| YORK® | YPC<br>*MILLENNIUM*™ CONTROL CENTER | |
|---|---|---|
| SERVICE MANUAL | Supersedes: 155.17-M2 (295) | Form 155.17-M2 (197) |

**NOTE:**
Literature Supplement and Service Bulletins have been added to end of manual.

# PART NUMBER 371-01288-101
# FOR
# TWO-STAGE ABSORPTION UNIT


28342A

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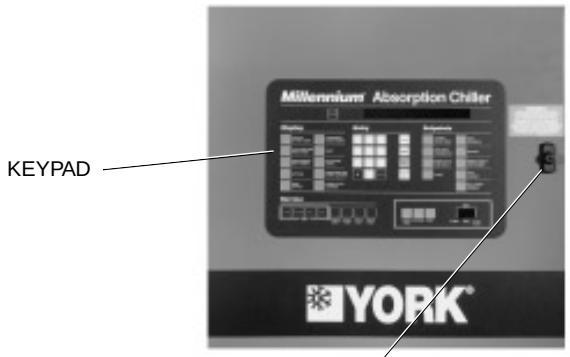


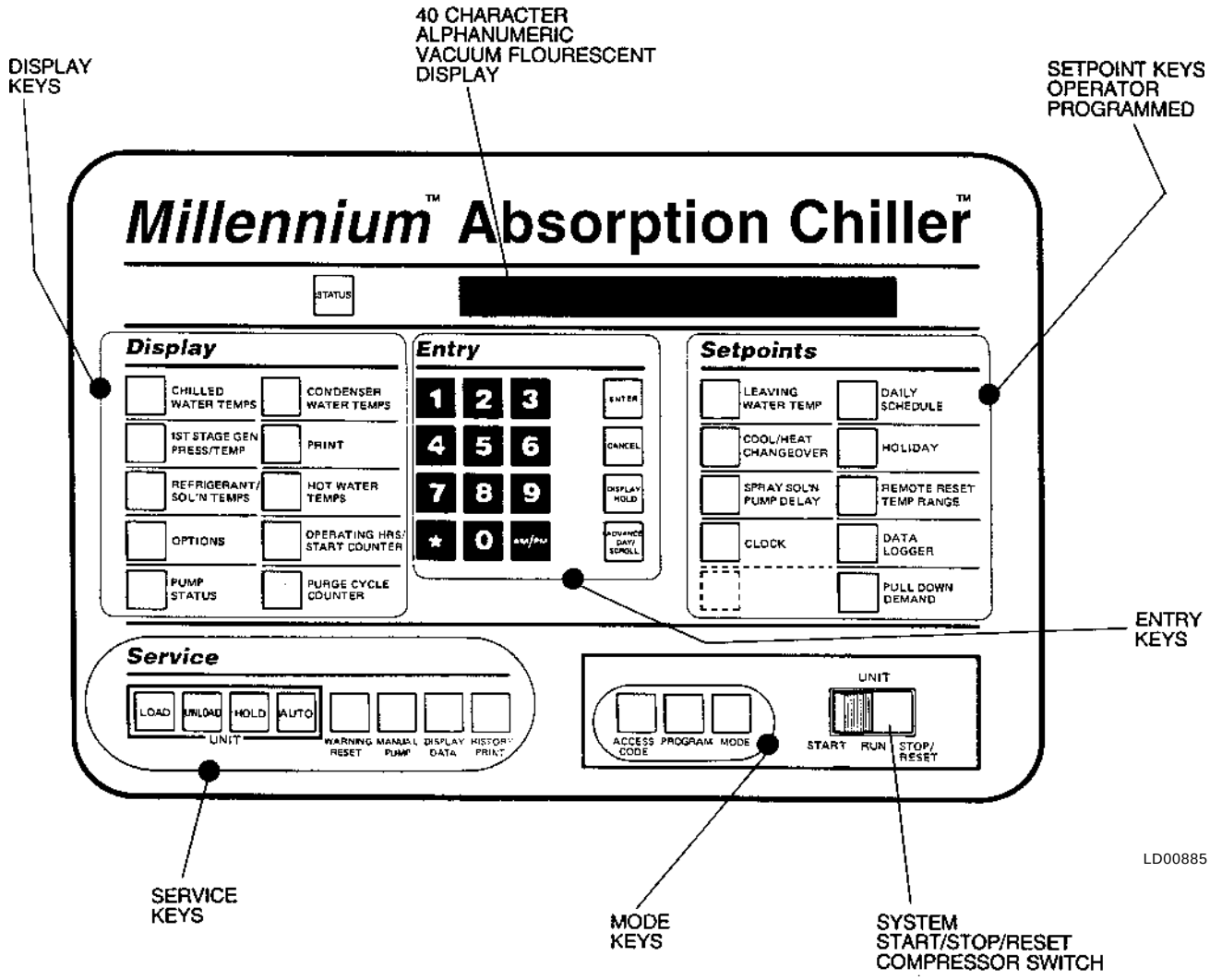


**FIG. 1 –** ISN PARAFLOW CONTROL CONTROL CENTER AND KEYPAD

# INTRODUCTION

This instruction provides a detailed description of the operation of each of the printed circuit boards and major components in the Control Center. The proper voltage level or signal for any operating condition are provided for all input and output connections of all the circuit boards. Special programming procedures, system commissioning checklist and troubleshooting procedures are also provided.

Several levels of supporting documentation are required to be used with this document. The Control Center **Operation** manual, Form 155.17-O2 provides Control Center and unit operation and display message details. **Field Control Modifications Diagram**, Form 155.17-PA1 provides details of remote start/stop inputs,cycling inputs, status outputs and remote setpoint interfacing. **Wiring Diagrams**, Form 155.17-W1 (Direct-Fired) and 155.19-W1 (Steam-Fired) provide the point to point connections of all printed circuit boards and other components within the Control Center.

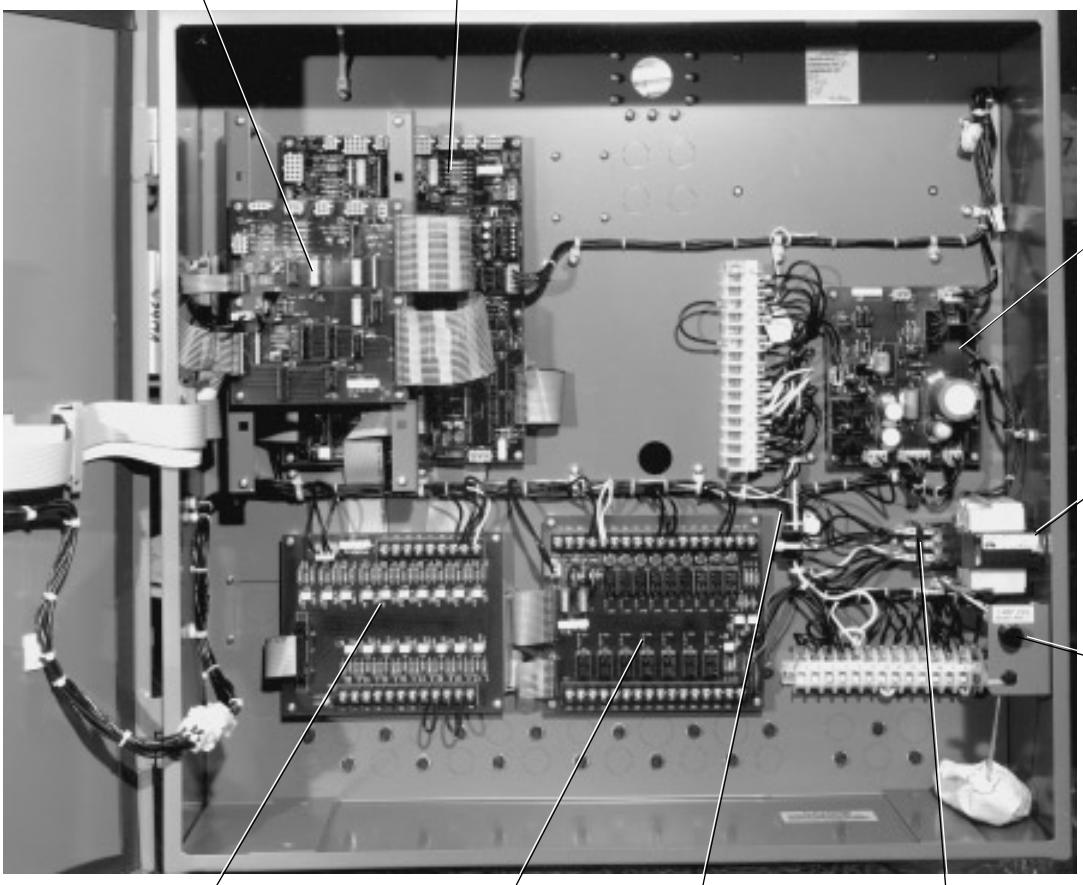


**FIG. 2 –** ISN PARAFLOW CONTROL CENTER – DOOR OPEN

# SYSTEM ARCHITECTURE

**(Refer to Fig.'s 3 & 4)**

The Control Center is a microprocessor based control system. The microprocessor, EPROM memory, RAM memory and supporting logic are located on the **Micro Board**. The operating program is stored in the EPROM. These logic circuits operate on +5VDC that is supplied from a +5VDC regulator that is located on the Micro Board. All system inputs and outputs pass through this board. However, since these circuits operate on +5VDC, the 115VAC inputs from external devices must be converted to +5VDC before entering the Micro Board. This function is provided by the **Digital Input Board**.

The **Digital Input Board** contains opto-couplers that convert the 115VAC digital inputs to +5VDC from pump starter overloads, remote cycling devices, high temperature/pressure safety devices and other system controls. The 115VAC voltage is isolated from the +5VDC by the opto-couplers. The output of this board is connected directly to the Micro Board. Under program control, the Micro Board responds to these inputs and starts or stops the unit or initiates other appropriate action.

The Micro Board also controls system solenoids and pumps. Since these devices are operated from 115VAC, the +5VDC Micro Board circuits must be isolated. This function is provided by the **Relay Board**. This board contains +12VDC relays that are controlled by the Micro Board. The contacts of each relay apply 115VAC to the system solenoids and pump starters. Also included on this board are triacs that are used to control the steam valve on steam units. Additional digital input capability is provided on the relay board by opto-couplers that perform the same function as those on the digital input board.

System pressures are sensed by **Transducers**. The output of the transducers is a DC voltage that is analogous to a given pressure. This voltage is input to the Micro Board. System temperatures are sensed by **Thermistors**. The output of the thermistors is a DC

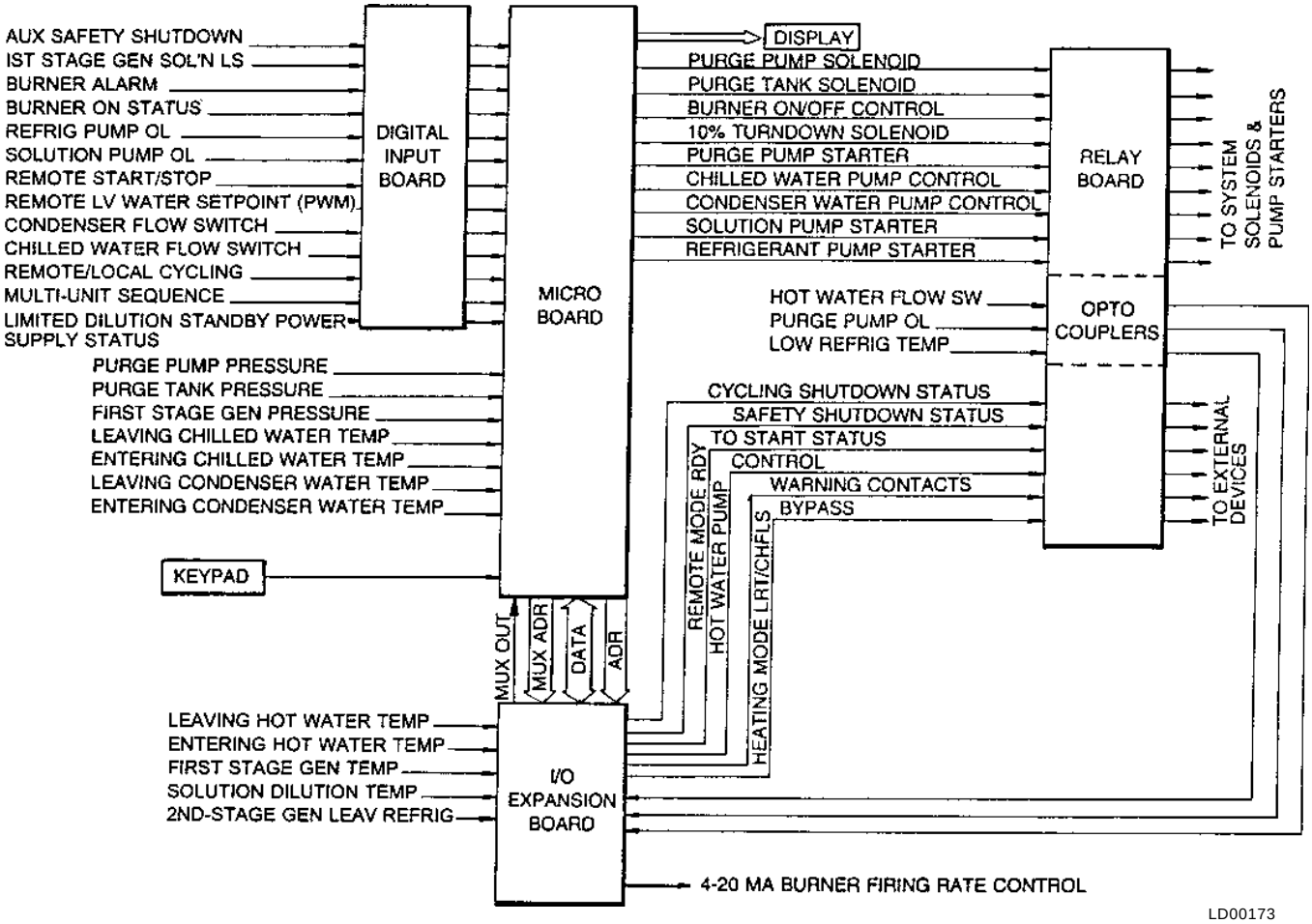


**FIG. 3 –** ISN PARAFLOW CONTROL CENTER – GAS/OIL-FIRED APPLICATION

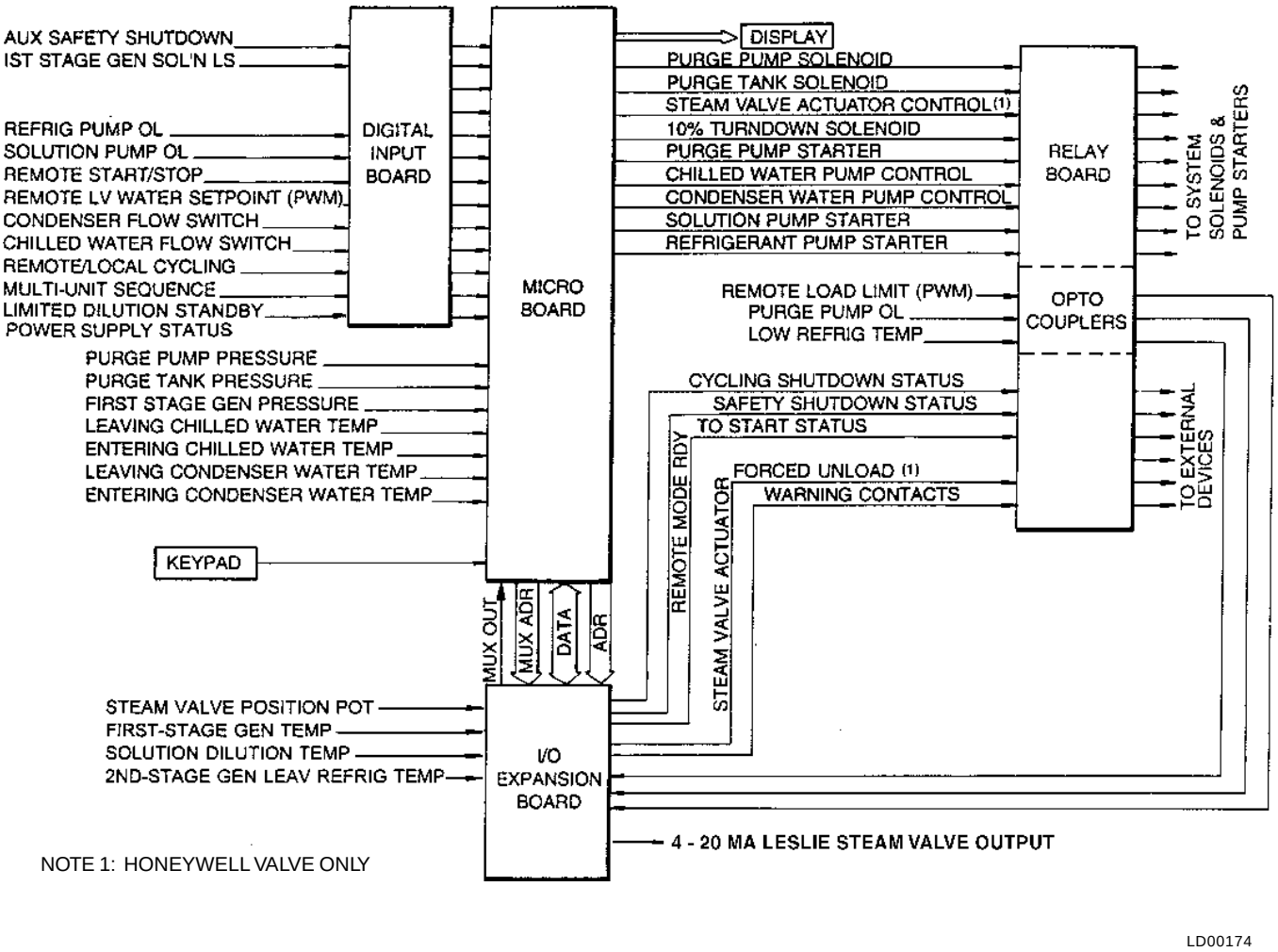


**FIG. 4 –** ISN PARAFLOW CONTROL CENTER – STEAM-FIRED APPLICATION

voltage that is analogous to a given temperature. This voltage is input to the Micro Board. The Micro Board interprets these pressure and temperature values and controls the unit accordingly.

The primary system temperature and pressure protection is provided by external **Electro-Mechanical Cut-out Switches** that are mounted at various places on the unit. These devices are connected to the Control Center in a way that shuts down the unit by providing a positive break of the start signal to the burner control center or steam shutoff valve when the safety threshold is exceeded. Simultaneously, an indication is provided to the Micro Board in the form of a digital input. Analog inputs to the Micro Board from thermistor and transducers provide backup safety shutdown functions.

The **I/O Expansion Board** allows additional digital inputs and outputs and analog inputs to be connected to the Micro Board. The analog inputs are multiplexed into the Micro Board and the digital inputs and outputs are applied directly to the Micro Board data bus. Also, the 4-20mA driver for burner control on gas/oil units is located on this board.

System pressures, temperatures and setpoints are displayed on the 40 character vacuum fluorescent **Display** that is mounted on the Control Center door.

A touch sensitive **Keypad**, mounted on the Control Center door, is used to enter the system setpoints, perform certain manual control operations and display system parameters.

A **Power Supply Board** supplies all of the regulated and unregulated DC supply voltage to all of the Control Center printed circuit boards.

# DIGITAL INPUT BOARD

The **Digital Input Board** converts 115VAC input signals to +5VDC logic level signals for use by the **Micro Board.** The board contains 17 identical level converter circuits. When the input to any circuit is 115VAC, the output of that circuit is +5VDC (logic high). When the input is 0VAC, the output is 0VDC. (Refer to Fig.'s 5, 6, 7, & 8.)

**INPUTS**

**J2-1 –** First-stage generator high temperature safety cutout switch (HT1 – steam and gas/oil units; HT1 & HT2 Model -20G thru -22G gas/oil units). 0VAC when switch is not tripped. 115VAC when switch is tripped. It is calibrated to trip at 330°F. The switch must be manually reset after the temperature decreases to 329°F. Gas/oil units Models -20G thru -22G have two first stage generators. Each has its own safety device, HT1 and HT2. **HT1** or **HT2** must remain open for more than 1 second in order to initiate a shutdown. This delay prevents nuisance trips on units equipped with dual fuel burners when the burner is switched to the alternate fuel while the unit is running.

**J2-2 –** Keypad start/run/stop-reset switch **Stop** input. 115VAC when switch is in the **Stop** position. Otherwise, 0VAC.

**J2-3 –** Keypad start/run/stop-reset switch **Start** input. 115VAC when switch is in the **Start** position. Otherwise, 0VAC.

**TB1-10** (Not used on steam units) **–** First-stage generator solution level sensor (LS) input. 0VAC when sensor detects sufficient level. 115VAC when sensor detects insufficient level. Sensor automatically resets when level is sufficient. Gas/oil-fired Models -20G thru -22G have two first stage generators. Each has its own level sensor connected to a common level sensor switch (LS).

**TB1-11** (Not used on steam units) **–** Burner alarm contacts input. 0VAC when burner has opened its alarm contacts indicating an alarm condition. Otherwise 115VAC. Models -20G thru -22G have two burners, each with its own alarm contacts, wired in series. The burner must be manually reset.

**TB1-18** (Not used on steam units) **–** Burner-On contacts input. 115VAC as long as burner main flame is established. Otherwise, 0VAC. Main flame is typically established 30 to 90 seconds after the start signal is sent to the burner control panel. Models -20G thru -22G have two burners, each with its own **Burner-On** contacts, wired in series.

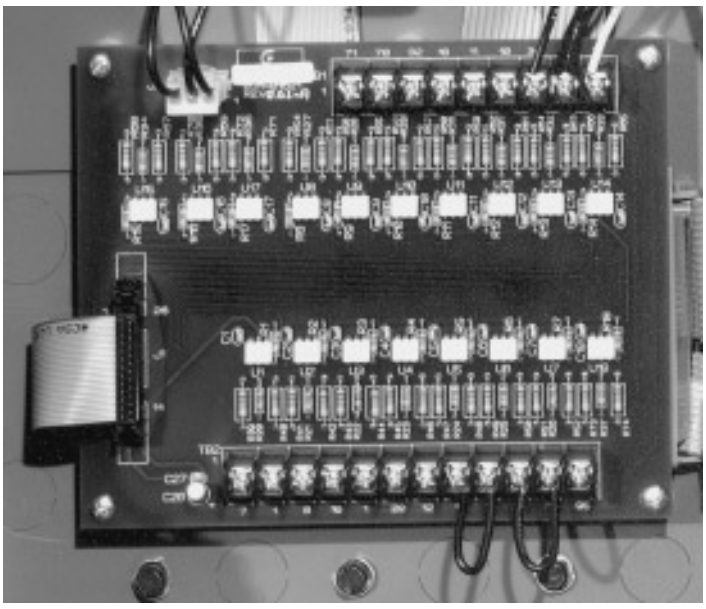

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**FIG. 5 –** DIGITAL INPUT BOARD

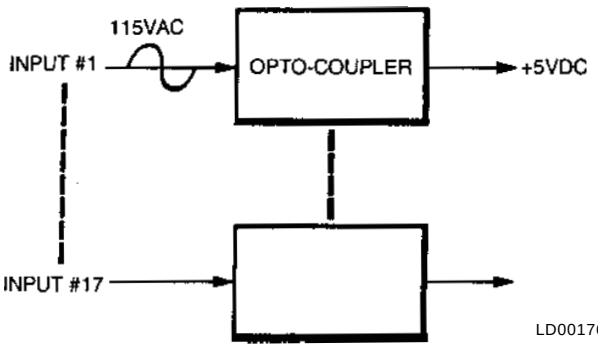


**FIG. 6 –** DIGITAL INPUT BOARD – SIMPLIFIED BLOCK DIAGRAM

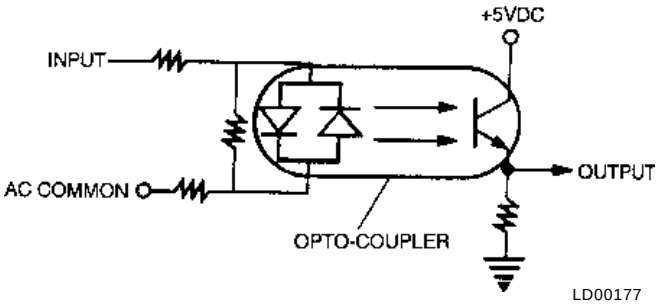


**FIG. 7 –** DETAILED SCHEMATIC REPRESENTATION DIGITAL INPUT BOARD

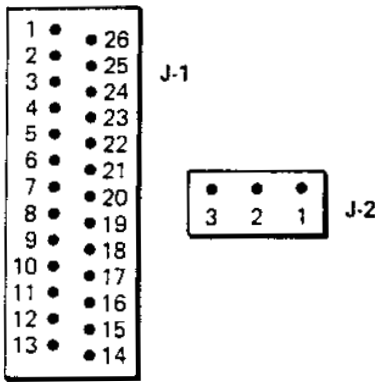


**FIG. 8 –** DIGITAL INPUT BOARD – PIN IDENTIFICATION

**TB1-31 –** Auxiliary safety shutdown input. Application of 115VAC (momentary or maintained) to this input initiates a safety shutdown. 0VAC allows the unit to restart, after the ISN ParaFlow Control Center has been reset. This is a general purpose safety shutdown input for customer use. Refer to Fig. 9.

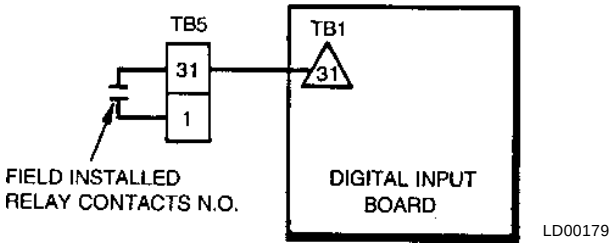


**FIG. 9 –** AUXILIARY SAFETY SHUTDOWN INPUT TYPICAL APPLICATION

**TB1-32 –** First-stage generator high pressure safety cutout switch (**HP1 –** steam and gas/oil units; **HP1 & HP2 –** Models -20G thru -22G gas/oil units). 0VAC when switch is not tripped. 115VAC when switch is tripped. It is calibrated to trip at 13.73 PSIA (709.8 mmHgA). It will automatically reset at 0.77 PSIA (39.8 mmHgA). Gas/oil units Models -20G thru -22G have two first stage generators. Each has its own safety device, HP1 and HP2.

**TB1-70 –** Refrigerant pump starter overload contacts. 0VAC when refrigerant pump motor protector (2OL) or motor thermal switch (MTH2) has tripped (opened) indicating an overload condition. Otherwise, 115VAC. Motor protector 2OL must be manually reset. Thermal switch MTH2 automatically resets.

**TB1-71 –** Solution pump starter overload contacts. 0VAC when solution pump motor protector (1OL) or motor thermal switch (MTH1) has tripped (opened) indicating an overload condition. Otherwise, 115VAC. Models -19GL thru -22G have two **Spray Solution Pumps** in addition to the solution pump. Spray Solution Pump No. 1 is protected by 4OL and MTH4. Spray Solution Pump No. 2 is protected by 5OL and MTH5. Motor protectors 1OL, 4OL, and 5OL must be manually reset. Motor thermal switches MTH1, MTH4 and MTH5 automatically reset. Models -16SL thru -19S have a SOLUTION pump and a SPRAY SOLUTION pump; the SOLUTION pump is protected by motor protector (10L) and motor thermal switch (MTH1), the SPRAY SOLUTION pump is protected by motor protector (4OL) and motor thermal switch (MTH4).

**TB2-7 –** Remote start input. 115VAC causes unit to start if in **REMOTE** mode and **UNIT** switch is in **RUN** position. Input is designed to accept 115VAC from external field supplied contacts to start unit. Refer to Fig. 10.

**TB2-1 –** Connected to 115VAC on digital input board.

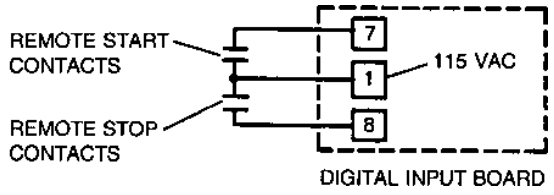


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**FIG. 10 –** REMOTE START AND STOP UNITS

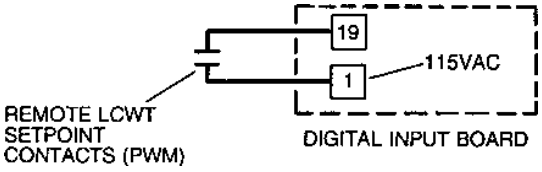


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**FIG. 11 –** REMOTE LEAVING WATER TEMP SETPOINT INPUTS (PWM)

**TB2-8 –** Remote stop input. 115VAC causes unit to stop if in **REMOTE** mode and **UNIT** switch is in **RUN** position. Input is designed to accept 115VAC from external field supplied contacts to stop unit. This signal must be maintained signal, not momentary. (Refer to Fig. 10.)

**TB2-19 –** Remote leaving water temp setpoint pulse width modulation (PWM) input from external energy management system or optional card file in ISN Para-Flow Control Center. A 1-11 second application of 115VAC in **REMOTE** mode resets the leaving water temp setpoint as follows: A 1 second application of 115VAC corresponds to the keypad programmed value (BASE). An 11 second application of 115VAC corresponds to the maximum allowed reset value, 10°F or 20°F as programmed. (Refer to Field Control Modifications diagram, Form 155.17-PA1 and Remote Reset Temp Range section of this book for details of this feature.) Refer to Fig. 11.

**TB2-1 –** Connected to 115VAC on digital input board. Source voltage for condenser water flow switch.

**TB2-20 –** Condenser water flow switch or interlock. 115VAC when flow switch is closed. 0VAC when flow switch is open.

**TB2-12 –** Chilled water flow switch. 115VAC when flow switch is closed. 0VAC when flow switch is open, indicating no flow.

**TB2-13 –** Remote or local cycling device. 115VAC allows unit to run as long as keypad **UNIT** switch is in **RUN** position and there are no other cycling or safety shutdowns. 0VAC causes unit to shutdown. If no cycling device connected, input must be jumpered as shown. (Refer to Fig. 12.)

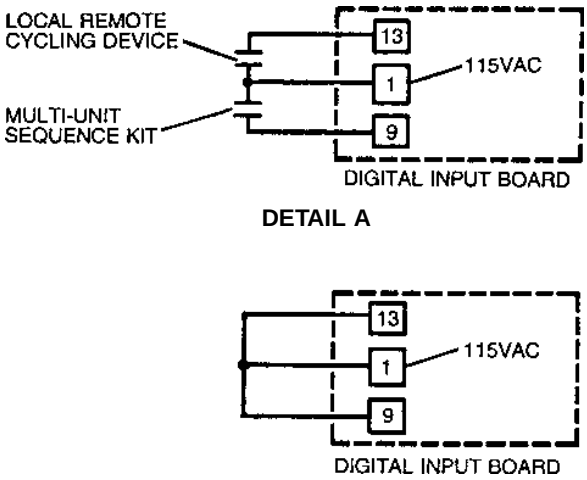


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**FIG. 12 –** LOCAL REMOTE CYCLE DEVICE AND MULTI-UNIT SEQUENCE KIT INPUTS

**TB2-1 –** Connected to 115VAC on digital input board. Source voltage for **Remote/Local Cycling Input** and **Multi-Unit Sequence Input**. (Refer to Fig. 12.)

**TB2-9 –** Multi-unit sequence unit device. 115VAC allows unit to run as long as keypad **UNIT** switch is in **RUN** position and there are no other cycling or safety shutdowns. 0VAC causes unit to shutdown. If no cycling device is connected, input must be jumpered as shown. (Refer to Fig. 12.)

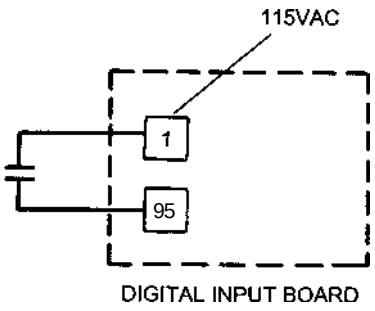


**FIG. 13 –** LIMITED DILUTION STANDBY POWER SUPPLY STATUS INPUT

**TB2-95 –** Limited dilution standby power supply status input. 115VAC when standby power supply is online supplying power to the MicroComputer Control Center and solution pump (3 solution pumps on Models -19GL thru -22G; 2 solution pumps on -16SL thru -19S). Otherwise, 0VAC. Applicable only to units equipped with EPROM version A.01F.07 or later. Refer to complete description of limited dilution standby power supply operation in Operation manual, Form 155.17-O2. (Refer to Fig. 13.)

## OUTPUTS

If the input is 115VAC, the output is +5VDC. If the input is 0VAC, the output is 0VDC.

**J1-1 –** Burner on. Not used on steam units.
**J1-2 –** First stage generator high pressure.
**J1-3 –** Refrigerant pump overload.
**J1-4 –** Solution pump overload.
**J1-5 –** Not used.
**J1-6 –** Not used.
**J1-7 –** First stage generator high temperature.
**J1-8 –** Local Stop.
**J1-9 –** Local Start.
**J1-10 –** Not used.
**J1-11 –** Not used.
**J1-12 –** Not used.
**J1-13 –** 5VDC return (GND).
**J1-14 –** +5VDC regulated.
**J1-15 –** Remote Start.
**J1-16 –** Remote Stop.
**J1-17 –** Remote leaving water temp setpoint (PWM)
**J1-18 –** Condenser water flow switch.
**J1-19 –** Chilled water flow switch.
**J1-20 –** Remote/local cycling device.
**J1-21 –** Multi-unit sequence device.
**J1-22 –** Not used.
**J1-23 –** Limited dilution standby power supply status input.
**J1-24 –** Auxiliary safety shutdown.
**J1-25 –** First stage generator solution level sensor. Not used on steam units.
**J1-26 –** Burner alarm. Not used on steam units.

# RELAY OUTPUT BOARD

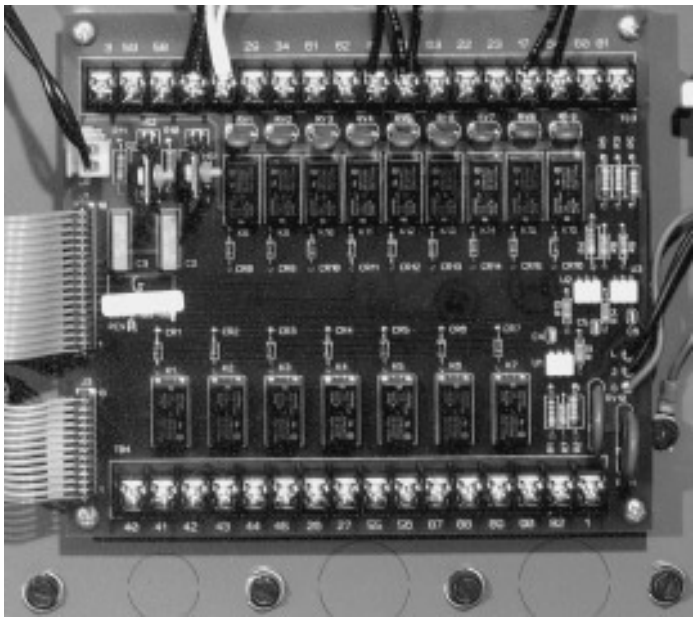

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**FIG. 14 –** RELAY BOARD

The Relay Output Board allows the Micro Board to be interfaced to 115VAC output signals. Ten board-mounted relays are driven directly by the Micro Board. The remaining six relays are indirectly driven by the Micro Board via the I/O Expansion Board. One side of each relay coil is connected to +12VDC regulated supply. The other side of each coil is driven by a relay driver on the Micro Board or I/O Expansion Board. The input is driven to logic low (<1VDC) condition to energize the relay. The contacts of each relay are interfaced to various 115VAC solenoids and pump starters. The relay board also contains two triacs that are used to control the steam valve actuator on steam units. The Micro Board controls these triacs with triac drivers that are located on the Micro Board. The relay board also contains three opto-couplers (identical to those used on the **Digital Input Board**) that provide expanded digital input capability. These opto-couplers convert 115VAC input signals to +5VDC logic level signals that are applied to the **I/O Expansion Board** where they are input to Micro Board. (Refer to Fig. 14, 15 (gas/oil units), 16 (steam units).

## INPUTS

The relay inputs are driven to a logic low (<1VDC) condition to energize the relay (close the contacts). The inputs are allowed to go to +12VDC to de-energize the relay (open the contacts). When an opto-coupler input is 115VAC, the output is +5VDC. When the opto-coupler input is 0VAC, the output is 0VDC.

**J3-1** – Cycling shutdown status contacts.
**J3-2** – Safety shutdown status contacts.
**J3-3** – Remote mode ready to start status contacts
**J3-4** – Hot water pump control (not used on steam units).
**J3-5** – Warning contacts.
**J3-7** – 5VDC return (GND).
**J3-8** – +5VDC regulated.
**J3-11** – Heating mode low refrigerant temp & chilled water flow switch bypass (gas/oil units); steam valve (Honeywell) close at unit shutdown (steam units).

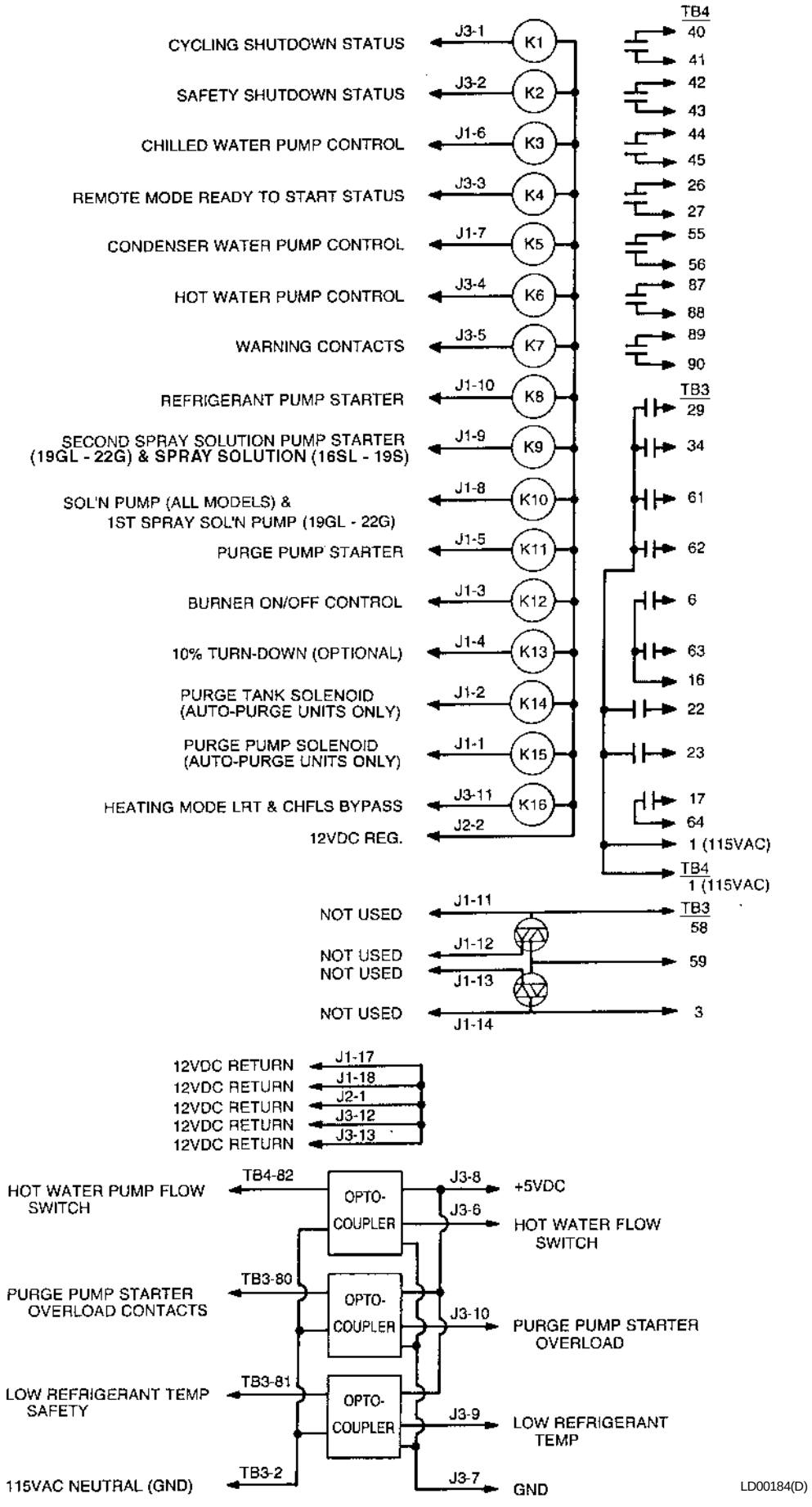



**FIG. 15** – RELAY BOARD (GAS/OIL-FIRED UNITS)

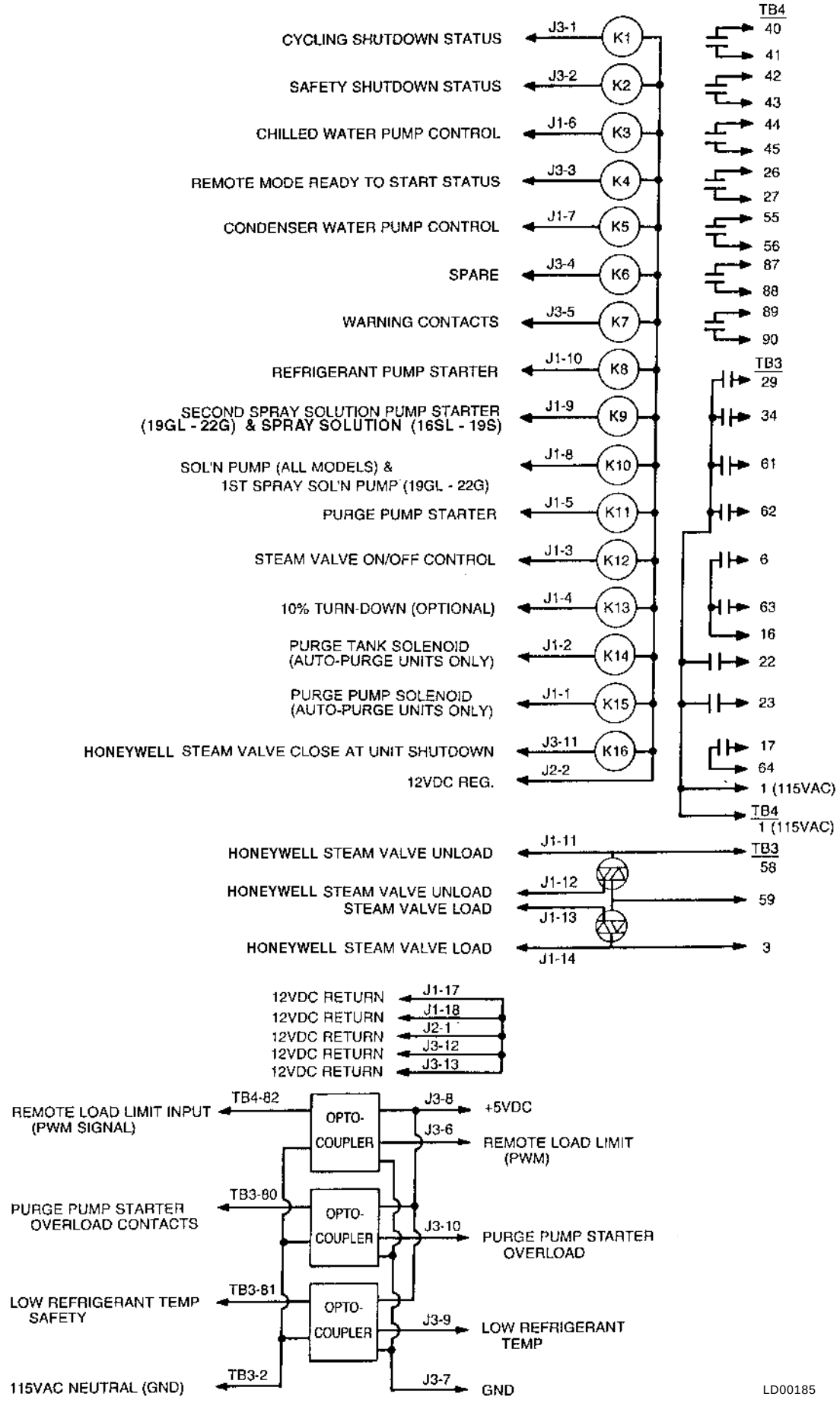



**FIG. 16 –** RELAY BOARD (STEAM-FIRED UNITS)

**J3-12 –** 12VDC return (GND).
**J3-13 –** 12VDC return (GND).

**J1-1 –** Purge pump solenoid (auto-purge units only)
**J1-2 –** Purge tank solenoids (auto-purge units only)
**J1-3 –** Burner on/off control (gas/oil); steam valve on/off control (steam units).
**J1-4 –** 10% turn-down (optional).
**J1-5 –** Purge pump starter.
**J1-6 –** Chilled water pump control.
**J1-7 –** Condenser water pump control.
**J1-8 –** Solution pump starter (all models) and first spray solution pump starter (Models -19GL thru -22G).
**J1-9 –** Second spray solution pump starter (Models -19GL thru -22G); Spray solution pump (Models -16SL thru -19S).
**J1-10 –** Refrigerant pump starter.
**J1-11 –** Honeywell steam valve unload (Note 1).
**J1-12 –** Honeywell steam valve unload (Note 1).
**J1-13 –** Honeywell steam valve load (Note 2).
**J1-14 –** Honeywell steam valve load (Note 2).
**J1-15 –** Not used.
**J1-16 –** Not used.
**J1-17 –** 12VDC return (GND).
**J1-18 –** 12VDC return (GND).

**NOTES:**

1. 0VAC as measured from J1-11 to J1-12 when Micro Board is commanding steam valve to unload. Approximately 115VAC when holding or loading.
2. 0VAC as measured from J1-13 to J1-14 when Micro Board is commanding steam valve to load. Approximately 115VAC when holding or unloading.

**J2-1 –** 12VDC return (GND).
**J2-2 –** +12VDC regulated.

**TB3-2 –** 115VAC neutral (GND).

**TB3-80 –** Purge pump starter overload. 0VAC when purge pump starter overload (3OL) has tripped. Otherwise, 115VAC.

**TB3-81 –** Low refrigerant temp safety. 115VAC when low refrigerant temp safety (LRT) has tripped. Otherwise, 0VAC. Input is bypassed (not used), when gas/oil units are in **HEATING ONLY** mode.

**TB4-82 –** Hot water flow switch (gas/oil units in **HEATING ONLY** mode). Remote load (steam) limit PWM input (steam units). **Gas/Oil –** 115VAC when hot water flow switch is closed. Otherwise, 0VAC. **Steam –** 115VAC for 1-11 seconds while the PWM input is present. Otherwise, 0VAC. (Refer to Field Control Modifications Diagram, Form 155.17-PA1 and "Remote Setpoints" section of this book for details of this feature.)

## OUTPUTS

**TB4-40/41 –** Cycling shutdown status contacts. Dry closure N.O. contacts (rated for 115VAC, 2 amps) available for remote status indications. Contacts close whenever chiller is shut down on a **Cycling** shutdown. A cycling shutdown is that which does not require a manual reset at the Control Center to restart the unit. (Refer to Operations manual, Form 155.17-O2 for list of cycling shutdowns.) The contacts remain closed as long as the shutdown condition exists. The contacts open and the unit automatically restarts when the condition that caused the shutdown clears. (Refer to Fig. 17.)

**TB4-42/43 –** Safety shutdown status contacts. Dry closure N.O. contacts (rated for 115VAC, 2 amps) available for remote status indications. Contacts close whenever unit shuts down on a **Safety** shutdown. A safety shutdown requires a manual reset at the Control Center to restart the unit. (Refer to Operations manual, Form 155.17-O2 for list of safety shutdowns.) The contacts remain closed as long as the safety shutdown condition exists. The contacts will open when the safety condition clears and the **UNIT** switch is pressed to the **STOP/RESET** position. Some safety shutdowns require pressing the **WARNING RESET** key (in **SERVICE** mode), instead of the **STOP/RESET** key to reset (refer to the Operations manual, Form 155.17-O2 for these exceptions). (Refer to Fig. 18.)

**TB4-44/45 –** Chilled water pump control contacts. Dry closure N.O. contacts (rated for 115VAC, 2 amps) that can be used to automatically start and stop the chilled water pump. An anti-chatter circuit on the Micro Board prevents the output from energizing the pump at a rate greater than once every 10 seconds. A program jumper (CHW Pump-J54), located on the Micro Board determines the operation of these contacts as follows: (Refer to Fig. 19.) These contacts do not operate in **HEATING** mode. Gas/oil-fired "S" series units not equipped with the high temperature option (separate heat exchanger) that operate in **HEATING ONLY** mode use the evaporator to heat the leaving hot water. These installations may not be equipped with a separate hot water pump. Therefore, the hot water pump contacts would be used to control the chilled water pump when these units are operating in **HEATING ONLY** mode.

**JUMPER INSTALLED –** The contacts are closed during start sequence, unit run, dilution cycle and following **LWT** shutdowns.

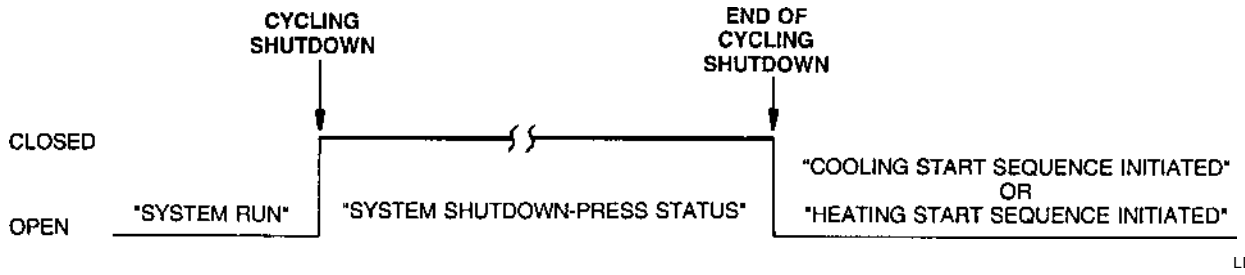
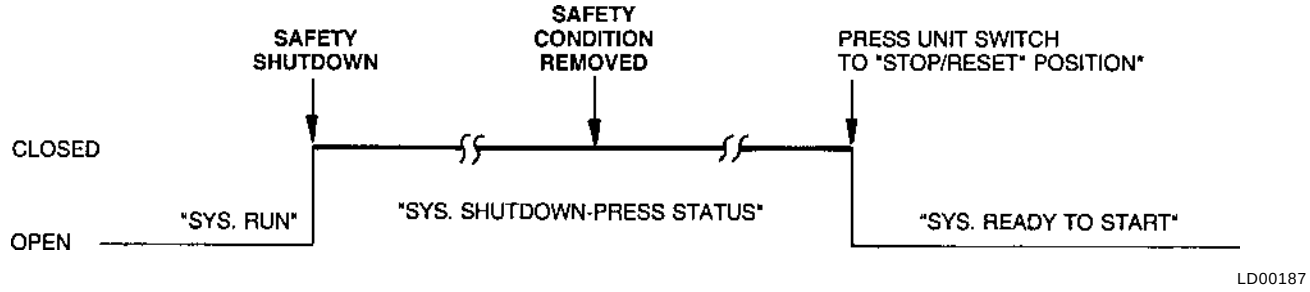
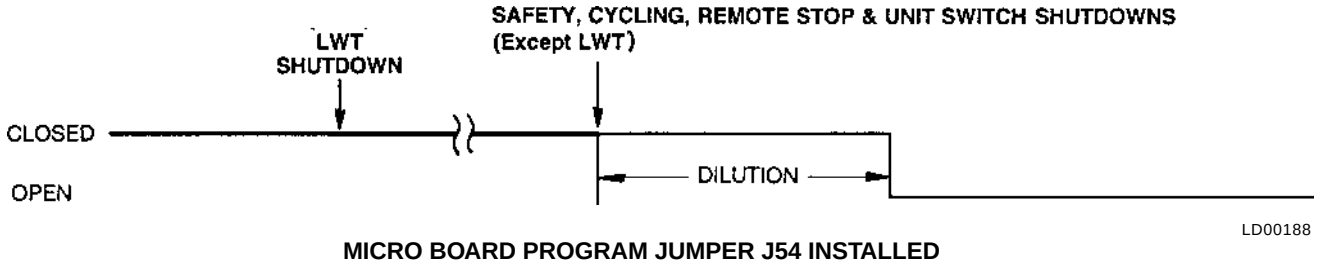



**FIG. 17 –** CYCLING SHUTDOWN STATUS CONTACTS – RELAY BOARD TB4-40/41

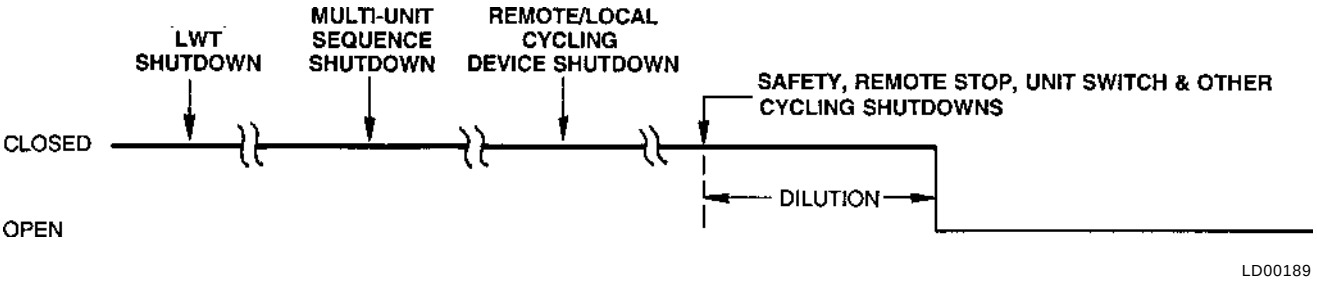



* Some Safety Shutdowns require pressing the **WARNING RESET** key in **SERVICE** mode. Refer to Operation manual, Form 155.17-O2 for details.

**FIG. 18 –** SAFETY SHUTDOWN STATUS CONTACTS – RELAY BOARD TB4-42/43




**MICRO BOARD PROGRAM JUMPER J54 INSTALLED**




**MICRO BOARD PROGRAM JUMPER J54 REMOVED**

(HWT) = HIGH WATER TEMP IN GAS/OIL **HEATING ONLY** MODE.

**FIG. 19 –** CHILLED WATER PUMP CONTROL CONTACTS – RELAY BOARD TB4-44/45

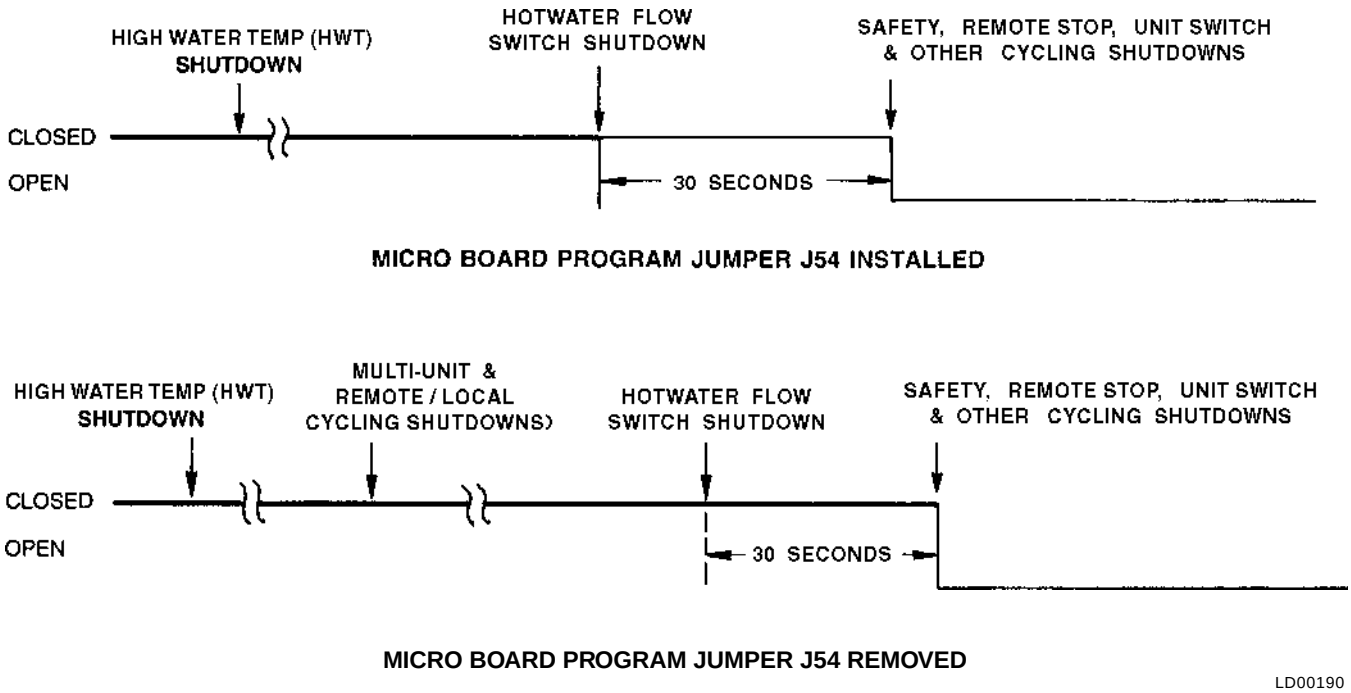



**FIG. 19A –** HOT WATER PUMP CONTROL CONTACTS – RELAY BOARD TB4-87/88

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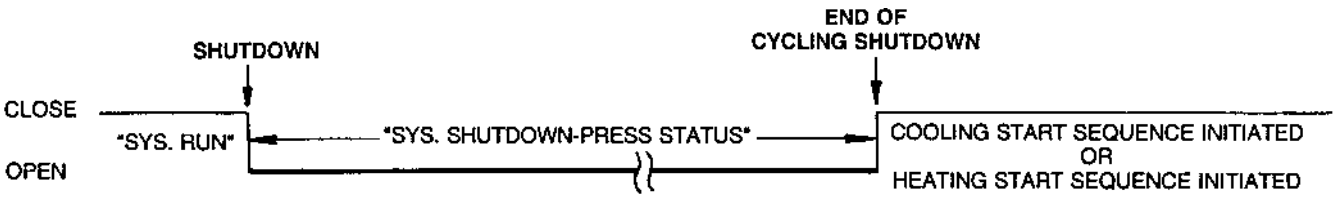
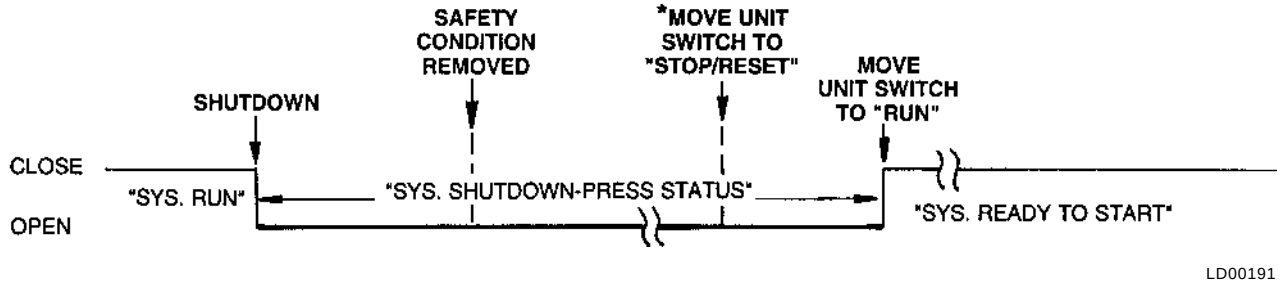
**CYCLING SHUTDOWN**




**SAFETY SHUTDOWN**




*Some Safety Shutdowns require pressing the **WARNING RESET** key in **SERVICE** mode. Refer to Operation manual, Form 155.17-O2 for details.

**FIG. 20 –** REMOTE MODE READY TO START STATUS CONTACTS – RELAY BOARD TB4-26/27

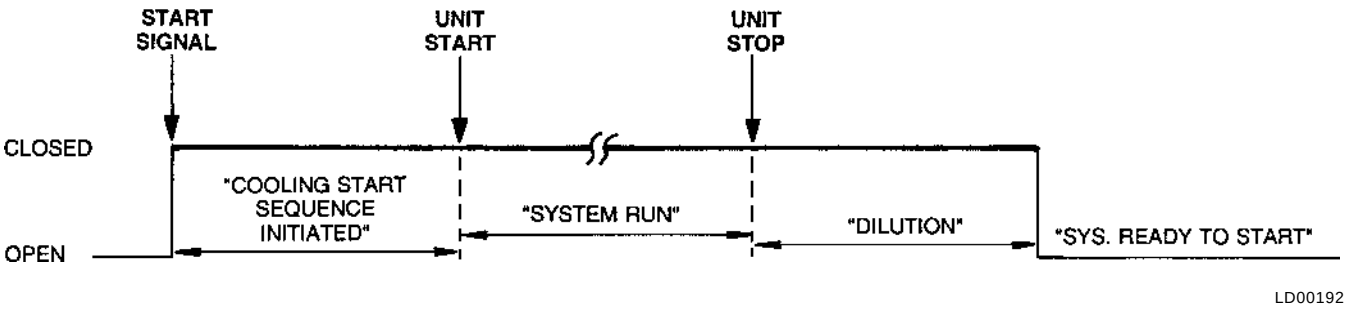



**FIG. 21 –** CONDENSER WATER PUMP CONTROL CONTACTS – RELAY BOARD TB4-55/56

**JUMPER REMOVED –** The contacts are closed during start sequence, unit run, dilution cycle, and following **LWT, Multi-unit**, and **Remote/Local Cycling** shutdowns.

**TB4-26/27 –** Remote mode ready to start status contacts. Dry closure N.O. contacts (115VAC, 2 amps) available for remote status indications. The contacts will be closed if the **UNIT** switch is in the **RUN** position, all safety and cycling shutdowns are satisfied and the 30 minute anti-recycle timer has elapsed. This indicates that the unit will start when a remote start signal is received. The contacts will be open under all other conditions, indicating the unit will not start. (Refer to Fig. 20.)

**TB4-55/56 –** Condenser water pump control contacts. Dry closure N.O. contacts (115VAC, 2 amps), that can be used to automatically start and stop the condenser water pump. The contacts are closed during start sequence, unit run and dilution cycles. Otherwise, they are open. These contacts do not operate in **HEATING** mode. (Refer to Fig. 21.)

