Technical Instruction Document

Instructions For:

Benchmark 2.0 LN 24 Month Maintenance Kit 58015-06
For Benchmark 2.0LN (VFD Design)

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 123612

ITEM 6
Burner Gasket
P/N 81101

ITEM 7
Blower Gasket
P/N 81068

ITEM 8
Condensate Trap O-Ring
P/N 84017

ITEM 9
Condensate Trap Orifice Gasket
P/N 81092

ITEM 10
Air/Fuel Valve To Gas Train O-Ring
P/N 88003

ITEM 11
LWCO Kit
P/N 69126

Latest Update: 07/28/2017

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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 2.0LN (VFD DESIGN) boilers.

This 24-Month Inspection Kit (part no. 58015-06) contains the replacement parts required to perform the waterside and fireside inspections on the Benchmark 2.0LN (VFD DESIGN) boilers.

2. CONTENTS OF KIT 58015-06

Table 1 lists the items included in the 24 Month Inspection Kit.

| Table 1. Benchmark 2.0LN: 24 Month Inspection Kit, Part No. 58015-06 |
| --- | --- | --- | --- |
| 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 | 123612 | EXHAUST MANIFOLD SEAL |
| 6 | 2 | 81101 | BURNER GASKETS |
| 7 | 1 | 81068 | BLOWER GASKET |
| 8 | 1 | 84017 | CONDENSATE TRAP O-RING |
| 9 | 1 | 81092 | CONDENSATE TRAP ORIFICE GASKET (.25" I.D.) |
| 10 | 1 | 88003 | O-RING |
| 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, below.

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 Technical Service Bulletin. However, following completion of these inspections, the Benchmark Boiler should be tested using the combustion calibration procedures provided in O & M Manual GF-123, or GF-123M. See section 7.2.
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.

**INSTRUCTIONS: PRELIMINARY INSPECTION**

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.
INSTRUCTIONS: PRELIMINARY INSPECTION

Figure 1. Benchmark 2.0 Low NOx (LN) Boiler (VFD Design)

5. WATERSIDE INSPECTION OF BENCHMARK 2.0 HEAT EXCHANGER

Benchmark 2.0LN Models contain a single heat exchanger as shown in Figure 2. Perform the waterside inspection as follows:

INSTRUCTIONS: Waterside Inspection

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 2), 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.
INSTRUCTIONS: Waterside Inspection

Figure 2. Benchmark 2.0LN (VFD Design) - Rear View

Figure 3. Benchmark 2.0LN (VFD Design) - Right Side View
6. FIRESIDE INSPECTIONS & COMPONENT REPLACEMENTS

Benchmark 2.0LN 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 and exhaust manifold using the procedures in sections 6.1.1 and 6.1.2, respectively.

6.1.1 Benchmark 2.0LN Burner Inspection

The burner assembly is located at the top of the heat exchanger as shown in Figure 4. As this illustration shows, the complete burner assembly for Benchmark 2.0LN (VFD Design) also includes the blower and air/fuel valve assemblies for the unit. Figure 5 shows the burner assembly mounting details and Figure 6 shows an exploded view of the burner assembly removed from the unit.

**INSTRUCTIONS: Benchmark 2.0LN Burner Inspection**

1. Ensure that the 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. Unscrew and remove the flame detector.
3. Disconnect the igniter cable from the igniter (Figure 5). Unscrew and remove the igniter.
4. Remove the two (2) 10-32 screws securing the gas injector to the burner. Separate the gas injector and gasket from the burner plate.
5. Disconnect the unit wiring harness connectors from the air/fuel valve and blower motor (Figure 6).
6. Disconnect the Fast-On wire leads connected to the blower proof switch and blocked inlet switch (Figure 6).
7. Disconnect the gas train from the air/fuel valve flange by removing the four (4) 1/2" bolts.
INSTRUCTIONS: Benchmark 2.0LN Burner Inspection

and nuts (Figure 5). The O-ring will be replaced at reassembly with the Air/Fuel Valve to Gas Train O-ring (P/N 88003) included in the kit.

