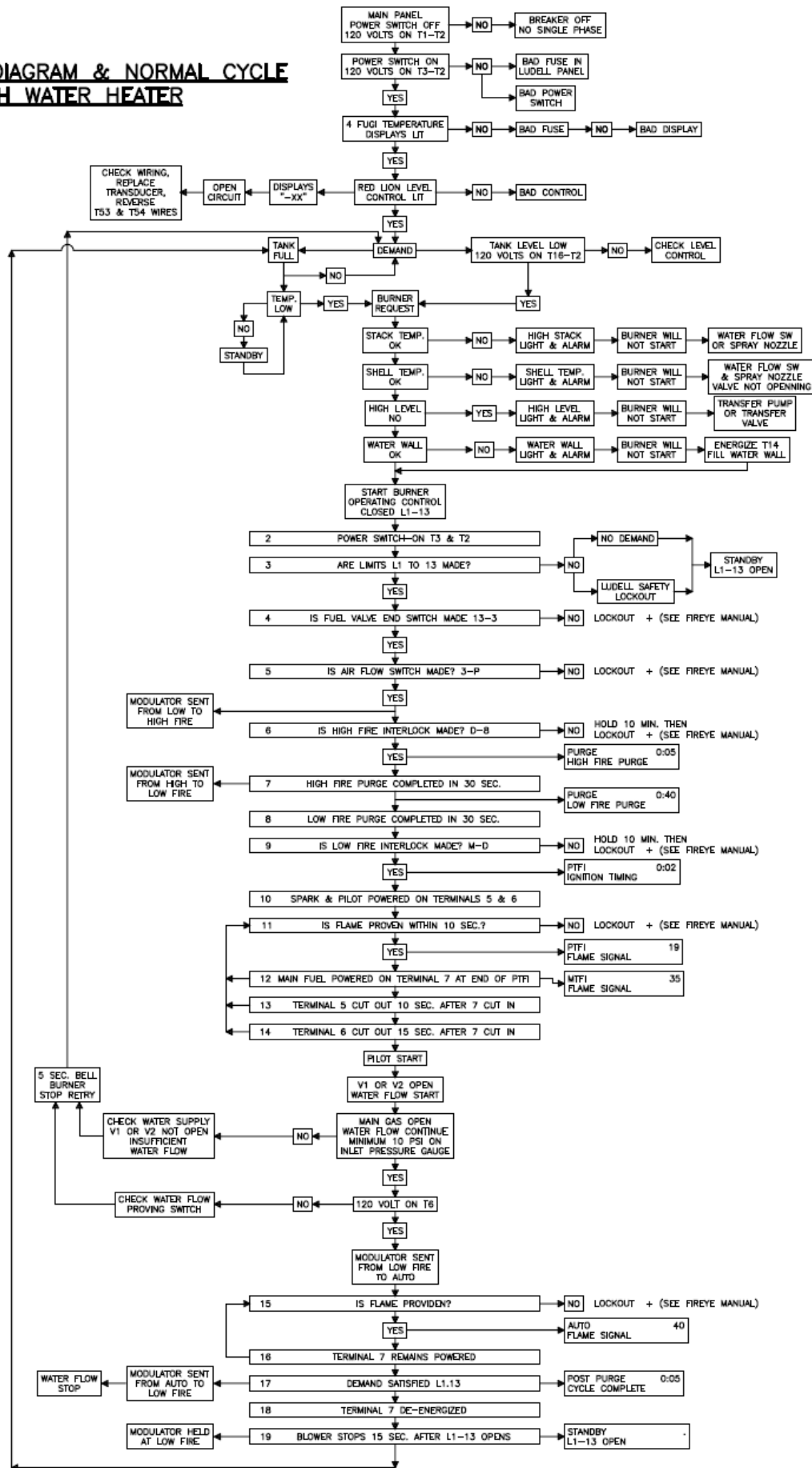


SECTION 8

TROUBLE SHOOTING GUIDE

LOGIC FLOW DIAGRAM & NORMAL CYCLE DCWH WATER HEATER



UNLESS OTHERWISE SPECIFIED DIM. ARE IN INCHES
ANGLES
SECTIONAL
FRANCHISES

LUDELL MFG. CO.
MILWAUKEE, WI 53005
PHONE (414) 978-4444
FAX (414) 978-4884

TRUCK
DRAWING LOGIC FLOW
NORMAL CYCLE DCWH

DATE: 01/11/02
BY: J. J. J. J. J.
CHECKED: J. J. J. J. J.
APPROVED: J. J. J. J. J.

