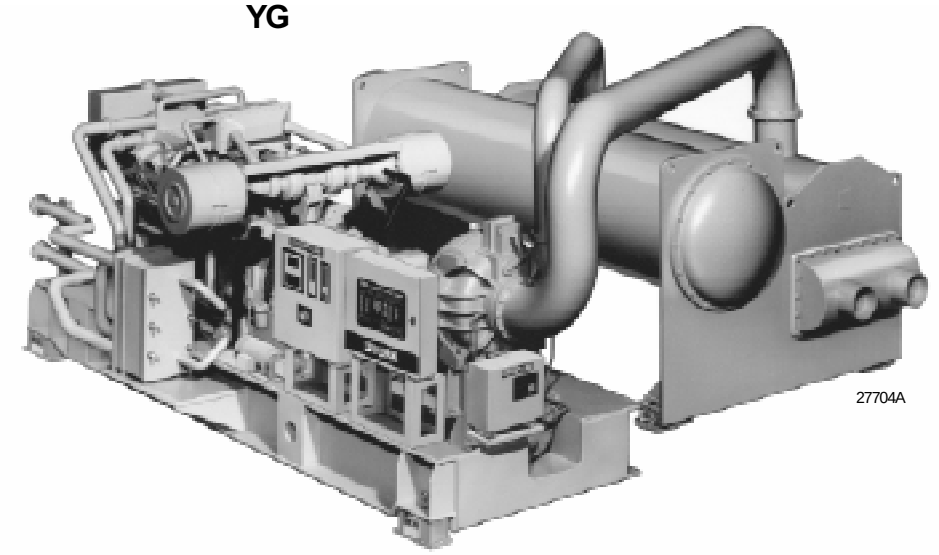
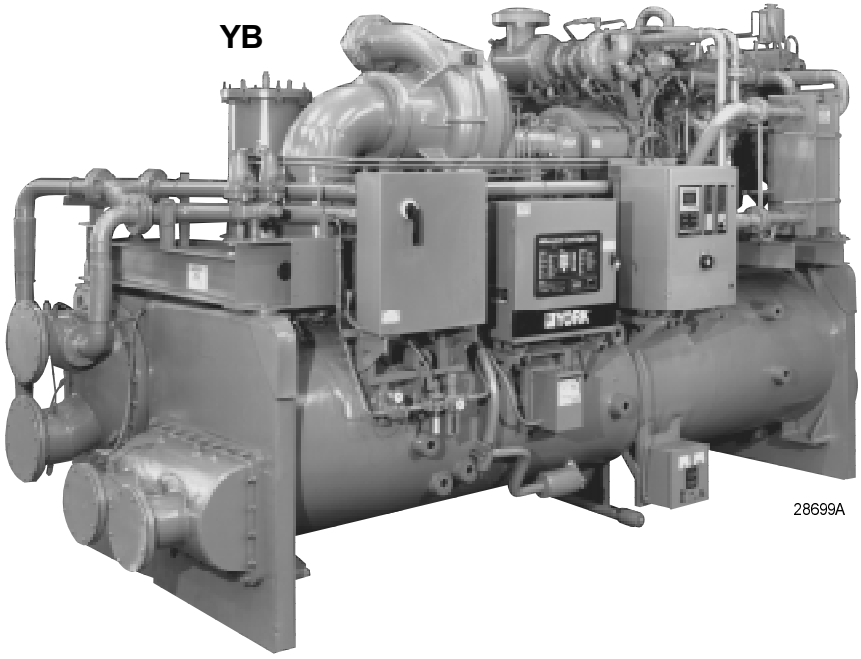
YORK®	*MILLENNIUM* ™ **CENTRIFUGAL LIQUID CHILLERS**	
OPERATING & MAINTENANCE	Supersedes: 160.60-O1 (1296)	Form 160.60-O1 (1197)

MODEL YG & YB
(DESIGN LEVEL A)

YG



YB



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.

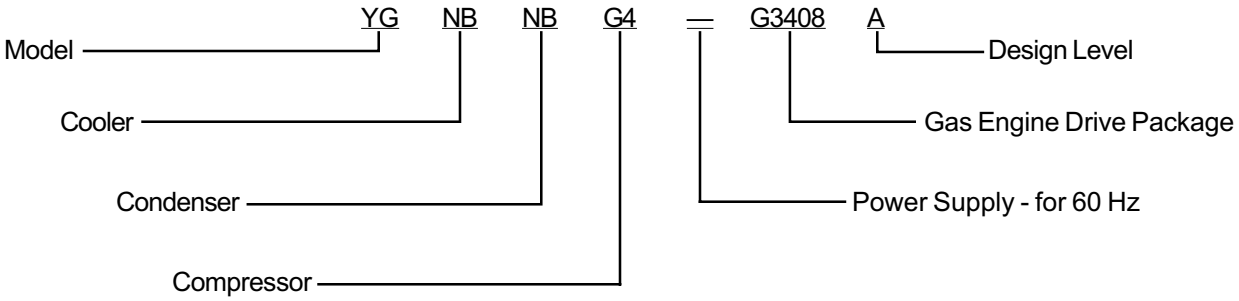
ABBREVIATIONS

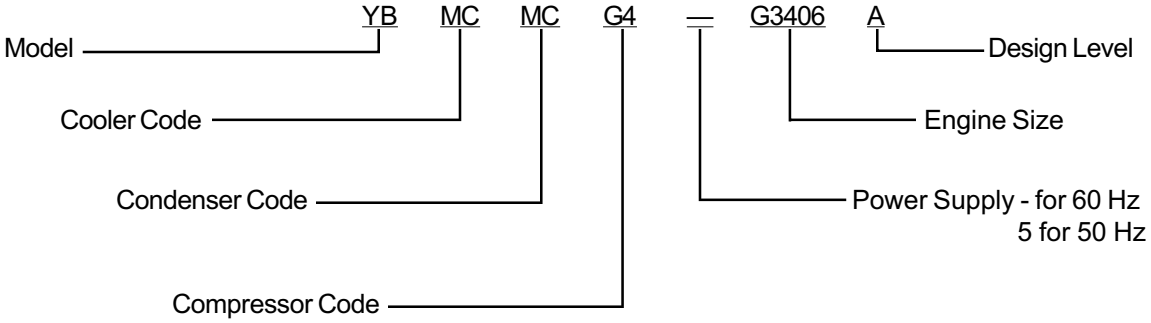
The abbreviations below are used in this manual.

ECP	=	Engine Control Panel	EMS	=	Energy Management System	HOT	=	High Oil Temperature
PLC	=	Programmable Logic Control	PWM	=	Pulse Width Modulation	OP	=	Oil Pressure
EIS	=	Electronic Ignition System	RTC	=	Real Time Clock	LCWT	=	Leaving Chilled Water Temp.
ECS	=	Engine Control Switch	PRV	=	Prerotation Vane	ECWT	=	Entering Condensing Water Temp.
SCM	=	Status Control Module	LWT	=	Low Water Temperature			

NOMENCLATURE

The model number denotes the following characteristics of the unit:





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MACH = X.XX; MACH'S X.XX 39

ENGINE RPM = XXXX; RPMS = XXXX 39

DELTA P OVER P = X.XX; PRV = XXX% 39

COMP. COASTDOWN; ENG SHTDN-PRESS STATUS 40

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START SEQ. INITIATED – COMPRESSOR PRELUBE 44
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LOW GEAR OIL TEMPERATURE SWITCH 46
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COMPR COASTDN; ENGINE SHTDN – PRESS STATUS 47
DAY TIME HIGH ENGINE GLYCOL TEMP 47
COMPR SHTDN; ENGINE COOLDN – PRESS STATUS 47
SUN 12:00 AM HIGH ENGINE VIBRATION FAULT 47

STANDARD DISPLAY MODE KEY MESSAGES

DISPLAY KEY	MESSAGE
Chilled Liquid Temps	CHILLED LEAVING=XXX.X°F; RETURN=XXX.X°F
Refrigerant Pressures	EVAP = XXXX.X PSIG; COND = XXXX.X PSIG
Comp Oil Pressure	OIL PRESSURE = XXX.X PSID
Engine Data	ENGINE OIL PRESSURE = XXX.X PSIG ENGINE MANIFOLD PRESSURE = XX.X PSIA ENGINE JACKET WATER TEMP = XXX.X°F AC INLET WATER TEMPERATURE = XXX°F
Engine RPM / % Vanes	ENGINE SPEED = XXXX RPM; VANES = XXX%
Condenser Liquid Temps	COND LEAVING = XXX.X°F; RETURN = XXX.X°F
Print	PRINT ENABLE PRINT REQUEST IN PROGRESS…
Chiller Data	SAT TEMPS EVAP = XXX .X°F, COND = XXX.X°F DISCHARGE TEMP = XXX.X°F, OIL TEMP = XXX.X°F HOP = XXXX.X PSIG; LOP = XXXX.X PSIG PROXIMITY SENS-POS:XX MILS; REF:XX MILS HIGH SPEED DRAIN TEMP = XXX.X°F DELTA P OVER P = X.XX; PRV = XXX% ENGINE RPM = XXXX; RPMS = XXXX MACH = X.XX; MACHS = X.XX REFRIG. LEVEL
Operating Hours/Start Counter	OPER. HOURS =XXXXX; START COUNTER = XXXXX
% Engine Load	G3516 ENGINE LOADING = XXX% ENGINE LOAD - > (30 - 39%): XXXX.X HOURS ENGINE LOAD - > (40 - 49%): XXXX.X HOURS ENGINE LOAD - > (50 - 59%): XXXX.X HOURS ENGINE LOAD - > (60 - 69%): XXXX.X HOURS ENGINE LOAD - > (70 - 79%): XXXX.X HOURS ENCilNE LOAD - > (80 - 89%): XXXX.X HOURS ENGINE LOAD - > (90 - 100%): XXXX.X HOURS

SETPOINT KEY	MESSAGE
Chilled Liquid Temp	LEAVING SETPOINT = XX.X°F
% Engine Load Limit	ENGINE LOAD LIMIT = XXX%
Pulldown Demand	SETPOINT = XXXMIN @ XXX% LOAD, XXX MIN LEFT
Clock	TODAY IS SUN 12:00AM XX/XX/XX
Service Interval	ENGINE SETPOINT = XXXX HRS, XXXX HRS REM COMPRESSOR SETP = XXXX HRS, XXXX HRS REM
Daily Schedule	SUN START = 00:00 AM, STOP = 00:00 AM MON START = 00:00 AM, STOP = 00:00 AM TUES START = 00:00 AM, STOP = 00:00 AM WED START = 00:00 AM, STOP = 00:00 AM THURS START = 00:00 AM, STOP = 00:00 AM FRI START = 00:00 AM, STOP = 00:00 AM SAT START = 00:00 AM, STOP = 00:00 AM HOLIDAY START = 00:00 AM, STOP = 00:00 AM
Holiday	S M T W T F S HOLIDAY NOTED BY *
Remote Reset Temp. Range	REMOTE TEMP RESET RANGE = 00°F
Data Logger	WTO AUTO PRINT INTERVAL = NOT PROGRAMMED

SECTION 1
DESCRIPTION OF SYSTEM AND FUNDAMENTALS OF OPERATION

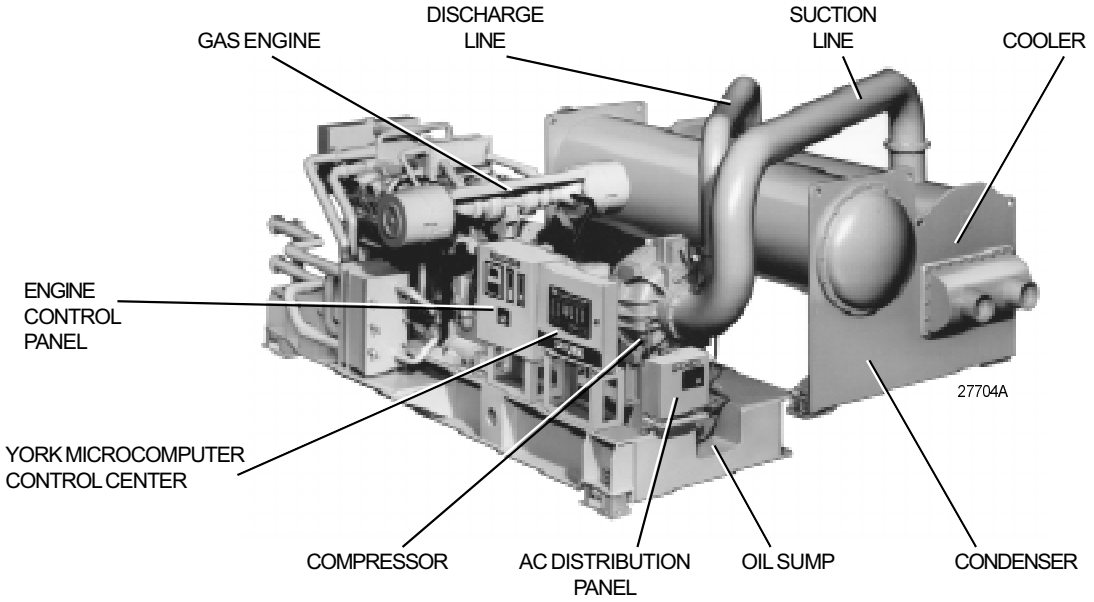


FIG. 1 – MODEL YG GAS ENGINE DRIVE CHILLER

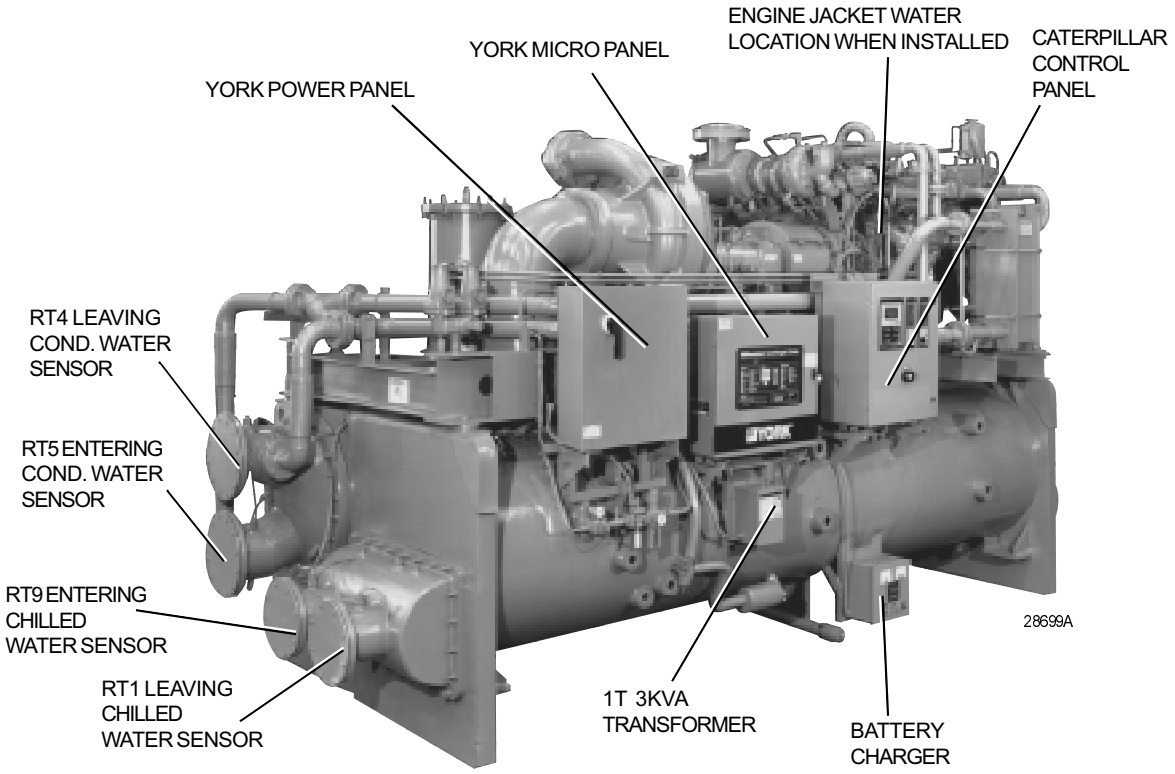


FIG. 1A – MODEL YB GAS ENGINE DRIVE CHILLER

SYSTEM OPERATING DESCRIPTION (See Fig. 1 or 1A)

The YORK Gas Engine Drive Centrifugal Chiller consists of two packages; a shell package and a drive line package. The shell package includes an evaporator and condenser with internal subcooler. The drive line package includes a compressor, compressor lubrication system, natural gas engine, clutch, speed increaser, torsional vibration reducing coupling, power panel, engine PLC panel, and chiller control panel.

The YORK Gas Engine Drive Centrifugal Chiller is commonly applied to large air conditioning systems, but may be used on other applications.

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.

In operation, a liquid (water or brine to be chilled) flows through the cooler, where boiling refrigerant 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 flowing 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 flows from the condenser (with integral sub-cooler) 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 unit 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 (Also see page 57)

The YG capacity control will employ the present form of automatic vane control presently utilized on the centrifugal chillers. In addition to this, the unit will control capacity by varying the engine speed.

The desired engine speed will be obtained from a three dimensional equation which will represent the compressor surge surface. The prerotation vane position and head (P Cond. minus P Evap. divided by P Evap.) are the two independent variables, which upon inserting into the equation, will yield a machine number. The machine number will then be used to calculate the desired engine speed. Each engine speed data point calculated will be set at a marginal value above its associated compressor surge point. This adjusted surface will provide a boundary on which high efficiency chiller operation may be achieved and below which surge may occur. Therefore, engine speed must always be set on or above this adjusted surface during system run.

You should note that automatic vane control will operate in the background as it has on previous products and will be inhibited only as required. At system start-up, the engine will be brought up to full speed. **Only after full speed has been reached and leaving chilled water temperature is close to setpoint (LCHWT) will the engine speed slowly approach the surface speed.** Since PRV position and head are dynamic, the surface speed must be calculated on a continuous basis.

Fig. 2 is a simple block diagram of the engine speed control:

Capacity control is achieved by use of prerotation vanes and impeller speed control. Prerotation vane position and engine speed are automatically controlled by the YORK Micro Panel to maintain leaving chilled liquid temperature at the desired setpoint without overloading the engine. Engine speed is set to optimize energy efficiency. The unit will be capable of operating with lower temperature cooling tower water during part load operation. At operating conditions requiring less than full impeller speed, engine speed is reduced to improve efficiency.

CATERPILLAR ENGINE CONTROL PANEL OPERATION

General

The Gas Engine Control Panel (referred to as ECP-Engine Control Panel) is designed for operation and protec-

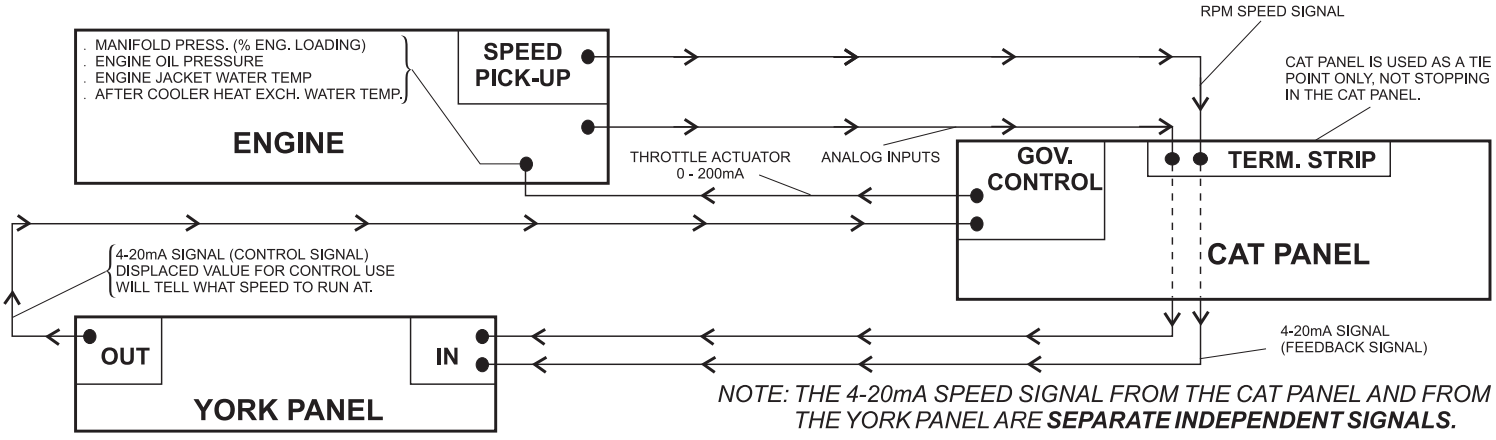


FIG. 2 – ENGINE SPEED CONTROL

LD02532

tion of the natural gas engine and drive components. (See Figs. 2A and 3, pages 15 & 16) The major components of this panel consist of a Status Control Module (SCM), Programmable Logic Controller (PLC) processor, Engine Control Switches and an Electronic Governor.

The main purpose of the ECP is to integrate the YORK Micro Panel controls with the Caterpillar Engine controls (primarily Status Control Module). The ECP is not intended to be the primary controller for the chiller system. The YORK Micro Panel acts as the system controller, providing start/stop initiation logic, clutch engage/disengage initiation and speed control via a 4-20mA speed reference signal based on system (engine and chiller) parameters.

In addition to integrating the YORK Controls with the Caterpillar Engine Controls, the ECP serves as the primary control and protection system for the drive line engine, clutch and gearbox. Engine protection and shutdown are provided by the Caterpillar Status Control Module for Electronic Ignition Engines (EIS). This module provides Overspeed, Overcrank, Low Lube Oil Pressure, High Jacket Water Temperature, Emergency Stop and Auxiliary (PLC initiated) Quick Safety Shutdown protection with LED indication of shutdown conditions. In addition, this module displays Engine Hours, Engine Speed, Engine Jacket Water Temperature, Engine Oil Pressure and Battery Voltage on an LCD digital display.

The drive line clutch and gearbox control/protection/indication is provided by the Drive Line PLC processor. The PLC provides gear box lubrication control/protection, clutch failure protection and additional drive line related protection. LED indication is provided for by Caterpillar modules for drive line related alarms and shutdowns: (See Fig. 2A and 3)

Alarms include:

- High Jacket Water Temperature Alarm
- Low Engine Oil Pressure Alarm
- System Not in Auto Alarm
- Low Gear Box Oil Pressure Alarm
- High Drive Line Vibration Alarm (Optional)
- Electronic Ignition System Alarm
- Low Battery Voltage Alarm
- High Inlet Manifold Temp Alarm (Optional)

Drive Line Safety Shutdowns include (in addition to SCM shutdowns):

- Low Jacket Water Level Shutdown
- High Gear Box Oil Temperature Shutdown
- High Drive Line Vibration Shutdown (Optional)
- PLC Failure Shutdown
- Low Gear Box Oil Pressure Shutdown
- Electronic Ignition System Shutdown
- Clutch Failure Shutdown
- Sensor Failure Shutdown consisting of:
  1. Low Oil Pressure Warning Switch, Fail
  2. Low Oil Pressure Shutdown Switch, Fail
  3. High Gear Oil Temperature Switch, Fail
  4. Clutch Engaged Pressure Switch, Fail

ENGINE CONTROL SWITCHES AND MANUAL ENGINE RUN

Four engine control switches are located on the inside of the ECP door. (See Fig. 3) This is by design to further emphasize that YORK's Micro Panel is the primary system control. However, the engine can be run de-clutched from the compressor under manual control for engine set-up and troubleshooting, if correct procedures are followed. The following guidelines should be followed to manually run the engine:

NOTE: It is recommended that the clutch air supply be disconnected and visual inspection made of the clutch friction shoes to confirm that the clutch is disengaged before manually running the engine.

1. Engine Control Switch

   The Engine Control Switch is a three (3) position maintained switch. Following is the functional description of each position.

   Left – OFF/RESET: This position is to be used when a system safety shutdown has occurred or it is intended that the system should not be run at that time. Placing the Engine Control Switch (ECS) in this position will reset engine shutdown and alarms if all engine shutdown conditions are no longer present.

   Center – AUTO: This position is the "normal" position to run the engine as part of the Chiller System. This is the position the switch has to be in for the system to run.

   Right – ENG MAINT: This position is to be used when it is intended to run the engine as a stand alone component ONLY. When this position is selected the Engine Maintenance Control Switch becomes "active".

2. Engine Maintenance Control Switch

   The Engine Maintenance Control Switch is a two (2) position maintained switch. Following is the functional description of each position. This switch is only active when the Engine Control Switch is in the "ENG MAINT" position.

