSSIBLE CAUSE	REMEDY
No oil pressure registers when pressing "Oil Pressure" display key.	Faulty oil pressure transducer. Faulty wiring/connectors.	Replace oil pressure transducer.

SECTION 5

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	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.
SLIDE VALVE WILL NOT MOVE	Slipper seals worn out or damaged. Unloader spindle or slide valve jammed. Slide stop indicator rod jammed.

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 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. 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. 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 UNLOAD	A side solenoid coil may be burned out, replace. Dirt inside solenoid valve preventing valve from operating both ways, clean. 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. Manually actuate solenoid.

Temperature Conversion Tables

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 found in the column on the right.

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	+88.9	**+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

SECTION 6
MAINTENANCE

RENEWAL PARTS

For any required Renewal Parts Model YS refer to 160.47-RP1, 160.47-RP2, and 160.47-RP3.

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 a leak exists frequent purging will be required or refrigerant will be lost.

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 33).

CONDUCTING 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 and dry nitrogen into the system through the charging valve to a pressure of 150 psig.
2. 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 purge and gauge valves. Be sure all valves to the atmosphere 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.

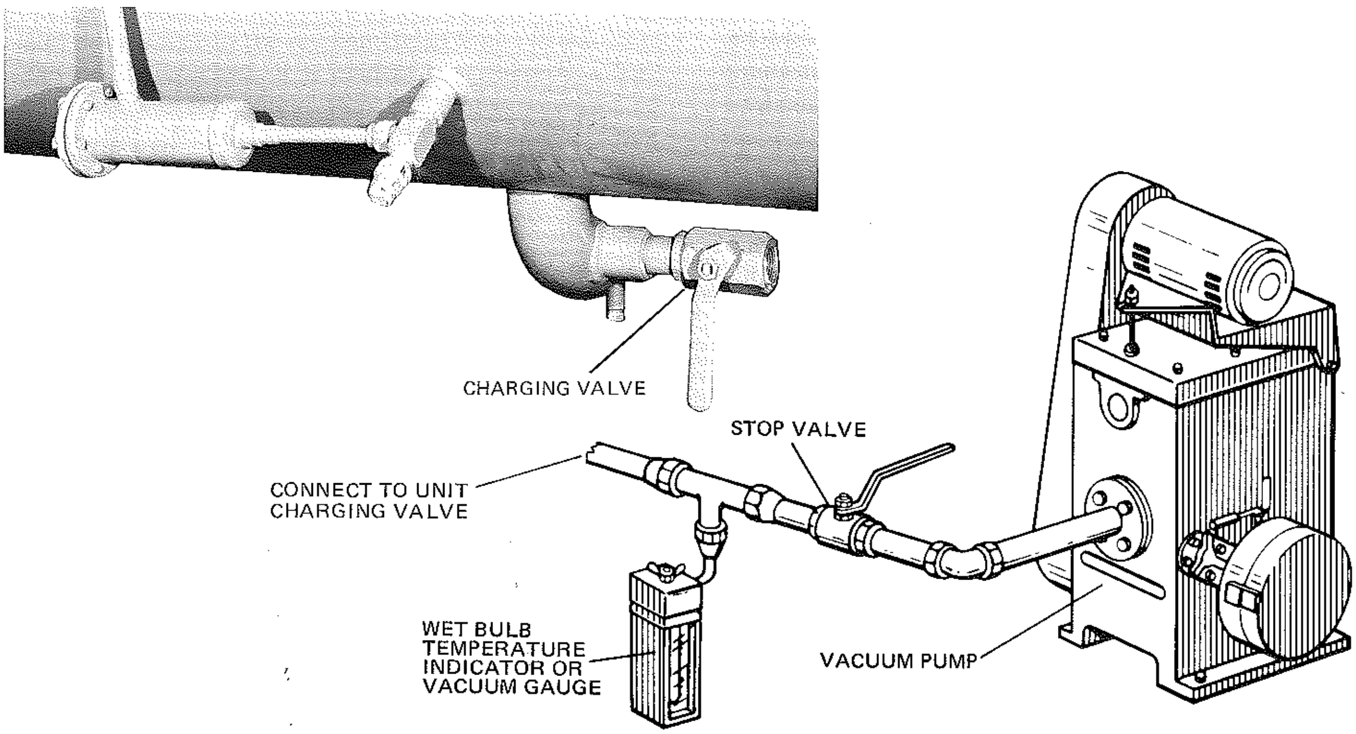


FIG. 16 – EVACUATION OF UNIT

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					
Atmospheric Pressure At Sea Level— 14.696 psia.	100	114.7	790					
	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
	29.842″	.039	.27	2	2,000	15	−9.4	Freezes
	29.882″	.019	1111.13	1.0	1,000	+1	−17.2	Recommended
	29.901″	.010	.069	.5	500	−11	−23.9	Field Evacua-