000042

NO.	REV.	DATE	DESCRIPTION



ED510 MESSAGES

RUN MESSAGES

STANDBY L1-13 OPEN		The operating control of the FLAME-MONITOR (terminals L1-13) is open. (No run signal from Ludell panel or lockout from Ludell panel)
PURGE HIGH FIRE PURGE	0:05	Firing rate motor sent to high fire (term. 10-X made), purge timing displayed upper right hand corner.
PURGE LOW FIRE PURGE	0:35	Firing rate motor sent to low fire (term. 10-12 made), purge timing displayed in upper right hand corner.
PTFI IGNITION TIMING	0:02	PTFI timing started. Pilot not proven yet. PTFI timing displayed in upper right hand corner.
PTFI FLAME SIGNAL	19	Pilot flame proven during PTFI. Flame signal strength displayed in upper right hand corner.
MTFI FLAME SIGNAL	25	Main flame proven during MTFI. Flame signal strength displayed in upper right hand corner.
AUTO FLAME SIGNAL	40	Modulator motor sent to auto position (term 10-11 made). Flame signal strength displayed in upper right hand corner.
POST PURGE CYCLE COMPLETE	0:05	Demand satisfied. L1-13 open. Blower motor de-energized 15 seconds after L1-13 opens.

HOLD MESSAGES

HOLD STANDBY 3-P INTLK CLOSED	0:23	Dipswitch #6 (3-P Proven Open to Start) is set in the Up position (Enabled). At the start of the cycle, the 3-P circuit was closed. It will hold in this position for 60 seconds and then lockout if the 3-P circuit does not open. (Air flow switch)
HOLD PURGE D-8 LIMIT OPEN	0:00	The control has driven the firing rate motor to high purge (term. 10-X made) and is waiting for the high fire switch (term. D-8) to close. It will hold this position for ten (10) minutes and then lockout if the D-8 circuit does not close. Applies to EP(D)160, EP(D)161, EP165, EP166, EPD167 and EP(D)170 programmers.
HOLD PURGE D-8 LIMIT CLOSED	0:00	Dipswitch #6 (3-P Proven Open to Start) is set in the up position (enabled). At the start of a cycle the D-8 circuit was closed. It will hold in this position for 30 seconds and the lockout if the D-8 circuit does not open. Possible solution is to remove jumper from D-8 circuit or properly set the firing rate motor and switches. Applies to EP(D)160, EP(D)161, EP165, EP166, EPD167 and EP(D)170 programmers
HOLD PURGE M-D LIMIT CLOSED	0:30	Dipswitch #6 (3-P Proven Open to Start) is set in the up position (enabled). At the end of high fire purge and beginning of low fire start, the M-D circuit is closed. It will hold in this position for 30 seconds and then lockout if the M-D circuit does not open. The solution is to remove jumper from the M-D circuit or properly set the firing rate motor and switches. Applies to EP(D)160, EP(D)161, EP165, EP166, EPD167 and EP(D)170 programmers



HOLD PURGE M-D LIMIT OPEN	0:00	The control has finished purge and the firing rate motor is driving to the low fire position (term. 10-12 made) waiting for the low fire start switch (term. M-D) to close. It will hold this position for ten (10) minutes and then lockout if the M-D circuit does not close, excluding the EPD167.
HOLD PURGE 3-P INTLK OPEN	0:10	The running interlock circuit (3-P) has not closed within the first ten (10) seconds of purge. The control will hold for ten (10) minutes and then lockout. Applies to recycle programmers only. (Air flow switch)
HOLD STANDBY FALSE FLAME	25	Flame has been sensed during the burner off time (term. L1-13 open) or during the purge period. This message will hold for sixty (60) seconds and then lockout if flame is still present. Flame signal strength is displayed in the upper right hand corner. (Scanner or Amplifier card)

