Engine Injector and Sleeve, Replacement (Conical)  
MP7, MP8, MP10

Engine Injector and Sleeve, Replacement (Conical)

⚠️ CAUTION

This bulletin describes important tools and procedure for engine injector and injector sleeve replacement. These tools and procedure replace all existing tools and procedures for conical sleeve replacement. If the procedure in this bulletin is not followed exactly, damage to the engine may result.

Note: Failure to follow the procedure in this bulletin exactly may result in warranty claim denial.

Contents

• “Sleeve Identification”, page 2
• “Engine Injector and Sleeve, Replacement (Conical)”, page 4
• “Conical Engine Injector and Sleeve Replacement Checklist”, page 28

Note: Information is subject to change without notice. Illustrations are used for reference only, and may differ slightly from the actual engine version. However, key components addressed in this information are represented as accurately as possible.
Service Procedures

2379-03-02-01

Engine Injector and Sleeve, Replacement (Conical)

**CAUTION**

This bulletin describes important tools and procedure for engine injector and injector sleeve replacement. These tools and procedure replace all existing tools and procedures for conical sleeve replacement. If the procedure in this bulletin is not followed exactly, damage to the engine may result.

Note: Failure to follow the procedure in this bulletin exactly may result in warranty claim denial.

You must read and understand the precautions and guidelines in Service Information, Function Group 20, “Engine Safety Practices” before performing this procedure. If you are not properly trained and certified in this procedure, ask your supervisor for training before you perform it.

**Special tools:** 9990006, 9990013, 9996049, 9998249, 9998250, 9998251, 85112740, 88800014, 88800457, 88800460, 88800387, 88880056, 88880099, J42885, PT2900, 2815–2V700

**Sleeve Identification**

Note: There are two types of injector sleeves used in Mack engines, conical and flat copper. The conical sleeves are made of stainless steel. A washer is used with the flat copper sleeves. You must determine which type of sleeve is in the engine to know the proper tools to use for the replacement procedure.
A. Flat Injector
B. Conical Injector

**CAUTION**

Conical and copper sleeves should not be mixed in the same engine. The same type of sleeve must be used in all six cylinders. Mixing sleeves can result in damage to the engine.

Note: When reinstalling the existing injector, it is acceptable to reuse the injector sleeve or install a new sleeve. When installing a new injector, a new injector sleeve must also be installed.
Engine Injector and Sleeve, Replacement (Conical)

1. Secure the vehicle for service by parking it on a flat level surface, applying the parking brake, chocking the rear wheels, and placing the transmission in neutral or park.

2. Disconnect all cables from the negative (ground) battery terminals to prevent personal injury from electrical shock and prevent damage to electrical components.

3. Drain the coolant from the radiator and engine using the coolant extractor.
   **Note:** An alternate method is to connect the drain hose to the drain fitting and drain the coolant.

   2815–2V700, 9990649, 85112740

4. Clean around the fuel supply line fitting on the filter housing. Loosen the fuel line at the filter housing to allow fuel to drain from the cylinder head. Allow the fuel to drain into a suitable container.

5. Remove the valve cover from the engine. Refer to Group 211 for service procedure.
   **Note:** Rotate the valve cover as needed, to clear the camshaft gear and damper.
   **Note:** Dependent upon chassis, engine cover may need to be removed for clearance to remove valve cover.

6. Remove the rocker arm shaft. Refer to Function Group 214 for service procedures.

---

**CAUTION**

The order of the rocker arm assembly must be maintained. Make certain the sets of four are kept together. Make certain the rocker arms are identified so they can be returned to their original positions on the shaft. Failure to heed this caution may result in severe engine damage.
7. Make sure the alignment sleeves remain in position on each bearing cap.

8. Mark the valve bridges so they can be installed in the same location during reassembly. Remove the valve bridges.

   **Note:** Mark the location of the injectors for reinstallation. Injectors must be installed in the same cylinder as they were removed.

9. Thoroughly clean around the injectors that are to be removed. Remove the injector hold down bolt.

10. **CAUTION**

    Do not use excessive force on the injector with the slide hammer. If the injector is stuck in the sleeve, the puller can be damaged by the slide hammer.

