



Installation


Cylinder head assembly

1. Install the cylinder head gasket.
2. Lift and install cylinder head assembly (93).


 Cylinder head assembly: **50 kg**

- ★ Check the punch mark on the mounting bolt head. If 5 marks are punched, replace it with a new one without using it.
- ★ Tighten the mounting bolts in the following order.

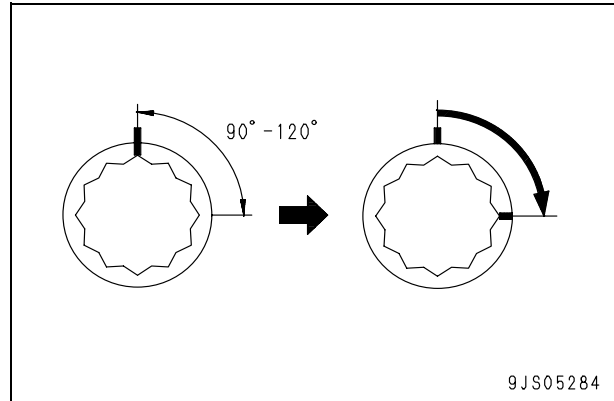
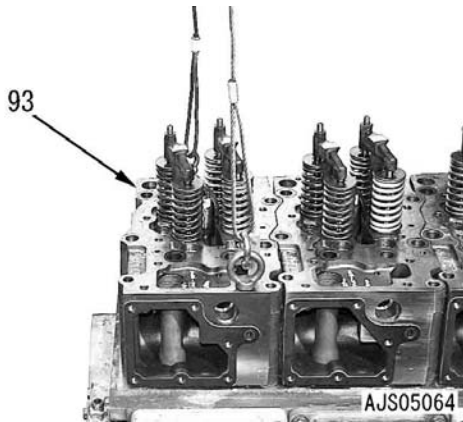
 Cylinder head assembly mounting bolt: **Molybdenum disulfide grease (LM-P)**

 Cylinder head mounting bolts (1 – 7):
1st time: $245 \pm 9.8 \text{ Nm}$ { $25 \pm 1 \text{ kgm}$ }
2nd time: $382.5 \pm 9.8 \text{ Nm}$ { $39 \pm 1 \text{ kgm}$ }
3rd time: $90 - 120^\circ$ retightening

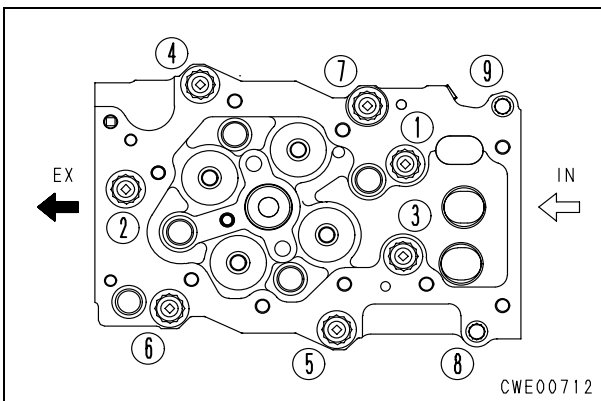
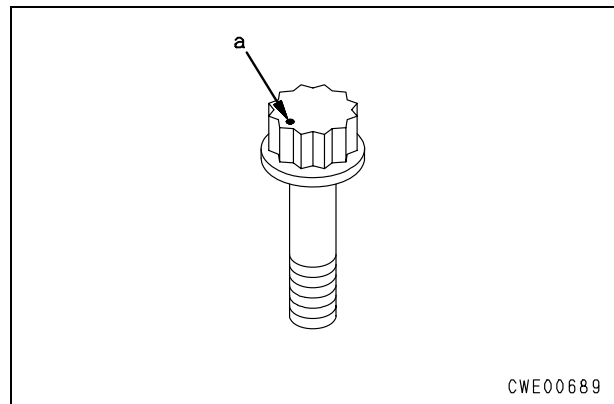
- ★ For retightening, use tool **A8** (see Special tool list). When not using tool **A8**, apply a marking to the cylinder head and bolt with a felt pen and then retighten the bolt by $90^\circ - 120^\circ$ (target is 120°).

 Cylinder head assembly mounting bolts (8 and 9):

$93.2 - 103 \text{ kgm}$ { $9.5 - 10.5 \text{ kgm}$ }




- ★ After tightening the main bolt, apply a punch mark (a) on its head (this mark shall not be applied to a new bolt).

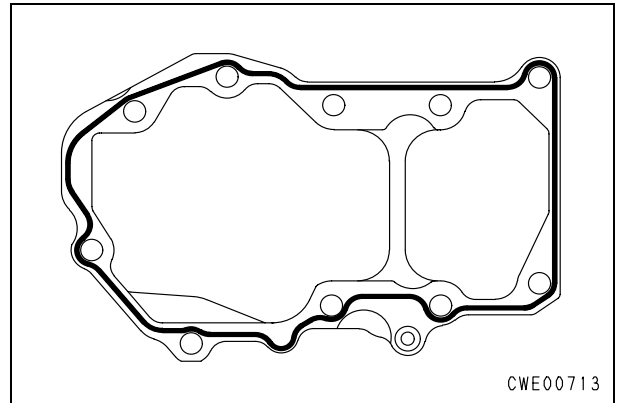
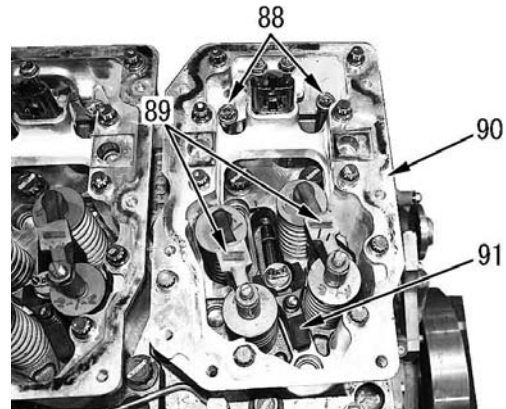
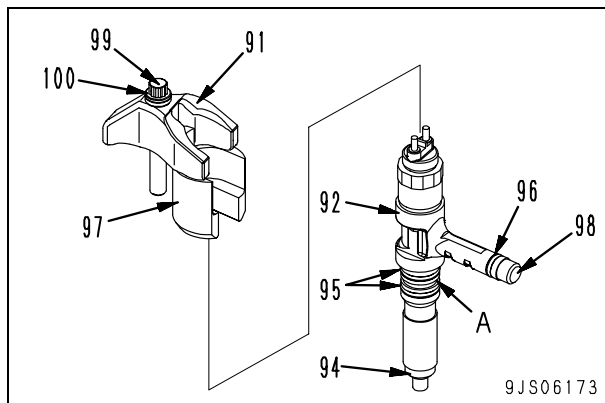