**TB4-87/88 –** Hot water pump control contacts. Not used on steam units. Not used in **COOLING ONLY** mode. Dry closure N.O. contacts (115VAC, 2 amps), that can be used to automatically start and stop the hot water pump. The contacts are closed during start sequence and unit run. Otherwise, they are open. (Refer to Fig. 22.) If the flow switch opens during unit run, these contacts remain closed for 30 seconds after unit shutdown in an attempt to re-establish flow. Gas/oil-fired S-series units not equipped with the high temperature option (separate heat exchanger) that operate in **HEATING ONLY** mode use the evaporator to heat the leaving hot water. These installations may not be equipped with a separate hot water pump. Therefore, the hot water pump contacts would be used to control the chilled water pump when these units are operating in **HEATING ONLY** mode.

**TB4-89/90 –** Warning contacts. Dry closure N.O. contacts (115VAC, 2 amps), that are used to activate an external customer supplied audible alarm when a warning condition occurs. The contacts close when a warning message is displayed. The contacts remain closed until the **WARNING RESET** key is pressed (in any mode), or the unit shuts down. These contacts only operate while the unit is running; if a warning condition occurs while the unit is shutdown, these contacts will not close. Refer to Operating manual, Form 155.17-O2 for list of **Warning** conditions.

**TB3-29 –** Refrigerant pump starter. Not used in **HEATING ONLY** mode. 115VAC when Micro Board is commanding the refrigerant pump to run. Otherwise, 0VAC. Pump runs anytime the unit is running and during dilution. On Models -16SL thru -19S, the refrigerant pump start is delayed for 10 minutes at unit start.

**TB3-34 –** Second spray solution pump starter (Models -19GL thru -22G); spray solution pump (Models -16SL thru -19S).115VAC when Micro Board is commanding this pump to run. Otherwise, 0VAC. Pump is started after a programmed delay and runs as long as unit is running and during dilution.

**TB3-61 –** Solution pump starter (all models), and first spray solution pump starter (Model -19GL thru -22G). 115VAC when Micro Board is commanding the solution pump to run. Otherwise, 0VAC. Models -19GL thru -22G have a **Spray** solution pump starter that is wired in parallel with the solution pump starter.

**TB3-62 –** Purge pump starter. 115VAC when Micro Board is commanding purge pump (3M) to run. Otherwise, 0VAC.

**TB3-6 –** Burner on/off control (gas/oil units); steam valve on/off control (steam units). **Gas/Oil Units –** 115VAC when Micro Board is commanding the burner to be on. Otherwise, 0VAC. Models -20G thru -22G have two burner control panels. Burner No. 1 control panel supplies the start signal to Burner No. 2 control panel. **Steam Units –** 115VAC when Micro Board is commanding the steam shutoff valve to open. 0VAC when it is commanding it to close.

**TB3-63 –** 10% turndown solenoid (optional). 115VAC when Micro Board is commanding the solenoid (3SOL) to energize (open) to artificially load the unit. Otherwise, 0VAC.

**TB3-22 –** Purge tank solenoid. Only supplied when unit is equipped with the **Automatic Purge System.** 115VAC when Micro Board is commanding the purge tank solenoid 1SOL to energize (open). Otherwise, 0VAC.

**TB3-23 –** Purge pump solenoid. Only supplied when unit is equipped with optional **Automatic Purge System.** 115VAC when Micro Board is commanding the purge pump solenoid (2SOL) to energize (open). Otherwise, 0VAC.

**TB3-17 – HEATING** mode low refrigerant temp and chilled water flow switch bypass (gas/oil units); steam valve close command at unit shutdown (steam unit). **Gas/Oil Units –** 115VAC when the Control Center is in **HEATING ONLY** mode and the first-stage generator solution level sensor (LS), high temp safeties (HT1, HT2), high pressure safeties (HP1, HP2) and burner control panel safety devices are not tripped. Otherwise, 0VAC. **Steam Units –** 115VAC when the Micro Board is commanding the steam valve to close at unit shutdown. Otherwise, signal varies with the unload commands that occur while the unit is running.

**TB3-58 –** Honeywell Steam valve unload. <20VAC when Micro Board is commanding the steam valve to unload. Otherwise, 115VAC.

**TB3-3 –** Honeywell Steam valve load. <20VAC when Micro Board is commanding the steam valve to load. Otherwise, 115VAC.

**J3-6 –** Hot water flow switch (gas/oil units); remote load limit PWM (steam units). **Gas/Oil Units –** +5VDC when hot water flow switch is closed. Otherwise, 0VDC. **Steam Units –** 1-11 second pulse width modulated signal. +5VDC for 1-11 seconds each time the PWM input is received. 0VDC when PWM signal is not being received.

**J3-10 –** Purge pump starter overload. 0VDC when purge pump starter overload (3OL) has tripped. Otherwise, +5VDC.

**J3-9 –** Low refrigerant temp safety. +5VDC when low refrigerant temp safety has tripped. Otherwise, 0VDC. Not used on **HEATING ONLY** applications.

# POWER SUPPLY BOARD

### POWER SUPPLY BOARD (Ref. Fig. 22 & 23)

This board provides the necessary operating voltages for all the PC boards in the ISN ParaFlow Control Center. A step-down transformer (1T) (external to the power supply board) provides 24VAC to a bridge rectifier. The unregulated output (≈30VDC) is applied to the I/O expansion board. This board has its own on-board 12VDC regulator.

Two switching regulators supply +12VDC and +10VDC to the Relay Output Board and Micro Board respectively. The 10VDC output is further regulated to +5VDC for use by the vacuum fluorescent display.

Finally, a voltage regulator supplies +24VDC to the optional card file for use by the remote LCWT setpoint card.

A **Display Reset Circuit** outputs a reset signal to the vacuum fluorescent display during low voltage situations. This prevents "latch-up" conditions in the display, whenever the +5VDC regulated output (J2-4) to the display is equal-to or less-than 4.7VDC, the $\overline{\text{RESET}}$ output (J6-2) transitions from +5VDC to a logic low condition (less-than 1VDC). This causes the display to blank for the duration of the condition.

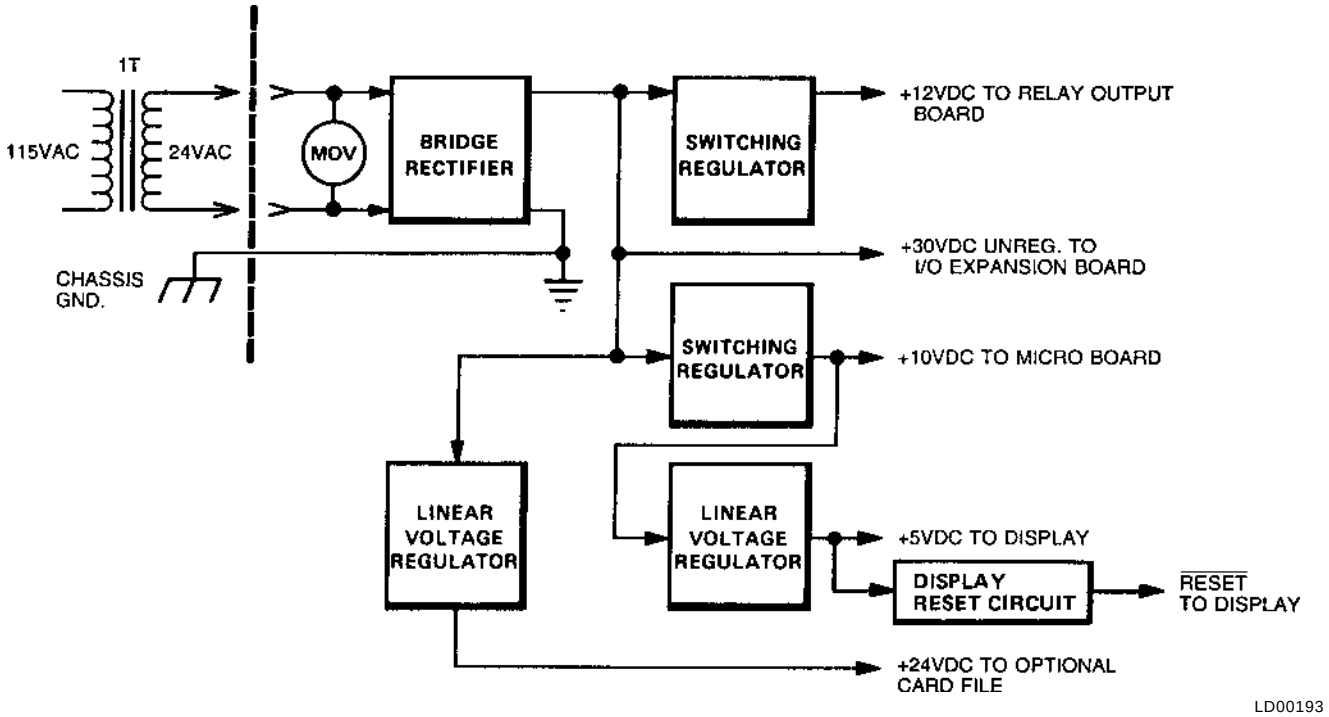



**FIG. 22 –** POWER SUPPLY BOARD BLOCK DIAGRAM

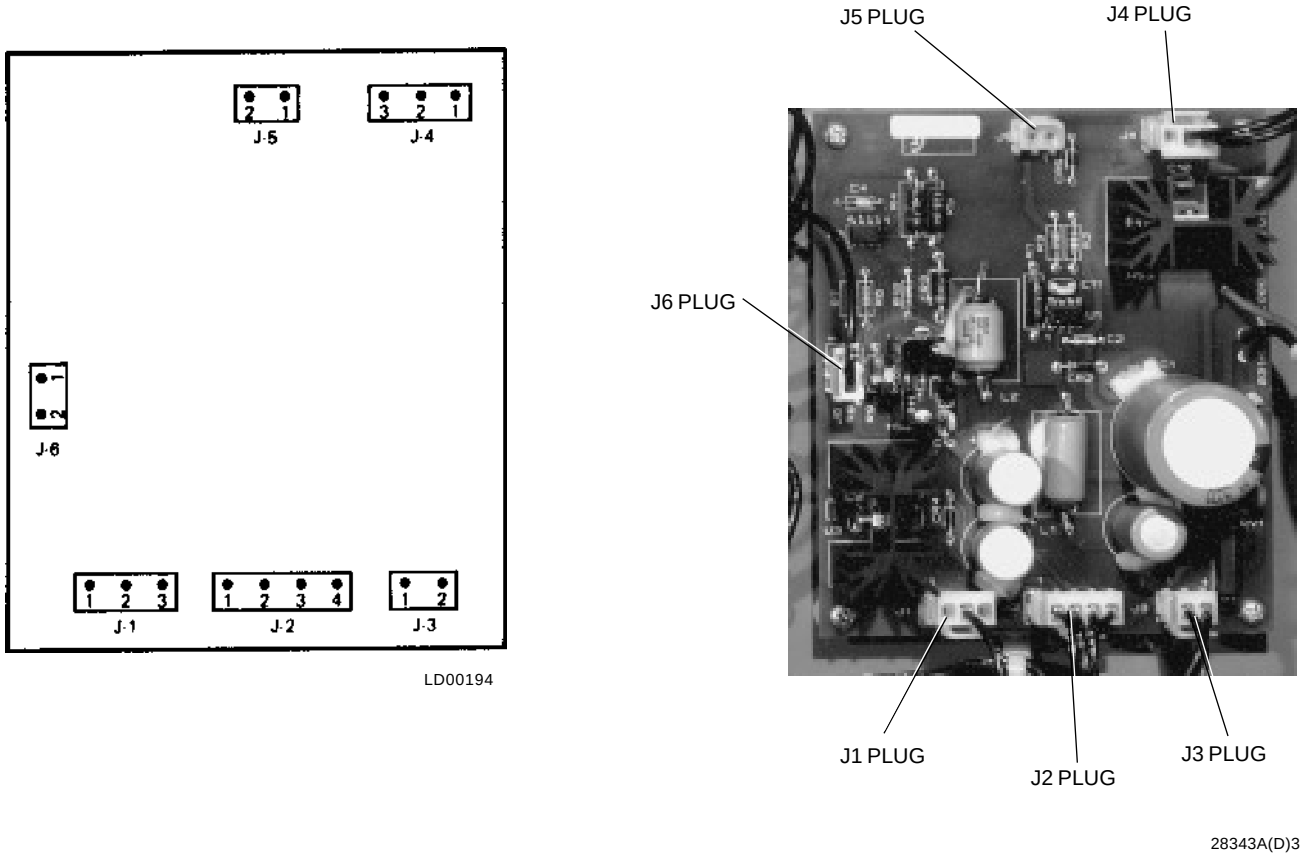



**FIG. 23 –** POWER SUPPLY BOARD

# MICRO BOARD

**(Refer to Figs. 24 thru 30)**

The Micro Board contains a microprocessor. An external **RAM** is provided for scratchpad memory and the operating program is stored in an external **EPROM**. Operator entered system setpoints are stored in battery-backed RAM available in the real-time clock (RTC). The RTC also stores and updates the time-of-day, day-of-week, and calendar date.

System analog parameters (Pressures, Temperatures, Motor Current) are input to the multiplexer (MUX). Under program control, these parameters are transmitted serially to the analog to digital converter where they are converted to digital words. The Micro Board compares these values to stored safety thresholds (EPROM) and initiates a chiller shutdown if thresholds are exceeded. These parameters are stored for: a.) subsequent viewing on the display if requested by the operator thru keypad operation; b.) data transmission thru RS-232 or RS-485 serial ports. The Micro Board also uses these parameters for system control.

An undervoltage detection circuit monitors the +5VDC unregulated (approximately 10VDC) input from the power supply board. This voltage is compared to a reference voltage. When the input voltage decreases to the reference voltage threshold, the undervoltage detector output transition is read by the Micro Board via the PIA No. 1 and the Micro Board initiates a chiller shutdown. If the **AUTO-R** (J50) program jumper on the Micro Board is installed (Auto-Restart After Power Failure) and the keypad **UNIT** switch is in the **RUN** position, the Micro Board will initiate a chiller start (START SEQUENCE INITIATED is displayed) when power is restored. If the **AUTO-R** (J50) program jumper is removed (Manual Restart After Power Failure), SYSTEM SHUTDOWN-PRESS STATUS is displayed when power is restored. MON 10:00 AM – POWER FAILURE is displayed when the operator presses the keypad **STATUS** key. The Micro Board will prevent a chiller restart until the operator moves the **COMPRESSOR** switch to the **STOP-RESET** position and then to the **START** position.

A watchdog circuit ensures that the complete program is executed every program cycle. This prevents the program from looping endlessly in a subroutine with

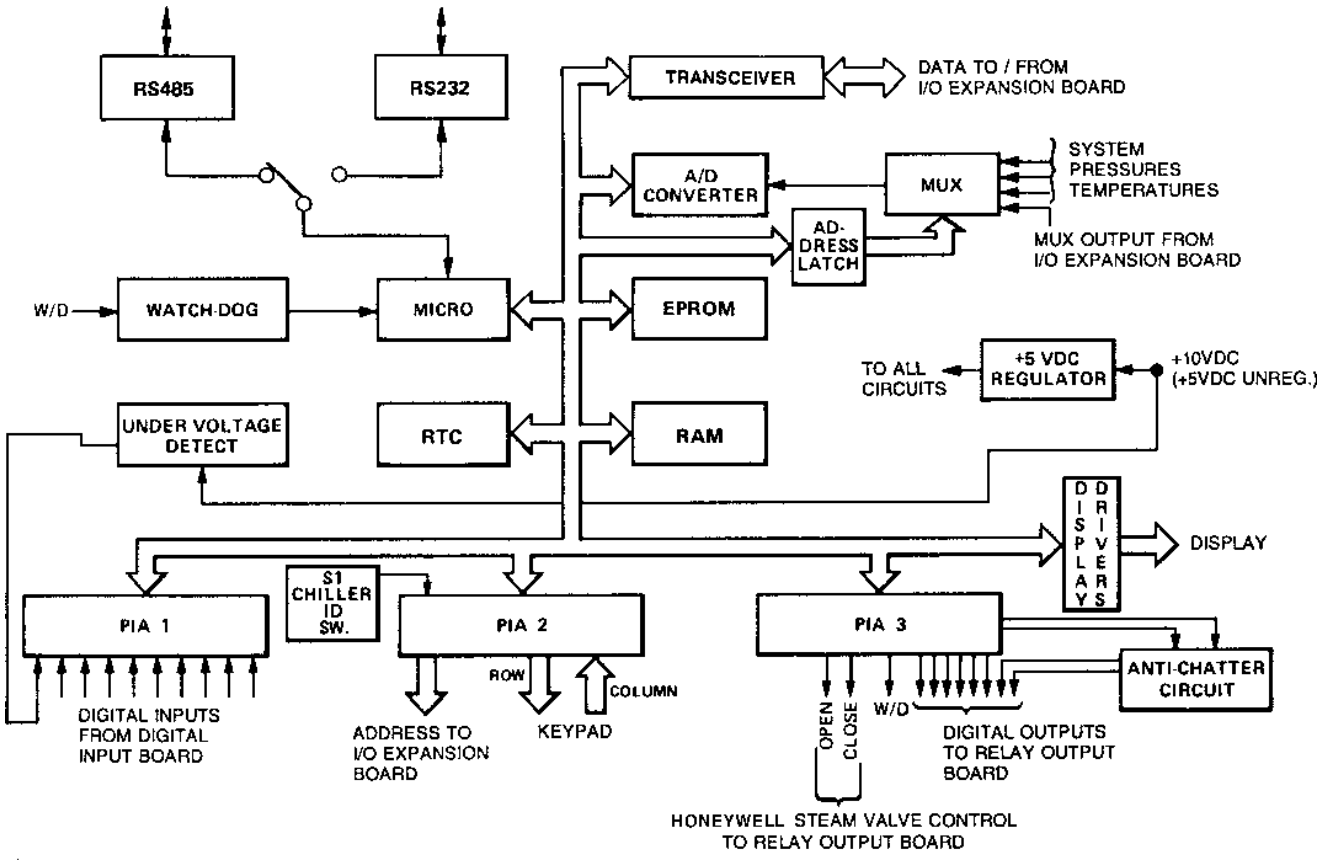



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**FIG. 24 –** MICRO BOARD BLOCK DIAGRAM

**J54** [• •] **CHW PMP**

**IN =** Causes chilled water pump contacts (Relay Board TB 4-44/45) to open at completion of the dilution cycle following all unit shutdowns except Low Water Temp (LWT) shutdowns. On LWT shutdowns, the contacts remain closed after the dilution has been completed. Pressing the **UNIT** switch to the **STOP-RESET** position while the unit is shut down on LWT, causes the contacts to open following the completion of the dilution cycle.

**OUT =** Causes chilled water pump contacts to open at com-pletion of the dilution cycle following all shutdowns except Low Water Temp, Multi-Unit, and Remote/Local cycling shutdowns. On these shutdowns, the contacts remain closed after the dilution has been completed. Pressing the **UNIT** switch to the **STOP-RESET** position while the unit is shut down on any of these shutdowns causes the contacts to open following the completion of the dilution cycle.

**JP1** ⌒ **NONTM/SC (Direct-Fired/Steam)**

**IN =** Configures the Micro Board for gas/oil-fired application.

**OUT =** Configures the Micro Board for steam-fed application.

**J53** [• •] **SENS –** Not Used.

**J52** [• •] **ENGL**

**IN =** System pressures displayed in mmHgA. System temperatures displayed in °F.

**OUT =** System pressures and temperatures are displayed in KPa (Kilo Pascals) and °C.

**JP2** ⌒ **R11 – ("S" Series Low Temp)**

**IN =** All G-series units; "S" series units equipped with the high temperature option (separate heat exchanger). Also, "S" series units that are not equipped with the high temperature option (separate heat exchanger) that only operate in **COOLING ONLY** mode.

**OUT =** Gas/oil-fired "S" series units that are not equipped with the high temperature option (separate heat exchanger) that operate in **HEATING ONLY** mode. Removal of this jumper causes the refrigerant (after a 10 minute delay at start), hot water, solution and spray solution (Model 16SL thru 19S after 30 to 120 second; 10 to 120 second with EPROM A.01F.09 or later, programmed delay at start) pumps to run during **HEATING ONLY** mode. These pumps also run during the 10 minute dilution cycle that occurs each time the unit shuts down. The leaving hot water setpoint range is 90-140°F.

**J51** • • **(WARNING OVERRIDE)**

**IN =** *CAUTION – Jumper should only be in when required for factory testing or field servicing. When installed, although the low refrigerant temperature override, high entering con-denser water temperature override, and first-stage generator high temp and high pressure override messages are dis-played, the unit can actually be loaded beyond the override thresholds using the **LOAD** keypad key in **SERVICE** mode.*

**OUT=** The above override functions inhibit or control loading at the respective thresholds.

**J50** • • **AUTO R**

**IN =** Enables auto-restart after power failure feature.

**OUT =** Enables manual-restart after power failure feature.

**JP3** ⌒ **WATER (Single Solution Pump)**

**IN =** Configures Micro Board for "G" series units, Models 15GL thru 19G and "S" series units Models 13S thru 16S. These units are equipped with a single Solution Pump.

**OUT=** Configures Micro Board for "G" series unit Models 19GL thru 22G and "S" series units Models 16SL thru 19S. These "G" series units have a Solution Pump, First Spray Solution Pump and a delayed-on Second Spray Solution Pump. These "S" series units have a Solution Pump and a delayed-on Spray Solution Pump.

**J55** [• •] (DIS / ENA) **TEST –** In the **DISABLE** position, the software diagnostic is disabled. This is the normal position for operating the unit.

• [• •] (DIS / ENA) **TEST –** In the **ENABLE** position, the software diagnostic is enabled. Refer to Testing Section of this book before putting the jumper in this position.

**J56** [• •] (MODEM / EMS) **RS232 –** In the **MODEM** position, a local printer can be connected to the RS-232 serial port (TB-8). Refer to Form 155.17-NO1.2 for details of the local printer option.

MODEM • / EMS [• / •] **RS232 –** In the **EMS** position, the YORK ISN Direct Digital Controller (DDC) can be connected to the RS485 serial port (Micro Board TB-7). The remote PWM leaving water temp setpoint and start/stop inputs to the digital input board cannot be used with the jumper in this position. Refer to Form 450.11-O1 for details of the ISN DDC.

**JP4** ⌒ **CSTDN (Single First-Stage Generator)**

**IN =** Configures the Micro Board for gas/oil-fired Models 15GL thru 19GL. These models have a single first-stage generator.

**OUT =** Configures the Micro Board for gas/oil-fired Models 20G thru 22G. These models have two first-stage generators.

**JP5** ⌒ **CURR UNBAL (Hot Water Setpoint Range)**

Applicable to all "G" series units and those "S" series units equipped with the high temperature option (separate heat **exchanger**). If JP2 is removed, the position of this jumper has no effect on unit operation.

**IN =** The allowable leaving hot water temperature setpoint range is 90-150°F. The jumper should be **IN** when the standard heat exchanger is used on gas/oil units.

**OUT =** The allowable leaving hot water temperature setpoint range is 90-175°F. The jumper should be **OUT** when the optional high temperature heat exchanger is used on gas/oil units.

**JP6** ⌒ **PRERUN (Entering Cond Water Temp Limit)**

**IN =** The minimum allowable entering condenser water temperature is 68°F. After 30 minutes of unit operation below 68°F, a warning message is displayed and the warning relay contacts are closed. This check is not performed in **HEATING ONLY** mode.

**OUT =** The minimum allowable entering condenser water tem-perature is 59°F. After 30 minutes of unit run time below 59°F, a warning message is displayed and the warning relay contacts are closed. This check is not performed in **HEATING ONLY** mode.

**JP7** ⌒ **–** Not Used.

**J57** **CLOCK**

[• •] • (CLKON / CLKOFF) In the **CLOCKON** position, the RTC clock (day, time, date) is permitted to run. This is the normal operating position. To turn on clock, move jumper to this position while AC power is applied to the ISN ParaFlow Control Center. Then proceed to program clock setpoint per operating instruc-tions, Form 155.17-O2. Clock will start when keypad **ENTER** key is pressed after clock setpoint is programmed. Placing the jumper in the **CLKON** position also resets the 7-day purge counter to zero.

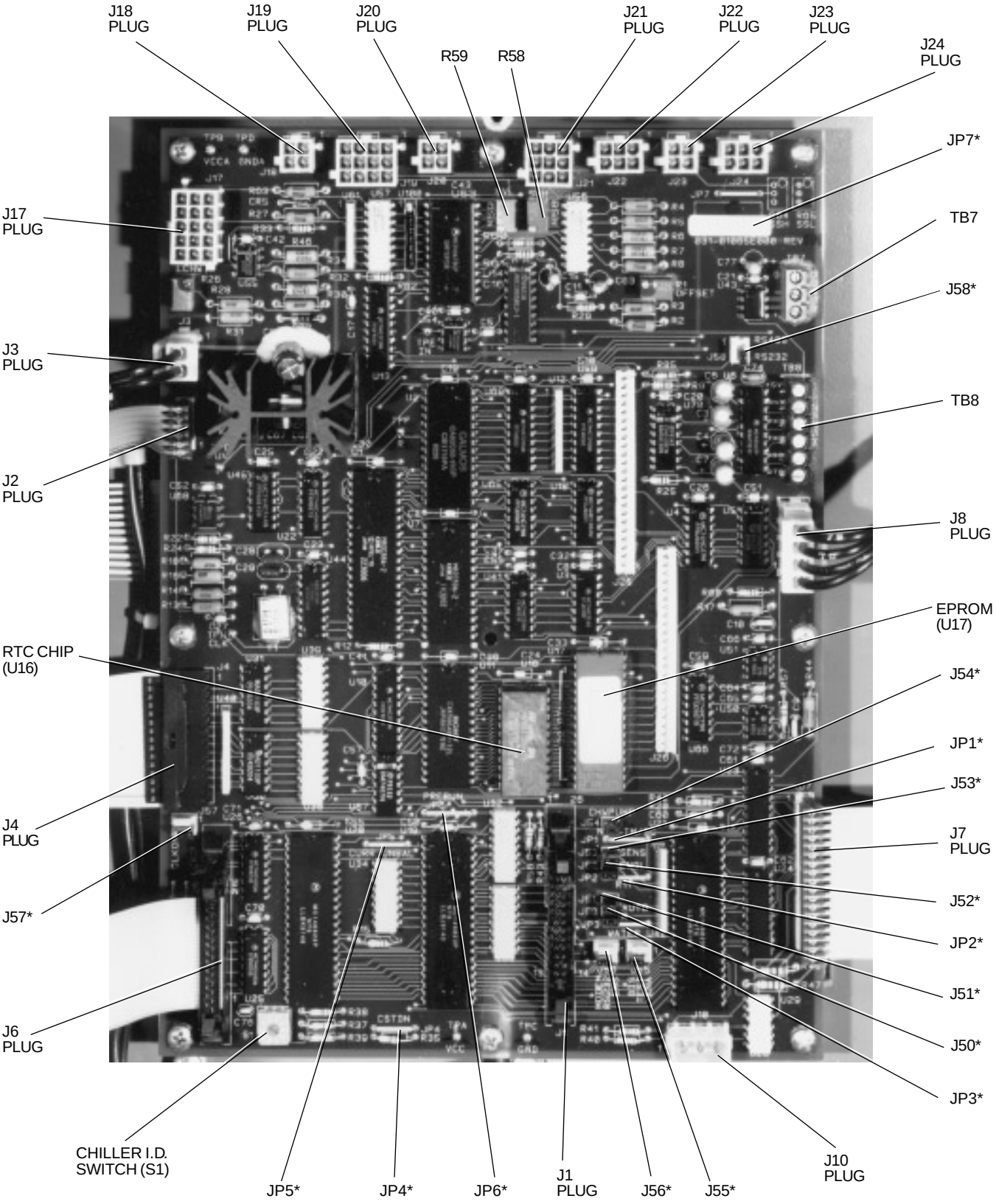
• [• •] (CLKON / CLKOFF) In the **CLOCKOFF** position, the RTC clock does not run. This position is used for long-term storage, shipping and winter shutdowns when AC power is removed from the ISN ParaFlow Control Center. This extends the life of the RTC battery. To turn clock off, move jumper to this position while AC power is applied to the ISN ParaFlow Control Center.

**J58** **SERIAL PORT SELECT –** The position of this jumper determines which serial port (RS232 or RS485) can be used.

RS-485 • [• •] RS-232 In this position, the RS232 port (TB8) is enabled. Place in this position when a local printer is connected to TB8. If this position is selected, program jumper J56 must be in **MODEM** position.

[• •] • (RS-485 / RS-232) In this position, the RS485 port (TB7) is enabled. Place in this position when the "YORK ISN DDC" Energy Management System is connected to TB7. If this position is selected, program jumper J56 must be in **EMS** position.

**FIG. 25 –** MICRO BOARD PROGRAM JUMPERS (MICRO BOARD 031-01065-001)




*PROGRAM JUMPER

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**FIG. 26 –** MICRO BOARD AND PIN IDENTIFICATION

the result that critical chiller parameters could be overlooked. Each program cycle (≈100MS) the Micro Board outputs a pulse to the watchdog circuit via the parallel interface adapter (PIA). This pulse starts a 2 second timer in the watchdog circuit. If another pulse is not received by the watchdog circuit before 2 seconds have elapsed, the watchdog circuit will output a reset pulse to the Micro Board. The Micro Board shuts down the chiller, reinitializes the program and displays MON 10:00 AM – PROGRAM INITIATED RESET . The Micro Board will automatically restart the chiller.

Serial data interfacing to external equipment is provided through an RS-232 port (TB8) **or** an RS-485 port (TB7). Both ports cannot be connected to external devices at the same time. The position of program jumper J58 determines which port is enabled.

The RS-232 port can be connected to a local printer (Refer to Form 155.17-NO1.2.) Program jumper J56 must be in the **MODEM** position when this port is used.

The RS-485 port can be connected to the "YORK ISN Direct Digital Controller" facility automation system. Program jumper J56 must be in the **EMS** position when this port is used.

The Real-Time Clock (RTC) circuit stores and updates the time-of-day, day-of-week and calendar date. Anytime the chiller shuts down on a safety or cycling shutdown, the "Day" and "Time" of shutdown is displayed along with the cause of shutdown. This "Time" information is also used to determine correct chiller start and stop times when the programmable internal time clock is used to automatically start and stop the chiller. The RTC chip contains a non-replaceable battery. This battery powers the RTC RAM in the event of an AC power failure. All of the keypad programmable setpoints are stored in the RTC RAM. Therefore, the setpoints will be saved during a power failure. The life of this battery is 5-10 yrs. During each program cycle, the Micro Board monitors the condition of the battery. If a low battery conditions is detected, REPLACE RTC. U16 – REPROGRAM SETPOINTS is displayed on the keypad display. If this message appears, the RTC Chip (U16) must be replaced. Refer to instructions in "Operating" manual, Form 155.17-O2. This RTC chip (YORK Part Number 031-00955-000) is available from the YORK Parts Distribution Centers. To conserve battery life over winter shutdowns, J57 Program Jumper must be positioned to the **CLOCK OFF** position. Refer to Fig. 25 for procedure. Also, the service technician must turn-on the clock during chiller commissioning.

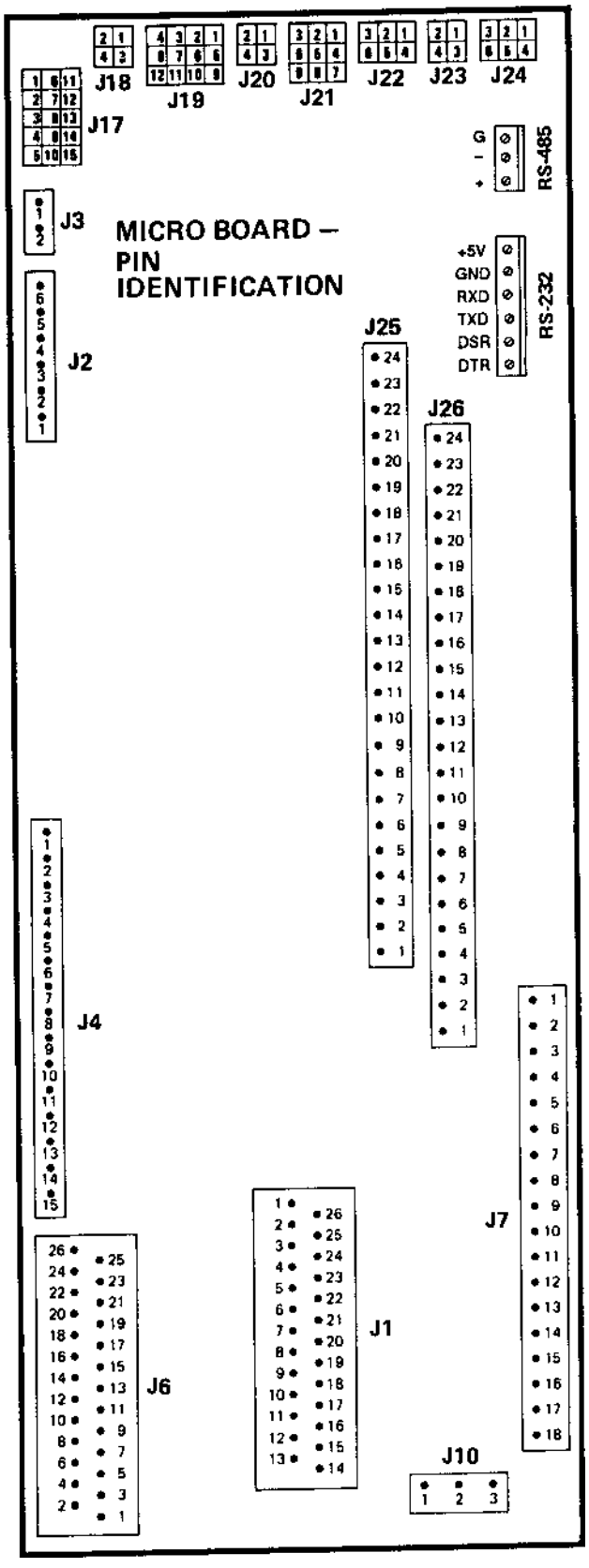
The Parallel Interface Adapters (PIA) allow the Micro Board to interface to digital inputs, or outputs. Each PIA formats the digital inputs, or outputs into 8 bit words. PIA No. 1 receives the digital (On/Off) inputs from the digital input board. These are 115VAC system inputs that have been converted to +5VDC/–0VDC digital inputs by the digital input board. In each program cycle, the digital inputs are read by the Micro Board. The Micro Board, under program control, acts accordingly on the digital inputs. For example, if the High Pressure (HP) input transitions from 0VDC to +5VDC, the Micro Board initiates a chiller shutdown and displays the appropriate message.

PIA No. 2 sends a 3-bit address to the I/O Expansion Board. This address is applied to a multiplexer. It outputs analog data to the multiplexer on the Micro Board. The data and associated addresses are as follows:

| ADDRESS | DATA |
|---|---|
| 000 | Steam valve position (steam units only) |
| 001 | 1st-stage generator No. 2 temp (gas/oil units Models -20G thru -22G only) |
| 010 | Solution dilution temp |
| 011 | 1st-stage generator No. 1 temp |
| 100 | Leaving hot water temp (gas/oil units only) |
| 101 | Entering hot water temp (gas/oil units only) |
| 110 | 2nd-stage generator leaving refrigerant temp |
| 111 | Not used. |

Each program cycle (approx. 100MS), the Micro Board applies all of these addresses (in sequence) to the I/O Expansion Board. As each address is received, the respective analog is transferred to the Micro Board. At the Micro Board, the data is further multiplexed to the analog-to-digital converter where it is converted to a digital value. Each value is stored for: a.) subsequent viewing on the display if requested by the operator thru keypad operation; b.) data transmission thru RS-232 or RS-485 serial ports; and c.) unit control thru program operation.

PIA No. 2 also interfaces to the front panel keypad to determine which key the operator is pressing (Refer to Fig. 28.) The keypad is a two-layer matrix of conductors arranged in a configuration of rows and columns. When a key is pressed, the conductor in that column makes contact with the conductor in that row. There are 6 PIA outputs to the keypad rows. The rows are designated 4, 8, 10, 20, 40, 80. There are 8 PIA inputs from the keypad columns. The columns are designated 1, 2, 4, 8, 10, 20, 40, 80. At regular intervals, the Micro Board reads the keypad keys by sequentially driving the PIA outputs to the rows to logic low (<1VDC) and reading the resultant voltage at the column input to the PIA. For example, when row 8 is driven to logic low, if no keys are accessed in that row, all column




**NOTE: USE AMP REMOVAL TOOL 724668-2 WHEN REMOVING PINS FORM J17-J24**

**FIG. 27 –** MICRO BOARD PLUG PIN IDENTIFICATION

inputs to the PIA will be +5VDC. However, if any key is pressed in row 8, the appropriate column input to the PIA would be at logic low (<1VDC) potential.

On steam-fired units that use Honeywell valves, PIA No. 3 drives the steam valve actuator via triacs that are located on the relay board. The actual leaving chilled water temperature (as detected by the leaving chilled water thermistor, RT1) is constantly compared to the **Leaving Chilled Water Setpoint.** The actuator is modulated in a pulsing action to achieve and maintain the setpoint. The **Open** triac is turned on to cause the actuator to open. The **Close** triac is turned on to cause actuator to close. At unit shutdown, the micro energizes relay K16 on the **Relay Board** to drive the steam valve closed. While the unit is shut down, the steam valve is maintained closed via relay K16. At unit start, relay K16 is de-energized. Refer to Steam Valve Control section for steam valve operation.

PIA No. 3 also interfaces to the **Relay Board** (J1) to control **DC** relays that allow the Micro Board logic level circuits to interface to 115VAC system solenoids and relays. On the relay board, one side of all the relays is tied to +12VDC. The other side of each relay is connected to the Micro Board via ribbon cable. Under program control, the micro energizes each of the relays by driving the appropriate PIA output to "Logic Low" (GND) potential. It de-energizes a relay by shutting off the PIA, allowing the output to go to +12VDC. To prevent relay chatter, anti-chatter circuits are employed for outputs J7-3 (steam shutoff valve – steam units; or burner on/off – gas/oil unit) and J7-5 (purge pump starter). These circuits prevent the outputs from energizing at a rate greater than once every 15 seconds for J7-3 and once every 30 seconds for J7-5.

A chiller identification switch (S1) is provided for use when "YORK Direct Digital Controller" energy management system or local system status printer is connected to the Micro Board serial data ports. The chiller ID switch can be used to assign an identification number (0 thru 7) to each chiller. If a local system status printer is applied, this number is printed at the top of each printout. Refer to YORK Form 155.17-NO1.2 for details of printer applications. This ID is useful in multiple chiller installations to identify individual printouts from different chillers.

Since the Micro Boards are universal in application, program jumpers are provided to configure for different applications. Refer to Fig. 25 for explanation of each program jumper.

Additional digital inputs to the Micro Board are provided from the **I/O Expansion Board.** These inputs are: Hot Water Flow Switch (gas/oil units), Remote Load Limit PWM (steam units), Purge Pump Starter Overload,

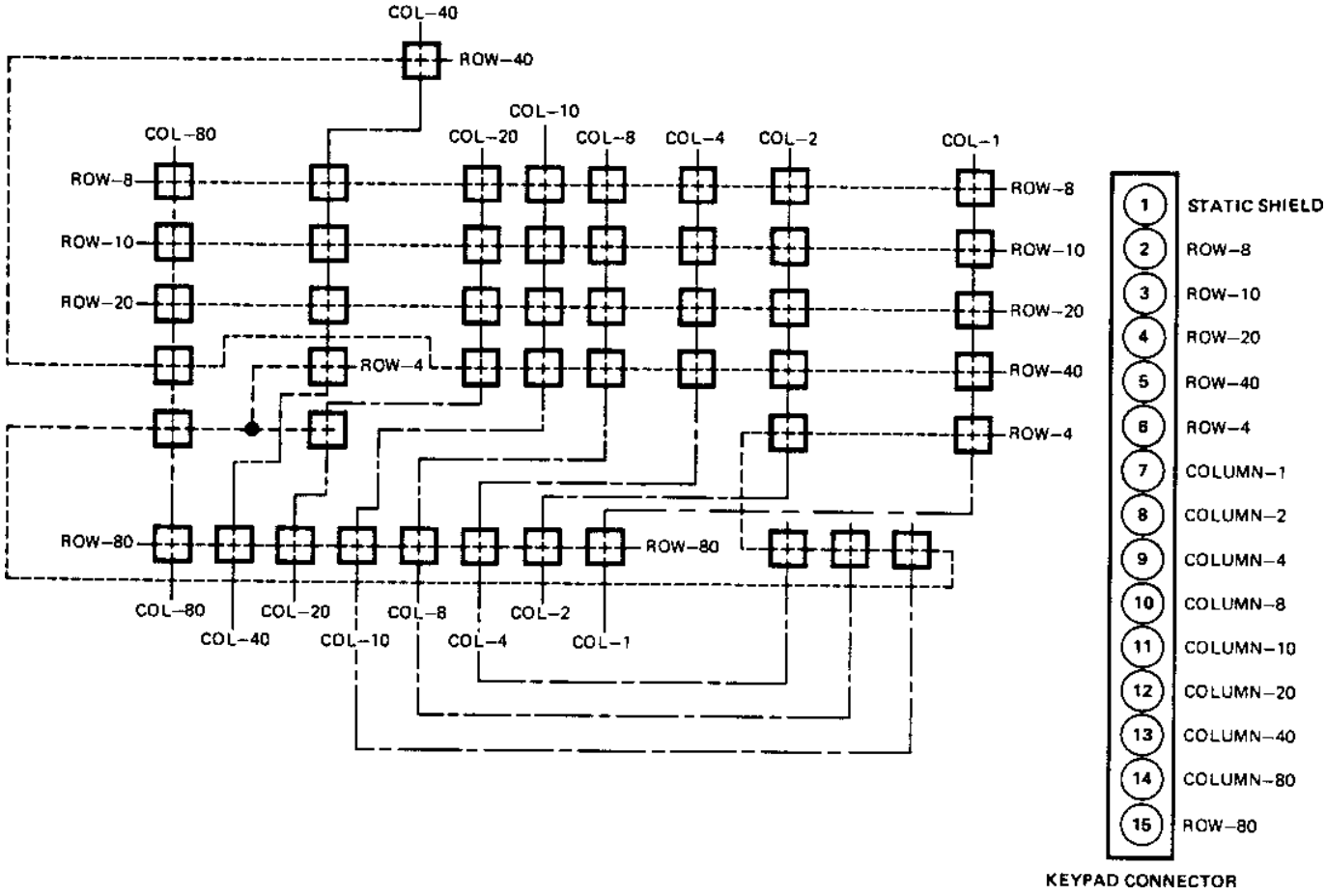



**FIG. 28 –** KEYPAD CONNECTION MATRIX

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and Low Refrigerant Temperature Safety Device. These 115VAC inputs are first applied to opto-couplers on the **Relay Board**, where the 115VAC is converted to +5VDC. These logic level outputs are then applied to the I/O Expansion Board where they are applied to a latch circuit that holds the data until read by the micro. The micro reads this data by applying control signals **OPTRD** and **OPTSEL** and address "100". The data is then transferred to the Micro Board address/data bus via a transceiver.

Additional digital outputs are output to the **Relay Board** via the **I/O Expansion Board**. These are: Cycling Shutdown Status Contacts, Safety Shutdown Status Contacts, Remote Mode Ready to Start Status Contacts, Warning Contacts, and Hot Water Pump Control (gas/oil units). The digital outputs are applied from the address/data bus to a latch circuit on the I/O Expansion Board via the transceiver. The data is latched into this circuit by control signal **OPTWR** and **OPTSEL** and address "011". The latch circuit drives +12VDC relays on the Relay Board. It energizes a relay by driving the output to "Logic Low" potential. Otherwise the output is +12VDC.

On gas/oil units, the micro supplies the firing rate signal to the burner control panel via the I/O Expansion Board. A digital word is sent from the transceiver to the digital-to-analog converter (DAC) that is located on the I/O Expansion Board. It is loaded into the DAC with control signals **OPTR, OPTSEL** and address bits "000", "001", and "010". The DAC and output transistor convert the digital word to a 4-20mA output that is provided to the burner control panel.

## MICRO BOARD INPUTS AND OUTPUTS

**J1-1 –** Burner on status input. +5 VDC as long as burner main flame is established. Otherwise, 0VDC. Spare on steam units.

**J1-2 –** First-stage generator high pressure safety cutout switch input. +5VDC when safety device(s) are tripped. Otherwise, 0VDC. Gas/oil units Models -20G thru 22G have two first-stage generators, each with its own cutout.

**J1-3 –** Refrigerant pump starter overload contacts input. 0VDC when refrigerant pump motor protector (2OL) or motor thermal switch (MTH2) has tripped (opened) indicating an overload condition. Otherwise, +5VDC.

**J1-4 –** Solution pump starter overload contacts input. 0VDC when solution pump motor protector (1OL) or motor thermal switch (MTH1) has tripped (opened) indicating an overload condition. Otherwise, +5VDC. Models -19GL thru -22G have two spray solution pumps in addition to the solution pump. Spray solution pump No. 1 is protected by 4OL and MTH4. Spray solution pump No. 2 is protected by 5OL and MTH5. Models -16SL thru -19S have a SOLUTION pump and a SPRAY SOLUTION pump; the SOLUTION pump is protected by motor protector (1OL) and motor thermal switch (MTH1), the SPRAY SOLUTION pump is protected by motor protector (4OL) and motor thermal switch (MTH4).

**J1-5 –** Not used.

**J1-6 –** Not used.

**J1-7 –** First-stage generator high temp safety cutout switch input. +5VDC when switch is tripped. Otherwise, 0VDC. Gas/oil units Model -20G thru -22G have two first-stage generators, each with its own safety cutout.

**J1-8 –** Keypad **START/RUN/STOP-RESET** switch **Stop** input. +5VDC when switch is in the Stop position. Otherwise, 0VDC.

**J1-9 –** Keypad **START/RUN/STOP-RESET** switch **Start** input. +5VDC when switch is in the Start position. Otherwise, 0VDC.

**J1-10 –** Not used.

**J1-11 –** Not used.

**J1-12 –** Not used.

**J1-13 –** +5VDC return (GND) output.

**J1-14 –** +5VDC output.

**J-15 –** Remote start input. Momentary or maintained +5VDC causes unit to start if in **REMOTE** mode and **UNIT** switch is in **RUN** position. Otherwise, 0VDC.

**J1-16 –** Remote stop input. Momentary or maintained +5VDC causes unit to stop if in **REMOTE** mode and **UNIT** switch is in **RUN** position. Otherwise, 0VDC.

**J1-17 –** Remote leaving water temp setpoint pulse width modulation (PWM) input. +5VDC for 1-11 seconds when PWM input is present. Otherwise, 0VDC. Signal is only accepted every 60 seconds. Any PWM input applied at a rate greater than 1 signal/60 seconds will be ignored. Refer to "Remote Setpoint" section and Form 155.17-PA1 for details.

**J1-18 –** Condenser water flow switch input. +5VDC when flow switch is closed. Otherwise, 0VDC.

**J1-19 –** Chilled water flow switch input. +5VDC when flow switch is closed. Otherwise, 0VDC.

**J1-20 –** Remote/local cycling device input. +5VDC allows unit to run as long as **UNIT** switch is in **RUN** position and there are no other safety or cycling shut-downs. 0VDC causes unit to shutdown.

**J1-21 –** Multi-unit sequence input. +5VDC allows unit to run as long as **UNIT** switch is in **RUN** position and there are no other safety or cycling shutdowns. 0VDC causes unit to shutdown.

**J1-22 –** Not used.

**J1-23 –** Limited dilution standby power supply status input.

**J1-24 –** Auxiliary safety shutdown input. Momentary or maintained application of +5VDC causes unit to shutdown. Otherwise, 0VDC.

**J1-25 –** First stage generator solution level sensor input. 0VDC when sensor detects sufficient level. Otherwise, +5VDC. Gas/oil units Models -20G thru -22G have two first-stage generators, each with its own level sensor.

**J1-26 –** Burner alarm contacts input. 0VDC when burner has opened its alarm contacts indicating an alarm condition. Otherwise, +5VDC. Models -20G thru -22G have two burners, each with its own alarm contacts. Not used on steam units.

**J2**

**J2-1 –** $2^2$ address bit to multiplexer on I/O Expansion Board. +5VDC in the active (Logic 1) state. Otherwise, 0VDC.

**J2-2 –** $2^1$ address bit to multiplexer on I/O Expansion Board. +5VDC in the active (Logic 1) state. Otherwise, 0VDC.

**J2-3 –** $2^0$ address bit to multiplexer on I/O Expansion Board. +5VDC in the active (Logic 1) state. Otherwise, 0VDC.

**J2-4 –** +5VDC output to I/O Expansion Board.

**J2-5 –** GND output to I/O Expansion Board.

**J2-6 –** Multiplexed 0-5VDC input from I/O Expansion Board as follows:

| CHANNEL | ADDRESS | DATA |
|---|---|---|
| 0 | 000 | Steam valve position potentiometer. Steam units only. Refer to I/O Expansion Board J6-2. |
| 1 | 001 | First-stage generator No. 2 temperature (gas/oil Models -20G thru -22G only). Refer Table 5. |
| 2 | 010 | Solution dilution temperature. Refer to Table 7. |
| 3 | 011 | First-stage generator No. 1 temperature. Refer to Table 5. |
| 4 | 100 | Leaving hot water temperature (gas/oil units only in **HEATING ONLY** or **COOLING AND HEATING** mode). Refer to Table 6. |
| 5 | 101 | Entering hot water temperature (gas/oil units in **HEATING ONLY** or **COOLING AND HEATING** mode). Refer to Table 6. |
| 6 | 110 | 2nd-stage generator leaving refrigerant temp |
| 7 | 111 | Not used. |

## J3

**J3-1 –** +5VDC return (GND) from power supply board.

**J3-2 –** +5VDC unregulated (10VDC) from power supply board.

## J4

**J4-1 –** +5VDC return.

**J4-2 –** Keypad output, row-8. This line is driven to GND when Micro Board is scanning row-8. Otherwise, +5VDC.

**J4-3 –** Keypad output, row-10. This line is driven to GND when Micro Board is scanning row-10. Otherwise, +5VDC.

**J4-4 –** Keypad output, row-20. This line is driven to GND when Micro Board is scanning row-20. Otherwise, +5VDC.

**J4-5 –** Keypad output, row-40. This line is driven to GND when Micro Board is scanning row-40. Otherwise, +5VDC.

**J4-6 –** Keypad output, row-4. This line is driven to GND when Micro Board is scanning row-4. Otherwise, +5VDC.

**J4-7 –** Keypad input, column-1, Logic Low when a key in column 01 is pressed. Otherwise, +5VDC.

**J4-8 –** Keypad input, column-2, Logic Low when a key in column 2 is pressed. Otherwise, +5VDC.

**J4-9 –** Keypad input, column-4, Logic Low when a key in column 4 is pressed. Otherwise, +5VDC.

**J4-10 –** Keypad input, column-8, Logic Low when a key in column 8 is pressed. Otherwise, +5VDC.

**J4-11 –** Keypad input, column-10, Logic Low when a key in column 10 is pressed. Otherwise, +5VDC.

**J4-12 –** Keypad input, column-20, Logic Low when a key in column 20 is pressed. Otherwise, +5VDC.

**J4-13 –** Keypad input, column-40, Logic Low when a key in column 40 is pressed. Otherwise, +5VDC.

**J4-14 –** Keypad input, column-80, Logic Low when a key in column 8 is pressed. Otherwise, +5VDC.

**J4-15 –** Keypad output, row-80. This line is driven to GND when Micro Board is scanning row-80. Otherwise, +5VDC.

## J6

**J6-1 –** "To" output. Control bit that is used to initiate the display self-test. Bit is GND for greater than 3 sec to initiate test. Otherwise, +5VDC.

**J6-3 –** $\overline{CS}$ (Chip Select) output. Control bit that is 0VDC to enable vacuum fluorescent display module to accept a character. Otherwise, +5VDC.

**J6-5 –** +5VDC.

**J6-7 –** "A" output. Not used.

**J6-9 –** $\overline{WR}$ (Write) output. Control bit that is 0VDC to write a character into the vacuum fluorescent display module. Otherwise, +5VDC.

**J6-11 –** $2^0$ bit output. ASCII that is +5VDC in the active state. Otherwise, 0VDC.

**J6-13 –** $2^1$ bit output. ASCII that is +5VDC in the active state. Otherwise, 0VDC.

**J6-15 –** $2^2$ bit output. ASCII that is +5VDC in the active state. Otherwise, 0VDC.

**J6-17 –** $2^3$ bit output. ASCII that is +5VDC in the active state. Otherwise, 0VDC.

**J6-19 –** $2^4$ bit output. ASCII that is +5VDC in the active state. Otherwise, 0VDC.

**J6-21 –** $2^5$ bit output. ASCII that is +5VDC in the active state. Otherwise, 0VDC.

**J6-23 –** $2^6$ bit output. ASCII that is +5VDC in the active state. Otherwise, 0VDC.

**J6-25 –** $2^7$ bit output. ASCII that is +5VDC in the active state. Otherwise, 0VDC.

**J7**

**J7-1 –** Purge pump solenoid valve output. Logic Low (<1VDC) when micro is commanding the purge pump solenoid valve to energize (open). Otherwise, +12VDC. This valve exists only on units equipped with automatic purge system.

**J7-2 –** Purge tank solenoid valve output. Logic Low (<1VDC) when micro is commanding the purge tank solenoid valve to energize (open). Otherwise, +12VDC. These valves exist only on units equipped with automatic purge system.

**J7-3 –** Burner on/off control output (gas/oil units). Steam shutoff valve output (steam units). Logic Low (<1VDC) when micro is commanding the burner (gas/oil) to be on or steam valve (steam unit) to open. Otherwise, +12VDC.

**J7-4 –** 10% turn down solenoid (optional) output. Logic Low (<1VDC) when the micro is commanding the solenoid to energize (open). Otherwise, +12VDC.

**J7-5 –** Purge pump starter output. Logic Low (<1VDC) when micro is commanding the purge pump to run. Otherwise, +12VDC.

**J7-6 –** Chilled water pump control output. Logic Low (<1VDC) when micro is commanding the chilled water pump to run. Otherwise, +12VDC.

**J7-7 –** Condenser water pump control output. Logic Low (<1VDC) when micro is commanding the condenser water pump to run. Otherwise, +12VDC.

**J7-8 –** Solution pump (all models) and first spray solution pump (Models -19GL thru -22G) starters output. Logic Low (<1VDC) when micro is commanding the pump(s) to run. Otherwise, +12VDC.

**J7-9 –** Second spray solution pump starter output (Models -19GL thru -22G). Spray solution pump starter output (Models -16SL thru -19S). Logic Low (<1VDC) when micro is commanding the pump to run. Otherwise, +12VDC.

**J7-10 –** Refrigerant pump starter output. Logic Low (<1VDC) when micro is commanding the pump to run. Otherwise, +12VDC.

**J7-11/12 –** Honeywell steam valve actuator close output. 0VAC (as measured from J7-11 to J7-12) when micro is commanding the steam valve to unload. Approximately 115VAC when holding or loading.

**J7-13/14 –** Honeywell steam valve actuator open output. 0VAC (as measured from J7-13 to J7-14) when micro is commanding the steam valve to load. Approximately 115VAC when holding or unloading.

**J7-15 –** Not used.

**J7-16 –** Not used.

**J7-17 –** +12VDC return (GND).

**J7-18 –** +12VDC return (GND).

**J8 –** Not used.

**J10 –** Not used.

**TB7 –** RS-485 serial port. Used for YORK FAX-4500 Energy Management System.

**TB7-1 –** RS-485 serial port balanced (+) I/O line. >+0.2VDC with respect to (–) line (TB7-2) is a logic 1 (mark). Greater than –0.2VDC is a logic 0 (space). Baud rate is determined by application.

**TB7-2 –** RS-485 serial port balanced (–) I/O line. See TB7-1.

**TB7-3 –** RS-485 serial port ground.

**TB8 –** RS-232 serial port. Used for: System Status Printer (Refer to Form 155.17-NO1.2.)

**TB8-1 –** DTR (Data Terminal Ready). Control signal to remote device. Logic High (+5 to +25VDC) when micro is ready to transmit to or receive data from remote device. Otherwise, Logic Low (–5 to –25 VDC).

**TB8-2 –** DSR (Data Set Ready). Control signal from remote device. Logic High (+5 to +25VDC) when remote device is ready to send data to or receive data

from the Micro Board. Otherwise, Logic Low (–5 to –25VDC).

**TB8-3 –** TXD (Transmit Data). Serial data to remote device. Logic 1 = –5 to –25VDC. Logic 0 = +5 to +25VDC. Baud rate is determined by the application.

**TB8-4 –** RXD (Receive Data). Serial data from remote device. Logic 1 = –5 to –25VDC. Logic 0 = +5 to +25VDC. Baud rate is determined by the application.

**TB8-5 –** Ground output to remote device.

**TB8-6 –** +5VDC output to remote device.

**J17-1 –** +5VDC return (GND).

**J17-2 –** Not used.

**J17-6 –** +5VDC output.

**J17-11 –** Purge pump transducer (PT3) input. (Purge pump transducer exists only on units equipped with Automatic Purge Hardware and EPROM version A.01F.09 or later.) +0.5 - 4.5VDC transducer output corresponds to 0.25 - 4.25PSIA (12.9 - 219.7mmHgA) transducer input. To calculate the transducer output voltage vs. a given input pressure, use the following formula: (Refer to Fig. 30.)

TO SOLVE FOR V:

$$V_{dc} = P_{PSIA} + 0.25$$

$$V_{dc} = \frac{P_{mmHgA}}{51.7} + 0.25$$

TO SOLVE FOR P:

$$P_{PSIA} = V_{dc} - 0.25$$

$$P_{mmHgA} = (V_{dc} - 0.25)\ 51.7$$

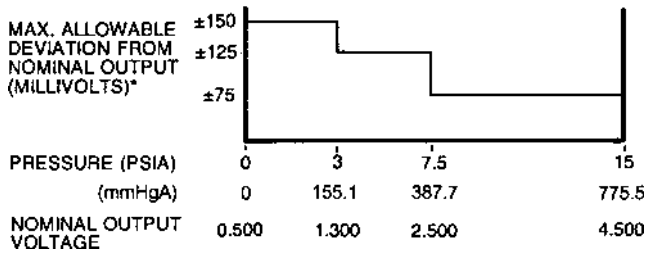


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**FIG. 29 –** FIRST-STAGE GENERATOR NO. 1 (ALL UNITS) AND NO. 2 (GAS/OIL 20G THRU 22G) TRANSDUCERS YORK PART NO. 025-29907-001

**J17-3 –** +5VDC return (GND).

**J17-4 –** Not used.

**J17-8 –** +5VDC output.

**J17-13 –** Purge tank transducer (PT4) input. (Purge tank transducer exists only on units equipped with Automatic Purge Hardware and EPROM version A.01F.09 or later.) +0.5 - 4.5VDC transducer output corresponds to 0.25 - 4.25PSIA (12.9 - 219.7mmHgA) transducer input. To calculate the transducer output voltage vs. a given input pressure, use the formula under J17-11. (Refer to Fig. 30.)

**J17-5 –** Not used.

**J17-9 –** Not used.

**J17-10 –** Not used.

**J17-15 –** Not used.

**J18-1 –** Not used.

**J18-2 –** Not used.

**J18-3 –** Not used.

**J18-4 –** Not used.

**J19-1 –** +5VDC return (GND).

**J19-2 –** Not used.

**J19-5 –** +5VDC output.

**J19-9 –** First-stage generator transducer (PT1) input (steam units). First-stage generator No. 1 transducer input (gas/oil units). +0.5 - 4.5VDC transducer output corresponds to 0 - 15PSIA (0 - 775.5mmHgA) pressure input. To calculate the transducer output voltage vs. a given input pressure. Use the following formula. (Refer to Fig. 29.)

TO SOLVE FOR V:

$$Vdc = \frac{P_{PSIA} + 1.875}{3.75}$$

$$Vdc = \frac{1.875 + \frac{P_{mmHgA}}{51.7}}{3.75}$$

TO SOLVE FOR P:

$P_{PSIA} = (3.75 \times V) - 1.875$

$P_{mmHgA} = [(3.75 \times V) - 1.875]\ 51.7$

**J19-4 –** Not used.

**J19-7 –** +5VDC output.

**J19-8 –** +5VDC return (GND).

**J19-12 –** First-stage generator No. 2 transducer (PT2) input (gas/oil units). +0.5 - 4.5VDC transducer output corresponds to 0 - 15PSIA (0 - 775.5mmHgA) pressure input. To calculate the transducer output voltage vs. a given input pressure, use the formula under J19-9. (Refer to Fig. 29.)

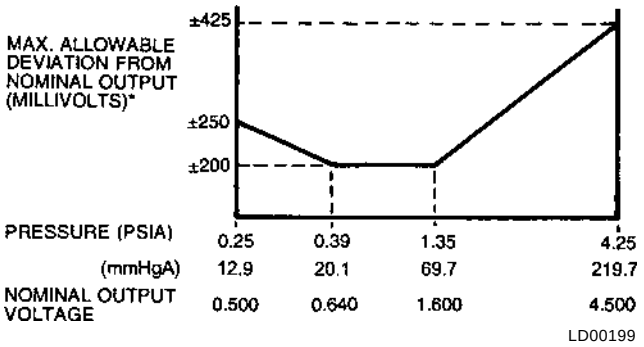



**FIG. 30 –** PURGE PUMP AND PURGE TANK TRANSDUCERS, YORK PART NO. 025-29907-002

**J19-3 –** Not used.

**J19-6 –** +5VDC output.

**J19-10 –** Leaving chilled water temperature thermistor (RT1) input. 0 - 5VDC. (Refer to Table 1.)

**J20-1 –** Not used.

**J20-2 –** Not used.

**J20-3 –** Not used.

**J20-4 –** Not used.

**J21-1 –** Not used.

**J21-2 –** Not used.

**J21-4 –** +5VDC output.

**J21-7 –** Entering chilled water temperature thermistor (RT9) input. 0 - 5VDC. (Refer to Table 2.)

**J21-3 –** Not used.

**J21-5 –** +5VDC output.

**J21-8 –** Refrigerant temperature thermistor (RT10) input. 0 - 5 VDC. (Refer to Table 3.)

**J21-6 –** Not used.

**J21-9 –** Not used.

**J22-1 –** Not used.

**J22-4 –** +5VDC output.

**J22-5 –** Entering condenser water temperature thermistor (RT5) input. 0 - 5VDC. (Refer to Table 4.)

**J22-3 –** Not used.

**J22-2 –** +5VDC output.

**J22-6 –** Leaving condenser water temperature thermistor (RT4) input. 0 - 5VDC. (Refer to Table 4.)

**J23-1 –** Not used.

**J23-2 –** Not used.

**J23-3 –** Not used.

**J23-4 –** Not used.

**J24-1 –** Not used.

**J24-2 –** Not used.

**J24-3 –** Not used.

**J24-4 –** Not used.

**J24-5 –** Not used.

**J24-6 –** Not used.

**J25-1 –** Address bit **A9** output. +5VDC in the active state (Logic 1). Otherwise, 0VDC.

**J25-2 –** Address bit **A10** output. +5VDC in the active state (Logic 1). Otherwise, 0VDC.

**J25-3 –** Address bit **A11** output. +5VDC in the active state (Logic 1). Otherwise, 0VDC.

**J25-4 –** Not used.

**J25-5 –** Not used.

**J25-6 –** Not used.

**J25-7 –** Not used.

**J25-8 –** $\overline{\text{OPTSEL}}$ (Option Select) output. 0VDC in the active state (Logic 0), when the micro is reading data from or writing data to the I/O Expansion Board. Otherwise, +5VDC.

