WL4

HEATED STRIP TANK

Installation, Operation & Maintenance Manual

For Water & Solvent Based Stripping Applications

Figure 1. WL4-DD Heated Strip Tank — control enclosure side view

Model: WL4-DD

2000W Total Heater Power | 240VAC Single Phase

Document Revision: 2.1 (Photo-Integrated Edition)

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1. GLOSSARY OF TERMS

This glossary defines technical terms, abbreviations, and component references used throughout this manual. Familiarize yourself with these definitions before proceeding to installation or operation sections.

1.1 Electrical Terms

Term	Definition
AC (Alternating Current)	Electrical current that reverses direction periodically. The WL4 operates on 240VAC.
AWG (American Wire Gauge)	Standard for measuring wire diameter. Lower numbers indicate larger wire. The WL4 uses 10-22 AWG wire.
Breaker	Automatic switch that interrupts current flow when amperage exceeds its rating. Protects circuits from overload.
DC (Direct Current)	Electrical current flowing in one direction. The indicator circuit uses 12VDC from the controller.
DPDT (Double Pole Double Throw)	Relay with two independent switch mechanisms, each with common, normally open, and normally closed contacts.
Ground	Electrical connection to earth providing safety path for fault currents.
L1, L2	Line 1 and Line 2 - the two hot legs of 240VAC single-phase power.
N.C. (Normally Closed)	Contact that is closed (conducting) when the relay or switch is de-energized.
N.O. (Normally Open)	Contact that is open (non-conducting) when the relay or switch is de-energized.
PID	Proportional-Integral-Derivative. Control algorithm that adjusts output based on error magnitude, accumulated error, and rate of change.
SPST-NO	Single Pole Single Throw, Normally Open. Simple relay with one switch that is open when de-energized.
SSR (Solid State Relay)	Electronic switch with no moving parts. Controls

	heater power via semiconductor switching.

1.2 Component Abbreviations

Abbreviation	Component	Function
BH	Breaker, Heater	13A double-pole breaker protecting heater circuit
BR	Breaker, Control	5A double-pole breaker protecting control circuit
CE	Ceramic Terminal	High-temperature terminal block in secondary enclosure
CSA	Current Sensor A	1A trip point sensor detecting any heater current
CSB	Current Sensor B	6A trip point sensor detecting full heater load
CT	Controller	Genesis Wizard WHMC PID temperature controller
CTRA	Controller Alarm Relay	Relay contacts for alarm output
CTRH	Controller Heater Relay	Relay K2 controlling heat call signal
F1	Fuse 1	1A fast-blow fuse protecting 12VDC indicator circuit
FL	Flasher	LSC-100B module providing flashing output for fault indication
GM	Ground Main	Main ground bus bar
H1, H2	Heater 1, Heater 2	1000W strip heaters (2 total)
HD	Heater Disconnect	Manual isolation switch for heater circuit
RL1	Relay 1	DPDT relay energized when heat is called
RL2	Relay 2	SPST-NO relay energized when heat is NOT called (fault detection)
SD	Snap Disc	Mechanical high-temperature safety cutoff (200°F N.C.)

SSR	Solid State Relay	Switches heater power on/off
T1, T1A, T1B	Terminal blocks	Power distribution terminal blocks
T2A, T2B, T2R	Terminal blocks	12VDC indicator circuit terminal blocks

1.3 Chemical Terms

Term	Definition
MEA (Monoethanolamine)	Common component in stripping solutions. Attacks common gasket materials and produces corrosive vapors that damage copper.
NMP (N-Methyl-2-pyrrolidone)	A common stripping solvent. Excellent solvent properties but attacks many plastics and elastomers.
KOH (Potassium Hydroxide)	Caustic additive enhancing stripping action. Highly alkaline.
Sludge	Accumulated coating residue that settles at tank bottom during stripping operations.

1.4 Materials and Ratings

Term	Definition
304 Stainless Steel	Common stainless alloy with good corrosion resistance. Used for tank structure.
316 Stainless Steel	Marine-grade stainless with enhanced corrosion resistance. Used for wetted fittings.
Calcium Silicate	Rigid, non-wicking insulation material. Will not absorb chemicals.
ePTFE (Expanded PTFE)	Chemically inert gasket material resistant to MEA and NMP.
FFKM (Perfluoroelastomer)	High-performance elastomer combining chemical resistance with flexibility.
Mineral Wool	Fibrous insulation material. Non-combustible, does not absorb moisture.
NEMA 4X	Enclosure rating indicating protection against water, dust, and corrosion.

NTC Thermistor	Negative Temperature Coefficient sensor. Resistance decreases as temperature increases.
PTFE (Polytetrafluoroethylene)	Chemically inert fluoropolymer. Resistant to virtually all chemicals.
TGGT	Teflon-Glass-Glass-Teflon. High-temperature wire insulation type.

2. SAFETY INFORMATION

Read and understand all safety information before installing, operating, or servicing this equipment. Failure to follow safety instructions may result in serious injury, death, or equipment damage.

2.1 Hazard Identification

⚠ **WARNING:** ELECTRICAL HAZARD: This equipment operates at 240VAC. Contact with energized components can cause severe injury or death. Always disconnect and lock out power before servicing.

⚠ **WARNING:** THERMAL HAZARD: Tank surfaces and solution reach 180°F (82°C) during operation. Contact causes severe burns. Allow equipment to cool before maintenance.

⚠ **WARNING:** CHEMICAL HAZARD: The stripping solution contains MEA, NMP, and KOH. These chemicals are corrosive and produce harmful vapors. Use appropriate PPE including chemical-resistant gloves, safety glasses, and respiratory protection. Ensure adequate ventilation.

2.2 Personal Protective Equipment

The following PPE is required when working with this equipment:

Task	Required PPE
Normal Operation	Safety glasses, chemical-resistant gloves when handling parts
Solution Handling	Face shield, chemical-resistant gloves, chemical apron, respiratory protection
Electrical Service	Insulated gloves rated for 240VAC, safety glasses
Tank Maintenance	Face shield, chemical-resistant gloves, chemical suit, respiratory protection

2.3 Safety Systems Overview

The WL4 incorporates multiple safety systems to protect personnel and equipment:

2.3.1 Redundant High-Temperature Protection

Two independent systems prevent overtemperature conditions. The PID controller monitors temperature and removes power to heaters if the setpoint is exceeded by a programmed amount. The mechanical snap disc provides a hardwired backup, opening at 200°F regardless of controller status. Both systems must fail for an overtemperature event to occur.

