FUEL SMART HYDROSTAT ®

MODEL 3250

Temp Limit / LWCO Control with Thermal Targeting™ for Water Boilers

120 VAC Operating Voltage

PATENT NO. 7,891,572

INSTALLATION INSTRUCTIONS and OPERATING MANUAL

- **Saves Fuel** – Features Thermal Targeting™ technology and Thermal Pre-Purge capability
- **Universal Design** – Replaces common cold-start and triple-action Aquastats*
- **Easy to Install** – Industry standard wiring, dial-type settings, no external sensors necessary
- **Operating Indicators** – LEDs, Dynamic Display and Test Button provide continual and on-demand status checks
- **Prioritizes Domestic Hot Water** – Gives priority to low limit setting or to calls from indirect water heater
- **Reduces Condensation** – Holds circulator off until boiler reaches 120°F

*Aquastat is a registered trademark of Honeywell International, Inc.

Three Function Design

Temperature Limit Control
Designed for cold start and tankless coil boilers.

Low Water Cut-Off
Provides protection against potentially dangerous low water conditions when installed with the Hydrolevel Electro-Well™ (see page 2 for details).

Boiler Reset Control
Utilizes *Thermal Targeting™* technology to conserve fuel by monitoring heating demand and establishing target boiler temperatures below the high limit setting (see page 7 for details).

⚠ **WARNING** **Electrical shock hazard.** To prevent electrical shock, death or equipment damage, disconnect power supply before installing or servicing control. Only qualified personnel may install or service this control in accordance with local codes and ordinances. Read instructions completely before proceeding.

⚠ **CAUTION** To prevent serious burns, boiler should be thoroughly cooled before installing or servicing control.

HYDROLEVEL COMPANY   83 Water Street • New Haven, CT 06511 • Phone (203) 776-0473 • FAX (203) 773-1019 • www.hydrolevel.com
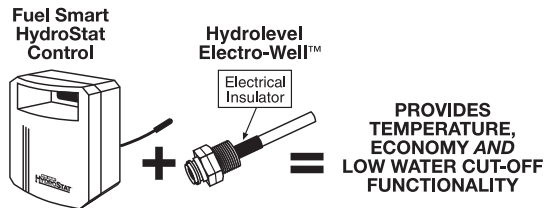
IMMERSION WELLS

Fuel Smart HydroStat can be installed on an existing immersion well already in the boiler or on a Hydrolevel Electro-Well™ (sold separately). The low water cut-off function is automatically activated when installed on an Electro-Well™.
IMPORTANT: The control will not provide low water cut-off protection when installed on a standard immersion well.
**NOTE:** Do not use heat-conducting grease.

Fuel Smart HydroStat installed with Hydrolevel Electro-Well™

Fuel Smart HydroStat Control   **Hydrolevel Electro-Well™**

Electrical Insulator

+ **=** **PROVIDES TEMPERATURE, ECONOMY *AND* LOW WATER CUT-OFF FUNCTIONALITY**

IMPORTANT: For proper operation of the low water cut-off function, there must be a minimum of ½" clearance between the copper well tube and any surface within the boiler.
See Electro-Well models on page 12.

Fuel Smart HydroStat installed with standard immersion well

Fuel Smart HydroStat Control   **Standard Immersion Well**

+ **=** **PROVIDES TEMPERATURE, AND ECONOMY FUNCTIONALITY ONLY**
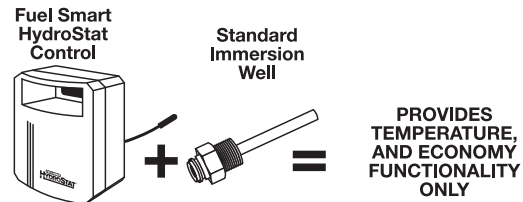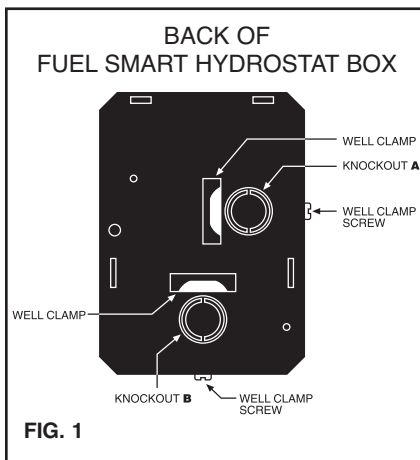
NOTE: When installed on a standard immersion well, the "LWCO Active" LED will not illuminate.

MOUNTING THE CONTROL

IMPORTANT Make sure that the immersion well or Electro-Well™ is installed in the boiler manufacturer's designated temperature limit control tapping.
NOTE: If installing an Electro-Well, pipe sealing compound should be used. **Teflon tape is not recommended.**

STEP 1   Two mounting positions are available on the back of the control (Fig. 1). Select which of the two positions (2 knockouts) is best for the location of the control. Remove the knockout.

BACK OF
FUEL SMART HYDROSTAT BOX

WELL CLAMP
KNOCKOUT **A**
WELL CLAMP SCREW
WELL CLAMP
KNOCKOUT **B**   WELL CLAMP SCREW

FIG. 1

STEP 2   Place control on the well. While holding box against well nut, tighten well clamp screw. (Fig. 2)

FIG. 2
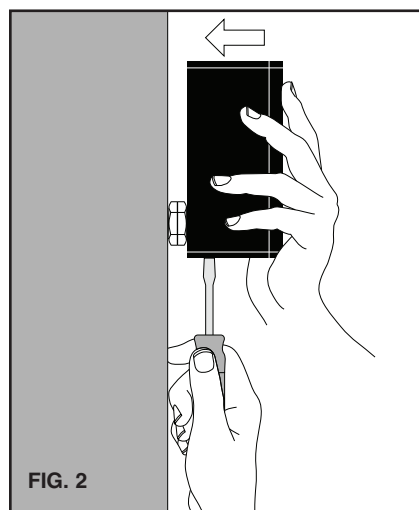
STEP 3   Insert sensor ALL THE WAY into well through the knockout (A or B) you have chosen. (Fig. 3)