**J25-9 –** Not used.

**J25-10 –** $\overline{\text{DEN}}$ (Data Enable) output. 0VDC in the active state (Logic 0), when the micro is reading data from or writing data to the I/O Expansion Board. Otherwise, +5VDC.

**J25-11 –** +5VDC output.

**J25-12 –** Not used.

**J25-13 –** Data bit **D7** input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J25-14 –** Data bit **D6** input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J25-15 –** Data bit **D5** input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J25-16 –** Data bit **D4** input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J25-17 –** Data bit **D3** input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J25-18 –** Data bit **D2** input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J25-19 –** Data bit **D1** input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J25-20 –** Data bit **D0** input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J25-21 –** +5VDC output.

**J25-22 –** $\overline{\text{OPTION}}$ control signal input. 0VDC in the active state (Logic 0) to enable the transceiver on the Micro Board to accept or transmit data to the I/O Expansion Board. Otherwise, +5VDC.

**J25-23 –** +5VDC output.

**J25-24 –** Not used.

**J26-1 –** Not used.

**J26-2 –** Not used.

**J26-3 –** Not used.

**J26-4 –** Not used.

**J26-5 –** Not used.

**J26-6 –** Not used.

**J26-7 –** Not used.

**J26-8 –** Not used.

**J26-9 –** Not used.

**J26-10 –** Not used.

**J26-11 –** Ground output.

**J26-12 –** $\overline{\text{OPTWR}}$ (Option Write) control signal output. 0VDC when micro is writing data to the I/O Expansion Board. Otherwise, +5VDC.

**J26-13 –** Ground output.

**J26-14 –** Not used.

**J26-15 –** Ground output.

**J26-16 –** Not used.

**J26-17 –** Ground output.

**J26-18 –** Not used.

**J26-19 –** Ground output.

**J26-20 –** Not used.

**J26-21 –** Ground output.

**J26-22 –** $\overline{\text{RESET}}$ control signal output. 0VDC in the active state when the micro resets the output latch on the I/O Expansion Board. Otherwise, +5VDC.

**J26-23 –** Ground output.

**J26-24 –** $\overline{\text{OPTRD}}$ (Option Read) control signal output.

**TABLE 1** – LEAVING CHILLED WATER TEMPERATURE

| temp(°F) | Vin | temp(°F) | Vin | temp(°F) | Vin | temp(°F) | Vin |
|---|---|---|---|---|---|---|---|
| 9.90 | 1.4280 | 15.13 | 1.5957 | 20.17 | 1.7634 | 25.08 | 1.9311 |
| 10.00 | 1.4310 | 15.22 | 1.5987 | 20.26 | 1.7664 | 25.17 | 1.9341 |
| 10.09 | 1.4341 | 15.32 | 1.6018 | 20.35 | 1.7695 | 25.26 | 1.9372 |
| 10.19 | 1.4371 | 15.41 | 1.6048 | 20.44 | 1.7725 | 25.35 | 1.9402 |
| 10.29 | 1.4402 | 15.50 | 1.6079 | 20.53 | 1.7756 | 25.43 | 1.9433 |
| 10.39 | 1.4432 | 15.60 | 1.6109 | 20.62 | 1.7786 | 25.52 | 1.9463 |
| 10.48 | 1.4463 | 15.69 | 1.6140 | 20.71 | 1.7817 | 25.61 | 1.9494 |
| 10.58 | 1.4493 | 15.78 | 1.6170 | 20.80 | 1.7847 | 25.70 | 1.9524 |
| 10.68 | 1.4423 | 15.87 | 1.6201 | 20.89 | 1.7878 | 25.79 | 1.9555 |
| 10.77 | 1.4554 | 15.97 | 1.6231 | 20.98 | 1.7908 | 25.87 | 1.9585 |
| 10.87 | 1.4584 | 16.06 | 1.6262 | 21.07 | 1.7939 | 25.96 | 1.9616 |
| 10.97 | 1.4615 | 16.15 | 1.6292 | 21.16 | 1.7969 | 26.05 | 1.9646 |
| 11.06 | 1.4645 | 16.24 | 1.6322 | 21.25 | 1.8000 | 26.14 | 1.9677 |
| 11.16 | 1.4676 | 16.34 | 1.6353 | 21.34 | 1.8030 | 26.23 | 1.9707 |
| 11.25 | 1.4706 | 16.43 | 1.6383 | 21.43 | 1.8060 | 26.31 | 1.9738 |
| 11.35 | 1.4737 | 16.52 | 1.6414 | 21.52 | 1.8091 | 26.40 | 1.9768 |
| 11.45 | 1.4767 | 16.61 | 1.6444 | 21.61 | 1.8121 | 26.49 | 1.9798 |
| 11.54 | 1.4798 | 16.70 | 1.6475 | 21.70 | 1.8152 | 26.58 | 1.9829 |
| 11.64 | 1.4828 | 16.80 | 1.6505 | 21.79 | 1.8182 | 26.67 | 1.9859 |
| 11.73 | 1.4859 | 16.89 | 1.6536 | 21.88 | 1.8213 | 26.76 | 1.9890 |
| 11.83 | 1.4889 | 16.98 | 1.6566 | 21.97 | 1.8243 | 26.84 | 1.9920 |
| 11.93 | 1.4920 | 17.07 | 1.6597 | 22.06 | 1.8274 | 26.93 | 1.9951 |
| 12.02 | 1.4950 | 17.16 | 1.6627 | 22.15 | 1.8304 | 27.02 | 1.9981 |
| 12.12 | 1.4981 | 17.26 | 1.6658 | 22.24 | 1.8335 | 27.11 | 2.0012 |
| 12.21 | 1.5011 | 17.35 | 1.6688 | 22.33 | 1.8365 | 27.20 | 2.0042 |
| 12.31 | 1.5042 | 17.44 | 1.6719 | 22.42 | 1.8396 | 27.28 | 2.0073 |
| 12.40 | 1.5072 | 17.53 | 1.6749 | 22.51 | 1.8426 | 27.37 | 2.0103 |
| 12.50 | 1.5103 | 17.63 | 1.6780 | 22.60 | 1.8457 | 27.46 | 2.0134 |
| 12.59 | 1.5133 | 17.72 | 1.6810 | 22.69 | 1.8487 | 27.55 | 2.0164 |
| 12.69 | 1.5164 | 17.81 | 1.6841 | 22.78 | 1.8518 | 27.64 | 2.0195 |
| 12.78 | 1.5194 | 17.90 | 1.6871 | 22.87 | 1.8548 | 27.73 | 2.0225 |
| 12.88 | 1.5225 | 17.99 | 1.6902 | 22.96 | 1.8579 | 27.81 | 2.0256 |
| 12.97 | 1.5255 | 18.08 | 1.6932 | 23.04 | 1.8609 | 27.90 | 2.0286 |
| 13.07 | 1.5286 | 18.17 | 1.6963 | 23.13 | 1.8640 | 27.99 | 2.0317 |
| 13.16 | 1.5316 | 18.26 | 1.6993 | 23.22 | 1.8670 | 28.08 | 2.0347 |
| 13.26 | 1.5347 | 18.35 | 1.7024 | 23.31 | 1.8701 | 28.17 | 2.0378 |
| 13.35 | 1.5377 | 18.44 | 1.7054 | 23.40 | 1.8731 | 28.25 | 2.0408 |
| 13.45 | 1.5408 | 18.54 | 1.7085 | 23.49 | 1.8762 | 28.34 | 2.0439 |
| 13.54 | 1.5438 | 18.63 | 1.7115 | 23.58 | 1.8792 | 28.43 | 2.0469 |
| 13.64 | 1.5469 | 18.72 | 1.7146 | 23.67 | 1.8823 | 28.52 | 2.0500 |
| 13.73 | 1.5499 | 18.81 | 1.7176 | 23.75 | 1.8853 | 28.61 | 2.0530 |
| 13.83 | 1.5530 | 18.90 | 1.7207 | 23.84 | 1.8884 | 28.69 | 2.0561 |
| 13.92 | 1.5560 | 18.99 | 1.7237 | 23.93 | 1.8914 | 28.78 | 2.0591 |
| 14.01 | 1.5591 | 19.08 | 1.7268 | 24.02 | 1.8945 | 28.87 | 2.0622 |
| 14.11 | 1.5621 | 19.17 | 1.7298 | 24.11 | 1.8975 | 28.96 | 2.0652 |
| 14.20 | 1.5652 | 19.26 | 1.7329 | 24.20 | 1.9006 | 29.04 | 2.0683 |
| 14.29 | 1.5682 | 19.36 | 1.7359 | 24.29 | 1.9036 | 29.13 | 2.0713 |
| 14.39 | 1.5713 | 19.45 | 1.7390 | 24.37 | 1.9067 | 29.22 | 2.0744 |
| 14.48 | 1.5743 | 19.54 | 1.7420 | 24.46 | 1.9097 | 29.31 | 2.0774 |
| 14.57 | 1.5774 | 19.63 | 1.7451 | 24.55 | 1.9128 | 29.39 | 2.0805 |
| 14.67 | 1.5804 | 19.72 | 1.7481 | 24.64 | 1.9158 | 29.48 | 2.0835 |
| 14.76 | 1.5835 | 19.81 | 1.7512 | 24.73 | 1.9189 | 29.57 | 2.0866 |
| 14.85 | 1.5865 | 19.90 | 1.7542 | 24.82 | 1.9219 | 29.66 | 2.0896 |
| 14.95 | 1.5896 | 19.99 | 1.7573 | 24.91 | 1.9250 | 29.75 | 2.0927 |
| 15.04 | 1.5926 | 20.08 | 1.7603 | 24.99 | 1.9280 | 29.83 | 2.0957 |

**TABLE 1 –** LEAVING CHILLED WATER TEMPERATURE (Cont'd.)

| temp(°F) | Vin | temp(°F) | Vin | temp(°F) | Vin | temp(°F) | Vin | temp(°F) | Vin |
|---|---|---|---|---|---|---|---|---|---|
| 29.92 | 2.0988 | 34.73 | 2.2665 | 39.57 | 2.4342 | 44.46 | 2.6019 | 49.48 | 2.7696 |
| 30.01 | 2.1018 | 34.82 | 2.2695 | 39.66 | 2.4372 | 44.55 | 2.6049 | 49.57 | 2.7726 |
| 30.10 | 2.1049 | 34.91 | 2.2726 | 39.74 | 2.4403 | 44.64 | 2.6080 | 49.66 | 2.7757 |
| 30.18 | 2.1079 | 34.99 | 2.2756 | 39.83 | 2.4433 | 44.73 | 2.6110 | 49.75 | 2.7787 |
| 30.27 | 2.1110 | 35.08 | 2.2787 | 39.92 | 2.4464 | 44.82 | 2.6141 | 49.84 | 2.7818 |
| 30.36 | 2.1140 | 35.17 | 2.2817 | 40.01 | 2.4494 | 44.91 | 2.6171 | 49.94 | 2.7848 |
| 30.45 | 2.1171 | 35.26 | 2.2848 | 40.10 | 2.4525 | 45.00 | 2.6202 | 50.03 | 2.7879 |
| 30.53 | 2.1201 | 35.34 | 2.2878 | 40.19 | 2.4555 | 45.09 | 2.6232 | 50.12 | 2.7909 |
| 30.62 | 2.1232 | 35.43 | 2.2909 | 40.27 | 2.4586 | 45.18 | 2.6263 | 50.22 | 2.7940 |
| 30.71 | 2.1262 | 35.52 | 2.2939 | 40.36 | 2.4616 | 45.27 | 2.6293 | 50.31 | 2.7970 |
| 30.79 | 2.1293 | 35.51 | 2.2970 | 40.45 | 2.4647 | 45.36 | 2.6324 | 50.40 | 2.8001 |
| 30.88 | 2.1323 | 35.70 | 2.3000 | 40.54 | 2.4677 | 45.36 | 2.6354 | 50.50 | 2.8031 |
| 30.97 | 2.1354 | 35.78 | 2.3031 | 40.63 | 2.4708 | 45.55 | 2.6385 | 50.59 | 2.8062 |
| 31.06 | 2.1384 | 35.87 | 2.3061 | 40.71 | 2.4738 | 45.64 | 2.6415 | 50.68 | 2.8092 |
| 31.14 | 2.1415 | 35.96 | 2.3092 | 40.80 | 2.4769 | 45.73 | 2.6446 | 50.78 | 2.8123 |
| 31.23 | 2.1445 | 36.05 | 2.3122 | 40.89 | 2.4799 | 45.82 | 2.6476 | 50.87 | 2.8153 |
| 31.32 | 2.1476 | 36.13 | 2.3153 | 40.98 | 2.4830 | 45.91 | 2.6507 | 50.96 | 2.8184 |
| 31.41 | 2.1506 | 36.22 | 2.3183 | 41.07 | 2.4860 | 46.00 | 2.6537 | 51.06 | 2.8214 |
| 31.49 | 2.1536 | 36.31 | 2.3214 | 41.16 | 2.4891 | 46.09 | 2.6568 | 51.15 | 2.8245 |
| 31.58 | 2.1567 | 36.40 | 2.3244 | 41.24 | 2.4921 | 46.18 | 2.6598 | 51.24 | 2.8275 |
| 31.67 | 2.1597 | 36.48 | 2.3274 | 41.33 | 2.4952 | 46.27 | 2.6629 | 51.34 | 2.8306 |
| 31.76 | 2.1628 | 36.57 | 2.3305 | 41.42 | 2.4982 | 46.36 | 2.6659 | 51.43 | 2.8336 |
| 31.84 | 2.1658 | 36.66 | 2.3335 | 41.51 | 2.5012 | 46.45 | 2.6690 | 51.52 | 2.8367 |
| 31.93 | 2.1689 | 36.75 | 2.3366 | 41.60 | 2.5043 | 46.55 | 2.6720 | 51.62 | 2.8397 |
| 32.02 | 2.1719 | 36.83 | 2.3396 | 41.69 | 2.5073 | 46.64 | 2.6751 | 51.71 | 2.8428 |
| 32.10 | 2.1750 | 36.92 | 2.3427 | 41.78 | 2.5104 | 46.73 | 2.6781 | 51.80 | 2.8458 |
| 32.19 | 2.1780 | 37.01 | 2.3457 | 41.87 | 2.5134 | 46.82 | 2.6811 | 51.90 | 2.8458 |
| 32.28 | 2.1811 | 37.10 | 2.3488 | 41.96 | 2.5165 | 46.91 | 2.6842 | 51.99 | 2.8519 |
| 32.37 | 2.1841 | 37.18 | 2.3518 | 42.05 | 2.5195 | 47.00 | 2.6872 | 52.09 | 2.8549 |
| 32.45 | 2.1872 | 37.27 | 2.3549 | 42.14 | 2.5226 | 47.09 | 2.6903 | 52.18 | 2.8580 |
| 32.54 | 2.1902 | 37.36 | 2.3579 | 42.23 | 2.5256 | 47.18 | 2.6933 | 52.28 | 2.8610 |
| 32.63 | 2.1933 | 37.45 | 2.3610 | 42.31 | 2.5287 | 47.27 | 2.6964 | 52.37 | 2.8641 |
| 32.72 | 2.1963 | 37.54 | 2.3640 | 42.40 | 2.5317 | 47.36 | 2.6994 | 52.46 | 2.8671 |
| 32.81 | 2.1994 | 37.62 | 2.3671 | 42.49 | 2.5348 | 47.45 | 2.7025 | 52.56 | 2.8701 |
| 32.89 | 2.2024 | 37.71 | 2.3701 | 42.58 | 2.5378 | 47.55 | 2.7055 | 52.65 | 2.8732 |
| 32.98 | 2.2055 | 37.80 | 2.3732 | 42.67 | 2.5409 | 47.64 | 2.7086 | 52.75 | 2.8763 |
| 33.07 | 2.2085 | 37.89 | 2.3762 | 42.76 | 2.5439 | 47.73 | 2.7116 | 52.84 | 2.8793 |
| 33.16 | 2.2116 | 37.98 | 2.3793 | 42.85 | 2.5470 | 47.82 | 2.7147 | 52.94 | 2.8824 |
| 33.24 | 2.2146 | 38.07 | 2.3823 | 42.94 | 2.5500 | 47.91 | 2.7177 | 53.03 | 2.8854 |
| 33.33 | 2.2177 | 38.15 | 2.3854 | 43.03 | 2.5531 | 48.00 | 2.7208 | 53.13 | 2.8885 |
| 33.42 | 2.2207 | 38.24 | 2.3884 | 43.12 | 2.5561 | 48.09 | 2.7238 | 53.22 | 2.8915 |
| 33.51 | 2.2238 | 38.33 | 2.3915 | 43.21 | 2.5592 | 48.18 | 2.7269 | 53.32 | 2.8946 |
| 33.59 | 2.2268 | 38.42 | 2.3945 | 43.30 | 2.5622 | 48.27 | 2.7299 | 53.41 | 2.9007 |
| 33.68 | 2.2299 | 38.51 | 2.3976 | 43.39 | 2.5653 | 48.37 | 2.7330 | 53.51 | 2.9007 |
| 33.77 | 2.2329 | 38.60 | 2.4006 | 43.48 | 2.5683 | 48.46 | 2.7360 | 53.60 | 2.9037 |
| 33.86 | 2.2360 | 38.69 | 2.4037 | 43.57 | 2.5714 | 48.55 | 2.7391 | 53.70 | 2.9068 |
| 33.94 | 2.2390 | 38.77 | 2.4067 | 43.65 | 2.5744 | 48.64 | 2.7421 | 53.79 | 2.9098 |
| 34.03 | 2.2421 | 38.86 | 2.4098 | 43.74 | 2.5775 | 48.74 | 2.7452 | 53.89 | 2.9129 |
| 34.12 | 2.2451 | 38.95 | 2.4128 | 43.83 | 2.5805 | 48.83 | 2.7482 | 53.98 | 2.9159 |
| 34.21 | 2.2482 | 39.04 | 2.4159 | 43.92 | 2.5836 | 48.92 | 2.7513 | 54.08 | 2.9190 |
| 34.29 | 2.2512 | 39.13 | 2.4189 | 44.01 | 2.5866 | 49.01 | 2.7543 | 54.17 | 2.9220 |
| 34.38 | 2.2543 | 39.22 | 2.4220 | 44.10 | 2.5897 | 49.11 | 2.7574 | 54.27 | 2.9251 |
| 34.47 | 2.2573 | 39.30 | 2.4250 | 44.19 | 2.5927 | 49.20 | 2.7604 | 54.36 | 2.9281 |
| 34.56 | 2.2604 | 39.39 | 2.4281 | 44.28 | 2.5958 | 49.29 | 2.7635 | 54.46 | 2.9312 |
| 34.64 | 2.2634 | 39.48 | 2.4311 | 44.37 | 2.5988 | 49.38 | 2.7665 | 54.55 | 2.9342 |

**TABLE 1 –** LEAVING CHILLED WATER TEMPERATURE (Cont'd.)

| temp(°F) | Vin | temp(°F) | Vin | temp(°F) | Vin | temp(°F) | Vin | temp(°F) | Vin |
|---|---|---|---|---|---|---|---|---|---|
| 54.65 | 2.9373 | 60.05 | 3.1050 | 65.75 | 3.2727 | 71.83 | 3.4404 | 78.42 | 3.6081 |
| 54.74 | 2.9403 | 60.15 | 3.1080 | 65.85 | 3.2757 | 71.95 | 3.4434 | 78.55 | 3.6111 |
| 54.84 | 2.9403 | 60.25 | 3.1111 | 65.96 | 3.2788 | 72.06 | 3.4465 | 78.67 | 3.6142 |
| 54.93 | 2.9464 | 60.36 | 3.1141 | 66.06 | 3.2818 | 72.18 | 3.4495 | 78.80 | 3.6172 |
| 55.03 | 2.9495 | 60.46 | 3.1172 | 66.17 | 3.2849 | 72.29 | 3.4526 | 78.93 | 3.6203 |
| 55.12 | 2.9525 | 60.56 | 3.1202 | 66.28 | 3.2879 | 72.41 | 3.4556 | 79.05 | 3.6233 |
| 55.22 | 2.9556 | 60.66 | 3.1233 | 66.39 | 3.2910 | 72.52 | 3.4587 | 79.18 | 3.6264 |
| 55.32 | 2.9586 | 60.76 | 3.1263 | 66.49 | 3.2940 | 72.64 | 3.4617 | 79.31 | 3.6294 |
| 55.41 | 2.9617 | 60.86 | 3.1294 | 66.60 | 3.2971 | 72.75 | 3.4648 | 79.44 | 3.6325 |
| 55.51 | 2.9647 | 60.96 | 3.1324 | 66.71 | 3.3001 | 72.87 | 3.4678 | 79.57 | 3.6355 |
| 55.61 | 2.9678 | 61.06 | 3.1355 | 66.82 | 3.3032 | 72.98 | 3.4709 | 79.69 | 3.6386 |
| 55.70 | 2.9708 | 61.17 | 3.1385 | 66.93 | 3.3062 | 73.10 | 3.4739 | 79.82 | 3.6416 |
| 55.80 | 2.9739 | 61.27 | 3.1416 | 67.03 | 3.3093 | 73.21 | 3.4770 | 79.95 | 3.6447 |
| 55.90 | 2.9769 | 61.37 | 3.1446 | 67.14 | 3.3123 | 73.33 | 3.4800 | 80.08 | 3.6477 |
| 56.00 | 2.9800 | 61.47 | 3.1477 | 67.25 | 3.3154 | 73.44 | 3.4831 | 80.20 | 3.6508 |
| 56.09 | 2.9830 | 61.57 | 3.1507 | 67.36 | 3.3184 | 73.56 | 3.4861 | 80.33 | 3.6538 |
| 56.19 | 2.9861 | 61.67 | 3.1538 | 67.47 | 3.3215 | 73.68 | 3.4892 | 80.46 | 3.6569 |
| 56.29 | 2.9891 | 61.78 | 3.1568 | 67.58 | 3.3245 | 73.80 | 3.4922 | 80.59 | 3.6599 |
| 56.39 | 2.9922 | 61.88 | 3.1599 | 67.68 | 3.3276 | 73.92 | 3.4953 | 80.72 | 3.6630 |
| 56.48 | 2.9952 | 61.98 | 3.1629 | 67.79 | 3.3306 | 74.04 | 3.4983 | 80.85 | 3.6660 |
| 56.58 | 2.9983 | 62.08 | 3.1660 | 67.90 | 3.3337 | 74.16 | 3.5014 | 80.98 | 3.6691 |
| 56.68 | 3.0013 | 62.18 | 3.1690 | 68.01 | 3.3367 | 74.28 | 3.5044 | 81.11 | 3.6721 |
| 56.78 | 3.0044 | 62.28 | 3.1721 | 68.12 | 3.3398 | 74.40 | 3.0575 | 81.24 | 3.6752 |
| 56.87 | 3.0074 | 62.39 | 3.1751 | 68.23 | 3.3428 | 74.52 | 3.5105 | 81.37 | 3.6782 |
| 56.97 | 3.0105 | 62.49 | 3.1782 | 68.34 | 3.3459 | 74.64 | 3.5136 | 81.50 | 3.6813 |
| 57.07 | 3.0135 | 62.59 | 3.1812 | 68.45 | 3.3489 | 74.75 | 3.5166 | 81.63 | 3.6843 |
| 57.17 | 3.0166 | 62.69 | 3.1843 | 68.56 | 3.3520 | 74.87 | 3.5197 | 81.76 | 3.6874 |
| 57.26 | 3.0196 | 62.80 | 3.1873 | 68.67 | 3.3520 | 74.99 | 3.5227 | 81.89 | 3.6904 |
| 57.36 | 3.0227 | 62.90 | 3.1904 | 68.78 | 3.3581 | 75.11 | 3.5258 | 82.02 | 3.6935 |
| 57.46 | 3.0257 | 63.01 | 3.1934 | 68.90 | 3.3611 | 75.23 | 3.5288 | 82.15 | 3.6965 |
| 57.56 | 3.0287 | 63.11 | 3.1965 | 69.01 | 3.3642 | 75.35 | 3.5319 | 82.28 | 3.6996 |
| 57.66 | 3.0318 | 63.22 | 3.1995 | 69.12 | 3.3672 | 75.47 | 3.5349 | 82.41 | 3.7026 |
| 57.76 | 3.0348 | 63.32 | 3.2025 | 69.23 | 3.3703 | 75.60 | 3.5380 | | |
| 57.86 | 3.0379 | 63.43 | 3.2056 | 69.34 | 3.3733 | 75.72 | 3.5410 | | |
| 57.96 | 3.0409 | 63.53 | 3.2086 | 69.45 | 3.3763 | 75.84 | 3.5441 | | |
| 58.06 | 3.0440 | 63.63 | 3.2117 | 69.56 | 3.3794 | 75.96 | 3.5471 | | |
| 58.15 | 3.0470 | 63.74 | 3.2147 | 69.67 | 3.3824 | 76.08 | 3.5501 | | |
| 58.25 | 3.0501 | 63.84 | 3.2178 | 69.78 | 3.3855 | 76.20 | 3.5532 | | |
| 58.35 | 3.0531 | 63.95 | 3.2208 | 69.89 | 3.3885 | 76.32 | 3.5562 | | |
| 58.45 | 3.0562 | 64.05 | 3.2239 | 70.01 | 3.3916 | 76.44 | 3.5593 | | |
| 58.55 | 3.0592 | 64.16 | 3.2269 | 70.12 | 3.3946 | 76.57 | 3.5623 | | |
| 58.65 | 3.0623 | 64.26 | 3.2300 | 70.24 | 3.3977 | 76.69 | 3.5654 | | |
| 58.75 | 3.0653 | 64.37 | 3.2330 | 70.35 | 3.4007 | 76.81 | 3.5684 | | |
| 58.85 | 3.0684 | 64.47 | 3.2361 | 70.46 | 3.4038 | 76.93 | 3.5715 | | |
| 58.95 | 3.0714 | 64.58 | 3.2391 | 70.58 | 3.4068 | 77.05 | 3.5745 | | |
| 59.05 | 3.0745 | 64.68 | 3.2422 | 70.69 | 3.4099 | 77.18 | 3.5776 | | |
| 59.15 | 3.0775 | 64.79 | 3.2452 | 70.80 | 3.4129 | 77.30 | 3.5806 | | |
| 59.25 | 3.0806 | 64.90 | 3.2483 | 70.92 | 3.4160 | 77.43 | 3.5837 | | |
| 59.35 | 3.0836 | 65.00 | 3.2513 | 71.03 | 3.4190 | 77.55 | 3.5867 | | |
| 59.45 | 3.0867 | 65.11 | 3..2544 | 71.15 | 3.4221 | 77.68 | 3.5898 | | |
| 59.55 | 3.0897 | 65.21 | 3.2574 | 71.26 | 3.4251 | 77.80 | 3.5928 | | |
| 59.65 | 3.0928 | 65.32 | 3.2605 | 71.37 | 3.4282 | 77.93 | 3.5959 | | |
| 59.75 | 3.0958 | 65.43 | 3.2635 | 71.49 | 3.4312 | 78.05 | 3.5989 | | |
| 59.85 | 3.0989 | 65.53 | 3.2666 | 71.60 | 3.4343 | 78.17 | 3.6020 | | |
| 59.95 | 3.1019 | 65.64 | 3.2696 | 71.72 | 3.4373 | 78.30 | 3.6050 | | |

**TABLE 2 –** ENTERING CHILLED WATER TEMPERATURE

| temp(°F) | Vin | temp(°F) | Vin | temp(°F) | Vin | temp(°F) | Vin |
|---|---|---|---|---|---|---|---|
| 15.01 | 1.5918 | 23.03 | 1.8604 | 30.78 | 2.1289 | 38.51 | 2.3975 |
| 15.16 | 1.5967 | 23.17 | 1.8652 | 30.92 | 2.1338 | 38.65 | 2.4023 |
| 15.31 | 1.6016 | 23.31 | 1.8701 | 31.06 | 2.1387 | 38.79 | 2.4072 |
| 15.46 | 1.6064 | 23.45 | 1.8750 | 31.20 | 2.1436 | 38.93 | 2.4121 |
| 15.61 | 1.6113 | 23.60 | 1.8799 | 31.34 | 2.1484 | 39.07 | 2.4170 |
| 15.76 | 1.6162 | 23.74 | 1.8848 | 31.48 | 2.1533 | 39.21 | 2.4219 |
| 15.91 | 1.6211 | 23.88 | 1.8896 | 31.62 | 2.1582 | 39.35 | 2.4268 |
| 16.05 | 1.6260 | 24.02 | 1.8945 | 31.76 | 2.1631 | 39.50 | 2.4316 |
| 16.20 | 1.6309 | 24.16 | 1.8994 | 31.90 | 2.1680 | 39.64 | 2.4365 |
| 16.35 | 1.6357 | 24.31 | 1.9043 | 32.04 | 2.1729 | 39.78 | 2.4414 |
| 16.50 | 1.6406 | 24.45 | 1.9092 | 32.18 | 2.1777 | 39.92 | 2.4463 |
| 16.64 | 1.6455 | 24.59 | 1.9141 | 32.32 | 2.1826 | 40.06 | 2.4512 |
| 16.79 | 1.6504 | 24.73 | 1.9189 | 32.46 | 2.1875 | 40.20 | 2.4561 |
| 16.94 | 1.6553 | 24.87 | 1.9238 | 32.60 | 2.1924 | 40.34 | 2.4609 |
| 17.09 | 1.6602 | 25.01 | 1.9287 | 32.74 | 2.1973 | 40.48 | 2.4658 |
| 17.23 | 1.6650 | 25.16 | 1.9336 | 32.88 | 2.2021 | 40.62 | 2.4707 |
| 17.38 | 1.6699 | 25.30 | 1.9385 | 33.02 | 2.2070 | 40.76 | 2.4756 |
| 17.53 | 1.6748 | 25.44 | 1.9434 | 33.16 | 2.2119 | 40.91 | 2.4805 |
| 17.68 | 1.6797 | 25.58 | 1.9482 | 33.30 | 2.2168 | 41.05 | 2.4854 |
| 17.82 | 1.6846 | 25.72 | 1.9531 | 33.44 | 2.2217 | 41.19 | 2.4902 |
| 17.97 | 1.6895 | 25.86 | 1.9580 | 33.59 | 2.2266 | 41.33 | 2.4951 |
| 18.11 | 1.6943 | 26.00 | 1.9629 | 33.73 | 2.2314 | 41.48 | 2.5000 |
| 18.26 | 1.6992 | 26.14 | 1.9678 | 33.87 | 2.2363 | 41.62 | 2.5049 |
| 18.41 | 1.7041 | 26.28 | 1.9727 | 34.01 | 2.2412 | 41.76 | 2.5098 |
| 18.55 | 1.7090 | 26.42 | 1.9775 | 34.15 | 2.2461 | 41.90 | 2.5146 |
| 18.70 | 1.7139 | 26.56 | 1.9824 | 34.29 | 2.2510 | 42.05 | 2.5195 |
| 18.84 | 1.7188 | 26.71 | 1.9873 | 34.43 | 2.2559 | 42.19 | 2.5244 |
| 18.99 | 1.7236 | 26.85 | 1.9922 | 34.57 | 2.2607 | 42.33 | 2.5293 |
| 19.13 | 1.7285 | 26.99 | 1.9971 | 34.71 | 2.2656 | 42.48 | 2.5342 |
| 19.28 | 1.7334 | 27.13 | 2.0020 | 34.85 | 2.2705 | 42.62 | 2.5391 |
| 19.43 | 1.7383 | 27.27 | 2.0068 | 34.99 | 2.2754 | 42.76 | 2.5439 |
| 19.57 | 1.7432 | 27.41 | 2.0117 | 35.13 | 2.2803 | 42.90 | 2.5488 |
| 19.71 | 1.7480 | 27.55 | 2.0166 | 35.27 | 2.2852 | 43.05 | 2.5537 |
| 19.86 | 1.7529 | 27.70 | 2.0215 | 35.41 | 2.2900 | 43.19 | 2.5586 |
| 20.00 | 1.7578 | 27.84 | 2.0264 | 35.55 | 2.2949 | 43.33 | 2.5635 |
| 20.15 | 1.7627 | 27.98 | 2.0313 | 35.69 | 2.2998 | 43.48 | 2.5684 |
| 20.29 | 1.7676 | 28.12 | 2.0361 | 35.83 | 2.3047 | 43.62 | 2.5732 |
| 20.44 | 1.7725 | 28.26 | 2.0410 | 35.97 | 2.3096 | 43.76 | 2.5781 |
| 20.58 | 1.7773 | 28.40 | 2.0459 | 36.11 | 2.3145 | 43.91 | 2.5830 |
| 20.73 | 1.7822 | 28.54 | 2.5058 | 36.25 | 2.3193 | 44.05 | 2.5879 |
| 20.87 | 1.7871 | 28.68 | 2.0557 | 36.39 | 2.3242 | 44.19 | 2.5928 |
| 21.01 | 1.7920 | 28.82 | 2.0605 | 36.53 | 2.3291 | 44.34 | 2.5977 |
| 21.16 | 1.7969 | 28.96 | 2.0654 | 36.67 | 2.3340 | 44.48 | 2.6025 |
| 21.30 | 1.8018 | 29.10 | 2.0703 | 36.81 | 2.3389 | 44.62 | 2.6074 |
| 21.45 | 1.8066 | 29.24 | 2.0752 | 36.95 | 2.3438 | 44.77 | 2.6123 |
| 21.59 | 1.8115 | 29.38 | 2.0801 | 37.09 | 2.3486 | 44.91 | 2.6172 |
| 21.73 | 1.8164 | 29.52 | 2.0850 | 37.23 | 2.3535 | 45.06 | 2.6221 |
| 21.88 | 1.8213 | 29.66 | 2.0898 | 37.37 | 2.3584 | 45.20 | 2.6270 |
| 22.02 | 1.8262 | 29.80 | 2.0947 | 37.51 | 2.3633 | 45.35 | 2.6318 |
| 22.17 | 1.8311 | 29.94 | 2.0996 | 37.66 | 2.3682 | 45.49 | 2.6367 |
| 22.31 | 1.8359 | 30.08 | 2.1045 | 37.80 | 2.3730 | 45.64 | 2.6416 |
| 22.45 | 1.8408 | 30.22 | 2.1094 | 37.94 | 2.3779 | 45.79 | 2.6465 |
| 22.60 | 1.8457 | 30.36 | 2.1143 | 38.08 | 2.3828 | 45.93 | 2.6514 |
| 22.74 | 1.8506 | 30.50 | 2.1191 | 38.22 | 2.3877 | 46.08 | 2.6563 |
| 22.88 | 1.8555 | 30.64 | 2.1240 | 38.36 | 2.3926 | 46.22 | 2.6611 |

**TABLE 2 –** ENTERING CHILLED WATER TEMPERATURE (Cont'd.)

| temp(°F) | Vin |
|---|---|
| 46.37 | 2.6660 |
| 46.51 | 2.6709 |
| 46.66 | 2.6758 |
| 46.80 | 2.6807 |
| 46.95 | 2.6855 |
| 47.09 | 2.6904 |
| 47.24 | 2.6953 |
| 47.39 | 2.7002 |
| 47.53 | 2.7051 |
| 47.68 | 2.7100 |
| 47.82 | 2.7148 |
| 47.97 | 2.7197 |
| 48.11 | 2.7246 |
| 48.26 | 2.7295 |
| 48.41 | 2.7344 |
| 48.56 | 2.7393 |
| 48.70 | 2.7441 |
| 48.85 | 2.7490 |
| 49.00 | 2.7539 |
| 49.15 | 2.7588 |
| 49.30 | 2.7637 |
| 49.44 | 2.7686 |
| 49.59 | 2.7734 |
| 49.74 | 2.7783 |
| 49.89 | 2.7832 |
| 50.04 | 2.7881 |
| 50.19 | 2.7930 |
| 50.34 | 2.7979 |
| 50.48 | 2.8027 |
| 50.63 | 2.8076 |
| 50.78 | 2.8125 |
| 50.93 | 2.8174 |
| 51.08 | 2.8223 |
| 51.23 | 2.8271 |
| 51.38 | 2.8320 |
| 51.53 | 2.8369 |
| 51.68 | 2.8418 |
| 51.83 | 2.8467 |
| 51.98 | 2.8516 |
| 52.13 | 2.8564 |
| 52.28 | 2.8613 |
| 52.44 | 2.8662 |
| 52.59 | 2.8711 |
| 52.74 | 2.8760 |
| 52.89 | 2.8809 |
| 53.04 | 2.8857 |
| 53.19 | 2.8906 |
| 53.34 | 2.8955 |
| 53.50 | 2.9004 |
| 53.65 | 2.9053 |
| 53.80 | 2.9102 |
| 53.95 | 2.0150 |
| 54.11 | 2.9199 |
| 54.26 | 2.9248 |
| 54.41 | 2.9297 |

| temp(°F) | Vin |
|---|---|
| 54.56 | 2.9346 |
| 54.72 | 2.9395 |
| 54.87 | 2.9443 |
| 55.02 | 2.9492 |
| 55.17 | 2.9541 |
| 55.33 | 2.9590 |
| 55.48 | 2.9639 |
| 55.64 | 2.9688 |
| 55.79 | 2.9736 |
| 55.95 | 2.9785 |
| 56.11 | 2.9834 |
| 56.26 | 2.9983 |
| 56.42 | 2.9932 |
| 56.57 | 2.9980 |
| 56.73 | 3.0029 |
| 56.89 | 3.0078 |
| 57.04 | 3.0127 |
| 57.20 | 3.0176 |
| 57.36 | 3.0225 |
| 57.51 | 3.0273 |
| 57.67 | 3.0322 |
| 57.83 | 3.0371 |
| 57.99 | 3.0420 |
| 58.15 | 3.0469 |
| 58.31 | 3.0518 |
| 58.47 | 3.0566 |
| 58.62 | 3.0615 |
| 58.78 | 3.0664 |
| 58.94 | 3.0713 |
| 59.10 | 3.0762 |
| 59.26 | 3.0811 |
| 59.42 | 3.0859 |
| 59.59 | 3.0908 |
| 59.75 | 3.0957 |
| 59.91 | 3.1006 |
| 60.07 | 3.1055 |
| 60.23 | 3.1104 |
| 60.39 | 3.1152 |
| 60.55 | 3.1201 |
| 60.72 | 3.1250 |
| 60.88 | 3.1299 |
| 61.04 | 3.1348 |
| 61.20 | 3.1396 |
| 61.37 | 3.1445 |
| 61.53 | 3.1494 |
| 61.69 | 3.1543 |
| 61.85 | 3.1592 |
| 62.02 | 3.1641 |
| 62.18 | 3.1689 |
| 62.34 | 3.1738 |
| 62.51 | 3.1787 |
| 62.67 | 3.1836 |
| 62.84 | 3.1885 |
| 63.01 | 3.1934 |
| 63.17 | 3.1882 |

| temp(°F) | Vin |
|---|---|
| 63.34 | 3.2031 |
| 63.51 | 3.2080 |
| 63.68 | 3.2129 |
| 63.84 | 3.2178 |
| 64.01 | 3.2227 |
| 64.18 | 3.2275 |
| 64.34 | 3.2324 |
| 64.51 | 3.2373 |
| 64.68 | 3.2422 |
| 64.85 | 3.2471 |
| 65.02 | 3.2520 |
| 65.19 | 3.2568 |
| 65.36 | 3.2617 |
| 65.53 | 3.2666 |
| 65.70 | 3.2715 |
| 65.87 | 3.2764 |
| 66.04 | 3.2813 |
| 66.21 | 3.2861 |
| 66.39 | 3.2910 |
| 66.56 | 3.2959 |
| 66.73 | 3.3008 |
| 66.91 | 3.3057 |
| 67.08 | 3.3105 |
| 67.25 | 3.3154 |
| 67.43 | 3.3203 |
| 67.60 | 3.3252 |
| 67.77 | 3.3301 |
| 67.95 | 3.3350 |
| 68.12 | 3.3398 |
| 68.30 | 3.3447 |
| 68.48 | 3.3496 |
| 68.66 | 3.3545 |
| 68.83 | 3.3594 |
| 69.01 | 3.3643 |
| 69.19 | 3.3691 |
| 69.36 | 3.3740 |
| 69.54 | 3.3789 |
| 69.72 | 3.3838 |
| 69.90 | 3.3887 |
| 70.08 | 3.3936 |
| 70.26 | 3.3984 |
| 70.45 | 3.4033 |
| 70.63 | 3.4082 |
| 70.81 | 3.4131 |
| 70.99 | 3.4180 |
| 71.17 | 3.4229 |
| 71.36 | 3.4277 |
| 71.54 | 3.4326 |
| 71.72 | 3.4375 |
| 71.91 | 3.4424 |
| 72.09 | 3.4473 |
| 72.28 | 3.4521 |
| 72.46 | 3.4570 |
| 72.64 | 3.4619 |
| 72.83 | 3.4668 |

| temp(°F) | Vin |
|---|---|
| 73.01 | 3.4717 |
| 73.20 | 3.4766 |
| 73.38 | 3.4814 |
| 73.57 | 3.4863 |
| 73.76 | 3.4912 |
| 73.95 | 3.4961 |
| 74.14 | 3.5010 |
| 74.33 | 3.5059 |
| 74.53 | 3.5107 |
| 74.72 | 3.5156 |
| 74.91 | 3.5205 |
| 75.10 | 3.5254 |
| 75.29 | 3.5303 |
| 75.48 | 3.5352 |
| 75.68 | 3.5400 |
| 75.87 | 3.5449 |
| 76.07 | 3.5498 |
| 76.26 | 3.5547 |
| 76.46 | 3.5596 |
| 76.65 | 3.5645 |
| 76.84 | 3.5693 |
| 77.04 | 3.5742 |
| 77.24 | 3.5791 |
| 77.44 | 3.5840 |
| 77.64 | 3.5889 |
| 77.84 | 3.5938 |
| 78.04 | 3.5986 |
| 78.24 | 3.6035 |
| 78.44 | 3.6084 |
| 78.64 | 3.6133 |
| 78.84 | 3.6182 |
| 79.04 | 3.6230 |
| 79.25 | 3.6279 |
| 79.45 | 3.6328 |
| 79.66 | 3.6377 |
| 79.86 | 3.6426 |
| 80.07 | 3.6475 |
| 80.27 | 3.6523 |
| 80.48 | 3.6572 |
| 80.68 | 3.6621 |
| 80.89 | 3.6670 |
| 81.10 | 3.6719 |
| 81.31 | 3.6768 |
| 81.52 | 3.6816 |
| 81.72 | 3.6865 |
| 81.93 | 3.6914 |
| 82.14 | 3.6963 |
| 82.35 | 3.7012 |
| 82.56 | 3.7061 |

**TABLE 3 –** REFRIGERANT AND MIXED WATER TEMPERATURE

| temp(°F) | Vin |
|---|---|
| 0.02 | 1.3818 |
| 2.45 | 1.4600 |
| 4.82 | 1.5381 |
| 7.14 | 1.6162 |
| 9.43 | 1.6943 |
| 11.68 | 1.7725 |
| 13.91 | 1.8506 |
| 16.11 | 1.9267 |
| 18.30 | 2.0068 |
| 20.48 | 2.0850 |
| 22.66 | 2.1631 |
| 24.83 | 2.2412 |
| 27.00 | 2.3193 |
| 29.18 | 2.3975 |
| 31.37 | 2.4756 |
| 33.58 | 2.5537 |
| 35.81 | 2.6318 |
| 38.06 | 2.7100 |
| 40.34 | 2.7881 |
| 42.66 | 2.8662 |
| 45.01 | 2.9443 |
| 47.42 | 3.0225 |
| 49.88 | 3.1006 |
| 52.40 | 3.1787 |
| 54.98 | 3.2568 |
| 57.65 | 3.3350 |
| 60.42 | 3.4131 |
| 63.27 | 3.4912 |
| 66.23 | 3.5693 |
| 69.34 | 3.6475 |
| 72.59 | 3.7256 |
| 76.02 | 3.8037 |
| 79.64 | 3.8818 |
| 83.48 | 3.9600 |
| 87.61 | 4.0381 |
| 92.05 | 4.1162 |
| 96.89 | 4.1943 |
| 102.22 | 4.2725 |
| 108.14 | 4.3506 |
| 114.81 | 4.4287 |
| 122.54 | 4.5068 |
| 131.66 | 4.5850 |
| 142.84 | 4.6631 |

**TABLE 4 –** ENTERING AND LEAVING CONDENSING WATER

| temp(°F) | Vin | temp(°F) | Vin | temp(°F) | Vin | temp(°F) | Vin |
|---|---|---|---|---|---|---|---|
| 40.12 | 1.8408 | 48.39 | 2.1094 | 56.61 | 2.3779 | 64.98 | 2.6465 |
| 40.27 | 1.8457 | 48.54 | 2.1143 | 56.76 | 2.3828 | 65.14 | 2.6514 |
| 40.42 | 1.8506 | 48.69 | 2.1191 | 56.91 | 2.3877 | 65.29 | 2.6563 |
| 40.58 | 1.8555 | 48.84 | 2.1240 | 57.06 | 2.3926 | 65.45 | 2.6611 |
| 40.73 | 1.8604 | 48.99 | 2.1289 | 57.21 | 2.3975 | 65.60 | 2.6660 |
| 40.88 | 1.8652 | 49.14 | 2.1338 | 57.36 | 2.4023 | 65.76 | 2.6709 |
| 41.03 | 1.8701 | 49.29 | 2.1387 | 57.51 | 2.4072 | 65.91 | 2.6758 |
| 41.18 | 1.8750 | 49.44 | 2.1436 | 57.66 | 2.4121 | 66.07 | 2.6807 |
| 41.33 | 1.8799 | 49.59 | 2.1484 | 57.81 | 2.4170 | 66.22 | 2.6855 |
| 41.48 | 1.8848 | 49.74 | 2.1533 | 57.97 | 2.4219 | 66.38 | 2.6904 |
| 41.64 | 1.8896 | 49.89 | 2.1582 | 58.12 | 2.4268 | 66.54 | 2.6953 |
| 41.79 | 1.8945 | 50.03 | 2.1631 | 58.27 | 2.4316 | 66.69 | 2.7002 |
| 41.94 | 1.8994 | 50.18 | 2.1680 | 58.42 | 2.4365 | 66.85 | 2.7051 |
| 42.09 | 1.9043 | 50.33 | 2.1729 | 58.57 | 2.4414 | 66.00 | 2.7100 |
| 42.24 | 1.9092 | 50.48 | 2.1777 | 58.72 | 2.4463 | 67.16 | 2.7148 |
| 42.39 | 1.9141 | 50.63 | 2.1826 | 58.87 | 2.4512 | 67.32 | 2.7197 |
| 42.54 | 1.9189 | 50.78 | 2.1875 | 59.02 | 2.4561 | 67.47 | 2.7246 |
| 42.70 | 1.9238 | 50.93 | 2.1924 | 59.17 | 2.4609 | 67.63 | 2.7295 |
| 42.85 | 1.9287 | 51.08 | 2.1973 | 59.33 | 2.4658 | 67.78 | 2.7344 |
| 43.00 | 1.9336 | 51.23 | 2.2021 | 59.48 | 2.4707 | 67.94 | 2.7393 |
| 43.15 | 1.9385 | 51.38 | 2.2070 | 59.63 | 2.4756 | 68.10 | 2.7441 |
| 43.30 | 1.9434 | 51.53 | 2.2119 | 59.78 | 2.4805 | 68.26 | 2.7490 |
| 43.45 | 1.9482 | 51.68 | 2.1268 | 59.93 | 2.4854 | 68.41 | 2.7539 |
| 43.60 | 1.9531 | 51.83 | 2.2217 | 60.09 | 2.4902 | 68.57 | 2.7588 |
| 43.75 | 1.9580 | 51.97 | 2.2266 | 60.24 | 2.4951 | 68.73 | 2.7637 |
| 43.90 | 1.9629 | 52.12 | 2.2314 | 60.39 | 2.5000 | 68.89 | 2.7686 |
| 44.05 | 1.9678 | 52.27 | 2.2363 | 60.54 | 2.5049 | 69.05 | 2.7734 |
| 44.20 | 1.9727 | 52.42 | 2.2412 | 60.69 | 2.5098 | 69.21 | 2.7783 |
| 44.35 | 1.9775 | 52.57 | 2.2461 | 60.85 | 2.5146 | 69.36 | 2.7832 |
| 44.50 | 1.9824 | 52.72 | 2.2510 | 61.00 | 2.5195 | 69.52 | 2.7881 |
| 44.65 | 1.9873 | 52.87 | 2.2559 | 61.15 | 2.5244 | 69.68 | 2.7930 |
| 44.80 | 1.9922 | 53.02 | 2.2607 | 61.30 | 2.5293 | 69.84 | 2.7979 |
| 44.95 | 1.9971 | 53.17 | 2.2656 | 61.45 | 2.5342 | 70.00 | 2.8027 |
| 45.10 | 2.0020 | 53.32 | 2.2705 | 61.61 | 2.5391 | 70.16 | 2.8076 |
| 45.25 | 2.0068 | 53.47 | 2.2754 | 61.76 | 2.5439 | 70.32 | 2.8125 |
| 45.40 | 2.0117 | 53.62 | 2.2803 | 61.91 | 2.5488 | 70.48 | 2.8174 |
| 45.55 | 2.0166 | 53.77 | 2.2852 | 62.06 | 2.5537 | 70.64 | 2.8223 |
| 45.70 | 2.0215 | 53.92 | 2.2900 | 62.21 | 2.5586 | 70.80 | 2.8271 |
| 45.85 | 2.0264 | 54.07 | 2.2949 | 62.36 | 2.5635 | 70.96 | 2.8320 |
| 46.00 | 2.0313 | 54.21 | 2.2998 | 62.52 | 2.5684 | 71.12 | 2.8369 |
| 46.15 | 2.0361 | 54.36 | 2.3047 | 62.67 | 2.5732 | 71.28 | 2.8418 |
| 46.30 | 2.0410 | 54.51 | 2.3096 | 62.82 | 2.5781 | 71.44 | 2.8467 |
| 46.45 | 2.0459 | 54.66 | 2.3145 | 62.98 | 2.5830 | 71.61 | 2.8516 |
| 46.60 | 2.0508 | 54.81 | 2.3193 | 63.13 | 2.5879 | 71.77 | 2.8564 |
| 46.75 | 2.0557 | 54.96 | 2.3242 | 63.29 | 2.5928 | 71.93 | 2.8613 |
| 46.90 | 2.0605 | 55.11 | 2.3291 | 63.44 | 2.5977 | 72.09 | 2.8662 |
| 47.05 | 2.0654 | 55.26 | 2.3340 | 63.59 | 2.6025 | 72.25 | 2.8711 |
| 47.20 | 2.0703 | 55.41 | 2.3389 | 63.75 | 2.6074 | 72.41 | 2.8760 |
| 47.35 | 2.0752 | 55.56 | 2.3438 | 63.90 | 2.6123 | 72.57 | 2.8809 |
| 47.50 | 2.0801 | 55.71 | 2.3486 | 64.06 | 2.6172 | 72.73 | 2.8857 |
| 47.65 | 2.0850 | 55.86 | 2.3535 | 64.21 | 2.6221 | 72.89 | 2.8906 |
| 47.79 | 2.0898 | 56.01 | 2.3584 | 64.36 | 2.6270 | 73.05 | 2.8955 |
| 47.94 | 2.0947 | 56.16 | 2.3633 | 64.52 | 2.6318 | 73.22 | 2.9004 |
| 48.09 | 2.0996 | 56.31 | 2.3682 | 64.52 | 2.6367 | 73.38 | 2.9053 |
| 48.24 | 2.1045 | 56.46 | 2.3730 | 64.83 | 2.6416 | 73.54 | 2.9102 |

**TABLE 4 –** ENTERING AND LEAVING CONDENSING WATER (Cont'd.)

| temp(°F) | Vin |
|---|---|
| 73.71 | 2.9150 |
| 73.87 | 2.9199 |
| 74.04 | 2.9248 |
| 74.20 | 2.9297 |
| 74.37 | 2.9346 |
| 74.53 | 2.9395 |
| 74.70 | 2.9443 |
| 74.86 | 2.9492 |
| 75.03 | 2.9541 |
| 75.19 | 2.9590 |
| 75.36 | 2.9639 |
| 75.52 | 2.9688 |
| 75.69 | 2.9736 |
| 75.85 | 2.9785 |
| 76.02 | 2.9834 |
| 76.19 | 2.9883 |
| 76.35 | 2.9932 |
| 76.52 | 2.9980 |
| 76.69 | 3.0029 |
| 76.85 | 3.0078 |
| 77.02 | 3.0127 |
| 77.19 | 3.0176 |
| 77.36 | 3.0225 |
| 77.53 | 3.0273 |
| 77.70 | 3.0322 |
| 77.86 | 3.0371 |
| 78.03 | 3.0420 |
| 78.20 | 3.0469 |
| 78.37 | 3.0518 |
| 78.54 | 3.0566 |
| 78.71 | 3.0615 |
| 78.88 | 3.0664 |
| 79.05 | 3.0713 |
| 79.22 | 3.0713 |
| 79.40 | 3.0811 |
| 79.57 | 3.0859 |
| 79.74 | 3.0908 |
| 79.91 | 3.0957 |
| 80.08 | 3.1006 |
| 80.26 | 3.1055 |
| 80.43 | 3.1104 |
| 80.60 | 3.1152 |
| 80.77 | 3.1201 |
| 80.95 | 3.1250 |
| 81.12 | 3.1299 |
| 81.29 | 3.1348 |
| 81.47 | 3.1396 |
| 81.64 | 3.1445 |
| 81.81 | 3.1494 |
| 81.99 | 3.1543 |
| 82.16 | 3.1592 |
| 82.33 | 3.1641 |
| 82.51 | 3.1689 |
| 82.69 | 3.1738 |
| 82.86 | 3.1787 |
| 83.04 | 3.1836 |
| 83.22 | 3.1885 |
| 83.39 | 3.1934 |
| 83.57 | 3.1982 |
| 83.75 | 3.2031 |
| 83.93 | 3.2080 |
| 84.10 | 3.2129 |
| 84.28 | 3.2178 |
| 84.46 | 3.2227 |
| 84.65 | 3.2275 |
| 84.83 | 3.2324 |
| 85.01 | 3.2373 |
| 85.19 | 3.2422 |
| 85.37 | 3.2471 |
| 85.55 | 3.2520 |
| 85.73 | 3.2568 |
| 85.92 | 3.2617 |
| 86.10 | 3.2666 |
| 86.28 | 3.2715 |
| 86.47 | 3.2764 |
| 86.65 | 3.2813 |
| 86.84 | 3.2861 |
| 87.02 | 3.2910 |
| 87.21 | 3.2959 |
| 87.39 | 3.3008 |
| 87.58 | 3.3057 |
| 87.76 | 3.3105 |
| 87.95 | 3.3154 |
| 88.13 | 3.3203 |
| 88.32 | 3.3252 |
| 88.51 | 3.3301 |
| 88.70 | 3.3350 |
| 88.88 | 3.3398 |
| 89.07 | 3.3447 |
| 89.26 | 3.3496 |
| 89.44 | 3.3545 |
| 89.63 | 3.3594 |
| 89.82 | 3.3643 |
| 90.01 | 3.3691 |
| 90.20 | 3.3740 |
| 90.39 | 3.3789 |
| 90.59 | 3.3838 |
| 90.78 | 3.3887 |
| 90.97 | 3.3936 |
| 91.16 | 3.3984 |
| 91.35 | 3.4033 |
| 91.54 | 3.4082 |
| 91.74 | 3.4131 |
| 91.93 | 3.4180 |
| 92.13 | 3.4229 |
| 92.32 | 3.4277 |
| 92.52 | 3.4326 |
| 92.72 | 3.4375 |
| 92.91 | 3.4424 |
| 93.11 | 3.4473 |
| 93.31 | 3.4521 |
| 93.51 | 3.4570 |
| 93.70 | 3.4619 |
| 93.90 | 3.4668 |
| 94.10 | 3.4717 |
| 94.30 | 3.4766 |
| 94.50 | 3.4814 |
| 94.70 | 3.4863 |
| 94.90 | 3.4912 |
| 95.11 | 3.4961 |
| 95.31 | 3.5010 |
| 95.52 | 3.5059 |
| 95.72 | 3.5107 |
| 95.93 | 3.5156 |
| 96.13 | 3.5205 |
| 96.34 | 3.5254 |
| 96.54 | 3.5303 |
| 96.75 | 3.5352 |
| 96.96 | 3.5400 |
| 97.17 | 3.5449 |
| 97.38 | 3.5498 |
| 97.59 | 3.5547 |
| 97.80 | 3.5596 |
| 98.01 | 3.5645 |
| 98.22 | 3.5693 |
| 98.43 | 3.5742 |
| 98.64 | 3.5791 |
| 98.86 | 3.5840 |
| 99.07 | 3.5889 |
| 99.29 | 3.5938 |
| 99.50 | 3.5986 |
| 99.71 | 3.6035 |
| 99.93 | 3.6084 |
| 100.14 | 3.6133 |
| 100.36 | 3.6182 |
| 100.58 | 3.6230 |
| 100.79 | 3.6279 |
| 101.01 | 3.6328 |
| 101.23 | 3.6377 |
| 101.45 | 3.6426 |
| 101.67 | 3.6475 |
| 101.89 | 3.6523 |
| 102.11 | 3.6572 |
| 102.33 | 3.6621 |
| 102.55 | 3.6670 |
| 102.78 | 3.6719 |
| 103.00 | 3.6768 |
| 103.22 | 3.6816 |
| 103.45 | 3.6865 |
| 103.67 | 3.6914 |
| 103.89 | 3.6963 |
| 104.12 | 3.7012 |
| 104.35 | 3.7061 |
| 104.58 | 3.7109 |
| 104.81 | 3.7158 |
| 105.04 | 3.7207 |
| 105.27 | 3.7256 |
| 105.50 | 3.7305 |
| 105.73 | 3.7354 |
| 105.96 | 3.7402 |
| 106.20 | 3.7451 |
| 106.44 | 3.7500 |
| 106.67 | 3.7549 |
| 106.91 | 3.7598 |
| 107.14 | 3.7646 |
| 107.38 | 3.7695 |
| 107.62 | 3.7744 |
| 107.86 | 3.7793 |
| 108.11 | 3.7842 |
| 108.35 | 3.7891 |
| 108.59 | 3.7939 |
| 108.84 | 3.7988 |
| 109.08 | 3.8037 |
| 109.32 | 3.8086 |
| 109.57 | 3.8135 |
| 109.82 | 3.8184 |
| 110.06 | 3.8232 |
| 110.31 | 3.8281 |
| 110.56 | 3.8330 |
| 110.81 | 3.8379 |
| 111.05 | 3.8328 |
| 111.31 | 3.8477 |
| 111.36 | 3.8525 |
| 111.82 | 3.8574 |
| 112.08 | 3.8623 |
| 112.34 | 3.8672 |
| 112.59 | 3.8721 |
| 112.85 | 3.8770 |
| 113.11 | 3.8818 |
| 113.37 | 3.8867 |
| 113.63 | 3.8916 |
| 113.88 | 3.8965 |
| 114.14 | 3.9014 |

**TABLE 5 –** FIRST-STAGE GENERATOR TEMP.

| temp(°F) | Vin |
|---|---|
| 119.26 | 0.5322 |
| 133.22 | 0.6885 |
| 145.23 | 0.8447 |
| 155.88 | 1.0010 |
| 165.72 | 1.1572 |
| 174.89 | 1.3135 |
| 183.61 | 1.4697 |
| 192.01 | 1.6260 |
| 200.16 | 1.7822 |
| 208.24 | 1.9385 |
| 216.25 | 2.0947 |
| 224.20 | 2.2510 |
| 232.35 | 2.4072 |
| 240.56 | 2.5635 |
| 249.03 | 2.7197 |
| 257.86 | 2.8760 |
| 267.04 | 3.0322 |
| 276.65 | 3.1885 |
| 286.90 | 3.3447 |
| 297.83 | 3.5010 |
| 310.07 | 3.6572 |
| 323.52 | 3.8135 |
| 338.75 | 3.9697 |
| 350.05 | 4.0723 |

**TABLE 6 –** LEAVING & ENTERING HOT WATER & SECOND-STAGE GEN. LEAVING REFRIGERANT TEMP

| temp(°F) | Vin |
|---|---|
| 90.00 | 1.1133 |
| 93.77 | 1.1914 |
| 97.43 | 1.2695 |
| 100.97 | 1.3477 |
| 104.42 | 1.4258 |
| 107.80 | 1.5039 |
| 111.12 | 1.5820 |
| 114.37 | 1.6602 |
| 117.61 | 1.7383 |
| 120.80 | 1.8164 |
| 123.95 | 1.8945 |
| 127.10 | 1.9727 |
| 130.24 | 2.0508 |
| 133.37 | 2.1289 |
| 136.50 | 2.2070 |
| 139.64 | 2.2852 |
| 142.80 | 2.3633 |
| 145.97 | 2.4414 |
| 149.17 | 2.5195 |
| 152.40 | 2.5977 |
| 155.70 | 2.6758 |
| 159.01 | 2.7539 |
| 162.39 | 2.8320 |
| 165.83 | 2.9102 |
| 169.34 | 2.9883 |
| 172.96 | 3.0664 |
| 176.65 | 3.1445 |
| 180.47 | 3.2227 |
| 184.40 | 3.3008 |
| 188.45 | 3.3789 |
| 192.69 | 3.4570 |
| 197.09 | 3.5352 |
| 201.70 | 3.6133 |
| 206.52 | 3.6914 |
| 210.32 | 3.7500 |
| 211.62 | 3.7695 |

**TABLE 7 –** SOLUTION TEMPS

| temp(°F) | Vin |
|---|---|
| 90.24 | 0.2930 |
| 110.58 | 0.4492 |
| 126.12 | 0.6055 |
| 139.04 | 0.7617 |
| 150.36 | 0.9180 |
| 160.60 | 1.0742 |
| 170.08 | 1.2305 |
| 179.08 | 1.3867 |
| 187.58 | 1.5430 |
| 195.87 | 1.6992 |
| 203.98 | 1.8555 |
| 212.00 | 2.0117 |
| 220.00 | 2.1680 |
| 228.04 | 2.3242 |
| 236.16 | 2.4805 |
| 244.49 | 2.6367 |
| 253.12 | 2.7930 |
| 262.11 | 2.9492 |
| 271.48 | 3.1055 |
| 281.37 | 3.2617 |
| 291.98 | 3.4180 |
| 303.47 | 3.5742 |
| 316.18 | 3.7305 |
| 330.40 | 3.8867 |
| 346.73 | 4.0430 |

**TABLE 8 –** BURNER LOAD COMMANDS

**COOLING ONLY** MODE or **COOLING AND HEATING** MODE

ERROR = Leaving Chilled Water Temp – Leaving Water Temp Setpoint

| ERROR | BURNER LOAD COMMAND |
|---|---|
| 0°F | Mid-Fire Load Command = 65% |
| ≥ +2.5°F | High-Fire Load Command = 100% |
| ≤ –2.5°F | Low-Fire Load Command = 30% |
| +0.2 to +2.5°F | Output goes to a firing rate proportional to the error and then proceeds to Full-Fire at a rate determined by the programmed **AUTO TEMP CONTROL RESET TIME** setpoint (1 to 20 minutes). Refer to “Special Programming Features” section. |
| –0.2 to –2.5°F | Output goes to a firing rate proportional to the error and then proceeds to Low-Fire at a rate determined by the programmed **AUTO TEMP CONTROL RESET TIME** setpoint (1 to 20 minutes). Refer to “Special Programming Features” section. |

**HEATING ONLY** MODE

ERROR = Leaving Hot Water Temp – Leaving Water Temp Setpoint

| ERROR | BURNER LOAD COMMAND |
|---|---|
| 0°F | Mid-Fire Load Command = 65% |
| ≥ +2.5°F | Low-Fire Load Command = 30% |
| ≤ –2.5°F | High-Fire Load Command = 100% |
| +0.2 to +2.5°F | Output goes to a firing rate proportional to the error and then proceeds to Low-Fire at a rate determined by the programmed **AUTO TEMP CONTROL RESET TIME** setpoint (1 to 20 minutes). Refer to “Special Programming Features” section. |
| –0.2 to –2.5°F | Output goes to a firing rate proportional to the error and then proceeds to High-Fire at a rate determined by the programmed **AUTO TEMP CONTROL RESET TIME** setpoint (1 to 20 minutes). Refer to “Special Programming Features” section. |

# STEAM VALVE CONTROL

## GENERAL

Early vintage units are equipped with Honeywell steam valves. Later vintage units that are equipped with EPROM version A.01F.08 (or later) could use either Honeywell or Leslie steam valves. The Honeywell valves are operated by 115VAC Pulse Width Modulated (PWM) signals from triacs located on the Relay Board. The Leslie valves are operated from a 4-20mA signal from the I/O Expansion Board. Program jumper JP2, on the I/O Expansion Board, must be removed to enable the 4-20mA output control.