Fuel injector

- ★ Make sure that inside of the injector hole is free from dusts.

 O-ring: **Engine oil (EO30)**

3. Assemble gasket (94) and O-rings (95) and (96) to fuel injector (92).
 - ★ Use care not to install O-ring (95) in groove (A) at the center.
4. Insert fuel injector (92) to adapter (97) and injector holder (91).
5. Attach spherical washer (100) to bolt (99) and then tighten injector holder (91) temporarily.
 -  Spherical washer: **Engine oil (EO30)**

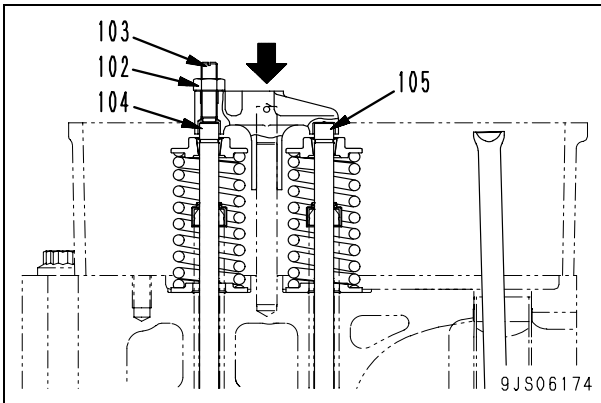


- ★ Tightening of injector holder (91) is done permanently after installing the intake manifold and tightening the high-pressure piping temporarily.
6. Install push rod (88).
 - ★ Check that the push rod end is securely placed in the cam follower socket.
 7. Apply gasket sealant and then install rocker housing (90).
 -  Rocker housing: **Gasket sealant (LG-7)**
 - ★ Diameter of the gasket sealant line shall be 2 to 3 mm and it should be applied along the housing groove as shown below.
 -  Rocker housing mounting bolt:
78.4 – 93.2 Nm {8.0 – 9.5 kgm}
 8. Install crosshead (89).

9. Adjust the crosshead in the following procedure.
 - 1) Loosen locknut (102) and then loosen adjustment screw (103) to a position where it does not contact with valve stem (104).
 - 2) Maintain the contact with valve stem (105) on the push rod side by pressing the contact surface against the rocker arm using a finger.
 - 3) Tighten adjustment screw (103) to confirm the position where adjustment screw (103) is contacted against valve stem (104).
 - 4) Drive in adjustment screw (103) further by 20 – 30° from the contacting position against valve stem (104).
 - 5) Tighten locknut (102) while suppressing move of adjustment screw (103).

Locknut:

53.0 – 64.7 Nm {5.4 – 6.6 kgm}



Rocker arm assembly

10. Install rocker arm assembly (87).
 - ★ Insert respective rocker arm at a position where the riveted side of the shaft faces the front side of the engine.
 - ★ When installing, direct the wider seat of the shaft to the rocker arm housing.
 - ★ Make sure that the ball of adjustment screw (86) is securely fitted to the push rod socket.
 - ★ When tightening the mounting bolt, make sure adjustment screw (86) is not pushing the push rod.

Threaded portion and seat of rocker arm assembly mounting bolt:

Engine oil (EO30)

Rocker arm assembly mounting bolt:

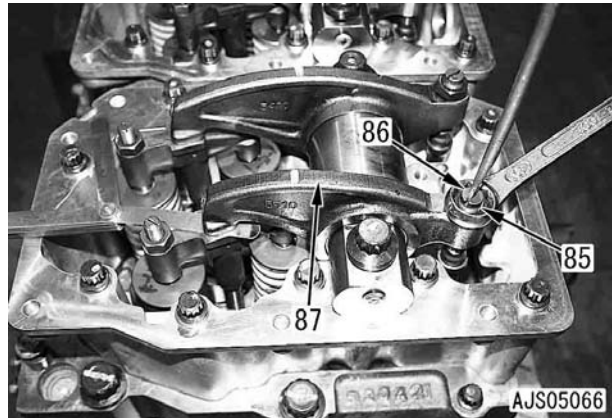
235.2 – 254.8 Nm {24 – 26 kgm}

 - ★ Adjust valve clearance, referring to "Testing and adjusting valve clearance" in Testing and adjusting.

Locknut (85):

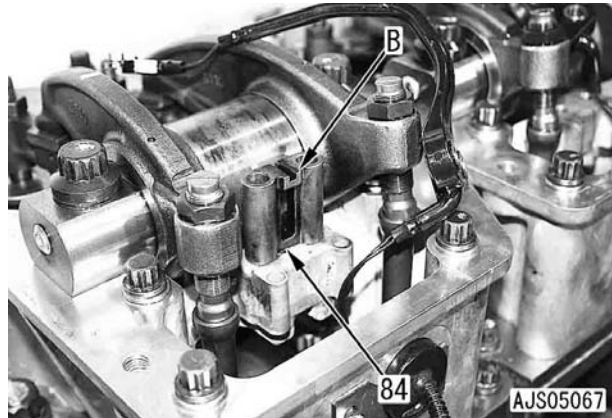
57.8 – 77.4 Nm {5.9 – 7.9 kgm}

- ★ After tightening the locknut, check the valve clearance again.