KNOCKOUT **A**

KNOCKOUT **B**

FIG. 3
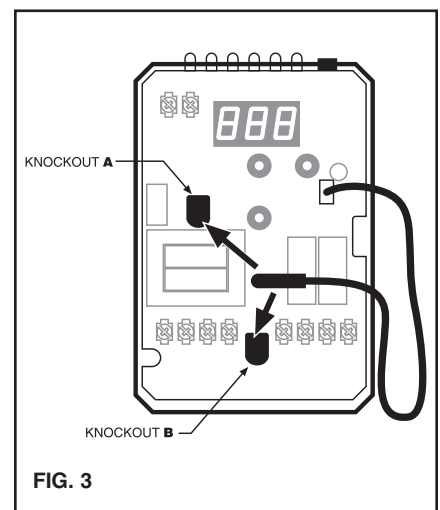
NOTE: In the case of space restrictions, the Fuel Smart HydroStat control may be mounted in a horizontal orientation without any loss of function. Hydrolevel recommends vertical mounting, when possible, for proper orientation of LED display.

REMOTE MOUNTING KITS are available separately for mounting the Fuel Smart HydroStat control box in a remote location. Each kit includes mounting hardware and a remote sensor. See page 12 for kit options.

⚠ **WARNING**	**Electrical shock hazard.** To prevent electrical shock, death or equipment damage, disconnect power supply before installing or servicing this control.
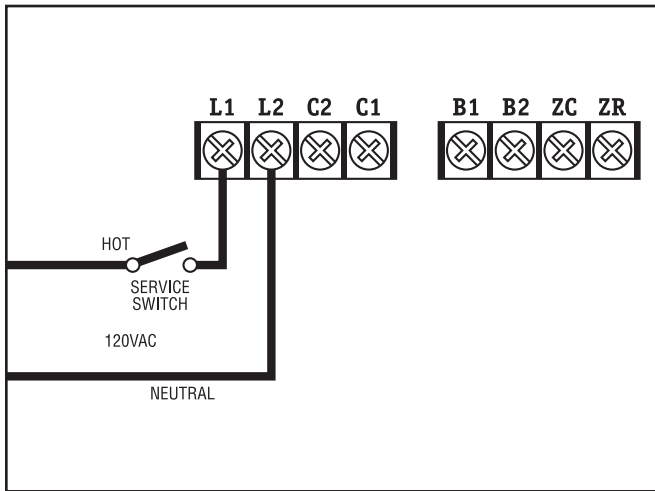
STEP 1 Connect 120 VAC Hot to terminal **L1.** Connect 120 VAC Neutral to terminal **L2.** Disconnect means and overload protection as required (provided by others).

STEP 2 Connect the burner circuit to **B1-B2.** (B2 is neutral.)

Select the Diagram that Matches your System Configuration on Pages 4, 5 or 6

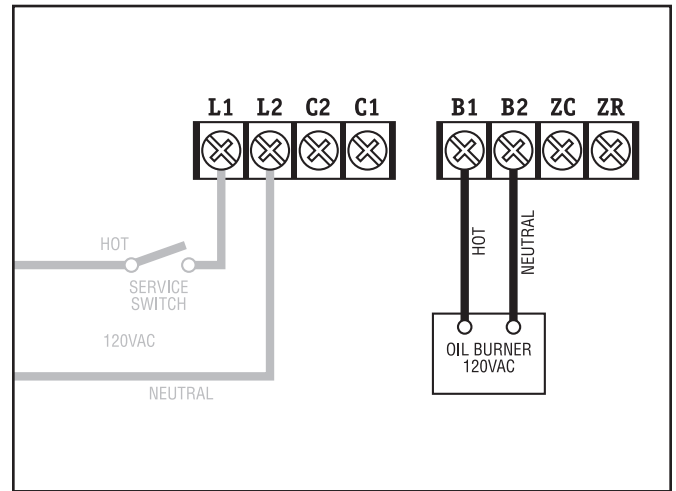> ⚠ **WARNING**   **Electrical shock hazard.** To prevent electrical shock, death or equipment damage, disconnect power supply before installing or servicing this control.

NOTE: For proper operation of the boiler reset function, all heating thermostats must input to **T-T** or **ZC-ZR** terminals as indicated below. Jumping the T-T terminals and wiring the thermostat to the primary will override the economy feature.

STEP 3A: HEATING ONLY – No Indirect Water Heater

CHOOSE ❶ OR ❷ BELOW

SINGLE CIRCULATOR

Connect thermostat or end switch from zone relay or multi-zone panel to **T-T.** Connect circulator to **C2-C1.** Move Zone/Indirect Switch up to **Z.**

MULTIPLE CIRCULATORS

Connect end switch from circulator relay or multi-zone panel to **ZC-ZR.** Move Zone/Indirect Switch up to **Z.**

STEP 3B: HEATING and Indirect Water Heater

IMPORTANT: When installing with an indirect water heater, the Zone/Indirect Switch must be set in the **I** position. When set in the **I** position, calls to **ZC-ZR** will bypass the Thermal Targeting feature and allow the boiler to fire to the high limit setting to heat the indirect tank. The indirect signal must be separate from all heating zone signals. If you choose not to separate the indirect signal from the heating zones, the Economy Feature should be turned OFF to ensure that the boiler supplies adequate temperature to heat the indirect tank (see page 7).