During unit run, the steam valve is modulated under Program Control to control the Leaving Chilled Water Temperature (LCWT) to the **LEAVING CHILLED WATER TEMP** setpoint. It is modulated between 20% of unit capacity and 100% valve position. The valve position that corresponds to 20% of unit capacity is determined by a procedure contained in YORK Form 155.17-NM1. With Honeywell valves, a limit switch opens to prevent the valve from decreasing to less than 20% of unit capacity. With Leslie valves, a programmable setpoint, MINIMUM ALLOWED LOADING, is programmed to a valve position between 5% to 60% that corresponds to 20% of unit capacity. The Leslie valve will not be allowed to close to a position less than the programmed value (however, the **UNLOAD** key can be used in **SERVICE** mode to manually drive the valve below this position). In either case, the steam valve position is its physical position with respect to fully closed to fully open. Its position is 0% when fully closed and 100% when fully open. With Honeywell valves, there is a position feedback potentiometer interfaced to the I/O Expansion Board that provides the valve position to the Micro Board. The 0% and 100% points are established with the "Steam Valve Potentiometer Calibration" procedure in this book. With Leslie valves, there is no position feedback potentiometer; the valve will be fully closed when the control output is 4mA and fully open when the output is 20mA.

The program monitors a). The error between the LCWT and the setpoint and b.) The rate of change of the LCWT within each SAMPLE PERIOD. While the unit is running, the duration of the run is divided into a continuous series of SAMPLE PERIODS. Each time the unit is started, when the unit enters **SYSTEM RUN**, the first SAMPLE PERIOD begins. When the first SAMPLE PERIOD ends, the next SAMPLE PERIOD begins, etc. This continues until the unit is shut down. Each time the unit is started (or the **AUTO** key is pressed in **SERVICE** mode), the sample period is 1 minute in duration until the steam valve position is greater than or equal to 50% or the LCWT is within 5°F of the setpoint. After this, the duration of each SAMPLE PERIOD is determined by the setpoint **SAMPLE FACTOR**. It is programmable over the range of 0.5 to 16 minutes. At the end of each sample period, the program responds with an output that contains a rate component and a proportion component. It will be in the form of **LOAD, UNLOAD** or **HOLD** output, as appropriate, to the steam valve actuator. The actual output is determined by the magnitude of error between the LCWT and the LCWT setpoint (proportion), and the amount of change (RATE) and direction of change of the LCWT within the SAMPLE PERIOD. If the LCWT falls to 3°F below setpoint or <40°F, the unit shuts down and displays DAY-TIME-LOW WATER TEMP-AUTOSTART.

The RATE component of the output is applied in response to the LCWT'S rate and direction of change (toward or away from setpoint) within the SAMPLE PERIOD. The amount of rate response is determined by the relationship of the rate of change (amount of LCWT change in the SAMPLE PERIOD) to the programmed **RATE LIMIT** setpoint. The closer the rate of change value is to the programmed **RATE LIMIT** setpoint, the greater the rate component in the output. The actual Rate Limit value programmed will be a function of conditions at the job site; such as length of chilled water loop, number of chillers, multiple chiller configuration (series or parallel), primary/secondary chilled water loop, etc. Short chilled water loops generally cause the LCWT rate of change to be greater. The greater the rate of change, the greater the tendency to overshoot or undershoot the setpoint. At unit commissioning, the service technician must evaluate the local conditions and refine the **RATE LIMIT** setpoint.

Typically, load and unload output requirements are balanced; the unit is required to load and unload at the same rate. However, in some applications, the unit will have a tendency to overshoot the LCWT setpoint and shutdown on "DAY-TIME-LOW WATER TEMP-AUTO-START". Short chilled water loops, series/parallel chillers, light load conditions and applications where loads are shed rapidly are typical causes of setpoint overshoot. These applications require a greater unload output than would usually be allowed under the same conditions. To accomodate these applications, setpoints **UNLOAD PULSE** (Honeywell valves) or **UNLOAD FACTOR** (Leslie valves) can be programmed to provide faster unloading. Refer to detailed description below.

Leslie valves have an additional setpoint, **DAC DIVIDE VALUE** that can be used to decrease the magnitude of the load and unload output that occurs at the end of the SAMPLE PERIOD when the LCWT is within 5°F of the setpoint. These smaller changes in output prevent

large excursions of the LCWT when the unit operates continuously under light load conditions. Refer to detailed description below.

The following is a description of the steam valve programmable setpoints. Refer to "Special Setpoints and Programming Procedures" section of this book for programming instructions.

### RATE LIMIT

**RATE LIMIT** is a field programmable setpoint that determines the Control Center's sensitivity/response to the rate of change of the Leaving Chilled Water Temperature (LCWT) within a SAMPLE PERIOD. The RATE OF CHANGE is defined as the amount of change in the LCWT within a SAMPLE PERIOD. The RATE OF CHANGE is calculated over each SAMPLE PERIOD of unit operating time and at the end of the SAMPLE PERIOD, the RATE OF CHANGE is compared to the **RATE LIMIT** setpoint. The closer the RATE OF CHANGE is to the **RATE LIMIT** setpoint, the greater the effect RATE OF CHANGE has on the output that occurs at the end of the SAMPLE PERIOD. If the RATE OF CHANGE equals or exceeds RATE LIMIT setpoint, there would be a maximum rate response. Therefore, rate sensitivity increases as the programmed **RATE LIMIT** setpoint is decreased. The **RATE LIMIT** setpoint is programmable over the range of 0.3 to 2.0°F in 0.1 increments. The default value is 1.0°F.

To illustrate, if the **RATE LIMIT** setpoint is programmed for 1.0°F and the LCWT increased 0.9°F in the SAMPLE PERIOD, there would be a greater rate response than if the LCWT had increased 0.5°F in the same period. In most applications, the default value (1.0°F) will provide proper operation. Programming a value less than 1.0 could tend to cause excessive steam valve movement resulting in excessive steam pressure fluctuation in certain installations.

In detecting the RATE OF CHANGE, the Control Center anticipates where the LCWT is going and responds accordingly to prevent setpoint overshoot. For example, if the LCWT is <5°F above setpoint and decreasing, an **UNLOAD** output would occur at the end of the SAMPLE PERIOD, even though the LCWT is above setpoint.

The response to RATE OF CHANGE is somewhat different if the LCWT is >5°F above the LCWT setpoint. This prevents the non-linear pulldown characteristics inherent in all absorption units from overshooting the LCWT setpoint. For example, if the LCWT decreases less than the **RATE LIMIT** setpoint within a SAMPLE PERIOD, there would be a **LOAD** output up to the maximum allowed. However, if the LCWT decreases greater than the **RATE LIMIT** setpoint within the SAMPLE PERIOD, there would be no **LOAD** output.

### **UNLOAD PULSE** (Honeywell valves only)

UNLOAD PULSE is a field programmable setpoint that determines the maximum allowed PWM pulse duration of the **UNLOAD** output for Honeywell valves. The maximum allowed duration of the **UNLOAD** output is programmable over the range of 6 to 12 seconds, in 1 second increments. The default value is 6.

Since the maximum allowed **LOAD** pulse is 6 seconds, programming this value to 6, would make the unit **LOAD** and **UNLOAD** at the same rate. In most applications, this will provide proper operation. However, if this value is programmed to "9", the maximum allowed **UNLOAD** pulse would be 9 seconds in duration, and this would cause the unit to unload at a faster rate. This can be helpful for applications where loads are shed rapidly.

### **UNLOAD FACTOR** (Leslie valves only)

UNLOAD FACTOR is a field programmable setpoint that can be used to make the unit unload at a faster rate. The programmed value is the multiplier for the **UNLOAD** output that occurs at the end of a SAMPLE PERIOD, when the program calls for unloading the steam valve. It is programmable from 1.0 to 2.0 in 0.1 increments. The default value is 1.0. At the end of a SAMPLE PERIOD, if the program determines that it is necessary to unload the steam valve, the decrease in the 4-20mA output that would normally occur, is multiplied by the programmed value. For example, if the program determines that the output should decrease 2.0mA, and the UNLOAD FACTOR is 1.5, then the output would decrease 3.0mA (i.e., 2.0 x 1.5 = 3.0). The greater the number programmed, the faster the steam valve will unload. This can be helpful for short water loops, continuous light load conditions and applications where loads are shed rapidly. However, default value 1.0 should provide proper operation in most installations.

### SAMPLE FACTOR

SAMPLE FACTOR is a field programmable setpoint that determines the duration of the SAMPLE PERIODS that occur after the initial 1 minute criteria is satisfied. Each time the unit is started, the duration of each SAMPLE PERIOD is 1 minute until the steam valve position is $\geq$ 50% or the Leaving Chilled Water Temperature (LCWT) is within 5°F of the LCWT setpoint. After that, the duration of the SAMPLE PERIODS will be whatever is programmed as SAMPLE FACTOR. It is programmable over the range of 0.5 to 16 minutes,

in 0.1 minute increments. The default value is 4.0 minutes.

While the unit is running, the duration of the operating time is divided into a continuous series of SAMPLE PERIODS. Each time the unit is started, when the unit enters **SYSTEM RUN**, the first SAMPLE PERIOD begins. When the first SAMPLE PERIOD ends, the next one begins, etc. This continues until the unit is shut down. The output is allowed to change only at the end of each SAMPLE PERIOD. For example, if 2.0 is programmed, each time the unit is started, the SAMPLE PERIODS will be 1 minute in duration until the steam valve reaches 50% position or the LCWT is within 5°F of the LCWT setpoint; the SAMPLE PERIODS will be 2 minutes in duration thereafter. The default value 4.0 should provide proper operation in most applications. However, applications with extremely short or long chilled water loops or with irregular load changes, could require the SAMPLE PERIOD to be longer or shorter.

### **DAC DIVIDE VALUE** (Leslie valves only)

DAC DIVIDE VALUE is a field programmable setpoint that can be used to decrease the magnitude of the **LOAD** and **UNLOAD** outputs. It can be programmed for 1, 2, 4 or 8. The default value is 1. After the Leaving Chilled Water Temp (LCWT) gets within 5°F of the LCWT setpoint, if a change in the 4-20mA output is called for at the end of a SAMPLE PERIOD, that change will be divided by the programmed DAC DIVIDE VALUE. For example, if the output is required to increase 2.5mA at the end of a SAMPLE PERIOD, and the programmed DAC DIVIDE VALUE is 4, the output would increase 0.6mA (2.5/4 = 0.6). The default value 1 should provide proper operation in most applications. However, this value can be adjusted to provide smaller changes in the output when the unit operates under conditions such as continuous light load.

### **MINIMUM ALLOWED LOADING** (Leslie valves only)

Refer to **MINIMUM ALLOWED LOADING** setpoint description in "Special Setpoints and Programming Procedures" section of this book.

### **SUMMARY OF STEAM VALVE OPERATION**

The following are the expected steam valve PULSE WIDTH MODULATED steam valve outputs for the listed Leaving Chilled Water Temperature (LCWT) errors from LCWT setpoint for Honeywell steam valves. Operation is similar for Leslie steam valves except they are controlled by a 4-20mA signal instead of PULSE WIDTH MODULATED signals.

| ERROR | OUTPUT |
|---|---|
| >+5°F | If LCWT decreases < RATE LIMIT in sample period, Load Pulse is < 6 seconds. The actual duration is determined by the relationship of the rate of change to the RATE LIMIT (*The closer the relationship, the shorter the pulse*). If LCWT decreased > RATE LIMIT in sample period, there is no load or unload pulse. Otherwise, if zero rate of change, output is 6 second Load Pulse. |
| <+5°F | If the LCWT increases in SAMPLE PERIOD, output is a Load Pulse up to 6 seconds. The actual duration is determined by the magnitude of error and the relationship of rate of change to the RATE LIMIT (*The greater the error and closer the relationship of rate of change to "RATE LIMIT", the longer the pulse*). If the LCWT decreases > the RATE LIMIT in the SAMPLE PERIOD, the output is an Unload Pulse up to the Maximum Allowed Duration. The Actual Pulse width is determined by the magnitude of error in conjunction with the rate of change. If the LCWT decreases < the RATE LIMIT in the SAMPLE PERIOD, the output is a **LOAD** (<6 seconds) or **UNLOAD** (UP TO MAXIMUM ALLOWED DURATION) Pulse determined by the magnitude of error and relationship of rate of change to RATE LIMIT. Otherwise, output is <6 second Load Pulse proportional to error. |
| >–3°F* | (OR <40°F). The output is a continuous Unload Signal. Unit shuts down and displays DAY-TIME-LOW WATER TEMP. |
| <–3°F | If the LCWT decreases in the SAMPLE PERIOD, output is an Unload Pulse up to the maximum allowed duration. The Actual Duration is determined by the magnitude of error and the relationship of rate of change to RATE LIMIT (*The greater the error and the closer the relationship of the rate of change to the "RATE LIMIT", the longer the pulse*). If the LCWT increases in the SAMPLE PERIOD, the output is a **LOAD** (UP TO 6 SECONDS) or **UNLOAD** (UP TO MAXIMUM ALLOWED DURATION) Pulse. Greater errors tend to produce Unload Pulses; lesser errors tend to produce Load Pulses. The Actual Pulse Width is determined by the magnitude of error and the relationship of the rate of change to the RATE LIMIT (*The greater the error and the closer the relationship of rate of change to "RATE LIMIT", the longer the pulse*). Otherwise, for zero rate of change the output is < 6 second Unload Pulse proportional to error. |

* If the setpoint is increased while the unit is running, the Low Water Temp Threshold is the previous threshold for 30 minutes.

# DISPLAY

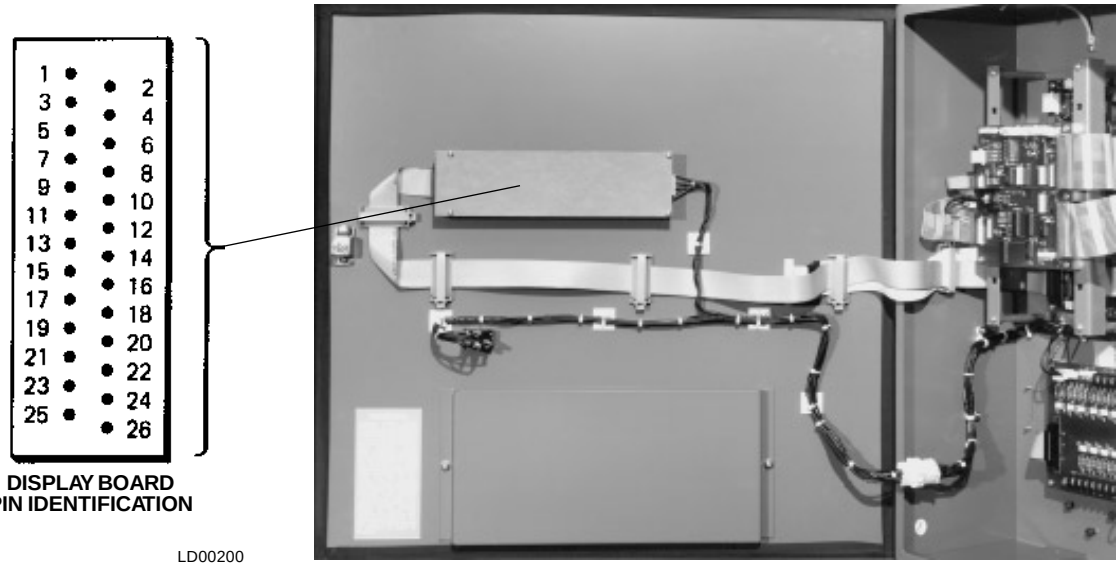



**FIG. 31 –** CONTROL CENTER DISPLAY BOARD

## DISPLAY (Refer to Fig. 31 & 32)

The Control Center Display P/N 031-00775-001 (Babcock VF-140-02 or -025 or IEE 33383-01 or -02) is a 40 character vacuum fluorescent dot matrix display. It receives a parallel 8-bit ASCII alphanumeric word from the Micro Board. Each 8-bit word represents a character.

When the Micro Board writes to the display, it provides the 8-bit word along with a **WR** pulse and the **DP** (chip select pulse). The Least Significant Bit (LSB) of the address bus, A∅ , must also be driven low to allow the display to accept data from the Micro Board.

In addition to the alphanumeric data that is written to the display, command codes are also written to the display. These codes control the position of the cursor.

When the Micro Board writes a command code to the display, it provides the code along with a **WR** and **DP** pulse. Also, the LSB of the address bus must be driven high to allow the display to accept a command code.

Each character is displayed on a 5 x 7 phosphor dot matrix (Fig. 32). A character generator interprets the ASCII word and illuminates the appropriate dots in the matrix to form the alphanumeric character.

The power supply board (031-01080) contains a reset circuit that resets the display during low voltage latch-ups. Whenever the +5VDC regulated supply voltage to the display decreases to 4.7VDC, the power supply drives the $\overline{\text{RESET}}$ input (J1-6) from +5VDC to a Logic Low condition (less than 1VDC). This causes the display to blank for the duration of the condition.

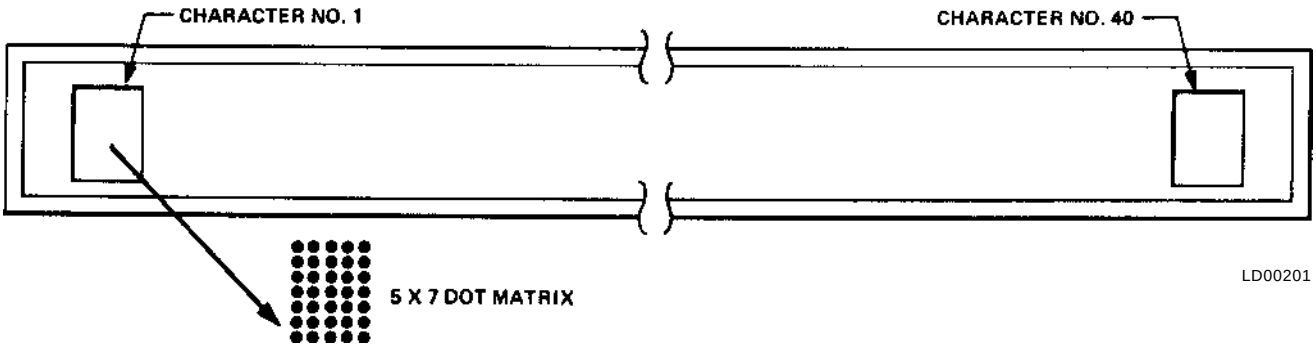



**FIG. 32 –** VACUUM FLUORESCENT DISPLAY

# I/O EXPANSION BOARD
**(Refer to Figs. 33 & 34)**

The **I/O Expansion Board** allows additional analog inputs to be multiplexed into the **Micro Board** thru an onboard multiplexer. It also allows additional digital input and output capability by providing direct access to the Micro Board data bus. Finally, it provides a 4-20mA burner control output for gas/oil-fired applications.

External analog inputs are connected to the multiplexer (MUX). Each program cycle, the micro accesses all these values by applying 3-bit addresses to the MUX. As each address is received, the appropriate analog input is sent to the Micro Board. The analog inputs and addresses are as follows:

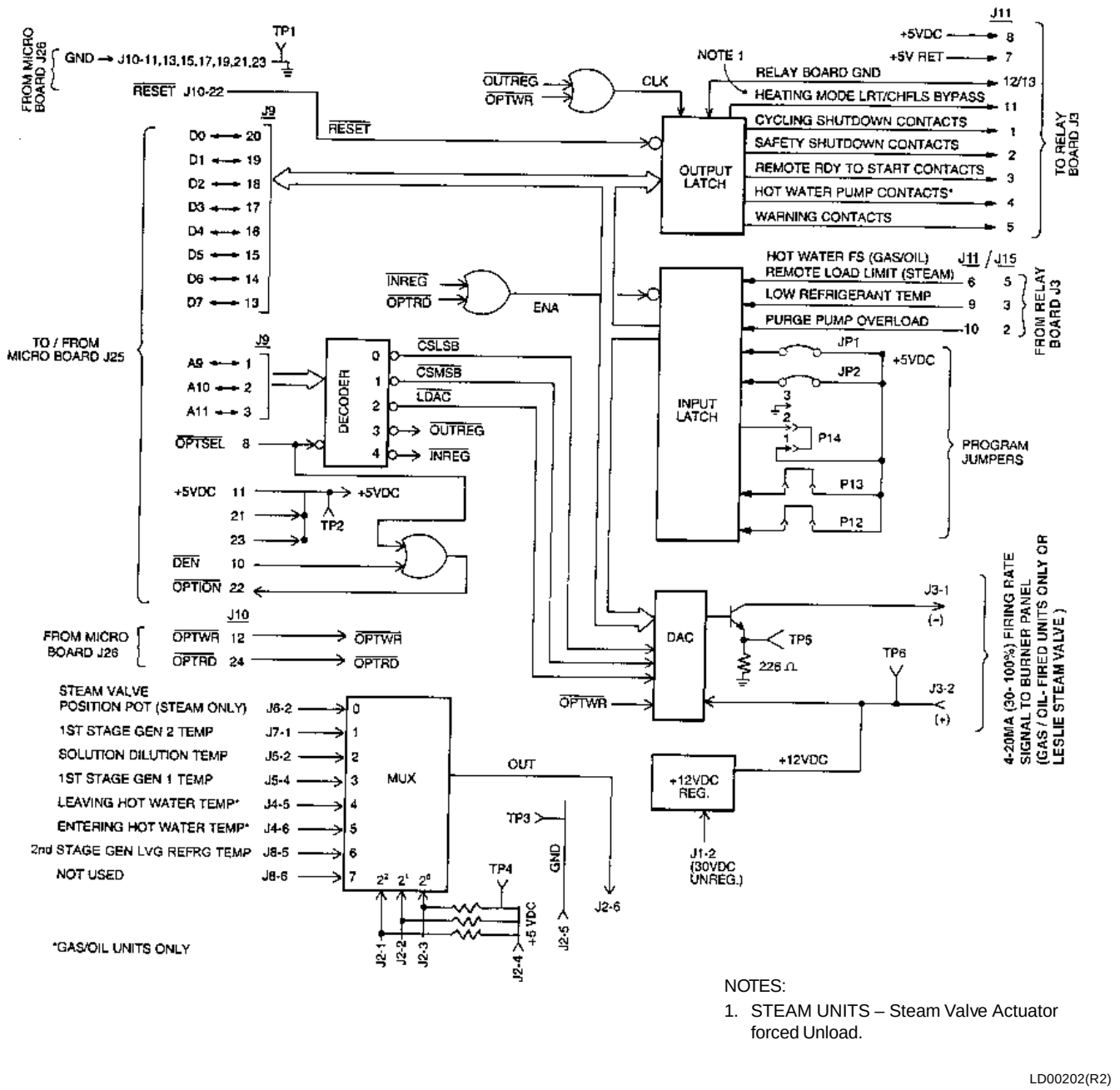
| ADDRESS | DATA |
|---|---|
| 000 | Steam valve position potentiometer (steam units only). Refer to I/O Expansion Board inputs and outputs, Section J6-2 for data values. |
| 001 | First-stage generator No. 2 temperature (gas/oil Models -20G & -22G only). Refer to Table 5 for data values. |
| 010 | Solution Dilution Temperature. Refer to Table 7 for data values. |
| 011 | First-stage generator No. 1 temperature. Refer to Table 5 for data values. |
| 100 | Leaving hot water temperature (gas/oil units only; in **HEATING ONLY** or **COOLING AND HEATING** mode). Refer to Table 6 for data values. |
| 101 | Entering hot water temperature (gas/oil units only; in **HEATING ONLY** or **COOLING AND HEATING ONLY** mode). Refer to Table 6 for data values. |
| 110 | 2nd-stage generator leaving refrigerant temp. |
| 111 | Not used. |

The micro controls relays that are located on the **Relay Board** via the output latch circuit. When the output latch circuit output is Logic 0 (<1VDC), the respective relay is energized. When the output is Logic 1 (+12 VDC), the respective relay is de-energized. The micro controls the output latch circuit by applying address 011 and control signal "$\overline{\text{OPTSEL}}$" (Option Select) to the decoder. "$\overline{\text{OPTSEL}}$" enables the decoder. The decoder decodes this address and outputs "$\overline{\text{OUTREG}}$" (Output Register). Simultaneously, the micro applies control signal "$\overline{\text{OPTWR}}$" (Option Write). When the output latch circuit receives these two control signals, the data that is on the Micro Board data bus is then loaded into the latch circuit. A Logic 0 causes the relay to energize; Logic 1 causes the relay to de-energize. The latch circuit will hold this state until again changed by the micro. To prevent relay chatter, the micro applies control signal "$\overline{\text{RESET}}$" during low voltage conditions and power-up and power-down transitions. While the reset signal is applied, the output latch circuit cannot change state. The relays that are controlled are as follows:

1. Warning status relay K7.
2. Hot water pump control relay K6. (Gas/oil units only; when used in **HEATING ONLY** or **COOLING AND HEATING** modes.)
3. **REMOTE** mode ready to start status relay K4.
4. Safety shutdown status relay K2.
5. Cycling shutdown status relay K1.
6. **HEATING** mode low refrigerant temp/chilled water flow switch bypass relay K16 (gas/oil units in **HEATING ONLY** mode). Steam valve actuator forced unload at unit shutdown relay K16 (steam units only).

Digital input signals are applied to the **Input Latch** circuit. These +5VDC or 0VDC logic level inputs have been converted from 115VAC/0VAC levels by opto-couplers on the **Relay Board**. Other digital inputs are **Program Jumpers** that can be used to complement the program jumpers that are located on the Micro Board. The micro reads these inputs by applying address 100 and control signal "$\overline{\text{OPTSEL}}$" simultaneously to the decoder. "$\overline{\text{OPTSEL}}$" enables the decoder. The decoder outputs "$\overline{\text{INREG}}$" and the micro simultaneously applies "$\overline{\text{OPTRD}}$" (Option Read) to the input latch circuit. This causes the digital inputs to be transferred to the Micro Board. The digital inputs are as follows:

1. Purge pump overload.
2. Low refrigerant temperature safety device.
3. Hot water flow switch (gas/oil units in **HEATING ONLY** or **COOLING AND HEATING** modes); remote steam limit pulse width modulation (PWM) input (steam units only).




NOTES:

1. STEAM UNITS – Steam Valve Actuator forced Unload.

LD00202(R2)

**FIG. 33 –** I/O EXPANSION BOARD BLOCK DIAGRAM

4. Program Jumper JP1 – Auto-purge hardware enable. Applicable to units equipped with EPROM version A.01F.09 or later and automatic purge hardware consisting of purge pump transducer (PT3), purge tank transducer (PT4), purge pump solenoid valve (2SOL) and purge tank solenoid valve (1SOL).

   IN = Disables auto-purge hardware operation.

   OUT = Enables auto-purge hardware operation and allows selection of automatic or manual purge operation via operation program mode selection. Refer to "Operation" manual, Form 155.17-O2 for details of the automatic purge operation.

5. Program Jumper JP2 – Steam valve type; Honey-

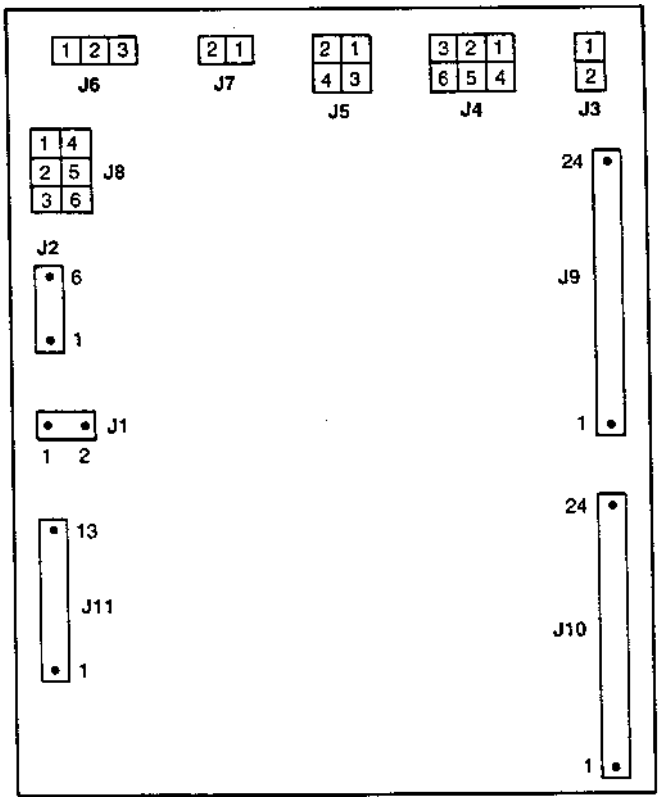



**FIG. 34 –** I/O EXPANSION BOARD PIN IDENTIFICATION

well or Leslie. The actual steam valve used determines the position of this jumper. This jumper determines which steam valve output (triac for Honeywell or 4-20mA for Leslie) is enabled. It also enables the appropriate steam valve control setpoint programming (refer to "Special Setpoints & Programming Procedures" section). Applicable to units equipped EPROM version A.01F.08 and later.

IN = Honeywell steam valve. Enables triac control output of relay board TB3-58/TB3-3 and Honeywell valve setpoint programming.

OUT = Leslie steam valve. Enables I/O Expansion Board 4-20mA output @ J3-1/J3-2 and Leslie valve setpoint programming.

6. Program Jumper P14 – Solution concentration display and safety shutdown feature enable/disable. EPROM version A.01F.09 or later only. Thermistor RT12 (2nd-stage leaving refrigerant temperature) is required for proper operation of this feature. Without RT12, a high concentration will be calculated and the unit will be prevented from running. Units built prior to August 1996 are not equipped with RT12. If EPROM version A.01F.09 (or later) is used in units not equipped with RT12, the feature must be disabled with this jumper. Later units equipped with RT12 must have the feature enabled.

   • [• •] – Disables Solution concentration display and safety shutdown feature. Units not equipped with thermistor RT12.
   3 2 1

   [• •] • – Enables Solution concentration display and safety shutdown feature. Units equipped with thermistor RT12.
   3 2 1

7. Program Jumper P13 – Variable low refrigerant temperature safety cutout enable/disable.

   IN = Enables variable LRT cutout feature. Refer to explanation in Operation manual, Form 155.17-02.

   OUT = LRT cutout fixed at 35.0°F.

8. Program Jumper P12 – English or German language.

   IN = All messages displayed in English language.

   OUT = All messages displayed in German langauge.

Whenever the micro transfers data to or from the Micro Board data bus as per above, it applies control signal "$\overline{\text{DEN}}$" (Data Enable) along with "$\overline{\text{OPTSEL}}$". These two signals are combined on the I/O Expansion Board to produce control signal "$\overline{\text{OPTION}}$". "$\overline{\text{OPTION}}$" is applied to the Micro Board where it enables the transceiver and allows the data to be transferred to or from the data bus.

On gas/oil-fired units, the **I/O Expansion Board** provides a 4-20mA (corresponding to 30-100% load command) firing rate command to the burner control panel. To compensate for burner tolerances, the output actually covers a span of 3-22mA to assure low-fire and high-fire conditions. This signal is developed from a 12 bit digital word that is input from the micro to a Digital-to-Analog Converter (DAC). The DAC converts the digital word to a 3-22mA signal. The 12 bit word is loaded into the DAC in two steps. First the lower order 8 bits are loaded. Then the upper order 4 bits are loaded. Address bits and "$\overline{\text{OPTSEL}}$" from the micro produce control signals "$\overline{\text{CSLSB}}$" (Chip Select Least Significant Byte), "$\overline{\text{CSMSB}}$" (Chip Select Most Significant Byte), and "$\overline{\text{LDAC}}$" (Load DAC). These control signals, along with "$\overline{\text{OPTWR}}$", load the data from the micro into the DAC. The DAC controls the output transistor to produce the appropriate 3-22mA. Output for leaving water temperature control as follows:

In **COOLING ONLY** mode or **COOLING AND HEATING**

mode, the 3-22mA output drives the burner to achieve the desired **Leaving Chilled Water Temperature** per the **LEAVING WATER TEMP** setpoint. In **HEATING ONLY** mode, the 3-22mA output drives the burner to achieve the desired **Leaving Hot Water Temperature** per the **LEAVING WATER TEMP** setpoint. A 3mA signal is a 30% load command (low fire). A 22mA signal is a 100% load command (high fire). The signal is scaled linearly between these extremes. The mid fire point is 12.5mA (65%). The load command, in terms of percent, can be viewed at any time by pressing the **DISPLAY DATA** key. One of the scrolled messages is BURNER LOAD COMMAND = XX%. When the unit is shut down, the load command is 3mA (30%). When the unit is running, the load command is determined by the error between the actual Leaving Chilled Water Temperature (Leaving Hot Water Temperature in **HEATING ONLY** mode) and the **LEAVING WATER TEMP** setpoint. Refer to Table 8. When the error is 0°F, the output is at 12.5mA. When the output is ≥ +2.5°F, the output is 22mA or 3mA (**HEATING ONLY** mode). When the error is ≤ –2.5°F, the output is 3mA or 22mA (**HEATING ONLY** mode). Errors between (+0.2°F to +2.5°F) and (–0.2°F to –2.5°F) produce an output that is proportional to the error. The output then increases to 22mA or 3mA appropriately at a rate determined by the programmed **AUTO TEMP CONTROL RESET TIME** setpoint (1 to 20 minutes) (Refer to "Special Programming Procedures" section for explanation of this setpoint). For example, if the unit is operating in **COOLING ONLY** mode, with the **AUTO TEMP CONTROL RESET** setpoint programmed for 20 minutes, and the error is 0°F the output will be 12.5mA (65%). If the Leaving Chilled Water Temperature increases 1 degree (error increases to +1°F), the output goes from 12.5mA (65%) to 16.3mA (79%). It will then take 20 minutes for the output to increase from 16.3mA to 22mA (100%). It will do this in a linear fashion.

If the unit is equipped with EPROM version A.01F.08 or later, the 4-20mA output can be used to drive a Leslie steam valve if I/O Expansion Board program jumper JP2 is cut. Refer to "Steam Valve Control" section for details of the Leslie steam valve operation.

## I/O EXPANSION BOARD INPUTS AND OUTPUTS

**J1-1 –** Not used.

**J1-2 –** 30VDC unregulated input.

**J2-1 –** Multiplexer address bit $2^2$ input. +5VDC in the active state (Logic 1). Otherwise, 0VDC.

**J2-2 –** Multiplexer address bit $2^1$ input. +5VDC in the active state (Logic 1). Otherwise, 0VDC.

**J2-3 –** Multiplexer address bit $2^0$ input. +5VDC in the active state (Logic 1). Otherwise, 0VDC.

**J2-4 –** +5VDC regulated input.

**J2-5 –** Ground input.

**J2-6 –** Multiplexed 0-5VDC output as follows:

| CHANNEL | ADDRESS | DATA |
|---|---|---|
| 0 | 000 | Steam valve position potentiometer. Steam units only. Refer to I/O Expansion Board J6-2. |
| 1 | 001 | First-stage generator No. 2 temperature. (gas/oil Models -20G thru -22G only). Refer Table 5. |
| 2 | 010 | Solution dilution temperature. Refer to Table 7. |
| 3 | 011 | First-stage generator No. 1 temperature. Refer to Table 5. |
| 4 | 100 | Leaving hot water temperature (gas/oil units only; in **HEATING ONLY** or **COOLING AND HEATING** mode). Refer to Table 6. |
| 5 | 101 | Entering hot water temperature (gas/oil units only; in **HEATING ONLY** or **COOLING AND HEATING** mode). Refer to Table 6. |
| 6 | 110 | 2nd-stage generator leaving refrigerant temperature. |
| 7 | 111 | Not used. |

**J3-2 –** +12VDC source voltage for 3-22mA (30-100%) load command to burner on gas/oil-fired units. See J3-1 below.

**J3-1 –** 3-22mA output (30-100%) for burner load command (gas/oil-fired units). Or, 4-20mA output for Leslie steam valve, if equipped with EPROM version A.01F.08 or later and I/O Expansion Board program jumper JP2 is cut. Refer to Table 8 and "I/O Expansion Board" section for description of burner load commands. Refer to "Steam Valve Control" section for Leslie steam valve operation. Current output can be measured by placing ammeter in series with J3-1. Output can also be monitored with voltmeter at test point TP5 to TP3 (GND) on I/O Expansion Board. Current can be calculated by measuring the voltage at TP5 and solving the following formula: (E = Voltage Measured At TP5)

$$I_{mA} = \frac{E}{226} \times 1000$$

**J4-1 –** Not used.

**J4-2 –** +5VDC output.

**J4-3 –** Not used.

**J4-4 –** +5VDC output.

**J4-5 –** Leaving hot water temp thermistor (RT2) input (gas/oil units only). Refer to Table 6. Not used on steam units.

**J4-6 –** Entering hot water temp thermistor (RT3) input (gas/oil units only). Refer to Table 6. Not used on steam units.

**J5-1 –** +5VDC output.

**J5-2 –** Solution dilution temperature thermistor (RT11) input. Refer to Table 7.

**J5-3 –** +5VDC output.

**J5-4 –** First-stage generator No. 1 temperature thermistor (RT6) input. Refer to Table 5.

**J6-1 –** +5VDC output (steam units only).

**J6-2 –** Honeywell steam valve position potentiometer input (steam units only). 0.440VDC to 0.587VDC (0.5VDC nominal) at 0% (closed) position. 4.374VDC to 4.619VDC (4.5VDC nominal) at 100% (fully open) position. Actual value is a result of the "Auto Calibration" procedure. (Refer to "Steam Valve Calibration" section.) Positions between 0% and 100% can be calculated as follows:

$$\%\ \text{Loading} = \frac{V - V_{LO}}{V_{HI} - V_{LO}} \times 100$$

V = Voltage @ J6-2 @ any position between 0% to 100%

$V_{LO}$ = Voltage @ J6-2 @ 0%

$V_{HI}$ = Voltage @ J6-2 @ 100%

**J6-3 –** Ground (–v) output (steam units only).

**J7-1 –** First-stage generator No. 2 temperature thermistor (RT7) input (gas/oil Models -20G thru -22G only). Refer to Table 5.

**J7-2 –** +5VDC output.

**J8-4 –** +5VDC output.

**J8-5 –** Second-stage generator leaving refrigerant temperature thermistor (RT12) input. (Applicable to units equipped with EPROM version A.01F.09 or later.) Refer to Table 6.

**J9-1 –** Address bit A9 input. +5VDC in the active state (Logic 1). Otherwise, 0VDC.

**J9-2 –** Address bit A10 input. +5VDC in the active state (Logic 1). Otherwise, 0VDC.

**J9-3 –** Address bit A11 input. +5VDC in the active state (Logic 1). Otherwise, 0VDC.

**J9-4 –** Not used.

**J9-5 –** Not used.

**J9-6 –** Not used.

**J9-7 –** Not used.

**J9-8 –** "$\overline{\text{OPTSEL}}$" (Option Select) control signal input. 0VDC in the active state (Logic 0) when the micro is writing data to or reading data from the I/O Expansion Board. Otherwise, +5VDC.

**J9-9 –** Not used.

**J9-10 –** "$\overline{\text{DEN}}$" (Data Enable) control signal input. 0VDC in the active state (Logic 0) when the micro is writing data to or reading data from the I/O Expansion Board. Otherwise, +5VDC.

**J9-11 –** +5VDC input.

**J9-12 –** Not used.

**J9-13 –** Data bit D7 input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J9-14 –** Data bit D6 input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J9-15 –** Data bit D5 input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J9-16 –** Data bit D4 input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J9-17 –** Data bit D3 input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J9-18 –** Data bit D2 input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J9-19 –** Data bit D1 input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J9-20 –** Data bit D0 input and output. +5VDC is Logic 1. 0VDC is Logic 0.

**J9-21 –** +5VDC input.

**J9-22 –** "$\overline{\text{OPTION}}$" control bit output. 0VDC in the active state (Logic 0) to enable the transceiver on the Micro Board to receive or transmit data from/to the I/O Expansion Board. Otherwise, +5VDC.

**J9-23 –** +5VDC input.

**J9-24 –** Not used.

**J10-1 –** Not used.

**J10-2 –** Not used.

**J10-3 –** Not used.

**J10-4 –** Not used.

**J10-5 –** Not used.

**J10-6 –** Not used.

**J10-7 –** Not used.

**J10-8 –** Not used.

**J10-9 –** Not used.

**J10-10 –** Not used.

**J10-11 –** Ground input.

**J10-12 –** "$\overline{\text{OPTWR}}$" (Option Write) control bit input. 0VDC in the active state (Logic 0) when the micro is writing data to the I/O Expansion Board. Otherwise, +5VDC.

**J10-13 –** Ground input.

**J10-14 –** Not used.

**J10-15 –** Ground input.

**J10-16 –** Not used.

**J10-17 –** Ground input.

**J10-18 –** Not used.

**J10-19 –** Ground input.

**J10-20 –** Not used.

**J10-21 –** Ground input.

**J10-22 –** "$\overline{\text{RESET}}$" control bit input. 0VDC (Logic 0) when the micro detects a low voltage condition on the +5VDC power supply. Otherwise, +5VDC.

**J10-23 –** Ground input.

**J10-24 –** "$\overline{\text{OPTRD}}$" (Option Read) control bit input. 0VDC in the active state (Logic 0) when the micro is reading data from the I/O Expansion board. Otherwise, +5VDC.

**J11-1 –** Cycling shutdown status contacts output. <1 VDC when micro is commanding the cycling shutdown status relay (K1) on the relay board to energize (close). Otherwise, +12VDC.

**J11-2 –** Safety shutdown status contacts output. <1 VDC when micro is commanding the safety shutdown status relay (K2) on the relay board to energize (close). Otherwise, +12VDC.

**J11-3 –** Remote mode ready to start status contacts output. <1VDC when the micro is commanding the remote mode ready to start relay (K4) on the relay board to energize (close). Otherwise, +12VDC.

**J11-4 –** Hot water pump contacts output (gas/oil units only). <1VDC when the micro is commanding the hot water pump relay (K6) on the relay board to energize (close) to run the hot water pump. Otherwise, +12VDC.

**J11-5 –** Warning contacts output. <1VDC when the micro is commanding the warning relay (K7) on the relay board to energize (close). Otherwise, +12VDC.

**J11-6 –** Hot water flow switch input (gas/oil units) or remote steam limit pulse width modulation (PWM) input (steam units). **Gas/Oil Units –** +5VDC when the hot water flow switch is closed. Otherwise, 0VDC. **Steam Units –** +5VDC for 1-11 seconds each time the PWM input is applied. Otherwise, 0VDC. (Refer to "Remote Setpoints" section and Form 155.17-PA1.)

**J11-7 –** +5VDC return (ground) output.

**J11-8 –** +5VDC output.

**J11-9 –** Low refrigerant temp safety device input. +5VDC when low refrigerant temp safety device (LRT) has tripped. Otherwise, 0VDC.

**J11-10 –** Purge pump starter overload input. 0VDC when the purge pump overload (3OL) has tripped. Otherwise, +5VDC.

**J11-11 – HEATING** mode low refrigerant temp and

chilled water flow switch bypass output (gas/oil units) or steam valve actuator forced unload at unit shutdown output (steam units). **Gas/Oil Units –** <1VDC when the micro is commanding relay (K16) on the relay board to energize (close). Otherwise, +12VDC. This is applicable only when the Control Center is in **HEATING ONLY** mode. **Steam Units –** <1VDC when micro is commanding relay (K16) on the relay board to energize (close) during unit shutdown to drive steam valve closed. Otherwise, +12VDC.

**J11-12 –** +12VDC return (ground).

**J11-13 –** +12VDC return (ground).

# REMOTE SETPOINTS

The following setpoints will be accepted from remote devices when the Control Center is in **REMOTE** mode:

**LOAD LIMIT –** The Control Center will accept Remote Load Limit setpoints via the following inputs. The value that is input can be viewed by pressing the **DISPLAY DATA** key. One of the scrolled messages is REMOTE LOAD LIMIT = XXX% .

**IMPORTANT!!!** **–** Gas/oil-fired units are allowed to load beyond any programmed or remote load limits until the BURNER CALIBRATION FULL TRAVEL CALIBRATION is performed.

**RS-485 Serial Port –** If the YORK ISN Direct Digital Controller (DDC) Energy Management System is connected to the RS-485 Serial Port (Micro Board TB7), and Micro Board program jumpers J58 and J56 are in the "RS-485" and "EMS" positions respectively, serial data commands from the ISN Direct Digital Controller can reset this setpoint over a range of 30-100% load command for gas/oil units; 20-100% steam valve position for steam units. Refer to Note 1 for steam units.

-OR-

**Pulse Width Modulation** (Steam units only) – On those steam units that do not have the YORK ISN Direct Energy Management System connected to the RS-485 serial port, a 1-11 second PWM signal can be input to the relay board TB4-82. This signal resets the setpoint over a range of 100% to 20% steam valve position. This input can be directly from an external energy management system. Refer to YORK Form 155.17-PA1 for details of this feature. Refer to Note 1.

-OR-

**4-20mA** or **0-10VDC** or **Contact Closure** (Steam units only) – On those steam units that do not have the York ISN Direct Digital Controller (DDC) EMS connected to the RS-485 serial port, the Control Center can be equipped with the optional **Remote Setpoint** board (Option Card) part number 031-00814-000. This board can receive a 4-20mA or 0-10VDC signal or contact closure from an external energy management system to reset the setpoint over a range of 100%-20% steam valve position. It converts the 4-20mA or 0-10VDC signal to a 1-11 second pulse width modulation (PWM) signal that is then input to the **Relay Board** PWM input TB4-82. The contact closure input is converted to a 0-10VDC level that is determined by the setting of a field adjustable potentiometer located on the **Remote Setpoint Board**. When the contacts are open, the level is 0VDC. When the contacts are closed, the level is determined by the setting of the potentiometer. This 0-10VDC level is converted to a 1-11 second PWM signal that is then applied to the **Relay Board** PWM input TB4-82. Refer to Page 54 of this

book and Form 155.17-PA1 for details of this feature. Refer to Note 1.

**LEAVING WATER TEMP –** The Control Center will accept **LEAVING CHILLED WATER TEMP** setpoints (gas/oil & steam units) and **LEAVING HOT WATER TEMP** setpoints (gas/oil units in **HEATING ONLY** mode) via the following inputs. The value that is input can be viewed in **REMOTE** mode by pressing the keypad **LEAVING WATER TEMP** setpoint key.

LVG CHILLED WATER SETPOINT = XX°F or

LVG HOT WATER SETPOINT = XX°F is displayed.

This setpoint can be reset over a range of 10°F or 20°F (Remote Reset Temp Range) above the **LEAVING CHILLED WATER TEMP** setpoint (BASE) or below the **LEAVING HOT WATER TEMP** that has been locally entered at the keypad by the unit operator. The **REMOTE RESET TEMP RANGE** (10°F or 20°F) setpoint is also entered at the keypad by the unit operator.

**RS-485 Serial Port –** If the YORK ISN Direct Digital Controller (DDC) Energy Management System is connected to the RS-485 serial port (Micro Board TB7), and Micro Board program jumpers J58 and J56 are in the "RS-485" and "EMS" positions respectively, serial data commands from the ISN Direct Digital Controller EMS can reset this setpoint.

-OR-

**Pulse Width Modulation –** On those units that do not have the YORK ISN Direct Digital Controller (DDC) Energy Management System connected to the RS-485 serial port, a 1-11 second PWM signal can be applied to the **Digital Input Board** PWM input TB2-19 to reset this setpoint. This input can be directly from an external energy management system. Refer to YORK Form 155.17-PA1 for details of this feature.

-OR-

**4-20mA** or **0-10VDC** or **Contact Closure –** On those units that do not have the YORK ISN Direct Digital Controller (DDC) Energy Management System connected to the RS-485 serial port, the Control Center can be equipped with the optional **Remote Setpoint** board (Option Card) part number 031-00814-000. This board can receive a 4-20mA or 0-10VDC signal or contact closure from an external energy management system to reset this setpoint. It converts the 4-20mA or 0-10VDC signal to a 1-11 second pulse modulation (PWM) signal that is then input to the **Digital Input Board** PWM input TB2-19. The contact closure input is converted to a 0-10VDC level that is determined by the setting of a field adjustable potentiometer located on the **Remote Setpoint Board**. When the contacts are open, the level is 0VDC. When the contacts are closed, the level is determined by the setting of the potentiometer. This 0-10VDC level is converted to a 1-11 second PWM signal that is then applied to the **Digital Input Board** PWM input TB2-19. Refer to Page 54 of this book and YORK Form 155.17-PA1 for details of this feature.

If it is desired to use the 4-20mA, 0-10VDC or contact closure inputs to reset the **LEAVING WATER TEMP** (gas/oil or steam unit), or **LOAD LIMIT** (steam unit) setpoint, a Card File (part number 031-00827-000) and 1 ea. Remote Setpoint Boards (part number 031-00814-000) are required. The card file mounts in the upper right corner inside the Control Center. The remote reset board slides into the card file. However, if it is desired to use these inputs to reset both the **LEAVING WATER TEMP** setpoint and **LOAD LIMIT** setpoint on a steam unit, 2 ea. remote setpoint boards are required; one for **LEAVING WATER TEMP** and one for **LOAD LIMIT**. Both boards are then inserted into a single card file. Page 54 of this book and YORK Form 155.17-PA1 provide details of this installation and the operation of these boards.

**NOTE:**

1. During system run on steam units, the steam valve is modulated between 20% of unit capacity and 100% valve position. On units equipped with Honeywell valves, the valve is prevented from unloading to less that 20% of unit capacity by a **Limit Switch** that is wired in series with the close winding of the steam valve actuator. The limit switch is part of the steam valve actuator. On units equipped with Leslie steam valves, there is no limit switch. The **MINIMUM ALLOWED LOADING** setpoint is set to the valve position that corresponds to 20% of unit capacity. This setpoint determines the lowest allowable steam valve position during unit run. If a remote device attempts to limit the loading to a valve position that is less than the **MINIMUM ALLOWED LOADING** setpoint, the MicroComputer Control Center will override the remote device as follows: If a **REMOTE LOAD LIMIT** setpoint is received that is not greater than the **MINIMUM ALLOWED LOADING** setpoint, the program will automatically set the **REMOTE LOAD LIMIT** setpoint to 1% above the **MINIMUM ALLOWED LOADING** setpoint. If the customer purchased factory testing, the **Limit Switch** (Honeywell) or **MINIMUM ALLOWED LOADING** (Leslie) setpoint is set at the factory. Otherwise, this must be performed in the field using instructions in YORK Form 155.17-NM1. The unit capacity percentage may not correspond to the steam valve position percentage that is displayed with the **DISPLAY DATA**

keypad key. The steam valve position that is displayed is an independent number that represents the percentage of full travel of the steam valve. When the steam valve is fully closed, the position is 0%; when fully open, the position is 100%. Therefore, 20% of unit capacity on a given unit could, for example, be achieved with 50% steam valve position on that unit. At unit shutdown, either steam valve is driven fully closed to the 0% position. A relay on the Relay Board bypasses the Honeywell valve limit switch to allow that valve to fully close.

## REMOTE SETPOINT BOARD
**(Refer to Figs. 35-37)**

The Remote Setpoint Board (part number 031-00814-000) allows the Control Center to accept a 4-20mA, 0-10VDC or contact closure input from an Energy Management System (EMS). This board slides into a Card File (part number 031-00827-000) that is field mounted in the upper right corner of the Control Center. Both the card file and the remote setpoint board(s) are customer options.

This board can be used to reset either the **LEAVING WATER TEMP** setpoint or the **LOAD LIMIT** setpoint (steam units only). If it is desired to reset both of these setpoints on a steam unit, then two cards are required. Otherwise, only one is required.

The Energy Management System (supplied by others) applies a 4-20mA, 0-10VDC or a dry contact closure to the **Remote Setpoint Board**. The board converts the 4-20mA or 0-10VDC input to a 1-11 second PWM signal. The contact closure input is converted to a 0-10VDC level, the value of which is determined by the setting of a field adjustable potentiometer located on the Remote Setpoint Board. When the contacts are open, the level is 0VDC. When the contacts are closed, the level (0-10VDC) is determined by the setting of the potentiometer. This 0-10VDC level is converted to a 1-11 second PWM signal. The PWM signal is then applied to TB4-82 of the **Relay Board** (load limit) or TB2-19 of the **Digital Input Board** (leaving water temp). Refer to Fig. 35.

The board creates the PWM signal by closing its board mounted dry contacts for 1-11 seconds every 80 seconds. One side of these contacts are connected to 115 VAC supplied by the Digital Input Board (leaving water temp) or Relay Board (load limit). The other side of these contacts is connected to the Digital Input Board TB2-19 (leaving water temp) or Relay Board TB4-82 (load limit). The contacts will close for 1-11 seconds, applying 115VAC for 1-11 seconds to these boards. This 115VAC PWM signal is converted to +5 VDC PWM signal by opto-couplers on the Digital Input Board and Relay Board. (Refer to Fig. 35.) The +5 VDC PWM pulse output of the Digital Input Board is applied to the Micro Board where it is converted to a digital word and stored for viewing using the keypad **LEAVING WATER TEMP** setpoint key and used to control the Leaving Chilled Water Temp (gas/oil units in **COOLING ONLY** or **COOLING AND HEATING** mode or steam units). The +5VDC PWM output of the Relay Board is applied to the I/O Expansion Board where it is read by the Micro Board. The Micro Board converts the PWM pulse to a digital word and stores it for viewing via the **DISPLAY DATA** keypad key and uses it to limit the loading of the steam valve.

The board contains five 2-pin connectors (JU1 thru JU5) that are used to configure the board for the desired input signal type. The two 2-pin jumper plugs are provided with each board. These jumper plugs should be installed on the 2-pin connectors as follows:

| INPUT | INSTALL JUMPERS ON: |
|---|---|
| 4-20mA | JU5 & JU3 |
| 0-10VDC | JU4 & JU2 |
| Contact Closure | JU1 & JU4 |

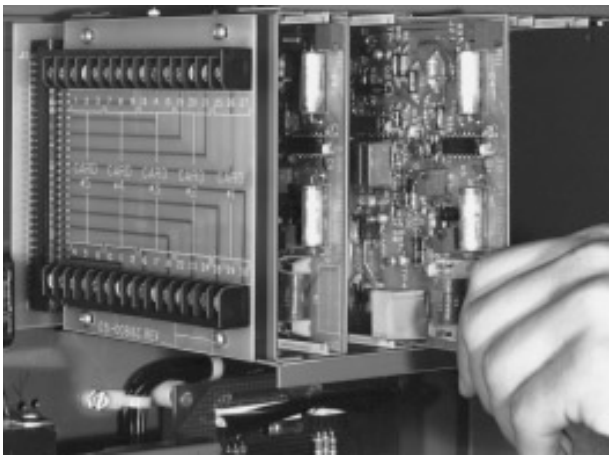
The **0-10VDC** input is applied to the board at J1-12 and passes through JU4 and JU2 to amplifier No. 1 where it is conditioned for input to the Analog-to PWM converter. This level can be monitored at TP3. The 80 second interval timer assures a PWM pulse is only output at a rate of 1 pulse every 80 seconds. The Micro Board ignores pulses received at a rate greater than 60 second intervals. The PWM output drives normally open relay (K1) which is normally de-energized. When the PWM pulse is output, relay (K1) is energized (closed) for a period of 1-11 seconds.

The **4-20mA** input is applied to the board at J1-12 and passes thru JU5 to the “Current to Voltage Converter” where the 4-20mA signal is converted to a 0-10VDC signal. This signal passes thru JU3 and then continues on the same path as the 0-10VDC signal discussed above.

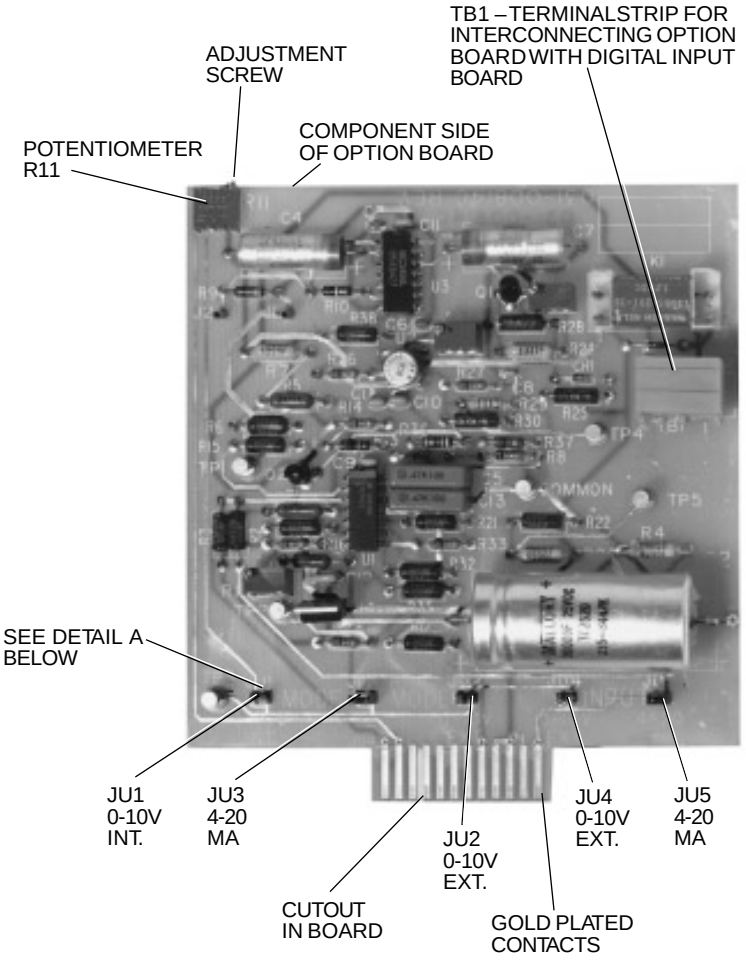
The **Contact Closure** input is applied at J1-1 and J1-2. When the contacts are open, 0VDC is applied to JU1. When the contacts are closed, a voltage (0-10VDC) corresponding to the setting of potentiometer R11 is applied to JU1. This signal passes thru JU1 and continues on the same path as the 0-10VDC signal discussed above.

Refer to YORK Form 155.17-PA1 for installation and application information on the Remote Setpoint Boards. Refer to the “Inputs & Outputs” section following for input signal vs. PWM output tables.

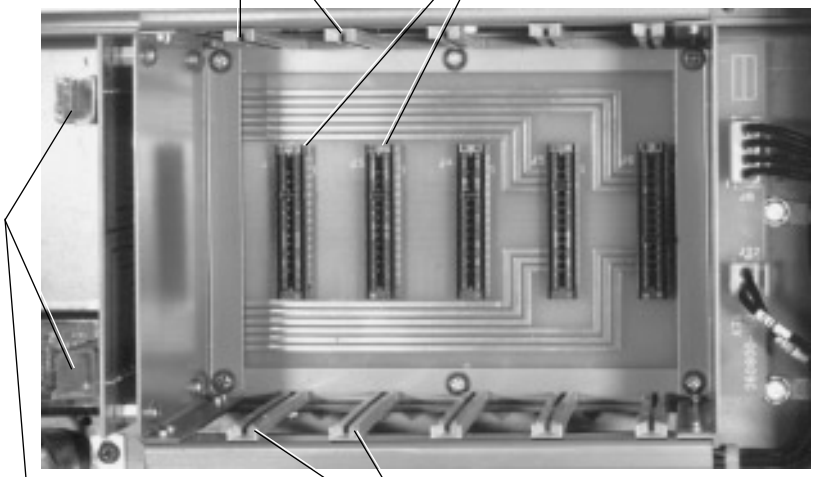
## REMOTE SETPOINT BOARD



22647A

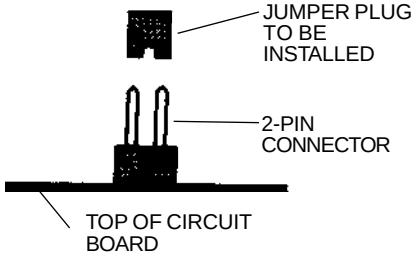



22681A




22646A

**DETAIL A –** TYPICAL OF JU1-JU5




NOTES:

1. Card edge guides used to slide option board into card file.
2. Option board to be installed into either connector J2 or connector J3 on the inside of the card file.