   Left – STOP:

   Right – Start/Run: This position should be selected if it is intended to run the engine stand alone at either Idle or Rated speed only. Selecting this position will immediately pre-lube (if equipped) and start the engine.

3. Engine Maintenance Speed Control Switch

   The Engine Maintenance Speed Control Switch is a three (3) position maintained switch. Following is the functional description of each position. This switch is only active when the Engine Control Switch is in the "ENG MAINT" position.

Left – PURGE: This position should be selected to purge the engine of unburned gas.

Center – IDLE: This position should be selected if it is desired to run the engine manually at Idle speed.

Right – RATED: This position should be selected if it is desired to run the engine manually at Rated speed.

*NOTE: **NEVER** MANUALLY ENGAGE THE CLUTCH TO ATTEMPT TO RUN THE SYSTEM WITHOUT THE YORK MICRO PANEL CONTROLS. THIS WILL RESULT IN COMPRESSOR DAMAGE AND POSSIBLE PERSONAL INJURY.*

4. Electronic Ignition System Diagnostic Reset: This switch is used to clear EIS alarms as described in the following section.

RESETTING SYSTEM UNDER ALARM/SAFETY SHUTDOWN CONDITIONS

1. Alarms – Engine Control Panel

The following procedure must be followed to clear ENGINE related alarm conditions:

A. Alarm conditions will flash the appropriate Alarm LED and sound the horn on the Alarm Module until the "Alarm Silence" button is pressed to acknowledge the alarm condition. At this time, the LED will stay on continuously and the horn will turn off.

B. If the alarm condition "clears itself" after the "Alarm Silence" button is pressed, the LED will extinguish, indicating the alarm condition has returned to normal operating state.

C. If the Alarm condition does not clear itself, the LED will remain on continuously until the cause of the condition is removed.

NOTE: Electronic Ignition System (EIS) Alarms are the one exception to the above procedure. The DIAGNOSTIC RESET push-button must also be pressed in addition to the above procedure.

2. Purging the Gas Engine

Safety shutdown is any normal shutdown that occurs during start-up or while in operation that causes the system to disengage the clutch (stops the compressor), closes the inlet vanes, and allows the compressor lubrication pump to run for two (2) minutes; and allows the gearbox lubrication pump to run during the four (4) minute coastdown (engine cooldown) cycle. When the "safety occurrence" failure has been satisfied, the system can be restarted. (i.e. "flow switch).

Emergency stop ("E" stop) is any failure that shuts down the system immediately without letting the system go through a normal shutdown procedure as described above. **Before attempting to re-start the system the engine must be purged of any raw gas or ignition by-products that may have been trapped in the engine/exhaust to prevent any possibility of damage/injury caused by ignition on start-up. (See "purge procedure" page 14.)**

Below is a list of quick shutdowns which require a purge:

Quick Shutdown (Also see page 49)

- Flow Switch
- Low Evap Press
- Low Oil Press
- High Press
- Evap Transducer or Probe Error
- High Discharge Temp
- High Oil Temp
- High Oil Pressure
- Faulty Cond Pressure XDCR
- Faulty Oil Pressure XDCR
- Oil Pressure XDRC Error
- Prox Sensor Safety Shutdown
- High Speed Drain Temp
- Aux Safety Shutdown
- Compressor Overspeed
- Surge Safety
- PLC Failure
- Engine Overload
- Engine Overspeed
- Engine Fault
- Clutch Failure
- Low Oil Pressure
- High Engine Jacket Temp
- Low Evap Pressure Brine
- Open Drain Temp Thermocouple

Quick Shutdown – YORK supplies a contact closure which tells the Caterpillar Panel it is an emergency and cuts the fuel and ignition. The YORK panel de-clutches.

COMP COASTDOWN – ENGINE SHUTDOWN

This shutdown occurs very quickly to avoid potential equipment damage.

NOTE: In a Quick Shutdown, the engine panel must be manually reset. This is due to the emergency stop on the engine.

A. Clutch Engage Failure Shutdown

If the clutch of the chiller driveline does not engage, a fault has occurred, and the engine will shut down. Before attempting to re-start the engine/chiller, a trained operator or YORK/Caterpillar Technician should troubleshoot the system and correct the problem.

B. PLC Failure Shutdown

The PLC (Program Logic Control) has been programmed to output a signal to a "watchdog" timer. If the PLC fails to output this pulse to the "watchdog" timer, the engine will shut down to assure that the engine does not run out of control.

C. Sensor Failure Shutdown

If any of the sensors fail, the engine control panel and engine ignition system can no longer control and monitor the engine. The engine is set to shut down if this occurs to assure that the engine will not fault, and further endanger the engine and operator personnel.

D. **Safety Shutdown – Emergency Stops – Purge Procedure (Also see page 53)**

Safety shutdowns can be intiated by the Engine Control Panel (ECP) or by the YORK Micro Panel. Safety shutdowns also require **both panels** to be reset. The followign procedure should be followed to reset the system after a safety shutdown:

NOTE: The system will run through a safety shutdown sequence when a safety shutdown has occurred. The sequence will include running the Compressor Lubrication Pump and the Gear Box Lubrication Pump for up to four (4) minutes. The following procedure will not be able to completely be carried out until the system has run through this shutdown sequence. ***Wait for the sequence to complete before executing the following procedure (with exception "A") to allow for proper lubrication of the compressor and the gearbox.***

1. Press the "**ALARM SILENCE**" push-button on the ECP to turn the horn off.
2. Move the "**ENGINE CONTROL SWITCH**" to the "**OFF/RESET**" position to reset the ECP. Leave the "**ENGINE CONTROL SWITCH**" in this position until this procedure is complete.
3. Press the "**DIAGNOSTIC RESET**" if the safety shutdown was initiated by the EIS system or caused an "**EIS SHUTDOWN DIAGNOSTIC**".
4. Place the "**START/RUN/STOP**" toggle switch on the YORK Micro Panel to the "**STOP**" position.
5. Press the "**WARNING RESET**" push-button on the YORK Micro Panel to reset the system. **NOTE: If the compressor lubrication pump is still running, the system will not reset.**
6. Place the engine control switch in the "**ENGINE MAINTENANCE**" mode, and turn the "**ENGINE MAINTENANCE SPEED CONTROL**" switch to the "**PURGE**" position.
7. Turn the "**ENGINE MAINTENANCE CONTROL**" switch to the "**START/RUN**" position and hold for fifteen (15) seconds. Return the switch to the "**STOP**" position.
8. Repeat steps "1" through "5" to reset the system.
9. Place the "**ENGINE CONTROL SWITCH**" (ECP) back in the "**AUTO**" position and close the door.
10. The system should now be reset.

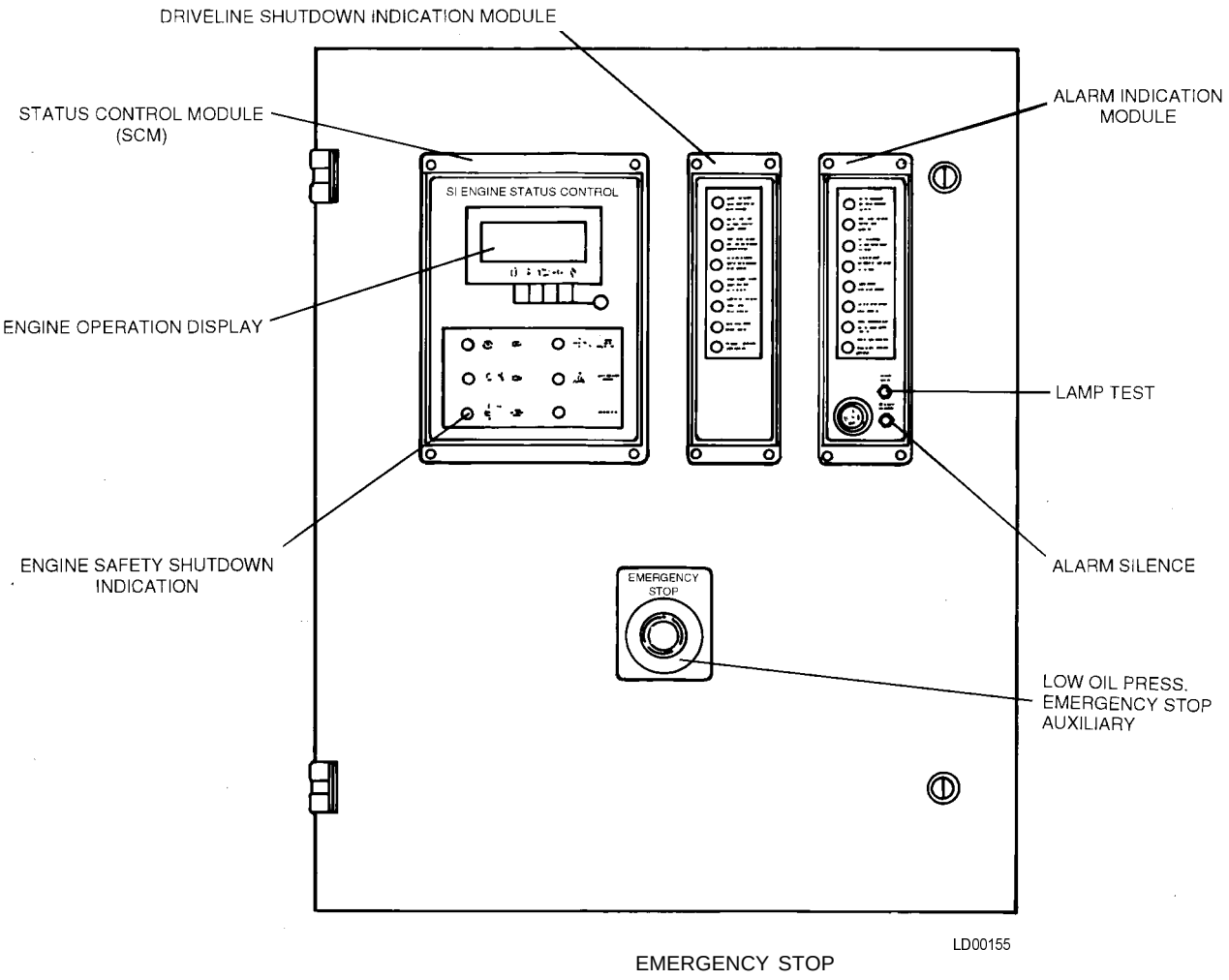
3. Safety Shutdowns – Emergency Stops (Also see page 53)

Safety shutdowns can be initiated by the Engine Control Panel (ECP) or by the YORK Micro Panel. Safety Shutdowns will also require **both** panels to be reset. Safety Shutdowns are distinguished from standard shutdowns in that the shutdown occurs very quickly to avoid potential equipment damage. The following procedure should be followed to reset the system after a safety shutdown:

NOTE: The system will run through Safety Shutdown sequence when a safety shutdown has occurred. The sequence will include running the Compressor Lubrication Pump and the Gear Box Lubrication Pump for up to four minutes. The procedure will not be able to completely be carried out until the system has run through this shutdown sequence. WAIT FOR THE SEQUENCE TO COMPLETE BEFORE FOLLOWING THE BELOW PROCEDURE (WITH THE EXCEPTION OF A) TO ALLOW FOR PROPER LUBRICATION OF THE COMPRESSOR AND GEAR BOX. ***DO NOT CYCLE POWER TO CLEAR FAULTS.***

1. Press the ALARM SILENCE push-button on the ECP to turn the horn off.
2. Move the "Engine Control Switch" to the OFF/RESET position to reset the ECP. Leave the "Engine Control Switch" in this position until this procedure is complete.
3. Press the DIAGNOSTIC RESET if the Safety Shutdown was initiated by the EIS system or caused an EIS Shutdown Diagnostic.
4. Place the START/RUN/STOP toggle switch on the YORK Micro Panel to the STOP position.
5. Press the WARNING RESET push-button on the Micro Panel to reset the system. Must be in "SERVICE" Mode (page 37).

   NOTE: If the Compressor Lubrication Pump is still running, the system will not reset.
6. Place the Engine Control Switch (ECS) back in the AUTO position and close the door.
7. The system should now be reset.
8. Push START/RUN/STOP toggle switch on YORK Micro Panel to START to restart the chiller.



EMERGENCY STOP

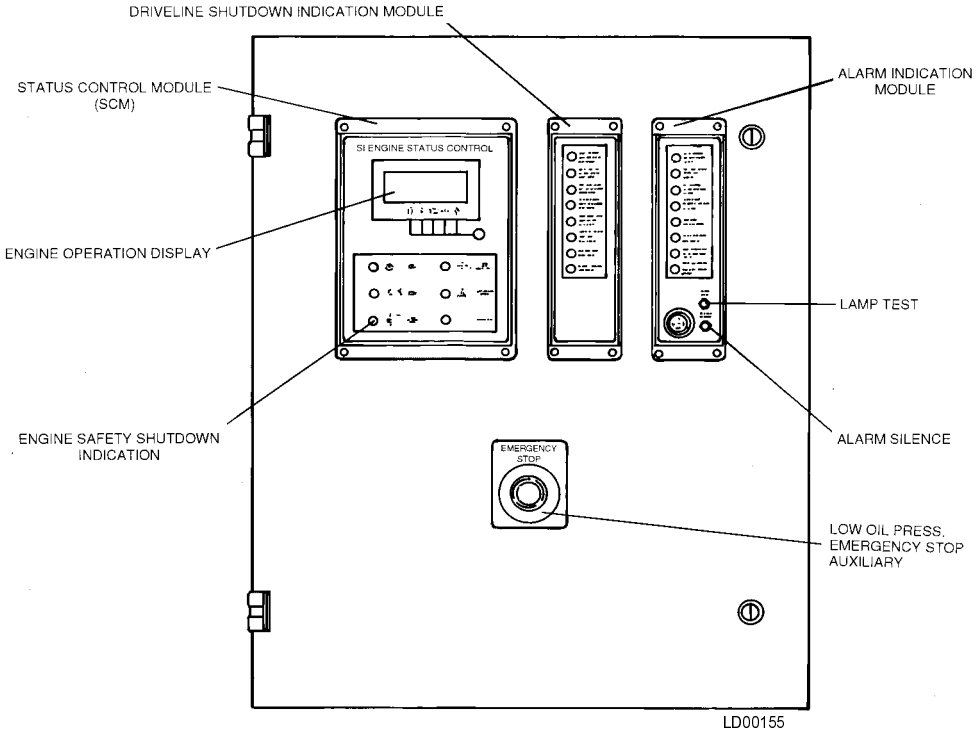
Alarms include:

- High Engine Coolant Temp Alarm
- High Drive-Line Vibration Alarm
- Low Engine Oil Pressure Alarm
- Electronic Ignition System Alarm
- System Not in Auto Alarm
- Low Battery Voltage Alarm
- Low Gear Box Oil Pressure Alarm
- High Air Inlet Manifold Temp Alarm

Safety Shutdowns include:

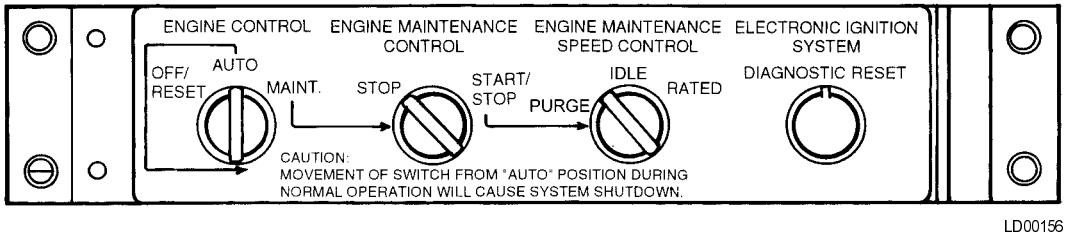
- Low Engine Coolant Level Shutdown
- Low Gear Box Oil Pressure Shutdown
- High Gear Box Oil Temperature Shutdown
- Electronic Ignition System Shutdown
- High Drive Line Vibration Shutdown
- Clutch Engage Failure Shutdown
- PLC Failure Shutdown
- Sensor Failure Shutdown consisting of:
  1. Low Oil Pressure Warning Switch, Fail
  2. Low Oil Pressure Shutdown Switch, Fail
  3. High Gear Oil Temperature Switch, Fail
  4. Clutch Engaged Pressure Switch, Fail

FIG. 2A – ENGINE CONTROL PANEL (ECP)

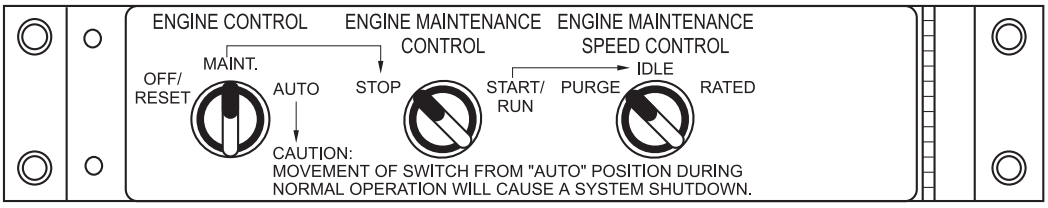


EMERGENCY STOP

YG PANEL



YB PANEL



Alarms include:

- High Engine Coolant Temp Alarm
- High Drive-Line Vibration Alarm (Optional)
- Low Engine Oil Pressure Alarm
- Electronic Ignition System Alarm
- System Not in Auto Alarm
- Low Battery Voltage Alarm
- Low Gear Box Oil Pressure Alarm
- High Air Inlet Manifold Temp Alarm (Optional)

Safety Shutdowns include:

- Low Engine Coolant Level Shutdown
- Low Gear Box Oil Pressure Shutdown
- High Gear Box Oil Temperature Shutdown
- Electronic Ignition System Shutdown
- Clutch Engage Failure Shutdown
- PLC Failure Shutdown
- Sensor Failure Shutdown consisting of:
  1. Low Oil Pressure Warning Switch, Fail
  2. Low Oil Pressure Shutdown Switch, Fail
  3. High Gear Oil Temperature Switch, Fail
  4. Clutch Engaged Pressure Switch, Fail

FIG. 3 – ENGINE CONTROL PANEL (ECP) (Cont'd) ENGINE CONTROL SWITCHES

SECTION 2
MICROCOMPUTER CONTROL CENTER

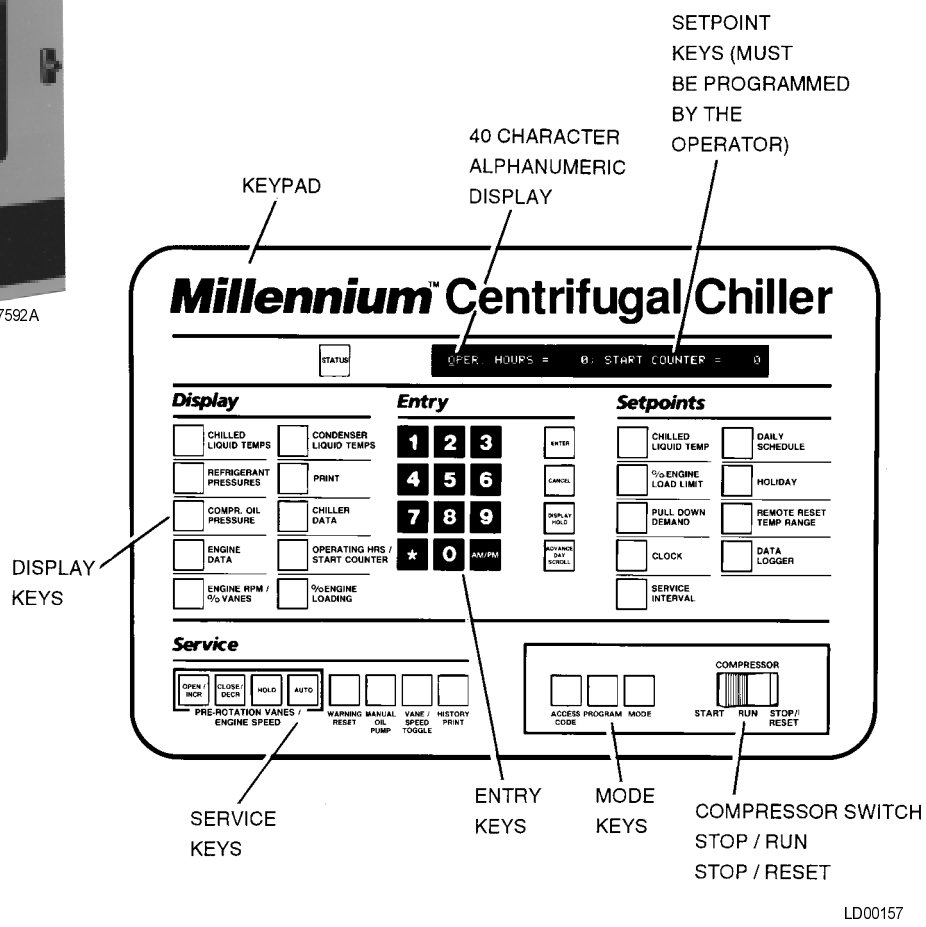


FIG. 4 – MICROCOMPUTER CONTROL CENTER AND KEYPAD

WARNING

This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. Operation of this equipment in a residential area is likely to cause interference in which case **the user at his own expense will be required to take whatever action may be required to correct the interference.**

Additionally, any electronic equipment can generate EMI (electromagnetic interference) which, depending upon the installation and magnitude, may affect other electronic equipment. The amount of EMI generated is determined by the source inductance, load inductance, and circuit impedances. Responsibility for assuring the satisfactory operation of other equipment included in the same power source as the YORK equipment rests solely with the user. YORK disclaims any liability resulting from any interference or for the correction thereof. Ear protection should be worn when machine is running.

INTRODUCTION

The YORK MicroComputer Control Center is a microprocessor based control system for R-134A centrifugal chillers. It controls the leaving chilled water temperature via prerotation vane and engine speed control and has the ability to limit engine loading via control of the prerotation vanes.

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 PSIG; in the metric mode, temperatures in °C, pressures in kPa).

- CHILLED LIQUID TEMPERATURES – LEAVING AND RETURN
- REFRIGERANT PRESSURES – EVAPORATOR AND CONDENSER
- DIFFERENTIAL COMPRESSOR OIL PRESSURE
- CONDENSER LIQUID TEMPERATURES – LEAVING AND RETURN
- PRINT*
- HISTORY PRINT*
- SATURATION TEMPERATURES – EVAPORATOR AND CONDENSER
- DISCHARGE TEMPERATURE
- COMPRESSOR OIL TEMPERATURE
- HIGH & LOW OIL PRESSURE TRANSDUCER PRESSURE
- ENGINE RPM % VANES
- % ENGINE LOADING
- % OPERATING HOURS/START COUNTER
- ENGINE DATA
- CHILLER DATA

The system setpoints (See Fig. 5) are operator entered on the front control center ***SETPOINTS*** keypad. These setpoints can also be displayed on the 40 character alphanumeric display. The system setpoints are:

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

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 Engine Load 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
8. System Run 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 engine load limit setpoint interface from three user input choices:

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

*These keys provide a print-out when the customer connects a compatible printer to the Micro Board RS-232 serial port. (See Form 160.60-N2.)

MICRO PANEL CONTROL CENTER

The Control Center front panel layout consists of five key groups, one switch, and 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, setpoints, and data can be viewed at this location. The main communications between the operator or service technician and the MicroComputer Control Center occur on this display.

DISPLAY – Provides 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 by 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 or engine speed control with visual display readout of operation. Also allows manual engine speed control with visual display readout of engine speed.
2. **Local –** allows manual chiller 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 % engine load 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 miutes 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 gauge (PSIG) 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).

