TECHNICAL INSTRUCTIONS

Benchmark® 3.0LN 24-Month Maintenance Kit# 58015-04

This kit applies to units with an Ignitor and a separate gas injector.

For units with an Ignitor-Injector (P/N 58023), see Kit 58025-04 and TID-0065.

Maintenance Kit 58015-04 Contents

ITEM 1
Igniter
P/N **GP-122435-S**

ITEM 2
Flame Detector
P/N **66034**

ITEM 3
Flame Detector Gasket
P/N **81048**

ITEM 4
Gas Injector Gasket
P/N **81047**

ITEM 5
Exhaust Manifold Seal
P/N **49102**

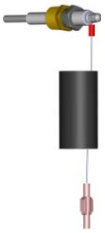
ITEM 6
Burner Gasket
P/N **81030**

ITEM 7
Condensate Trap O-Ring
P/N **84017**

ITEM 8
Condensate Trap Orifice Gasket
P/N **81092**

ITEM 9
Exhaust Manifold Orifice Gasket
P/N **81098**

ITEM 10
Burner Housing Gasket
P/N **81019**



ITEM 11
LWCO Kit
P/N **69126**

Latest Release: 10/12/2017 **(Replaces TSB-2009-15)**

DISCLAIMER

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1. INTRODUCTION

This Technical Instruction Document provides the procedures to perform waterside and fireside inspections of the heat exchangers contained in Benchmark 3.0LN and 3.0LN Dual-Fuel Boilers.

The replacement parts required to perform the waterside and fireside inspections on the Benchmark 3.0LN and 3.0LN Dual-Fuel Boilers are provided in the 24 - Month Inspection Kit, part number **58015-04**, listed and described in section 2.

2. CONTENTS OF KIT 58015-04

The items included in the 24 Month Inspection Kit required for Benchmark 3.0LN and 3.0LN Dual-Fuel Boilers are listed in Table 1.

Table 1. Benchmark 3.0LN: 24 Month Inspection Kit, Part Number 58015-04

ITEM	QTY	PART NO.	DESCRIPTION
1	1	GP-122435-S	IGNITER
2	1	66034	FLAME DETECTOR
3	1	81048	FLAME DETECTOR GASKET
4	1	81047	GAS INJECTOR GASKET
5	1	49102	EXHAUST MANIFOLD SEAL
6	2	81030	BURNER GASKETS
7	1	84017	CONDENSATE TRAP O-RING
8	1	81092	CONDENSATE TRAP ORIFICE GASKET (.25" I.D.)
9	1	81098	EXHAUST MANIFOLD ORIFICE GASKET
10	1	81019	BURNER HOUSING GASKET
11	1	69126	LWCO / CAPACITOR ASSEMBLY KIT

3. TOOLS, TEST EQUIPMENT & MATERIALS REQUIRED

The items required to perform the inspections, replacements and tests specified in this document are listed in section 3.1, 3.2 and 3.3 which follow.

3.1 Tools

Common hand tools, plus the items listed below are required:

- Small Wire Brush
- Spark Gap Feeler Gauge

3.2 Test Equipment

No test equipment is required to perform the 24 - month inspections include in this document. However, following completion of these inspections, the Benchmark Boiler should be tested using the combustion calibration procedures provided in O & M Manual GF-116, or GF-117. See section 7.2 for instructions.

3.3 Materials

Expendable materials required to perform the procedures described in this document are not included in the 24 -Month Inspection Kits. These materials may include such items as:

- Pipe joint compound
- Teflon tape
- Cleaning solvents and materials
- High-temperature anti-seize compound

4. PRELIMINARY INSPECTION PROCEDURES

Perform the preliminary set-up and disassembly procedures in this section before performing the waterside and fireside inspections included in this document.

WARNING!

High voltages are used to power these boilers and so it is required that all power applied to these boilers is removed first before performing any of the procedures described in this document. Serious personal injury or death may occur if this warning is not observed.

1. At the front panel of the unit, set the **ON/OFF** switch on the C-More Control Panel to the **OFF** position.
2. Disconnect electrical power to the unit by turning off the external circuit breaker.
3. **Turn off the external gas supply shutoff valve**.
4. Close the water supply and return valves to the unit.
5. Refer to Figure 1 and remove the top and side panels of the unit.
6. With the top and side panels removed, the burner, heat exchangers and exhaust manifold can be accessed to prepare the boiler for the required waterside and fireside inspections described in sections 5 and 6.

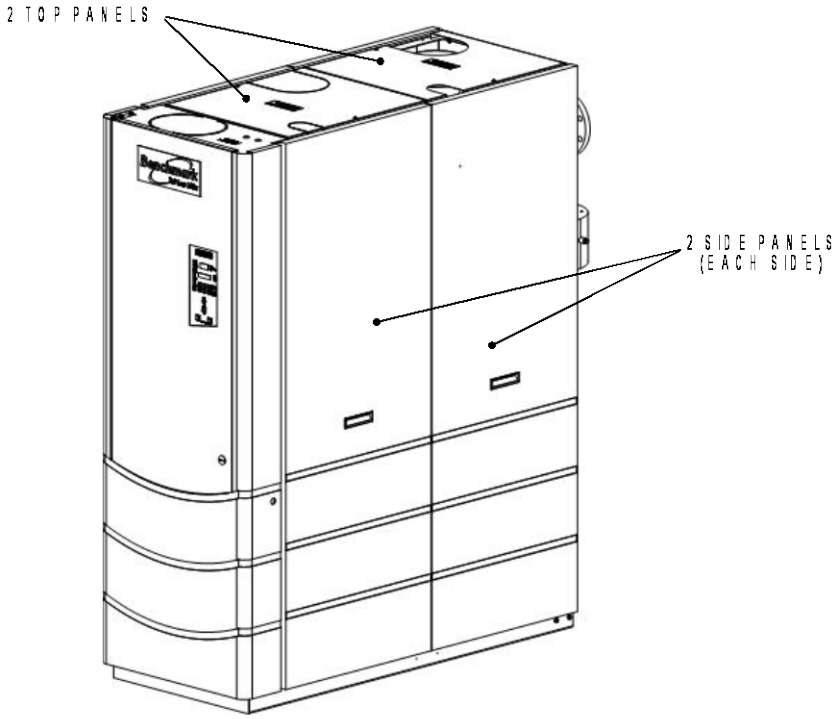

Figure 1. Benchmark 3.0 Low NOx (LN) Boiler

5. WATERSIDE INSPECTION OF BENCHMARK 3.0 HEAT EXCHANGER

Benchmark 3.0LN units contain both a primary heat exchanger and a secondary heat exchanger, as shown in Figure 2. Perform the waterside inspection as follows:

1. Ensure that the preliminary set-up and disassembly procedures in section 4 have been performed to provide access to the unit‘s heat exchangers.
2. Allow the unit to cool prior before proceeding.
3. At the rear of the unit (Figure 3), slowly open the drain valve and drain the boiler water from both heat exchangers.
4. Open the P&T relief valve, or loosen/remove the shell sensor to allow air to enter the heat exchangers during draining.
5. After the heat exchangers have been drained, remove the 2-1/2 inch access port plugs on the right side of the primary and secondary heat exchangers, as shown in Figure 2.
6. If waterside inspection is required by your local inspector, follow the inspector's instructions. Upon satisfactory completion of the inspection, proceed to step 7.
7. Apply pipe compound to the threads of the access port plugs and replace them using a pipe wrench.
8. Close the drain valve at the rear of the boiler.
9. Close the P&T relief valve or reinstall/tighten the shell sensor removed in step 4.
10. Open the water supply and return valves to the unit and refill the heat exchangers. This completes the waterside inspection for the unit.

