



Hydrogen Field Service Bulletin
H2 Leak Repair
ENP-680
September 12, 2018

1. Introduction

Leak detection and repair is one of the basic skills all fleet maintenance, inspection and service personnel must have.

For routine maintenance, the entire fuel system can be leak tested with leak detection solution. All joints and connections should be tested.

Leaks usually occur at fitting connections. When checking for leaks always use solutions designed for use with stainless steel and brass.

A hydrogen cylinder tank plug is used in this repair example.

Warning Messages Used in this Bulletin



Personal injury or death will occur if procedures are not followed.



Personal injury or death may occur if procedures are not followed.



Damage to equipment, fuel system or vehicle is possible if instructions are not followed.

2. Affected Units

This service procedure is specific to the Toyota Hydrogen system 25440000.

3. Tools and Materials

- Personal protective equipment (PPE), including eye and gloves as needed.
- Standard hand tools including torque wrench
- Leak detection solution, Swagelok Snoop or similar.
- O-ring lubricant, fluorinated grease Molykote HP300.
- Quantity 6 replacement adapter fittings with O-rings and backup rings, as needed.
- Isopropyl alcohol (IPA).
- CMM
- Camera
- Pressure test equipment including gasses

4. Procedure



- A. Depressurize and/or defuel the system as necessary.
- B. Purge the system components with nitrogen before starting work.

Removal of Components

1. Defuel the system.
 - a. Since the component being replaced is a tank plug, the system must be **defueled** and then purged with nitrogen. (There is no way to isolate the hydrogen within the tank when servicing.)
2. Purge the system with nitrogen before starting work.
3. Label each adapter fitting in the system Beta-001 through Beta-006, using the tank naming convention as per Figure 1.
4. Loosen tube clamps on live PRD tubes at the end of each tank. Remove tube clamps if necessary.
5. Disassemble tubing and fittings in each end of tank.
6. Remove the existing adapter fitting from tank. Ensure no damage to tank neck (ID). Refer to Figure 2. Take Photos of internal bore of each cylinder.
7. Set parts aside for inspection See section 24 and checklist file "Beta System Adapter Checklist" for inspection requirements.

Installation of Components

8. Clean each adapter fitting with Isopropyl alcohol (IPA) using a lint-free cloth.
9. Clean ID of each tank neck boss with Isopropyl alcohol (IPA) using a lint-free cloth. Do not reuse cloths. See Figure 3
 - a. Inspect ID of tank neck for damage.
 - b. Measure and record ID of tank neck. Caution: Care must be taken to ensure no damage to tank ID when measuring.
10. Clean white and brown backup rings and white silicone o-ring with IPA using a lint-free cloth.
11. Lubricate all surfaces of white backup ring PN 87006552MC and install onto adapter fitting. See Figure 4.
12. Lubricate all surfaces of brown backup ring PN 87906553MC and install onto adapter fitting. See Figure 4.

13. Lubricate ALL SURFACES of white O-ring PN 87006554MC with a small amount of Molykote HP300. See Figure 5.
14. Install white O-ring PN 87006554MC onto adapter fitting, being careful not to twist o-ring. Visually confirm that o-ring is not twisted, and rests flush against brown backup ring. Parts must be installed parallel to each other. See Figure 5.
 - a. Apply a small amount of lubricant (Molykote HP300) to the outside diameter of the o-ring.
15. Lubricate the first 2-3 threads (M45 adapter thread) of the adapter fitting PN 161553-01 with a small amount of Molykote HP300. See Figure 5.
16. Carefully insert adapter fitting (assembly with seals) into tank neck, being careful to prevent any metal-to-metal contact between the fitting and tank neck boss.
17. Torque to 30 N-m.
18. Re-install the removed fittings and tubing into each adapter.
 - a. Perform fit-check of each tube to verify that it is not pre-stressed.
 - b. Shift location of remote PRD if required to ensure that there is no pre-stress on the tube.
 - c. Verify that all fittings have been installed and tightened. Torque 9/16 SAE fittings and Swagelok medium pressure fittings to 35 Nm with calibrated torque wrench.
19. Purge system with nitrogen.
20. Perform pressure test of the fittings.
 - a. Use Mirai valve manual lock-off to close tanks 2-5.
 - b. Connect vehicle to the hydrogen refueler and dispense hydrogen into tank 1.
 - c. Slowly increase pressure to 0.7-1.4 MPa (100-200 psi).
 - d. Apply Snoop leak detection fluid to adapter fitting and live fittings connected to PRD. Watch for foam and bubbles. Hydrogen leak detection may take several minutes. If there are leaks, stop.
 - e. Slowly increase pressure to 7 MPa (1000 psi), while monitoring for bubbles on the fittings. Verify a leak-free connection. If there are leaks, stop.
 - f. Slowly increase pressure to 35 MPa (5000 psi), while monitoring for bubbles on the fittings. Verify a leak-free connection. If there are leaks, stop.
21. Transfer the fuel from the test tank to the next tank.
 - a. Close the manual lock-off on the Mirai valve for tank 1.
 - b. Open the manual lock-off on the Mirai valve for tank 2.
 - c. Slowly transfer fuel from tank 1 to tank 2 until pressures equalize, by opening tank 1.