2.3.2 SSR Failure Detection

A hardwired relay logic circuit detects SSR failure independent of the controller. If current flows through the heaters when the controller is not calling for heat, the RED indicator flashes to alert the operator. This detection works even if the controller malfunctions.

2.3.3 Manual Disconnect

The heater disconnect switch (HD) provides complete isolation of the heater circuit from line voltage. Use this switch before any work on heater wiring or components. The control circuit remains powered to maintain scheduling and allow controller access.

2.3.4 Circuit Protection

Separate breakers protect the control circuit (5A) and heater circuit (13A). A 1A fuse protects the 12VDC indicator circuit. These devices interrupt power before wiring or components are damaged by overcurrent conditions.

3. SYSTEM DESCRIPTION

3.1 Intended Use

The WL4 Heated Strip Tank is designed for heating water or solvent-based coating stripping solutions to their optimal operating temperature of 180°F (82°C). The system is specifically engineered for solvent or water based chemical stripping solutions that are either alkaline or acid activated.

Metal parts (aluminum and steel) are lowered into the heated solution where old coatings are chemically removed. Stripped coating material settles to the tank bottom as sludge for periodic removal.

NOTE: This equipment is intended for industrial use only. Do not use for food preparation, medical applications, or any purpose other than coating removal.

3.2 System Architecture

The electrical system uses a two-rung architecture that separates control and power circuits for safety and serviceability:

3.2.1 Rung 1: Control Circuit (5A Breaker)

The control circuit provides always-on 240VAC power to the Genesis controller, current sensors, indicator relay coils, and SSR control input. This circuit remains powered whenever the main disconnect is closed, allowing controller programming and status monitoring even when the heater circuit is isolated.

3.2.2 Rung 2: Heater Circuit (13A Breaker)

The heater circuit carries power through the SSR and snap disc safety to the strip heaters. This circuit can be completely isolated via the heater disconnect switch (HD) without affecting the control circuit. The heaters are wired in parallel, each drawing approximately 4.17A at 240VAC.

3.3 Major Components

3.3.1 Main Control Enclosure

The main enclosure is a NEMA 4X rated 304 stainless steel cabinet measuring 16" × 24" × 8". It houses the Genesis controller, breakers, disconnect switch, SSR, relays, current sensors, terminal blocks, and indicator LEDs. The enclosure mounts to the tank frame via standoff brackets, maintaining a 3" insulated gap from the inner tank exterior wall.

Figure 2. Control enclosure side of the WL4 tank. Visible features (top to bottom on the right-side cabinet): RED indicator LED (fault), main heater disconnect rotary switch (black handle, top), red emergency shutoff actuator, and main disconnect switch (yellow/red rotary, lockable). Tank lid shows the red lifting handles, FFKM seal, and 3" PTFE-lined chimney vent. Forklift slots are integrated into the base.

All wiring between the main control enclosure and the secondary junction enclosure is routed through vapor-tight flexible metal conduit (FMC) sealed with NEMA 4X liquid-tight fittings. This protects the inter-enclosure conductors from corrosive vapors emitted by the heated stripping solution. See Figure 3.

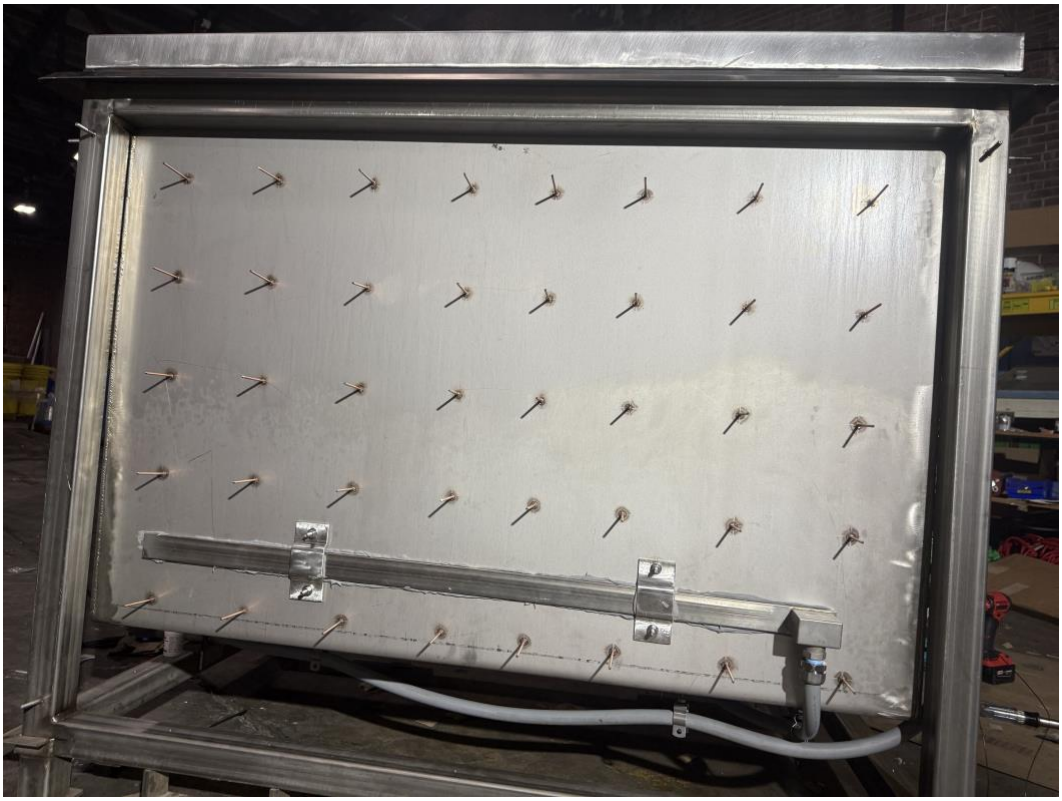

Figure 3. Vapor-tight flexible metal conduit (FMC) routing between the main control enclosure and the secondary junction enclosure on the tank exterior. The FMC carries the L1/L2 heater conductors, snap-disc safety wires, and ground from the main enclosure to the ceramic terminal blocks shown in Figure 5. Liquid-tight NEMA 4X fittings at each end maintain the ingress rating against splashing solution and corrosive vapor. The studded panel is the standoff/mounting structure that maintains the 3" insulated gap between the main enclosure back wall and the tank exterior.