CHOOSE FROM ❸ THROUGH ❽ BELOW OR ON PAGE 5 OR 6

SINGLE CIRCULATOR

Connect thermostat or end switch from zone relay or multi-zone panel to **T-T.** Connect circulator to **C2-C1.** Connect end switch from indirect zone relay to **ZC-ZR.** Move Zone/Indirect Switch down to **I.**

MULTIPLE CIRCULATORS

Connect end switch from heating circulator relays or multi-zone panel to **T-T.** Connect end switch from indirect circulator relay to **ZC-ZR.** Move Zone/Indirect Switch to **I.**
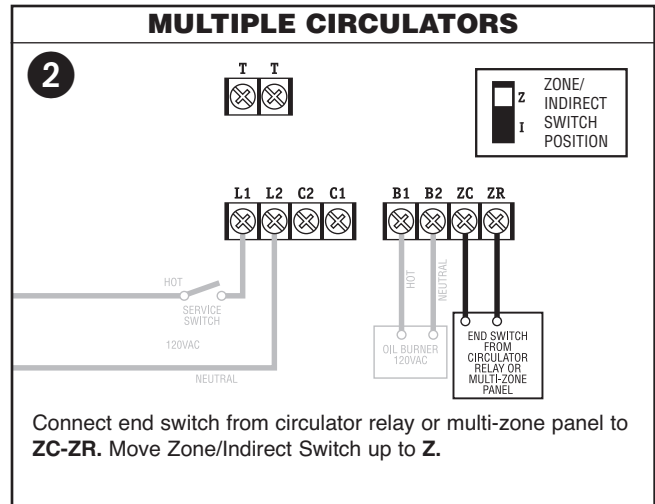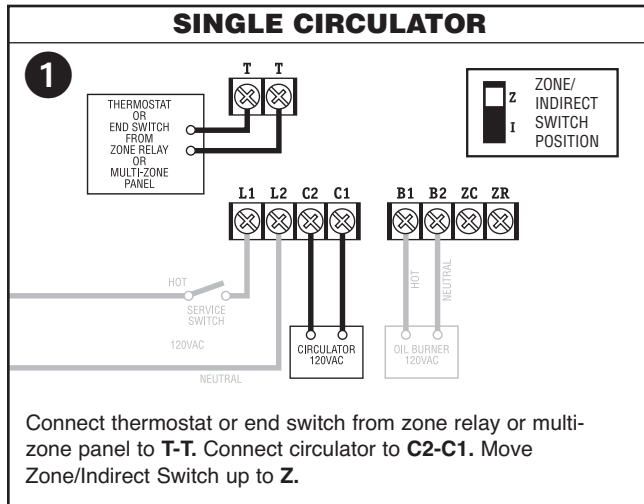
⚠ **WARNING** **Electrical shock hazard.** To prevent electrical shock, death or equipment damage, disconnect power supply before installing or servicing this control.

NOTE: For proper operation of the boiler reset function, all heating thermostats must input to **T-T** or **ZC-ZR** terminals as indicated below. Jumping the T-T terminals and wiring the thermostat to the primary will override the economy feature.

STEP 3B: HEATING and Indirect Water Heater – continued
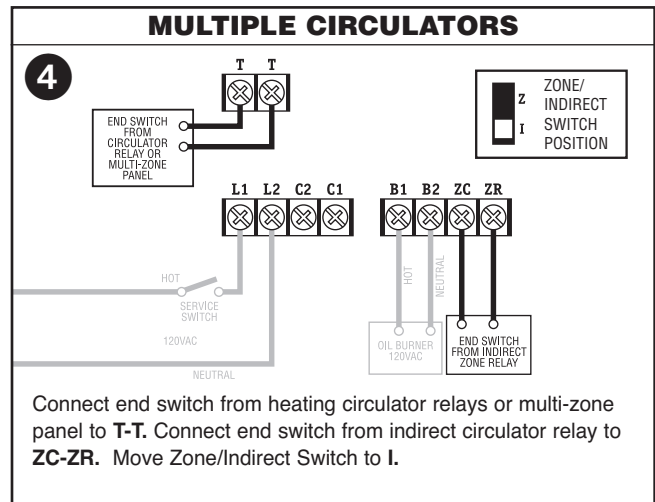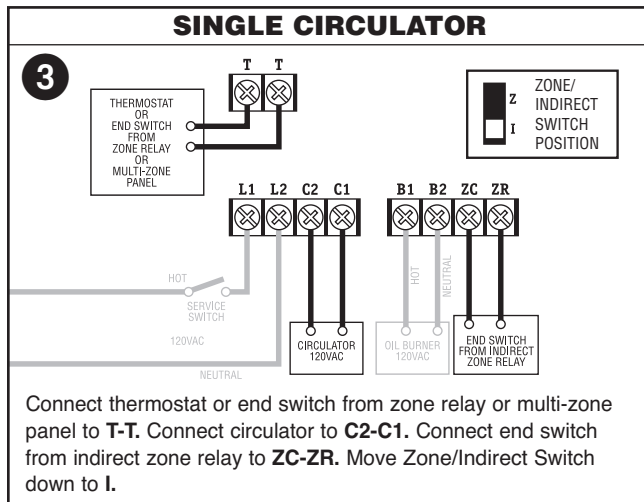
MULTIPLE CIRCULATORS — Typical Zone Panel with Priority Zone

NOTE: The wire from **ZR** to the hot terminal of the indirect circulator will ensure that indirect calls will fire to limit and receive priority over heating calls.