- d. Close the manual lock-off on the Mirai valve for tank 1.
- 22. Connect vehicle to the hydrogen refueler and dispense hydrogen into tank 2.
- 23. Repeat steps 20-22 above for each tank to be tested. Note that tank 6 must be pressurized with tank 4 for testing, and tank 5 must be pressurized with tank 3 for testing because they have no inlet fuel lines to the Mirai valves.

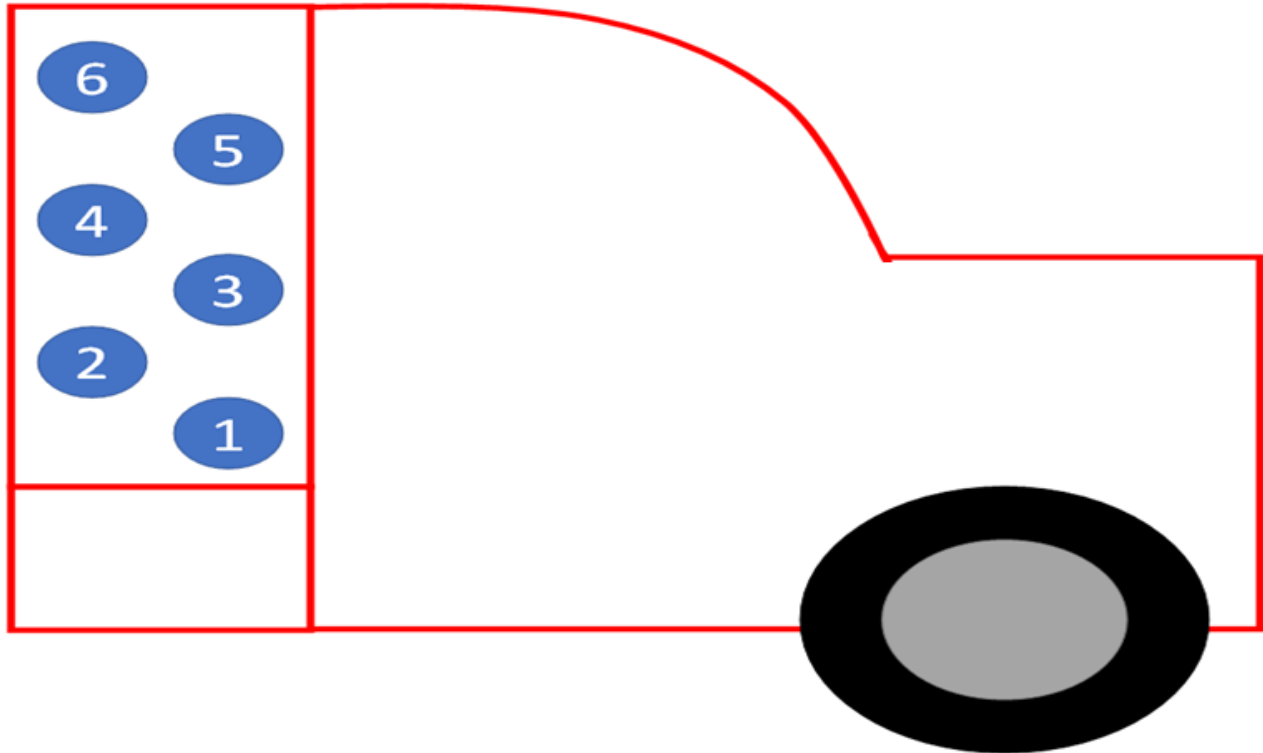


Figure 1 - Cylinder Numbering



Figure 2. Remove the leaking component.