Injector wiring harness

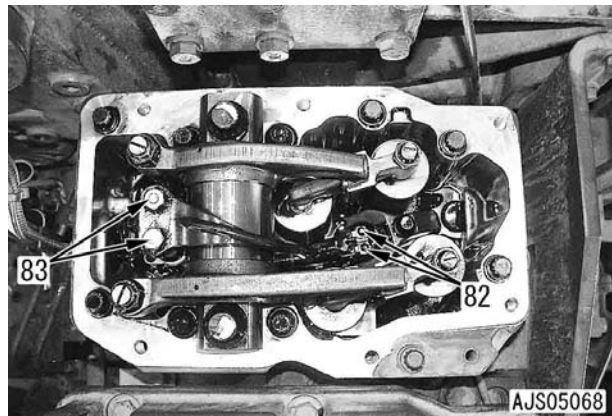
11. Install spacer (84).
 - ★ When installing the spacer, direct its projection (B) toward the outside.



12. Install terminal mounting nut (82) and wiring harness fixing bolt (83).
 - ★ Tighten the terminal mounting nuts alternately.


Terminal mounting nut:

2 ± 0.2 Nm {0.2 ± 0.02 kgm}



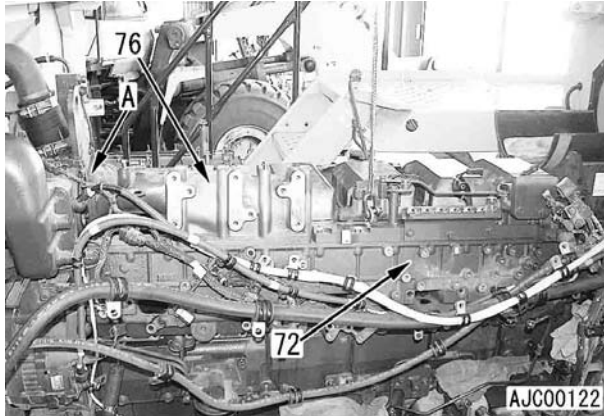
Air intake manifold assembly

13. Place diffuser (76) on air lifted intake manifold assembly (72) being lifted.

 Air intake manifold and diffuser assembly:

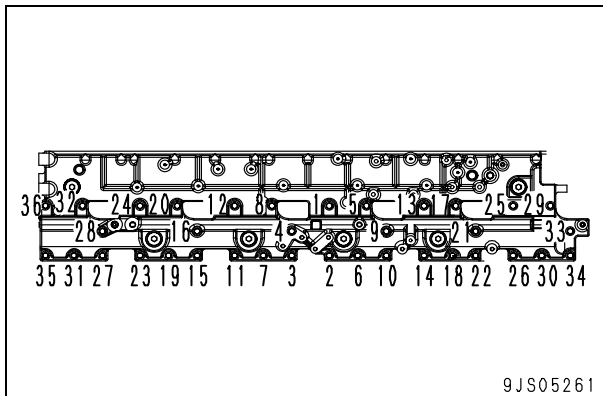
135kg

- ★ Pay attention to biting of the tube into (A) portion.



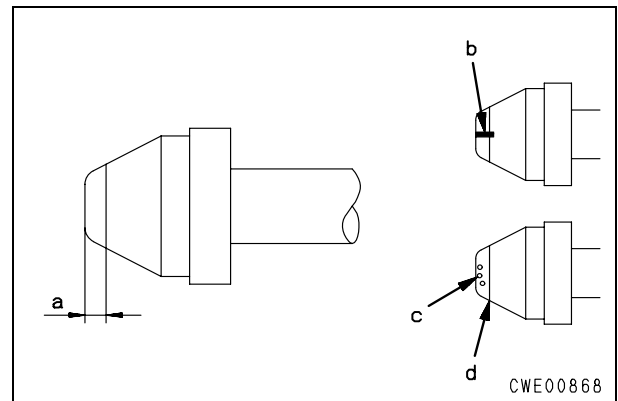
14. Install air intake manifold assembly (72).

- ★ Tighten the mounting bolts in the order indicated in the figure (clockwise starting at the center).






- ⚠ Before installing the high-pressure piping, check it for the following defects. If there is any of these defects, it can cause fuel leakage. Accordingly, replace the high-pressure piping.

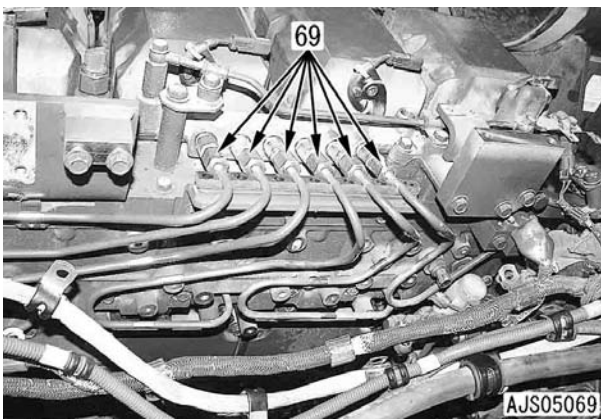
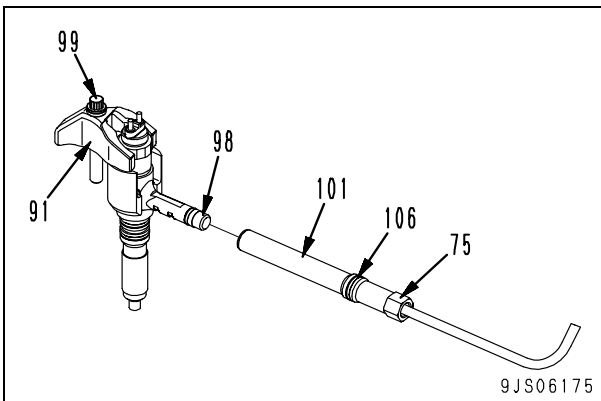
- Check the taper seal of the connecting part (Part (a): Part of 2 mm from the end) for visible lengthwise slit (b) and dent (c).
- Check part (d) (end of the taper seal: Part at 2 mm from the end) for stepped-type wear (fatigue) which your nail can feel.