SINGLE CIRCULATOR — Multiple Zone Valves including Indirect, No Zone Control Panel
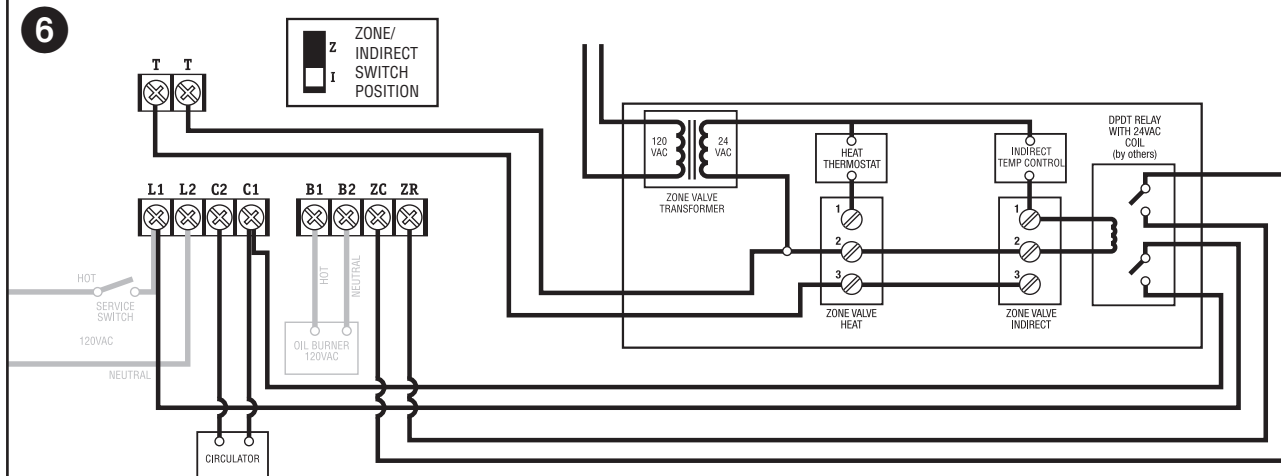
NOTE: When using zone valves for both heat and indirect, the calls must be separated in order to prioritize indirect calls. This can be accomplished by using a general purpose relay as shown above. However, for ease of installation, a zone control panel is recommended (see wiring diagram 7 on next page).
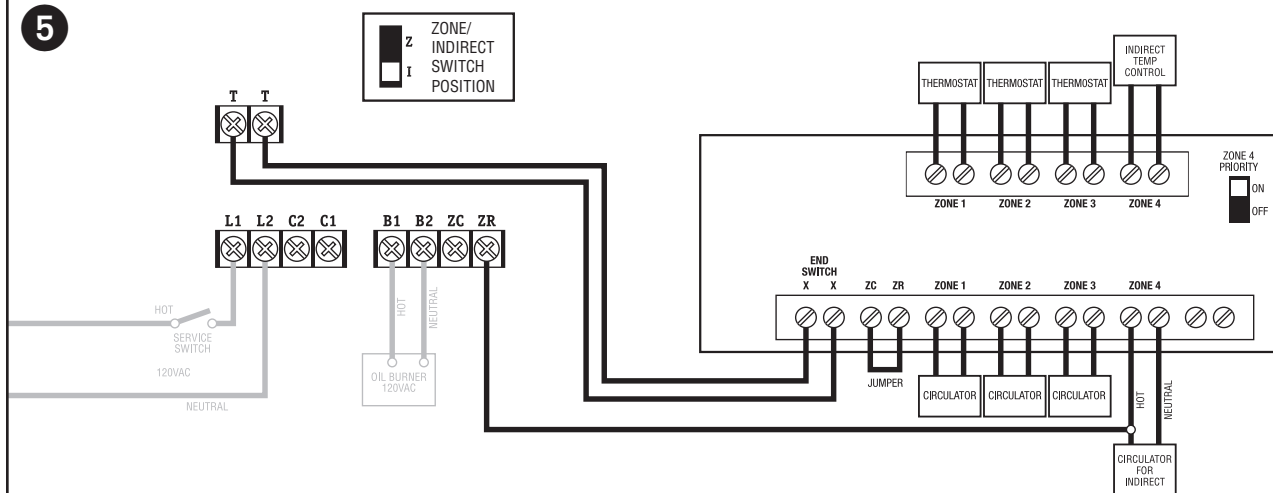
⚠ WARNING **Electrical shock hazard.** To prevent electrical shock, death or equipment damage, disconnect power supply before installing or servicing this control.

NOTE: For proper operation of the boiler reset function, all heating thermostats must input to **T-T** or **ZC-ZR** terminals as indicated below. Jumping the T-T terminals and wiring the thermostat to the primary will override the economy feature.

STEP 3B: HEATING and Indirect Water Heater – continued

SINGLE CIRCULATOR — Typical Multiple Zone Valve Panel with Indirect

7
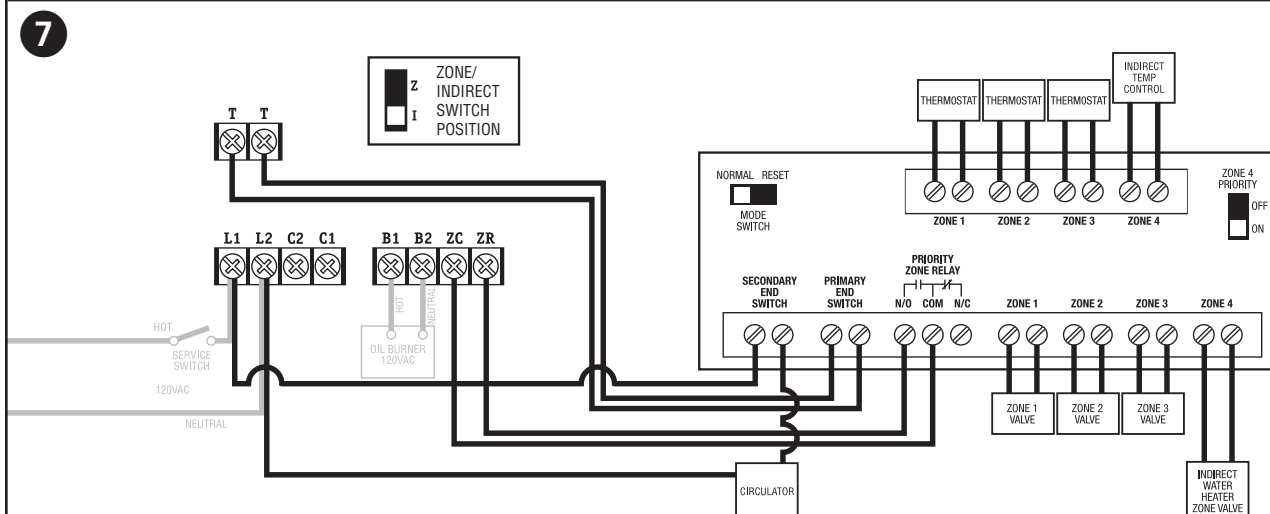
NOTE – If a Zone Valve Control Panel has no priority zone: To ensure adequate boiler temperature to satisfy the domestic hot water tank, it may be necessary to turn the Economy Feature off.

