

# 80X3

Excavator

## SERVICE MANUAL

WLSM0806-00LX

Mar. 2013

**SUMITOMO**

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: [www.heydownloads.com](http://www.heydownloads.com) by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

## SAFETY

---

### Warning

Before starting the engine, check the safety messages in this operator's manual.  
Check all the warning labels on the machine.  
Check that there is no one anywhere in or around the work range for the machine.  
Check the operation methods in a safe location before starting the actual work.  
Understand the operation of this machine well, then operate it according to service-related laws and ordinances.  
The operator's manual and service manual can be ordered from any LBX Link-Belt dealer.

### Warning

Working in untidy work clothes or in clothes with which safety cannot be ensured leads to damage to the machine and injury of the operator themselves.  
Always work dressed for safety.  
In order to work more safely, it is recommended to wear additional safety gear.  
(Helmet, safety shoes, earplugs, goggles, work clothes, and gloves)

### Warning

Work with great care when the engine is running.

### Warning

Check and verify hydraulic equipment.  
Work according to the procedure.  
Do not change the procedure.

### Warning

When bleeding the pressure from hydraulic circuits to inspect the machine's hydraulic cylinders, make sure that there is no one in the vicinity before doing the work.

### Warning

Use gloves when handling hot parts.

### Warning

Lower the parts to the ground before inspecting or repairing attachments and lower parts.

### Warning

Check that all hoses and tubes are securely connected.  
Replace any damaged hose or tube.  
Do not use your hands to check for oil leaks. Use a piece of cardboard or wood.

### Warning

When removing an attachment pin or other hard pin, use a hammer with a soft head.

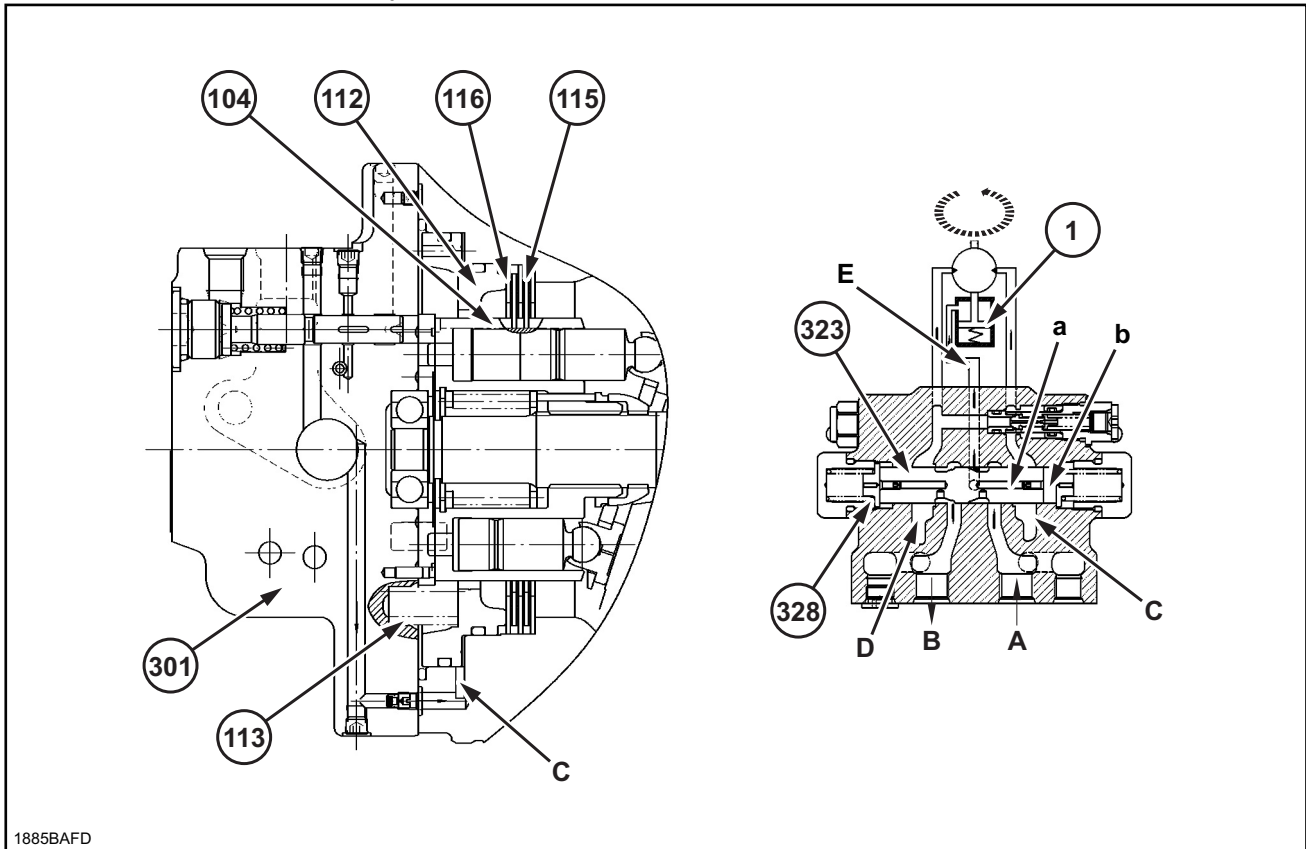
### Warning

When installing a pin with a hammer and working with a grinder, wear protective eyewear.  
At this time, use goggles or a protector that meets the standards.

**A. LOWER**

## A. LOWER

This friction plate (115) meshes with the cylinder block (104) of the hydraulic motor section. Accordingly, brake force on the cylinder block (104) is released and the hydraulic motor is also able to rotate freely.



### 2. During stopping

Feeding of pressurized oil to ports A or B is stopped.

The brake valve spool (323) moves to the neutral position.

Port E is cut off.

The pressure of cylinder chamber c is reduced.

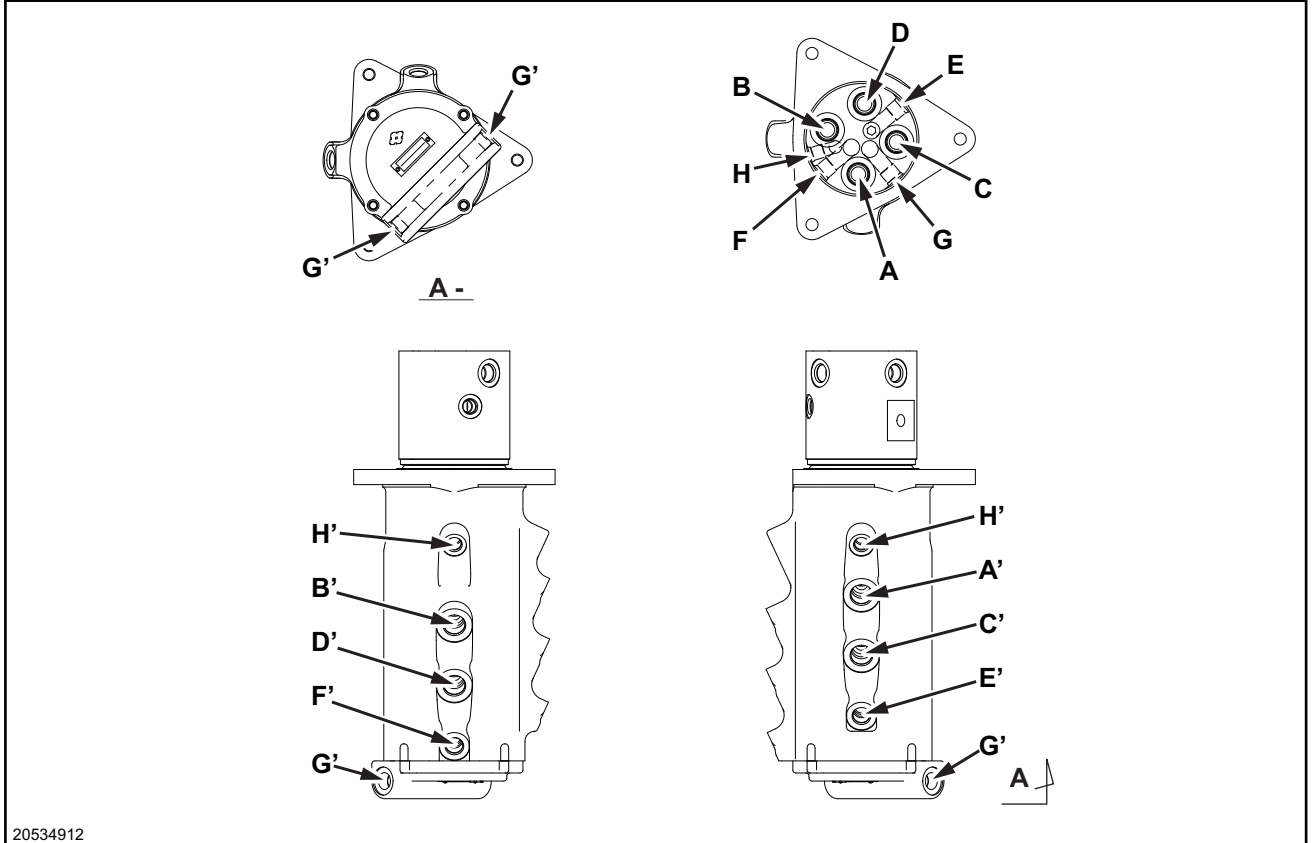
If this pressure is reduced to 0.63 MPa (91.3838 psi) or below, the hydraulic pressure of the piston (112) becomes smaller than the spring (113) force.

The piston (112) presses the partner plate (116) and friction plate (115) due to the force of the spring (113).

This pressing force produces friction force that becomes brake force.

The friction plate (115) meshes with the cylinder block (104) of the hydraulic motor section.

Center Joint (blade)



20534912

Port	Port name	Port size
A, A'	Main port (backward right)	G1/2
B, B'	Main port (backward left)	G1/2
C, C'	Main port (forward right)	G1/2
D, D'	Main port (forward left)	G1/2
E, E'	Blade port (blade-up)	G3/8
F, F'	Blade port (blade-down)	G3/8
G, G'	Drain port *G (2 locations), G' (1 location)	G3/8
H, H'	Pilot port *H (2 locations), H' (1 location)	G1/4

A. LOWER

## A. LOWER

### Removal and Installation of Upper Roller

Job code

AJJR01

#### Warning

- When loosening the check valve, loosen it a little at a time and stop when any grease appears.
- The pressure inside the cylinder is very high, so there is the danger of grease being expelled and the plug flying off if the check valve is loosened too much.
- The check valve adjustment procedure should not be done in front of the check valve.

#### Caution

- Be sure to stop the engine before beginning work.

#### Items to prepare

- Box wrenches [19 mm (0.748 in), 24 mm (0.945 in)]
- Jack (That meets the lifting weight.)
- Rag
- Cleaning fluid
- Wood planks, etc.

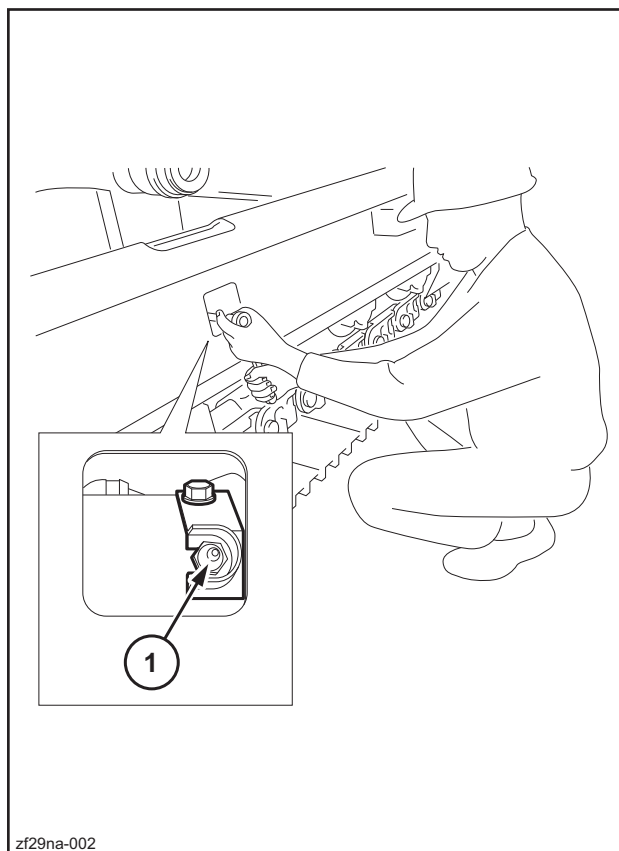
#### Removal of Upper Roller

1. Use a box wrench [19 mm (0.748 in)] to loosen the check valve (1) to release grease, and then loosen the track shoe tension.

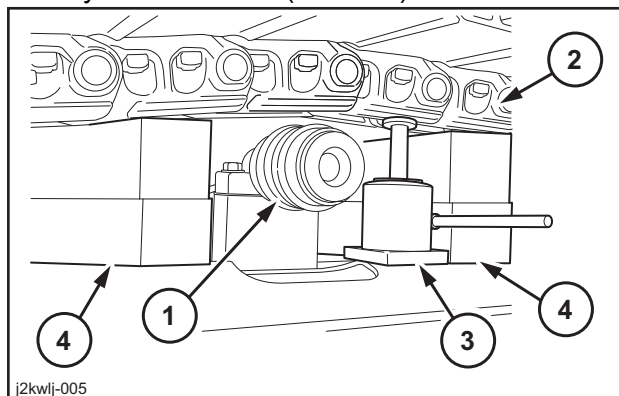
#### Warning

- If the check valve (1) is too loose, it may fly off.
- Do not place your body in front.

Do not loosen the check valve all at once. Loosen it slowly while monitoring the grease output and shoe loosening. Use a rag to catch grease that trickles out of the check valve.



2. Use a jack (3) to lift the top of the shoe, and then insert wood planks (4) to separate the shoe (2) and upper roller (1) by about 10 mm (0.394 in).

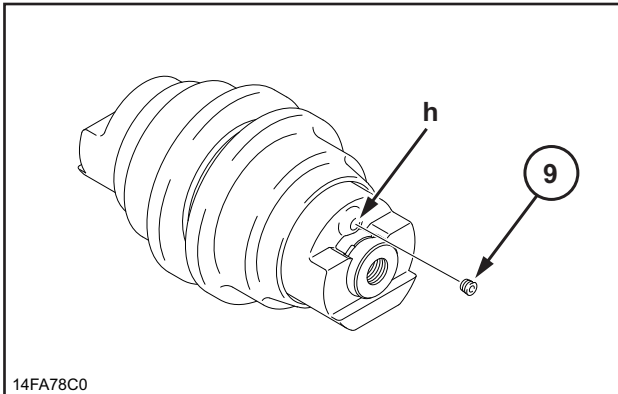


[3] Disassembled parts can easily rust or collect dust. Therefore, immediately after disassembling parts, take precautions to prevent the parts from rusting or collecting dust.

3. Disassembly procedure

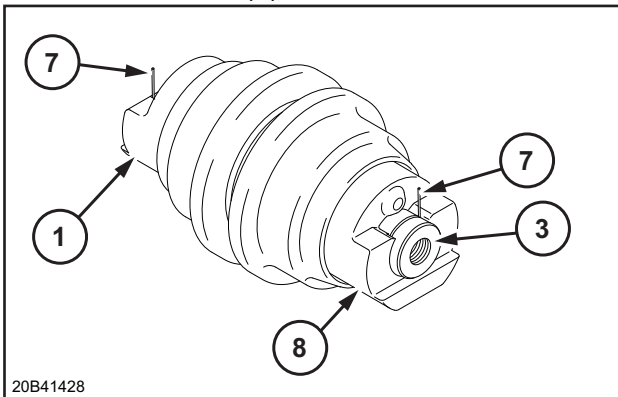
[1]

- a. Clean the lower roller with kerosene.
- b. Remove the plug (9) from the collar (8) and drain the oil.

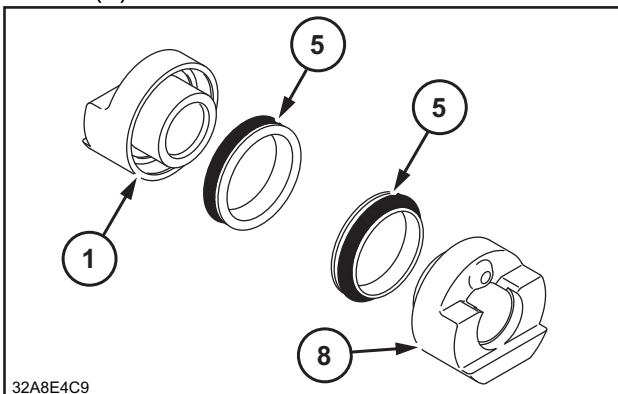


[2]

- a. Remove the wire clips (7) from the shaft (3).
- b. Remove the collars (1) and (8) from the shaft (3).

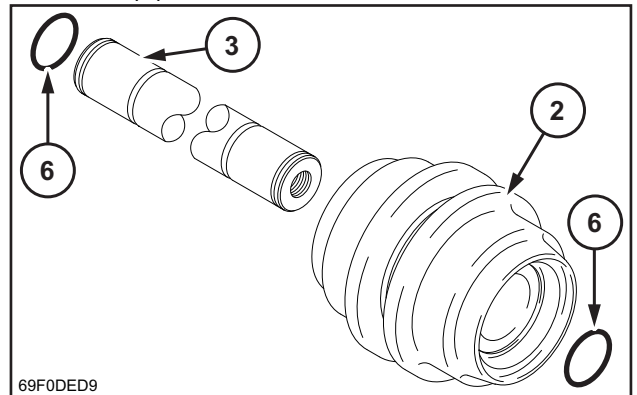


[3] Use the removal jig to remove the floating seals (5) from the collars (1) and (8).

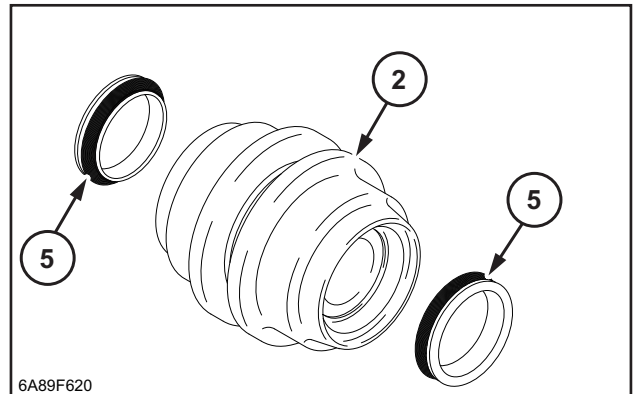


[4]

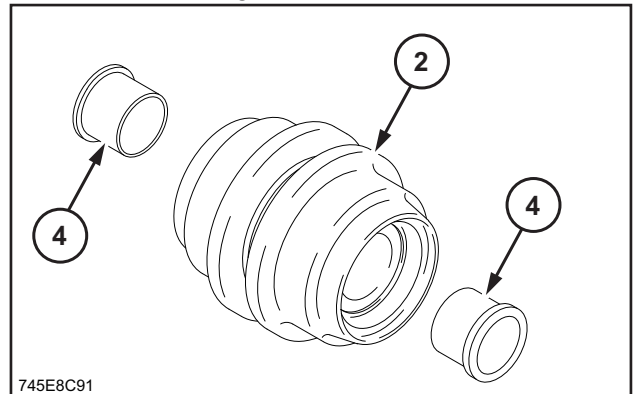
- a. Remove the O-rings (6) from the shaft (3).
- b. Pull out the shaft (3) from the roller (2).



[5] Remove the floating seals (5) from the roller (2).



[6] Use the removal jig and press to remove the bushings (4) from the roller (2).



[7] Parts cleaning

a. Rough cleaning

- a) Insert parts into a container for rough cleaning filled with kerosene.

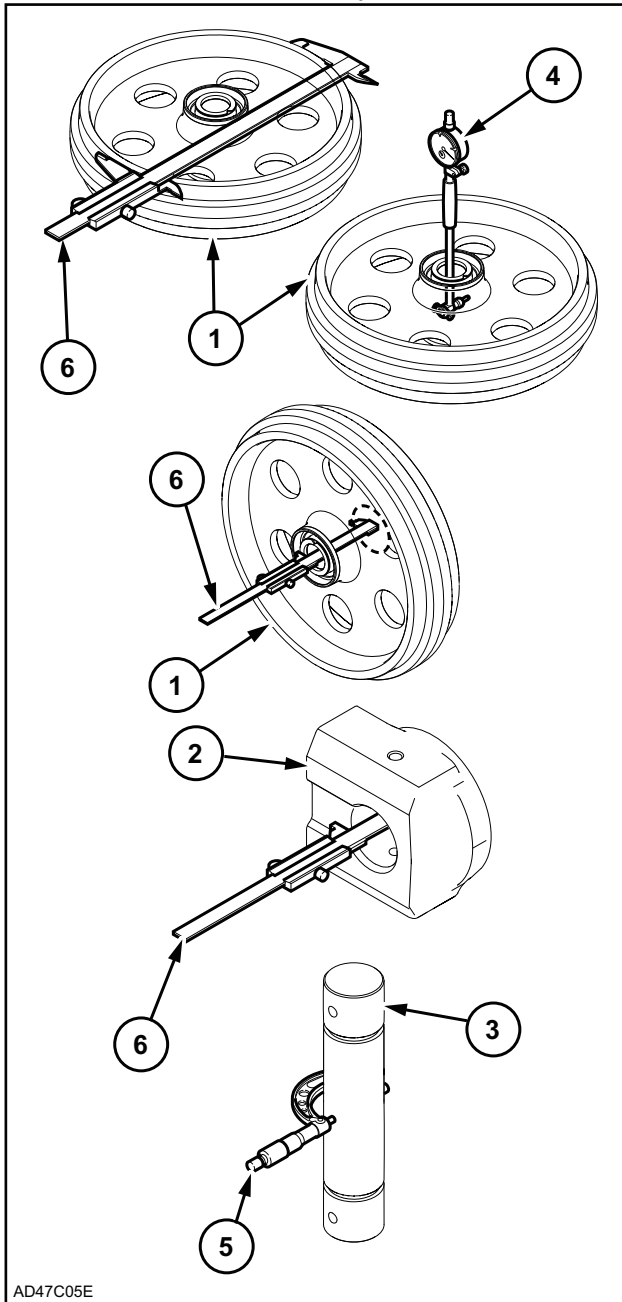
\* cClean off adhered matter that can form sharp points and cause scratches.

Immerse parts in kerosene until adhered matter such as dust and grease floats to the top.

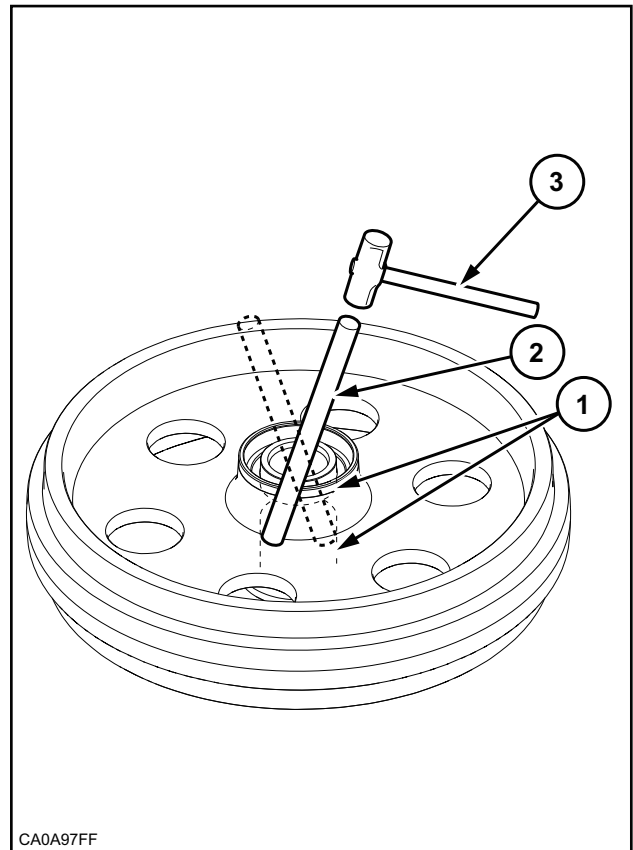
A. LOWER

## A. LOWER

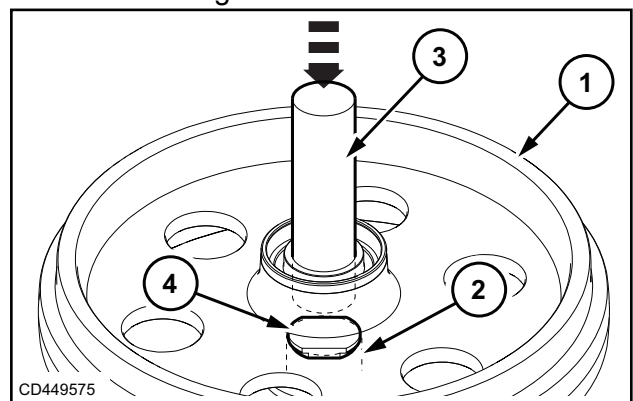
10. Use a micrometer caliper (5), cylinder gauge (4), and caliper (6) to measure the roller (with bushing) (1), hub (2), and shaft (3) for wear and deformation. Replace with new parts as necessary.



11. When replacing the bushing (1), remove it by placing a striking rod (2) against the end surface and striking that with a hammer (3) uniformly left and right as shown in the diagram.
- Be careful not to scratch the inside of the roller when striking the end surface of the bushing.



12. Invert the roller (1), use jig A (4) to push up against the bushing (2), and press with a rod-shaped object (3) (such as a shaft). The bushing comes off.



### Assembly Procedures

1. Clean all parts.
  - Find a clean location.
  - Place a rubber plate or cloth on the work platform so as not to damage the parts.
  - In order to clean off adhered matter that forms sharp points and causes scratches, immerse parts in cleaning fluid (1) until dirt and grease float to the top.

## Assembly and Disassembly of Center Joint

### ⚠ Caution

- The following cautions for hydraulic equipment should be observed with these parts.
- To ensure safe operations, wear protective gears for the work and follow all precautions.
- When removing devices or positioning devices at the time of installation, use a removal jig and a hammer or steel rod.
- Make sure that the jig is used for disassembly of the axle and rotor.
- Follow the precautions below when suspending the load.
  - The liftcrane must be operated by a qualified operator.
  - Do not stand or pass under the suspended load.
  - Check the weight of the load to determine whether it can be carried by hand or whether a liftcrane must be used.
- Be sure to repair any parts damaged during disassembly, and prepare replacement parts in advance.
- If any parts are significantly rusted or dirty, clean them before disassembling.
- Any foreign matter entering the equipment during assembly can create a malfunction. Therefore, after thoroughly cleaning the equipment with cleaning oil, air blow the equipment, and assemble in a clean location.
- When assembling V-rings, O-rings, and other sliding parts, be sure to coat them with new grease.
- As a rule, replace all seal parts such as O-rings with new parts.

### ⚠ Caution

#### <General cautions>

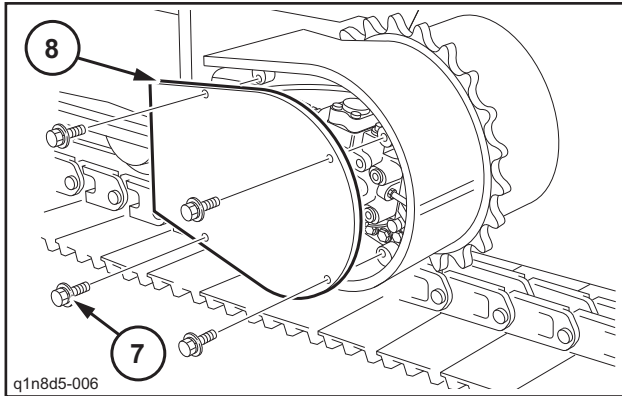
- Be careful not to drop precision parts or let bump them with other parts during work.
- Do not forcefully open or hit parts in an effort to speed up operations. Pay careful attention and proceed slowly so as not to deform any parts, create any oil leaks, or compromise the efficiency of the equipment, etc.
- Disassembled parts can easily rust or collect dust. Therefore, immediately after disassembling parts, take precautions to prevent the parts from rusting or collecting dust.
- Make sure that foreign matter such as debris and moisture does not enter.
- The work platform used should be solid, stable, and sufficiently spacious. Also, items should be clean and free of debris and moisture. Remove debris and moisture before performing work.
- Inspect, remove debris and moisture, and clean tools and jigs before work.
- Jigs and tools that are appropriate to the contents of work should be used.

#### Items to prepare

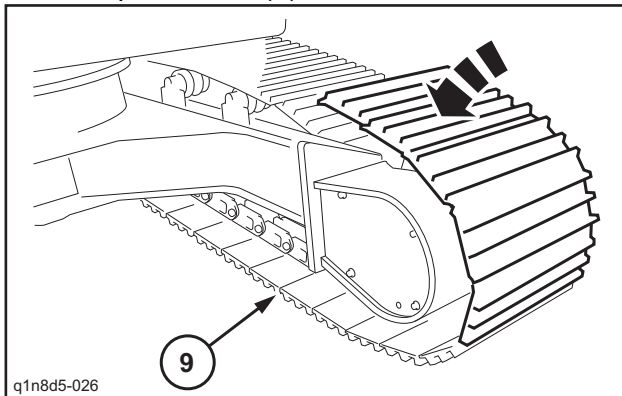
- Hexagon wrench
- Torque wrench
- Box wrench
- Lights
- Mirror
- Brush (plastic)

## A. LOWER

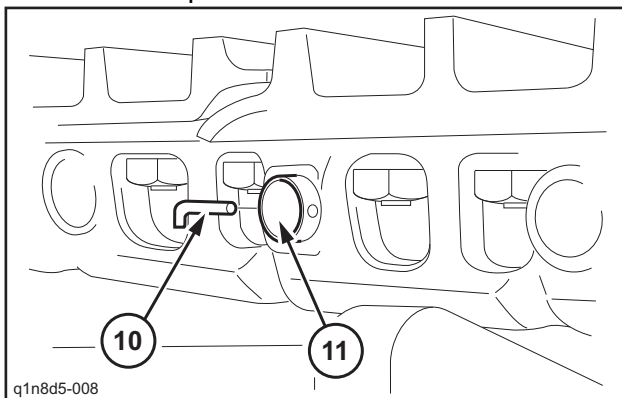
5. Use a wrench [19 mm (0.748 in.)] to install the cover (8) with 4 bolts (7).



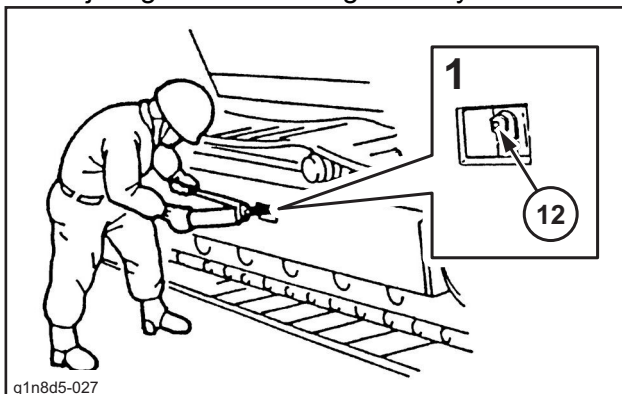
6. Wrap the shoe (9).



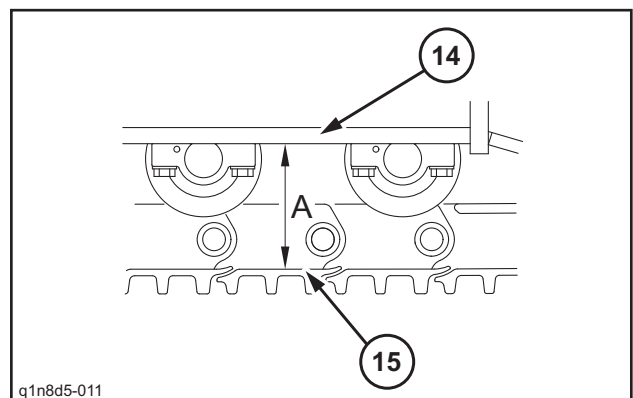
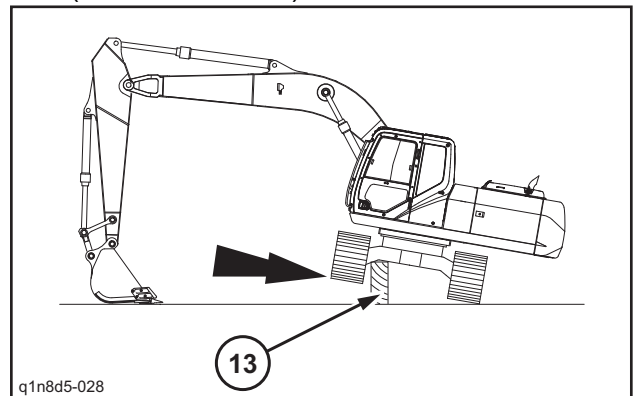
7. Insert the master pin (11).  
Insert the S-pin (10) and bend it so that it cannot slip out.



8. Tighten the check valve (12).  
While monitoring the track shoe tension, inject grease into the grease cylinder.

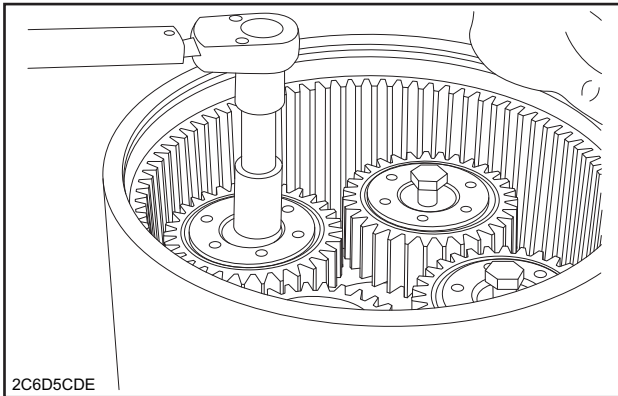


9. To adjust the track shoe tension, raise the lower side frame as shown in the diagram. Place a wood plank (13) or the like under the lower frame to prevent falling. Adjust the tension so that the distance indicated with A between the frame bottom (14) of the center area of the lower side frame and the lowest hanging part of the top of the shoe plate (15) is 180 - 205 mm (7.087 - 8.071 in.).

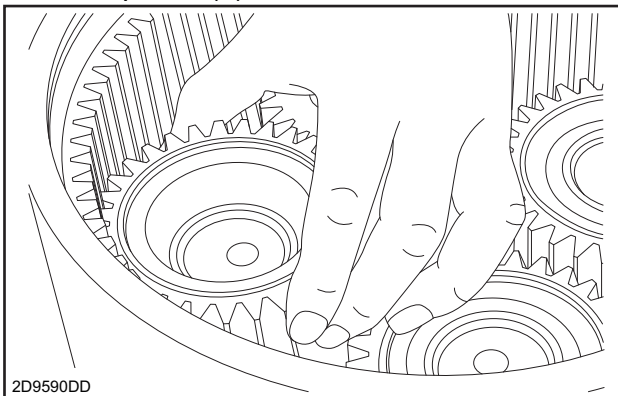


7. Removal of planetary gear (2)

[1] Loosen the 4 hexagon bolts (51) and remove from the spindle (2).



- [2] Remove the 4 planetary gears 2 (7) and 4 needle roller bearings with holders (28), and 4 bearing inner races (30).
- [3] Remove the 4 thrust washers 2 (11) from the spindle (2).
- [4] Remove the thrust collar 1 (9) from the spindle (2).



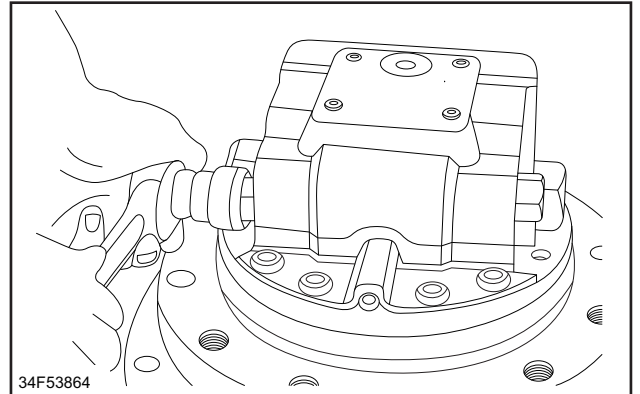
8. Removal of rear flange

[1] Invert the travel motor. (motor faces up)

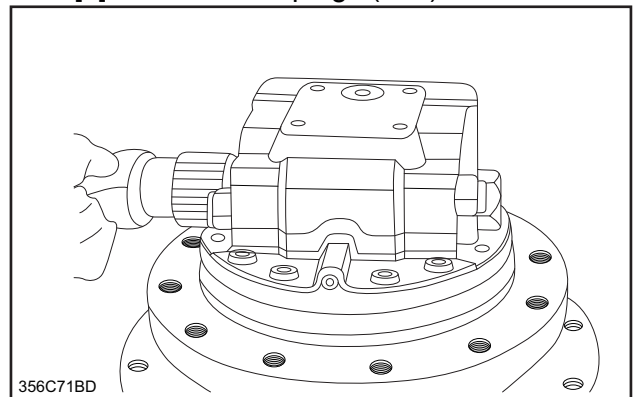
Note

- The next operation is to make the plugs easy to remove when the inside of the rear flange is disassembled. At this time, loosen the plugs enough so that they can be removed by hand.
- When the inside of the rear flange is not being disassembled, do not loosen the plugs.

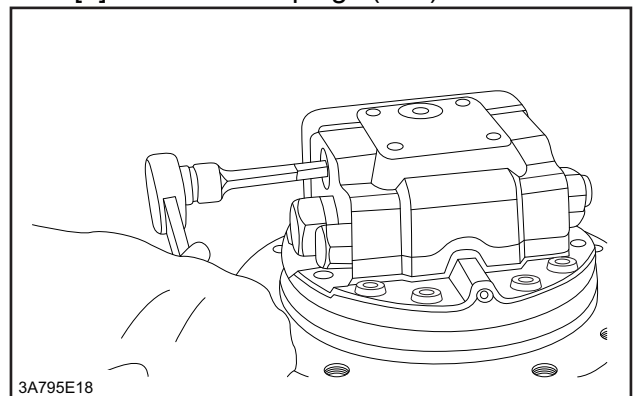
[2] Loosen the 2 sleeves (203).



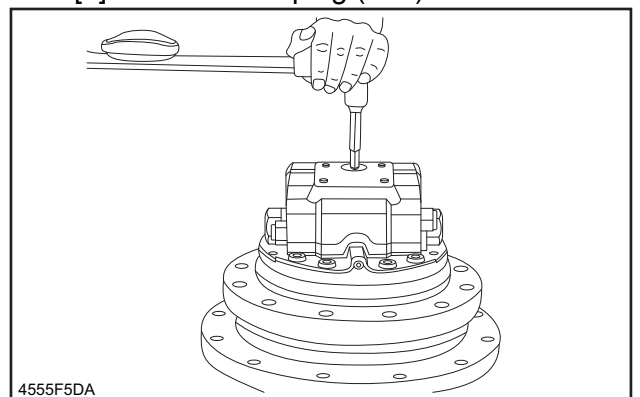
[3] Loosen the 2 plugs (324).



[4] Loosen the 2 plugs (382).



[5] Loosen the 1 plug (382).

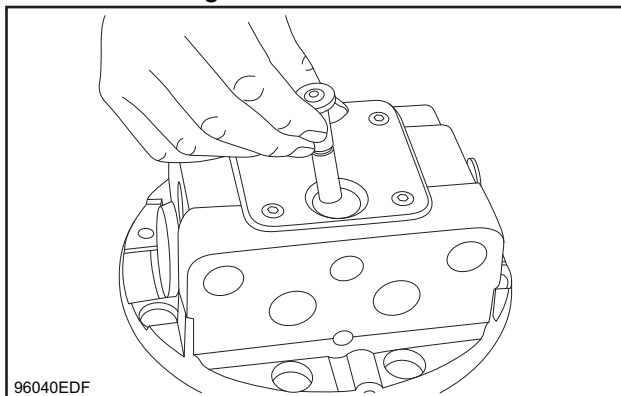


## A. LOWER

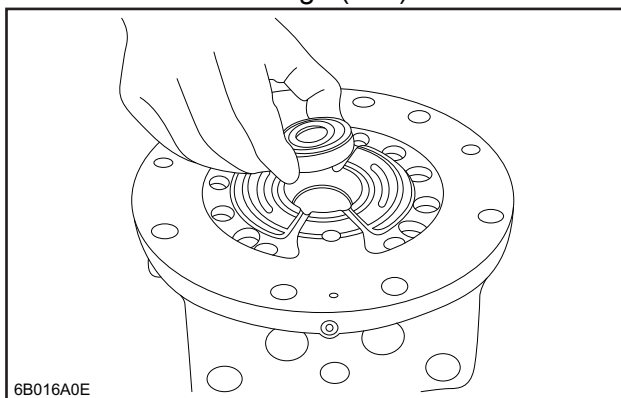
[2] Replace parts if the following corresponding abnormal conditions (symptoms) are present.

Part No.	Part name	Symptom	Reference value (standard dimensions)	Permissible limit value (judgment value)
[1]	Hub	<ul style="list-style-type: none"> <li>Significant external damage.</li> <li>Pitching on ring gear tooth surfaces.</li> <li>Abnormal wear due to seizing.</li> </ul>	-	-
[2]	Spindle	<ul style="list-style-type: none"> <li>Significant external damage.</li> <li>Abnormal wear due to seizing.</li> </ul>	-	-
[3] etc.	Carrier assembly	<ul style="list-style-type: none"> <li>Abnormal wear due to seizing.</li> </ul>	-	-
[4] [6] [5] [7]	Sun gear 1 Sun gear 2 Planetary gear 1 Planetary gear 2	<ul style="list-style-type: none"> <li>Pitching on tooth surfaces.</li> <li>Flaking symptoms appearing on rolling surface of bearing.</li> </ul>	-	-
[10] [11] [12]	Thrust washer 1 Thrust washer 2 Thrust washer 3	<ul style="list-style-type: none"> <li>The sliding surface is discolored or abnormally worn.</li> </ul>	-	-
[24]	Ball bearing	<ul style="list-style-type: none"> <li>Indentations present.</li> <li>Flaking symptoms appearing.</li> <li>Uneven wear.</li> </ul>	-	-
[27] [28]	Needle roller bearing	<ul style="list-style-type: none"> <li>Pitching on roller.</li> <li>Abnormal wear on holder end surface.</li> </ul>	-	-
[29] [30]	Bearing inner race	<ul style="list-style-type: none"> <li>Flaking symptoms appearing on rolling surface of bearing.</li> </ul>	-	-
[301]	Rear flange	<ul style="list-style-type: none"> <li>Scratches on surface that slides against spool [323].</li> </ul>	-	-
[102]	Shaft	<ul style="list-style-type: none"> <li>Surface in contact with oil seal [132] worn.</li> <li>Spline worn.</li> </ul>	-	-
[103]	Swash plate	<ul style="list-style-type: none"> <li>Seizing symptoms present.</li> </ul>	-	-
[104]	Cylinder block	<ul style="list-style-type: none"> <li>Spline section worn.</li> <li>Significant wear on bore inner surface.</li> <li>Scratches and wear on surface that slides against timing plate [109].</li> </ul>	-	-
[105] [106]	Piston assembly Piston Shoe	<ul style="list-style-type: none"> <li>Gap in axis direction of piston [105] and shoe [106].</li> <li>Abnormal wear and uneven wear on shoe.</li> </ul>	Gap 0.05 mm (0.00197 in.)	Gap 0.15 mm (0.00197 in.)
[107]	Retainer plate	<ul style="list-style-type: none"> <li>Uneven wear on sections that slide against shoe [106].</li> <li>Scratches or uneven wear on surface that slides against thrust ball [108].</li> </ul>	-	-
[108]	Thrust ball	<ul style="list-style-type: none"> <li>Uneven wear on spherical section that slides against the retainer plate [107].</li> </ul>	-	-
[109]	Timing plate	<ul style="list-style-type: none"> <li>Seizing symptoms and uneven wear on sliding surfaces.</li> </ul>	-	-
[115] [116]	Friction plate Partner plate	<ul style="list-style-type: none"> <li>Uneven wear on both end surfaces.</li> <li>Specified torque not produced.</li> <li>Seizing symptoms present.</li> </ul>	Braking torque 120 N•m (88.52 lbf • ft.)	Braking torque 120 N•m (88.52 lbf • ft.)