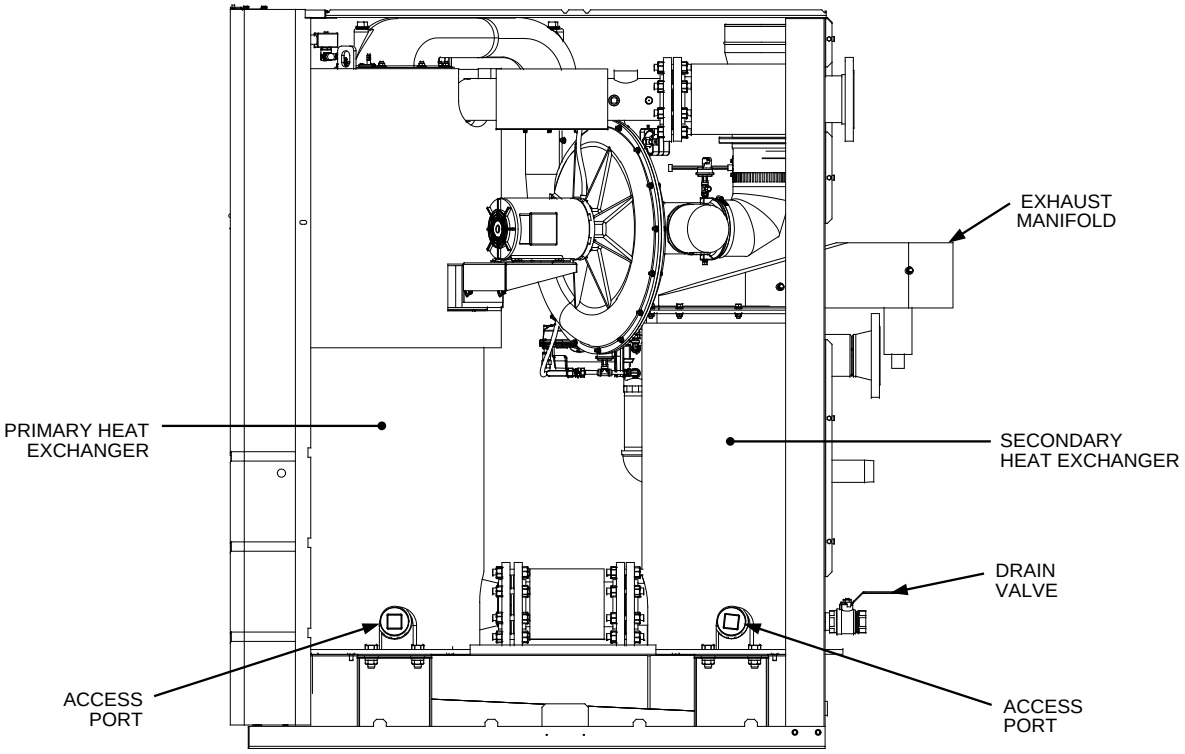

Figure 2. Benchmark 3.0LN - (Right Side View)

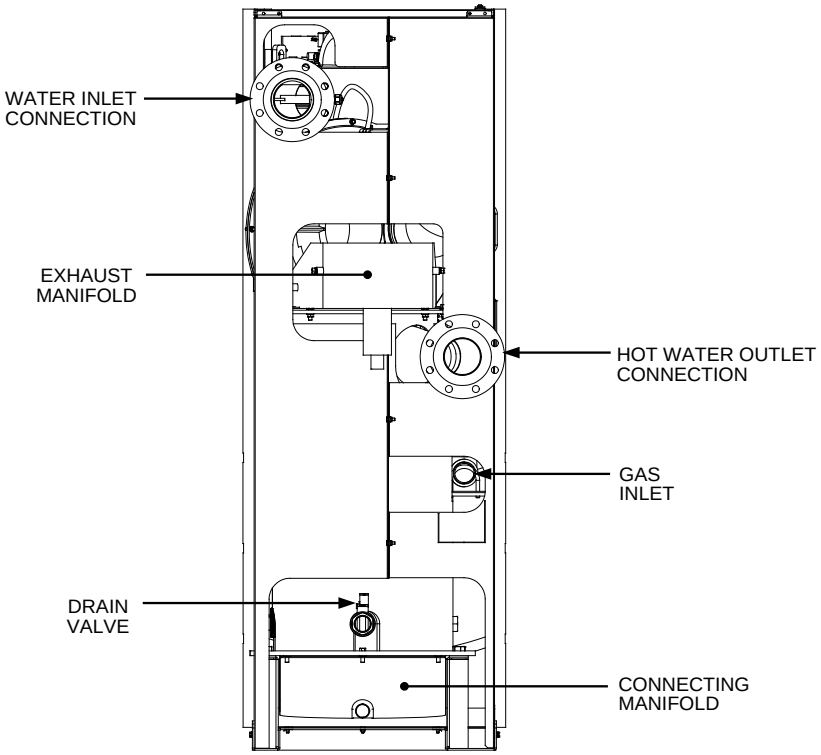

Figure 3. Benchmark 3.0LN - (Rear View)

6. FIRESIDE INSPECTIONS & COMPONENT REPLACEMENTS

Benchmark 3.0LN heat exchanger fireside inspections include removal of the burner and exhaust manifold assembly from the boiler. In addition, the 24 Month Inspection Kit includes the recommended replacement parts for annual maintenance, which should also be performed at this time. Therefore, the procedures in this section are organized as follows:

Fireside Inspections:

- Burner Inspection
- Exhaust Manifold Inspection

Annual Maintenance Replacements:

- Burner Component Replacement
- Condensate Trap Component Replacements

The procedures for the above inspections and replacements are provided in the following sections.

6.1 Fireside Inspection of Benchmark 3.0 Heat Exchangers

Perform the fireside inspections of the low NOx burner (section 6.1.1) and exhaust manifold (section 6.1.5).

6.1.1 Burner Inspection

The burner assembly is located at the top of the primary heat exchanger as shown in Figure 4.