MULTIPLE CIRCULATORS — Typical Three Zone Switch Relay
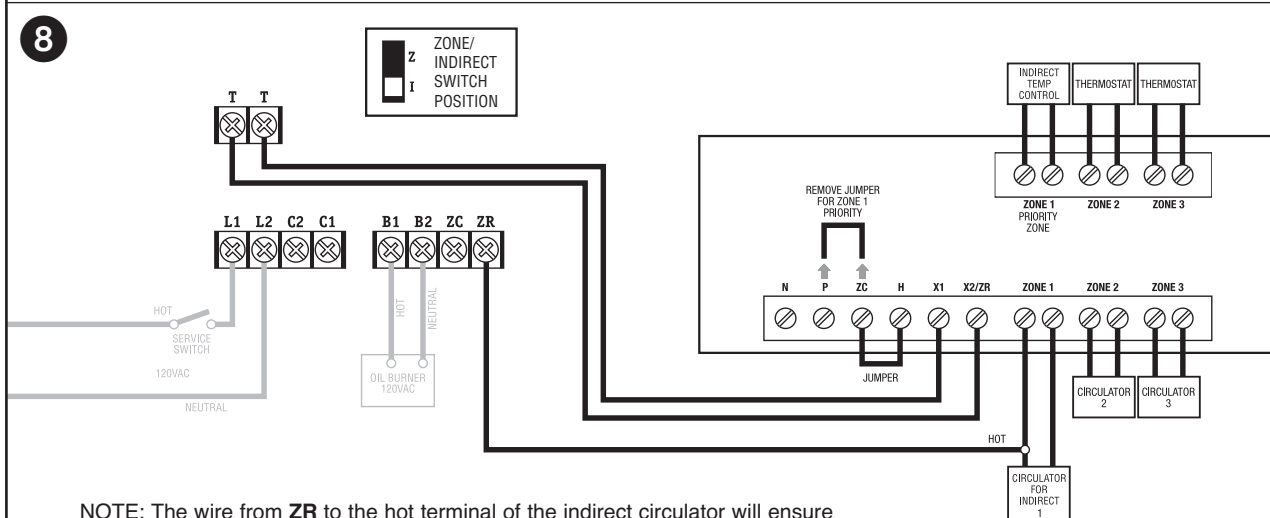
8

NOTE: The wire from **ZR** to the hot terminal of the indirect circulator will ensure that indirect calls will fire to limit and receive priority over heating calls.
Taco's SR503 combines ZR amd X2.

SETTING THE CONTROL

NOTE: Settings can be checked using the TEST/SETTINGS Button. See page 8 for details.

Setting the High Limit

The high limit is factory set at 190°F. To adjust, turn the HI TEMP Dial **A** until the desired setting is displayed. (Setting range: 100°-220°F)

Setting the Low Limit

The low limit is designed to maintain temperature in boilers equipped with tankless coils used for domestic hot water. The low limit is factory set to OFF. Prior to adjusting, remove the jumper (not equipped on all units) **B**. Then turn the LO TEMP Dial **C** clockwise until the desired temperature is displayed. For proper operation, the low temperature limit setting should be at least 10° below the high limit setting. **NOTE:** For cold start operation, the low limit must be turned OFF. **IMPORTANT:** If low limit temperature cannot be set above 140°F, remove jumper **B**. (Setting range: OFF or 110°-200°F).

Setting the Economy Feature

The Economy Feature is factory set for a 1 zone heating system. To adjust, turn the ECONOMY Dial **D** until the number displayed equals the number of heating zones. **Do not include indirect water heaters in the number of heating zones.** The Economy Feature conserves fuel by reducing boiler temperature (see "How Thermal Targeting Works" below). If the heating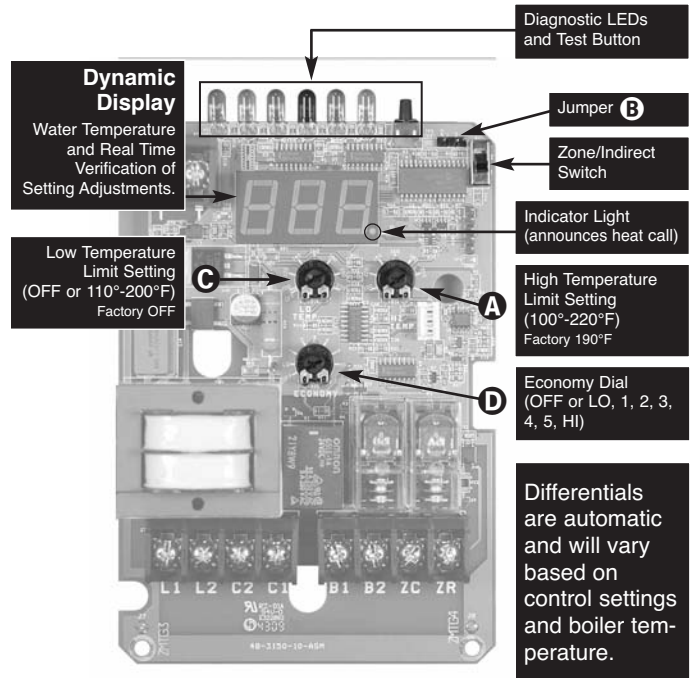 system is unable to supply needed heat to the house, the ECONOMY Dial should be turned to a lower setting (example: In a three zone house, turn the dial to 2 or 1). Conversely, if the boiler provides adequate heat, added fuel savings can be achieved by selecting a higher setting (example: 4 or 5). If the heating and indirect water heater signals were not separated when wiring the control, the Economy Feature should be turned OFF to ensure the boiler supplies adequate temperature to heat the indirect tank.