3.3.2 Secondary Junction Enclosure

The secondary junction is a smaller NEMA 4X rated 304 stainless steel enclosure (Hammond 1414N4SSC4 or equivalent, Type 4X/4/13/12, IP66, 6" × 4" × 4") mounted to the tank interior and accessed through a bolted exterior service panel — the "snap disc panel" — secured by four nuts on the same side of the tank as the main control enclosure (see Figure 4). Inside the smaller enclosure are the snap disc thermostat and ceramic high-temperature terminal blocks where heater leads transition from TGGT high-temperature wire to standard PTFE-insulated wire routed back to the main enclosure through vapor-tight FMC (see Figure 5). A small red indicator on the upper face of the exterior panel shows snap disc status.

Figure 4. Secondary junction enclosure panel ("snap disc panel") mounted to the tank interior and accessible through the exterior panel, next to the main control enclosure. The bolted stainless steel panel is secured by 4 nuts and provides service access to the smaller NEMA 4x enclosure that houses the snap disc and heater wire terminations. A small red indicator on the upper face shows the snap disc status. The unit is mounted on the same side as the bracket/handle hook used for forklift handling.

Figure 5. Interior of the secondary junction enclosure. Top: liquid-tight conduit fitting where the FMC bundle from the main enclosure enters; the red and black PTFE-insulated wires drop down to the snap disc. Center: snap disc thermostat (round disc, N.C. opens at 200°F ± 5°F) wired in series with the L1 heater hot path. Lower left and right: ceramic high-temperature terminal blocks where TGGT-insulated heater leads (cloth-jacketed, white) transition to standard PTFE-insulated wires routed back to the main enclosure. Bottom: two liquid-tight conduit fittings where the heater leads exit toward the strip heaters. Yellow wire nuts secure tap connections at the snap disc. Hammond enclosure label (1414N4SSC4, Type 4X/4/13/12, IP66) visible at right.

3.3.3 Strip Heaters

Two 1000W strip heaters are mounted horizontally on the interior tank walls, 6" above the tank bottom. Each heater measures 40" long × 1.5" wide × 0.5" thick. Heater terminals are enclosed and epoxy-filled for moisture resistance.

3.3.4 Temperature Sensor (Redundant Probes)

Two 100K NTC thermistor probes (Genesis 80-0319) are mounted externally on the tank wall via lug connections inside a small NEMA 4X probe enclosure. Each probe reads solution temperature conductively through the 7-gauge (0.1793") stainless steel tank wall. Silicone thermal pads ensure good

thermal contact between each sensor and the tank wall. Redundancy lets the controller cross-check readings: if the primary probe fails open or short, the controller can fall back to the secondary probe rather than tripping a SENSOR alarm and shutting down heating mid-shift.

Figure 6. Redundant thermistor probe enclosure on the tank exterior. Two lug-style probes are bolted to the stainless tank wall through silicone thermal pads (visible cream-colored backing). The blue-jacketed loop is the nickel plated copper lead from one probe; the second probe attaches at the lower-left lug and is aluminum galvanically separated from the stainless steel tank. Probe leads exit through a liquid-tight conduit fitting (right) and return to the controller via the vapor-tight FMC. Disconnect both leads before measuring resistance using the table in Section 4.4.

3.3.5 Genesis Wizard WHMC Controller

The Genesis Wizard Heat Modulation Control (WHMC) provides PID temperature control, scheduling capability (20 setback schedules plus 9 holiday schedules), alarm outputs, and the 12VDC supply for the indicator circuit.

3.3.6 Drain Valves and Vent

Two ball valves are mounted on the side opposite the control enclosure: a 1" maintenance drain (upper, blue handle) for routine liquid removal, and a 2" sludge drain (lower, blue handle) for periodic removal of accumulated coating residue. The 3" chimney vent (PTFE-coated fiberglass) on top of the lid connects to facility exhaust. See Figure 7.

Figure 7. Drain side of the WL4 tank, opposite the control enclosure. Upper valve: 1" maintenance drain (used for routine liquid removal during sludge service or relocation). Lower valve: 2" sludge drain (used to discharge accumulated coating residue from the tank bottom). Both valves are 316 stainless steel ball valves. The 3" PTFE-lined chimney vent is visible on top.

4. SPECIFICATIONS

4.1 Electrical Specifications

Parameter	Value
Input Voltage	240VAC Single-Phase, 60Hz
Total Connected Load	2000W
Operating Current	8.33A (both heaters)
Per-Heater Current	4.17A
Control Circuit Breaker	5A Double-Pole
Heater Circuit Breaker	13A Double-Pole
Indicator Circuit Protection	1A Fast-Blow Fuse
Minimum Wire Size (Supply)	10 AWG

4.2 Temperature Specifications

Parameter	Value
Normal Operating Temperature	180°F (82°C)
PID High-Limit Setpoint	200°F (93°C)
Snap Disc Cutoff Temperature	200°F (93°C) ± 5°F
Maximum Solution Temperature	200°F (93°C)
Sensor Range	-58°F to 572°F (-50°C to 300°C)
Sensor Accuracy	±0.5°F (±0.3°C)

4.3 Physical Specifications

Parameter	Value
Inner Tank Dimensions	30" W × 40" L × 32" H (approximate)
Tank Wall Thickness	7 Gauge (0.1793") 304 Stainless Steel
Main Enclosure	16" × 24" × 8" NEMA 4X 304SS

Secondary Enclosure	6" × 4" × 4" NEMA 4X 304SS
Sidewall/Bottom Insulation	3" High-Density Mineral Wool
Lid Insulation	Calcium Silicate (welded-in)
Sludge Drain	2" Diameter
Maintenance Drain	1" Diameter
Vent	3" Chimney with PTFE-Coated Fiberglass Vent

4.4 Thermistor Resistance Table

Use this table to verify thermistor operation. Disconnect sensor leads before measuring resistance.

Temperature (°F)	Temperature (°C)	Resistance (kΩ)
-58	-50	1127
32	0	353.7
77	25	100.0
122	50	33.49
167	75	15.44
180	82	12.0 (approximate)
212	100	7.686
302	150	2.298
392	200	0.841

5. INSTALLATION

5.1 Site Requirements

Verify the following requirements are met before installation:

Requirement	Specification
Electrical Service	240VAC single-phase, 20A minimum dedicated circuit
Floor	Level concrete capable of supporting filled tank weight
Ventilation	Exhaust connection for 3" chimney vent; minimum 100 CFM
Clearance - Sides	24" minimum for service access
Clearance - Front	36" minimum for parts loading
Ambient Temperature	50°F to 104°F (10°C to 40°C)

5.2 Positioning

1. Using a forklift rated for the tank weight, position the tank in the designated location using the integrated forklift slots.