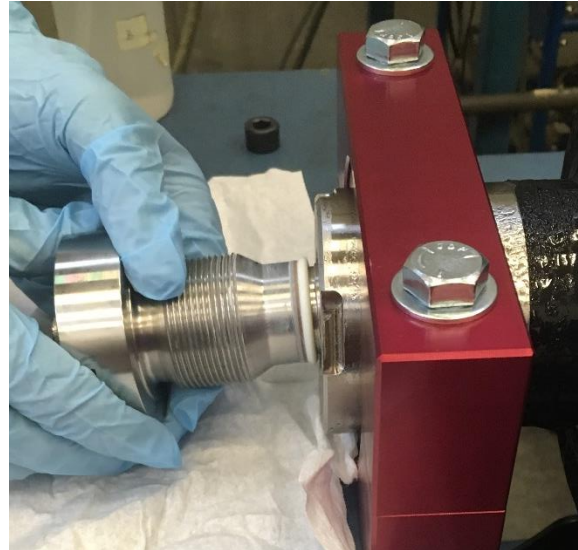


Figure 3. Clean the mating surfaces and install the component.



Figure 4. Clean the fitting and install the first seal (backup ring).

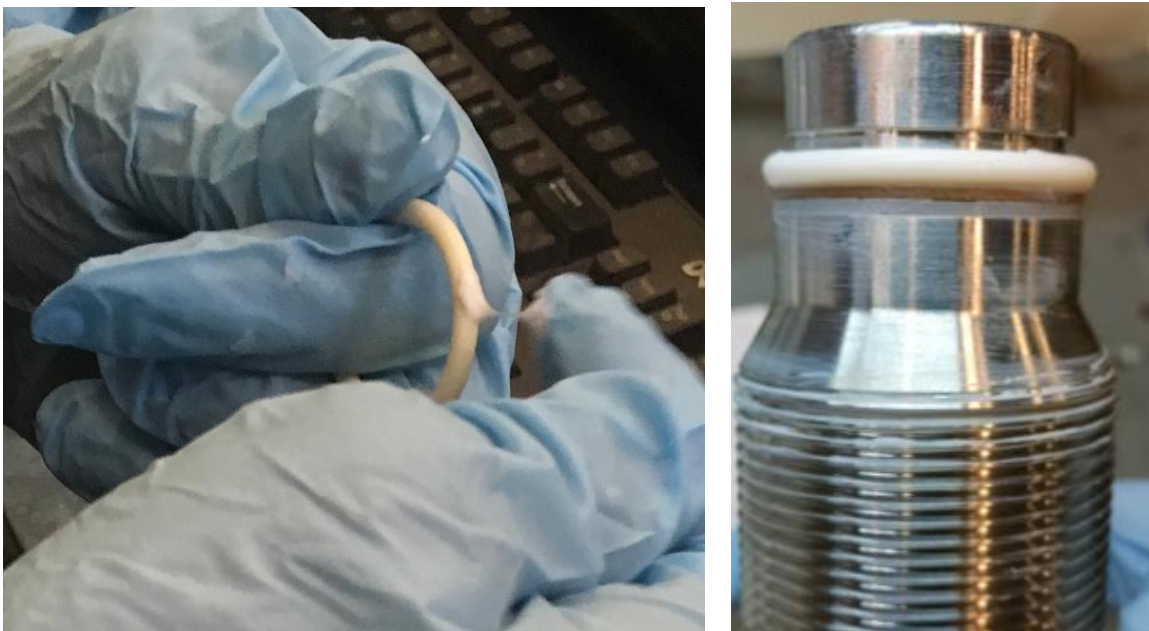


Figure 5. Clean and lubricate the O-ring and install it on the fitting.