**High-pressure piping**

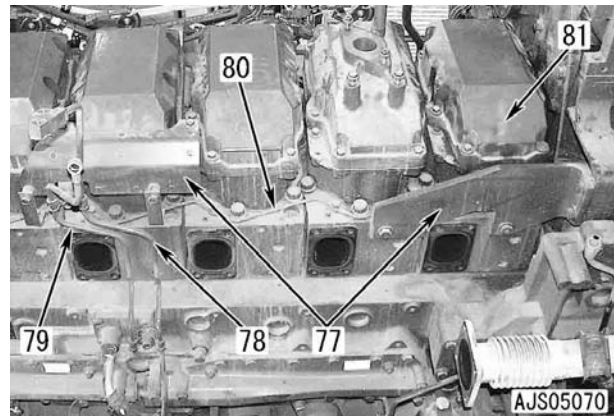
- ⚠ When handing the high-pressure pipe and clamp, pay attention the following.

- It is strictly prohibited to bend the high-pressure piping to use it again or using it in other locations.
 - Install the specified clamp securely in the specified position with the specified torque.
 - Don't apply lubricant and the like to the high-pressure piping sleeve nut and the threaded portion of the mating side.
- ★ Axial force in the tightening can be excessive, potentially damaging the high-pressure piping.

15. Install O-ring (106) to high-pressure piping sleeve (101).
 O-ring: **Engine oil (EO30)**
16. Tighten sleeve nut (75) temporarily aligning it connector (98) of the injector.
 ★ When it is difficult to hitch sleeve nut to the threaded portion, turn the spanner while pushing sleeve nut (75) end toward the injector by use of a short bar and the like.
17. Tighten the common rail side sleeve nut (69) temporarily, too.
18. Tighten injector holder (91) permanently.
 Injector holder mounting bolt:
58.9 – 73.5 Nm {6.0 – 7.5 kgm}
19. Tighten high-pressure piping sleeve nuts (69) and (75) permanently using the spanner type torque wrench.
 Sleeve nut: **39.2 – 44.1 Nm {4 – 4.5 kgm}**
 ★ After finishing the work, check that O-ring (106) is not projected from the end of the sleeve nut (75).



20. Install cylinder head cover (81).
 ★ A different tightening torque is employed for No. 2 cylinder mounting bolt alone.
 Cylinder head cover mounting bolt:
No.1, 3, 4, 5 and 6 cylinders:
9.8 ± 1.0 Nm {1.0 ± 0.1 kgm}
No. 2 cylinder:
58.8 – 73.5Nm {6 – 7.5 kgm}
21. Install air vent tube (80).
 Air bleeding tube joint bolt (Cylinder head side):
9.8 – 12.7 Nm {1.0 – 1.3 kgm}
22. Install turbocharger coolant tube (79) and lubrication tube (78).
23. Install bracket (77).



High-pressure piping clamp

24. Install the clamp on the high-pressure pipe in the following procedure.

- 1) Manually tighten 17 high-pressure piping clamps (107) temporarily in the position indicated in the figure.
- 2) Manually tighten common rail slide clamp bracket (108) and clamp (52) temporarily and then tighten clamp (52).

Common rail side clamp bolt:

$9.8 \pm 1.0 \text{ Nm}$ { $1 \pm 0.1 \text{ kgm}$ }

- 3) Tighten common rail side clamp bracket (108) to the specified torque.

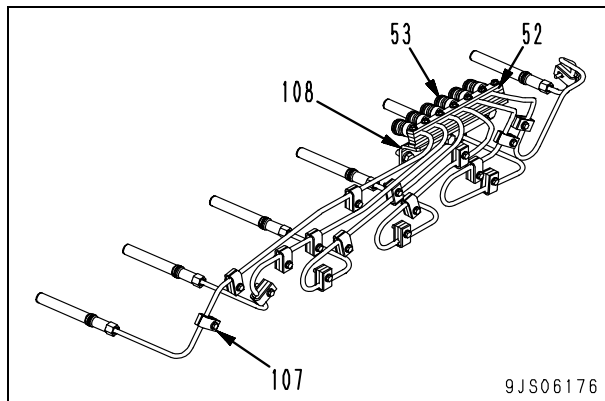
- 4) Tighten high-pressure piping clamp (107).