2. Verify the tank is level in both directions using a spirit level on the tank rim. Shim as necessary.

3. Connect the 3" chimney vent to the facility exhaust system using appropriate PTFE-lined ductwork.

CAUTION: Do not move the tank when it contains more than one-third of its liquid capacity.

5.3 Electrical Connection

⚠ **WARNING:** Electrical installation must be performed by a qualified electrician in accordance with local codes and the National Electrical Code (NEC).

1. Verify incoming power is de-energized and locked out.

2. Route supply conductors through the conduit entry on the main enclosure.

3. Connect L1 to the incoming L1 terminal, L2 to the incoming L2 terminal, and ground to the ground bus.

4. Verify all connections are tight and properly torqued.

5. Close the enclosure and verify all covers and gaskets are properly seated.

5.4 Initial Fill

1. Verify both drain valves (2" sludge drain and 1" maintenance drain) are closed.

2. Remove the lid and set aside.

3. Slowly fill the tank with stripping solution to the fill line, approximately 6" below the tank rim.

4. Replace the lid, ensuring the FFKM seal is properly seated.

⚠ **WARNING:** Wear appropriate PPE including face shield, chemical-resistant gloves, and respiratory protection when handling stripping solution.

6. OPERATION

6.1 Control Panel Overview

The main control panel contains the following operator-accessible components:

Component	Location	Function
Main Disconnect	Lower left side enclosure	Master power on/off
Heater Disconnect (HD)	Upper left side enclosure	Isolates heater circuit for service
Genesis Controller	Upper center panel	Temperature display, setpoint, programming
GREEN LED	Left panel	Normal heating - full load
YELLOW LED	Left panel	Degraded heating - one heater only
RED LED	Left panel	Fault condition (solid or flashing)

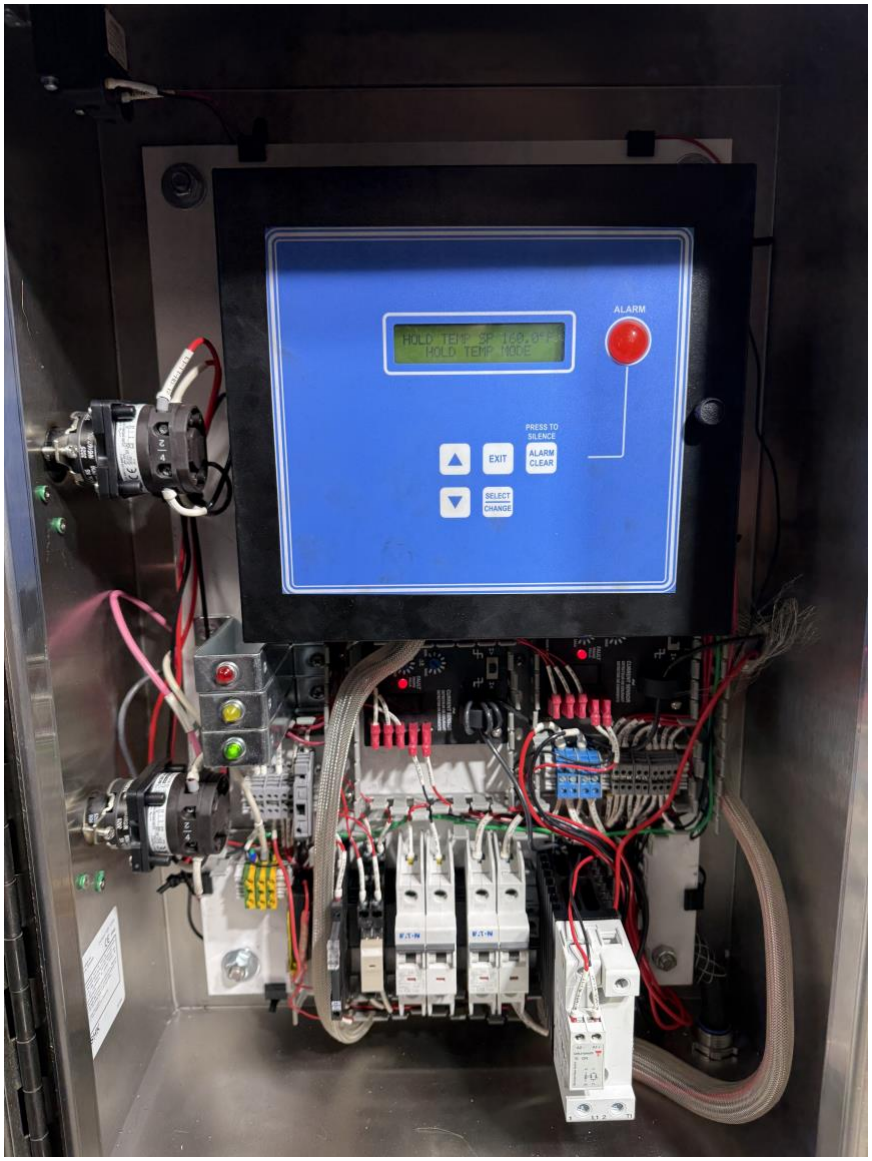

Figure 8. Inside the main NEMA 4X control enclosure (portrait view). Top: Genesis Wizard WHMC controller (blue panel) with LCD display, UP/DOWN navigation arrows, EXIT/ALARM-CLEAR buttons, and red ALARM indicator. Middle left: pilot-light selector switches and the GREEN/YELLOW/RED status LEDs that report system state per Section 6.2. Middle right and below: terminal blocks (T1/T1A/T1B), current sensors CSA (1A trip) and CSB (6A trip), RL1/RL2 indicator relays, control breaker BR (5A) and heater breaker BH (13A), and the SSR with heat sink at lower right. Wiring colors per Section 12: red = L1 control, black = L2 control, white = 12VDC indicator returns.