24. Inspect adapter fitting.

- Perform visual inspection for each fitting and O-ring. Fill out “Beta System Adapter Checklist”. Look for debris, damage, O-ring twist, degree of lube, and order of O-rings. Take photo of each adapter fitting.
- Inspect o-ring for twisting or misalignment.
- Record measurements for each of the 6 adapter fittings as per Figure 6 below.
- Record surface finish of the sealing surfaces.

25. Package adapters, backing rings and O-rings removed from Beta system in clean bags. Ship them to Lincoln for further testing and analysis.

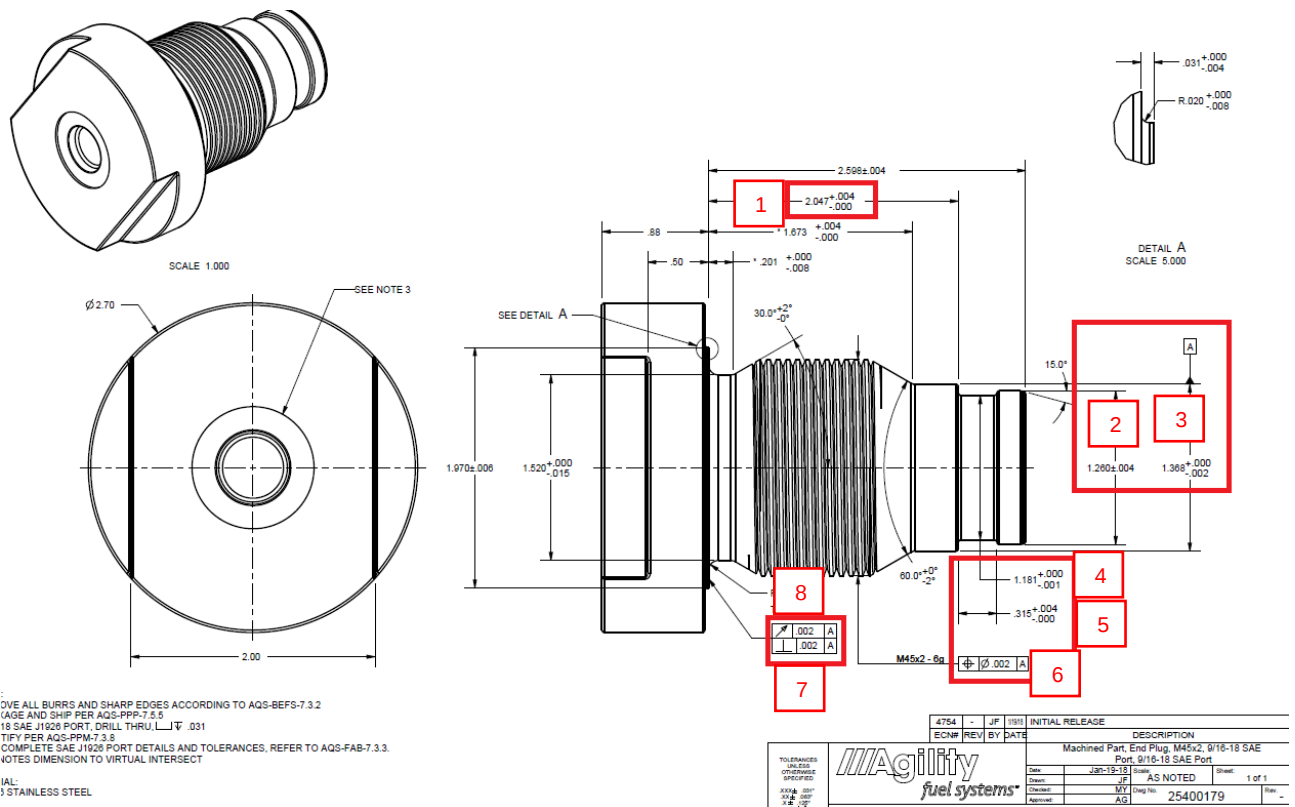


Figure 6. Adapter fitting measurements.

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