    Install the puller onto the injector. Position the puller fork in the groove on the injector and lock the arm using the thumb screw on the side. Secure the puller by screwing down the screw toward the inner cup of the injector. Install the slide hammer. Use reasonable force with the slide hammer to pull the injector free from the cylinder head.

    **Note:** Use care when removing the injector because the injector hold down is not secure and could fall off if not held in place.
11
Install the protective sleeve over the injector to prevent damage.

---

9998249

12
Clean the protective plug and install it into the injector bore of the cylinder head to protect it from debris. Using compressed air, clean out the injector hold down bolt holes.

**DANGER**

Compressed air can cause serious personal injury. When using compressed air for cleaning, wear a protective face shield, protective clothing and protective shoes. Pressurized water could cause particles and/or hot water to be sprayed in your direction and cause personal injury. The maximum air pressure must be below 200 kPa (30 psi) for cleaning purposes.

**CAUTION**

It is very important to clean out injector yoke bolt holes. If fluid is not cleaned out, hydraulic lock can occur when tightening tools or injectors and can result in lack of low clamp load and cylinder head cracking at the injector yoke bolt hole.

*Note:* Make sure the protective plug is clean so it does not introduce dirt or contaminants into the engine.

---

9998251
To help determine if an injector can be reused, the following pictures show examples of both reusable and not reusable injectors. Review the examples and compare the removed injectors to the examples shown. Look for signs of carbon deposits and soot above the sealing area caused by combustion gas leakage. Also look for signs of uneven and broad wear around the sealing ring area that can be caused by the injectors moving in the seats and letting combustion gas pass.
Reusable Injector

1. Non-contact area. Soot deposits are not visible and no combustion gas leakage shown.
2. Sealing area uniform, normal sealing ring shown.
3. Below the sealing area. Where combustion gases are present, it will normally be sooty.
4. Just above the sealing area, no severe wear shown or soot deposits visible.
Reusable Injector

1. Non-contact area. Soot deposits are not visible and no combustion gas leakage shown.
2. Sealing area uniform, normal sealing ring shown.
3. Below the sealing area, where combustion gases are present, it will normally be sooty.
4. Just above the sealing area, no severe wear shown or soot deposits visible.
Reusable Injector

1. Non-contact area. Soot deposits are not visible and no combustion gas leakage shown.
2. Sealing area uniform, normal sealing ring shown.
3. Below the sealing area. Where combustion gases are present, it will normally be sooty.
4. Just above the sealing area, no severe wear shown or soot deposits visible.
**Not Reusable Injector**

1. Non-contact area. Soot deposits are visible and combustion gas leakage shown.
2. Sealing area, very broad sealing ring showing injector movement.
3. Below the sealing area. Where combustion gases are present, it will normally be sooty.
4. Just above the sealing area, severe ring wear shown, soot deposits visible.
Not Reusable Injector

1. Non-contact area. Soot deposits are visible and combustion gas leakage shown.
2. Sealing area, very broad sealing ring showing injector movement.
3. Below the sealing area. Where combustion gases are present, it will normally be sooty.
4. Just above the sealing area, severe ring wear shown, soot deposits visible.
**Not Reusable Injector**

1. Non-contact area. Soot deposits are visible and combustion gas leakage shown.
2. Sealing area, very broad sealing ring showing injector movement.
3. Below the sealing area. Where combustion gases are present, it will normally be sooty.
4. Just above the sealing area, severe ring wear shown, soot deposits visible.
Not Reusable Injector

1. Non-contact area. Soot deposits are visible and combustion gas leakage shown.
2. Sealing area, very broad sealing ring showing injector movement.
3. Below the sealing area. Where combustion gases are present, it will normally be sooty.
4. Just above the sealing area, severe ring wear shown, soot deposits visible.
If initial inspection indicates the injector may be reused, clean the cap nut seat surface of hard carbon deposits with a soft cloth and diesel fuel. This is the only approved cleaning procedure. There are new injector cap coatings that can be damaged by improper cleaning methods.

**CAUTION**

The only approved cleaning procedure for conical injectors is a soft cloth with diesel fuel. It is extremely important on cap nuts with MN phosphate. Other cleaning methods will remove the phosphate coating.