6.2 LED Status Indicators

The LED indicators provide immediate visual feedback on system status:

LED State	Heat Called?	Current	Meaning	Action Required
GREEN	Yes	8.33A	Normal operation, both heaters	None

			running	
YELLOW	Yes	~4.17A	Degraded operation, one heater failed	Schedule heater replacement
RED (solid)	Yes	0A	SSR open or snap disc tripped	Check snap disc, SSR, wiring
OFF	No	0A	Standby, temperature at setpoint	None - normal idle state
RED (flashing)	No	≥1A	SSR stuck closed - DANGER	DISCONNECT POWER IMMEDIATELY

⚠ **WARNING:** A flashing RED LED indicates the SSR has failed in the closed (conducting) position. Heaters are running uncontrolled. Disconnect power immediately using the main disconnect or facility breaker.

6.3 Startup Procedure

1. Verify the tank contains adequate solution (minimum 4" above heaters).

2. Verify the lid is in place and the exhaust system is operating.

3. Close the main disconnect switch. The controller will power on and display current temperature.

4. Close the heater disconnect switch (HD).

5. Verify the controller setpoint is 180°F (82°C).

6. The system will begin heating. The GREEN LED illuminates when heaters are energized.

7. Allow 10-12 hours for the solution to reach operating temperature from a cold start.

NOTE: Use the controller scheduling function to automatically start heating before the work shift begins.

6.4 Normal Operation

1. Verify the GREEN LED is illuminated and the controller displays the setpoint temperature (±2°F).

2. Open the lid. Parts may be loaded using appropriate handling equipment.

3. Lower parts into the solution slowly to minimize splashing.

4. Allow parts to soak for the required stripping time (varies by coating type and thickness).

5. Remove parts and rinse according to your facility procedures.

6. Close the lid between loading cycles to minimize vapor loss and heat loss.

CAUTION: Never leave the tank operating unattended with the lid open.

6.5 Shutdown Procedure

1. Remove all parts from the tank.

2. Close the lid and ensure it is properly seated.

3. Leave the main disconnect closed to maintain controller scheduling.

For extended shutdown (weekends, holidays):

1. Open the main disconnect switch.

2. Allow the tank to cool completely before any maintenance.

7. CONTROLLER PROGRAMMING

Refer to the Genesis Wizard WHMC manual (Part Number 44-0371) for complete programming instructions. This section covers the essential settings for the WL4 application.

7.1 Factory Default Settings

Parameter	Setting	Notes
Temperature Setpoint	180°F	Normal operating temperature
High Limit	200°F	Alarm and heater cutoff
Low Limit	150°F	Low temperature alarm
Sensor Type	100K NTC	Do not change
Display Units	°F	May be changed to °C

7.2 Setting the Temperature Setpoint

1. Press the SET button on the controller front panel.

2. Use the UP/DOWN arrows to adjust the setpoint value.

3. Press SET again to confirm, or wait 10 seconds for automatic confirmation.

CAUTION: Do not set the operating temperature above 190°F. Higher temperatures approach the high-limit cutoff and may cause nuisance trips.

7.3 Programming Schedules

The controller supports 20 setback schedules that can automatically adjust the temperature setpoint based on time of day and day of week. Use this feature to preheat the tank before the work shift begins.

Example: To have the tank reach 180°F by 7:00 AM on weekdays, program the heating to begin at 3:00 AM (allowing 4 hours for heat-up).

NOTE: Refer to the Genesis manual Section 5 for detailed schedule programming instructions.

7.4 Alarm Configuration

The controller provides several alarm outputs:

Alarm Type	Default Setting	Description

High Temperature	200°F	Solution exceeds safe operating temperature
Low Temperature	100°F	Solution below effective stripping temperature
Sensor Open	Enabled	Thermistor wire broken or disconnected
Sensor Short	Enabled	Thermistor wire shorted

8. THEORY OF OPERATION

8.1 Temperature Control Loop

The Genesis WHMC controller continuously monitors the solution temperature via the 100K NTC thermistor mounted on the tank wall. When the measured temperature falls below the setpoint, the controller energizes relay K2 (CTRH - Controller Heater Relay).

The K2 normally-open contact closes, providing 240VAC to the SSR control input and the RL1 relay coil. The SSR conducts, allowing power to flow through the snap disc safety switch to the heaters. The heaters remain energized until the temperature reaches setpoint, at which point K2 de-energizes and the heating cycle ends.

The PID algorithm anticipates temperature changes and modulates the heat call signal to minimize overshoot and maintain stable temperature control.

8.2 Current Sensing Logic

Two current-sensing relays monitor the L2 return path from the heaters:

CSA (Current Sensor A) trips at 1A, detecting ANY current flow through the heaters. When current is present, CSA's normally-closed contact opens and its normally-open contact closes.

CSB (Current Sensor B) trips at 6A, detecting FULL LOAD current (both heaters operating). This threshold is set between single-heater current (4.17A) and full current (8.33A).

This arrangement distinguishes three states: no current (0A), partial current (~4.17A, one heater), and full current (8.33A, both heaters).

8.3 Relay Logic for LED Indication

RL1 is a DPDT relay that energizes whenever heat is called (K2 N.O. closed). It routes the 12VDC indicator signal based on heat call status.

RL2 is an SPST-NO relay that energizes when heat is NOT called (K2 N.C. closed). It routes any detected current through the flasher module to create a flashing fault indication.

The logic produces five distinct states:

State	Heat Call	Current	LED Result
Normal Heating	Yes (RL1 on)	8.33A (CSA+CSB trip)	GREEN
Degraded Heating	Yes (RL1 on)	4.17A (CSA trips, CSB no)	YELLOW
Open Fault	Yes (RL1 on)	0A (CSA no trip)	RED solid

Standby	No (RL2 on)	0A (CSA no trip)	OFF
Stuck SSR Fault	No (RL2 on)	≥1A (CSA trips)	RED flash

8.4 Safety Independence

The hardwired relay logic (RL1, RL2, CSA, CSB, flasher) operates independently of the controller firmware and software. If the controller malfunctions or displays incorrect information, the LED indicators still correctly reflect the actual state of current flow and heat call signals.

Similarly, the snap disc high-limit safety operates as a direct mechanical switch in the heater power path. It will interrupt heater power at 200°F regardless of controller status.