LOCKOUT MESSAGES

LOCKOUT STANDBY 3-P INTLK CLOSED		Dipswitch #6 (3-P Proven Open to Start) is set in the Up position (Enabled). At the start of the cycle, the 3-P circuit was closed, and the control has waited 60 seconds for the 3-P circuit to open. (Air flow switch)
LOCKOUT PURGE D-8 LIMIT OPEN		The control has held for more than 10 minutes waiting for the high fire switch (D-8) to close. Applies to EP(D)160, EP(D)161, EP165, EP166, EPD167 and EP(D)170 programmers.
LOCKOUT PURGE D-8 LIMIT CLOSED		Dipswitch #6 (3-P proven open to start) is set in the up position (enabled). The D-8 circuit has been closed for 30 seconds at the start of cycle. Applies to EP(D)160, EP(D)161, EP165, EP166, EPD167 and EP(D)170 programmers
LOCKOUT PURGE M-D LIMIT CLOSED		Dipswitch #6 (3-P proven open to start) is set in the up position (enabled). The M-D circuit has been closed for 30 seconds at the end of high purge or at the beginning of low fire start. Applies to EP(D)160, EP(D)161, EP165, EP166, EPD167 and EP(D)170 programmers
LOCKOUT PURGE 3-P INTLK OPEN		The running interlock circuit (3-P) has opened during the purge period or failed to close within the first 10 seconds of purge on non-recycle programmers or has not closed within 10 minutes on recycle programmers. (Air flow switch)
LOCKOUT STANDBY 13-3 FUEL VALVE END SWITCH		The fuel valve end switch wired between terminals 13 and 3 opened during purge or at start up. (Proof of closer switch in gas valve)
LOCKOUT PURGE M-D LIMIT OPEN		The control has held for more than 10 minutes waiting for the low fire switch (M-D) to close. This does not apply to the EPD167 or EP387.
LOCKOUT PTFI 3-P INTLK OPEN		The running interlock circuit (3-P) has opened during the pilot trial for ignition period. Applies to non-recycle programmers only. (Air flow switch)
LOCKOUT MTFI 3-P INTLK OPEN		The running interlock circuit (3-P) has opened during the main trial for ignition period. Applies to non-recycle programmers only. (Air flow switch)
LOCKOUT AUTO 3-P INTLK OPEN		The running interlock circuit (3-P) has opened during the main burner on period. Applies to non-recycle programmers only. (Air flow switch)

LOCKOUT STANDBY FALSE FLAME	Flame has been sensed during the burner off time (term. L1-13 open) or during the purge period for sixty (60) seconds. (Scanner or Amplifier card)
LOCKOUT PTFI FLAME FAIL	A flame failure occurred during the pilot trial for ignition period.
LOCKOUT MTFI FLAME FAIL	A flame failure occurred during the main trial for ignition period.
LOCKOUT AUTO FLAME FAIL	A flame failure occurred during the main burner on period.
LOCKOUT PTFI SCANNER NOISE	This message appears because of ignition cable noise. Reroute scanner wires away from high voltage ignition cables. Check for proper spark gap or cracked porcelain. Check for proper grounding of wiring base and power supply. Replace worn ignition cable and/or faulty connections. (Scanner problem)
LOCKOUT PURGE SHORT CIRCUIT TERM 5,6,7	Excessive current or short circuit detected on terminals 5, 6, or 7 during PTFI, MTFI, or Auto. The control will lockout upon sensing this condition on two consecutive cycles.
LOCKOUT PTFI FUEL VALVE STATE CHANGE	During pilot trial for ignition period, voltage sensed on terminal 7 is different from the previous cycle. (e.g.: jumper added or removed between term. 7 and 5 or 6).
LOCKOUT AUTO LINE FREQUENCY NOISE DETECTED	Electrical noise detected on terminals L1 and L2.
LOCKOUT AC POWER FAIL	A power interruption to terminals L1 and L2 has caused the control to lockout. Applies to EP165 and EP166 programmers only.