1. Ensure that all preliminary set-up and disassembly procedures in section 4 have been completed.

> **WARNING!**
>
> THE BURNER ASSEMBLY MAY BE EXTREMELY HOT. TO AVOID BURNS, ALLOW IT TO COOL SUFFICIENTLY BEFORE ATTEMPTING TO REMOVE IT FOR INSPECTION.

2. Disconnect the lead wire from the flame detector, shown in Figure 5, below.
3. Remove the two (2) screws securing the flame detector to the burner housing flange and then remove the flame detector and gasket.
4. Disconnect the igniter cable from the igniter (Figure 5), then unscrew and remove the igniter.
5. Remove the two (2) 10-32 screws securing the staged ignition assembly to the burner housing and then separate the staged ignition assembly from the burner. Remove the gas injector gasket (P/N **81070**) from the burner, as it will be replaced during reassembly.
6. Disconnect the burner housing from the blower by removing the six (6) 1/4-20 screws using a 3/8" wrench.
7. Remove the eight (8) 3/8-16 nuts and washers from the burner flange (Figure 5) using a 9/16" wrench.
8. Remove the burner housing from the burner flange by pulling straight up.

NOTE

The burner housing weighs approximately 20 pounds.

9. Remove the grounding screw.

10. If there is an extension ring around the burner, remove it.
11. Remove the burner and two (2) burner gaskets by pulling straight up. Figure 6 shows an exploded view of the Benchmark 3.0LN burner assembly.

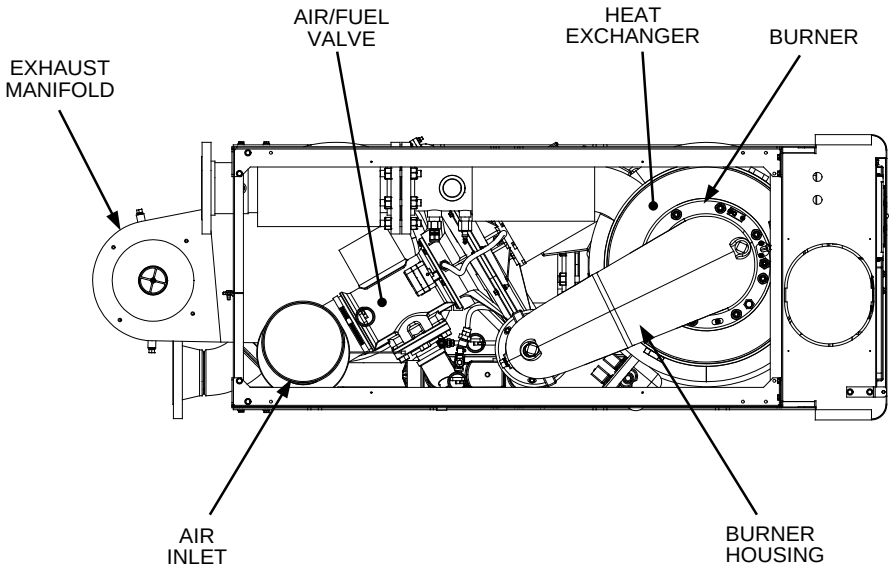

Figure 4. Benchmark 3.0LN - Top View

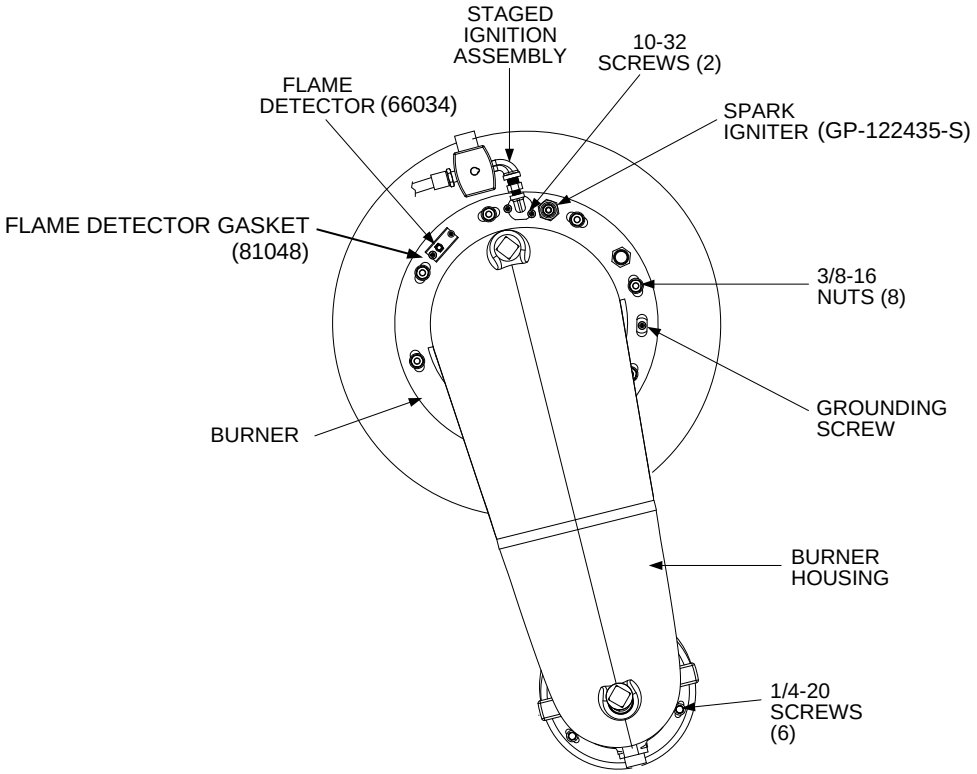

Figure 5. Benchmark 3.0LN Burner Disassembly – Top View

6.1.2 Burner Reassembly

Referring to Figure 6, below, reassemble the burner assembly as described below. The following parts from the kit will be used during this procedure:

- Burner Gasket P/N **81030** (2)
- Burner Housing Gasket P/N **81019**
- Gas Injector Gasket P/N **81047**