9. TROUBLESHOOTING

9.1 Symptom-Based Troubleshooting

Symptom	Possible Cause	Corrective Action
Controller no power	Main Disconnect open	Close Main Disconnect
	Breaker (BR) tripped	Reset BR
GREEN but not heating	Solution level too low	Fill tank; heaters must be submerged
	Excessive heat loss	Close lid; check insulation
YELLOW instead of GREEN	One heater burned out	Test resistance; replace
RED solid	SSR failed open	Replace SSR
	Snap disc tripped	Check overtemp
	Heater Disconnect open	Close HD
RED flashing	SSR failed shorted	DISCONNECT; replace SSR
All LEDs off	12V fuse (F1) blown	Replace F1
	12V output failed	Check controller
	Desired Temp Reached, System Standby	Normal Condition
SENSOR OPEN alarm	Broken thermistor wire	Check cable continuity
SENSOR SHORT alarm	Damaged cable	Replace sensor

9.2 Heater Testing

To test heater resistance:

1. Open main disconnect and heater disconnect.

2. Disconnect heater leads at the ceramic terminal block.

3. Measure resistance across each heater's two leads.

4. Expected resistance: 57.6Ω per heater ($240V^2 \div 1000W = 57.6\Omega$).

5. Open circuit (infinite resistance) indicates failed heater element.

6. Very low resistance indicates short circuit.

9.3 SSR Testing

To test SSR operation:

1. Verify controller is calling for heat (observe controller display).

2. Measure AC voltage at SSR control input terminals. Should read ~240VAC when heat is called.

3. Measure AC voltage at SSR load output terminals. Should read near 0V when SSR is conducting (heat called), or line voltage when not conducting.

4. If control voltage is present but load does not switch, SSR has failed open.

5. If load conducts without control voltage, SSR has failed shorted.

10. MAINTENANCE

10.1 Maintenance Schedule

Interval	Task	Reference
Daily	Visual inspection of LEDs and temperature display	Section 10.2
Daily	Check solution level	Section 10.2
Weekly	Verify exhaust system operation	Section 10.3
Weekly	Check enclosure door seals	Section 10.3
Monthly	Remove sludge accumulation	Section 10.4
Monthly	Clean vent screen	Section 10.4
Quarterly	Inspect all electrical connections	Section 10.5
Quarterly	Test snap disc operation	Section 10.5
Annually	Full system inspection	Section 10.6
Annually	Replace gaskets as needed	Section 10.6

10.2 Daily Inspection

Before each operating shift:

1. Verify the GREEN LED illuminates when heating and the display shows the correct setpoint temperature.

2. Check solution level is adequate (minimum 4" above heaters, maximum approximately 6" below tank rim).

3. Verify exhaust system is operating (feel for airflow at vent connection).

4. Look for any leaks, unusual odors, or signs of equipment damage.

10.3 Weekly Inspection

1. Verify exhaust flow rate meets minimum requirements (100 CFM).

2. Inspect enclosure door gaskets for damage or deterioration.

3. Verify lid seal is intact and properly seated.

10.4 Monthly Maintenance

10.4.1 Sludge Removal

Coating residue accumulates at the tank bottom and must be removed periodically to maintain effective stripping and prevent heater damage. Use the two ball valves on the drain side of the tank (see Figure 7 in Section 3.3.6).

1. Allow the tank to cool to 120°F or less.

2. Drain the liquid chemical out of the tank using the 1" maintenance drain (upper valve, Figure 7).

3. Place a suitable container under the 2" sludge drain (lower valve, Figure 7).

4. Open the drain valve and allow sludge to flow out. If thick, sometimes a double diaphragm pump is required.

5. Close the drain after rinse out with water is clear.

6. Dispose of sludge according to facility hazardous waste procedures.

7. Top off the tank with fresh solution as needed.

10.4.2 Vent Cleaning

1. Remove the vent from the chimney.

2. Rinse with clean water to remove accumulated residue.

3. Inspect for damage or deterioration of PTFE coating.

4. Replace if damaged. Reinstall clean.

10.5 Quarterly Maintenance

⚠ **WARNING:** De-energize and lock out all power before performing electrical maintenance.

1. Open main disconnect and lock out.

2. Open the main enclosure door (refer to Figure 8 for the internal layout).

3. Open the secondary junction enclosure and verify the snap disc and ceramic terminals (refer to Figure 5).

4. Inspect all terminal connections for tightness. Re-torque as needed.

5. Check for signs of corrosion, discoloration, or damage.

6. Verify the snap disc resets properly (it should be closed at room temperature).

7. Close enclosure and restore power.

10.6 Annual Maintenance

Perform a comprehensive system inspection including:

1. All quarterly maintenance items.
2. Complete drain and tank interior inspection.
3. Heater inspection for scale buildup or damage.
4. Replacement of all ePTFE gaskets and the FFKM lid seal.
5. Calibration verification of the temperature sensor.
6. Test of all safety systems including snap disc and controller high-limit.

11. MOVING OR REPOSITIONING THE TANK

⚠ **WARNING:** The tank must NOT be lifted or moved when it contains more than one-third (1/3) of its liquid capacity. Moving a heavily loaded tank risks structural damage and creates a severe spill hazard.

If the tank must be relocated:

1. Shut down the heating system completely using both the heater disconnect and main disconnect.

2. Allow the solution to cool to a safe handling temperature (below 100°F).

3. Drain the tank until it contains no more than one-third of its capacity using the 1" maintenance drain (see Figure 7).

4. Collect drained solution in appropriate containers for reuse or disposal.

5. Disconnect all electrical connections at the main enclosure.

6. Cap or plug any open conduit entries.

7. Using a forklift rated for the tank weight plus remaining liquid, lift the tank using the integrated forklift slots.

8. Transport to the new location and position as described in Section 5.2.

9. Reconnect electrical service per Section 5.3.

10. Refill with retained solution and fresh makeup as needed.

12. COMPLETE SYSTEM WIRING LIST

This section provides the complete wire-by-wire listing of all electrical connections in the WL4 system. Use this reference for installation verification, troubleshooting, and repair. Refer to Figure 8 (Section 6.1) for the physical layout of components inside the main control enclosure, Figure 5 for the secondary junction enclosure interior, and Figure 3 for the vapor-tight FMC routing between them.