High-pressure piping side clamp bolt:

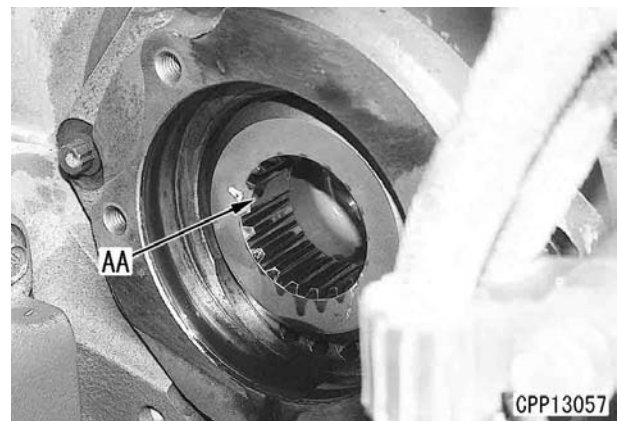
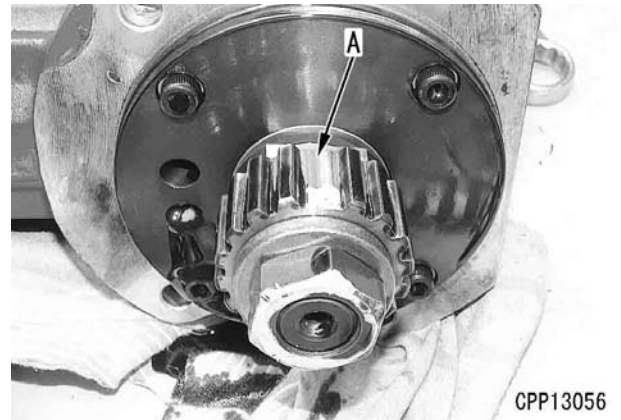
$11.8 - 14.7 \text{ Nm}$ { $1.2 - 1.5 \text{ kgm}$ }

- 5) Install cover (53) on the common rail side sleeve nut.

★ When installing it, direct the slit downward.

**Fuel supply pump**

25. Install the fuel supply pump assembly by aligning (A) and (AA) at the position where a spline tooth is missing.

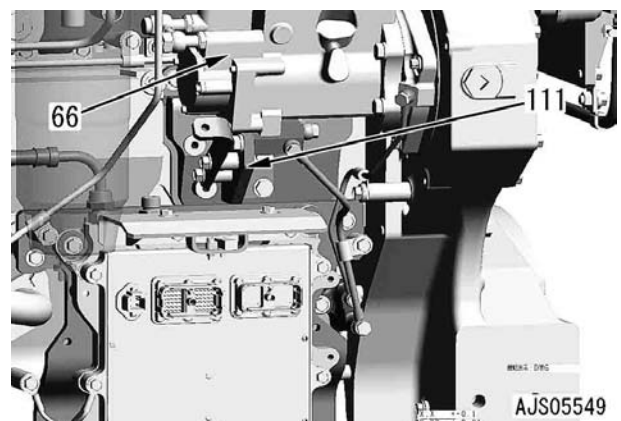


Fuel supply pump (66) mounting bolt:

$59 - 74 \text{ Nm}$ { $6 - 7.5 \text{ kgm}$ }



Bottom bracket (111) mounting bolt:

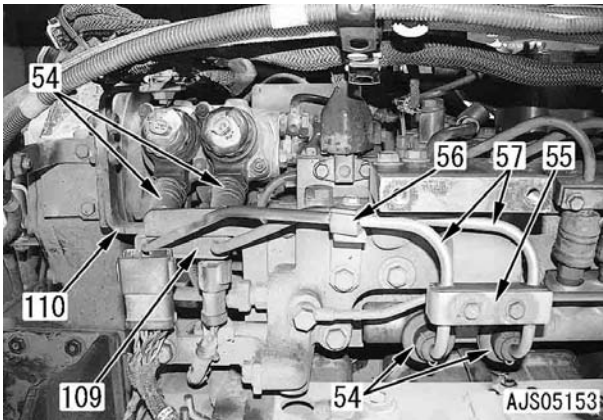
$58.8 - 73.5 \text{ Nm}$ { $6.0 - 7.5 \text{ kgm}$ }



High-pressure piping


▲ Handle the high-pressure piping and clamp in the same way as the piping between the fuel injector and common rail (noted in the foregoing) is handled.

26. Tighten high-pressure piping (57) temporarily.
27. Tighten clamps (55), (56) and (109) temporarily.
28. Tighten bracket (110) temporarily.
29. Tighten high-pressure piping (57) permanently.
 High-pressure piping sleeve nut:
39.2 – 44.1 Nm {4.0 – 4.5 kgm}
30. Tighten clamps (55), (56) and (109) permanently.
 Clamping bolt:
9.8 ± 1.0 Nm {1 ± 0.1 kgm}
31. Tighten bracket (110) permanently.
32. Install cover (54).




- Carry out the succeeding installation in the reverse order of removal.


[*1]

-  Air hose clamp:
8.8 ± 0.5 Nm {0.9 ± 0.05 kgm}




[*2]

-  Komaclone tube assembly hose clamp:
5.9 ± 0.49 Nm {0.6 ± 0.05 kgm}



[*3]

-  Air cleaner band:
12.7 – 17.6 Nm {1.3 – 1.8 kgm}


[*4]

-  Tube (15) joint bolt:
19.6 – 29.4 Nm {2.0 – 3.0 kgm}
-  Tube (14) joint bolt:
14.8 – 19.6 Nm {1.51 – 1.99 kgm}
-  Tube (14) sleeve nut:
84 – 132 Nm {8.5 – 13.5 kgm}


[*5]

-  Tube (18) joint bolt:
24.5 – 34.3 Nm {2.5 – 3.5 kgm}
-  Tube (18) (Supply pump side):
14.8 – 19.6 Nm {1.51 – 1.99 kgm}

[*6]

-  Air hose clamp:
9.8 ± 1.0 Nm {1.0 ± 0.1 kgm}

[*7]

-  Coolant tube assembly (26) joint bolt:
24.5 – 34.3 Nm {2.5 – 3.5 kgm}

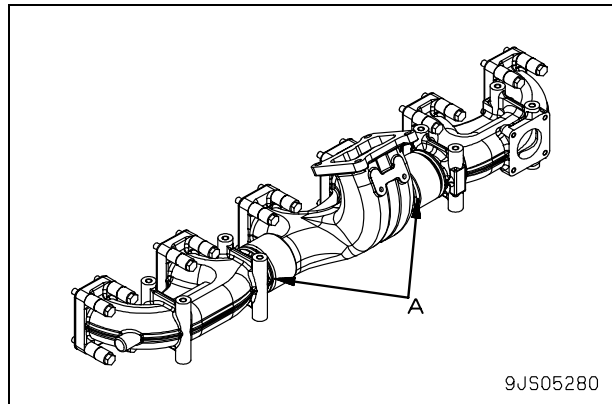
[*8]

Exhaust manifold assembly



1. When the exhaust manifold assembly was disassembled, apply connection (A) (2 locations) with the adhesive (heat resistant sealing agent) before assembling it.