- e. Temporarily tighten the plug (382) in the rear flange (301) with the hexagon wrench.



- [2] Coat the ball bearing (150) with hydraulic oil and fit the ball bearing (150) into the rear flange (301).  
 [3] Fit the parallel pin (342) in the pin hole of the rear flange (301).



- [4] Coat the surface of the timing plate (109) that matches with the rear flange (301) with grease. Use the parallel pin (342) and ball bearing (150) as a guide and install the timing plate (109) on the rear flange (301).  
 [5] Use the parallel pin (342) and ball bearing (150) as a guide and install the timing plate (109) on the rear flange (301).

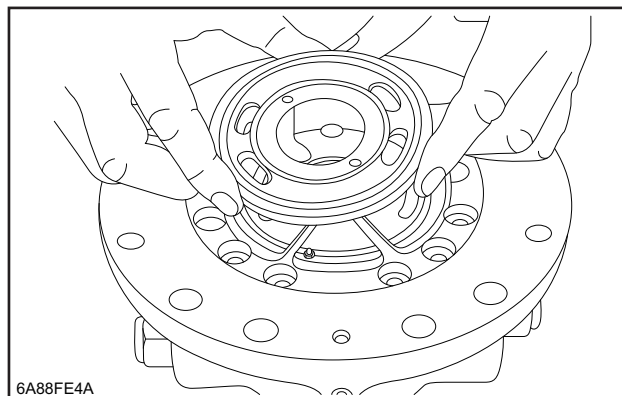
Note

- Install the timing plate (109) until the timing plate (109) is attached to the rear flange (301). Attaching the timing plate (109) to the rear flange (301) prevents the timing plate (109) from falling from the rear flange (301) when the rear flange (301) is installed on the spindle (2).

- [6] Install the 10 springs (113) in the rear flange (301).

Note

- Thoroughly coat the spring (113) with grease and secure them so that they do not fall from the rear flange (301).

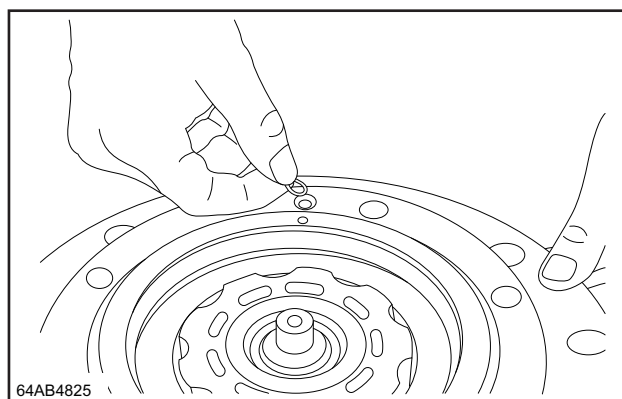


11. Connection between rear flange and spindle

- [1] Install the O-rings (43) and (44) in the spindle (2) O-ring grooves.

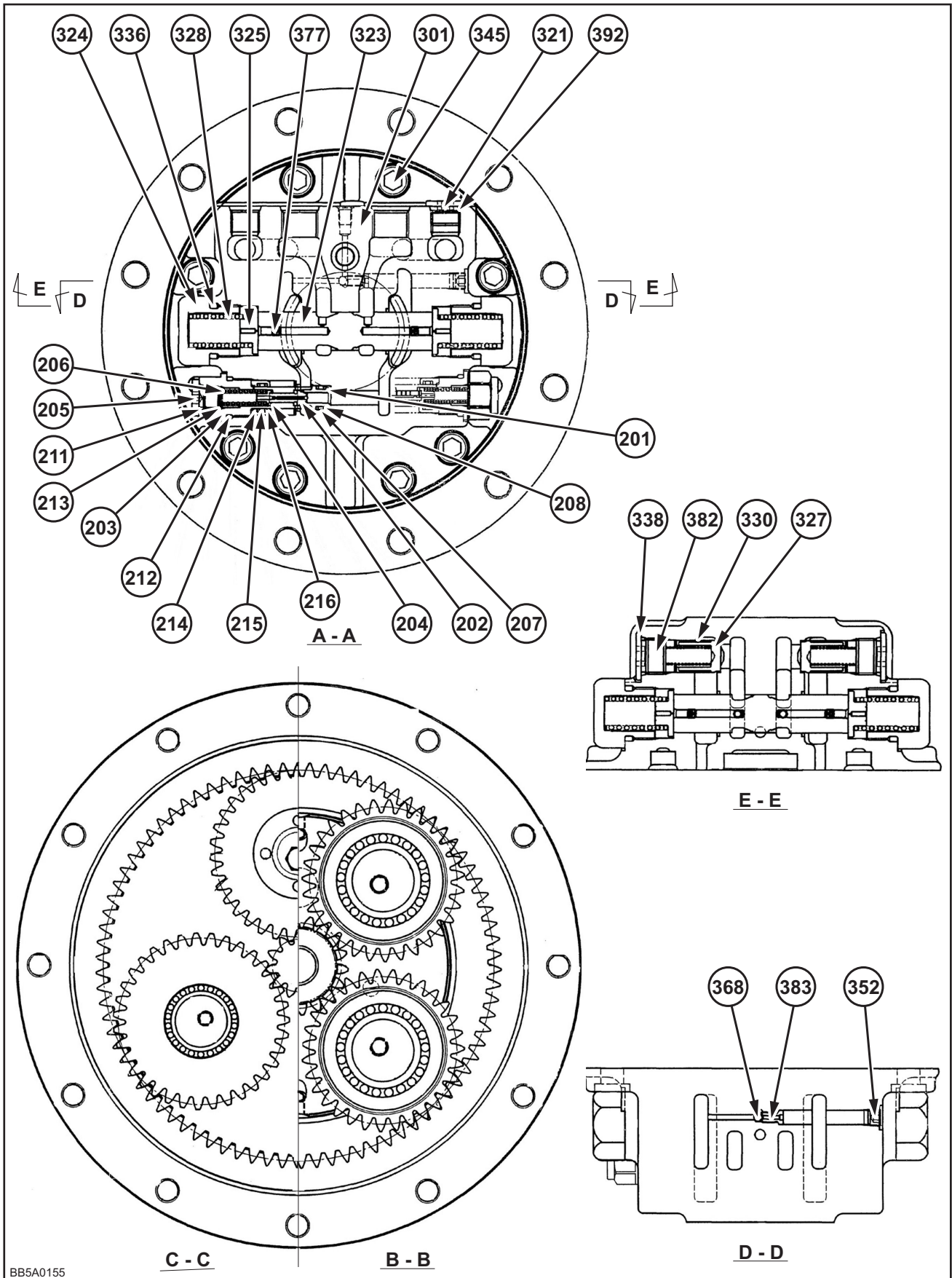
Note

- Install the O-ring (43) without applying grease. If grease is applied for reassembly, grease may ooze out from the matching surface of the rear flange (301) and spindle (2) during travel motor operation. This can be mistaken for an oil leak, so do not apply grease.



- [2] Fit the 2 parallel pins (42) into the spindle (2).

# A. LOWER



## Part Table

Code	Part name	Q'ty	Code	Part name	Q'ty
1	Hub	1	139	O-ring	1

## Drain Volume Measurement Procedures

### Preparations

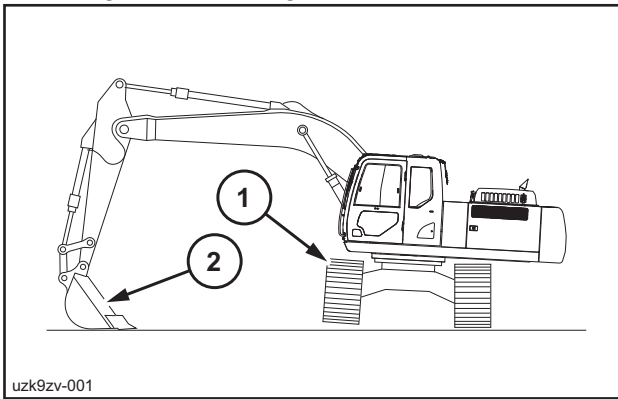
#### Measuring conditions

Engine speed	2000 min <sup>-1</sup> (2000 rpm)
Mode	SP mode
Oil temperature	About 50°C (122.0 °F)

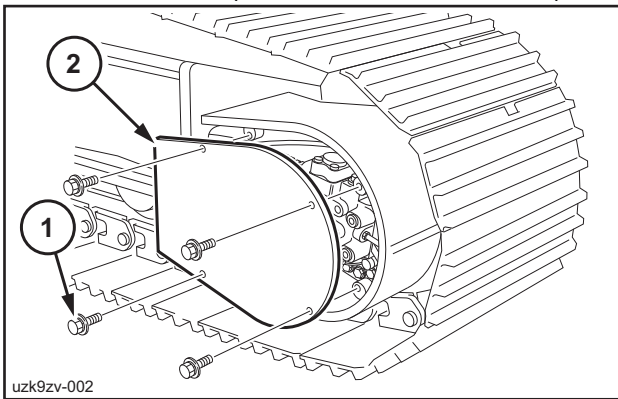
- \* Be careful.  
The drain volume varies greatly with the oil temperature.

### Travel Motor Drain Volume Measurement

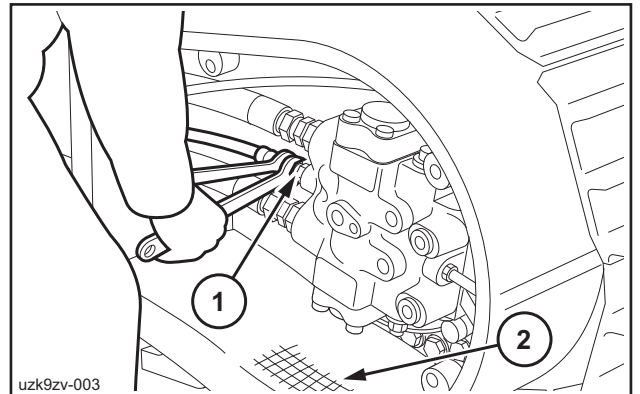
1. Allow the bucket (2) to touch the ground so as to elevate one shoe crawler (1) as in the diagram on the right.



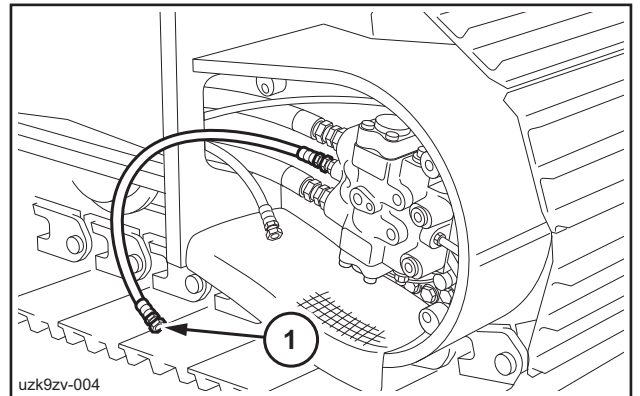
2. Use a wrench [ 19 mm ( 0.748 in. ) ] to remove the bolts (1), then remove the cover (2).  
Tightening torque for bolt installation : 63.7 - 73.5 N · m ( 46.991 - 54.220 lbf · ft. )



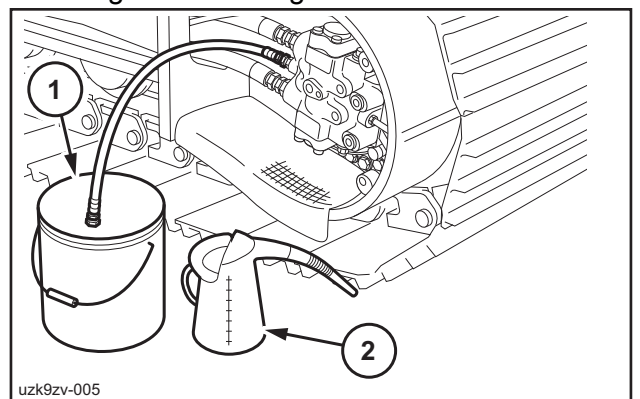
3. Always lay a rag (2) underneath before removing the drain hose (1).  
Use a wrench [ 27 mm ( 1.063 in. ) ] to remove the drain hose (1). (Always install a cap on the removed drain hose (1).)



4. Install the extension hose for measurement (1) on the side of the motor from which the drain hose was removed.

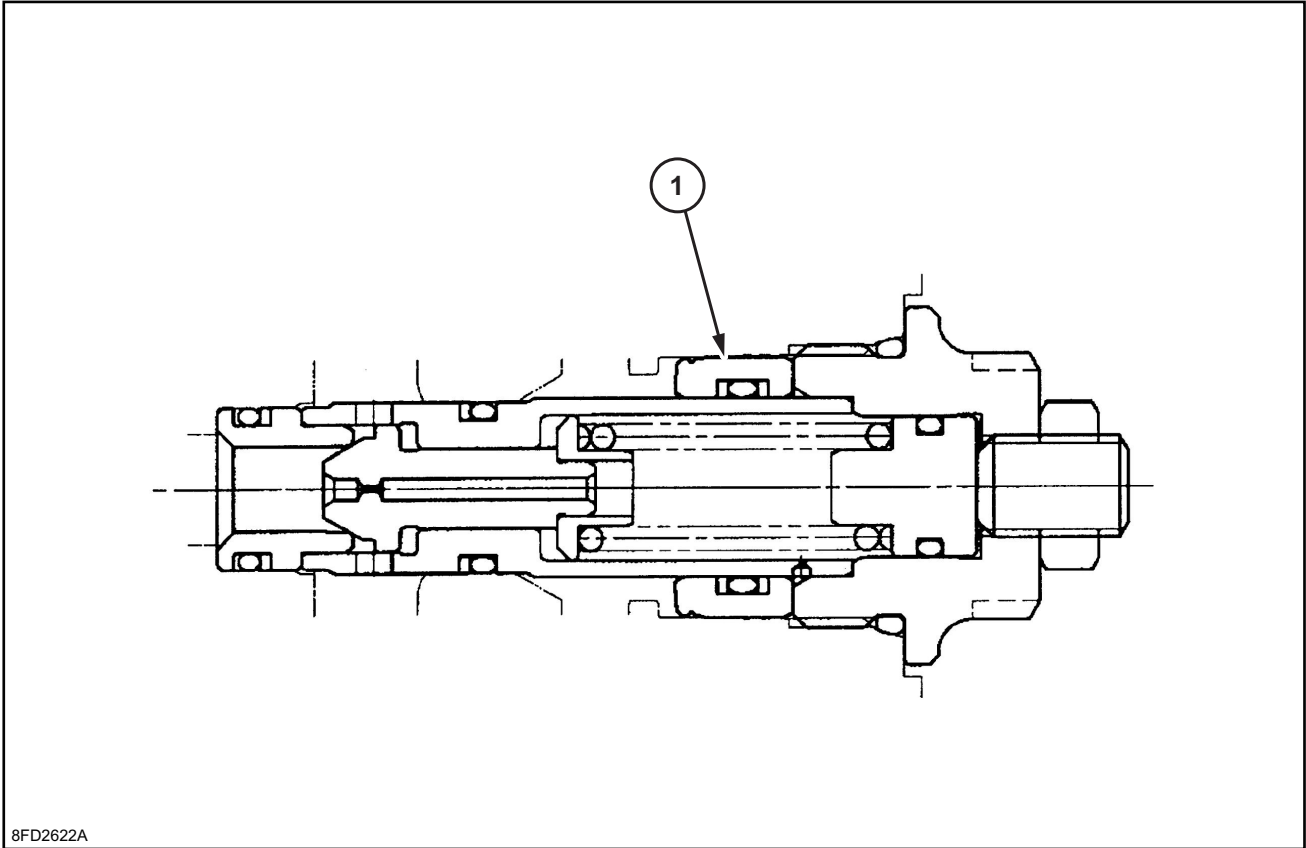


5. Prepare a waste oil can (1) and measuring container (2) and set them as in the diagram on the right.



## B. C. SWING UNIT, COUNTERWEIGHT

- Relationship between relief valve set pressure and adjusting amount (reference)  
About 9.7 MPa (1407.021 psi) /rotation  
Refrain from adjusting as long as no problems have occurred.



8FD2622A

(Fig. 3-1) Structure of relief valve

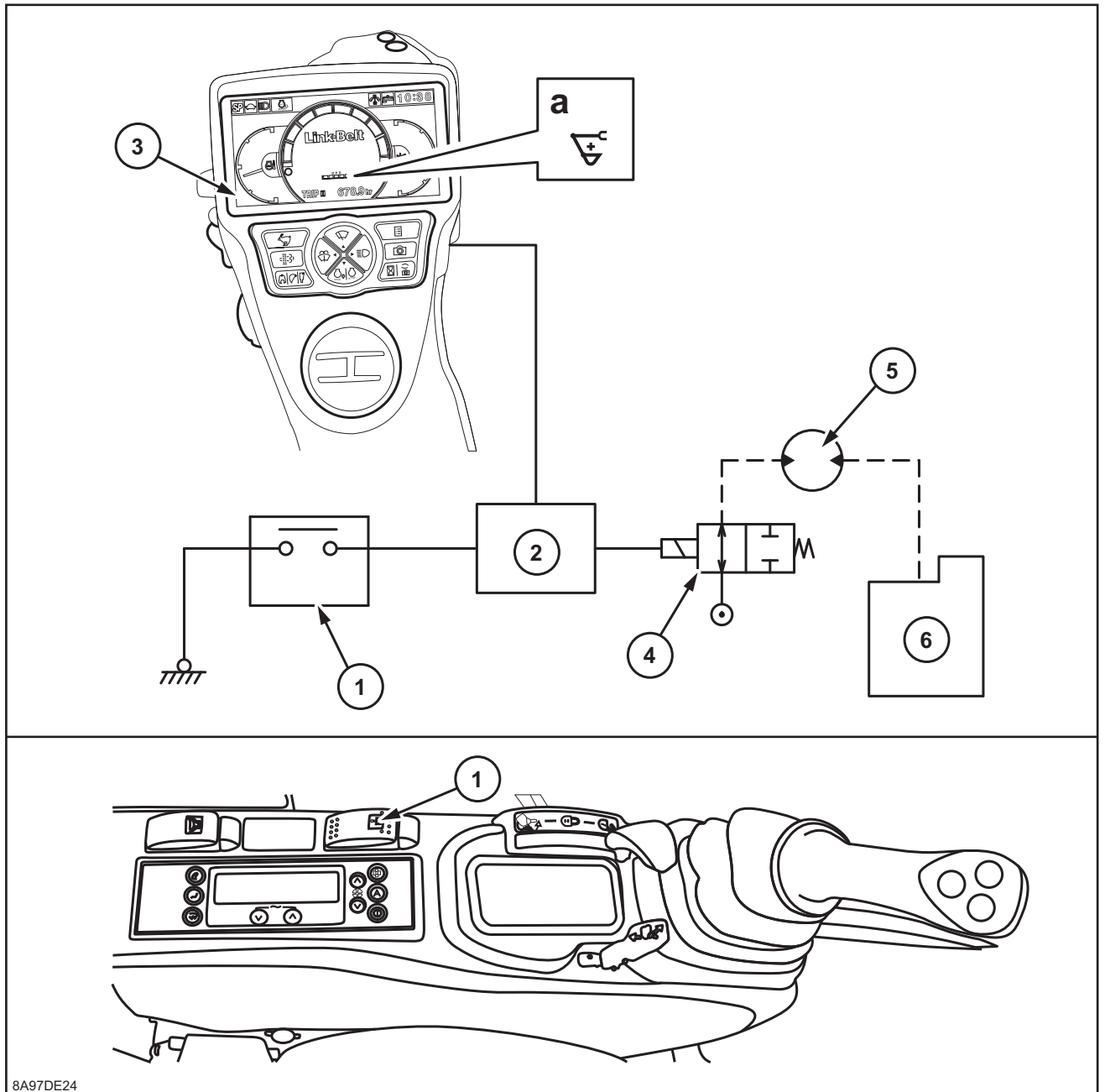
1	Shockless piston
---	------------------

Relief valve operation consists of the following 2 stages.

- 1st stage: See (Fig. 3-2).

The shockless piston moves at the beginning of operation, and the inside of the spring chamber is held to a low pressure.

Therefore, the pressurized area of the poppet becomes the poppet seat section pressurized area (S1), which is a quite large pressurized area compared to the pressurized area (S1-S2) for normal relief setting.



8A97DE24

1	Free swing switch	3	Monitor	5	Swing Motor
2	Computer A	4	Free swing solenoid valve	6	Control valve
		a	Free swing icon		

Operation explanation

[1] Free swing operation condition

a. When the free swing switch is pressed.

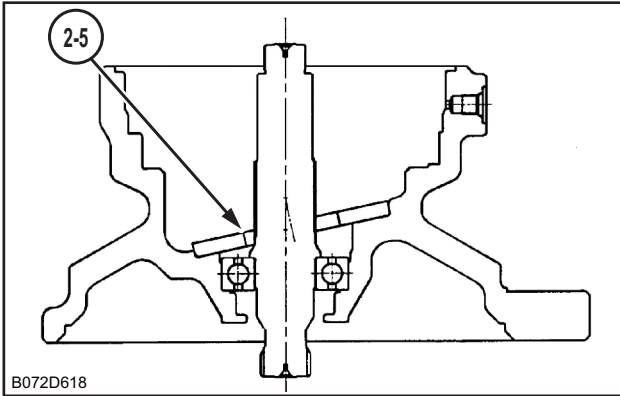
- \* The free swing is disabled during a swing lock.
- \* The free swing icon is displayed on the monitor.

[2] Free swing end condition

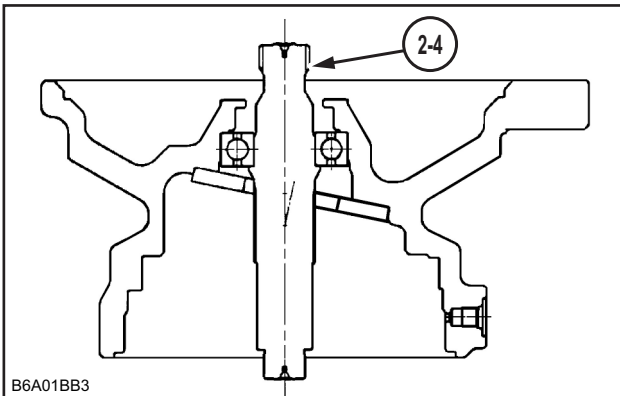
a. When the free swing switch is pressed during free swing.

## B. C. SWING UNIT, COUNTERWEIGHT

14. Remove the thrust plate (2-5).



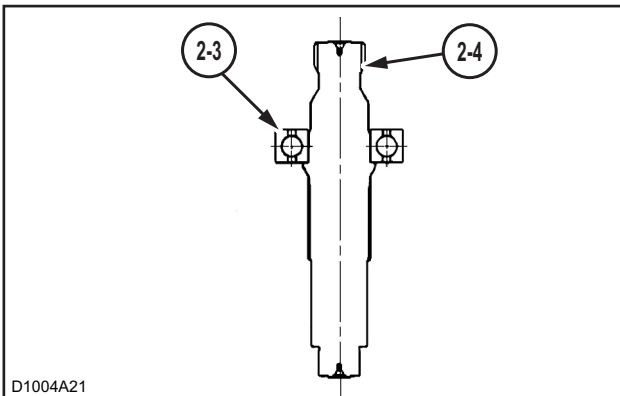
15. Lightly strike the end of the shaft (2-4) with a hammer to remove the shaft.



16. Disassemble the shaft (2-4) and ball bearing (2-3).

### ⚠ Caution

Only perform this when disassembly is required. The removed bearing cannot be reused.

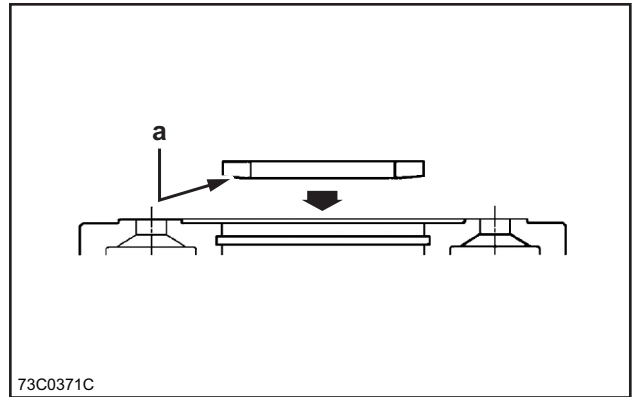
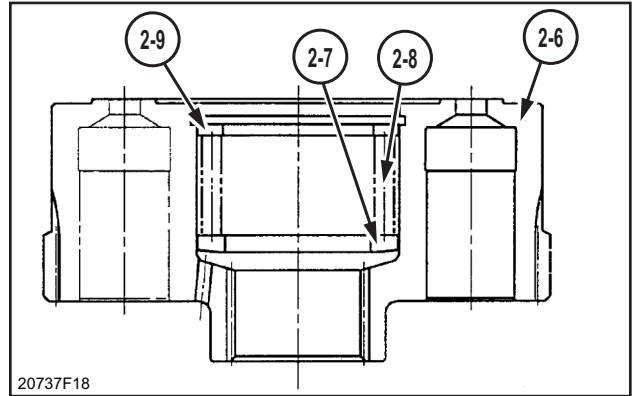


## Assembly

1. Install the collar (2-7), spring (2-8), and washer (2-9) on the cylinder block (2-6).

### Note

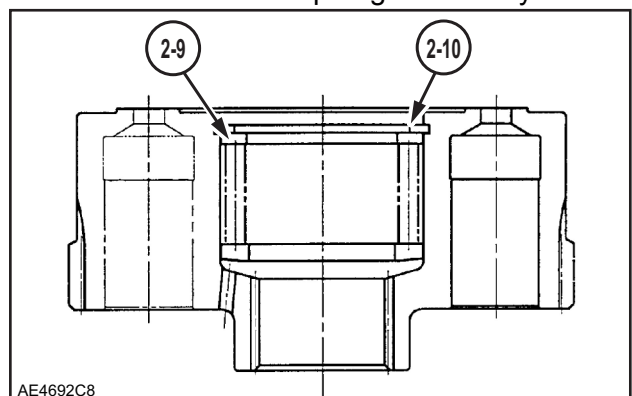
Be careful to install the collar (2-7) in the correct direction.



Cylinder block

a Tapered surface

2. Install the snap ring (2-10) while pushing the washer (2-9). Check that the snap ring is securely held.



3. Coat the pin (2-11) with grease and install it on the cylinder block (2-6).

## Assembly and Disassembly of Swing Unit

Job code

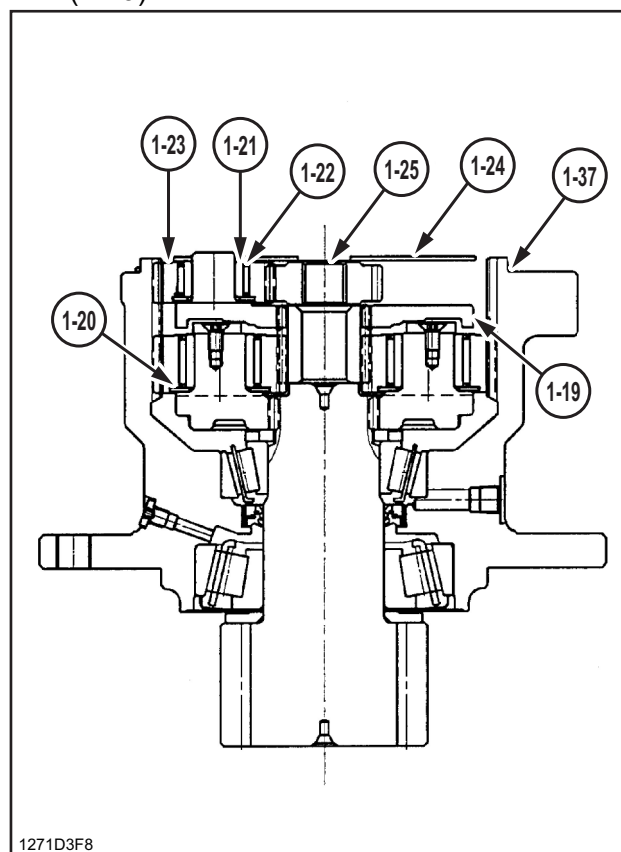
CMMO03

### ⚠ Caution

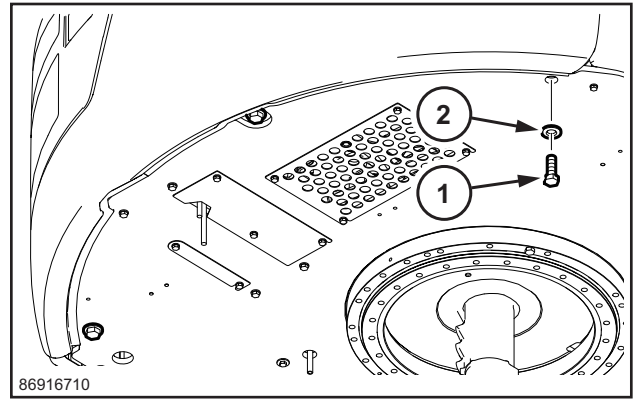
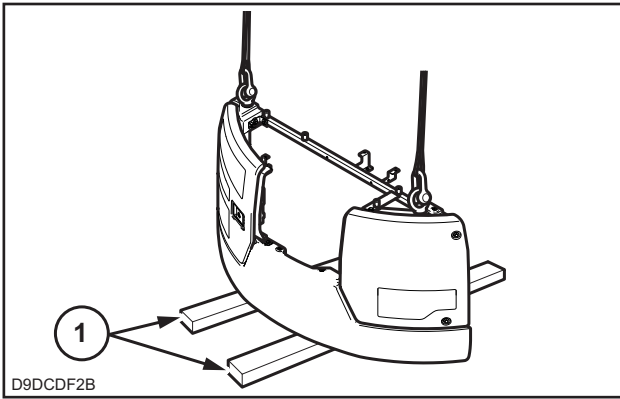
1. Read and understand the contents of this maintenance manual before performing disassembly, reassembly, inspection, repair, or other such work of this product.
2. Handle this product according to the separate "Usage Precautions".
3. When removing this product from the equipment it is mounted on, stop that equipment system and wait for the surface temperature of this product to fall to about 40 °C ( 104.0 °F ) or below before removing it. Working on this product while it is still hot can cause burns. Additionally, always bleed out the pressure before removing any line from this product. Removing a pressurized line can result in oil spraying out and causing injury or oil leak.
4. Use the specialty tools and measurement instruments for disassembly, reassembly, inspection, and repair, etc. of this product. Using an inappropriate tool may result in injury or product damage.
5. Be careful of parts falling when performing disassembly, reassembly, inspection or repair, etc. of this product. This may result in injury or parts damage.
6. Do not directly touch with bare hands the machined edges or threaded sections of parts during disassembly, reassembly, inspection, or repair etc. of this product. This may result in injury.
7. Check performance after reassembly. Do not resume use unless performance is fully recovered. Using this product at a sub-par performance level may result in product damage.
8. The cautions (mark !) listed in this maintenance manual do not cover all possible dangers. Always think of safety first during disassembly, inspection, reassembly, repair, or other such work.

### Disassembly

1. Remove the O-ring (1-37), thrust plate (1-24), drive gear (1-25), planetary gear (1-23), needle bearing (1-22), inner race (1-21), thrust washer (1-20), and holder (1-19).

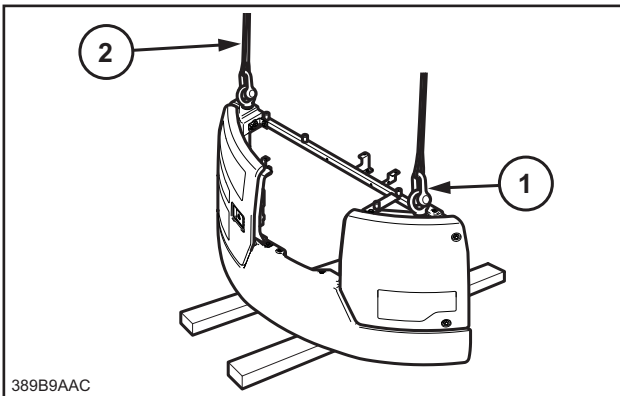


## B. C. SWING UNIT, COUNTERWEIGHT

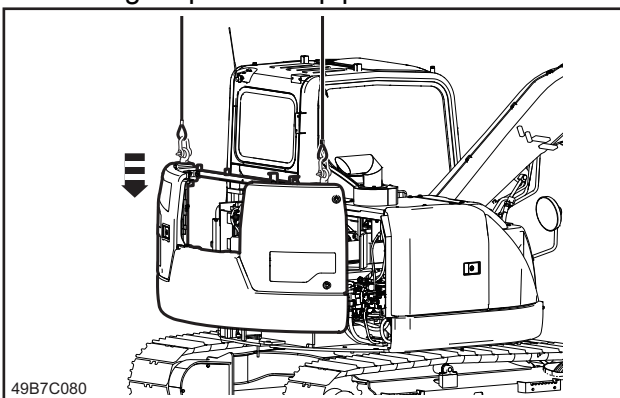


### Installation of Counterweight

1. Connect the shackles (1) to the eyebolts, and then thoroughly secure the counterweight with the wire ropes (2) and liftcrane so that it does not fall over.

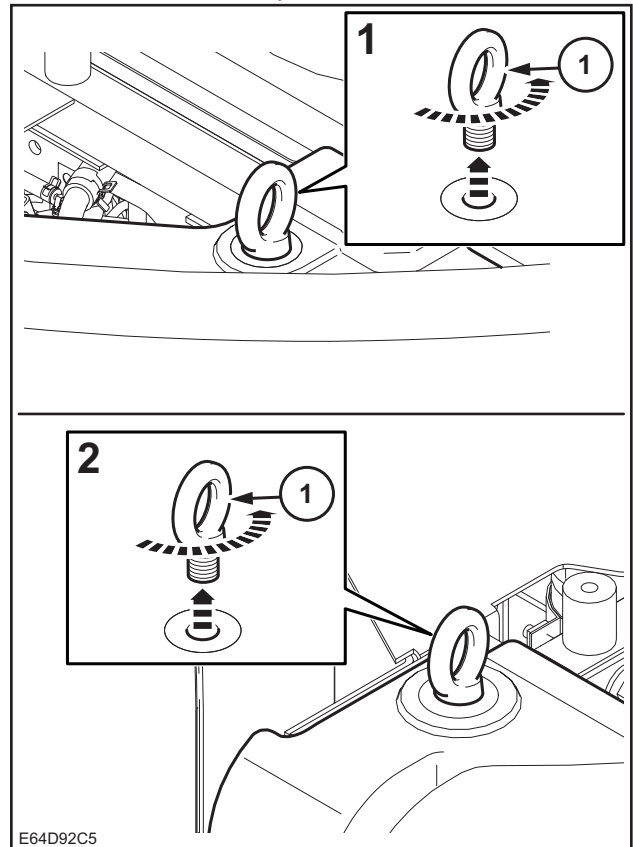


2. Use the wire ropes and liftcrane to lift and install the counterweight.
  - Suspend the counterweight so that it does not interfere with the housing, engine parts and pipes.



3. Use a box wrench [46 mm (1.811 in.)] to install the 5 bolts (1) and 5 washers (2) on the lower section of the counterweight.
  - Bolt (1) tightening torque: 850.2 - 992.4 N·m (627.18 - 732.08 lbf·ft.)

4. Remove the 2 eyebolts (M24) (1).



## Specifications

### 80X3

#### Engine

Name	Isuzu AP-4LE2X diesel engine
Type	4-cycle water-cooled overhead camshaft type, common rail system (electronic control), cooled EGR, with turbocharger (variable displacement type)
No. of cylinders - bore x stroke	4 - D85 mm (3.346 in.) x 96 mm (3.780 in.)
Total stroke volume	2.179 L (0.57564 gal.)
Maximum torque	199 N·m/1800 min <sup>-1</sup> (146.80 lbf·ft/1800 rpm)
Starter	24 V 3.2 kW reduction type
Charging generator	24 V 50 A AC type
Battery	12 V 72 Ah/5 hr. x 2

#### Cooling System

Fan type	D475 mm (18.701 in.) 7 blades, suction
Radiator	
Fin type	Wavy
Fin pitch	1.75 mm (0.06890 in.)
Oil cooler	
Fin type	Wavy
Fin pitch	1.75 mm (0.06890 in.)
Intercooler	
Fin type	Wavy
Fin pitch	2.0 mm (0.0787 in.)
Fuel cooler	
Fin type	Wavy
Fin pitch	2.0 mm (0.0787 in.)

#### Capacities, Filters

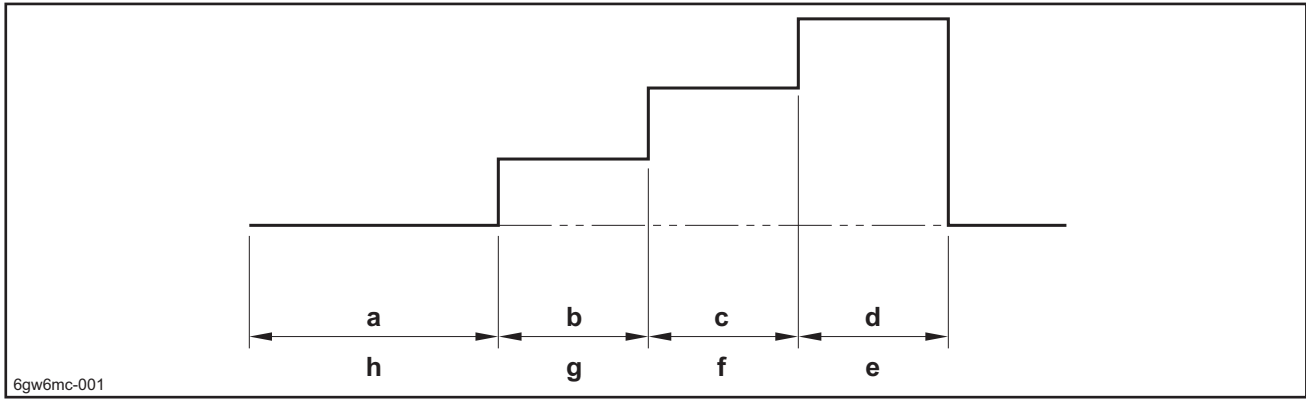
##### ■Coolant and Oil Capacities

Coolant	12.2 L (3.223 gal.)
Fuel	120 L (31.70 gal.)
Engine lubricating oil	11.5 L (3.038 gal.)
Travel reduction gear lubricating oil (one side)	1.1 L (0.291 gal.)
Hydraulic oil	96.3 L (25.440 gal.)
Hydraulic oil tank regulation amount	51 L (13.47 gal.)

##### ■Fuel Filter

Main filter	2 μm
Pre-filter	5.5 μm

## H. ENGINE



a	5 min.	d	3 min.	g	1200 min <sup>-1</sup> (1200 rpm)
b	3 min.	e	SP mode	h	Low idle
c	3 min.	f	1500 min <sup>-1</sup> (1500 rpm)		

### [3] End conditions for auto warm up

Auto warm up is ended and operation shifts to idling start under the following conditions.

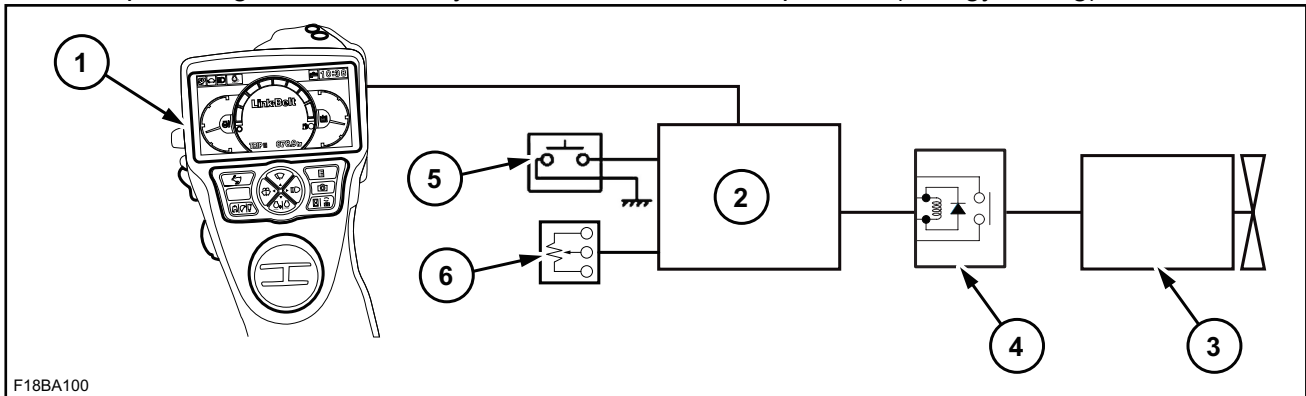
- Coolant temperature is 50°C (122.0°F) or more.
- The one-touch idle switch is pressed.
- The entire auto warm up process has ended (after 14 min.).
- An operation lever is operated (upper, swing, travel, option 1, option 2 pressure sensor is ON).
- When DPD regeneration is started
- When the throttle volume is operated

\* Once canceled, auto warm up is not performed until the key is switched OFF.