12.1 Main Incoming Power

Wire Label	From	To	Gauge	Purpose/Notes
L1-DC-12	Incoming L1	Main Disconnect	12 AWG	Main hot leg feed
L2-DC-12	Incoming L2	Main Disconnect	12 AWG	Main hot leg feed
L1-DC-T1-12	Main Disconnect	Terminal 1 (L1)	12 AWG	Switched L1 distribution
L2-DC-T1-12	Main Disconnect	Terminal 1 (L2)	12 AWG	Switched L2 distribution
G-GM	Incoming Ground	Ground Bus (GM)	10 AWG	Main system ground

12.2 Rung 1: Control Circuit (5A Breaker)

12.2.1 Control Breaker Feed

Wire Label	From	To	Gauge	Purpose/Notes
L1-T1-BR-18	Terminal 1 (L1)	Breaker Control (L1)	18 AWG	5A double-pole breaker
L2-T1-BR-18	Terminal 1 (L2)	Breaker Control (L2)	18 AWG	5A double-pole breaker
L1-BR-T1A-18	Breaker Control (L1)	Sub-Terminal 1A (L1)	18 AWG	Always-on 240V hub
L2-BR-T1A-18	Breaker Control (L2)	Sub-Terminal 1A (L2)	18 AWG	Always-on 240V hub

12.2.2 Controller Power

Wire Label	From	To	Gauge	Purpose/Notes
L1-T1A-CT-18	Sub-Terminal 1A	Controller (L1)	18 AWG	PID controller

	(L1)			power
L2-T1A-CT-18	Sub-Terminal 1A (L2)	Controller (L2)	18 AWG	PID controller power

12.2.3 Alarm Circuit

Wire Label	From	To	Gauge	Purpose/Notes
L1-T1A-CRA-18	Sub-Terminal 1A (L1)	CTRA COM	18 AWG	Controller alarm relay common
L1-CRA-AL-18	CTRA N.O.	Alarm Device (hot)	18 AWG	Alarm output - closes on fault
L2-T1A-AL-18	Sub-Terminal 1A (L2)	Alarm Device (neutral)	18 AWG	240V return

12.2.4 Current Sensor Power

Wire Label	From	To	Gauge	Purpose/Notes
L1-T1A-CSA-18	Sub-Terminal 1A (L1)	CSA Power (L1)	18 AWG	1A trip sensor - always energized
L2-T1A-CSA-18	Sub-Terminal 1A (L2)	CSA Power (L2)	18 AWG	1A trip sensor power return
L1-T1A-CSB-18	Sub-Terminal 1A (L1)	CSB Power (L1)	18 AWG	6A trip sensor - always energized
L2-T1A-CSB-18	Sub-Terminal 1A (L2)	CSB Power (L2)	18 AWG	6A trip sensor power return

12.2.5 RL1 Coil - Heat Called Relay (DPDT)

Wire Label	From	To	Gauge	Purpose/Notes
L1-T1A-CNO-18	Sub-Terminal 1A (L1)	CTRH (COM)	18 AWG	Always-on 240V to K2 common
L1-CNO-T1B-18	CTRH N.O. (switched)	Sub-Terminal 1B (L1)	18 AWG	Heat signal distribution
L1-T1B-RL1-18	Sub-Terminal 1B (L1)	RL1 Coil (A1)	18 AWG	RL1 control side A1
L2-T1A-RL1-18	Sub-Terminal 1A	RL1 Coil (A2)	18 AWG	240V return

	(L2)			

12.2.6 RL2 Coil - Fault Detection Relay (SPST-NO)

Wire Label	From	To	Gauge	Purpose/Notes
L1-T1A-CNC-18	Sub-Terminal 1A (L1)	CTRH N.C.	18 AWG	Controller heater relay N.C. contact
L1-CNC-RL2-18	CTRH N.C. (switched)	RL2 Coil (A1)	18 AWG	RL2 energizes when heat NOT called
L2-T1A-RL2-18	Sub-Terminal 1A (L2)	RL2 Coil (A2)	18 AWG	240V return

12.2.7 SSR Control Side

Wire Label	From	To	Gauge	Purpose/Notes
L1-T1B-SSR-18	Sub-Terminal 1B (L1)	SSR Control (A1)	18 AWG	240V control signal when heat called
L2-T1A-SSR-18	Sub-Terminal 1A (L2)	SSR Control (A2)	18 AWG	240V return

12.3 Rung 2: Heater Circuit (13A Breaker)

12.3.1 Heater Disconnect and Breaker

Wire Label	From	To	Gauge	Purpose/Notes
L1-T1-HD-12	Terminal 1 (L1)	Heater Disconnect (L1 in)	12 AWG	Double-pole isolation switch
L2-T1-HD-12	Terminal 1 (L2)	Heater Disconnect (L2 in)	12 AWG	Double-pole isolation switch
L1-HD-BH-12	Heater Disconnect (L1 out)	Breaker Heater (L1)	12 AWG	13A double-pole breaker
L2-HD-BH-12	Heater Disconnect (L2 out)	Breaker Heater (L2)	12 AWG	13A double-pole breaker

12.3.2 SSR Load Side and Heater Hot Path (L1)

Wire Label	From	To	Gauge	Purpose/Notes

L1-BH-SSR-12	Breaker Heater (L1)	SSR Load Input	12 AWG	Main heater power in
L1-SSR-SD-12	SSR Load Output	Snap Disc (in)	12 AWG	Switched heater power
L1-SD-CE-12	Snap Disc (out)	Ceramic Terminal (L1)	12 AWG	High-limit safety (N.C. 200°F)
L1-CE-H1-14	Ceramic Terminal (L1)	Heater 1 (L1)	14 AWG	~4.17A per heater
L1-CE-H2-14	Ceramic Terminal (L1)	Heater 2 (L1)	14 AWG	~4.17A per heater

12.3.3 Current Sense and Heater Return Path (L2)

Wire Label	From	To	Gauge	Purpose/Notes
L2-BH-CSA-12	Breaker Heater (L2)	CSA Sense Loop (in)	12 AWG	Return current through CSA sense
L2-CSA-CSB-12	CSA Sense Loop (out)	CSB Sense Loop (in)	12 AWG	Daisy-chain to CSB
L2-CSB-CE-12	CSB Sense Loop (out)	Ceramic Terminal (L2)	12 AWG	Continue to heaters
L2-CE-H1-14	Ceramic Terminal (L2)	Heater 1 (L2)	14 AWG	Parallel return
L2-CE-H2-14	Ceramic Terminal (L2)	Heater 2 (L2)	14 AWG	Parallel return

12.4 Ground

Wire Label	From	To	Gauge	Purpose/Notes
GM-ENC	Ground Bus (GM)	All Metal Enclosures	Varies	Equipment grounding
G-CT-14	Ground Bus (GM)	Controller Ground	14 AWG	Dedicated clean reference