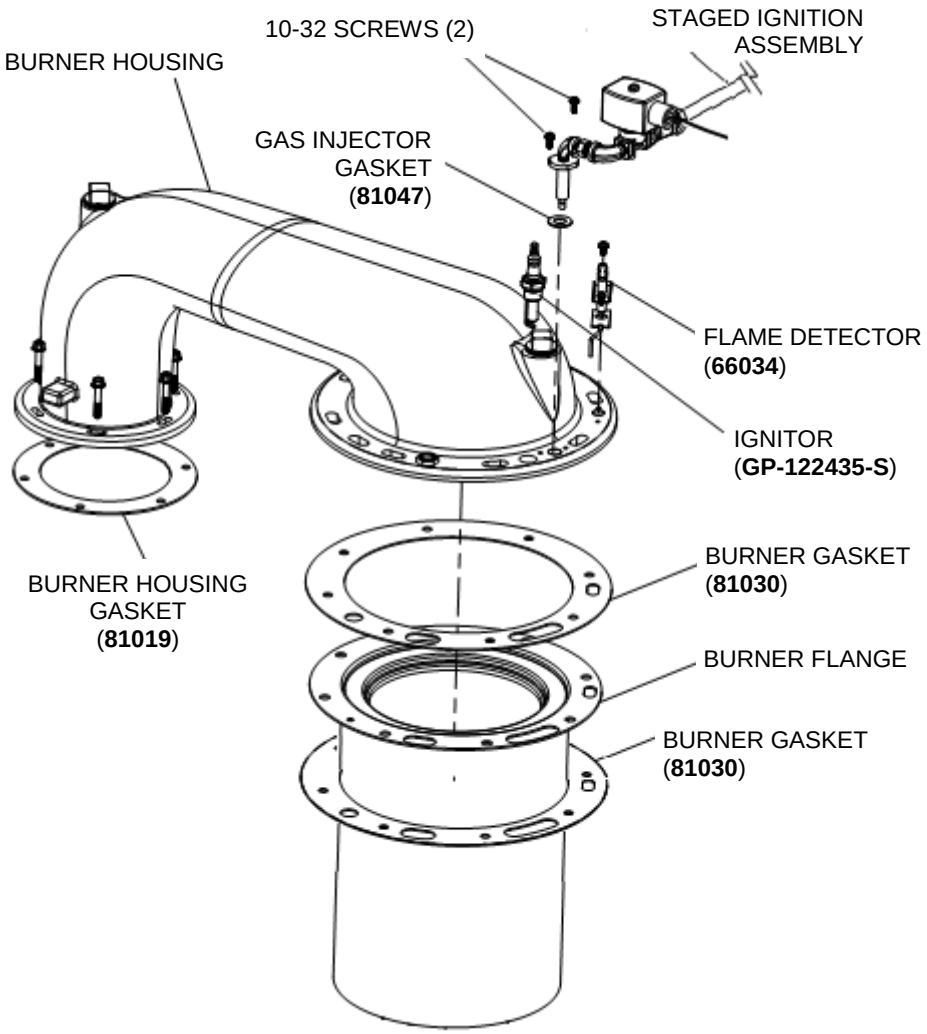

Figure 6. Benchmark 3.0LN Burner Assembly Exploded View

1. Replace both burner gaskets with two new burner gaskets (P/N **81030**), one above and one below the burner flange.

IMPORTANT!

When installing new burner gaskets, it is imperative that the gaskets be properly aligned to assure that the cutouts for the observation port, igniter-injector, and flame detector line up with those in the heat exchanger top plate, burner flange and burner housing. Failure to properly align these items may result in damage to the gaskets or interference with the components.

2. Place the burner back into the heat exchanger.

3. Place the new burner housing gasket (P/N **81019**) on top of the blower, ensuring is positioned correctly in relation to the burner housing's mounting holes.
4. Position the burner housing on the blower and the burner flange, aligning it with both burner and blower.
5. Reinstall the the six (6) 1/4-20 screws that connect the burner housing to the blower, but only hand-tighten them at this point, to ensure proper positioning.
6. If there was an extension ring around the burner at disassembly, replace it.
7. Add one 3/8" flat washers to each of the eight (8) mounting studs coming up through the burner flange, removed in section 6.1.1, step 7.

IMPORTANT!

It is imperative that the burner housing is fully tighten to the top of the heat exchanger ***BEFORE*** its other end is bolted to the blower.

8. Apply Loctite 246 to the mounting studs and then loosely tighten the eight (8) 3/8-16 nuts attaching the burner housing to the burner, and then **torque the eight nuts in a star (or alternating) pattern to 35 ± 5 ft./lbs.** to to ensure a uniform seal.
9. Fully tighten the the six (6) 1/4-20 screws hand-tighten in step 5 to fully connect the burner housing to the blower. **DO NOT ATTEMPT** to pull the burner housing down to meet the blower. If there is a gap, adjust the blower mounting plate till the blower contacts the housing.
10. Check to ensure that the grounding screw is reinstalled. Also, ensure that conductive, high-temperature, anti-seize compound is applied to the threads of the ground screw.
11. Reinstall the staged ignition assembly with the new gas injector gasket (P/N **81070**) on the burner housing using the two (2) 10-32 screws removed in section 6.1.1, step 5.
12. After servicing is complete, perform a water bubble test during purge to ensure the burner gaskets are providing a good seal, as specified in section 7.2.

6.1.3 Igniter Replacement

Complete the instructions below on Benchmark 3.0 LN units to reinstall the igniter (P/N **GP-122435-S**).

1. Using a spark gap feeler gauge, check to ensure that the igniter is gapped at 1/8".
2. Prior to installation, a high-temperature anti-seize compound ***must*** be applied to the igniter threads.
3. Reinstall the igniter in the location shown in Figure 9. Do not over-tighten. A slight snugging up is sufficient.
4. Reconnect the igniter cable.

6.1.4 Flame Detector Replacement

Flame detector (P/N **66034**) and gasket (P/N **81048**) are used on Benchmark 3.0 Low NOx units. Complete the instructions below to replace these parts.

1. Refer to Figure 7 to locate the flame detector installation location.
2. Install the replacement flame detector and gasket in the location shown. Secure the flame detector to the burner housing flange using the two screws removed in section 6.1.1, step 3.
3. Reconnect the flame detector lead wire.

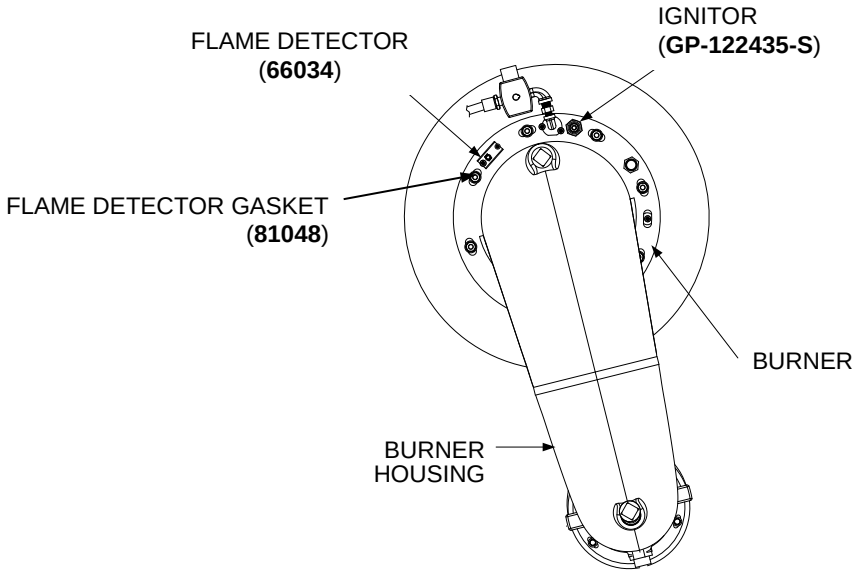

Figure 7. Burner Assembly Igniter & Flame Detector Locations

6.1.5 Exhaust Manifold Inspection

The exhaust manifold of the Benchmark 3.0LN is installed on the top of the secondary heat exchanger, at the rear of the unit, as shown below in Figure 8. Perform the following steps to remove and inspect the manifold:

1. Remove the four (4) bolts securing the flue starter section collar to the top of the exhaust manifold.
2. Disconnect the flue starter section from the exhaust manifold.
3. Disconnect the condensate trap drain hose from the 1-1/2" O.D. pipe on the bottom of the exhaust manifold.
4. Using a 3/4" socket wrench, remove the five (5) bolts securing the exhaust manifold to the heat exchanger (Figure 9). Also, remove the three (3) hex nuts from the manifold PEM studs. Remove the complete exhaust manifold from the unit.
5. Remove the silicone rubber seal from the recess in the flange of the exhaust manifold. Ensure that all seal residue is removed from the flanges of the exhaust manifold and secondary heat exchanger.
6. From the opening at the top of the manifold, remove the condensate trap float (with guide attached). Also, remove the orifice gasket located beneath the float.

7. Inspect and clean the exhaust manifold as necessary.
8. Replace the exhaust manifold seal (P/N **49102**) with the new seal provided in the kit. Install the adhesive-backed seal in the recess of the exhaust manifold flange (Figure 9) so that the adhesive side is in contact with the exhaust manifold.
9. Align the exhaust manifold with the upper flange of the secondary heat exchanger. Secure the manifold in place using the five (5) bolts removed in step 4. Also, replace the hex nuts on the three (3) PEM studs. Alternately tighten the bolts and nuts to obtain a uniform seal.
10. From the opening at the top of the manifold, install the new orifice gasket (0.75" I.D., P/N **81098**) provided in the kit. Ensure that the gasket is lying flat in the bottom of the condensate trap.
11. Next, insert the condensate float (with guide attached) into the trap.
12. Reconnect the 1-1/2" I.D. drain hose to the condensate trap drain opening.
13. Reconnect the flue starter section and collar to the top of the exhaust manifold using the bolts removed in step 1.
14. Benchmark 3.0LN units also contain a second, external condensate trap. This trap is attached to the exhaust manifold at the rear of the unit using an adapter. Disconnect this trap from the manifold and perform the procedure described in section 6.2.2.
15. Upon completion of the procedure described in section 6.2.2, reconnect the condensate trap to the 1-1/2" pipe on the connecting manifold.