	29.917″	.002	.014	.1	100	−38	−38.9	tion Conditions
	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 Gh. Absolute Pressure at 32°F
= 29.921 inches Hg.

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

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: Be sure the vacuum indicator is valved off while holding the system vacuum and be sure to open the valve 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 above, the leak must be found and repaired.

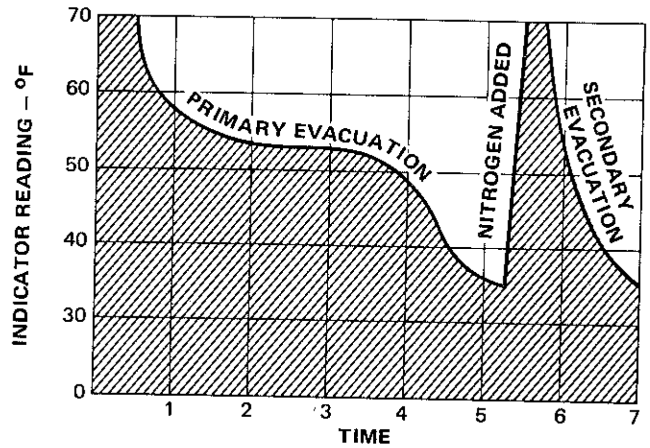


FIG. 17 – SATURATION CURVE

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 obtained 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 saturation temperature is considerably below that of room temperature, 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. 17.

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 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 can not 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.

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 57.5 psig for 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 cylinder. This connection should be as short as possible but long enough to permit sufficient flexibility for changing cylinders. 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.

TABLE 4 – REFRIGERANT CHARGE

UNIT CODE — MODELS	LBS.
BBBBS0/S1, BBBAS0/S1	460
BBCBS0/S1, BBCAS0/S1	480
BABBS0/S1, BABAS0/S1	490
BACBS0/S1, BACAS0/S1	520
CBBBS0/S1, CBBAS0/S1, CABBS0/S1, CABAS0/S1	620
CBCBS0/S1, CBCAS0/S1, CACBS0/S1, CACAS0/S1	650
CBCBS2, CBCAS2, CACBS2, CACAS2	680
CBDBS0/S1, CBDAS0/S1, CADBS0/S1, CADAS0/S1	710
CBDBS2, CBDAS2, CADBS2, CADAS2	750
DCCBS2/S3, DCCAS2/S3, DCDBS2/S3, DCDAS2/S3, DBCBS2/S3, DBCAS2/S3, DACBS2/S3, DACAS2/S3	840
DBDBS2/S3, DBDAS2/S3	910
DADBS2/S3, DADAS2/S3	950
ECEAS4, ECEBS4	1300
EBEAS4, EBEBS4	1350
EAEAS4, EAEBS4	1400
EBFBS4, ECFAS4, ECFBS4	1450
EAFAS4, EAFBS4, EBFAS4	1520
FBFBS4/S5, FCFAS4/S5, FCFBS4/S5	1900
FAFAS4/S5, FAFBS4/S5, FBFAS4/S5	2000

CHECKING THE REFRIGERANT CHARGE DURING UNIT SHUT DOWN

SECTION 6

The refrigerant charge is specified for each Codepak model (See Table 4). 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 shut down.

