Engine and cooling system *(ALL-R401-001-K-50-A)*

Removal and installation of supply pump assembly *(PC88MR-AD70-924-K-00-A)*

★ Special tools

Symbol	Part No.	Part name	Necessity	Q'ty
A-1	790–101–3000	Push puller	■	1

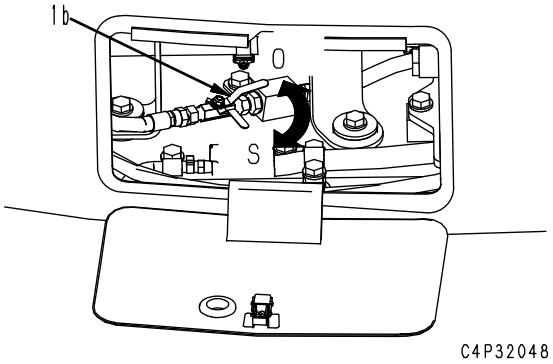
⚠ Place the machine on a level ground and lower the work equipment to the ground in a stable posture.

⚠ Stop the engine, turn the battery disconnect switch to OFF position, and remove the key. (For details, see "Testing and adjusting", "Handling battery disconnect switch".)

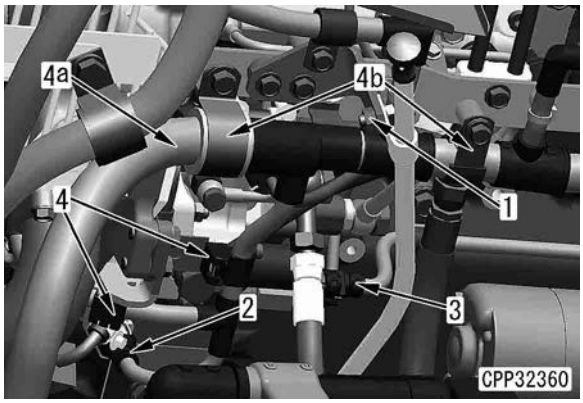
⚠ Set the lock lever in LOCK position.

Removal *(PC88MR-AD70-520-K-00-A)*

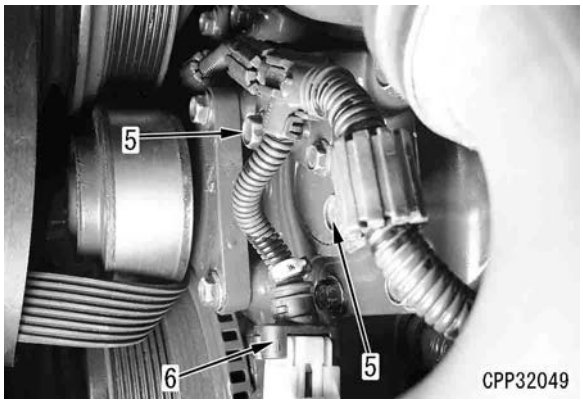
1. Open cover (1a), and turn valve (1b) to CLOSE position (S).



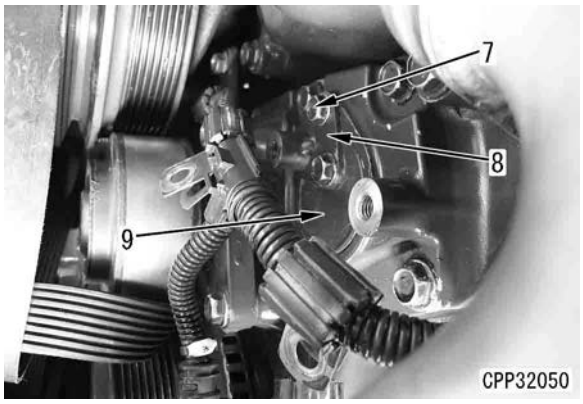
2. Remove the counterweight assembly. For details, see "Removal and installation of counterweight assembly".
3. Remove the fan belt. For details, see "Removal and installation of fan belt".
4. Remove clamp mounting nut (1).
5. Disconnect connector (2) of oil pressure switch and connector (3) of supply pump regulator SCV.
6. Remove clip (4).
7. Remove clamp (4b) of wiring (4b).



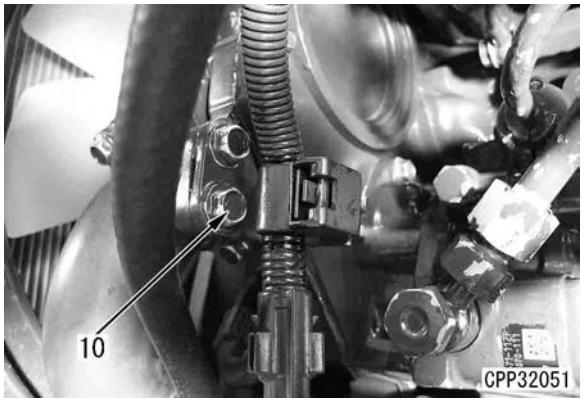
8. Remove clamp mounting bolts (5) (2 piece), and disconnect crank rotation sensor NE connector (6).



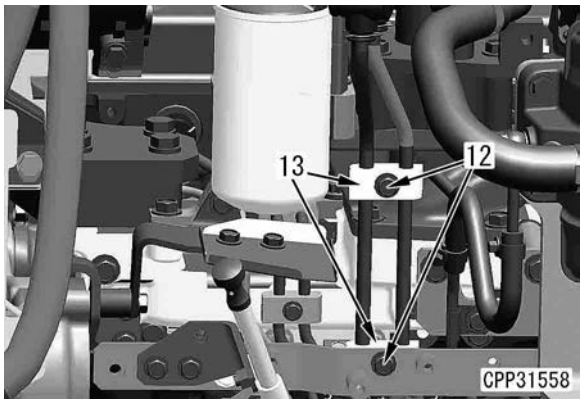
9. Remove mounting bolt (7), and remove plates (8) and (9). [*1]



10. Remove bolts (10) (2 pieces), and disconnect wiring (11).



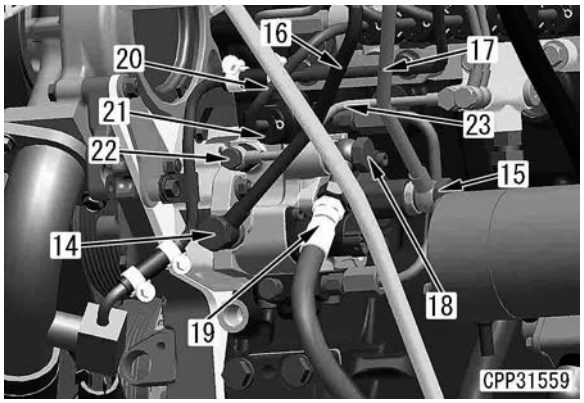
11.Remove mounting bolts (12) (2 pieces), and remove clamp (13).