**CAUTION**

Do not use a wire wheel to clean the cap nut seat surface. Only use a soft cloth and diesel fuel to clean the cap nut seat surface. The use of excessive force must be avoided and can damage the seat surface resulting in an injector that cannot be reused.

After cleaning, inspect the injector nozzle cap nut seat surface for pitting or related damage.

**Note:** Pitting on surfaces other than the cap nut seat surface does not effect the function of the injector and is acceptable.

- If there is pitting or other damage, the injector and sleeve can not be reused. **When installing a new injector, a new injector sleeve must also be installed.** Proceed to Step 17 for injector sleeve removal.

- If there is no pitting on the seat surface, the injector can be reused. Proceed to the next step for injector sleeve cleaning.

**Note:** When reinstalling the existing injector, it is acceptable to reuse the injector sleeve or install a new sleeve.
16
Install the protective sleeve J42885-25. Use brush 88880056 to clean the injector sleeve. Wipe out injector sleeve after brushing with a lint free cloth and brake clean or contact cleaner to remove any loose deposits. After cleaning the sleeve, carefully inspect the inside surface of the sleeve, especially the bottom surface. Any remaining contamination is unacceptable and must be removed.

• If there is any indication of a discrepancy that raises concern about suitability of the sleeve for reuse, replace it with a new sleeve. Proceed to the next step for sleeve removal.

• If the sleeve can be reused, proceed to Step 39 for injector installation. **The injector must be reinstalled in the same cylinder from which it was removed.**

17
Install two sealing rings to prevent dirt from entering the fuel gallery when the injector sleeve is removed.

**Note:** Two sealing rings are required to cover the fuel gallery.

18
Apply multipurpose grease to all threads to prevent wear. Snug the collar nut against the hex head of the center shaft. Turn the center shaft clockwise until it stops. Then back the center shaft off one and a half turns.
19 Install the extractor into the sleeve. The puller is installed correctly when the outer barrel tabs are resting on the cylinder head and the top outer diameter of the inner tool is slightly above or flush with the bottom of the cutout on the outer barrel. Turn the center shaft clockwise until contact with the sleeve is felt. Using a wrench, turn the center shaft one additional flat. Turn the knurled collar clockwise until contact is made between the thrust bearing and outer barrel.

**CAUTION**

Do not use air tools to remove injector sleeves, or damage to the injector bore can result.

**Note:** This tool can be used to remove both copper and conical sleeves.

88800387, 88800460, 88880099

20 Use a wrench to hold the center shaft to prevent it from turning. Turn the collar nut clockwise until the injector sleeve is removed. Loosen the center shaft to release the jaws from the injector sleeve.

21 Absorb any remaining coolant with a lint-free cloth.

**Note:** Check that the piston is free of any fluids.
22 Attach a small diameter air line to a wet / dry shop vacuum nozzle that can reach into the coolant passages in the injector sleeve bore. Remove all remaining fuel and coolant. A lint free paper shop towel can also be used to absorb liquid. All fluids must be completely removed before proceeding. Remove the two sealing rings from the fuel passage when all fluid has been removed.

**Note:** Do not use a shop rag as it could possibly contain contamitnates, metal chips, etc.

9998250, PT2900

23 Inspect condition of the J-42885-25 O-rings before installing the protective sleeve. If necessary, replace O-rings (part numbers 507688 and 10914). Install the injector bore sealing tool, J-42885-25, to protect the fuel passage area and prevent debris from entering.

**J-42885-25**

24 Using the cleaning kit, J42885, clean the injector sleeve seat of the cylinder head.

**Note:** The injector bore sealing tool must be used to prevent dirt from entering the fuel passage.

**Note:** A high speed drill or angle die grinder works best for cleaning with the J42885-2 brush tip.

J42885-1, J42885-2, J42885-3, J42885-4, J-42885-25
Using the brush, clean the cylinder head injector bore walls for the injector sleeve.

**Note:** The injector bore sealing tool must be used to prevent debris from entering the fuel passage.

**Note:** Inspect brush for missing wire bristles and for brush tightness in bore. If several wire bristles are missing or brush fits loose in the bore replace brush.

