



MILLENNIUM CENTRIFUGAL LIQUID CHILLERS

OPERATING & MAINTENANCE

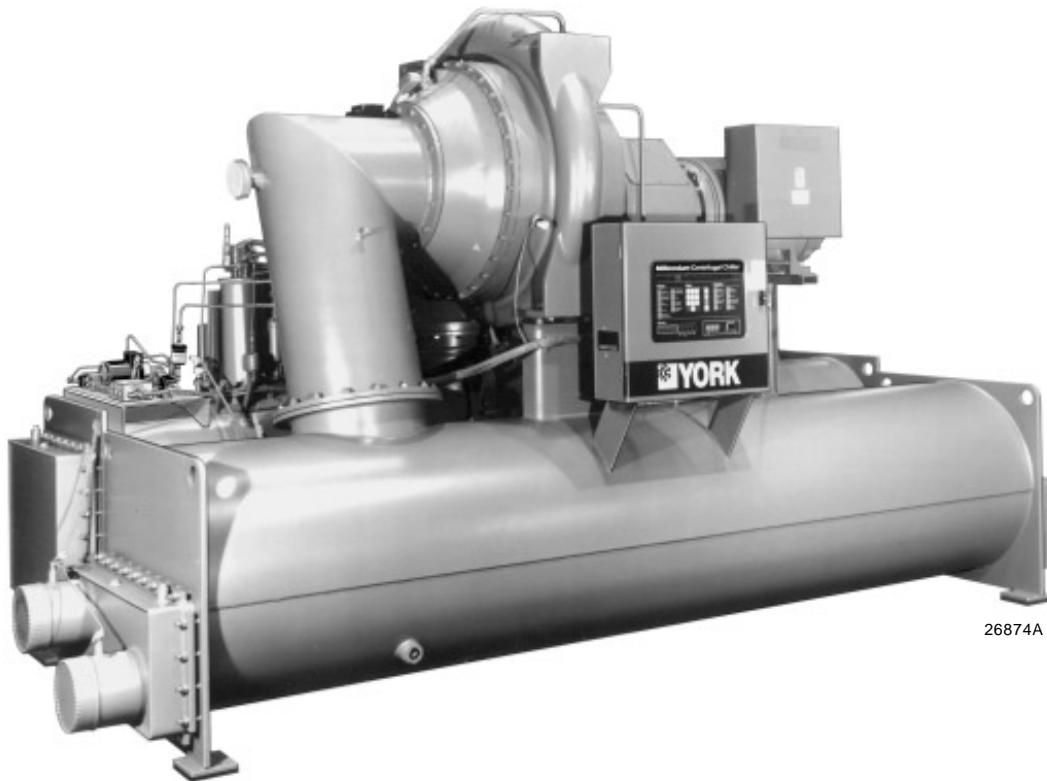
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FORM 160.48-01

**MODEL YT G0 A1 B1 thru YT L6 D8 F2 (STYLE H)
HCFC-123 (cooling only)**

**WITH MICROCOMPUTER CONTROL CENTERS
PART #371-01200-002, #371-01200-007 & 371-01200-014
FOR ELECTRO-MECHANICAL STARTER,
SOLID STATE STARTER &
VARIABLE SPEED DRIVE**



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WARNING

SYSTEM CONTAINS REFRIGERANT UNDER PRESSURE.

SERIOUS INJURY COULD RESULT IF PROPER PROCEDURES ARE NOT FOLLOWED WHEN SERVICING SYSTEM. ALL SERVICE WORK SHALL BE PERFORMED BY A QUALIFIED SERVICE TECHNICIAN IN ACCORDANCE WITH YORK INSTALLATION/OPERATION MANUAL.

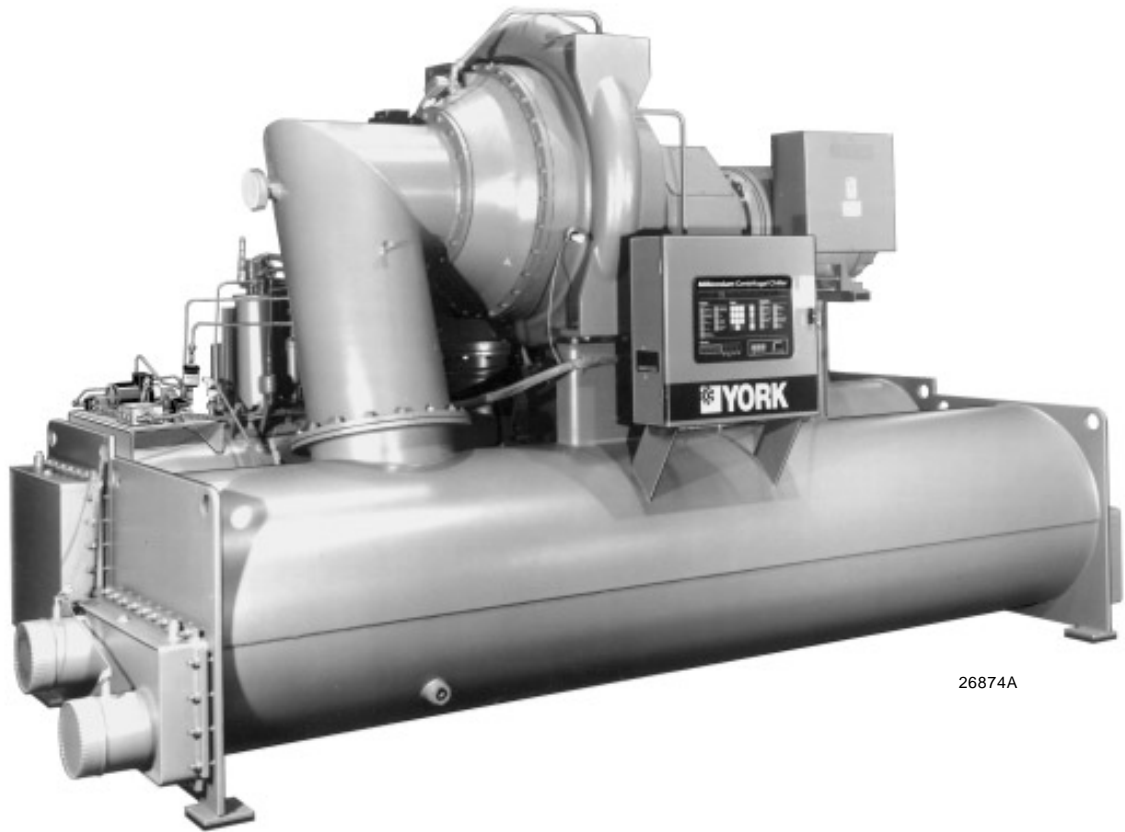
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NOTE: This instruction covers operation of chillers equipped with Electro-Mechanical or Solid State Starters. If chiller is equipped with Variable Speed Drive, Form 160.00-O1 is to be used in conjunction with this manual.

REFERENCE LITERATURE

| DESCRIPTION | FORM NO |
|------------------------------------|--------------|
| INSTALLATION | 160.48-N1 |
| OPERATION – VARIABLE SPEED DRIVE | 160.00-O1 |
| RENEWAL PARTS – UNIT | 160.48-RP5 |
| RENEWAL PARTS – CONTROL PANEL | 160.48-RP3 |
| RENEWAL PARTS – B & C COMPRESSOR | 160.45-RP2.2 |
| RENEWAL PARTS – E COMPRESSORS | 160.48-RP1 |
| RENEWAL PARTS – F COMPRESSORS | 160.48-RP2 |
| RENEWAL PARTS – C3 COMPRESSORS | 160.48-RP4 |
| WIRING (WITH EM STARTER) | 160.48-PA19 |
| WIRING (WITH SOLID STATE STARTER) | 160.48-PA20 |
| WIRING (WITH VARIABLE SPEED DRIVE) | 160.48-PA21 |



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FIG. 1 - YT CHILLER WITH ELECTRO-MECHANICAL STARTER



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FIG. 2 - YT CHILLER WITH VARIABLE SPEED DRIVE

SECTION 1

DESCRIPTION OF SYSTEM AND OPERATIONAL FUNDAMENTALS

SYSTEM OPERATION DESCRIPTION

YORK Millenium chillers are commonly applied to large air conditioning systems, but may be used on other applications. The unit consists of an open motor mounted to a compressor (with integral speed increasing gears) condenser with purge unit, sub-cooler, cooler and flow control chamber.

The chiller 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 nighttime, weekends, and holidays. The operating status, temperatures, pressures, and other information pertinent to operation of the chiller are automatically displayed and read on a 40 character alphanumeric message display. Other displays can be observed by pressing the keys as labeled on the control center. The chiller with the MicroComputer Control Center is applied with an Electro-Mechanical Starter, a factory packaged YORK Solid State Starter or a factory packaged Variable Speed Drive that produces even greater efficiency and energy savings.

In operation, a liquid (water or brine) to be chilled flows through the cooler, where refrigerant, boiling at low pressure and temperature, absorbs heat from the water. The chilled liquid is then piped 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 chiller to complete the chilled liquid circuit.

The refrigerant vapor, which is produced by the boiling action in the cooler, flows to the compressor where the rotating impeller increases its pressure and temperature and discharges it into the condenser. Water flow-

ing through the condenser tubes absorbs heat from the refrigerant vapor, causing it to condense. The condenser water is supplied to the chiller from an external source, usually a cooling tower. The condensed refrigerant drains from the condenser into the flow control chamber, where the flow restrictor meters the flow of liquid refrigerant to the cooler to complete the refrigerant circuit.

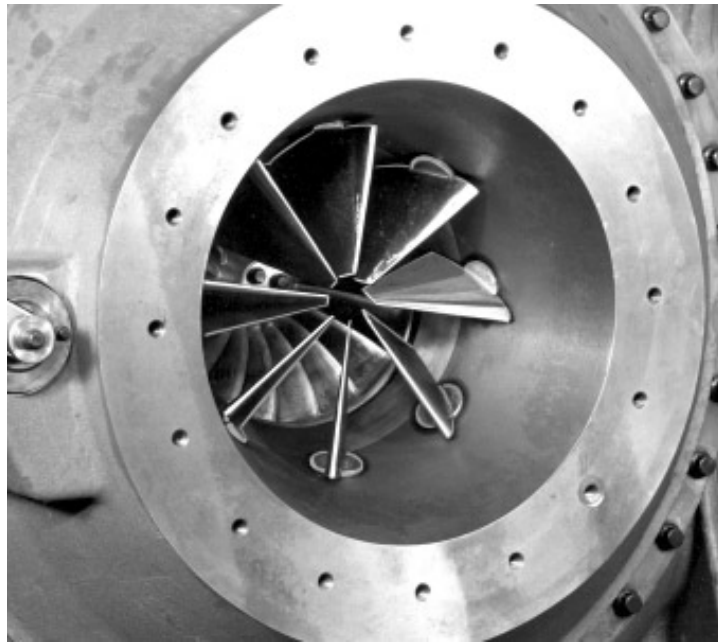
The major components of a chiller are selected to handle the refrigerant which would be evaporated at full load design conditions. However, most systems will be called upon to deliver full load capacity for only a relatively small part of the time the unit is in operation.

CAPACITY CONTROL

The major components of a chiller are selected for full load capacities; therefore, capacity must be controlled to maintain a constant chilled liquid temperature leaving the cooler. Prerotated vanes (PRV), located at the entrance to the compressor impeller, compensate for variation in load. (See Fig. 3 Detail A)

The position of these vanes is automatically controlled through a lever arm attached to an electric motor located outside the compressor housing. The automatic adjustment of the vane position in effect provides the performance of many different compressors to match various load conditions from full load with vanes wide open to minimum load with vanes completely closed.

For Variable Speed Drive units, the capacity is controlled by speed modulation as well as prerotation vane control. The Variable Speed Drive selects the combination of compressor motor speed and prerotation vane opening for the most efficient operation. (See Form 160.00-O1)



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FIG. 3 (DETAIL A) - COMPRESSOR PREROTATION VANES

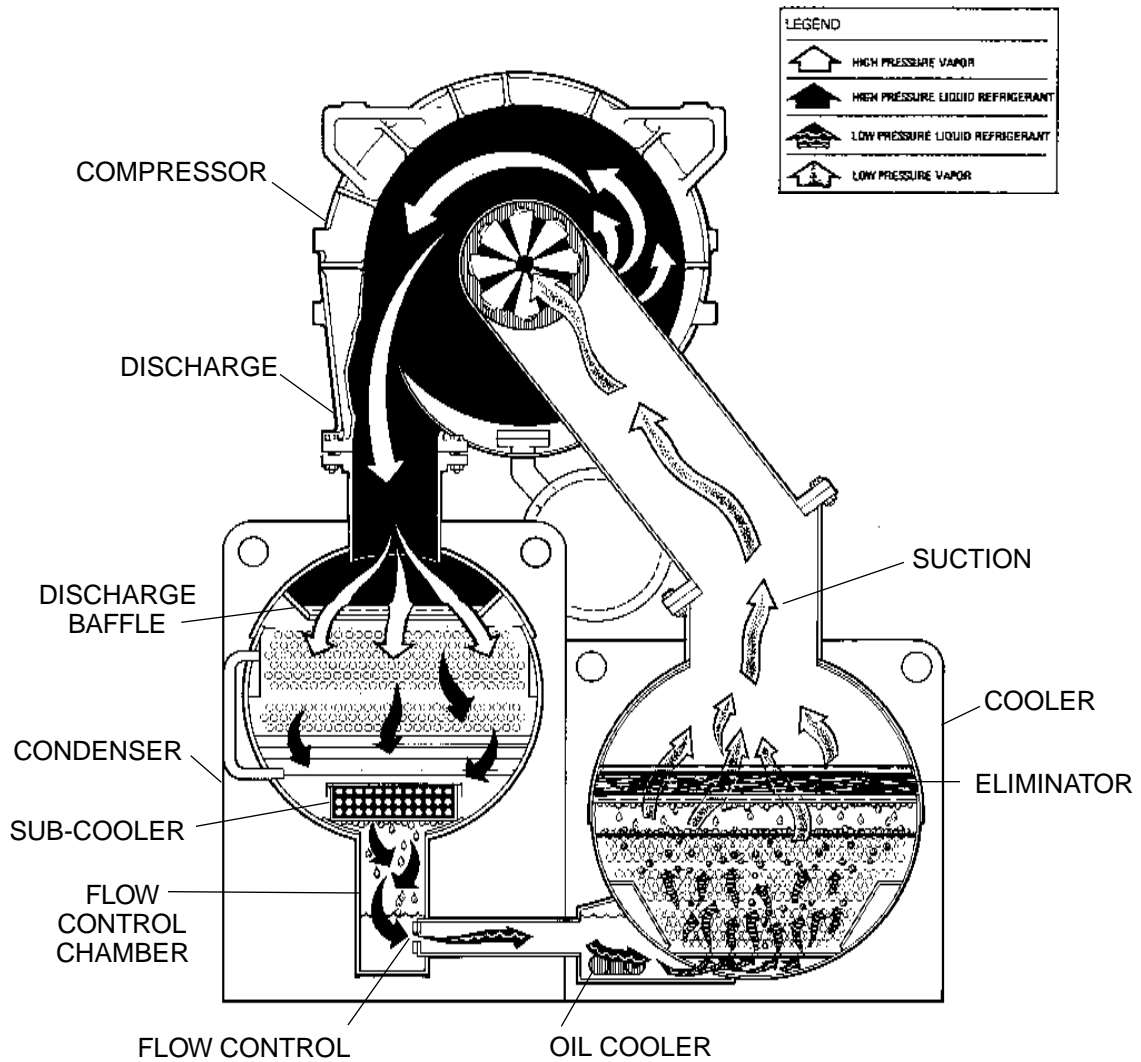


FIG. 3 - REFRIGERANT FLOW THROUGH CHILLER

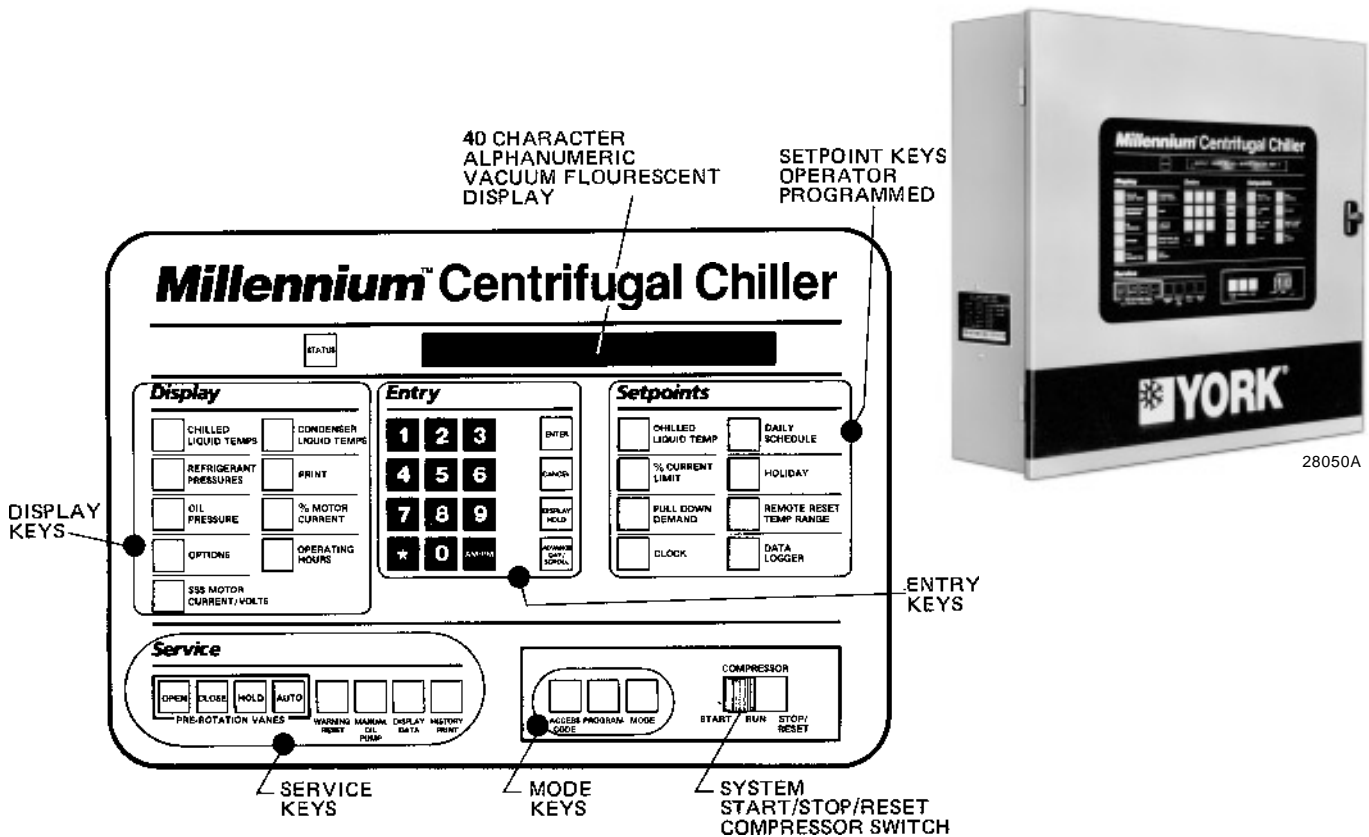


FIG. 4 - MICROCOMPUTER CONTROL CENTER AND KEYPAD

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Section 2 MICROCOMPUTER CONTROL CENTER

NOTE: This instruction covers operation of chillers equipped with Electro-Mechanical or Solid State Starters. If chiller is equipped with Variable Speed Drive, Form 160.00-O1 is to be used in conjunction with this manual.

INTRODUCTION

The YORK MicroComputer Control Center is a micro-processor based control system for centrifugal chillers. It controls the leaving chilled water temperature via prerotation vane control and has the ability to limit motor current via control of the prerotation vanes. Further, it is compatible with YORK Solid State Starter, Electro-Mechanical Starter and Variable Speed Drive applications.

A keypad mounted on the front of the Control Center (see Fig. 4) allows the operator to display system operating parameters on a 40 character alphanumeric display that is part of the keypad. These readings are displayed via "Display" keypad as follows: In the English mode; temperatures in °F, pressures in (PSIA); in the metric mode, temperatures in °C, pressures in (KPa).

- CHILLED LIQUID TEMPERATURES - LEAVING AND RETURN
- REFRIGERANT PRESSURES - EVAPORATOR AND CONDENSER
- DIFFERENTIAL OIL PRESSURE
- CONDENSER LIQUID TEMPERATURES - OPTIONAL FIELD INSTALLED - LEAVING AND RETURN
- OPTIONS
- PRINT
- HISTORY PRINT
- MOTOR CURRENT IN % OF FULL LOAD AMPS
- SATURATION TEMPERATURES - EVAPORATOR AND CONDENSER
- DISCHARGE TEMPERATURE
- OIL TEMPERATURE
- PURGE PRESSURE
- SOLID STATE STARTER MOTOR CURRENT/ VOLTS

The system setpoints (see Fig. 4) are operator entered on the front control center “**Setpoints**” keypad. These set points can also be displayed on the 40 character alphanumeric display. The system setpoints are:

- CHILLED LIQUID TEMPERATURE (LCWT)
- % CURRENT LIMIT
- PULLDOWN DEMAND LIMIT
- CLOCK (TIME-OF-DAY)
- DAILY SCHEDULE (7 DAY TIME-CLOCK PROGRAMMING)
- HOLIDAY
- REMOTE RESET TEMPERATURE RANGE
- DATA LOGGER

The cause of all system shutdowns (safety or cycling) is preserved (until the system is reset or restarts) in the microcomputer’s memory for subsequent viewing on the keypad display. The operator is continually advised of system operating conditions by various background and warning messages. The keypad contains special service keys for use by the service technician when performing system troubleshooting.

The MicroComputer Control Center is designed to be compatible with most energy management systems (EMS) in use today. The standard design allows for the following EMS interface:

1. Remote Start
2. Remote Stop
3. Remote LCWT Setpoint (Pulse Width Modulated signal)
4. Remote Current Limit Setpoint (Pulse Width Modulated signal)
5. A “Remote Mode Ready to Start” Status Contacts
6. Safety Shutdown Status Contacts
7. Cycling Shutdown Status Contacts

As an enhancement to the standard EMS features, an optional card file with plug-in printed circuit boards is available. These optional cards will accept a remote LCWT 0° to 10°F or 0° to 20°F setpoint offset and/or remote current limit setpoint interface from three user input choices:

1. 4-20 mA
2. 0-10 VDC
3. contact closures

CONTROL CENTER

The Control Center front panel layout consists of five key groups, one switch, and a 1 line by 40 character alphanumeric vacuum fluorescent display: (See Fig. 4)

CHARACTER DISPLAY - The alphanumeric vacuum fluorescent display is located to the right of the “**STATUS**” key. All messages, parameters, set points, and data can be viewed at this location. The main communications between the operator or service technician and the MicroComputer Control Center occurs on this display.

DISPLAY - Provide a direct read-out of each monitored parameter on the alphanumeric display.

ENTRY - These keys are used to enter the values for the operator programmed setpoints. These keys are used in conjunction with the “**SETPOINT**” keys while in program mode.

SETPOINTS - These keys are used as follows:

1. To view each setpoint, in any Mode, or
2. To select the individual setpoints that are programmed by the operator in “**Program**” Mode only.

Pressing the appropriate key enables the operator to program that setpoint pressing the “**ENTRY**” keys.

SERVICE - Included in this group of keys are those

functions that are only relevant to servicing the chiller. Typically, these keys would not be used for daily chiller operation.

ACCESS CODE - Permits operator to access the program.

PROGRAM - Permits operator to program the Control Center.

MODE - Permits operator to check what mode the Control Center is presently in (“**LOCAL**”, “**REMOTE**” or “**SERVICE**”).

1. **Service** - allows manual PRV control with visual display readout of PRV operation.
2. **Local** - allows manual compressor start from the “**COMPRESSOR**” switch on control center front.
3. **Program** - allows operator programming of system setpoints.
4. **Remote** - allows remote start, remote stop of compressor and remote reset of LCWT and % current limit.