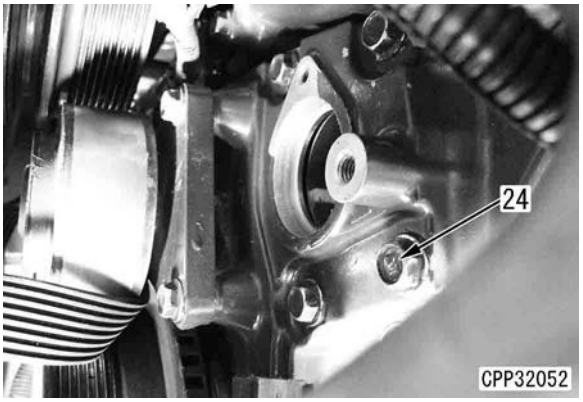
12.Remove joint bolts (14) and (15), and disconnect fuel tubes (16) and (17). [*2]
13.Remove joint bolt (18), and disconnect fuel hose (19). [*3]
14.Remove fuel spray prevention caps (21) (2 pieces) of fuel high-pressure pipe (20). [*4]
15.Remove fuel high-pressure pipes (20). [*5]

★ When removing the fuel high-pressure pipe, be careful not to apply excessive force to the tube.

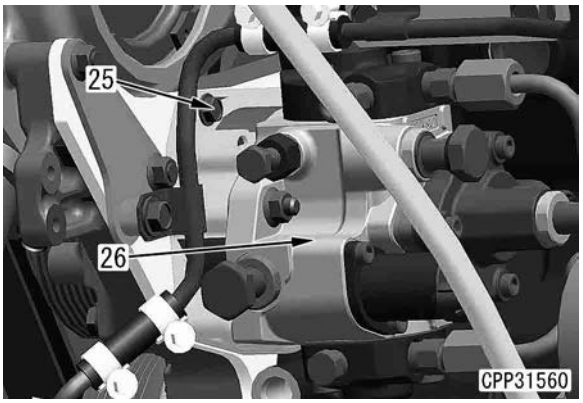
16.Remove joint bolt (22), and disconnect tube (23).



17.Remove mounting bolts (24) (4 pieces).

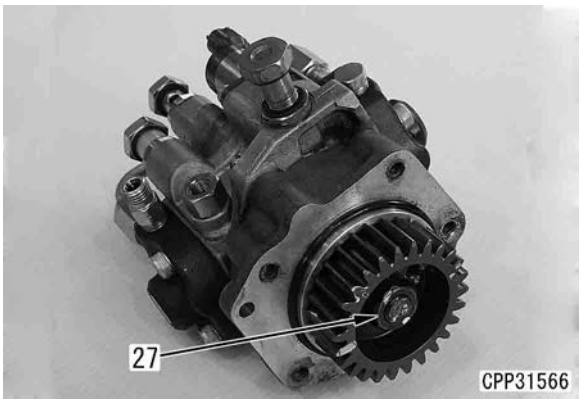


18.Remove mounting bolts (25), and remove supply pump assembly (26) together with the gear. [*6]

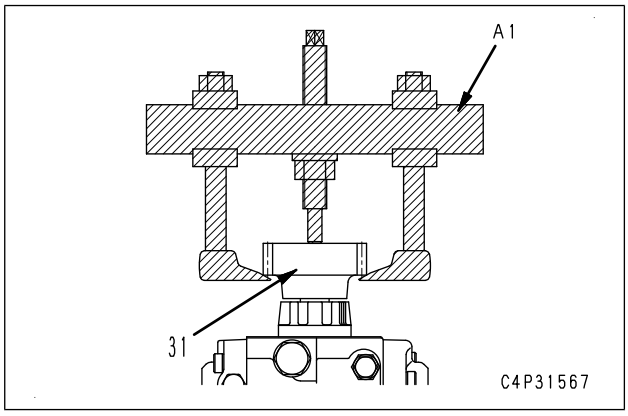


19.Loosen nut (27).

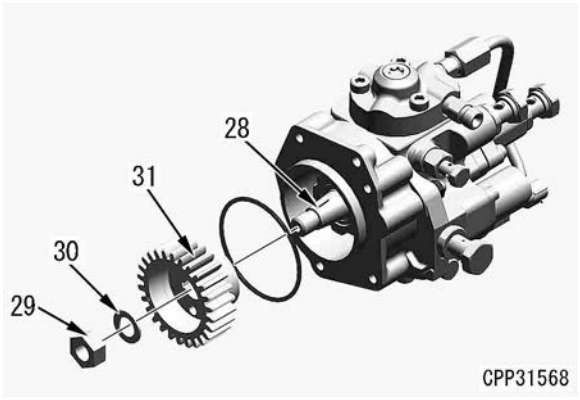
★ Do not remove nut (27) from the shaft.



20.Install tool A1 in between the flange and gear (31) of the supply pump.



21.Remove nut (29), washer (30) and gear (31) from shaft (28). [*6]



Installation *(PC88MR-AD70-720-K-00-A)*

- Perform installation in the reverse order to removal.

[*1]

Mounting bolt (7):
8.8 to 14.7 Nm {0.9 to 1.5 kgm}

[*2]

Joint bolts (14) and (15):
14.8 to 12.7 Nm {15 to 1.3 kgm}

[*3]

Joint bolt (18):
9.8 to 12.7 Nm {1.0 to 1.3 kgm}

[*4]

★ Make the slit of the fuel spray prevention caps installed to fuel high-pressure pipe (12) to face down.

★ The fuel spray prevention caps are installed so that fuel will not spout over the hot part of the engine when it leaks by any chance.

[*5]

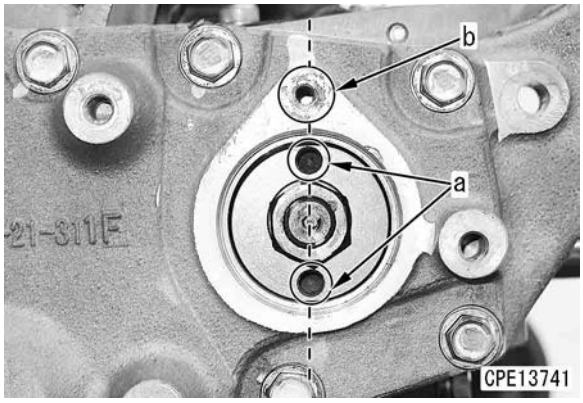
1. Install fuel high-pressure pipe (20).
   ★ When installing fuel high-pressure pipe (20), be careful not to apply excessive force to the tube.

Sleeve nut for fuel high-pressure pipe (20):
39.0 to 44.0 Nm {4.0 to 4.5 kgm}

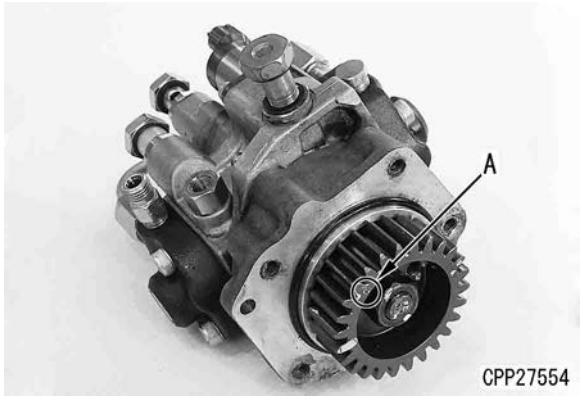
[*6]

- Perform positioning of supply pump gear
  ★ Perform the positioning of top positions of pistons #1 and #4.

★ When installing the supply pump assembly to the front cover, align straightly tapped hole (a) of the gear and the tapped hole (b) of the front cover viewing from the engine front.



★ Install it with the stamp mark "C" (A) part of the gear facing the idler pulley.



Gear mounting nut (27):
58.8 to 68.6 Nm {6.0 to 7.0 kgm}

Removal and installation of injector assembly *(PC88MR-AE60-924-K-00-A)*

⚠ Place the machine on a level ground and lower the work equipment to the ground in a stable posture.