OUT OF RANGE VALUES FOR YG & YB CHILLER VARIABLES (R134A)

VARIABLE	DISPLAY -> X'S WHEN,
EVAP PRESSURE (WATER & BRINE)	<= 6.8 PSIG OR >= 77.4 PSIG
COND PRESSURE	<= 6.8 PSIG OR >= 315.0 PSIG
HOP TRANSDUCER PRESSURE	>= 315.0 PSIG
LOP TRANSDUCER PRESSURE	>= 315.0 PSIG
DISCHARGE TEMPERATURE	<= 20.3°F OR >= 226.4°F
OIL TEMPERATURE	<= 20.3°F OR >= 226.4°F
LEAVING COND WATER TEMP.	<= 8.4°F OR >= 134.1°F
ENTERING COND WATER TEMP.	<= 8.4°F OR >= 134.1°F
LEAVING CHILLED WATER TEMP.	>= 81.1°F
ENTERING CHILLED WATER TEMP.	<= 0.1°F OR >= 93.0°F

FIG. 5 – SYSTEM PARAMETERS – OUT OF RANGE READINGS (Also see page 51)

To Display **CHILLED LIQUID TEMPS**:

Press "**CHILLED LIQUID TEMPS**" display key as described on page 19 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 on page 19 to produce the following alphanumeric display message:

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

To Display **COMPRESSOR OIL PRESSURE**:

Use "**COMPRESSOR OIL PRESSURE**" display key as described on page 19 to produce the following alphanumeric display message:

OIL PRESSURE = XXXX.X PSID

The differential pressure displayed is the pressure difference between the high side oil pressure transducer (output of oil filter) and the low side oil pressure transducer (compressor housing). Displayed value includes offset pressure derived from auto-zeroing during "**START SEQUENCE INITIATED**." If either transducer is out-of-range, XX.X is displayed. Oil pressure is calculated as follows:

____PSID = (HOP – LOP) – OFFSET PRESSURE

OFFSET PRESSURE – Pressure differential between the HOP transducer and LOP transducer outputs during a 10 second period beginning 3 seconds after the start of "**COMPRESSOR START SEQUENCE INITIATED**." During this time the tranducers will be sensing the same pressure and their outputs should indicate the same pressure. However, due to accuracy tolerances in tranducer design, differences can exist. Therefore, to compensate for differences between transducers and assure differential pressure sensing accuracy, the **OFFSET PRESSURE** is subtracted algebraically from the differential pressure. The offset pressure calculation will not be performed if either transducer is out-of-range. The offset value will be taken as 0 psi in this instance.

To Display **ENGINE DATA**:

Press the "**ENGINE DATA**" display key as described on page 19 to produce the following alphanumeric display message:

ENGINE OIL PRESSURE = XXX.X PSIG

ENGINE MANIFOLD PRESSURE = XX.X PSIG

ENGINE JACKET WATER TEMPERATURE = XXX.X°F

AC INLET WATER TEMPERATURE = XXX°F

To Display **ENGINE RPM% VANES**:

Press the "**ENGINE RPM% VANES**" key as described on page 19 to produce the following alphanumeric display message:

ENGINE SPEED = XXXX RPM, VANES = XXX %

To Display **CONDENSER LIQUID TEMPERATURES**:

Use the "**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, or both termistors are "out of range" the display will blank when this key is pressed.

To initiate a **PRINT** to the Printer:

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

PRINT REQUEST IN PROGRESS...

Refer to "MicroComputer Control Center - System Status Printers" Instruction (Form 160.60-N2) for details of the optional printers.

SELECTING ENGINE TYPE

The engine type displayed with the % **ENGINE LOADING KEY** is a result of program jumper configurations performed only by a qualified YORK service technician. Refer to YORK service manual form no. 160.60-M1.

To Display **% ENGINE LOADING**:

Press the "**% ENGINE LOADING**" display key to display **ENGINE LOADING** as a percent and loading history messages, as hours. The messages are as follows: (see graph below)

G3512 ENGINE LOADING =	XXX%
ENGINE LOAD (30 - 39%):	XXXX.X HOURS*
ENGINE LOAD (40 - 49%):	XXXX.X HOURS*
ENGINE LOAD (50 - 59%):	XXXX.X HOURS*
ENGINE LOAD (60 - 69%):	XXXX.X HOURS*
ENGINE LOAD (70 - 79%):	XXXX.X HOURS*
ENGINE LOAD (80 - 89%):	XXXX.X HOURS*
ENGINE LOAD (90 -100%):	XXXX.X HOURS*

---

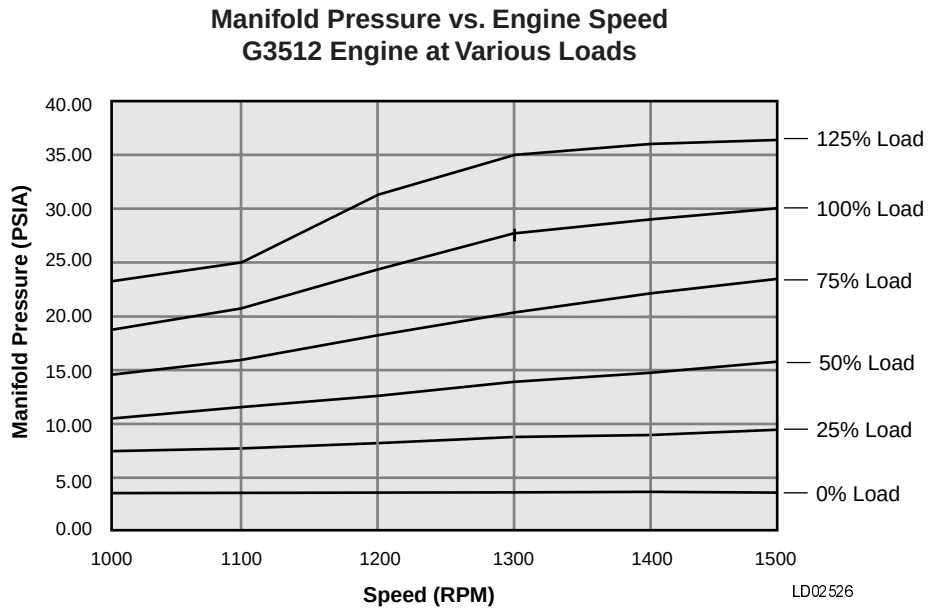
* Keeping the "Engine Loading" key depressed will allow you to see these messages.

Engine loading (%) is calculated as a function of manifold pressure (PSIA) and engine speed (RPM). The chiller MicroComputer Control Center receives the manifold pressure value and engine speed value from the Engine Control Center. The program inserts these values into a load profile graph as shown below to determine the % engine loading.

Fig. 6 shows graphs for each series engine.

ENGINE TYPE	RPM RANGE	OVERSPEED THRESHOLD RPM
G3408S *	1400 TO 1800	2100
G3412	1400 TO 1800	2100
G3508	1000 TO 1500	1750
G3512	1000 TO 1500	1750
G3516	1000 TO 1500	1750
G3606	700 TO 1000	1167
G3408L**	1400 TO 1800	2100
G3406***	1400 TO 1800	2100

* Stoichometric
** Lean Burn Engine (EPROM version C.04F.15 and earlier only)
*** ERPOM version C.04F.16 and later.



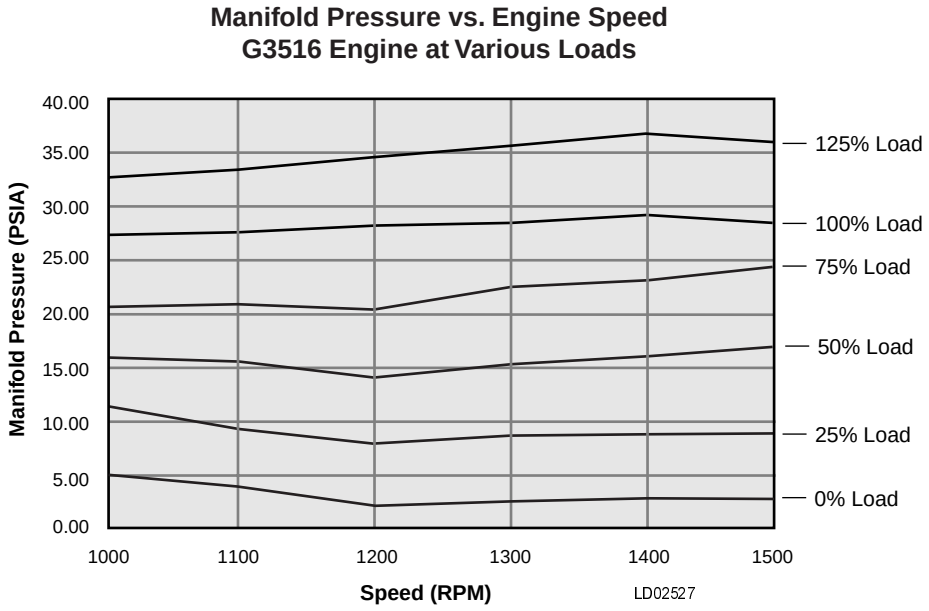
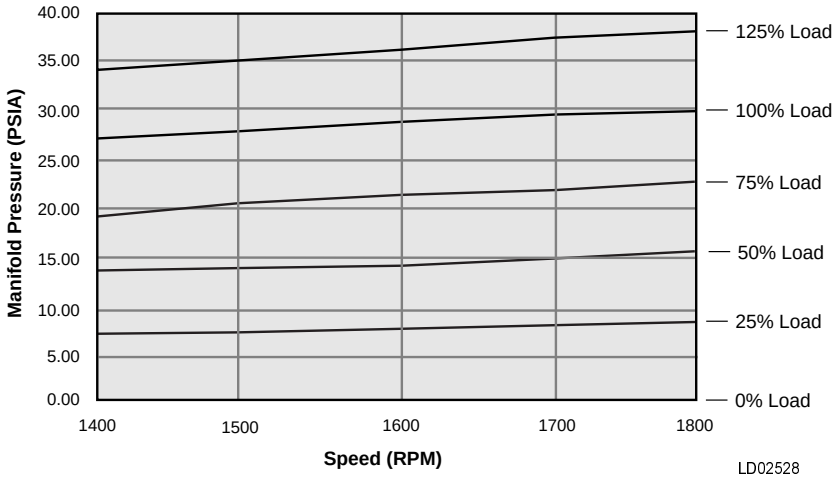


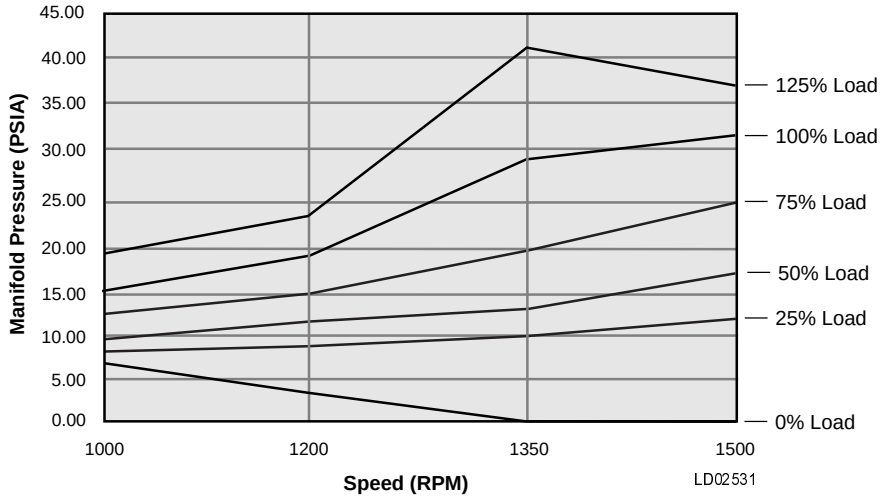
FIG. 6 – MANIFOLD PRESSURE VS. ENGINE SPEED

G3412 Loading Chart

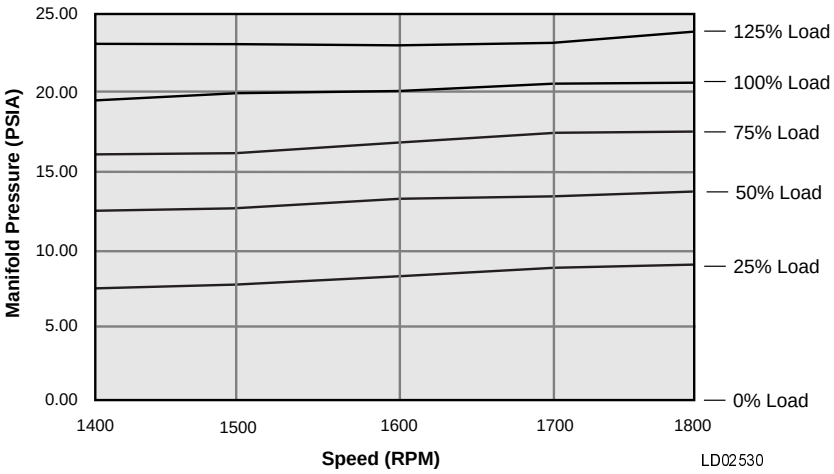


	0%	25%	50%	75%	100%	125%
1400	0.0	7.5	14.0	19.8	27.0	34.3
1500	0.0	7.9	14.3	20.5	27.8	35.0
1600	0.0	8.2	14.7	21.2	28.8	36.5
1700	0.0	8.5	15.0	22.0	29.5	37.2
1800	0.0	8.9	15.4	22.7	29.9	37.9

Manifold Pressure vs. Engine Speed
G3508 Engine at Various Loads

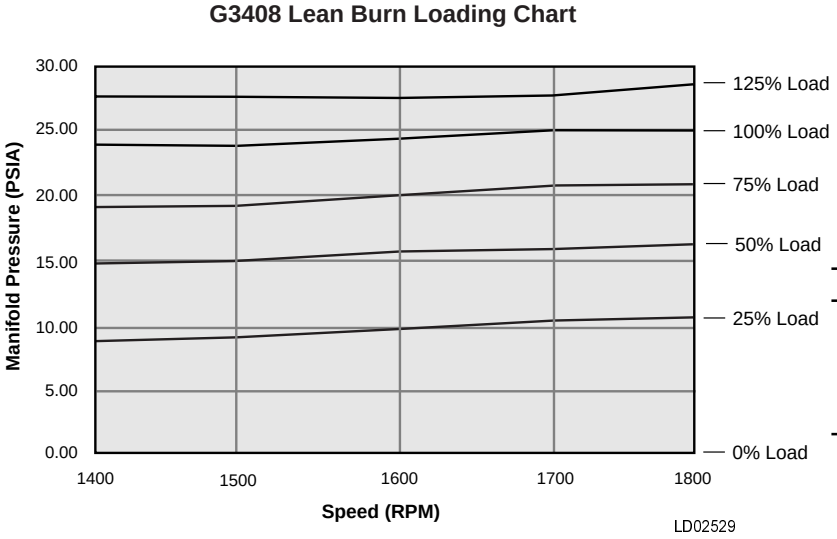


G3408 Stoichiometric Loading Chart



	0%	25%	50%	75%	100%	125%
1400	0.0	7.5	12.2	15.6	19.4	22.7
1500	0.0	7.8	12.5	15.8	19.7	22.7
1600	0.0	8.2	13.0	16.5	20.1	22.7
1700	0.0	8.6	13.3	17.0	20.4	22.7
1800	0.0	8.9	13.3	16.9	20.5	23.4

FIG. 6 – MANIFOLD PRESSURE VS. ENGINE SPEED (Cont'd)



	0%	25%	50%	75%	100%	125%
1400	0.0	9.1	14.8	18.9	23.6	27.6
1500	0.0	9.5	15.2	19.2	23.9	27.6
1600	0.0	10.0	15.8	20.0	24.4	27.6
1700	0.0	10.4	16.2	20.6	24.8	27.6
1800	0.0	10.8	16.2	20.5	24.9	28.4

FIG. 6 – MANIFOLD PRESSURE VS. ENGINE SPEED (Cont'd)

To Display **CHILLER DATA** press the "**CHILLER DATA**" key as described in page 19 to produce the following alphanumeric display messages:

```
SAT. TEMP EVAP = XXX.X °F,  COND = XXX.X °F
DISCHARGE TEMP = XXX.X °F,  OIL = XXX.X °F
HOP = XXXX.X PSIG;  LOP = XXXX.X PSIG
PROXIMITY SENS-POS:  XX MILS,  REF:XX MILS
HIGH SPEED DRAIN TEMP = XXX.X °F
DELTA P OVER P = X.XX;  PRV = XXX %
ENGINE RPM = XXXX,  RPMS = XXXX
MACH = X.XX;  MACHS = X.XX
```

To Display **OPERATING HOURS** and **STARTS COUNTER**:

Use the "**OPERATING HOURS**" key as described on page 19 to produce the following message:

```
OPER. HOURS = XXXXX;  START COUNTER = XXXXX
```

*NOTE: The operating hours and starts counter can be reset to zero. Refer to "Programming the Micro - Computer Control Center", page 27. However, the purpose of the "**OPERATING HOURS**" key is to display the total accumulated chiller run time. Therefore, the operating hours should not be arbitrarily reset.*

SYSTEM SETPOINTS

The system setpoints may be programmed by the system operator. The "**SETPOINTS**" keys are located on the Control Center keypad (See Fig. 4). To program, see "Programming System Setpoints", page 27. 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 27.

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.

% ENGINE LOAD LIMIT – This key displays the maximum value of engine loading permitted by its programmed setting. The value is in terms of percent of engine loading. If not programmed, the default value is 100%. (See "Programming System Setpoints", page 27).

PULL DOWN DEMAND – This function is used to provide energy savings following the chiller start-up. This key displays a programmable engine load limit and a 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 engine load limit control returns to % engine load limit setpoint. The maximum permitted Engine Loading is in terms of %. The duration of time that the Engine Loading is limited is in terms of minutes (to a maximum of 255). If not programmed, the default value is 100% for 00 minutes (See "Programming Systems Setpoints", page 27). Thus, no pull down demand limit is imposed following system start, and the % Engine Load 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 1/1/95
```

(See "Programming System Setpoints", page 27).

SERVICE INTERVAL – This key shows engine setpoint and compressor setpoint hours. Along with the hours remaining before the engine/compressor is due for service. (See page 30).

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 27). 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: 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/RESET TEMP 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 **REMOTE/RESET TEMP RANGE** 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 160.60-PW3 or 160.66-PW3.

*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 160.60-N2 for operation instructions.

DISPLAYING SYSTEM SETPOINTS

The currently programmed Setpoint values can be viewed at any time (See page 37) 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** the 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 "**CHILLED LIQUID TEMP**" setpoint key as described on page 23 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 were received within 30 minutes.*

To Display **% ENGINE LOAD LIMIT** Setpoint:

Use "**% ENGINE LOAD LIMIT**" setpoint key as described above to produce the following message:

ENGINE LOAD LIMIT = XXX%

*NOTE: The value displayed is the actual % engine load 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 engine limit setpoint input.*

To Display **PULL DOWN DEMAND** Setpoint:

Use "**PULL DOWN DEMAND**" setpoint key as described on page 23 to produce the following message:

```
SETPOINT = XXX MIN @ XXX% LOAD, XXX MIN LEFT
```

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

Use "**CLOCK**" setpoint key as described on page 23 to produce the following message:

```
TODAY IS DAY XX:XX AM/PM 1/1/95
```

To Display **SERVICE INTERVAL**:

Press and hold the "**SERVICE INTERVAL**" setpoint key. The display will show engine and compressor hours and hours left before the engine and compressor require checking/servicing.

```
ENGINE SETPOINT = XXXX HRS, XXXX HRS REM
```

```
COMPRESSOR SETPOINT = XXXX HRS, XXXX REM
```

For the procedure on how to reset HOURS REMAINING and hours for SERVICE INTERNAL, refer to YORK Service Manual 160.60-M1. *This is to be performed only by a qualified YORK service mechanic*.

To Display **DAILY SCHEDULE** Setpoints:

- Press and hold "**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
THUR START = 05:00 AM  STOP = 07:00 PM
FRI START = 05:00 AM  STOP = 07:00 PM
SAT START = 05:00 AM  STOP = 07:00 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 RESET TEMP RANGE**" setpoint key as described above to produce the following message:

```
REMOTE TEMP SETPOINT RANGE = XX°F
```

To Display **DATA LOGGER** setpoints:

Refer to YORK Form 160.60-N2 for operation of this key.
Example of Printout from Data Logger.

YORK SYSTEM 1 UPDATE
c 1995 YORK INTERNATIONAL CORP.
VERSION C.04F.00
TODAY IS THU 11:37AM 03/14/96
SYSTEM RUN – LEAVING TEMP CONTROL

LEAVING CHILLED WATER TEMP = 51.5 F
RETURN CHILLED WATER TEMP = 57.4 F
LEAVING CONDENSER WATER TEMP = 82.2 F
RETURN CONDENSER WATER TEMP = 78.9 F
EVAPORATOR SATURATION TEMP = 50.2 F
CONDENSER SATURATION TEMP = 84.0 F
DISCHARGE TEMPERATURE = 100.2 F
OIL TEMPERATURE = 114.6 F

EVAPORATOR PRESSURE = 45.8 PSIG
CONDENSER PRESSURE = 93.7 PSIG
HIGH OIL PRESSURE = 79.4 PSIG
LOW OIL PRESSURE = 39.9 PSIG
OIL PRESSURE DIFFERENTIAL = 40.6 PSID

LEAVING CHILLED H20 SETPOINT = 51.0 F
REMOTE TEMP SETPOINT RANGE = 20.0 F

COMPRESSOR OIL PUMP – ON
CHILLED WATER PUMP – ON
VENT LINE VALVE – ON
RETURN OIL SOLN VALVE – ON
HIGH SPEED THRUST VALVE – ON
REMOTE READY TO START – OFF
SAFETY SHUTDOWN RELAY – OFF
CYCLING SHUTDOWN RELAY – OFF

PROXIMITY SENSOR POSITION = 66 MILS
PROXIMITY SENSOR REFERENCE = 67 MILS
HIGH SPEED DRAIN TEMPERATURE = 126.1 F
LEVEL CONTROL POSITION = 20%
LEVEL CONTROL SETPOINT = 20%

ENGINE SPEED = 1647 RPM
ENGINE RPMS TARGET = 1640 RPM

ENGINE LOAD LIMIT = 85%
ENGINE LOADING = 53%
PERCENT VANES OPEN = 24%
PERCENT DAC OUTPUT = 58%

ENGINE OIL PRESSURE = 63.2 PSIG
ENGINE MANIFOLD PRESSURE = 13.4 PSIA
ENGINE JACKET WATER TEMP = 191.1 F
ENGINE SCAC TEMPERATURE = 83.8 F
ENGINE MACH NUMBER = 12.14
PRESSURE RATIO (DP/P) = 0.83
SURFACE SPEED CONTROL = ACTIVE

ENGINE LOAD -> (30 - 39%): 0.1 HRS
ENGINE LOAD -> (40 - 49%): 0.7 HRS
ENGINE LOAD -> (50 - 59%): 0.5 HRS
ENGINE LOAD -> (60 - 69%): 0.3 HRS
ENGINE LOAD -> (70 - 79%): 0.1 HRS
ENGINE LOAD -> (80 - 89%): 0.0 HRS
ENGINE LOAD -> (90 - 100%): 0.1 HRS

ENGINE MODEL = G3412
COMPRESSOR MODEL = H2
COMPRESSOR GEAR CODE = FH

PULLDOWN LIMIT SETPOINT = 40%
PULLDOWN LIMIT TIME SETPOINT = 20 MIN
PULLDOWN LIMIT TIME LEFT = 0 MIN
WTO AUTO PRINT INTERVAL = NOT PROGRAMMED

OPERATING HOURS = 32
START COUNT = 54

SUN START = 00:00AM, STOP = 00:00AM
MON START = 00:00AM, STOP = 00:00AM
TUE START = 00:00AM, STOP = 00:00AM
WED START = 00:00AM, STOP = 00:00AM
THU START = 00:00AM, STOP = 00:00AM
FRI START = 00:00AM, STOP = 00:00AM
SAT START = 00:00AM, STOP = 00:00AM
HOL START = 00:00AM, STOP = 00:00AM

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. 7). For all the programming system setpoints shown below you MUST be in the "Program mode, select setpoint'' mode.

1. Press "**ACCESS CODE**" key.

2. This is displayed:

   ENTER VALID 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.*

   *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,*

   INVALID ACCESS CODE

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

6. 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**" 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:

   PROGRAM MODE, SELECT SETPOINT

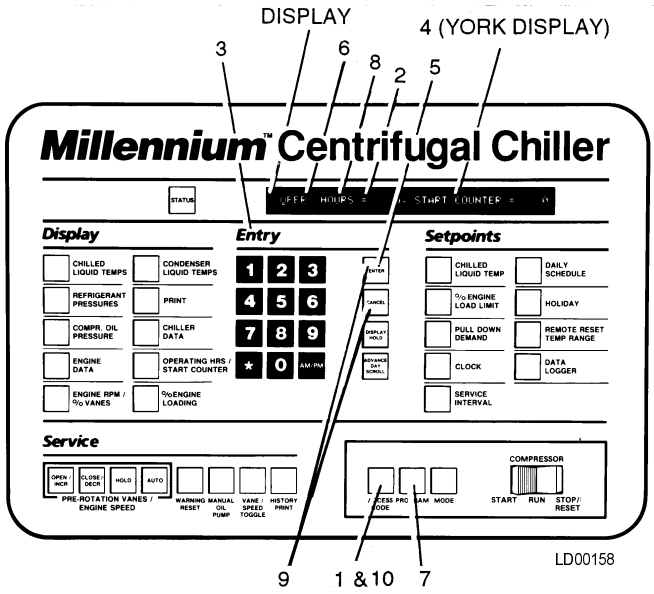


FIG. 7 – KEYPAD – PROGRAMMING SYSTEM SETPOINTS

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,

   OUT OF RANGE - TRY AGAIN!

   message will be displayed for 2 seconds, then the

   PROGRAM MODE. SELECT SETPOINTS

   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.

    ACCESS TO PROGRAM MODE DISABLED

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

To enter **CHILLED LIQUID TEMP** Setpoint:

(Refer to Fig. 8)

1. Press and release "**CHILLED LIQUID TEMP**" 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 25.

2. Use "**ENTRY**" keys to enter desired value.

3. Press and release "**ENTER**" key. This message is displayed:

   PROGRAM MODE, SELECT SETPOINT

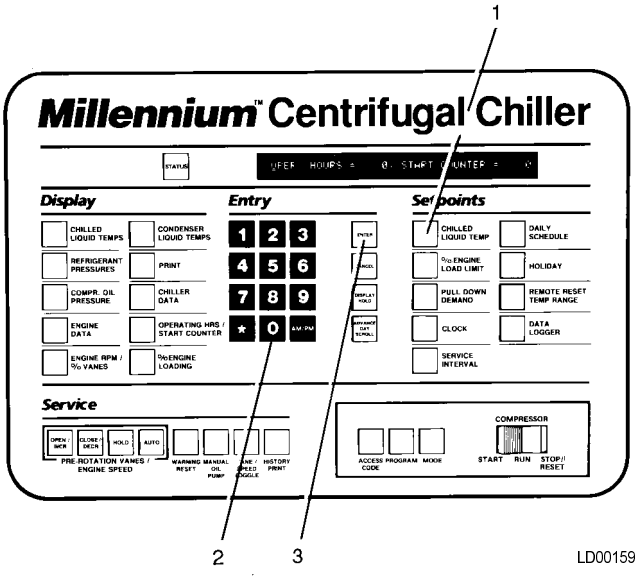


FIG. 8 – KEYPAD – PROGRAMMING "LEAVING CHILLED WATER TEMP." SETPOINT

To Enter **% ENGINE LOAD LIMIT** Setpoint:

(Refer to Fig. 9)

1. Press and release "**% ENGINE LOAD LIMIT**" setpoint key. The following program prompt message is displayed:

   ENGINE LOAD LIMIT = XXX %

2. Use "**ENTRY**" keys to enter desired value.

3. Press and release "**ENTER**" key. This message is displayed:

   PROGRAM MODE. SELECT SETPOINT

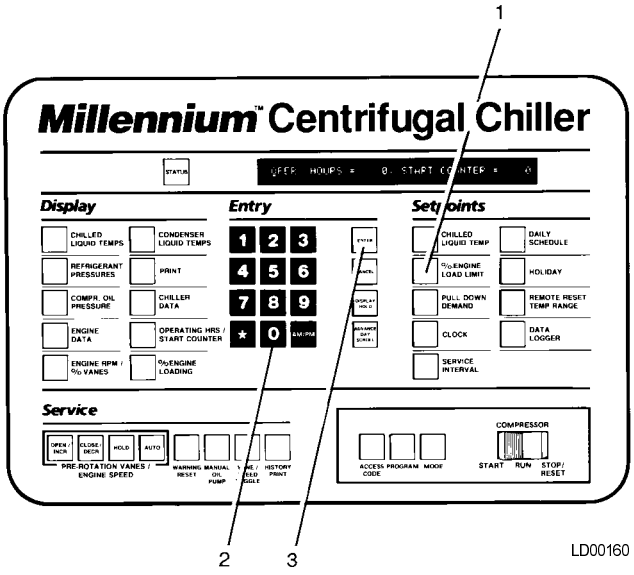


FIG. 9 – KEYPAD - PROGRAMMING "ENGINE LOAD LIMIT" SETPOINT

To Enter **PULL DOWN DEMAND** Setpoint:

(Refer to Fig. 10)

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

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

2. Use "**ENTRY**" keys to enter desired values. For explanation, see **PULL DOWN DEMAND**, page 23. Note the "XX min left" is not an operator entered value.

3. Press and release "**ENTER**" key. This message is displayed:

   PROGRAM MODE. SELECT SETPOINT

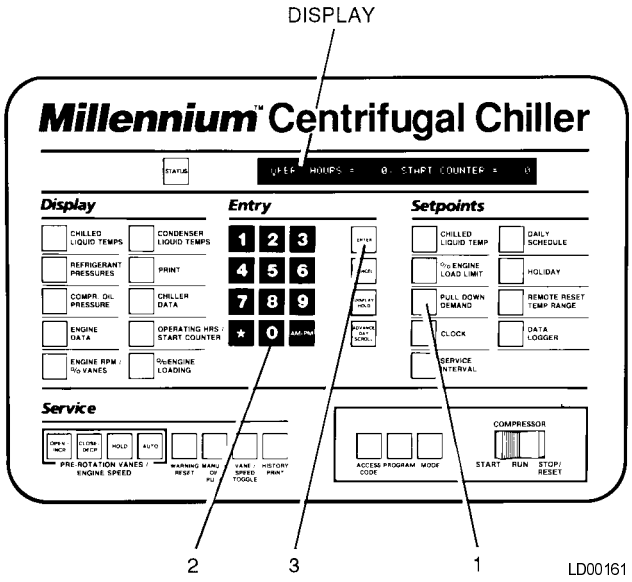


FIG. 10 – KEYPAD - PROGRAMMING "PULL DOWN DEMAND" SETPOINT

To Enter **CLOCK** Setpoint:

(Refer to Fig. 11)

1. Assure Micro Board Program jumper J57 is in "CLKON" position.

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

   TODAY IS MON 10:30 PM 1/1/95

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 02/04/95.

7. Press and release "**ENTER**" key. This message is displayed:

   PROGRAM MODE. SELECT SETPOINT

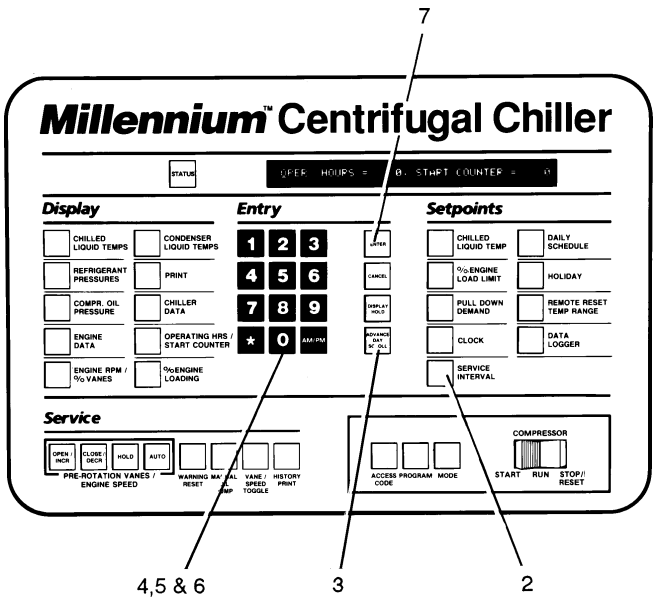
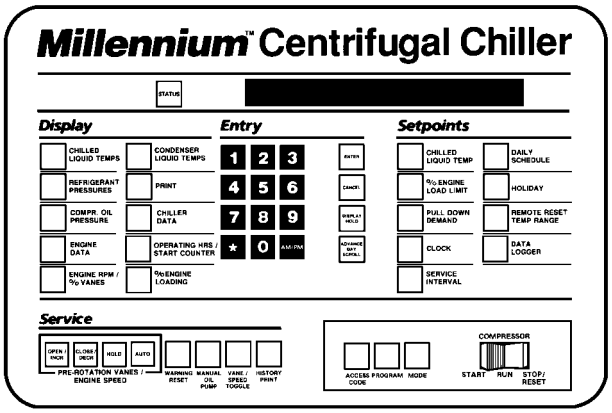


FIG. 11 – KEYPAD - PROGRAMMING "CLOCK" SETPOINT

To enter **SERVICE INTERVAL** Setpoint:

NOTE: This is only to be performed by a qualified YORK service mechanic. Refer to YORK Service Manual 160.60-M1.



LD00457

To enter **DAILY SCHEDULE** Setpoint:

(Refer to Fig. 12)

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

   SUN START = XX.XX AM. STOP = XX.XX AM

2. If the displayed start and stop time is not the desired schedule, enter the desired start and stop times as follows:

   a. If you don't want the chiller to automatically start and stop on this day, press the "**CANCEL**" key.

   b. Use the "**ENTRY**" keys to enter desired hours and minutes start time.

   c. If necessary, press the "**AM/PM**" key to change "**AM**" to "**PM**" or vice versa.

   d. Use the "**ENTRY**" keys to enter desired hours and minutes stop time.

   e. If necessary, press the "**AM/PM**" key to change "**AM**" to "**PM**" or vice versa.

3. Press the "**ADVANCE DAY/SCROLL**" key. The following prompt message is displayed:

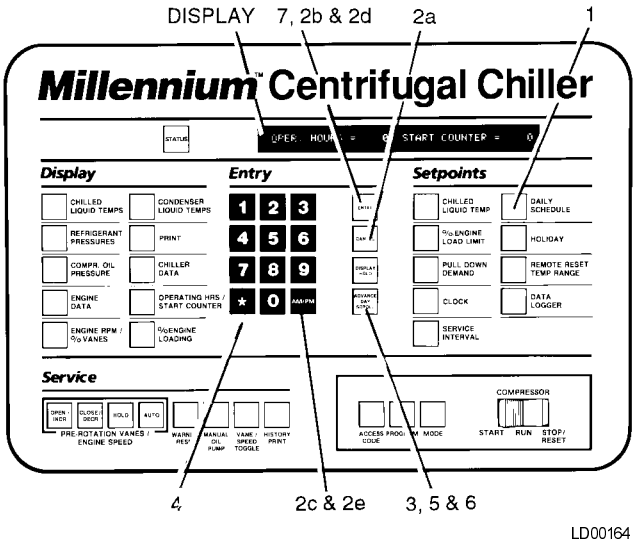
   MON START = XX.XX AM. STOP = XX.XX AM

4. Enter the desired start and stop time per Step 2.

5. Press the "**ADVANCE DAY/SCROLL**" key. The following prompt message is displayed:

   REPEAT MON SCHEDULE MON-FRI? YES = 1. NO = 0

   a. If you press the "**1 ENTRY**" key, Monday's start and stop time will be automatically entered for Tuesday through Friday.



LD00164

FIG. 12 – KEYPAD - PROGRAMMING "DAILY SCHEDULE" SETPOINT

- or -

   b. If you press the "**0 ENTRY**" key, Tuesday through Friday can be programmed with different start and stop times.

6. Use the "**ADVANCE DAY/SCROLL**" key with procedure in Step 2. To enter start and stop times for remainder of the week plus a holiday schedule if required.

7. Press the "**ENTER**" key, and this message is displayed:

   PROGRAM MODE, SELECT SETPOINT

To Enter HOLIDAY Setpoint:

(Refer to Fig. 13)

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. This 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.

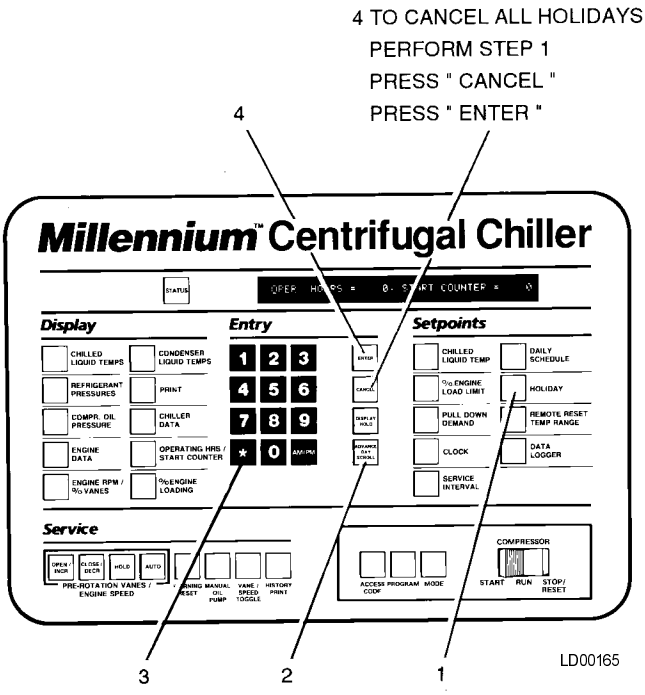


FIG. 13 – KEYPAD - PROGRAMMING "HOLIDAY" SETPOINT

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

(Refer to Fig. 14)

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

   REMOTE TEMP SETPOINT RANGE = XX °F

2. Use "**ENTRY**" to enter desired value (10 or 20).
3. Press and release "**ENTER**" key. This message is displayed:

   PROGRAM MODE. SELECT SETPOINT

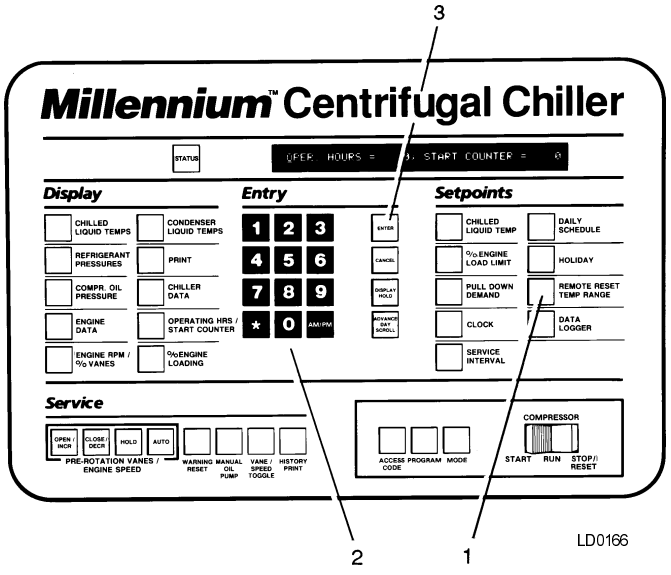


FIG. 14 – KEYPAD - PROGRAMMING "REMOTE RESET" TEMP RANGE

To Enter **DATA LOGGER** Setpoint:

(Refer to Form 160.60-N2 for operation of this key.)

SERVICE KEYS

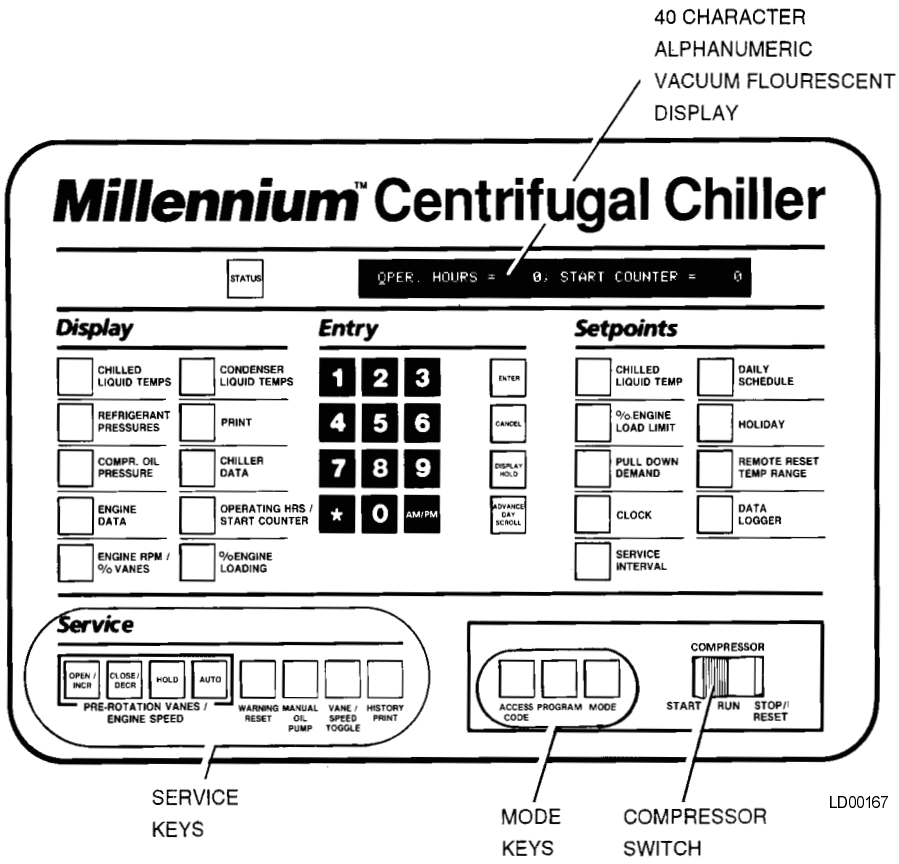


FIG. 15 – KEYPAD – SERVICE KEYS LOCATION

The "**SERVICE**" keys are provided for the service technician's use when performing routine maintenance or when troubleshooting the system. The "**WARNING RESET**" and "**PREROTATION VANES/ENGINE SPEED**" keys are enabled in "**SERVICE**" mode only. The remainder of the **SERVICE** keys are enabled in "**SERVICE**", "**LOCAL**" or "**REMOTE**" mode.

REFRIGERANT LEVEL CONTROL

1. Description
2. Automatic operation
3. Manual Operation
4. Fixed Position Operation

(Refer to the YORK Service manual on setting the parameters in this section.)

The subject chillers can now be ordered with an optional condenser refrigerant level control consisting of:

A. Level control actuator

B. Refrigerant level sensor, R134a - 025-31712-000

C. Refrigerant level control board, 031-01655-000

The refrigerant level sensor senses the actual refrigerant level in the condenser and outputs an analog voltage to the micro board that represents this level. During unit run, the micro board modulates the refrigerant level actuator that is connected to the variable orifice to maintain the condenser refrigerant level to the setpoint level programmed into the MicroComputer Control Center by the field service technician.

The refrigerant level sensor outputs a voltage from TB-3 over the range of 0.24VDC to 4.31VDC corresponding to a level of 0% to 100%. At the end of each **level control period** (programmable from 1.0 to 5.0 seconds), the micro board drives the close output (J10-1) or open output (J10-3) to <1 VDC for an appropriate number of seconds to turn on the close or open triac driver on the "refrigerant level control" board. When the appropriate triac turns on, it shorts the close (2) or open (3) coil of the "level control actuator" to common terminal (X). This causes the actuator to turn in the desired direction to open or close the refrigerant level valve.

"AUTOMATIC" OPERATION

The entire chiller run time is divided into **level control periods.** The **level control period** is programmable over the range of 1.0 to 5.0 seconds. Upon entering "system run," the level control period timer is started. When it has elapsed, it is again initiated. Each time the level control period has elapsed, it is restarted.

At the end of each level control period, the proportion error and rate and direction (toward or away from setpoint) of change during the level control period are evaluated to determine whether the response should be an open or close output and the duration of the output. The proportion error is compared to programmable setpoints **proportion limit close** and **proportion limit open** to determine the influence of proportion error in the response. The rate of change and direction of change during the level control period are then compared to programmable setpoints **rate limit close** and **rate limit open** to determine the influence of rate of change in the response.

To explain: At the completion of each level control period, the actual refrigerant level is compared to the **level setpoint** (programmable from 20% to 80%) to determine the proportion error. An error of plus or minus 3% is considered zero. The proportion error is then compared to setpoints **proportion limit close** (if level below setpoint) and **proportion limit open** (if level above setpoint). Both of these setpoints are programmable over the range of 10% to 50%. If the proportion error exceeds the limit setpoint, the proportion error influence in the response will be large. If the proportion error is less than the limit setpoint, the proportion error influence in the response will be a result of how close the proportion error is to the proportion limit setpoint. Close yields larger influence, further yields smaller influence. Next, the amount of change in the refrigerant level during the level control period is compared to programmable setpoints **rate limit close** (if level less than setpoint) and **rate limit open** (If level greater than setpoint). Both of these setpoints are programmable over the range of 10% to 50%. A level change of plus or minus 1% during the level control period is considered zero. If the level change exceeds the limit setpoint, the rate influence in the response will be large. If the level change is less than the limit setpoint, the rate influence in the response will be a result of how close the percentage change is to the rate limit setpoint. Close yields larger influence, further yields smaller influence.

Therefore, the values programmed for **proportion limit close, proportion limit open, rate limit close** and **rate limit open** determine the sensitivity of the response. Smaller values generally yield greater response for the same level of refrigerant level change in the **level control period.** The smaller the number programmed for the **level control period,** the more often an output is applied to the level control actuator.

Anytime the vanes (PRV) are fully closed (vane motor switch closed), the output to the level control is opposite of the output to the vane motor. If a "close" signal is being applied to the vane motor, an "open" signal will be applied to the level control. If an "open" signal is being applied to the vane motor, a "close" signal will be applied to the level control. This operation is in effect whether the chiller is running or shutdown and continues for as long as the vane motor switch **(VMS)** is closed.

While the chiller is shutdown, a "close" signal is continuously applied to the vane motor. This causes the vanes to fully close, closing the VMS. The closing of the VMS initiates an "open" signal to the level control. This "open" signal is applied to the level control for the duration of the shutdown (unless someone manually operates the vanes in **service** mode; then, the level control output is as explained above). Therefore, the orifice will be in the full open position prior to starting the chiller.

Because the orifice is in the full open position while the chiller is shutdown, the sensed refrigerant level will be approximately 0%. Elevated evaporator pressure with respect to condenser pressure could cause the level to be higher.

When the chiller is started, after the VMS opens when entering "system run", a linearly increasing ramp is applied to the level setpoint. This ramp cause the setpoint to go from the initial refrigerant level (approximately 0%) to the programmed setpoint over a period of 15 minutes. While this ramp is in effect,

PULLDN LEVEL=XXX%; SETP=XXX%; ACTUAL=XXX%

is one of the scrolled messages under the **display data** key. "PULLDN LEVEL" is the ramping setpoint that will ramp up to the programmed setpoint "SETP". "SETP" is the level setpoint programmed by the service technician. "ACTUAL" is the present refrigerant level. After the 15 minute ramp period has elapsed, this message is replaced by

ACTUAL LEVEL=XXX%; LEVEL SETP=XXX%

If the initial refrigerant level is greater than the programmed setpoint, there is no ramp period. It immediately begins to control to the programmed setpoint.

While the chiller is running, as long as the VMS is open, the level control controls to the programmed setpoint. However, if the vanes close (VMS CLOSES), the outputs to the level control will be opposite of the outputs applied to the vane motor as described above; normal level control is terminated and any ramp that is in effect is terminated. When the VMS opens, if the actual level is less than the setpoint, the setpoint is ramped from the actual level to the programmed setpoint over a 15 minute period.

PULLDN LEVEL=XXX%; SETP=XXX%; ACTUAL=XXX%

is displayed as one of the scrolled messages under the **display data** key while the ramp is in effect. If the actual level is greater than the level setpoint when the VMS opens, normal level control is resumed and

ACTUAL LEVEL=XXX%; LEVEL SETP=XXX%

is displayed instead of the ramp message.

If the **refrigerant level sensor** output ever goes to greater than 4.4VDC,

WARNING–REFRIGERANT LEVEL OUT OF RANGE

is displayed and the level control actuator is driven open until the level is within range. When within range, the warning message is automatically cleared and automatic operation returns.

The refrigerant level control is optional. Therefore, the program operation described here must be "ENABLED" on those units so equipped and "DISABLED" on all other units using the "PROGRAMMING" procedure below.

"MANUAL" OPERATION

Manual operation of the variable orifice is allowed in "SERVICE" mode if **manual level control** is selected using the **programming** procedure below. The "PRE-ROTATION VANES" manual control keys are used to perform the open, close, hold and auto function for the variable orifice when **manual level control** is selected. Either manual level control or manual control or manual vane control can be selected using the procedure below. When **manual level control** is selected, the pre-rotation vanes keys cannot be used to control the vanes. After the service technician has completed any **manual level control** operation, the control center should be returned to **manual level control** using the procedure below.

To determine if manual level control or manual vane control has been selected, press the display data key.

MANUAL LEVEL CONTROL ALLOWED

or

MANUAL VANE OPERATION ALLOWED

is displayed as one of the scrolled messages.

If manual level control is selected and the control is selected and the control center is operating in "SERVICE" mode,

SYSTEM RUN—AUTO LEVEL CONTROL

is displayed unless an "OPEN" command is given, then

SYSTEM RUN—LEVEL VALVE OPENING

is displayed.

SYSTEM RUN—LEVEL VALVE CLOSING

is displayed when a close command is given.

"FIXED" POSITION OPERATION

It might be necessary to operate the chiller with the variable orifice in a fixed position. This could be necessary until a replacement component arrives, if there is a failure of a refrigerant level control component.

To operate the orifice in a fixed position, enable **manual level control** using the "PROGRAMMING" procedure below. Then, in service operating mode, use the "OPEN" and "CLOSE" vanes keys as described above under **manual operation** to drive the orifice to the desired position. When the desired position is achieved, press the "HOLD" key. This maintains the orifice at the desired position. Return to **local** or **remote** mode. The open and close outputs to the orifice are now disabled and it will remain stationary.

To return to automatic operation, enter **service** mode and press the "AUTO" key. Then return to **local** or **remote** mode as desired.

NOTE: For programming setpoints refer to YORK service manual, 160.60-M1. Programming is to be done only by a qualified YORK service mechanic.

SELECTION OF MANUAL SPEED OR MANUAL VANE CONTROL (VANE/SPEED TOGGLE KEY)

1. You must be in "**SERVICE**" mode.
2. Enter Access Code (**9 6 7 5**).
3. Press "**ENTER**".
4. Press "**PROGRAM**".
5. Press "**VANE/SPEED TOGGLE**" key.
6. Select 0 = for Vane Position
   1 = for Engine Speed
   2 = for Level
7. Press "**ENTER**" after selecting 0, 1, or 2.
8. Press "**INCR**" or "**DECR**" keys as desired.

Below is a procedure which will allow you to look at your changes (vane, engine, speed, level) while standing in front of the panel. Your changes will be viewed on the YORK Micro Panel display.

1. You must be in "**SERVICE**" mode.
2. Enter access code "**9 6 7 5**."
3. Press "**ENTER**."
4. Press "**PROGRAM**"

   PROGRAM MODE, SELECT SETPOINT

5. Press "**VANE SPEED TOGGLE**" key.

   MAN. CONTROL→ __ (0=VANE, 1=ENGINE, 2=LEVEL)

6. Select: 0 = Vane Position
   1 = Engine Speed
   2 = Level
7. Press "**ENTER**" after selecting 0, 1, or 2.

   PROGRAM MODE, SELECT SETPOINT

8. Press "**PROGRAM**" key

   SYSTEM RUN, PRESS STATUS

9. Press "**VANE SPEED TOGGLE**" key **one** time, then press the "**HOLD**" key (This will tell you what you will manually control)

   Example: If you selected these vanes, the display will show you:

   SERVICE KEYS CONTROL = VANE POSITION

10. Hold in (press) the "**VANE SPEED TOGGLE**" key again to display:

    VANES: HOLD; ENGINE: INCR; LEVEL: AUTO

11. Press the "**INCR**" or "**DECR**" key as desired and you will see the change on the display.

PREROTATION VANES/ENGINE SPEED KEYS

OPEN/INCR – Press and release this key to drive the prerotation vanes open or increase engine speed. If the chiller is running, this message is displayed:

SYSTEM RUN – VANES OPENING

If chiller is not running, this message is displayed:

SYS READY TO START – VANES OPENING

The vanes will continue to open until the "**CLOSE/DECR**", "**HOLD**", or "**AUTO**" (if temperature error requires it) keys are pressed and released.

HOLD – Press and release this key to hold the prerotation vanes/engine speed at their present position. If chiller is running, this message is displayed:

SYSTEM RUN – VANES HOLDING

If chiller is not running, this message is displayed:

SYS READY TO START – VANES HOLDING

The vanes will remain stationary until the "OPEN", "HOLD" or "AUTO" keys are pressed and released.

AUTO – Press and release this key to put the prerotation vanes or engine speed under LCWT control as long as the engine load limit setpoint is not reached, which causes the engine load limit function to override the LCWT control. If system is running, this message is displayed:

SYSTEM RUN – AUTO SPEED/AUTO VANES

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

SYSTEM RUN – VANES OPENING

If the vanes are closing, this message is displayed:

SYSTEM RUN – VANES CLOSING