## Idling Stop

### Purpose

To stop the engine automatically after a certain time has passed. (Energy saving)



1	Monitor	3	Engine	5	One-touch idle switch
2	Computer A	4	Idle stop relay	6	Throttle volume

### Operation explanation

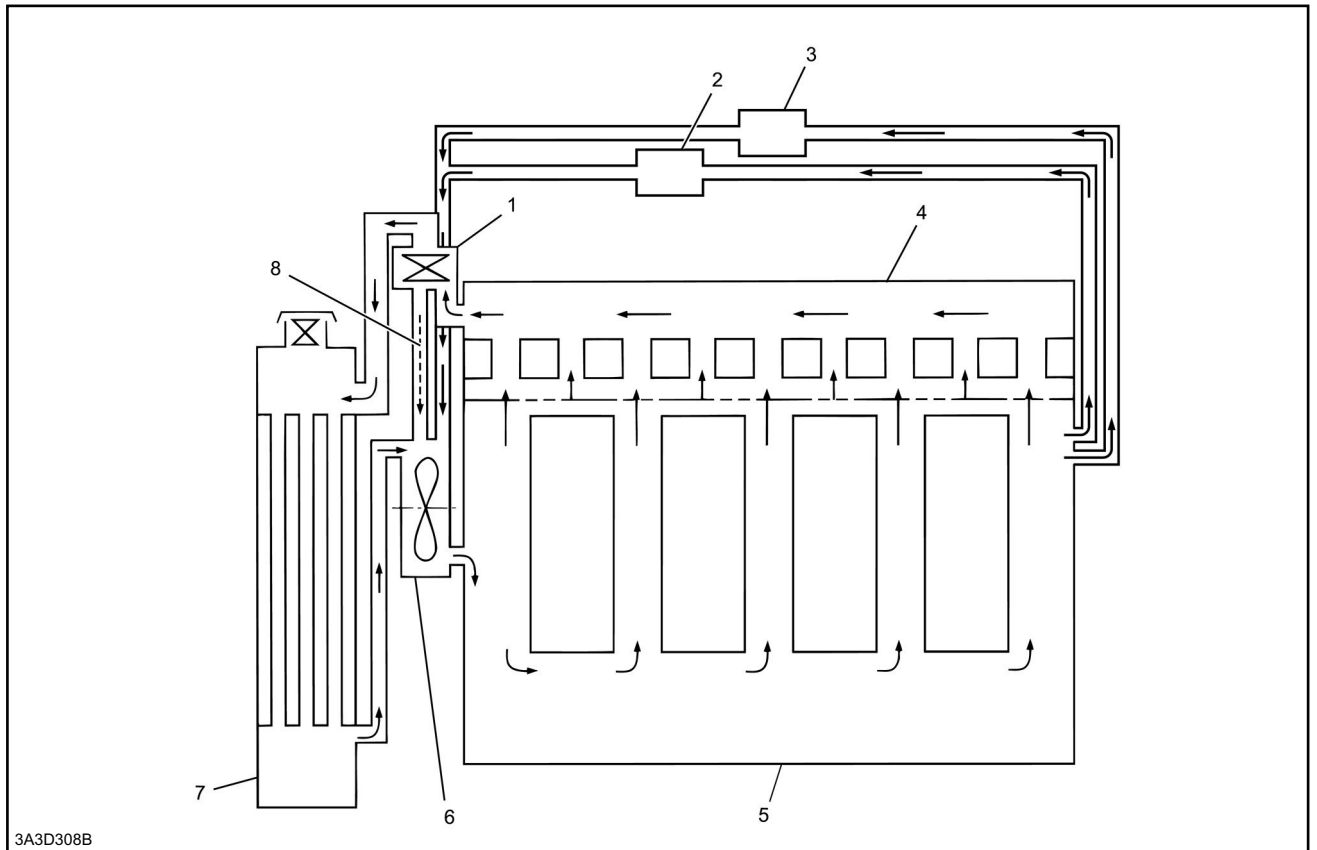
#### [1] Idle stop mode operation conditions

The idle stop operates in the flow of 1 to 3.

- Press the auto idle switch to switch to the idle stop mode.
- With the gate lever raised and engine speed less than 1200 min<sup>-1</sup> (1200 rpm), when the throttle volume, auto idle switch or one-touch idle switch has not been operated for 15 sec., a warning is displayed on the monitor screen and buzzer sounds.
- After 3 more min. have passed, the idle stop relay turns ON and the engine is stopped.

\* To restart the engine, turn the key OFF and perform cranking to start the engine.

\* If the engine is not restarted, turn the key OFF.



3A3D308B

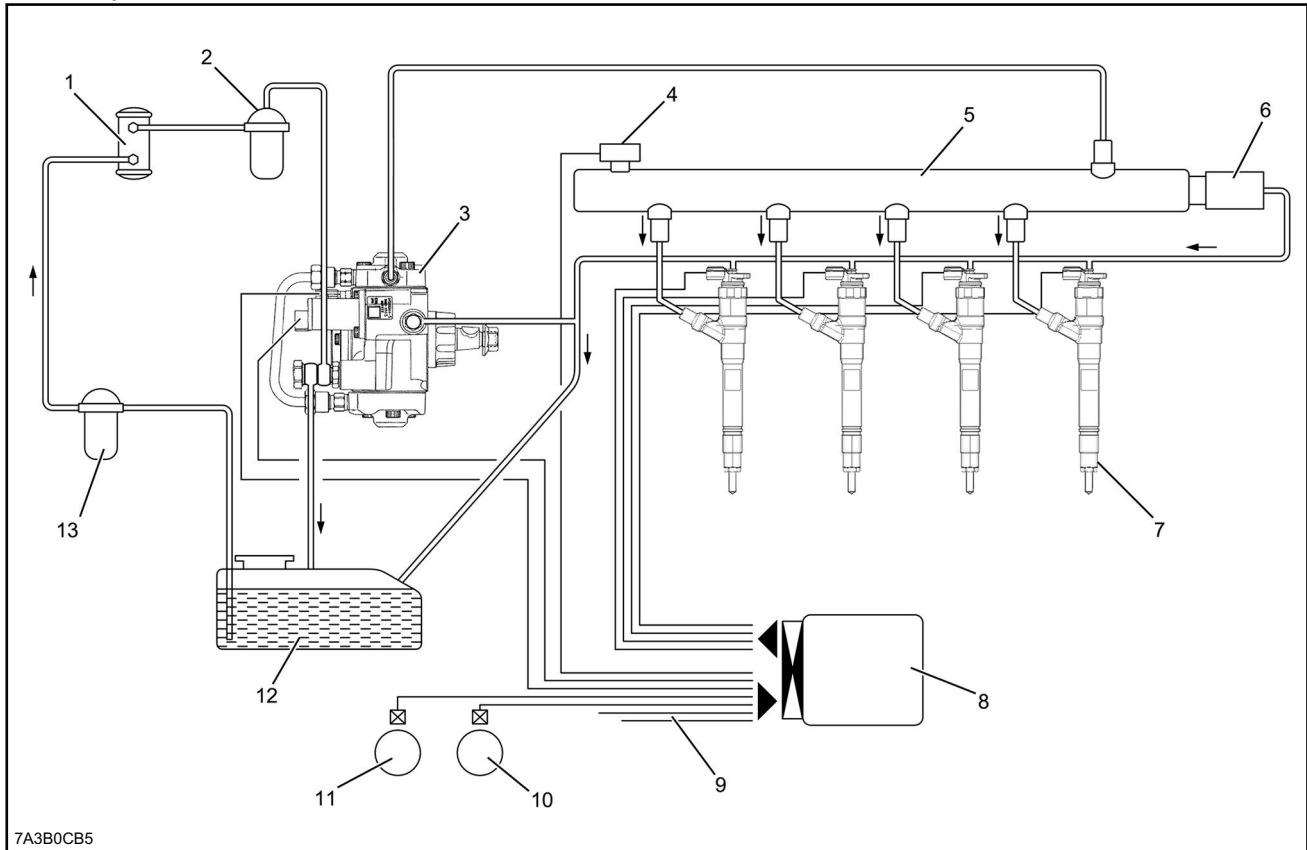
1	Thermostat	4	Cylinder head	7	Radiator
2	Oil cooler	5	Cylinder block	8	Bypass pathway
3	EGR cooler	6	Water pump		

### Water pump

The water pump is a centrifugal impeller type pump and is workn by the engine fan belt.

## H. ENGINE

System schematic



1	Electromagnetic pump	6	Pressure limiter	11	CMP sensor
2	Fuel filter	7	Injector	12	Fuel tank
3	Supply pump	8	ECM	13	Pre-fuel filter
4	FRP sensor	9	Various sensors (Throttle, boost, water temperature)		
5	Common rail (fuel rail)	10	CKP sensor		

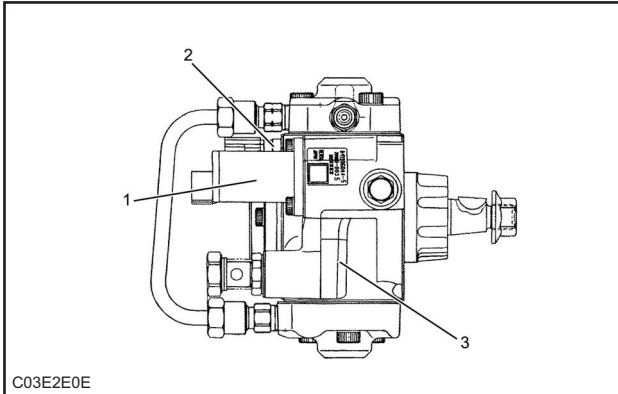
### Fuel system

The fuel is supplied to the supply pump from the fuel tank, and then it is boosted by the pump before being supplied to the common rail (fuel rail).

At this time, the fuel amount to be supplied to the common rail (fuel rail) is controlled by regulating the suction control valve based on the signal from the ECM.

**Supply pump**

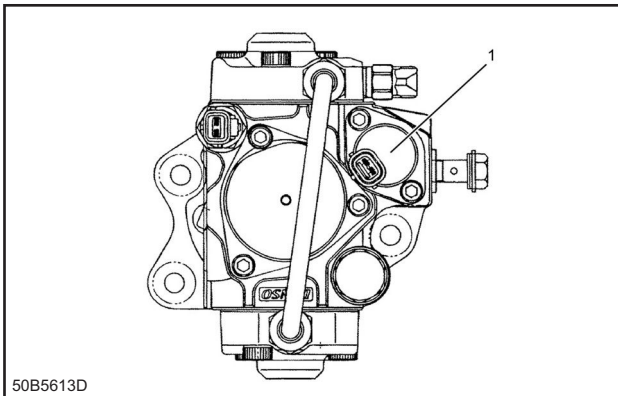
The supply pump highly pressurizes the fuel using the engine torque, and force-feeds the fuel to the common rail (fuel rail). Also, the suction control valve, the fuel temperature sensor, the feed pump, etc., are installed on the supply pump.



1	Suction control valve
2	Fuel temperature sensor
3	Feed pump

**Suction control valve**

The suction control valve is installed on the supply pump and controls the fuel force-feed to the common rail (fuel rail). The ECM controls the fuel discharge amount by regulating the energizing time to the suction control valve.



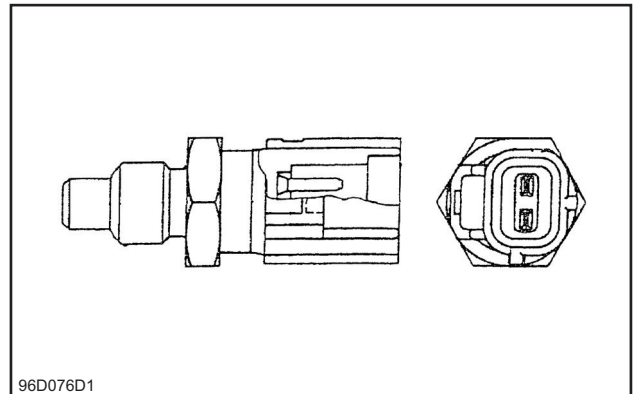
1	Suction control valve
---	-----------------------

**Fuel temperature sensor**

The fuel temperature sensor is installed on the supply pump, and the thermistor changes the resistance according to changes in temperature. The resistance value becomes lower when the fuel temperature is high, and it becomes higher when the fuel temperature is low. The ECM applies 5 V to the fuel temperature sensor through the pull-up resistor, and it calculates the fuel temperature from changes in the voltage and uses it for controlling the supply pump, etc. The voltage becomes lower when the resistance is lower, and it becomes higher when the resistance is higher.

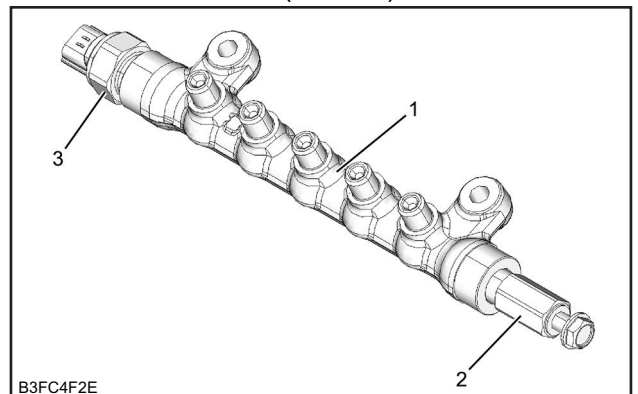
**Note**

- Do not replace the fuel temperature sensor. When a malfunction is found, replace the supply pump assembly.



**Common rail (fuel rail)**

The common rail (fuel rail) receives the fuel from the supply pump, retains the fuel pressure, and distributes the fuel to each cylinder. The FRP sensor and the pressure limiter are installed on the common rail (fuel rail).



## H. ENGINE

---

Pin No.	Pin name	Connection
101	SG-5VRT5	CMP sensor, fuel pressure sensor, EGR position sensor GND
102	-	-
103	OM-EBM2	EGR valve DC servo motor work V
104	-	-
105	OP-SCVHI	SCV-HI work
106	-	-
107	IF-CRANK	CKP sensor signal
108	SG-SLD4	CKP sensor shield
109	SG-5VRT4	CKP sensor, fuel temperature sensor, coolant temperature sensor GND
110	OM-EBM3	EGR valve DC servo motor work W
111	OM-EBM1	EGR valve DC servo motor work U
112	-	-
113	OP-SCVHI	SCV-HI work
114	-	-
115	-	-
116	OP-COM2	Injector power source 2, No. 2 cylinder, No. 3 cylinder
117	OS-INJ3	Injector 3 control, No.4 cylinder
118	OS-INJ4	Injector 4 control, No.2 cylinder
119	OS-INJ1	Injector 1 control, No.1 cylinder
120	OS-INJ2	Injector 2 control, No.3 cylinder
121	OP-COM1	Injector power source 1, No. 1 cylinder, No. 4 cylinder

Cracks and twists in the pipes and hoses related to oil, and correct connections thereof. Extensively check for any leaks or clogging.

Whether there is any oil leakage, damage, or dents on the pipes in the lubricating system.

Malfunctions in air intake system parts related to turbocharger inspection

- Diagnostic aids
    - Malfunctions in the air intake system such as a decrease in oil, an increase in oil, and excessive blow-by gas
    - Malfunctions in the engine body such as oil burning and excessive blow-by gas
- Perform functional diagnostic inspections, and check the operation, control, etc., of each part. Repair if a malfunction is detected.

### Engine Output Deficiency

#### 1. Insufficient engine output description of symptom

The engine output is below the predicted output, the output does not change even when the throttle lever (throttle lever) is raised, or the response is poor.

#### 2. Insufficient engine output diagnostics

- Preliminary inspection
  - Before using this section, perform functional inspections or OBD system checks to check the following.
  - The ECM and diagnostic light are operating properly.
  - Diagnostic Trouble Code verification.
  - The scan tool data is within the normal operating range.
  - Check the machine condition to locate the indicated symptom.
  - Check with the customer to verify whether they are using the specified engine oil and fuel.
  - Various causes are conceivable for insufficient output. Therefore, carefully check the engine body and items related to the machine.
  - Check what kind of operations result in insufficient output.
  - If insufficient output phenomena include hesitation and lag, issues related to the machine may be involved. Contact the machine manufacturer.
  - If a malfunction diagnostic scan tool is available, the engine output at the rated point can be verified by simply checking the boost at the rated point.

#### • Visual inspection

Careful visual inspection is required for certain symptom procedures. This can lead to correcting a problem without further inspections, and can save valuable time.

The inspection covers the following items.

Whether there is dirt or clogging of the air cleaner element.

Correct wiring connections, tightening, and disconnections

Whether the power source for any aftermarket accessories is being taken from the ECM power source.

Whether the ECM ground is clean and securely installed to the correct position.

Cracks and twists in the pipes and hoses related to fuel, air, and oil, and correct connections thereof. Extensively check for any leaks or clogging.

Whether there are any fuel leaks, damage, or dents on the pipes in the fuel system.

Increases in resistance due to dirt and clogging in air intake system parts, especially the air cleaner element, or to collapsing of the air intake piping

Malfunctions in exhaust system parts

#### • Diagnostic aids

Malfunctions in the fuel system such as no fuel, fuel freezing, air in the fuel pipe, filter malfunctions, pipe malfunctions, poor fuel quality, and fuel tank malfunctions

Malfunctions in the air intake system such as filter clogging and air intake pipe malfunctions

Malfunctions in the exhaust system such as an exhaust pipe malfunction, etc.

Malfunctions in the throttle position sensor, harness, etc., of the sensor input circuit system

Malfunctions in the input circuit system of switches

Malfunctions in the engine body such as insufficient compression pressure, valve clearance, turbocharger, supply pump, injector, common rail (fuel rail), and other mechanical failures

Failures related to equipment on the machine side such as hydraulic pumps

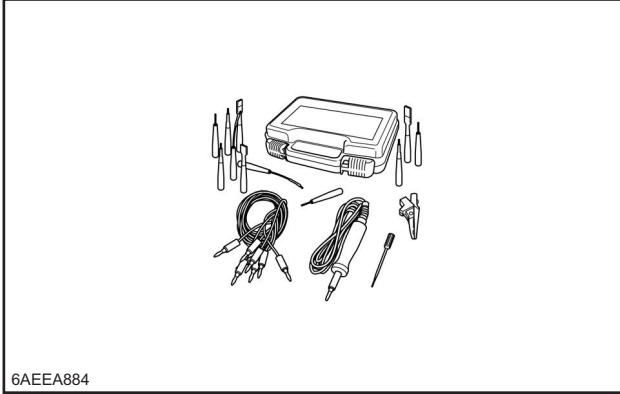
Effects of aftermarket electrical components such as wireless devices and lights

## H. ENGINE

### 2. Cautions on electronic system

#### Using circuit test tools

Unless instructed in the diagnostic procedures, do not use a test light when diagnosing the powertrain electronic system. When a probe connector is required in the diagnostic procedure, use the connector test adapter kit.



SST: 5-8840-2835-0 - connector test adapter kit

#### Aftermarket electronic equipment

Aftermarket electronic equipment refers to commercially available electronic equipment attached to the machine after it has been shipped from the factory. Be careful, as such accessories are not taken into particular consideration at the machine design stage. Aftermarket electronic equipment may cause malfunctions in the electronic control system, even if the equipment is properly attached. This includes equipment not connected to the electronic system of the machine, such as mobile telephones and radios. Therefore, when diagnosing powertrain problems, confirm whether such aftermarket electronic equipment is attached first and then remove them from the machine if such equipment is attached. If the problem has not been resolved after removing the equipment, perform the diagnosis using the regular procedure.

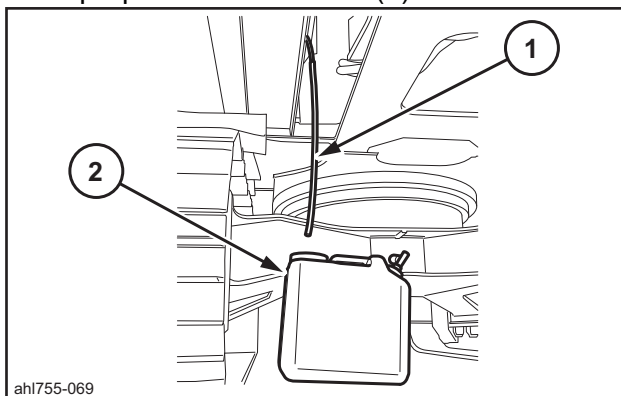
#### Caution

- Make sure that aftermarket electronic equipment is connected to a circuit that is not involved with the circuits of the electronic control system for both power and ground.

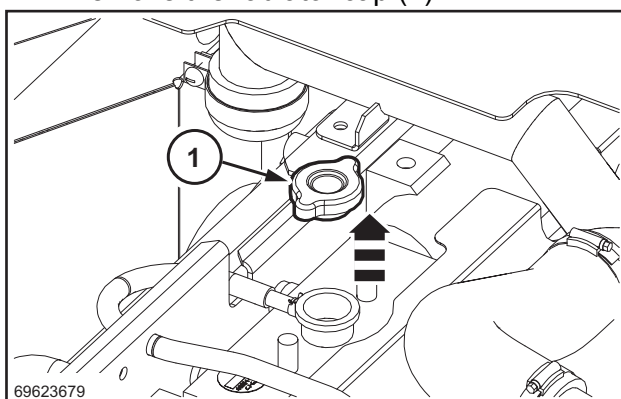
Welding work on the machine

When performing welding work on the machine, make sure to disconnect the battery prior to the work. Current that occurs during welding may lead to failure and/or damage to the electronic control system.

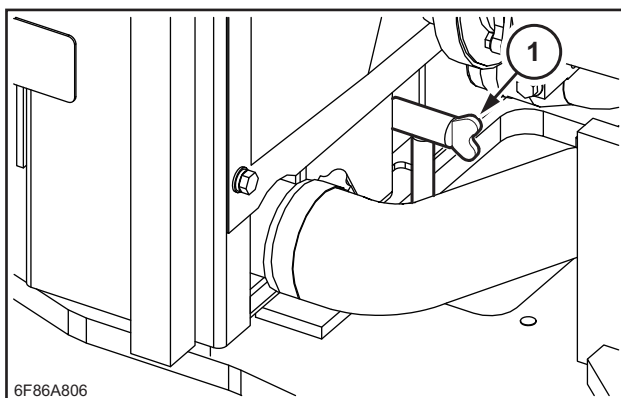
2. Install the drain hose (1), and then prepare the drain tank (2).



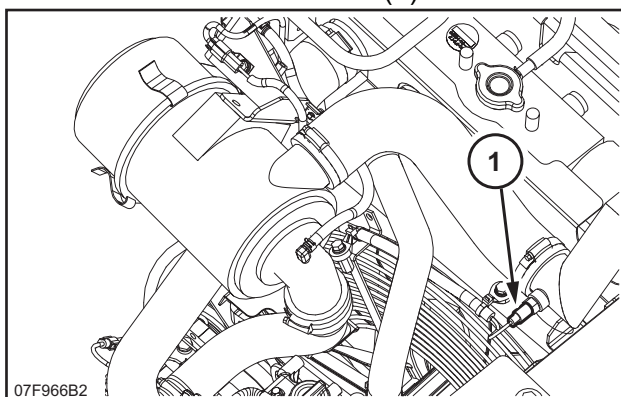
3. To make it easier to drain the coolant, remove the radiator cap (1).



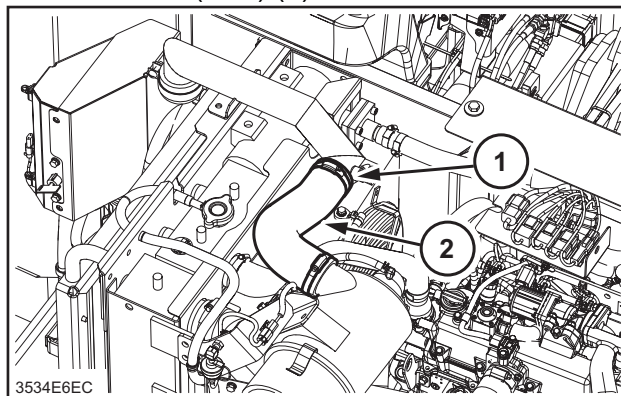
4. Loosen the drain plug (1), and then drain the coolant.



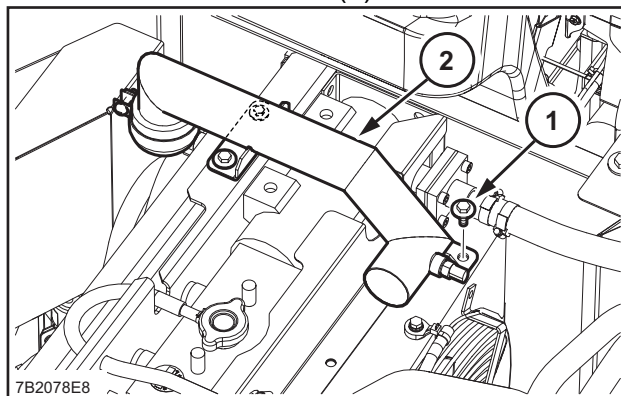
5. Remove the connector (1).



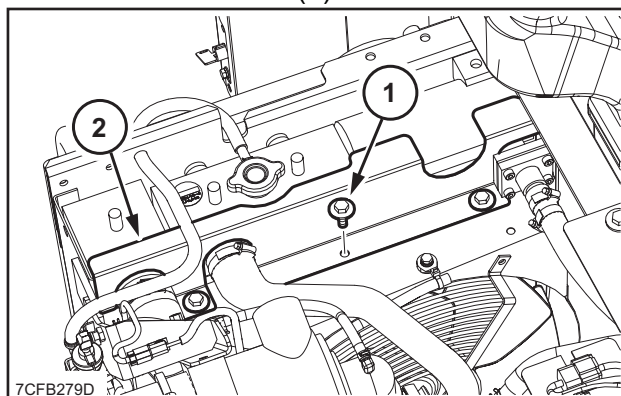
6. Use a wrench [7 mm (0.276 in.)] to loosen the hose band (1), and then remove the air hose (inlet) (2).



7. Use a wrench [13 mm (0.512 in.)] to remove the 3 bolts (1), and then remove the inlet air bracket (2).



8. Use a wrench [13 mm (0.512 in.)] to remove the 3 bolts (1), and then remove the seal bracket (2).



## H. ENGINE

[4] Temporarily tighten the EGR cooler to the EGR pipe.

**Note**

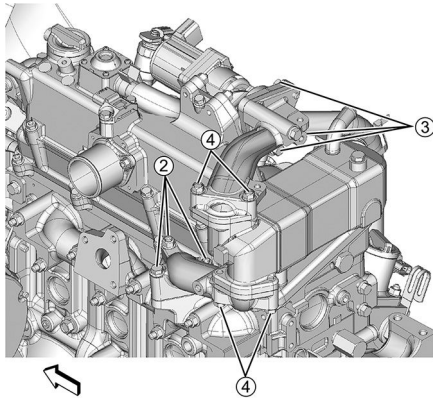
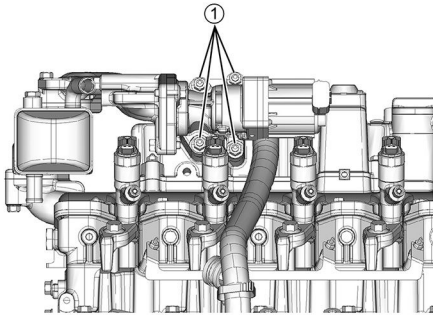
- Temporarily tighten the entire component until seated.

[5] Securely tighten the EGR cooler assembly to the intake chamber and the exhaust manifold.

**Note**

- After temporarily tightening all the components, securely tighten in the numerical order shown in the diagram.

tightening torque : 27 N · m { 2.8 kgf · m / 20 lbf · ft. }



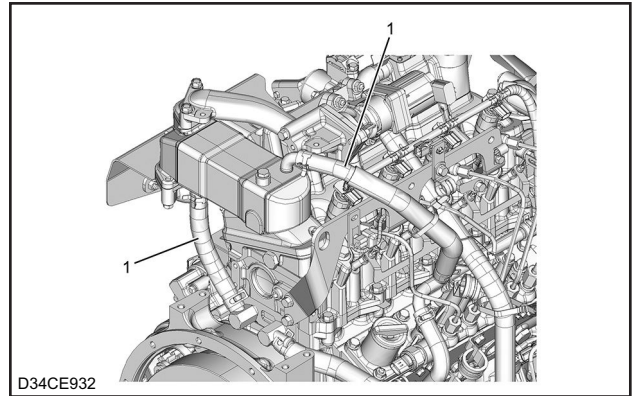
63A27EA9

**Note**

- Tighten the heat protector tightening bolts.

tightening torque : 27 N · m { 2.8 kgf · m / 20 lbf · ft. }

[6] Connect the water rubber hose to the EGR cooler assembly.



D34CE932

1	Water rubber hose
---	-------------------

[7] Connect the harness clip to the EGR pipe.

tightening torque : 27 N · m { 2.8 kgf · m / 20 lbf · ft. }

[8] Connect the harness connector to the EGR valve.

### 2. Coolant filling

[1] Loosen the plug using a wrench.

[2] Replenish the radiator with coolant.

**Caution**

- Take care to prevent overflow coolant from splashing on to the exhaust system parts.
- Wipe off any coolant overflow.

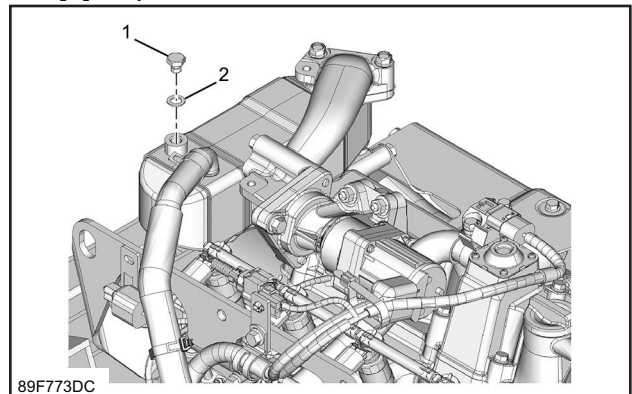
[3] Tighten the plug using a wrench.

**Caution**

- Use a new gasket.

tightening torque : 28 N · m { 2.9 kgf · m / 21 lbf · ft. }

[4] Replenish the radiator with coolant.



89F773DC

1	Plug
2	Gasket

### 3. Battery ground cable connect

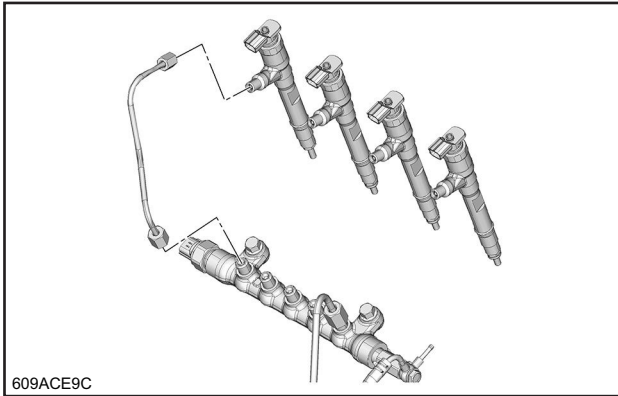
[1] Connect the battery ground cable to the battery.

21. Injection pipe removal

- [1] Remove the injection pipe from the injector and the common rail (fuel rail) assembly.

Note

- Do not reuse the injection pipe.

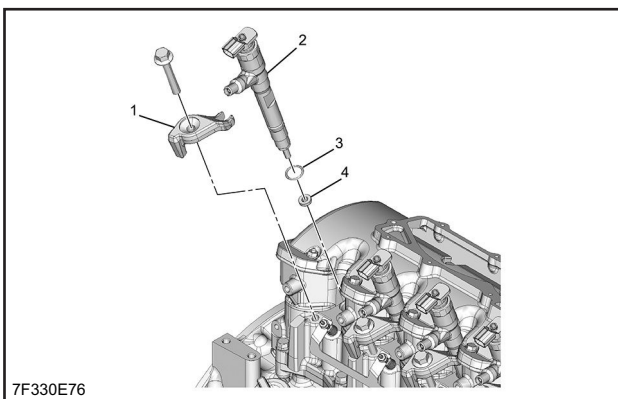


22. Injector removal

- [1] Disconnect the harness connector from the injector.
- [2] Remove the injector from the cylinder head assembly.
- [3] Remove the injector gasket from the injector.
- [4] Remove the O-ring from the injector.

Note

- Do not reuse the injector gasket or the O-ring.



1	Injector clamp
2	Injector
3	O-ring
4	Injector gasket

Note

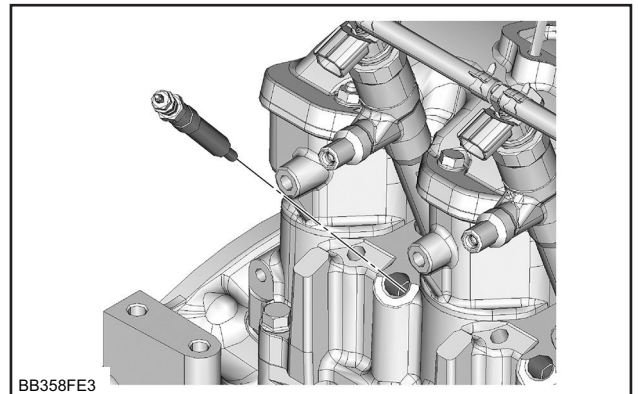
- Absolutely never touch the injector solenoid because doing so can hinder performance or cause damage.
- Store the removed injector with the cylinder number on it.

23. Glow plug connector removal

- [1] Remove the glow plug connector from the glow plug.

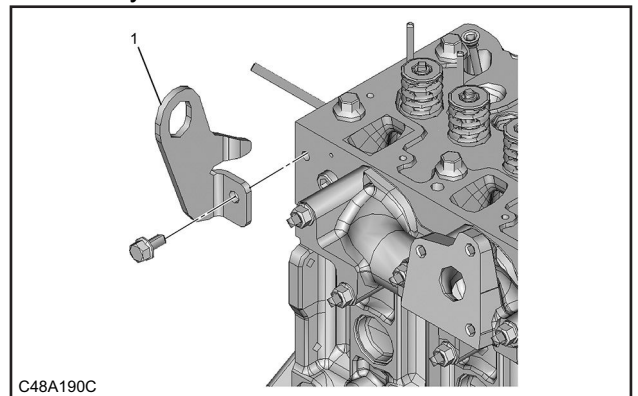
24. Glow plug removal

- [1] Remove the glow plug from the cylinder head.



25. Engine hanger removal

- [1] Remove the engine hanger from the cylinder head.



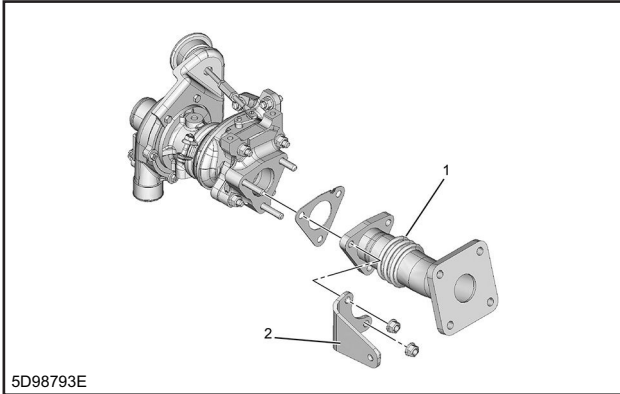
1	Engine hanger
---	---------------

## H. ENGINE

[2] Temporarily tighten the exhaust pipe to the turbocharger assembly.

Note

- Install together with the bracket.



5D98793E

1	Exhaust pipe
2	Bracket

[3] Temporarily tighten the integrated oxidation catalyst silencer to the exhaust pipe.

[4] Temporarily tighten the U-bolts to the integrated oxidation catalyst silencer.

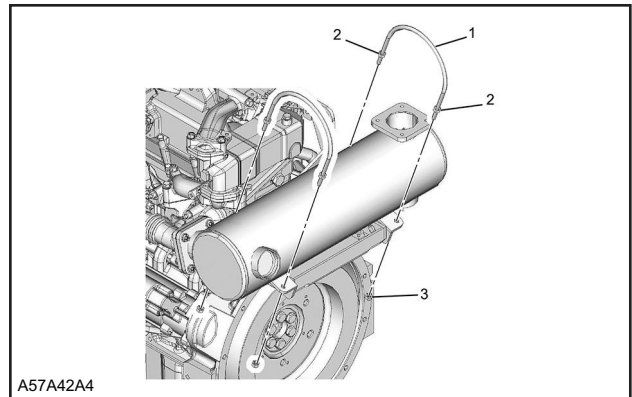
Note

- Temporarily tighten nut A until the end of the threaded portion of the U-bolt.
- With nut A tightened, temporarily tighten the integrated oxidation catalyst silencer.
- Temporarily tighten the U-bolts to the integrated oxidation catalyst silencer with nut B.

tightening torque : 5 N · m { 0.5 kgf · m / 3.69 lbf · ft. }

Caution

- Temporarily tighten so that the U-bolt protrusion amounts are even in the front and rear of the integrated oxidation catalyst silencer.
- Install so that the U-bolts are not tilted.



A57A42A4

1	U-bolt
2	Nut A
3	Nut B

[5] Securely tighten the U-bolts to the integrated oxidation catalyst silencer.

Note

- Securely tighten the U-bolts after settling the entire integrated oxidation catalyst silencer.
- Tighten nut A and securely tighten.

tightening torque : 25 N · m { 2.5 kgf · m / 18 lbf · ft. }

[6] Securely tighten the exhaust pipe to the turbocharger assembly.

tightening torque : 24 N · m { 2.4 kgf · m / 18 lbf · ft. }

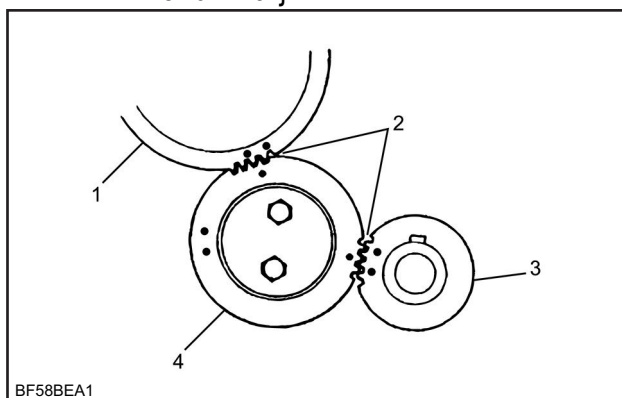
[7] Securely tighten the integrated oxidation catalyst silencer to the exhaust pipe.

tightening torque : 24 N · m { 2.4 kgf · m / 18 lbf · ft. }

[8] Securely tighten the support bracket to the silencer bracket.

tightening torque : 24 N · m { 2.4 kgf · m / 18 lbf · ft. }

tightening torque : 25.5 N · m { 2.6 kgf · m / 19 lbf · ft. }



1	Camshaft gear
2	Timing point
3	Crank gear
4	Idle gear A

[5] Apply engine oil to the idle gear.

Note

- Apply engine oil to the thrust collar, the bolt, and the threaded portion.

[6] Install the thrust collar to the idle gear.

Note

- Install so that the chamfered side of the thrust collar faces the outside.

2. Camshaft gear installation

[1] Install the camshaft gear to the camshaft.

Note

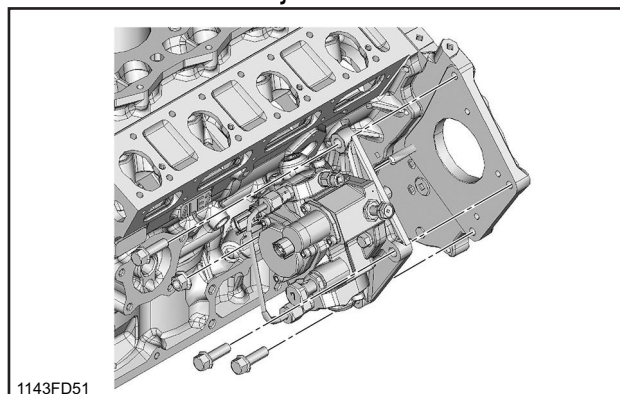
- Install after meshing so as to align the idle gear alignment marks.

tightening torque : 88 N · m { 9.0 kgf · m / 65 lbf · ft. }

3. Fuel supply pump installation

[1] Install the fuel supply pump to the front oil pump plate.

tightening torque : 48 N · m { 4.9 kgf · m / 35 lbf · ft. }



[2] Connect the harness connector to the fuel supply pump.

4. Idle gear B installation

[1] Install the idle gear shaft to the cylinder block.

[2] Apply engine oil to the idle gear.

Note

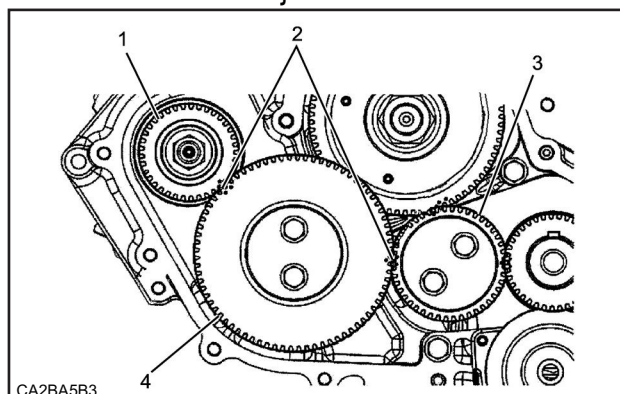
- Apply to idle gear B and the idle gear shaft.

[3] Install idle gear B to the idle gear shaft.

Note

- Install after meshing so as to align the idle gear B alignment marks with idle gear A and the supply pump gear.

tightening torque : 25.5 N · m { 2.6 kgf · m / 19 lbf · ft. }

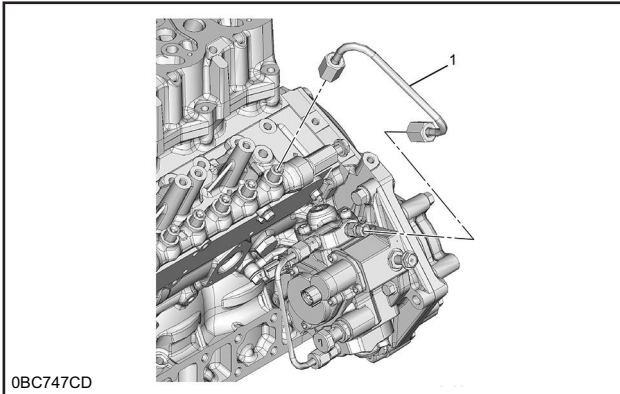


1	Supply pump gear
2	Timing point
3	Idle gear A
4	Idle gear B

## H. ENGINE

### 34. Fuel pipe removal

- [1] Remove the fuel pipe from the fuel supply pump and the common rail (fuel rail) assembly.



0BC747CD

1	Fuel pipe
---	-----------

### 35. Fuel return pipe removal

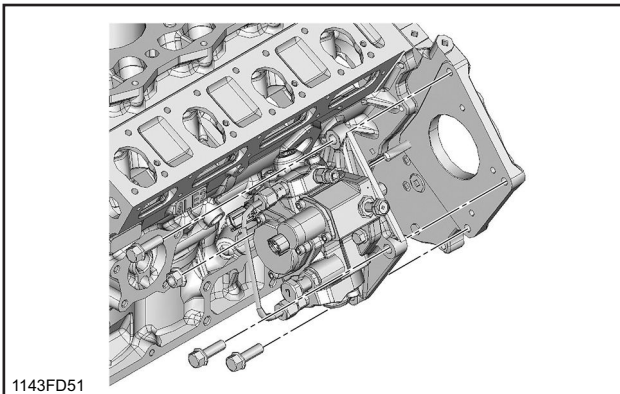
- [1] Remove the fuel return pipe from the fuel supply pump.