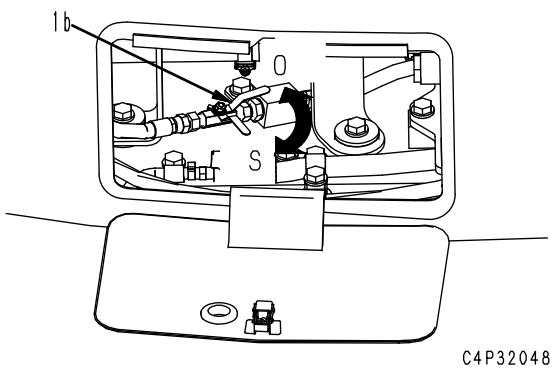
⚠ Stop the engine, turn the battery disconnect switch to OFF position, and remove the key. (For details, see "Testing and adjusting", "Handling battery disconnect switch".)

⚠ Set the lock lever in LOCK position.

★ When disconnecting the wiring harness, check the positions of each clamp.

Removal *(PC88MR-AE60-520-K-00-A)*

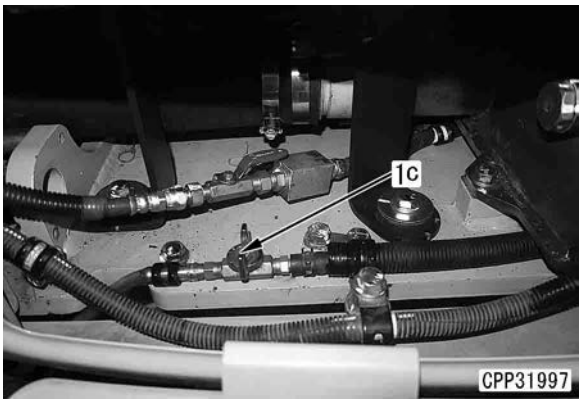
1. Open cover (1a), and turn valve (1b) at the bottom of the main pump to CLOSE position (S).



2. Open fuel drain cock (1c), and drain the fuel.

When filled up with fuel:
125 ℓ

★ It is for fuel not to flow reverse from return fuel piping into cylinder.



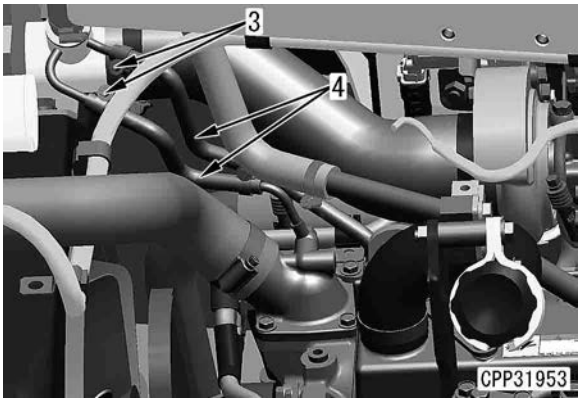
3. Remove engine hood assembly. For details, see "Removal and installation of engine hood assembly".
4. Remove KCCV ventilator. For details, see "Removal and installation of KCCV ventilator".
5. Remove KDOC muffler. For details, see "Removal and installation of KDOC muffler".
6. Disconnect the air conditioner compressor assembly, and move it to the machine side. For details, see "Removal and installation of air conditioner compressor assembly".

★ Do not disconnect the air conditioner hose.

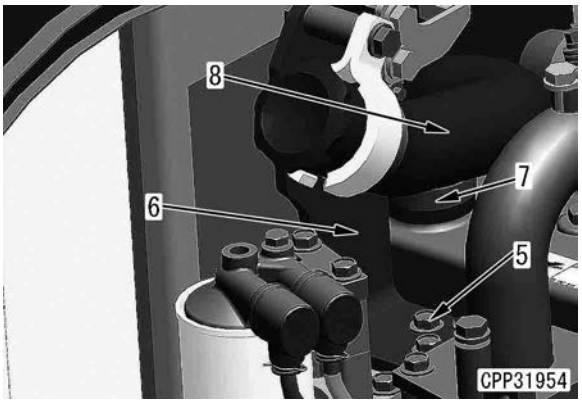
7. Remove clamp (1), and remove aftercooler upper hose (2). [*1]

★ Also remove the hose on the ribbon heater side.

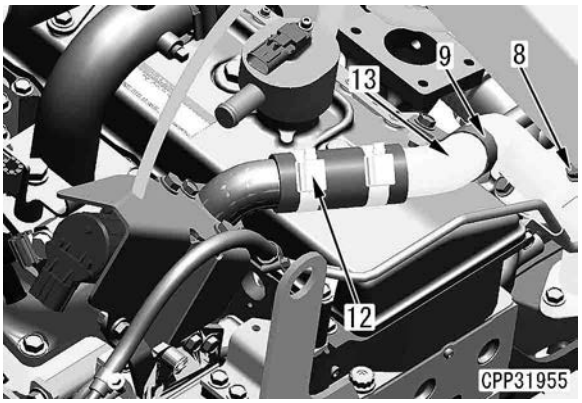
8. Remove clamp (3), and remove KCCV piping (4). [*2]

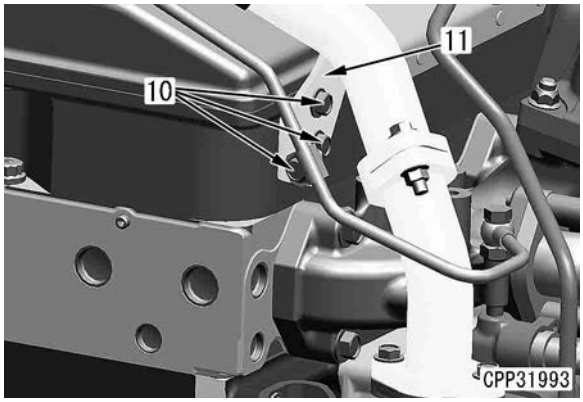


9. Remove mounting bolt (5) (1 piece).
10. Remove clamp (6), and remove engine oil filler hose (7). [*3]

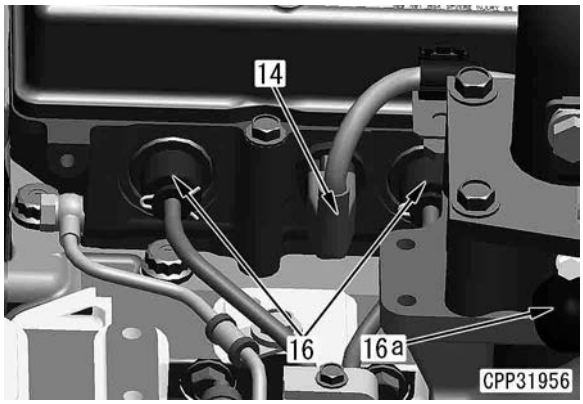


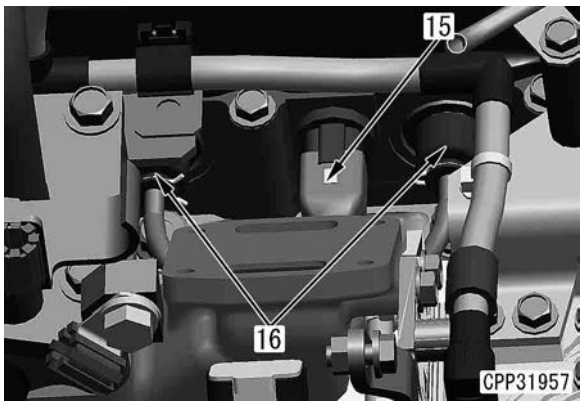
11. Remove mounting bolts (8) (2 pieces) of EGR piping (13), and remove clamp (9).
12. Remove mounting bolts (10) (3 pieces), and remove bracket (11).
13. Remove clamp (12), and remove EGR piping (13) together with the hose. [*4]