COMPRESSOR - “START”, “RUN”, “STOP/RESET” SWITCH - This 3 position rocker switch is used to start (except in “**REMOTE**” mode), stop/run/reset the system.

OPERATION

DISPLAYING SYSTEM PARAMETERS

The “**Display**” keys are used to display selected monitored parameters as follows: (Refer to Fig. 4)

- Press and **release** the appropriate “**DISPLAY**” key - the message will be displayed for 2 seconds.
- or -
- Press and **hold** the appropriate “**DISPLAY**” key - the message will be displayed and updated every 0.5 seconds until the “**DISPLAY**” key is released.
- or -
- Press and **release** appropriate “**DISPLAY**” key, then press and **release** the “**DISPLAY HOLD**” key - the message will be displayed and updated every 2 seconds until the “**DISPLAY HOLD**” key is again pressed and released, or 10 minutes have elapsed, whichever comes first.

NOTE: If the display actually displays X's, then the monitored parameter is out of normal operating range (Ref. Fig. 5). If the “English/Metric” jumper is installed on the Micro Board, all temperatures are displayed in degrees Fahrenheit (°F) and all pressures are displayed in pounds per square inch absolute (PSIA), except oil pressure which is displayed in pounds per square inch differential (PSID). If the “English/Metric” jumper is not installed, all temperatures are displayed in degrees Centigrade (°C) and all pressures are displayed in Kilo-Pascals (KPa).

| VARIABLE | DISPLAY -> X'S WHEN | EPROM VERSION |
|----------------------------|---|--|
| CONDENSER PRESSURE | = < 9.3 PSIA; > 41.6 PSIA | (3.B) (3.C) |
| | = < 10.0 PSIA; > 40.0 PSIA | (Later Versions) |
| EVAPORATOR PRESSURE | = < 5.0 PSIA; > 12.9 PSIA | (3.B) (3.C) |
| | = < 4.0 PSIA; > 12.5 PSIA | (Later Versions) |
| PURGE PRESSURE | = < 9.0 PSIA; > 78.2 PSIA | (3.B) (3.C) (3.E) |
| | = < 14.7 PSIA OR > 75.0 PSIA (Low Pressure Purge Unit) | (Later Versions) |
| | = < 00.0 PSIA or > 100.0 PSIA (High Pressure Pump Assisted Purge Unit) | 031-01097-001 Through -012 Rev. .10 and higher |
| DISCHARGE TEMPERATURE | = < 20.3°F; > 226.4°F | |
| OIL TEMPERATURE | = < 20.3°F; > 226.4°F | |
| LEAVING COND. WATER TEMP. | = < 8.4°F; > 114.4°F | |
| ENTERING COND. WATER TEMP. | = < 8.4°F; => 114.4°F | |
| LEAVING EVAP. WATER TEMP. | = < 0°F; => 81.1°F | |
| ENTERING EVAP. WATER TEMP. | = < 0.1°F; > 93.0°F | |

FIG. 5 - SYSTEM PARAMETERS - OUT OF RANGE READINGS

To Display **CHILLED LIQUID TEMPERATURES**:

Press “**CHILLED LIQUID TEMPS**” display key as described above to produce the following alphanumeric display message:

CHILLED LEAVING = XXX.X °F, RETURN = XXX.X °F

To Display **REFRIGERANT PRESSURE**:

Use “**REFRIGERANT PRESSURE**” display key as described above to produce the following alphanumeric display message:

EVAP = XXXX.X PSIG, COND = XXXX.X PSIG

To Display **OIL PRESSURE**:

Use “**OIL PRESSURE**” display key as described above to produce the following alphanumeric display message:

OIL PRESSURE = XXXX.X PSID

To Display **OPTIONS**:

Use the “**OPTIONS**” key to display and program the optional parameters for “Guardian Service” and “Remote Chiller Communications”. Refer to instruction Form 160.46-NOM 4.1 for operation and programming. If this option is not installed,

NO OPTIONS INSTALLED

is displayed when this key is pressed.

To Display **SSS MOTOR CURRENT/VOLTS: (Solid State Starter Applications Only)**

If chiller is equipped with a YORK Solid State Starter, use “**SSS MOTOR CURRENT/VOLTS**” key to display 3-phase compressor motor current and 3-phase solid state starter input line voltage. Continuously pressing this key will display the motor current and line voltage alternately. When used with the “**DISPLAY HOLD**” key, motor current and line voltage will alternately be displayed each time this key is pressed. The messages are as follows:

A AMPS = XXXX; B AMPS = XXXX; C AMPS = XXXX

V A - B = XXXX; V B - C = XXXX; V C - A = XXXX

If chiller is not equipped with Solid State Starter, this key produces the following message:

SOLID STATE STARTER NOT INSTALLED

In program mode, this key is used to display the applicable line voltage range (200-208 VAC, 220-240 VAC, 380 VAC, 400 VAC, 415 VAC, 440-480 VAC, 500-600 VAC, Supply Voltage Range Disabled). The correct line voltage range is programmed at the YORK factory and is checked by the service technician at start-up. For security reasons, a special access code is required to program the line voltage range. The line voltage range is used to determine a low line voltage threshold for cycling shutdown. Refer to "System Setpoints" below for Trip/Reset values.

To Display **CONDENSER LIQUID TEMPERATURES:** (Field Installed Option Package)

Use "**CONDENSER LIQUID TEMPS**" display key as described above to produce the following alphanumeric display message:

COND LEAVING = XXX.X °F. RETURN = XXX.X °F

NOTE: If the condenser liquid thermistors are not connected, the display will blank when this key is pressed.

To initiate a **PRINT** to Printer:

Press the "**PRINT**" key to initiate a printout to an optional printer. When the key is pressed,

PRINT ENABLE

is displayed. Refer to "MicroComputer Control Center - System Status Printers" instruction (Form 160.48-NO1.2) for details of the optional printers.

To Display **MOTOR CURRENT:**

Press the "**% MOTOR CURRENT**" display key as described above to display motor current as a percent of Full Load Amps (FLA). The message is as follows:

MOTOR CURRENT = XXX % FLA

NOTE: For Solid State Starter Applications - the % Motor Current displayed is the highest of three line currents divided by the programmed chiller

FLA value x 100%.

For Electro-Mechanical Starter Applications
- the % of Motor Current displayed is the highest of the three line currents converted to analog voltage calibrated to be 9.7 VDC @ 100% FLA.

To Display **OPERATING HOURS:**

Use the "**OPERATING HOURS**" key as described on page 8 to produce the following message:

ACCUMULATED RUN TIME = XXXXX HRS.

Version 3.E and later EPROM versions provide **OPERATING HOURS** and **STARTS COUNTER:**

OPER. HOURS = XXXXX; START COUNTER = XXXXX

SYSTEM SETPOINTS

The system setpoints may be programmed by the system operator. The "**Setpoints**" keys are located on the Control Center keypad. To program, see "Programming System Setpoints" on page 13. The following is a description of these setpoints (with the English/Metric jumper installed on the Micro Board):

CHILLED LIQUID TEMP - This key displays the leaving chilled water temperature (LCWT) setpoint in degrees Fahrenheit. If not programmed, the default value is 45°F. See "Programming System Setpoints", page 13.

NOTE: If an Energy Management System is interfaced to the Control Center for the purpose of remote LCWT setpoint reset, then the operator-programmed chilled liquid temp will be the base or lowest setpoint available to the Energy Management System (EMS). This chilled liquid temp value must also be entered into the EMS. Further, any subsequent change to this value must also be entered into the EMS.

% CURRENT LIMIT - This key displays the maximum value of motor current permitted by its programmed setting. The value is in terms of percent of Full Load Amps (FLA). If not programmed, the default value is 100%. See "Programming System Setpoints", page 13.

If chiller is equipped with a YORK Solid State Starter, the system FLA is also displayed. This value is programmed by the factory and should never be changed. The Micro Board uses this value to calculate and display the % Motor Current parameter that is displayed when the "**% MOTOR CURRENT**" display key is pressed. Also, proper current limit control depends on the correctly programmed FLA value. For security reasons, a special access code is required to program the FLA value. It should only be changed by a service technician.

PULL DOWN DEMAND - This function is used to provide energy savings following the chiller start-up. This key displays a programmable motor current limit and programmable period of time. Operation is as follows:

Whenever the system starts, the Pull Down Demand Limit is maintained for the programmed time, then the current limit control returns to % Current Limit setpoint. The maximum permitted motor current is in terms of % FLA. The duration of time that the current is limited is in terms of minutes (to a maximum of 255). If not programmed, the default value is 100% FLA for 00 minutes (See "Programming System Setpoints", page 13). Thus, no pull down demand limit is imposed following system start, and the % Current Limit setpoint is used.

CLOCK - This key displays the day of the week, time of day and calendar date. If not programmed, the default value is

SUNDAY 12:00 AM 1/1/89

(See "Programming System Setpoints", page 13.)

DAILY SCHEDULE - This key displays the programmed daily start and stop times, from Sunday through Saturday plus Holiday. If desired, the Control Center can be programmed to automatically start and stop the chiller as desired. This schedule will repeat on a 7-day calendar basis. If the Daily Schedule is not programmed, the default value is 00:00 AM start and stop times for all days of the week and the holiday. (Note that the system will not automatically start and stop on a daily basis with these default values because 00:00 is an "Impossible" time for the Micro Board; see "Programming System Setpoints", page 13). Finally, one or more days in the week can be designated as a holiday (See description under "HOLIDAY" setpoint) and the Control Center can be programmed (using "DAILY SCHEDULE" setpoint) to automatically start and stop the chiller on those days so designated. The operator can override the time clock at any time using the "COMPRESSOR" switch.

Note that if only a start time is entered for a particular day, the compressor will not automatically stop until a scheduled stop time is encountered on a subsequent day.

HOLIDAY - This key indicates which days in the upcoming week are holidays. On those designated days, the chiller will automatically start and stop via the holiday start and stop times programmed in the "DAILY SCHEDULE" setpoint. It will do this one time only and the following week will revert to the normal daily schedule for that day.

REMOTE/RESETTEMP RANGE - This key displays the maximum offset of remote LCWT setpoint reset. This offset is either 10° or 20°F as programmed. When in the remote mode, this value is added to the operator programmed chilled liquid temp setpoint and the sum equals the temperature range in which the LCWT can

be reset. For example, if the operator programmed chilled liquid temp setpoint is programmed with a value of 10°F, then the chilled liquid temp setpoint can be remotely reset over a range of 46°F to 56°F (46 + 10 = 56). If not programmed, the default value for this parameter is 20°F. For additional information on remote LCWT reset, refer to Form 160.46-PA4.1.

*NOTE: If an Energy Management System is interfaced to the Control Center for the purpose of remote LCWT setpoint reset, then the operator programmed **REMOTE RESET TEMP RANGE** value determines the maximum value of temperature reset controlled by the Energy Management System.*

DATA LOGGER - This key is used when an optional printer is connected to the MicroComputer Control Center. Refer to Form 160.48-NO1.2 for operation instructions.

SSS MOTOR CURRENT/VOLTS - This key is used on Solid State Starter applications only. Although this is a display key, it is also used to program the applicable AC power line voltage range (200-208 VAC, 220-240 VAC, 380 VAC, 400 VAC, 415 VAC, 440-480 VAC, 550-600 VAC). The MicroComputer Control Center uses this entry to determine the undervoltage-shutdown threshold. For each line voltage category, there are two shutdown thresholds - a minimum line voltage level required to start the compressor and a minimum level required after the Control Center is in "RUN" mode. In "RUN" mode, the voltage must be less than the run threshold for 20 continuous seconds in order to initiate a shutdown. When the chiller shuts down,

MON 10:00 AM LOW LINE VOLTAGE

is displayed. This undervoltage protection can be disabled. The selectable supply voltage ranges and their shutdown thresholds are as follows:

| supply voltage range | TO START | RUN |
|-------------------------------|----------|---------|
| 200-208 VAC | 174 VAC | 160 VAC |
| 200-240 | 200 | 185 |
| 380 | 331 | 305 |
| 400 | 349 | 320 |
| 415 | 362 | 335 |
| 440-480 | 400 | 370 |
| 550-600 | 502 | 460 |
| Supply voltage range disabled | 0 | None |

If Control Center is equipped with version 3.E and later EPROM, an overvoltage shutdown threshold is also checked. If the line voltage exceeds the overvoltage threshold for 20 continuous seconds, the chiller shuts down,

MON XX:XX AM HIGH LINE VOLTAGE

is displayed. The high line voltage check is disabled along with the low line voltage check if desired. Refer to the following chart for thresholds.

For security reasons, a special access code is required to program the supply voltage range. The supply voltage range is programmed at the factory and should only be changed by a service technician.

| LOW/HIGH VOLTAGE TRIP/RESET VALUES | | | | |
|---|----------------------------------|---------------------|-----------------------------------|---------------------|
| compressor motor supply voltage range - (V) | low line voltage operating point | | high line voltage operating point | |
| | cutout-(V) (on fall) | cutin-(V) (on rise) | cutout-(V) (on rise) | cutin-(V) (on fall) |
| 200-208 | 160 | 174 | 227 | 220 |
| 220-240 | 185 | 200 | 262 | 254 |
| 380 | 305 | 331 | 415 | 402 |
| 400 | 320 | 349 | 436 | 423 |
| 415 | 335 | 362 | 454 | 440 |
| 440-480 | 370 | 400 | 524 | 508 |
| 550-600 | 460 | 502 | 655 | 635 |
| Supply voltage range disabled | None | 0 | None | 0 |

PURGE - There is one programmable purge setpoint: **“EXCESS PURGETHRESHOLD”**.

The **EXCESS PURGE THRESHOLD** is the number of purge exhausts that are allowed to occur in 1 hour of chiller operating time before an excess purge warning message is displayed. If the number of purge exhausts exceed this value, **“WARNING - EXCESS PURGE”** is displayed on the keypad display (Refer to description of this message in **“DISPLAY MESSAGES”** section of this book). The **DISPLAY DATA** key is used to program this setpoint. It is programmable from 10 to 30 purge exhausts per hour by operating personnel. The default value is 20 purge exhausts per hour. Field service personnel can program this setpoint over a wider range (Refer to service manual Form 160.48-M2, Section 13). The typical value would be the default value 20/hour. However, the number can be lowered to detect small leaks.

DISPLAYING SYSTEM SETPOINTS

The currently programmed setpoint values can be viewed at any time (see page 20) in **“SERVICE”**, **“LOCAL”** or **“REMOTE”** operating mode as follows:

- Press and **release** the appropriate **“Setpoint”** key - the message will be displayed for 2 seconds.
- or -
- Press and **hold** the appropriate **“Setpoint”** key - the message will be displayed as long as the key is pressed.
- or -
- Press and **release** appropriate **“Setpoint”** key, then

press and **release** the **“DISPLAY HOLD”** key. The message will be displayed until the **“DISPLAY HOLD”** key is again pressed and released, or 10 minutes have elapsed, whichever comes first.

To Display **CHILLED LIQUID TEMP** Setpoint:

Use the **“CHILLED LIQUID TEMP”** setpoint key as described on page 8 to produce the following message:

LEAVING SETPOINT = XX.X °F

*NOTE: The value displayed is the actual LCWT setpoint. For example, the value displayed in **“LOCAL”** or **“PROGRAM”** modes is that which is operator programmed. The value displayed in the **“REMOTE”** mode is that base setpoint with added temperature reset by an Energy Management System, via remote LCWT setpoint (PWM signal) if a remote reset signal was received within 30 minutes.*

To Display **% CURRENT LIMIT** Setpoint:

Use **“% CURRENT LIMIT”** setpoint key as described on page 8 to produce the following message:

CURRENT LIMIT = XXX ° FLA

*NOTE: The value displayed is the actual % current limit setpoint. For example; the value displayed in **“LOCAL”** or **“PROGRAM”** mode is that which is operator programmed. The value displayed in the **“REMOTE”** mode is that which has been programmed by the Energy Management System via the remote current limit setpoint input.*

If chiller is equipped with a YORK Solid State Starter, the message is:

CURRENT LIMIT = XXX % FLA; *MTR CUR = 000 FLA

NOTE: On Solid State Starter applications, this value is programmed at the YORK factory. A special access code is required.

To Display **PULL DOWN DEMAND** Setpoint:

Use **“PULL DOWN DEMAND”** setpoint key as described on page 8 to produce the following message:

SETPOINT = XX MIN @ XX% LOAD, XX MIN LEFT

To Display **CLOCK** Setpoint (Time of Day):

Use **“CLOCK”** setpoint key as described on page 10 to

produce the following message:

TODAY IS DAY XX:XX AM/PM 1/1/89

To Display **DAILY SCHEDULE** Setpoints:

- Press and hold the “**DAILY SCHEDULE**” setpoint key.

The chiller start and stop times for each day of the week are sequentially displayed, beginning with Sunday and ending with Holiday. The display will continuously scroll until the “**DAILY SCHEDULE**” key is released.

-or-

- Press and release the “**DAILY SCHEDULE**” setpoint key. Then press and release the “**DISPLAY HOLD**” key.

The chiller start and stop times for each day of the week are sequentially displayed beginning with Sunday and ending with Holiday. The display will continuously scroll until the “**DISPLAY HOLD**” key is again pressed and released, or 10 minutes have elapsed, whichever comes first.

The display message for DAILY SCHEDULE will scroll in the following sequence:

SUN START = 08:30 AM STOP = 06:00 PM

MON START = 05:00 AM STOP = 07:00 PM

TUE START = 05:00 AM STOP = 07:00 PM

WED START = 05:00 AM STOP = 07:00 PM

THU START = 05:00 AM STOP = 07:00 PM

FRI START = 05:00 AM STOP = 07:00 PM

SAT START = 05:00 AM STOP = 01:00 PM

HOL START = 00:00 AM STOP = 00:00 PM

To Display **HOLIDAY** Setpoints:

Use “**HOLIDAY**” setpoint key as described in the beginning of this section to produce the following message:

S _ M _ T _ W _ T _ F _ S _ HOLIDAY NOTED BY *

*NOTE: On the days that are designated by an *, the chiller will automatically start and stop per the holiday schedule established in “DAILY SCHEDULE” setpoints.*

To Display **REMOTE RESET TEMP RANGE** Setpoint:

Use “**REMOTE RESETTEMP RANGE**” setpoint key as described above to produce the following message:

REMOTE RESETTEMP RANGE = 10 °F

- or -

REMOTE RESETTEMP RANGE = 20 °F

To Display **DATA LOGGER** Setpoints:

Refer to YORK Form 160.48-NO1.2 for operation of this key.

To Display **UNDERVOLTAGE** Setpoints:

(Solid State Starter Applications Only)

Press “**SSS MOTOR CURRENT/VOLTS**” key in “**PROGRAM**” mode to display the selected voltage range. One of the following messages will be displayed:

SUPPLYVOLTAGE RANGE 200 – 208

- or -

SUPPLYVOLTAGE RANGE 220 – 240

- or -

SUPPLYVOLTAGE RANGE 380

- or -

SUPPLYVOLTAGE RANGE 400

- or -

SUPPLYVOLTAGE RANGE 415

- or -

SUPPLYVOLTAGE RANGE 440 – 480

- or -

SUPPLYVOLTAGE RANGE 550 – 600

- or -

SUPPLYVOLTAGE RANGE DISABLED

A special access code is required to program the Supply Voltage Range. The Supply Voltage Range is programmed at the factory and checked at system start-up. (Note to service technician: Refer to programming instructions in Service Instruction 160.48-M2).

To Display **PURGE** Setpoint:

Press “**DISPLAY DATA**” key in “**PROGRAM**” mode to display the **excess purge threshold**. The following is displayed:

MAXIMUM PURGES PER HOUR = XX

PROGRAMMING THE MICROCOMPUTER CONTROL CENTER

PROGRAMMING SYSTEM SETPOINTS

The system setpoints can be entered at any time . . . even when the system is running. Proceed as follows to enter system setpoints. (Refer to Fig. 6)

1. Press "ACCESS CODE" key.
2. This is displayed:



3. Using "Entry" keys, enter 9 6 7 5.
4. As each digit is entered, the characters Y O R K are displayed.

NOTE: If digits other than 9 6 7 5 are entered, Y O R K is still displayed.

NOTE: For ease in remembering the code, note that the letters Y O R K correspond to the digits 9 6 7 5 on a telephone dial.

5. Press "ENTER" key.

NOTE: If digits other than 9 6 7 5 were entered in step No. 4,



is displayed when the "ENTER" key is pressed. If this occurs, enter the correct access code (9675) and proceed.

6. This is displayed:



NOTE: Unless terminated by pressing the "ACCESS CODE" key again, the operator will have access to the "PROGRAM" key for 10 minutes. When 10 minutes have elapsed, access to program key will be automatically disabled and the operator must return to step No. 1 to gain access.

7. Press "PROGRAM" key.
8. This is displayed:

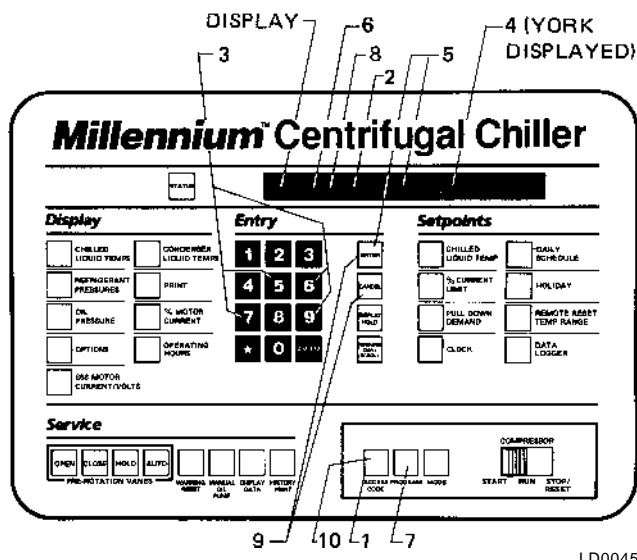


FIG. 6 - KEYPAD - PROGRAMMING SYSTEM SETPOINTS

9. Enter setpoints as detailed below. If you make a mistake when entering a value, press "CANCEL" key and then "ENTER" key. The display will revert to the default values and the cursor will return to the first changeable digit. You can then proceed to enter the correct values. If the entered value exceeds acceptable limits,



message will be displayed for 2 seconds, then the



message will reappear.

10. When all the desired setpoints have been entered, press the "ACCESS CODE" key to exit program mode and terminate access to program mode.



is displayed. The Control Center will automatically return to "LOCAL", "REMOTE" or "SERVICE" mode . . . whichever was last selected.

To enter **CHILLED LIQUIDTEMP** Setpoint:
(Refer to Fig. 7)

1. Press and release “**CHILLED LIQUIDTEMP**” setpoint key. The following program prompt message will be displayed:

LEAVING SETPOINT = XX.X °F (BASE)

(BASE) refers to the base or lowest setpoint available to an Energy Management System. If any Energy Management System is applied, this value must be entered into the Energy Management System. Refer to previous explanation or **REMOTE/RESET TEMP RANGE**, page 10.