8. Disconnect the inlet air flex hose from the air/fuel valve by loosening the hose clamp (Figure 5).

9. Remove the six (6) 1/4-20 hex nuts and flat washers securing the blower to the burner plate (Figure 6).

10. Remove the blower and air/fuel valve from the burner plate by lifting straight up. Also, remove the blower gasket which will be replaced with the new gasket provided in the kit.

11. Remove the grounding screw.

12. Next, remove the eight (8) 3/8-16 nuts from the burner flange using a 9/16” wrench.

NOTE
The burner assembly weighs approximately 30 pounds.

13. Remove the burner assembly from burner flange by pulling straight up.

14. Remove and replace the burner gaskets.

15. Beginning with the burner assembly removed in step 13, reinstall all the components in the reverse order that they were removed. However, during this reassembly process, the following items (included in the kit) should be replaced:

(a) Blower gasket (part no. 81068)
(b) Gas injector gasket (part no. 81047)
(c) Igniter (see section 6.2.1.1)
(d) Flame detector and gasket (see section 6.2.1.2)

16. Make sure to align the staged ignition assembly, igniter and flame detector holes in the burner plate with the heat exchanger top head.

17. Check to ensure that the grounding screw is reinstalled.

18. Reattach the Air/Fuel Valve to the gas-train flange by reinstalling the four (4) 1/2" bolts and nuts (Figure 4). Replace the Air/Fuel Valve to Gas Train O-ring (P/N 88003) with the one provided in the kit. Use an alternating pattern when tightening the bolts to ensure a uniform seal.

19. Next, refer to section 6.2 and replace the igniter, flame detector and gasket using the items provided in the kit.

20. Following replacement of the igniter and flame detector, proceed to the exhaust manifold inspection procedure in section 6.1.2.
INSTRUCTIONS: Benchmark 2.0LN Burner Inspection

**Figure 4. Benchmark 2.0LN (VFD Design) - Top View**

**Figure 5. Benchmark 2.0LN (VFD Design) Burner Assembly Removal**
INSTRUCTIONS: Benchmark 2.0LN Burner Inspection

Figure 6. Benchmark 2.0LN (VFD Design) Burner Assembly - Exploded View

6.1.2 Benchmark 2.0LN Exhaust Manifold Inspection

The exhaust manifold of the Benchmark 2.0LN is installed at the rear of the unit as shown in Figure 7. Perform the following steps to remove and inspect the manifold:

INSTRUCTIONS: Exhaust Manifold Inspection

1. Disconnect the flue starter section from the exhaust manifold.
2. Disconnect the condensate trap from the 1/2" NPT port on the side of the manifold.
3. Using a 3/4" socket wrench, remove the three bolts securing the exhaust manifold to the heat exchanger (Figure 7).
4. Remove the exhaust manifold and seal from the rear of 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 heat exchanger.
6. Inspect and clean the exhaust manifold as necessary.
7. Replace the exhaust manifold seal (part no. 123612) with the new seal provided in the 24-month maintenance kit. Install the adhesive-backed seal in the recess of the exhaust manifold flange (adhesive side down).
INSTRUCTIONS: Exhaust Manifold Inspection

8. Align the exhaust manifold with the lower heat exchanger flange and secure it in place using the three (3) bolts removed in step 3. Alternately tighten the bolts to obtain a uniform seal.

9. Reconnect the flue starter section to the exhaust manifold.

10. Prior to reconnecting the condensate trap, perform the procedure described in section 6.2.2.

11. Reconnect the condensate trap to the 1/2" NPT condensate drain port on the exhaust manifold.

---

**Figure 7. Benchmark 2.0LN Exhaust Manifold Location**

**Figure 8. Benchmark 2.0LN Exhaust Manifold - Top View**
6.2 Annual Maintenance Item Replacements

The 24-Month Inspection Kit also contains burner assembly components and condensate trap components that should be replaced every year.

6.2.1 Burner Assembly Component Replacements

The burner assembly component replacements provided in the kit include a spark igniter, flame detector and flame detector gasket. These items were previously removed from the burner during the inspection procedure in section 6.1.1.