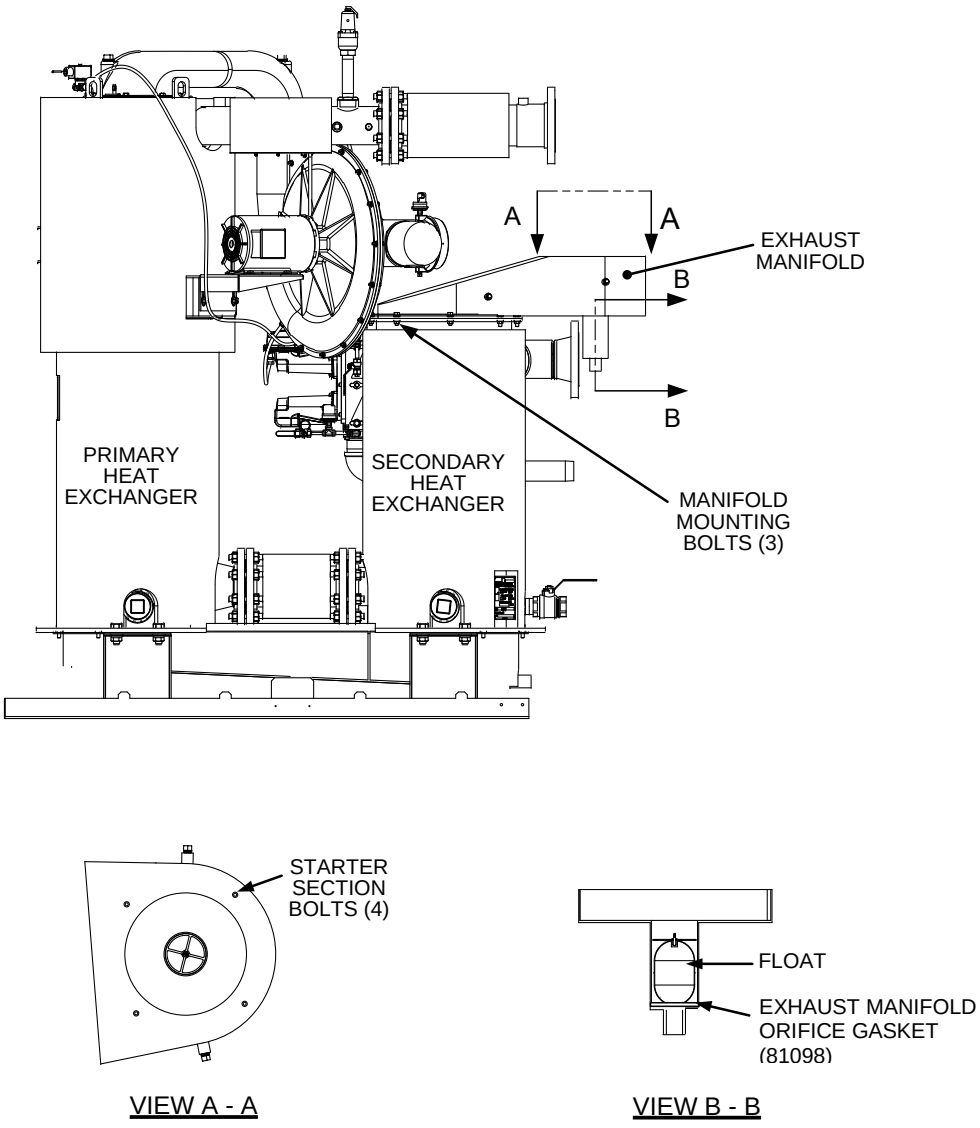

Figure 8. Benchmark 3.0LN Exhaust Manifold Location

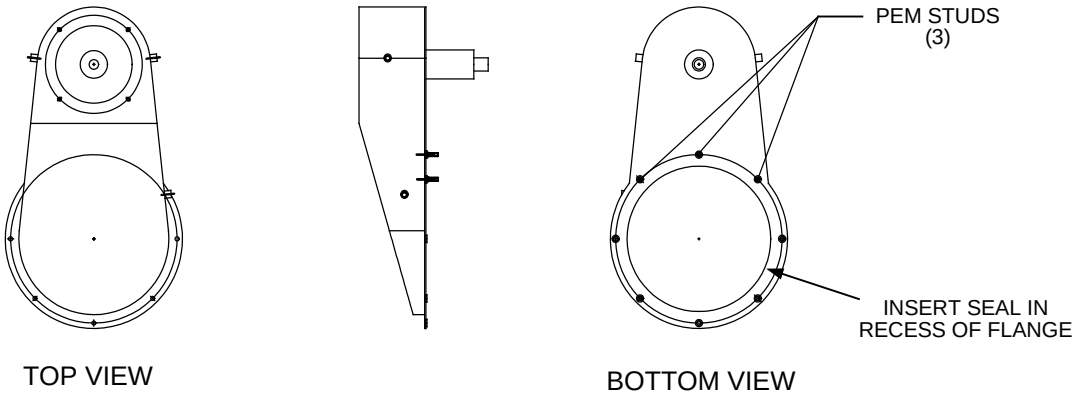

Figure 9. Benchmark 3.0LN Exhaust Manifold

6.1.6 External Condensate Trap Maintenance

NOTE

Benchmark 3.0LN boilers actually contain two condensate traps. One is an integral part of the unit's exhaust manifold. This trap is inspected and serviced during the exhaust manifold inspection procedures described in section 6.1.2. The second, external condensate trap (P/N **24060**), is used on all Benchmark models. The inspection and servicing procedure for the external condensate trap is described below.

NOTE

There are two slightly different types of external condensate traps (P/N **24060**) that may be used at your site; an older style without an inlet adapter, or a newer style with a built-in inlet adapter (see Figure 10). Maintenance is the same, except that the newer style does not need an orifice gasket (Step 6).

For Benchmark 3.0 boilers, the external condensate trap (P/N **24060**) is attached to the connecting manifold drain pipe using a special adapter (Figure 10). This trap should be disconnected from the connecting manifold and serviced as follows:

1. If the trap is still attached to the connecting manifold, loosen the adapter thumb screw and disconnect the trap from the manifold.
2. Remove the connections on the inlet and outlet sides of the condensate trap, as shown in Figure 10.
3. Refer to Figure 10 and loosen the four (4) thumb screws securing the cover on the condensate trap and then remove the cover.
4. Remove and discard the cover O-ring gasket currently installed in trap. It will be replaced with the new O-ring included in the kit during reassembly.
5. Remove the float (with float guide attached) from the condensate trap.
6. On older-style traps, remove and discard the currently installed orifice gasket from the trap. A new orifice gasket will be installed in step 9. The newer traps, with a built-in inlet adaptor, do not use an orifice gasket, so this step may be bypassed for those traps.
7. Thoroughly clean the trap and float. Also inspect the drain piping for blockage. If the trap cannot be thoroughly cleaned, replace the entire condensate trap (P/N **24060**).
8. Check the condensate drain pipe on the connecting manifold (Figure 11) to ensure it is clear of blockage.
9. On older-style traps, replace the orifice gasket with a new gasket included with the kit (P/N **81092**). Ensure that the replacement gasket is lying flat in the trap.
10. Replace the cover O-ring (P/N **84017**) with the new one provided in the kit.
11. Reinstall the float with float guide attached.
12. Replace the condensate trap cover and tighten the four (4) thumb screws.
13. Reassemble all piping and hose connections to the condensate trap inlet and outlet.
14. Reconnect the trap to the connecting manifold drain pipe using the trap adapter (Figure 11). Tighten the adapter thumb screw.
15. Ensure that the trap is horizontal and level to ensure proper drainage.

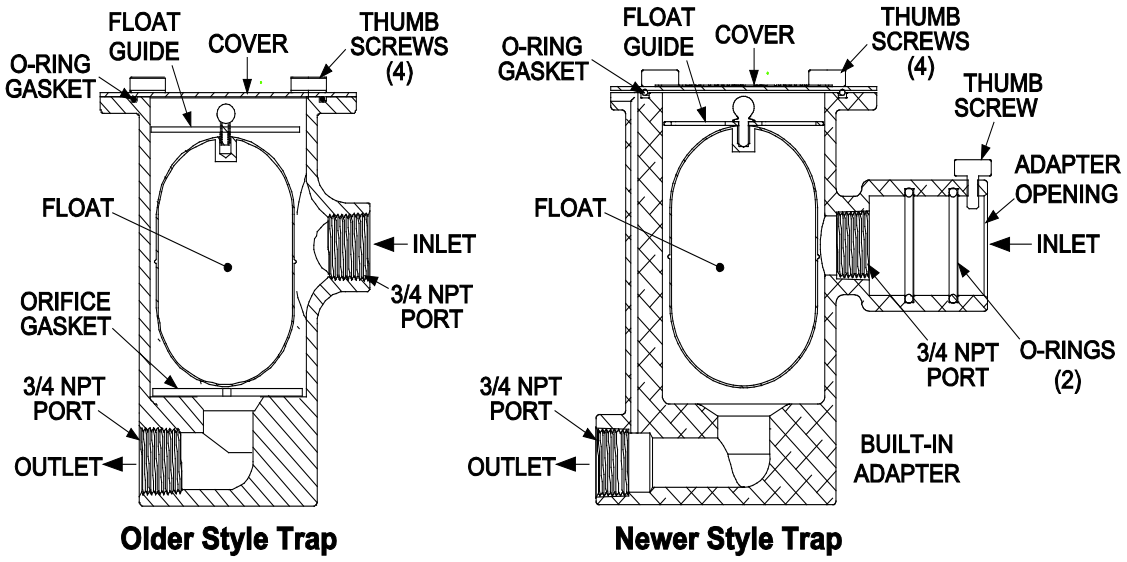

Figure 10. Condensate Trap P/N 24060

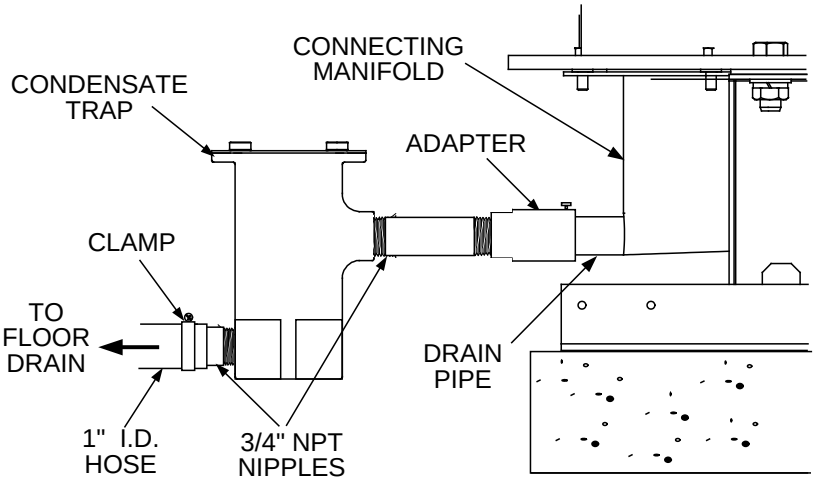

Figure 11. Connecting Manifold Condensate Drain Location

6.2 Replacing the LWCO Probe/Capacitor Assembly

The replacement LWCO probe sensor comes with a capacitor assembly attached. This procedure replaces an old probe assembly with a new probe assembly (P/N **69126**).