---

Using the brush, clean the injector sleeve opening in the cylinder head.

**Note:** The injector bore sealing tool must be used to prevent debris from entering the fuel passage.

**Note:** Inspect brush for missing wire bristles and for brush tightness in bore. If several wire bristles are missing or brush fits loose in the bore replace brush.

**Note:** When replacing the injector sleeves, it is important to check that the sleeve bore in the cylinder head is free from any carbon deposits or other residue (i.e., pieces of O-ring, etc.) before installing a new injector sleeve. Repeat cleaning if necessary.

---

**WARNING**

Do not attempt to blow away debris using compressed air. Doing so can result in eye injury.

Using the chip vacuum, remove all debris from the injector sleeve bore.

**Note:** Injector sleeve seat in cylinder head and the bore for injector sleeve tip must be COMPLETELY clean and dry.

---

Remove the injector bore sealing tool from the cylinder head. Using the chip vacuum, remove any remaining debris.
29
Saturate a lint free paper shop towel with brake clean or contact cleaner. Wipe out injector sleeve bore with special attention to the injector sleeve seating area and injector sleeve O-ring sealing area in the cylinder head.

30
Ensure the piston is at the lowest position in the cylinder. If not, use the flywheel turning tool to place the piston at its lowest position.

Note: This is to ensure that the sleeve installation tool does not damage the piston due to tool length.

88800014, 9996956

31
Note: Make sure the sleeve bore surface in the cylinder head is clean and dry prior to sealant being applied.

Before installing a conical sleeve, apply Loctite spray activator 7649 to the bottom surface of the sleeve where sealing compound is to be applied and allow to completely dry. When activator is dry, apply a 2-3 mm bead of Mack approved sealing compound (part number 1161059) to the bottom of the injector sleeve.

32
Note: Always use the new O-ring included in the sleeve kit.

Lubricate a new injector sleeve O-ring with clean coolant or soapy water. Install the O-ring on the injector sleeve and lubricate again with clean coolant or soapy water.

CAUTION

Clean coolant or soapy water is the only approved lubricant for the injector sleeve O-ring. If oil is used it can cause the O-ring to swell and be damaged during installation.
CAUTION

Failure to use the proper bit can result in the bit breaking off into the cylinder head. These types of failures are not covered by warranty.

Using calipers, measure the swedging bit to make sure that the proper swedging tool is used. Measurement should read 7.9 ± 0.05 mm. Also, verify that the swedging bit has four stages and the length is 120 mm.

Note: Swedging bit, 88880054, can be ordered as a spare part if the bit is worn or broken.

88880054

CAUTION

Clean coolant or soapy water is the only approved lubricant for the injector sleeve O-ring. If oil is used it can cause the O-ring to swell and be damaged during installation.

Note: The O-ring is used on the tool to protect the cylinder head bore only. The O-ring only needs to be replaced when damaged. A used injector sleeve O-ring can be used on the tool.

Note: Special tool 88800457 can only be used on the conical injector sleeves. It CAN NOT be used on the copper injector sleeve.

88800457

X = 7.9 ± 0.05 mm

Conical Injector Sleeve Installation Tool, 88800457
Failure to loosen the swedging bit can result in the bit being twisted or broken.

Place the new injector sleeve on the installation tool. Thread the swedging bit completely into the flaring tool until it stops (finger tight). Loosen the swedging bit 180° before installing the tool in the cylinder head. Lubricate the swedging bit and the threads on the tool with fresh, extreme pressure NLGI #2 grease or equivalent.

88800457

36

Note: Remove any oil from the injector hold down bolt holes to avoid hydraulic lock for this step and when the injector is installed.

Carefully place the sleeve installation tool and new injector sleeve into the injector bore of the cylinder head. Carefully move the injector sleeve downward into the injector bore so that the swedging bit is guided into the injector tip bore in the cylinder head. Using hand force, press down on the installation tool until the injector sleeve bottoms against the bore. The shoulder of the hold down should be flush with the top of the cylinder head. Use the injector hold down yoke and bolt 8192804 to hold the tool in position. To ensure that the sleeve is bottomed in the cylinder head, tighten the bolt to 80 ± 5 Nm (60 ± 4 ft-lb).