6.2.1.1 Igniter Replacement

Spark igniter, part no. GP-122435-S, is used in all Benchmark models. Replacement is accomplished as follows:

INSTRUCTIONS: Igniter Replacement

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

6.2.1.2 Flame Detector Replacement

Flame detector, part no. 66034 and gasket, part no. 81048 are used only on Benchmark Low NOx models. Replacement is accomplished as follows:

INSTRUCTIONS: Flame Detector Replacement

1. Refer to Figure 9 to locate the flame detector installation location.
2. Install the replacement flame detector and gasket in the location shown. Hand-tight only.
3. Reconnect the flame detector lead wire.
INSTRUCTIONS: Flame Detector Replacement

Figure 9. Burner Assembly Igniter & Flame Detector Locations
6.2.2 External Condensate Trap Maintenance

The condensate trap, part no. 24060 is used with all Benchmark models. The trap should be inspected, cleaned and reassembled as follows:

**NOTE:**
The condensate trap should already be disconnected from the exhaust manifold of the unit during the exhaust manifold inspection procedure.

**INSTRUCTIONS: External Condensate Trap Maintenance**

1. Remove the connections on the inlet and outlet sides of the condensate trap shown in Figure 10.
2. Refer to Figure 10 and loosen the four (4) thumbscrews securing the cover on the condensate trap. Remove the cover.
3. Remove and discard the O-ring gasket currently installed in trap. It will be replaced with the new O-ring included in the Maintenance Kit during reassembly.
4. Remove the float (with float guide attached) from the condensate trap.
5. Remove and discard the currently installed orifice gasket from the trap. The new orifice gasket from the maintenance kit will be installed during reassembly.
6. Thoroughly clean the trap and float. Also inspect the drain piping for blockage. If the trap cannot be thoroughly cleaned, replace the condensate trap.
7. Check the condensate drain port on the exhaust manifold (Figure 11) to ensure it is clear of blockage.
8. After the above items have been inspected and thoroughly cleaned, replace the orifice gasket (use new gasket) and float in the condensate trap. Replace the O-ring (use new O-ring) and replace the trap cover.
9. Reassemble all piping and hose connections to the condensate trap inlet and outlet. Reconnect trap to condensate drain connection on the connecting manifold.

![Figure 10. Condensate Trap Part No. 24060](image-url)
6.3 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).

INSTRUCTIONS: Replacing the LWCO Probe/Capacitor

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.

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.
INSTRUCTIONS: Replacing the LWCO Probe/Capacitor

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.

6.4 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.

6.4.1 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.

INSTRUCTIONS: Low Water Cutoff (LWCO) - Capacitor Electrical Short Test

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.
INSTRUCTIONS: Low Water Cutoff (LWCO) - Capacitor Electrical Short Test

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).

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.

5. Confirm that the ohmmeter does NOT read a short.
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 all required inspections and replacements, perform the following reassembly and setup procedures:

INSTRUCTIONS: Reassembly and Set-Up

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 and top panels.

7.2 Final Testing Following Inspections

Upon completion of the inspections and replacements specified in this Technical Service Bulletin, perform the Combustion Calibration Tests specified in Chapter 4 of the O & M Manual GF-123, or GF-123M.

Following successful completion of the Combustion Calibration Tests, return the Benchmark 2.0LN Boiler to service use.

--- END ---
## Change log:

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<td>02/10/2015</td>
<td>Rev-A: Initial release, converted from TSB- TSB-2009-17</td>
<td></td>
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<tr>
<td>09/28/2016</td>
<td>Rev B: <strong>DIR 388</strong>: Corrected P/N of item 6 Burner Gasket in Section 2 to 81101</td>
<td>Chris Blair</td>
</tr>
<tr>
<td>07/28/2017</td>
<td>Rec C: <strong>DIR 17-049</strong>: Corrected Item 5 Exhaust Manifold Seal from P/N 49102 to 123612 in Table 1, updated formatting to current standard.</td>
<td>Chris Blair</td>
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