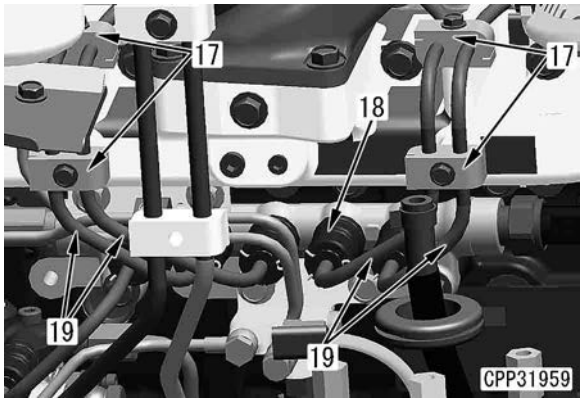
14. Disconnect connectors CN1 (14) and CN2 (15) on the intake side.
15. Remove fuel spray prevention cap (16) on the injector side.
16. Disconnect ribbon heater wiring E01 (16a).



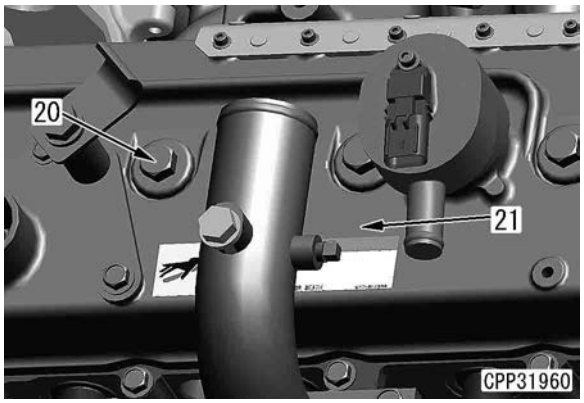


17. Remove clamp (17).
18. Remove fuel spray prevention caps (18) (4 pieces) on the common rail side.
19. Loosen the sleeve nuts on the injector side and common rail side to remove fuel high-pressure pipe (19).

★ When removing fuel spray prevention cap (19), be careful not to apply excessive force to the tube.



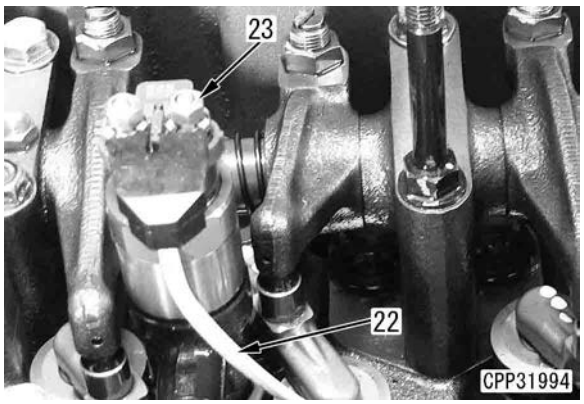
20.Remove mounting bolts (20) (3 pieces) and remove cylinder head cover (21).



21.Remove nuts (23) (8 pieces) of injector harness (22) from the injector.

★ Installing position of injector wiring harness

Color of injector wiring harness	Cylinder No.
White	1, 3
Black	2, 4



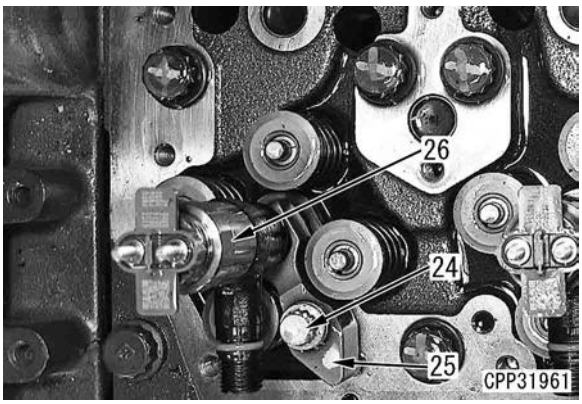
22.Remove mounting bolts (24) (4 pieces), and remove injector holders (25) (4 pieces).

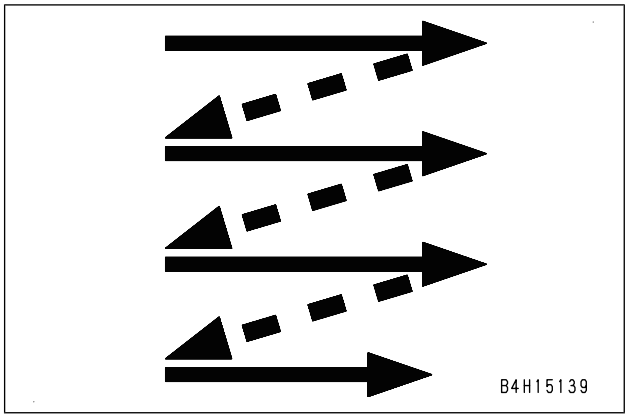
★ Always replace this bolt with a new bolt when reassembling, because it is not reusable.

23.Remove injector assemblies (26) (4 pieces).

★ Record the cylinder number to which the injector is installed and the character string (M) listed on the QR code tab (Q) as a set, and remove the injector.

★ Read character string (M) in the order indicated by the arrow in the figure.

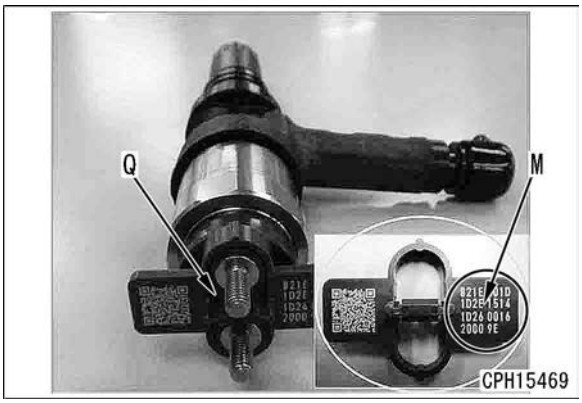




★ Check the noted character string (M) is correct.

★ Do not remove QR code tab (Q) attached to the injector head.

★ Do not damage the QR code tab (Q) on the injector head. (Reference: The QR code or character string indicates the compensation value for fuel injection of the injector, which is specific to each injector.)



