

2013 Toyota Prius Head Gasket Replacement (DRAFT)

Prep – Shroud Removal, Fluid Drain / Flush

1. Ramp up car, remove bottom skid plate.
2. Bring the car off ramps, pull into garage.
3. Jack up car on both sides, rest on jack stands, drain coolant and inverter coolant.
4. Remove filler plug for transmission IAW <https://www.youtube.com/watch?v=kRWprvDMTas>
 - a. Measure how much transmission fluid was removed.
 - b. Refill with slightly more fluid.
 - c. Torque drain plug and filler plug to 29 ft-lbs.
5. Plug coolant and fill with hose water.
6. Start the car and put it into maintenance mode.
7. Run the car until the radiator fan starts, then shut down. Drain water.
8. Repeat steps 5-7 until water comes out mostly clear, then repeat with Distilled water.
9. Run engine again until hot, drain water and leave drained.
10. Drain oil and oil filter.

Head Gasket Replacement Start

11. Remove Trunk shrouds.
12. Disconnect hybrid battery and 12v accessory battery.
13. Remove passenger side front wheel.
14. Remove shroud in wheel well to gain access to engine front.
15. Disconnect crankshaft position sensor, oil pressure sensor, and oxygen sensor from behind engine. Label accordingly.
16. Remove wiper cowl and wiper motor. Place hardware aside with assembly.
17. Remove air intake system, place screws inside Air Intake.
18. Labeling/coloring pink wire harnesses as removed all wire connections surrounding engine. Take images of harness locations.
19. Mark Ground Straps with pink marking "G1", "G2", etc., disconnect ground straps and retain bolts in threaded holes.
20. Pull aside wiring harness and rest over inverter.
21. Pull coil packs and spark plugs, retain bolts onto valve cover. Label coils and spark plug accordingly.
22. Disconnect coolant line bolt on top of valve cover, reinsert into Valve Cover.
23. Remove 12mm connected to EGR on top of valve cover. Label as *Valve Cover EGR Screw* and place in *Bin 1 - EGR*.
24. Remove 10mm valve cover screws, take note of longer screw locations and **take care not to damage windshield.** Place screws into *Bin 2 – Valve Cover* as necessary.
25. Remove valve cover with a large flat blade. Stow in a plastic bag, note two small gasket locations.
26. Remove intake + throttle body, disconnect harness as required. Label accordingly and place bolts/nuts into *Bin 3 – Intake & Throttle Body*.
27. Remove threaded studs for Intake Manifold on Cylinder Head and place in *Bin 3*.
28. If applicable, remove EGR Cooler. https://www.youtube.com/watch?v=2_Hr2tAK7-c

- a. For Cooler removal, remove rear studs attached to exhaust then remove 12mm underneath cooler. Leave stud under cooler in place. Place hardware into *Bin 1 - EGR*
 - b. Begin cleaning out EGR Cooler and EGR Valve.
29. Remove AC Line 10mm bracket adjacent to coolant reservoir. Place bracket and hardware into *Bin 4 – AC Bracket*.
30. **Brace engine with jack and wood blocks.**
31. Remove engine mounting bolts/nut (14mm nut, 17mm bolts.) Place in *Bin 5 – Engine Mount*.
32. Remove engine mounting bracket (17mm, extended + impact.) Place in *Bin 5*.
33. Remove engine mounting stud (8mm.) Place in *Bin 5*.
34. Remove timing cover engine mount bolts (14mm x 3). Remove Timing Cover Engine Mount and place hardware in *Bin 6 – Timing Cover Engine Mount*. Mark Timing Cover Engine Mount bolt holes IAW *Figure 1*.
35. Remove crankshaft pulley (19mm, impact or use bolts to lock down pulley) and harmonic balancer with puller. Place hardware into *Bin 7 – Harmonic Balancer*.
36. Mark Oil Filter Housing bolt locations IAW *Figure 1*.
37. Remove Oil filter housing bolts and remove housing. **Catch oil with a pan and note two gaskets underneath the housing.** Bag Oil Filter Housing and place hardware into *Bin 8 – Oil Filter Housing*.