1. Cut the shell harness wire just below the female spade connector (Figure 12). The new LWCO assembly includes a new female connector to crimp onto the shell harness wire.

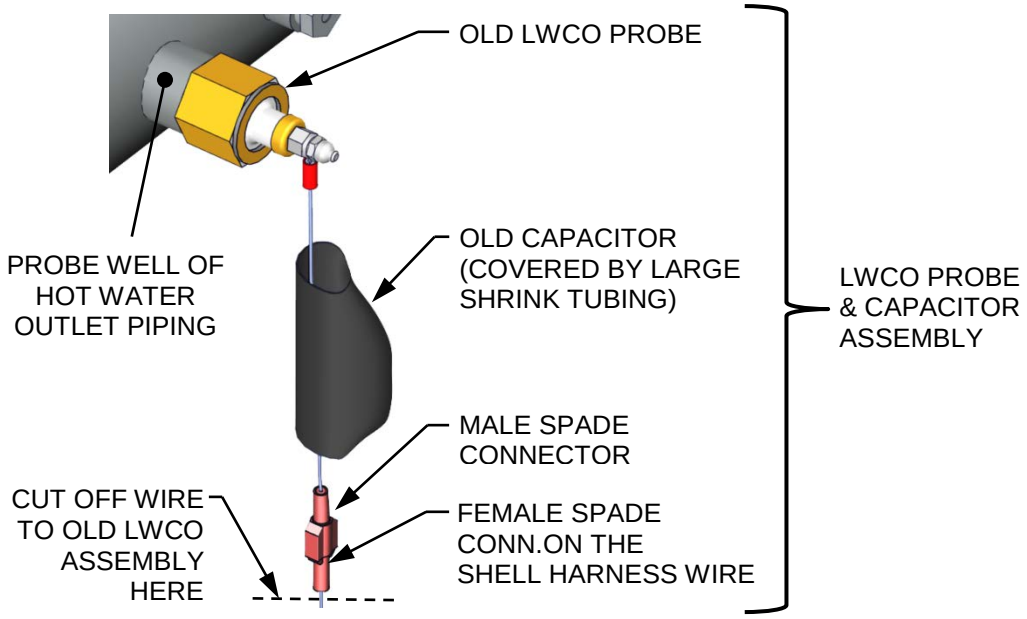

Figure 12: Removing Old LWCO Probe/Capacitor Assembly

2. Remove the LWCO probe from the recess well on the hot water outlet piping by unscrewing the brass coupling to which it is attached.
3. Retrieve the new LWCO probe from the kit and sparingly apply an NSF approved pipe dope to the threads of the brass coupling (Do NOT use Teflon tape) and install into the probe well vacated by the old LWCO probe.
4. The new LWCO assembly comes with a spare female connector already inserted into the male connector, and this should be crimped onto the stripped end of the shell harness wire.

6.3 Low Water Cutoff (LWCO) Capacitor Integrity Test

The LWCO capacitor should be tested for electrical shorts after it has been replaced. The LWCO capacitor integrity test consists of two parts as described in the next two sections. The first procedure explains how to test for electrical shorting of the LWCO probe capacitor, while the second procedure instructs how to perform the standard Low Water Cutoff test using the C-More controls.

Refer to Figure 13 for an illustration of the LWCO probe assembly and its typical installation.

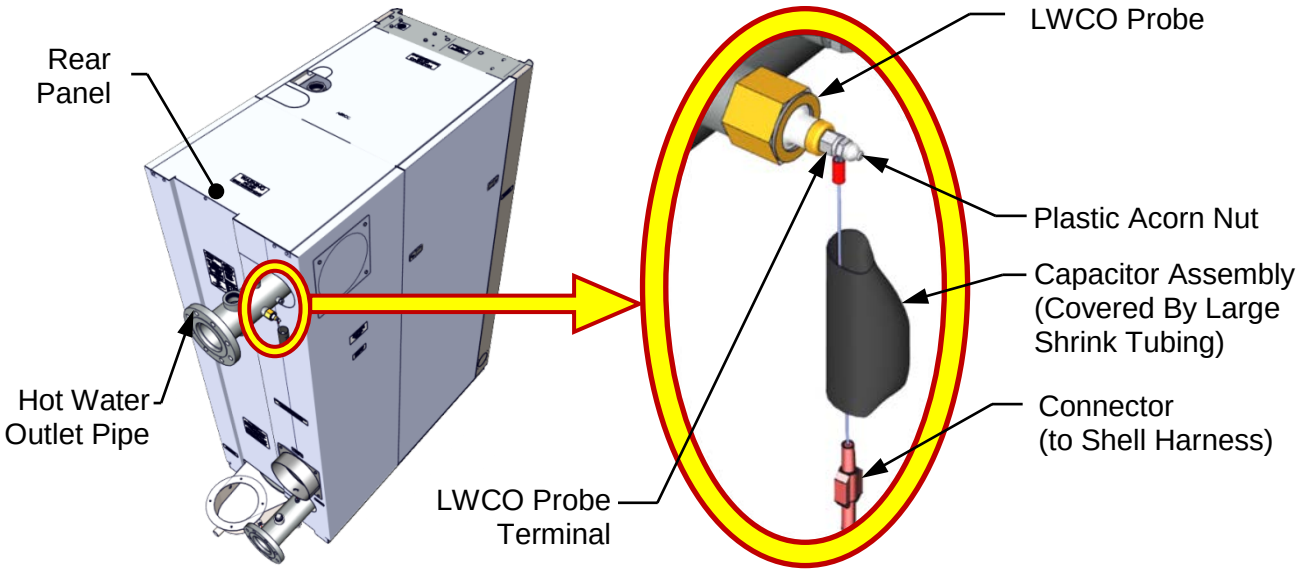

Figure 13: LWCO Probe Location (BMK3000 Shown)

6.3.1 Low Water Cutoff (LWCO) - Capacitor Electrical Short Test

This test determines if there is an electrical short between the LWCO capacitor and the heat exchanger. Perform the capacitor electrical short test as described below.

1. Turn OFF AC power to the unit.

WARNING!

High voltages are used to power these units and so it is required that power applied to these units is removed first before performing the procedure described in this instruction. Serious personal injury or death may occur if this warning is not observed.

2. Remove the Shell Harness Cable (male) connector from the P-5 (female) connector on the rear panel of the C-More controller (see Figure 14).