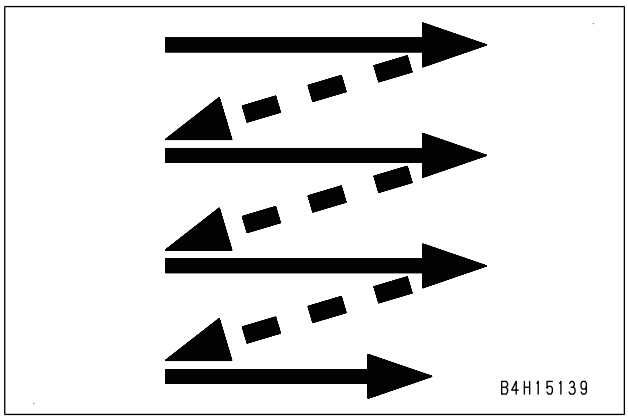
Installation *(PC88MR-AE60-720-K-00-A)*

1. Injector assembly

★ When replacing the injector assembly or engine controller assembly, write the character string into the engine controller according to the following procedure. For details, see Testing and adjusting, "Writing compensation values at replacement of injector and engine controller".

- Note the number of cylinder to which a new injector is installed and character string (M) listed on the QR code tab at the top of the injector as a set.

  ★ Read character string (M) in the order indicated by the arrow in the figure.



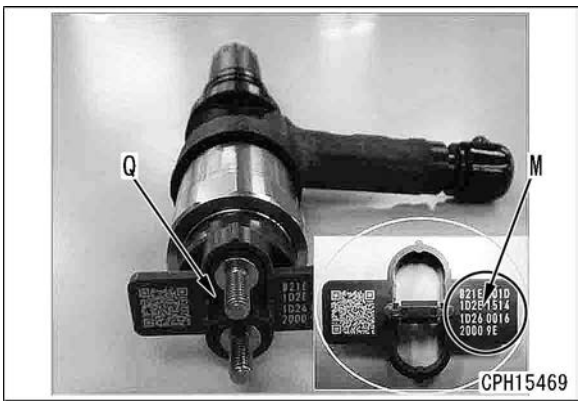
  ★ Be sure to check that the recorded character string is correct.

- Write the recorded character string into the engine controller.

  ★ Be sure to write the noted character string into the cylinder number column of the cylinder to which the injector is installed.

  ★ If the character strings are not written correctly, the engine may not operate normally.

  (Reference: The QR code or character string indicates the compensation value for fuel injection of the injector, which is specific to each injector.)



1) Install gasket (27) to injector assembly (26).
2) Install O-rings (28) and (29) to injector assembly (26).

   ★ Do not put the O-ring in spill groove (e).
3) Apply engine oil to O-ring (28) and head side inserting hole of injector assembly (26).

   O-ring and head side inserting hole:

   Engine oil
4) Make the fuel inlet hole of injector assembly (26) to face to the fuel inlet manifold side, and insert it into the cylinder head while inserting injector holder (25) into (f) part of the injector.

   ★ Be careful that gasket (27) at the tip of the injector nozzle does not fall.
5) Tighten the mounting bolt (24) of injector holder (25) lightly.

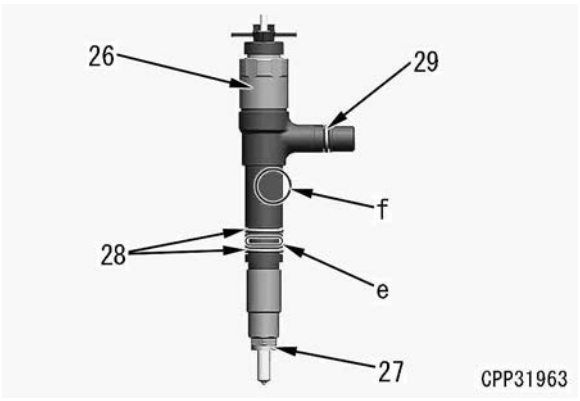
   ★ Apply Loctite 204 to threaded part of mounting bolt (24).

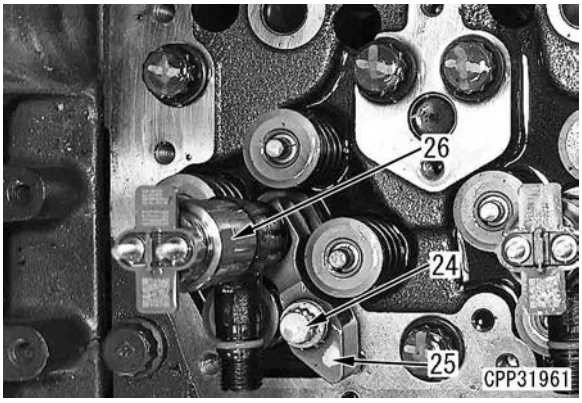
   Threaded part:

   Adhesive (Loctite No. 204 or equivalent)

   ★ Do not tighten this bolt excessively.

   ★ Always use a new bolt, because it is not reusable.





2. Cylinder head assembly

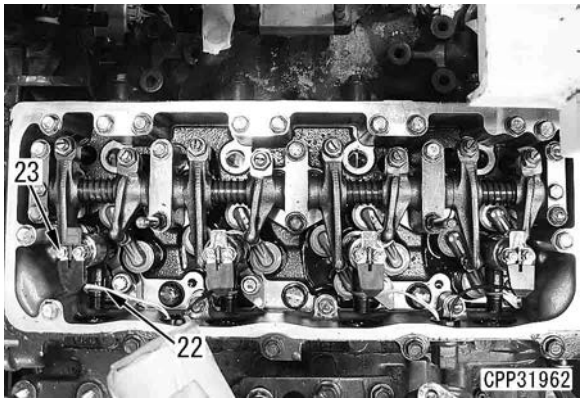
1) Tighten injector harness (22) with nut (23).

Lock nut (23):
2.0 to 2.4 Nm {0.20 to 0.24 kgm}

★ Be careful that the injector harness is not pinched by the tool and rocker housing.

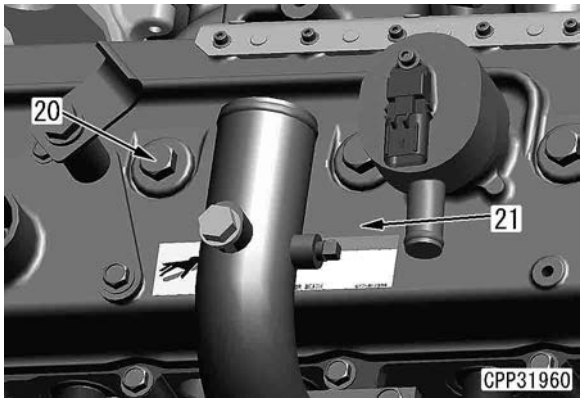
★ Installing position of injector wiring harness

Color of injector wiring harness	Cylinder No.
White	1, 3
Black	2, 4



2) Tighten cylinder head cover (21) with mounting bolt (20).

Mounting bolt (20):
7.8 to 9.8 Nm {0.8 to 1.0 kgm}



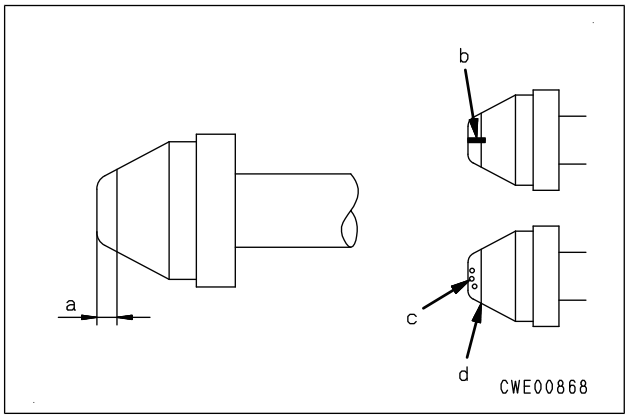
3. Fuel high-pressure pipe

⚠ Do not bend the fuel high-pressure pipe to correct.