SETTING	
OFF	Disables economy function. Will allow boiler to fire until hi-limit temp is reached and re-fire with a 10° subtractive differential.
LO	Provides lowest level of fuel savings. Use this setting only if the house does not stay warm at higher settings.
1	Recommended setting for single zone systems
2	Recommended setting for Two zone systems
3	Recommended setting for Three zone systems
4	Recommended setting for Four zone systems
5	Recommended setting for Five zone systems
HI	Provides highest level of fuel savings

Dynamic Display — Water Temperature and Real Time Verification of Setting Adjustments.

Diagnostic LEDs and Test Button

Jumper **B**

Zone/Indirect Switch

Indicator Light (announces heat call)

Low Temperature Limit Setting (OFF or 110°-200°F) Factory OFF **C**

High Temperature Limit Setting (100°-220°F) Factory 190°F **A**

Economy Dial (OFF or LO, 1, 2, 3, 4, 5, HI) **D**

Differentials are automatic and will vary based on control settings and boiler temperature.

Setting the Zone/Indirect Switch

See WIRING on page 4-6.

Activating Thermal Pre-Purge (optional)

NOTE: Activation of this feature is not recommended for boilers with tankless coils.

Fuel Smart HydroStat has a Thermal Pre-Purge feature to maximize efficiency. When activated, the control will purge higher boiler temperatures down to 135° at the start of any thermostat call and supply the latent energy in the boiler to the heating zone that is calling. During the purge cycle, the display will indicate **Pur.** If the heat is not sufficient to satisfy the thermostat, the control will energize the burner. This feature works with single- and multi-zone heating systems utilizing circulators or zone valves. No change in wiring is needed.

To Activate Thermal Pre-Purge
Push and hold the TEST/SETTINGS button for 20 seconds. The display will read **Pur On.** To deactivate the feature, push and hold the button a second time for 20 seconds. The display will read **Pur OFF.**

SYSTEM START-UP

At initial start up, with the Economy Feature active, the control establishes a 145°F target temperature. To test the high limit shut-off function, the Economy Dial must be turned to OFF. Once tested, restore the Economy setting. If the heating demand is high, the target will increase over time to satisfy the heat load. **NOTE: To reduce the potential for condensing, the control will allow the boiler to heat to 120°F prior to energizing the circulator.**

HOW THERMAL TARGETING WORKS

Thermal Targeting technology analyzes thermostat activity and continually evaluate how much heat the house requires. When it is very cold outside, the heat demand is high and the Fuel Smart HydroStat will raise the boiler's Target temperature to provide needed heat to the home. When the outside temperature is milder, the heat demand is lower. During these periods, the Fuel Smart HydroStat will lower the boiler's Target temperature – saving fuel – while continuing to provide comfort to the house.
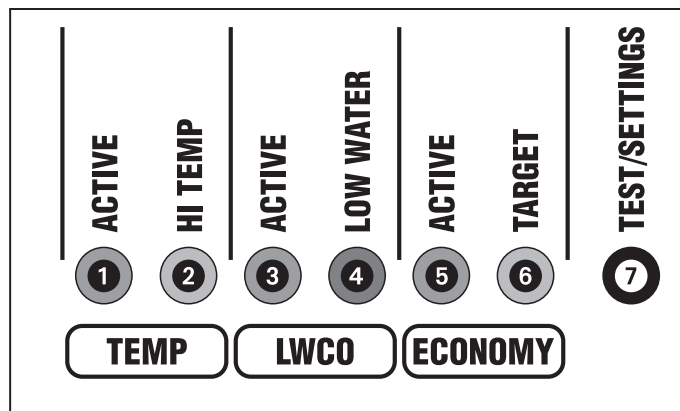
❶ TEMP **ACTIVE** Indicates that the Fuel Smart HydroStat control is powered and that the temperature function is active.

❷ TEMP **HI TEMP** Illuminates when the boiler water temperature reaches the high limit setting. It will remain lit until the water temperature falls 10°. The Fuel Smart HydroStat prevents burner operation while this LED is on. See Differential explanation on page 7.

❸ LWCO **ACTIVE** Indicates that the low water cut-off (LWCO) function of the Fuel Smart HydroStat is active. When the control is installed with a Hydrolevel Electro-Well, this LED will be on at all times when the control is powered. **IMPORTANT:** If the control is installed with a well other than the Electro-Well, this LED will not illuminate indicating that the control is not providing low water cut-off functionality.

❹ LWCO **LOW WATER** Illuminates if the boiler is in a low water condition. The Fuel Smart HydroStat will prevent burner operation during this condition. **IMPORTANT:** The system must be checked by a qualified heating professional prior to resuming operation.
WARNING: DO NOT ADD WATER UNTIL THE BOILER HAS FULLY COOLED.

❺ ECONOMY **ACTIVE** Indicates that the Thermal Targeting function is active and the Fuel Smart HydroStat will reduce boiler temperature to conserve fuel. The Economy feature is activated using the ECONOMY dial. (See "How Thermal Targeting Works" on page 7 for more information).

❻ ECONOMY **TARGET** When the Economy feature is active, the Fuel Smart HydroStat continually sets target temperatures below the high limit setting to maximize fuel efficiency. When the boiler water reaches the target temperature, the LED illuminates and the burner will shut down. The boiler water will continue to circulate and heat the house as long as the thermostat call continues. The LED will stay lit until the boiler temperature drops below the differential set point at which point the boiler will be allowed to fire again. See Differential explanation on page 7. **NOTE:** This LED illuminates regularly during normal boiler operation.