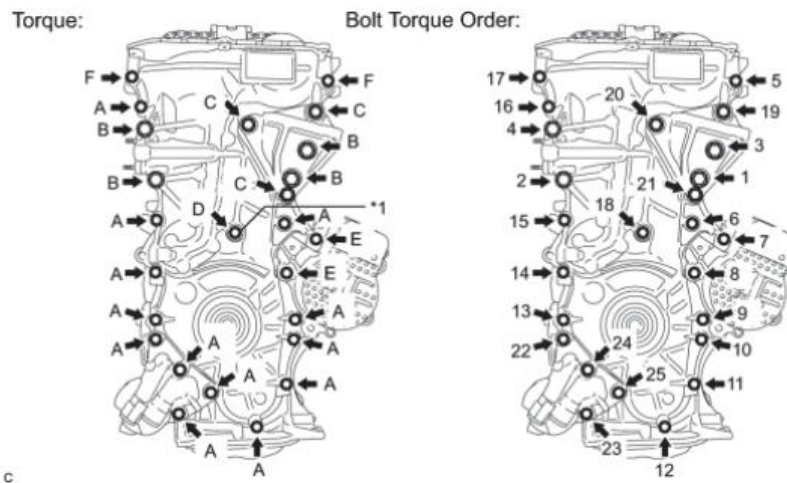
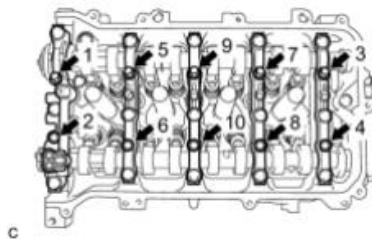


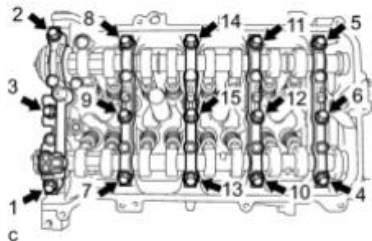
Figure 1

38. Remove lowermost bolt under water pump at 3 o'clock (Next to Bolts 9 and 10 in Figure 1.) Place into *Bin 9 – Water Pump*.
39. Remove Timing Tensioner (10mm x 2, **spring loaded**), retain Timing Tensioner temporarily and place hardware into *Bin 10 – Timing Tensioner*.
40. Remove 4 more bolts securing Water Pump and remove water pump. Mark Water Pump bolt locations IAW *Figure 1*. Retain Water Pump temporarily and place hardware into *Bin 9*.
41. Remove Thermostat (10mm, move dipstick as required), retain Thermostat temporarily and place hardware into *Bin 11 - Thermostat*.

42. Loosen relevant Camshaft Carrier bolts by loosening cap bolts IAW Cam Shaft Removal and Install Manual PDF and *Figure 2*. Loosen applicable Bearing Cap Bolts IAW *Figure 2*.
43. Prevent cams from rotating with shop towel trick IAW <https://youtu.be/yRtLXxkdns?t=1533>
44. Prior to removing Timing Cover, take note of timing cover bolt locations and sequence for removal (reverse of installation). Keep like hardware together and prepare *Bin 12 – Timing Cover*.
45. Remove all Timing Cover bolts in reverse order of *Figure 1* and slowly pry off Timing Cover. Bag Timing Cover and place hardware into applicable bags in *Bin 12*.
46. Remove Timing Guide (towards front of car, two bolts), then remove timing chain and opposite timing guide on pivot pin. Retain guides temporarily and place hardware into *Bin 13 – Forward Timing Guide*.
47. Remove Camshaft Carrier bolts by loosening and removing 15 cap bolts IAW Cam Shaft Removal and Install Manual PDF and *Figure 2*.



(a) Uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.



(b) Uniformly loosen and remove the 15 bearing cap bolts in the sequence shown in the illustration.

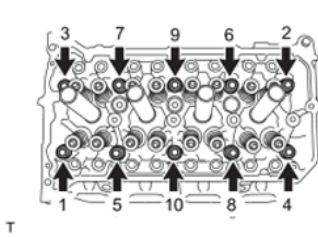
NOTICE:

Uniformly loosen the bearing cap bolts while keeping the camshaft housing level.

Figure 2

48. Pry Camshaft Carrier carefully to remove. Bag Camshaft Carrier with bolts attached. Ensure cams are locked in position.
49. Remove Cam Followers and take care to retain caps underneath followers. **Take careful note of location of followers and caps, place onto a cardboard cutout or into numbered Ziploc bags if necessary to keep track. (1-16)**
50. Remove Exhaust Manifold shield and unbolt Exhaust Manifold. Retain Shield and bag hardware in *Bin 14 – Exhaust Manifold Shield*.
51. Remove Fuel Rail bolts and push fuel rail to the side over wire harness. Place hardware into *Bin 15 – Fuel Rail*.
52. If not already completed, remove EGR Cooler and begin cleaning. Place hardware into *Bin 1*.
53. Disconnect hardware and hoses to the rear of the head.
 - a. Two 12mm bolts hold down the large metal pipe connected to the head. One is very hard to reach.