### 36. Fuel supply pump removal

- [1] Disconnect the harness connector from the fuel supply pump.  
 [2] Remove the fuel supply pump from the front oil pump plate.

#### Note

- Remove the tightening bolts, and remove together with the bracket.

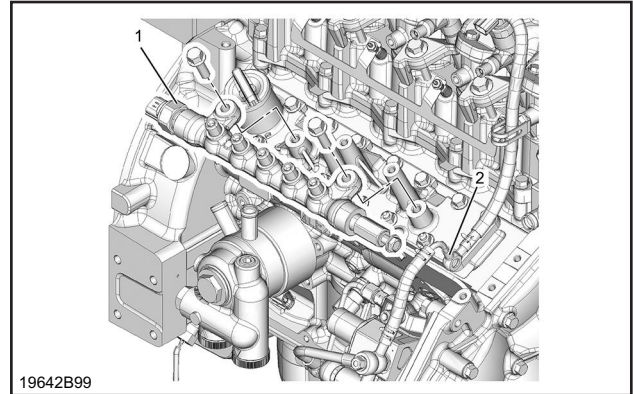


1143FD51

### 37. Common rail assembly removal

- [1] Disconnect the harness connector from the common rail (fuel rail) assembly.  
 [2] Remove the fuel leak-off pipe from the common rail (fuel rail) assembly.

- [3] Remove the common rail (fuel rail) assembly from the common rail (fuel rail) bracket.



19642B99

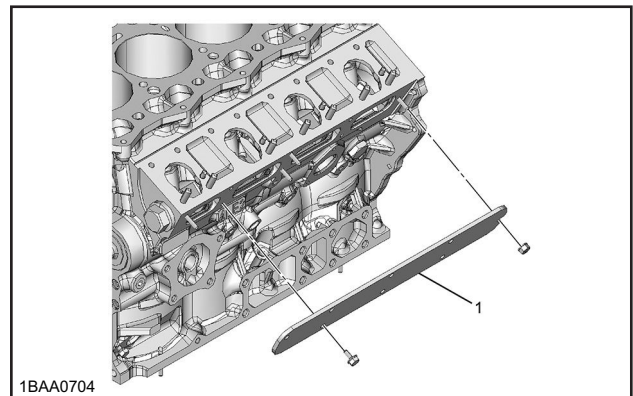
1	Common rail (fuel rail) assembly
2	Fuel leak-off pipe

### 38. Housing cover removal

- [1] Remove the housing cover from the cylinder block.

#### Caution

- Be careful not to deform when removing.



1BAA0704

1	Housing cover
---	---------------

### 39. Idle gear A measurement

#### Caution

- Before removing the idle gear, measure the end play of the gear.

- [1] Measure the backlash using a dial gauge.

#### Note

- Install the dial gauge as shown in the diagram, and measure by turning the gear left and right.
- If the measured value exceeds the limit, replace the thrust collar or the idle gear.

specified value : 0.04 mm { 0.0016 in. }

Crank gear, idle gear

limit : 0.2 mm { 0.008 in. } Crank gear, idle gear

Note

- Return the engine speed sensor 1 rotation, and secure with a nut.

tightening torque : 29 N · m { 3.0 kgf · m / 21 lbf · ft. }

- [2] Inspect the engine speed sensor.

Note

- Check the output voltage at maximum speed without load and low speed without load.

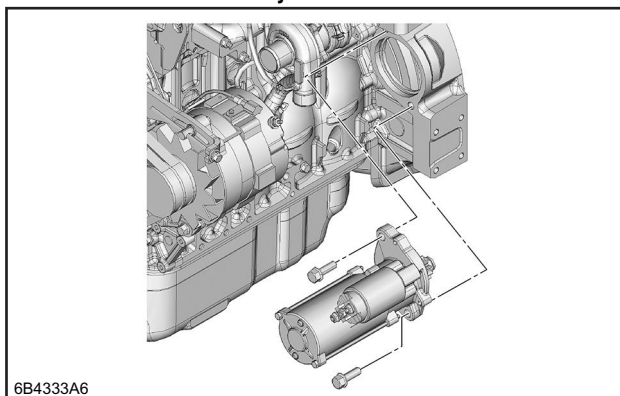
Engine speed	Specified output voltage	
	Voltage waveform	AC voltage
Maximum speed without load	: 20 - 72 V	: 7.1 - 25.5 V
Low speed without load	: 9 to 40 V	: 3.2 - 14.2 V

Note

- If the measured value is outside the specified output voltage, adjust the engine speed sensor until it is within the specified output voltage.

12. Starter motor installation

- [1] Install the starter motor to the flywheel housing.  
tightening torque : 103 N · m { 10.5 kgf · m / 76 lbf · ft. }
- [2] Install the ground cable to the starter motor.  
tightening torque : 24 N · m { 2.4 kgf · m / 18 lbf · ft. }



13. Oil level gauge guide tube installation

- [1] Install the oil level gauge guide tube to the cylinder block.  
tightening torque : 24 N · m { 2.4 kgf · m / 18 lbf · ft. }
- [2] Install the oil level gauge to the oil level gauge guide tube.

14. Idle gear A installation

- [1] Align the No. 1 cylinder to compression top dead center.

Note

- Rotate the crankshaft in the forward direction and align the No. 1 cylinder piston to compression top dead center.

- [2] Install the idle gear shaft to the cylinder block.

- [3] Apply engine oil to the idle gear.

Note

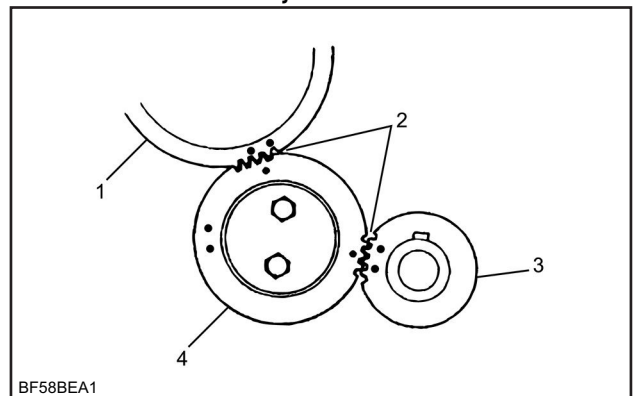
- Apply to idle gear A and the idle gear shaft.

- [4] Install idle gear A to the idle gear shaft.

Note

- Install after meshing so that the alignment mark of the crankshaft gear is as shown in the diagram.

tightening torque : 25.5 N · m { 2.6 kgf · m / 19 lbf · ft. }



1	Camshaft gear
2	Timing point
3	Crank gear
4	Idle gear A

- [5] Apply engine oil to the idle gear.

Note

- Apply engine oil to the thrust collar, the bolt, and the threaded portion.

- [6] Install the thrust collar to the idle gear.

Note

- Install so that the chamfered side of the thrust collar faces the outside.

## H. ENGINE

### 47. Water hose connect

- [1] Connect the water hose to the water pump assembly.

#### Note

- Install the hose clip.

### 48. Engine coolant temperature sensor connect

- [1] Connect the harness connector to the engine coolant temperature sensor.

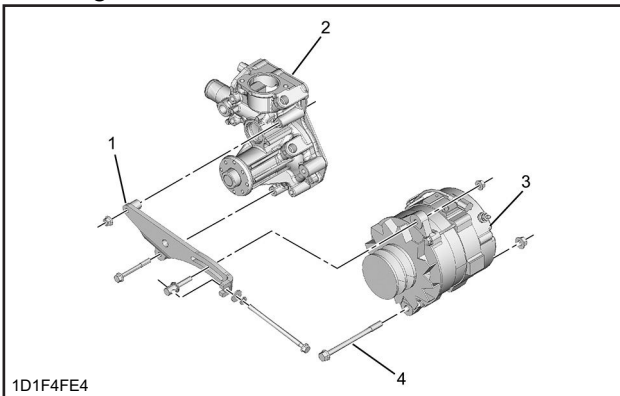
### 49. Generator installation

- [1] Install the adjust plate to the water pump assembly.  
tightening torque :  $23.5 \text{ N} \cdot \text{m}$  {  $2.4 \text{ kgf} \cdot \text{m}$  /  $17 \text{ lbf} \cdot \text{ft.}$  }
- [2] Temporarily tighten the generator to the generator bracket.
- [3] Temporarily tighten the generator to the adjust plate.

#### Note

- Securely tighten the bolt and the nut after adjusting the cooling fan belt.

- [4] Connect the harness connector to the generator.



1D1F4FE4

1	Adjust plate
2	Water pump assembly
3	Generator
4	Bolt

### 50. Fan pulley installation

- [1] Install the fan pulley to the water pump assembly.  
tightening torque :  $10 \text{ N} \cdot \text{m}$  {  $1.0 \text{ kgf} \cdot \text{m}$  /  $7.38 \text{ lbf} \cdot \text{ft.}$  }

### 51. Cooling fan belt installation

- [1] Install the cooling fan belt to the pulley.

### 52. Cooling fan belt adjustment

- [1] Check the tension of the cooling fan belt.

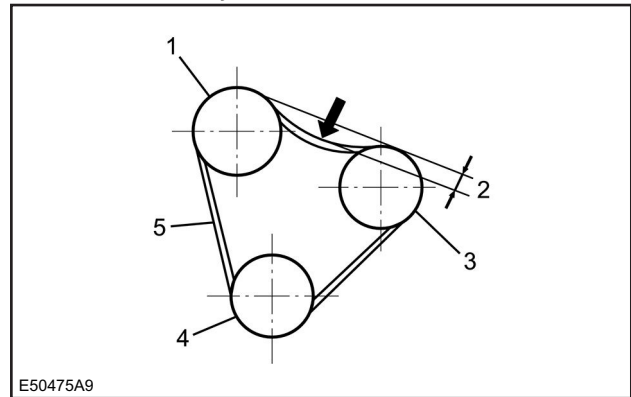
#### Note

- Measure the amount of flex in the cooling fan belt when pushing with the specified force on the section indicated by the arrow in the diagram.

standard :  $98 \text{ N}$  {  $10.0 \text{ kg}$  /  $22 \text{ lb}$  }

specified value :  $7.7 - 8.7 \text{ mm}$  {  $0.303 - 0.343 \text{ in.}$  } New product

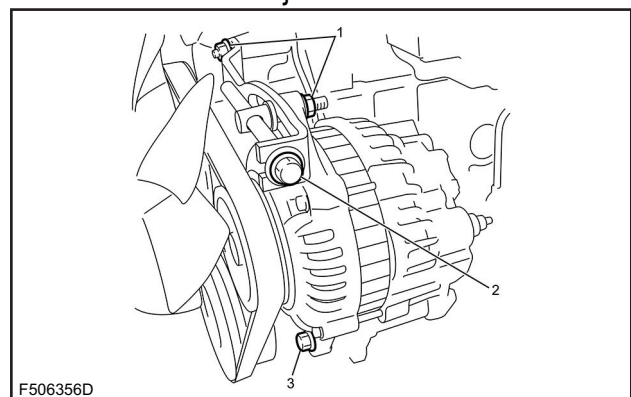
specified value :  $8.3 - 9.3 \text{ mm}$  {  $0.327 - 0.366 \text{ in.}$  } Reuse



E50475A9

1	Fan pulley
2	Amount of flex
3	Generator pulley
4	Crank pulley
5	Fan belt

- [2] Adjust the cooling fan belt to the specified value using the adjust bolt.  
tightening torque :  $23 \text{ N} \cdot \text{m}$  {  $2.3 \text{ kgf} \cdot \text{m}$  /  $17 \text{ lbf} \cdot \text{ft.}$  } M8 x 1.25  
tightening torque :  $48 \text{ N} \cdot \text{m}$  {  $4.9 \text{ kgf} \cdot \text{m}$  /  $35 \text{ lbf} \cdot \text{ft.}$  } M10 x 1.25



F506356D

1	Nut
2	Adjust bolt
3	Mounting bolt

[2] Temporarily tighten the fuel pipe to the common rail (fuel rail) assembly.

**Caution**

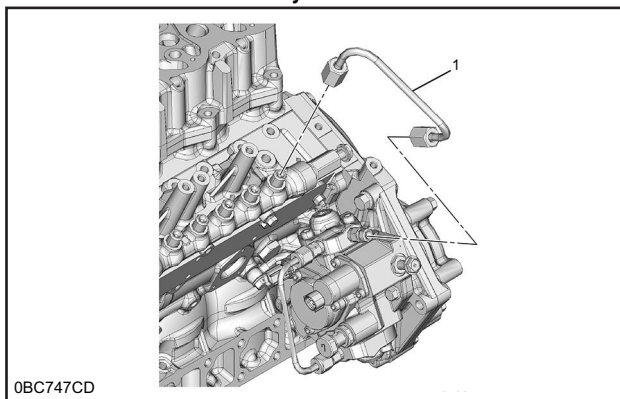
- Use a new fuel pipe.

**Note**

- Verify that there is no dirt in the fuel pipe.

[3] Securely tighten the fuel pipe to the fuel supply pump.

[4] Securely tighten the fuel pipe to the common rail (fuel rail) assembly.  
tightening torque : 44 N · m { 4.5 kgf · m / 32 lbf · ft. }



1 Fuel pipe

**11. Timing gear case installation**

[1] Apply liquid gasket to the front oil pump plate.

**Note**

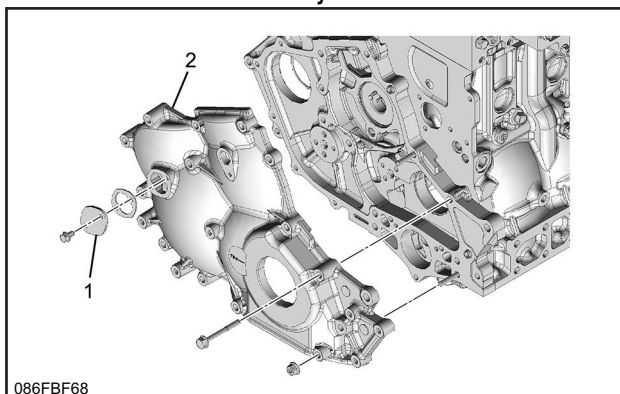
- Apply ThreeBond 1207B.

[2] Install the timing gear case to the front oil pump plate.

tightening torque : 23.5 N · m { 2.40 kgf · m / 17 lbf · ft. }

[3] Install the idle gear cover to the front oil pump plate.

tightening torque : 10 N · m { 1.0 kgf · m / 7.38 lbf · ft. }



086FBF68

1	Idle gear cover
2	Timing gear case

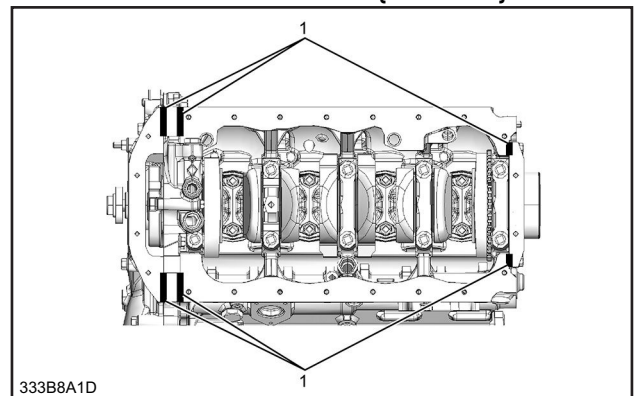
**12. Oil pan installation**

[1] Apply liquid gasket to the cylinder block.

**Note**

- Apply ThreeBond 1207B to the installation surface between the cylinder block and the front oil pump plate.

bead width : 3 mm { 0.12 in. }



1 Liquid gasket application area

[2] Install the oil pan to the cylinder block.  
tightening torque : 10 N · m { 1.0 kgf · m / 7.38 lbf · ft. }

**13. CMP sensor installation**

[1] Apply engine oil to the O-ring.

[2] Install the CMP sensor to the timing gear case.

tightening torque : 5 N · m { 0.5 kgf · m / 3.69 lbf · ft. }

[3] Connect the harness connector to the CMP sensor.

**14. Crankshaft pulley installation**

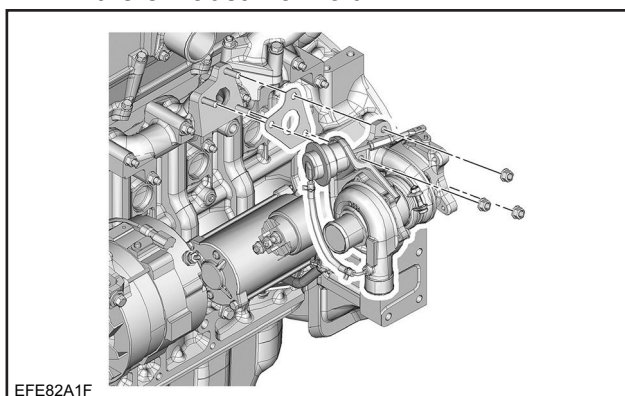
[1] Install the crankshaft pulley to the crankshaft.

**Caution**

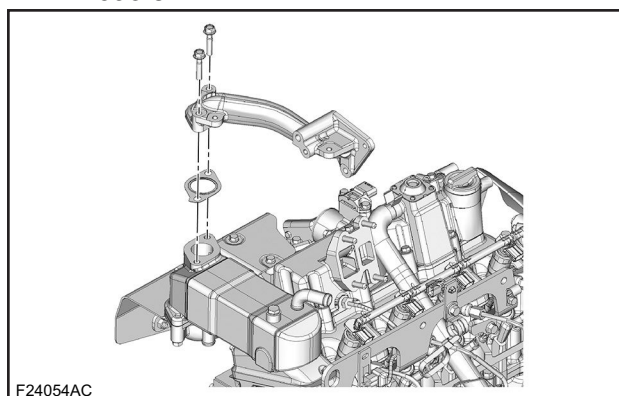
- Do not reuse the bolt and the washer.

## H. ENGINE

- [4] Remove the turbocharger assembly from the exhaust manifold.

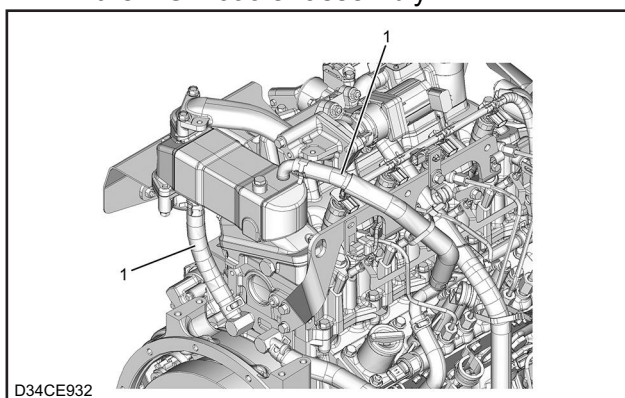


- [5] Remove the EGR pipe from the EGR cooler.



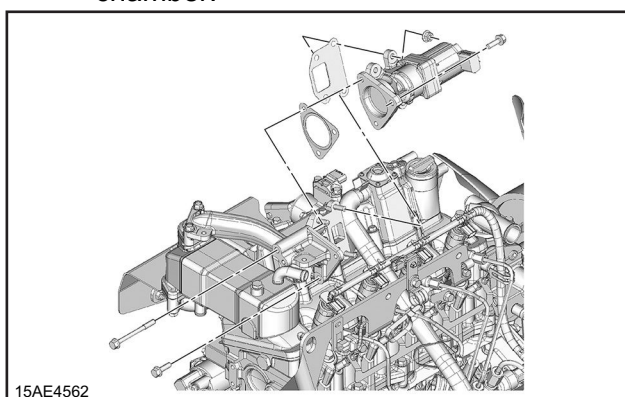
### 6. EGR valve removal

- [1] Disconnect the harness connector from the EGR valve.  
[2] Disconnect the harness clip from the EGR pipe.  
[3] Disconnect the water rubber hose from the EGR cooler assembly.

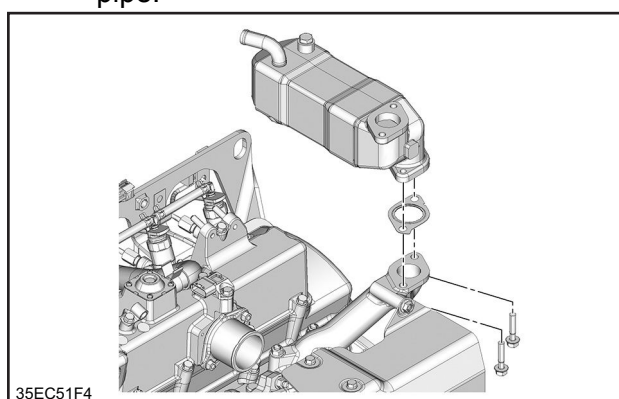


1 Water rubber hose

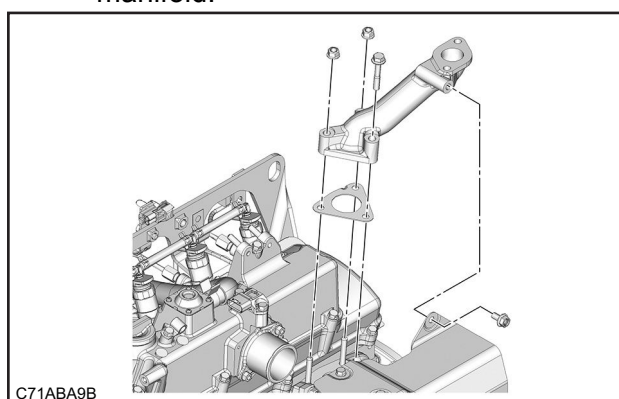
- [4] Remove the EGR valve from the intake chamber.



- [6] Remove the EGR cooler from the EGR pipe.



- [7] Remove the EGR pipe from the exhaust manifold.



### 7. Exhaust manifold removal

- [1] Remove the exhaust manifold from the cylinder head.

31. Crankshaft pulley removal

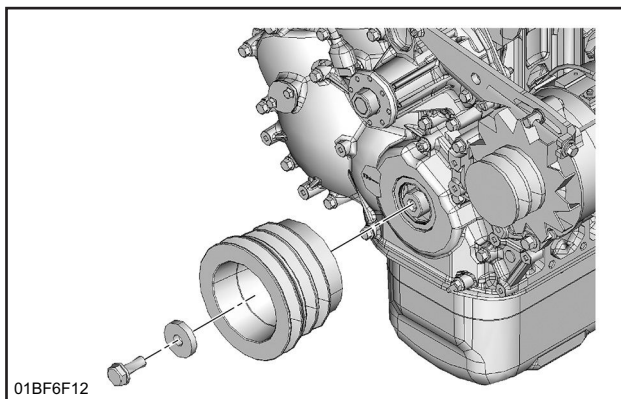
- [1] Remove the crankshaft pulley from the crankshaft.

Note

- Remove after stopping the crankshaft from turning.

**⚠ Caution**

- Do not reuse the bolt and the washer.

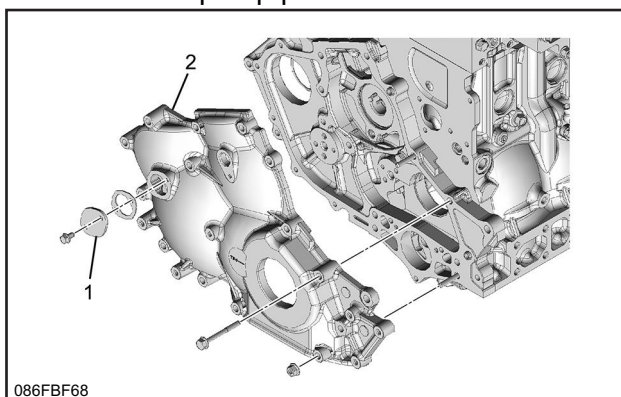


32. CMP sensor removal

- [1] Disconnect the harness connector from the CMP sensor.
- [2] Remove the CMP sensor from the timing gear case.
- [3] Remove the O-ring from the CMP sensor.

33. Timing gear case removal

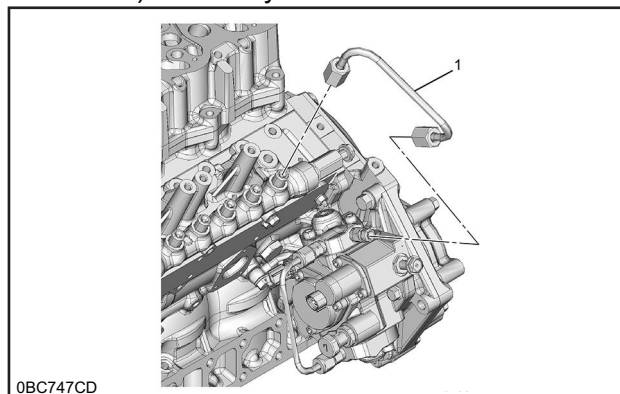
- [1] Remove the idle gear cover from the front oil pump plate.
- [2] Remove the timing gear case from the front oil pump plate.



1	Idle gear cover
2	Timing gear case

34. Fuel pipe removal

- [1] Remove the fuel pipe from the fuel supply pump and the common rail (fuel rail) assembly.



1	Fuel pipe
---	-----------

35. Fuel return pipe removal

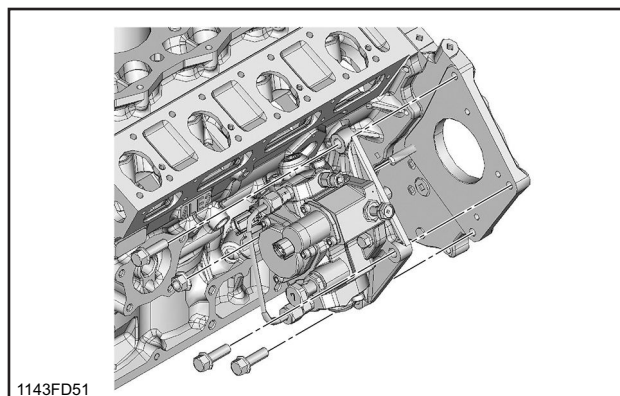
- [1] Remove the fuel return pipe from the fuel supply pump.

36. Fuel supply pump removal

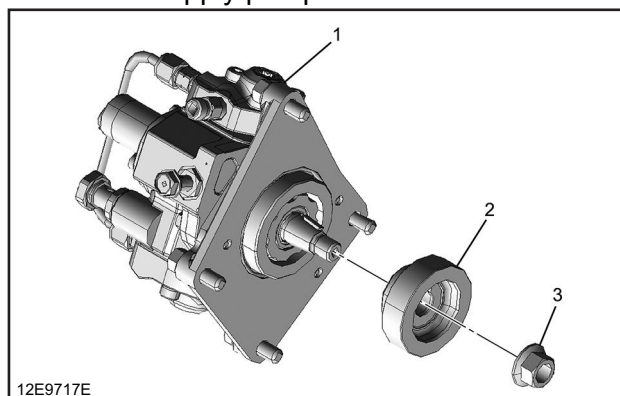
- [1] Disconnect the harness connector from the fuel supply pump.
- [2] Remove the fuel supply pump from the front oil pump plate.

Note

- Remove the tightening bolts, and remove together with the bracket.

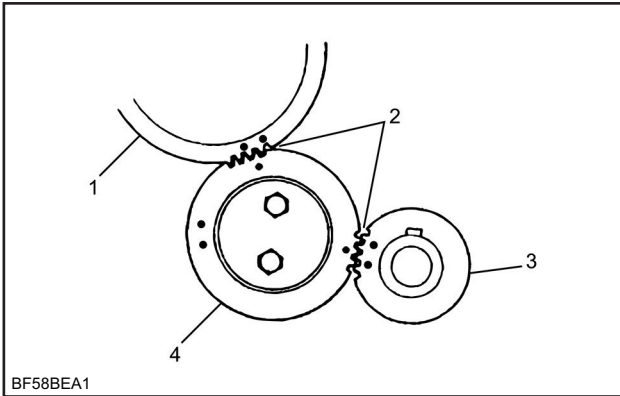


- [3] Remove the supply pump gear from the fuel supply pump.



## H. ENGINE

tightening torque : 25.5 N · m { 2.6 kgf · m / 19 lbf · ft. }



BF58BEA1

1	Camshaft gear
2	Timing point
3	Crank gear
4	Idle gear A

[5] Apply engine oil to the idle gear.

### Note

- Apply engine oil to the thrust collar, the bolt, and the threaded portion.

[6] Install the thrust collar to the idle gear.

### Note

- Install so that the chamfered side of the thrust collar faces the outside.

### 14. Camshaft gear installation

[1] Install the camshaft gear to the camshaft.

### Note

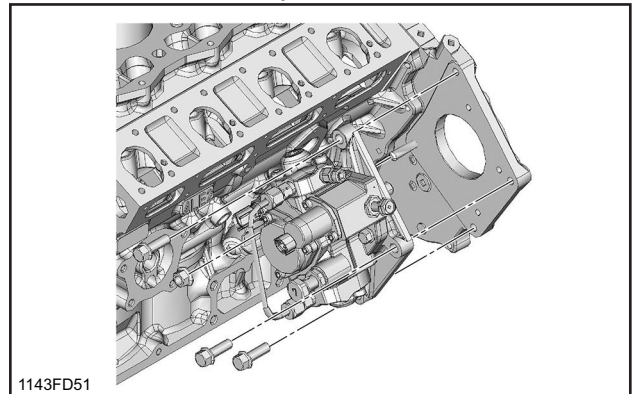
- Install after meshing so as to align the idle gear alignment marks.

tightening torque : 88 N · m { 9.0 kgf · m / 65 lbf · ft. }

### 15. Fuel supply pump installation

[1] Install the fuel supply pump to the front oil pump plate.

tightening torque : 48 N · m { 4.9 kgf · m / 35 lbf · ft. }



1143FD51

[2] Connect the harness connector to the fuel supply pump.

### 16. Idle gear B installation

[1] Install the idle gear shaft to the cylinder block.

[2] Apply engine oil to the idle gear.

### Note

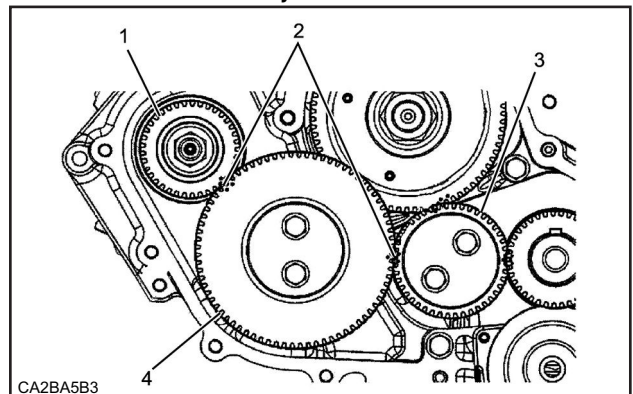
- Apply to idle gear B and the idle gear shaft.

[3] Install idle gear B to the idle gear shaft.

### Note

- Install after meshing so as to align the idle gear B alignment marks with idle gear A and the supply pump gear.

tightening torque : 25.5 N · m { 2.6 kgf · m / 19 lbf · ft. }

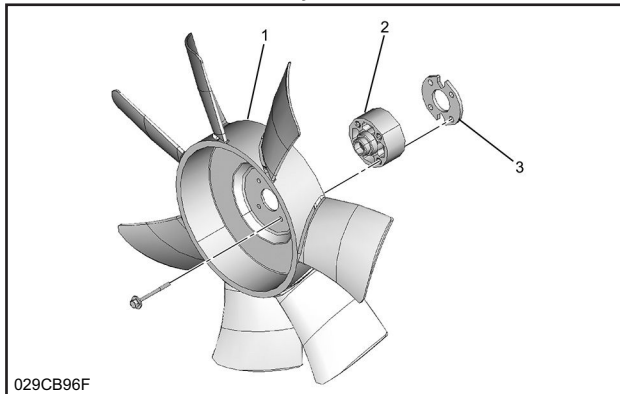


CA2BA5B3

1	Supply pump gear
2	Timing point
3	Idle gear A
4	Idle gear B

50. Cooling fan installation

[1] Install the cooling fan to the fan pulley.  
tightening torque : 10 N · m { 1.0 kgf · m / 7.38 lbf · ft. }



029CB96F

1	Cooling fan
2	Adapter
3	Spacer

51. Engine oil filling

[1] Refill the engine with engine oil.

Note

- Check the tightening of the oil pan drain plug again.

52. Coolant filling

[1] Loosen the plug using a wrench.  
[2] Replenish the radiator with coolant.

**⚠ Caution**

- Take care to prevent overflow coolant from splashing on to the exhaust system parts.
- Wipe off any coolant overflow.

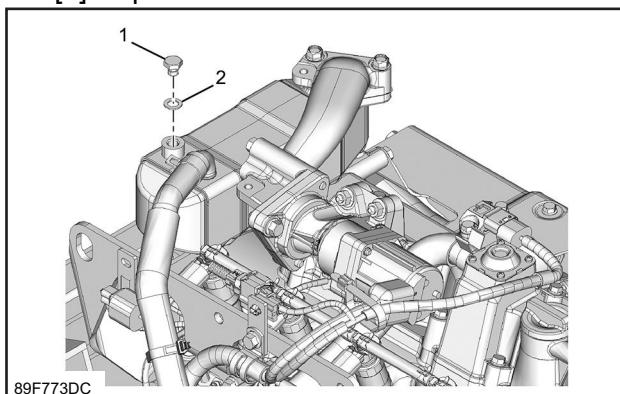
[3] Tighten the plug using a wrench.

**⚠ Caution**

- Use a new gasket.

tightening torque : 28 N · m { 2.9 kgf · m / 21 lbf · ft. }

[4] Replenish the radiator with coolant.



89F773DC

1	Plug
2	Gasket

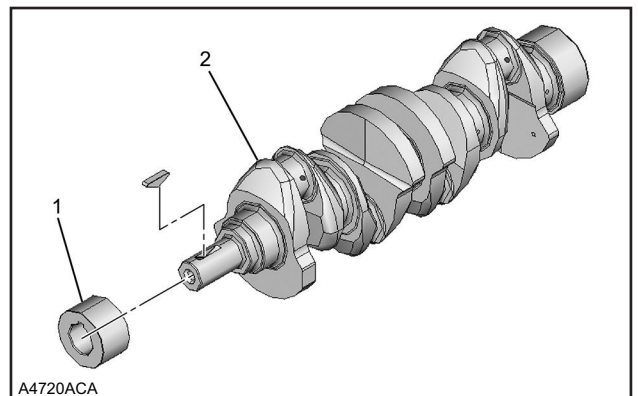
53. Battery ground cable connect

[1] Connect the battery ground cable to the battery.

Disassembly of Crankshaft

1. Crankshaft gear removal

[1] Remove the crankshaft gear from the crankshaft.



A4720ACA

1	Crankshaft gear
2	Crankshaft

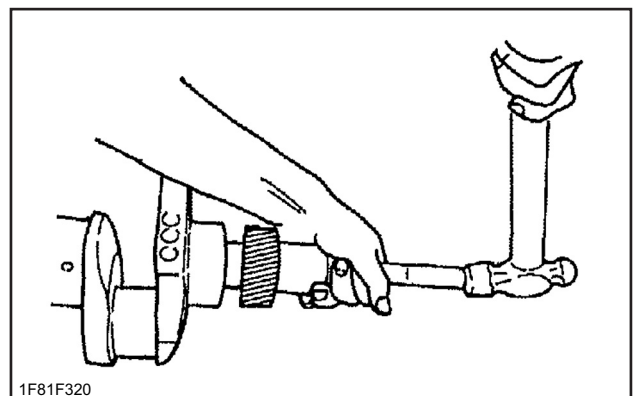
Assembly of Crankshaft

1. Crankshaft gear installation

[1] Install the crankshaft gear to the crankshaft using a brass rod.

Note

- Press the crankshaft gear using a brass rod and a hammer.



1F81F320

Inspection

1. Crankshaft measurement

[1] Measure the outer diameter using a micrometer.

Note

- Measure the outer diameter of the journal section to calculate uneven wear and the amount of wear.

## H. ENGINE

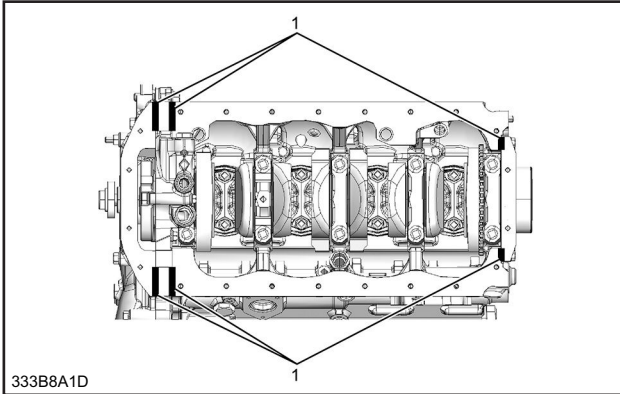
### 3. Oil pan installation

[1] Apply liquid gasket to the cylinder block.

#### Note

- Apply ThreeBond 1207B to the installation surface between the cylinder block and the front oil pump plate.

bead width : 3 mm { 0.12 in. }



333B8A1D

1 Liquid gasket application area

[2] Install the oil pan to the cylinder block.  
tightening torque : 10 N · m { 1.0 kgf · m / 7.38 lbf · ft. }

### 4. Tappet installation

[1] Apply engine oil to the tappet.

#### Note

- Apply to the bottom surface and the outer circumference of the tappet.

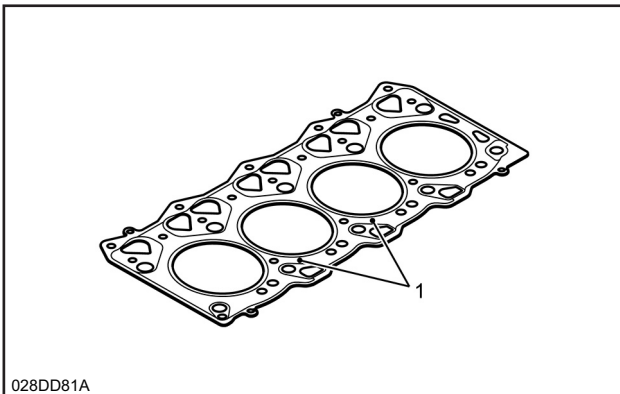
[2] Install the tappet to the cylinder block.

### 5. Cylinder head assembly installation

[1] Install the cylinder head gasket to the cylinder block.

#### Note

- Install with the marked side facing upward.



028DD81A

1 Mark

[2] Apply engine oil to the bolt.

#### Note

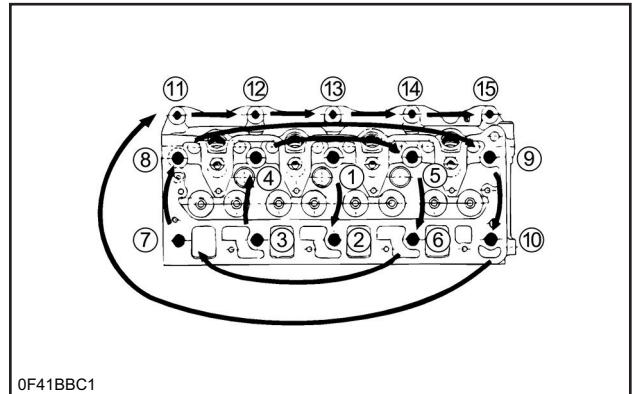
- Apply engine oil to the threaded portion and the seat surface of the head bolt.

[3] Install the cylinder head assembly to the cylinder block.

[4] Tighten the head bolts using a torque wrench.

#### Note

- Tighten M12 head bolts 1 to 10 in the numerical order shown in the diagram.



0F41BBC1

tightening torque : 88 N · m { 9.0 kgf · m / 65 lbf · ft. } 1st time  
tightening torque : 88 N · m { 9.0 kgf · m / 65 lbf · ft. } 2nd time  
tightening angle : 60 ° 3rd time

#### Note

- Tighten M8 head bolts 11 - 15 in the numerical order shown in the diagram.

tightening torque : 29 N · m { 3.0 kgf · m / 21 lbf · ft. }

### 6. Push rod installation

[1] Install the push rod to the cylinder block.

#### Note

- Pass it through the cylinder block and insert it into the tappet.

### 7. Rocker arm bracket installation

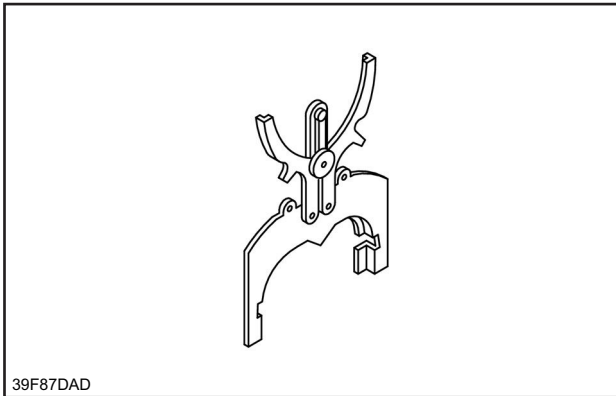
[1] Apply liquid gasket to the rocker arm bracket.

#### Note

- Apply ThreeBond 1207B after cleaning the rocker arm bracket and the cylinder head.

2. Piston ring installation

[1] Install the piston rings to the piston using a special tool.



39F87DAD

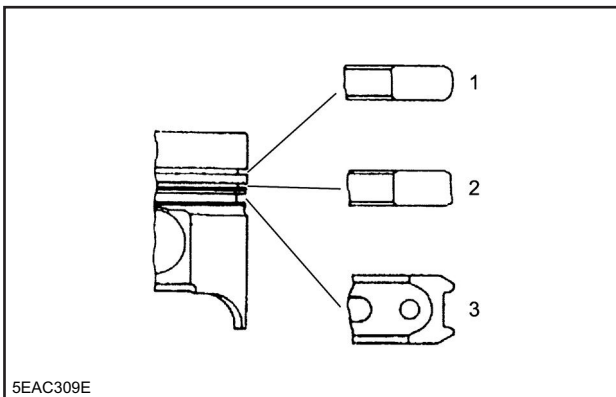
SST: 1-8522-1029-0 - piston ring setting tool

Note

- Install the oil ring so that the ring and the coil expander joints are 180° in the opposite direction.
- Check the coil expander for gaps in the joint section.
- Face the T mark or the 1T or 2T mark side of the compression ring upward, and assemble in the order of the second ring, the top ring, and the compression ring.

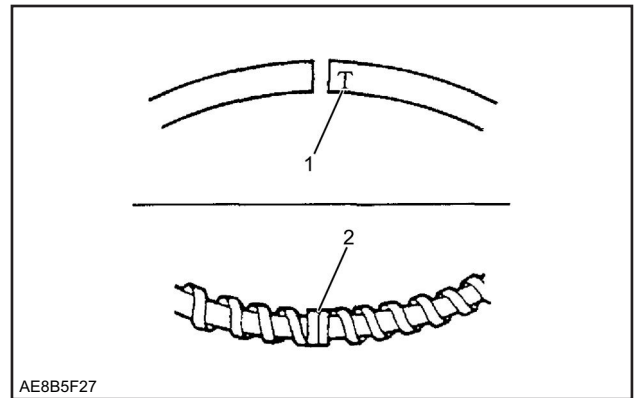
⚠ Caution

- Be careful as the shape of the top and second compression rings differ.