2. Use “**ENTRY**” keys to enter desired value.
3. Press and release “**ENTER**” key. This message is displayed:

PROGRAM MODE, SELECT SETPOINT

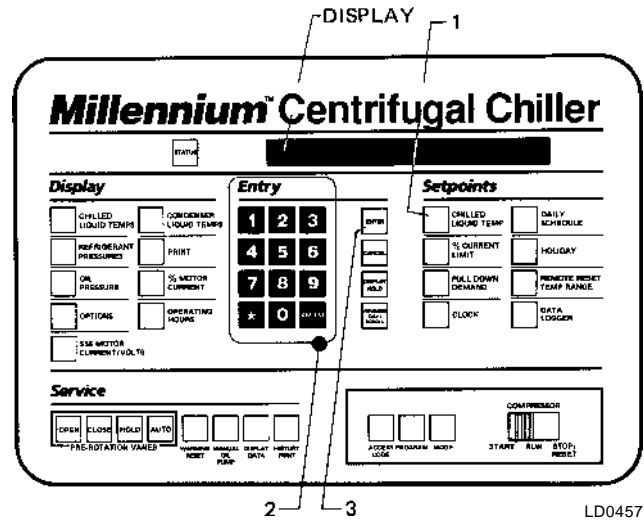


FIG. 7 - KEYPAD - PROGRAMMING “LEAVING CHILLED WATER TEMP” SETPOINT

To Enter **% CURRENT LIMIT** Setpoint:
(**Electro-Mechanical Starter or VSD**)
(Refer to Fig. 8)

1. Press and release “**% CURRENT LIMIT**” setpoint key. The following program prompt message is displayed:

CURRENT LIMIT = XXX % FLA

2. Use “**ENTRY**” keys to enter desired value.
3. Press and release “**ENTER**” key. This message is displayed:

PROGRAM MODE, SELECT SETPOINT

(**Solid State Starter**)
(Refer to Fig. 8)

1. Press and release “**% CURRENT LIMIT**” setpoint key. The following message is displayed:

CURRENT LIMIT = XXX % FLA MTR CUR = __ _ FLA

2. Use “**ENTRY**” keys to enter desired current limit value.

NOTE: Motor Current FLA value is entered by YORK factory and checked at system start-up. It cannot be changed without special access code. (Note to service technician: refer to Programming Instructions in Service Instruction Form 160.48-M2.)

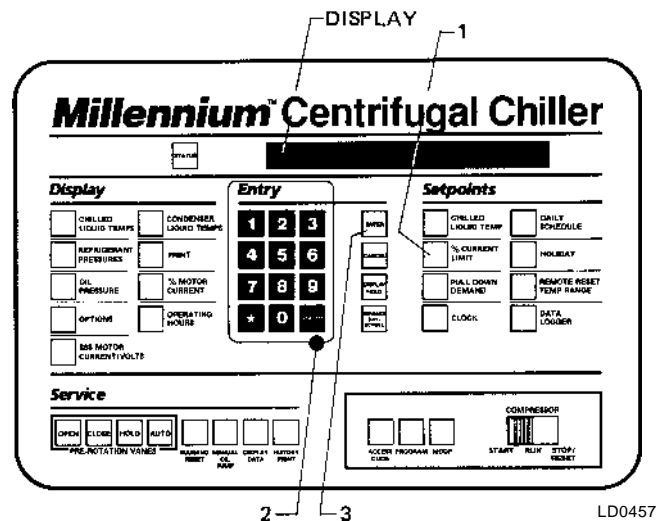


FIG. 8 - KEYPAD - PROGRAMMING “% CURRENT LIMIT” SETPOINT

3. Press and release “**ENTER**” key. The following message is displayed:

PROGRAM MODE, SELECT SETPOINT

To Enter **PULL DOWN DEMAND** Setpoint:
(Refer to Fig. 9)

1. Press and release “**PULL DOWN DEMAND**” setpoint key. The following program prompt message is displayed:

SETPOINT = XXX MIN @ XXX % FLA, XX MIN LEFT

2. Use “**Entry**” keys to enter desired values. For explanation, see **PULL DOWN DEMAND**, page 10. Note that ‘XX min left’ is not an operator entered value.
3. Press and release “**ENTER**” key. This message is displayed:

PROGRAM MODE, SELECT SETPOINT

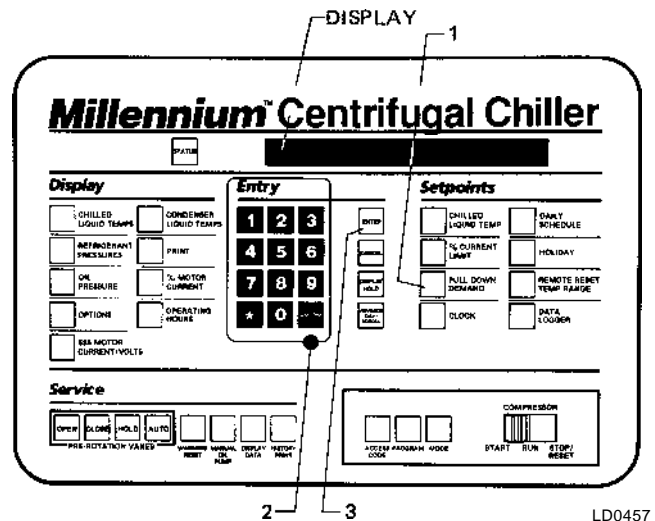


FIG. 9 - KEYPAD - PROGRAMMING “PULL DOWN DEMAND” SETPOINT

To Enter **CLOCK** Setpoint:
(Refer to Fig. 10)

1. Assure Micro Board Program jumper J-57 is in “**CLKON**” position.
2. Press and release “**CLOCK**” setpoint key. The following program prompt message is displayed:

CURRENT LIMIT = XXX % FLA

3. Press “**ADVANCE DAY|SCROLL**” key until the proper day of week appears on the display.
4. Use “**Entry**” keys to enter proper time of day.
5. Press “**AM/PM**” key to change the AM to PM or vice versa.
6. Use “**Entry**” keys to enter proper calendar date. (MONTH/DAY/YR). If month and day are single digit entries, precede the entry with “0”. For example 02/04/88.
7. Press and release “**ENTER**” key. This message is displayed:

PROGRAM MODE, SELECT SETPOINT

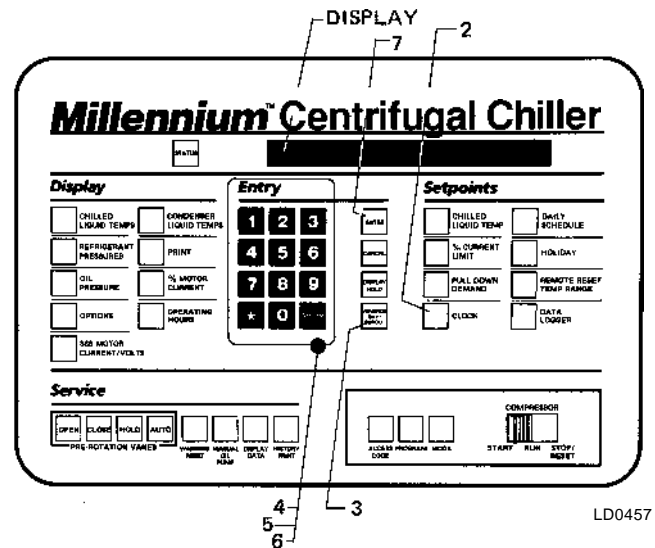


FIG. 10 - KEYPAD - PROGRAMMING “CLOCK” SETPOINT

To Enter **DAILY SCHEDULE** Setpoint:
(Refer to Fig. 11)

1. Press and release "**DAILY SCHEDULE**" setpoint key.
The following program prompt message is displayed:

DAY START XX:XX AM/PM STOP XX:XX AM/PM

2. Press "**ADVANCE DAY/SCROLL**" key until the day you wish to program appears on the display.
3. Use "**Entry**" keys to enter desired start time. If you wish to cancel the scheduled start and stop times for a particular day, press "**CANCEL**" key and then "**ENTER**" key.
4. Press "**AM/PM**" key to change the AM to PM or vice versa. If the desired entry is already displayed, proceed to enter the stop time. The cursor will automatically move to the stop time.
5. Use "**Entry**" keys to enter desired stop time.
6. Press "**AM/PM**" key to change the AM to PM or vice versa.
7. Press and release "**ENTER**" key. This message is displayed:

PROGRAM MODE, SELECT SETPOINT - or -

Press "**ADVANCE DAY/SCROLL**" key. The display will advance to the next consecutive day and the previous day will be automatically entered.

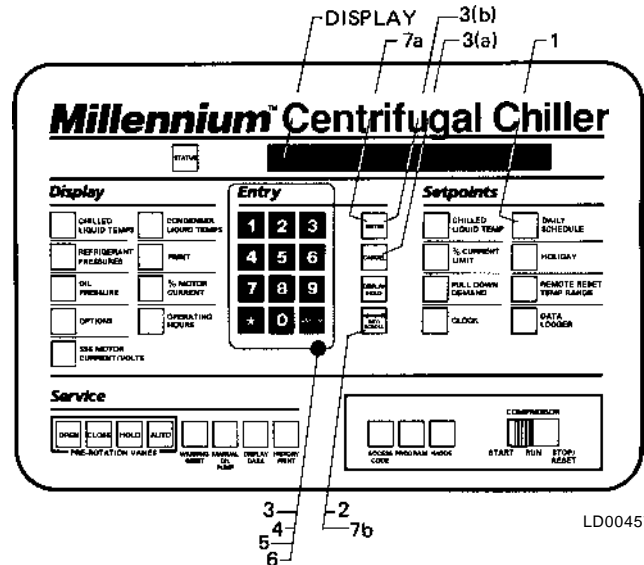


FIG. 11 - KEYPAD - PROGRAMMING "DAILY SCHEDULE" SETPOINT

To Enter **HOLIDAY** Setpoint: (Refer to Fig. 12)

1. Press and release "**HOLIDAY**" setpoint key. The following program prompt message is displayed:

S _ M _ T _ W _ T _ F _ S _ HOLIDAY NOTED BY *

2. Press and release "**ADVANCE DAY/SCROLL**" key to move cursor to the day that you wish to designate as a holiday.
3. Press and release "*" entry key. An * will appear next to the selected day.
4. After you have placed an * next to each of the days that you wish to designate a holiday, press "**ENTER**" key. The following message is displayed:

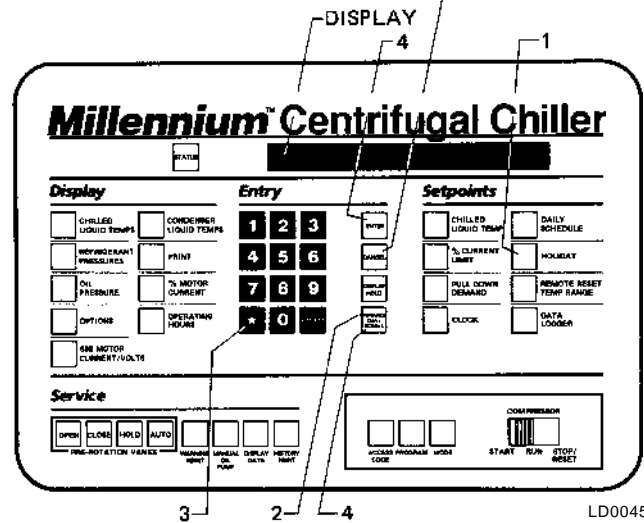
PROGRAM MODE, SELECT SETPOINT

To cancel **all** of the designated holidays: perform Step 1, press "**CANCEL**" key, and then press "**ENTER**" key. This message is displayed:

PROGRAM MODE, SELECT SETPOINT

To cancel **one** of the designated holidays: perform Step 1, press "**ADVANCE DAY/SCROLL**" key until the cursor appears to the right of the desired day, press the "*" key, then press the "**ENTER**" key.

4
TO CANCEL ALL HOLIDAYS
PERFORM STEP 1
PRESS "CANCEL"
PRESS "ENTER"



4 - TO CANCEL ONE OF THE DESIGNATED HOLIDAYS--
PRESS "ADVANCE DAY / SCROLL"
PRESS "*" KEY
PRESS "ENTER"

FIG. 12 - KEYPAD - PROGRAMMING "HOLIDAY" SETPOINT

To Enter **REMOTE/RESET TEMP RANGE** Setpoint:
(Refer to Fig. 13)

1. Press and release “**REMOTE/RESET TEMP RANGE**” setpoint key. The following program prompt message is displayed:

REMOTE/RESET TEMP RANGE = XX °F

2. Use “**Entry**” keys to enter desired value (10 or 20).
3. Press and release “**ENTER**” key. The following message is displayed.

PROGRAM MODE, SELECT SETPOINT

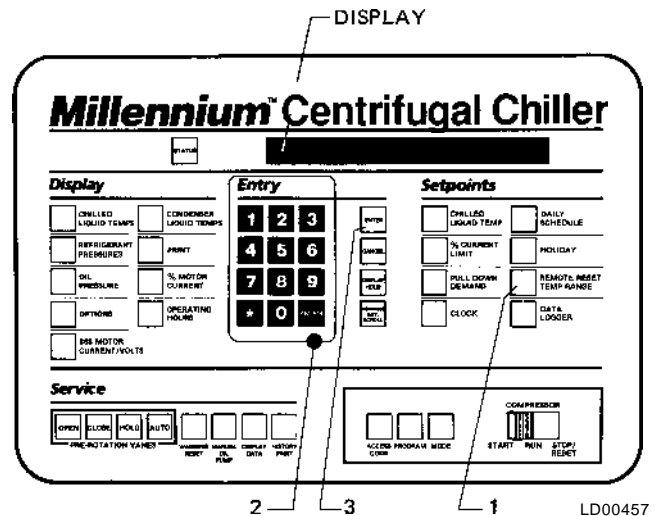


FIG. 13 - KEYPAD - PROGRAMMING “REMOTE RESET TEMP RANGE” SETPOINT

To Enter **DATA LOGGER** Setpoint:

Refer to Form 160.48-NO1.2 for operation of this key.

To Enter **EXCESS PURGE THRESHOLD** Setpoint:
(Refer to Fig. 14)

1. Press and release “**DISPLAY DATA**” key. The following program prompt message is displayed:

MAXIMUM PURGES PER HOUR = XX

2. Use “**ENTRY**” keys to enter desired values.
3. Press and release “**ENTER**” key. The following message is displayed:

PROGRAM MODE, SELECT SETPOINT

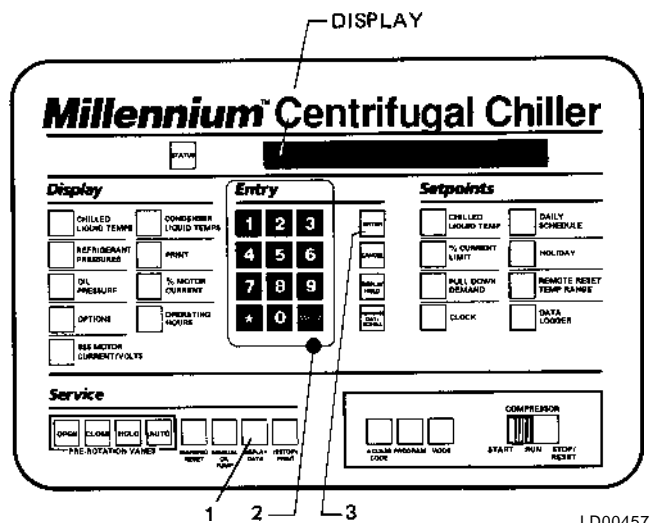


FIG. 14 - KEYPAD - PROGRAMMING “EXCESS PURGE THRESHOLD” SETPOINT

SERVICE KEYS

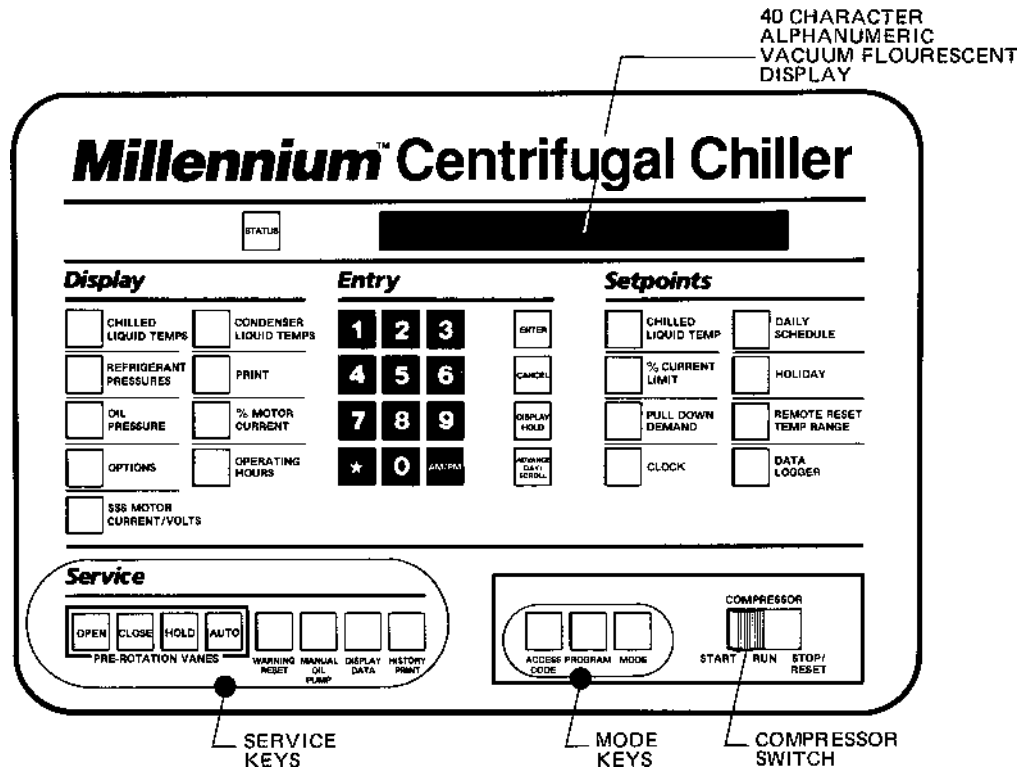


FIG. 15 - KEYPAD - SERVICE KEYS LOCATION

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The “**SERVICE**” keys are provided for the service technician’s use when performing routine maintenance or when troubleshooting the system. The “**WARNING RESET**” and “**PREROTATIONVANES**” keys are enabled in “**SERVICE**” mode only. The remainder of the Service keys are enabled in “**SERVICE**”, “**LOCAL**” or “**REMOTE**” mode.

PREROTATION VANES KEYS

OPEN - Press and release this key to drive the prerotation vanes open. If the chiller is running,

SYSTEM RUN - VANES OPENING

is displayed. If chiller is not running,

SYS READY TO START - VANES OPENING

is displayed. The vanes will continue to open until the “**CLOSE**”, “**HOLD**”, or “**AUTO**” (if temperature error requires it) keys are pressed and released. (This function applies to non-Variable Speed Drive applications only.)

HOLD - Press and release this key to hold the prerotation vanes in their present position. If chiller is running,

SYSTEM RUN - VANES HOLDING

is displayed. If chiller is not running,

SYS READY TO START - VANES HOLDING

is displayed. The vanes will remain stationary until the “**OPEN**”, “**HOLD**” or “**AUTO**” keys are pressed and released. (This function applies to non-Variable Speed Drive applications only.)

AUTO - Press and release this key to put the prerotation vanes under LCWT control as long as the current limit setpoint is not reached, which causes the current limit function to override the LCWT control. If system is running,

SYSTEM RUN - AUTO VANES

is displayed. The actual opening and closing of the vanes is indicated on the display. When the vanes are opening,

SYSTEM RUN - VANES OPENING

is displayed. If the vanes are closing,

SYSTEM RUN - VANES CLOSING

is displayed. Whenever the Control Center is in “**LOCAL**”, “**REMOTE**” or “**PROGRAM**” mode, the vane con-

trol circuitry is automatically placed in "AUTO" mode and the vanes operate to control the leaving chilled water temperature to the programmed setpoint. (This function applies to non-Variable Speed Drive applications only.)

CLOSE - Press and release this key to drive the prerotation vanes closed. If the chiller is running,

SYSTEM RUN -VANES CLOSING

is displayed. If chiller is not running,

SYS READY TO START - VANES CLOSING

is displayed. When the vanes are fully closed,

SYS READY TO START -VANES CLOSED

is displayed. The vanes will continue to close until the "OPEN", "HOLD" or "AUTO" keys are pressed. (This function applies to non-Variable Speed Drive applications only.)

OTHER SERVICE KEYS

WARNING RESET - Press and release this key to reset the excess purge counting circuitry and the excess purge display message. Also, any "WARNING" or "STATUS" message can be reset with this key, unless the condition still exists. To reset any cycling or warning message, place the Control Center in "SERVICE" mode and press "WARNING RESET" key. To reset any safety shutdown message, press "WARNING RESET" key in "SERVICE" mode with the "COMPRESSOR" switch in the "STOP/RESET" position.

MANUAL OIL PUMP - This key is operational in any mode. Press and release this key to run the oil pump. Press and release the key again to stop the oil pump. A 10-minute maximum is imposed on the running of the oil pump (i.e., the oil pump will automatically shut off after 10 minutes). If a longer running time is desired, the key must be pressed again.

DISPLAY DATA - This key is operational in any three of the Control Center modes of operation ("SERVICE", "LOCAL" or "REMOTE"). It is used to display certain system operating parameters that are relevant to troubleshooting the chiller system.

Press and hold the "DISPLAY DATA" key. The following messages will sequentially scroll on the display. Each message will be displayed for 2 seconds.

No. 1

SAT TEMPS EVAP = XX.X °F, COND = XX.X °F

No. 2

DISCHARGE TEMP = XXX.X °F, OILTEMP = XXX.X °F

No. 3

PURGE PRESSURE = XX.X PSIA

No. 4 (See Note below)

60 MINUTE PURGE COUNT BYPASS; XX MIN LEFT

Purge exhausts are not counted during the first 60 minutes of chiller operation. Therefore, this message replaces the purge count messages below during the first hour of operation.

PURGES LAST XX MIN = XX, MAX PURGES/HR = XX

After the first hour of chiller operation has elapsed, purge exhausts are counted. This message is displayed during the first hour following the initial 1 hour bypass (see above), and after the excess purge message is cleared. The minutes elapsed during this first hour of purge exhaust counting are displayed. The purge count is incremented each time a purge exhaust occurs. Also, the excess purge threshold that has been programmed by the operator or service person is displayed as **MAX PURGES/HR**. When the minute count reaches 60, this message is replaced with the following message:

PURGES LAST HOUR = XX; MAX PURGES/HR = XX

After the initial 1 hour bypass and the first hour of purge exhaust counting has elapsed as explained above (2 hours of chiller run time), this message is displayed thereafter. A running total of the number of purge exhausts that have occurred within the last hour is displayed. The excess purge threshold that has been programmed by the operator or service person is displayed as **MAX PURGES/HR**.

To hold each of the above messages, press and release the "DISPLAY DATA" key, then press and release the "DISPLAY HOLD" key. Message No. 1 above will be displayed and updated every 2 seconds until the "DISPLAY DATA" key is again pressed and released. Message No. 2 is then displayed and updated every 2 seconds until the "DISPLAY DATA" key is again pressed and released. Message No. 3 is then displayed and updated every 2 seconds until either the "DISPLAY DATA" key is again pressed and released (whereupon message No. 1 is displayed), or the "DISPLAY HOLD" key is pressed and released (whereupon the "DISPLAY DATA" messages are removed from the display.)

NOTE: Purge Count - following a 1 hour bypass at start, purge exhausts are counted and displayed in the above messages while the chiller is running. With the exception of the first hour after the bypass, the value displayed is the number of exhausts that have occurred in the "Last Hour". For example, if you walk up to the Micro Panel at 9:11 AM and press the "DISPLAY DATA" key

and it says that there have been 7 purges in the "Last Hour", that means that there have been 7 exhausts since 8:11 AM. If you do this at 2:57 PM, it means that there have been 7 exhausts since 1:57 PM, etc.

The purge count is reset to zero by:

- A. Clearing the excess purge message.
- B. Moving the Micro Board program jumper J-57 (CLK ON/OFF) from "CLK OFF" to CLOCK ON" position.

C. Starting the chiller.

The purge count is frozen by the following:

- A. When the chiller is not running.
- B. An excess purge message is being displayed and at least 1 full hour of purge exhausts have accumulated.

HISTORY PRINT - This key is used to initiate a history print to the optional printer. Refer to Form 160.48-NO1.2 for operation of this key.

OPERATING MODES

The MicroComputer Control Center can be operated in four different operating modes as follows:

SERVICE - Enables all the Service keys except "DISPLAY DATA", "MANUAL OIL PUMP", and "HISTORY PRINT", which are enabled in all modes. See "Service Keys", page 18.

LOCAL - This is the normal operating mode. The compressor can be started and stopped from the Control Center. Also, the **Display** and **Setpoints** parameters can be displayed.