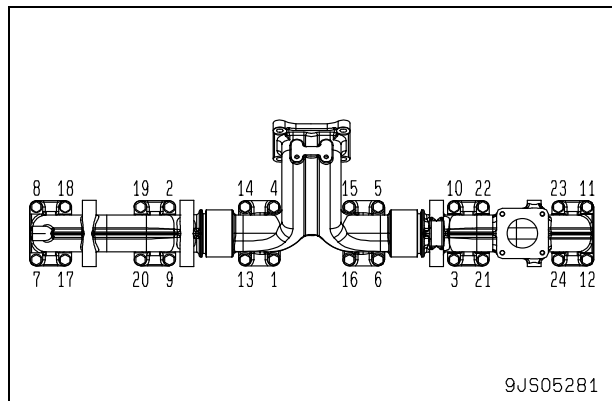
 Exhaust manifold connection:

Liquid adhesive (Holtz MH 705)



- ★ Tighten the mounting bolts in the following order.

-  Exhaust manifold mounting bolt:
Seizure prevention compound (LC-G)
-  Exhaust manifold mounting bolt:
1st time: 39.2 – 58.8 Nm {4.0 – 6.0 kgm}
2nd time:
98.1 – 122.6 Nm {10 – 12.5 kgm}



Reference

Installation of turbocharger assembly

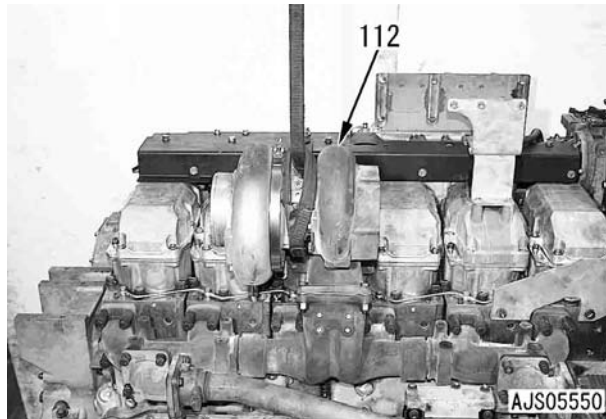
1. Lift and install turbocharger assembly (112).

Turbocharger assembly: **55 kg**

Turbocharger mounting bolt and nut:

Seizure prevention compound (LC-G)

Turbocharger mounting bolt and nut:

78.5 – 88.3 Nm {8.0 – 9.0 kgm}

- ⚠ **Make sure that a clearance of 10 mm minimum is provided between the high-pressure piping and adjacent wiring harness. If not, secure the clearance by adjusting the wiring harness position.**

- **Bleeding air**

Bleed air from the fuel system, referring to “Bleeding air from fuel system” in Testing and adjusting.

[*9]



Oil tube (44) joint bolt:

7.8 – 9.8 Nm {0.8 – 1.0 kgm}

Tubes (45) and (46) sleeve nut:

54 – 93 Nm {5.5 – 9.5 kgm}

Tube (46) joint bolt:

24.5 – 34.3 Nm {2.5 – 3.5 kgm}

[*10]



Tube (51) joint bolt:

19.6 – 29.4 Nm {2.0 – 3.0 kgm}

[*11]



Oil tube (63) joint bolt (Supply pump side):

7.9 – 12.7 Nm {0.8 – 1.3 kgm}

Oil tube (63) joint bolt (Block side):

9.8 – 12.7 Nm {1.0 – 1.3 kgm}

Tube (65) joint bolt (Supply pump side):

14.8 – 19.6 Nm {1.51 – 1.99 kgm}

Tubes (64) (bottom) and (65) sleeve nut:

84 – 132 Nm {8.5 – 13.5 kgm}

[*12]



Tube (68) joint bolt (Corrosion resistor side):

24.5 – 34.3 Nm {2.5 – 3.5 kgm}

Removal and installation of fuel injector assembly

Special tools

Sym- bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	1	795-799-5410 Adapter	■	1	N	
		795-799-5420 Remover	■	1	N	
	2	795T-675-1110 Socket	●	1	N	○

Removal

- ⚠ Stop the machine on level ground and set the frame lock bar.
- ⚠ Lower the work equipment to the ground completely and stop the engine. Apply the parking brake and put the blocks under the wheels.
- ⚠ Disconnect the negative terminal (–) of the battery before starting with the work.

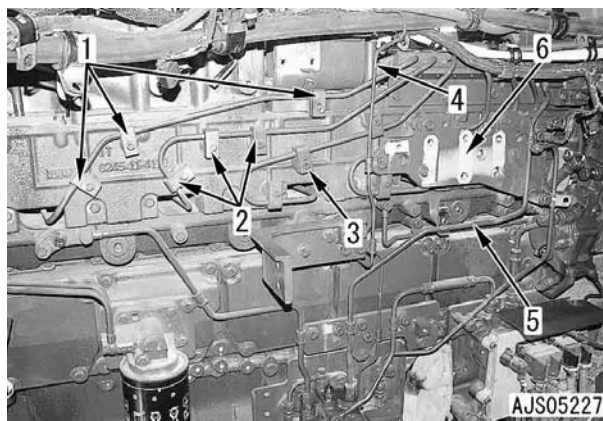
- Remove the engine hood and covers, referring to "Removal and installation of engine hood assembly."
- Remove the filter, air tube, injector wiring harness brackets, referring to "Removal and installation of cylinder head assembly."
 - Overall view of top surface