LD00204(R)

**FIG. 35 –** CARD FILE AND BOARDS

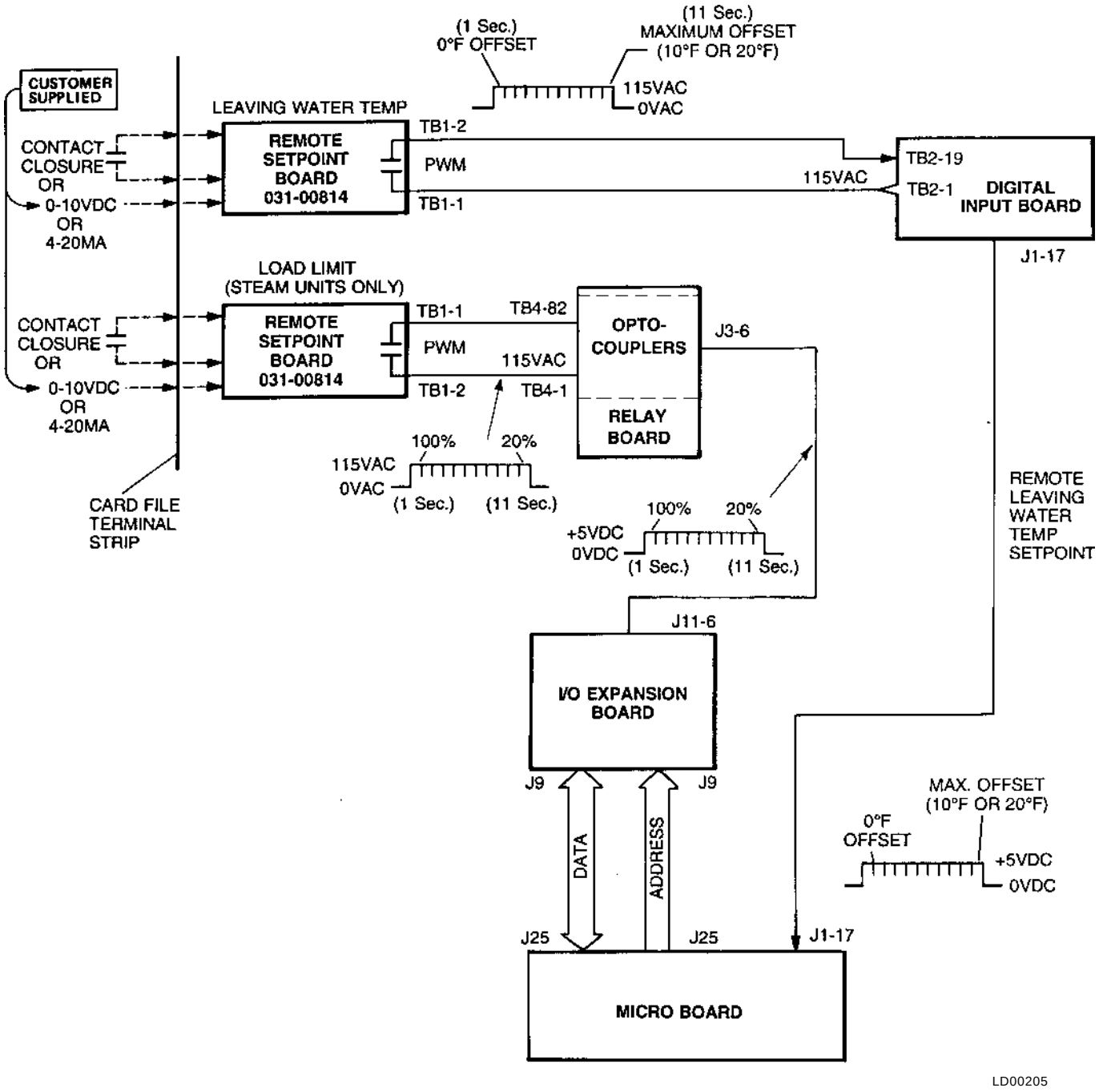



**FIG. 36 –** REMOTE SETPOINT BOARD INTERFACE BLOCK DIAGRAM

## REMOTE SETPOINT BOARD INPUTS AND OUTPUTS

Regardless of which setpoint the Remote Setpoint Board (part number 031-00814-000) is used to reset, the operation of the board is the same. If it is used to reset **Leaving Water Temp** (chilled or hot), it is installed in card file slot J3. If it is used to reset **Steam Load Limit** (steam units only), it is installed in card file slot J2. Refer to YORK Form 155.17-PA1 for installation and application details.

| 4-20mA INPUT | PWM OUTPUT (SECONDS) |
|---|---|
| 4mA | 1.0 |
| 5mA | 1.6 |
| 6mA | 2.3 |
| 7mA | 2.9 |
| 8mA | 3.5 |
| 9mA | 4.1 |
| 10mA | 4.8 |
| 11mA | 5.4 |
| 12mA | 6.0 |
| 13mA | 6.6 |
| 14mA | 7.3 |
| 15mA | 7.9 |
| 16mA | 8.5 |
| 17mA | 9.1 |
| 18mA | 9.8 |
| 19mA | 10.4 |
| 20mA | 11.0 |

| 0-10VDC INPUT | PWM OUTPUT (SECONDS) |
|---|---|
| 0VDC | 1.0 |
| 1VDC | 2.0 |
| 2VDC | 3.0 |
| 3VDC | 4.0 |
| 4VDC | 5.0 |
| 5VDC | 6.0 |
| 6VDC | 7.0 |
| 7VDC | 8.0 |
| 8VDC | 9.0 |
| 9VDC | 10.0 |
| 10VDC | 11.0 |

| CONTACT CLOSURE INPUT | PWM OUTPUT (SECONDS) |
|---|---|
| Contacts Open | 1.0 |
| Contacts Closed | 1-11 seconds as determined by the setting of potentiometer R11 on Remote Reset Board. The setting of the pot establishes a 0-10VDC input to the Analog-to-PWM converter. This 0-10VDC input is then interpreted the same as the 0-10VDC input above. |

Refer to YORK Form 155.17-PA1 to calculate the actual setpoint change that results from a given 4-20mA, 0-10VDC or contact closure input. Also, refer to this form for the external connections to the card file.

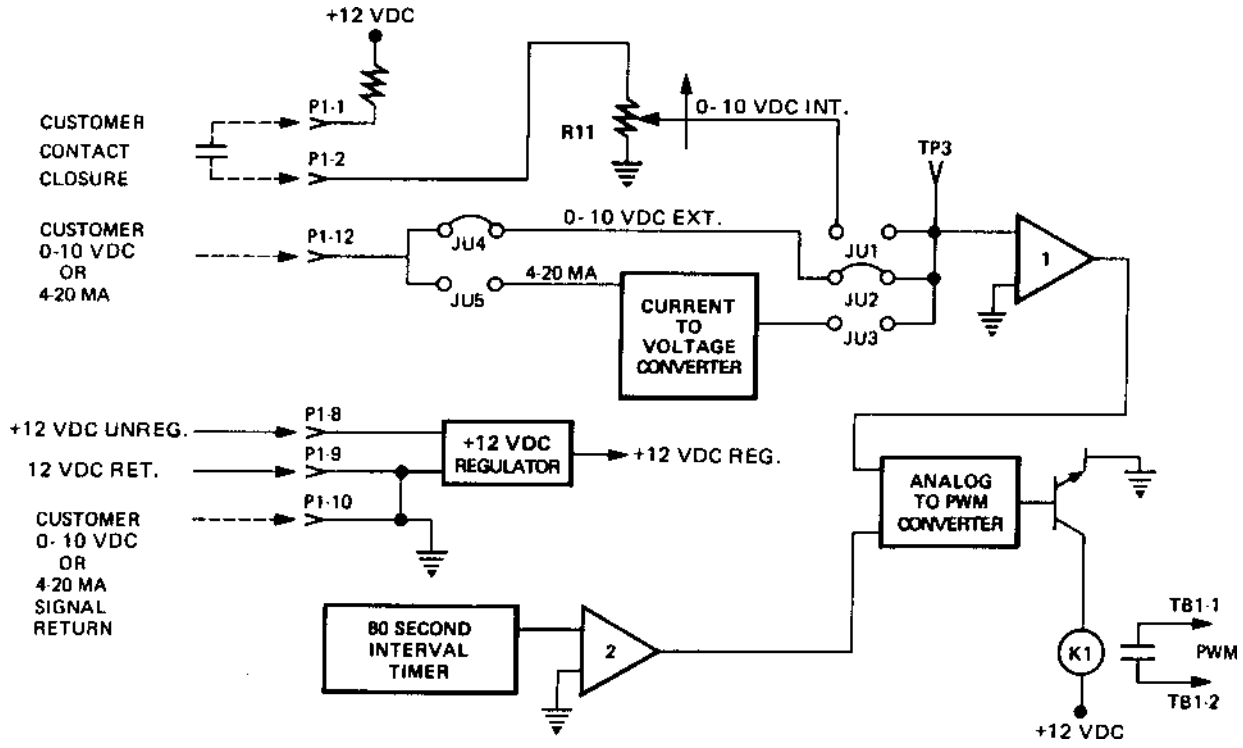



**FIG. 37 –** REMOTE SETPOINT BOARD SIMPLIFIED BLOCK DIAGRAM PART NO. 031-00814-000

# SPECIAL SETPOINTS & PROGRAMMING PROCEDURES

The following special setpoints and programming procedures are for factory or field service technician use only. The correct setpoint values are established and entered at the YORK factory, prior to shipment. However, local operating conditions or service requirements might demand these values to be changed from the nominal (typical) values entered by the factory. Setpoints other than operating hours, start counter, cycle counters and auto purge enable/disable should be changed only after factory consultation. As outlined in the System Commissioning Checklist, the service tech-nician must verify the nominal values have been entered by the YORK factory.

The following is a description of each setpoint followed by a detailed change procedure for each. A special access code is required.

To view the setpoint values that have been entered, use the procedure below to gain access to **PROGRAM** mode, then refer to specific procedure for each setpoint. Follow that procedure but do not enter new values or press the **ENTER** key.

To change any of the setpoint values, follow the procedure below to gain access to **PROGRAM** mode. Then refer to the specific procedure for the desired setpoint.

1. Press **ACCESS CODE** key.
2. ENTER VALID ACCESS CODE is displayed.
3. Using **Entry** keys enter **1 3 8 0.**
4. As each digit is entered, the characters **Y O R K** are displayed. NOTE: If digits other that **1 3 8 0** are entered, **Y O R K** is still displayed.
5. Press **ENTER** key.
   NOTE: If digits other than **1 3 8 0** 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 (1380) and proceed.
6. ACCESS TO PROGRAM KEY AUTHORIZED is displayed.
   NOTE: Unless terminated by pressing the **ACCESS CODE** key again, the operator will have access to the **PROGRAM** key for 10 minutes. When 10 minutes have elapsed, access to **PROGRAM** key will be automatically disabled and the operator must return to Step No. 1 to gain access. Whenever **PROGRAM** mode is in effect, each key closure will re-initialize the 10 minute timer. Automatic exiting of **PROGRAM** mode will occur only if no key has been pressed in the last 10 minutes.
7. Press **PROGRAM** key.
8. PROGRAM MODE, SELECT SETPOINT is displayed.
9. Select and perform desired procedure from the following:

**SPRAY SOL'N PUMP DELAY –** With Micro Board program jumper JP3 **OUT**, the Control Center is configured for "G" series, Models -19GL thru -22G and "S" series, Models -16SL thru -19S.

The "G" series models have a solution pump, a first spray solution pump and a delayed-on second spray solution pump. The first spray solution pump is turned on coincident with the solution pump. The second spray solution pump should not be started until the first spray solution pump has pumped solution to the second spray solution pump. The delay between the start of the first spray solution pump and the second spray solution pump is the **SPRAY SOL'N PUMP DELAY**. It is programmable from 30 to 120 seconds (10 to 120 seconds with EPROM version A.01F.09 or later), with 90 being both the nominal delay and the default value.

The "S" series models have a solution pump and a delayed-on spray solution pump. The spray solution pump is started 30 to 120 seconds (10 to 120 seconds with EPROM version A.01F.09 or later) after the solution pump. This delay is programmed with the **SPRAY SOL'N PUMP DELAY** setpoint.

This setpoint is established and entered into the Control Center at the YORK factory. It should not be arbitrarily changed. If field adjustment is required, a qualified technician can change this value using the procedure below.

To enter **SPRAY SOLUTION PUMP DELAY** setpoint (Models -19GL thru -22G, and -16SL thru -19S only; Micro Board program jumper JP3 must be **OUT**):

1. Press **SPRAY SOL'N PUMP DELAY** key.
   NOMINAL DELAY = 90 SEC: DELAY = XXX SEC is displayed.

2. Using the **Entry** keys, enter the desired delay value. Nominal delay value is 90 seconds. If **CANCEL** key is pressed, 90 is displayed. Use leading zeroes where necessary (i.e., **0 70** sec.)

3. Press **ENTER** key.
PROGRAM MODE, SELECT SETPOINT is displayed.

4. Press **ACCESS CODE** key.
ACCESS TO PROGRAM KEY DISABLED is displayed momentarily. The display then returns to the normal background message.

**AUTO TEMP CONTROL RESET TIME –** Gas/oil units use a 4-20mA burner control signal. When the error between the leaving water temp and the setpoint is 0°F, the output goes to mid-fire (65% load command). When the error is greater than or equal to +2.5°F, the output goes to high-fire – cooling (100% load command) or low-fire – heating (30% load command). When the error is greater than or equal to –2.5°F, the output goes to low-fire – cooling (30% load command) or high-fire – heating (100% load command). Errors between 0.2°F to 2.5°F produce an output above or below the mid-fire point that is proportional to the error. The output then increases to high-fire or low-fire at a rate determined by this setpoint (1 to 20 minutes).

This setpoint is programmable from 1-20 minutes and is factory set for 20 minutes. The default value is 20 minutes. This feature can be disabled; the reset time is then "**0**". To change this value, proceed as follows:

**To Disable Auto Temp Control Reset Time:**

1. Press **WARNING RESET** key.

2. Use **ADVANCE DAY/SCROLL** key to cause
AUTO TEMP CONTROL RESET DISABLED to be displayed. Each time the key is pressed, the message scrolls to a different message.

3. Press **ENTER** key.
PROGRAM MODE, SELECT SETPOINT is displayed.

4. Press **ACCESS CODE** key.
ACCESS TO PROGRAM KEY DISABLED is momentarily displayed. The display then returns to the normal background message.

**To Enable Auto Temp Control Reset Time:**

1. Press **WARNING RESET** key.

2. Use **ADVANCE DAY/SCROLL** key to cause
AUTO TEMP CONTROL RESET ENABLED to be displayed. Each time the key is pressed, the message scrolls to a different message.

3. Press **ENTER** key.
AUTO TEMP CONTROL RESET TIME = XX MIN. is displayed.

4. Using the **Entry** keys, enter desired value. Use leading zeroes where necessary (ie., 05). If the **CANCEL** key is pressed, the default value **"20"** is displayed.

5. Press **ENTER** key.
PROGRAM MODE, SELECT SETPOINT is displayed.

6. Press **ACCESS CODE** key.
ACCESS TO PROGRAM MODE DISABLED is displayed momentarily. The display then returns to the normal background message.

**To Enter Auto Temp Control Reset Time:**

1. Press **WARNING RESET** key. If the reset time is not enabled, the time cannot be changed. If
AUTO TEMP TEMP CONTROL RESET DISABLED is displayed, perform procedure above to enable reset time. Otherwise, proceed with this procedure.

2. AUTO TEMP CONTROL RESET TIME = XX MIN. is displayed. Using the **Entry** keys, enter desired value. Use leading zeroes where necessary (ie., 05). If the **CANCEL** key is pressed, the default value **"20"** is displayed.

3. Press **ENTER** key.
PROGRAM MODE, SELECT SETPOINT is displayed.

4. Press **ACCESS CODE** key.
ACCESS TO PROGRAM KEY DISABLED is displayed momentarily. The display then returns to the normal background message.

**AUTO-TEMP CONTROL DELAY –** Gas/oil-fired units (Micro Board program jumper JP-1 is **IN**). Require that the burner be held at minimum fire for a period of time at unit start. This prevents unstable burner operation due to a **"COLD STACK"**. The duration of time it is restricted to minimum fire before being allowed to go to automatic temperature control is defined as the "AUTO-TEMP CONTROL DELAY". While it is in effect, SYSTEM RUN – COLD STACK FIRING LIMIT is displayed. It is programmable from 0-10 minutes with 4 minutes being the default and nominal value. Use following procedure to change value.

To enter the **AUTO-TEMP CONTROL DELAY** (Gas-fired units only):

1. Press and release the **DISPLAY DATA** key. The following program prompt message is displayed:
   AUTO-TEMP CONTROL DELAY = XX MIN.
2. Using the **Entry** keys, enter the desired value (0-10 min.). Use leading zeroes where necessary (i.e., **06**). If the **CANCEL** key is pressed, the default value **"4"** appears.
3. Press **ENTER** key.
   PROGRAM MODE, SELECT SETPOINT is displayed.
4. Press **ACCESS CODE** key,
   ACCESS TO PROGRAM KEY DISABLED is displayed momentarily. The display then returns to the normal background message.

**ALCOHOL SEPARATION PROCEDURE –** An alcohol separation procedure may have to be performed if excess alcohol was introduced into the system. This procedure requires the unit to run with the refrigerant pump off. The refrigerant pump is turned off by manually tripping the refrigerant pump motor protector (MP2) located in the power panel. The procedure below allows the Control Center to ignore the open motor protector (bypass the refrigerant pump overload contacts) for a maximum of 30 minutes of unit run time. After 30 minutes, the bypass is automatically eliminated.

To bypass **REFRIGERANT PUMP THERMALS / OVERLOADS**:

1. Press **MANUAL PUMP** key. If unit equipped with EPROM version A.01F.09 or later I/O Expansion Board program jumper JP1 is removed,
   PURGE TYPE = X (0=MAN; 1=AUTO TANK) is displayed. Press **ADVANCE DAY/SCROLL** key to scroll message to Step No. 2. Otherwise, proceed to Step No. 2.
2. REF PMP OL BYPASS = 1 (0 = OFF, 1 = ON) or
   REF PMP OL BYPASS = 0 (0 = OFF, 1 = ON) is displayed indicating the refrigerant pump overload is bypassed or is not bypassed.
3. Using the **Entry** keys, press **"1"** key to bypass the refrigerant pump overloads for 30 minutes. After 30 minutes, the bypass is automatically eliminated. Press **"0"** key to turn off the bypass.
4. Press **ENTER** key.
5. Press **ACCESS CODE** key.
   ACCESS TO PROGRAM KEY DISABLED is displayed momentarily. The display then returns to the normal background message.

**MAXIMUM ALLOWED ENTERING CONDENSER WATER TEMP –** The maximum allowed entering condenser water temperature is determined by the design of the unit. The various models have different limitations.

When the entering condenser water temperature exceeds the programmed value for 10 continuous minutes after a 30 minute bypass at start, the load command is limited to 60% and
WARNING - ENT COND WATER TEMP HIGH LIMIT is displayed. The value is programmable from 75°F to 95°F. The default value is 86°F. Use procedure below to change value. This check is not performed in **HEATING ONLY** mode.

To enter the **MAXIMUM ALLOWED ENTERING CONDENSER WATER TEMPERATURE**:

1. Press and release the **CONDENSER WATER TEMPS** key. The following program prompt message is displayed:
   MAX ALLOWED CONDENSER WATER TEMP = XX.X°F
2. Using the **Entry** keys, enter the desired value (75-95°F). If the **CANCEL** key is pressed, the default value 86.0°F appears.
3. Press the **ENTER** key.
   PROGRAM MODE, SELECT SETPOINT is displayed.
4. Press **ACCESS CODE** key.
   ACCESS TO PROGRAM KEY DISABLED is displayed momentarily. The display then returns to the normal background message.

**MAXIMUM ALLOWED LOADING –** Site conditions and various unit conditions that routinely occur during unit commissioning sometimes make it desirable to limit the loading ability of the unit in both **COOLING** and **HEATING** modes. For instance, non-condensibles sometimes take a few days to be completely removed. During the purging process, the firing rate of the unit should be limited due to the possibility of high 1st-stage generator pressure nuisance trips. If necessary, the maximum loading for both the **HEATING** and **COOLING** modes may be limited between 40% and 100% as desired until the situation allows the design heat input to be established.

On steam units equipped with Leslie steam valve (I/O Expansion Board program jumper JP2 removed), the **MAXIMUM ALLOWED LOADING** setpoint must be set

to a value that is greater than the **MINIMUM ALLOWED LOADING** setpoint (see explanation of **MINIMUM ALLOWED LOADING** setpoint in this section). A MAXIMUM ALLOWED LOADING value less than or equal to the programmed **MINIMUM ALLOWED LOADING** setpoint will not be accepted.

During operation, the load command will be limited to the programmed value. When the load command reaches this value, SYSTEM RUN-MAXIMUM COOLING is displayed in **COOLING** or **COOLING AND HEATING** mode, SYSTEM RUN-MAXIMUM HEATING is displayed in **HEATING ONLY** mode.

**IMPORTANT!!!** – On gas/oil units, the unit will be allowed to load beyond this programmed value until the GAS/OIL BURNER CALIBRATION is performed. This setpoint is not effective until the calibration is performed.

To enter these values, proceed as follows:

To enter **MAXIMUM ALLOWED LOADING**:

1. Press and release the **LOAD** key. The following prompt message is displayed:

   Gas or oil-fired units (program jumper JP1-IN)
   MAX ALLOWED LOADING, COOL = XXX%; HEAT = XXX%

   -OR-

   Steam-fed units (program jumper JP1-OUT)
   MAX ALLOWED LOADING = XXX%

2. Using the **Entry** keys, enter the desired value (40-100%) for **HEATING** and **COOLING**. Steam-fed units operate only in **COOLING** mode. Use leading zeroes where necessary (i.e., **075**%). If the **CANCEL** key is pressed, the default value **100**% appears. To enter the "Heat" value, first enter the desired "Cool" value. The cursor will move to the first changeable digit of the "Heat" value.

3. Press **ENTER** key.

   PROGRAM MODE, SELECT SETPOINT is displayed. (Steam units equipped with Leslie steam valves only: if the value entered is not greater than the value programmed for **MINIMUM ALLOWED LOADING** setpoint, OUT OF RANGE – TRY AGAIN will be displayed.)

4. Press **ACCESS CODE** key.

   ACCESS TO PROGRAM KEY DISABLED is displayed momentarily. The display then returns to the normal background message.

**7-DAY PURGE CYCLE COUNTER AND EXCESS PURGE CYCLE COUNTER –** Anytime the EPROM (IC U17 on Micro Board) or the real time clock (RTC) chip (IC U16 on Micro Board) is replaced, an erroneous number could appear in the 7-day purge cycle counter. If this happens, the counter can be reset to zero as follows:

- With AC power applied to Control Center, remove Micro Board program jumper (J57) from "CLKON" position and replace it to the "CLKON" position.

-OR-

- With AC power applied to Control Center, remove Micro Board program jumper (J57) from "CKLOFF" position and place it on the "CLKON" position.

Although the excess purge counter value cannot be displayed, it is automatically reset to zero when either of the above procedures is performed.

**OPERATING HOURS, START COUNTER AND TOTAL (LIFETIME) PURGE COUNTER –** These values should not be arbitrarily changed or reset. However, since these values are stored in the Micro Board RTC chip (IC U16 on Micro Board), replacing either the Micro Board or RTC chip will cause these values to be lost. Therefore, the service technician should note these values prior to replacing either of these components. After the new component is installed, these values should be entered using the procedure below.

***CAUTION!!! –*** *If zeroes are entered for all digits for both OPERATING HOURS and START COUNTER or for any PURGE counter, all counters are reset to zero. Refer to reset procedures that follows.*

To enter **OPERATING HOURS, START COUNT** values:

1. Press **OPERATING HRS./START COUNTER** display key.
   OPER. HOURS = _ _ _ _ _; START COUNTER = _ _ _ _ _
   is displayed.

2. Using the **Entry** keys, enter the desired values for operating hours and start counter. Use leading zeroes where necessary (i.e., **00417**). The cursor will move left to right as digits are entered.

3. Press **ENTER** key.
   PROGRAM MODE, SELECT SETPOINT is displayed.

4. Press **ACCESS CODE** key.
   ACCESS TO PROGRAM KEY DISABLED is displayed momentarily and the display then returns to the normal background message.

**TO ENTER LIFETIME PURGE COUNT VALUES:**

1. Press **PURGE CYCLE COUNTER** key. If unit is equipped with EPROM version A.01F.09 (or later with I/O Expansion Board jumper JP1 installed) or A.01F.08 or earlier, lifetime manual purge count is displayed as follows:

   LIFETIME PURGE COUNTS = XXXXX

   If unit equipped with EPROM version A.01F.09 or later (with I/O Expansion Board program jumper JP1 removed),
   LIFETIME PURGES, AUTO=XXXXX; MAN=XXXXX is displayed.

2. Using **Entry** keys, enter desired values. Use leading zeroes where necessary (ie., **00045**). The cursor will move to the left as digits are entered.

3. Press **ENTER** key.
   PROGRAM MODE, SELECT SETPOINT is displayed.

4. Press **ACCESS CODE** key.
   ACCESS TO PROGRAM KEY DISABLED is displayed momentarily. The display then returns to the normal background message.

To reset **OPERATING HOURS, START COUNTER** and **TOTAL (LIFETIME) PURGE COUNTER** to zero: *(NOTE: This procedure resets ALL of these values to zero simultaneously. It is not possible to reset them individually.)*

1. Press the **OPERATING HRS./START COUNTER** or **PURGE CYCLE COUNTER** display keys.

2. Using the **Entry** keys, enter zeroes for all changeable digits.

3. Press the **ENTER** key.
   PROGRAM MODE, SELECT SETPOINT is displayed.

4. Press the **ACCESS CODE** key.
   ACCESS TO PROGRAM KEY DISABLED is displayed momentarily. The display then returns to the normal background message.

**LEAVING CHILLED WATER TEMPERATURE MINIMUM ALLOWED SETPOINT –** The overall programmable range of Leaving Chilled Water Temperature (LCWT) setpoints is 42-77°F. However, each unit is designed with a specific minimum allowed LCWT setpoint. This setpoint is programmed into the Control Center at the factory. The setpoint must never be set lower than this value. To prevent customer personnel from setting it lower than the allowed value, factory personnel use the special access code (1380) to program the LCWT setpoint. This value becomes the lowest allowed setpoint. If someone tries to enter a lower value using the general access code (9675), the program will reject it and display
OUT OF RANGE - TRY AGAIN. If the Micro Board or "RTC" chip (IC U16) is replaced, this value must be programmed by the field serviceman using the procedure below.

To illustrate the above: If a particular direct-fired unit is designed to produce a LCWT of 43.5°F, factory personnel would program the LCWT setpoint to 43.5°F using the special access code (1380). The allowable range of LCWT setpoints for this unit then becomes 43.5-77°F.

To enter the **LEAVING CHILLED WATER TEMP MINIMUM ALLOWED SETPOINT** value:

1. Press **LEAVING WATER TEMP** setpoint key.
   LVG CHILLED WATER SETP = XX.X°F (BASE) is displayed.

2. Using the **Entry** keys, enter the desired value (42-77°F). If the **CANCEL** key is pressed, default value 44.0°F is displayed.

3. Press **ENTER** key.
   PROGRAM MODE, SELECT SETPOINT is displayed.

4. Press **ACCESS CODE** key.
   ACCESS TO PROGRAM KEY DISABLED is displayed momentarily. The display then returns to the normal background message.

**SOLUTION CONCENTRATION DISPLAY ENABLE/DISABLE –** The solution concentration display and safety shutdown feature is only applicable to units equipped with thermistor RT12 (2nd-stage leaving refrigerant temperature) and EPROM version A.01F.09 (or later). This feature must be enabled with I/O Expansion Board program jumper J14. After the feature has been enabled, the procedure below can be used to enable or disable the display of the actual solution concentration calculated by the Control Center. Normally, the solution concentration that is displayed under the **1ST-STAGE GEN PRESS/TEMP** key, should be enabled. However, under certain operating conditions, it may be desired to disable the solution concentration display. Even though the display is disabled, the "High Solution Concentration" warning and safety shutdown functions are still operational. To enable or disable the display, proceed as follows:

1. Press and release the **UNLOAD** key. Use **ADVANCE DAY/SCROLL** key, if necessary to display the following:
   SHOW SOL'N CONCENTRATION=0 (0=NO; 1=YES) or
   SHOW SOL'N CONCENTRATION=1 (0=NO; 1=YES)

is displayed indicating the display is presently disabled or enabled.

2. Using the **ENTRY** keys, press "**0**" to disable the display or "**1**" to enable the display.

3. Press **ENTER** key.

4. Press **ACCESS CODE** key.
   ACCESS TO PROGRAM KEY DISABLED is displayed momentarily. The display then returns to the normal background message.

**STEAM VALVE CONTROL (Steam Units Only) –** There are several programmable values that affect the control of the steam valve. The description of these set-points is provided in the "Steam Valve Control" section of this book. Units with EPROM version A.01F.07 are equipped with Honeywell steam valves. Units with EPROM version A.01F.08 or later, could be equipped with either Honeywell or Leslie steam valves. These units require the I/O Expansion Board program jumper JP2 to be configured for the appropriate application. If the unit is equipped with a Honeywell valve, JP2 must be "IN" to allow the Honeywell valve setpoints to be pro-grammed. If the unit is equipped a Leslie valve, JP2 must be "OUT" to allow the Leslie valve setpoints to be programmed. The setpoints for both valves are listed below, followed by programming instructions for each setpoint:

| HONEYWELL | LESLIE |
|---|---|
| Rate limit | Rate limit |
| Unload pulse | Unload factor |
| Sample factor | Sample factor |
| | DAC divide value |
| | Minimum allowed loading |

**TO PROGRAM THE SETPOINTS:** Press **CHILLED WATER TEMPS** key. Use the **ADVANCE DAY/SCROLL** key to select the setpoint you want to change. Each time this key is pressed, the next setpoint prompt is displayed. After desired vallues are entered, press the **ENTER** key. When complete, press **ACCESS CODE** key to exit.
ACCESS TO PROGRAM KEY DISABLED will be displayed. The Leslie steam valve **MINIMUM ALLOWED LOADING** setpoint requires a different procedure as detailed below.

**Honeywell Valve Setpoints**

RATE LIMIT = X.X; UNLOAD PULSE = XX

Using the **Entry** keys, enter the desired RATE LIMIT value (0.3°F to 2.0°F). Use leading zeroes where necessary (i.e., **0.5**). The cursor will move under the first changeable digit of the UNLOAD PULSE value. Then enter the desired UNLOAD PULSE value (6 to 12 seconds). If the **CANCEL** key is pressed, default values 1.0 (RATE LIMIT) and 6 (UNLOAD PULSE) are displayed.

SAMPLE FACTOR = XX.X

Using **Entry** keys, enter desired SAMPLE FACTOR value (0.5 to 16 minutes). Use leading zeroes where necessary (i.e., **00.5**). If **CANCEL** key is pressed, default value 4.0 is displayed.

**Leslie Valve Setpoints**

RATE LIMIT = X.X; UNLOAD FACTOR = X.X

Using the **Entry** keys, enter the desired RATE LIMIT value (0.3°F to 2.0°F). Use leading zeroes where necessary (i.e., **0.5**). The cursor will move under the first changeable digit of the UNLOAD FACTOR. Then, enter the desired UNLOAD FACTOR value (1.0 to 2.0). If the **CANCEL** key is pressed, default value 1.0 is displayed for both RATE LIMIT and UNLOAD FACTOR.

SAMPLE FACTOR = XX.X

Using the **Entry** keys, enter the desired SAMPLE FACTOR value (0.5 to 16 minutes). Use leading zeroes where necessary (i.e., **00.5**). If **CANCEL** key is pressed, default value 4.0 is displayed.

DAC DIVIDE VALUE = X

Using the **Entry** keys, enter the desired DAC DIVIDE VALUE (1, 2, 4, 8). If the **CANCEL** key is pressed, default value 1 is displayed.

MIN ALLOWED LOADING

Follow instructions under "Minimum Allowed Loading" in "Special Setpoints and Programming Procedures" section.

**MINIMUM ALLOWED LOADING** (steam units equipped with Leslie steam valves only) (EPROM version A.01F.08 or later only) – During **UNIT RUN**, steam units cannot be allowed to unload below 20% of unit capacity. Oper-ating below this capacity results in unstable operation. The steam valve position corresponding to 20% of unit capacity is determined by a procedure in YORK Form155.17-NM1. This position is entered in the procedure below. During **UNIT RUN**, the unit will not be allowed to unload below this steam valve position unless manually controlled using the **UNLOAD** keypad key in **SERVICE** mode. When fully closed, the valve position is 0%; fully open is 100%. The valve position corresponding to 20% of unit capacity could be from 5% to 60% steam valve position.

To assure that the unit will not unload to less than the **MINIMUM ALLOWED LOADING** setpoint position, the following safeguards are in place:

If a remote device attempts to limit the loading to a valve position that is less than the **MINIMUM ALLOWED LOADING** setpoint, the MicroComputer Control Center will override the remote device as follows: If a **REMOTE LOAD LIMIT** setpoint is received that is not greater than the **MINIMUM ALLOWED LOADING** setpoint, the program will automatically set the **REMOTE LOAD LIMIT** setpoint to 1% above the **MINIMUM ALLOWED LOADING** setpoint.

Similarly, the program will assure that the **MAXIMUM ALLOWED LOADING** setpoint is set to a value greater than **MINIMUM ALLOWED LOADING** setpoint. If a service technician attempts to enter a **MINIMUM ALLOWED LOADING** setpoint that is not less the **MAXIMUM ALLOWED LOADING** setpoint, OUT OF RANGE – TRY AGAIN is displayed.

I/O Expansion Board program jumper JP2 must be removed to enable the following procedure. If the customer purchased factory testing, this setpoint is set at the factory. Otherwise, the procedure to determine the steam valve position corresponding to 20% of unit capacity and the following setpoint entry must be performed in the field.

1. Press **UNLOAD** key. Use **ADVANCE DAY/SCROLL** key to scroll thru messages until MIN ALLOWED LOADING = XX% is displayed.

2. Using the **Entry** keys, enter desired value (5% to 60%). Use leading zeroes where necessary (i.e., **07**). If **CANCEL** key is pressed, default value 5% is displayed. The value entered must be less than the programmed **MAXIMUM ALLOWED LOADING** setpoint. Otherwise, OUT OF RANGE – TRY AGAIN is displayed in the next step.

3. Press **ENTER** key. PROGRAM MODE, SELECT SETPOINT is displayed.

4. Press **ACCESS CODE** key to exit. ACCESS TO PROGRAM KEY DISABLED is displayed momentarily. The display then returns to the normal foreground message.

# WARNING MESSAGE OVERRIDE PROCEDURE

If Micro Board program jumper (J51) is **IN**, and the Control Center is in **SERVICE** mode, the **LOAD** key can be used to manually load the unit beyond certain override thresholds. For example, in normal operation the load signal is driven down to 30%, regardless of load requirement, when the 1st-stage generator pressure reaches 659.7mmHg (12.76 PSIA). This feature allows the **LOAD** key to manually drive the load signal up to any desired value greater than 30% even though the pressure is 659.7mmHg (12.76 PSIA). This feature should only be used at the YORK factory during testing. The following is a list of the functions that can be overriden with this feature: (Refer to "Display Messages" section of Form 155.17-O2 for details of each message.)

- WARNING – Low Refrigerant Temperature
- WARNING – High Gen Pressure Override
- WARNING – High Gen 1 Pressure Override*
- WARNING – High Gen 2 Pressure Override*
- WARNING – High Gen Temperature Override
- WARNING – High Gen 1 Temp Override*
- WARNING – High Gen 2 Temp Override*
- WARNING – Ent Cond Water Temp High Limit

*Gas-fired Models -20G thru -22G only.

# STEAM VALVE POTENTIOMETER CALIBRATION
## (HONEYWELL VALVES ONLY)

The steam valve contains a 0-135 OHM position feedback potentiometer. It indicates the position (0-100%) of the steam valve to the Micro Board. To assure the pot indicates 100% when the steam valve is fully open, and 0% when fully closed, calibration is necessary. The calibration procedure, once initiated, is automatic. It must be performed anytime the steam valve, steam valve pot, Micro Board or Micro Board "Real-Time Clock" (RTC) IC U16 is replaced. The calibrated values are stored in the "RTC" chip.

The automatic calibration is initiated by the service technician. Once initiated, the MicroComputer Control Center automatically drives the steam valve to the fully loaded (open) position. When the valve stops moving for a period of approximately 30 seconds, that position is marked as the 100% position. The steam valve is then driven to the fully unloaded (closed) position. When it stops moving for a period of approximately 30 seconds, that position is marked as the 0% position. If the feedback voltage to the I/O Expansion Board J6-2 from the pot was 4.007VDC to 4.643VDC (4.496VDC nominal) at the 100% point, it is considered a valid (pass) 100% calibration. Otherwise, it is considered an invalid (fail) 100% calibration. If the feedback voltage was 0.415VDC to 0.879VDC (0.488VDC nominal) at the 0% point, it is considered a valid (pass) 0% calibration. Otherwise, it is considered an invalid (fail) 0% calibration. A fail indication for either the 0% or 100% point requires troubleshooting to locate the cause of the problem.

To perform the calibration, gain access to **PROGRAM** mode using the procedure below. Then proceed with the calibration procedure.

1. Press **ACCESS CODE** key.
   ENTER VALID ACCESS CODE _ _ _ _ is displayed.

2. Using **Entry** keys, enter **1 3 8 0**. As each digit is entered, the characters **Y O R K** are displayed. NOTE: If digits other than 1 3 8 0 are entered, **Y O R K** is still displayed.

3. Press **ENTER** key. If digits other than 1 3 8 0 were entered in step 2, INVALID ACCESS CODE is displayed when the **ENTER** key is pressed. If this occurs, enter the correct access (1380) code and proceed.

4. ACCESS TO PROGRAM KEY AUTHORIZED is displayed. NOTE: Unless terminated by pressing the **ACCESS CODE** key again, the operator will have access to **PROGRAM** mode for 10 minutes. When 10 minutes have elapsed, access to **PROGRAM** mode will be automatically disabled and the operator must return to Step No. 1 to gain access.

5. Press **PROGRAM** key.
   PROGRAM MODE, SELECT SETPOINT is displayed.

### CALIBRATION PROCEDURE:

1. Unit must be shut down with the **UNIT** switch in **STOP/RESET** position.

2. Press **AUTO** service key.
   AUTO-CAL STEAM VALVE POT – LOAD X.XXXV is displayed. The steam valve is driven to the fully open (loaded) position while this is displayed. As the steam valve is loading, the voltage feedback from the steam valve pot is displayed. It will increment as the valve opens. When the valve stops moving for approxi-mately 30 seconds, the voltage value at that time is logged as the 100% point and it is immediately driven to the closed (unloaded) position.
   AUTO-CAL STEAM VALVE POT – UNLOAD X.XXXV is displayed. The voltage feedback from the pot will decrement as the valve unloads. When the valve stops moving for approximately 30 seconds, the voltage value is logged as the 0% point.

3. The pass/fail message is now displayed. Refer to above description of pass/fail criteria. If the auto-calibration was successful at both the 0% (lo) and 100% (hi) points,
   PASS LO = X.XXXV, PASS HI = X.XXXV is displayed.
   The voltage value displayed is that which has been logged as the fully closed and open points (i.e., the voltage feedback from the pot when the steam valve was at its fully closed and open position positions). If either the lo or hi points are not within the allowed voltage range, "FAIL" is substituted for "PASS".

4. If either "PASS" or "FAIL "is displayed, press the **ENTER** key. PROGRAM MODE, SELECT SETPOINT is displayed. If "PASS" is displayed for both lo and hi, the calibration is complete. However, if "FAIL" is displayed for either one, the calibration is not successful and the service technician must trouble-shoot the problem.

5. Press **ACCESS CODE** key.
   ACCESS TO PROGRAM MODE DISABLED is displayed.

# GAS/OIL BURNER CALIBRATION

Burners used on gas/oil units are usually capable of firing rates higher than required for rated unit capacity. Using more burner output than required wastes fuel and can cause unit damage. Therefore, the burner firing rate must be limited to the MBH heat input (for **HEATING** or **COOLING** mode, whichever is higher, see below) specified in the factory test report. This is accomplished by adjusting the burner linkage so that full travel of the burner motor limits the fuel input to the specified value. The burner motor will be at full travel when it receives a 100% load command from the MicroComputer Control Center. The burner linkage must also be adjusted so that with the burner motor at minimum travel, the burner is at the minimum fire rate that will allow stable unit operation. The burner will be at minimum travel when it receives a 30% load command from the MicroComputer Control Center. Both of these adjustments are part of the "Burner Linkage Adjustment" procedure contained in YORK Form 155.17-NM1. Both must be performed prior to the calibration procedure below.

The next procedure that must be performed is the "Burner Motor Full Travel Calibration". This procedure is part of the calibration procedure listed below. This is necessary because the position of the burner stroke is displayed on the keypad display (via **DISPLAY DATA** key) in terms of "Percent Load"; minimum travel is displayed as 30% load command, and full travel is displayed as 100% load command. However, since there is no position feedback from the burner, the actual position must be derived from the current output from the Control Center to the burner. To explain, during unit operation the burner motor is modulated over the range of minimum travel to full travel by a 4-20mA output from the I/O Expansion Board. Typically, a 4mA output will drive it to the minimum travel position (Minimum Fire). A 20mA output will drive it to the full travel position (Full Fire). Due to variations in burner stroke tolerances, different burners could require more or less current output to reach full travel extremes. For example, one burner might be at minimum travel at 3.8mA and full travel at 18.5mA; another might be at minimum travel at 4.5mA and full travel at 20.5mA. To establish what output current is required to drive the motor to the full travel extremes, the calibration procedure below drives the burner motor to full travel and stores the current output value as "100% Load Command"; then it drives the motor to minimum travel and stores the current output value as "30% Load Command". Henceforth, whenever the burner drive current is that which was stored at minimum travel, LOAD COMMAND = 30% is displayed; when the current is that which was stored at full travel, LOAD COMMAND = 100% is displayed via the **DISPLAY DATA** key. The % load command displayed between these extremes is a linear result of the current output as follows:

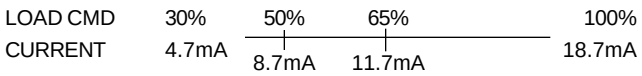
$$\%\ \text{Load CMD} = (I_{ACTUAL} - I_{30\%}) \times [70 \div (I_{100\%} - I_{30\%})] + 30$$

Units that operate in both **COOLING** and **HEATING** modes, usually require a different maximum burner output for **COOLING** and **HEATING** modes; some units require a maximum burner output for **COOLING** mode that is higher than that required for **HEATING** mode, other units require a maximum burner output for **HEATING** mode that is higher than that required for **COOLING** mode. The mode requiring the highest maximum output becomes the full fire rate of the unit. The maximum burner output of the remaining mode will be a percentage of full fire rate of the unit. For example, if **HEATING** mode of a unit is the full fire mode, and it has a **HEATING** mode burner travel from 4.7mA (Min Travel) to 18.7mA (Full Travel) and only 70% "Burner Load Command" is required to achieve the full fire heat input in **COOLING** mode, then full travel in **COOLING** mode will be from 4.7mA to 13.1mA. In **COOLING** mode the current output will be limited to 13.1mA and LOAD COMMAND = 100% will be displayed (via **DISPLAY DATA** key) at this value. LOAD COMMAND = 30% will be displayed at 4.7mA current output. The percent load command between these extremes is a linear result of the current output. This example is diagrammed below. The factory test report lists the heat input (MBH) required for both **HEATING** and **COOLING** modes.

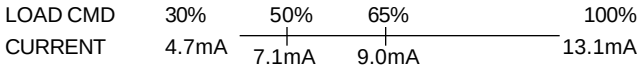
The complete procedure to determine the percentage of full fire rate application to the remaining mode is contained in "YORK Absorption" service manual, Form 155.17-NM1. It must be performed prior to programming this percentage in the **FULL FIRE MODE SETPOINT** procedure below. This percentage is entered with the prompt MAX MMM INPUT = XXX% OF FULL FIRE ; where "MMM" is replaced by "CLG" or "HTG" as appropriate. The mode identified as requiring the full fire rate is also programmed using the **FULL FIRE MODE SETPOINT** procedure. In this procedure, the **FULL FIRE** mode is entered with the prompt FULL FIRING MODE = 0 (0=CLG; 1=HTG) . The **FULL FIRE MODE SETPOINT** procedure must be performed after the "Burner Motor Full Travel Calibration" procedure is performed.

EXAMPLE:
**HEATING** mode Full Fire = 100% (unit full fire rate)
**COOLING** mode Full Fire = 70% of unit full fire rate

**HEATING MODE**




**COOLING MODE**




***NOTE!!*** *The programmed value for the maximum firing rate of the LESSER of the two modes (**COOLING** or **HEATING**) cannot be mathematically derived, but must be found by manually loading the unit to the maximum heat input specified for the lessor mode while clocking the gas meter to the burner. The "Percent Load Command" displayed at this point is the value which is entered in the procedure below. This procedure is included in YORK Form 155.17-NM1. The percentage cannot be determined by dividing the lesser required maximum heat input (MBH) by the greater required heat input (MBH).*

## BURNER MOTOR FULLTRAVEL CALIBRATION

Before the following procedure can be performed, the Burner Linkage Adjustment must be performed per above description and YORK Form 155.17-NM1.

**IMPORTANT!!! –** Gas/oil-fired units are allowed to load beyond any programmed or remote load limits until the "Burner Calibration Full Travel Calibration" is performed.

The following procedure pertains to both single and dual burner units. For single burner units, two people are required – one at the burner to observe the modulating motor rotation and one at the MicroComputer Control Center to capture the burner control current value. For dual burner units, three people are required – one at each burner as well as one at the MicroComputer Control Center.

With dual burner units, both burner controls are wired in series. The 4-20mA control signal from the I/O Expansion Board travels through the first burner control, then through the second burner control and returns to the I/O Expansion Board. If both modulating motors were ideally matched for rotation, for the same output current, either burner motor could be used for calibration. However, burner tolerances require that the travel of both motors be considered.

"Full Travel" as discussed in Step 7 below, is the point where the (last) modulating motor stops rotating while opening its gas valve. "Minimum Travel" as discussed in Step 8 below, is the point where the (last) modulating motor stops rotating while closing its gas valve. This guarantees that both gas valves will fully close and fully open for the 4-20mA control signal. This may introduce some slack at the top and/or bottom for one or both burners, depending upon the degree of match in rotation of the two motors.

Pencil marks should be made on the motor, prior to the procedure below, to mark the limits of travel.

1. Micro Board program jumper JP1 (gas/oil units) and J51 (limit override) must be installed prior to performing this procedure.

2. The following setpoints must be programmed as follows prior to performing this procedure. These setpoints limit loading and will prevent the burner from going to "Full Travel". If these setpoints are not set as follows, the "Burner Full Travel Calibration" will not be correct.

   a. "MAX ALLOWED LOADING" must be set to **"100%".**

   b. "AUTO-TEMP CONTROL DELAY" must be set to **"0"** minutes.

   c. "PULLDOWN DEMAND LIMIT" MUST BE SET TO **"0"** MINUTES, START **"100%"**, STOP **"100%**.

   After the burner calibration is completed, these setpoints must be returned to their original values.

3. The unit must be running in **SERVICE** operating mode.

4. Enter **PROGRAM** mode using access code 1 3 8 0. PROGRAM MODE, SELECT SETPOINT is displayed.

5. Press **AUTO** key. PERFORM BURNER CALIBRATION? (1=YES; 0=NO) is displayed and the burner is driven toward the closed position. If it is desired to perform the following procedure, press **"1"**. Otherwise, press **"0"** to exit. If **"0"** is pressed, PROGRAM MODE, SELECT SETPOINT is displayed.

   *NOTE: If at any stage in the calibration process it is desired to terminate the procedure, press the **"*"** key. All previously programmed calibration values are retained. Also, any unit shutdown during this procedure, terminates the procedure.*

6. Press the **ENTER** key. BURNER CONTROL CURRENT = XX.XMA is displayed.

The burner will be driven open until it reaches the full travel position and stops rotating. The current displayed is that which is being output to the burner control. It will increase as the motor rotates toward full travel position.

7. At the instant the motor reaches full travel position, the person at the burner must signal the person at the MicroComputer Control Center to capture the motor current value. This is done by pressing the **HOLD** key. For dual burner units, both burner persons must signal, with the last signal used for the capture. The lowest current value that will be accepted is 18.3mA. Lower current values will be ignored by the software. Pressing the **HOLD** key also causes the motor to reverse direction and travel toward the minimum travel position.

8. When the motor reaches minimum travel position, the person at the burner must signal the person at the MicroComputer Control Center to press the **HOLD** key to capture the motor current value. For dual burner units, both persons must signal with the last signal used for capture. The highest current value that will be accepted for minimum travel is 5.0mA. Higher current values will be ignored by the software.

9. FULL FIRE CONTROL RANGE = XX.XMA TO XX.XMA is displayed.

10. Press the **ENTER** key.
    PROGRAM MODE, SELECT SETPOINT is displayed.

11. Press **PROGRAM** key to exit. The normal foreground message is displayed.

12. Remove Micro Board program jumper J51.

13. Return setpoints changed in step 2 to their original values.

## FULL FIRE MODE SETPOINT

This procedure must be performed after the above "Burner Full Travel Calibration" is performed. If the unit only operates in **COOLING ONLY** mode, the **FULL FIRE MODE** is programmed to "CLG". If the unit operates in both **COOLING ONLY** and **HEATING ONLY** mode, typically one mode requires a different maximum burner output that is higher than the other. The mode requiring the highest maximum output becomes the **FULL FIRE MODE** of the unit. The maximum burner output of the remaining mode will be a percentage of full fire rate of the unit. The procedure to determine the percentage of full fire for the lessor mode is in "Service" manual, Form 155.17-NM1.

1. Enter **PROGRAM** mode using access code 1 3 8 0.
   PROGRAM MODE, SELECT SETPOINT is displayed.

2. Press **HOLD** key.
   FULL FIRING MODE=0 (0=CLG; 1=HTG) is displayed.

3. Using **Entry** keys, press **"0"** or **"1"** as appropriate or press **ADVANCE DAY/SCROLL** key to advance to the next prompt in Step 5. If the **CANCEL** key is pressed, default value **"0"** is displayed.

4. Press **ENTER** key.

5. Press **ADVANCE DAY/SCROLL** key.
   MAX MMM INPUT = XXX% OF FULL FIRE is displayed. "MMM" is automatically replaced by the alternate mode from that which was designated as the **FULL FIRE MODE** in Step 3.

6. Using the **Entry** keys, enter the percentage of full fire for this mode. The procedure to determine this percentage is detailed in YORK "Absorption" Service manual, Form 155.17-NM1.

7. Press **ENTER** key.

8. Press **PROGRAM** key to exit. The normal foreground message is displayed.

# LIMITED DILUTION CYCLE STANDBY POWER SUPPLY

## GENERAL

Limited Dilution cycles can be performed during utility power failures using an emergency generator to supply power to the MicroComputer Control Center and all solution pumps. Refer to “Operation” manual, Form 155.17-O2 for complete explanation of sequence of operation and all display messages associated with the “Limited Dilution Cycle”.

Refer to Fig. 38 and 39. When a utility power failure occurs, an “Automatic Transfer Switch” (ATS) must transfer the ParaFlow unit power source from utility power to generator power. Simultaneously, two sets of normally open contacts that are a part of the “ATS” close: one set to start the emergency generator; the other set to signal the digital input board at terminal TB2-95 that a standby power supply is on line and a “Limited Dilution” cycle should be performed. (NOTE: Units must be equipped with digital input board P/N 031-01621-001 (Standard units) or 031-01621-002 (VDE units) to have TB2-95; previous digital input board 031-00935-000 does not have TB2-95). When utility power is restored, the “ATS” transfers the power source to utility power and simultaneously opens both sets of contacts to stop the generator and signal the digital input board that utility power has been restored.

The following is the hardware that must be customer supplied.

a. Automatic Transfer Switch (ATS)

b. Non-fused Disconnect Switch (DISC SW)

c. Fuses or Circuit Breaker – UL approved CB for Heating & Air Conditioning & Refrigeration Applications (HACR)

d. Emergency Generator (EMER GEN)

This equipment must be selected in accordance with the power requirements of the ParaFlow Absorption unit that it will be connected to. These power requirements are in “ParaFlow Applications Data” manual, Form 155.17-AD1.

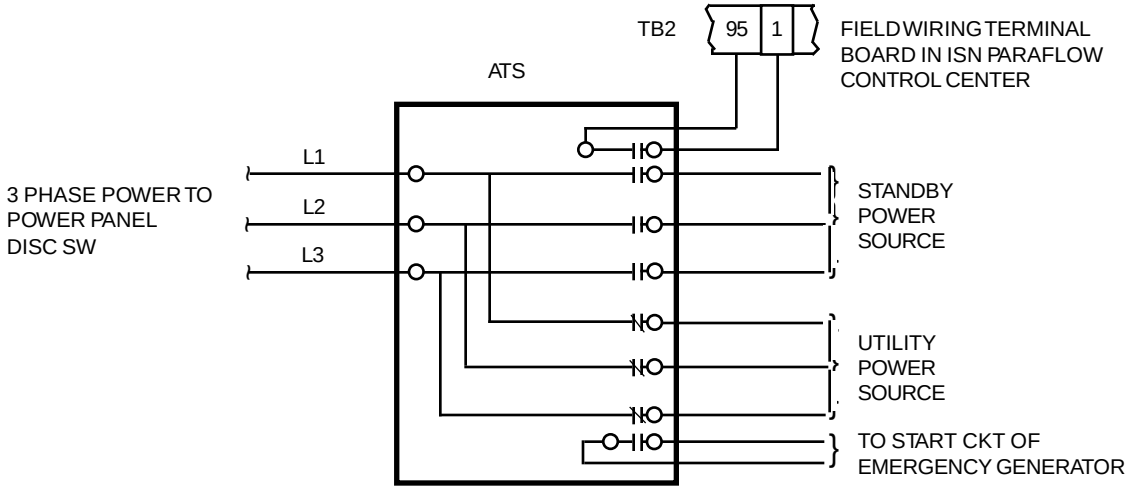



**FIG. 38 –**

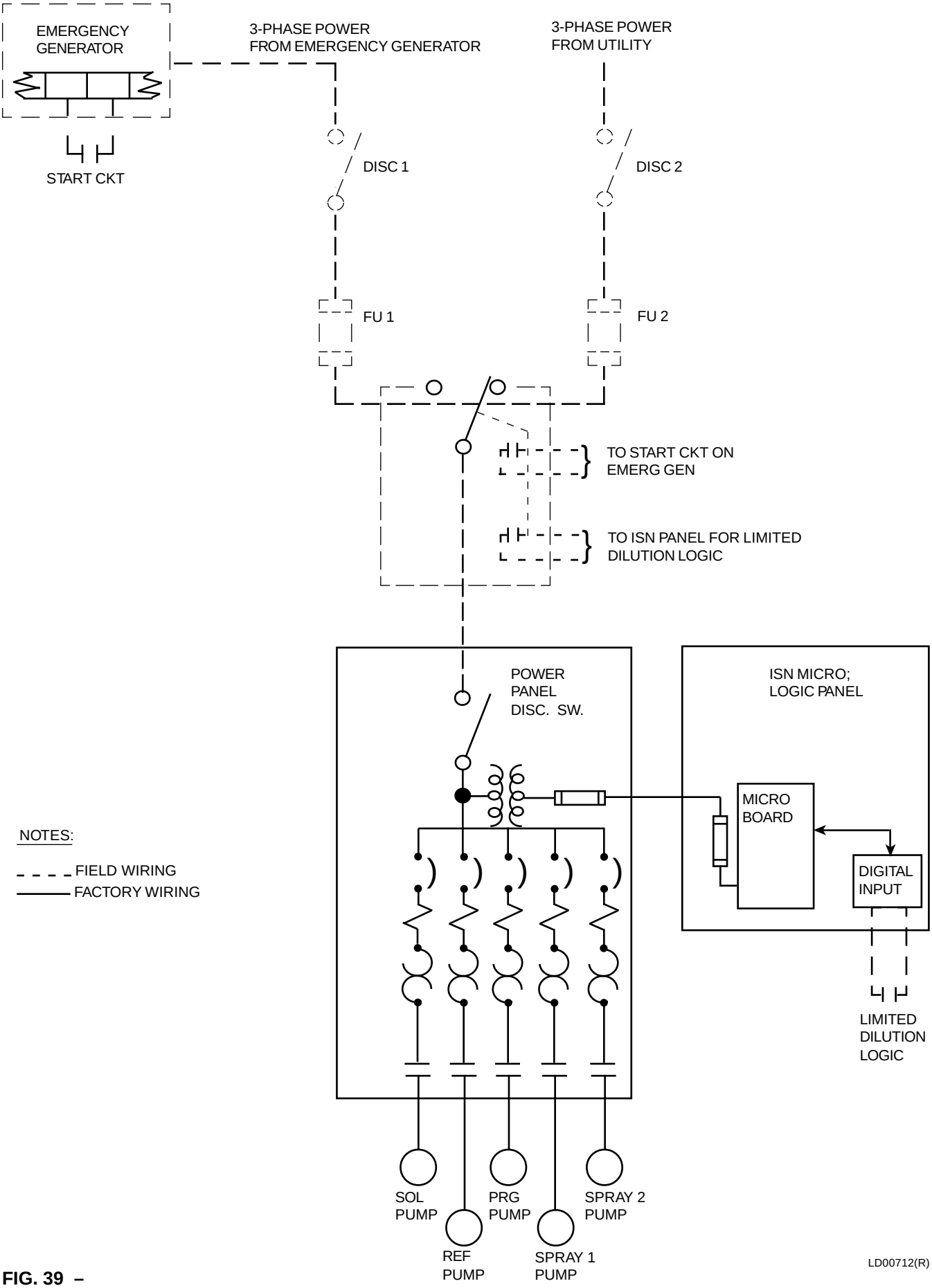

EMERGENCY GENERATOR
START CKT
3-PHASE POWER FROM EMERGENCY GENERATOR
3-PHASE POWER FROM UTILITY
DISC 1
DISC 2
FU 1
FU 2
TO START CKT ON EMERG GEN
TO ISN PANEL FOR LIMITED DILUTION LOGIC
POWER PANEL DISC. SW.
ISN MICRO; LOGIC PANEL
MICRO BOARD
DIGITAL INPUT
LIMITED DILUTION LOGIC
NOTES:
FIELD WIRING
FACTORY WIRING
SOL PUMP
PRG PUMP
SPRAY 2 PUMP
REF PUMP
SPRAY 1 PUMP
LD00712(R)

**FIG. 39 –**

# TESTING

## SOFTWARE DIAGNOSTICS

The diagnostic software consists of six tests. These tests are Ram test, A/D test, display test, keyboard test, digital input test, and digital output test. The diagnostic software is stored in the same memory as the operating program. To enable the diagnostic, enter **SERVICE** mode and place Micro Board program jumper J55 in the **ENABLE** position. To disable the diagnostic, leave **SERVICE** mode and place J55 jumper plug in the **DISABLE** position. After the diagnostic is enabled, all further service technician interaction is done on the front panel keypad. When the diagnostic is enabled, the service technician is presented with a menu from which he can choose the test to be performed. The menu and six tests are described as follows:

*CAUTION: BEFORE BEGINNING THIS TEST, REMOVE WIRE NO. 5 FROM TB6-5 AND PRESS THE MANUAL TRIP BUTTON ON ALL PUMP OVERLOADS MOUNTED IN THE POWER PANEL. This prevents the burner (gas/oil) from being turned on or the steam shutoff valve (steam units) from being opened during the following tests. Also, it prevents the system pumps from being inadvertantly turned on. Upon completion of these tests, replace wire no. 5 and reset the pump overloads.*

## MENU

Upon entering the diagnostic software, the technician will observe a menu from which one of the six tests may be chosen. Press **"9"** key to view all five tests. The tests may be chosen by selecting the numeric key listed with the test. The keys and tests are as follows:

| | |
|---|---|
| 0 – Ram test | 3 – Keyboard test |
| 1 – A/D test | 4 – Digital input test |
| 2 – Display test | 5 – Digital output test |

The numeric keys are located under **Entry** on the front of the Control Center.

## RAMTEST

This test will check all ram locations in the system. The ram consists of two areas:

EXT – External Ram
RTC – Ram Internal to the Clock

After the test is completed, the display will show the two areas with either a pass or fail. A failed condition would indicate that the Micro Board should be replaced.

Press the **"*"** key after the test is over to return to the main menu.

## A/DTEST

This test will allow the technician to select any of the analog input channels and display the voltage on that channel on the display. The display will show the voltage found on that channel in volts (0-5.000V). Upon entering this test, the technician will be asked to push one of the display function keys to select a group of analog channels; from here an individual channel may be selected. The analog channels associated with the display keys are as follows:

CHILLED LIQUID TEMPS
ECWT – Entering Chilled Water Temp
LCWT – Leaving Chilled Water Temp
(The analog voltage displayed for LCWT is that which is measured at IC U53 pin #7, not Micro Board input J19-10)

FIRST-STAGE GENERATOR PRESS/TEMP

| | | |
|---|---|---|
| Gen1 | 0->T | – First-stage Generator No. 1 Temp |
| | 1->P | – First-stage generator No. 1 Pressure |
| Gen2 | 2->T | – First-stage generator No. 2 Temp (gas/oil Models -20G to -22G only) |
| | 3->P | – First-stage generator No. 2 Pressure (gas/oil Models -20G to -22G only) |

REFRIGERANT/SOL'N TEMPS
REF – Refrigerant temp
SOL – Solution temp

CONDENSER WATER TEMPS
ECNWT – Entering Condenser Water Temp
LCNWT – Leaving Condenser Water Temp

HOT WATER TEMPS (Gas/oil units operating in **HEATING ONLY** or **COOLING AND HEATING** mode)
LHWT – Leaving Hot Water Temp
EHWT – Entering Hot Water Temp

PRINT (only if equipped with optional automatic purge system)
PRG TNK – Purge Tank Pressure
PRG PMP – Purge Pump Pressure

DISPLAY DATA
Mixed Water Temp (optional)
Steam Valve Position Feedback (steam units only)

After tests are completed, press "*" key to return to main menu.

## DISPLAY TEST

This test will make sure the display is functioning. Upon entering this test, the technician will be instructed to press a key to start the test. Once the test has started, the technician will see various characters, numbers and symbols scroll past on the display. After the test has started, any key can be pressed to return to the main menu.

## KEYPAD TEST

This test allows the service technician to make sure that all the keys on the keypad are functioning. Upon entering this test, the technician will be instructed to press any of the keys. When each key is pressed, a description of that key is displayed on the display. To exit this test and return to the main menu, press the "*" key.

## DIGITAL INPUT TEST

This test will display the state of each digital input. A mnemonic for each of the inputs will be displayed with its associated state (1 if high; 0 if low). The inputs are:

STOP – unit switch stop input
GENTMP – first-stage generator high temp safety switch (two switches wired in series on gas/oil Models -20G – -22G)
AUX – auxiliary safety shutdown
STRT – unit switch start input
SOLN-OL – solution pump overload 1OL & motor thermal MTH1 in series
REFR-OL – refrigerant pump overload 2OL & motor thermal MTH2 in series
GENPRS – first-stage generator high pressure safety switch (two switches wired in series on gas/oil Models -20G – -22G).
FLAME – "Burner On" indication from burner control panel (gas/oil units only)
CWFLOW – chilled water flow switch
SYSCY – remote/local cycling input
MULCY – multi unit sequence input
SOLVL – first-stage generator solution level safety switch (gas/oil units only; two sensors used on Models -20G – -22G)
BNRALM – burner alarm from burner control panel (gas/oil units only)
J54 – chilled water pump program jumper on Micro Board. IN = 0; OUT = 1
JP5 – curr unbal program jumper on Micro Board. IN = 0; OUT = 1
JP6 – prerun program jumper on Micro Board. IN = 0; OUT = 1
RSTRT – remote start input
UV – under voltage input from power failure circuit on Micro Board. 1 = OK
RSTOP – remote stop input
RLCWT – remote leaving chilled water temp setpoint PWM input
CDFLOW – condenser water flow switch
PRGPMP – purge pump overload 3OL
REFTMP – low refrigerant temp safety switch
HWFLOW – hot water flow switch (optional on gas/oil units); or remote PWM steam limit input (steam units only).

After tests are complete, press "*" key to return to main menu.