It is very important to clean out injector yoke bolt holes. If fluid is not cleaned out, hydraulic lock can occur when tightening tools or injectors and can result in lack of low clamp load and cylinder head cracking at the injector yoke bolt hole.
37
Flare the injector sleeve by turning the nut clockwise while holding the spindle until the swedging bit has been pulled completely through the injector sleeve.

⚠️ CAUTION

Failure to hold the spindle can result in a twisted or broken swedging bit.

38
Remove sleeve installation tool from the injector bore. If the injector is not being installed immediately, install the protective plug into the injector bore to protect it from debris. Clean the protective plug before installation.
Before installing the new or reused injector, install a new upper O-ring (large diameter, violet) on the top injector groove only. If new injectors have O-rings installed on both top and bottom locations of the injector, remove the lower O-ring.

---

**CAUTION**

Do **NOT** replace the lower O-ring (small diameter, violet). It has been determined that the lower O-ring is not required for conical injectors. The lower O-ring **MUST** be installed on flat injectors or damage to the engine may result.

---

1. Replace upper O-ring
2. Remove and discard lower O-ring

---

Lubricate the O-ring with clean engine oil.

**Note:** Clean engine oil is the only approved lubricant for the injector O-ring.

---

**CAUTION**

Any oil which may have pooled in the bottom of the injector yoke bolt hole must be cleaned from the hole to avoid hydraulic lock when the bolt is installed and tightened. Hydraulic lock can result in a lack of clamp load and a cylinder head cracked at the bolt hole.

Clean the injector hold down yoke and apply light coat of oil to the threads and underside of the head of a NEW bolt Slip the injector hold down and bolt onto the injector.
1. Use finger to apply paste to injector
2. Graphite Paste

**CAUTION**

Do not get any hard particles on the injector sealing surfaces. Hard particles will prevent a good seal and damage to engine can result.

**Note:** Always wear gloves when applying graphite sealant paste.

Wipe the injector conical area with a lint free paper shop towel to remove any residue before applying the graphite paste. Use a finger tip to apply a thin layer of graphite sealant paste (part number 85134750) all around the injector cap nut cone.

43

**Note:** Replace the injector hold down fastener each time an injector is installed. The bolt cannot be reused and must be replaced.

**Note:** If available, use an electronic digital torque wrench for the tightening procedure.

Center the injector and hold down between the valve springs and then push down on the injector using hand pressure to seat the O-ring. Clamp the injector in position with the injector hold down by tightening the injector hold down bolt. Tighten the injector hold down bolt using the following five step procedure:

1. Tighten 20 +5-0 Nm (15 +4-0 ft-lb).
2. Tighten 180 ±5 degrees angle of tightening.
3. Loosen the hold down bolt until torque is 10 to 15 Nm (7.0 to 11.0 ft-lb).

**Note:** This should be achieved by loosening with an angle of 100-110 degrees. Do not completely loosen the bolt to prevent components from moving after the previous seating process.

4. Tighten 20 +5-0 Nm (15 +4-0 ft-lb).
5. Tighten 90 ±5 degrees angle of tightening.
When replacing injectors, the engine control module (ECM) must be programmed with the new injector’s trim codes. The code is printed on top of the injector electrical connector. The programming is performed using Tech Tool and is necessary to ensure that engine timing and emission levels are correct.

**Note:** Due to the ECM self learning capability, it is necessary to reset learned ECM parameters after servicing some engine related components. This allows the ECM to learn the new components behavior. After servicing is complete, perform the “Learned Data Reset” using Tech Tool. This is located in the Function Group 1 menu.

**Note:** If reinstalling an injector into the same location, reprogramming is not required.

45
Install the valve bridges onto the same cylinders as marked at disassembly. Lubricate the valve bridges and camshaft lobes with engine oil.

46
Install the rocker shaft. Refer to Group 214 for service procedures.

47
Adjust all of the valves and injectors. Refer to Group 214 for service procedures.

48
Install the valve cover on the cylinder head. Refer to Group 211 for procedure.

49
Secure the fuel supply line fitting at the fuel filter housing (loosened earlier to drain fuel from the cylinder head). Clean any fuel that remains around the fitting. Always replace the fuel line seal washers.