- b. Place any additional hardware in *Bin 16 – Cylinder Head Misc.*
54. Clean oil surrounding Head Bolts.
55. Break loose Head Bolts in specific sequence IAW *Figure 3.*

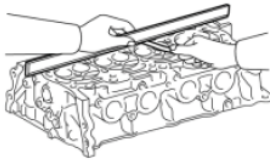


(a) Using a 10 mm bi-hexagon wrench, uniformly loosen and remove the 10 cylinder head bolts and 10 plate washers in several steps in the sequence shown in the illustration.

- Be careful not to drop washers into the cylinder head.
- Head warpage or cracking could result from removing the bolts in the wrong order.

Figure 3

56. Remove head bolts and retain them temporarily. Remove head bolt washers from head.
57. Remove Cylinder Head Assembly from Engine Block. Remove Exhaust Port Gasket and Bag Cylinder Head Assembly.
58. Remove Head Gasket.
59. Begin Cylinder Head flatness inspection IAW *Figure 4.* Clean all removed parts.



(a) Using a precision straightedge and feeler gauge, measure the warpage of the contact surfaces where the cylinder head contacts the cylinder block and manifold.

Text in Illustration

*a	Cylinder Head Lower Side:
*b	Intake Manifold Side:
*c	Exhaust Manifold Side:

Maximum Warpage:

Item	Specified Condition
Cylinder block side	0.05 mm (0.00197 in.)
Intake manifold side	0.10 mm (0.00394 in.)
Exhaust manifold side	0.10 mm (0.00394 in.)

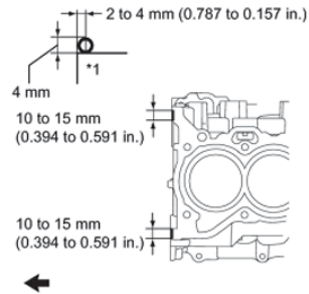
If the warpage is more than the maximum, replace the cylinder head.

Figure 4

60. Disassemble Valve Springs and replace Valve Stem Seals.
61. Remove Fuel Injector Gaskets on Cylinder Head. Retain with removed gaskets.
62. Replace Fuel Injector O-Rings on Fuel Rail (NOTE: Injectors have gasoline behind them, handle with extreme care.)
63. Replace Valve Cover Seals. For 10mm Bolt in the middle of Valve Cover, replace Grommet.
64. Remove the frontmost rail on Cam Carrier and clean out oil filter. Reassemble and if not already completed, remove gasket and O-ring.

65. Replace Fuel Injector Gaskets on Cylinder Head.
66. Ensure ALL mating surfaces are clean and free of all debris. Ensure cylinders are free of debris and tools. Ensure Head Bolt holes are clear.
67. Apply sealant to Engine Block IAW *Figure 5* and install new Head Gasket.

(a) Apply seal packing (Diameter 4.0 mm (0.157 in.)) to the cylinder block as shown in the illustration.



Text in Illustration

*1	Cylinder Block
➔	Engine Front

Figure 5

68. Apply sealant to new Head Gasket IAW *Figure 6*.

(c) Apply seal packing (Diameter 4.0 mm (0.157 in.)) to the new cylinder head gasket as shown in the illustration.

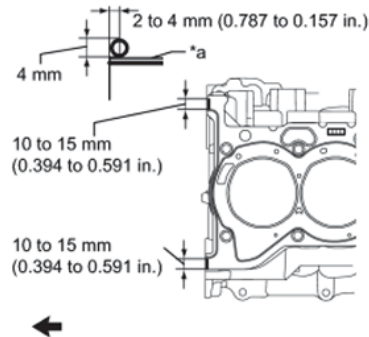
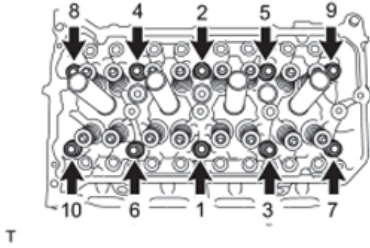


Figure 6

69. Apply small amount of oil/assembly lube to new Head Bolts and slide new Head Bolt Washer onto bolts with smaller diameter (chamfered) side to Cylinder Head.
70. Lightly run threads on new Head Bolts. Using special socket (12mm Triple Square or Toyota recommended), lightly snug all Head Bolts in sequence IAW *Figure 7*.
71. Torque all Head Bolts in sequence to 36 ft-lbs IAW *Figure 7*.