⚠ Be sure to use the genuine fuel high-pressure pipe clamp and strictly observe the specified tightening torque.

⚠ Check the following items and install the fuel high-pressure pipe. If it has any defect, replace the high-pressure pipe with a new one since fuel may leak.

- Be sure that the taper seal part of the connection ((a) part: 2 mm area from the tip-end) is free from longitudinal slits (b) or pits (c) with visual check.
  Be sure that part (d) (2 mm from the tip-end) is free from steps which can be felt by your fingernail, and from fatigue.

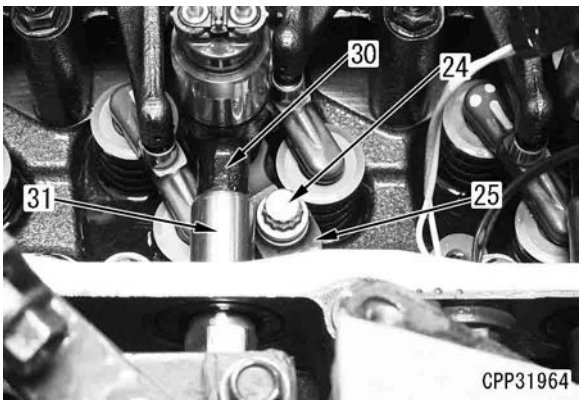


1) Temporarily tighten the injector side of fuel high-pressure pipe (19) to inlet connectors (30) (4 pieces) with sleeve nut (31).

★ Also temporarily tighten the common rail side of the fuel high-pressure pipes with sleeve nut.

2) Tighten mounting bolt (24) of injector holder (25) to the specified torque.

Mounting bolt (24):
39.0 to 49.0 Nm {4.0 to 5.0 kgm}



3) Tighten the mounting sleeve nut of the fuel high-pressure pipe on the injector side to the specified torque.

Mounting sleeve nut:
39.0 to 44.0 Nm {4.0 to 4.5 kgm}

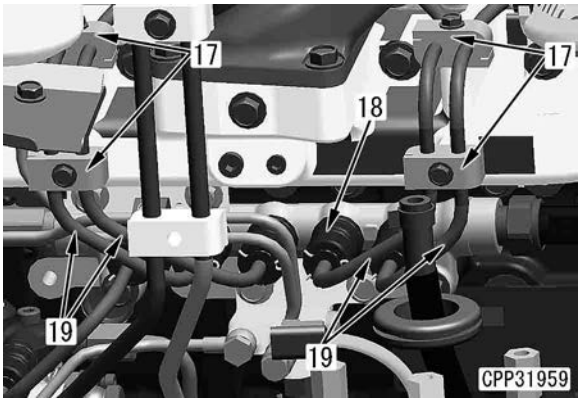
4) Tighten the mounting sleeve nut of the fuel high-pressure pipe on the common rail side to the specified torque.

Mounting sleeve nut:
39.0 to 44.0 Nm {4.0 to 4.5 kgm}

5) Install clamp (17) of fuel high-pressure pipe (19).
6) Install fuel spray prevention cap (18) to each sleeve nut of the fuel high-pressure pipes.

★ Make the slit of the fuel spray prevention cap to face down.

★ The fuel spray prevention caps are installed so that fuel will not spout over the hot part of the engine when it leaks by any chance.



- Perform subsequent installation in the reverse order to removal.

[*1]

- Insertion positions of aftercooler upper hose (2) and the clamp must be as shown in the following figure.

★ Install the hose and tube to the position marked when they were installed.

★ Check mark (e) of the hose facing upward and then install it.

a: 5 mm

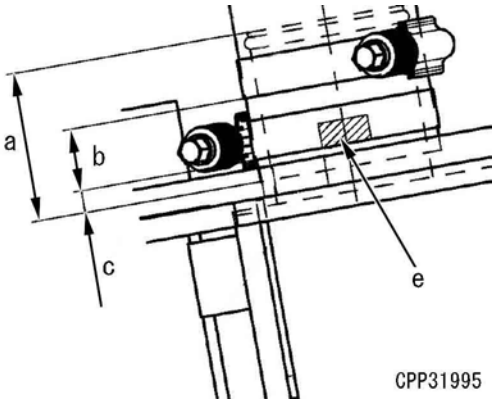
b: 60 mm

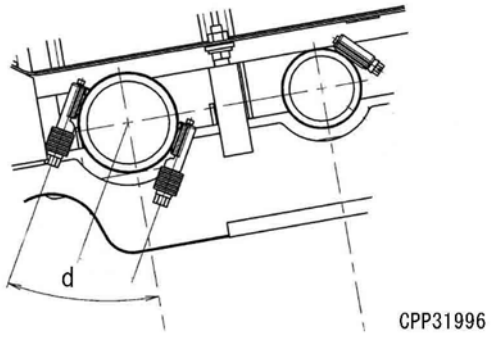
c: 9 mm

d: 30 deg.

Clamp (1):

10.5 ± 0.5 Nm {1.1 ± 0.05 kgm}





[*2]

Clamp (3):

3.0 to 3.5 Nm {0.30 to 0.35 kgm}

[*3]

Clamp (6):

5.9 ± 0.49 Nm {0.6 ± 0.05 kgm}

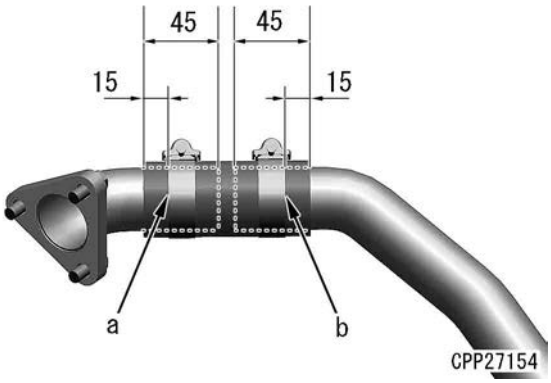
[*4]

- Insertion position of EGR piping (13) and the clamp must be as shown in the following figure.

★ Install the hose and tube to the position marked when they were installed.

Clamp (12):

8.8 ± 0.49 Nm {0.9 ± 0.05 kgm}



- Bleed air
  Bleed air in the fuel system. For details, see "Testing and adjusting", "Bleed air from fuel system".
- Test fuel
  Check for fuel leakage. For details, see "Testing and adjusting", "Testing fuel circuit for leakage".
- Refill with oil
  Check that the oil filler plug is closed before refilling.
  Refill it with oil to the specified level through the oil filler port. Run the engine to circulate the oil through the piping. Then check the oil level again.

When it is filled up with fuel:
125 ℓ (specified capacity: 100 ℓ)

Removal and installation of cylinder head assembly *(PC88MR-A100-924-K-00-A)*

⚠ Place the machine on a level ground and lower the work equipment to the ground in a stable posture.

⚠ Stop the engine, turn the battery disconnect switch to OFF position, and remove the key.

(For details, see Testing and adjusting, "Handling battery disconnect switch".)