PROGRAM - Allows the operator to program the **Setpoints** parameters, and change operating modes.

REMOTE - In this mode, the Control Center will accept control signals from a remote device (i.e., Energy Management System) or cycling inputs. The control signal inputs are:

1. Remote Start
2. Remote Stop
3. Remote LCWT Setpoint
4. Remote Current Limit Setpoint

NOTE: The compressor can be stopped by the "COMPRESSOR" switch, regardless of the operating mode. The switch must be in "RUN" position to enable "REMOTE" mode. The operator cannot locally start the compressor using the "COMPRESSOR" switch when in the "REMOTE" mode.

To determine which operating mode the Control Center is presently in, simply press the "MODE" key.

- If the Control Center is in "LOCAL" mode, this is displayed:

LOCAL OPERATING MODE IN EFFECT

- If the Control Center is in "REMOTE" mode, this is displayed:

REMOTE OPERATING MODE IN EFFECT

- If the Control Center is in "SERVICE" mode, this is displayed:

SERVICE OPERATING MODE IN EFFECT

To change operating mode, proceed as follows:

1. Press "ACCESS CODE" key.
2. This message appears:

INTERVALID ACCESS CODE _ _ _ _

3. Using "Entry" keys, enter **9 6 7 5**.
4. As each digit is entered, the characters **Y O R K** are displayed.

NOTE: If digits other than **9 6 7 5** are entered, **Y O R K** is still displayed.

5. Press "ENTER" key.

NOTE: If digits other than **9 6 7 5** were entered in step No. 4,

INVALID ACCESS CODE

is displayed when the "ENTER" key is pressed. If this occurs, enter the correct access code (9 6 7 5) and proceed.

6. This message is displayed:

ACCESS TO PROGRAM KEY AUTHORIZED

NOTE: Unless terminated by pressing the "ACCESS CODE" key again, the operator will have access to the "PROGRAM" key for 10 minutes.

When 10 minutes have elapsed, access to “PROGRAM” key will be automatically disabled and the operator must return to step No. 1 to gain access.

7. Press “PROGRAM” key.
8. This message is displayed:

PROGRAM MODE, SELECT SETPOINT

9. Press “MODE” key.
10. The mode that has been previously selected will be displayed as follows:

LOCAL MODE SELECTED

- or -

SERVICE MODE SELECTED

- or -

REMOTE MODE SELECTED

11. Press “ADVANCE DAY” key to scroll to desired mode. Each time this key is pressed, a different mode is displayed as above:

12. When the desired mode is displayed, press “ENTER” key.

13. This message is displayed:

PROGRAM MODE, SELECT SETPOINT

14. Press “ACCESS CODE” key to exit “PROGRAM” mode and terminate access to “PROGRAM” mode.

15. This message is displayed:

ACCESS TO PROGRAM MODE DISABLED

COMPRESSOR SWITCH

(Refer to Fig. 15, page 18)

This rocker switch is used to locally operate the compressor. It is used to start, run and stop the compressor. Also, it resets the Control Center after a safety shutdown.

To **START*** chiller compressor in “LOCAL” mode:

Move “COMPRESSOR” switch from “STOP/RESET” to “START” position. Switch will spring-return to “RUN” position.

**NOTE: The operator cannot start the compressor (using this switch) when the Control Center is in “REMOTE” mode.*

To **STOP** compressor:

Move switch from “RUN” to “STOP/RESET” position.

To **RESET** Control Center:

Following a safety shutdown, the operator is required to reset the Control Center prior to restarting the system. Move switch from “RUN” to “STOP/RESET” position.

DISPLAY MESSAGES

The following display messages will be automatically displayed unless the operator is requesting additional information via the keypad.

SYSTEM RUN – CURRENT LIMIT IN EFFECT

Displayed when the chiller is running, and the motor current is equal to or greater than the operator-programmed “XXX % FLA” current limit value. When the motor current reaches 100% of this value, the prerotation vanes are not permitted to open further. If the current continues to rise to 104% of this value, the vanes will be driven closed - not fully closed; only far

enough to allow the current to decrease to a value less than 104% of the operator-programmed “XXX % FLA” current limit.

For example:

With the operator-programmed “% CURRENT LIMIT” set at 50% and the FLA of the chiller equal to 200A, the current limit circuit would perform as follows:

(100%) (50% x FLA) = Vanes inhibited from opening further

(104%) (50% x FLA) = Vanes driven toward close position

Therefore:

(100%) (50% x 200) = 100A = Vanes stop opening
(104%) (50% x 200) = 104A = Vanes driven toward close position

SYSTEM RUN – AUTO VANES

Displayed when the chiller is running, the MicroComputer Control Center is in “**SERVICE**” mode, and the vanes are operating in “**AUTO**” mode.

SYSTEM RUN – VANES OPENING

Displayed when the chiller is running and the Micro-Computer Control Center is in “**SERVICE**” mode with:

- The vanes operating in “**AUTO**” mode and opening to maintain the leaving chilled water temperature setpoint.
- or-
- The operator has pressed the vanes “**OPEN**” key on the keypad.

SYSTEM RUN –VANES CLOSING

Displayed when the chiller is running and the Micro-Computer Control Center is in “**SERVICE**” mode with:

- The vanes operating in “**AUTO**” mode and closing to maintain the leaving chilled water temperature setpoint.
- or-
- The operator has pressed the vanes “**CLOSE**” key on the keypad.

SYSTEM RUN –VANES HOLDING

Displayed when the chiller is running, the Micro-Computer Control Center is in “**SERVICE**” mode, and the operator has pressed the vanes “**HOLD**” key.

SYS READY TO START – VANES OPENING

Displayed when the chiller is not running and the operator has pressed the vanes “**OPEN**” key on the keypad.

SYS READY TO START – VANES CLOSING

Displayed when the chiller is not running and the operator has pressed the vanes “**CLOSE**” key on the keypad.

SYS READY TO START – VANES HOLDING

Displayed when the chiller is not running and the operator has pressed the vanes “**HOLD**” key on the keypad.

SYSTEM RUN – LOW PRESSURE LIMIT IN EFFECT

Displayed when the chiller is running and the evaporator pressure falls to 5.55 PSIA (R11); 4.50 PSIA (R123). Simultaneously, the prerotation vanes will be prevented from further opening. This action maintains chiller operation to prevent low-evaporator-pressure shutdown at 5.42 PSIA (R11); 4.40 PSIA (R123). When the evaporator pressure rises to 5.65 PSIA (R11); 4.70 PSIA (R123), the vanes will be permitted to open. Low pressure limit feature is not used when program jumper (JP-3) is cut (Brine application).

SYSTEM RUN – HIGH PRESSURE LIMIT IN EFFECT

Displayed when the chiller is running and the condenser pressure rises to 28.8 PSIA. Simultaneously, the prerotation vanes will be inhibited from further opening. This action occurs to prevent system shutdown on high condenser pressure at 29.7 PSIA. When the condenser pressure falls to 28.6 PSIA, the vanes will be permitted to open.

SYSTEM RUN – PRESS STATUS

Displayed when the chiller is running. It instructs the operator to press the “**STATUS**” key, whereupon the following message will be displayed. The following “Warning Messages” are displayed alternately with the foreground message. The foreground message is displayed for 2 seconds, then the warning message is displayed for 2 seconds, etc. It is not necessary to press the “**STATUS**” key.

WARNING: COND OR EVAP TRANSDUCER ERROR

Indicates a probable condenser or evaporator transducer problem, because the output is unreasonable. The microprocessor arrives at this conclusion by subtracting the evaporator transducer output from the condenser transducer output. The result must be zero or some positive number. If the result is a negative number, it concludes that there is a probable condenser or evaporator transducer problem. This function is inhibited for the first 10 minutes of chiller run-time, and is checked every 10 minutes thereafter. Message is reset by pressing the “**WARNING RESET**” key in the “**SERVICE**” mode.

WARNING: PURGE FLOAT SWITCH ERROR

Indicates the microprocessor is receiving conflicting digital signals from purge top float switch and purge bottom float switch (i.e., liquid is simultaneously above TFS and below BFS . . . an impossible condition). Message is reset by pressing “**WARNING RESET**” key in the “**Service**” mode.

WARNING: HIGH PURGE PRESSURE

If the purge transducer output is indicating a pressure greater than 95 PSIA (for 255 continuous sec.) the above warning message is displayed alternately with the normal foreground message. When the pressure decreases to less than 95 PSIA, the message is automatically cleared.

MON XX:XX WARNING – EXCESS PURGE

Anytime after the first hour of chiller operation, if the purge exhaust count equals the programmed “**MAX PURGE/HR**” threshold, this message is alternately displayed with the normal foreground message. The day and time displayed is the time the excess purge event occurred. This message will be displayed until manually cleared using the “**WARNING RESET**” key in the “**Service**” mode. Clearing the message also resets the purge exhaust count to zero and invokes the message

PURGES.LAST XX MIN = XX; MAX PURGES/HR = XX

While the excess purge message is displayed, the purge exhaust count will continue to increment until the 1 hour period has elapsed. The count is then frozen until the excess purge message is cleared. This provides a record of the total number of purge exhausts that occurred within the 1 hour period that the excess purge event occurred.

Refer to “**DISPLAY DATA**” key in SERVICE KEYS section for complete explanation of purge counting.

NOTE: If the “STATUS” key is arbitrarily pressed, without the operator being prompted by the

PRESS STATUS

message, this message shall be displayed:

NO MALFUNCTION DETECTED

SYSTEM RUN – LEAVING TEMP CONTROL

Displayed while the chiller is running. Indicates that the prerotation vanes are being controlled by the leaving chilled water temperature (LCWT). This is the normal mode of chiller operation. Thus, if the LCWT is above the setpoint, but pulling down rapidly, the vanes will pulse closed as the LCWT nears the setpoint.

SYSTEM READY TO START

Indicates that the system is not running, but will start upon application of a start signal.

SYSTEM SHUTDOWN – PRESS STATUS

Displayed when chiller is shut down on a cycling shutdown, safety shutdown (operator must move the “**COMPRESSOR**” switch to “**STOP/RESET**” in order to restart) or operator-initiated shutdown (within 30 minutes of initial start-up). The status message consists of the day and time of shutdown, cause of shutdown, and type of restart required. Upon pressing “**STATUS**” key, “System Shutdown Message” will be displayed for 2 seconds and then return to

SYSTEM SHUTDOWN – PRESS STATUS

Display can be held indefinitely by depressing “**DISPLAY HOLD**” key. For examples of “System Shutdown Messages”, see below.

SYSTEM SHUTDOWN MESSAGES

Day of Week Time of Day Cause of Shutdown Type of Restart

MON 10:00 AM – LOW WATER TEMP – AUTOSTART

Chiller was shut down Monday at 10:00AM because the LCWT has decreased to a value that is 4°F below the operator-programmed chilled liquid temperature setpoint. However, if the setpoint is less than 40°F, the chiller will always shut down at 36°F. Further, if the chiller is running and the setpoint is changed, the (Low Water Temperature) cutout will be 36°F for 10 minutes in order to eliminate nuisance trips. Finally, for brine chilling applications, the LWT cutout is always 4°F below the setpoint (The water jumper on the Micro Board must be removed for a brine unit).

MON XX:XX AM – LOW WATER TEMP – VSD – AUTOSTART

Variable Speed Drive has shut down the chiller because the LCWT has decreased to a value that is 4°F below the operator-programmed chilled liquid temperature setpoint. If the chiller is running and the setpoint is increased greater than 4°F, the Variable Speed Drive will initiate a shutdown. The shutdown is caused by LWT contact supplied from the Variable Speed Drive. To cause the Micro Board to monitor the Variable Speed Drive LWT input, the non-Variable Speed Drive jumper on the Micro Board must be removed.

MON XX:XX AM – FLOW SWITCH – AUTOSTART

Chiller is shut down because a chilled-liquid flow switch has opened. The flow switch must open for a minimum of 2 seconds in order to cause a shutdown. The flow switch is checked 25 seconds into “Start Sequence Initiated” and continuously thereafter.

MON XX:XX AM – SYSTEM CYCLING – AUTOSTART

A remote command (computer relay contact or manual switch) connected to the Remote/Local cycling input of the digital input board has shut down the chiller.

MON XX:XX AM – MULTI UNIT CYCLING – AUTOSTART

Lead/Lag sequence control accessory has shut down the chiller.

MON XX:XX AM – POWER FAILURE – AUTOSTART

The chiller is shut down because there has been a power interruption or failure. The chiller will automatically restart when power is restored. This message will be displayed if the Micro Board is configured for “**AUTO RE-START AFTER POWER FAILURE**”. The Micro Board is factory set for manual restart after power failure. To convert it to auto restart after power failure, remove one of the two-pin program jumpers from the cloth bag located inside the Control Center and place it on the terminals labeled “Auto R” (J-60) on the Micro Board.

MON XX:XX AM – POWER FAILURE

The chiller is shut down because there has been a power interruption or failure. When power is restored, the chiller can be restarted by pressing the “**COMPRESSOR**” switch to “**STOP/RESET**” position and then to “**START**” position. This message will be displayed if the Micro Board is configured for “**MANUAL RESTART AFTER POWER FAILURE**”. The Micro Board is factory set for manual restart after power failure. This has been accomplished by removing the two-pin jumper from the terminals labeled “Auto R” (J-60) on the Micro Board.

AC UNDERVOLTAGE – AUTOSTART

The chiller is shut down because the MicroComputer Control Center was in “**RUN**” mode, displaying

SYSTEM RUN – LEAVING TEMP CONTROL

but the motor current was less than 10% FLA for 25 continuous seconds. This is indicative of an AC undervoltage condition that has caused the start relay (1R) in the MicroComputer Control Center to de-energize. This condition is checked when the MicroComputer Control Center goes into “**RUN**” mode (after 30 second pre-lube). This condition can also be caused by failure of any component that would cause a loss of the start signal from the Control Center. In essence, this check assures that the compressor is running when the Control Center is displaying

SYSTEM RUN – LEAVING TEMP CONTROL

If equipped with 3.E or later EPROM. This check is not performed when Micro Board program jumper JP-4 is removed (Steam Turbine applications).

MON XX:XX AM – INTERNAL CLOCK – AUTOSTART

The operator-programmed daily stop schedule has shut down the chiller. The chiller will automatically restart when the operator-programmed daily start schedule initiates a start. It can be overridden by pressing the “**COMPRESSOR**” switch to the “**START**” position.

REMOTE STOP

This message will be displayed when a remote device (typically an Energy Management System) has commanded the chiller to shut down. The chiller will restart upon application of a separate start signal from the remote device. This message will only be displayed when Control Center is in “**REMOTE**” mode.

ANTI-RECYCLE, XX MIN LEFT

The chiller may not restart more frequently than every 30 minutes. Displayed when chiller is shut down and there is time remaining on the anti-recycle timer. In normal operation, chiller cannot be restarted until

ANTI-RECYCLE, 00 MIN LEFT

is displayed. However, when servicing the chiller, it may be desirable to inhibit this 30-minute timer. If so, simply install a jumper plug in the unmarked terminals of the Micro Board directly under Auto Restart jack.

WARNING

Remove this jumper after servicing. Failure to do this voids the Warranty.

MON XX:XX AM – LOW EVAP PRESSURE

The chiller is shut down because the evaporator pressure has decreased to 5.42 PSIA (R11); 4.40 PSIA (R123). The chiller will be allowed to start when the pressure increased to 5.43 PSIA (R11); 4.41 PSIA (R123). To restart chiller, press the “**COMPRESSOR**” switch to the “**STOP/START**” position and then to the “**START**” position.

MON XX:XX AM – LOW EVAP PRESSURE – BRINE

The chiller is shut down because the brine Low Evapo-

rator Pressure (LEP, not included with standard Control Center) safety contacts have opened. The brine LEP safety is located external to the Control Center. Safety cutout settings will vary with the brine application. To restart the chiller, wait until the safety contacts close, press the **"COMPRESSOR"** switch to the **"STOP/RESET"** position and then to the **"START"** position.

MON XX:XX AM – LOW OIL PRESSURE

The chiller is shut down because the oil pressure has decreased to 15 PSID while running, or never achieved 20 PSID prior to compressor start during the oil pump pre-lube run. The chiller will be allowed to restart when the pressure increases to 20 PSID. Differential pressure is sensed by two pressure transducers. To restart chiller, press **"COMPRESSOR"** switch to **"STOP/RESET"** position and then to the **"START"** position.

MON XX:XX AM – HIGH PRESSURE

The chiller is shut down because condenser pressure has increased to 15 PSIG (29.7 PSIA). System will be allowed to restart when pressure decreases to 9 PSIG (23.7 PSIA). Pressure is sensed by a High Pressure (HP) safety control that is located on a mounting bracket above the oil-pump starter located on the condenser near the purge unit. This message is prompted by the opening of the HP safety control contacts. To restart chiller, press **"COMPRESSOR"** switch to the **"STOP/RESET"** position and then to the **"START"** position.

MON XX:XX AM – EVAP TRANS OR PROBE ERROR

The chiller is shut down because the leaving chilled water temperature minus the evaporator saturation temperature is outside the range of -2.5°F to +25°F continuously for 10 minutes. To restart the chiller, press **"COMPRESSOR"** switch to **"STOP/START"** position and then to **"START"** position. On Brine applications (program jumper JP-3 removed), this check is no longer performed when the evaporator transducer is reading a pressure below its "out-of-range" threshold.

MON XX:XX AM – MOTOR CONTROLLER – EXT. RESET

The chiller is shut down because a current module (CM-2 Electro-Mechanical starter application), or the YORK Solid State Starter, or Variable Speed Drive initiated a shutdown. To restart system, reset the external device that caused the shutdown. The chiller will automatically restart.

NOTE: The following motor controller shutdowns do not require an external reset to restart the chiller.

1. Variable Speed Drive - over-current, repeat trip, over-temperature.

2. Solid State Starter - power fault, 110°F start inhibit, phase rotation/loss, out of lock.
3. Current Module - power fault.

MON XX:XX AM – POWER FAULT – AUTOSTART

The chiller is shut down because of a Solid State Starter or current module (CM-2 Electro-Mechanical starter application) "Power Fault" shutdown. The chiller will automatically restart. This function is sensed by the motor controller input to the digital input board. A power-fault shutdown is initiated by the motor controller contacts (CM-1) opening and reclosing in one second.

MON XX:XX AM HIGH DISCHARGE TEMP

The chiller is shut down because the discharge temperature has increased to 220°F. The system will be allowed to restart when the temperature has decreased to 219°F. Temperature is sensed by a thermistor RT2. To restart the chiller, press **"COMPRESSOR"** switch to **"STOP/RESET"** position and then to the **"START"** position.

MON XX:XX AM HIGH OIL TEMP

The chiller is shut down because the oil temperature has increased to 180°F. The system will be allowed to restart when the temperature decreases to 179°F. The temperature is sensed by a thermistor RT3. To restart the chiller, press **"COMPRESSOR"** switch to **"STOP/RESET"** position and then to the **"START"** position.

MON XX:XX AM – OIL PRESSURE TRANSDUCER

Chiller is shut down because to oil pressure has increased to 60 PSID. The chiller will be allowed to restart when the oil pressure decreases to 59 PSID. Pressure is sensed by two oil-pressure transducers that are sensing low and high sump pressure. This safety shutdown is provided primarily as a check on the oil pressure transducers. Display of this message is generally indicative of a defective transducer or interface. To restart the chiller, press **"COMPRESSOR"** switch to **"STOP/RESET"** position and then to the **"START"** position.

VANE MOTOR SWITCH OPEN

Chiller is shut down because a system-start sequence has been initiated, but the prerotation vanes are not fully closed.

MON XX:XX AM – STARTER MALFUNCTION DETECTED

The chiller is shut down because the Control Center has detected a motor-current value greater than 15%

FLA for 10 seconds minimum anytime when the compressor-start signal is not energized. To restart the chiller, press “COMPRESSOR” switch to “STOP/RESET” a position and then to the “START” position.

MON XX:XX AM – PROGRAM INITIATED RESET

The chiller is shut down because the Micro Board did not receive a hardware-generated interrupt on schedule. Typical is an Analog/Digital Converter interrupt. This message is indicative of a Micro Board hardware failure or electrical noise on Micro Board. The chiller will automatically restart. This message indicates that the watchdog timer-circuit has reset the microprocessor. This occurs when the time needed to step through program is longer than allowable, thus the software program is initialized at the beginning.

SYSTEM READY TO START – PRESS STATUS

The chiller was shut down on a safety shutdown and will start upon application of a local or remote start signal. Since the message states that the chiller is “Ready to Start”, it means that the condition that caused the shutdown no longer exists and the Control Center has been manually reset. When the “STATUS” key is pressed, a message is displayed that describes the reason for shutdown. The message will be displayed for 2 seconds and then return to

SYSTEM READY TO START – PRESS STATUS

Those messages that could be displayed are any of the previously described safety-shutdown messages or warning messages. They can be cleared from the display by entering “Service” mode and pressing “WARNING RESET” key. Or, the message will be cleared by initiating a compressor start.

START SEQUENCE INITIATED

Indicates that the Micro Board has received a local or remote start signal and has initiated the chiller start-up routine. This is the compressor pre-lube period. The duration of this period is controlled by the “Prerun” (JP-6) wire jumper on the Micro Board as follows:

| FUNCTION | Jumper Position |
|---------------------------|-----------------|
| 30 SEC. OIL PUMP RERUN | INSTALLED |
| *180 SEC. OIL PUMP RETURN | CUT |

* Only used on YDTK 131-144 “F” compressors.

SYSTEM COASTDOWN

Displayed while motor is decelerating after a chiller shut down. The oil pump is running during this period. The duration of this period is controlled by the “CSTDN” (JP-4) wire jumper on the Micro Board as follows:

| FUNCTION | Jumper Position |
|--------------------|-----------------|
| 150 SEC. COASTDOWN | INSTALLED |
| * 6 MIN. COASTDOWN | CUT |

* Use on steam turbine applications only.

MON XX:XX AM – MTR PHASE CURRENT UNBALANCE

(Solid State Starter Applications Only)

The chiller is shut down because the compressor-motor current was unbalanced while the chiller was running. The current balance is only checked after the motor has been running for a minimum of 45 seconds and the motor current is 80% FLA or greater. If the current in any phase deviates from the average $\frac{a+b+c}{3}$ current by greater than 30% for a minimum of 45 consecutive seconds, a shutdown is initiated. To restart the system, press the “COMPRESSOR” switch to “STOP/RESET” position and then to the “START” position. An example of the conditions for shutdown is as follows:

If

$$I_{\phi A} = 200A$$

$$I_{\phi B} = 200A$$

$$I_{\phi C} = 118A$$

Then

$$I_{AV} = \frac{200 + 200 + 118}{3}$$

$$I_{AV} = 173A$$

$$I_{ACCEPTABLE} = 173 \pm 30\% = 121A \text{ or } 225A$$

Therefore
 Since $I_{\phi C} = 118A$ which is less than the acceptable 121A, the chiller would shut down if this unbalance exists for 45 consecutive seconds.

MON XX:XX AM – LOW LINEVOLTAGE

(Solid State Starter Applications Only)

Chiller is shut down because the voltage in any phase of line voltage has decreased below the under-voltage-shutdown threshold for 20 consecutive seconds, or failed to achieve the minimum required starting line-voltage. Refer to explanation under “System Setpoints - SSS Motor Current/Volts”, page 8. The system will automatically restart when all phases of line voltage increase to the minimum required starting voltage.

MON XX:XX AM – HIGH LINEVOLTAGE

(Solid State Starter Applications Only)

Chiller is shut down because the voltage in any phase of line voltage has increased above the over-voltage threshold for 20 consecutive seconds. Refer to explanation under “System Setpoints - SSS Motor Current/ Volts”, page 8. The system will automatically restart when all phases of line voltage decrease to the maximum allowable line voltage to start the chiller.

MON 09:30 AM LOW OIL TEMPERATURE – AUTOSTART

Whenever the oil temperature falls below 55°F, or the oil temperature sensor is disconnected from the Micro Board, the preceding message will appear. The system will automatically restart when the display indicates 71°F.