(d) Step 1:



(1) Using a 10 mm bi-hexagon wrench, install and uniformly tighten the 10 cylinder head bolts in several steps, in the sequence shown in the illustration.

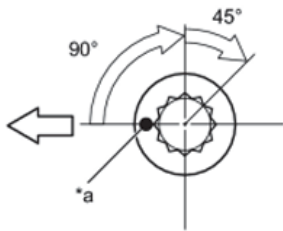
Torque: **49 N·m (500 kgf·cm, 36ft·lbf)**

NOTICE:

Do not drop the plate washers into the cylinder head.

Figure 7

72. Paint a mark on all Head Bolts IAW *Figure 8* and, using a breaker bar with special socket, torque Head Bolts 90 degrees in sequence IAW *Figure 7*.



Text in Illustration

*a	Paint Mark
→	Engine Front

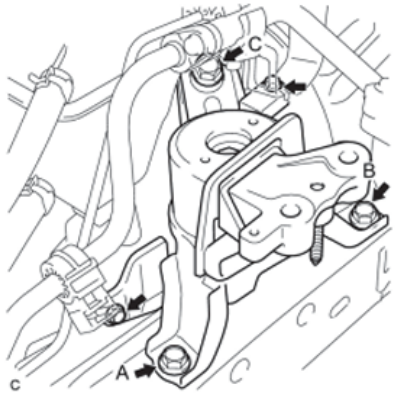
Figure 8

73. Using a breaker bar, torque Head Bolts 45 degrees in sequence IAW *Figure 7*.

74. Confirm all Head Bolt paint marks are in correct end position.

75. **COMPLETE LATER – Cylinder Head Install to Thermostat**

76. Install RH Engine Mounting Insulator and A/C Line bracket IAW *Figure 16*.



(a) Position the engine mounting insulator sub-assembly RH as shown in the illustration.

(b) Temporarily install bolt A to the engine mounting insulator sub-assembly RH.

(c) Tighten the 3 bolts to the engine mounting insulator sub-assembly RH in the order the bolt B, bolt C and bolt A.

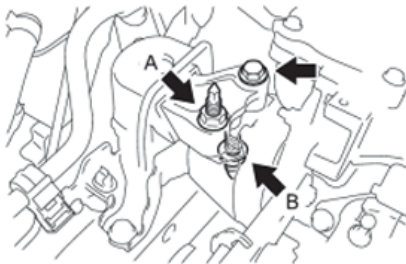
Torque: **95 N·m (969 kgf·cm, 70ft·lbf)**

(d) Install the 2 cooler brackets with the 2 bolts.

Torque: **9.8 N·m (100 kgf·cm, 87in·lbf)**

Figure 16

77. With Engine jacked into position, install RH Engine Mount hardware IAW *Figure 17*.



(h) Install the engine mounting insulator RH with the bolt and 2 nuts.

Nut A - Torque: **95 N·m (969 kgf·cm, 70ft·lbf)**

Nut B - Torque: **52 N·m (530 kgf·cm, 38ft·lbf)**

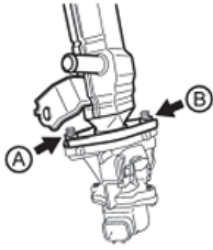
Bolt - Torque: **95 N·m (969 kgf·cm, 70ft·lbf)**

Figure 17

78. Remove Oil Pan drain plug and replace gasket washer. Reinstall plug and torque to 27 ft-lbs.

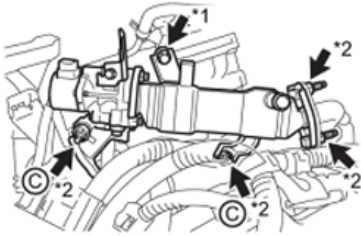
79. Ensure EGR Cooler is free of moisture by blowing out with compressed air and leaving out to dry overnight.

80. If applicable, rebuild EGR Cooler with new gaskets and reinstall EGR IAW *Figure 18*. Omit installing Stud Bolt and Nut underneath Cooler and retain hardware.



(a) Temporarily install the EGR cooler sub-assembly with the 2 nuts (A and B).

Text in Illustration



*1	Bolt
*2	Stud Bolt and Nut

(b) Set a new gasket and EGR valve with cooler assembly.

(c) Using an E8 "TORX" wrench, install the 4 stud bolts.

Torque: **9.5 N·m (97 kgf·cm, 84in·lbf)**

(d) Temporarily install the 2 nuts (C) and bolt.

(e) Tighten the nut (A).