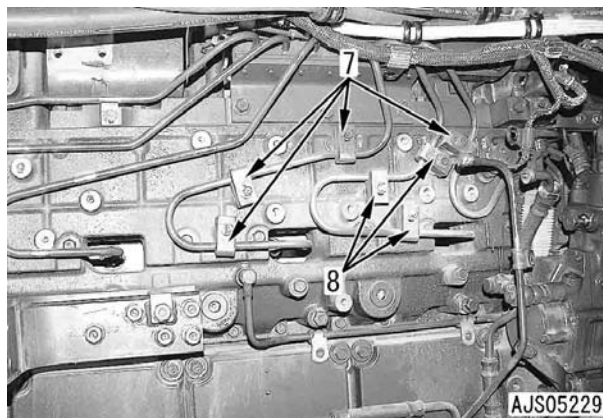
- Overall view of right side



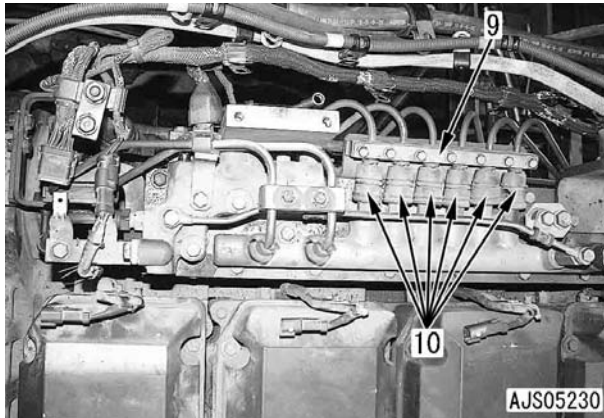
- Disconnect high-pressure piping clamps (1) to (3).
- Remove tubes (4) and (5). [*1]
- Remove bracket (6).



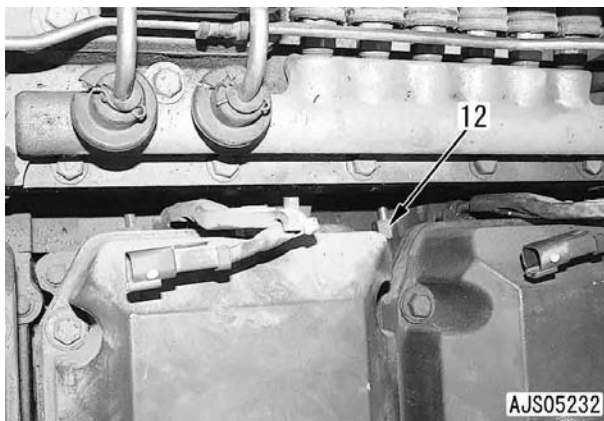
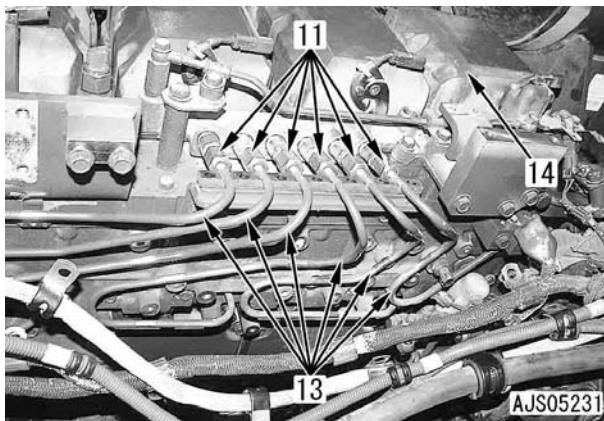
- Disconnect high-pressure piping clamps (7) and (8).
 - ★ A clamp is provided on the fuel supply pump side.



7. Remove clamp (9).
8. Remove cover (10).

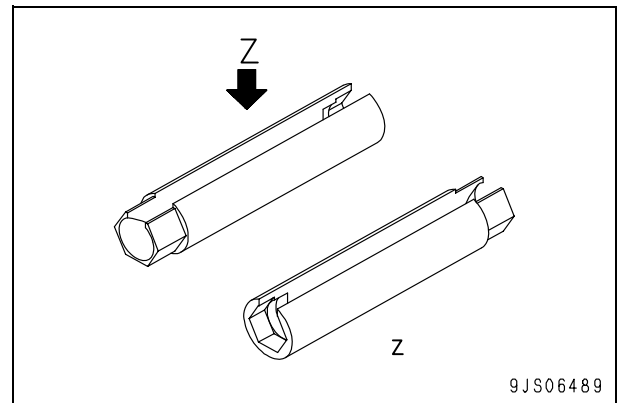


9. Disconnect 6 sleeves (11) and (12).
10. Remove high-pressure pipings (13).
11. Remove cylinder head cover (14).

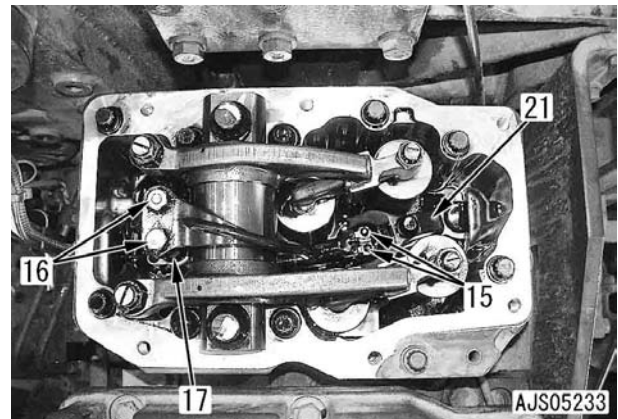


- ★ When tool **A2** is not available, disconnect sleeve (12) through the top.