## DIGITAL OUTPUT TEST

This routine allows the technician to monitor and change the state of the digital outputs. The technician will see an output listed, along with its present state (1 = high; 0 = low). At this time the output state can be changed by pressing the **"1"** key to make it high or **"0"** key to make it low. The outputs are:

SOLN PUMP – solution pump starter (all models) and first spray solution pump starter (Models -19GL – -22G)
SPRAY PUMP – second spray solution pump starter (Models -19GL – -22G & -16SL – -19S)
CHILLED WATER PUMP – chilled water pump starter
CONDENSER WATER PUMP – condenser water pump starter
REFRIG PUMP – refrigerant pump starter
BURNER – on/off signal to burner control panel (gas/oil units); steam shutoff valve (steam units)
PURGE TANK SOL – purge tank solenoid valves (supplied only if equipped with optional automatic purge system)
PURGE PUMP SOL – purge pump solenoid valve (supplied only if equipped with optional automatic purge system)
PURGE PUMP – purge pump starter
STEAM VALVE OPEN – steam valve load command (steam units only)
STEAM VALVE CLOSE – steam valve unload command (steam units only)
TURNDOWN SOL – 10% turndown solenoid valve (optional)
*CYCLING SD – cycling shutdown status contacts
*SAFETY SD – safety shutdown status contacts
*EMS – remote ready to start status contacts
*HW PUMP – hot water pump starter (gas/oil units only)
*WRNG ALARM – warning alarm status contacts
*CHFLS/LRT BYPASS – gas/oil units low refrigerant temp and chilled water flow switch bypass in **HEATING ONLY** mode. Steam units steam valve close at unit shutdown.

After tests are complete, press "*" key to return to main menu.

*These outputs go thru the I/O Expansion Board which has inverted outputs. Therefore, the logic is inverted; "0" to de-energize, "1" to energize.

# SYSTEM COMMISSIONING CHECKLIST

1. Verify that all program jumpers on Micro Board and I/O Expansion Board are in the correct positions for the application. Remove or install program jumpers as required. Refer to Fig. 25 and "I/O Expansion Board" section. ***CAUTION: PROGRAM JUMPER J51 MUST BE REMOVED!!***

2. Start Real-Time Clock

   Refer to Micro Board program jumper J57, Fig. 25.

3. Program System Setpoints
   a. Refer to Operation manual, Form 155.17-O2.
   b. The design (minimum allowed, Refer to "Special Setpoints and Programming Procedures" section) **LEAVING CHILLED WATER** setpoint is factory set to value listed in "Factory Test Report". Verify correct value is programmed.
   c. The **DESIGN LEAVING HOT WATER** setpoint (if applicable) is factory set to value listed in "Factory Test Report". Verify correct value is programmed.

4. Check Solution Pump Delay setpoint (Models -19GL – -22G & -16SL – -19S).

   Factory set to the value listed in "Factory Test Report". Refer to "Special Setpoints and Programming Procedures" section.

5. Check Auto-Temp Control Reset Time setpoint (gas/oil units only) factory set to 20 minutes. Refer to "Special Setpoints and Programming Procedures" section.

6. Check Auto-Temp Control Delay setpoint (gas/oil units only).

   Factory set to value listed in factory test report. Refer to "Special Setpoints and Programming" section.

7. Automatic Purge System (units equipped with EPROM version A.01F.09 or later and auto-purge hardware consisting of purge pump transducer PT3, purge tank transducer PT4, purge tank solenoid 1SOL and purge pump solenoid 2SOL).
   a. Enable auto-purge hardware by removing I/O Expansion Board program jumper JP1.
   b. Using instructions in Operation manual, Form 155.17-O2, select AUTO or MANUAL PURGE operation.

8. Check Maximum Allowed Entering Condenser Water Temp setpoint.

   Factory set to value listed in "Factory Test Report". Refer to "Special Setpoints and Programming Procedures" section.

9. Enable Solution Concentration display (units equipped with EPROM version A.01F.09 or later).

   Refer to "Special Setpoints and Programming Procedures" section.

10. Check Maximum Allowed Loading setpoint.

    Refer to "Special Setpoints and Programming Procedures" section.

11. Perform steam valve calibration procedure (steam units that are equipped with Honeywell valves).

    After steam valve actuator and position feedback potentiometer have been field wired, refer to "Steam Valve Calibration Procedure" section.

12. Perform alcohol separation procedure (if required).

    Refer to "Special Setpoints and Programming Procedures" section.

13. Perform burner calibration (gas/oil fired units).

    Refer to "Gas/Oil Burner Calibration" section.

14. Program Steam Valve setpoints. Honeywell valve: Rate Limit, Unload Pulse, Sample Factor. Leslie valve (EPROM version A.01F.08 or later): Rate Limit, Unload Factor, Sample Factor, DAC Divide Value.

    Refer to "Special Setpoints and Programming Procedures" section.

15. Check Minimum Allowed Loading setpoint (units equipped with EPROM version A.01F.08 or later and Leslie steam valves). If the customer purchased factory testing, this setpoint is entered at the YORK factory. Otherwise, the procedure to determine this setpoint and the setpoint entry must be performed in the field.

    Refer to "Special Setpoints and Programming Procedures" section for explanation of this setpoint. If it is necessary to perform the procedure to determine this setpoint value, refer to YORK Form 155.17-NM1.

***IMPORTANT:*** *The "**Factory Test Report**" referenced above is supplied to the responsible sales/service office. This report lists those setpoints that are established by the design of the unit and programmed by factory personnel prior to unit shipment. These setpoints **MUST BE LOGGED** and stored for future reference in a safe location at the customer's facility. Replacement of the Micro Board or Micro Board **RTC** chip (IC-U16) will cause these setpoints to be lost. If any of these components are replaced, a qualified service technician will have to enter all of these setpoints.*

# TROUBLESHOOTING

**(Refer to Figs. 40 thru 49)**

The failures or problems that could be encountered in the ISN ParaFlow Control Center can be placed in the following major categories:

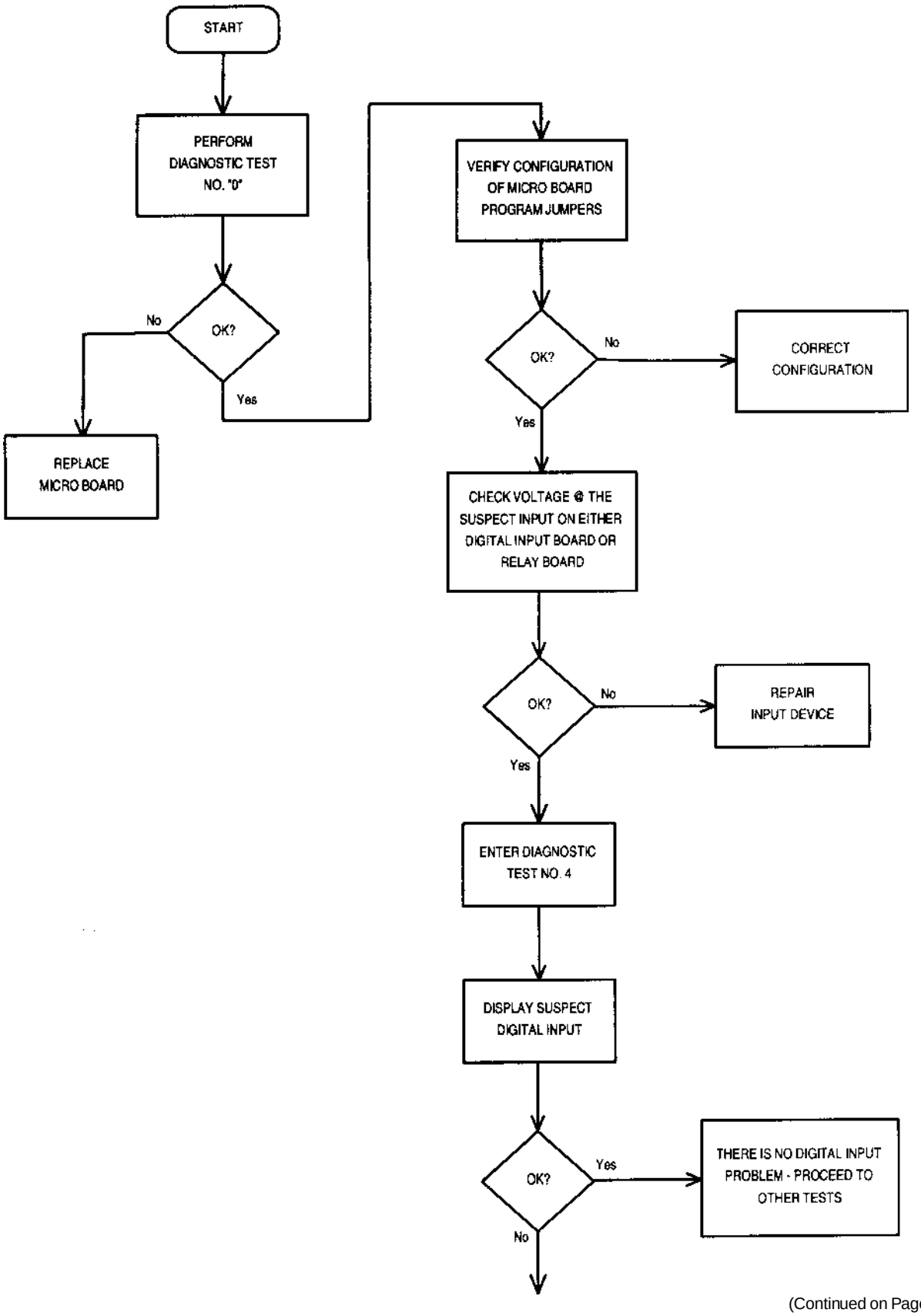
- Digital Inputs
- Relay Outputs
- Transducers and Thermistors
- Keypad Display
- Keypad Keys
- Steam Valve Actuator Control Outputs (steam units only)
- 4-20mA Burner Firing Rate Control Output (gas/oil units only)
- Leaving Water Temp Remote Setpoint Interface
- Load Limit Remote Setpoint Interface (steam units only)
- EMI Noise

Each category requires a specific procedure to resolve the problem. The symptom determines which procedure should be selected. These procedures direct the technician along the path that leads to the resolution of the problem.

The technician should understand the overall operation and the function and operation of each major component and printed circuit board in the ISN ParaFlow Control Center. Also required is a knowledge of the expected voltage level at the input or output of a printed circuit board for any operating condition. Finally, the technician should understand the system interface and be able to utilize unit wiring diagrams to follow signal flow through the system. Several levels of documentation are required for this understanding. The unit Wiring Diagram (Form 155.17-W1 – gas/oil; Form 155.19-W1 – steam) is the top level document. It provides the overall wiring configuration. The Service manual (Form 155.17-M2) provides the details of the operation of each printed circuit board and the expected voltage level at the input or output of each board for any operating condition. Also, block diagrams provide signal flow and simplified representations of board circuitry. The “Operation” manual (Form 155.17-O2) provides the details of the messages that are displayed on the keypad display.

When the unit shuts down on a safety or cycling shutdown, or is being prevented from starting for any reason, a message is displayed on the keypad alphanumeric display. This message states the reason for shutdown or the reason the unit is being prevented from starting. Before beginning the troubleshooting process, the technician should refer to “Operation” manual, Form 155.17-O2 for a detailed description of this message.

# TROUBLESHOOTING PROCEDURES
## DIGITAL INPUTS

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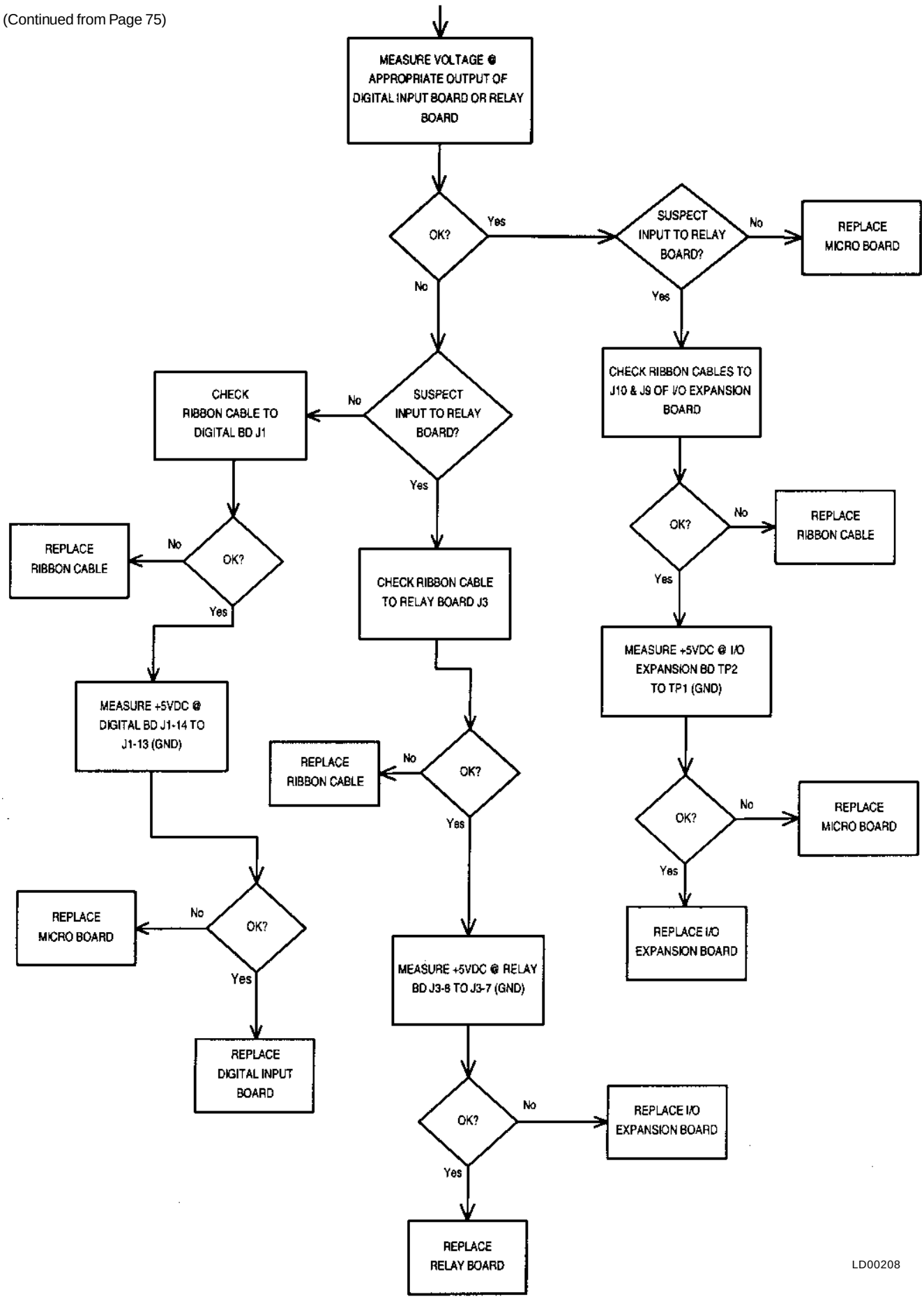
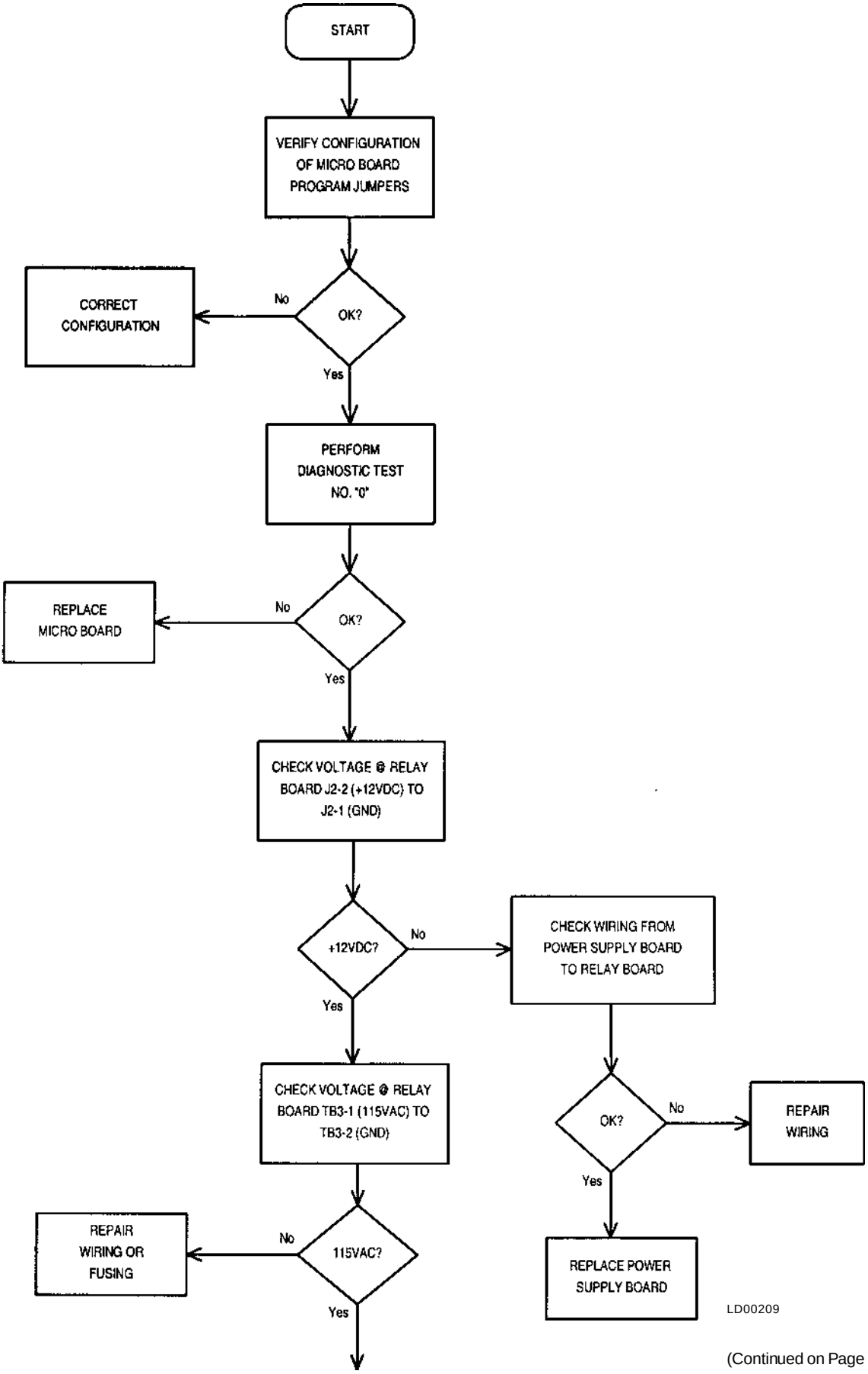



**FIG. 40**

# RELAY OUTPUTS

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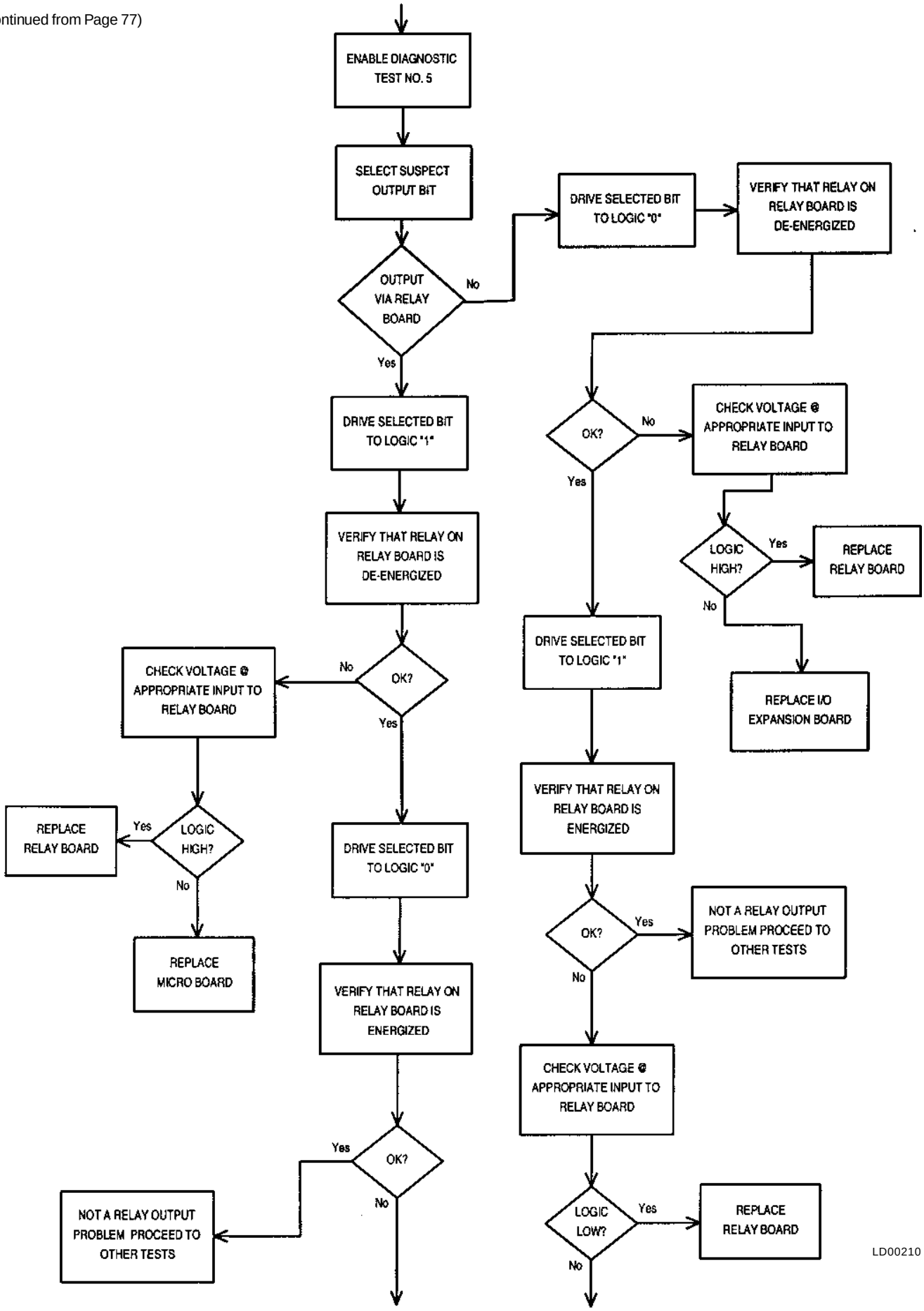


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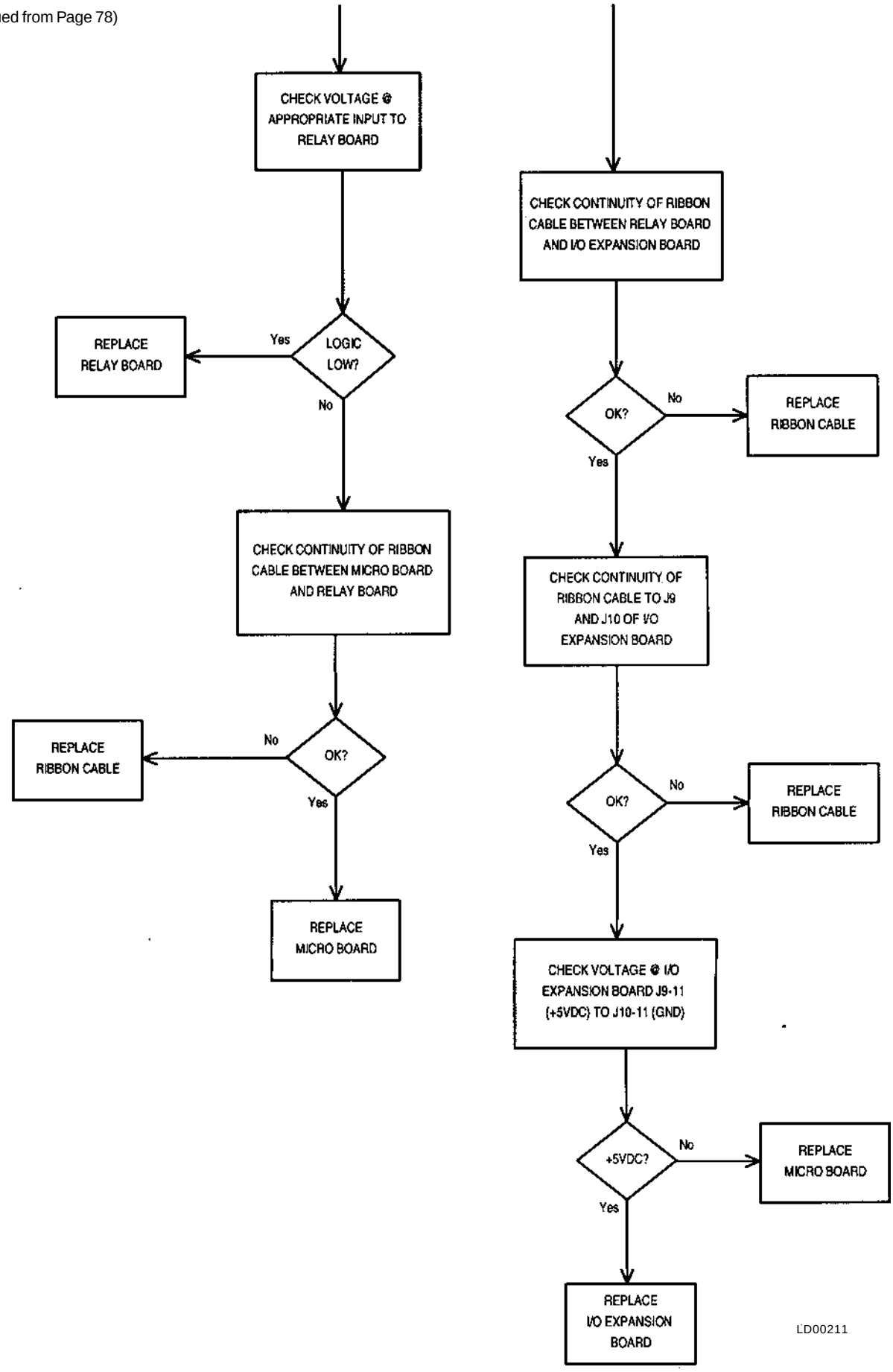
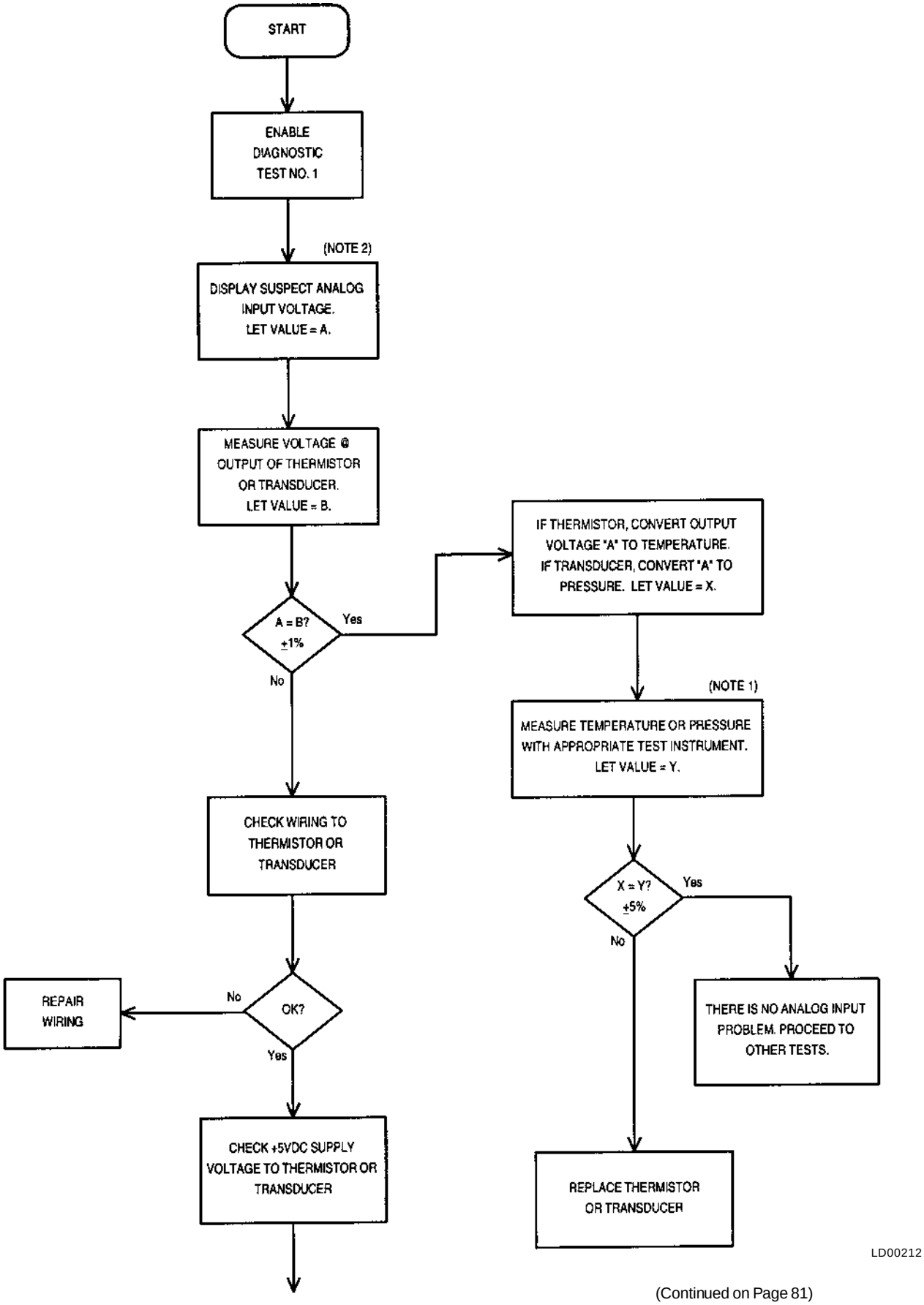



**FIG. 41**

# TRANSDUCERS AND THERMISTORS

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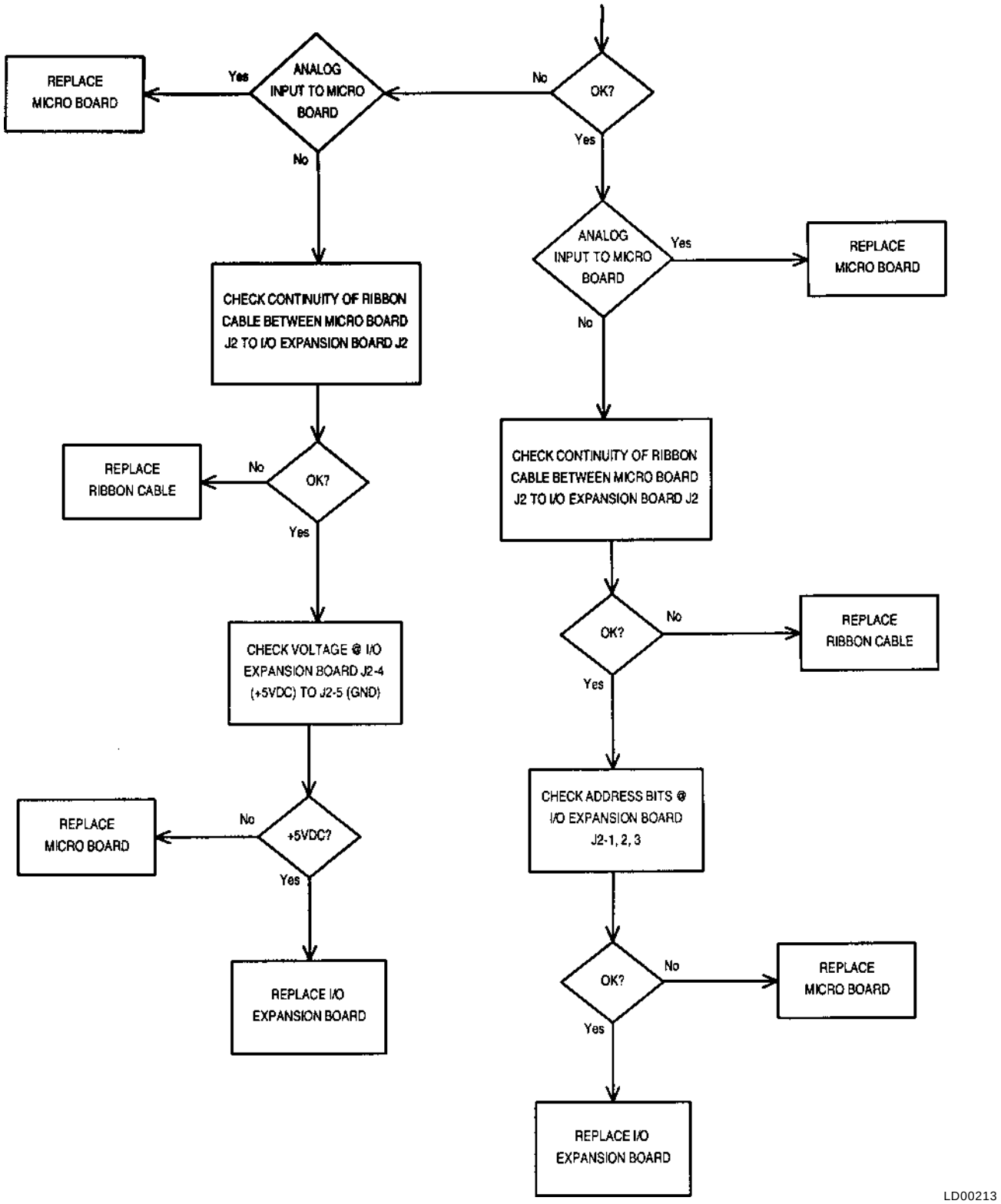
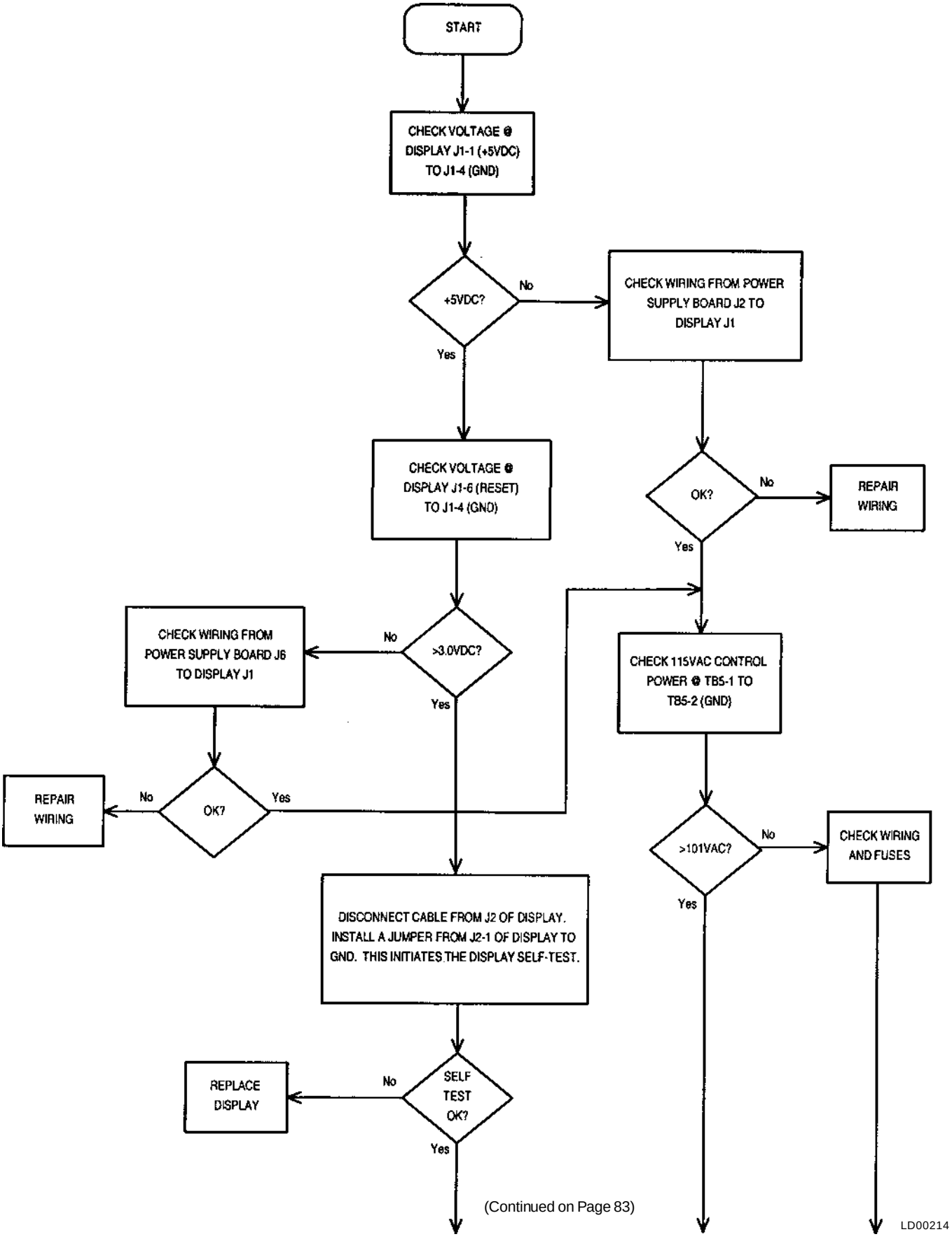



NOTES:

1. Test instrumentation is listed in YORK Form 155.17-NM1 ParaFlow Absorption Operation and Maintenance.
2. When "Leaving Chilled Water Temp" is selected, the analog voltage displayed is that which is measured at Micro Board IC U53 Pin #7, not Micro Board J19-10.

**FIG. 42**

# KEYPAD DISPLAY

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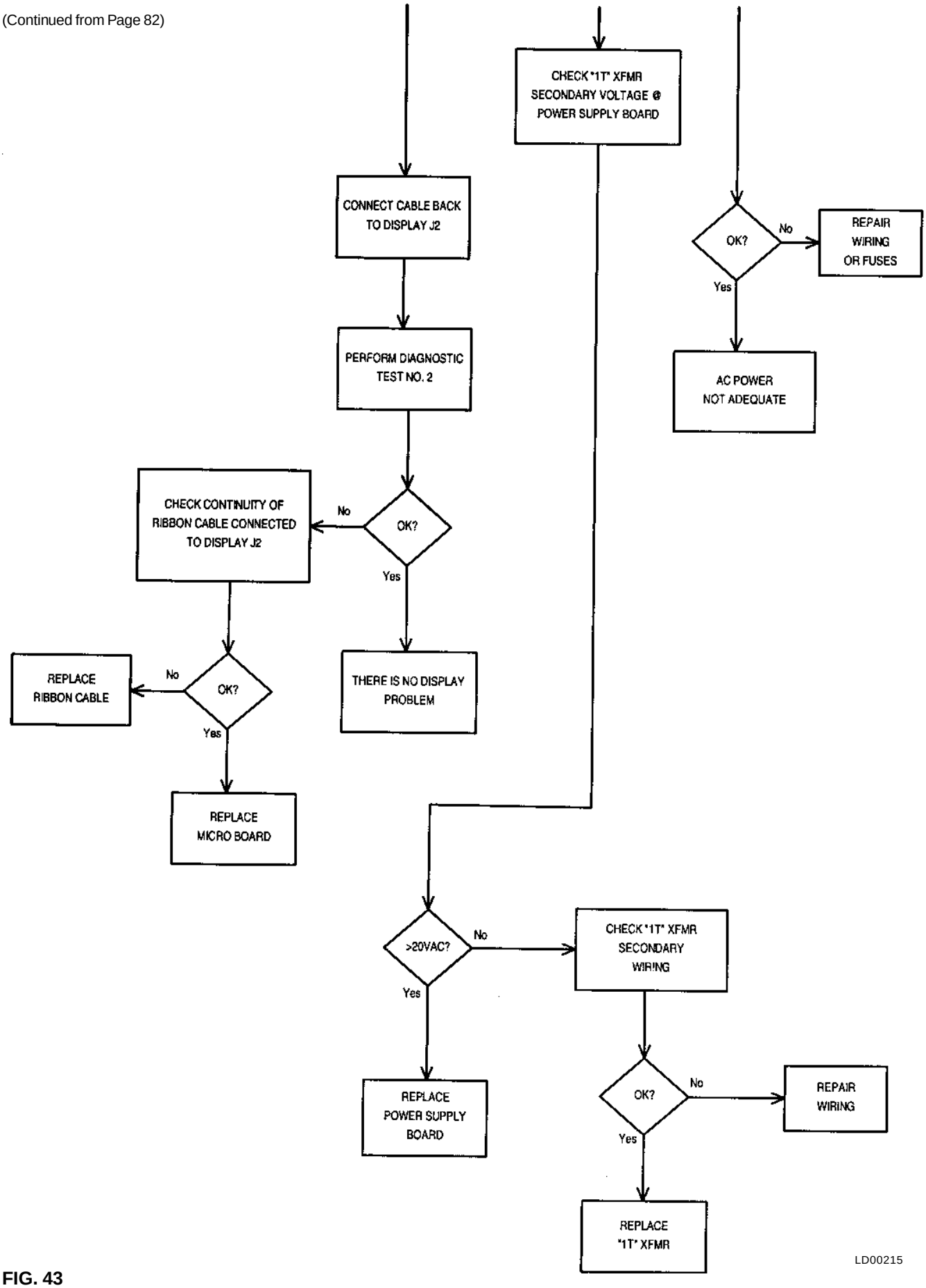



**FIG. 43**

# KEYPAD KEYS

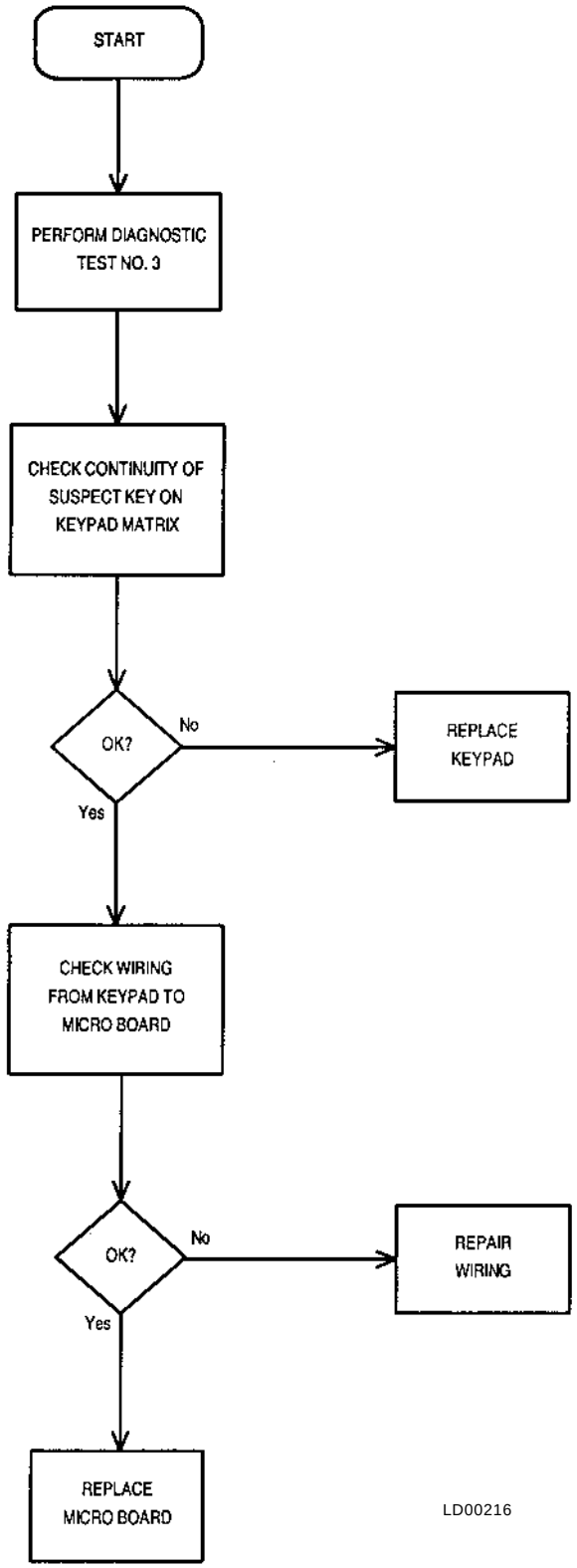
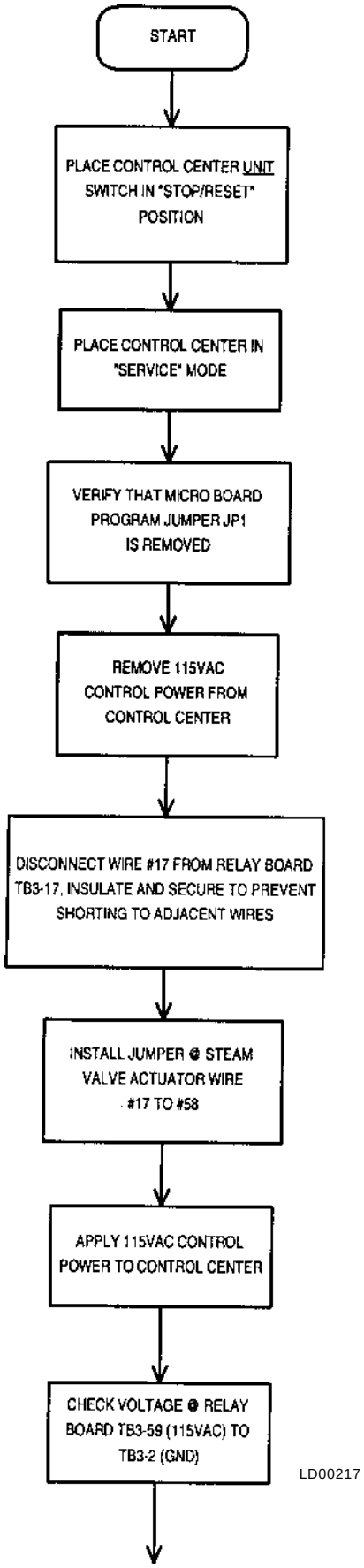



**FIG. 44**

# STEAM VALVE ACTUATOR CONTROL OUTPUTS (STEAM UNITS ONLY)




**CAUTION!!!:** At completion of tests, it is important that all wires have been returned to their original proper configuration and all jumpers that were installed as part of these tests have been removed!!!

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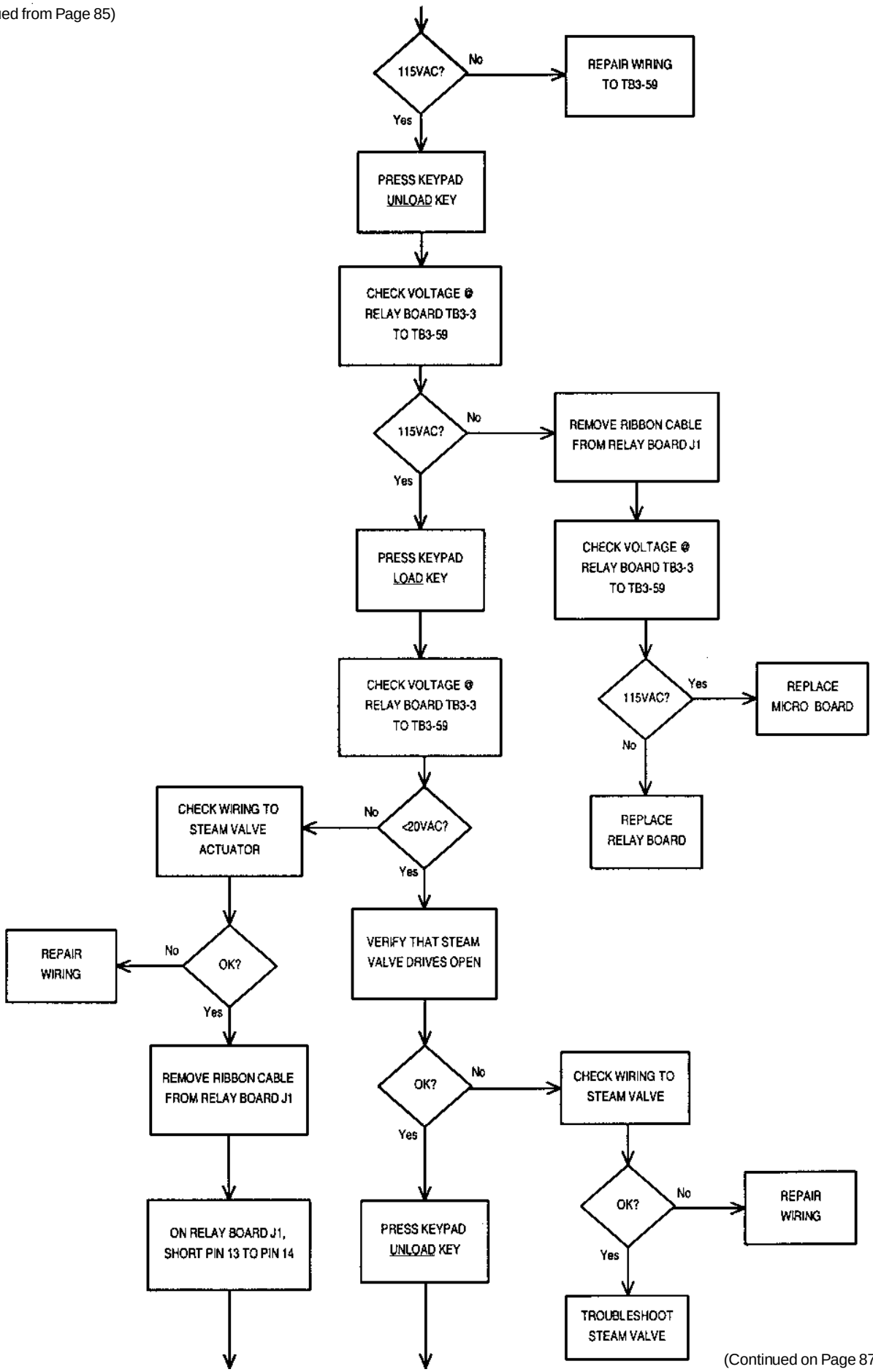


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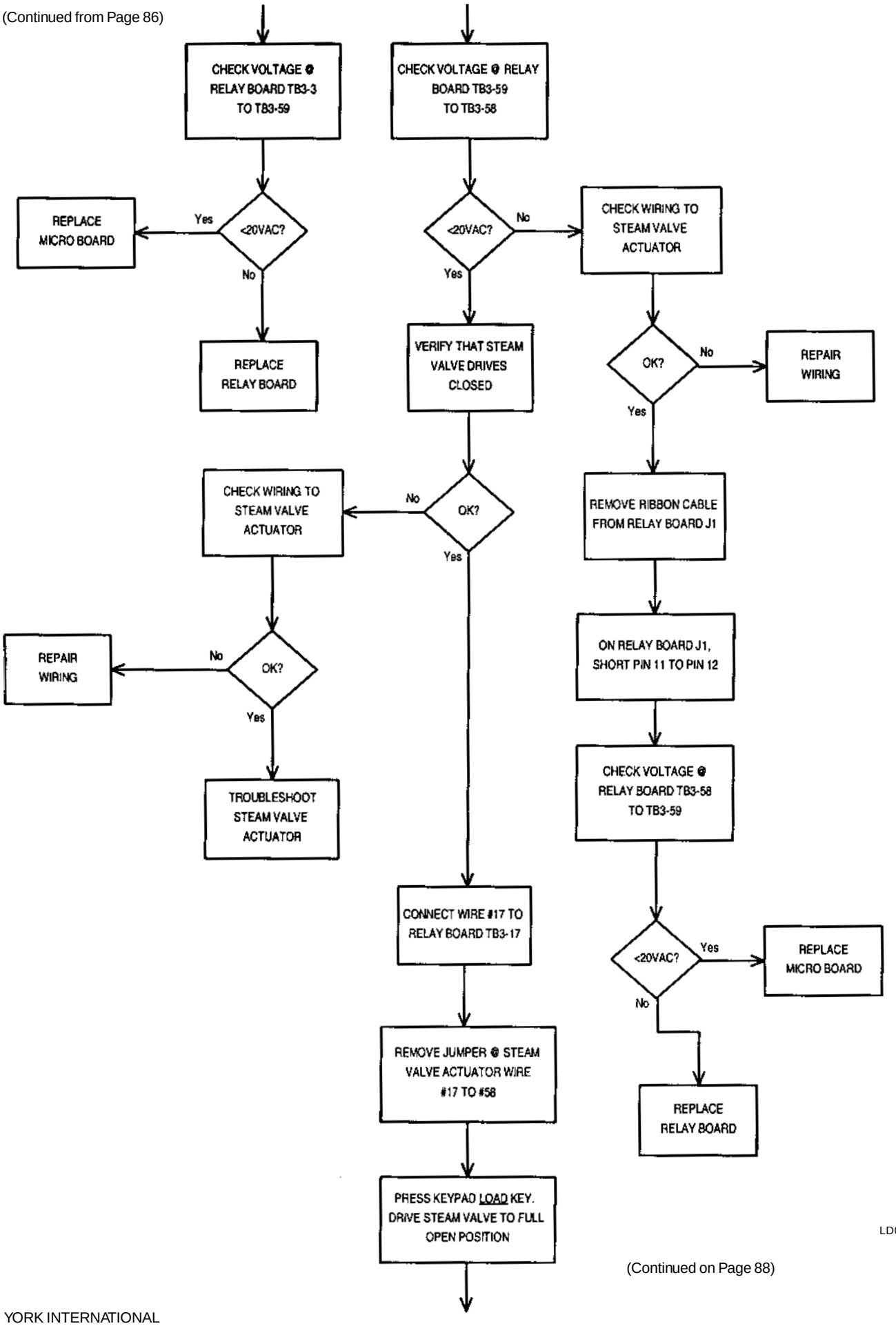


LD00219

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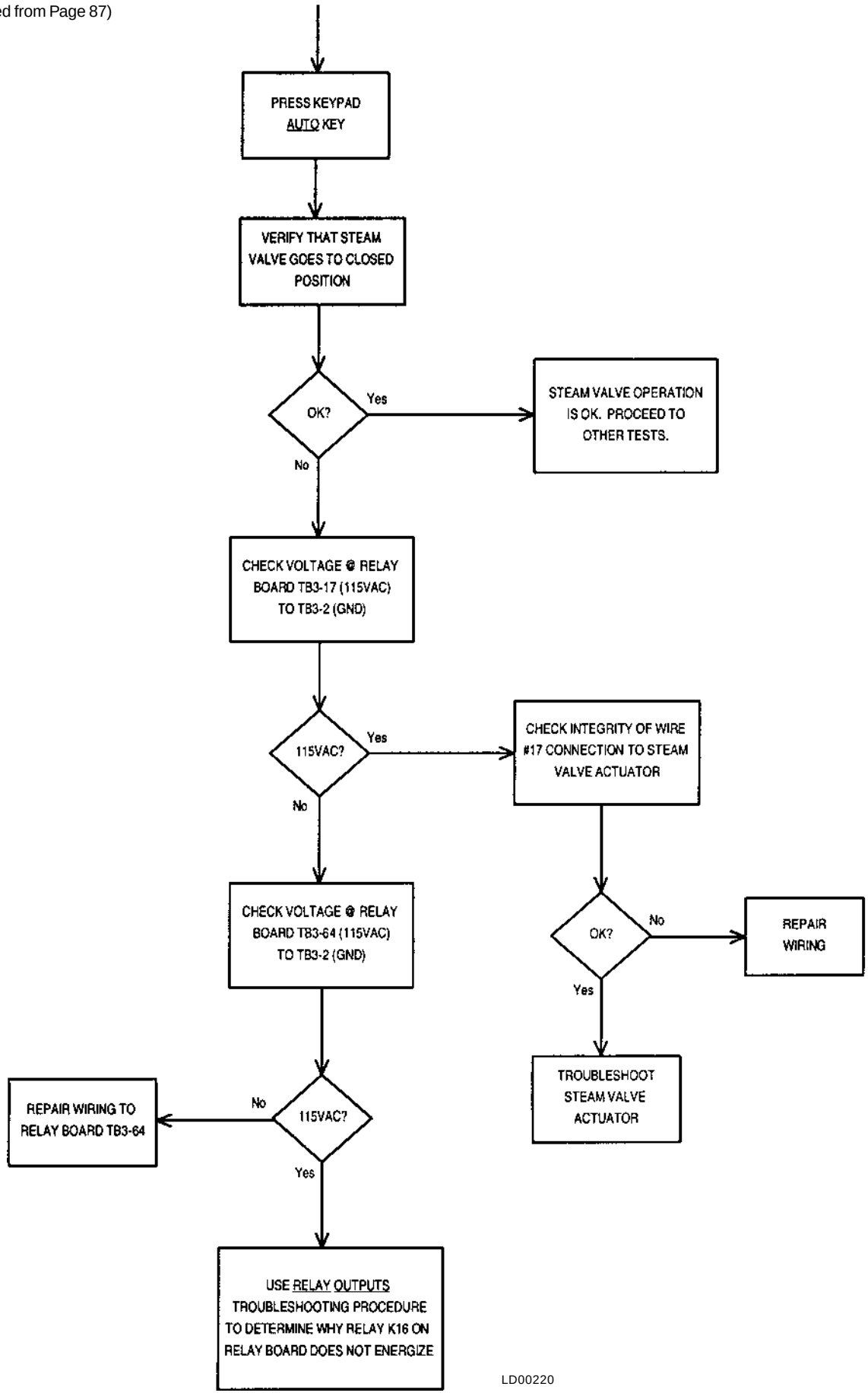
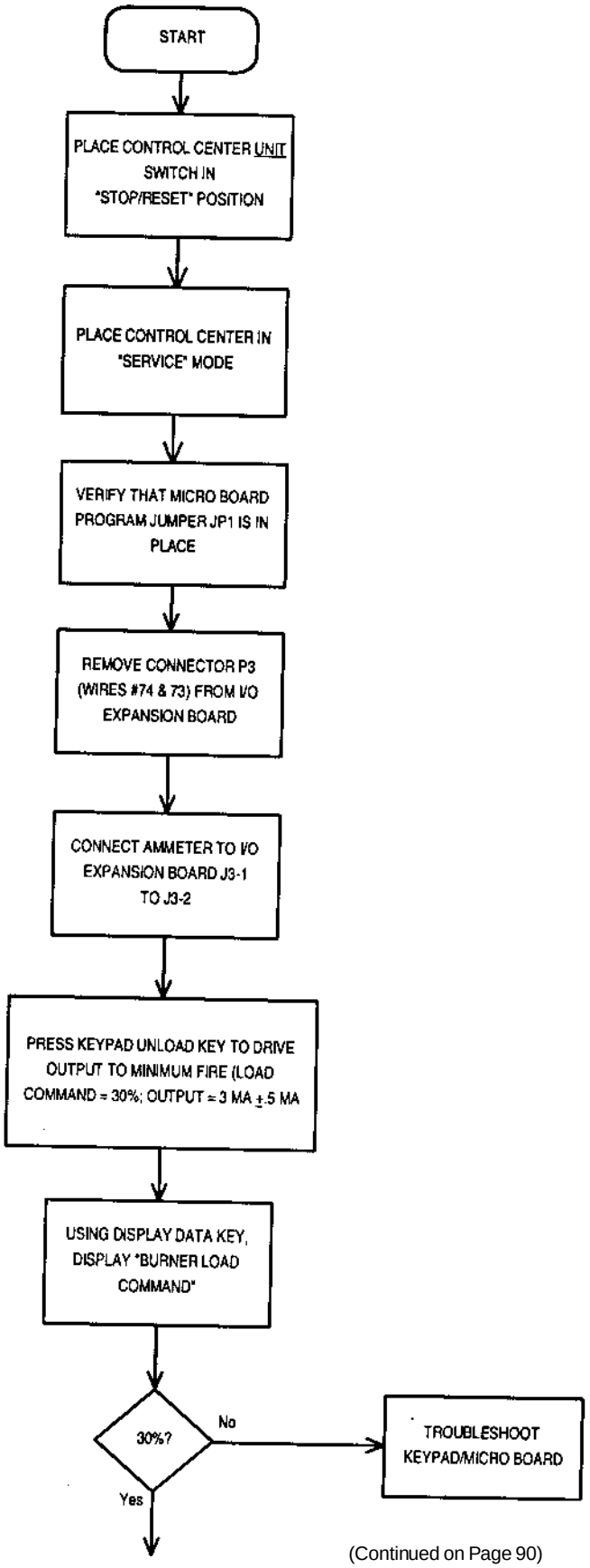



**FIG. 45**

# 4-20 MA BURNER FIRING RATE CONTROL OUTPUT (GAS/OIL UNITS ONLY)

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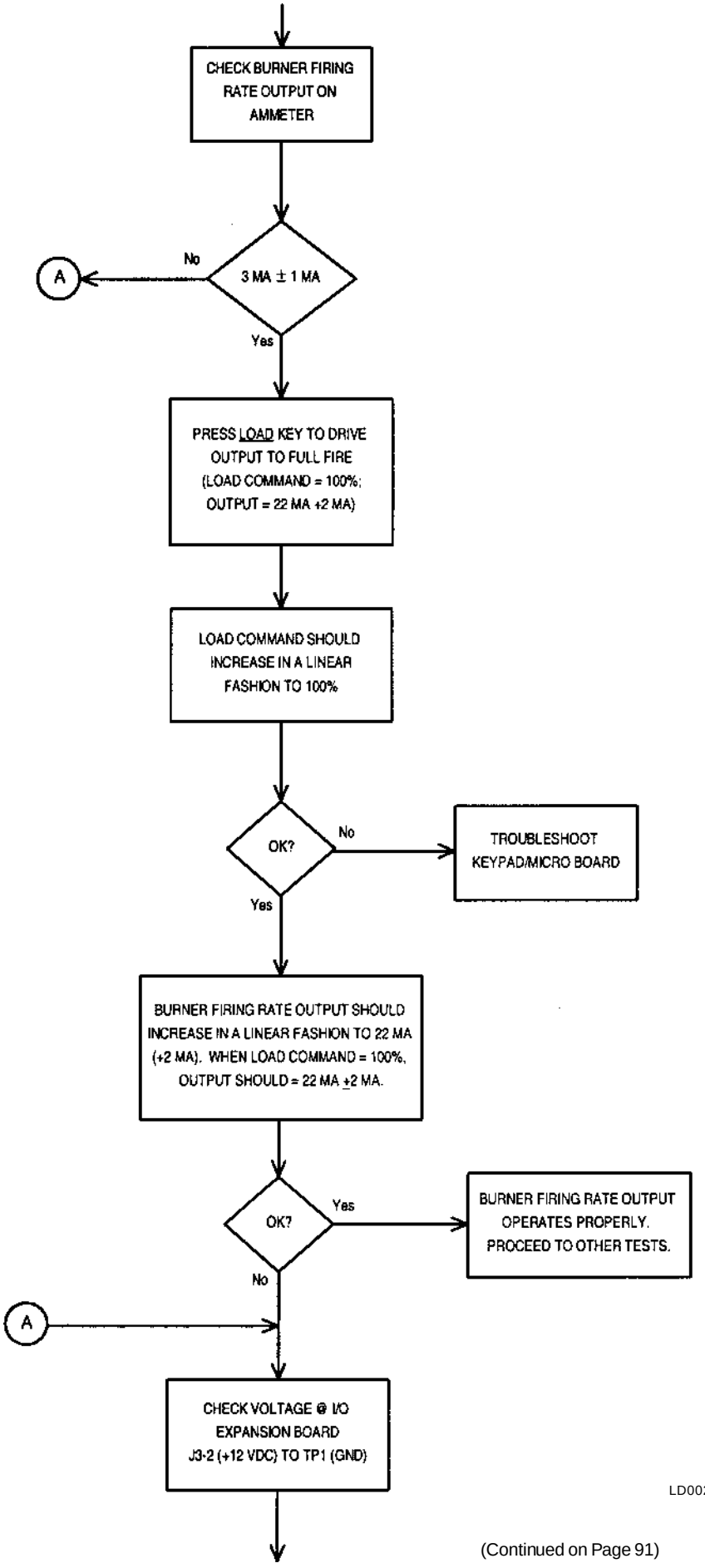


LD00222

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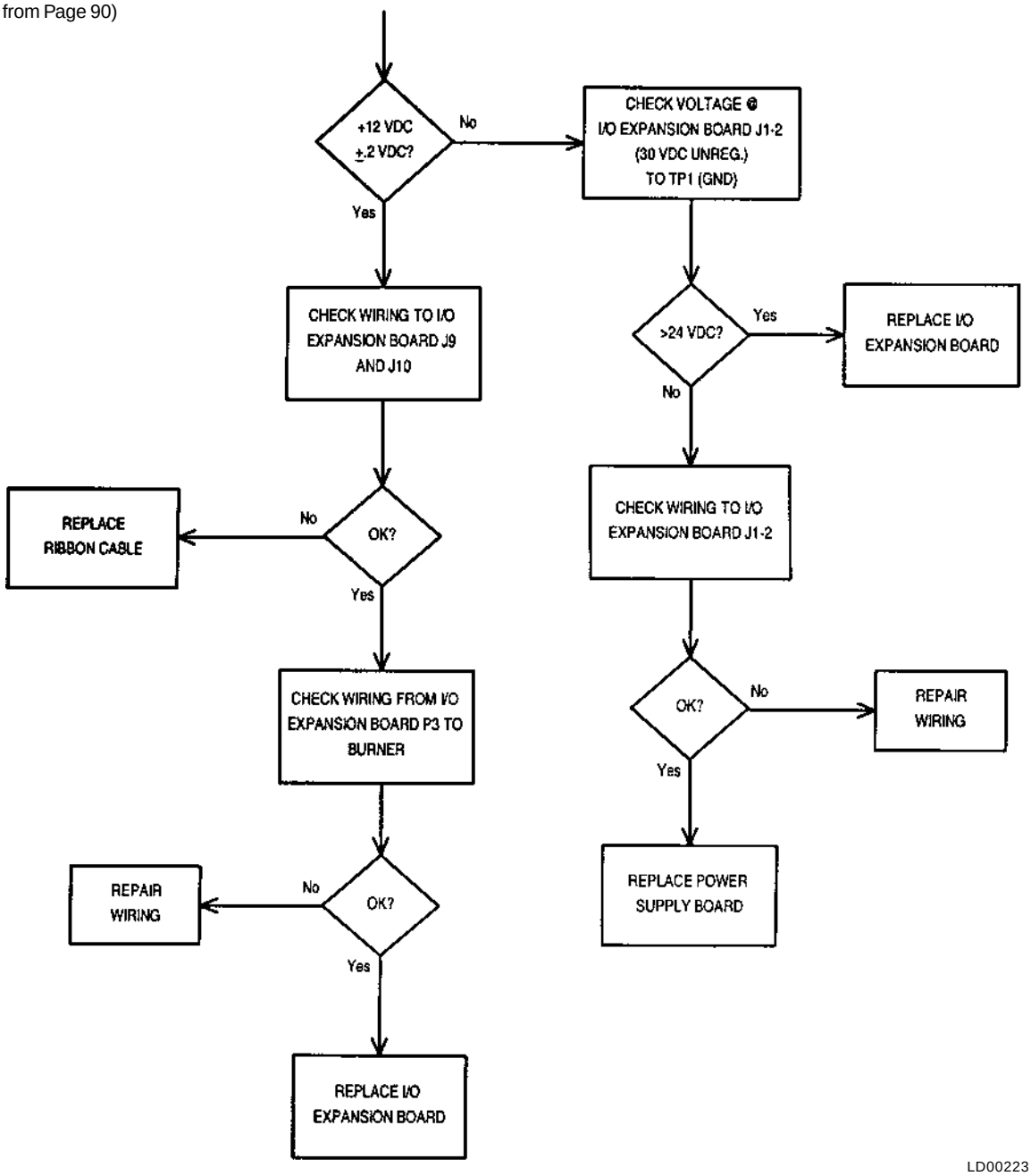
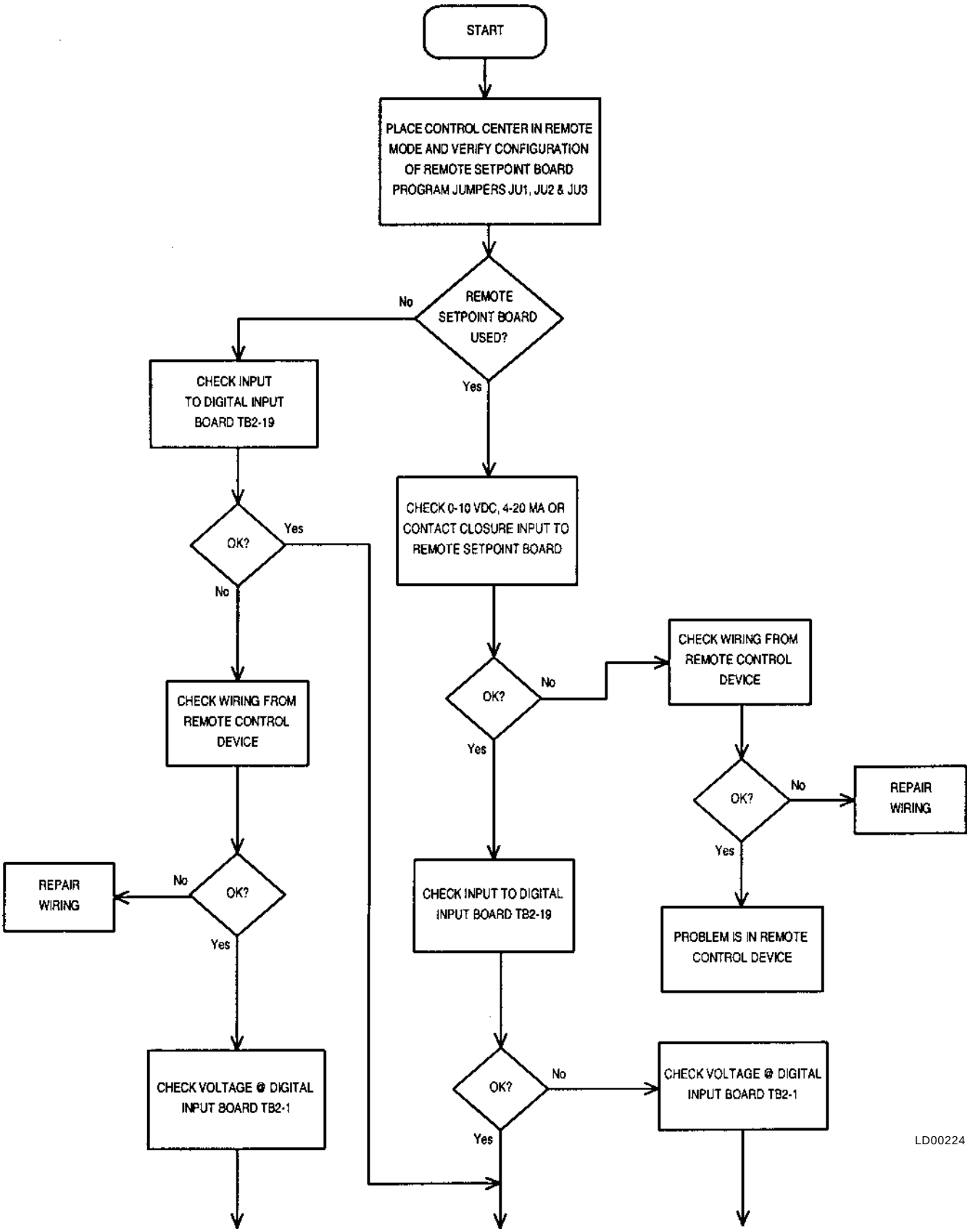



NOTE: At completion of testing, connect plug P3 (wires #74 &#73) to I/O Expansion Board J3 and return the burner firing rate control to automatic mode by pressing the **AUTO** key in **SERVICE** mode or placing the Control Center in **LOCAL** or **REMOTE** mode.