Torque: **21 N·m (214 kgf·cm, 15ft·lbf)**

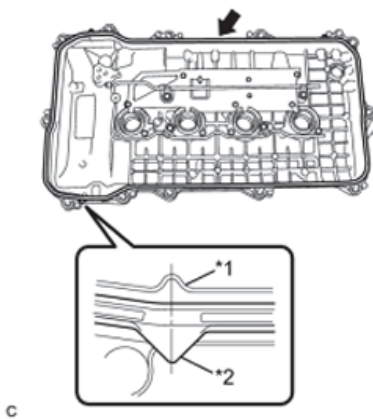
(f) Tighten the 3 nuts (B and C) and bolt.

Torque: **21 N·m (214 kgf·cm, 15ft·lbf)**

Figure 18

81. If not already completed, replace two gaskets on Camshaft Carrier.

82. Install new Valve Cover Gasket on Valve Cover IAW *Figure 19*. Ensure gasket is aligned with Valve Cover Rib.



and the center of the cylinder head gasket tab is within 4 mm (0.157 in.).

Figure 19

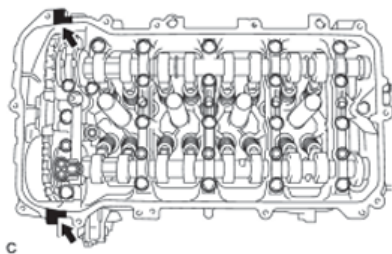
83. Apply Sealant to Camshaft Carrier and install Valve Cover IAW *Figure 20*. Ensure centermost bolt gets grommet (Seal Washer) installed on top of Valve Cover under bolt head.

Seal packing:

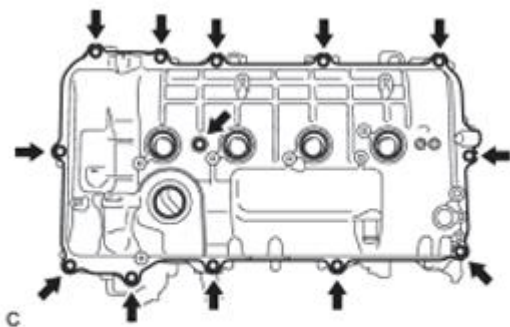
Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

Standard diameter:

4.0 mm (0.157 in.)



- Remove any oil from the contact surfaces.
- Install the cylinder head cover sub-assembly within 3 minutes and tighten the bolts within 15 minutes of applying seal packing.
- Do not start the engine for at least 2 hours after the installation.



Torque: 10 N·m (102 kgf·cm, 7ft·lbf)

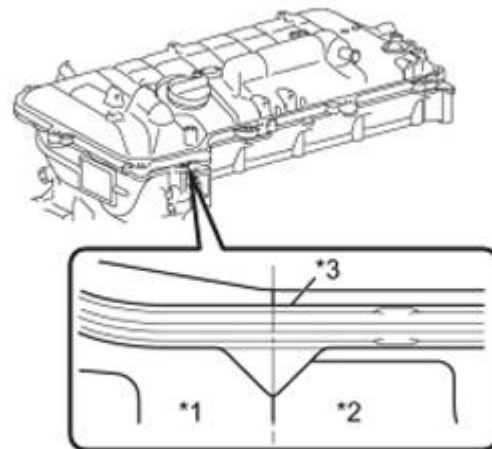


Figure 20

84. If required, install EGR bolt to Valve Cover. Torque IAW *Figure 18*.

85. **If not installing Oil Catch Assembly, skip to step 87.**

- a. Create your oil catch assembly as follows:
 - i. PCV -> 3/8" (10mm) ID hose -> Oil Catch Can -> 1/2" (13mm) ID hose -> 3/4" to 1/2" hose reducer -> 3/4" ID hose -> Intake manifold port.
- b. Find suitable installation location for Oil Catch Can and install. Ensure hoses can reach air intake manifold/PCV.
- c. Attach 3/8" Hose to PCV Valve and clamp down.
- d. Leave 3/4" hose nearby intake manifold installation location.
- e. For more info see:
https://www.reddit.com/r/prius/comments/y1sobj/oil_catch_can_installation_photos_2013_prius/

86.

Check After Reassembly:

- **Check all drain plugs for leaks.**
- **After car is placed back on ground, ensure coolant plug is open and drain as much water is possible. Refill coolant IAW <https://www.youtube.com/watch?v=UixpP-PwGZc>**
- **After car is started, check Fuel Rail for leaks and proper installation.**
- **Check Timing Cover for leaks after a week of driving.**