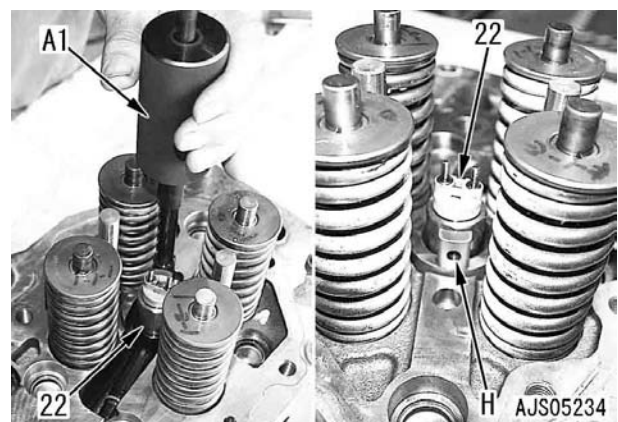
- Tool **A2**



12. Disconnect terminal mounting nuts (15).
★ Loosen the nuts alternately.
13. Remove wiring harness assembly mounting bolts (16) and spacer (17).
14. Remove fuel injector holder (21).



15. Using tool **A1**, remove fuel injector assembly (22).
★ Remove the assembly by hitching tip of tool **A1** on hole (H) of the fuel injector.
★ Do not grip the solenoid valve at the top of the injector to pull off the injector with pliers.




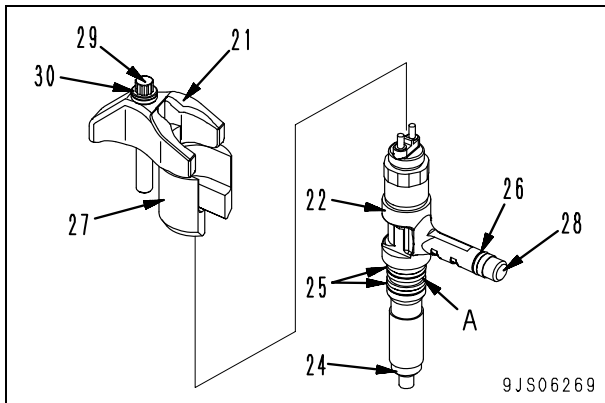
Installation

Fuel injector

- ★ Check that the inside of the injector sleeve is free from dirt.

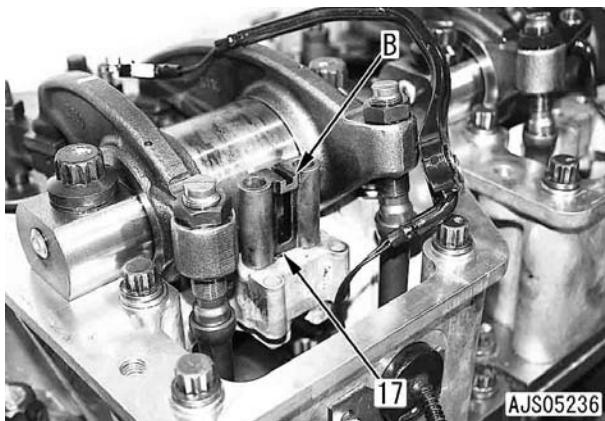
 O-ring: **Engine oil (EO30)**

1. Assemble gasket (24) and O-rings (25) and (26) to fuel injector (22).
 - ★ Use care not to install O-ring (25) in groove (A) at the center.
2. Insert fuel injector (22) to adapter (27) and injector holder (21).
3. Attach spherical washer (30) to bolt (29) and then tighten injector holder (31) temporarily.
 -  Spherical washer: **Engine oil (EO30)**
 - ★ Tightening of injector holder (21) permanently after tightening the high-pressure piping temporarily.




Injector wiring harness

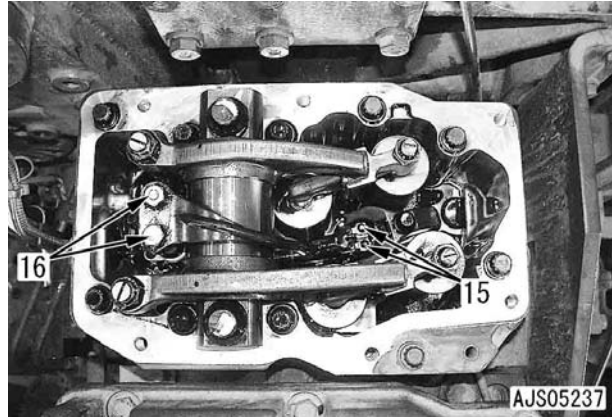
4. Install spacer (17).
 - ★ When installing the spacer, direct its projection (B) toward the outside.



5. Install terminal mounting nut (15) and wiring harness fixing bolt (16).
 - ★ Tighten the terminal mounting nuts alternately.

 Terminal mounting nut:

$2 \pm 0.2 \text{ Nm } \{0.2 \pm 0.02 \text{ kgm}\}$



High-pressure piping

⚠ When handling the high-pressure pipe and clamp, pay attention the following.

- It is strictly prohibited to bend the high-pressure piping to use it again or using it in other locations.
- Install the specified clamp securely in the specified position with the specified torque.
- Don't apply lubricant and the like to the high-pressure piping sleeve nut and the threaded portion of the mating side.
- ★ **Axial force in the tightening can be excessive, potentially damaging the high-pressure piping.**

⚠ Before installing the high-pressure piping, check it for the following defects. If there is any of these defects, it can cause fuel leakage. Accordingly, replace the high-pressure piping.

- Check the taper seal of the connecting part (Part (a): Part of 2 mm from the end) for visible lengthwise slit (b) and dent (c).
- Check part (d) (end of the taper seal: Part at 2 mm from the end) for stepped-type wear (fatigue) which your nail can feel.