MON XX:XX AM FAULTY DISCHARGE TEMP SENSOR

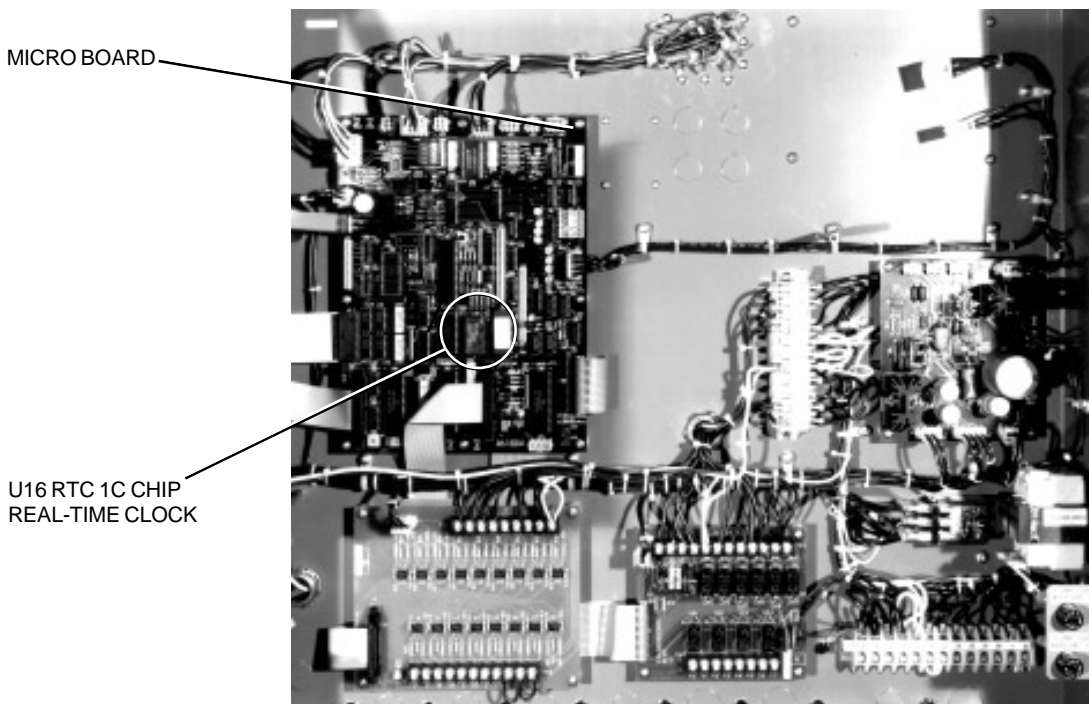
Whenever the discharge temperature falls below 32°F, or the discharge temperature sensor is disconnected from the Micro Board, the preceding message will appear. To restart the system when the discharge temperature rises or the sensor has been connected, press the “COMPRESSOR” switch to the “STOP/RESET” position and then to the “START” position.

MON XX:XX AM – AUX SAFETY SHUTDOWN

The system is shut down because an external device, connected to digital input board TB1-31 (Aux Safety Shutdown Input), has initiated a system shutdown. This input is a general purpose input that can be used to annunciate a user-defined safety shutdown. To restart chiller, press “COMPRESSOR” switch to “STOP/RESET” position and then to the “START” position.

REPLACE RTC, U16 – REPROGRAM SETPOINTS

Indicates that the battery located inside the **REAL-TIME CLOCK** IC Chip (U16 on the Micro Board) is defective. This battery provides back-up power to the RTC memory (RAM) in the event of a utility AC power failure. This assures the system setpoints will be maintained. If this message appears, the RTC IC Chip (U16) on the Micro Board must be replaced. If there had been a power failure while this message is displayed, the setpoints will have been lost and must be reprogrammed. Order a replacement RTC IC Chip (YORK part number 031-00955-000) from the YORK Parts Distribution Center. With AC power removed from system, locate RTC Chip U16 on the Micro Board and remove existing RTC Chip from socket and discard. Observe anti-static precautions and install new RTC Chip in socket. Assure proper IC orientation - orientation notch must be UP. (Refer to Fig. 16)



24673A

FIG. 16 - MICROCOMPUTER CONTROL CENTER - INTERIOR -WITH PANEL OPEN - LOCATION OF REAL TIME CLOCK U16 RTC IC CHIP

SECTION 3 SYSTEM OPERATING PROCEDURES

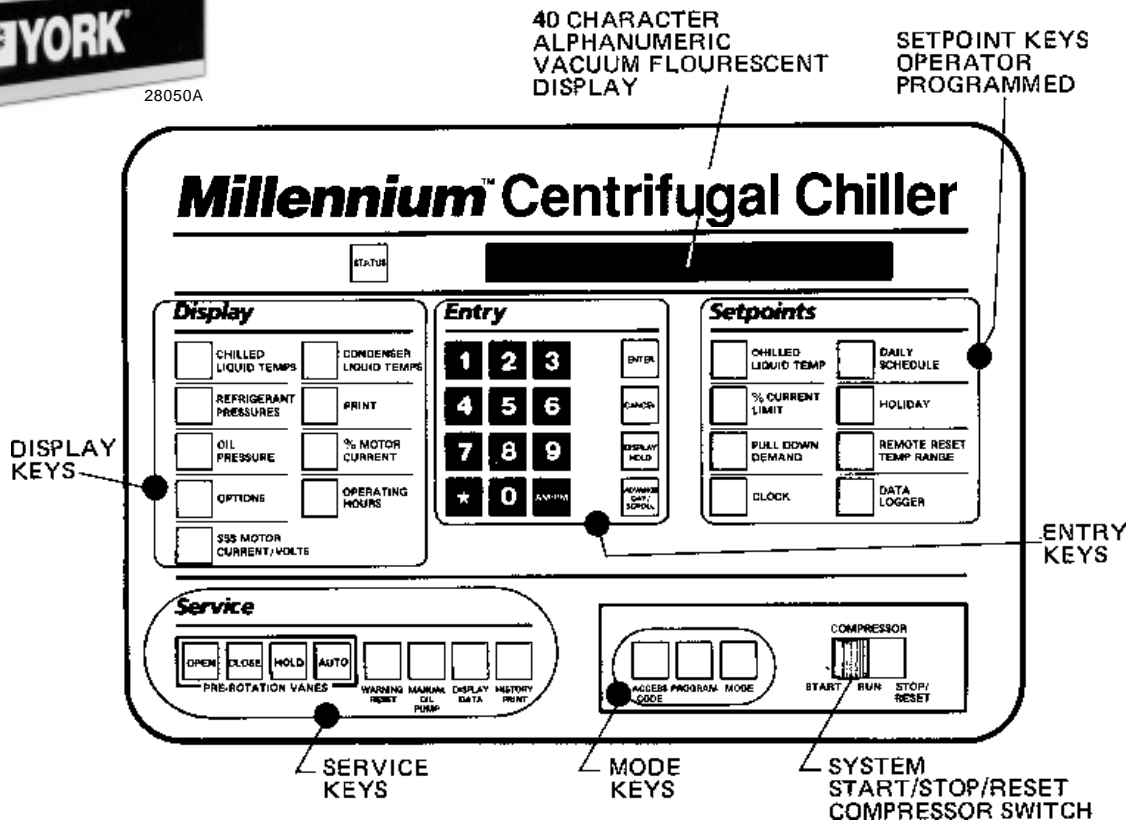


FIG. 17 - MICROCOMPUTER CONTROL CENTER AND KEYPAD

LD00457

WARNING

OIL HEATERS

If the oil heater is de-energized during a shut-down period, it must be energized for 12 hours prior to starting compressor, or remove all oil and recharge compressor with new oil. (See "Oil Charging Procedure", page 44.)

NOTE: The oil heater is thermostatically controlled and remains energized as long as the fused disconnect switch to the starter or Variable Speed Drive 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 "Oil Charging Procedure", page 44.)

START-UP PROCEDURE

Pre-Starting

Prior to starting the chiller observe the MicroComputer Control Center. Make sure the display reads

SYSTEM READY TO START

To pre-start the chiller use the following procedure:

1. **OIL HEATER** - The oil heater must be energized for 12 hours prior to starting the chiller. The unit will not start if the oil is less than 71°F. If not possible the compressor oil should be drained and new oil must be charged into the oil sump. (See "Oil Charging Procedure", page 44.)
2. **OIL PUMP** - To check, press and release the "**MANUAL OIL PUMP**" key under "**Service**" on the Control Center. The oil pump will run for 10 minutes and shut down. Press and release the "**MANUAL OIL PUMP**" key to stop the operation of the oil pump for less than 10 minutes of operation.
3. **PREROTATION VANES** - To perform this test the starter interlock terminals 3 and 4 must be jumpered to allow vanes to open (remove the jumper after test). Make sure the Control Center is in the "**SERVICE**" mode, then press the prerotation vanes "**OPEN**" and "**CLOSE**" keys to observe the operation of the prerotation vanes. The Control Center supplies a signal to operate the prerotation vanes. The movement of the vanes will be displayed on the control center. The display readout is active whenever power is supplied to the control center. Return from the "**Service**" mode to "**Local**", "**Program**", or "**Remote**" mode to suit the method of operation selected for the chiller application. On Variable Speed Drive units, the vanes may be manually controlled by a switch on the capacity board in the logic box. Thus, the keypad vane control keys are non-functional on Variable Speed Drive units.
4. **% CURRENT LIMIT** - Press the "**% CURRENT LIMIT**" setpoint key on the Control Center. The display should read

CURRENT LIMIT = 100% FLA

On Solid State Starter units only, the display is

CURRENT LIMIT = 100% FLA, MTR CUR = XXXX FLA

if the Control Center was not programmed. If the setpoint is not 100% and was predetermined for the job application the Control Center should be programmed to that specification.

5. All Control Center setpoints should be programmed before the chiller is started. Prior to start, the clock

must be programmed for the proper day 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 12:00A.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 chiller to start unless chilled liquid flow is established through the unit. (A field supplied 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 chiller, 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 chiller.) 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. 17)

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

When the chiller is shut down, the prerotation vanes will close automatically to prevent loading the compressor on start-up. When the prerotation vanes are fully closed the display will read

SYSTEM READY TO START - VANES CLOSED

when in "**SERVICE**" mode. When the chiller starts to operate, the following automatic sequences are initiated: (Refer to Fig. 18, "Chiller Starting & Shutdown Sequence".)

1. The MicroComputer Control Center alphanumeric display message will read

START SEQUENCE INITIATED

for the first 30 seconds of the starting sequence. (3 min. if Micro Board JP-6 removed)

2. The compressor vent line solenoid valve will open after the first 5 minutes of unit operation. The solenoid will close automatically after the compressor shuts down.

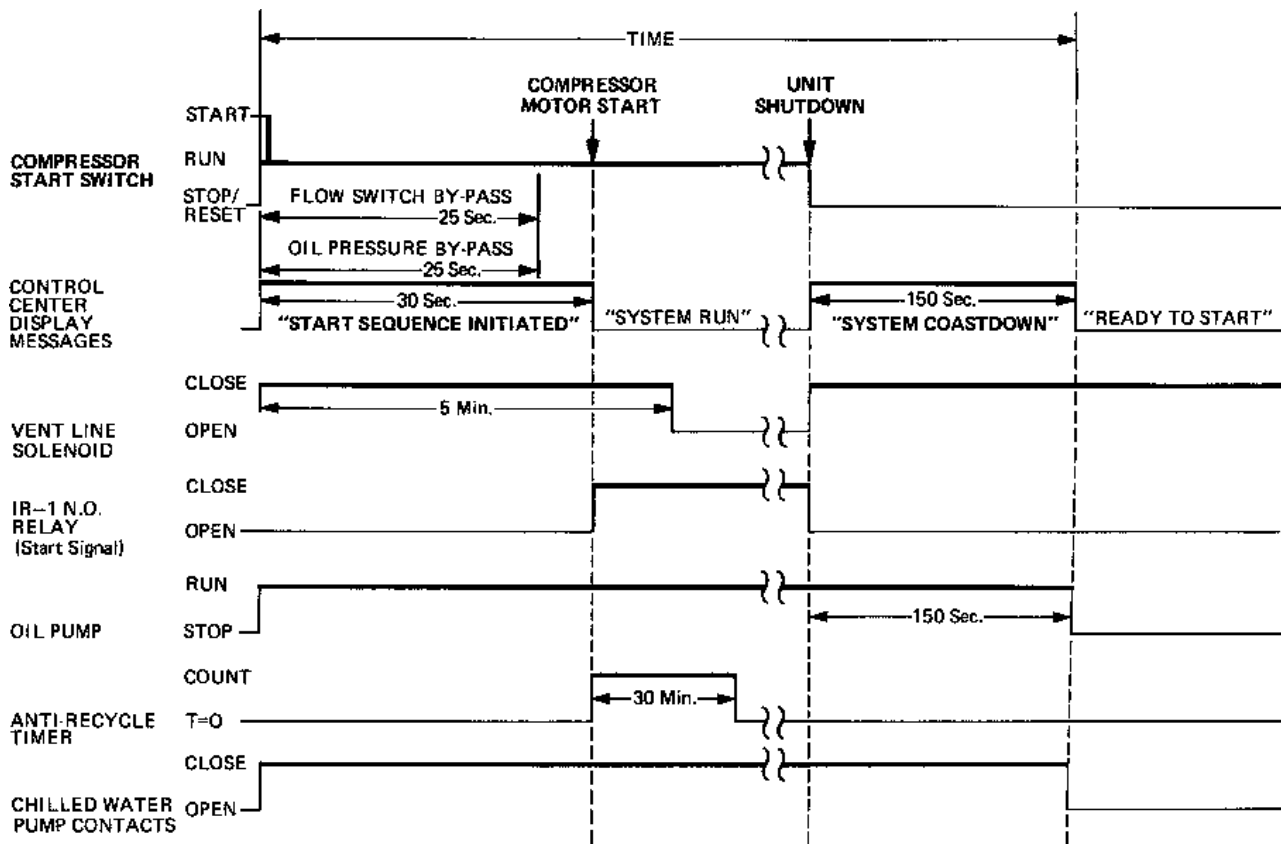


FIG. 18 - CHILLER STARTING SEQUENCE & SHUTDOWN SEQUENCE

LD00465

3. The 1R-1 contacts of the 1R start relay will remain open for the first 30 seconds of oil pump operation. These contacts will close, starting the compressor motor and the condenser water pump at the end of the 30 second period.
4. The oil pump will start to circulate oil for a 30 second pre-run to establish oil flow and adequate lubrication to all bearings, gears, and rotating surfaces within the compressor.

The high and low oil pressure transducers (OP) 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 PRESSURE

DAY 10:30 AM - LOW OIL TEMP - AUTOSTART

DAY 11:30 AM - OIL PRESSURE 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 af-

ter the compressor starts. If the chiller shuts down during this period of time it cannot be started until the timer completes the 30 minute cycle.

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 the first 30 seconds of 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

Chiller OPERATION

After the compressor reaches its operating speed the prerotation vanes will begin to open under the control of the micro processor board or the logic section of the Variable Speed Drive which senses the leaving chilled liquid temperature. The unit capacity will vary to main-

tain the leaving chilled liquid temperature setpoint. The prerotation vanes are modulated by an actuator under the control of the microprocessor board or logic section of the Variable Speed Drive. The vane control routine employs proportional plus derivative (rate) control action. A drop in chilled liquid temperature will cause the actuator to close the prerotation vanes (and also decreases the speed of the motor if equipped with a Variable Speed Drive) to decrease chiller capacity. When the chilled liquid temperature rises, the actuator will open the prerotation vanes and increase the compressor motor speed of the chiller (if controlled by the Variable Speed Drive), to increase the capacity of the unit.

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 MicroComputer Control Center 40 to 100% three phase peak current limit software function, plus the 3 phase 100% solid state overload current limiter (CM-2) on Electro-Mechanical Starter applications or the solid state starter current limit function will override the temperature control function (or the logic section of the Variable Speed Drive) and prevent the prerotation vanes from opening beyond the “% **CURRENT LIMIT**” setting.

If the load continues to decrease, after the prerotation vanes are entirely closed, the chiller 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

- or -

MON 03:50 PM – LOW WATER TEMPERATURE – VSD 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 or the capacity control board (part of the logic section of the Variable Speed Drive).

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

Condenser Water Temperature Control

The YORK Millenium chiller is designed to use less power by taking advantage of lower than design temperatures that are naturally produced by cooling towers throughout the operating year. Exact control of condenser water, such as a cooling tower bypass, is not necessary for most installations. The chiller requires only that the minimum condenser water temperature be no lower than the value determined by referring to Fig. 19.

At start-up the entering condenser water temperature may be as much as 25°F colder than the standby return

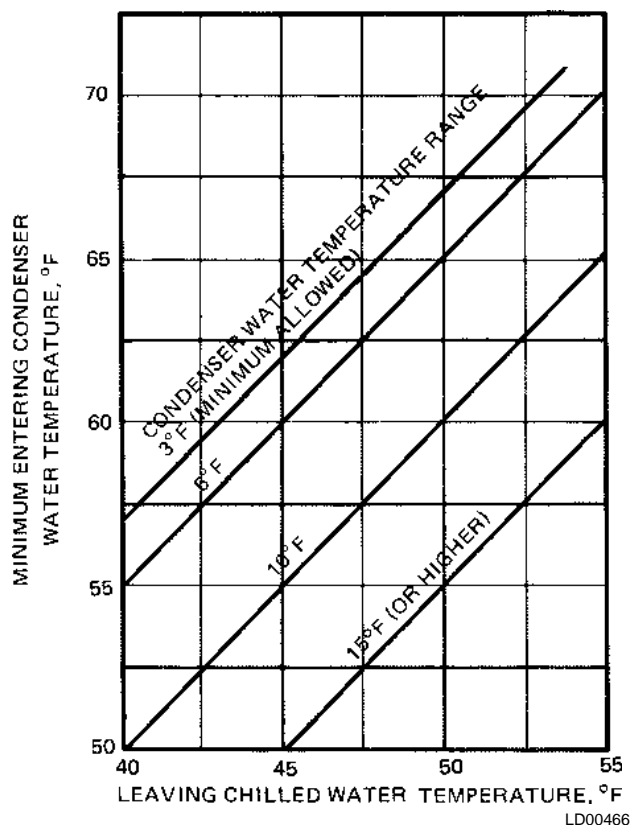


FIG. 19 - MINIMUM ENTERING CONDENSING WATER TEMPERATURE

chilled water temperature. Cooling tower fan cycling will normally provide adequate control of the entering condenser water temperature on most installations.

CHECKING OPERATION

During operation, the following conditions should be periodically checked:

1. On starting, the prerotation vanes should remain closed.
2. Be sure the oil pump is operating while unit is running.
3. Check Oil Pressure display. A gradual decrease in bearing oil 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% or more 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.

YORK
Maintenance & Energy Services

LIQUID CHILLER LOG SHEET

Chiller Location _____
System No. _____

| | |
|----------------------------|------------------------------------|
| * Date | |
| * Time | |
| Hour Meter Reading | |
| O.A. Temperature O.B./W.B. | |
| Compressor | * Oil Level |
| | * Oil Pressure |
| | * Oil Temperature |
| | * Suction Temperature |
| | * Discharge Temperature |
| PRV % Open | |
| Motor | * Volts |
| | * Amps % FLA |
| Refrig. | * Section Pressure |
| | * Inlet Temperature |
| | * Inlet Pressure |
| Cooler | * Outlet Temperature |
| | * Outlet Pressure & (SAT TEMP) |
| | * Flow Rate—GPM |
| Condenser | * Discharge Pressure |
| | * Corresponding Temp & (SAT TEMP) |
| | * High Pressure Liquid Temperature |
| | * System Air—Degrees |
| | * Inlet Temperature |
| Water | * Inlet Pressure |
| | * Outlet Temperature |
| | * Outlet Pressure |
| * Flow Rate—GPM | |

Remarks: _____

YORK
Maintenance & Energy Services

LIQUID CHILLER LOG SHEETS

... an Energy-Saving approach to your Service needs ...

FORM 160.44-F6



LD00467

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*NOTE: These items can be printed by an electronic printer connected to J-11 of the Micro Board and pressing the PRINT key on the Micro Board or automatically using the Data Logger feature.

FIG. 20 - LIQUID CHILLER LOG SHEETS - FORM 160.44-F6

An optional status printer is available for this purpose or Fig. 20 shows a log sheet used by YORK personnel for recording test data on chillers. It is available from the factory in pads of 50 sheets each under Form No. 160.44-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 146.48-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 (See Section 2)

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

Daily

1. Check MicroComputer Control Center displays.

2. If the compressor is in operation, check the bearing oil pressure by pressing "**OIL PRESSURE**" 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 LIQUIDTEMPERATURES**" display key.
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 LIQUIDTEMPS**" key and the "**Refrigerant Pressures**" key.
5. Check the condenser saturation temperature (based upon condenser pressure sensed by the condenser transducer). Press the "**DISPLAY DATA**" key. This key may be depressed repeatedly after depressing the "**Display Hold**" key to display three different parameters.
6. Check the compressor discharge temperature. Press "**Display Data**" key. During normal operation discharge temperature should not exceed 220°F.
7. Check the compressor motor voltage and current

(amps) at E-M starter (or Variable Speed Drive), 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. If the chiller is controlled by a YORK Variable Speed Drive, check the operating lights on the logic section. (Refer to 160.00-O1)
11. Press the **"STATUS"** key whenever the display indicates so. This allows any warning messages to be displayed, such as **"EXCESS PURGE"**, **"HIGH PURGE PRESSURE"**, **"REPROGRAM SETPOINTS"**, etc.

Weekly

1. Check the refrigerant charge. (See "Checking the Refrigerant Charge", page 55)

Quarterly

1. Change the purge unit dehydrator at least quarterly, or more often if required.
2. Clean purge foul gas strainer.
3. Perform chemical analysis of oil.
4. Clean water strainer on VSD (if equipped).

Semi-Annually (or more often as required.)

1. Change and inspect compressor oil filter element.
2. Oil return system
 - a. Change dehydrator.
 - b. Check nozzle of eductor for foreign particles.
3. Check controls and safety cutouts.
4. Check level of coolant if equipped with SSS or VSD.

Annually (more often if necessary.)

1. Drain and replace the oil in the compressor oil sump (See "Oil Charging Procedure", page 44).
2. Cooler and Condenser
 - a. Inspect and clean water strainers.
 - b. Inspect and clean tubes as required.
 - c. Inspect end sheets.
 - d. Backflush heat exchanger on VSD (if equipped).
3. Compressor Drive Motor (See motor manufacturer's maintenance and service instruction supplied with unit)
 - a. Clean air passages and windings per manu-

facturer's instructions.

- b. Meg motor windings - See Fig. 30 for details.
- c. Relubricate ball bearings.

CAUTION: *Don't overlook motor drive end bearing located in motor support of F1, F2 compressors.*

4. Purge unit.
 - a. Clean and inspect all valves.
 - b. Drain and flush purge shell.
 - c. Clean orifices.
5. Inspect and service electrical components as necessary.
6. Perform chemical analysis of system.

Every Two Years

1. If unit is equipped with SSS or VSD, flush cooling circuit and replace with new coolant solution, York Part # 013-04129-000.

NEED FOR PURGING THE SYSTEM

To assure satisfactory operation, it is important that these systems be kept free of moisture laden air and noncondensable gases. Air in the system usually collects in the condenser, blanketing some of the condensing surface, causing the discharge pressure and temperature to rise, resulting in high operating cost, and possibly surging, or shutdown of system by high pressure cutout. Moisture in the system causes acid formation which is destructive to internal system parts.