Whenever the Control Center is in "**LOCAL**", "**REMOTE**" or "**PROGRAM**" mode, the vane control circuitry is automatically placed in "**AUTO**" mode and the vanes operate to control the leaving chilled water temperature to the programmed setpoint.

CLOSE/DECR – Press and release this key to drive the prerotation vanes closed. If chiller is running, this message is displayed:

SYSTEM RUN – VANES CLOSING

If chiller is not running, this message is displayed:

SYS READY TO START – VANES CLOSING

When the vanes are fully closed, this message is displayed:

SYS READY TO START – VANES CLOSED

The vanes will continue to close until the "OPEN", "HOLD" or "AUTO" keys are pressed.

OPEN/INCR – Press and release this key to increase the speed of the engine. If the unit is running, this message is displayed:

SYSTEM RUN – SPEED SIGNAL INCREASING

When the unit reaches maximum speed, this message is displayed:

SYSTEM RUN – SPEED SIGNAL MAXIMUM

CLOSE/DECR – Press and release this key to decrease the speed of the engine. If the unit is running, this message is displayed:

SYSTEM RUN – SPEED SIGNAL DECREASING

When the unit reaches minimum speed, this message is displayed:

SYSTEM RUN – SPEED SIGNAL MINIMUM

If the unit is running and the "HOLD" key is depressed the speed will stop at this point. Pressing "OPEN/INCR" or "CLOSE/DECR" will allow the speed to continue on its way to maximum or minimum speed. The display will show:

SYSTEM RUN – SPEED SIGNAL HOLD

If the unit is running and the "AUTO" key is depressed the YORK Micro Panel will look at its inputs and decide on the operation of the speed. Display will show:

SYSTEM RUN – AUTO SPEED SIGNAL

VANE/SPEED TOGGLE

SERVICE KEYS CONTROL: VANE POSITION

This key will allow you to select whether keys control speed or vane position.

HISTORY PRINT – This key is used to initiate a history print to the optional printer. Refer to Form 160.60-N2 for operation of this key. When the "**HISTORY PRINT**" key is pressed, the display will show the following:

PRINT REQUEST IN PROGRESS . . .

OTHER SERVICE KEYS

WARNING RESET – To reset any cycling or warning message, unless the condition still exists, place the Control Center in "**SERVICE**" mode and press "**WARNING RESET**" key. To reset most safety shutdown messages, 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. The manual oil pump feature is disabled from "Start Sequence Initiated" to system shutdown.

CALIBRATION PROCEDURES

1. PRV motor wiring checkout
2. Vane motor potentiometer calibration*
3. Bearing proximity/sensor warning reset procedure*
4. Drive line parameter selection*

1. PRV MOTOR WIRING CHECKOUT (SETUP OF VANE MOTOR IS IN THE YG/YB SERVICE MANUAL, FORM 160.60-M1).

a. Place the "**COMPRESSOR**" switch into **STOP/RESET** position. Verify that the system is in "**SERVICE**" mode by pressing "**MODE**" key and observing the displayed message. See "Operating Modes", page 37.

- Display will show system ready to start
- Vane/Speed toggle must be in vane (0) position to operate the vanes
- Press [OPEN / INCR] key and vanes should OPEN
- Press [CLOSE / DECR] key and vanes should CLOSE
- Press [HOLD] key and vanes should HOLD

2. OIL PUMP PRESSURE ADJUSTMENT

Confirm that AC supply to the oil pump is turned on.

a. Manually run the oil pump by means of depressing and releasing the "**MANUAL OIL PUMP**" key under "**SERVICE**" section of the control panel keypad. To stop the oil pump, depress and release the same key.

b. Manually run the oil pump for 90 seconds, observing all lubrication system connections for oil leaks.

NOTE: The oil level will drop initially and oil should be added while the pump is running to establish a level midway in the top sight glass, which should then stabilize. The oil pressure should be 35 PSID minimum steady.

* Refer to the YORK service manual (only to be performed by a qualified YORK service mechanic). Improper settings may cause severe damage to the unit.

OPERATING MODES

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

1. **SERVICE –** enables all the "**SERVICE**" keys except "**MANUAL OIL PUMP**", and "**HISTORY PRINT**", which are enabled in all modes. See "**Service Keys**", page 32.
2. **LOCAL –** This is the normal operating mode. The chiller can be started and stopped from the Control Center. Also, the **Display** and **Setpoints** parameters can be displayed.
3. **PROGRAM –** Allows the operator to program the ***Setpoints*** parameters, and change operating modes.
4. **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:

- Remote Start
- Remote Stop
- Remote LCWT Setpoint
- Remote Engine Load Limit Setpoint

*NOTE: The chiller 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 chiller 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 MODE

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

  REMOTE MODE

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

  SERVICE MODE

To change operating mode, proceed as follows:

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

   ENTER VALID 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 the "**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 the "**ENTER**" key.
13. This message appears:

    PROGRAM MODE, SELECT SETPOINT

14. Press "**ACCESS CODE**" key to exit "**PROGRAM**" mode and terminate access to "**PROGRAM**" mode.
15. This message appears:

    ACCESS TO PROGRAM MODE DISABLED

COMPRESSOR SWITCH/EMERGENCY STOP SWITCH

(See Fig. 15, page 32)

This rocker switch is used to locally operate the chiller. It is used to start, run and stop the compressor. Also, it resets the Micro 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 chiller (using this switch) when the Control Center is in "REMOTE**" mode.*

To **STOP** compressor:

Move switch from "**RUN**" to "**STOP/RESET**" position. This will initiate a standard shutdown which **takes several minutes to complete**.

To **RESET** Control Center:

Following a safety shutdown, the operator is required to reset the Control Center prior to restarting the system. Refer to description on page 13 to reset the system.

Emergency Stop Switch (located on engine panel: To perform an emergency stop the red push-button on the Engine Control Panel (ECP) must be depressed. This will initiate a quick shutdown of the system. **This is for emergency shutdowns only.**

DISPLAY MESSAGES

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

SYSTEM RUN – LEAVING TEMP CONTROL

Chiller is operating with prerotation vane and engine speed control in response to leaving chilled water temperature. Engine loading is less than 98% of operator programmed load limit.

SYSTEM RUN – ENGINE LOAD LIMIT IN EFFECT

Displayed when the chiller is running, the engine loading is equal to the operator-programmed "XXX%" engine load limit value. When the engine loading reaches 98% of this value, the prerotation vanes are not permitted to open further. If the engine loading continues to rise to 102% of this value, the vanes will be driven closed-not fully closed; only far enough to allow the engine loading to decrease to 100% of the operator-programmed "XXX%" engine load limit.

For example:

With the operator-programmed "**% ENGINE LOAD LIMIT**" set at 50%, the engine load limit circuit would perform as follows:

(98%) (50%) = Vanes inhibited from opening further
(102%) (50%) = Vanes driven toward close position

AUTO

SYSTEM RUN – AUTO SPEED/AUTO VANES = <98% ENGINE LOAD

SYSTEM RUN – VANES OPENING

SYSTEM RUN – VANES CLOSING

Either or switches back and forth with the above reading/display of:

SYSTEM RUN – AUTO SPEED/AUTO VANES

SYSTEM RUN - ENGINE LOAD LIMIT IN EFFECT = <98% ENGINE LOAD

The previous displays are displayed when the chiller is running, the MicroComputer is in "**SERVICE**" mode, and the vanes are opening in "**AUTO**" mode.

OPEN

SYSTEM RUN – AUTO SPEED/AUTO VANES = with AUTO pressed

SYSTEM RUN – VANES OPENING = with OPEN pressed

The above displayed when the chiller is running and the MicroComputer Center is in the "**SERVICE**" mode and vane/speed toggle is set for "**VANES**".

CLOSE

SYSTEM RUN – AUTO SPEED/AUTO VANES = with AUTO pressed

SYSTEM RUN – VANES CLOSING = with CLOSE pressed

The above displayed when the chiller is running, the microcomputer center is in the "**SERVICE**" mode, and vane/speed toggle is set for "**VANES**".

HOLD

SYSTEM RUN – AUTO SPEED/AUTO VANES = with AUTO pressed

SYSTEM RUN – VANES HOLDING = with HOLD pressed

The above displayed when the chiller is running, the MicroComputer Center is in the "**SERVICE**" mode, and vane/speed toggle is set for "**VANES**".

SYSTEM RUN – LOW PRESSURE LIMIT IN EFFECT

Displayed when the chiller is running and the evaporator pressure falls to 27 PSIG. Simultaneously, the prerotation vanes will be prevented from further opening and speed may not be increased. This action maintains chiller op-

eration to prevent low-evaporator-pressure shutdown at 25 PSIG. When the evaporator pressure rises to 28 PSIG, the vanes will be permitted to open and speed may be increased. Low pressure limit feature is not used when program jumper (JP3) is cut (Brine application).

SYSTEM RUN – HIGH PRESSURE LIMIT IN EFFECT

Displayed when the chiller is running and the condenser pressure rises to 162.5 PSIG. Simultaneously, the prerotation vanes will be inhibited from further opening and speed may not be increased. This action occurs to prevent system shutdown on high condenser pressure at 180 PSIG.

SYSTEM RUN – PRESS STATUS

Displayed when the chiller is running. It instructs the operator to press the "**STATUS**" key, whereupon a diagnostic message will be displayed:

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.

*NOTE: If the "**STATUS**" key is arbitrarily pressed, without the operator being prompted by the*

PRESS STATUS

message, this message will be displayed:

NO MALFUNCTION DETECTED

WARNING – PRV POT OR SWITCH ERROR

In normal operation when the system enters run and the RPM is up to speed, the vane motor switch would open and the vanes would be opened automatically. This message is to catch those times when this does not happen.

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 RUN – SETPOINT OVERRIDE

This message will appear when the RTC battery fails. To correct this message, you must press "**STATUS**" and the following message will be displayed:

REPLACE RTC, U16 – REPROGRAM SETPOINTS

Install a good RTC and reprogram setpoints.

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 shutdown on a cycling shutdown, safety shutdown (operator must move the "**COMPRESSOR**" switch to "**STOP/RESET**" in order to restart and reset – see page 13 for explanation) or operator-initiated shutdown. 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. Display can be held for 10 minutes by depressing "**DISPLAY HOLD**" key. For examples of System Shutdown Messages, see below.

MACH = X.XX; MACH'S X.XX

MACH/MACH'S = MACH = IMPELLER OPERATING TIPSPEED (From Tach)

MACH'S = RPM'S working to achieve from the mach no.

PRESSURE RATIO & % VANES = MACH'S

The desired engine speed will be obtained from a three dimensional equation which will represent the compressor surge surface. Pre-rotation vane (PRV) Position and head ((P COND. – P EVAP.)/P EVAP.) are the two independent variables which upon inserting into the equation will yield a mach no. The mach no. will then be used to calculate the desired engine speed. Each engine speed data point calculated will be set at a marginal value above its associated compresser surge point. This adjusted surface will provide a boundary on which high efficiency chiller operation may be achieved and below which surge may occur. Therefore, engine speed must always be set on or above this adjusted surface during system run.

ENGINE RPM = XXXX; RPMS = XXXX

RPMA = Actual running speed of the motor

RPMS = When in capacity control, the RPMS is the desired speed to run at for optimum efficiency. The RPMS is the surface surge point on the surge map. This RPMS "Target Value" when in capacity control will try to be met with the RPM number. These two should be fairly close; this will take time to achieve; it does not happen fast.

CAPACITY CONTROL TAKES OVER WHEN THE L.C.W. TEMP SETPOINT IS ACHIEVED.

DELTA P OVER P = X.XX; PRV = XXX%

Delta P over P = it is the difference of the following:

$$\frac{\Delta P}{P} = \frac{\text{Condenser} - \text{Evaporator}}{\text{Evaporator}}$$

PRV = This readout shows the percent that the vanes are open on the chiller.

SYSTEM SHUTDOWN MESSAGES

For YG chillers there are two types of shutdowns, quick and standard.

- **QUICK SHUTDOWN:** is performed when the possibility of damage due to continued running exists. YORK supplies a contact closure which tells the CAT panel it is an emergency and cuts the fuel and ignition. The YORK Panel de-clutches. The following message is displayed.

COMP. COASTDN; ENG SHTDN-PRESS STATUS

This shutdown occurs very quickly to avoid potential equipment damage.

NOTE: On a quick shutdown the engine panel must be manually reset. This is due to the emergency stop on the engine.

- **STANDARD SHUTDOWN:** is performed in all other situations. The following message is displayed after clutch disengagement.

COMPR. COASTDN; ENG COOLDN-PRESS STATUS

Quick safety shutdowns are initiated by the YORK Micro Panel or Engine Control Panel (ECP) and will require resetting the ECP as well as the YORK Micro Panel.

A quick safety shutdown initiated by the Micro Panel will be indicated by a flashing ESTOP LED on the status control module of the engine panel, as well as an appropriate message on the Micro Panel display. Follow the procedure detailed in the Engine Control Panel section to reset the system.

COMPR SHUTDOWN – ENGINE COOLDOWN

This is displayed after the 150 sec. compressor coastdown period has been completed. This message is displayed for 1.5 minutes while the engine completes the cooldown period. At the completion of the cooldown period, the engine shuts down.

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

MON 10:00 AM – LOW WATER TEMP – AUTOSTART

Chiller had a **standard shutdown** on Monday at 10:00 AM 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 shutdown 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 – FLOW SWITCH

Chiller had a **quick shutdown** 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 initiated a **standard shutdown** of the chiller.

MON XX:XX AM – MULTI UNIT CYCLING – AUTOSTART

Lead/Lag sequence control accessory initiated a **standard shutdown** of the chiller. This can be checked on the digital input PCB at [1] and [9] .

MON XX:XX AM – POWER FAILURE

Chiller had a **quick shutdown** because of AC power failure. Follow the procedure detailed in Engine Control Panel section to reset system (page 14).

MON XX:XX AM – INTERNAL CLOCK – AUTOSTART

The operator-programmed daily stop schedule initiated a **standard shutdown** of 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 perform a **standard shutdown**. 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.

MON XX:XX AM – LOW EVAP PRESSURE

The chiller had a **quick shutdown** because the evaporator pressure has decreased to 25.0 PSIG. Safety shutdown reset procedure required (page 14).

MON XX:XX AM – LOW EVAP PRESSURE – BRINE

The chiller had a **quick shutdown** because the brine Low Evaporator 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. Safety shutdown reset procedure is required (page 14).

MON XX:XX AM – LOW OIL PRESSURE

The chiller had a **quick shutdown** because the oil pressure has decreased to 15 PSID while running, or never achieved 25 PSID prior to compressor start during the oil pump pre-lube run. Differential pressure is sensed by two

pressure transducers. Page 14 reset procedure required.

MON XX:XX AM – HIGH PRESSURE

The chiller had a **quick shutdown** because condenser pressure has increased to 180 PSIG. After following safety shutdown reset procedures on page 12, the system will be allowed to restart when pressure decreases to 120 PSIG. Pressure is sensed by a High Pressure (HP) safety control that is located on a mounting bracket located on the condenser. This message is prompted by the opening of the HP safety control contacts.

MON XX:XX AM – EVAP TRANS OR PROBE ERROR

The chiller had a **quick shutdown** 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. Safety shutdown reset procedure required (page 14).

On Brine applications (program jumper JP3 is removed), this check is not performed when the evaporator transducer is reading a pressure below its "out-of-range" threshold.

MON XX:XX AM HIGH DISCHARGE TEMP

The chiller had a **quick shutdown** 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. Safety shutdown reset procedure required (page 14).

MON XX:XX AM HIGH OIL TEMP

The chiller had a **quick shutdown** 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 thermistor RT3. Safety shutdown reset procedure required (page 14).

MON XX:XX AM – HIGH OIL PRESSURE

Chiller had a **quick shutdown** because the oil pressure has increased to 125 PSID (during the first 7 minutes of compressor operation), 60 PSID (after the first 7 minutes of compressor operation). The chiller will be allowed to restart when the oil pressure decreases to 59 PSID. Safety shutdown reset procedure required (page 14).

MON XX:XX AM FAULTY COND PRESSURE XDCR

The chiller had a **quick shutdown** because the condenser transducer is indicating a pressure of less than 6.8 PSIG or a pressure greater than 300 PSIG. This is generally indicative of a defective condenser transducer or the transducer has been disconnected. After the problem has been corrected, the chiller can be restarted. Safety shutdown reset procedure required (page 14).

MON XX:XX AM FAULTY OIL PRESSURE XDCR

The chiller had a **quick shutdown** because either the high side or low side compressor oil pressure transducer was out-of-range (displaying x's) while chiller was running. Safety shutdown reset procedure required (page 14).

VANE MOTOR SWITCH OPEN

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

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 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 the "**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.

START SEQ. INITIATED - COMPRESSOR PRELUBE

This message will be displayed when going into a start sequence mode. If all of the items below are met you will see this message.

1. Gear box is in prelube (1 min.)
2. Engine is in prelube (1 min.)
3. Engine is cranking
4. Engine starts
5. Engine goes to min. speed
6. Jacket water temp. is greater than 120°F

MON 09:30 AM LOW OIL TEMPERATURE – AUTOSTART

If the chiller is running and the oil temperature (as indicated by thermistor RT3) falls below 55°F, the chiller will have a standard shutdown and display this message. The chiller will automatically restart when the oil temperature increases to >71°F AND is greater than the condenser saturated temperature by 40°F. Refer to the message "MON XX:XX AM LOW OIL TEMP DIFF - AUTOSTART".

MON XX:XX LOW OIL TEMP DIFF – AUTOSTART

Indicates the **chiller** is shut down for the following reason:

1. The chiller has been shutdown and the oil temperature minus the condenser saturation temperature is less than 40°F.

   The chiller will restart automatically affer the condition clears if the "**COMPRESSOR**" switch is in the "**RUN**" position.

   *NOTE: This check is made **only** when the chiller is shutdown. It is **not** checked when the chiller is running.*

DAY – TIME – OIL PRESSURE XDCR ERROR

Indicates chiller had a **quick shutdown** because the difference between the High Side Oil Pressure Transducer Output and the Low Side Transducer Output was greater than 15.0 PSID during the "TRANSDUCER AUTO-ZEROING SEQUENCE" that occurs 3 seconds after compressor pre-lube is initiated. Message is displayed immediately after the Auto-Zeroing sequence has completed. This indicates that one of the transducer outputs is incorrect, possibly due to an incorrect or defective transducer. Safety shutdown reset procedure is required (page 14).

MON XX:XX AM FAULTY DISCHARGE TEMP SENSOR

Whenever the discharge temperature falls below 30°F, or the discharge temperature sensor is disconnected from the Micro Board, the preceding message will appear. The system will restart when the discharge temperature rises or the sensor has been connected. This is a **quick shutdown**.

MON XX:XX AM – PROX SENSOR SAFETY SHUTDOWN

The chiller had a **quick shutdown** because the "Proximity/Temp Sensor" has detected that the distance between the compressor high speed thrust collar and the sensor probe has increased ≥ 10 mills or decreased ≥ 20 mils from the reference position or that the bearing temperature has increased above 250°F.

WARNING

Although this message is generally indicative of a defective proximity probe, it is possible that the compressor has been damaged.

If the chiller has shut down displaying this message, it cannot be restarted until a qualified service technician performs a visual inspection of the high speed thrust bearing and performs a special reset procedure. This special reset procedure is detailed in YORK Service Manual, Form 160.60-M1. ***Failure to perform the visual inspection prior to restarting the chiller could result in severe compressor damage!!!!*** *In addition to 160.60-M1 procedures, the safety shutdown reset procedure (page 14) is required.*

FAULTY PROXIMITY PROBE

The chiller has shutdown because the "**PROXIMITY/TEMPERATURE SENSOR**" has detected that the distance between the compressor high speed thrust collar and the sensor has decreased to (equal or less than) 17 mils. (Probe is defective if reading is less than 17 mils or 0.42 volts). Check probe and wiring.