5EAC309E

1	Top ring
2	Second ring
3	Oil ring



AE8B5F27

1	T mark (or 1T or 2T)
2	Joint section

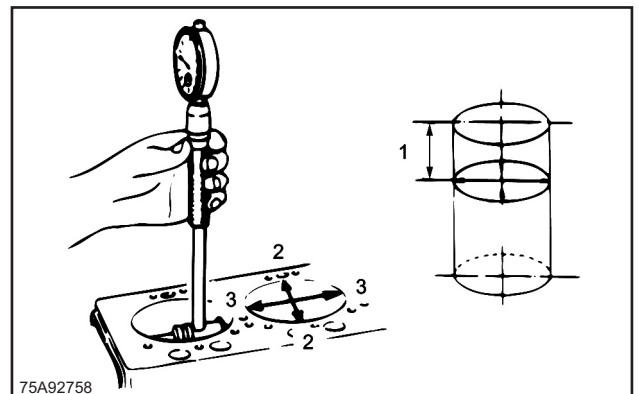
Inspection

1. Piston measurement

[1] Measure the cylinder block using a cylinder gauge.

Note

- Measure the inner diameter of the cylinder in the axis direction and the thrust direction 13 mm {0.512 in} from the top surface of the cylinder block.



75A92758

1	Measurement position
2	Axis direction
3	Thrust direction

[2] Measure the piston using a micrometer.

Note

- Measure the outer diameter at the specified position of the piston.

## H. ENGINE

### 38. Idle gear B removal

- [1] Remove idle gear B from the idle gear shaft.

#### Note

- Remove the idle gear B shaft and the thrust plate.

### 39. Idle gear A removal

- [1] Remove idle gear A from the idle gear shaft.

#### Note

- Remove the idle gear A shaft and the thrust plate.

### 40. Camshaft gear removal

- [1] Remove the camshaft gear from the camshaft.

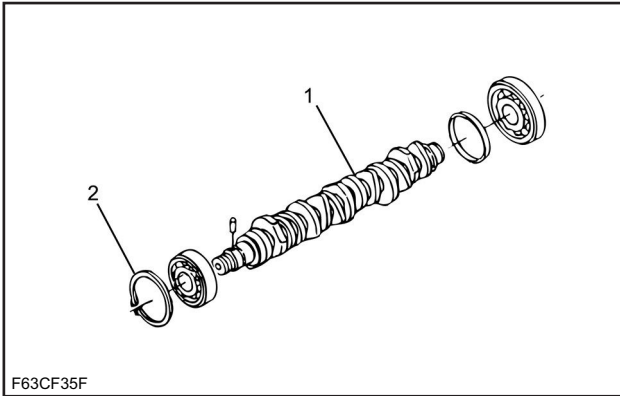
### 41. Camshaft removal

- [1] Remove the camshaft from the cylinder block.

#### Note

- Remove the snap ring, and pull the camshaft from the cylinder block together with the bearing.

- [2] Remove the camshaft bearing from the camshaft.



F63CF35F

1	Camshaft
2	Snap ring

## Installation of Camshaft

### 1. Camshaft installation

- [1] Apply engine oil to the camshaft.

#### Note

- Apply to the camshaft journal section, the bearing, the cam surface, and the cylinder block bearing.

- [2] Install the camshaft bearing to the camshaft.

#### Caution

- Be careful not to damage the bearing.

- [3] Install the camshaft to the cylinder block.

#### Note

- Install the snap ring to the outside of the front bearing, and verify that the camshaft rotates smoothly.

### 2. Idle gear A installation

- [1] Align the No. 1 cylinder to compression top dead center.

#### Note

- Rotate the crankshaft in the forward direction and align the No. 1 cylinder piston to compression top dead center.

- [2] Install the idle gear shaft to the cylinder block.

- [3] Apply engine oil to the idle gear.

#### Note

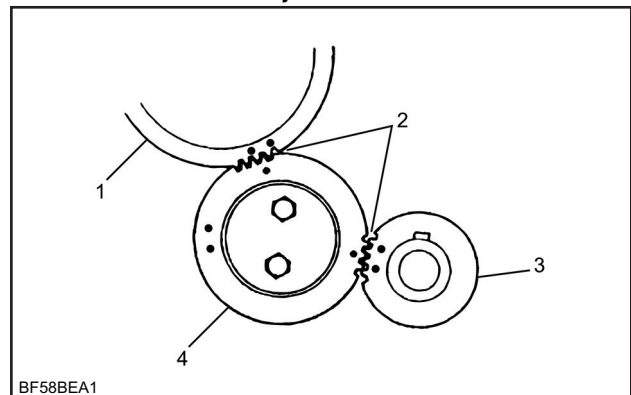
- Apply to idle gear A and the idle gear shaft.

- [4] Install idle gear A to the idle gear shaft.

#### Note

- Install after meshing so that the alignment mark of the crankshaft gear is as shown in the diagram.

tightening torque : 25.5 N · m { 2.6 kgf · m / 19 lbf · ft. }



BF58BEA1

1	Camshaft gear
2	Timing point
3	Crank gear
4	Idle gear A

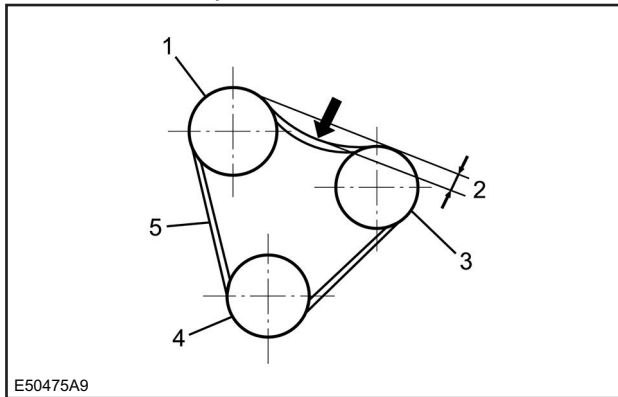
38. Cooling fan belt adjustment

[1] Check the tension of the cooling fan belt.

Note

- Measure the amount of flex in the cooling fan belt when pushing with the specified force on the section indicated by the arrow in the diagram.

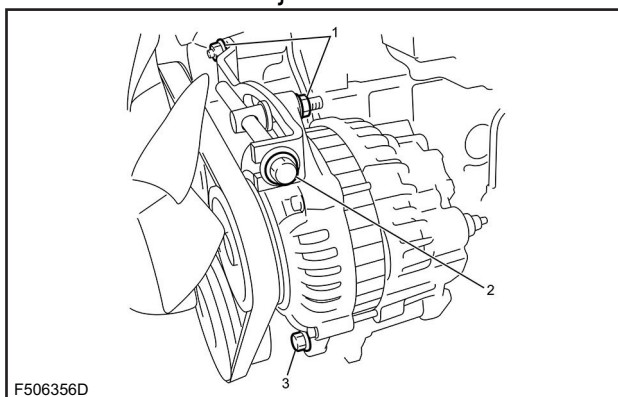
standard : 98 N { 10.0 kg / 22 lb }  
 specified value : 7.7 - 8.7 mm { 0.303 - 0.343 in. } New product  
 specified value : 8.3 - 9.3 mm { 0.327 - 0.366 in. } Reuse



E50475A9

1	Fan pulley
2	Amount of flex
3	Generator pulley
4	Crank pulley
5	Fan belt

[2] Adjust the cooling fan belt to the specified value using the adjust bolt.  
 tightening torque : 23 N · m { 2.3 kgf · m / 17 lbf · ft. } M8 x 1.25  
 tightening torque : 48 N · m { 4.9 kgf · m / 35 lbf · ft. } M10 x 1.25

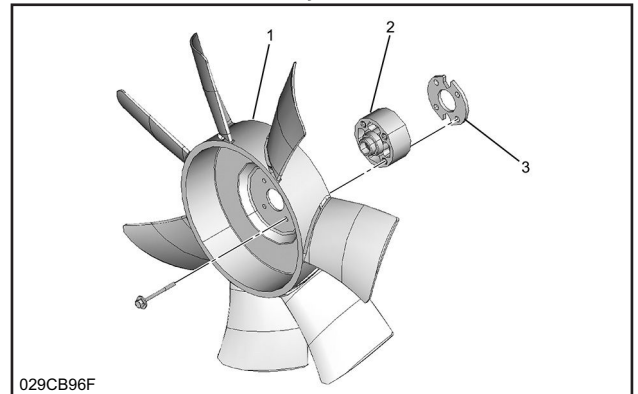


F506356D

1	Nut
2	Adjust bolt
3	Mounting bolt

39. Cooling fan installation

[1] Install the cooling fan to the fan pulley.  
 tightening torque : 10 N · m { 1.0 kgf · m / 7.38 lbf · ft. }



029CB96F

1	Cooling fan
2	Adapter
3	Spacer

40. Coolant filling

[1] Loosen the plug using a wrench.  
 [2] Replenish the radiator with coolant.

⚠ Caution

- Take care to prevent overflow coolant from splashing on to the exhaust system parts.
- Wipe off any coolant overflow.

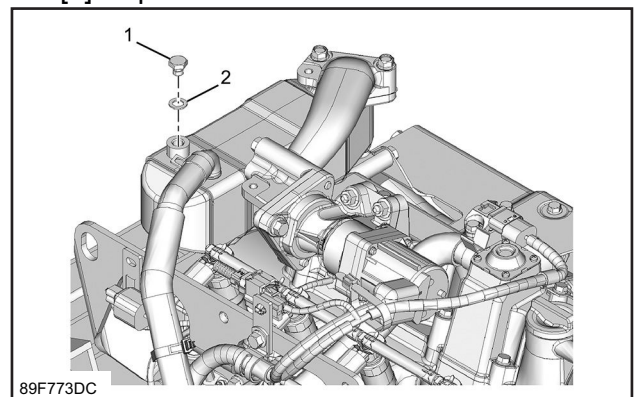
[3] Tighten the plug using a wrench.

⚠ Caution

- Use a new gasket.

tightening torque : 28 N · m { 2.9 kgf · m / 21 lbf · ft. }

[4] Replenish the radiator with coolant.



89F773DC

1	Plug
2	Gasket

41. Battery ground cable connect

[1] Connect the battery ground cable to the battery.

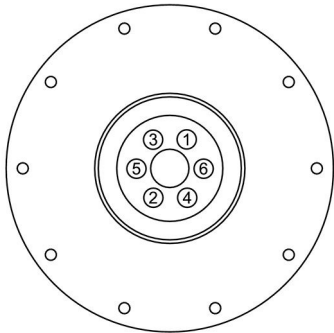
## H. ENGINE

### 7. Flywheel removal

[1] Remove the flywheel from the crankshaft.

#### Note

- Make an alignment mark before removing.
- Gradually loosen the flywheel mounting bolts in the order shown in the diagram while making sure that the flywheel does not rotate.



88601C85

#### Note

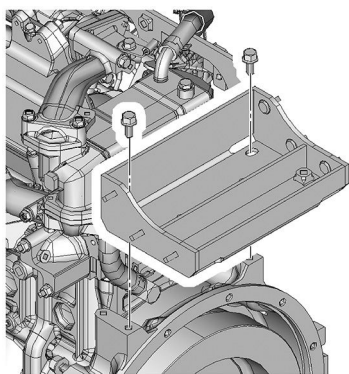
- Remove the flywheel while lightly tapping with a plastic hammer.

#### ⚠ Caution

- Do not damage the ring gear.

### 8. Flywheel housing removal

[1] Remove the silencer bracket from the flywheel housing.

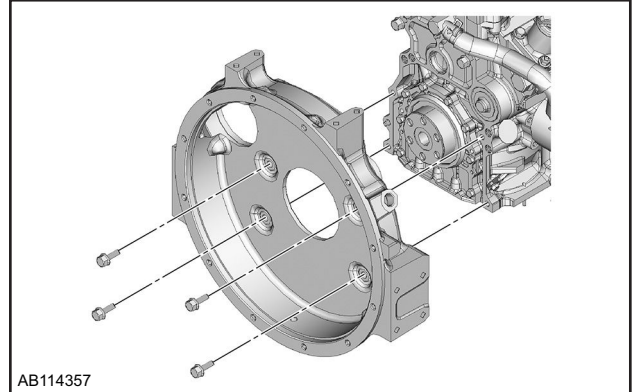


982B7622

[2] Remove the flywheel housing from the cylinder block.

#### Note

- Remove while lightly tapping the housing with a plastic hammer.



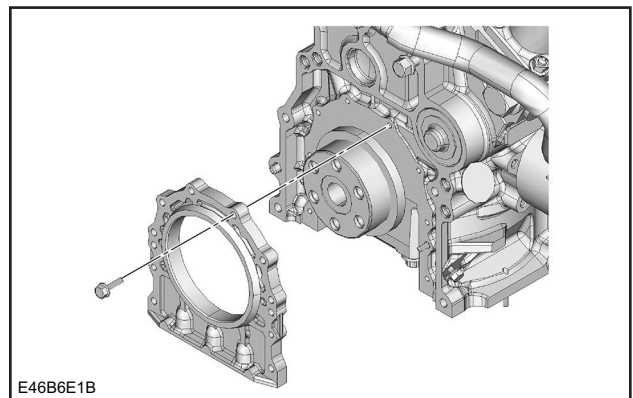
AB114357

### 9. Oil seal retainer removal

[1] Remove the oil seal retainer from the cylinder block.

#### ⚠ Caution

- Be careful not to damage or deform when removing.



E46B6E1B

### 10. Crankshaft rear oil seal removal

[1] Remove the crankshaft rear oil seal from the oil seal retainer.

#### Note

- Use a workr, etc., to pry the oil seal, and remove it.

#### ⚠ Caution

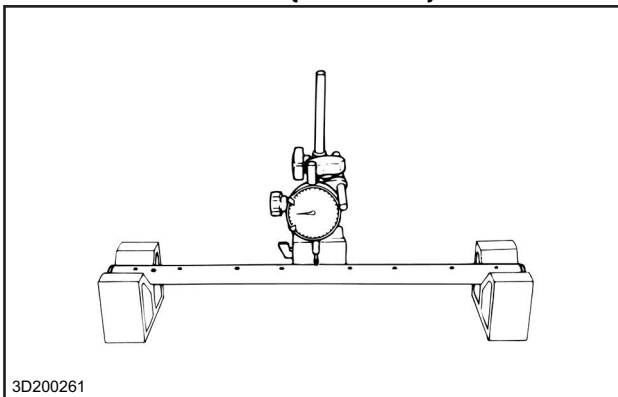
- Be careful not to damage the oil seal contact surface of the retainer.

[2] Measure the fluctuation a using dial gauge.

Note

- Slowly rotate the rocker arm shaft and measure fluctuation of the dial gauge at the center part of the rocker arm shaft.
- If the measured value exceeds the limit, replace the rocker arm shaft.

specified value : less than 0.2 mm { less than 0.008 in. }  
 limit : 0.3 mm { 0.012 in. }

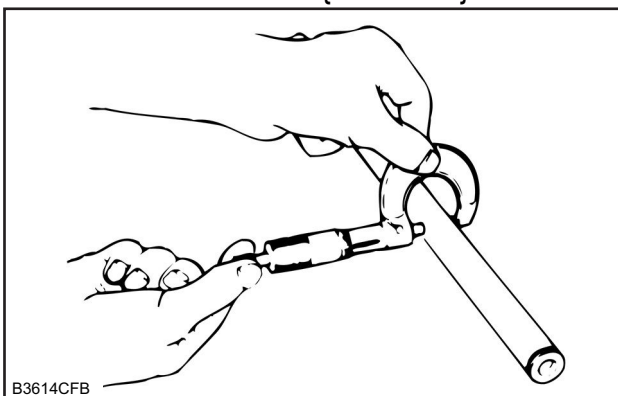


[3] Measure the outer diameter using a micrometer.

Note

- Measure the outer diameter of the rocker arm shaft.
- If the measured value is less than the limit, replace the rocker arm shaft.

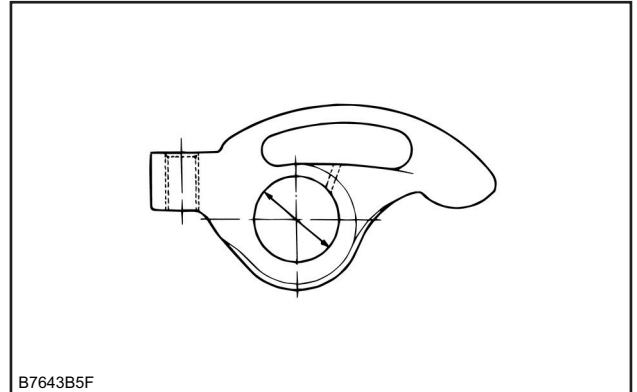
specified value : 12.00 mm { 0.472 in. }  
 limit : 11.85 mm { 0.467 in. }



[4] Measure the inner diameter using a vernier caliper.

Note

- Use a vernier caliper or a cylinder gauge to measure the inner diameter of the rocker arm.



[5] Calculate the clearance from the measured value.

specified value : 0.005 - 0.045 mm  
 { 0.0002 - 0.0018 in. }  
 limit : 0.2 mm { 0.008 in. }

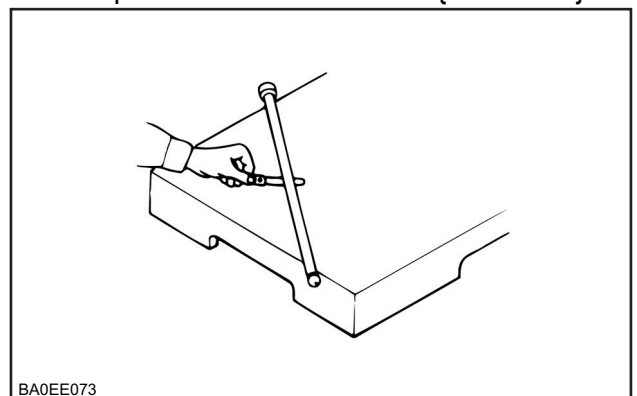
3. Push rod measurement

[1] Measure the bend using a feeler gauge.

Note

- Rotate the push rod on a level block and measure the bend of the push rod with a feeler gauge.
- If the measured value exceeds the limit, replace the push rod.

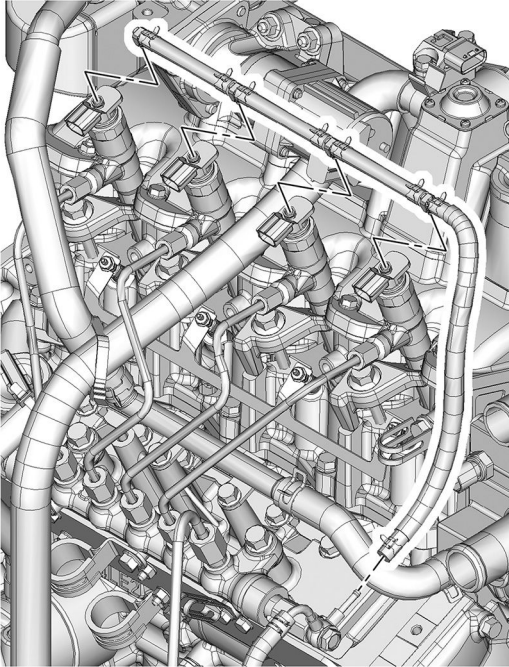
specified value : 0.3 mm { 0.012 in. }



## H. ENGINE

### 13. Fuel leak-off hose installation

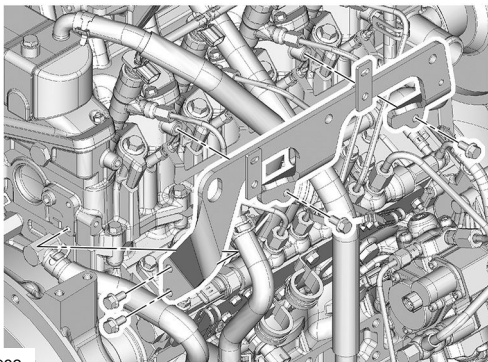
- [1] Install the fuel leak-off hose to the injector.



39FEC226

### 14. Harness bracket installation

- [1] Install the harness bracket to the cylinder head.  
tightening torque : 24 N · m { 2.4 kgf · m / 18 lbf · ft. }

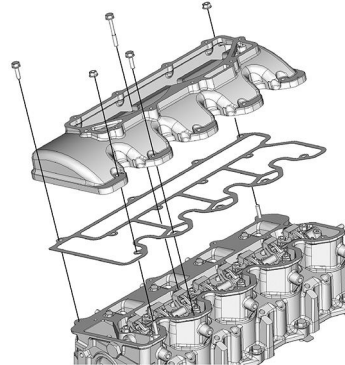


2FBEC982

Connect the engine harness to the harness bracket.

### 15. Cylinder head cover installation

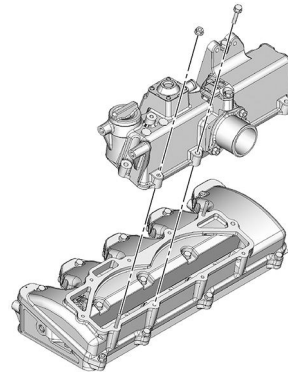
- [1] Install the cylinder head cover to the rocker arm bracket.  
tightening torque : 10 N · m { 1.0 kgf · m / 7.38 lbf · ft. }



A6914508

### 16. Intake chamber installation

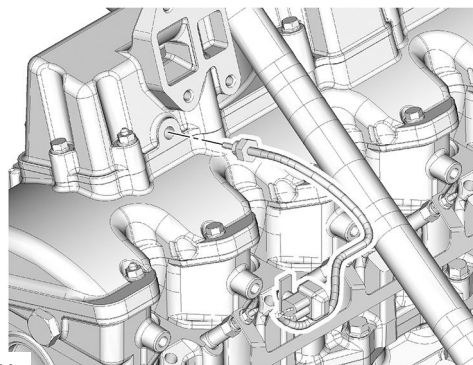
- [1] Install the intake chamber to the cylinder head cover.  
tightening torque : 10 N · m { 1.0 kgf · m / 7.38 lbf · ft. }



952F02AD

### 17. IMT sensor installation

- [1] Install the IMT sensor to the intake chamber.  
tightening torque : 20 N · m { 2.0 kgf · m / 15 lbf · ft. }



C44647A8

Connect the harness connector to the IMT sensor.

### 18. PCV hose installation

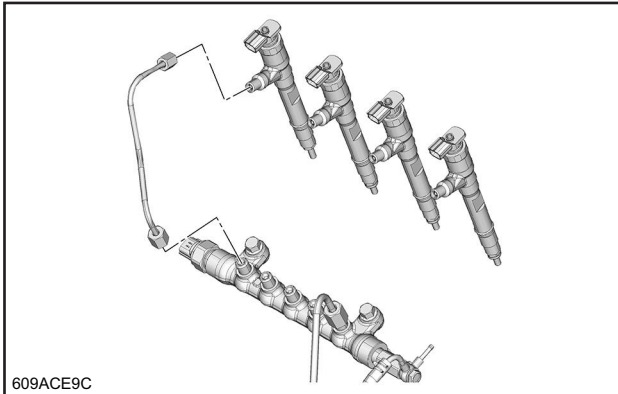
- [1] Install the PCV hose to the intake chamber.

21. Injection pipe removal

- [1] Remove the injection pipe from the injector and the common rail (fuel rail) assembly.

Note

- Do not reuse the injection pipe.

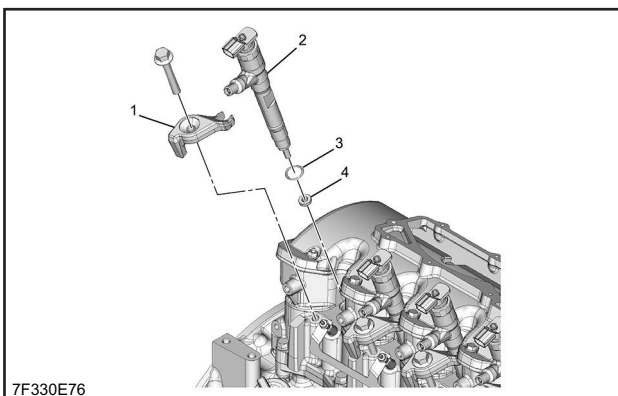


22. Injector removal

- [1] Disconnect the harness connector from the injector.
- [2] Remove the injector from the cylinder head assembly.
- [3] Remove the injector gasket from the injector.
- [4] Remove the O-ring from the injector.

Note

- Do not reuse the injector gasket or the O-ring.



1	Injector clamp
2	Injector
3	O-ring
4	Injector gasket

Note

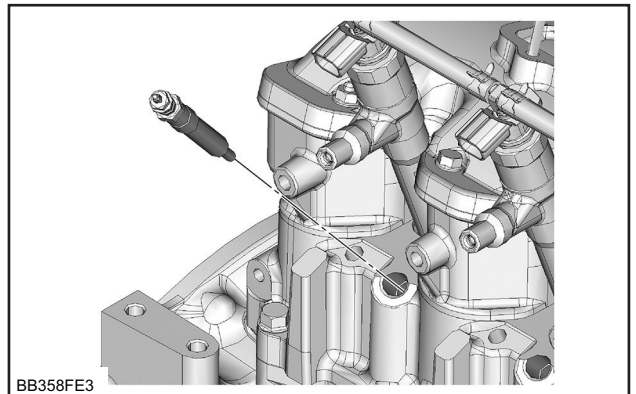
- Absolutely never touch the injector solenoid because doing so can hinder performance or cause damage.
- Store the removed injector with the cylinder number on it.

23. Glow plug connector removal

- [1] Remove the glow plug connector from the glow plug.

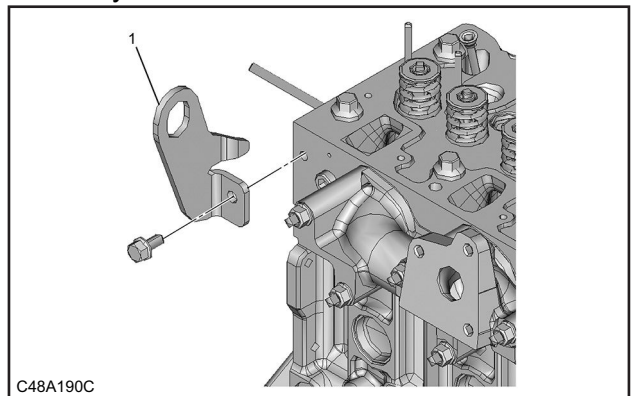
24. Glow plug removal

- [1] Remove the glow plug from the cylinder head.



25. Engine hanger removal

- [1] Remove the engine hanger from the cylinder head.



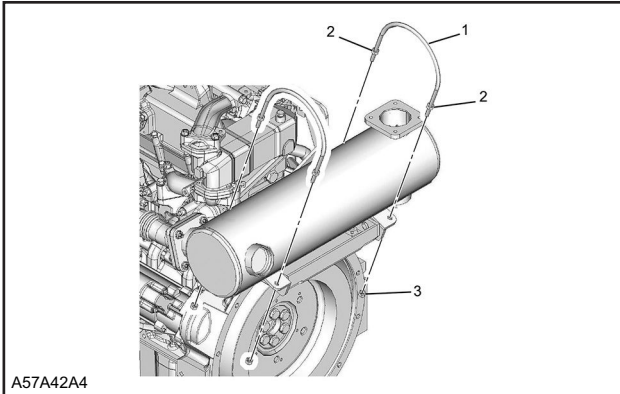
1	Engine hanger
---	---------------

## H. ENGINE

tightening torque : 5 N · m { 0.5 kgf · m / 3.69 lbf · ft. }

### ⚠ Caution

- Temporarily tighten so that the U-bolt protrusion amounts are even in the front and rear of the integrated oxidation catalyst silencer.
- Install so that the U-bolts are not tilted.



A57A42A4

1	U-bolt
2	Nut A
3	Nut B

[5] Securely tighten the U-bolts to the integrated oxidation catalyst silencer.

### Note

- Securely tighten the U-bolts after settling the entire integrated oxidation catalyst silencer.
- Tighten nut A and securely tighten.

tightening torque : 25 N · m { 2.5 kgf · m / 18 lbf · ft. }

[6] Securely tighten the exhaust pipe to the turbocharger assembly.

tightening torque : 24 N · m { 2.4 kgf · m / 18 lbf · ft. }

[7] Securely tighten the integrated oxidation catalyst silencer to the exhaust pipe.

tightening torque : 24 N · m { 2.4 kgf · m / 18 lbf · ft. }

[8] Securely tighten the support bracket to the silencer bracket.

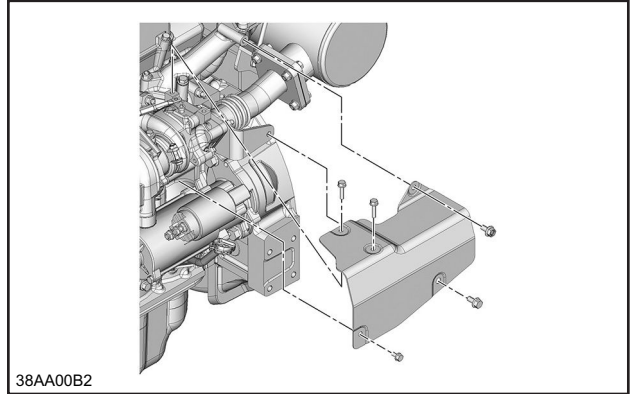
tightening torque : 24 N · m { 2.4 kgf · m / 18 lbf · ft. }

26. Turbocharger heat protector installation

[1] Install the turbocharger heat protector to the turbocharger.

tightening torque : 27 N · m { 2.8 kgf · m / 20 lbf · ft. } M8

tightening torque : 10 N · m { 1.0 kgf · m / 7.38 lbf · ft. } M6



38AA00B2

27. Pressure sensor/boost temperature sensor connect

[1] Connect the harness connector to the boost pressure sensor/boost temperature sensor.

### Note

- Install the harness clip.

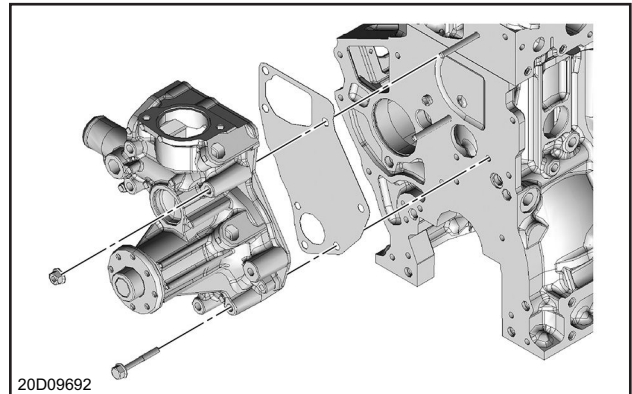
28. Water pump assembly installation

[1] Install the water pump assembly to the cylinder block and the cylinder head.

### Note

- Install the water pump assembly to the cylinder block and the cylinder head.

tightening torque : 23 N · m { 2.3 kgf · m / 17 lbf · ft. }



20D09692

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: [www.heydownloads.com](http://www.heydownloads.com) by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

1	Cooling fan
2	Adapter
3	Spacer

2. Generator inspection

5. Battery ground cable connect

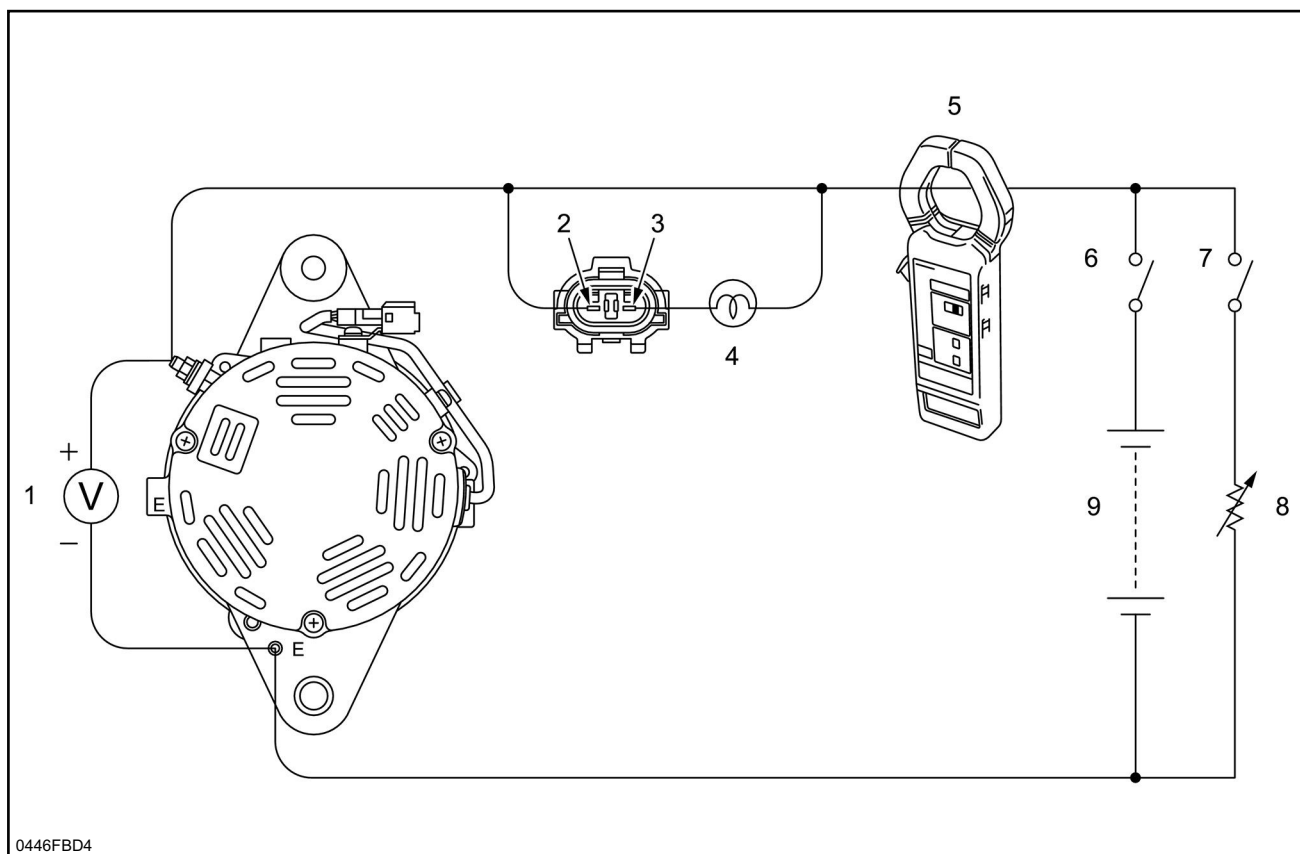
[1] Connect the battery ground cable to the battery.

Inspection

1. Generator safety information

**⚠ Caution**

- Take caution because disassembly and maintenance at the market is not covered as a product liability.
- The inspection method after disassembly stated here is for reference purposes only.



1	Voltage meter	4	Charge light (24 V, 3 W)	7	Switch 2
2	R-terminal	5	Current meter	8	Variable resistor
3	L-terminal	6	Switch 1	9	Battery (24 V)

# H. ENGINE

1	Adjust plate
2	Water pump assembly
3	Generator
4	Bolt

## 9. Fan pulley installation

- [1] Install the fan pulley to the water pump assembly.  
tightening torque : 10 N · m { 1.0 kgf · m / 7.38 lbf · ft. }

## 10. Cooling fan belt installation

- [1] Install the cooling fan belt to the pulley.

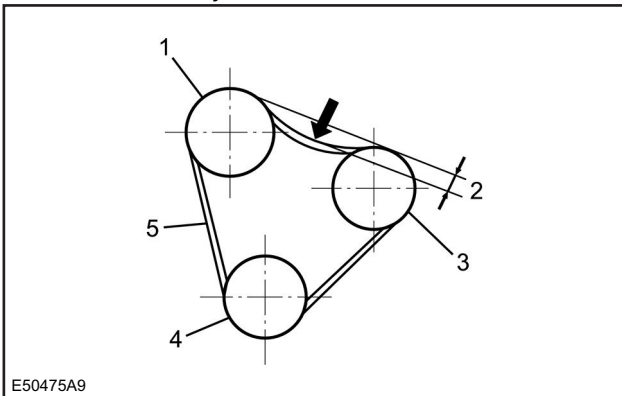
## 11. Cooling fan belt adjustment

- [1] Check the tension of the cooling fan belt.

### Note

- Measure the amount of flex in the cooling fan belt when pushing with the specified force on the section indicated by the arrow in the diagram.

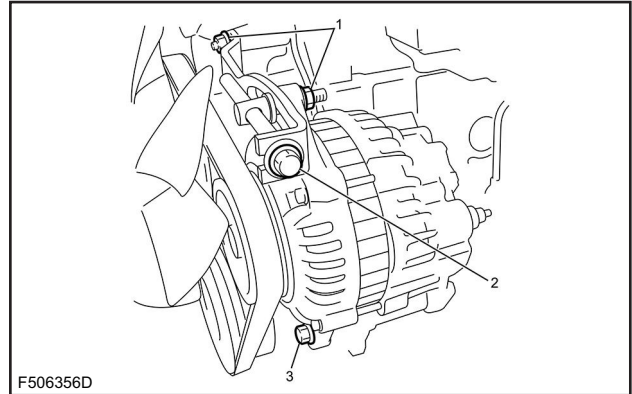
standard : 98 N { 10.0 kg / 22 lb }  
 specified value : 7.7 - 8.7 mm { 0.303 - 0.343 in. } New product  
 specified value : 8.3 - 9.3 mm { 0.327 - 0.366 in. } Reuse



E50475A9

1	Fan pulley
2	Amount of flex
3	Generator pulley
4	Crank pulley
5	Fan belt

- [2] Adjust the cooling fan belt to the specified value using the adjust bolt.  
 tightening torque : 23 N · m { 2.3 kgf · m / 17 lbf · ft. } M8 x 1.25  
 tightening torque : 48 N · m { 4.9 kgf · m / 35 lbf · ft. } M10 x 1.25

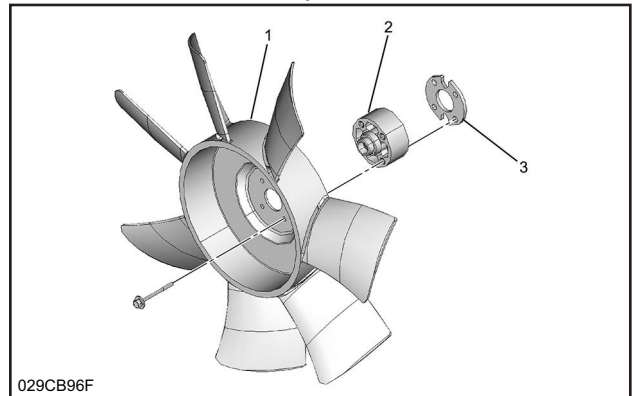


F506356D

1	Nut
2	Adjust bolt
3	Mounting bolt

## 12. Cooling fan installation

- [1] Install the cooling fan to the fan pulley.  
 tightening torque : 10 N · m { 1.0 kgf · m / 7.38 lbf · ft. }



029CB96F

1	Cooling fan
2	Adapter
3	Spacer

## 13. Battery ground cable connect

- [1] Connect the battery ground cable to the battery.

## Preheating System

### Removal and Installation of Glow Plug

#### Removal of Glow Plug

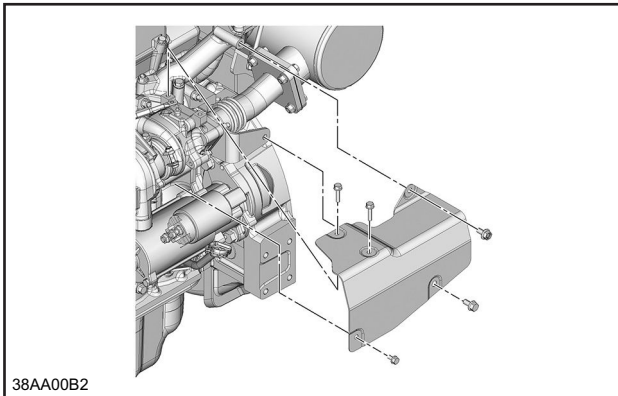
1. Battery ground cable disconnect
  - [1] Disconnect the battery ground cable from the battery.
2. Coolant drain
  - [1] Drain coolant from the radiator.

#### ⚠ Caution

- After draining the coolant, do not forget to tighten the drain plug.

#### 3. Turbocharger heat protector removal

- [1] Remove the turbocharger heat protector from the turbocharger.

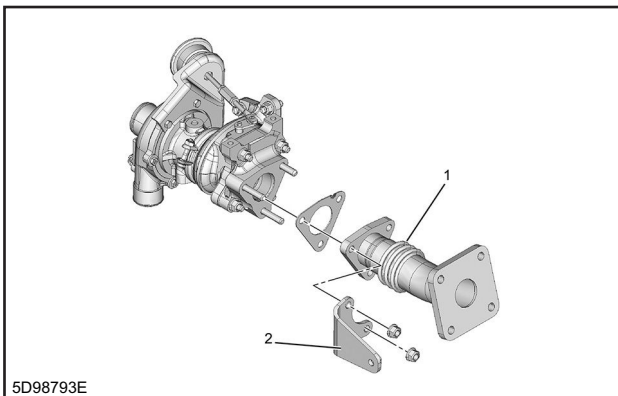


#### 4. Integrated oxidation catalyst silencer removal

- [1] Remove the integrated oxidation catalyst silencer from the exhaust pipe.
- [2] Remove the exhaust pipe from the turbocharger assembly.

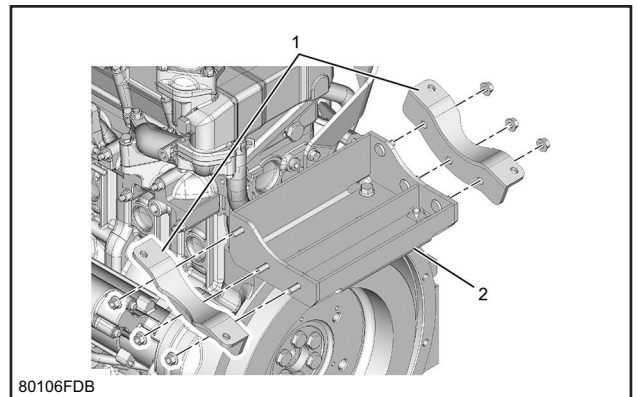
#### Note

- Remove together with the bracket.



1	Exhaust pipe
2	Bracket

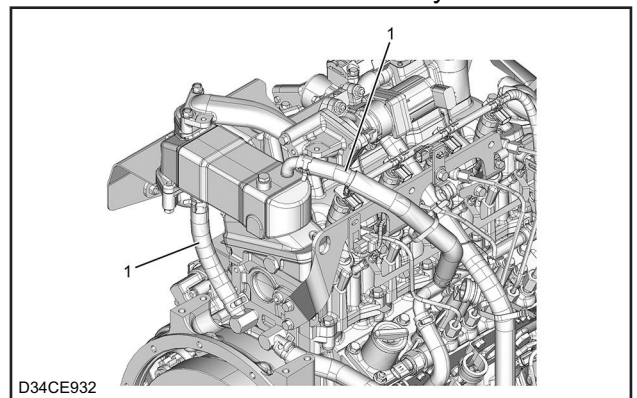
- [3] Remove the support bracket from the silencer bracket.