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 upper sight glass.

Charge the refrigerant in accordance with the method shown under REFRIGERANT CHARGING, above. 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.

MEGGING THE MOTOR

While the main disconnect switch and compressor motor starter 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.
2. If readings fall below shaded area, remove external leads from motor and repeat test.

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

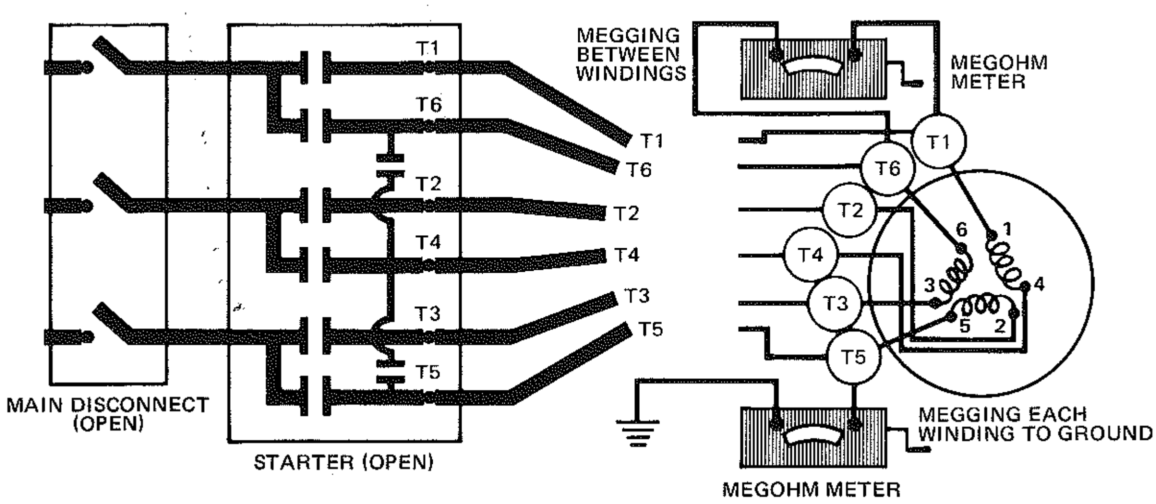


FIG. 18 – DIAGRAM, MEGGING MOTOR WINDINGS

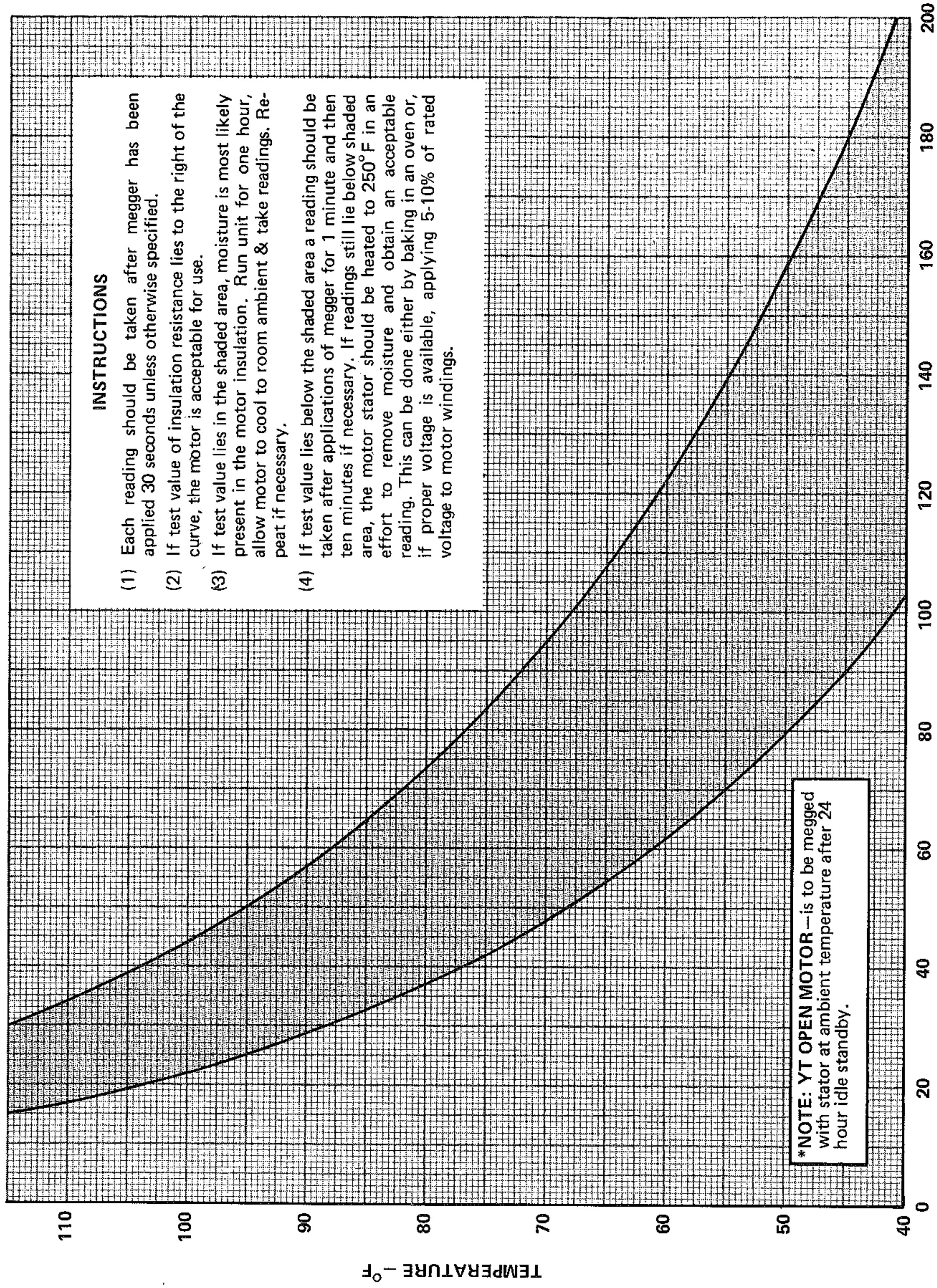


FIG 19 – MOTOR STATOR TEMPERATURE AND INSULATION RESISTANCES

SECTION 6

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 treatment 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 the 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 foreign 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 this type organization. The Dow Industries Service Division of the Dow Chemical Company, Tulsa, Oklahoma, with branches in principal cities is one of the most reliable of these companies.

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 12 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, 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, passages, or dirty oil filters. If the unit is shutting down on High Oil Temperature (HOT) or Low Oil Pressure (OP), change the oil filter element. Examine the oil filter element for the presence of foreign material. If foreign material is 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 160.47-O1.1 and Wiring Diagrams, Forms 160.47-PA2.1, or 160.47-PA2.2.

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

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 schedule of its functioning parts to keep it operating at its peak efficiency. Therefore, the following maintenance should be performed when prescribed.

COMPRESSOR

1. Oil Filter — The oil filter must be changed when the oil pressure drops 30% or semi-annually if not required earlier.

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

2. Oil Changing — The oil in the compressor must be changed annually or earlier if it becomes dark or cloudy.

COMPRESSOR MOTOR

1. Check motor mounting screws frequently to insure tightness.

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

PRESSURE TESTING

The unit should be pressure tested annually. 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 36 and 37 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.

OIL RETURN SYSTEM

1. Clean the strainer in the oil return system semi-annually or earlier if the oil return system fails to operate.

2. When the strainer is cleaned the nozzle of the eductor should be checked for any foriegn 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.

3. A 5-11 year life battery is part of the RTC-Real Time Clock. To replace refer to the MicroComputer Control Center Operating Instruction Form 160.47-O1.1.

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