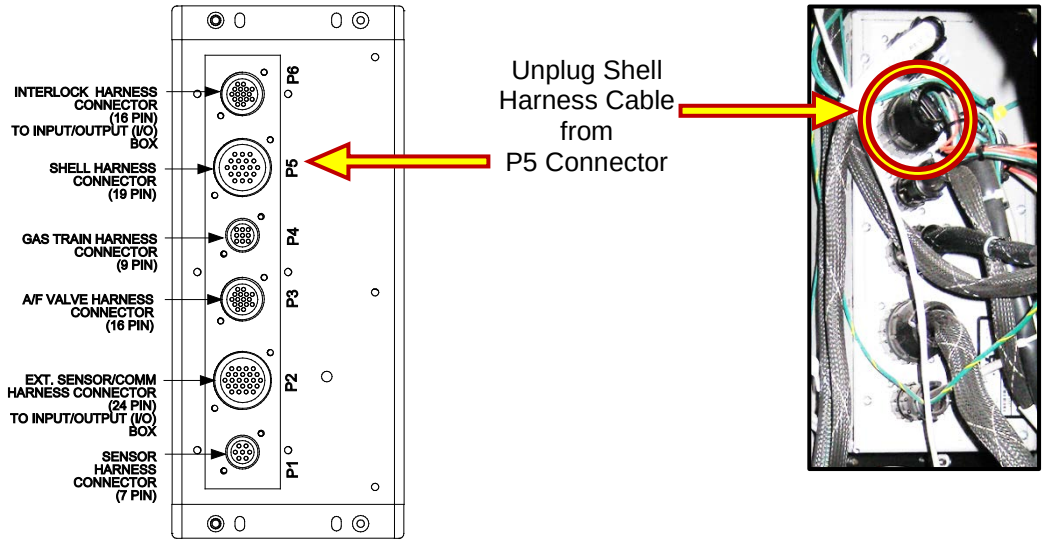

Figure 14: Removing Cable from P5 Connnector

3. Using an ohmmeter, connect one ohmmeter probe to the LWCO capacitor terminal on the unit shell as shown on left in Figure 15.
4. Connect the second ohmmeter probe to Pin #6 of Shell Harness Connector (removed from the C-More controller) as shown on right in Figure 15.

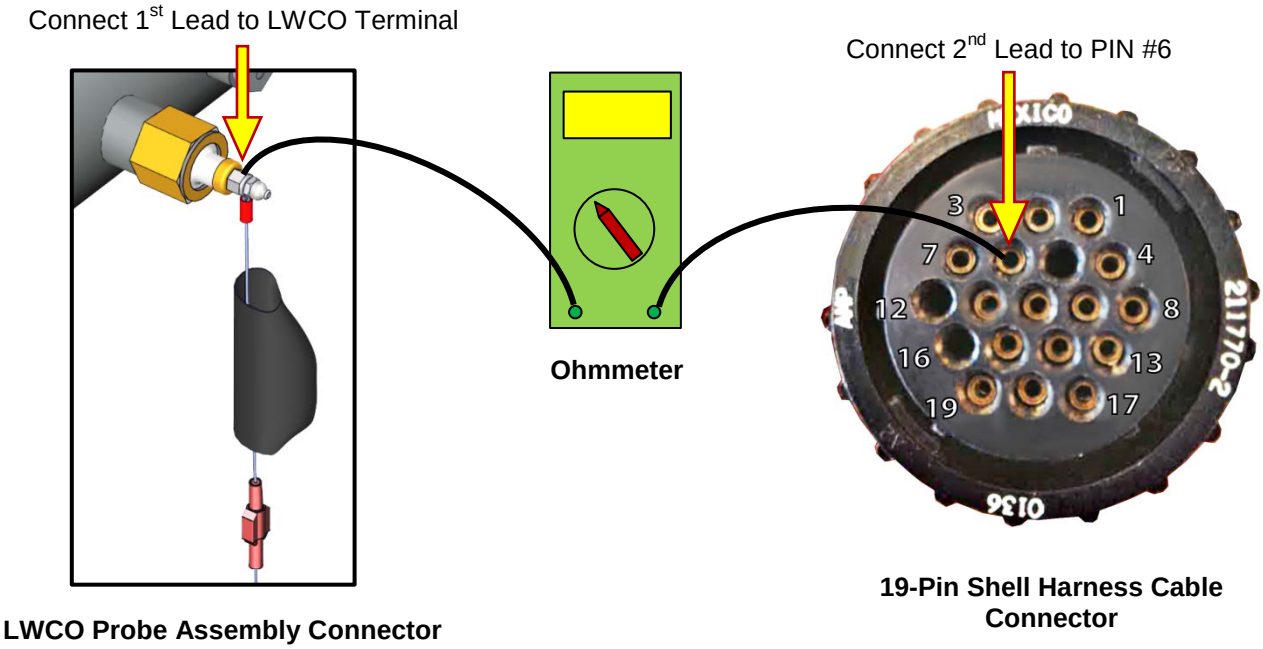

Figure 15: Connecting Ohmmeter between LWCO Probe & Shell Harness Cable

5. Confirm that the ohmmeter does NOT read a short.

NOTE

If the ohmmeter reads a short, the capacitor assembly needs to be replaced. See section 4.9 for replacement instructions or contact AERCO technical support for more information.

6. Remove both ohmmeter probes and reconnect the Shell Harness connector to the P5 connector on the rear of the C-More controller.

7. FINAL REASSEMBLY AND TESTING

Upon completion of all waterside and fireside inspections, reassemble the unit and perform the tests specified in sections 7.1 and 7.2.

7.1 Reassembly and Set-Up Following Completion of Inspections

Following completion of the all required inspections and replacements, perform the following reassembly and setup procedures:

1. Ensure that the heat exchanger has been filled and the water supply and return valves have been opened.
2. Turn ON the external circuit breaker to the unit.
3. At the front panel of the unit, set the **ON/OFF** switch on the C-More Control Panel to the **ON** position.
4. Press the **LOW WATER LEVEL RESET** button to reset the low water cutoff.
5. Press the **CLEAR** switch to reset the fault relay. This will turn off the **FAULT** LED and clear any displayed error message.
6. Replace the unit side panels and top panels.

7.2 Final Testing Following Inspections

Upon completion of the inspections and replacements specified in this document, perform the Combustion Calibration Tests specified in Chapter 4 of the O & M Manual GF-116, or GF-117 (Dual-Fuel).

Perform a water bubble test during purge to ensure the burner gaskets, replaced in section 6.1.2, are providing a good seal.

Following successful completion of the Combustion Calibration Tests, return the Benchmark 3.0LN Boiler to service use.

Change Log:

Date	Description	Changed By
06/03/2016	Rev B: **DIR 335**: Clarified reassembly order in section 6.1.2, added water bubble test to section 7.2	Chris Blair
10/12/2017	Rev C: **DIR 335**: Changed “Blower Plenum” to “Burner Housing” and “Burner Housing Gasket” P/N 81019, modified section 6.1.2.	Chris Blair

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