WARNING

Although this message is generally indicative of a defective proximity probe, it is possible that the compressor has been damaged.

If the chiller has shut down displaying this message, it cannot be restarted until a qualified service technician performs a visual inspection of the high speed thrust bearing and performs a special reset procedure. This special reset procedure is detailed in YORK Service Manual, Form 160.60-M1. ***Failure to perform the visual inspection prior to restarting the chiller could result in severe compressor damage!!!!*** *In addition to 160.60-M1 procedures, the safety shutdown reset procedure (page 14) is required.*

MON XX:XX AM – HIGH SPEED DRAIN TEMP

The chiller had a **quick shut down** because the "Proximity/Temperature Sensor" has detected the temperature of the high speed drain line has reached 250.0°F or greater.

WARNING

Although this message is generally indicative of a defective proximity probe, it is possible that the compressor has been damaged.

If the chiller has shut down displaying this message, it cannot be restarted until a qualified service technician performs a visual inspection of the high speed thrust bearing and performs a special reset procedure. This special reset procedure is detailed in YORK Service Manual, Form 160.60-M1. ***Failure to perform the visual inspection prior to restarting the chiller could result in severe compressor damage!!!!*** *In addition to 160.60-M1 procedure, the safety shutdown reset procedure (page 14) is required.*

MON XX:XX AM – OPEN DRAIN TEMP THERMOCOUPLE

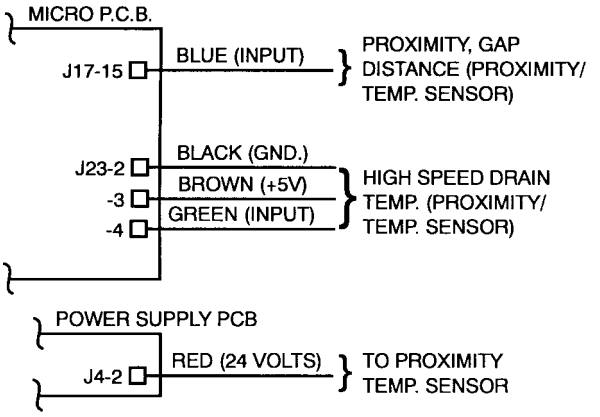
The chiller is shutdown because the "Proximity/Temperature Sensor" thermocouple or high speed drain temperature wiring between the "Proximity/Temperature Sensor" module and the MicroComputer Control Center has been disconnected or has a poor electrical connection.

IMPORTANT: Open thermocouple shutdowns would typically indicate hardware or wiring defects and should not result in any damage to the compressor high speed thrust

bearing. Therefore, a bearing inspection is not required. However, due to the critical nature of these circuits, anytime this shutdown occurs, a special reset procedure **must** be performed by a qualified service technician before the chiller can be restarted. This procedure is detailed in service manual Form 160.60-M1.

MON XX:XX AM DC UNDER VOLTAGE

The "Proximity/Temperature Sensor" module becomes unstable in operation when the +24 VDC supply decreases to +17VDC. Therefore, the Micro Board monitors the +24VDC supply and when it decreases to +19VDC, it shuts down the chiller and displays this message, preventing invalid "Proximity Sensor Safety" or "High Speed Drain Temp" safety shutdowns. The chiller will automatically restart when the voltage increases to greater than +19.7VDC. DC undervoltage is a **standard shutdown**.



MON XX:XX AUX SAFETY SHUTDOWN

The system had a **quick shutdown** because an external device, connected to digital input board TB1-31 (Auxiliary 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. Safety shutdown reset procedure required (page 14).

WARNING – PRV POT OR SWITCH ERROR

An error has been detected with the vane position sensor or vane motor closed switch. Chiller will run at fixed speed until error is corrected. May require recalibration of PRV sensor or checkout of vane motor switch.

WARNING – CONDENSER TRANSDUCER OR PROBE ERROR

An error has been detected with the condenser pressure transducer or leaving condenser water sensor. Chiller will run at fixed speed until error is corrected. Condenser saturation temperature must equal leaving condenser water temperature +25 / –2.5°F.

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).

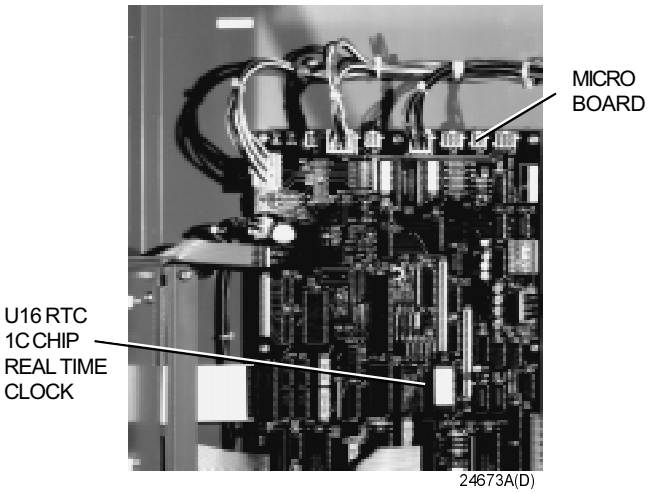
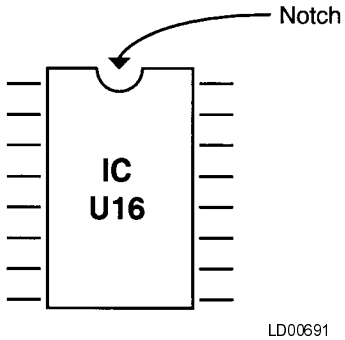


FIG. 16 – MICROCOMPUTER CONTROL CENTER - LOCATION OF REAL-TIME CLOCK U16



ENGINE RELATED DISPLAY MESSAGES

(Displayed on YORK Micro Panel)

ENGINE START SIGNAL

The chiller startup has been initiated and the engine control will pre-lube the speed increaser for one (1) minute and pre-lube the engine if equipped with optional pre-lube pump. After pre-lubing is completed the engine will be cranked to start. Ten seconds of cranking is typical; however, cranking will occur periodically over a 6 minute period if startup is not successful.

ENGINE WARMUP

The engine is running on its own and the compressor pre-lube will begin when the engine jacket water reaches 120°F.

START SEQ. INITIATED – COMPRESSOR PRELUBE

This message will be displayed when going into a start sequence mode. If all of the items below are met you will see this message

1. Gear Box is in prelube (1 min.)
2. Engine is in prelube (1 min.)
3. Engine is cranking
4. Engine starts
5. Engine goes to min. speed
6. Jacket water temp. is greater than 120°F

SYSTEM RUN; STOP SEQUENCE INITIATED

A **standard shutdown** sequence is in progress. The PRVs will close while speed is held constant. Engine speed will then be dropped and the clutch disengaged. The total time required from stop initiate to declutch can be up to 2 minutes depending on initiated speed and PRV conditions.

WARNING – HIGH ENGINE VIBRATION DETECTED

On "YB" units only, this is a 4-20mA input signal to measure vibration on the 3406 engine in inches per second and can detect vibration from 0.00 to 2.00 in./sec. This is read from J6-2 on the I/O Expansion PCB and its readings are averaged on a 5 point rolling average. Once the vibration cutout level is set, if at any time the vibration readings are within 20% below the programmed cutout level for 5 seconds continuously, the panel will show this message when the "**STATUS**" key is depressed. This will persist until the vibration readings fall below 20% below setpoint for 5 seconds continuously.

WARNING – COMPRESSOR SERVICE TIME ELAPSED

This message has a range of 750 hours to 9900 hours with a default value of 750 hours which can be set by the operator.

COMPR. COASTDOWN: ENGINE COOLDOWN

The clutch has been disengaged and the compressor is in its 150 second post-lube. The engine will be running at idle speed to allow it to cool down. This is displayed for 2.5 minutes while coastdown is in progress.

COMPR SHUTDOWN: ENGINE COOLDOWN

Displayed after the 150 second compressor coastdown period has been completed. This message is displayed for 1.5 minutes while the engine completes the cooldown period. At the completion of the cooldown period, the engine shuts down.

MANUAL ENGINE CYCLING

This will be displayed if the switch in the Caterpillar panels is in the maint. position. If the panel is in auto you should never see this message.

COMPRESSOR ROTATION FAULT

This fault occurs when the compressor is turning and it should not be. To clear, place the unit in "**STOP/RESET**", move the unit switch to "**START/RUN**" and the following will be displayed:

COMPR. COASTDN; ENGINE SHTDN – PRESS STATUS

Press "**STATUS**" and the following is displayed:

DAY TIME COMPRESSOR ROTATION FAULT

After a 150 sec. coastdown, **move** the compressor switch to the "**STOP/RESET**".

WARNING – ENGINE SERVICE TIME ELAPSED

This message has a range setting of 750 hours to 9900 hours with a default value of 750 hours. This can be set by the operator.

SUN 12:00 AM GENSET OVERRIDE

NOTE: This message is applicable only to units equipped with Level "17" EPROM or later.

This display was created to inhibit operation of the chiller if the engine was powered by a generator (genset). If this condition arises, the engine control panel will open contact TB1 - 11 to signal this condition to the chiller. As soon as TB1 - 11 (P11-B7) opens, the software will initiate a cycling shutdown and display the message. After coastdown sequence, as soon as TB1 - 11 closes again, the unit will auto-restart and run normally. This feature is enabled by removing wire jumper JP1 on the Micro Board. If JP1 is left installed, this feature will remain disabled.

LOW GEAR OIL TEMPERATURE SENSOR

NOTE: This message is applicable only to units equipped with Level "17" EPROM or later.

This message is on the "YB" units only. This sensor monitors the gear oil temperature in the gearbox and if it is too low, will prevent a system start/engine start condition by producing a cycling condition. Once the gear oil is up to temperature, the chiller is allowed to start. Once running, a low gear oil temperature condition will not shut the unit down due to the fact that a low gear oil temperature condition is virtually impossible to attain once the unit is running. The new sensor, while digital in nature, is read from an analog input (J7-1) on the I/O Expansion Board.

NOTE: 0 to 1VDC = Open/Tripped state
3.5 to 5VDC = Non-Tripped state

To summarize: If the low gear oil temperature is detected while the unit is stopped, the message

SUN 12:00 AM LOW GEAR OIL TEMP – AUTO START

is displayed and the unit is prevented from starting.

LOW GEAR OIL TEMP SENSE FAULT

NOTE: This message is applicable only to units equipped with Level "17" EPROM or later.

This message is on "YB" units only. If the sensors input is in the "**SENSOR ERROR**" range, another cycling shutdown is requested.

LOW GEAR OIL TEMP SENSE FAULT

This notifies the operator that the sensor feedback is not functioning correctly probably due to noise feedback on the sensor connection. This cycling condition, like above, can only be triggered before a system start/engine start condition and will prevent a start of the unit. Once the sensor falls into a legal sensor category (Open/Close), the chiller and will be permitted to start (if the above logic determines that the switch is closed). One the unit is running, this cycling condition is prevented from tiggering.

NOTE: 1 to 3.5VDC = Sensor Error

To summarize: If a low gear oil temperature sensor error is detected while the unit is stopped, the message:

SUN 12:00 AM LOW GEAR OIL TEMPS SENS FAULT

is displayed and the unit is prevented from starting. As soon as the switch is determined to be in the "closed" position, the unit is permitted to start.

ENGINE VIBRATION = X.XX IN/SEC [0.40/0.65/0.60]

This display is showing you the min./max./default values of the engine vibration. The panel stores a programmable safety cutout level for the sensor. This cutout level determines when the chiller issues a warning or an emergency safety stop to the engine based on the vibration sensor feedback. The engine vibration sensor cutout can be modified by using a special access code to enter program mode and by pressing the "**ENGINE DATA**" key. This message can be scrolled by using the "**ADVANCE DAY/SCROLL**" key while in the program mode.

WARNING – HIGH ENGINE VIBRATION DETECTED

This message is displayed when the "**STATUS**" key is pressed. This condition will persist until the vibration readings fall below 20% below setpoint for 5 seconds continuously.

ENGINE VIBRATION LEVEL = X.XX IN/SEC

This is the present value of the engine vibration level that can be shown by pressing the "**ENGINE DATA**" key and holding it until displayed as this message.

ENGINE VIBRATION SENSOR

This is used on "YB" units only. This sensor uses a 4-20mA input to measure vibration on the 3406 engine in inches per second and can detect vibrations from 0.00 to 2.00 in./sec. This is read from an analog input in the I/O Expansion Board and its readings are averaged on a 5 point rolling average. Once the vibration cutout level is set, if at any time the vibration readings are within 20% below the programmable cutout level for 5 seconds continuously, the panel will issue a warning indication and the message:

WARNING – HIGH ENGINE VIBRATION DETECTED

will be displayed when the "**STATUS**" key is pressed. This will persist until the vibration readings fall below 20% below setpoint for 5 seconds continuously.

GEAR LUBE PUMP

The gear lube system pump must not be energized when the oil in the gear is below 60°F. The Caterpillar engine control panel will not energize the gear lube system pump until after a start command is received from the YORK chiller control panel.

The gear is equipped with an adjustable temperature switch which will provide a contact closure when the gear oil temperature is above the setpoint. The temperature setting for the low gear oil temp shall be set for 65°F.

Voltage will be supplied to the switch from the I/O Expansion PCB in the YORK Micro Panel. The return signal from the low gear oil temperature switch shall be connected to the I/O Expansion PCB.

ENGINE RELATED SHUTDOWN MESSAGES

(Displayed on YORK Micro Panel)

COMPRESSOR OVERSPEED

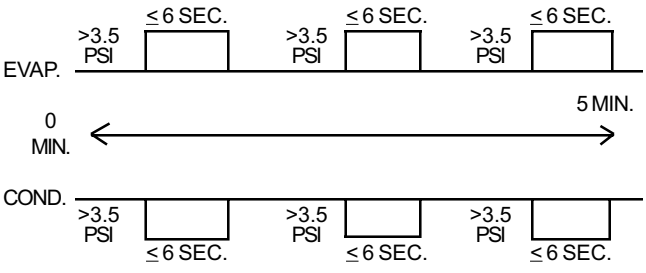
The chiller had a **quick shutdown** because the impeller tip speed exceeded 750 ft./sec. Safety shutdown reset procedure required (page 14). Also check that the compressor code and gear code are programmed correctly.

SURGE SAFETY

The chiller had a **quick shutdown** because three major surge events were detected within a five minute period. This is the pressure difference between the evaporator and condenser pressure. Factors initiating a surge should be corrected. "**SURGE SAFETY**" shutdowns are looking at fluctuations over a time period, consisting of three surge events (>3.5 psi) lasting no longer than 6 seconds over a five minute period. A surge event must consist of all the following:

1. The condenser must **decrease** greater than 3.5 psi or the evaporator must **increase** greater than 3.5 psi.
2. The duration of the decrease/increase must last no longer than 6 seconds in length consisting of 3.5 psi increase or decrease as stated above **without** a positive up swing.
3. **You must experience 3 of the above surges in a five minute period.**

If all of the above are met, the chiller will shut down on: "**SURGE SAFETY SHUTDOWN**"



SURGE SAFETY SHUTDOWN

This message will appear after 3 surges in a 5 minute period.

PLC FAILURE

The chiller had a **quick shutdown** because failure of the programmable controller in the Engine Control Panel was detected. Safety shutdown reset procedure required (page 14).

ENGINE OVERSPEED

The chiller had a **quick shutdown** because the Micro Panel detected excessive engine speed as follows:

- 2100 RPM for 3400 series
- 1750 RPM for 3500 series
- 1167 RPM for 3600 series

ENGINE OVERLOAD

The chiller had a **quick shutdown** because the Micro Panel detected continuous operation at greater than 110% load for 30 seconds. Safety shutdown reset procedure required (page 14).

ENGINE CRANKING FAULT

Engine cranks several times. Caterpillar panel allows 6 minutes to start (allowing intermittent cranking). After 6 minutes of intermittent cranking the Caterpillar panel should shut down on engine fault. If the Caterpillar panel does not detect this in the 6 minutes, the YORK panel will shut down on this message after 8 minutes.

LOW GEAR OIL TEMPERATURE SWITCH

If a low gear oil temperature sensor error is detected while the unit is stopped, the message

SUN 12:00 AM LOW GEAR OIL TEMP SENS FAULT

is displayed and the unit is prevented from starting. As soon as the switch is determined to be in the closed position, the unit is permitted to start.

HIGH AFTER COOLER WATER TEMPERATURE

The chiller had a **standard shutdown** because cooling solution at the aftercooler inlet exceeded 130°F. To restart chiller when temperature falls below 130°F press compressor switch to stop/reset, then to start position. Follow alarm reset procedure on page 14 to clear Engine Control Panel alarms. At 93.1° load limit is 90%. At 92.0° after load limit has occured, load limit is released. This is true unless a lower engine load limit is programmed with the panel. Refer to page 51 (EAGT).

ENGINE FAULT

The chiller had a **quick shutdown** that was initiated by the Engine Control Panel. This is J2-1 on the digital input PCB in the YORK Panel.

CLUTCH FAILURE

The chiller had a **quick shutdown** because an error was detected in association with the clutch bladder pressure switch controls. Either the contacts were made when not allowed (before the clutch engage signal) or not made when expected (after clutch engagement). Safety shutdown reset procedure required (page 14).

LOW ENGINE OIL PRESSURE

The chiller had a **quick shutdown** because low engine oil pressure was detected by the micro panel. Engine oil pressure must be greater than 24 PSIG while running. Safety shutdown reset procedure required (page 14).

HIGH ENGINE JACKET TEMP

The chiller had a **quick shutdown** because the Micro Panel detected jacket water temperature in excess of 239°F. Safety shutdown reset procedure required (page 14).

SURFACE SPEED CONTROL: ACTIVE

This is found under the “hidden key” to display when the surface speed control is active. If the unit has been programmed for variable speed control, there are no overrides, and temperature condition allow, the following message will be displayed as a scrolled message under the hidden key:

SURFACE SPEED CONTROL: ACTIVE

If the unit has not been programmed for variable speed control, an override is in effect, or temperature conditions do not allow for surface speed control to become active, the following message will be displayed as a scrolled message under the hidden key:

SURFACE SPEED CONTROL: NOT ACTIVE

These messages are also shown on the standard/history printout in accordance with the conditions stated above.

SURFACE SPEED CONTROL ACTIVE

The RPM is being controlled to RPMs to allow variable speed. This is telling you that all criteria has been not for the speed to decrease.

HIGH ENGINE GLYCOL TEMP

This will be displayed if the engine aftercooler glycol temperature increases to 131.2°F. Unit will go down on:

COMPR COASTDN; ENGINE SHTDN – PRESS STATUS

will then show:

DAY TIME HIGH ENGINE GLYCOL TEMP

After the engine aftercooler temperature drops to less than 130.0°F and after 150 sec. coastdown the display will change to:

COMPR SHTDN; ENGINE COOLDN – PRESS STATUS

Place the compressor switch into stop/reset position, then press warning reset.

SUN 12:00 AM HIGH ENGINE VIBRATION FAULT

If vibration readings continue to rise, the panel will initiate an emergency stop shutdown if the sensor feedback rises above setpoint for 2.5 seconds continuously. The panel will issue a shutdown and display the above message.

SECTION 3
SYSTEM OPERATING PROCEDURES

WARNING

OIL HEATERS

If the oil heater is de-energized during a shutdown period, they 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 61.)

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

CHECKING THE OIL LEVEL IN THE OIL RESERVOIR

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

If the oil level 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 61.)

START-UP PROCEDURE (Also see page 50)

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 unit. The unit will not start if the oil is less than 71°F or less than condenser saturation temp +40°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 61.)
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 –** Make sure the control center is in the "**SERVICE**" mode, and vane/speed toggle START-UP is set for "**VANE**" then press the prerotation vanes "**OPEN/INCR**" and "**CLOSE/INCR**" 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. Refer to Section 2.
4. **% ENGINE LOAD LIMIT –** Press the "**% ENGINE LOAD LIMIT**" setpoint key on the Control Center. The display should read:

   ENGINE LOAD LIMIT = 100%

   If the setpoint is not 100% and was predetermined for the job application, the Control Center should be programmed to that specification. To program, refer to Section 2.
5. All Control Center setpoints should be programmed before the chiller is started. (Refer to Section 2). 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
   % Engine Load Limit = 100%
   Pulldown Demand = None
   Clock = Sun 12:00 A.M.
   Daily Schedule = None
   Holiday= None
   Remote Reset Temp. Range = 20°F
   Data Logger = No Operation

Start-Up

1. Turn on the 460 volt supply power via the AC power starter panel located on the drive line package. Verify that DC supply for engine is 24VDC.
2. Check engine control switch in engine panel, it should be set to "**AUTO**".
3. If the chiller water pump is manually operated, start the pump. The control center will not allow the unit 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.
4. To start the unit, 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 unit.) 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. 4)

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 in the "**SERVICE**" mode the display will read:

SYSTEM READY TO START – VANES CLOSED

When the unit starts to operate, the following automatic sequences are initiated: (Refer to Fig. 17, Chiller Starting and Shutdown Sequence Chart).

YG CHILLER START SEQUENCE (Also see pgs 50 & 57)

1. "**COMPRESSOR**" switch to "**START**"

   ENGINE START SIGNAL

   is displayed.
2. Engine Control Panel (ECP) will pre-lube speed increaser and engine (if equipped with optional pre-lube pump) for one (1) minute.
3. Engine Control Panel (ECP) will control engine cranking over an eight (8) minute period if required to successfully start.
4. When engine running at minimum speed (400 RPM)

   ENGINE WARMUP

   is displayed on Micro Panel until jacket water reaches 120°F.
5. When jacket water exceeds 120°F compressor pre-lube is started, this message is displayed:

   START SEQUENCE INITIATED – COMPRESSOR PRE-LUBE
6. Three seconds into pre-lube sequence auto zeroing of compressor oil transducers for ten (10) seconds.