CHECK MESSAGES

CHECK PURGE D-8 HI LIMIT	0:15	The "Run-Check" switch has been placed in the Check position during purge and will hold indefinitely. The firing rate motor is being driven to the high purge position.
CHECK PURGE M-D LOW LIMIT	0:45	The "Run-Check" switch has been placed in the Check position after high fire purge and will hold indefinitely. The firing rate motor is being driven to the low fire position.
CHECK PTFI FLAME SIGNAL	19	The "Run-Check" switch has been placed in the Check position during the pilot trial for ignition period. Flame signal strength is displayed in the upper right hand position. The control will lockout on safety only when no flame signal is sensed for a continuous 30 seconds while the control is in the Check position.
CHECK AUTO LOW FIRE SIGNAL	25	The "Run-Check" switch has been placed in the Check position during the main burner on period, and the firing rate motor is driven to the low fire position. Flame signal strength is displayed in the upper right hand corner.

CHECK STANDBY
UNIT ADDRESS 00

The "Check-Run" switch has been placed in the Check position with the operating control circuit (L1-13) open. Every time the Reset button is depressed and held for one second will increment the Unit Address by one. Refer to programmer bulletin for additional information on Unit Address.

DIAGNOSTIC MESSAGES

	POSSIBLE CAUSE	SOLUTION
LOCKOUT AUTO CHECK AMPLIFIER	<ul style="list-style-type: none"> — High electrical noise — Defective field wiring. — Defective amplifier. — Defective IR scanner. 	<ul style="list-style-type: none"> — Check for proper ground on power supply. — Install noise suppressor on power supply (P/N 60-2333). — Make sure line phase on interlock circuit is the same as found on L1/L2 power supply to E100/E110. — Replace amplifier. — Replace IR cell.
LOCKOUT PTFI CHECK CHASSIS	<ul style="list-style-type: none"> — Voltage on terminal 7 at improper time. — Defective Chassis. — Defective Programmer. 	<ul style="list-style-type: none"> — Check wiring to terminal 7. — Replace Chassis (EB700). — Replace Programmer.
LOCKOUT PURGE CHECK PROGRAMMER	<ul style="list-style-type: none"> — Voltage on terminal 5 or 6 at improper time. — High Electrical Noise. — Failed Programmer. — Worn Chassis. 	<ul style="list-style-type: none"> — Check wiring to terminals 5 and 6. — Install noise suppressor on power supply — Re-route scanner wires away from high voltage wiring. — Replace Programmer. — Replace Chassis.
LOCKOUT AUTO CHECK SCANNER	<ul style="list-style-type: none"> — Flame signal detected during shutter close time on 45UV5 scanner. 	<ul style="list-style-type: none"> — Stuck scanner shutter. Replace 45UV5 scanner.
LOCKOUT AUTO CHECK EXPANSION MODULE	<ul style="list-style-type: none"> — The E300 Expansion Module has a defective optocoupler. 	<ul style="list-style-type: none"> — Replace E300 Expansion Module.
LOCKOUT AUTO AUTO CHECK AMPLIFIER FAIL	<ul style="list-style-type: none"> — Amplifier has failed diagnostic checks. 	<ul style="list-style-type: none"> — Replace amplifier.
FIREYE ED510 SYSTEM ERROR	<ul style="list-style-type: none"> — Defective programmer. 	<ul style="list-style-type: none"> — Replace programmer.

Test Procedures for Ludell Water heater Lockouts

These tests assume that the Heater is in operation at the time these tests are performed.