1	Support bracket
2	Silencer bracket

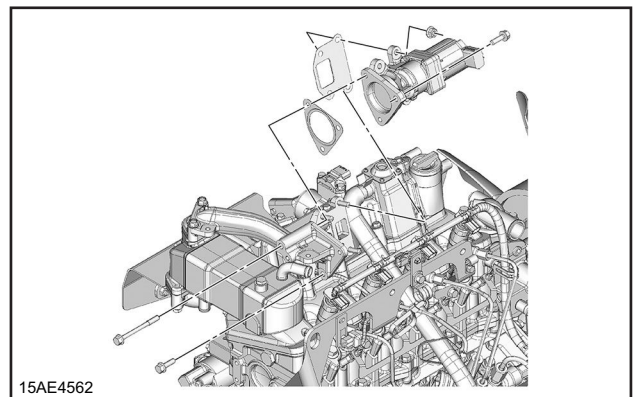
#### 5. EGR valve removal

- [1] Disconnect the harness connector from the EGR valve.
- [2] Disconnect the harness clip from the EGR pipe.
- [3] Disconnect the water rubber hose from the EGR cooler assembly.



1	Water rubber hose
---	-------------------

- [4] Remove the EGR valve from the intake chamber.



## H. ENGINE

---

Using the trouble diagnosis scan tool to read Diagnostic Trouble Codes  
Diagnostic Trouble Codes can be read using the trouble diagnosis scan tool.

Note

- For the work procedure, refer to the manual of the trouble diagnosis scan tool.

If a Diagnostic Trouble Code is recorded

Perform repairs accurately according to the specified Diagnostic Trouble Code chart.

If there is no Diagnostic Trouble Code  
Select the symptom from Diagnosis by symptom. Complete the repair according to the diagnostic procedure. It is also possible to perform the inspection by referring to the functional diagnosis.

When the appropriate symptom is not found

Investigate the complaint in detail.

Create a diagnosis plan.

Utilize the schematics and operation principles.

When repair history for similar cases are available, request technical assistance. Combine technical knowledge and effective utilization of available service information.

Intermittent

A failure condition that does not always appear is referred to as "intermittent".

Observe the Diagnostic Trouble Code information and the data display.

Verify the symptoms and conditions reported by the customer.

Use a check sheet or other method to check the circuit or electronic system components.

If no trouble is detected

This situation indicates that the machine is determined as operating properly. The condition reported by the customer may be normal. Check the customer complaint by comparing to other machines that are operating properly. However, depending on the condition, it may be intermittent. Before returning the machine, check the complaint under the conditions given by the customer.

Investigate the complaint again.

If the complaint cannot be adequately detected or checked, it is necessary to perform the diagnosis again to verify the complaint. As stated above in "Intermittent", the complaint may be an intermittent or normal condition.

Repair and verify.

Perform the repair when the cause has been checked. Check that the operation is performed properly, and that the symptom has been corrected. This includes the verification test performed on the machine or other methods to check that the complaint has been resolved.

Check by testing under the conditions given by the customer.

When a Diagnostic Trouble Code is diagnosed, verify that the malfunction has been repaired by reproducing the condition that appeared when the Diagnostic Trouble Code was set while checking the scan tool data.

### [7] Verification after repair

Machine repair verification

When a repair has been performed for the electronic control system, it is necessary to verify that the repair is accurate after repairing the machine. If this check is not adequate, the diagnostic light may illuminate again while returning the machine to the customer, or drivability problems may occur. Especially for an intermittent failure, it is necessary to verify by reproducing the conditions of the customer complaint.

About the machine repair verification

It is effective to use the OBD system check for the machine repair verification.

After the repair is completed, the person who has performed the machine diagnosis shall review either the Diagnostic Trouble Code that was diagnosed or the scan tool data, or both, and record it.

Clear the Diagnostic Trouble Code.

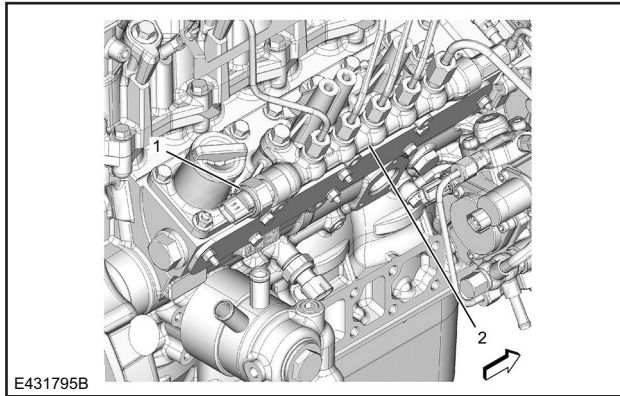
Run the machine based on the scan tool data.

Check the Diagnostic Trouble Code status information of the specified Diagnostic Trouble Code that was diagnosed until the diagnosis test related to that Diagnostic Trouble Code is implemented by the control unit.

Installation of Fuel pressure sensor

1. Fuel pressure sensor installation

- [1] Install the FRP sensor to the common rail (fuel rail) assembly.  
tightening torque : 98 N · m { 10.0 kgf · m / 72 lbf · ft. }



E431795B

1	FRP sensor
2	Common rail (fuel rail) assembly

- [2] Connect the harness connector to the FRP sensor.

2. Battery ground cable connect

- [1] Connect the battery ground cable to the battery.

Removal and Installation of Engine coolant temperature sensor

Removal of Engine coolant temperature sensor

1. Battery ground cable disconnect

- [1] Disconnect the battery ground cable from the battery.

2. Coolant drain

- [1] Drain coolant from the radiator.

**Caution**

- After draining the coolant, do not forget to tighten the drain plug.

3. Engine coolant temperature sensor disconnect

- [1] Disconnect the harness connector from the engine coolant temperature sensor.

4. Engine coolant temperature sensor removal

- [1] Remove the engine coolant temperature sensor from the water pump assembly.

Installation of Engine coolant temperature sensor

1. Engine coolant temperature sensor installation

- [1] Install the engine coolant temperature sensor to the water pump assembly.

tightening torque : 20 N · m { 2.0 kgf · m / 15 lbf · ft. }

2. Engine coolant temperature sensor connect

- [1] Connect the harness connector to the engine coolant temperature sensor.

3. Coolant filling

- [1] Loosen the plug using a wrench.
- [2] Replenish the radiator with coolant.

**Caution**

- Take care to prevent overflow coolant from splashing on to the exhaust system parts.
- Wipe off any coolant overflow.

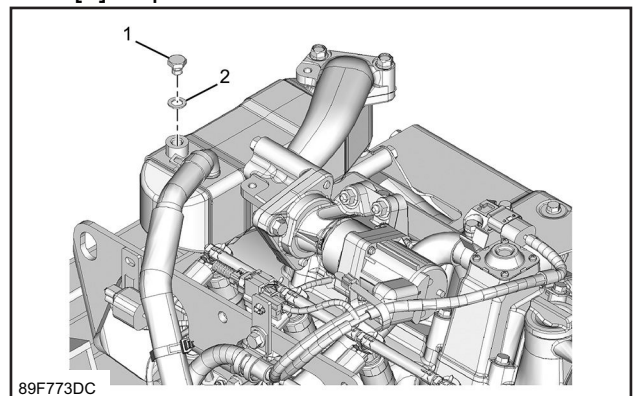
- [3] Tighten the plug using a wrench.

**Caution**

- Use a new gasket.

tightening torque : 28 N · m { 2.9 kgf · m / 21 lbf · ft. }

- [4] Replenish the radiator with coolant.



89F773DC

1	Plug
2	Gasket

4. Battery ground cable connect

- [1] Connect the battery ground cable to the battery.

## H. ENGINE

---

- [5] Observe the Diagnostic Trouble Code information with a trouble diagnosis scan tool.

### Diagnostic Trouble Code P0089 Fuel Pressure Regulator Performance

1. Diagnostic Trouble Code P0089 priority Diagnostic Trouble Code  
Diagnostic Trouble Code P0091  
Diagnostic Trouble Code P0092  
Diagnostic Trouble Code P0192  
Diagnostic Trouble Code P0193  
Diagnostic Trouble Code P0201  
Diagnostic Trouble Code P0202  
Diagnostic Trouble Code P0203  
Diagnostic Trouble Code P0204  
Diagnostic Trouble Code P2146  
Diagnostic Trouble Code P2149

2. Diagnostic Trouble Code P0089 diagnostics

- [1] Wait for the specified time to reduce the fuel pressure from the common rail (fuel rail).  
specified time : 2 min
- [2] Observe the Fuel Rail Pressure (FRP) Sensor display on the trouble diagnosis scan tool.  
values : 0.9 - 1.0 V
- [3] If the Fuel Rail Pressure (FRP) Sensor display is outside the specified range, inspect for poor connections at the FRP sensor harness connector.
- [4] If a problem is found, repair the harness connector.
- [5] Inspect for poor connections at the ECM harness connector.
- [6] If a problem is found, repair the harness connector.
- [7] Inspect each circuit for high resistance.
- [8] If a problem is found, repair the circuit.
- [9] If the harness connector and each circuit are normal, replace the FRP sensor.  
Refer to "Common rail assembly removal".  
Refer to "Common rail assembly installation".

Note

- Do not replace the FRP sensor separately. If a problem is found, replace the common rail (fuel rail) assembly.

- [10] Inspect for poor connections at the suction control valve harness connector.

- [11] If a problem is found, repair the harness connector.

- [12] Inspect for poor connections at the ECM harness connector.

- [13] If a problem is found, repair the harness connector.

- [14] Inspect each circuit for high resistance.

- [15] If a problem is found, repair the circuit.

- [16] Turn OFF the ignition switch for 30 seconds or more.

- [17] Start the engine.

- [18] Rev the engine several times while observing the Actual Fuel Rail Pressure display on the trouble diagnosis scan tool.

- [19] Observe the Actual Fuel Rail Pressure display on the trouble diagnosis scan tool, and verify that it is within the specified range at a sufficient rate.  
Specified value : (-5) - 5 MPa

Note

- If possible, compare with other machines with the same engine equipped.

- [20] If the reading is within the specified range, replace the fuel filter.

- [21] If the reading is outside the specified range, replace the fuel supply pump and the fuel filter.  
Refer to "Fuel supply pump removal".  
Refer to "Fuel supply pump installation".

Note

- When replacing the fuel supply pump, the fuel filter must be replaced at the same time.

3. Diagnostic Trouble Code P0089 confirm resolution

- [1] Clear the Diagnostic Trouble Code with a trouble diagnosis scan tool.
- [2] Turn OFF the ignition switch for 30 seconds or more.
- [3] Start the engine.
- [4] Perform a test-run.
- [5] Observe the Diagnostic Trouble Code information with a trouble diagnosis scan tool.

- [7] Measure the voltage between the FRP sensor signal circuit and a known good GND.  
voltage : 4.5 V
- [8] If the reading is more than or equal to the specified value, inspect the signal circuit between the ECM and the FRP sensor for a short to the 5 V power supply circuit.
- [9] If a problem is found, repair the signal circuit.
- [10] Connect a fused jumper wire between the FRP sensor signal circuit and the GND circuit.
- [11] Observe the Fuel Rail Pressure (FRP) Sensor display on the trouble diagnosis scan tool.  
voltage : 0.1 V
- [12] If the reading is less than or equal to the specified value, inspect for poor connections at the FRP sensor harness connector.
- [13] If a problem is found, repair the harness connector.
- [14] If the harness connector is normal, replace the FRP sensor.  
Refer to "Common rail assembly removal".  
Refer to "Common rail assembly installation".

## Note

- Do not replace the FRP sensor separately. If a problem is found, replace the common rail (fuel rail) assembly.

- [15] Inspect the GND circuit between the ECM and the FRP sensor for an open circuit or high resistance.

## Note

- The FRP sensor shares the GND circuit with other sensors.
- Diagnostic Trouble Codes on sensors that share this circuit may be set.

- [16] If a problem is found, repair the GND circuit.
- [17] Inspect the signal circuit between the ECM and the FRP sensor for an open circuit or high resistance.
- [18] If a problem is found, repair the signal circuit.

- [19] Inspect for poor connections at the ECM harness connector.
- [20] If a problem is found, repair the harness connector.
- [21] If the harness connector is normal, replace the ECM.
- [22] Set the injector ID code on the ECM.
3. Diagnostic Trouble Code P0193 confirm resolution
- [1] Clear the Diagnostic Trouble Code with a trouble diagnosis scan tool.
- [2] Turn OFF the ignition switch for 30 seconds or more.
- [3] Start the engine.
- [4] Perform a test-run.
- [5] Observe the Diagnostic Trouble Code information with a trouble diagnosis scan tool.

## Diagnostic Trouble Code P0201 Injector Circuit - Cylinder 1

1. Diagnostic Trouble Code P0201 diagnostics
- [1] Turn OFF the ignition switch.
- [2] Disconnect the harness connector from the No. 1 cylinder injector.
- [3] Measure the resistance in the charge voltage circuit between the ECM and the cylinder No. 1 injector.  
values : 1.0  $\Omega$
- [4] If the reading is more than or equal to the specified value, repair an open circuit or high resistance in the charge voltage circuit between the ECM and the No. 1 cylinder injector.
- [5] Turn ON the ignition switch.
- [6] Measure the voltage between the No. 1 cylinder injector harness connector charge voltage circuit and the frame ground.  
values : 1.0 V
- [7] If the reading is more than or equal to the specified value, inspect the control circuit between the ECM and the No. 1 cylinder injector.

## Note

- There should be no short to the charge voltage circuit.

- [8] If a problem is found, repair the control circuit.

## H. ENGINE

---

- [14] If the EGR solenoid circuit is normal, replace the EGR valve.  
Refer to "EGR Cooler and EGR Valve removal".  
Refer to "EGR Cooler and EGR Valve installation".

- [15] Restore the machine.  
[16] Turn ON the ignition switch.  
[17] Clear the Diagnostic Trouble Code with a trouble diagnosis scan tool.  
[18] Turn OFF the ignition switch for 30 seconds or more.  
[19] Start the engine.  
[20] Perform a test-run.  
[21] Observe the Diagnostic Trouble Code information with a trouble diagnosis scan tool.  
[22] If Diagnostic Trouble Code P0404 is set, replace the ECM.  
[23] Set the injector ID code on the ECM.  
3. Diagnostic Trouble Code P0404 confirm resolution

- [1] Clear the Diagnostic Trouble Code with a trouble diagnosis scan tool.  
[2] Turn OFF the ignition switch for 30 seconds or more.  
[3] Start the engine.  
[4] Perform a test-run.  
[5] Observe the Diagnostic Trouble Code information with a trouble diagnosis scan tool.

### Diagnostic Trouble Code P0409 Exhaust Gas Recirculation 1 Sensor Circuit

1. Diagnostic Trouble Code P0409 priority Diagnostic Trouble Code Diagnostic Trouble Code P1655  
2. Diagnostic Trouble Code P0409 diagnostics

- [1] Turn OFF the ignition switch.  
[2] Disconnect the harness connector from the EGR valve.  
[3] Turn ON the ignition switch.  
[4] Observe the EGR Brushless Position 1, EGR Brushless Position 2, and EGR Brushless Position 3 data displays on the trouble diagnosis scan tool for any display that shows ON.

- [5] If there is a data display showing ON, inspect the signal circuit between the ECM and the EGR valve of the EGR showing ON.

#### Note

- There should be no short to the battery or the ignition power supply.
- There should be no short to 5 V power supply circuit.

- [6] If a problem is found, repair the signal circuit.  
[7] Measure the voltage between the EGR position sensor 5 V power supply circuit and a known good GND circuit.  
voltage : 4.5 V  
[8] If the reading is less than or equal to the specified value, inspect the 5 V power supply circuit between the ECM and the EGR position sensor for an open circuit or high resistance.

#### Note

- The EGR position sensor shares the 5 V power supply circuit with other sensors.
- Diagnostic Trouble Codes on sensors that share this circuit may be set.

- [9] If a problem is found, repair the 5 V power supply circuit.  
[10] Measure the voltage between the EGR position sensor 5 V power supply circuit and the GND circuit.  
voltage : 4.5 V  
[11] If the reading is less than or equal to the specified value, inspect the GND circuit between the ECM and EGR position sensor for an open circuit or high resistance.

#### Note

- The EGR position sensor shares the GND circuit with other sensors.
- Diagnostic Trouble Codes on sensors that share this circuit may be set.

- [12] If a problem is found, repair the GND circuit.  
[13] While momentarily disconnecting the fused jumper wire from the EGR position sensor 1 signal circuit and the 5 V power supply circuit, observe the EGR Brushless Position 1 display on the trouble diagnosis scan tool.

- [3] Turn ON the ignition switch.
- [4] Observe the Fuel Rail Pressure (FRP) Sensor display on the trouble diagnosis scan tool, and verify that it is within the specified range.  
voltage : 0.9 - 1.0 V
- [5] If the Fuel Rail Pressure (FRP) Sensor display is outside the specified range, inspect for poor connections at the FRP sensor harness connector.
- [6] If a problem is found, repair the harness connector.
- [7] Inspect for poor connections at the ECM harness connector.
- [8] If a problem is found, repair the harness connector.
- [9] Inspect each circuit for high resistance.
- [10] If a problem is found, repair the circuit.
- [11] If the harness connector and each circuit are normal, replace the FRP sensor.  
Refer to "Common rail assembly removal".  
Refer to "Common rail assembly installation".

Note

- Do not replace the FRP sensor separately. If a problem is found, replace the common rail (fuel rail) assembly.

- [12] Inspect the fuel system between the fuel tank and the fuel supply pump for clogging.
- [13] If a problem is found, repair the clogging in the fuel system.
- [14] Inspect the fuel hose between the fuel tank and the fuel supply pump for cuts and cracks.
- [15] If a problem is found, replace the fuel hose.

Note

- A slight vacuum will form in the fuel hose leading from the fuel tank to the fuel supply pump when the engine is running.
- If the fuel hose is not connected securely, air may enter.
- If the engine speed or the engine load increases when air has entered the fuel system, fluctuation in the common rail (fuel rail) pressure occurs, and Diagnostic Trouble Code P1093 may be set.

- [16] Check that an appropriate clamp is used between the fuel tank and the fuel supply pump.
- [17] If a problem is found, replace the clamp.
- [18] Operate the priming pump until it becomes heavy.

Note

- When a leakage exists in the fuel system between the priming pump and the fuel supply pump, the pressing weight of the priming pump does not become heavy.

- [19] Start the engine.
- [20] Inspect the high-pressure side of the fuel system and check for a fuel leak between the fuel supply pump and the common rail (fuel rail).

Note

- Fuel may leak under the cylinder head cover from the inlet of the high pressure hose.
- If the fuel leaks under the cylinder head cover, the engine oil level will increase.
- Inspect for a fuel leakage into the engine oil.

- [21] If a fuel leakage is found, repair.
- [22] Turn OFF the ignition switch.
- [23] Remove the fuel hose on the fuel supply pump side from the fuel filter.

Note

- Use a pan to catch the fuel from the removed fuel hose.
- Clean the pressure gauge and the connection hose before connecting to the fuel pipe.
- The fuel supply pump may be damaged due to foreign material that has entered the connection hose.

- [24] Connect the pressure gauge between the fuel filter and the removed fuel hose.

Note

- Verify that the fuel system is connected securely.

## H. ENGINE

- [9] If a problem is found, repair or replace the fuel pipe.
- [10] Turn OFF the ignition switch.
- [11] Disconnect the harness connector from the fuel filter pressure sensor.
- [12] Inspect for poor connections at the fuel filter pressure sensor harness connector.
- [13] If a problem is found, repair the harness connector.
- [14] Disconnect the harness connector from the ECM.
- [15] Inspect for poor connections at the ECM harness connector.
- [16] If a problem is found, repair the harness connector.
- [17] Inspect each circuit between the ECM and the fuel filter pressure sensor for high resistance.
- [18] If a problem is found, repair the applicable circuit.
- [19] Replace the fuel filter pressure sensor.

### 3. Diagnostic Trouble Code P2540 confirm resolution

- [1] Clear the Diagnostic Trouble Code with a trouble diagnosis scan tool.
- [2] Turn OFF the ignition switch for 30 seconds or more.
- [3] Start the engine.
- [4] Perform a test-run.
- [5] Observe the Diagnostic Trouble Code information with a trouble diagnosis scan tool.

### Diagnostic Trouble Code U0073 CAN-Bus Malfunction

#### 1. Diagnostic Trouble Code U0073 diagnostics

- [1] Turn OFF the ignition switch.
- [2] Measure the resistance between the terminals of the termination resistor harness connector.

#### Note

- Make a measurement from the back with the harness connector connected.
- Verify that the parallel resistance of the 120 Ω resistor in the termination resistor and the 120 Ω resistor in the ECM is 60 Ω.

resistance : 50.0 - 70.0 Ω

- [3] If the resistance is outside the specified range, disconnect the harness connector from the termination resistor.
- [4] Measure the resistance of the termination resistor.  
resistance : 110.0 - 130.0 Ω
- [5] If the resistance is outside the specified range, replace the termination resistor.
- [6] Connect the harness connector to the termination resistor.
- [7] Disconnect the harness connector from the control unit of the machine.
- [8] Measure the resistance between the terminals of the termination resistor harness connector.

#### Note

- Make a measurement from the back with the harness connector connected.

resistance : 50.0 - 70.0 Ω

- [9] If the resistance is within the specified range, replace the control unit of the machine.
- [10] Disconnect the harness connector from the ECM.
- [11] Measure the resistance between the terminals of the termination resistor harness connector.

#### Note

- Make a measurement from the back with the harness connector connected.

resistance : 110.0 - 130.0 Ω

- [12] If the resistance is within the specified range, replace the ECM.
- [13] Set the injector ID code on the ECM.
- [14] Turn OFF the ignition switch.
- [15] Connect the harness connector to the ECM.
- [16] Turn ON the ignition switch.
- [17] Measure the voltage between the termination resistor harness connector CAN-High terminal and GND.
- [18] Measure the voltage between the termination resistor harness connector CAN-Low terminal and GND.  
voltage : 1.5 - 3.5 V
- [19] If the voltage is outside the specified range, replace the ECM.
- [20] Set the injector ID code on the ECM.
- [21] Turn OFF the ignition switch.

## J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

### ■Control Valve and Cylinder

Control valve			
Type	Quadruple spool Quintuple spool	One-piece type x 1	
Operating type	Hydraulic pilot type: travel, swing, and operating machine		
Cylinder		No. of cylinders x tube bore - rod diameter - stroke	
Boom cylinder	1 x D115 mm (D4.528 in.) - D75 mm (D2.953 in.) - 850 mm (33.465 in.)		
Arm cylinder	1 x D100 mm (D3.937 in.) - D65 mm (D2.559 in.) - 755 mm (29.724 in.)		
Bucket cylinder	1 x D85 mm (D3.346 in.) - D55 mm (D2.165 in.) - 655 mm (25.787 in.)		
Blade cylinder	1 x D110 mm (D4.331 in.) - D70 mm (D2.756 in.) - 180 mm (7.087 in.)		
Boom swing	1 x D95 mm (D3.740 in.) - D55 mm (D2.165 in.) - D675 mm (D26.575 in.)		
Blade cylinder	1 x D110 mm (D4.331 in.) - D70 mm (D2.756 in.) - D180 mm (D7.087 in.)		

### Capacities, Filters

#### ■Hydraulic Oil Filters

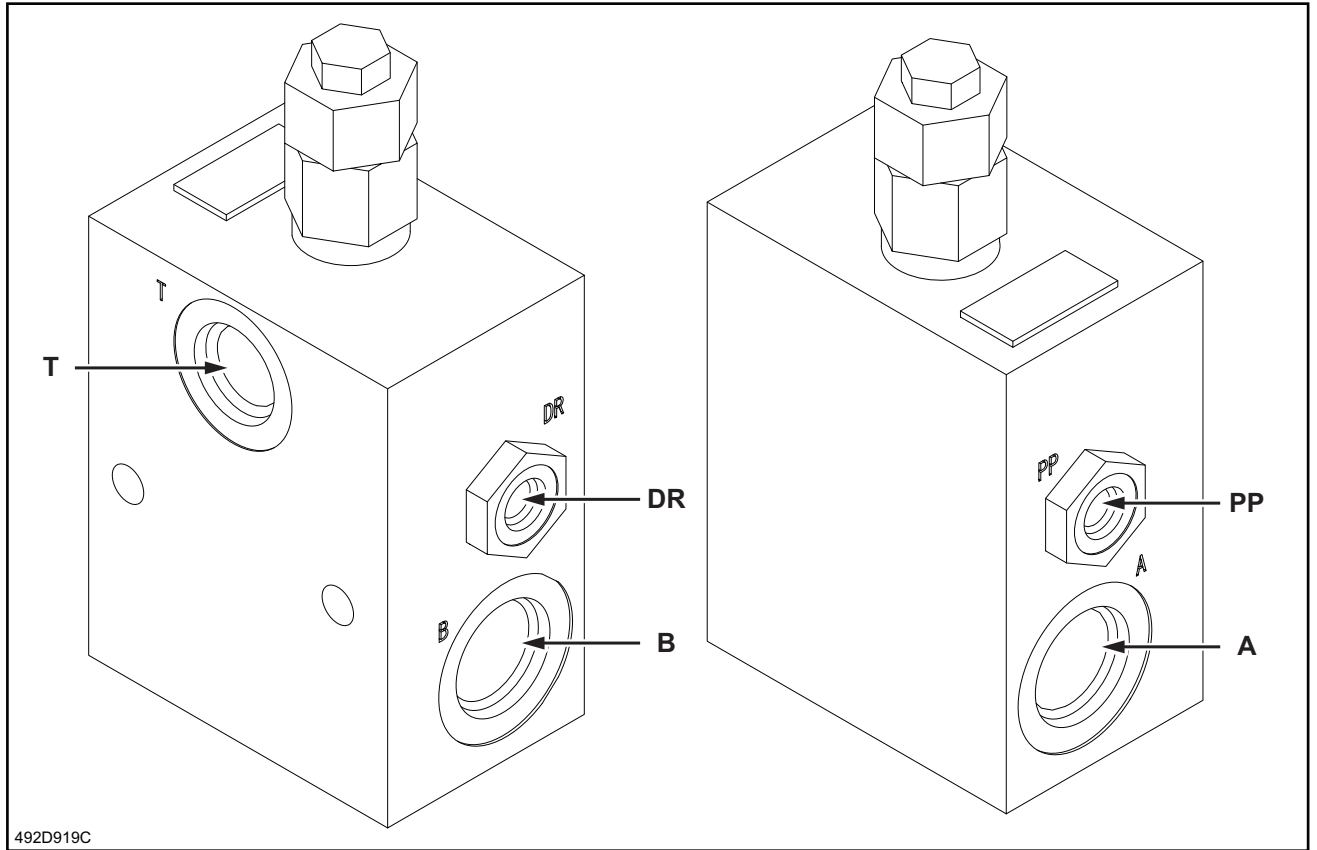
Suction filter (inside tank)	105 μm
Return filter (inside tank)	6 μm
Pilot line filter (inside housing)	8 μm

### Crusher Mode

Operation explanation

- [1] Each time the attachment select switch is pressed, it switches between Normal Mode → Breaker Mode → Crusher Mode → Normal Mode.
- [2] Crusher can be used by selecting Crusher Mode.
- [3] When the key is turned OFF once, then ON again, the attachment mode selected previously is retained.

Shut-off Valve

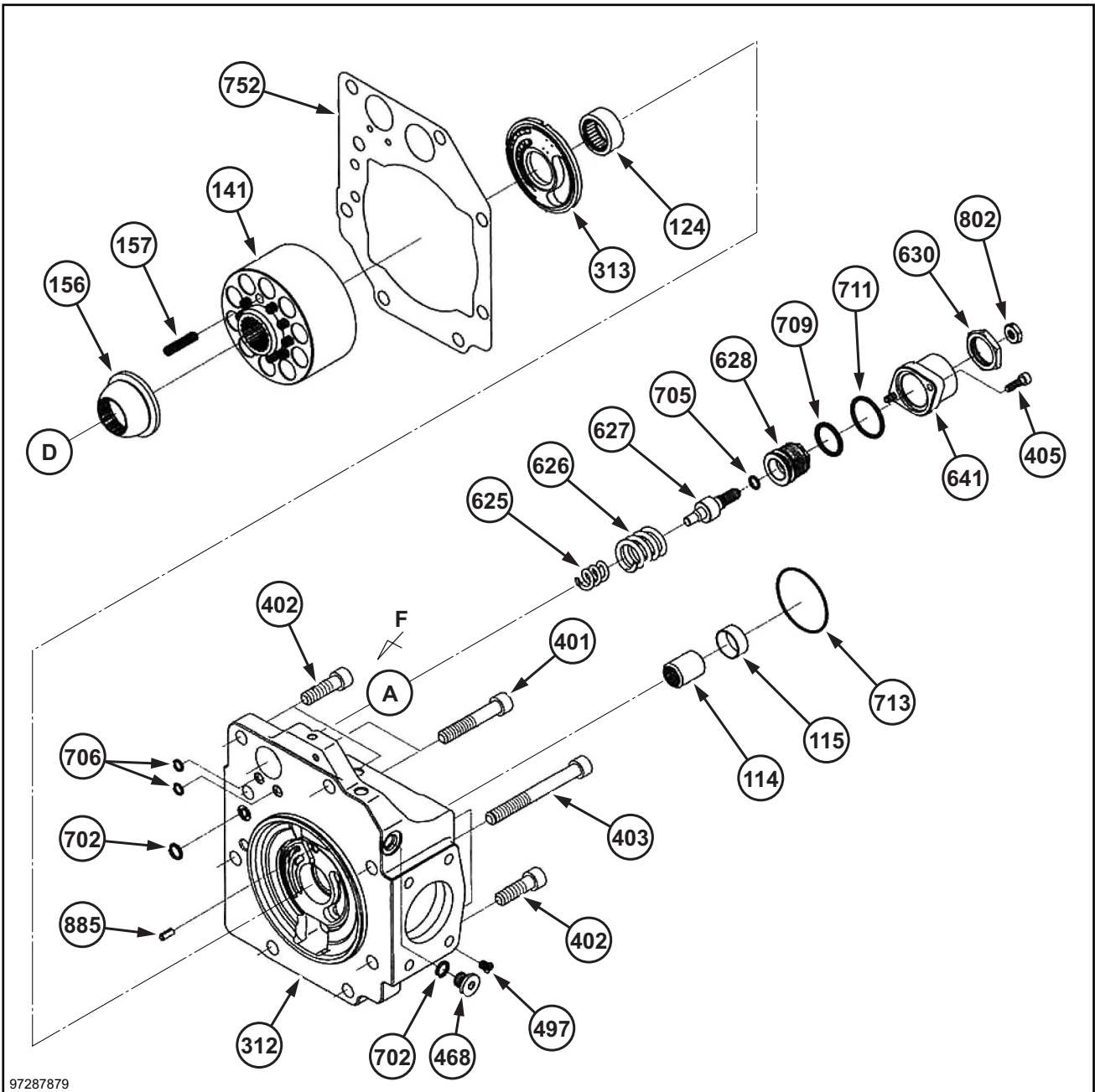


492D919C

Port	Port size
A	G1
B	G1
T	G3/4
PP	G1/4
DR	G1/4

J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)



97287879

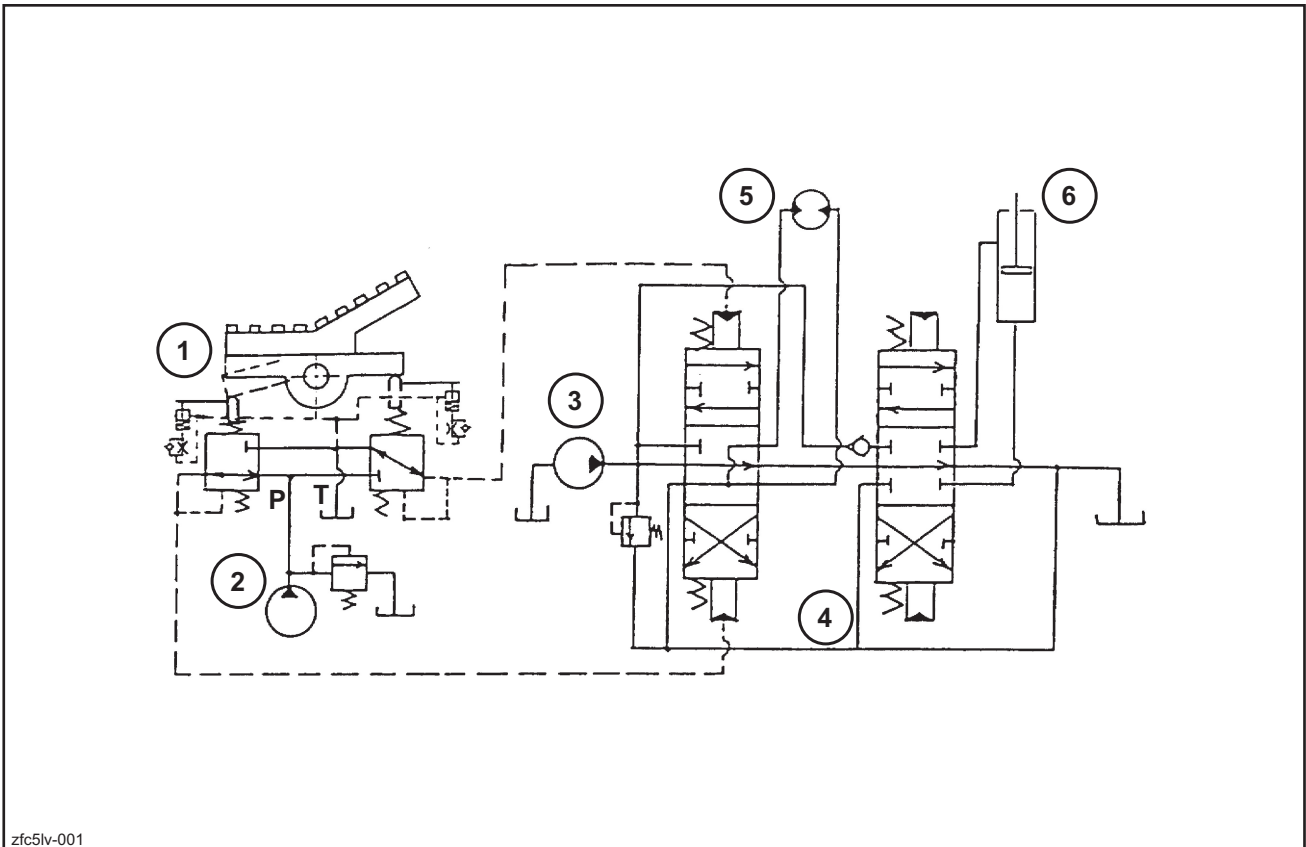


**Travel Pilot Valve (remote control valve)**

Operation

The remote control valve with built-in damper (hereinafter, remote control valve with damper) is a remote control valve that incorporates into the remote control valve main unit a damping function for preventing the man-machine system hunting (lever hunting) phenomenon.

Operation of the remote control valve with damper is divided into the Pressure Reduction Valve Section and the Operation Section Damping Mechanism Section. The explanations in these 2 sections are based on the hydraulic circuit diagram, assembly cross-section diagram, and damping operation explanation diagram below. The diagram below is a typical usage example for the remote control valve.



zfc5lv-001

Hydraulic circuit diagram

1	Remote control valve	4	Control valve
2	Pilot pump	5	Hydraulic motor
3	Main pump	6	Hydraulic cylinder

**Pressure Reduction Valve Section**

1. For the neutral state

The spool (301) is pushed up by the return spring (335) via the spring seating (311) and washer 1 (215) and is in the neutral position shown in the assembly cross-section diagram.

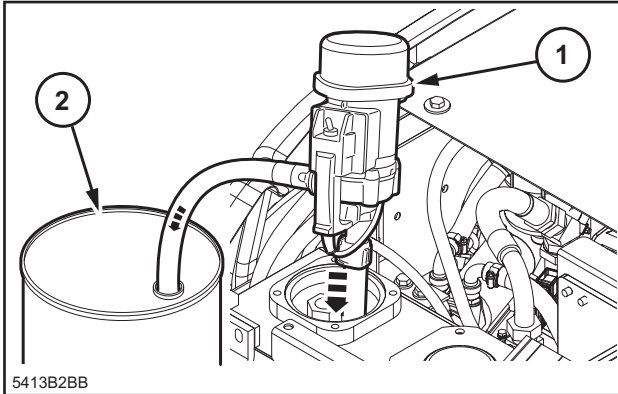
Therefore, since the output port is connected only to port T by the spool switching function, the pressure at output ports 1 and 2 is the same as the pressure at port T.

2. When the remote control valve operation section is tilted from the neutral state

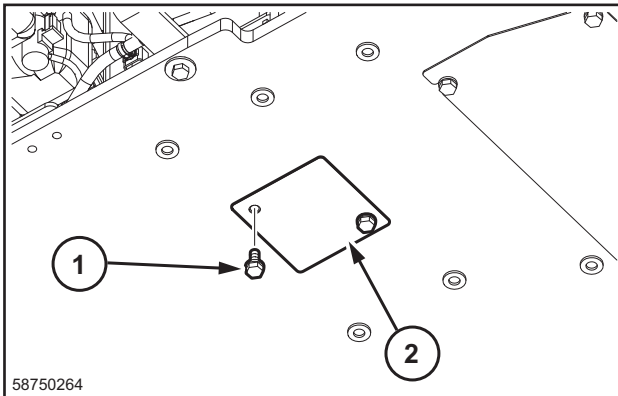
In the assembly cross-section diagram, when the cam (420) is rotated clockwise, the port 1 side push rod (214) is pushed down, the spool moves down via washer 1, the spring seating, the secondary pressure setting spring (324), washer 2 (217), and washer 3 (313), the port P and port 1 are connected, and the oil fed from the pilot pump flows to port 1 and generates pressure.

## J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

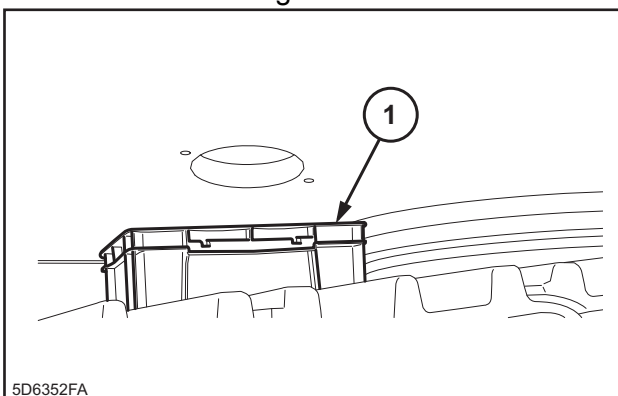
4. Operate the feed pump (1) and transfer the oil inside the hydraulic tank to the waste oil tank (2).



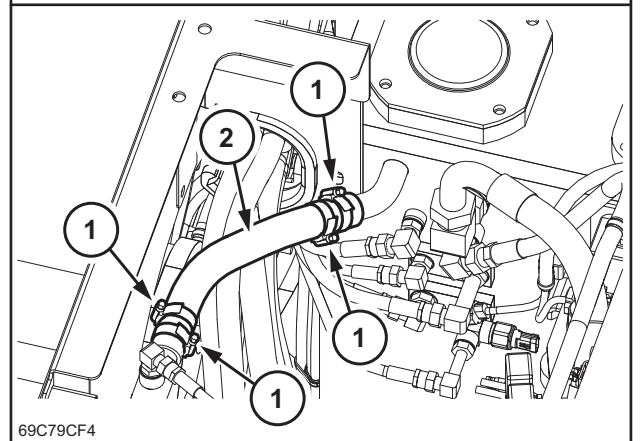
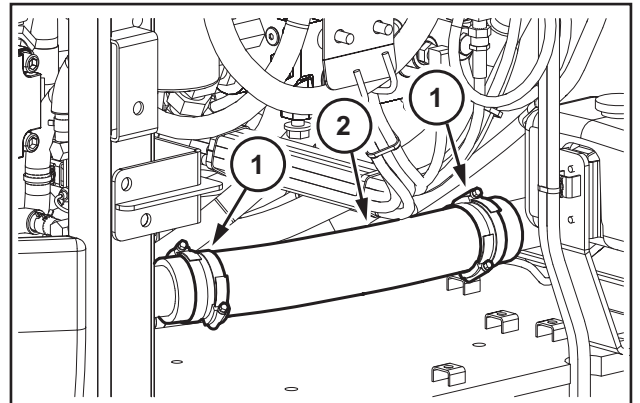
5. Use a wrench [17 mm (0.669 in.)] to remove the 2 bolts (1), and then remove the under cover (2).  
Tightening torque for bolt installation: 37.75 - 40.65 N·m (27.8478 - 29.9870 lbf·ft.)



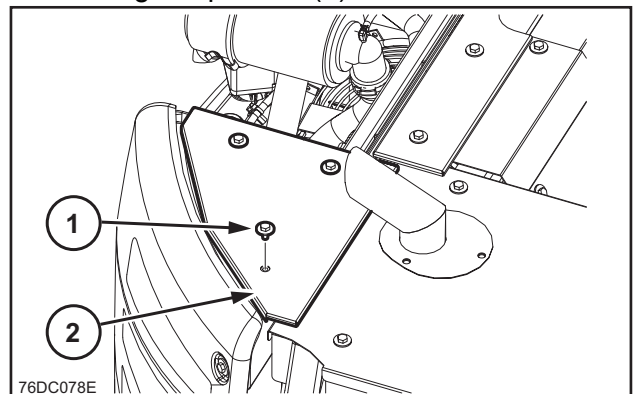
6. Prepare a waste oil can (1) under the hydraulic tank.
- Remove the right side cover and right front side door.
  - Remove the right lower side cover.



7. Use a wrench [7 mm (0.276 in.)] to loosen the hose band (1), and then remove the hose (2).
- Use caps to cover the hose to prevent any entry of water, dust or dirt.

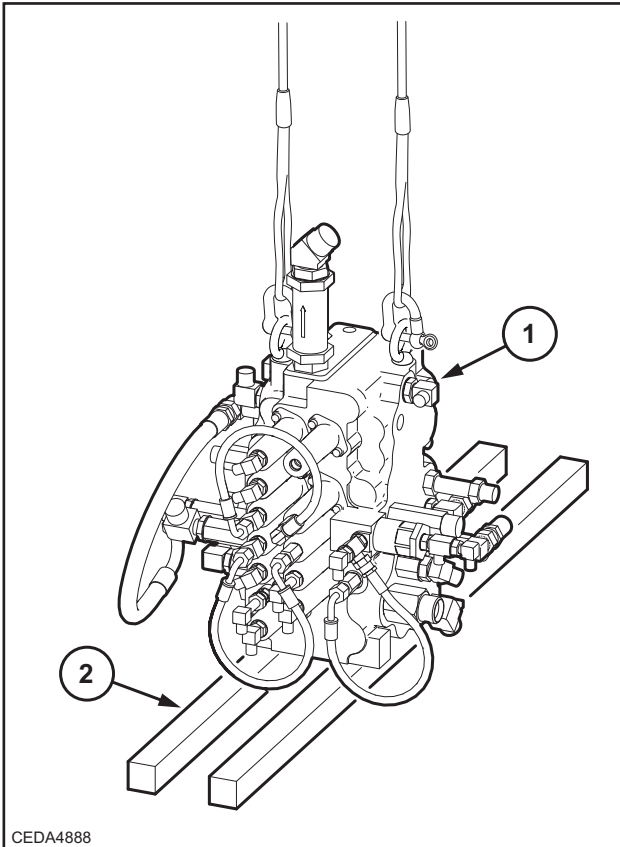


8. Remove the engine hood.  
For details, see "Removal and Installation of Engine Hood".
9. Use a wrench [17 mm (0.669 in.)] to remove the 3 bolts (1), and then remove the right top cover (2).