**FIG. 46**

# LEAVING WATER TEMP. REMOTE SETPOINT INTERFACE (0-10VDC, 4-20MA, CONTACT CLOSURE PWM)

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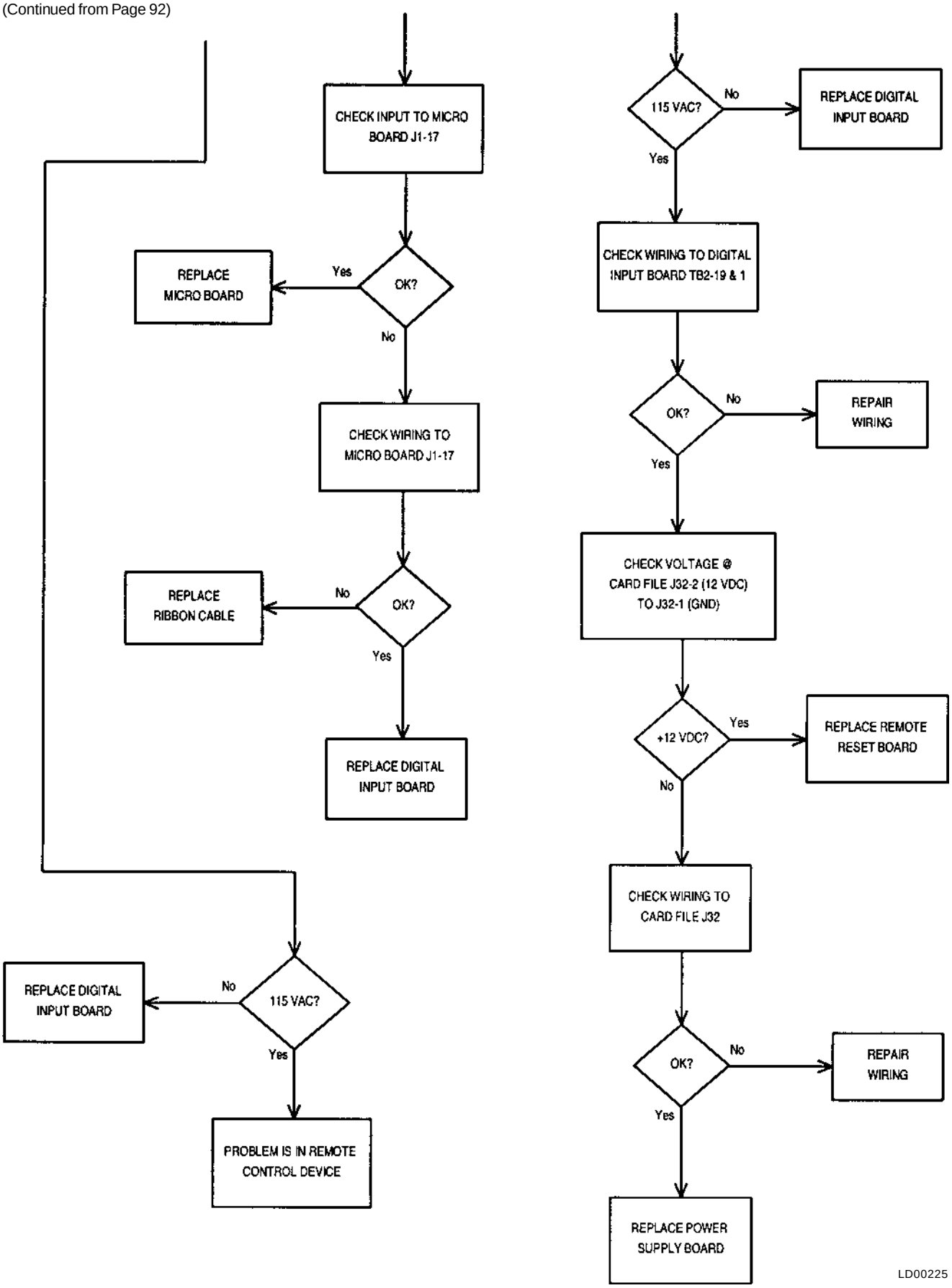
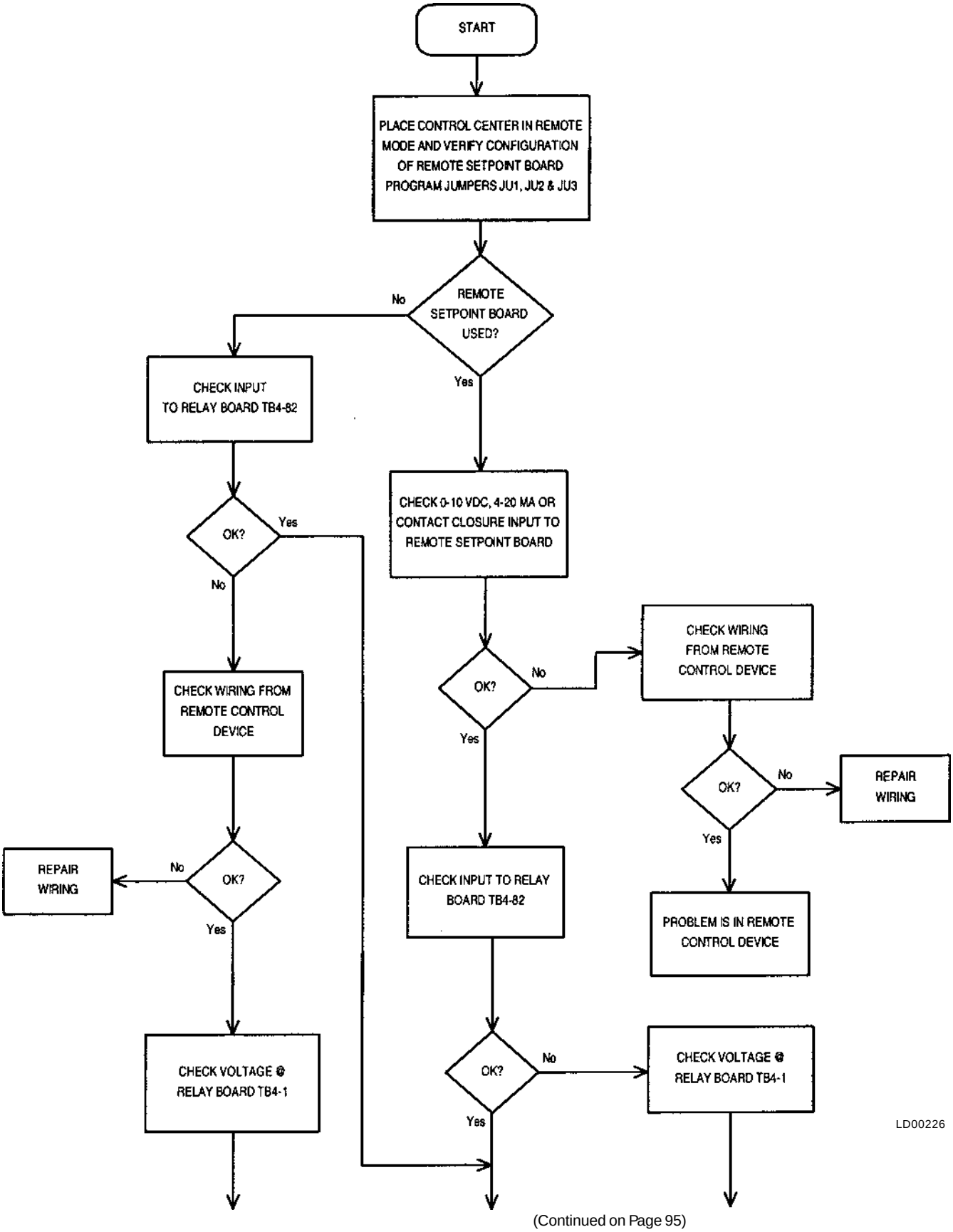



**FIG. 47**

# LOAD LIMIT REMOTE SETPOINT INTERFACE
# (0-10VDC, 4-20MA, CONTACT CLOSURE PWM)

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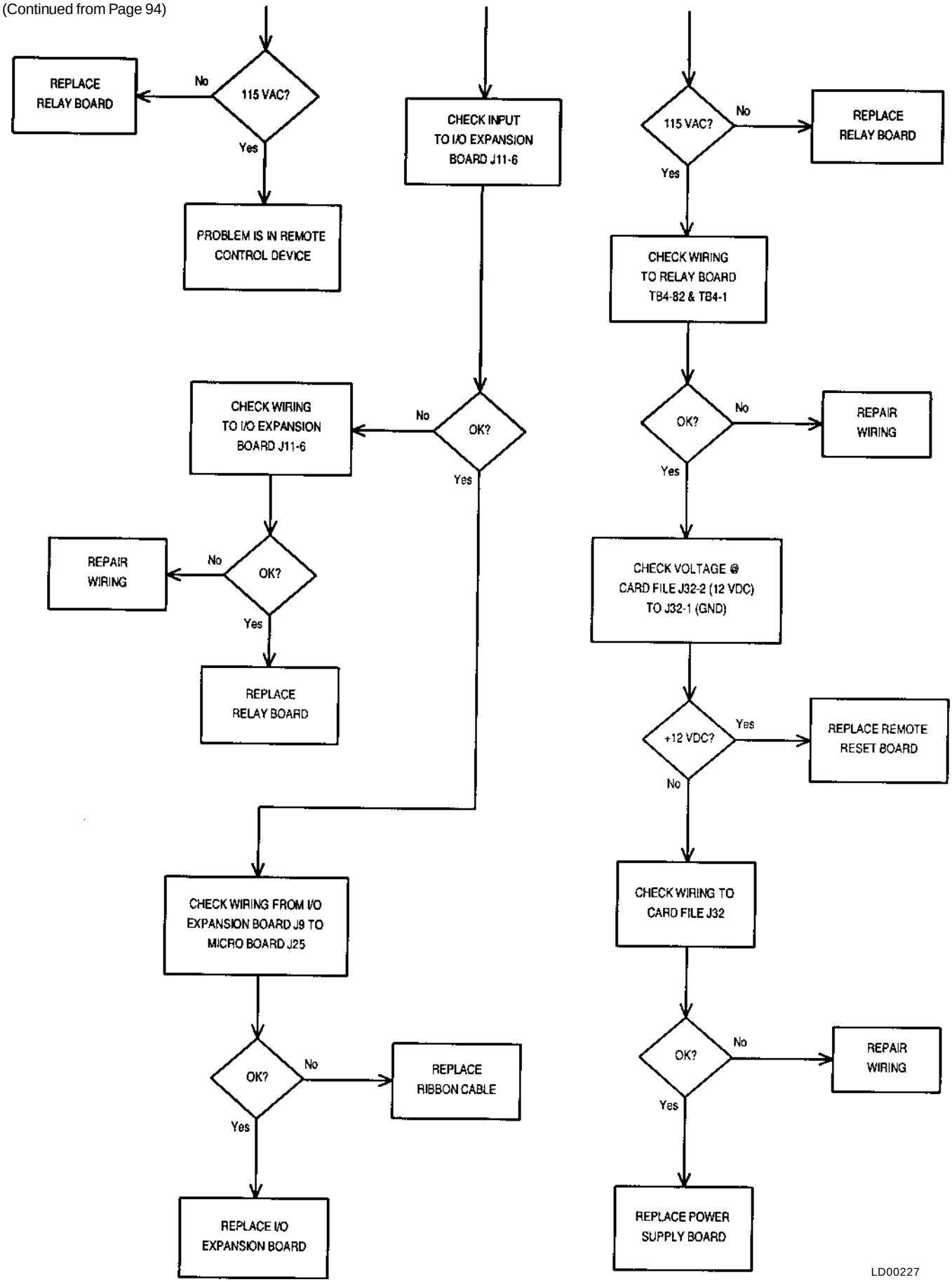


**FIG. 48**

# EMI NOISE

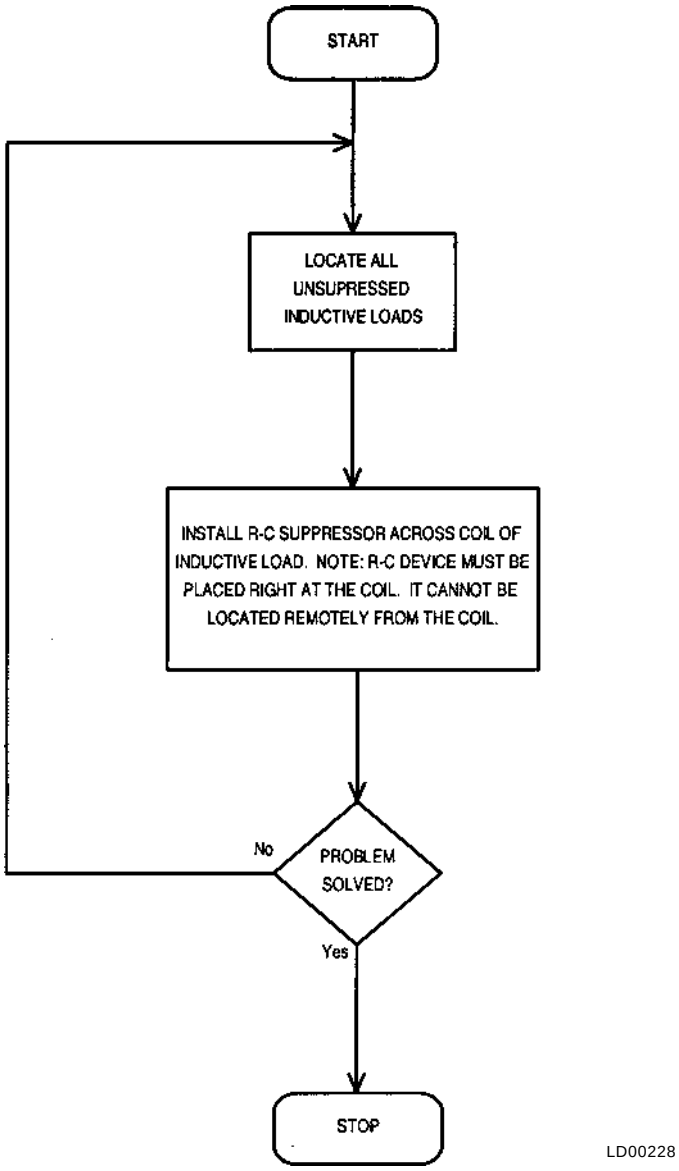


**FIG. 49**

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Form 155.17-M2 (1196)
Supersedes: 155.17-M2 (295)

| | | |
|---|---|---|
| YORK® | Form Number: 155.17-M2 (LS01) | 1006 |
| | Supersedes: None | |
| **LITERATURE SUPPLEMENT** | File with: 155.17-M2 (197) | |
| Subject: YPC (ParaFlow) Absorption, EPROMS | | |

**EPROM version A.01F.14, checksum 4F1C:**

This EPROM version was issued for limited field testing purposes only. It was not incorporated in any production units.

**EPROM version A.01F.15, checksum FF5C:**

On or about September 2005, all units will be shipped with this version of EPROM. This EPROM has the same part number as previous 2 Meg EPROMS (031-02069-001). When ordering this EPROM from the Baltimore Parts Center, you will receive this latest version.

The program modifications and/or changes in this EPROM are as follows:

1. The auto purge control logic sequence has been modified to incorporate a two-minute waiting period between the start of opening of purge pump solenoid, 2SOL and the opening of the purge tank solenoid, 1SOL. This two minute period will allow the 2SOL to open fully before opening 1SOL, thus exposing the non-condensables in the purge tank to the purge pump suction.

2. On units with hi-temperature heating (JP5 cut), the allowable leaving hot water temperature operating range (LHWT) will now be from 90° F (32.2° C) to 180° F (82.2° C).

3. For units with the heating option, when the unit has shutdown on a “Day-Time-High Water Temp – Auto Start”. The customer’s hot water pump will continue to run to circulate water. On previous version’s the pump shut-down.

4. When the unit has shutdown on either “Day-Time-Low Refrigerant-Temperature - Analog” or “Day-Time-Low Refrigerant Temperature – Digital”, the chilled water pump did not shutoff when the Refrigerant Temperature increased to the reset threshold (5° above cutout) and the solution temperature was <136° F. In previous version, the pump continued to run under this circumstance. This has been corrected in this version.

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Form 155.17-M2 (LS01)
New Release

YORK®

File in SM2 Manual(s).

SERVICE BULLETIN

94-11

Supersedes: Nothing | 394 | Form 155.17-M2 (SB-1)

File with Form: 155.17-M2

SUBJECT: **MICROCOMPUTER CONTROL CENTER (PARAFLOW ABSORPTION UNITS) SERVICE MANUAL UPDATE - EPROM VERSION A.01F.06**

On/about January 1994, ParaFlow Absorption units will be shipped with the subject EPROM. It supersedes Version A.01S.05 and A.01F.05. It contains the following enhancements that revise the Service Manual 155.17-M2 as follows:

## I/O EXPANSION BOARD PROGRAM JUMPER J12

IN - All messages displayed in English Language.
OUT - All messages displayed in German Language.

## MICRO BOARD PROGRAM JUMPER JP2

IN - All units except S-Series with Low Temp Heat Exchanger operating in "HEATING ONLY" Mode.

OUT - S-Series units equipped with Low Temp Heat Exchanger and operating in "HEATING ONLY" Mode. This causes the refrigerant, solution and spray solution pumps to run while the unit is operating. The operating sequence is as follows:

When the Start Sequence begins, the hot water pump is turned on and the Start Signal is sent to the burner. A 30 second bypass is begun to allow the Hot Water Flow Switch to close. After a 30-90 second delay, the "BURNER ON" contacts between Terminals 38 and 39 close to signal the Control Center. Coincident with the "BURNER ON" contacts closing, the refrigerant, solution and spray solution pumps are turned on and "**SYSTEM RUN-LEAVING HOT WATER CONTROL**" is displayed. When System Shutdown occurs, all pumps shutoff coincident with the removal of the Start Signal.

## STEAM VALVE CONTROL (STEAM UNITS ONLY)

The Steam Valve Control Routine has been revised to provide more stable operation. This supersedes the operation shown in FIG. 28. The operation is as follows:

**GENERAL**

During unit run, the steam valve is modulated under Program Control to control the leaving chilled water temperature (LCWT) to the "LEAVING CHILLED WATER TEMPERATURE SETPOINT". It is modulated between 20% of unit capacity and 100% capacity. A limit switch opens to prevent the steam valve from decreasing to less than 20% of unit capacity. This limit switch is set at the YORK factory to the 20% capacity point. This point is independent of the steam valve position. The steam valve position is its physical position with respect to fully closed and fully open. Its position is 0% when fully closed and 100% when fully open. These points are established with the "STEAM VALVE POTENTIOMETER CALIBRATION" procedure. Therefore, the 20% capacity point could be 40% Steam Valve Position. This relationship will vary from unit to unit.

The program constantly monitors **A.)** The error between the LCWT and the setpoint and **B.)** The rate of change of the LCWT within each 4 minute sample period. It responds with an output that contains a proportion component and rate component accordingly as follows: Every 4 minutes the output is a load, unload or hold response as appropriate until the LCWT reaches setpoint. The load and unload responses are in the form of load and unload pulses from the Microcomputer Control Center to the Steam Valve Actuator. The duration of these pulses and whether the output is a load or unload pulse is determined by the magnitude of error between the LCWT and the LCWT setpoint; whether the error is above or below the LCWT setpoint; and the amount (RATE) and direction of change of the LCWT within the 4 minute sample period. If the LCWT falls to 3°F below setpoint or <40°F, the unit shuts down and displays "DAY-TIME-LOW WATER TEMP-AUTOSTART".

The rate component of the output is applied in response to the LCWT's rate and direction of change (TOWARD OR AWAY FROM SETPOINT). The amount of rate response is determined by the relationship of the rate of change (AMOUNT OF CHANGE IN 4 MINUTE SAMPLE PERIOD) to the programmed "RATE LIMIT" value. The closer the rate of change value is to the "RATE LIMIT" value, the greater the rate component in the output. The actual "RATE LIMIT" value programmed is a function of conditions at the jobsite; such as length of chilled water loop, number of chillers, multiple chiller configuration (SERIES OR PARALLEL), primary/secondary chilled water loop, etc. For example, short chilled water loops generally cause the LCWT rate of change to be greater. The greater the rate of change, the greater the tendency to overshoot or undershoot the setpoint, causing large excursions in the LCWT. At unit commissioning, the service technician must evaluate the local conditions and refine the "RATE LIMIT" setpoint as required. Refer to below for details of "RATE LIMIT" setpoint.

To accelerate LCWT pulldown at Start, each time the unit goes into "SYSTEM RUN" or is placed in **AUTO** Mode in **SERVICE** Mode, the output

interval is every 1 minute (INSTEAD OF THE NORMAL 4 MINUTE INTERVAL) until the Steam Valve Position is greater than or equal to 50% or the LCWT falls to within 5°F of the setpoint. Then, the Control returns to the normal 4 minute intervals.

Another Field programmable variable is the "MAXIMUM ALLOWED UNLOAD (CLOSE) PULSE". This is required because certain units in some installations could have a tendency to undershoot the LCWT setpoint and shutdown on "LOW WATER TEMP". The conditions that can cause this are the same as those that cause a rapid rate of change in the LCWT. These conditions require a longer duration unload pulse when the LCWT is below or near the setpoint. Typical applications require the maximum allowed load and unload pulses to be the same (6 SECONDS). However, if the longer unload pulses are needed, the service technician cal select an appropriate value. Refer to below for details.

**RATE LIMIT**

"RATE LIMIT" is a field programmable variable that determines the Control Center's sensitivity/response to the rate of change of Leaving Chilled Water Temperature (LCWT). The "RATE OF CHANGE" is defined as the amount of change in the Leaving Chilled Water Temperature in a 4 minute period. The LCWT's rate of change is calculated over each 4 minute interval of unit operating time. At the end of each 4 minute interval, the rate of change is compared to the "RATE LIMIT" value. The close the rate of change value is to the "RATE LIMIT", the greater the rate component will be in the Output Pulse. In other words, the greater the effect rate of change will have on the duration and polarity (LOAD OR UNLOAD) of the Output Pulse. This means that rate sensitivity increase programmed "RATE LIMIT" value is decreased.

To illustrate, the "RATE LIMIT" is programmable from 0.5° to 2.0°F in 0.1°F increments. The default value is 1.0°F. The smaller the number programmed, the greater the sensitivity to rate of change. If 2.0 is programmed, and the LCWT increases 1.0°F in the 4 minute internal, there would be minimal rate response. However, if 0.5 was programmed under the same conditions, there would be maximum rate response because the LCWT change (1.0°F) exceeded the programmed threshold (0.5°F). In most installations, 1.0 will be the optimum value for "RATE LIMIT". Programming a value less than 1.0 will tend to cause excessive steam valve movement resulting in excessive steam pressure fluctuation in most installations.

In detecting the rate of change, the Control Center anticipates where the LCWT is going and responds accordingly to prevent overshoot and undershoot. For example, if the LCWT is <5°F above setpoint and decreasing, a Close Pulse would be applied at the end of the 4 minute interval, even though the LCWT is above setpoint.

## MAXIMUM ALLOWED UNLOAD (CLOSE) PULSE

The maximum allowed duration of the Close Pulse is programmable from 6 to 12 seconds in 1 second increments. The Default Value is 6. Since the Maximum Allowed Open Pulse is 6 seconds, programming this value to "6" would make the load and unload response the same. However, if this value is programmed to "9", for example, the maximum allowed close pulse would be longer than the maximum allowed Open Pulse. This provides the unit with an "UNLOAD BIAS". This Bias, generally, causes the unit to unload faster than it loads.

## PROGRAMMING

To program the above "RATE LIMIT" and "MAXIMUM ALLOWED UNLOAD PULSE", proceed per the instructions under "SPECIAL SETPOINTS AND PROGRAMMING PROCEDURES" Section below.

## SUMMARY OF STEAM VALVE OPERATION

The following are the expected steam valve outputs for the listed Leaving Chilled Water Temperature errors from setpoint:

| ERROR | OUTPUT |
|---|---|
| >+5°F | If LCWT decreases < "RATE LIMIT" in 4 minute sample period, Load Pulse is < 6 seconds. The actual duration is determined by the relationship of the rate of change to the "RATE LIMIT" (THE CLOSER THE RELATIONSHIP, THE SHORTER THE PULSE). If LCWT decreased > "RATE LIMIT" in four minute period, there is no load or unload pulse. Otherwise, if zero rate of change, output is 6 second Load Pulse. |
| <+5°F | If the LCWT increases in 4 minute sample period, output is a Load Pulse up to 6 seconds. The actual duration is determined by the magnitude of error and the relationship of rate of change to the "RATE LIMIT" (THE GREATER THE ERROR AND CLOSER THE RELATIONSHIP OF RATE OF CHANGE TO "RATE LIMIT", THE LONGER THE PULSE). If the LCWT decreases > the "RATE LIMIT" in the 4 minute sample period, the output is an Unload Pulse up to the Maximum Allowed Duration. The Actual Pulse width is determined by the magnitude of error in conjunction with the rate of change. If the LCWT decreases < the "RATE LIMIT" in the 4 minute sample period, the output is a Load (< 6 seconds) or Unload (UP TO MAXIMUM ALLOWED DURATION) Pulse determined by the magnitude of error and relationship of rate of change to "RATE LIMIT". Otherwise, output is < 6 second Load Pulse proportional to error. |
| >-3°F* | (OR <40°F). The output is a continuous Unload Signal. Unit shutsdown and displays "DAY-TIME-LOW WATER TEMP". |
| <-3°F | If the LCWT decreases in the 4 minute sample period, output is an Unload Pulse up to the maximum allowed duration. The Actual Duration is determined by the magnitude of error and the relationship of rate of change to "RATE LIMIT" (THE GREATER THE ERROR AND THE CLOSER THE RELATIONSHIP OF THE RATE OF CHANGE TO THE "RATE LIMIT", THE LONGER THE PULSE). If the LCWT increases in the 4 minute sample period, the output is a Load (UP TO 6 SECONDS) or Unload (UP TO MAXIMUM ALLOWED DURATION) Pulse. Greater errors tend to produce Unload Pulses; lesser errors tend to produce Load Pulses. The Actual Pulse Width is determined by the magnitude of error and the relationship of the rate of change to the "RATE LIMIT" (THE GREATER THE ERROR AND THE CLOSER THE RELATIONSHIP OF RATE OF CHANGE TO "RATE LIMIT", THE LONGER THE PULSE). Otherwise, for zero rate of change the output is < 6 second Unload Pulse proportional to error. |

* If the setpoint is increased while the unit is running, the Low Water Temp Threshold is the previous threshold for 30 minutes

Add the following to **SPECIAL SETPOINTS AND PROGRAMMING PROCEDURES** Section:

**MAXIMUM ALLOWED LOADING** - The service technician can now program a maximum allowed loading setpoint of 40-100% for both cooling and heating mode. Previously, it was 50-100%.

**STEAM VALVE CONTROL** (STEAM UNITS ONLY) - There are two programmable values that affect the control of the Steam Valve; "RATE LIMIT" and "MAXIMUM ALLOWED UNLOAD PULSE". The value entered as "RATE LIMIT" determines the response to rate of change of Leaving Chilled Water Temperature. The value entered as "UNLOAD PULSE" will be the maximum Allowed Unload Pulse. Refer to description of **STEAM VALVE CONTROL** above for description of these setpoints. To program, proceed as follows:

1.) Using Access Code 1 3 8 0, enter **PROGRAM MODE**.

2.) Press keypad **CHILLED WATER TEMPS** key.
"RATE LIMIT" = X.X; UNLOAD PULSE = XX" is displayed.

3.) Using **ENTRY** keys, enter the desired rate limit value. The cursor will move under the first changeable digit of the Unload Value. Then enter the desired Unload Pulse Value. Use leading zeros where necessary (ie, 06). If the **CANCEL** key is pressed, default values of 1.0 (RATE LIMIT) and 6 (UNLOAD PULSE) are displayed.

4.) Press **ENTER** key. "PROGRAM MODE, SELECT SETPOINT" is displayed.

5.) Press **ACCESS CODE** key. **ACCESS TO PROGRAM KEY DISABLED** is displayed momentarily. The Display then returns to the normal background message.

S. L. Baer - 36BE
ELECTRONIC PRODUCTS SERVICE ENGINEER

YORK®

File in ABS, SM Manual(s)

SERVICE BULLETIN

Supersedes: Nothing

Form: 155.17-M2 (SB2)(396)

File with Form: 155.17-M2

SUBJECT: MICROCOMPUTER CONTROL CENTER (PARAFLOW ABSORPTION UNITS) - SERVICE MANUAL REVISION

THE FOLLOWING ARE REVISIONS TO SERVICE MANUAL 155.17-M2 (295):

## GAS/OIL BURNER CALIBRATION

THE FOLLOWING SETPOINTS MUST BE SET AS FOLLOWS PRIOR TO PERFORMING THE BURNER FULL TRAVEL CALIBRATION. THESE SETPOINTS LIMIT LOADING AND WILL PREVENT THE BURNER FROM GOING TO FULL TRAVEL. IF THESE SETPOINTS ARE NOT SET AS FOLLOWS, THE BURNER FULL TRAVEL CALIBRATION WILL NOT BE CORRECT.

1.) "MAX ALLOWED LOADING" MUST BE SET AT 100%.
2.) "AUTO-TEMP CONTROL DELAY" MUST BE SET AT 0 MINUTES.
3.) "PULLDOWN DEMAND LIMIT" MUST BE SET AT 0 MINUTES, START 100%, STOP 100%.

AFTER THE BURNER CALIBRATION IS COMPLETED, THESE SETPOINTS MUST BE RETURNED TO THEIR ORIGINAL VALUES.

## RELAY OUTPUT BOARD - INPUTS & OUTPUTS

TB4-82 - CHANGE TO READ..."HOT WATER FLOW SWITCH (GAS/OIL UNITS IN **HEATING ONLY** MODE)."

TB4-87/88 - REMOVE THE SENTENCE "THESE CONTACTS DO NOT OPERATE IN **HEATING MODE**. ADD "IF THE FLOW SWITCH OPENS DURING UNIT RUN, UNITS EQUIPPED WITH EPROM VERSION A.01F.07 OR LATER WILL MAINTAIN THESE CONTACTS CLOSED FOR 30 SECONDS AFTER UNIT SHUTDOWN IN AN ATTEMPT TO RE-ESTABLISH WATER FLOW.

J1-9 - ADD "SPRAY SOLUTION PUMP (MODELS 16SL THRU 19S)".

TB3-34 - ADD "SECOND SPRAY SOLUTION PUMP STARTER (MODELS -19GL THRU 22G); SPRAY SOLUTION PUMP (MODELS 16SL THRU 19S)."

TB3-29 - ADD "ON MODELS 16SL THRU 19S, THE REFRIGERANT PUMP START IS DELAYED FOR 10 MINUTES AT UNIT START.

FIG. 15 - REVISE PER ATTACHED FIG.
FIG. 16 - REVISE PER ATTACHED FIG.

FIG. 19 - REVISE PER ATTACHED FIG.
FIG. 19A - ADD NEW FIG. 19A

## DIGITAL INPUT BOARD - INPUTS

J2-1 - ADD "ON UNITS EQUIPPED WITH EPROM VERSION A.01F.07 OR LATER, **HT1** OR **HT2** MUST REMAIN OPEN FOR MORE THAN 1 SECOND IN ORDER TO INITIATE A SHUTDOWN. THIS DELAY PREVENTS NUISANCE SHUTDOWNS ON UNITS EQUIPPED WITH DUAL FUEL BURNERS WHEN THE BURNER IS SWITCHED TO THE ALTERNATE FUEL WHILE THE UNIT IS RUNNING.

TB2-91 - CHANGE TO READ TB2-95.

TB2-12 - ADD "ON UNITS EQUIPPED WITH EPROM VERSION A.01F.07 (OR LATER), 115VAC WHEN FLOW SWITCH IS CLOSED. 0VAC WHEN FLOW SWITCH IS OPEN INDICATING NO FLOW."

TB1-71 - ADD "MODELS 16SL THRU 19S HAVE A SOLUTION PUMP AND A DELAYED-ON SOLUTION SPRAY PUMP.

## MICRO BOARD INPUTS & OUTPUTS

J1-19 - ADD "ON UNITS EQUIPPED WITH EPROM VERSION A.01F.07 (OR LATER), +5VDC WHEN FLOW SWITCH IS CLOSED AND 0VDC WHEN FLOW SWITCH IS OPEN."

J1-4 - ADD "MODELS 16SL THRU 19S HAVE A SOLUTION PUMP AND A DELAYED-0N SPRAY SOLUTION PUMP."

J7-9 - CHANGE TO READ "SECOND SPRAY SOLUTION PUMP STARTER OUTPUT (MODELS 19GL THRU 22G) OR SPRAY SOLUTION PUMP OUTPUT (MODELS 16SL THRU 19S).

J17-11 - CHANGE TO READ: "PURGE PUMP TRANSDUCER EXISTS ONLY ON UNITS EQUIPPED WITH AUTOMATIC PURGE HARDWARE AND EPROM VERSION A.01F.09 OR LATER."

J17-13 - CHANGE TO READ: "PURGE TANK TRANSDUCER EXISTS ONLY ON UNITS EQUIPPED WITH AUTOMATIC PURGE HARDWARE AND EPROM VERSION A.01F.09 OR LATER."

## MICRO BOARD - PROGRAM JUMPERS

JP2 - OUT = CHANGE TO READ...."REMOVAL OF THIS JUMPER CAUSES THE REFRIGERANT (AFTER 10 MINUTE DELAY AT START), HOT WATER, SOLUTION AND SPRAY SOLUTION (-16SL THRU -19S; AFTER 30 TO 120 SECOND PROGRAMMED DELAY AT START) PUMPS TO RUN DURING **HEATING ONLY** MODE."

JP3 - IN = CONFIGURES THE MICRO BOARD FOR "G" SERIES -15GL THRU -19G AND "S" SERIES -13S THRU -16S. THESE UNITS ARE EQUIPPED WITH A

SINGLE SOLUTION PUMP.

JP3 - OUT = CONFIGURES MICRO BOARD FOR "G" SERIES -19GL THRU -22G AND "S" SERIES -16SL THRU -19S. THESE "G" SERIES UNITS HAVE A SOLUTION PUMP, FIRST SPRAY SOLUTION PUMP AND A DELAYED-ON SECOND SPRAY SOLUTION PUMP. THESE "S" SERIES UNITS HAVE A SOLUTION PUMP AND A DELAYED-ON SPRAY SOLUTION PUMP.

## I/O EXPANSION BOARD - INPUTS & OUTPUTS

J8-5 - CHANGE TO READ: "(APPLICABLE TO UNITS EQUIPPED WITH EPROM VERSION A.01F.09 OR LATER)".

## I/O EXPANSION BOARD - PROGRAM JUMPERS

JP1 - CHANGE TO READ: "APPLICABLE TO UNITS EQUIPPED WITH EPROM VERSION A.01F.09 OR LATER AND AUTOMATIC PURGE HARDWARE CONSISTING OF PURGE PUMP TRANSDUCER (PT3), PURGE TANK TRANSDUCER (PT4), AND PURGE PUMP SOLENOID VALVE (2SOL) AND PURGE TANK SOLENOID VALVE (1SOL).

## STEAM VALVE CONTROL

**GENERAL**

ADD THE FOLLOWING: UNITS EQUIPPED WITH EPROM VERSION A.01F.07 OR LATER HAVE AN ADDITIONAL PROGRAMMABLE VARIABLE CALLED **SAMPLE FACTOR**. THIS SETPOINT ALLOWS THE SERVICE TECHNICIAN TO CHANGE THE DURATION OF THE 4 MINUTE SAMPLE PERIOD TO 0.5 - 16 MINUTES. ALTHOUGH THE 4 MINUTE SAMPLE PERIOD SHOULD PROVIDE PROPER OPERATION IN MOST APPLICATIONS, THIS SETPOINT PROVIDES GREATER FLEXIBILITY IN ADJUSTING THE CONTROL TO THE LOCAL OPERATING CONDITIONS.

**SAMPLE FACTOR**

ADD NEW SUBHEADING **SAMPLE FACTOR** (APPLICABLE TO UNITS EQUIPPED WITH EPROM VERSION A.01F.07 OR LATER): SAMPLE FACTOR IS A FIELD PROGRAMMABLE VARIABLE THAT DETERMINES THE DURATION OF THE SAMPLE PERIOD THAT FOLLOWS THE INITIAL 1 MINUTE PERIOD EMPLOYED AT UNIT START. EACH TIME THE UNIT IS STARTED, THE DURATION OF THE SAMPLE PERIOD IS 1 MINUTE UNTIL THE STEAM VALVE POSITION IS $\geq$ 50% OR THE **LCWT** IS WITHIN 5 F OF SETPOINT. THE DURATION OF THE SAMPLE PERIOD THEN BECOMES 4 MINUTES THEREAFTER. THE **SAMPLE FACTOR** SETPOINT ALLOWS THE SERVICE TECHNICIAN TO CHANGE THE DURATION OF THIS 4 MINUTE PERIOD TO 0.5 - 16 MINUTES. THE DEFAULT VALUE IS 4 MINUTES. THE DEFAULT VALUE WILL PROVIDE PROPER OPERATION IN MOST APPLICATIONS. HOWEVER, APPLICATIONS WITH EXTREMELY SHORT OR LONG CHILLED WATER LOOPS OR WITH IRREGULAR LOAD CHANGES, COULD REQUIRE THE SAMPLE PERIOD TO BE SHORTER OR LONGER.

## SPECIAL SETPOINTS AND PROGRAMMING PROCEDURES

**STEAM VALVE CONTROL** (STEAM UNITS ONLY) - ADD THE FOLLOWING: UNITS

EQUIPPED WITH EPROM VERSION A.01F.07 OR LATER HAVE AN ADDITIONAL SETPOINT CALLED **SAMPLE FACTOR**. THE VALUE PROGRAMMED DETERMINES THE DURATION OF THE SAMPLE PERIOD EMPLOYED AFTER THE INITIAL 1 MINUTE PERIOD AT UNIT START. IT IS PROGRAMMABLE OVER THE RANGE OF 0.5 TO 16 MINUTES IN 0.1 MINUTE INCREMENTS. THE DEFAULT VALUE IS 4 MINUTES. THIS DEFAULT VALUE WILL PROVIDE PROPER OPERATION IN MOST APPLICATIONS. HOWEVER, LONG OR SHORT CHILLED WATER LOOPS OR IRREGULAR LOAD CHANGES COULD REQUIRE A LONGER OR SHORTER SAMPLE PERIOD. REFER TO COMPLETE EXPLANATION OF THIS SETPOINT IN "STEAM VALVE CONTROL" SECTION OF THIS BOOK. TO PROGRAM THIS VALUE, PROCEED AS FOLLOWS:

1.) PRESS **CHILLED WATER TEMPS** KEY.
"RATE LIMIT = X.X; UNLOAD PULSE = XX" IS DISPLAYED.

2.) PRESS **ADVANCE DAY/SCROLL** KEY.
"SAMPLE FACTOR = XX.X" IS DISPLAYED.

3.) USING **ENTRY** KEYS, ENTER THE DESIRED SAMPLE FACTOR VALUE. USE LEADING ZEROES WHERE NECESSARY (ie, 00.5). IF THE **CANCEL** KEY IS PRESSED, THE DEFAULT VALUE "04.0" IS DISPLAYED.

4.) PRESS **ENTER** KEY.
"PROGRAM MODE, SELECT SETPOINT" IS DISPLAYED.

5.) PRESS **ACCESS CODE** KEY.
"ACCESS TO PROGRAM MODE KEY DISABLED" IS DISPLAYED MOMENTARILY. THE DISPLAY THEN RETURNS TO THE NORMAL FOREGROUND MESSAGE.

**SOLUTION CONCENTRATION DISPLAY** - CHANGE TO READ: "APPLICABLE TO UNITS EQUIPPED WITH EPROM VERSION A.01F.09 OR LATER.

**SPRAY SOL'N PUMP DELAY** - CHANGE TO READ...."WITH MICRO BOARD PROGRAM JUMPER JP2 OUT, THE CONTROL CENTER IS CONFIGURED FOR S" SERIES MODELS -16SL THRU -19S AND "G" SERIES MODELS -19GL THRU -22G. THE "S' SERIES MODELS HAVE A SOLUTION PUMP AND A SPRAY SOLUTION PUMP. THE SPRAY SOLUTION PUMP IS STARTED AFTER THE PROGRAMMED DELAY. THE "G" SERIES MODELS HAVE 1 SOLUTION PUMP AND 2 SPRAY SOLUTION PUMPS."

## LIMITED DILUTION CYCLE STANDBY POWER SUPPLY

ADD NEW SECTION "**LIMITED DILUTION CYCLE STANDBY POWER SUPPLY**".

### GENERAL

ON UNITS EQUIPPED WITH EPROM VERSION A.01F.07 OR LATER, LIMITED DILUTION CYCLES CAN BE PERFORMED DURING UTILITY POWER FAILURES USING AN EMERGENCY GENERATOR TO SUPPLY POWER TO THE MICROCOMPUTER CONTROL CENTER AND THE SOLUTION PUMP (3 SOLUTION PUMPS ON MODELS -19GL THRU -22G). REFER TO OPERATION MANUAL FORM 155.17-02 FOR COMPLETE EXPLANATION OF SEQUENCE OF OPERATION AND ALL DISPLAY MESSAGES ASSOCIATED WITH THE "LIMITED DILUTION CYCLE".

REFER TO FIG 37A AND 37B. WHEN A UTILITY POWER FAILURE OCCURS, AN "AUTOMATIC TRANSFER SWITCH" (ATS) MUST TRANSFER THE PARAFLOW UNIT POWER SOURCE FROM UTILITY POWER TO GENERATOR POWER. SIMULTANEOUSLY, TWO SETS OF NORMALLY OPEN CONTACTS THAT ARE A PART OF THE "ATS" CLOSE: ONE SET TO START THE EMERGENCY GENERATOR; THE OTHER SET TO SIGNAL THE DIGITAL INPUT BOARD AT TERMINAL TB2-95 THAT A STANDBY POWER SUPPLY IS ON LINE AND A "LIMITED DILUTION" CYCLE SHOULD BE PERFORMED. (NOTE: UNITS MUST BE EQUIPPED WITH DIGITAL INPUT BOARD P/N 031-01621-001 (STANDARD UNITS) OR 031-01621-002 (VDE UNITS) TO HAVE TB2-95; PREVIOUS PREVIOUS DIGITAL INPUT BOARD 031-00935-000 DOES NOT HAVE TB2-95). WHEN UTILITY POWER IS RESTORED, THE "ATS" TRANSFERS THE POWER SOURCE TO UTILITY POWER AND SIMULTANEOUSLY OPENS BOTH SETS OF CONTACTS TO STOP THE GENERATOR AND SIGNAL THE DIGITAL INPUT BOARD THAT UTILITY POWER HAS BEEN RESTORED.

THE FOLLOWING IS THE HARDWARE THAT MUST BE CUSTOMER SUPPLIED.

A.) AUTOMATIC TRANSFER SWITCH (ATS)
B.) NON-FUSED DISCONNECT SWITCH (DISC SW)
C.) FUSES OR CIRCUIT BREAKER - UL APPROVED CB FOR HEATING & AIR CONDITIONING & REFRIGERATION APPLICATIONS (HACR)
D.) EMERGENCY GENERATOR (EMER GEN)

THIS EQUIPMENT MUST BE SELECTED IN ACCORDANCE WITH THE POWER REQUIREMENTS OF THE PARAFLOW ABSORPTION UNIT THAT IT WILL BE CONNECTED TO. THESE POWER REQUIREMENTS ARE CONTAINED IN **PARAFLOW APPLICATIONS DATA MANUAL** FORM **155.17-AD1**.

## SYSTEM COMMISSIONING CHECKLIST

4. CHANGE TO READ: "CHECK SPRAY SOLUTION PUMP DELAY SETPOINT (MODELS - 16SL THRU 19S AND -19GL THRU -22G ONLY).

7. CHANGE TO READ: "AUTOMATIC PURGE SYSTEM (UNITS EQUIPPED WITH EPROM VERSION A.01F.09 OR LATER AND AUTO-PURGE HARDWARE CONSISTING OF PURGE PUMP TRANSDUCER (PT3), PURGE TANK TRANSDUCER (PT4), PURGE TANK SOLENOID (1SOL) AND PURGE PUMP SOLENOID (2SOL).

9. CHANGE TO READ: "ENABLE SOLUTION CONCENTRATION DISPLAY (UNITS EQUIPPED WITH EPROM VERSION A.01F.09 OR LATER)"

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SERVICE ENGINEER

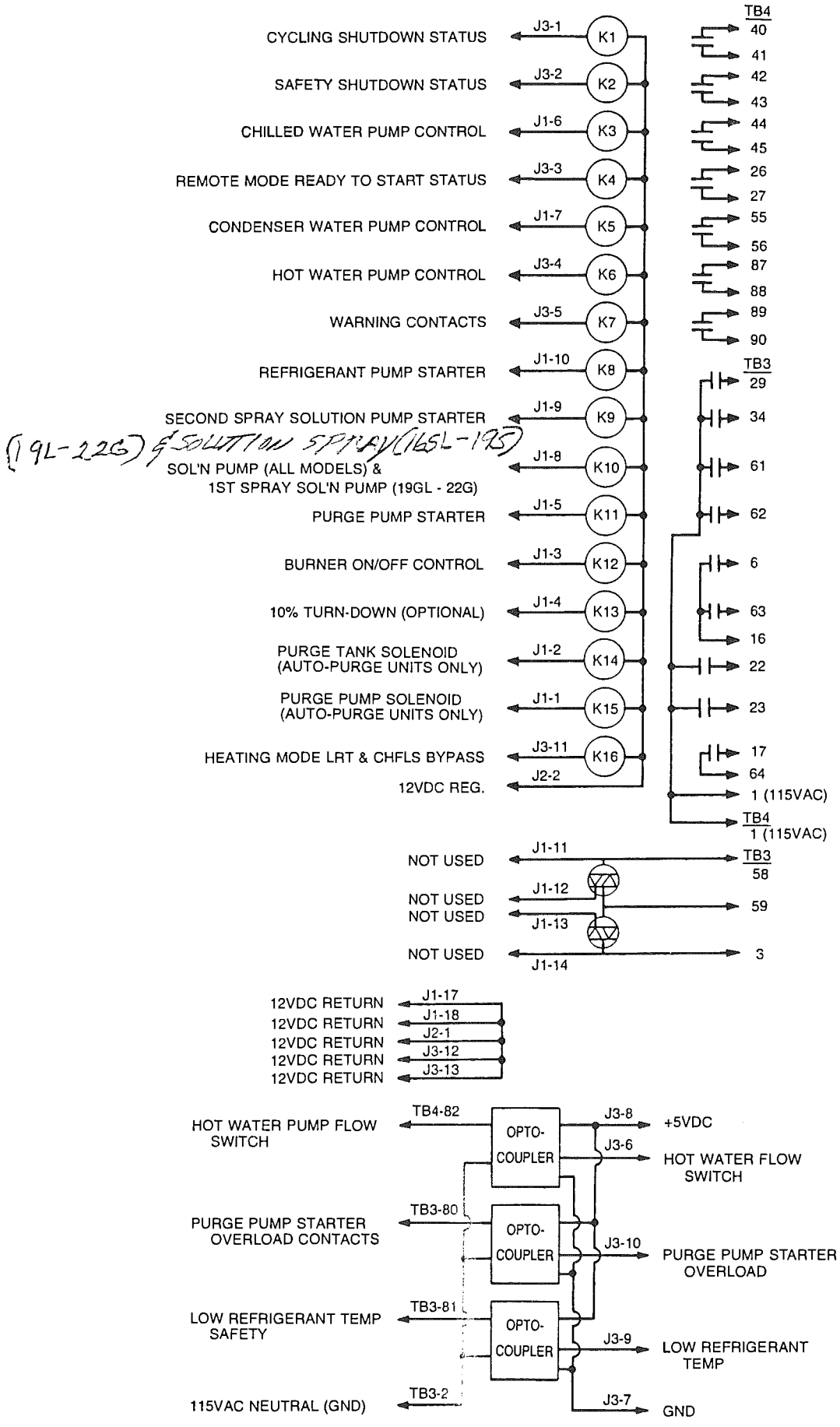



**FIG. 15** – RELAY BOARD (GAS/OIL-FIRED UNITS)

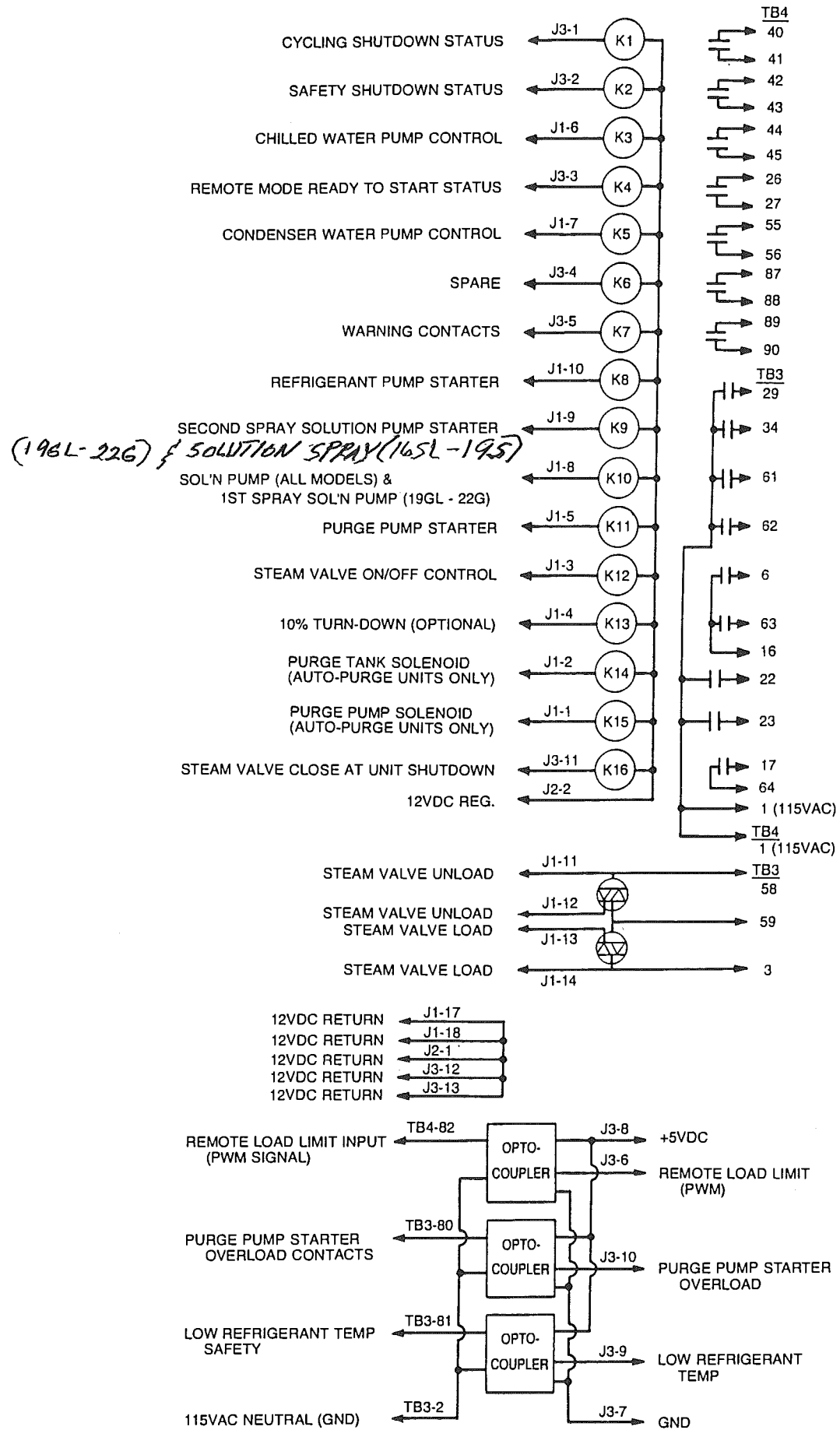



**FIG. 16 – RELAY BOARD (STEAM-FIRED UNITS)**

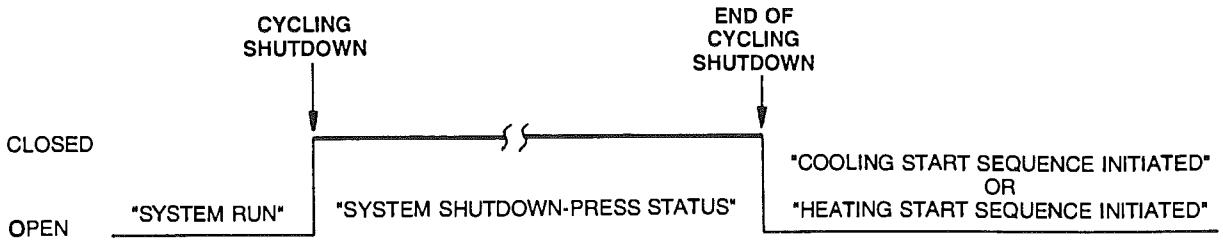
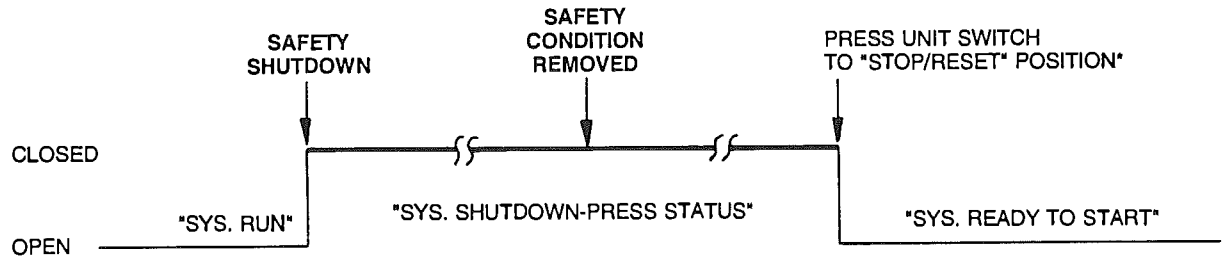
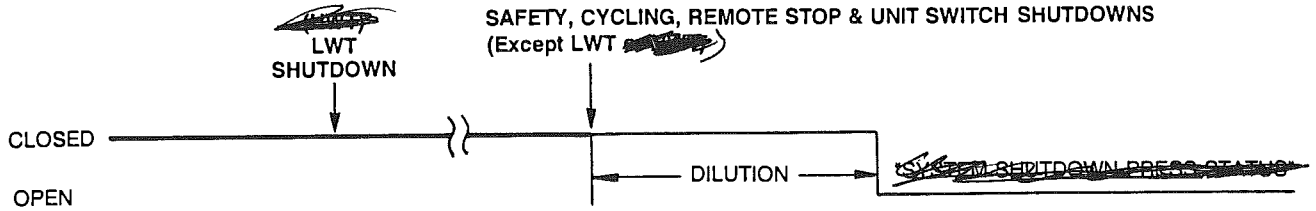



**FIG. 17** – CYCLING SHUTDOWN STATUS CONTACTS – RELAY BOARD TB4-40/41

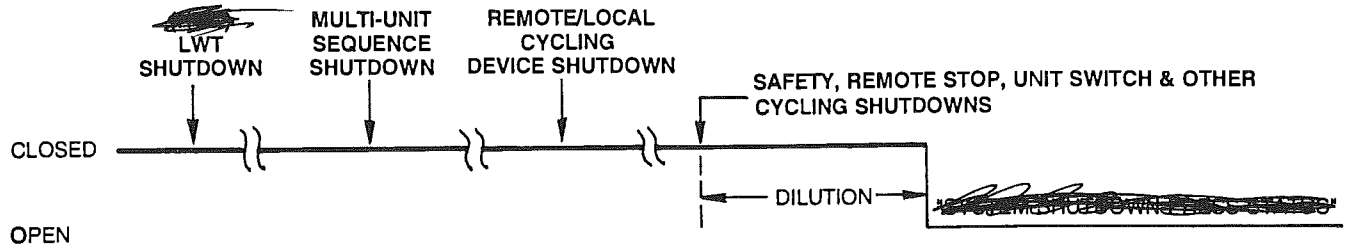



*Some Safety Shutdowns require pressing the **WARNING RESET** key in **SERVICE** mode. Refer to Operation manual, Form 155.17-O2 for details.