MAIN CONTROL PANEL

Refer to Ludell Drawing # D00951

1. **To test the High Stack temperature setting:** Push the green SEL button once on the stack temperature digital control on the upper right side of the main control panel. Note the set point. Then, use the down arrow to lower the set point to the desired level, and push the SEL twice to enter the new value. The alarm should sound and the burner will shut off. Once the temperature has lowered, the heater will restart; or you can restore the previous control limit setting.
2. **To test the Shell Temperature switch:** It is necessary to remove the out going wire from terminal #10 and connect it to terminal #11. The burner will stop as soon as the wire is removed from terminal #10, but the indicator light will not light until the wire is touched to terminal #11.
3. **To test the Low Water Wall switch:** Remove the out going wire from terminal #70. This will simulate that the water wall which protects the shell from the heat is low. The burner will stop, and the Low Water Wall light and alarm will sound. When the water wall is restored, the heater will start. The heater will not start if this water wall is low.
4. **To test the DC High Shell Water (Flood):** Momentarily touch a wire from ground to terminal #71. This will simulate that the water level in the shell is too high and will electrically shut the incoming water valves and turn the burner off. Once the level is lowered the heater will restart.
5. **To test Water Pressure Proving switch:** When the pilot is energized and the water valve is opened, the 10 psi water pressure proving switch must be made before the main fuel oil valve is opened; allowing the burner to restart. While the heater is running, turn off the three phase disconnect at the starter for the makeup (sea water) pump. This will cause the burner to shut down. No alarm will sound, but the burner will try to restart. If there is less than 10 PSI of water pressure, the burner will not stay on. Once the 10 PSI is sensed the Fireye continues.

POWERFLAME BURNER PANEL

Refer to Ludell Drawing # D00589

6. **To test the Burner Pilot Lockout switch:** Remove the out going wire from terminal #IG. This will cause the pilot not to light and the burner will lockout. Replace the wire before proceeding.
7. **To test the Air Proving switch:** Remove the out going wire from terminal #A1. This will cause the Fireye to think that the burner blower did not start and will cause the burner to lockout. Replace the wire before proceeding.
8. **To test the Proof of Closure switch:** Remove the out going wire from terminal #PC1. This will cause the Fireye to think that the main fuel oil valve is open and lockout the burner. Replace the wire before proceeding.
9. **To test a Flame out:** Remove the out going wire from terminal #OV. This will close the main fuel oil valve and cause the Fireye to lockout. Replace the wire before proceeding.

SECTION 8

TROUBLE SHOOTING GUIDE

PROBLEM

POSSIBLE

1. Heater will not start.
 - Low/High gas pressure safety switch tripped (Manual reset required)
 - Inoperative level control (Check level controls)
 - Safety lockout Fireye or over temperature (Review lockout message in Fireye manual)
2. Heater fails to shut off.
 - Inoperative level controls (Check level controls)
 - Water flow proving switch failure (Check water flow proving switch)
 - Water valve failure (Valve stuck open)
 - Recirculation temperature switch adjustment or failure (Check inlet temp switch setting and tank temp switch setting)
3. High Tank Level (Alarm)
 - Transfer valve closed (Check transfer valves)
 - High rate transfer valve inoperative (Check transfer valve Aquomatic)
 - Transfer pump inoperative (Check transfer pump operation)
 - Defective level control/shorted probe (Left most Warrick control in the panel. LED should be lit to run pump)
4. Over Temperature (Alarm)
 - Plugged spray nozzle (Check spray pattern)
 - Stack temperature switch adjustment (Check stack temp switch adjustment)
 - Water flow defective/plugged (Check water flow switch and tube for blockage)
 - Surface temperature switch tripped (no water or low flow)
5. Water Wall be lit)
 - No water in water wall (Check sight gas for level, right most Warrick in panel for LED should be lit)
 - Water wall pressure switch adjustment (Older units only)
 - Tube to switch plugged (Older units only)
6. Low Water Temp tank
 - Water flow rate to high (Check flow rate, pressure on inlet water pressure gage)
 - Modulation temperature control adjustment or inoperative (Inlet temp switch set too low or Temp switch set too low)
 - Burner problem (Burner needs service)
7. Flame Fail
 - Cracked/broken spark rod-no-spark (Check spark rod adjustment)
 - Gas valve(s) off-gas supply
 - UV Scanner/fireeye problem (Check for flame signal see coded messages)
 - Burner adjustment/linkage loose (Check burner/linkage)
 - Dirty/Plugged air inlet (Remove dirt from air inlet and blower wheel)

LUDELL SERVICE: 1-800-558-0800
1-414-476-9934