❼ TEST/SETTINGS Button

To Test Low Water Cut-Off: Press and hold the Test/Settings button for 5 seconds. The display will read LCO.

LWCO TEST LCO

The red Low Water light should illuminate and the burner circuit (B1 and B2) should de-energize. **NOTE:** The control must be installed with a Hydrolevel Electro-Well for low water cut-off functionality (see page 2 for more details).

To View Current Settings: Press and release the Test/Settings Button in short intervals to sequentially display the following settings:

HIGH LIMIT SETTING HL
▼
LOW LIMIT SETTING LL
▼
ECONOMY SETTING ECO
▼
CURRENT TARGET TEMPERATURE $\square\square\square$
▼
PRE-PURGE SETTING Pur

The display will return to boiler temperature (default) if Test/Settings Button in not pressed for 5 seconds.

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Burner Will Not Fire	See Flow Chart 1, page 10
Burner Will Not Shut Down	See Flow Chart 2, page 11
Temperature Display Exceeds High Limit Setting	Under normal operation, boiler temperature will continue to rise after the control shuts off the burner. This condition, known as "thermal stacking", results from hot boiler surfaces continuing to release heat into the boiler water.
No or Insufficient Domestic Hot Water	For boilers equipped with a tankless coil, make sure the low limit setting on the HydroStat is set properly. **NOTE:** If the low limit setting is dialed fully counter clockwise, it will shut off the low temperature maintenance feature and will function as a cold start control. If installed with an indirect water heater, check that the Zone/Indirect Switch is set in the Indirect (**I**) position. Verify that the end switch in the relay box controlling the indirect water heater is connected to the **ZC-ZR** terminals. This will ensure that the domestic water calls are prioritized. (see "Heating and Indirect Water Heater" on page 4-6).
Boiler Will Not Maintain Low Limit Temperature	Check for overlapping high temperature setting. If the high limit setting is set below the low limit setting, the control will default to the high limit setting and the corresponding high limit differential setting.
House Will Not Get or Stay Warm	1. Check for air-bound radiators. 2. Check thermostat settings including heat anticipator settings (common on non-digital thermostats). 3. Check the Economy setting. The Economy feature, much like outdoor reset controls, lowers average boiler temperature and can slow or, in some cases, prevent the house from coming up to temperature. Move to a lower setting (see "Setting the Economy Feature" on page 7).
Circulator Contacts C1 and C2 Not Energized on Call for Heat	Check to see that boiler water is at or above 120°F. On a call for heat, the control will not permit the circulator to operate if the boiler water temperature is below 120°F.

Troubleshooting Flow Chart 1 – Burner Will Not Fire

Does the Display Read *Pur*? — **YES** → **The Control is Purging Latent Heat from the Boiler.** → The Thermal Pre-Purge feature holds off the burner until the circulator has purged the boiler temperature down to 135°F.

NO ↓

Is the Green LED (TEMP ACTIVE) On? — **NO** → **The Control is Not Powered.** → The Temp Active LED will be on at all times when the control is powered.
▶ Check for 120 VAC on terminals L1 and L2.

YES ↓

Is the Red LED (LOW WATER) On? — **YES** → **The Control is Sensing Low Water.** → CAUTION – ALWAYS ALLOW A BOILER TO COOL BEFORE ADDING WATER
The burner will not fire until the low water condition is satisfied.
▶ Check that the system is filled with water.
▶ Check that the sensor is inserted correctly into well.
Note: The use of heat-conductive grease may interfere with the contact between the spring clip and the copper well tube.
▶ Check that the control is tightly clamped to the well.

NO ↓

Is the Yellow LED (HI TEMP) On? — **YES** → **The Control is Sensing High Temperature.** → The burner will not fire until the boiler water has dropped to the high limit differential set-point (10° below high limit setting).
▶ Check that the high temperature setting is correct.

NO ↓

Is the Yellow LED (TARGET) On? — **YES** → **The Boiler has Reached the Target Temperature.** → When the ECONOMY function is active, the control monitors heating demand and establishes Target boiler temperatures below the high limit setting to conserve fuel (see "How Thermal Targeting Works" on page 7). The burner will not fire until the boiler temperature drops to the automatically calculated Target Temp Differential.

NO ↓

Is the Thermostat (T-T) Calling for Heat? — **NO** → **Is the External Zone (ZC-ZR) Calling for Heat?** — **NO** → **Is the Low Limit Dial Set to OFF?** — **YES** → When the low temperature setting is set to OFF, the HydroStat will act as a cold start control. The burner will not fire unless there is a call from the thermostat (T-T) or an external zone (ZC-ZR).
▶ Set thermostat to call for heat. Burner should fire.
▶ If the boiler has a tank-less coil, set the Low Temperature Limit to maintain temperature.

(Thermostat **YES**) ↓   (External Zone **YES**) ↓   (Low Limit Dial **NO**) ↓

Is There 120 VAC Between B1 and B2? — **YES** → **The Control is Operating Properly.** → HydroStat is supplying 120 VAC to the burner circuit.
▶ Recheck wiring and operation of burner and other limit controls.

NO ↓

Replace Control → If both the red and yellow LEDs are off and there is a call to fire the burner, there will be 120 VAC on terminals B1 and B2.
▶ If 120 VAC is not present, the control should be replaced.

Troubleshooting Flow Chart 2 – Burner Will Not Shut Down

Is the Red LED (LOW WATER) On? — YES → **The Control is Sensing Low Water.**

NO ↓

Is either Yellow LED On? — YES → **The Control has Reached Target or High Limit Temperature.**

⚠ **WARNING!**

TURN OFF POWER TO BURNER IMMEDIATELY!
CAUTION – ALWAYS ALLOW A BOILER TO FULLY COOL BEFORE ADDING WATER.