A Turboguard purge unit is furnished and mounted at the rear of the system (See Fig. 21). The purpose of

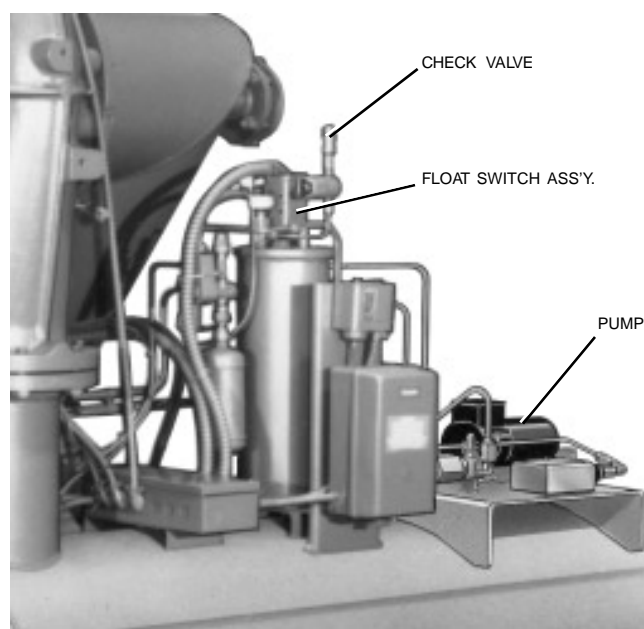


FIG. 21 - TURBOGUARD PURGE UNIT

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this unit is to automatically remove the mixture of noncondensable gases and refrigerant from the top of the condenser, expel the noncondensables to the atmosphere and return the refrigerant to the system.

IMPORTANT

The purge unit operates continuously when the system is in operation.

The Turboguard purge unit includes a display message on the control center display. The message reads

WARNING: EXCESS PURGE

if an excessive air leak is present within the chiller. The **“WARNING RESET”** should be pushed with the Control Center in **“Service”** mode to reset the display. Leak check and correct the leak if the display continues to show this message.

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 Table 2, “Operating Analysis Chart” (pages 50 and 51) of this instruction manual. 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 chiller 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, and low and high pressures, etc. Table 1 is an explanation of each specific shutdown. If the chiller 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 are displayed. Safety shutdowns require the operator to manually reset the Control Center prior to restarting the chiller. When the display reads “Start Sequence Initiated” the cause of the safety shutdown is automatically cleared from the 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 Temperature
- High Oil Temperature
- Oil Pressure Transducer
- Starter Malfunction Detected
- Faulty Discharge Temperature
- Sensor Aux. Safety Shutdown
- Motor Phase Current Unbalance (Solid State Starter Unit only)
- VSD Shutdowns (See Form 160.00-O1)

If the chiller 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 restarting the chiller. The chiller will automatically restart when the cycling condition is removed.

CYCLING SHUTDOWNS

- Power Failure (If auto restart programming jumper is installed on the Micro Board)
- Low Water Temperature
- 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, the logic board of the SSS or VSD may be required)
- Power Fault
- Low Oil Temperature
- Program Initiated Reset
- AC Undervoltage
- Low Line Voltage (Solid State Starter Units only)
- VSD Shutdowns (See Form 160.00-O1)

STOPPING THE SYSTEM (See Fig. 4)

The MicroComputer Control Center can be programmed to start and stop automatically (maximum, once each day) whenever desired. Refer to Section 2. To stop the chiller proceed as follows:

1. Push the compressor switch to **“STOP/RESET”**. The Control Center display will show

SYSTEM COASTDOWN

for 150 seconds (6 min. if Micro Board jumper JP-4 removed). The compressor, condenser water, and cooling tower fans will stop automatically. The oil pump will continue to run for a period of 150 seconds. The oil pump will then stop automatically. Once stopped, the

SYSTEM COASTDOWN

display will be replaced by

SYSTEM READY TO START

2. Stop the chilled water pump (if not wired into the Microcomputer Control Center, in which case it will shut off automatically simultaneously with the oil pump.) (The actual water pump contact operation is dependent upon the position of Micro Board jumper J-54.)
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 chiller 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. After the system pressure has risen above atmospheric, test all system joints for refrigerant leaks with a leak detector. If equipment room is below 70°F, circulate hot water (not to exceed 100°F) through the cooler tubes to raise the system pressure. If any leaks are found, they should be repaired before allowing the system to stand for a long period of time.

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 a Variable Speed Drive, drain its water cooling system. If Solid State Starter, drain water from starter cooling loop. Isolate the Turboguard purge unit from the main system.)
3. Isolate the Turboguard purge unit from the main system.
4. 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.
5. 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 compressor. Install a new filter element and charge compressor with fresh oil. Replace purge unit and oil return filters. 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 compressor sump oil heater for at least 12 hours.
2. Operate the "Oil Pump" (press and release the manual oil pump key) until steady oil pressure is established. Then press and release the "Oil Pump" key to stop operation of the oil pump. If the water systems were drained fill the condenser water circuit and chilled liquid circuit.

SECTION 4 SYSTEM COMPONENTS DESCRIPTION - COMPRESSOR/MOTOR ASSEMBLY

CASING - The casing is accessible with vertical circular joints and fabricated of close-grain cast iron. The motor assembly is completely removable from the compressor rotor and scroll assembly. Compressor castings are designed for 15 PSIG working pressure and hydrostatically pressure tested at 50 PSIG.

COMPRESSOR - The rotor assembly consists of a heat treated alloy steel drive shaft (integral with pinion gear) and a lightweight, high strength, fully shrouded cast

aluminum impeller. The impeller is designed for balanced thrust. The impeller is dynamically balanced to insure vibration free operation and is overspeed tested for safety.

BEARINGS - Insert type journal and thrust bearings are fabricated of aluminum alloy and are precision bored and axially grooved.

INTERNAL GEARS - Single helical gears with crowned teeth are employed so that more than one tooth is in contact at all times to provide even distribution of the

compressor load with quiet operation. Gears are integrally assembled in the compressor rotor support and are oil film lubricated. Each gear is individually mounted in journal bearings with individual thrust bearings to insure proper balance of forces from the impeller and motor.

LUBRICATION SYSTEM - YORK lubricating oil is forced to all bearings and filtered by an externally mounted 15 micron replaceable cartridge oil filter equipped with service valves. An automatic oil recovery system returns oil to the compressor that has migrated into the refrigerant system. Heat is removed from the oil by a refrigerant-cooled oil cooler, located in the evaporator. All oil piping is completely factory-installed and tested. A thermostatically controlled heater is supplied in the oil reservoir to limit the amount of refrigerant absorbed by the oil when the compressor is not operating.

Oil (under pressure) is supplied from the oil reservoir by an internally-mounted submersible oil pump. Oil Pump motors are available in 208 through 600V-3Ph-60/50Hz to match the application and are supplied complete with starter and current sensing overloads for extra protection. The oil reservoir heater is 1000 watts, 115V-1Ph-60/50Hz immersion type. A separate three phase power supply is required except when ordered with a YORK Solid State Starter or Variable Speed Drive. A gravity flow oil reservoir is provided to feed the bearings and gears during coast down in the event of a power failure.

CAPACITY REDUCTION - Prerotation vanes (PRV) modulate the unit capacity from 100% to 10% of design, on normal air conditioning jobs. The prerotation vanes are airfoil-shaped and made of manganese bronze. An external, electric PRV operator automatically controls the vane position through a simple, reliable linkage.

SHAFT SEAL - The compressor drive shaft seal consists of a spring-loaded, precision lapped carbon ring, high temperature elastomer "O" ring static seal, and stress-relieved, precision lapped cast iron collar. The seal features a small face area and low rubbing speed. It provides an efficient seal under both vacuum and pressure conditions. The seal is oil-flooded at all times and is pressure-lubricated during compressor operation.

OPEN MOTOR - The 3600 RPM open motor is a drip-proof, squirrel cage, induction type constructed to YORK design specifications by nationally-known manufacturers. Standard low voltage (208 through 600V-3Ph-60/50Hz) motors are available for full-voltage (across-the-line) or reduced-voltage (solid state, star delta or auto transformer) starting. Standard high voltage (2300 through 4160V-3Ph60/50Hz) motors are available for full-voltage (across-the-line) or reduced-voltage (primary reactor or auto transformer) starting. Open close coupled motors are built with a cast iron adapter flanged between the motor and compressor. This unique design allows the motor to be coupled to the compressor.

MOTOR TERMINAL BOX - The casing is fabricated of heavy gauge steel. There are six terminals (three for

high voltage) in the terminal box. Provisions are furnished for 208 through 600 volts for three-lead types of starting (solid state, across-the-line, and auto transformer). Motor terminal lugs are furnished with the YORK Current Guard Starter and the Variable Speed Drive mounted in the power section. Overload/overcurrent transformers (CT's) are furnished as listed below; in motor terminal box, as follows:

| Application | #CT's Furnished in Motor Terminal Box |
|-------------|---------------------------------------|
| E-M STARTER | 3 |
| SS STARTER | 0 |
| VS DRIVE | 0 |

COMPRESSOR LUBRICATION SYSTEM

The chiller lubrication system consists of the oil pump, oil filter, oil cooler and all interconnecting oil piping and passages. (See Fig. 22) There are seven main points within the motor-compressor which must be supplied with forced lubrication as follows:

1. Compressor Drive Shaft (Low Speed)
 - a. Shaft seal.
 - b. Front and rear journal bearings - one on each side of driving gear.
 - c. Low speed thrust bearing (forward and reverse).
2. Compressor Driven Shaft (High Speed)
 - a. Forward and reverse high speed thrust bearing.
 - b. Three journal bearings (YDTJ67 through 95 and YDTL108 through 126). Two journal bearings (YDTL131 and 144).
3. Speed Increasing Gears
 - a. Meshing surfaces of drive and pinion gear teeth.

To provide the required amount of oil under the necessary pressure to properly lubricate these parts, a motor driven submersible oil pump is located in a remote oil sump.

Upon pressing of the "**Compressor Start**" switch on the control center, the oil pump is immediately energized. After a 30 second delay to allow the system oil pressure to stabilize, the compressor motor will start. The oil pump will continue to run during the entire operation of the compressor, and for 150 seconds during compressor coastdown.

The submerged oil pump takes suction from the surrounding oil and discharges it to the oil cooler where heat is rejected. The oil flows from the oil cooler to the oil filter. The oil leaves the filter and flows to the emergency oil reservoir where it is distributed to the compressor bearings. The oil lubricates the compressor rotating components and is returned to the oil sump.

Since the emergency oil reservoir is at the highest point in the lubrication system, it provides an oil supply to

the various bearings and gears in the event of a system shutdown due to power failure. The reservoir, located on the top of the compressor, allows the oil to be distributed through the passages by gravity flow, thus providing necessary lubrication during the compressor coastdown.

OIL PUMP

For normal operation the oil pump should operate at all times during the chiller operation. Manual pump operation may be used to establish stable oil pressure before starting. When depressed and released, the "**Manual Oil Pump**" key will operate the oil pump for 10 minutes and then automatically shut off. To stop the oil pump sooner, depress the "**Manual Oil Pump**" key again.

On shutdown of the system for any reason, the oil pump operates and continues to run for 150 seconds. The system cannot restart during that time interval.

OIL HEATER

During long idle periods, the oil in the compressor oil reservoir tends to absorb as much refrigerant as it can hold, depending upon the temperature of the oil and the pressure in the reservoir. As the oil temperature is lowered, the amount of refrigerant absorbed will be increased. If the quantity of refrigerant in the oil becomes excessive, violent oil foaming will result as the pressure within the system is lowered on starting. This foaming is caused by refrigerant boiling out of the oil as the pressure is lowered. If this foam reaches the oil pump suction, the bearing oil pressure will fluctuate with possible temporary loss of lubrication, causing the oil pressure safety cutout to actuate and stop the system. See Section 2.

To maintain the lowest possible concentration of refrigerant in the oil, the compressor oil reservoir is equipped with a 115 volt electric reservoir oil heater. The oil heater is thermostatically controlled at all times during compressor shutdown to maintain the sump oil at 135°F to 145°F. If the oil temperature falls below 55°F, the display will read

SYSTEM SHUTDOWN – PRESS STATUS

Pressing the "**STATUS**" key causes the message to read

DAY 10:00 AM – LOW OIL TEMP – AUTOSTART

The system will be allowed to automatically restart when oil temp rises to 71°F.

SHELLS - The cooler and condenser shells are rolled carbon steel plate with fusion welded seams. A thick tube sheet is welded to each end of the shell and is drilled and reamed to accommodate the tubes. All shells have a design working pressure of 15 PSIG and are pressure-tested at 30 PSIG.

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 (300 PSI has flanges). 1/2" coupling and separable well are located in the entering and leaving chilled liquid nozzles for temperature sensing elements. Plugged 1/2" or 3/4" 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 distribute refrigerant. Intermediate steel tube supports are spaced at intervals of less than four feet. Highly efficient, aluminum mesh eliminators are located above the tube bundle to prevent liquid refrigerant carryover into the compressor.

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 efficient elimination of noncondensibles. Intermediate steel tube supports are spaced at intervals of less than four feet.

REFRIGERANT FLOW CONTROL - The flow control chamber is welded to the bottom of the condenser to allow complete drainage of liquid refrigerant from the condenser. The chamber contains a single fixed-orifice flow control with no moving parts.

BURSTING DISC - A 2" or 3" frangible carbon bursting disc relief device is located in the compressor suction line.

CONTROL CENTER (See Section 2)

A microprocessor based Control Center is factory mounted, wired and tested on each 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 use.

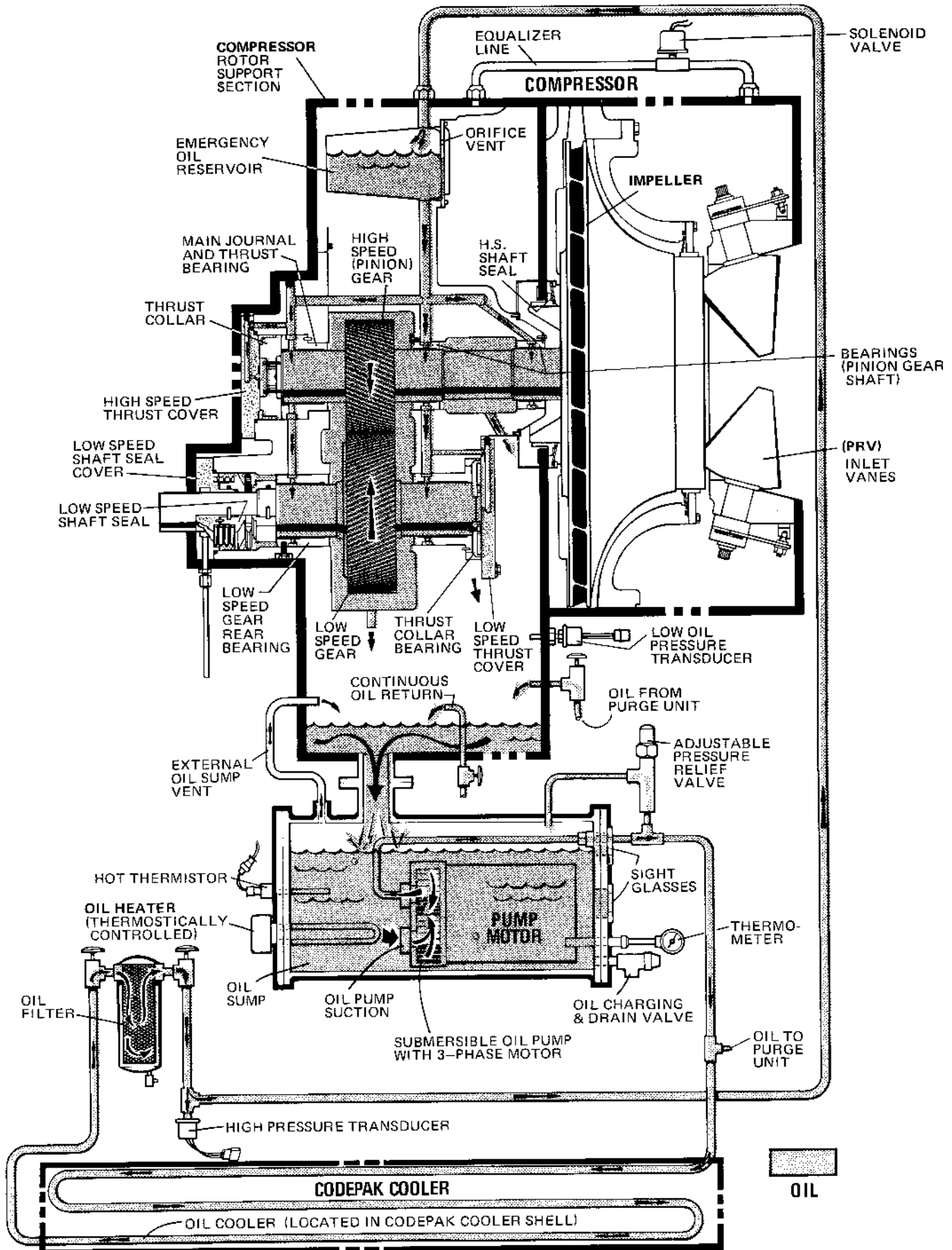


FIG. 22 - SCHEMATIC DRAWING - YT COMPRESSOR LUBRICATION SYSTEM

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SOLID STATE STARTER (OPTIONAL)

The 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 chiller. 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.

VARIABLE SPEED DRIVE (OPTIONAL)

A 460V-3ph-60/50Hz Variable Speed Drive can be factory packaged with the chiller. It is designed to vary the compressor motor speed and prerotation vane position by controlling the frequency and voltage of the electrical power to the motor. Operational information is contained in Form 160.00-O1. The control logic automatically adjusts motor speed and compressor prerotation

vane position for maximum part load efficiency by analyzing information fed to it by sensors located throughout the chiller.

SECTION 5

OPERATIONAL MAINTENANCE

USE OF PUMP ASSISTED TURBOGUARD PURGE UNIT

PURGING THE SYSTEM

To assure satisfactory operation, it is important that these systems be kept free of moisture-laden air and noncondensable gases. Air in the system usually collects in the condenser, blanketing some of the condensing surface, causing the discharge pressure and temperature to rise, resulting in high operating costs and possibly shutdown of the system by the high pressure cutout. Moisture in the system causes acid formation which is destructive to internal system parts.

A purge unit is furnished to automatically remove the mixture of noncondensable gases and refrigerant from the top of the condenser, expel the noncondensibles to the atmosphere and return the refrigerant to the system.

IMPORTANT

The purge unit operates continuously only when the system is in operation.

OPERATION

Purge operation is as follows: There is a fill and drain cycle which is controlled via the action of the tank float switches. The oil boost pump raises the oil supply pressure to the purge tank to enable exhaust release at 90 PSIA. When an exhaust is made, the tank pressure will

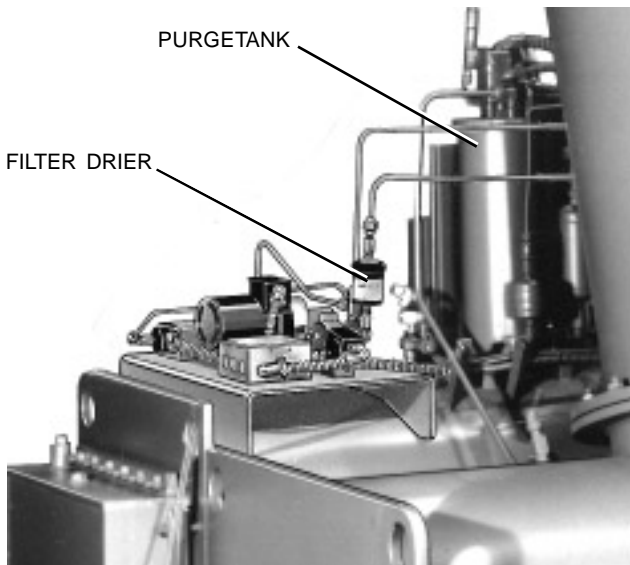
drop from 90 to 80 PSIA. The pump is also used in the drain portion of the purge cycle to pump out the purge tank. This provides for uniform purge cycle duration. The oil supply to the purge tank is taken downstream from the chiller oil cooler in order to provide cool oil to the tank and increase refrigerant separation efficiency. If the purge air exhaust solenoid valve fails to open at 90 PSIA, the power to the pump will be cut off at 105 PSIA with the high pressure cutout switch. Manual reset is required in order to re-energize the boost pump.

START-UP

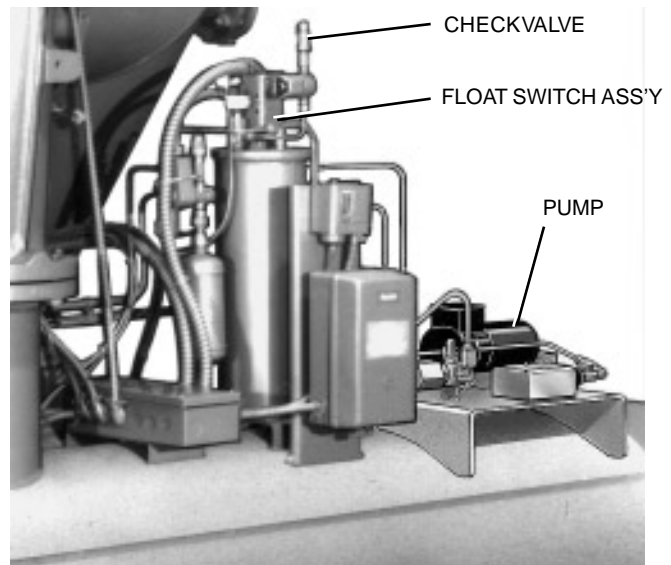
1. Place the control panel in "**PROGRAM**" operating mode as follows:
 - a. Press "**Access Code**" key.
 - b. This is displayed:

ENTER VALID ACCESS CODE
 - c. Using "**Entry**" keys enter the special service access code. (See Section 2)
 - d. As each digit is entered, the characters **Y O R K** are displayed.

*NOTE: If digits other than the correct digits are entered, **Y O R K** is still displayed.*
 - e. Press the "**ENTER**" key.



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FIG. 23 - PUMP ASSISTED TURBOGUARD PURGE UNIT COMPONENTS

NOTE: If digits other than the correct digits were entered in step No. 4,

INVALID ACCESS CODE

is displayed when the "ENTER" key is pressed. If this occurs, enter the correct access code and proceed.

f. This is displayed:

ACCESS TO PROGRAM KEY AUTHORIZED

NOTE: Unless terminated by pressing the "ACCESS CODE" key again, the operator will have access to the "PROGRAM" mode key for 10 minutes. When 10 minutes have elapsed, access to the "PROGRAM" mode key will be automatically disabled and the operator must return to step No. 1 to gain access.

g. Press the "PROGRAM" mode key.

h. This is displayed:

PROGRAM MODE, SELECT SETPOINT

2. Select the Turboguard boost pump, as follows:

- Press the "AUTO" prerotation vanes service key.
- Press the "ADVANCE DAY/SCROLL" entry key repeatedly (if needed) until the following message is displayed:

TURBOGUARD BOOST PUMP SELECTED

c. Press the "ENTER" key and the display will read:

PROGRAM MODE; SELECT SETPOINT

- Press the "AUTO" prerotation vanes service key to verify that the following message is displayed:

TURBOGUARD BOOST PUMP SELECTED

- Press the "ACCESS CODE" mode key to exit "PROGRAM" mode.

3. All field piping connections should be leak checked.

- The purge pump motor will be energized when the chiller compressor is started; the purge pump motor fan should be in motion. If the pump motor fails to start, try resetting the high pressure cutout switch by depressing and releasing the manual reset button. The purge will go through a fill/drain cycle every 8 to 12 minutes depending on the amount of air present in the system. An air exhaust is made if enough noncondensable is present to bring purge condenser pressure to 90 PSIA. Purge cycling can be monitored on the control panel by using the "DISPLAY DATA" service key to purge tank pressure.

Excess Purge Threshold

The excess purge threshold can be programmed by the service person or customer operator personnel. When this threshold is met, an excess purge message is displayed alternately with the normal foreground message. The service person, using the special service access code, can program the threshold for 1-30 purges per hour. The customer operator personnel, using access code **9 6 7 5**, can program the threshold for 10-30 purges per hour. The default value is 20. To enter the excess purge threshold:

- Press the "ACCESS CODE" mode key.
- The following message is displayed:

ENTER VALID ACCESS CODE

3. Using “**entry**” keys enter the appropriate access code per above description.
4. As each digit is entered, the characters **Y O R K** are displayed.