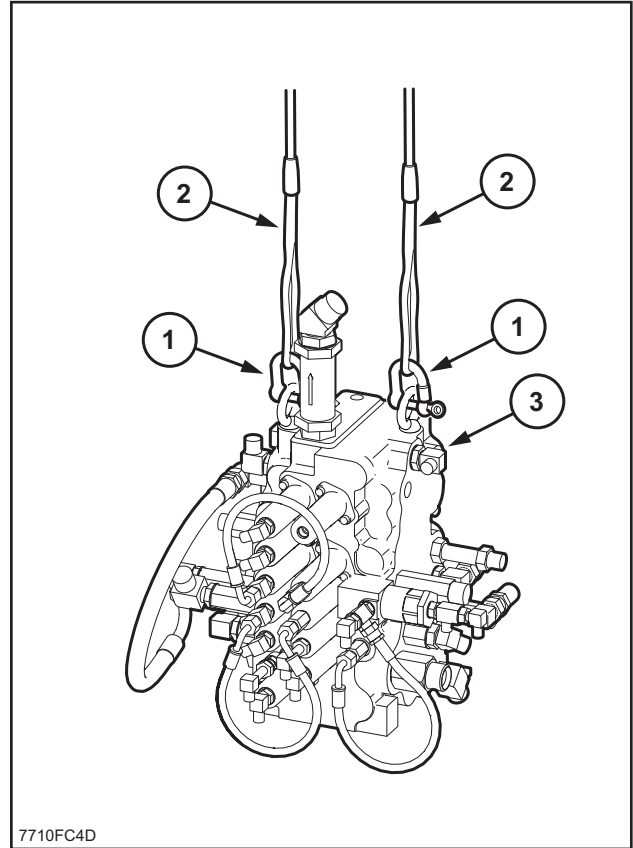


## J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

12. Place the control valve (1) on wood planks (2).

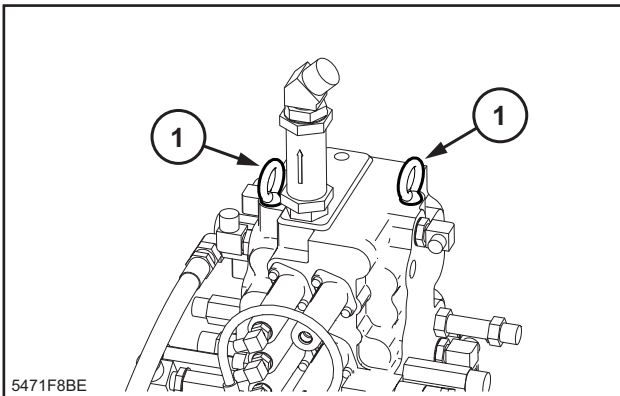


2. Install the 2 shackles (1) on the eyebolts, and then use the liftcrane and 2 wire ropes (2) to lift the control valve (3).

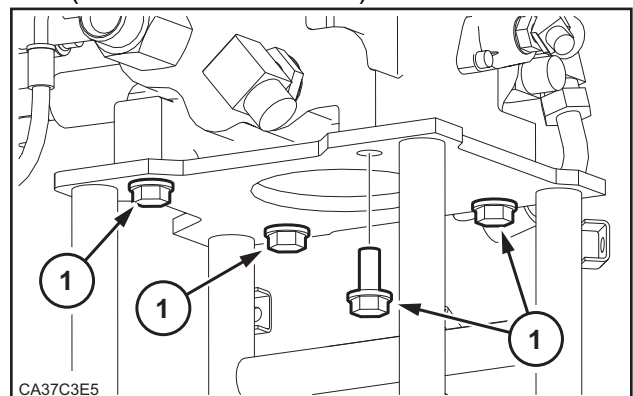


### Installation of Control Valve

1. Install the 2 eyebolts (1) (M10) on the control valve.

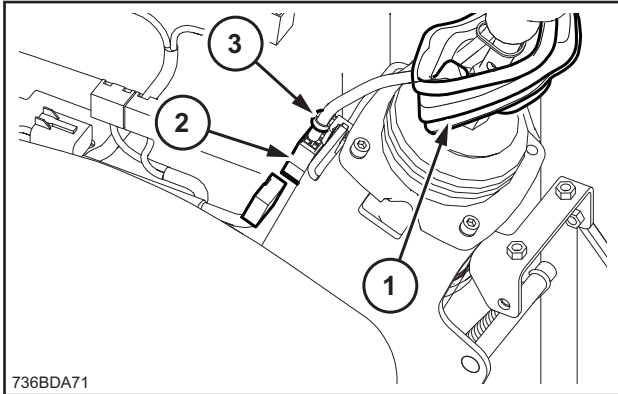


3. Use a wrench [17 mm (0.669 in.)] to install the 4 bolts (1) on the control valve.  
Bolt (1) tightening torque: 267 - 312 N·m (196.96 - 230.15 lbf·ft.)

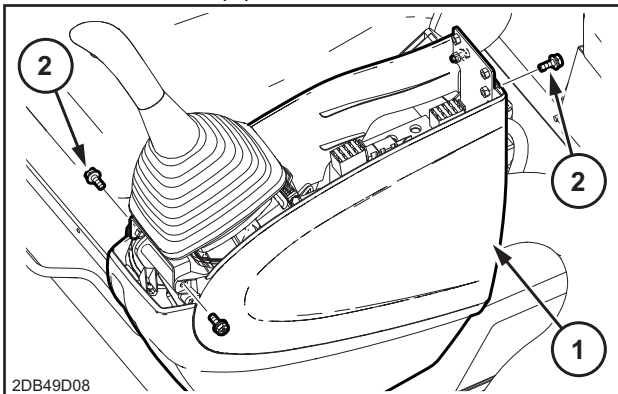


## J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

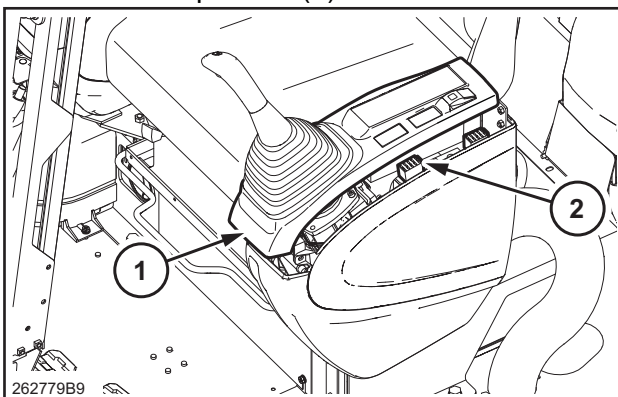
7. Install the horn switch connector (2), bundle with the wire band (3), and then cover the control lever boot (1).



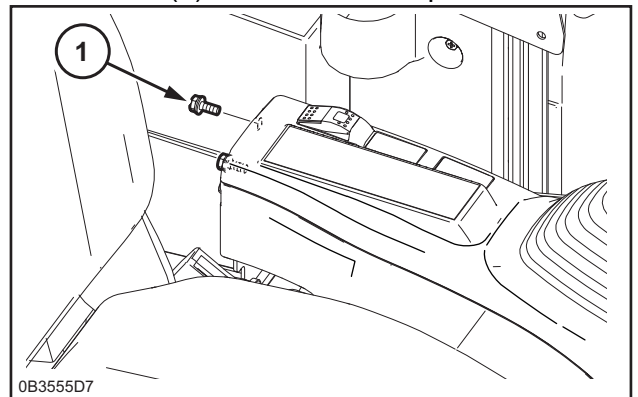
8. Use a Phillips screwdriver or box wrench [10 mm (0.394 in.)] to install the cover (1) with 5 bolts (2).



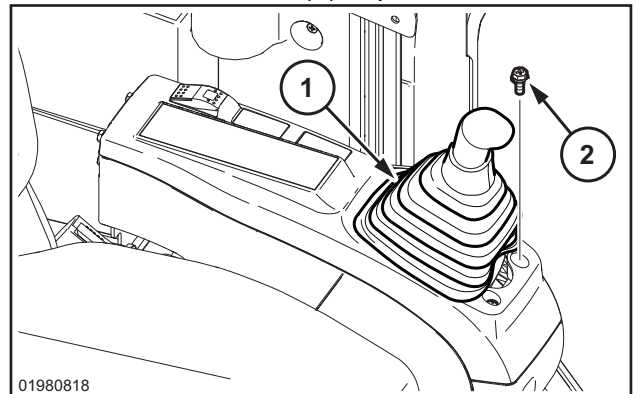
9. Install the connector (2) and install the console top cover (1).



10. Use the Phillips screwdriver to install the 2 screws (1) of the console top cover.

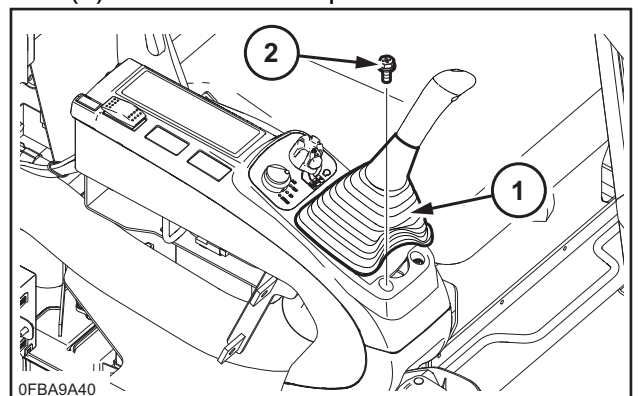


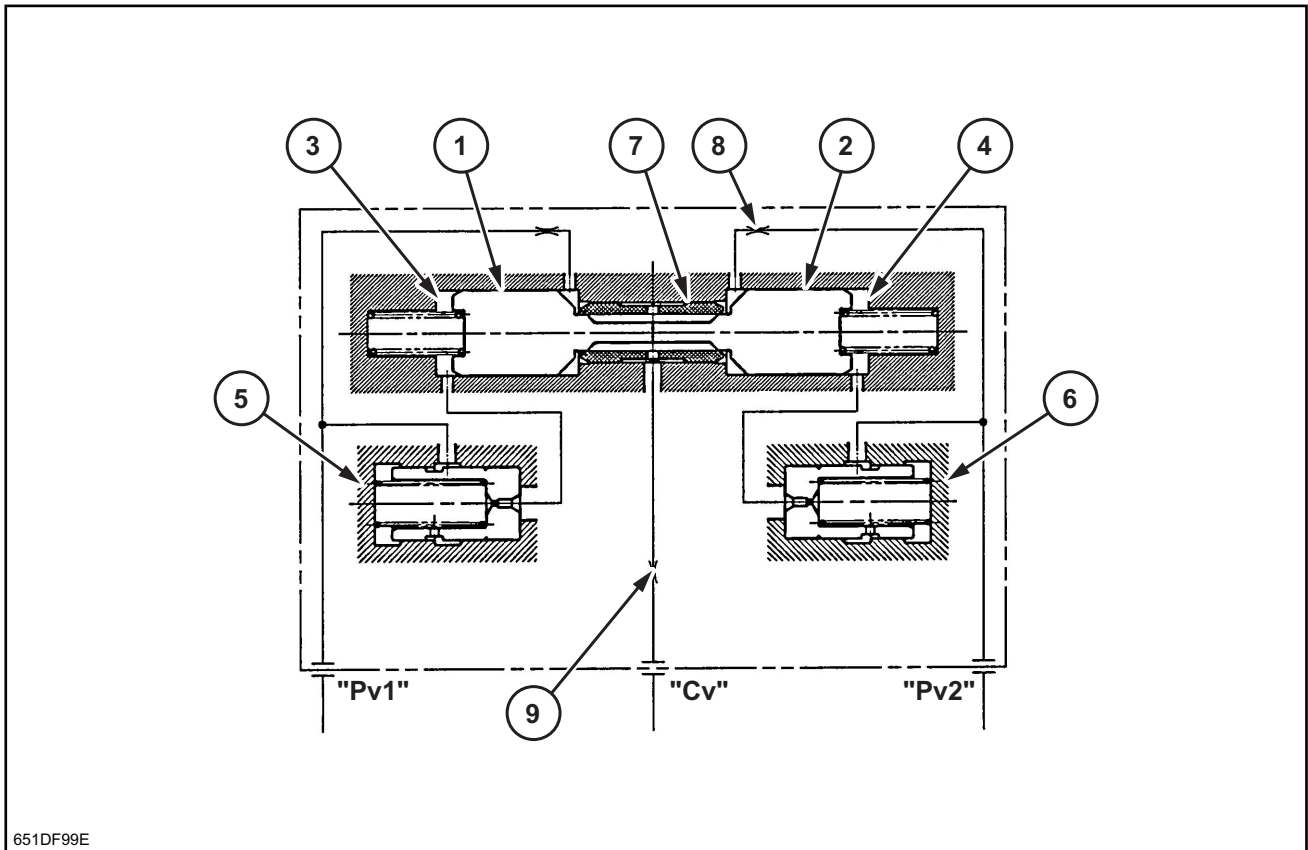
11. Use a Phillips screwdriver or box wrench [10 mm (0.394 in.)] to install the 2 bolts (2) for the console top cover and place the control lever boot (1) in place.



### Removal of Operation Remote Control Valve (right side)

1. Roll up the boot (1) of the control lever and use the Phillips screwdriver or box wrench [10 mm (0.394 in.)] to remove the 2 bolts (2) of the console top cover.



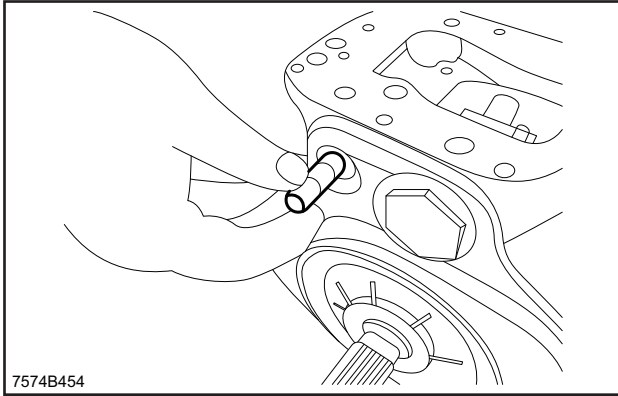


(Fig. 3) Reverse prevention valve model

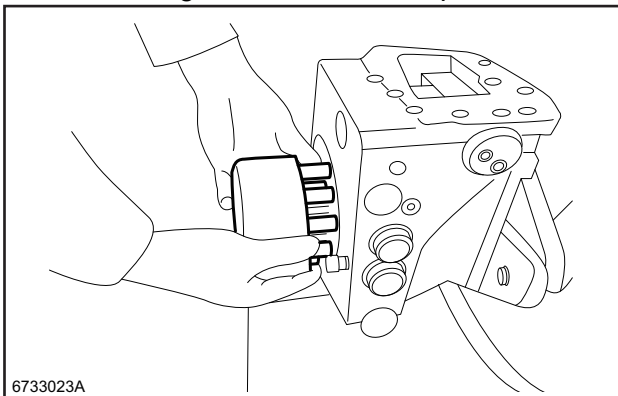
1	Check valve 1	4	Damper chamber 2	7	Sleeve
2	Check valve 2	5	Flow control valve 1	8	Orifice A
3	Damper chamber 1	6	Flow control valve 2	9	Orifice B

## J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

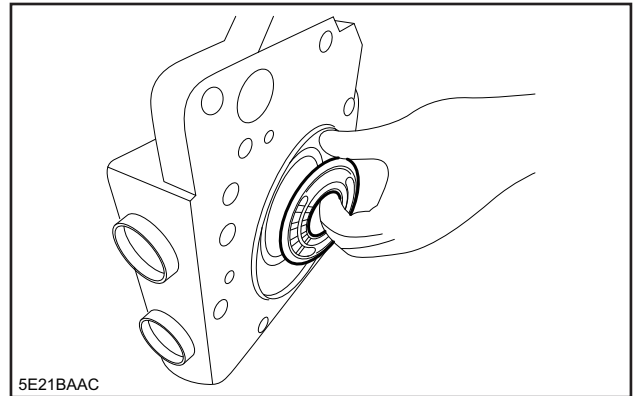
4. Install the ROH plug (467) after installing the compensation piston (621) and piston case (622), and Pf piston (655) and Pf piston case (657) on the pump casing (F).
  - Apply a thin layer of grease on the O-ring on the outer circumference to prevent the O-ring from being cut when installing the Pf piston case.



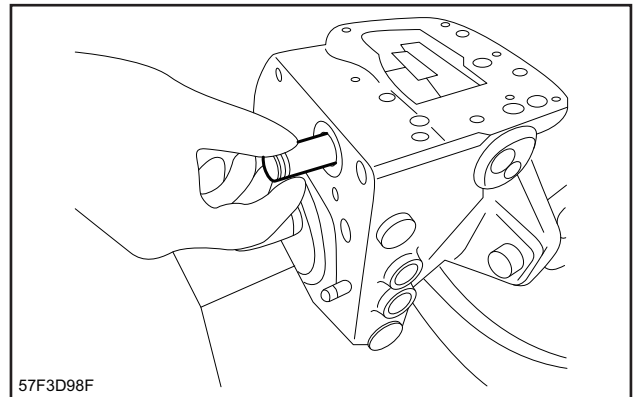
5. Assemble the cylinder block (141), piston subassemblies (151, 152), holder plate (153), spherical bushing (156), and cylinder spring (157), align the spherical bushing and cylinder block spline, and insert them into the drive shaft (111).
  - Be careful not to damage the sliding surfaces of the cylinder block, spherical bushing, shoe, and swash plate.



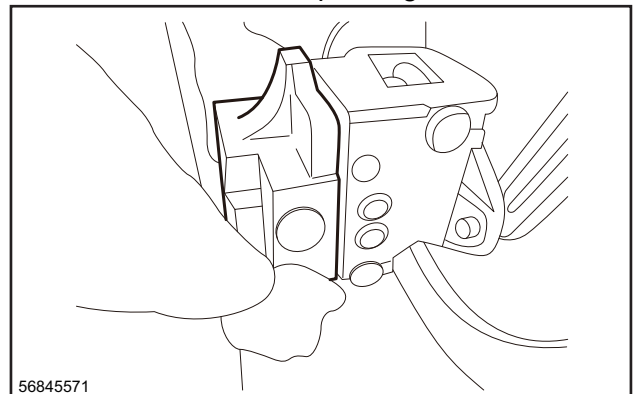
6. Align the valve plate (313) with the spring pin (885) and install it on the pump casing (F) (271) side of the valve cover (312).
  - To prevent it from falling off, apply grease to the installation surface of the valve cover/valve plate.
  - Be careful not to mistake the suction and discharge directions of the valve plate.



7. Install the spool subassembly (650) into the pump casing (F) (271).
  - Install so that the disc-shaped hole for pin insertion is on top side.



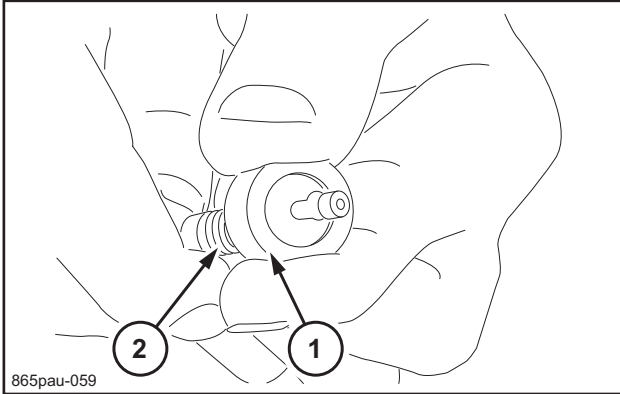
8. After correctly installing the seat packing F (752) on the matching surface of the valve cover (312), tighten the hexagon socket head bolts (401, 402, 403) and couple the pump casing (F) and the valve cover.
  - Install the seal pipe on the valve cover in advance.
  - When installing the valve cover, be careful not to scratch the needle pin roller bearing rotation section of the drive shaft or the seat packing F.



## J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

2. Press in the spring seating (1) and move it to the side while bending the secondary pressure spring (2) to pass the seating over the larger hole and install it on each of the spools.

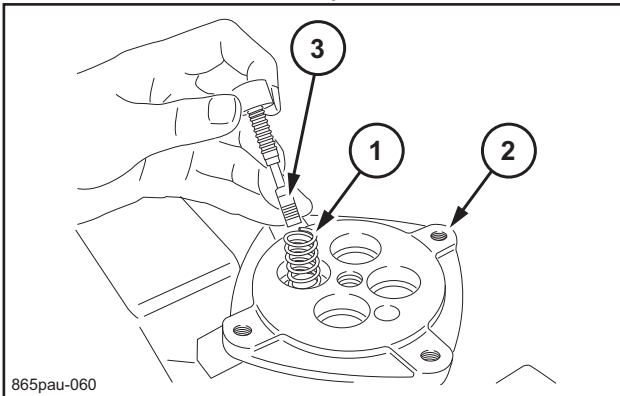
- Do not press in the spring seating by 6 mm ( 0.236 in. ) or more.



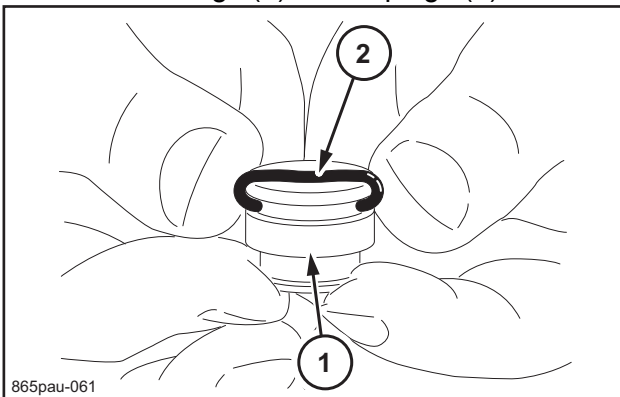
3. Install the return springs (1) in the casing (2).

Install the pressure reducing valve assembly (3) in the casing (2).

- Install them in the positions they were in before disassembly.

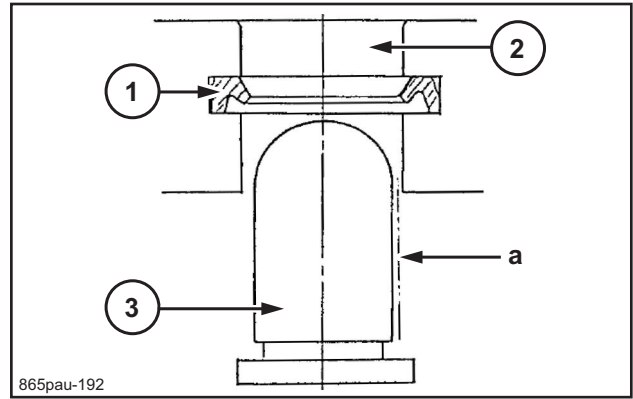


4. Install O-rings (2) on the plugs (1).



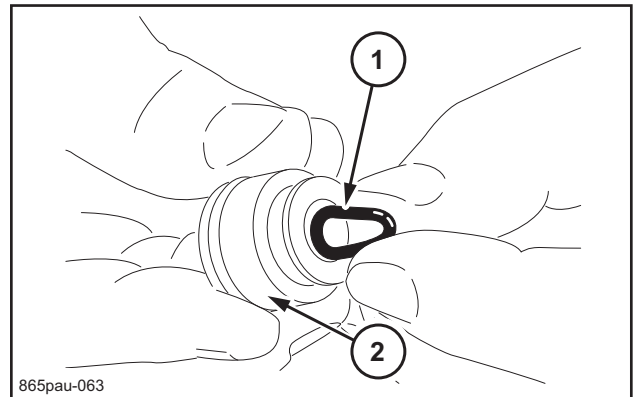
5. Install seal (1) on the plug (2).

- Install so that the seal lips are as shown in the diagram below.



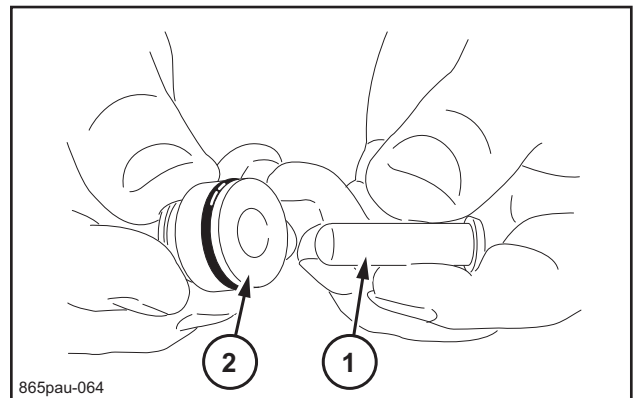
3 Push rod

a Hydraulic oil application



6. Install push rods (1) into the plugs (2).

- Apply hydraulic oil to surface of the push rod.



7. Install the plug assembly (1) in the casing (2).

If the return spring is weak, it will be stopped by the sliding resistance of the O-ring.

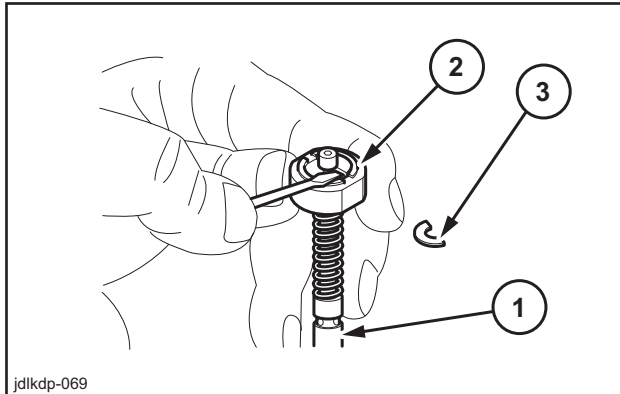
- Be careful not to scratch the casing hole by forcing in the spool.

## J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

19. For disassembly of the pressure reducing valve assemblies, place the bottom end of the spools (1) perpendicular on a level work platform, lower the spring seating (2), and use the end of a small flathead screwdriver to remove the 2 half-circle washers 1 (3).

Be careful not to scratch the surface of the spool.

Do not press in the spring seating by 4 mm (0.157 in.) or more.

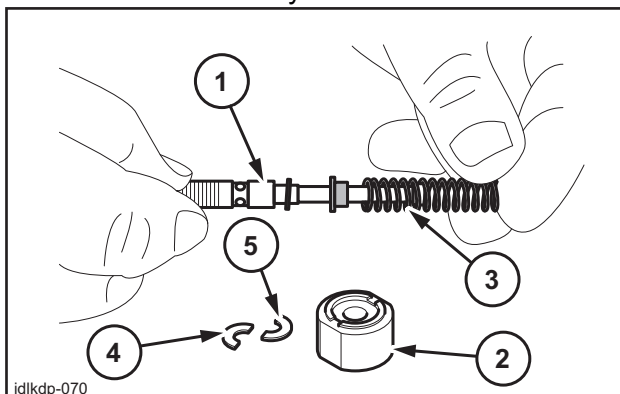


jdlkdp-069

20. Separate the spools (1), spring seating (2), secondary pressure springs (3), washers 2 (4), and washers 3 (5).

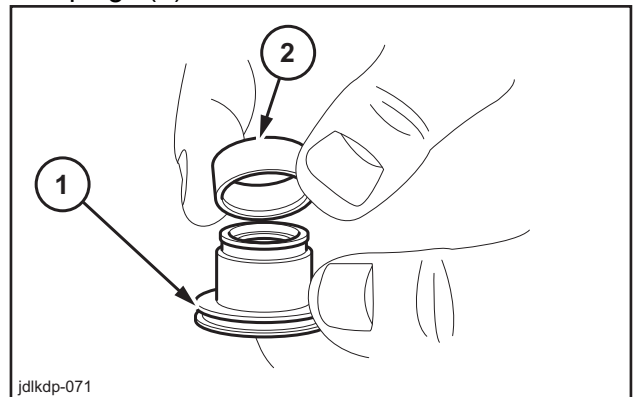
Handle as an assembly until assembly is performed.

Washers 2 are used for pre-set adjustment of the secondary pressure springs, so thickness is different for each spool assembly. Additionally, these are sometimes not used, so record the status for each assembly.



jdlkdp-070

21. Remove the grease cups (2) from the plugs (1).

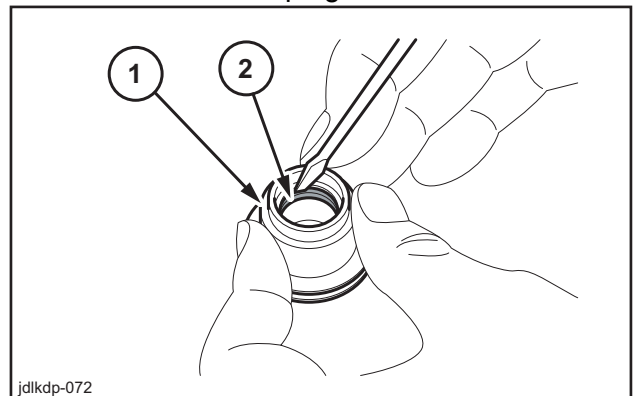


jdlkdp-071

22. Remove the NHU packings (2) from the plugs (1).

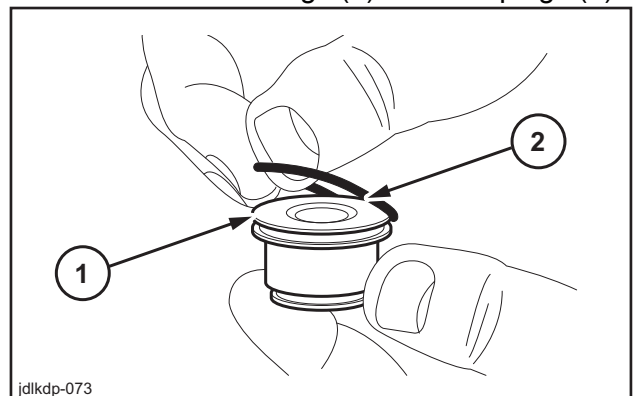
Use a small flathead screwdriver, etc. to remove.

- Be careful not to scratch the inner surface of the plugs.



jdlkdp-072

23. Remove the O-rings (2) from the plugs (1).



jdlkdp-073

24. Cleaning parts

- Clean all parts by placing them in a rough cleaning container filled with white kerosene. (rough cleaning)
- Scratching can easily occur if cleaning of parts is begun just after parts are immersed in white kerosene, so let each part sit in white kerosene until debris and grease sufficiently loosen off from the surface of parts and float to the surface.

## J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

---

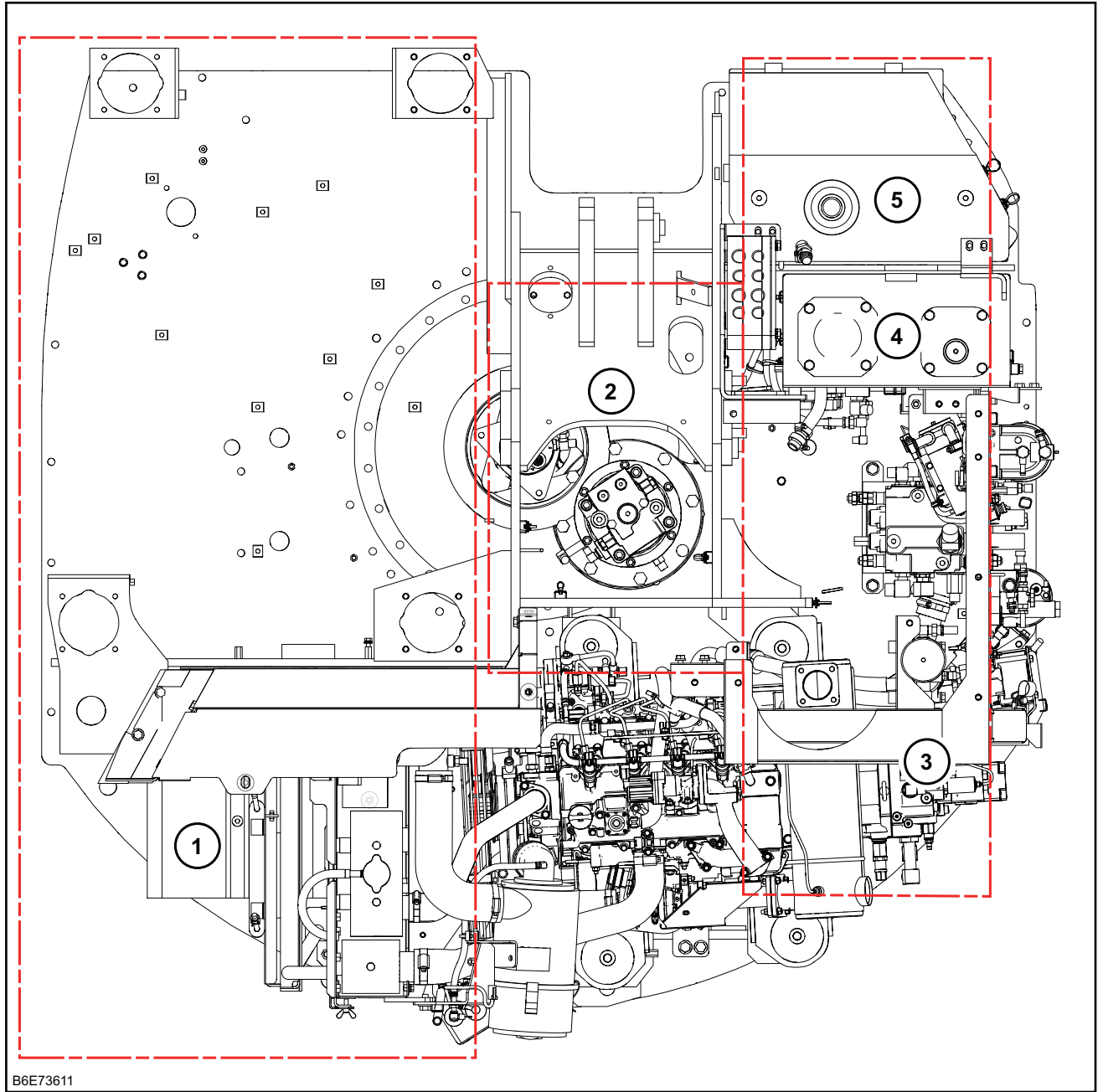
### Operating Method

1. If both the travel speed select switch and the attachment select switch on the switch panel are held down, the display switches to the service support screen.
2. CHECK the select service support screen.
3. MACHINE STATUS the select service support screen.
4. The hydraulic oil temperature is displayed in the "Hyd.OIL TEMP" column.

MACHINE STATUS					2/15
BOOST PRESS.	0	1	5	0	KPa
BAROMETRIC PRESS.	0	1	0	0	KPa
BOOST TEMP.	0	0	7	0	°C
AIR INLET TEMP.	0	0	3	5	°C
FUEL TEMP.	0	0	6	0	°C
MANIFOLD INNER TEMP.	0	0	6	0	°C
COOLANT TEMP.	0	0	8	0	°C
HYD. OIL TEMP.	0	0	9	0	°C
P.SOL;FAN CONTROL	0	4	2	0	mA

zbvdp-002

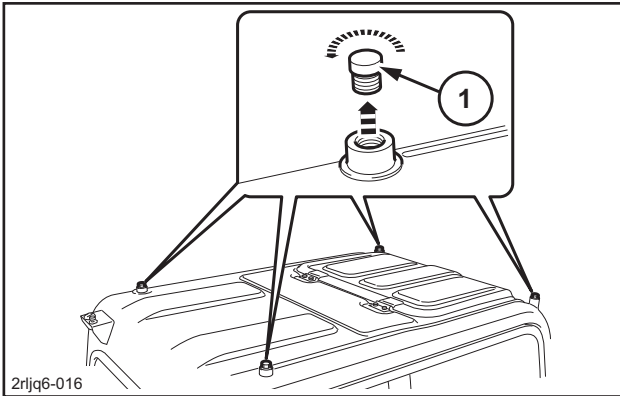
Overall View



1	Left side housing	3	Pump chamber	5	Fuel tank
2	Swing body center section	4	Hydraulic tank		

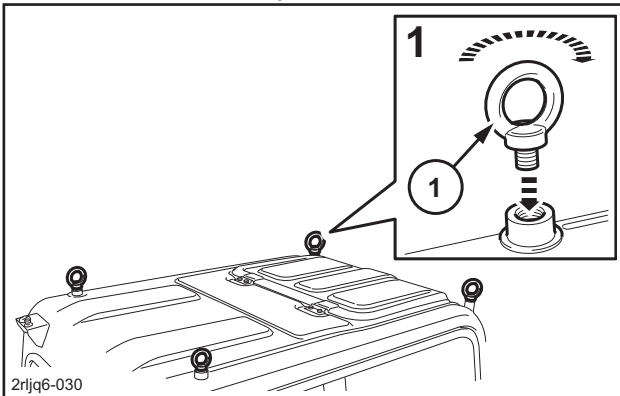
# N. CAB

10. Remove the 4 caps (1) from the top of the cab.

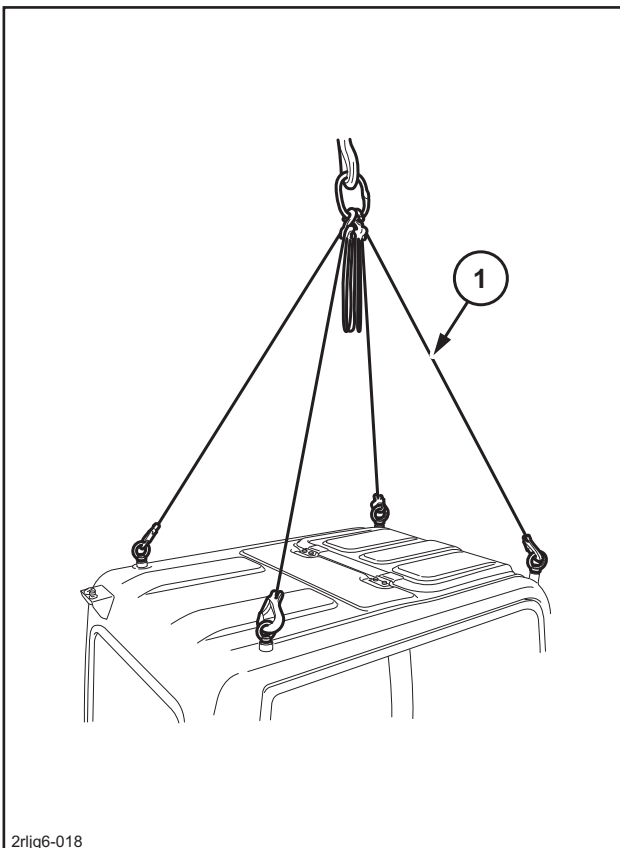


11. Install the 4 eyebolts (M24) (1) in place of the removed caps.

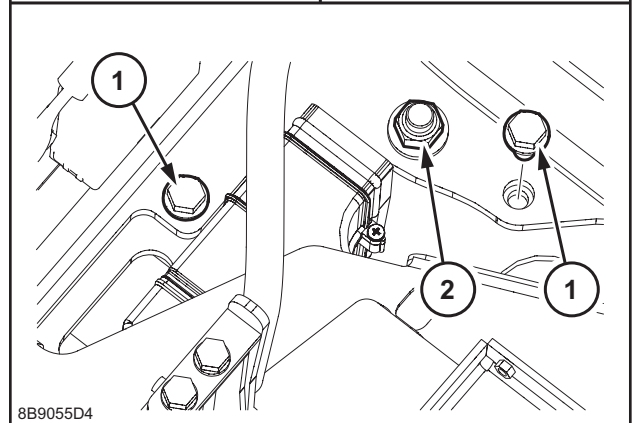
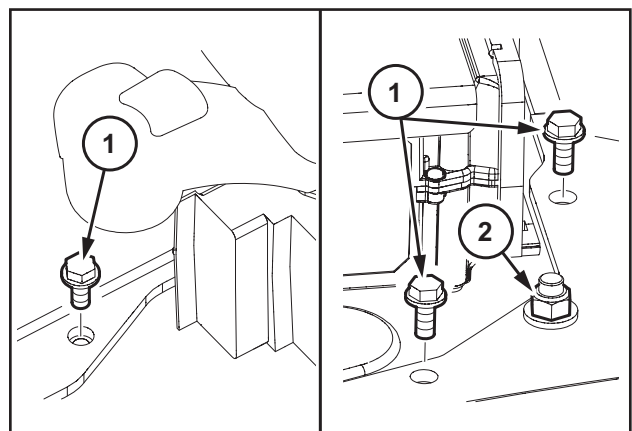
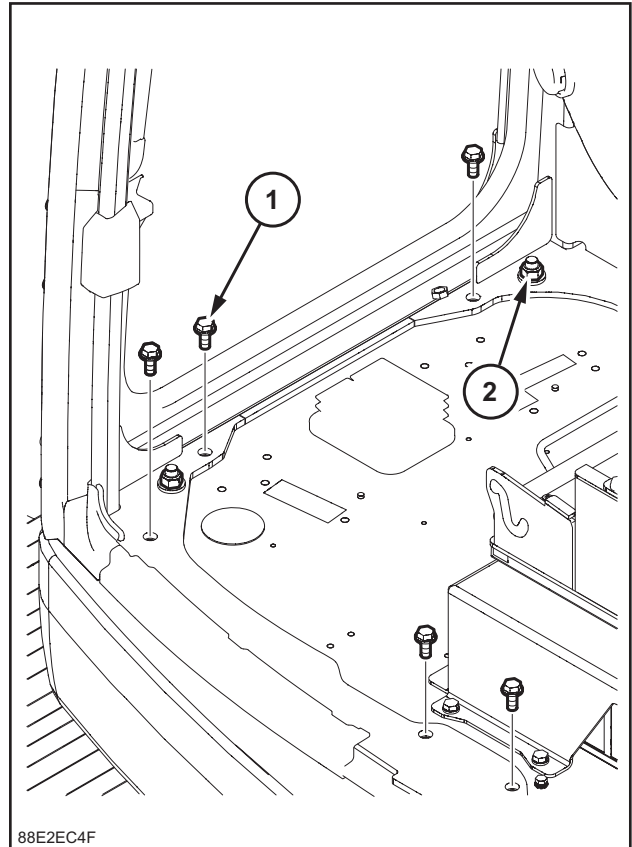
- Fully tighten the eyebolts, and then loosen them by a half turn.