7. Compressor oil pump starts and chilled water pump contacts close at thirteen (13) seconds into pre-lube sequence, oil pressure must exceed 25 PSID.
8. At 50 seconds into compressor pre-lube, if compressor oil pressure is adequate and engine is at idle RPM (730 for 3600's, 980 for 3500's, 1380 for 3400's), the clutch engage signal is sent to the Engine Control Panel (ECP). Condenser water pump contacts are closed.
9. If clutch engagement is detected by clutch pressure switch closure, speed is ramped from idle to full speed (approximately 39 seconds; varies with conditions). Vanes remain closed.
10. When at full speed, leaving chilled water temperature control is initiated.

YG CHILLER SHUTDOWN SEQUENCE

Standard Shutdown

1. "**COMPRESSOR**" switch to "**STOP**".

   SYSTEM RUN; STOP SEQ. INITIATED

   is displayed.
2. Engine speed is held constant while vanes are closed.
3. When the vanes have fully closed (vane switch has closed), the MicroComputer Control Center will ramp the engine speed down to idle speed (730 RPM for model 3600s, 980 RPM for model 3500s, 1380 RPM for model 3400s) minimum over the programmed "Speed Signal Rampdown Time" (typically, 10 seconds). The "Speed Signal Rampdown Time" is programmed by a qualified service technician following instructions in Special Setpoints and Programming Procedures Section of Service Manual 160.60-M1.
4. As the engine speed is ramping down to idle speed, the MicroComputer Control Center will disengage the clutch at the programmed "Declutch" RPM. The "Declutch RPM" is programmed by a qualified service technician following instructions in Special Setpoints and Programming Procedures section of Service Manual 160.60-M1. The engine then begins a 4-minute cooldown period.

   COMPR COASTDOWN; ENGINE COOLDOWN

   is displayed for the first 2.5 minutes while the coastdown is in progress. Then,

   COMPR SHUTDOWN; ENG COOLDOWN

   is displayed for the remaining 1.5 minutes while engine completes cooldown period. Compressor oil pump runs as long as engine runs.
5. Engine shuts down.

   SYSTEM SHUTDOWN

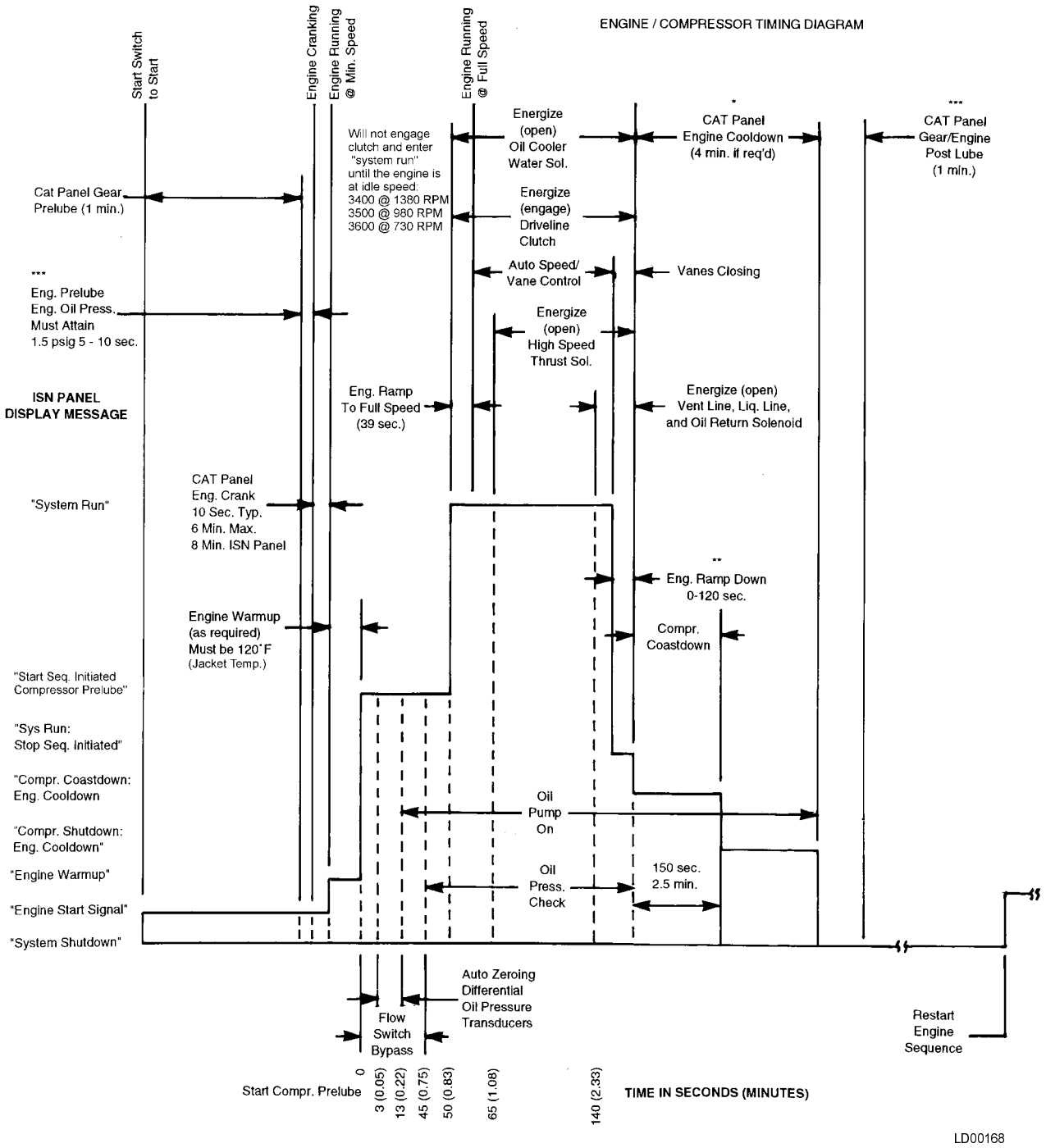
   is displayed. Engine Control Panel (ECP) post-lubes gear box for one (1) minute.

Quick Safety Shutdown (Also see page 13)

1. Safety condition detected.

   COMPR COASTDOWN; ENG SHTDN-PRESS STATUS

   is displayed.
2. Clutch disengaged and engine ignition killed immediately with simultaneous fuel valve shutoff.



* The shutdown sequence shown, beginning at the start of rampdown, is for a normal stop. For a quick (safety) shutdown, the rampdown and engine cooldown periods do not occur; the engine ignition and fuel are cut off at the point where the rampdown would normally start. However, a coastdown will occur for all shutdowns. The message displayed during the coastdown period shows:

COMPRESSOR COASTDOWN – ENGINE SHUTDOWN

** The engine rampdown time is dependent upon initial PRV position, programmed "Speed Signal Rampdown Time" and programmed "Declutch RPM." These setpoints are programmed by a qualified service technician.

*** The engine pre-lube and post-lube times apply only to chillers with optional engine lube pump; gear box pre-lube/post-lube applies to all chillers.

FIG.17 – CHILLER START SEQUENCE & SHUTDOWN SEQUENCE (Also see page 57)

OPERATIONAL THRESHOLDS CHART

APPLICATION		DEVICE	UNITS	OPERATING POINT			
CHILLED WATER	BRINE			ON RISE		ON FALL	
X	X	HDT	DEG. F / DEG. C	220 / 104.4		219 / 103.9	
X	X	HOT	DEG. F / DEG. C	180 / 82.2		179 / 81.7	
X	X	OP	PSID / kPa	25 / 172		15 / 104	
X	X	HP (R-134A)	PSIG / kPa	CUTOUT 180 / 1241	INHIBIT PRV OPENING & RPM INCREASE 162.5 / 1120	ALLOW PRV OPENING & RPM INCREASE 160 / 1103	CUTIN 120 / 827
X		LEP (R-134A)	PSIG / kPa	CUTIN 25.1 / 173	ALLOW PRV OPENING & RPM INCREASE 28.0 / 193	INHIBIT PRV OPENING & RPM INCREASE 27.0 / 186	CUTOUT 25.0 / 172
	X	ILEP	PSIG				
X	X	HOP FOR FIRST 7 MINUTES OF COMPR. OPERATION	PSID / kPa	125 / 861.9		124 / 855.0	
X	X	HOP AFTER FIRST 7 MINUTES OF COMPR. OPERATION	PSID / kPa	60 / 413.7		59 / 406.8	
X	X	FDTS	DEG.F / DEG. C	30.0 / -1.10		29.9 / -1.20	
X		LWT	DEG. F / DEG. C	CHILLED LIQUID TEMP. SETPOINT		AT OR ABOVE LCWT = 40 / 4.4, LWT = 4 / 2.2 BELOW THE CHILLED LIQ. TEMP. SETPOINT: WHEN THE SETPOINT IS RAISED. LWT = 36 / 2.2 FOR 10 MINUTES. BELOW LCWT = 40 / 4.4, LWT = 36 / 2.2	
	X	LWT	DEG.F / DEG. C	CHILLED LIQUID TEMP. SETPOINT		LWT = 4 / 2.2 BELOW THE CHILLED LIQ. TEMP. SETPOINT	
X	X	LOT	DEG.F / DEG. C	71.0 / 21.7		55.0 / 12.8	
X	X	LOTD	DEG.F / DEG. C	40 / 22.2		39.9 / 22.1	
X	X	HSDT	DEG.F / DEG. C	CUTOUT 250 / 121.1		CUTIN 180 / 82.2 & MANUAL RESET	
X	X	EOS	1 RPM	CUTOUT 1.167 x RPM max.		CUTIN CUTOUT - 1	
X	X	EJWT	DEG.F / DEG. C	CUTOUT 239 / 115		CUTIN 238.9 / 114.9	
X	X	EOP	PSIG / kPaG	CUTIN > CUTOUT		CUTOUT FOR RPM < 0.81 x RPM min. 8.0 / 55.2 FOR RPM ≥ 0.81 x RPM min. 24.0 / 165.5*	
X	X	EAGT	DEG. F / DEG. C	CUTOUT 130.1 / 54.5	LIMIT ENG. LOADING TO 90% 93 / 33.4	ALLOW ENG. LOADING TO 100% 92.0 / 33.3	CUTIN 130.0 / 54.4
X	X	EOLD	PERCENT	CUTOUT 110% FOR 30 SEC.	INHIBIT PRV OPENING 100	ALLOW PRV OPENING TO 98	CUTIN 109
X	X	COS	FT. / SEC.	CUTOUT 750		CUTIN < CUTOUT	

* Measured after Engine running (> 400 RPM) for more than 9 seconds.

TABLE 1 – CHILLER OPERATIONAL THRESHOLDS (Also see page 19)

3. Compressor coastdown for 150 seconds with compressor oil pump running.
4. Engine control panel (ECP) post-lubes gear box for one (1) minute.

CHILLER OPERATION

After the compressor reaches its operating speed, the Prerotation Vanes will begin to open under the control of the Microprocessor board which senses the leaving chilled liquid temperature. The unit capacity will vary to maintain the leaving chilled liquid temperature setpoint. The Prerotation Vanes are modulated by an actuator under the control of the Microprocessor board. 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 to decrease chiller capacity. When the chilled liquid temperature rises, the actuator will open the Prerotation Vanes to increase the capacity of the unit.

However, the loading of the engine cannot exceed the setting of the "**% ENGINE LOAD LIMIT**" at any time during the operation, since the MicroComputer Control Center 50 to 100% engine load limit software function will override the temperature control function and prevent the prerotation vanes from opening beyond the % engine load 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

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

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

Condenser Water Temperature Control

The YORK Millennium 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 the formula below:

$$\text{Min. ECWT} = \text{LCHWT} - \text{C RANGE} + 5 + \frac{15 \times \%\text{LOAD}}{100}$$

where: ECWT = entering condensing water temperature
LCHWT = leaving chilled water temperature
C RANGE = condensing water temperature range

At start-up the entering condenser water temperature may be as much as 25°F colder than the standby return 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 until the compressor is up to speed, then the vane motor should cause the vanes to modulate with load requirements.
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.

Automatic data logging is possible by connecting the optional printer and programming the DATA LOGGER function; Ref. Form 160.60-N2.

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 identified by higher than normal temperature differences between leaving condenser water and condenser saturation temperature.

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 LIQUID TEMPERATURES**" 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 LIQUID TEMPS**" key and the "**REFRIGERANT PRESSURES**" key.
5. Check the condenser saturation temperature (based upon condenser pressure sensed by condenser transducer). Press the "**CHILLER DATA**" key. This key may be depressed repeatedly after depressing the "**DISPLAY HOLD**" key to display different parameters.
6. Check the compressor discharge temperature. Press "**CHILLER DATA**" key. During normal operation discharge temperature should not exceed 220°F.
7. Check for any signs of dirty or fouled condenser tubes. (The temperature difference between water leaving condenser and condenser saturation temperature should not exceed the difference recording for a new unit by more than 4°F.)
8. Verify proper water treatment.
9. Press the "**STATUS**" key whenever the display indicates so. This allows any warning messages to be displayed.

Weekly

1. Check the oil charge (See "Oil Charging Procedure", page 61).

Quarterly

1. Perform chemical analysis of compressor oil.

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 or eductor for foreign particles.
3. Check controls and safety cutouts.

Annually (more often if necessary.)

1. Drain and replace the oil in the compressor oil sump (See Oil Charging Procedure, page 61.)
2. Cooler and Condenser
   a. Inspect and clean facility water strainers.
   b. Inspect and clean tubes as required.
   c. Inspect end sheets.

NEED FOR MAINTENANCE OR SERVICE

If the system is malfunctioning in any manner or the unit is stopped on one of the safety controls, consult the OPERATING ANALYSIS CHART (pages 64 and 65) 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 unit 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 2 (page 62) is an explanation of each specific shutdown. If the unit shuts down on a "Safety" shutdown, the display will read:

SYSTEM SHUTDOWN – PRESS STATUS

Upon pressing the status key, the day-of-week, time-of-day and cause of shutdown is displayed. Safety shutdowns require the operator to manually reset the control center prior to restarting the chiller. When the display reads:

START SEQUENCE INITIATED

the cause of the safety shutdown is automatically cleared from the memory.

SAFETY SHUTDOWNS (Also see page 14)

- Low Discharge Temperature
- High Discharge Temperature
- Low Evaporator Pressure
- High Condenser Pressure
- Faulty Condenser Transducer
- Low Oil Pressure Differential
- High Oil Pressure Differential
- High Oil Temperature
- Faulty Oil Transducer
- Oil Transducer Differential Error
- Proximity Sensor Fault
- High Drain Line Temperature
- Open Thermocouple
- Faulty Proximity Sensor
- Power Failure

- Auxiliary Shutdown
- Chilled Water Flow Fault
- Compressor Overspeed Fault
- Compressor Rotation Fault
- Engine Clutch Failure
- Engine Cranking Fault
- Engine High Jacket Water Temperature
- Engine Low Oil Pressure
- Engine Overload Fault
- Engine Overspeed Fault
- Engine Panel Safety Shutdown
- Engine PLC Controller Fault
- Faulty Discharge Sensor
- Surge Safety Shutdown
- 24 Volt DC Power Fault
- Flow Switch
- Manual Engine Shutdown

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 unit. The unit will automatically restart when the cycling condition is removed.

CYCLING SHUTDOWNS

- Remote Cycling Shutdown
- Multi-Unit Cycling Shutdown
- Low Water Temperature Shutdown
- Time Clock
- Vane Motor Switch Open
- Low Oil Temperature
- Low Oil Temperature – Differential
- DC Undervoltage
- High Engine Aftercooler Water Temp – Manual Restart

STOPPING THE SYSTEM

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 will display:

   SYSTEM RUN – STOP SEQUENCE INITIATED

   The prerotation vanes will close, engine speed reduce, and cluch disengage. After the clutch is disengaged the display will read:

   COMPRESSOR COASTDOWN: ENGINE COOLDOWN

   After 2.5 minutes the display will read:

   COMPRESSOR SHUTDOWN; ENGINE COOLDOWN

   After 1.5 minutes the engine completes the cooldown period and is shut down.

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 J54.)
3. Open the switch to the cooling tower fan motors, if used.
4. The compressor sump oil heater (thermostically control) 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. Test all system joints for refrigerant leaks with a leak detector. 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. Drain cooling water from drive line heat exchangers.

3. Move jumper J57 on the micro board from CLOCK ON position (CLKON) to CLOCK OFF position (CLKOFF) while 115VAC control power is applied. This conserves the battery.
4. Open the main disconnect switches to the condenser water pump and the chilled water pump. Open the 460 volt circuit to the power panel.

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. Move Jumper J57 on the micro board from CLOCK OFF position (CLKOFF) to CLOCK ON position (CLKON) and reset the clock. Energize the 460 volt circuit to the power panel to energize the compressor sump oil heater for at least 12 hours.
2. Operate the Oil Pump (press and release "**OIL PUMP**" key) until steady oil pressure is established. 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
YG & YB SYSTEM COMPONENTS DESCRIPTION

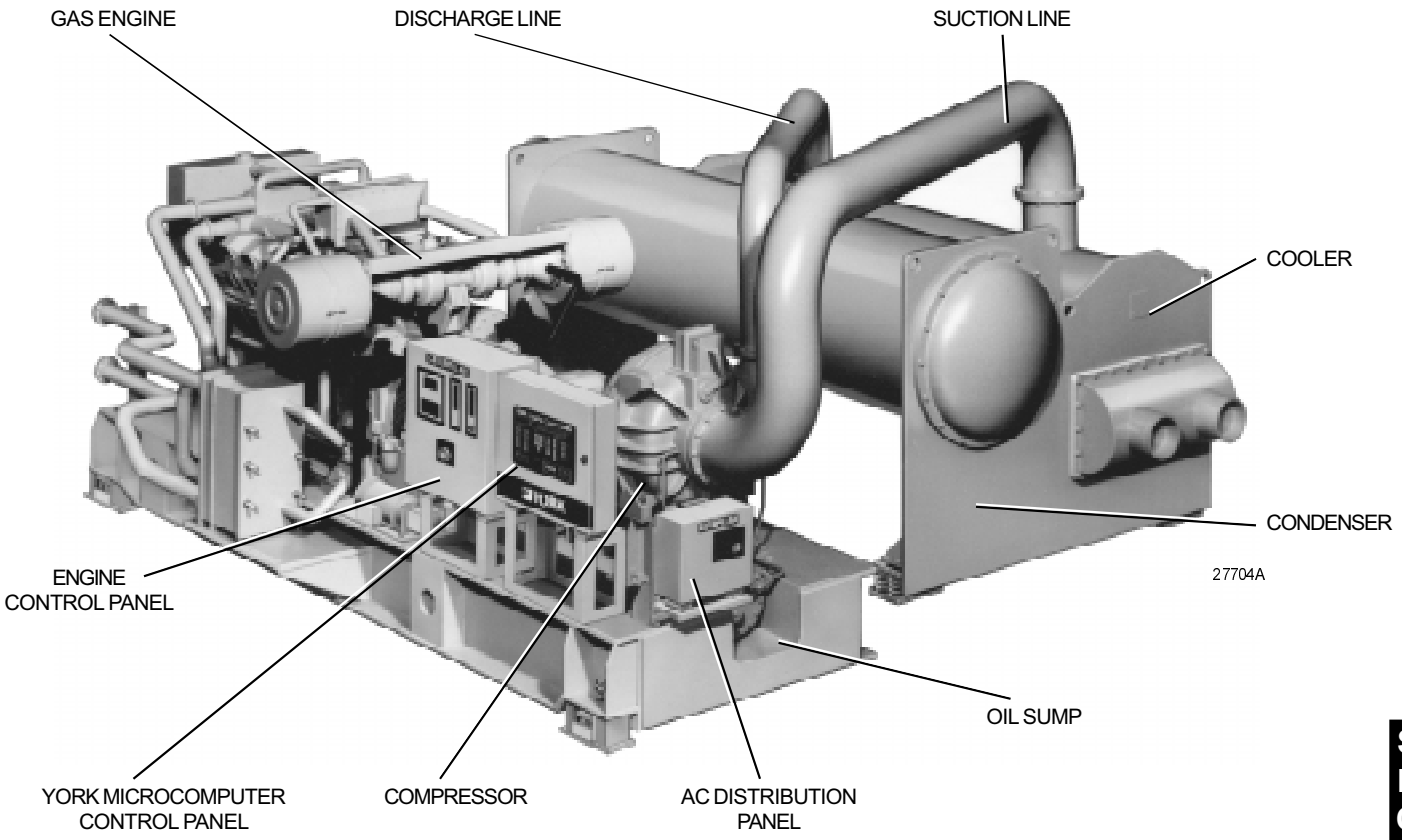


FIG. 18 – YG CHILLER SYSTEM COMPONENTS

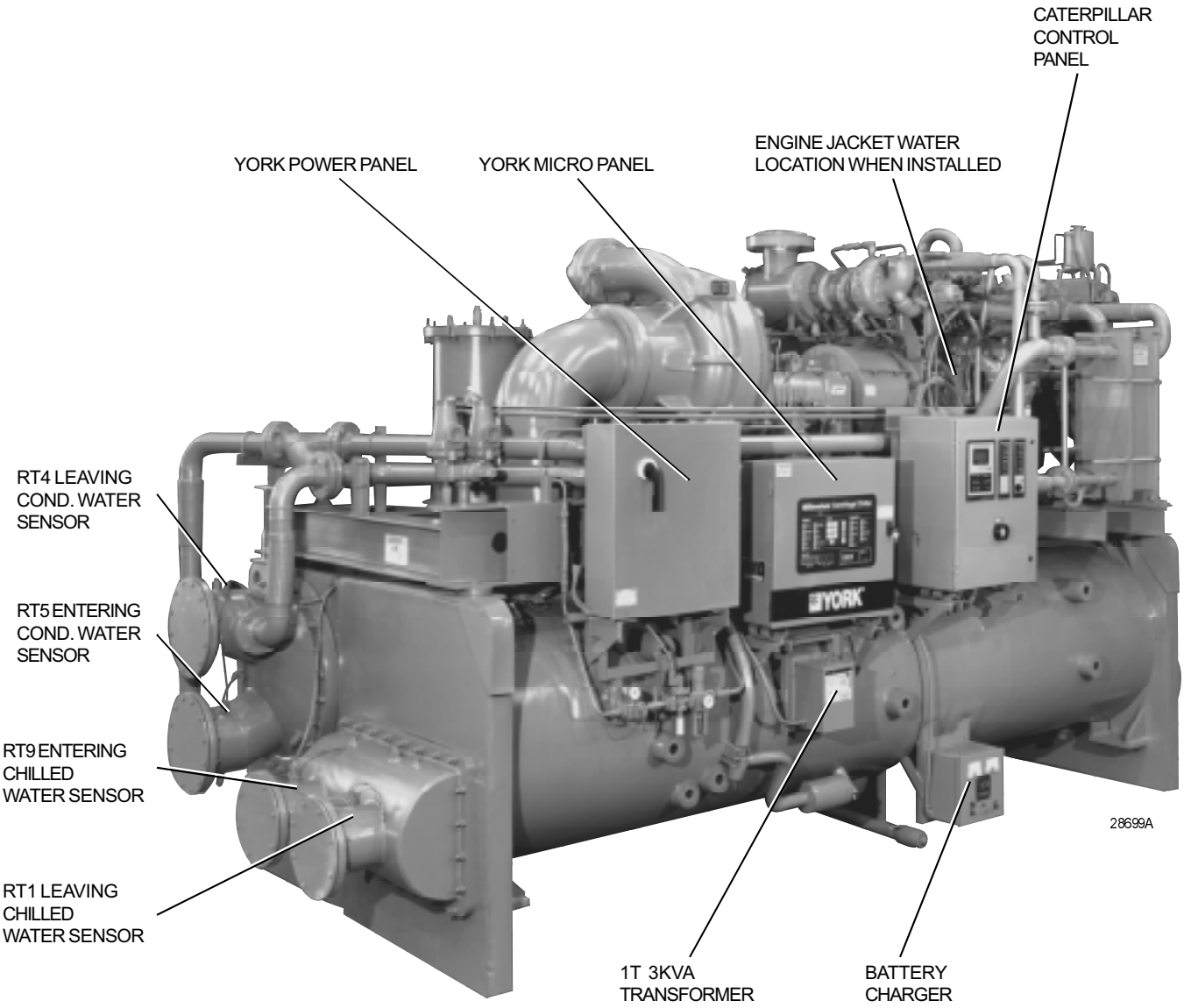


FIG. 18A – YB CHILLER SYSTEM COMPONENTS

GENERAL

YG Models

The YG Millennium Gas-Engine-Drive Chiller ships as two packages – a shell package and a drive line package. The shell package includes an evaporator and condenser with internal subcooler. The drive line package includes a compressor, compressor lubrication system, natural gas engine, clutch, speed increaser, torsional vibration reducing coupling and all control panels. Interconnecting piping is shipped separately for field connection.

The initial charge of oil and refrigerant (HFC-134a) is supplied, shipped in containers and cylinders for field installation by YORK.

Assembly will be under the supervision of YORK factory service. All piping and wiring required to join the shell package to the driveline package will be completed in the field. Factory trained field service representatives will supervise the final leak testing, charging and the initial start-up. The complete installation will be checked for procedural and operational compliance by a factory trained service representative from YORK.

YB Models

The YORK Millennium YB Gas-Engine-Drive Centrifugal Chiller is completely factory packaged including evaporator, condenser with integral subcooler, compressor, compressor lubrication system, natural gas engine, air actuated clutch, speed increaser, torsional vibration reducing coupling, power panel, engine PLC panel, Chiller Control Panel and all interconnecting unit piping and wiring. This chiller is painted with durable alkyd-modified, vinyl enamel machinery paint prior to shipment.

The initial charge of compressor oil and refrigerant (HFC-134a) will be supplied, shipped in containers and cylinders for installation by YORK. The engine and the gearbox will be charged with the initial charge of oil prior to shipment. The engine jacket glycol and battery acid will be supplied and installed by the local Caterpillar dealer.

YORK will retain factory trained service representatives of the engine manufacturer to provide start-up service and operator instruction for the gas engine.

STARTING SEQUENCE (Also see pages 49 & 50)

1. Depress "**COMPRESSOR START**" switch.
2. CATERPILLAR engine starts.
3. Thirteen (13) seconds after the CATERPILLAR engine jacket water temperature reaches 120°F, the compressor oil pump is energized. Thirty-seven (37) seconds after the pre-lube cycle begins, the clutch engages.
4. Thirty-nine (39) seconds after the clutch engages, the engine should be up to full speed and the unit will go into temperature control to modulate the vanes.

COMPRESSOR

The compressor is a single-stage centrifugal type powered by a CATERPILLAR gas-fuel turbocharged engine.

The rotor assembly consists of a heat-treated alloy steel drives shaft and impeller shaft with a cast aluminum,fully shrouded impeller. The impeller is designed for balanced thrust and is dynamically balanced and over-speed tested.

The insert type journal and thrust bearings are fabricated of aluminum alloy. Single helical gears with crowned teeth are designed so that more than one tooth is in contact at all times. Gears are integrally assembled in the compressor rotor support and are film lubricated. Each gear is individually mounted in its own journal and thrust bearings.

The open-drive compressor shaft seal consists of a springloaded, precision carbon ring, high temperature elastomer "O" ring static seal, and stress-relieved, precision lapped collars. The seal is oil-flooded at all times and is pressure-lubricated during compressor operation.

CAPACITY CONTROL

Prerotation vanes (PRV) and engine speed are used to modulate chiller capacity from 100% to as low as 15% of design for normal air conditioning applications. Operation is by external, electric PRV actuator which automatically controls the vane position to maintain a constant leaving chilled liquid temperature. Engine will operate at the lowest possible speed as determined by actual operating conditions and compressor characteristics. This improves chiller efficiency.

COMPRESSOR LUBRICATION SYSTEM

The lubrication system consists of the oil pump, oil filter, oil cooler, and all interconnecting oil piping and passages. There are main points within the 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. Two journal bearings.
3. **Speed Increasing Gears in Compressor**
   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.

After pressing of the "**COMPRESSOR START**" switch on the control center and the engine reaches minimum run speed with jacket water temperature at 120°F, the compressor prelube begins. The oil pump is energized after 13 seconds. After a 50 second delay to allow the system oil pressure to stabilize, the clutch will be engaged. The oil pump will continue to run during the entire operation of the compressor, and for a minimum of 150 seconds during compressor coastdown, or until the engine shuts down, whichever is longer.

The submerged oil pump takes suction from the surrounding oil and discharges 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, located inside the compressor, 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 in 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 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, or as long as the engine runs. The system cannot restart during that time interval.

OIL HEATERS

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 upon startup. 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 Control Center, Section 2.

To maintain the lowest possible concentration of refrigerant in the oil, the compressor oil reservoir is equipped with 115 and 460 volt electric reservoir oil heaters. The oil heaters are 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 and is at least 40°F greater than condenser saturation temperature.

HEAT EXCHANGERS

Evaporator and condenser shells are fabricated from rolled carbon steel plates with fusion welded seams. The refrigerant side of each shell is designed for 180 PSIG design working pressure, tested at 270 PSIG.

Heat exchanger tubes are internally and externally enhanced type.

The evaporator is a shell and tube, flooded type heat exchanger. A distributor trough provides uniform distribution of refrigerant over the entire shell length. Aluminum mesh eliminators or a suction baffle are located above the tube bundle to prevent liquid refrigerant carryover into the compressor. Two 1-1/2" liquid level sight glasses are located on the side of the shell to aid in determining proper refrigerant charge at standby. The evaporator shell contains a dual refrigerant relief valve as set at 180 PSIG.

The condenser is a shell and tube type, with a discharge gas baffle to prevent direct high velocity impingement on the tubes. A separate subcooler is located inside the condenser.

The removable compact water boxes are fabricated of steel. The design working pressure is 150 PSIG and the boxes are tested at 225 PSIG. Integral steel water baffles provide the required pass arrangements.

REFRIGERANT FLOW CONTROL

Refrigerant flow to the evaporator is controlled by a variable flow control valve or fixed orifice plate.

MICROCOMPUTER CONTROL CENTER (See Sect. 2)

The MicroComputer Control Center is factory mounted, on the drive line, wired and tested. The electronic panel automatically controls the operation of the unit in meeting system cooling requirements while minimizing energy usage. For detailed information on the Control Center, refer to Section 2 of this manual.

ENGINE CONTROL PANEL, CLUTCH, AND GEARBOX

In addition to integrating the YORK Controls with the CATERPILLAR Engine Controls, the ECP (Engine Control Panel) serves as the primary control and protection system for the drive line engine, clutch and gearbox.

The drive line clutch and gearbox control/protection/annunciation is provided by the Drive Line PLC processor. The PLC provides gearbox lubrication control/protection, clutch failure protection and additional drive line related protection. LED indication is provided by CATERPILLAR alarm and indication modules for drive line related alarms and shutdowns.

CLUTCH

The pneumatic clutch is designed to operate at 100 PSI which is controlled by an air pressure regulator on the CATERPILLAR drive line base. This regulator is supplied by an air compressor supplied by the customer which must provide at least 125 PSI.

GEARBOX (SPEED INCREASER)

The gearbox is provided by Nuttall Gear Corporation. The gear box lube system comes pre-set at 15-20 PSI operating differential. The gear mesh is sprayed with oil for proper operation. The gearbox is protected by pressure and temperature transducers. Output RPM of the gear box when the CATERPILLAR engine is at full speed is 3600 RPM.