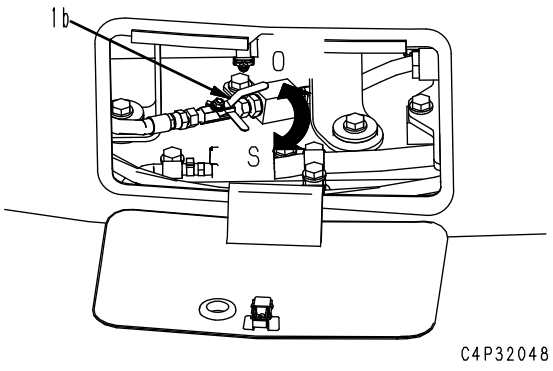
⚠ Set the lock lever in LOCK position.

Removal *(PC88MR-A100-520-K-00-A)*

★ Record the disconnected position of the hose and wiring connector to avoid misplacing.

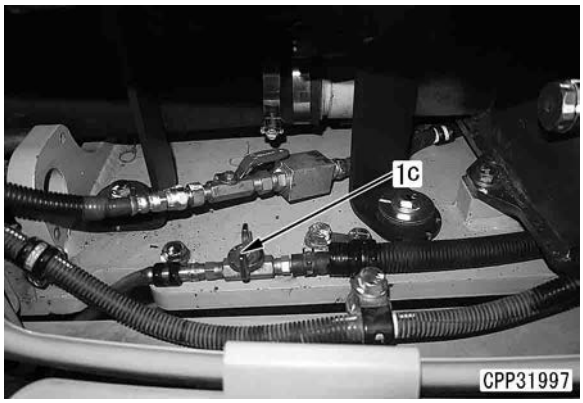
1. Open cover (1a) and turn valve (1b) at the bottom of the main pump to CLOSE position (S).

   ★ Disconnect the fuel hose.



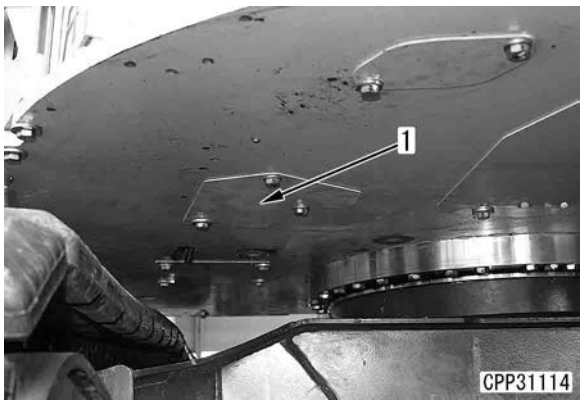
2. Disconnect hose (1c).

   ★ It is for fuel not to flow reverse from return fuel piping into cylinder.

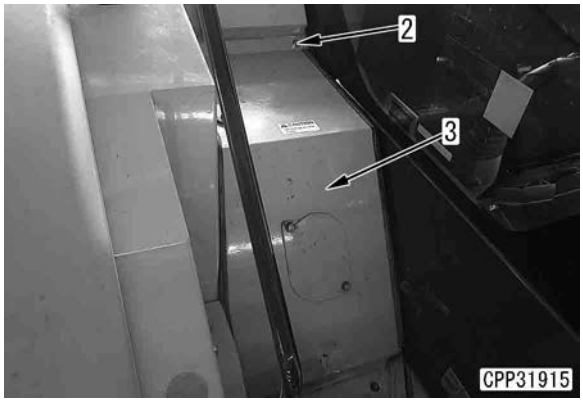


3. Remove engine hood assembly. For details, see "Removal and installation of engine hood assembly".
4. Remove KCCV ventilator. For details, see "Removal and installation of KCCV ventilator".
5. Remove KDOC muffler. For details, see "Removal and installation of KDOC muffler".
6. Open cover (1), loosen the coolant drain plug, and drain the coolant.

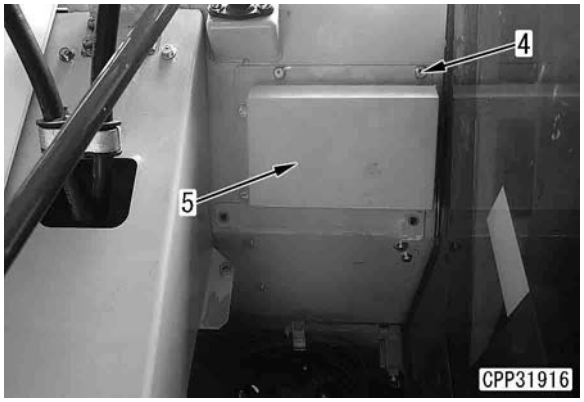
   Coolant:
   13 ℓ



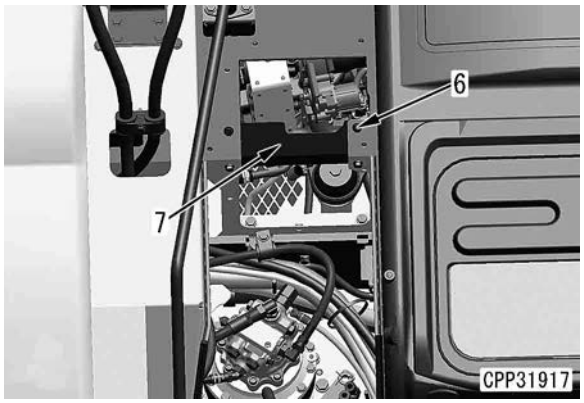
7. Remove mounting bolts (2) (6 pieces), and remove cover (3).



8. Remove mounting bolts (4) (6 pieces), and remove cover (5).



9. Remove mounting bolts (6) (4 pieces), and remove bracket (7).

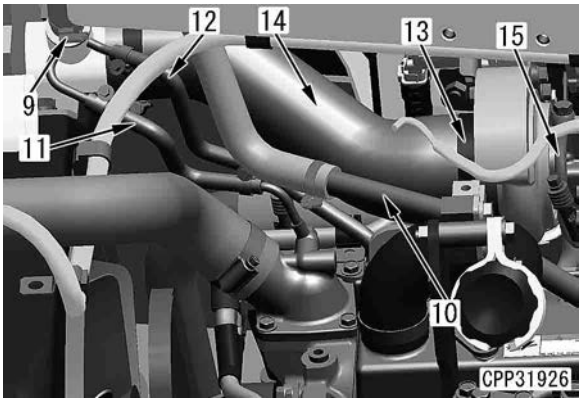


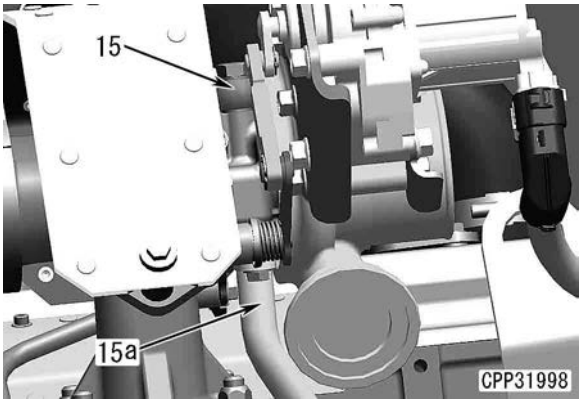
10. Disconnect the air conditioner compressor assembly, and reposition it out of the way for working. For details, see "Removal and installation of air conditioner compressor assembly".

★ Do not disconnect the hose.