50
Install all previously removed cables to the ground (negative) battery terminals.
51
Use coolant extractor to fill the system with approved coolant per specifications.

2815–2V700, 85112740

52
Prime the fuel system by pumping the hand priming pump on the fuel filter housing until resistance is felt indicating that the system is full of fuel.

53
Start the engine and run until the engine clears and runs without stumbling. This procedure may need to be repeated once or twice to get the fuel system completely free of air.

Note: If the engine does not start on the first attempt, prime the fuel system again, and refer to the previous step. Engine priming may need to occur several times in order to get the engine to start.

54
Allow the engine to run at low idle for about 5 minutes. Check for any fuel leaks and correct if necessary.

Note: The engine speed should not be increased as any air pockets can be forced into the cylinder head which can result in the engine shutting off.
Conical Engine Injector and Sleeve Replacement Checklist

1. Drain fuel from the cylinder head. (Step 4)

2. Thoroughly clean area around the injectors that are to be removed. (Step 9)

3. Install the protective plug into the injector bore of the cylinder head after injectors have been removed. (Step 12)

4. Using compressed air, clean out the injector hold down bolt holes. (Step 12)

5. Install two sealing rings to prevent dirt from entering the fuel gallery when the injector sleeve is removed. (Step 17)

6. Install the extractor and puller into the sleeve and remove the injector sleeve. (Steps 19 and 20)

7. Remove the two sealing rings from the fuel passage and install the injector bore sealing tool, J-42885-25. (Steps 22 and 23)

8. Using the cleaning kit, J42885, clean the injector sleeve seat of the cylinder head. All remaining sealing compound (1161059) MUST BE REMOVED AND SURFACE COMPLETELY DRY. (Steps 24-27)

9. Measure swedging bit:
   Length_______ mm
   Diameter_______ mm
   (Step 33)

10. Apply Loctite spray activator 7649 to the bottom surface of the sleeve where sealing compound is to be applied and allow to completely dry. (Step 31)
When activator is dry, apply a 2-3 mm bead of Mack approved sealing compound (part number 1161059) to the bottom of the injector sleeve. (Step 31)

Lubricate a new injector sleeve O-ring with clean coolant or soapy water. Install the O-ring on the injector sleeve and lubricate again with clean coolant or soapy water. (Step 32)

Use the injector hold down yoke and bolt 8192804 to hold the tool in position. To ensure that the sleeve is bottomed in the cylinder head, tighten the bolt to 80 ± 5 Nm (60 ± 4 ft-lb). (Step 36)

Before installing the new or reused injector, install a new upper O-ring (large diameter, violet) on the top injector groove only. If new injectors have O-rings installed on both top and bottom locations of the injector, remove the lower O-ring. Lubricate the O-ring with clean engine oil. (Steps 39 and 40)

Wipe the injector conical area with a lint free paper shop towel to remove any residue before applying the graphite paste. Use a finger tip to apply a thin layer of graphite sealant paste (part number 85134750) all around the injector cap nut cone. (Step 42)

If available, use an electronic digital torque wrench for the tightening procedure

Install NEW injector hold down bolt and follow five step tightening procedure:
1. Tighten 20 +5-0 Nm (15 +4-0 ft-lb).
2. Tighten 180 ±5 degrees angle of tightening.
3. Loosen the hold down bolt until torque is 10 to 15 Nm (7.0 to 11.0 ft-lb).

Note: This should be achieved by loosening with an angle of 100-110 degrees. Do not completely loosen the bolt to prevent components from moving after the previous seating process.
4. Tighten 20 +5-0 Nm (15 +4-0 ft-lb).
5. Tighten 90 ±5 degrees angle of tightening.

(Step 43)

Adjust all of the valves and injectors. Refer to Group 214 for service procedures. (Step 47)
When replacing injectors, the engine control module (ECM) must be programmed with the new injector’s trim codes. The code is printed on top of the injector electrical connector. The programming is performed using Tech Tool and is necessary to ensure that engine timing and emission levels are correct. (Step 44)

Perform a "Learn Data Reset". (Step 44)