**FIG. 18** – SAFETY SHUTDOWN STATUS CONTACTS – RELAY BOARD TB4-42/43




**MICRO BOARD PROGRAM JUMPER J54 INSTALLED**

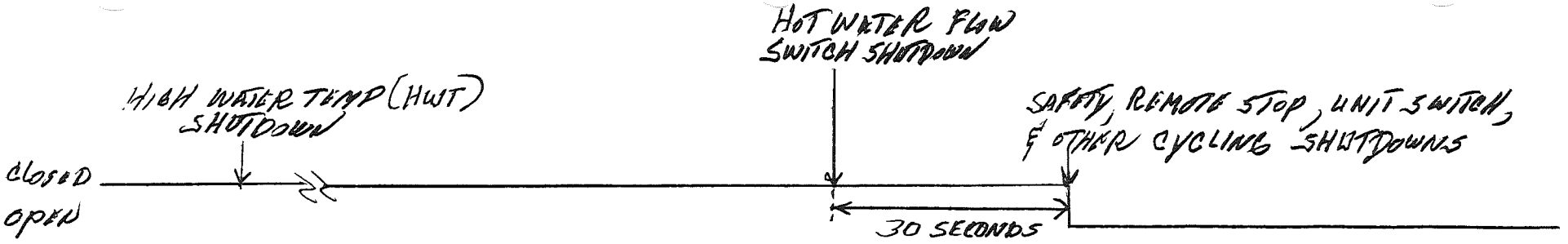



**MICRO BOARD PROGRAM JUMPER J54 REMOVED**

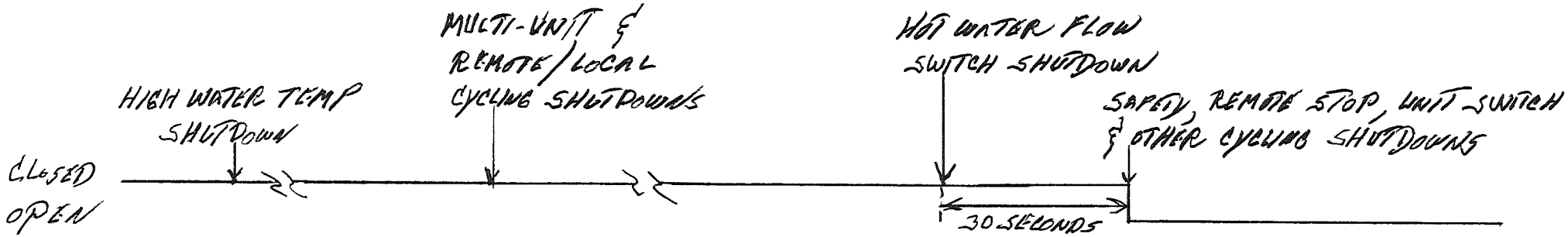
(LWT) = HIGH WATER TEMP IN GAS/OIL HEATING ONLY MODE.

**FIG. 19** – CHILLED WATER PUMP CONTROL CONTACTS – RELAY BOARD TB4-44/45

AND
HOT WATER PUMP CONTROL CONTACTS – RELAY BOARD TB4-87/88



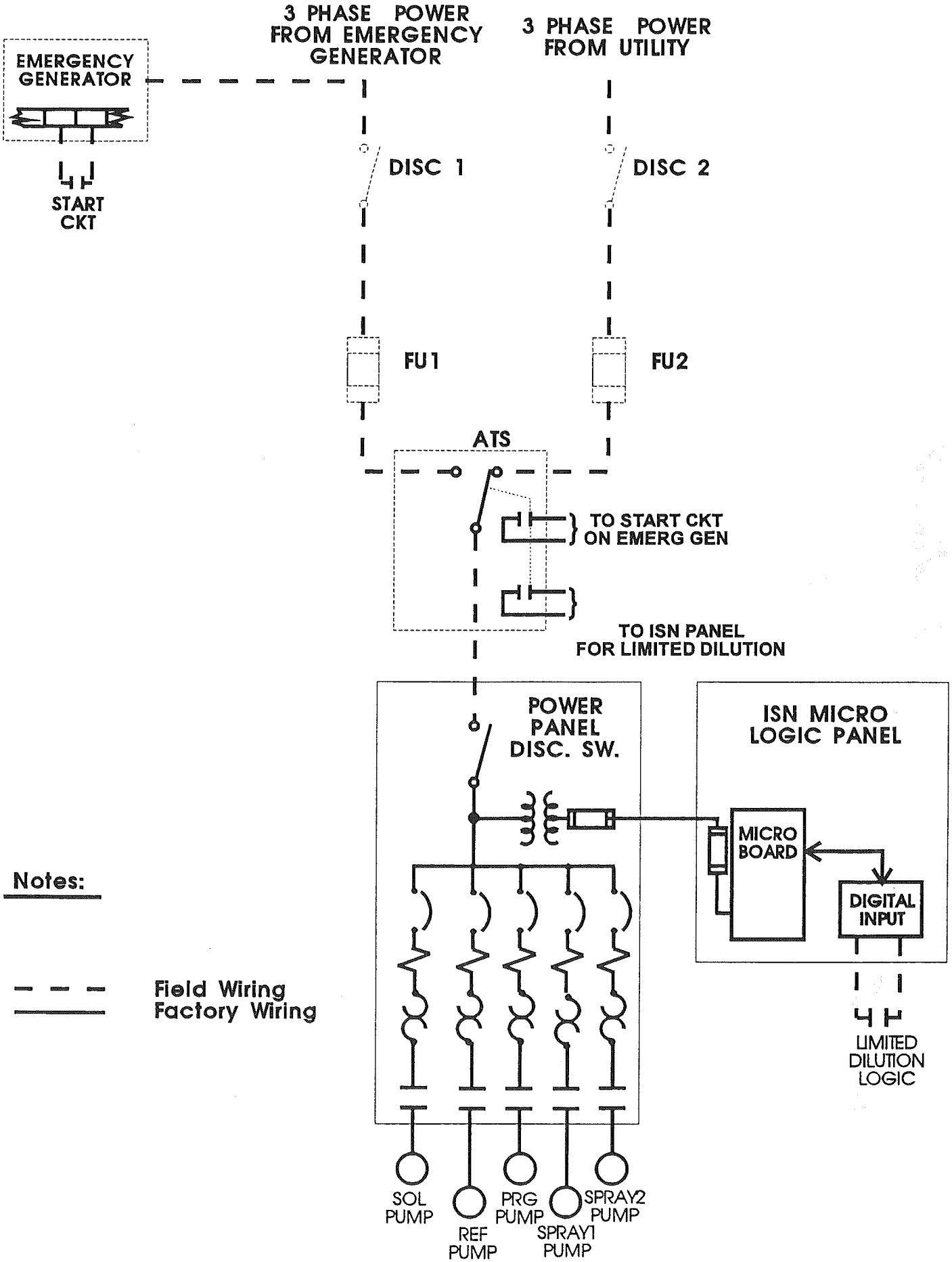

MICRO BOARD PROGRAM JUMPER J54 INSTALLED




MICRO BOARD PROGRAM JUMPER J54 REMOVED

FIG. 19A - HOT WATER PUMP CONTROL CONTACTS - RELAY BOARD TBY-87/89

Fig. 37A

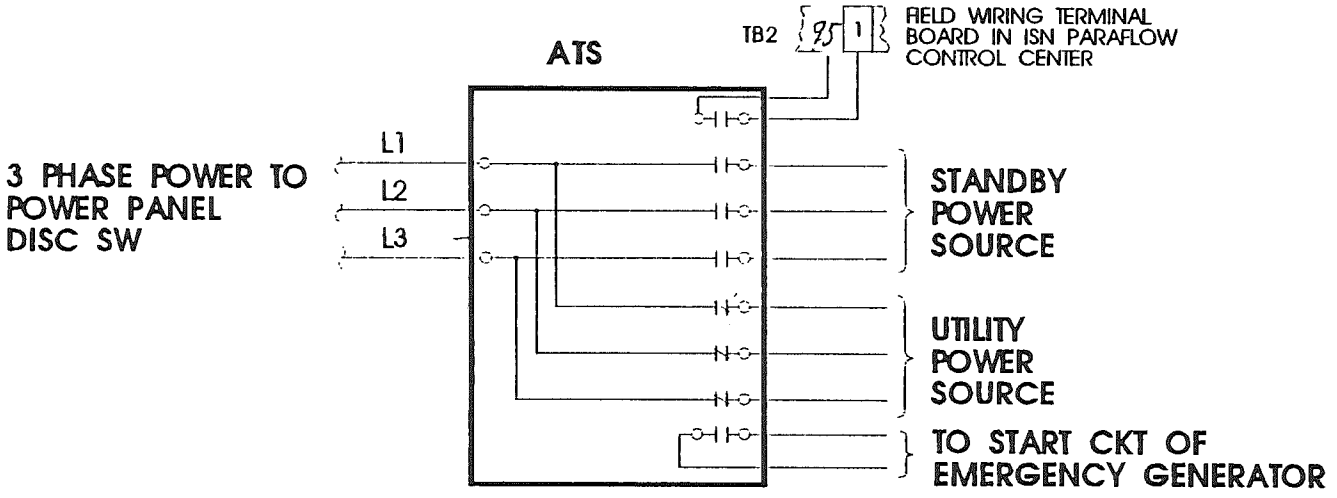



Notes:

Field Wiring

Factory Wiring

Fig. 37.


ATS
TB2
95
1
FIELD WIRING TERMINAL BOARD IN ISN PARAFLOW CONTROL CENTER
3 PHASE POWER TO POWER PANEL DISC SW
L1
L2
L3
STANDBY POWER SOURCE
UTILITY POWER SOURCE
TO START CKT OF EMERGENCY GENERATOR

| YORK® | FILE IN ABS, 2SAM MANUAL(S) | |
|---|---|---|
| **SERVICE BULLETIN** | Supersedes: Nothing | Form 155.17-M2 (SB3) |
| | File with Form 155.17-M2 | |

**SUBJECT: MILLENNIUM CONTROL CENTER (YPC ABSORPTION UNITS) - EPROM VERSION A.01F.08**

On/About November 1996, YPC absorption units will be shipped with EPROM version A.01F.08 (P/N 031-01669-002). It supersedes version A.01F.07 and contains the following enhancements:

**LESLIE STEAM VALVE**

Previously, all steam units were equipped with **Honeywell** steam valves. The Honeywell valve is controlled by applying 115VAC from the Microcomputer Control Center relay board to the open or close valve terminals.

The subject EPROM provides for the use of **Leslie** steam valves. These valves are controlled by a 4-20ma signal from J3 of the microcomputer control I/O expansion board. This output is enabled when I/O expansion board program jumper JP2 is cut.

**OPERATION**

There is no position feedback potentiometer. Therefore, the steam valve calibration procedure that is required for the Honeywell valve, is not required for the Leslie valve. The fully closed position will be displayed as 0% and the fully open position as 100%. During unit run, the valve is modulated between 20% and 100% of unit capacity to control the leaving chilled water temperature (LCWT) to the leaving chilled water temp setpoint. The valve position that corresponds to the 20% of unit capacity operating point is determined by a field procedure performed by the field service technician (ref YORK Form 155.17-NM1). This valve position is then programmed as the **minimum allowed loading** setpoint (5-60%) by the field service technician using the procedure below.

During unit run, the position of the steam valve is changed, as required, at the end of each sample/output interval. Each time the unit is started, the sample/output interval is 1 minute long until the steam valve position is greater than or equal to 50% or the leaving chilled water temperature (LCWT) decreases to within 5°F of the LCWT setpoint. After that, the sample/output interval is 0.5 to 16 minutes, as programmed in the **sample factor** setpoint below. Other programmable setpoints, as detailed below, affect the amount of valve position change that occurs at the end of each sample/output interval. For example, if the unit is used in an application where loads are shed quickly and fast unloading is required, the **unload** setpoint can be used to make the unit unload faster. If the unit is constantly used under light load conditions, the **DAC Divide Value** setpoint can be used to decrease the amount of change in valve position that would normally occur at the end of each sample/output interval. The **rate limit** setpoint determines the response sensitivity to the LCWT rate of change within the sample/output interval. These setpoints are detailed below.

**PROGRAMMABLE SETPOINTS**

The following field programmable variables allow the field service technician to fine tune the valve control to local site conditions.

1.) **Minimum Allowed Loading –** Programmable from 5% to 60% in 1% increments. Typically set at 20% of unit capacity. Operating below this capacity will result in unstable operation. During unit run, the steam valve will not be allowed to unload below the programmed steam valve position. However, using the load/unload keypad keys in **service** mode, will allow the service technician to unload below this position.

   To assure that the unit will not unload to less than the **minimum allowed loading** setpoint position, the following safeguards are in place:

   If a remote device attempts to limit the loading to a valve position that is less than the “MINIMUM ALLOWED LOADING” setpoint, the Microcomputer Control Center will override the remote device as follows: if a **remote load limit** setpoint is received that is not greater than the “MINIMUM ALLOWED LOADING” setpoint, the program will automatically set the “REMOTE LOAD LIMIT” setpoint to 1% above the “MINIMUM ALLOWED LOADING” setpoint.

Similarly, the program will assure that the "MAXIMUM ALLOWED LOADING" setpoint is set to a value greater than the "MINIMUM ALLOWED LOADING" setpoint. If a service technician attempts to enter a "MAXIMUM ALLOWED LOADING" setpoint that is not greater than the "MINIMUM ALLOWED LOADING" setpoint, or a "MINIMUM ALLOWED LOADING" setpoint that is not less than the "MAXIMUM ALLOWED LOADING" setpoint, "OUT OF RANGE - TRY AGAIN" is displayed.

2.) **Unload –** Programmable from 1.0 to 2.0 in 0.1 increments. Default value is 1.0. The value programmed is the multiplier for the change in output when the program calls for unloading the steam valve. At the end of each sample period, if the program determines that it is necessary to unload the steam valve, the decrease in the 4-20ma output signal that would normally occur, is multiplied by the programmed **unload** value. For example, if the program determines that the output should decrease 2.0ma and the **unload** value is 1.5, the output would decrease 3.0ma (i.e. 2.0 x 1.5 = 3.0). The greater the number programmed, the faster the unit (steam valve) will unload. This can be helpful for short water loops, light load conditions and applications where loads are shed rapidly.

3.) **Sample Factor –** Programmable from 0.5 to 16 minutes in 0.1 minute increments. The default value is 4.0 minutes. The value programmed for the **sample factor** determines what the sample/output interval will be after the initial 1 minute interval criteria is satisfied each time the unit is started. The 4-20ma output is allowed to change only at the end of each sample/output interval. Every time the unit is started, the sample/output interval is 1 minute until the steam valve reaches 50% position or the leaving chilled water temp (LCWT) is within 5°F of the LCWT setpoint. After that, the interval will be whatever is programmed as **sample factor**. For example, if 2.0 is programmed, each time the unit is started, the sample/output interval will be 1 minute until the steam valve command reaches 50% or the LCWT is within 5°F of the LCWT setpoint; it will be 2 minutes thereafter. This value should be adjusted for optimum LCWT control.

4.) **DAC Divide Value –** Allowable programmable values are 1, 2, 4, 8. The default value is 1. After the LCWT gets within 5°F of the LCWT setpoint, at the end of each sample/output interval the change in the 4-20ma output will be divided by the programmed **DAC Divide Value**. For example, if the called for output change would be for an increase of 2.5ma, and the **DAC Divide Value** is programmed as 4, the actual change in output would be an increase of 0.6ma (2.5/4 =0.6). This value can be adjusted to provide smaller changes in output when the LCWT is near setpoint. This prevents overshoot and undershoot of the LCWT setpoint.

5.) **Rate Limit –** Programmable from 0.3°F to 2.0°F in 0.1°F increments. Default value is 1.0°F. Value programmed determines the sensitivity and response to the rate of change of the leaving chilled water temperature (LCWT). The "rate of change" is defined as the amount of change of the LCWT in the sample/output interval. The LCWT's rate of change is calculated over each sample/output interval. At the end of each sample/output interval, the rate of change is compared to the programmed **rate limit** value. The closer the rate of change is to **rate limit**, the greater the rate component will be in the change in output. In other words, the greater effect rate of change will have on the change in output. This means that rate sensitivity increases as the programmed **rate limit** value is decreased.

**TO PROGRAM THE ABOVE SETPOINTS** - Enter "PROGRAM" mode using access code 1-3-8-0, then proceed as follows:

**Minimum Allowed Loading**

1.) Press "UNLOAD" key. "MIN ALLOWED LOADING = XX%" is displayed.

2.) Enter desired value. Use leading zeroes where necessary (i.e. 05%). The value entered must be less than the value entered for "MAX ALLOWED LOADING" setpoint. Otherwise, "OUT OF RANGE - TRY AGAIN" is displayed.

3.) Press "ENTER" key.

4.) Press "PROGRAM" key to exit or continue to next.

**Rate Limit, Unload**

1.) Press "CHILLED WATER TEMPS" key. "RATE LIMIT = X.X: UNLOAD = X.X" is displayed.

2.) Enter desired value for rate limit. Then enter desired value for unload. Use leading zeroes where necessary (i.e. 0.5).

3.) Press "ENTER" key.

4.) Press "PROGRAM" key to exit or "ADVANCE DAY/SCROLL" key to continue to sample factor prompt.

**Sample factor**

1.) Press "CHILLED WATER TEMPS" key. Press "ADVANCE DAY/SCROLL" key until "SAMPLE FACTOR = XX.X" is displayed. Each time the "ADVANCE DAY/SCROLL" key is pressed, the message will alternate with a different message.

2.) Enter the desired value. Use leading zeroes where necessary (i.e. 05.0).

3.) Press “ENTER” key.

4.) Press “PROGRAM” key to exit or “ADVANCE DAY/SCROLL” key to continue to “DAC Divide Value” prompt.

**DAC Divide Value**

1.) Press “Chilled Water Temps” key. Press “Advance Day/Scroll” key until “DAC Divide Value = X” is displayed. Each time the “Advance Day/Scroll” key is pressed, the message will alternate with a different message.

2.) Enter desired value.

3.) Press “Enter” key. Press “Program” key to exit.

**STEAM VALVE SELECTION**

The position of I/O expansion board program jumper **JP2** determines which steam valve output will be enabled. This jumper must be installed or cut depending on which steam valve is used as follows:

**In -** Honeywell steam valve. Enables the 115VAC pulse width modulation (PWM) output from the relay board.

**Cut -** Leslie Steam Valve. Enables the 4-20ma output from the I/O expansion board J3.

**GAS/OIL BURNER CALIBRATION**

The BURNER CALIBRATION procedure has been modified. The **full fire mode setpoint** selection and the **percent of full fire** of the **alternate mode** programming procedure, has been separated from the BURNER FULL TRAVEL CALIBRATION procedure. The following is a description both procedures as they are now performed with this EPROM version. The burner calibration theory is explained in SERVICE MANUAL 155.17-M2.

**BURNER FULL TRAVEL CALIBRATION**

1.) Micro board PROGRAM JUMPER JP1 (gas/oil units) and J51 (limit override) must be installed prior to performing this procedure.

2.) The following setpoints must be programmed as follows prior to performing this procedure. These setpoints limit loading and will prevent the burner from going to “full travel”. If these setpoints are not set as follows, the BURNER FULL TRAVEL CALIBRATION will not be correct.

a.) “MAX ALLOWED LOADING” must be set to **100%**.

b.) “AUTO-TEMP CONTROL DELAY” must be set to **0** minutes.

c.) “PULLDOWN DEMAND LIMIT” must be set to **0** minutes, start **100%**, stop **100%**.

After the burner calibration is completed, these setpoints must be returned to their original values.

3.) The unit must be running in **service** operating mode.

4.) Enter **program** mode using access code 1-3-8-0. “PROGRAM MODE, SELECT SETPOINT” is displayed.

5.) Press **auto** key. “PERFORM BURNER CALIBRATION? (1=YES;0=NO)” is displayed and the burner is driven toward the closed position. If it is desired to perform the following procedure, press **1**. Otherwise, press **0** to exit. If **0** is pressed, “PROGRAM MODE, SELECT SETPOINT” is displayed.

**Note:** If at any stage in the calibration process it is desired to terminate the procedure, press the “*” key. All previously programmed calibration values are retained. Also, any unit shutdown during this procedure, terminates the procedure.

6.) Press **enter** key.
“BURNER CONTROL CURRENT = XX.Xma” is displayed. The burner will be driven open until it reaches the full travel position and stops rotating. The current displayed is that which is being output to the burner control. It will increase as the motor rotates toward full travel position.

7.) At the instant the motor reaches full travel position, the person at the burner must signal the person at the Control Center to capture the motor current value. This is done by pressing the **hold** key. For dual burner units, both burner persons must signal, with the last signal used for the capture. The lowest current value that will be accepted is 18.3ma. Lower current values will be ignored by the software. Pressing the **hold** key also causes the motor to reverse direction and travel toward the minimum travel position.

8.) When the motor reaches minimum travel position, the person at the burner must signal the person at the Control Center to press the **hold** key to capture the motor current value. For dual burner units, both persons must signal with the last signal used for capture. The highest current value that will be accepted for minimum travel is 5.0ma. Higher current values will be ignored by the software.

9.) “FULL FIRE CONTROL RANGE = XX.Xma TO XX.Xma” is displayed.

10.) Press the **enter** key. “PROGRAM MODE, SELECT SETPOINT” is displayed.

11.) Press **program** key to exit. The normal foreground message is displayed.

12.) Remove micro board program jumper J51.

13.) Return setpoints changed in step 2 to their original values.

**FULL-FIRE MODE SETPOINT**

This procedure must be performed after the above BURNER FULL TRAVEL CALIBRATION is performed. If the unit only operates in **cooling only** mode, the "FULL FIRE MODE" is programmed to "CLG". If the unit operates in both **cooling only** and **heating only** mode, typically one mode requires a different maximum burner output that is higher than the other. The mode requiring the highest maximum output becomes the "FULL FIRE MODE" of the unit. The maximum burner output of the remaining mode will be a percentage of full fire rate of the unit. The procedure to determine the percentage of full fire for the lessor mode is in SERVICE MANUAL 155.17-NM1.

1.) Enter **program** mode using access code 1-3-8-0. "PROGRAM MODE, SELECT SETPOINT" is displayed.

2.) Press **hold** key. "FULL FIRING MODE=0 (0=CLG;1=HTG)" is displayed.

3.) Using **entry** keys, press **0** or **1** as appropriate or press **advance day/scroll** key to advance to the next prompt in step 5. If the **cancel** key is pressed, default value **0** is displayed.

4.) Press **enter** key.

5.) Press **advance day/scroll** key. "MAX MMM INPUT = XXX% OF FULL FIRE" is displayed. "MMM" is automatically replaced by the alternate mode from that which was designated as the full fire mode in step 3.

6.) Using the **entry** keys, enter the percentage of full fire for this mode. The procedure to determine this percentage is detailed in YORK ABSORPTION SERVICE MANUAL 155.17-NM1.

7.) Press **enter** key.

8.) Press **program** key to exit. The normal foreground message is displayed.

**CONDENSER WATER FLOW SWITCH SHUTDOWNS**

Condenser water flow switch cycling shutdowns now operate as follows:

If the condenser water flow switch opens while the unit is running, a **cycling** shutdown is initiated, "DAY-TIME-COND FLOW SWITCH - AUTOSTART" is displayed as STATUS and a normal dilution is performed. If the flow switch closes before the dilution terminates, the unit will automatically restart. However, if the flow switch does not close before the dilution terminates, the **cycling** shutdown becomes a **safety** shutdown coincident with the dilution termination, all pumps are shut off and "DAY-TIME-COND FLOW SWITCH" replaces the previous **cycling** shutdown message (the day and time displayed is the time the cycling shutdown occurred; this provides a record of the initial event.) If the safety shutdown occurs, the unit can be restarted by moving the **unit switch** to "STOP-RESET", then to "START" position.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| YORK® | FILE IN ABS, 2SAM MANUAL(S) | |
|---|---|---|
| **SERVICE BULLETIN** | Supersedes: Nothing | Form 155.17-M2 (SB4) (1296) |
| | File with Form 155.17-M2 | |

**SUBJECT: MILLENNIUM CONTROL CENTER (YPC ABSORPTION UNIT) - SERVICE MANUAL REVISION**

On/about December 1996, YPC absorption units will be shipped with EPROM version A.01F.09 (P/N 031-01669-002). It contains enhancements that revise the Service Manual 155.17-M2 as follows:

**PROGRAM JUMPERS –** I/O EXPANSION BOARD

**J14 –** Solution concentration display and safety shutdown feature enable/disable. EPROM version A.01F.09 or later only. Thermistor RT12 (2nd stage leaving refrigerant temperature) is required for proper operation of this feature. Without RT12, a high concentration will be calculated and the unit be prevented from running. Units built prior to 8/96 are not equipped with RT12. If EPROM version A.01F.09 (or later) is used in units not equipped with RT12, the feature must be disabled with this jumper. Later units equipped with RT12 must have the feature enabled.

. ▭ – Disables Solution Concentration display and safety shutdown feature. Units not equipped with thermistor RT12.
3 2 1

▭ . – Enables Solution Concentration display and safety shutdown feature. Units equipped with thermistor RT12.
3 2 1

**JP1 –** In the description of this program jumper, reference is made to auto-purge operation being supported by EPROM version A.01F.07. This should be changed to A.01F.09 or later.

**GAS/OIL UNITS - BURNER CALIBRATION**

The burner calibration procedure must be performed in order for all the programmed load limits to operate properly. If this calibration is not performed, the unit will be allowed to load to 100% even though a number less than 100% is programmed for "MAX ALLOWED LOADING" setpoint.

**SPECIAL SETPOINTS AND PROGRAMMING PROCEDURES**

MINIMUM ALLOWED LOADING (Leslie steam valves only) – The **unload** key is still used to program this setpoint. However, since this key is now also used to program the CONCENTRATION DISPLAY ENABLE/DISABLE, the **advance day/scroll** key must be used after the **unload** key is pressed, to scroll to the prompt message for this setpoint. Each time the **advance day/scroll** key is pressed, the display alternates between prompts.

SPRAY SOLUTION PUMP DELAY – In previous EPROM versions, this setpoint was programmable over the range of 30 to 120 seconds. It is now programmable over the range of 10 to 120 seconds.


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File in ABS, 2SAM Manual(s).

**SERVICE BULLETIN**

| Supersedes: Nothing | 198 | Form 155.17-M2 (SB5) |
|---|---|---|
| File with Form: 155.17-M2 | | |

Subject: Microcomputer Control Center (Paraflow Absorption) -
Eprom Version A.01F.10

On/about December 1997 the Paraflow Absorption Units will be shipped with Eprom version A.01F.10 (P/N 031-01669-002). This Eprom has the following enhancements that revise Service Manual 155.17-M2 as follows:

## CHINESE LANGUAGE DISPLAY

### GENERAL

With this Eprom version, the Control Center can be equipped with an optional Chinese Language Display, either as a field retrofit or Factory supplied option on new units. It is mounted on the Control Center door, above the standard Display. Both Displays will be present, displaying messages in English and Chinese simultaneously. The Chinese language Display consists of a 240 x 64 graphics LCD display (p/n 031-01653-000) mounted on a printed circuit board (p/n 031-01616-000). Either Simplified or Traditional Chinese characters can be displayed. Refer to Figure 1 for interface wiring.

In operation, the Micro Board sends English Language data to the Chinese Display printed circuit board, where it is simultaneously routed to the English Display and translated into Chinese. The Chinese Display printed circuit board contains two eproms (in location U13 & U14) that translate the English data into either Simplified or Traditional Chinese, depending on the eproms installed. Eproms p/n 031-01768-001 (U13) and 031-01768-002 (U14) translate to Simplified characters; 031-01768-003 (U13) and 031-01768-004 (U14) translate to Traditional characters.

When the Control Center is equipped with the Chinese Language Display, it is also equipped with a Keypad that contains both English and Chinese (Simplified or Traditional) labeling. Keypad p/n 024-27808-000 labeling is in English and Simplified Chinese characters. Keypad p/n 024-27807-000 labeling is in English and Traditional Chinese characters.

Due to the additional power requirements, an additional Transformer (2T), p/n 025-27911-000, is required to power the Chinese language Display.

Chinese Display operation must be enabled by performing the special programming procedure below.

## PROGRAM JUMPERS

Program Jumpers, located on the Chinese Display printed circuit board must be configured as follows:

| JUMPER | POSITION | FUNCTION |
|---|---|---|
| PT0 | | Not used |
| PT1 | | Not used |
| PT2 | | Not used |
| PT3 | | Not used |
| PT4 | On | Normal operation |
| | Off | Display test mode (see below) |
| PT5 | | Not used |
| PT6 | | Not used |
| PT7 | | Not used |
| DS1 | Pins 1 & 2 | Contrast - VL Electronics LCD display |
| | Pins 2 & 3 | Contrast - Optrex LCD display |

## CHINESE DISPLAY ENABLE

Since this Eprom version is also used on units that are not equipped with the Chinese Language display, the Program must be configured accordingly. If the Chinese Language Display is present, "Chinese Display Selected" must be programmed below. Otherwise, "Chinese Display Not Selected" must be programmed.

> **IMPORTANT!! - If the Chinese Display is not present and "Chinese Display Selected" is programmed, the English Language Display will not operate properly.**

1.) Enter PROGRAM mode using ACCESS CODE 1 3 8 0.
2.) Press hidden, unembossed and unlabled keypad key located directly below the CLOCK Setpoint key. "Chinese Display Not Selected" or "Chinese Display Selected" is displayed.
3.) Use ADVANCE DAY/SCROLL key to select appropriate entry. Each time the key is pressed, the display alternates.
4.) Press ENTER key. "Program Mode Select Setpoint" is displayed.
5.) Press PROGRAM key to exit.

## TESTING

The following testing procedures can be used to verify operation of the Chinese Language Display:

SIMPLIFIED CHINESE CHARACTERS

1.) Remove Program Jumper PT4 from Chinese Display printed circuit board.
2.) Press CHILLED LIQUID TEMPS key.
3.) Verify Entering and Leaving Chilled Water Temperatures are displayed on both the English and Chinese Displays and that English letters "SIMP" are displayed in the upper right corner of the Chinese Display.
4.) Replace Program jumper PT4, removed in step 1.

TRADITIONAL CHINESE CHARACTERS

1.) Remove Program Jumper PT4 from Chinese Display printed circuit board.
2.) Press CHILLED LIQUID TEMPS key.
3.) Verify Entering and Leaving Chilled Water Temperatures are displayed on both the English and Chinese Displays and that English letters "TRAD" are displayed in the upper right corner of the Chinese Display.
4.) Replace Program Jumper PT4, removed in step 1.

CHINESE LCD DISPLAY

1.) Remove Program Jumper PT4 from Chinese Display printed circuit board.
2.) Press HOLIDAY key. Verify all pixels of Chinese Display illuminate and the English Display shows normal Holiday display.
3.) Press DAILY SCHEDULE key. Verify YORK logo appears on the Chinese Display and normal Daily Schedule data appears on English Display.
4.) Replace Program Jumper PT4, removed in step 1.

## SERVICE REPLACEMENT

The LCD Display supplied under YORK part number 031-01653-000 could be from either of two manufacturers: "Optrex DMF5005NY-LY" or "VL Electronics MGLS-24064-TC-HV-G-LED4G". These Displays require different contrast bias voltages. The position of Program Jumper DS1 and adjustment of Potentiometer R7 on the Chinese display printed circuit board determines the bias voltage. If service replacement of the LCD Display is required, DS1 must be positioned and R7 must be adjusted to achieve the required bias voltage (read at TP-C) as follows:

| DISPLAY | DS1 | TP-C |
|---|---|---|
| VL Electronics | Pins 1 & 2 | -9.5 vdc |
| Optrex | Pins 2 & 3 | -7.8 vdc |

## INPUTS/OUTPUTS & TEST POINTS

J1 - English data input to Chinese Display printed circuit board.
J2 - English data output to Vacuum Florescent (English) Display.
J3 - Chinese data to Chinese Display.
J4-1 - +8 vdc backlight power to Chinese Display.
J4-2 - Gnd.
J5-1 - 24 vac power supply input to Chinese Display printed circuit board.
J5-2 - 24 vac return.
J5-3 - Gnd.
TP-A - +5 vdc.
TP-B - Gnd.
TP-C - Contrast voltage output to Chinese Display. -9 vdc with DS-1 on pins 1 & 2. -7.8 vdc with DS-1 on pins 2 & 3. Adjusted with Potentiometer R7.

## RETROFIT KIT

The Chinese Language Display can be retrofit to existing Paraflow Absorption Chillers equipped with the Microcomputer Control Center. Retrofit Kits p/n 371-02401-002 (Simplified Chinese) and 371-02401-003 (Traditional Chinese) can be ordered from the YORK Service Parts Distribution Center. Each Kit consists of a complete Microcomputer Control Center door with the following items mounted to the door:

1.) English/Simplified Chinese Keypad (024-27808-000) or English/Traditional Chinese Keypad (024-27807-000) according to kit ordered.
2.) Rocker switch
3.) Door lock
4.) All ribbon cables that interface to components on door.
5.) All door decals.
6.) Standard Vacuum Florescent Display (English language)
7.) Chinese language LCD Display (031-01653-000) mounted on a printed circuit board (031-01616-000) that is equipped with either Simplified Chinese translation eproms 031-01768-001 (U13) and 031-01768-002 (U14) or Traditional Chinese translation Eproms 031-01768-003 (U13) and 031-01768-004 (U14), according to Kit ordered.
8.) 115vac/24vac supply transformer (025-27911-000) for Chinese LCD Display.
9.) Installation instructions.

## SYSTEM COMMISSIONING CHECKLIST

Add the following to the "System Commissioning Checklist" section in Service Manual 155.17-M2:

- "Configure Control Center for either English language or Chinese language Display. Refer to Special Setpoints and Programming Procedures section."

## REMOTE LOAD LIMIT

In previous eprom versions, when LESLIE Steam Valve application was selected, the Steam Valve operation would become unstable when the valve position reached the Remote Load Limit value. When the Load Limit position was reached, the valve would then be driven closed by approximately 15% and then open until the Load Limit position was again reached. This oscillation would continue as long as the unit was running and the load was sufficient drive the valve to the Remote Load Limit value.

This oscillatory operation has been eliminated in this eprom version.

S. L. Baer
York Factory Service

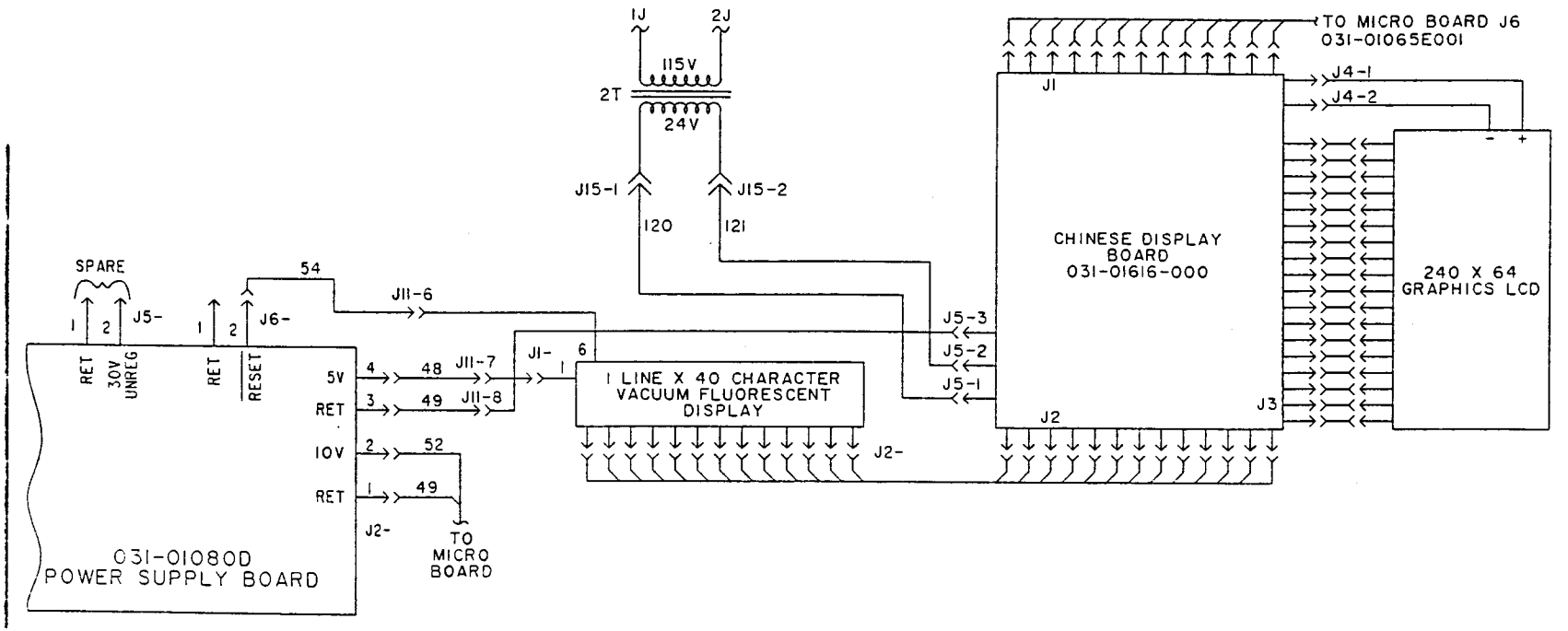



FIG. 1 - CHINESE LANGUAGE DISPLAY WIRING

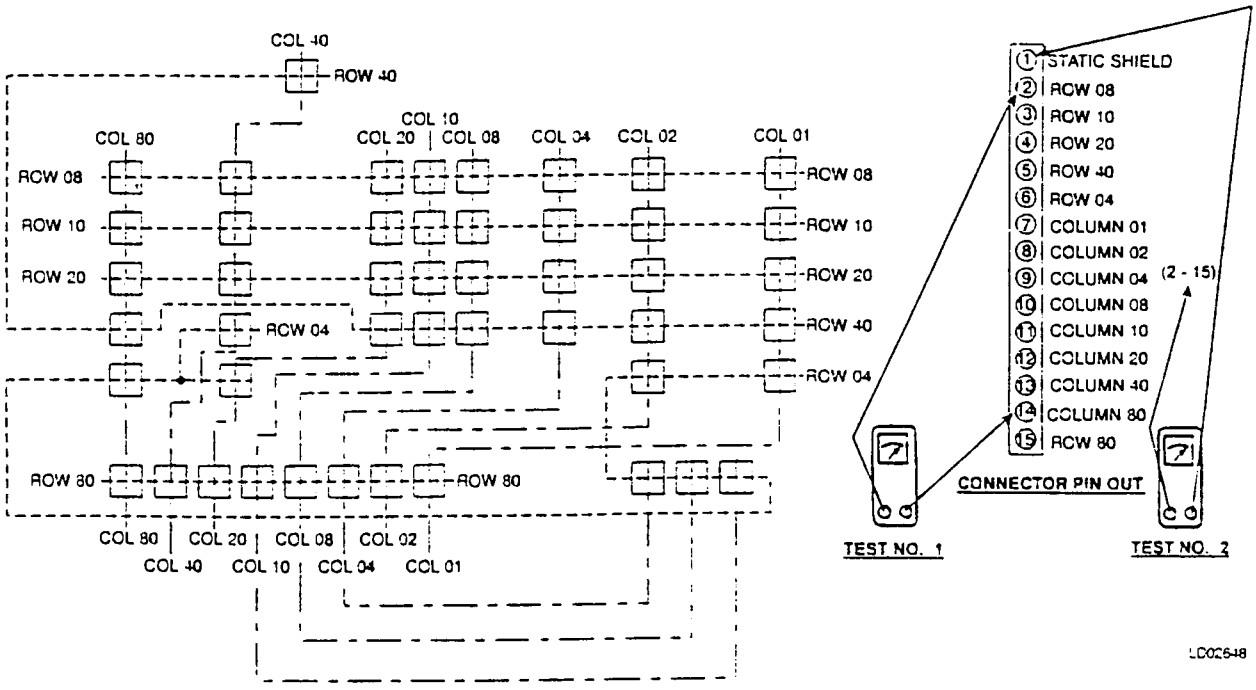
| YORK® | SERVICE BULLETIN | |
|---|---|---|
| SERVICE BULLETIN | Supersedes:Nothing | Form 155.17-M2 (SB6) (598) |
| | File With 155.17-M2 | |

SUBJECT: HOW TO CHECK FOR DEFECTIVE KEY PAD. ( YT-YK-YS-YG-YB- PARAFLOW - ISOFLOW MICRO PANELS )

GENTLEMEN,

YOU WILL FIND BELOW A PROCEDURE ON HOW TO CHECK OUT THE KEY PAD ON THE MICRO PANEL TO DETERMINE IF YOU HAVE ONE OR MORE DEFECTIVE KEYS.

**NOTE** : FOR THOSE OF YOU THAT HAVE YG / YB LITERATURE , THIS TEST IS IN YORK FORM NO.160.60-M1 , PAGE NO. 112 , UNDER PROBLEMS AND SOLUTIONS. ***IMPORTANT*** : PLEASE MAKE NOTE THAT IN TEST NO.1 , ITEMS 7 AND 8 BELOW, THE READINGS ARE DIFFERENT AND SHOULD BE CHANGED AS SHOWN BELOW IN YOUR YG / YB LITERATURE.




TEST NO. 1

1. Remove power from the micro panel.
2. EXAMPLE: To check out the "**CHILLED LIQUID TEMP**" key.
3. The "**CHILLED LIQUID TEMP**" key is in the upper left corner of the display.
4. The "**CHILLED LIQUID TEMP**" key is in Row 8, Col 80 (see above Fig.)
5. Place the ohm meter in the "Keypad Connector" in Pin 2 (Row 8) and Pin 14 (Col 80). See above.
6. Press the "**CHILLED LIQUID TEMP**" key.
7. OHM METER READING MUST READ GREATER THAN 10.000 OHMS ( KEY NOT DEPRESSED )
8. OHM METER READING MUST READ LESS THAN 100 OHMS ( KEY DEPRESSED )

TEST NO. 2

With power removed, use the ohmmeter to read from Pin No. 1 to all of the other pins (2-15) on the keypad connector. This is to assure there is no shorts between the static shield and the keys.

| YORK® | SERVICE BULLETIN | |
|---|---|---|
| SERVICE BULLETIN | Supersedes:Nothing | Form 155.17-M2 (SB7) (698) |
| | File With 155.17-M2 | |

SUBJ.: CHECKING THE 5 VOLT SUPPLY

**PROBLEM**: DISPLAY SHOWS NO.'S, LETTERS,
CHARACTERS, ETC.....

**FILE IN**: YT,YK,YS,YG,YB, PARAFLOW &
ISO FLOW MICRO PANEL SERV. LIT.

**SOLUTION:**

THE PROBLEM DESCRIBED ABOVE DEPICTS THAT THE 5 VOLT SUPPLY IS BEING PULLED DOWN.

TO TROUBLE SHOOT THIS PROBLEM, PLACE YOUR METER LEADS ON TPA ( +5V ) AND TPC ( GND. ) TO MONITOR THE 5 VOLT SUPPLY. THESE TEST POINTS ARE LOCATED ON THE MICRO BOARD AT THE BOTTOM CENTER OF THE BOARD.

ONCE YOUR METER IS CONNECTED , START REMOVING ALL THE COMPONENTS ( ONE AT A TIME ) THAT THE 5 VOLT SUPPLY FEEDS ( IE.. TRANSDUCERS, THERMISTORS, ETC.. ).

WHEN YOU REMOVE THE COMPONENT THAT IS PULLING DOWN THE SUPPLY YOUR METER WILL RISE BACK UP TO 5 VOLTS. REPLACE THE DEFECTIVE COMPONENT.

| YORK® | SERVICE BULLETIN | |
|---|---|---|
| SERVICE BULLETIN | Supersedes:Nothing | Form 155.17-M2 (SB8)(798) |
| | File With 155.17-M2 | |

**SUBJ.: CARD FILE PROBLEM ?**
( 2 CHILLERS READING
DIFFERENT TEMPS. WITH
**PRODUCTS**: YT / YK / YS / YG /YB
ISO FLOW / PARAFLOW

**PROBLEM**: THERE ARE TWO CHILLERS AT THE JOB USING A 0 TO 10 VOLT DC SIGNAL FOR THE REMOTE RESET TEMP. RANGE

CHILLER NO. ONE IS READING : 44 DEG. AT A ZERO VDC SIGNAL.

CHILLER NO. TWO IS READING : 46 DEG. AT A ZERO VDC SIGNAL

" THERE ARE NO ADJUSTMENTS ON THE BOARDS IN THE CARD FILE NOR ON THE FILE RACK ITSELF TO ADJUST TO HAVE THESE TWO READ THE SAME "

**SOLUTION** : CHECK THE FOLLOWING IN THE ORDER SHOWN:

1. IS THE REMOTE TEMP. RANGE SETTING THE SAME ON BOTH CHILERS.VIEW ON THE DISPLAY. ( SHOULD BE THE SAME )
2. IS THE LEAVING SET POINT BASE SETTING DIFFERENT BETWEEN THE TWO CHILLERS. VIEW ON THE DISPLAY. ( SHOULD BE THE SAME )
3. IS THE ZERO VOLTS BEING SUPPLIED TO US FROM THE JOHNSON / HONEYWELL / ETC.... SUPPLIER A CONSTANT / STABLE ZERO VOLTS.
4. THE PLUG IN BOARD IN THE CARD FILE IS DEFECTIVE. TRY SWAPPING THE BOARDS TO SEE IF THE TEMPERATURE FOLLOWS.

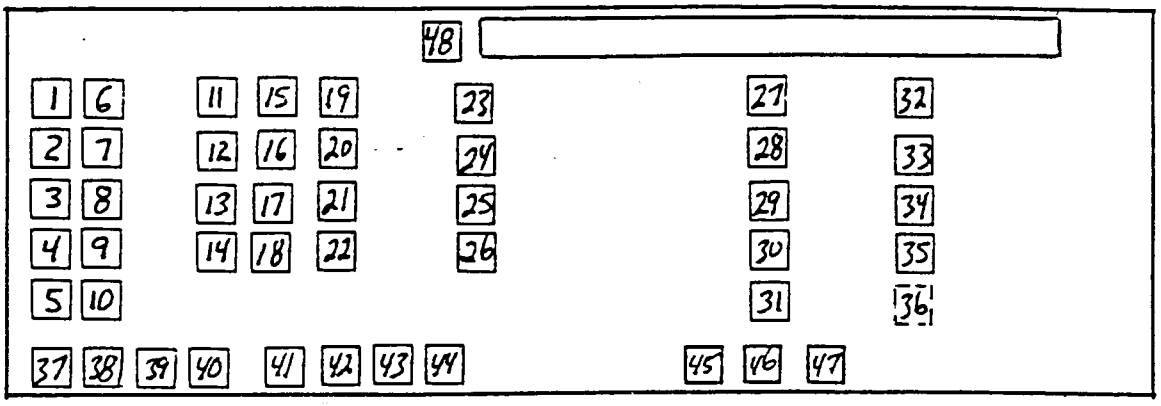
# SERVICE BULLETIN

| SERVICE BULLETIN | Supersedes:Nothing | Form 155.17-M2 (SB9)(798) |
|---|---|---|
| | File With 155.17-M2 | |

SUBJ.:KEY PAD CHECK OUT

**PRODUCTS**: YT,YK,YS,YG,YB,
PARAFLOW, ISO FLOW

YOU WILL FIND BELOW A LAYOUT OF THE YORK KEYPAD. I NUMBERED EACH KEY TO HELP YOU LOCATE THE KEY THAT COROSPONDS TO THE PIN LAYOUT SHOWN BELOW. SIMPLY FILL IN THE BLANKS BELOW WHEN TROUBLESHOOTING THE KEYPAD:




| KEY | PIN | PIN | Depressed / not depressed | KEY | PIN | PIN | Depressed / not depressed |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 14 | | 25 | 4 | 9 | |
| 2 | 3 | 14 | | 26 | 5 | 9 | |
| 3 | 4 | 14 | | 27 | 2 | 8 | |
| 4 | 5 | 14 | | 28 | 3 | 8 | |
| 5 | 6 | 14 | | 29 | 4 | 8 | |
| 6 | 2 | 13 | | 30 | 5 | 8 | |
| 7 | 3 | 13 | | 31 | 6 | 8 | |
| 8 | 4 | 13 | | 32 | 2 | 7 | |
| 9 | 6 | 13 | | 33 | 3 | 7 | |
| 10 | 6 | 12 | | 34 | 4 | 7 | |
| 11 | 2 | 12 | | 35 | 5 | 7 | |
| 12 | 3 | 12 | | 36 | 6 | 7 | |
| 13 | 4 | 12 | | 37 | 15 | 14 | |
| 14 | 6 | 12 | | 38 | 15 | 13 | |
| 15 | 2 | 11 | | 39 | 15 | 12 | |
| 16 | 3 | 11 | | 40 | 15 | 11 | |
| 17 | 4 | 11 | | 41 | 15 | 10 | |
| 18 | 5 | 11 | | 42 | 15 | 9 | |
| 19 | 2 | 10 | | 43 | 15 | 8 | |
| 20 | 3 | 10 | | 44 | 15 | 7 | |
| 21 | 4 | 10 | | 45 | 6 | 9 | |
| 22 | 5 | 10 | | 46 | 6 | 10 | |
| 23 | 2 | 9 | | 47 | 6 | 11 | |
| 24 | 3 | 9 | | 48 | 13 | 5 | |

Key *not depressed* **must read greater** than 1MEG ohm ( note: this reading used to be 10,000 ohms )
Key *depressed* **must read less** than 100 ohms

MAKE EXTRA COPIES OF THIS SHEET FOR FUTURE JOBS

| | |
|---|---|
| 1 | STATIC SHIELD |
| 2 | ROW88 |
| 3 | ROW16 |
| 4 | ROW29 |
| 5 | ROW49 |
| 6 | ROW64 |
| 7 | COLUMN81 |
| 8 | COLUMN82 |
| 9 | COLUMN84 |
| 10 | COLUMN88 |
| 11 | COLUMN16 |
| 12 | COLUMN28 |
| 13 | COLUMN48 |
| 14 | COLUMN88 |
| 15 | ROW89 |

CONNECTOR PIN OUT

| YORK® | SERVICE BULLETIN | |
|---|---|---|
| SERVICE BULLETIN | Supersedes: Nothing | Form 155.17-M2 (SB10)(798) |
| | File With 155.17-M2 | |
| | | |

SERVICE BULLETIN

**SUBJ.: PRINTER READINGS ARE ALL ZERO ( 0 )**

**FILE IN**: YT,YK,YS,YG,YB.PARAFLOW, ISO FLOW
SERVICE MANUALS

PROBLEM: **WHEN USING ANY OF THE APPROVED YORK PRINTERS ON ANY OF THE ABOVE CHILLERS, YOU EXPERIENCE THAT THE PRINT OUT SHOWS ALL ZERO'S AFTER THE DEVICE / COMPONENT DESCRIBED.**

SOLUTION: 1. THE CHILLER HAS NOT RUN, THEREFORE THERE IS NOTHING STORED IN THE BUFFER ON THE MICRO BOARD, THUS *ALL READINGS WILL BE ZERO* ON THE PRINTOUT.

2. ALSO CHECK:
   A. DIP SWITCH SETTINGS ON THE PRINTER
   B. CHECK THE JUMPER ON THE MICRO BOARD TO ASSURE IT IS IN THE PROPER POSITION.
   C. RE-CHECK THE WIRING OF THE PRINTER TO THE PANEL.

| YORK® | File in 2SAM Manual | | |
|---|---|---|---|
| SERVICE BULLETIN | Supersedes: Nothing | 399 | Form: 155.17-M2 (SB11) |
| | File with Forms: 155.17-M2 | | |

Subject: Microcomputer Control Center (Paraflow Absorption) -
Eprom Version A.01F.12

On/about March 1999, Paraflow Absorption Units will be shipped with eprom version A.01F.12 (P/N 031-01669-002). This eprom has the following enhancements that revise Service Manual 155.17-M2 as follows:

## PURGE OPERATION - "REPAIR" MODE

In addition to the existing AUTO and MANUAL purge modes, REPAIR mode is a new manual purge operation for those units equipped with the Automatic purge system. It allows the Purge Pump to be manually operated independent of the Purge Solenoid Valves and the Purge Solenoid Valves to be manually operated independent of the Purge Pump. In the servicing of the unit, there might be instances where it is desired to open the Purge Solenoid Valves even though the Purge pump is not running. It might also be desired to turn off the Pump with the Valves still open. **This operation must be performed only by a qualified Service Technician using extreme caution because the unit interior could be exposed to the atmosphere through the open valves!!!**

In this operation, both the Purge Tank Solenoid Valve (1SOL) and the Purge Pump Solenoid Valve (2SOL) are controlled simultaneously. If commanded to open, both open simultaneously; if commanded to close, both close simultaneously.

If I/O Expansion Board Program Jumper JP1 has been removed, enabling the Automatic Purge hardware, REPAIR mode can be selected using the usual Purge mode selection prompt as follows:

1.) Enter PROGRAM mode using Access Code 1 3 8 0.
"PROGRAM MODE, SELECT SETPOINT" is displayed.
2.) Press MODE key.
3.) Use ADVANCE DAY/SCROLL key to select SERVICE mode.
4.) Press ENTER key.
"PROGRAM MODE, SELECT SETPOINT" is displayed.
5.) Press MANUAL PUMP key.
"PURGE TYPE = X (0=MAN;1=AUTO;2=REPAIR)" is displayed.
6.) Using ENTRY keys, press 2 to select REPAIR mode.

7.) Press ENTER key.
"PROGRAM MODE, SELECT SETPOINT" is displayed.
8.) Press PROGRAM key to exit Program mode. A normal foreground message is displayed. REPAIR mode has now been selected.

After REPAIR mode is selected above, it can be used while still in SERVICE mode as follows: (When SERVICE mode is exited, the Purge mode will default to AUTO TANK Purge).

To operate Purge Pump independent of Purge Solenoid Valves:

1.) Press PUMP STATUS key.
"PURGE PUMP-OFF-REPAIR MODE" or "PURGE PUMP-ON-REPAIR MODE" is displayed, indicating the pump status.
2.) To start Pump:
If the pump is off, it can be turned on by pressing the MANUAL PUMP key.
To stop Pump:
If the Pump is on, it can be turned off by pressing the MANUAL PUMP key. However, the procedure to do this differs slightly depending upon whether the Purge Solenoid Valves are closed or open. If closed, the Pump turns off when the MANUAL PUMP key is pressed. If open, turning the Pump off could expose the unit interior to the atmosphere if proper precautions have not been previously taken. Therefore, pressing the MANUAL PUMP key does not immediately turn the Pump off. It must be pressed several times and a series of prompts must be answered before the Pump will be turned off as follows: The first press produces a caution message "CAUTION! LEAK POTENTIAL-PURGE VALVES OPEN". The second press displays prompt message "CONTINUE WITH OPERATION? (0=NO;1=YES). If it is safe to proceed, press ENTRY key "1" (otherwise press "0" to abort procedure and return to step 1 above). If "1" was pressed to continue, prompt message "ARE YOU SURE? (0=NO;1=YES)" is displayed. If it is still safe to proceed, press "1" again (otherwise, press 0 to abort and return to step 1 above). If "1" was pressed, the pump will turn off.

To operate Purge Solenoid Valves independent of Purge Pump:

1.) Press PUMP STATUS key until "PURGE SOLENOID VALVES CLOSED" or "PURGE SOLENOID VALVES OPEN " is displayed, indicating Solenoid status.
2.) To close Solenoid Valves:
If the Solenoid Valves are open, pressing the MANUAL PUMP key causes them to close.
To open solenoid Valves:
If the Solenoid Valves are closed, they can be opened by pressing the MANUAL PUMP key. However, the procedure to do this differs slightly depending upon whether the Purge Pump is on or off. If on, the Valves open when the MANUAL PUMP key is pressed. If off, opening the Solenoid Valves could expose the unit

interior to the atmosphere if proper precautions have not been taken. Therefore, pressing the MANUAL PUMP key does not immediately cause the Valves to open. It must be pressed several times and a series of prompts must be answered before the Valves will open as follows: The first press produces a caution message "CAUTION! LEAK POTENTIAL-VACUUM PUMP OFF". The second press displays prompt message "CONTINUE WITH OPERATION? (0=NO;1=YES). If it is safe to proceed, press ENTRY key "1" (otherwise, press "0" to abort procedure and return to step1 above). If "1" was pressed to continue, prompt message "ARE YOU SURE? (0=NO;1=YES)" is displayed. If it is safe to proceed, press "1" again (otherwise, press "0" to abort and return to step 1, above). If "1" was pressed, the Valves will open.

## EXCESS PURGE WARNING

Previously, the Excess Purge warning message and alarm occurred when there were > 6 purges within 7 consecutive days, after at least 150 hours of operating time had been accumulated. In this eprom version, the threshold is programmable over the range of 2 to 6 purges, with 4 being the Default. The threshold only has to be met or exceeded to initiate the message and alarm.

Program the Excess Purge threshold as follows:

1.) Enter PROGRAM MODE using Access Code 1 3 8 0.
"PROGRAM MODE, SELECT SETPOINT" is displayed.
2.) Press PURGE CYCLE COUNTER key.
3.) Use the ADVANCE DAY/SCROLL key to display the following message. Each time the key is pressed, the message alternates.
"EXCESS PRG WRNG = X PURGES PER 7 DAYS"
4.) Using ENTRY keys, enter the desired value between 2 and 6. If the CANCEL key is pressed, Default value 4 is displayed.
5.) Press ENTER key.
6.) Press PROGRAM key to exit.

## DIRECT FIRED UNITS - LEAVING CHILLED WATER CONTROL

In previous eprom versions, the Burner Load Command would not Unload until the Leaving Chilled Water Temperature decreased to within 2.5 Degrees F of the Leaving Chilled Water Temp Setpoint. In some applications, this allowed the unit to shutdown on a Low Water Temp cycling shutdown because the Load Command would not begin to unload early enough as the load decreased.

A RATE control routine has been added to allow the unit to begin unloading before the Leaving chilled water temperature has decreased to within 2.5 Degrees F of the Setpoint.

Associated with this control are two new programmable Setpoints, **RATE COUNT** and **RATE SENSE.**

The amount of decrease in the Leaving Chilled Water temperature is evaluated over periods of time called the RATE COUNT periods. They are programmable over a range of 5 to 180 seconds. These periods run consecutively and continuously as long as the unit is running (ie, when the first one ends, the next one begins, etc). At the end of each period, the temperature error (difference between actual leaving chilled water and Leaving Chilled Water Setpoint) is compared to the temperature error of the previous period. The difference between these errors is the rate of decrease and is compared to the programmed RATE SENSE (0.2 to 2.5 Degrees F) value to determine the magnitude of Load Command reduction required. If the error is greater than the RATE SENSE, the Load command is reduced by a greater amount than if it is less than RATE SENSE. In this way, the value programmed for RATE SENSE determines the rate sensitivity of the control (ie, smaller values produce greater sensitivity).

To program the RATE SENSE and RATE COUNT, proceed as follows: (Default values should provide acceptable operation in most applications)

1.) Enter PROGRAM mode using Access Code 1 3 8 0.
"PROGRAM MODE, SELECT SETPOINT" is displayed.
2.) Press CHILLED WATER TEMPS key.
"RATE SENSE = X.X" is displayed.
3.) Using ENTRY keys, enter desired value between 0.2 and 2.5. If CANCEL key is pressed, Default value 2.5 is displayed.
4.) Press ENTER key.
5.) Press ADVANCE DAY/SCROLL key.
"RATE COUNT = XX " is displayed.
6.) Using ENTRY keys, enter desired value between 5 and 180. Use leading zeroes where necessary (ie, 090). If CANCEL key is pressed, Default value 30 is displayed.
7.) Press ENTER key.
8.) Press PROGRAM key to exit. A normal foreground message is displayed.

S.L. Baer
York Factory Service

| YORK® | File in 2 SAM Manual | | |
|---|---|---|---|
| SERVICE BULLETIN | Supersedes: Nothing | 1099 | Form: 155.17-M2 (SB12) |
| | File with Form: 155.17-M2 | | |

**Subject: Microcomputrer Control Center (Paraflow Absorption) – Eprom Version A.01F.13**

On/about October 1999, Paraflow Absorption Units will be equipped with eprom version A.01F.13 (P/N 031-01669-002). The Program storage capacity of this eprom is greater than previous versions. Therefore, **it can only be used in Micro Board 031-01065-002. It will not operate in Micro Board 031-01065-000 or 031-01065-001**. This eprom has the following enhancements that revise Service Manual 155.17-M2 as follows:

## STEAM VALVE CALIBRATION

In previous eprom version A.01F.12, a Program reset could occur during the Steam Valve Potentiometer calibration procedure, causing the procedure to terminate prematurely. If this occurred, the calibration procedure could not be successfully performed. The subject eprom version prevents the occurrence of this reset and allows the complete calibration procedure to be performed.

## "PURGE TRANSDUCER ERROR" WARNING MESSAGE

In all previous eprom versions, the message "Warning – Purge Transducer Error" would be displayed when either the Purge Pump Transducer or Purge Tank Transducer is indicating a pressure of 0.0mmHgA continuously for 25 seconds. In certain applications, however, the Purge Pump is capable of decreasing the pressure to this level in normal operation.

Therefore, to eliminate this erroneous indication, this Warning message is no longer displayed.