FOR FURTHER INFORMATION ON THE CLUTCH AND GEARBOX CONSULT THE CATERPILLAR DRIVE LINE MANUAL.

ENGINE VIBRATION SENSOR

This is used on "YB" units only. This sensor uses a 4-20mA input to measure vibration on the 3406 engine in inches per second and can detect vibrations from 0.00 to 2.00 in./sec. This is read from an analog input in th I/O Expansion Board and its reading are averaged on a 5 point rolling average. Once the vibration cutout level is set, if at any time the vibration readings are within 20% below the programmable cutout level for five seconds continuously, the panel will issue a warning indication and the message

WARNING – HIGH ENGINE VIBRATION DETECTED

will be displayed when the "**STATUS**" key is pressed. This will persist until the vibration readings fall below 20% below setpoint for five seconds continuously.

LOW GEAR OIL TEMPERATURE SWITCH

If a low gear temperature sensor error is detected while the unit is stopped, the message

SUN 12:00 AM LOW GEAR OIL TEMP SENS FAULT

is displayed and the unit is prevented from starting. As soon as the switch is determined to be in the "closed" position, the unit is permitted to start.

GEAR LUBE PUMP

The gear lube system pump must not be energized when the oil in the gear is below 60°F. The Cat Engine Control Panel will not energize the gear lube system pump until after a start command is received from the YORK Chiller Control Panel.

The gear is equipped with an adjustable temperature switch which will provide a contact closure when the gear oil temperature is above the setpoint. The temperature setting for the low gear oil temp. shall be set for 65°F.

Voltage will be supplied to the switch from the I/O Expansion PCB in the YORK Micro Panel. The return signal from the low gear oil temp switch shall be connected to the I/O Exansion PCB.

ENGINE VIBRATION SENSOR

An engine vibration transmitter sensor was added to the "YB" chillers. This sensor uses a 4 to 20mA input to measure vibration on the 3406 engine in inches per second and can detect vibrations varying from 0.00 to 2.00 in./sec. The new sensor is read from an analog input (J6-2) on the I/O Expansion Board.

The present value of the engine vibration level can be shown by pressing the "**ENGINE DATA KEY**" and holding it until the message:

ENGINE VIBRATION LEVEL = X.XX IN./SEC.

is displayed. The number shown in the message above is always the present level of vibration feedback from the sensor.

In addition, the panel stores a programmable safety cutout level for the sensor. This cutout level determines when the chiller issues a warning or an emergency safety stop to the engine based on the vibration sensor feedback. The engine vibration sensor cutout can be modified by using a special access code. The display will show:

ENGINE VIBRATION SHUTDOWN = X.XX IN/SEC. (0.40/0.65/0.60)

Once the vibration level is set, if at any time the vibration readings are greater than 20% below the programmable cutout level for 5 seconds continuously, the panel will issue a warning indication and the message:

WARNING – HIGH ENGINE VIBRATION DETECTED

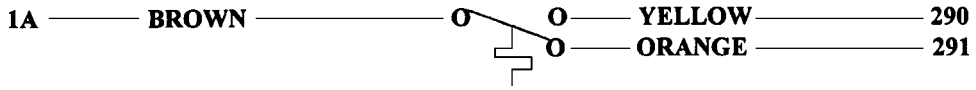
will be displayed when the "**STATUS**" key is pressed. This condition will persist until the vibration reading fall below 20% below the setpoint for 5 seconds continuously.

If, however, the vibration readings continue to rise, the panel will initiate an emergency stop shutdown if the sensor feedback rises above setpoint for 2.5 seconds continuously. The panel will issue a shutdown and the message.

SUN 12:00 AM HIGH ENGINE VIBRATION FAULT

will be displayed when the "**STATUS**" key is pressed. This condition will persist until the readings fall below the cutout setpoint.

GEAR OIL TEMPERATURE SWITCH CONNECTIONS TO THE CATERPILLAR ENGINE PANEL



Description of Operation:

The gear lube system pump must not be energized when the oil in the gear is below 60°F. The Cat. Engine Control Panel will not energize the gear lube system pump until after a start command is received from the YORK Chiller Control Panel.

The gear is equipped with an adjustable temperature switch which will provide a contact closure when the gear oil temperature is above the setpoint. The temperature setting for the low gear oil temperature shall be set for 65°F.

Five volts shall be supplied to the switch from J7 Pin 2 on the I/O Expansion PCB in the YORK Micro Panel. The return signal from the low gear oil temperature switch shall be connected to J7, Pin 1 on the I/O Expansion Board.

PHYSICAL LOCATION OF THE TEMPERATURE SWITCH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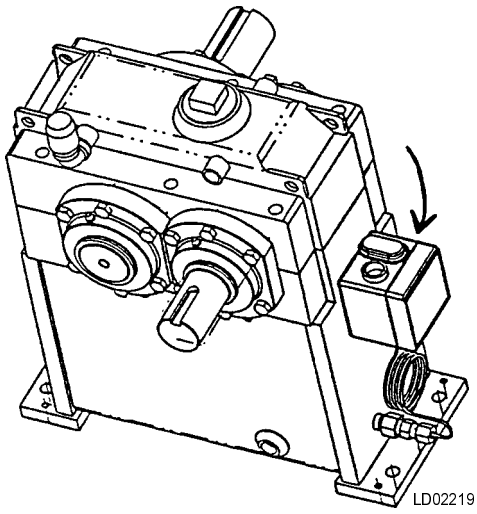
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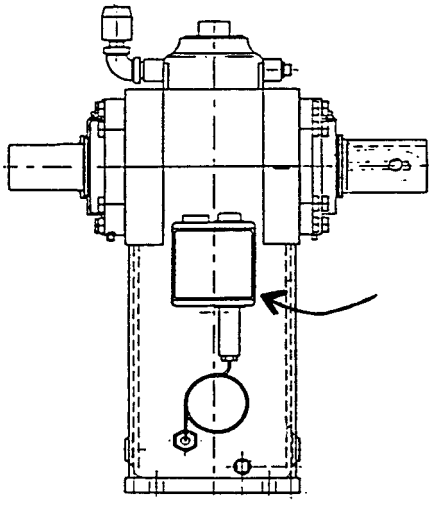
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SECTION 5
OPERATIONAL MAINTENANCE

OIL RETURN SYSTEM

The oil return continuously maintains the proper oil level in the compressor oil sump.

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 the dehydrator.
2. Remove the dehydrator.
3. Assemble the new filter-drier.
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.

OIL CHANGE

The normal oil charge for the compressor is 20 gal., type “K” for R-134a application.

New YORK Refrigeration oil 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 reservoir proceed as follows:

1. The unit must be shut down.
2. Immerse the suction connection of the oil charging pump in a clean container of new oil and connect to the oil charging valve located on the remote oil reservoir cover plate. 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 power panel to energize the oil heater. (See Section 3, System Operating Procedures). 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 be started manually 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.

SECTION 6
TROUBLE SHOOTING

TABLE 2 – 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	Flow Switch	Manual	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		
		Remote Stop		Energy Management System		
MON.	10:00 AM	Low Evap. Press.	Manual	Low Evap. Pressure Transducer (LEP)	25 PSIG (R-134A)	25.1 PSIG (R-134A)
MON.	10:00 AM	Low Evap. Press. Brine	Manual	LEP external control (Brine units only)	Set to Job Spec.	Set to Job Spec.
MON.	10:00 AM	Low Oil Pressure	Manual	Low Oil Pressure Transducer (OP)	25 PSID	15 PSID
MON.	10:00 AM	High Pressure	Manual	High Pressure Safety Control (HP)	180 PSIG (R-134A)	120 PSIG (R-134A)
MON.	10:00 AM	Evap. Trans or Probe Error	Manual	Evap. Pressure Transducer or Leaving Chilled Water Thermistor (RS1)		
MON.	10:00 AM	High Discharge Temperature	Manual	Discharge Temperature Thermistor (RT2)	220°F	219°F
MON.	10:00 AM	High Oil Temperature	Manual	Oil Temperature Thermistor (RT3)	170°F	169°F
MON.	10:00 AM	Power Failure	Manual	Micro Board undervoltage circuit on 5V unregulated supply	8.29 VDC	7.84 VDC
MON.	10:00 AM	High Oil Pressure	Manual	Compressor Oil Pressure Differential	100 PSID (during first 7 minutes of compressor operation); 60 PSID after first 7 minutes of compressor operation)	59 PSID
		Vane Motor Switch Open	Autostart	Vane Motor Switch		
MON.	10:00 AM	Program Initiated Reset	Autostart	Micro Board		
		Replace RTC-IC Chip Reprogram Setpts.		RTC-IC Chip Thermistor (RT3)		
MON.	10:00 AM	Low Oil Temperature	Autostart	Oil Temperature Thermistor (RT3)	71.0°F	55°F
MON.	10:00 AM	Faulty Discharge Temp. Sensor	Manual	Discharge Temp. Thermistor (RT2) disconnected or faulty . (min system oper. temp. = 32°F)	30.0°F	29.9°F

PROGRAMMED SETPOINTS BY OPERATOR	START-UP OF SYSTEM AFTER SHUTDOWN	PROBABLE CAUSE AND SERVICE REQUIRED
4°F below chilled water setpt. (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.
	Restart allowed when water flow is restored to close flow switch. Manual reset of ECP required.	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.
	Start up by start signal from remote start switch.	Remote Stop Contact Closure.
	To restart, press compressor switch from STOP/RESET to START position. Manual reset of ECP required.	See OPERATING ANALYSIS, Table 3 Sympton 2.
	To restart, press compressor switch from STOP/RESET to START position. Manual reset of ECP required.	See OPERATING ANALYSIS, Table 3 Sympton 2.
	To restart, press compressor switch from STOP/RESET to START position. Manual reset of ECP required.	See OPERATING ANALYSIS, Table 3 Symptom 4, 5, 6, 7, 9, 10, 11.
	Will restart when . . . See Operational Press. falls 120+ PSIG. To restart press compressor switch from STOP/ RESET to START position. Manual reset of ECP required.	See OPERATING ANALYSIS, Table 3 Symptom 1 - High Discharge Pressure.
	To restart, press compressor switch from STOP/RESET to START position. Manual reset of ECP required.	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 min. following a 10-min. bypass at start-up.
	To restart, press compressor switch from STOP/RESET to START position. Manual reset of ECP required.	Condenser tubes dirty or scaled or high condenser water temperature. (See Symptom 1, Table 3.)
	To restart, press compressor switch from STOP/RESET to START position. Manual reset of ECP required.	Dirty oil filter or restricted oil cooler line. Change oil filter. See OPERATING ANALYSIS, Table 3, Sym. 9
	To restart, press compressor switch to STOP/RESET position and then START position. Manual reset of ECP required.	Power Failure.
	Will start at 59 PSID when compressor switch is placed to STOP/RESET and then START. Manual reset of ECP required.	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.	Vanes are set improperly. Reset vane linkage, check vane positions using the Service key switch and proper keys on the MicroComputer Control Center.
		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 UI6.
	Auto restart allowed when oil temperature reaches 71°F.	Oil Temp. Thermistor disconnected from Analog Input Board. Reconnect or replace open sensor.
	Press STOP/START switch and then START switch. Manual reset of ECP required.	Faulty Discharge Temperature Thermistor (RT2) or disconnected from Analog Input Board. Connect or replace open sensor.

TABLE 3 – OPERATING ANALYSIS CHART

RESULTS	POSSIBLE CAUSE	REMEDY
1. SYMPTOM: ABNORMALLY HIGH DISCHARGE PRESSURE		
Temperature difference between saturation temperature and water off condenser higher than normal.	Air in condenser.	
High discharge pressure.	Condenser tubes dirty or scaled.	Clean condenser tubes. Check water conditioning.
	High condenser water temperature.	Reduce condenser water inlet temperature. (Check cooling tower and water circulation.)
Temperature difference between condenser water on and water off higher than normal, with normal cooler pressure.	Insufficient condensing water flow.	Increase the quantity of water through the condenser to proper value.
2. SYMPTOM: ABNORMALLY LOW SUCTION PRESSURE		
Temperature difference between leaving chilled water and refrigerant in cooler greater than normal with high discharge temperature.	Insufficient charge of refrigerant. Flow orifice blocked.	Check for leaks and charge refrigerant into system. 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 engine load. cutout.	Insufficient load for system capacity.	Check prerotation vane motor operation and setting of low water temperature
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 engine) 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 connecrtions to oil pump and press manual reset on oil pump starter in AC panel.
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. (Refer to Charging the System With Oil, page 61.)
	Burned out oil heater.	Replace oil heater.

TABLE 3 – OPERATING ANALYSIS CHART - CONT'D

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 misadjsuted.	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.
NOTE: When oil pump is run without an oil supply it will vibrate and become extremely noisy.	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 office 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 writing/connectors.	Replace oil pressure transducer.
11. SYMPTOM: REDUCED OIL PUMP CAPACITY		
Oil pump pumping capacity.	Excessive end clearance in pump. Other worn pump parts.	Inspect and replace worn parts.
	Partially blocked oil supply inlet.	Check oil inlet for blockage.

NOTES:

1. When the system shuts down on an "E" stop, the YORK Panel must be "off" to run the engine in maintenance mode.
2. Resetting the Caterpillar Control Panel **erases** diagnostic readings after a shutdown.
3. The YB Caterpillar Panel does not have a manual reset button like the YG Panel. Turning the YB unit off resets the Caterpillar Panel. (The 3406 Engine does not have an EIS shutdown)

SECTION 7
MAINTENANCE

CHECKING SYSTEM FOR LEAKS

Leak Testing During Operation

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

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

If any leaks are indicated, they must be repaired immediately. Usually, leaks can be stopped by tightening flare nuts or flange bolts. However, if it is necessary to repair a welded joint, the refrigerant charge must be removed (See HANDLING REFRIGERANT FOR DISMANTLING AND REPAIR, page 68.)

CONDUCTING R-22/LEAK TEST

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 refrigerants 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.

VACUUM TESTING

After the leak 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 and start the pump (See VACUUM DEHYDRATION).
2. Open wide all systems valves, including gauge valves. Be sure all valves to the atmosphere are closed.
3. Operate the vacuum pump in accordance with VACUUM DEHYDRATION until a wet bulb temperature of +32°F or a pressure of 5 mm Hg is reached. See Table 4 for corresponding values of pressure.
4. To improve evacuation, circulate hot water (not to exceed 125°F) through the cooler and condenser tubes to thoroughly dehydrate the shells. If a source of hot water is not readily available, a portable water heater should be employed. DO NOT USE STEAM. A suggested method is to connect a hose between the source of hot water under pressure and the cooler head drain connection, out the cooler vent connection, into the condenser head drain and out the condenser vent. To avoid the possibility of causing leaks, the temperature should be brought up slowly so that the tubes and shell are heated evenly.
5. Close the system charging valve and stop valve between the vacuum indicator and the vacuum pump. Then disconnect the vacuum pump, leaving the vacuum indicator in place.
6. Hold the vacuum obtained in Step 3 in the system for 8 hours; the slightest rise in pressure indicates a leak or the presence of moisture, or both. If after 8 hours the wet bulb temperature in the vacuum indicator has not risen above 40°F or a pressure of 6.3 mm Hg, the system may be considered tight.

   NOTE: Be sure the vacuum indicator is valved off while holding the system vacuum and be sure to open the valve between the vacuum indicator and the system when checking the vacuum after the 8 hour period.
7. If the vacuum does not hold for 8 hours within the limits specified in Step 6 above, the leak must be found and repaired.

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 4) 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 pres-

TABLE 4 – SYSTEM PRESSURES

*GAUGE INCHES OF MERCURY (HG) BELOW ONE STANDARD ATMOSPHERE	ABSOLUTE PSIA	ABSOLUTE MILLIMETERS OF MERCURY (HG)	ABSOLUTE MICRONS	BOILING TEMPERATURES OF WATER °F	
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	WATER FREEZES
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		

* 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

sure 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 vacuum pump. The length of time necessary for the hydration of a system is dependent on the size or volume of the system, the capacity and efficiency of the vacuum pump, the room temperature and the quantity of water present in the system. By the use of the vacuum indicator as suggested, the test tube will be evacuated to the same pressure as the system, and the distilled water will be maintained at the same saturation temperature as any free water in the system, and this temperature can be observed on the thermometer.

If the system has been pressure tested and found to be tight prior to evacuation, then the saturation temperature recordings should follow a curve similar to the typical saturation curve shown as Fig. 19.

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

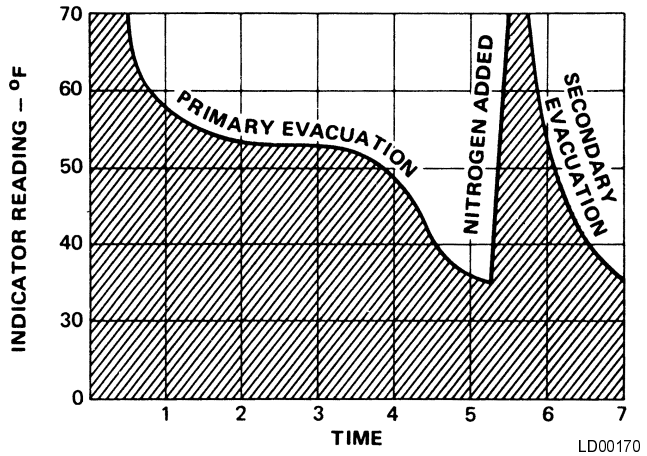

FIG. 19 – SATURATION CURVE

temperature of 35°F or a pressure of 5 mm Hg. is reached.

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

temperature will return to approximately ambient temperature. Close off the system again, and start the second evacuation.

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

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

During the primary 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 freeze point of the cooler liquid. For water, the refrigerant pressure corresponding to the freezing point is 30 PSIG for R134a (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 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.

TABLE 5 – REFRIGERANT CHARGE – YG MODELS

SHELL CODES		R-134A (lbs.)
COOLER	CONDENSER	
L	L	1125
M	M	1405
N	N	1810
P	P	1900
Q	Q	2500
R	R	3310
S	S	3550

Refrigerant charge for YB Models is 1400 lbs.

Refrigerant may be furnished in drums containing either 30, 50, 125 or 1750 lbs. of refrigerant. These drums are not returnable and they should be stored for future 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 Millennium model (see Table 5). Charge the correct amount of refrigerant and record the level in the cooler sight glasses.

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 have 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 bottom of the upper sight glass.

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

HANDLING REFRIGERANT FOR DISMANTLING AND REPAIRS

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

CONDENSERS AND COOLERS

GENERAL

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

CHEMICAL WATER TREATMENT

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

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

CLEANING COOLER AND CONDENSER TUBES

Cooler

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

Condenser

In a condenser, trouble due to fouled tubes is usually indicated by a steady rise in head pressure, over a period of time, accompanied by a steady rise in condensing temperature, and noisy operation.

TUBE FOULING

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

1. Rust or sludge, which finds its way into the tubes and accumulates there. This material usually does not build up on the inner tube surfaces as scale, but does interfere with heat transfer. Rust or sludge can generally be removed from the tubes by a thorough brushing process.
2. Scale, due to mineral deposits. These deposits, even though very thin and scarcely detectable upon physical inspection, are highly resistant to heat transfer. They can be removed most effectively by circulating an acid solution through the tubes.

TUBE CLEANING PROCEDURES

Brush Cleaning of Tubes

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

Improved results can be obtained by admitting water into the tube during the cleaning process. This can be done by mounting the brush on a suitable length of 1/8" pipe with a few small holes at the brush end and connecting the other end by a 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 specialized services 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 in R-134a systems may result in refrigerant leaking into the water circuit, or water leaking into the shell depending on the pressure levels. If refrigerant is leaking into the water it can be detected at

the liquid head vents after a period of shutdown. If water is leaking into the refrigerant, 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 or 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 leak detector.
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 leak detector. 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 though the tube walls. A fan placed at the end of the cooler opposite the detector will assure that any leakage will travel through the tube to the detector.
5. Mark any leaking tubes for later identification.
6. If any tube sheet joints are leaking, the leak should be indicated by the detector. 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 units are shutting down on (HOT) High Oil Temperature or Low Oil Pressure (LOP), 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 more 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 Charging –** The oil in the compressor must be charged annually or earlier if it becomes dark or cloudy.

PRESSURE TESTING

The unit should be pressure tested annually. Any leaks found must be repaired immediately. Air and moisture are the worst enemies of these systems and experience has shown that units which are maintained tight, are systems that provide trouble-free efficient operation.

COOLER AND CONDENSER

The major portion of maintenance on the condenser and cooler will deal with the maintaining 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 saturation 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 page 69 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 or refrigerant may have leaked from the chiller.

OIL RETURN SYSTEM

1. Change the dehydrator in the oil return system semi-annually or earlier if the 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 Fig. 16.

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Supersedes: 160.60-O1 (1296)