*NOTE: If digits other than the correct digits are entered, **Y O R K** is still displayed.*

5. Press the “**ENTER**” key.

NOTE: If digits other than the correct digits were entered in step No. 4,

INVALID ACCESS CODE

*is displayed when the “**ENTER**” key is pressed. If this occurs, enter the correct access code and proceed.*

6. The following message is displayed:

ACCESS TO PROGRAM KEY AUTHORIZED

*NOTE: Unless terminated by pressing the “**ACCESS CODE**” mode key again, the operator will have access to the “**PROGRAM**” mode key for 10 minutes. When 10 minutes have elapsed, access to the “**PROGRAM**” mode key will be automatically disabled and the operator must return to step No. 1 to gain access.*

7. Press the “**PROGRAM**” mode key. The following message is displayed:

PROGRAM MODE, SELECT SETPOINT

8. Press the “**DISPLAY DATA**” service key. This message is displayed:

MAXIMUM PURGES PER HOUR = XX

9. Using the “**ENTRY**” keys, enter the desired value. Use leading zeroes where necessary (i.e.: 06).

10. Press the “**ENTER**” key.

11. Press the “**PROGRAM**” mode key to exit “**PROGRAM**” mode.

Purge Messages

The purge messages are displayed as part of the scrolled messages using the “**DISPLAY DATA**” service key as follows:

No. 1

PURGE PRESSURE = XXX PSIA

This message displays the pressure as sensed by the purge transducer.

No. 2

60 MINUTE PURGE COUNT BYPASS; XX MIN LEFT

Purge exhausts are not counted during the first 60 minutes of chiller operation. Therefore, this message replaces the purge count messages below during the first hour of operation.

No. 3

PURGES LAST XX MIN = XX; MAX PURGES/HR = XX

After the first hour of chiller operation has elapsed, purge exhausts are counted. This message is displayed during the first hour following the initial 1 hour bypass (see above), and after the excess purge message is cleared. The minutes elapsed during this first hour of purge exhaust counting are displayed. The purge count is incremented each time a purge exhaust occurs. Also, the excess purge threshold that has been programmed by the operator or service person is displayed as “**MAX PURGES/HR**”. When the minute count reaches 60, this message is replaced with the following message:

No. 4

PURGES LAST HOUR = XX; MAX PURGES/HR = XX

After the initial 1 hour bypass and the first hour of purge exhaust counting has elapsed as explained above (2 hours of chiller run time), this message is displayed thereafter. A running total of the number of purge exhausts that have occurred within the last hour is displayed. The excess purge threshold that has been programmed by the operator or service person displayed as “**MAX PURGES/HR**”.

Excess Purge

Anytime after the first hour of chiller operation, if the purge exhaust count equals the programmed “**MAX PURGES/HR**” threshold,

DAY <TIME > WARNING – EXCESS PURGE

is alternately displayed with the normal foreground message. The day and time displayed is the time the excess purge event occurred. This message will be displayed until manually cleared using the “**WARNING RESET**” service key in “**SERVICE**” mode. Clearing the message also resets the purge exhaust count to zero and invokes the message:

PURGES LAST XX MIN = XX; MAX PURGES/HR = XX

While the excess purge message is displayed, the purge exhaust count will continue to increment until the 1 hour period has elapsed. The count is then frozen until the excess purge message is cleared. This provides a record of the total number of purge exhausts that occurred within the 1 hour period that the excess purge event occurred.

Purge Count

Following a 1 hour bypass at start, purge exhausts are counted and displayed in the above messages while the chiller is running. With the exception of the first hour after the bypass, the value displayed is the number of exhausts that have occurred in the "Last Hour". For example, if you walk up to the control panel at 9:11 AM and press the "DISPLAY DATA" service key and it says that there have been 7 purges in the "Last Hour", that means that there have been 7 exhausts since 8:11 AM. If you do this at 2:57 PM, it means that there have been 7 exhausts since 1:57 PM, etc. The purge count is reset to zero by the following:

1. Clearing the excess purge message.
2. Moving the Micro Board program jumper J-57 (CLK ON/OFF) from "CLK OFF" to "CLK ON" position.
3. Starting the chiller.

The purge count is frozen by the following:

1. When the chiller is not running.
2. An excess purge message is being displayed and at least 1 full hour of purge exhausts have accumulated.

High Purge Pressure Warning Message

If the purge transducer output is indicating a pressure

of greater than 95.0 PSIA for 255 continuous seconds, the following message is alternately displayed with the normal foreground message:

WARNING – HIGH PURGE PRESSURE

When the pressure decreases to less than 95.0 PSIA, the message is automatically cleared.

Excess Purge Alarm Contacts

A set of alarm contacts are provided on relay board P/N 031-00932-002 at terminals TB4-55/56. These are dry N.O. contacts rated at 2A inductive @ 250 VAC and 5A resistive @ 250 VAC.

These contacts can be used to annunciate an excess purge condition to a remote location. Anytime an excess purge condition occurs, these contacts close and remain closed until the excess purge warning message is cleared by pressing the "WARNING RESET" service key in "SERVICE" mode. This causes the contacts to open.

MAINTENANCE

In addition to standard Turboguard purge maintenance requirements, the exhaust orifice should be cleaned and checked on a yearly basis.

OIL RETURN SYSTEM

OIL RETURN

The oil return system continuously maintains the proper oil level in the compressor oil sump. (See Fig. 25.)

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

CHANGING THE DEHYDRATOR

To change the dehydrator use the following procedure:

1. Shut the stop valves on the condenser gas line, oil return line to rotor support and inlet end of dehydrator.
2. Remove the dehydrator as follows: Refer to Fig. 26.

- a. Remove connection on the inlet end of dehydrator.
- b. Place wrenches on the dehydrator outlet and inlet ends and the flare nut. Loosen the flare nut and unscrew the dehydrator.
3. Assemble the new filter-drier as follows:
 - a. Place the outlet and inlet ends of the dehydrator between the flare nuts.
 - b. Tighten the flare nuts.
4. Open condenser stop valve and check dehydrator connections for refrigerant leaks.
5. Open all the dehydrator stop valves to allow the liquid refrigerant to flow through the dehydrator and condenser-gas through the eductor.

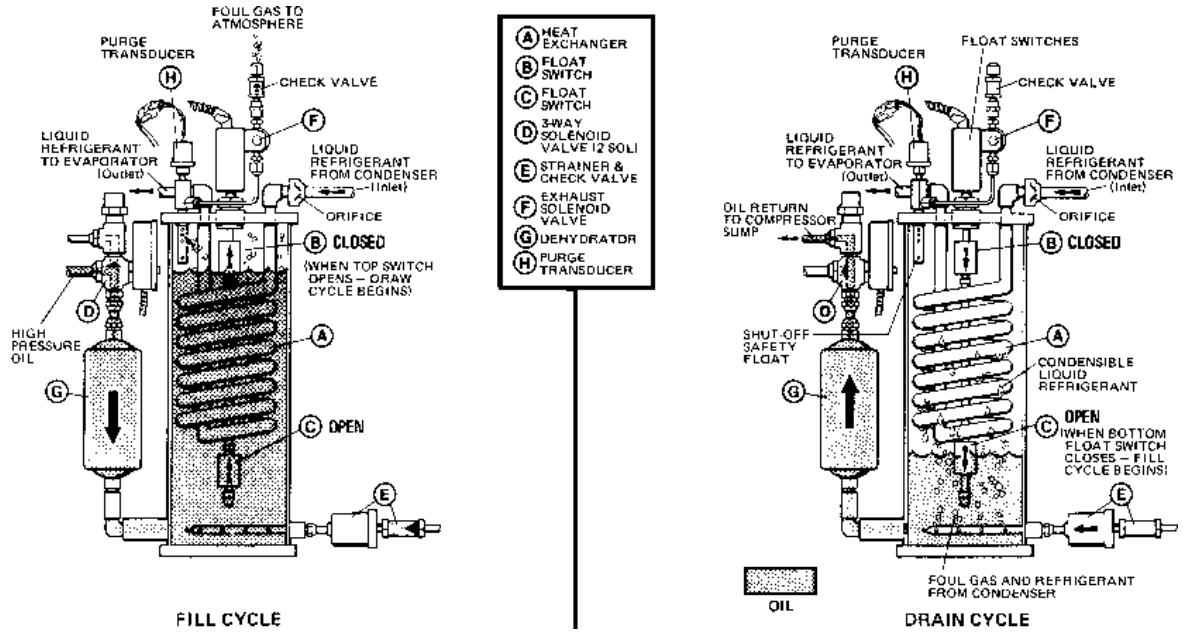
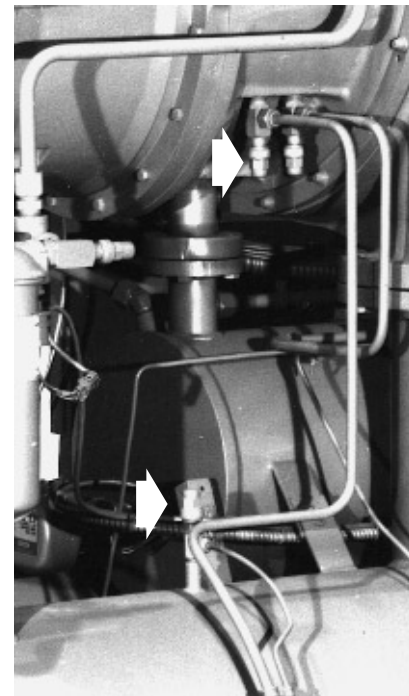
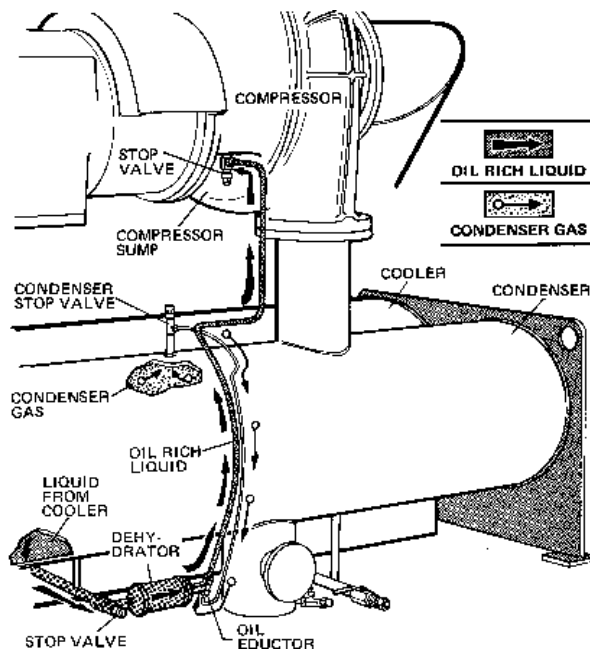


FIG. 24 - SCHEMATIC OPERATIONAL DIAGRAM

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LD00469

22621A(D)

FIG. 25 - OIL RETURN SYSTEM

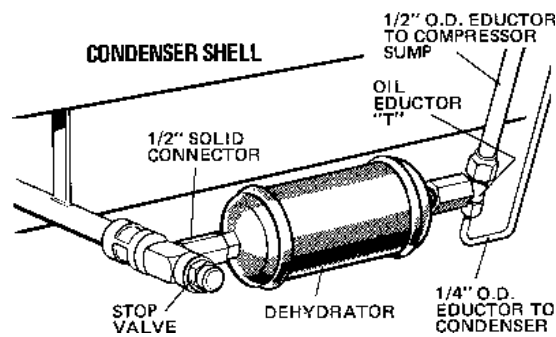


FIG. 26 - ASSEMBLY OF DEHYDRATOR

LD00470

CHARGING THE UNIT WITH OIL

THE OIL CHARGE

The nominal oil charge for the compressor is: 10 gal. "B" and "C" compressor; 15 gal. "E" and "F" compressor.

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

OIL CHARGING PROCEDURE

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

1. The unit should be shut down.

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

2. Immerse the suction connection of the oil charging pump in a clean container of new oil and connect

the pump discharge connection to the oil charging valve (A) located on the remote oil reservoir cover plate. (See Fig. 27) 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 compressor oil reservoir 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 or Variable Speed Drive to energize the oil heater. (See "System Operating Procedures", page 28). This will keep the concentration of refrigerant in the oil to a minimum.

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

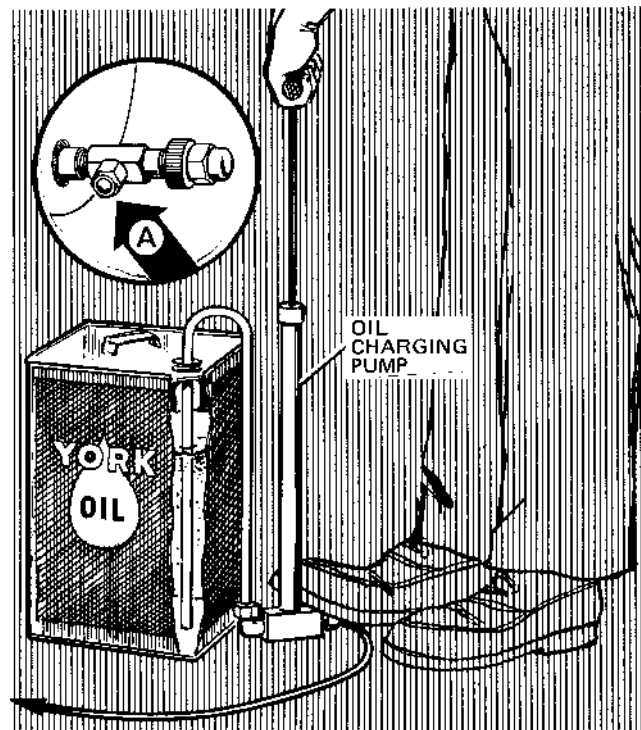
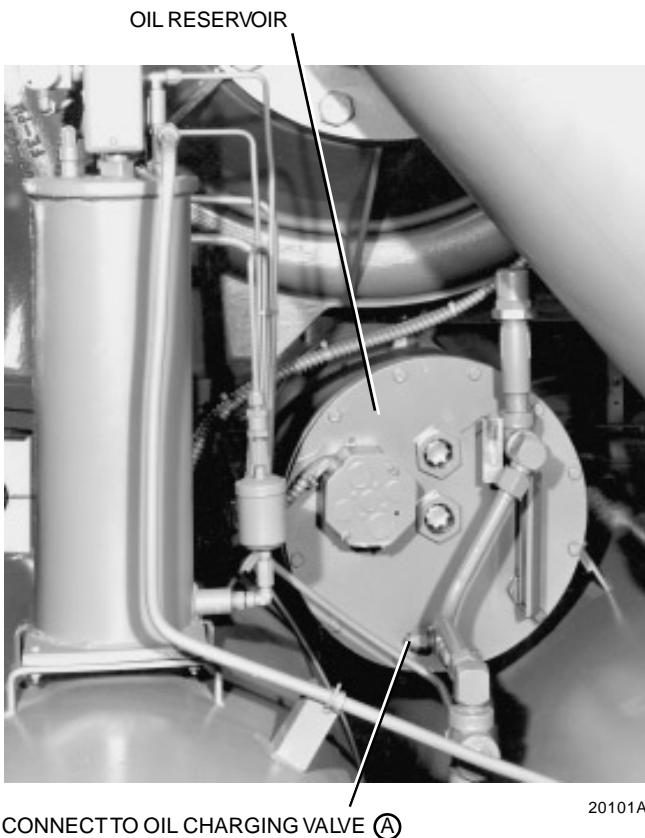


FIG. 27 - CHARGING OIL RESERVOIR WITH OIL

SECTION 6 TROUBLE SHOOTING

TABLE 1 - CAUSES OF NORMAL AND SAFETY SYSTEM SHUTDOWNS IN ACCORDANCE WITH THE MICROCOMPUTER CONTROL CENTER DISPLAY

| SHUTDOWN CAUSE CONTROL CENTER DISPLAY | | | | GOVERNING CONTROL FUNCTION | | |
|--|-------------|---------------------------------|-------------------|---|------------------------|----------------------------------|
| DAY OF WEEK | TIME OF DAY | CAUSE OF SHUTDOWN | METHOD OF RESTART | DESCRIPTION | OPERATING POINT | |
| | | | | | ON RISE | ON FALL |
| MON. | 10:00 AM | Low Water Temperature | Autostart | Low Water (LWT) | Chilled water setpoint | 4°F below chilled water setpoint |
| MON. | 10:00 AM | Low Water Temperature VSD | Autostart | Low Water (LWT) | Chilled water setpoint | 4°F below chilled water setpoint |
| MON. | 10:00 AM | Flow Switch | Autostart | Flow Switch | | |
| MON. | 10:00 AM | System Cycling | Autostart | A remote command (computer relay contact or manual switch) | | |
| MON. | 10:00 AM | Multi-Unit Cycling | Autostart | (Optional) Lead-Lag Sequence Control | | |
| MON. | 10:00 AM | Internal Clock | Autostart | Internal Clock | | |
| MON. | 10:00 AM | AC Undervoltage | Autostart | <15% FLA for 25 continuous seconds | | |
| MON. | 10:00 AM | Power Fault | Autostart | CM-2 Current Module or Solid State Starter | | |
| | | Remote Stop | | Energy Management System | | |
| MON. | | Anti-Recycle, 20 Min. Left | | Anti-Recycle Timer | | |
| MON. | 10:00 AM | Low Evap. Pressure | | Low Evap. Pressure Transducer (LEP) | 5.43 PSIA | 5.42 PSIA |
| MON. | 10:00 AM | Low Evap. Pressure Brine | | LEP external control (Brine units only) | Set to Job Spec. | Set to Job Spec. |
| MON. | 10:00 AM | Low Oil Pressure | | Low Oil Press. Transducer (OP) High Oil Press. Transducer (OP) | 20 PSID | 15 PSID |
| MON. | 10:00 AM | High Pressure | | High Pressure Safety Control (HP) | 15 PSIG | 9 PSIG |
| MON. | 10:00 AM | Evap. Transducer or Probe Error | | Evap. Pressure Transducer or Leaving Chilled Water Thermistor (RS1) | | |
| MON. | 10:00 AM | Motor Controller - Ext. Reset | | CM-2 or Solid State Starter or Variable Speed Drive | | |
| MON. | 10:00 AM | High Discharge Temperature | | Discharge Temperature Thermistor (RT2) | 220°F | 219°F |
| MON. | 10:00 AM | High Oil Temperature | | Oil Temperature Thermistor (RT3) | 180°F | 179°F |
| MON. | 10:00 AM | Power Failure | Autostart | Micro Board undervoltage circuit on 5V unregulated supply | 8.29 VDC | 7.84 VDC |
| MON. | 10:00 AM | Power Failure | | Micro Board undervoltage circuit on 5V unregulated supply | 8.29 VDC | 7.84 VDC |

TABLE 1 - CAUSES OF NORMAL AND SAFETY SYSTEM SHUTDOWNS IN ACCORDANCE WITH THE MICROCOMPUTER CONTROL CENTER DISPLAY - CONTINUED

| PROGRAMMED SETPOINTS BY OPERATOR | START-UP OF SYSTEM AFTER SHUTDOWN | PROBABLE CAUSE AND SERVICE REQUIRED |
|---|--|--|
| 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. |
| 4°F below chilled water setpoint (If set to 40°F would be 36°F.) (36°F minimum) | If system is running and setpoint is increased 4°, VSD will Initiate Shutdown. Automatic Restart when water temperature reaches setpoint. | System load is less than minimum capacity. |
| | Automatic Restart when water flow is restored to close flow switch. | Lack of water flow. Check operation of chilled water pump. |
| | Automatic Restart upon remote command. | Contact - connected to the Remote/Local cycling input of the Digital Input Board. |
| | Automatic Restart upon remote command. | Contact - connected to the Multi-Unit cycling input of the Digital Input Board. |
| Daily Schedule programmed to shut down unit. | Will automatically restart when programmed schedule permits. | Pressing Compressor Start Switch overrides the program. |
| | | Cycling shutdown occurs when motor current is >15% FLA for 25 seconds during chiller operation. |
| | Will start automatically following coastdown. | Motor Controller contacts opening and closing in less than 3 seconds due to a power fault condition. |
| | Start up by start signal from remote start switch. | Remote Stop Contact Closure. |
| Will not start until 30 minute timer is timed out. | Will restart when time left = 00 minutes. | Minimum time between successive compressor starts is 30 minutes. |
| | To restart, press compressor switch from STOP/RESET to START position. | See OPERATING ANALYSIS, Table 2 Symptom 2. |
| | To restart, press compressor switch from STOP/RESET to START position. | See OPERATING ANALYSIS, Table 2 Symptom 2. |
| | Will restart when pressure increases to 20 PSID. To restart, press compressor switch from STOP/RESET to START position. | See OPERATING ANALYSIS, Table 2 Symptom 4, 5, 6, 7, 9, 10, 11. |
| | Will restart when pressure falls to 9 PSIG. To restart, press compressor switch from STOP/RESET to START position. | See OPERATING ANALYSIS, Table 2 Symptom 1 - High Discharge Pressure. |
| | To restart, press compressor switch from STOP/RESET to START position. | Defective Evap. Pressure Transducer or Leaving Chiller Water thermistor (RS1). LCWT minus saturation temp. is less than -2.5°F or greater than 25°F Checked every 10 minutes following a 10-min. bypass at start-up. |
| | Reset the device that caused the shutdown. Chiller will start automatically. | CM-2 or Solid State Starter or Variable Speed Drive has shut down chiller. |
| | 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 2. |
| | To restart, press compressor switch from STOP/RESET to START position. | Dirty oil filter or restricted oil cooler line. Change oil filter. See Symptom 9, Table 2. |
| Optional AUTO Restart Plug is installed on Micro Board. | Will restart automatically when voltage reaches 8.29VDC. An undervoltage circuit on Micro Board monitors the 5VDC unregulated supply for an undervoltage condition. | Power Failure. |
| Auto restart plug is removed on Micro Board. | To restart, press compressor switch to STOP/RESET position and then to START position. | Power Failure. |

TABLE 1 - CAUSES OF NORMAL AND SAFETY SYSTEM SHUTDOWNS IN ACCORDANCE WITH THE MICROCOMPUTER CONTROL CENTER DISPLAY - CONTINUED

| SHUTDOWN CAUSE CONTROL CENTER DISPLAY | | | | GOVERNING CONTROL FUNCTION | | |
|---------------------------------------|-------------|--|-------------------|--|-------------------------------|---------|
| DAY OF WEEK | TIME OF DAY | CAUSE OF SHUTDOWN | METHOD OF RESTART | DESCRIPTION | OPERATING POINT | |
| | | | | | ON RISE | ON FALL |
| MON. | 10:00 AM | Oil Pressure Transducer Error | | High Oil Pressure Transducer or Low Oil Pressure Transducer | 60 PSID | 59 PSID |
| | | Vane Motor Switch Open | Autostart | Vane Motor Switch | | |
| MON. | 10:00 AM | Starter Malfunction Detected | | Motor Current >15% for 10 seconds with Control Center not calling for motor to run. | | |
| MON. | 10:00 AM | Program Initiated Reset | Autostart | Micro Board | | |
| | | Replace RTC-IC Chip Reprogram Setpoints | | RTC-IC Chip | | |
| MON. | 10:00 AM | Low Oil Temperature | Autostart | Oil Temperature Thermistor (RT3) | 71.0°F | 55°F |
| MON. | 10:00 AM | Faulty Discharge Temperature Sensor | | Discharge Temp. Thermistor (RT2) disconnected or faulty (min. system operating temp. = 32°F) | 30.0°F | 29.9°F |
| MON. | 10:00 AM | Low Line Voltage (SSS units only) | | SSS Logic Board | See legend on wiring diagram. | |
| MON. | 10:00 AM | Motor Phase Current Unbalance (SSS units only) | | SSS Logic Board | See Section 2. | |