12.5 12V DC Indicator Circuit

12.5.1 Controller 12V Supply

Wire Label	From	To	Gauge	Purpose/Notes
CT12-F1-22	Controller 12V+	Fuse 1 (in)	22 AWG	1A fast-blow protection
F1-CSC-22	Fuse 1 (out)	CSA Relay COM	22 AWG	12V to current sensor relay
CT12-T2R-22	Controller 12V-	Terminal 2R	22 AWG	Common return bus

12.5.2 CSA Relay Outputs

Wire Label	From	To	Gauge	Purpose/Notes
CNN-RL1C-22	CSA Relay N.C.	RL1 Pole 1 COM (in)	22 AWG	No current path (<1A)
CSN-T2A-22	CSA Relay N.O.	Terminal 2A	22 AWG	Current detected path (≥1A)

12.5.3 RL1 Pole 1 - Red LED Solid Path

Wire Label	From	To	Gauge	Purpose/Notes
RL1P1O-T2B-22	RL1 Pole 1 N.O. (out)	Terminal 2B	22 AWG	Red LED when heat called + no current

12.5.4 RL2 Fault Path - Red LED Flash

Wire Label	From	To	Gauge	Purpose/Notes
T2A-RL2C-22	Terminal 2A	RL2 COM (in)	22 AWG	To fault relay contact
RL2O-FL-22	RL2 N.O. (out)	Flasher In	22 AWG	To LSC-100B blinker module
FL-T2B-22	Flasher Out	Terminal 2B	22 AWG	Flashing output to red LED

12.5.5 RL1 Pole 2 - Green/Yellow Path

Wire Label	From	To	Gauge	Purpose/Notes
T2A-RL1C-22	Terminal 2A	RL1 Pole 2 COM (in)	22 AWG	Current detected to RL1
RL1P2O-CBC-22	RL1 Pole 2 N.O.	CSB Relay COM	22 AWG	To CSB for load

	(out)			indication

12.5.6 CSB Relay Outputs

Wire Label	From	To	Gauge	Purpose/Notes
CBN-G-22	CSB Relay N.O.	Green LED (+)	22 AWG	Full load (≥6A) - both heaters
CBC-Y-22	CSB Relay N.C.	Yellow LED (+)	22 AWG	Partial load (<6A) - one heater out

12.5.7 Red LED

Wire Label	From	To	Gauge	Purpose/Notes
T2B-R-22	Terminal 2B	Red LED (+)	22 AWG	Fault indicator (solid or flash)

12.5.8 LED Common Returns

Wire Label	From	To	Gauge	Purpose/Notes
T2R-R-22	Terminal 2R	Red LED (-)	22 AWG	Common return
T2R-G-22	Terminal 2R	Green LED (-)	22 AWG	Common return
T2R-Y-22	Terminal 2R	Yellow LED (-)	22 AWG	Common return

13. MAINTENANCE RECORDS

Use the following pages to document all maintenance activities performed on this equipment. Maintaining accurate records helps identify trends, schedule preventive maintenance, and provides documentation for warranty and regulatory purposes.

13.1 Equipment Information

Field	Value
Model Number	WL4-DD
Serial Number	
Installation Date	
Installation Location	
Installed By	
Warranty Expiration	

13.2 Daily Inspection Checklist

Complete this checklist at the start of each operating shift. Check (✓) each item when verified satisfactory. Note any issues in the Comments column.

Item	Check	Comments
Date / Shift:		
Controller displays correct temperature	☐	
GREEN LED illuminates when heating	☐	
Solution level adequate (4" above heaters)	☐	
Exhaust system operating	☐	
No visible leaks	☐	
No unusual odors	☐	
Lid seal properly seated	☐	

Enclosure doors closed	☐	
Inspector Initials:		

(Reproduce this checklist as needed for daily use)

13.3 Weekly Inspection Checklist

Item	Check	Comments
Week Ending:		
Exhaust flow rate verified (100 CFM min)	☐	
Main enclosure door gasket condition	☐	
Secondary enclosure gasket condition	☐	
Lid FFKM seal condition	☐	
Tank exterior - no damage or corrosion	☐	
Solution appearance (color, clarity)	☐	
Inspector Signature:		

13.4 Monthly Maintenance Checklist

Item	Check	Comments
Month/Year:		
Sludge removed from tank bottom	☐	Amount removed:
Vent cleaned	☐	
Vent condition (replace if damaged)	☐	
Solution topped off with fresh chemical	☐	Amount added:
All daily/weekly items verified	☐	
Technician Signature:		

Date Completed:		

13.5 Quarterly Maintenance Checklist

Item	Check	Comments
Quarter/Year:		
Power locked out before electrical work	☐	Lockout ID:
All terminal connections inspected/torqued	☐	
No corrosion or discoloration observed	☐	
Snap disc tested (closed at room temp)	☐	
SSR mounting and heat sink secure	☐	
Relay mounting secure	☐	
Breakers tested (trip and reset)	☐	
Thermistor cable condition	☐	
All monthly items completed	☐	
Technician Signature:		
Date Completed:		

13.6 Annual Maintenance Checklist

Item	Check	Comments
Year:		
Complete tank drain performed	☐	
Tank interior inspected	☐	
Heater elements inspected for scale/damage	☐	
ePTFE panel gaskets replaced	☐	

FFKM lid seal replaced	☐	
Thermistor calibration verified	☐	Measured vs. Actual:
Snap disc high-limit tested	☐	Trip temp:
Controller high-limit tested	☐	Trip temp:
All quarterly items completed	☐	
Fresh solution installed	☐	Volume:
System startup verified normal	☐	
Technician Signature:		
Supervisor Approval:		
Date Completed:		

13.7 Maintenance Log

Record all maintenance activities, repairs, and component replacements below.

Date	Description of Work	Parts Used	Technician

(Continue on additional pages as needed)

13.8 Component Replacement Record

Track replacement of major components for warranty and lifecycle management.

Component	Date Installed	Date Replaced	Reason	Tech
Heater 1				
Heater 2				
SSR				
Snap Disc				
Thermistor				
Controller				
RL1 Relay				
RL2 Relay				
CSA Sensor				
CSB Sensor				
Control Breaker (BR)				
Heater Breaker (BH)				
12V Fuse (F1)				
Flasher Module				
FFKM Lid Seal				
Panel Gaskets				
Vent				

— End of Manual —