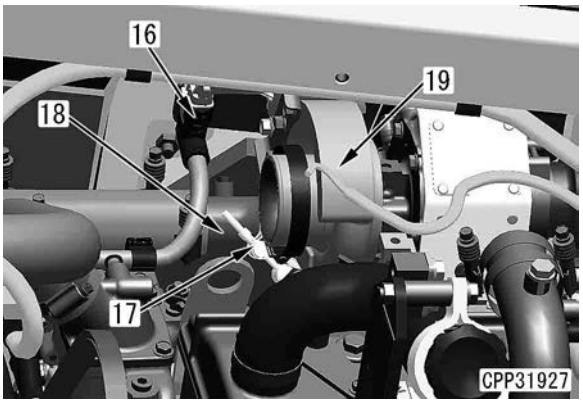
11. Remove clamp (7), and remove aftercooler upper hose (8). [*1]

12. Remove clamp (9), and remove KCCV piping (10). [*2]
13. Remove clamp (10a), and remove hoses (11) and (12). [*3]
14. Remove clamp (13), and air cleaner hose (14). [*4]
15. Remove lubricating oil drain tubes (15) and (15a).

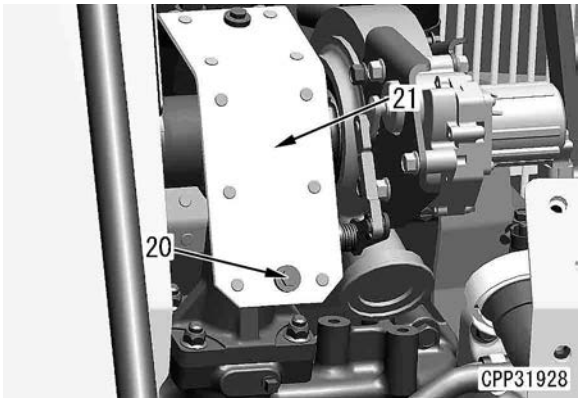




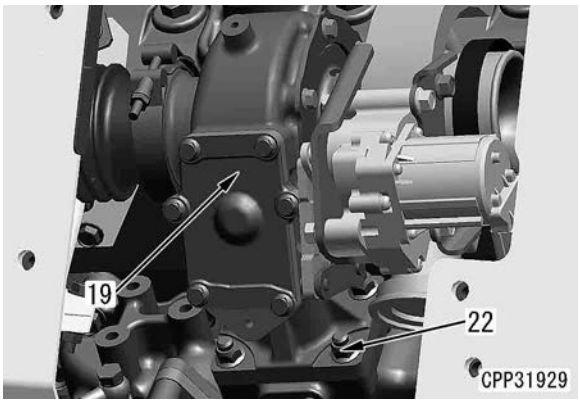
16. Disconnect connector VFT (16).
17. Disconnect clamp (17), and disconnect VFT assembly (19) from tube (18) on the air intake outlet side. [*5]



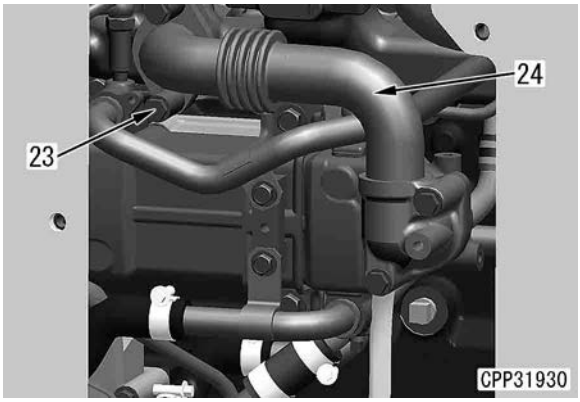
18. Remove KDOC assembly. For details, see "Removal and installation of KDOC assembly".
19. Remove mounting bolts (20) (3 pieces), and remove VFT cover (21). [*6]



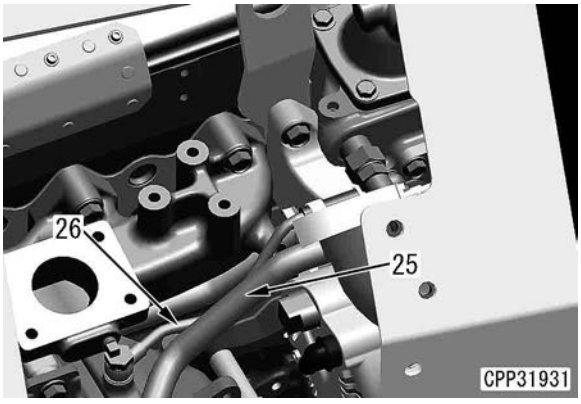
20.Remove mounting nuts (22) (4 pieces), and remove VFT assembly (19).



21.Remove mounting bolt (23) (4 pieces), and remove tube (24). [*7]

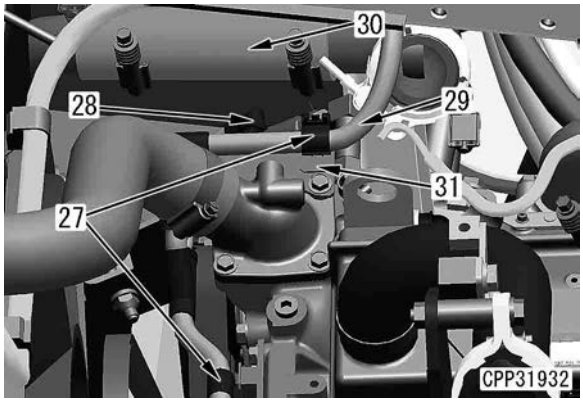


22.Remove tubes (25) and (26).

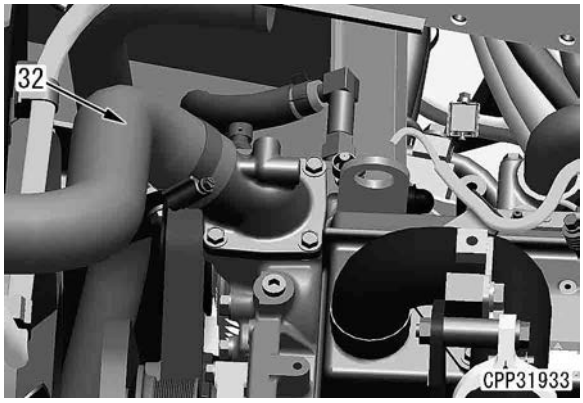


23.Disconnect clamp (27).

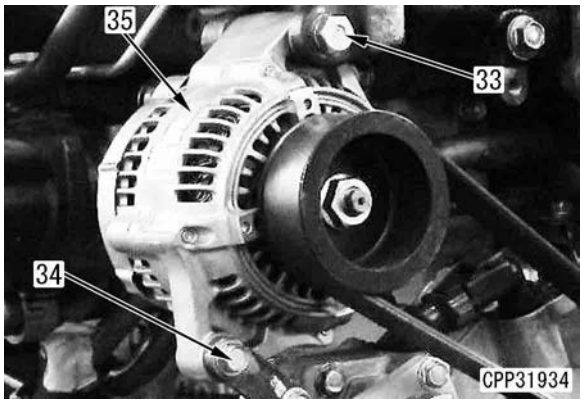
24.Disconnect connector TWTR (28), and reposition wiring (29) out of the way.
25.Remove hose (30).
26.Remove bracket (31).



27.Disconnect radiator upper hose (32) from the radiator side. [*8]



28.Remove the fan belt. For details, see "Removal and installation of fan belt".
29.Remove mounting bolt (33), and loosen bolt (34) to move alternator (35) to the machine side.



30.Remove clamp (36), and disconnect radiator lower hose (37). [*9]