TABLE 1 - CAUSES OF NORMAL AND SAFETY SYSTEM SHUTDOWNS IN ACCORDANCE WITH THE MICROCOMPUTER CONTROL CENTER DISPLAY - CONTINUED

| PROGRAMMED SETPOINTS BY OPERATOR | START-UP OF SYSTEM AFTER SHUTDOWN | PROBABLE CAUSE AND SERVICE REQUIRED |
|---|---|---|
| | Will start at 59 PSID when compressor switch is placed to STOP/RESET and then START. | This Shutdown is provided to check on Oil pressure Transducers for failure in the high state. Replace Oil Pressure Transducer in oil sump or compressor. |
| | Restart automatically after Vane Motor arm linkage is set properly. Press STOP/RESET and then START switch. | Vaness are set improperly. Reset vane linkage, check vane positions using the Service key switch and proper keys on the MicroComputer Control Center or switch of capacity board of Variable Speed Drive. |
| | Press compressor STOP/RESET switch and then START switch. | Check motor starter operation. Motor current value greater than 15%. |
| | | Watchdog timer circuit has reset software program. Chiller will automatically restart. |
| | Reprogram the Control Center Setpoints and proceed with Normal Start-up. | Weak Battery. Replace RTC-IC chip U16. |
| | Press STOP/RESET switch and then START switch. | Oil Temperature Thermistor disconnected from Analog Input Board. Reconnect or replace open sensor. |
| | Press STOP/START switch and then START switch. | Faulty Discharge Temperature Thermistor (RT2) or disconnected from Analog Input Board. Connect or replace open sensor. |
| | Chiller will automatically restart when all phases of line voltage increase to the minimum required starting level. | Low AC Line Voltage |
| | Press STOP/RESET switch and then START switch. | Motor Phase Current Unbalance |

TABLE 2 - OPERATING ANALYSIS CHART

| RESULTS | POSSIBLE CAUSE | REMEDY |
|--|--|--|
| 1. SYMPTOM: ABNORMALLY HIGH DISCHARGE PRESSURE | | |
| Temperature difference between liquid refrigerant out and water off condenser higher than normal. | Air in condenser. | Purge unit operates automatically to take care of this condition. Test for air leaks if display reads: WARNING – EXCESS PURGE |
| 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 | | |
| 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 prerotation vane motor operation and setting of low water temperature cutout. |
| 3. SYMPTOM: HIGH COOLER PRESSURE | | |
| High chilled water temperature. | Prerotation vanes fail to open. | Check the prerotation vane motor positioning circuit. |
| | System overloaded. | Be sure the vanes are wide open (without overloading the motor) until the load decreases. |
| 4. SYMPTOM: NO OIL PRESSURE WHEN SYSTEM START BUTTON PUSHED | | |
| Low oil pressure displayed on control center; compressor will not start. | Oil pump running in wrong direction. | Check rotation of oil pump. (Electrical Connections) |
| | Oil pump not running. | Check electrical connections to oil pump and press manual reset on oil pump starter (on condenser shell in front of purge unit). |
| 5. SYMPTOM: COMPRESSOR STARTS, NORMAL OIL PRESSURE DEVELOPS, FLUCTUATES FOR SHORT WHILE, THEN COMPRESSOR STOPS ON OIL PRESSURE CUTOUT | | |
| 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 compressor and charge new oil into the compressor. (See "Oil Charging Procedure", page 44.) |
| | Burned out oil heater. | Replace oil heater. |

TABLE 2 - OPERATING ANALYSIS CHART - CONTINUED

| RESULTS | POSSIBLE CAUSE | REMEDY |
|--|--|---|
| 6. SYMPTOM: UNUSUALLY HIGH OIL PRESSURE DEVELOPS WHEN OIL PUMP RUNS | | |
| Unusually high oil pressure is displayed when the oil pressure display key is pressed when the oil pump is running. | High oil pressure. Transducer defective. Relief valve is misadjusted. | Replace low or high oil pressure transducer. Adjust external relief valve. |
| 7. SYMPTOM: OIL PUMP VIBRATES OR IS NOISY | | |
| Oil pump vibrates or is extremely noisy with some oil pressure when pressing "Oil Pressure" display key. | Misalignment of pump or piping. Mounting bolts loose. Bent shaft. Worn pump parts. | Correct condition or replace faulty part. |
| <i>NOTE: When oil pump is run without an oil supply it will vibrate and become extremely noisy.</i> | Oil not reaching pump suction inlet in sufficient quantity. | Check oil supply and oil piping. |
| 8. SYMPTOM: OIL PRESSURE GRADUALLY DECREASES (NOTED BY OBSERVATION OF DAILY LOG SHEETS) | | |
| 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. |
| 9. SYMPTOM: OIL RETURN SYSTEM CEASES TO RETURN AN OIL/REFRIGERANT SAMPLE | | |
| Oil refrigerant return not functioning. | Filter-drier in oil return system dirty. | Replace oil filter-drier with new. |
| | Jet or orifice of oil return jet clogged. | Remove jet, inspect for dirt. Remove dirt using solvent and replace. |
| 10. SYMPTOM: OIL PUMP FAILS TO DELIVER OIL PRESSURE | | |
| No oil pressure registers when pressing "Oil Pressure" display key when oil pump runs. | Faulty oil pressure transducer. Faulty wiring/connectors. | Replace oil pressure transducer. |
| 11. SYMPTOM: REDUCED OIL PUMP CAPACITY | | |
| Oil pump pumping capacity low. | Excessive end clearance in pump. Other worn pump parts. | Inspect and replace worn parts. |
| | Partially blocked oil supply inlet. | Check oil inlet for blockage. |
| 12. SYMPTOM: IMPROPER PURGE UNIT OPERATION | | |
| Purge unit not purging and air is present in the unit. | 1. Faulty float switch assembly. 2. Faulty three-way oil solenoid valve. 3. Faulty exhaust solenoid valve. 4. Faulty pressure transducer. | Check these components and replace where necessary. |
| Purge unit purging air and refrigerant | 1. Faulty exhaust solenoid valve. 2. Faulty pressure transducer. 3. Lack of cooling. | Restore refrigerant liquid cooling supply. |

SECTION 7 MAINTENANCE

RENEWAL PARTS

For any required Renewal Parts refer to Forms listed on page 2.

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 Repairs", page 55).

CONDUCTING PRESSURE TEST

With the refrigerant 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. Do not use excessive amounts of R-22; use only enough for proper leak detection.

To test with R-22, proceed as follows:

1. With no pressure in the system, charge R-22 gas into the system through the charging valve to a pressure of 2 PSIG.
2. Build up the system pressure with dry nitrogen to approximately 10 PSIG. To be sure that the concentration of refrigerant has reached all parts of the system, slightly open the oil charging valve and test for the presence of refrigerant with a leak detector.
3. Test around each joint and factory weld. It is important that this test be thoroughly and carefully done, spending as much time as necessary and using a good leak detector.
4. To check for refrigerant leaks in the cooler and condenser, open the vents in the cooler and condenser heads and test for the presence of refrigerant. If no refrigerant is present, the tubes and tube sheets may be considered tight. If refrigerant is detected at the vents, the heads must be removed, the leak located (by means of soap test or leak detector) and repaired.
5. When absolute tightness of the system has been established, blow the mixture of nitrogen and refrigerant through 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. 28 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 5mm 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

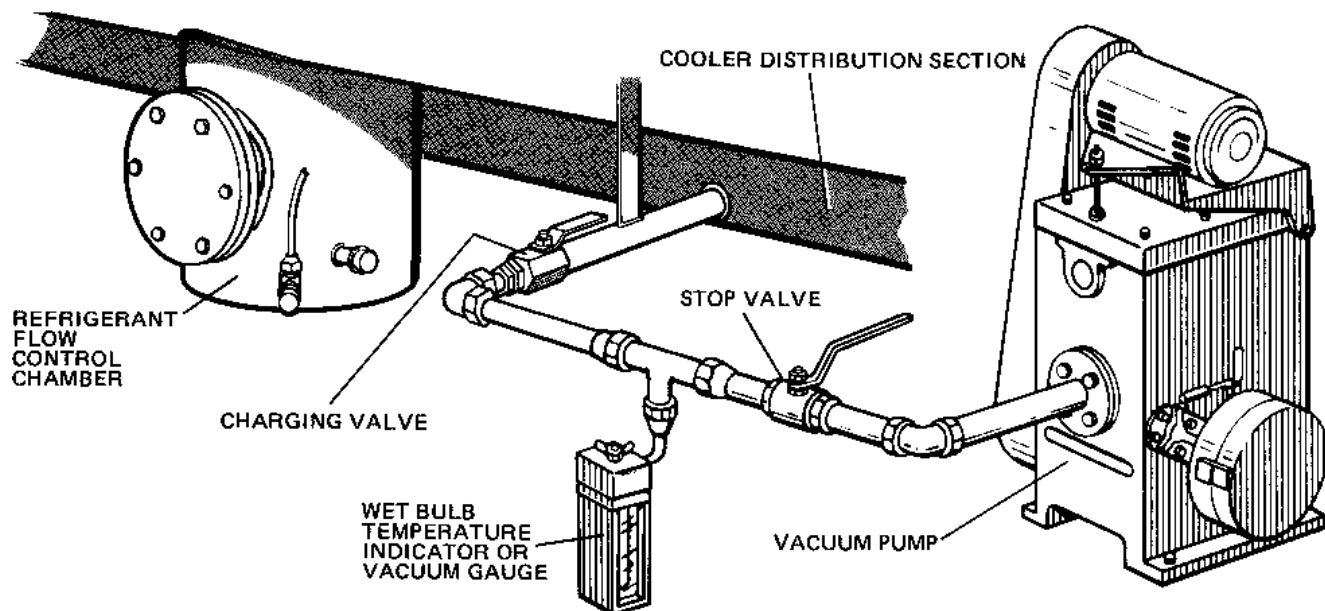


FIG. 28 - EVACUATION OF CHILLER

LD00473

TABLE 3 - SYSTEM PRESSURES

| *GAUGE INCHES OF MERCURY (HG) BELOW ONE STANDARD ATMOSPHERE | ABSOLUTE | | | BOILING TEMPERATURES OF WATER °F |
|---|----------|--------------------------------|---------|--|
| | PSIA | MILLIMETERS OF MERCURY (HG) | MICRONS | |
| 0 | 14.696 | 760 | 760,000 | 212 |
| 10.24* | 9.629 | 500 | 500,000 | 192 |
| 22.05* | 3.865 | 200 | 200,000 | 151 |
| 25.98* | 1.935 | 100 | 100,000 | 124 |
| 27.95* | .968 | 50 | 50,000 | 101 |
| 28.94* | .481 | 25 | 25,000 | 78 |
| 29.53* | .192 | 10 | 10,000 | 52 |
| 29.67* | .122 | 6.3 | 6,300 | 40 |
| 29.72* | .099 | 5 | 5,000 | 35 |
| 29.842* | .039 | 2 | 2,000 | 15 |
| 29.882* | .019 | 1.0 | 1,000 | +1 |
| 29.901* | .010 | .5 | 500 | -11 |
| 29.917* | .002 | .1 | 100 | -38 |
| 29.919* | .001 | .05 | 50 | -50 |
| 29.9206* | .0002 | .01 | 10 | -70 |
| 29.921* | 0 | 0 | 0 | |

**WATER
FREEZES**

* One standard atmosphere = 14.696 PSIA
 = 760 mm Hg. absolute pressure at 32°F
 = 29.921 inches Hg. absolute at 32°F

NOTES: PSIG = Lbs. per sq. in. gauge pressure
 = Pressure above atmospheric
 PSIA = Lbs. per sq. in. absolute pressure
 = Sum of gauge plus atmospheric pressure

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. Close the system charging valve and the stop valve between the vacuum indicator and the vacuum pump. (See Fig. 28) 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 6.3mm 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.

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

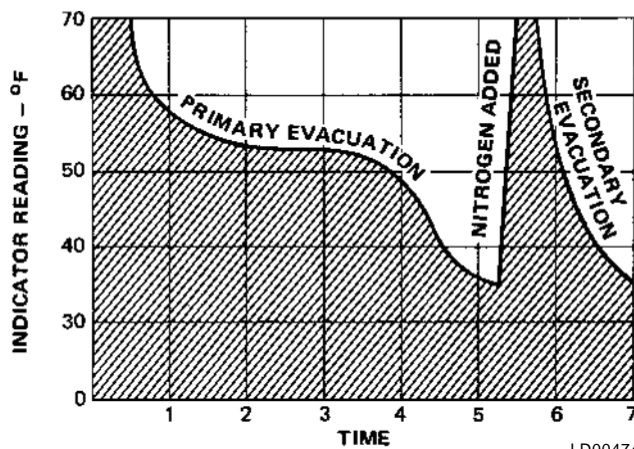


FIG. 29 - SATURATION CURVE

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. 29.

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 5mm 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 5mm 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 5mm Hg. in the primary evacuation. During the primary pull-

down 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 20.4 in Hg. vacuum for R-123 (at sea level).

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

Refrigerant may be furnished in drums containing either 100, 200 or 650 lbs. of refrigerant. These drums are not returnable and they should be stored for future

TABLE 4 - REFRIGERANT CHARGE

| SHELL CODES | | LBS. |
|-------------|------------|------|
| COOLER | COMPRESSOR | |
| G0, G1, G3 | B | 890 |
| G0, G1, G3 | C | 890 |
| H1, H3 | ↓ | 970 |
| J1, J3 | ↓ | 1130 |
| K1, K3 | ↓ | 1270 |
| G0, G1, G3 | E | 890 |
| H1, H3 | ↓ | 970 |
| J1, J3 | ↓ | 1130 |
| K1, K3 | ↓ | 1270 |
| L1, L3 | ↓ | 1390 |
| K4, K6 | F | 1390 |
| K7, K9 | ↓ | 1530 |
| L4, L6 | ↓ | 1590 |

use if it should ever become necessary to remove refrigerant from the system.

CHECKING THE REFRIGERANT CHARGE DURING UNIT SHUT DOWN

The refrigerant charge is specified for each chiller 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 sight glass $\pm 1/4$ inch.

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, the following paragraphs outline the procedure for handling the refrigerant while the system is open.

Since Refrigerant-123 boils at 82°F under atmospheric pressure, it will not be necessary to remove the refrigerant if the system is to be open for only a few hours. Any part of the system which is above the liquid level will be accessible without disturbing the refrigerant charge.

If the system must remain open for more than a few hours the refrigerant should be drained and stored in clean drums for the duration of the repair period.

If conditions permit, the system pressure should be as near as possible to atmospheric before opening the system and the refrigerant charge should be kept as near as possible to 82°F to keep either the refrigerant loss or the air intake to a minimum. After the system has been reassembled, the air should be removed by means of the purge unit. (See "Purging the System", page 39.)

MEGGING THE MOTOR

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

1. Using a megohm meter (megger), meg between phases and each phase to ground (See Fig. 30); these readings are to be interpreted using the graph shown in Fig. 31.

2. If readings fall to the left of the applicable curve, remove external leads from the motor and repeat test.

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

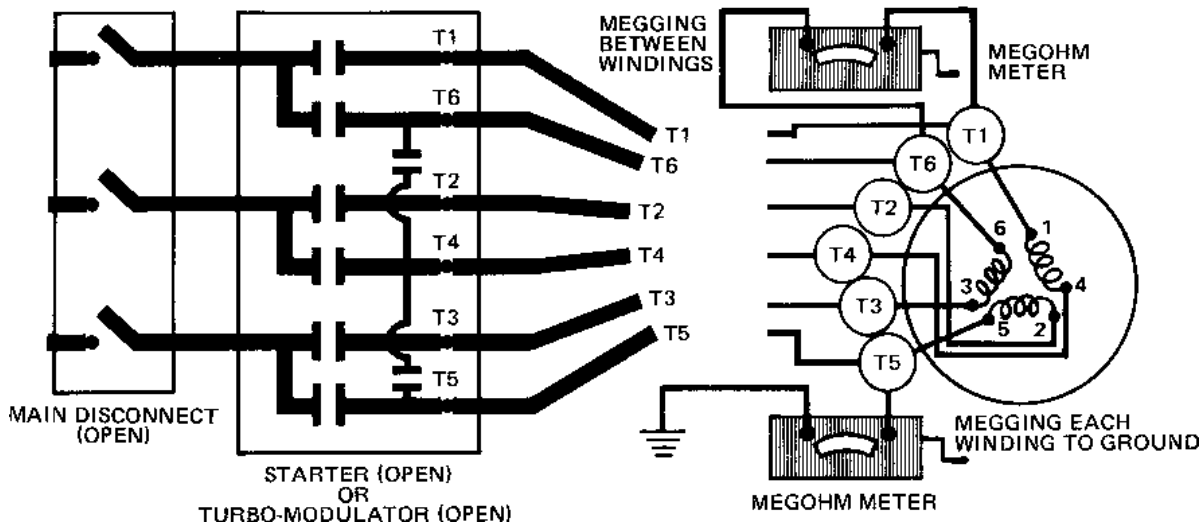


FIG. 30 - DIAGRAM, MEGGING MOTOR WINDINGS

LD00475

CONDENSERS AND COOLERS

GENERAL

Maintenance of condenser and cooler shells is important to provide trouble free operation of the chiller. 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 prefer-

ably 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.

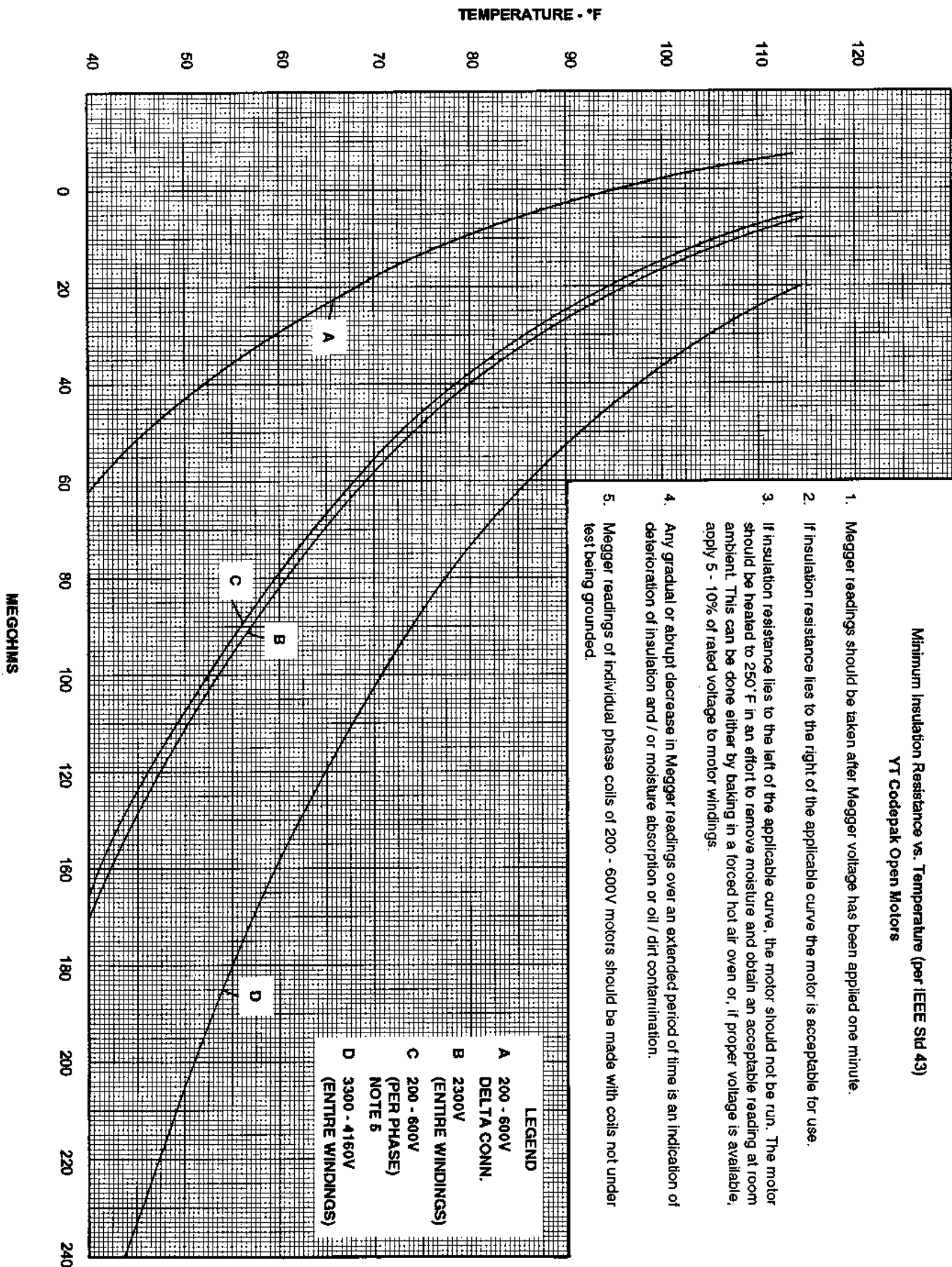


FIG. 31 - MOTOR STATOR TEMPERATURE AND INSULATION RESISTANCES

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 Tube

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 of 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 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, checking the operation of the oil pump, and observing the operation of the compressor.

Internal wearing of compressor parts could be a serious problem caused by improper lubrication, brought

about by restricted oil lines, passages, or dirty oil filters. If the unit is shutting down on (HOT) High Oil Temperature or Low Oil Pressure (OP), change the oil filter element. Examine the oil filter element for the presence of aluminum particles. If aluminum particles are noticeable and the same conditions continue to stop the unit operation after a new filter element is installed, notify the nearest YORK office to request the presence of a YORK service man.

ELECTRICAL CONTROLS

For information covering the MicroComputer Control Center operation, refer to Section 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 8 PREVENTIVE MAINTENANCE

It is the responsibility of the owner to provide the necessary daily, monthly and yearly maintenance requirements of the system. **IMPORTANT:** If a unit failure occurs due to improper maintenance during the warranty period; YORK will not be liable for costs incurred to return the system to satisfactory operation.

In any operating system it is most important to provide a planned maintenance and inspection of its functioning parts to keep it operating at its peak efficiency. Therefore, the following maintenance should be performed when prescribed.

COMPRESSOR

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 aluminum particles which would indicate possible bearing wear. If aluminum 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 chiller should be pressure tested annually. Any leaks found must be repaired immediately. If frequent purging has occurred, the unit must be pressure tested as soon as possible to prevent air and moisture from entering the unit. Air and moisture are the worst enemies of the R-123 system and experience has shown that units which are maintained tight, are systems that will provide trouble free efficient operation.

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 58 and 59 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.

PURGE UNIT

Every Three Months

1. Change the purge unit dehydrator.
 - a. If the unit is operating;
 - 1) When the purge unit is in the drain cycle, close the valve in the high pressure oil supply line and allow the unit to complete the drain cycle.
 - 2) Close condenser gas and oil return valves and replace the dehydrator.
 - 3) Open all valves to return the purge unit to normal operation.

Annually

1. Clean and inspect all valves which are part of the purge unit system.
2. Drain and flush the oil and refrigerant from the purge unit shell.
 - a. Before flushing remove the float assembly from the purge unit shell.
 - b. Disconnect the oil line from the bottom of the purge unit shell.
 - c. To clean - flush refrigerant from the top of the purge unit shell and let the refrigerant drain from the bottom through the oil line connection.
 - d. After a complete flushing, replace the float assembly and the oil drain line.
3. Clean the following orifice.
 - a. One (1) orifice in the liquid line feed to the cooling coil.
 - b. Purge unit exhaust orifice.
4. Inspect the foul gas inlet check valve.

OIL RETURN SYSTEM

1. Change the dehydrator in the oil return system semi-annually or earlier if the oil return system fails to operate.
2. When the dehydrator is changed the nozzle of the eductor should be checked for any foreign particles that may be obstructing the jet.

ELECTRICAL CONTROLS

1. All electrical controls should be inspected for obvious malfunctions.
2. It is important that the factory settings of controls (operation and safety) not be changed. If the settings are changed without YORK's approval the warranty will be jeopardized.
3. A 5-11 year life battery is part of the RTC-Real Time Clock. To replace refer to Section 2.