► Recheck wiring. Make sure that burner is wired to B1. Burner should never fire when red or yellow LED is lit.

NO ↓

Is the Thermostat (T-T) Calling for Heat? — YES → **The Control is Operating Normally.**

The burner will continue to fire when there is a call from the thermostat or external zone.

NO ↓

Is the External Zone (ZC-ZR) Calling for Heat? — YES → **The Control is Operating Normally.**

NO ↓

Is the Low Limit Dial Set to OFF? — NO →

► Check temperature display. When the Low Limit is set, the HydroStat will fire the burner until the temperature reaches the Low Limit Setting.

YES ↓

Is there 120 VAC between B1 and B2? — NO → **Recheck Wiring.**

When there is no call to fire the burner, the voltage should be 0 volts between B1 and B2.

► Make sure the burner is wired to B1.

YES ↓

Replace Control.

If there is no call for heat (from T-T, ZC-ZR or Low Limit), there should be 0 VAC between B1-B2.

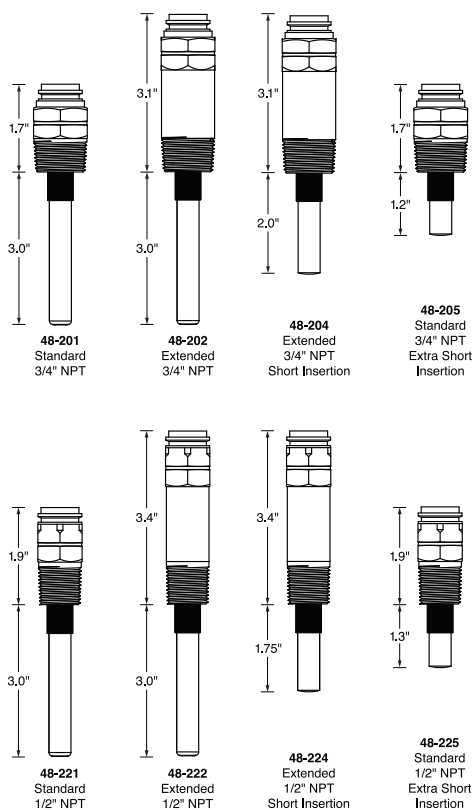► If there is voltage between B1-B2, the control should be replaced.

MAINTENANCE

Remove the Electro-Well from the heating system every five years and clean any scale or sediment deposits from all parts that are exposed to the boiler water. After cleaning, reinstall the well using pipe sealing compound. **Teflon tape is not recommended.**
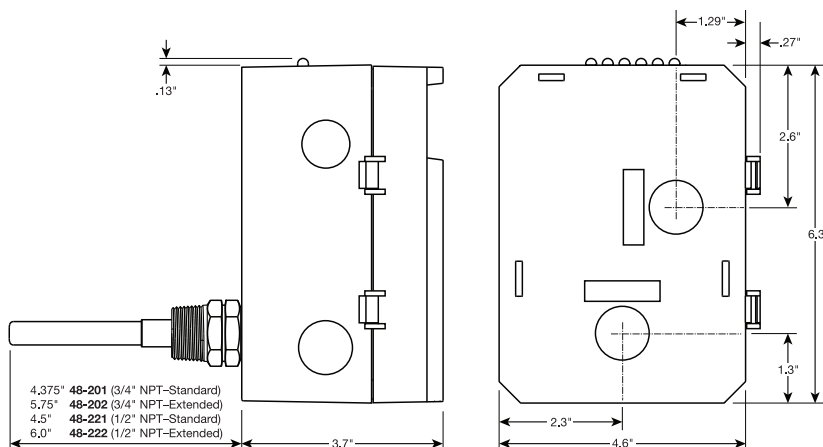
REMOTE MOUNTING KITS

Part No.	Description
48-101	HydroStat Remote Mount Kit with 24" sensor
48-102	HydroStat Remote Mount Kit with 48" sensor

Part No.	Description
48-103	HydroStat Remote Mount Kit with 10' sensor
48-104	HydroStat Remote Mount Kit with 20' sensor
48-121	HydroStat Pipe Mounting Kit with 48" sensor

ELECTRO-WELLS

3.1"
1.7"
3.0"
48-201
Standard
3/4" NPT

3.1"
3.0"
48-202
Extended
3/4" NPT

3.1"
2.0"
48-204
Extended
3/4" NPT
Short Insertion

1.7"
1.2"
48-205
Standard
3/4" NPT
Extra Short
Insertion

3.4"
1.9"
3.0"
48-221
Standard
1/2" NPT

3.4"
3.0"
48-222
Extended
1/2" NPT

3.4"
1.75"
48-224
Extended
1/2" NPT
Short Insertion

1.9"
1.3"
48-225
Standard
1/2" NPT
Extra Short
Insertion

DIMENSIONS

.13"
1.29"
.27"
2.6"
6.3"
1.3"
2.3"
4.6"
3.7"

4.375" **48-201** (3/4" NPT–Standard)
5.75" **48-202** (3/4" NPT–Extended)
4.5" **48-221** (1/2" NPT–Standard)
6.0" **48-222** (1/2" NPT–Extended)

SPECIFICATIONS FUEL SMART HYDROSTAT MODEL 3250

Input voltage	120 VAC, 60 HZ
Burner contacts	7.4 FLA, 44.4 LRA@120 VAC
Circulator contacts	5.8 FLA, 34.8 LRA@120 VAC
Operating range – low limit	Off or 110°F - 200°F (43°C - 93°C)
Operating range – high limit	100°F - 220°F (38°C - 104°C)

(UL) LISTED

MADE IN

LIMITED MANUFACTURER'S WARRANTY

HYDROLEVEL COMPANY 83 Water Street • New Haven, CT 06511 • Phone (203) 776-0473 • FAX (203) 773-1019 • www.hydrolevel.com