12. Use chains (1) and liftcrane to secure the cab.



13. Use a wrench [19 mm (0.748 in)] to remove the 10 cab bolts (1) and 4 nuts (2).



## TABLE OF CONTENTS


<b>Electrical and Engine Functions and Service Support</b> .....	<b>7-3</b>
<b>Basic Functions</b> .....	<b>7-4</b>
Monitor Display Dimming.....	7-4
Eco gauge.....	7-4
Diagnostic Trouble Code Indicator.....	7-5
Clock.....	7-6
Fuel economy gauge.....	7-6
<b>Accessories</b> .....	<b>7-8</b>
Working Light.....	7-8
Radio Mute.....	7-9
Back monitor.....	7-9
Anti-theft.....	7-10
<b>Battery Disconnect Switch</b> .....	<b>7-11</b>
<b>Milli-amp List</b> .....	<b>7-12</b>
<b>Safety</b> .....	<b>7-14</b>
<b>Service Support</b> .....	<b>7-15</b>
Screen Operations.....	7-15
Screen Display List.....	7-15
CHECK Screen List.....	7-16
SETUP Screen List.....	7-30
<b>Setting</b> .....	<b>7-36</b>
Model Select.....	7-36
Throttle Volume Default Setting Value.....	7-40
Password Setting.....	7-40
Clock Adjustment.....	7-40
Parameter Setting.....	7-41
Screen Brightness Setting.....	7-43
<b>Connection Connector Pin Layout</b> .....	<b>7-44</b>
Computer A.....	7-44
Computer B.....	7-45
Monitor.....	7-46
<b>Sequence Circuit Diagram</b> .....	<b>7-47</b>
Code table.....	7-47
Overall.....	7-49
Block diagram.....	7-51
<b>Electrical Equipment Layout Diagram</b> .....	<b>7-60</b>
Main Unit Left Side Layout Diagram (radiator chamber).....	7-60
Engine Section Layout Diagram.....	7-62
Main Unit Right Side Layout Diagram (pump chamber).....	7-64
Cab Layout Diagram 1.....	7-65
Cab Layout Diagram 2.....	7-67
Layout Around Operator Seat.....	7-69
Stand Alone Parts Diagram.....	7-70
<b>Removal and Installation of Wiper Controller</b> .....	<b>7-86</b>
Removal of Wiper Controller.....	7-86
Installation of wiper controller.....	7-86
<b>Removal and Installation of Wiper Motor</b> .....	<b>7-87</b>
Removal of Wiper Motor.....	7-87
Installation of wiper motor.....	7-88

## R. ELECTRICAL PARTS

### Milli-amp List

	Unit	75X3/80X 3	130X3	145X3	160X3	210X3	235X3	250X3	300X3	350X3	470X3
Rotation speed SP	min <sup>-1</sup>	2000 (2000)	2000 (2000)	1850 (1850)	2100 (2100)	1800 (1800)	1700 (1700)	2000 (2000)	1800 (1800)	1900 (1900)	2000 (2000)
Rotation speed H	min <sup>-1</sup>	1900 (1900)	1850 (1850)	1750 (1750)	2000 (2000)	1650 (1650)	1600 (1600)	1850 (1850)	1700 (1700)	1750 (1750)	1800 (1800)
Rotation speed A max	min <sup>-1</sup>	1800 (1800)	1700 (1700)	1650 (1650)	1900 (1900)	1550 (1550)	1550 (1550)	1750 (1750)	1600 (1600)	1650 (1650)	1650 (1650)
Rotation speed A min (low idle)	min <sup>-1</sup>	1000 (1000)	1000 (1000)	1000 (1000)	1000 (1000)	900 (900)	900 (900)	900 (900)	900 (900)	900 (900)	900 (900)
Idle up (during low-speed rotation)	min <sup>-1</sup>	-	-	-	-	-	1200 (1200)	1200 (1200)	-	-	-
Idle up (during SP travel)	min <sup>-1</sup>	-	-	2000 (2000)	2200	-	1800 (1800)	-	-	-	-
Rotation speed; Manual DPD regeneration	min <sup>-1</sup>	-	1050 (1050)	1050 (1050)	1050 (1050)	1000 (1000)	1000 (1000)	1000 (1000)	1000 (1000)	1000 (1000)	1000 (1000)
Milli-amp SP (Hi)	mA	600	600	600	600	600	600	600	585	560	480
Milli-amp SP (Low)	mA	586	571	571	600	586	586	586	585	500	470
Milli-amp H (Hi)	mA	600	600	600	600	600	600	600	570	560	470
Milli-amp H (Low)	mA	570	571	571	570	570	570	570	570	500	470
Milli-amp A max (Hi)	mA	600	537	537	600	600	600	600	550	560	450
Milli-amp A max (Low)	mA	570	500	500	570	570	570	570	550	500	450
Milli-amp A other	mA	300	213	213	441	314	314	290	405	380	275
Milli-amp during traveling	mA	600	600	600	600	600	600	600	585	500	480
Horsepower boost (sharp load)	Y/N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Horsepower boost (sharp operation)	Y/N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Horsepower boost (boom up)	Y/N	-	N	N	N	N	N	N	N	Y	N
Overload set pressure	MPa	Not set	17.3 (2509.428 )	16.5 (2393.386 )	16.8 (2436.902 )	19.4 (2814.041 )	19.1 (2770.525 )	20.0 (2901.073 )	20.6 (2988.106 )	20.5 (2973.600 )	21.5 (3118.654 )

HOT-MAX TIME	hour	Maximum heating operation time
RECIRC.AIR MAX-TEMP.	°C (°F)	Maximum inside air temperature
RECIRC.AIR MIN-TEMP.	°C (°F)	Minimum inside air temperature
INTAKE AIR MAX-TEMP.	°C (°F)	Maximum outside air temperature
INTAKE AIR MIN-TEMP.	°C (°F)	Minimum outside air temperature

To switch to a page from 1 to 7, press the light switch  → while the WORK HISTORY

screen is displayed, and select the desired page.

**ENGINE HISTORY**

The engine speed, coolant temperature, fuel temperature, and suction air temperature distributions, etc. can be displayed.

<b>ENGINE HISTORY</b>				1/18
ROTATION < R1	0 0 1 0	hour		
R1 ≤ ROTATION < R2	0 0 2 0	hour		
R2 ≤ ROTATION < R3	0 0 3 0	hour		
R3 ≤ ROTATION < R4	0 0 2 0	hour		
R4 ≤ ROTATION < R5	0 0 1 0	hour		
R5 ≤ ROTATION < R6	0 0 0 5	hour		
R6 ≤ ROTATION	0 0 0 5	hour		

ke61mp-001

**1. Actual speed distribution**

<b>ENGINE HISTORY</b>				1/18
ROTATION < R1	0 0 1 0	hour		
R1 ≤ ROTATION < R2	0 0 2 0	hour		
R2 ≤ ROTATION < R3	0 0 3 0	hour		
R3 ≤ ROTATION < R4	0 0 2 0	hour		
R4 ≤ ROTATION < R5	0 0 1 0	hour		
R5 ≤ ROTATION < R6	0 0 0 5	hour		
R6 ≤ ROTATION	0 0 0 5	hour		

ke61mp-001

ROTATION < R1	hour	S ≤ 1025
R1 ≤ REV. SPEED < R2	hour	1025 ≤ S < 1225
R2 ≤ REV. SPEED < R3	hour	1225 ≤ S < 1425
R3 ≤ REV. SPEED < R4	hour	1425 ≤ S < 1625
R4 ≤ REV. SPEED < R5	hour	1625 ≤ S < 1825

R5 ≤ REV. SPEED < R6	hour	1825 ≤ S < 2025
R6 ≤ REV. SPEED	hour	2025 ≤ S

**2. Water temperature distribution**

<b>ENGINE HISTORY</b>				2/18
TEMP < T1	0 0 1 0	hour		
T1 ≤ TEMP < T2	0 0 2 0	hour		
T2 ≤ TEMP < T3	0 0 3 0	hour		
T3 ≤ TEMP < T4	0 0 2 0	hour		
T4 ≤ TEMP < T5	0 0 1 0	hour		
T5 ≤ TEMP < T6	0 0 0 5	hour		
T6 ≤ TEMP	0 0 0 5	hour		
<b>TEMP MAX</b>				°C

ke61mp-002

TEMP. < T1	hour	T < 77
T1 ≤ TEMP. < T2	hour	77 ≤ T < 82
T2 ≤ TEMP. < T3	hour	82 ≤ T < 97
T3 ≤ TEMP. < T4	hour	97 ≤ T < 100
T4 ≤ TEMP. < T5	hour	100 ≤ T < 103
T5 ≤ TEMP. < T6	hour	103 ≤ T < 105
T6 ≤ TEMP.	hour	105 ≤ T
-	-	-
TEMP. MAX	°C (°F)	Maximum temperature

**3. Fuel temperature distribution**

<b>ENGINE HISTORY</b>				3/18
TEMP < T1	0 0 1 0	hour		
T1 ≤ TEMP < T2	0 0 2 0	hour		
T2 ≤ TEMP < T3	0 0 3 0	hour		
T3 ≤ TEMP < T4	0 0 2 0	hour		
T4 ≤ TEMP < T5	0 0 1 0	hour		
T5 ≤ TEMP < T6	0 0 0 5	hour		
T6 ≤ TEMP	0 0 0 5	hour		
<b>TEMP MAX</b>				°C

ke61mp-003

TEMP. < T1	hour	T < 40
T1 ≤ TEMP. < T2	hour	40 ≤ T < 50
T2 ≤ TEMP. < T3	hour	50 ≤ T < 60
T3 ≤ TEMP. < T4	hour	60 ≤ T < 70
T4 ≤ TEMP. < T5	hour	70 ≤ T < 80
T5 ≤ TEMP. < T6	hour	80 ≤ T < 90
T6 ≤ TEMP.	hour	90 ≤ T
-	-	-
TEMP. MAX	°C (°F)	Maximum temperature

## R. ELECTRICAL PARTS

RESERVE 1	(Option)
-----------	----------

### REMOTE SUPPORT

Value	Contents	Remarks
0	None	Currently not supported
1	Used	Currently not supported

### FMS

Value	Contents	Remarks
0	None	Currently not supported
1	Used	Currently not supported

### FREE SWING

Value	Contents	Remarks
0	None	
1	Used	

### ANGLE SENSOR

Value	Contents	Remarks
0	MONO	Supported from Ver. 2.00
1	OFFSET	Supported from Ver. 2.00
2	ELEVETER	Supported from Ver. 2.00

### PARAMETERS

The work mode speed and pump milli-amps can be set.

#### 1. Engine

<table border="1"> <thead> <tr> <th>PARAMETERS</th> <th>01/03</th> </tr> </thead> <tbody> <tr> <td>Lo-IDLE ENGINE SPEED</td> <td>: 1 0 0 0 min<sup>-1</sup></td> </tr> <tr> <td>AUTO IDLE TIME</td> <td>: 0 0 0 5 sec</td> </tr> <tr> <td>AUTO IDLE ENGINE SPEED</td> <td>: 1 2 0 0 min<sup>-1</sup></td> </tr> <tr> <td>IDLE SHUT DOWN TIME</td> <td>: 0 0 3 . 0 min</td> </tr> <tr> <td>AUTO POWER BOOST</td> <td>: + + + + on/off</td> </tr> <tr> <td>PUMP POWER AT START</td> <td>: 0 0 5 0 mA</td> </tr> <tr> <td>PUMP POWER DOWN</td> <td>: 0 0 0 0 mA</td> </tr> <tr> <td>REV. LIMIT AT BREAKER</td> <td>: on/of</td> </tr> <tr> <td>ENABLE POWER SAVE</td> <td>: + + + + on/off</td> </tr> </tbody> </table>	PARAMETERS	01/03	Lo-IDLE ENGINE SPEED	: 1 0 0 0 min <sup>-1</sup>	AUTO IDLE TIME	: 0 0 0 5 sec	AUTO IDLE ENGINE SPEED	: 1 2 0 0 min <sup>-1</sup>	IDLE SHUT DOWN TIME	: 0 0 3 . 0 min	AUTO POWER BOOST	: + + + + on/off	PUMP POWER AT START	: 0 0 5 0 mA	PUMP POWER DOWN	: 0 0 0 0 mA	REV. LIMIT AT BREAKER	: on/of	ENABLE POWER SAVE	: + + + + on/off
PARAMETERS	01/03																			
Lo-IDLE ENGINE SPEED	: 1 0 0 0 min <sup>-1</sup>																			
AUTO IDLE TIME	: 0 0 0 5 sec																			
AUTO IDLE ENGINE SPEED	: 1 2 0 0 min <sup>-1</sup>																			
IDLE SHUT DOWN TIME	: 0 0 3 . 0 min																			
AUTO POWER BOOST	: + + + + on/off																			
PUMP POWER AT START	: 0 0 5 0 mA																			
PUMP POWER DOWN	: 0 0 0 0 mA																			
REV. LIMIT AT BREAKER	: on/of																			
ENABLE POWER SAVE	: + + + + on/off																			

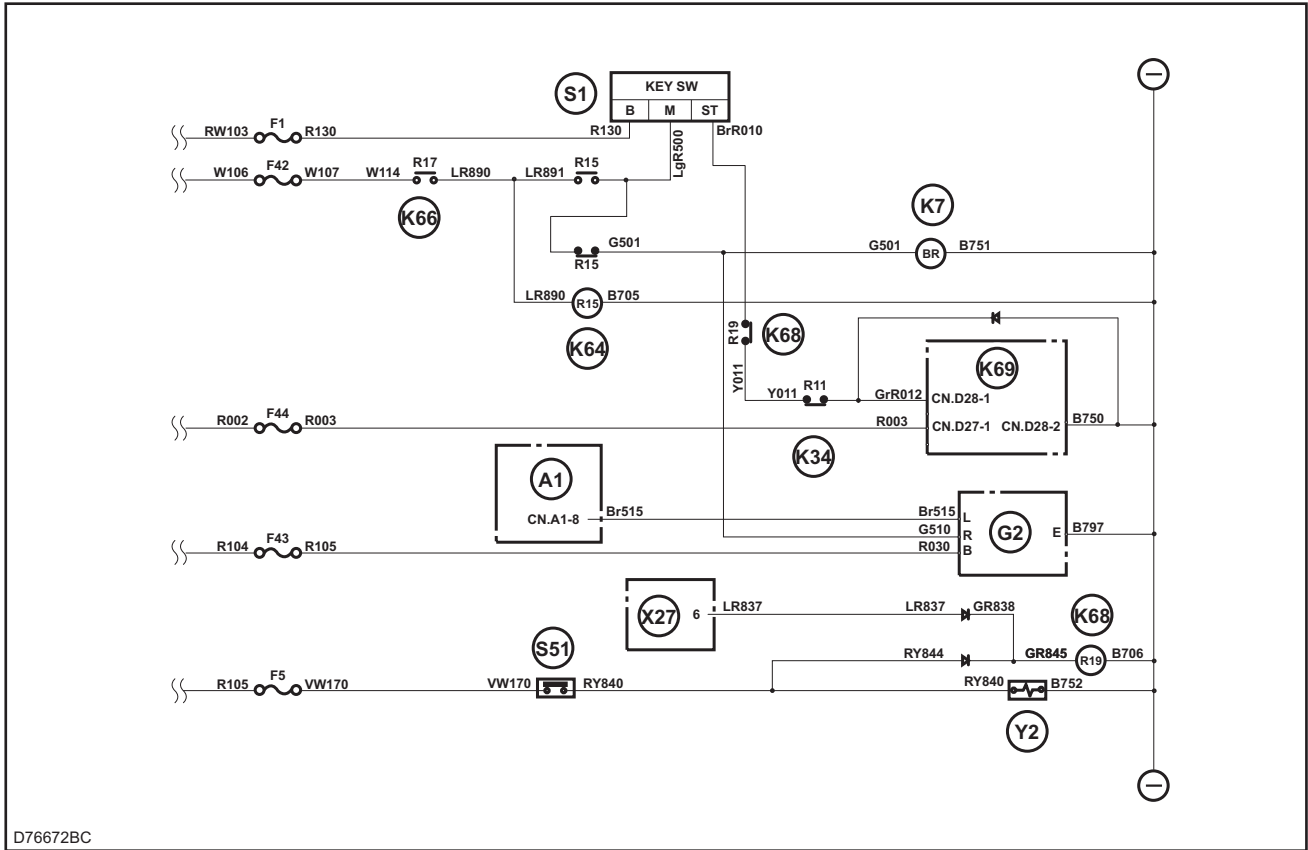
3C23326C

Lo-IDLE ENGINE SPEED	min <sup>-1</sup> (rpm)	Low idle engine speed
AUTO IDLE TIME	sec	Auto idle time
AUTO IDLE ENGINE SPEED	min <sup>-1</sup> (rpm)	Auto idling speed
IDLE SHUT DOWN TIME	min	Idle shutdown time
AUTO POWER BOOST	on/off	Auto pressure boost control ON/OFF
PUMP POWER AT START	mA	When the operation of horsepower proportional valve ATT is started
PUMP POWER DOWN	mA	Horsepower proportional valve down offset amount
REV. LIMIT AT BREAKER	on/off	Flow control by engine speed (in breaker mode)

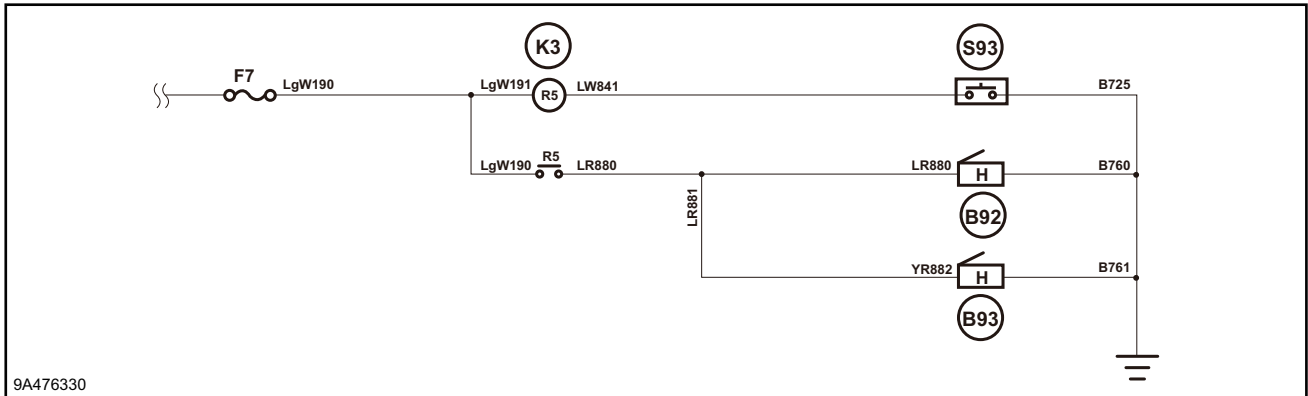


# R. ELECTRICAL PARTS

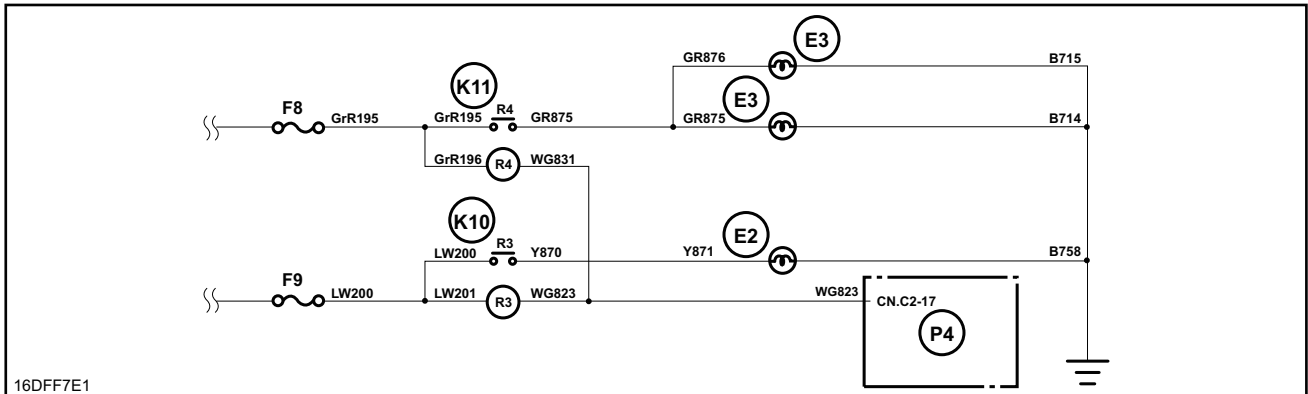
## Lever Lock



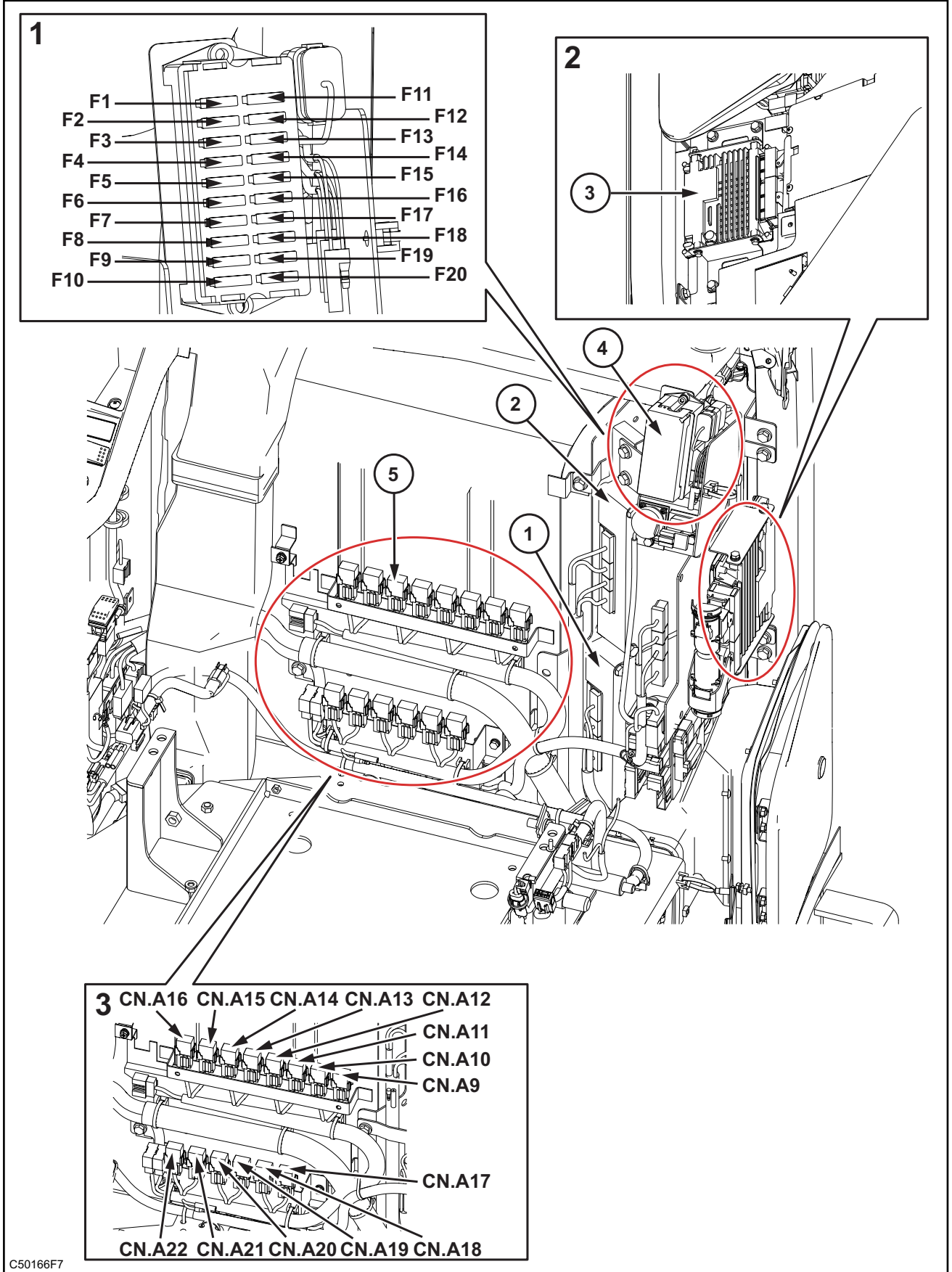
## Horn



## Working lights



Cab Layout Diagram 2

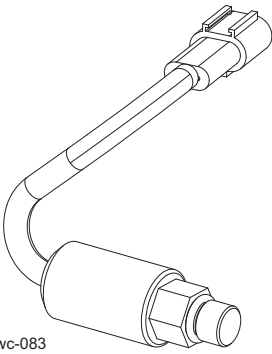
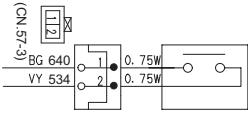
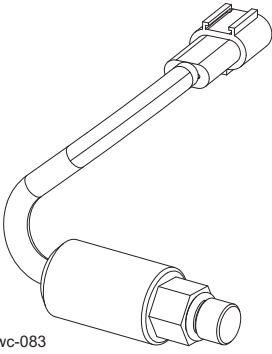
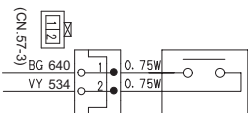
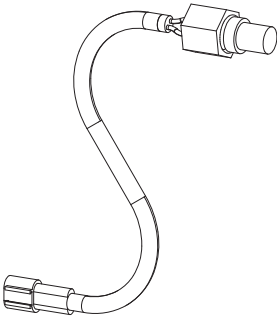
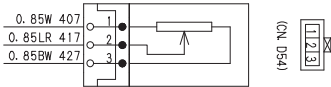
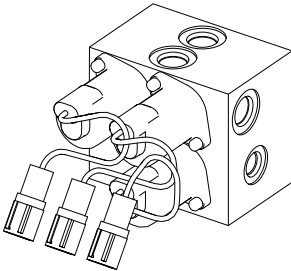
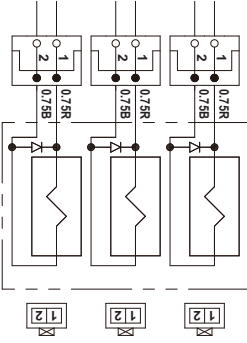


C50166F7

1	Computer B	3	ECM (engine control module)	5	Relay
2	Computer A	4	Fuse box		

R. ELECTRICAL PARTS

# R. ELECTRICAL PARTS

Name	Shape	Circuit	Remarks
Pressure switch (travel and upper)	 <p>akffwc-083</p>	 <p>akffwc-084</p>	Specification; 1.96 MPa Sumitomo part No.; KHR26940
Pressure switch (swing) (blade) (boom swing)	 <p>akffwc-083</p>	 <p>akffwc-084</p>	Specification; 0.49 MPa Sumitomo part No.; KHR21490
Pressure sensor (filter)	 <p>akffwc-085</p>	 <p>8E3E78EB</p>	Sumitomo part No.; KHR32870
3 stack solenoid valve	 <p>6663F8B2</p>	 <p>74A67703</p>	Sumitomo part No.; KHJ15440

**Removal and Installation of Monitor**

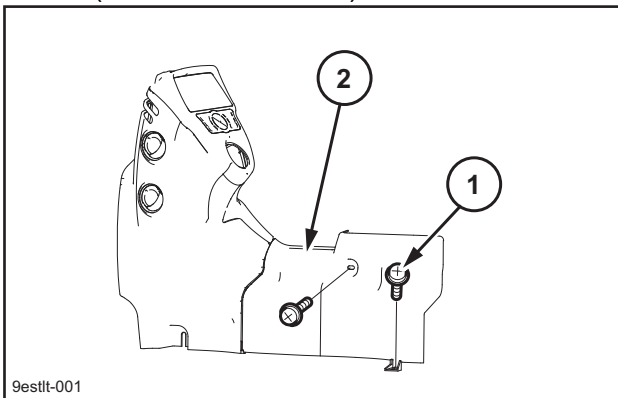
Job code	<b>RMIN01</b>
----------	---------------

Items to prepare

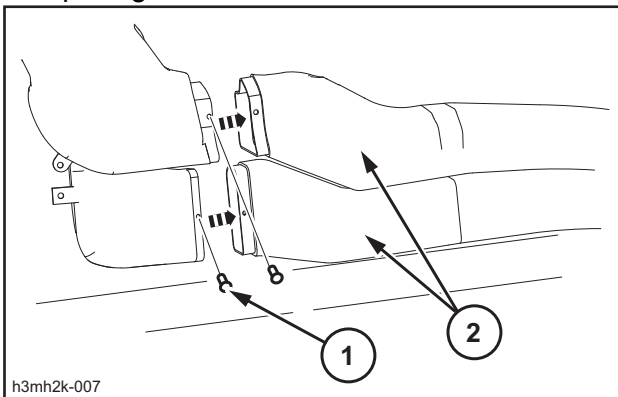
- Wrench [10 mm (0.394 in.)]
- Hexagon wrench
- Phillips screwdriver

Removal of Monitor

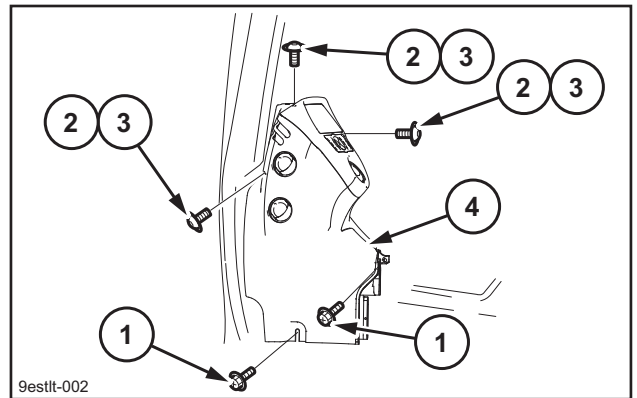
1. Use a Phillips screwdriver or box wrench [10 mm (0.394 in.)] to remove the 2 bolts (1), and then remove the side front lower trim (2).
  - Bolt (1) tightening torque: 5.9 - 7.8 N·m (4.353 - 5.753 lbf·ft.)



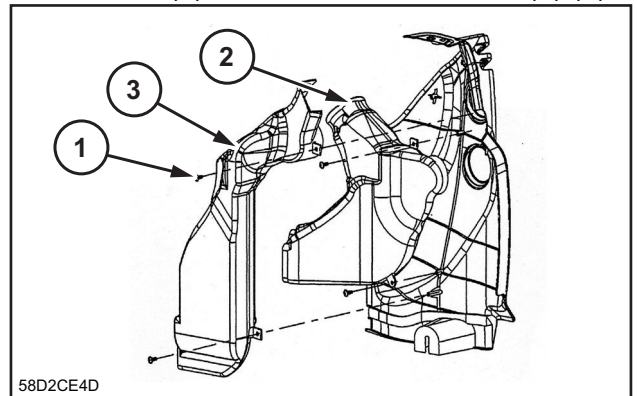
2. Use a flathead screwdriver or longnose pliers to remove the clip pins (1), and then remove the air conditioner ducts (2) by pulling them forward.



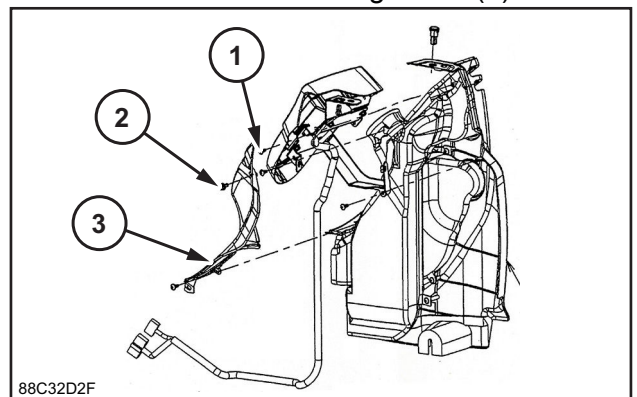
3. Use a Phillips screwdriver or box wrench [10 mm (0.394 in.)] to remove the 2 bolts (1), use a hexagon wrench [5 mm (0.197 in.)] to remove the 3 bolts (2) and 3 washers (3), and then remove the front upper trim assembly (4).
  - Bolt (1) tightening torque: 5.9 - 7.8 N·m (4.353 - 5.753 lbf·ft.)



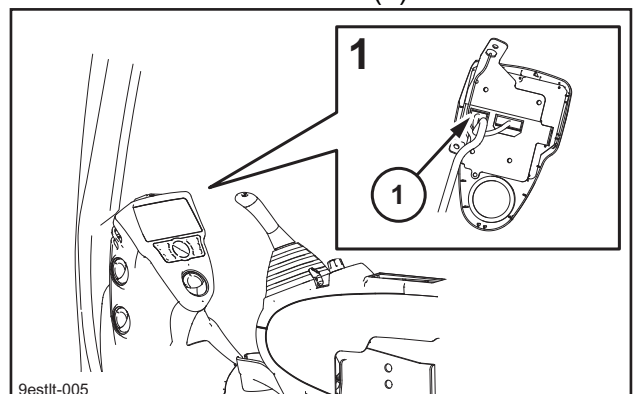
4. Use the flathead screwdriver or longnose pliers to remove the truss head tapping screws (1), and then remove ducts (2) (3).



5. Use the flathead screwdriver or longnose pliers to remove the truss head tapping screws (1), and then use a wrench [10 mm (0.394 in.)] to remove the 1 bolt (2) and remove the side front right trim (3).



6. Remove the connector (1).



## R. ELECTRICAL PARTS

P	W	B	R	Y	G	L	Br	Lg	O	Sb	V
Pink	White	Black	Red	Yellow	Green	Blue	Brown	Light green	Orange	Sky blue	Violet

Code	Part name	Code	Part name	Code	Part name
1	Main key switch	7	Compressor	13	Inside air sensor
2	A/C main power supply	8	Blower OFF relay	14	Motor actuator (air mix)
3	Power supply for compressor clutch	9	Blower motor	15	Motor actuator (mode)
4	Power supply for controller	10	Blower amp	16	Motor actuator (refresh/recirculate switch)
5	Sunlight sensor	11	Compressor relay	17	CAN signal
6	Pressure switch (receiver dryer)	12	Evaporator sensor	18	Control panel (TKS-CP208D0)

### note\_caution

- Wire diameters that are not indicated are 0.5.
- Broken lines indicate wiring on the vehicle side.
- Codes displayed on the connectors indicate the code colors seen from the connection ports of the connectors.

## Explanation of Functions

### Explanation of Control

#### Back-up function

Even when air conditioner operation is stopped (switched OFF) with the vehicle main key power supply or operation panel ON/OFF switch, the set temperature and all the other setting states are stored in memory, so the next time air conditioner operation starts, it goes into the same state as before it was stopped.

When the vehicle main key power supply is cut off, the data is backed up by storing it in the internal EEPROM.

However, if the main key power supply is cut off within 0.5 sec. of switch input, that switch input is not stored into memory.

Also, the data read out from EEPROM when the power is switched ON is judged to see if it is within the valid range. If data outside the valid range was written into memory, for example due to noise, then operation starts from the default setting values to avoid abnormal operation.

#### Fahrenheit temperature display

To switch, hold down both the temperature setting UP and DOWN switches for 5 sec.

The display toggles between Celsius and Fahrenheit display each time the switches are both held down for 5 sec.

The Fahrenheit display is a 2-digit integer and below the decimal point is not used, so "F" is displayed.

However, in case of trouble, this display takes priority.

When this display is switched, the new status is backed up in memory, so even if the main key power supply is switched OFF, the display status is retained.

Internal calculations are all done in Celsius. Only the operation panel display is in Fahrenheit.

Therefore, the display may differ slightly from the exact Fahrenheit temperature.

Below is shown the Fahrenheit temperature and the corresponding Celsius temperature used in internal processing.

### Caution

Temperatures are given in Celsius in this manual.

Therefore, see the table below to convert Fahrenheit displays to Celsius display values.

Fahrenheit display [°F]	Interior recognition set temperature (Celsius) [°C]
63 F	18.0
64 F	18.5

[2] Sensor diagnosis

The detection value (AD value or °C ( °F )) for each sensor is displayed.

[3] Coolant temperature signal recognition value

This displays the reception status for the coolant temperature signal sent from the vehicle.

4. Display contents in monitor mode

In monitor mode, the data (detection value for each sensor, coolant temperature signal recognition, etc.) is displayed in the 3-digit of the 7-segment display for the temperature setting.

Selection of displayed data is done using the air flow setting switch and AUTO switch.

The air flow setting switch moves the display on the dedicated monitor mode 7-segment display through 16 displays, 0 - F, and the corresponding data is displayed. (Table A)

Hexadecimal data display and decimal data display can be selected with the AUTO switch.

Only for the coolant temperature signal recognition value, the value detected immediately before entry into monitor mode is displayed.

The difference between hexadecimal data and decimal data is indicated by the 3rd-digit of the 7-segment display for the temperature setting. For hexadecimal data, "H" is displayed there and for decimal data, numbers (0 - 9) are displayed there.

[1] Hexadecimal display

AD values 00H - FFH are displayed.

When the AD value corresponds to that in Table B (or Table C for the solar radiation sensor), this indicates a disconnection or short.

In the hexadecimal display, when the value of a sensor changes in monitor mode, the hexadecimal display changes with it.

If the display before entering monitor mode was HL. \*, the error judgment value is displayed. (In other words, the detected value before the abnormality was detected) In the same way, if the display before entering monitor mode was \*\*. E, the display becomes \*\*.E and the error judgment value is displayed.

[2] Decimal display

Decimal display is used from -99.9 °C - 99.9 °C ( -147.8 °F - 211.8 °F ).

Also, the "-" minus display is displayed on the left side of the 3 digit segment.

5. Air conditioner operation in monitor mode

When the system enters monitor mode, all output (operation) through control is stopped and until monitor mode is ended, operations and settings of basic control through all the switches are not possible.

6. Ending monitor mode

In monitor mode, if the operation panel ON/OFF switch closed path continues for 1 sec. while the refresh/recirculate select switch closed path is ongoing, monitor mode is ended and the system returns to the basic control state.

The same also occurs if the vehicle main key power supply is switched OFF.

Table A: Monitor mode display contents

Exclusively for monitor mode 7 seg	Display contents
0	Inside air sensor temperature data
1	Evaporator sensor temperature data
2	Solar radiation compensation data
3	Outside air data
4	-
C	Coolant temperature signal status data

## R. ELECTRICAL PARTS

Step	Action	Standard value	Yes	No
3	The panel snow mark flashes.		<ul style="list-style-type: none"> <li>Inside air sensor and evaporator sensor simultaneous disconnection or short</li> <li>Computer breakdown</li> </ul> See the Monitor Mode section too.	<ul style="list-style-type: none"> <li>Inside air sensor or harness disconnection or short</li> <li>The inside air sensor connector is disconnected or has a contact defect.</li> </ul> See the Monitor Mode section too. Inspect and repair or replace part.
4	The panel snow mark flashes.		<ul style="list-style-type: none"> <li>The evaporator sensor connector is disconnected or there is a contact defect.</li> <li>Evaporator sensor simultaneous disconnection or short</li> </ul> See the Monitor Mode section too. Inspect and repair or replace part.	Go to Step 5
5	When the set temperature is 18.0 and the blow mode is set to vent mode, the blow temperature drops.	18.0 °C (64.4 °F)	Go to Step 6	Go to Step 7
6	Cool air is flowing into the inside air sensor section.		Inspect the duct or eliminate the cause of the cool air infiltration.	Computer breakdown or inside air sensor defect Inspect and replace.
7	The air mix damper is at the COOLMAX position.		Switch compressor clutch ON/OFF and inspect and repair the power supply circuit. See the cooling cycle troubleshooting.	Go to Step 8
8	If air mix damper stops midway, remove the cause or correct the problem, and then measure the operating force. Is it 1.5 kgf or less?	1.5 kgf or less	Motor actuator breakdown or computer breakdown Replacement	<ul style="list-style-type: none"> <li>Inspect, repair, or replace the motor actuator lever link section.</li> <li>Clean the lever link section, then apply grease.</li> </ul>

The blow temperature does not go up.

Step	Action	Standard value	Yes	No
1	HL. E is displayed on the panel set temperature display section.		<ul style="list-style-type: none"> <li>The air mix motor actuator connector is disconnected or has a contact defect.</li> <li>Air mix motor actuator defect</li> <li>Main harness continuity defect</li> </ul>	Go to Step 2

## Assembly and Disassembly of Unit

**⚠ Caution**

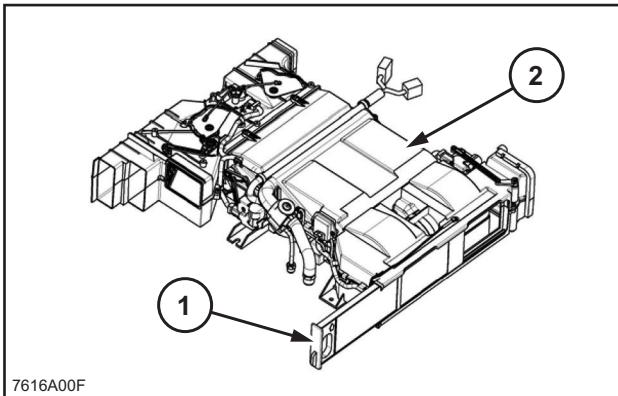
- Be sure to stop the engine before beginning work.

**⚠ Caution**

- When replacing the evaporator, resupply and check the compressor oil quantity.

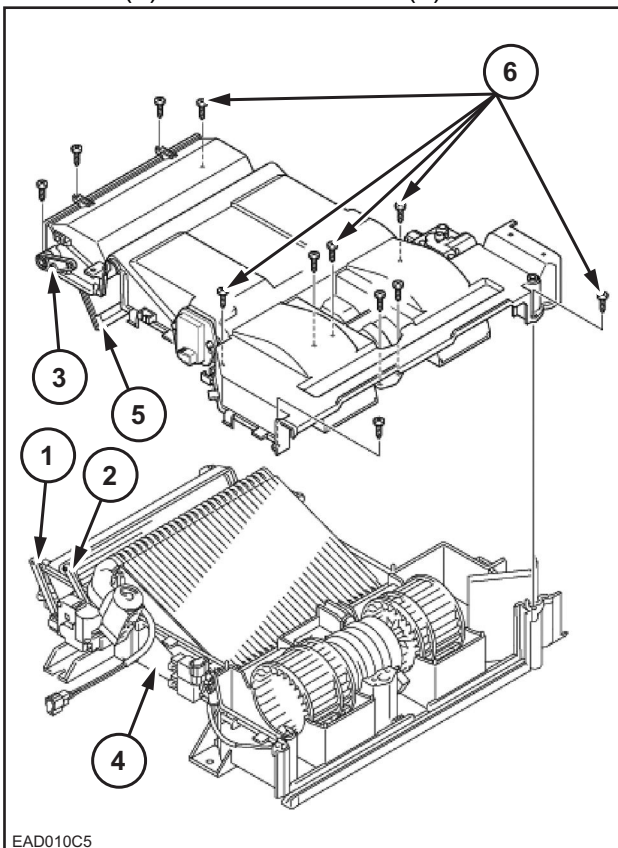
### Removal of inside air filter

1. Slide the inside air filter (1) to the left and remove it from the unit (2).



### Removal of Blower Unit

1. Remove rod air MIX (1) and rod sub air MIX (2) from lever air MIX (3).

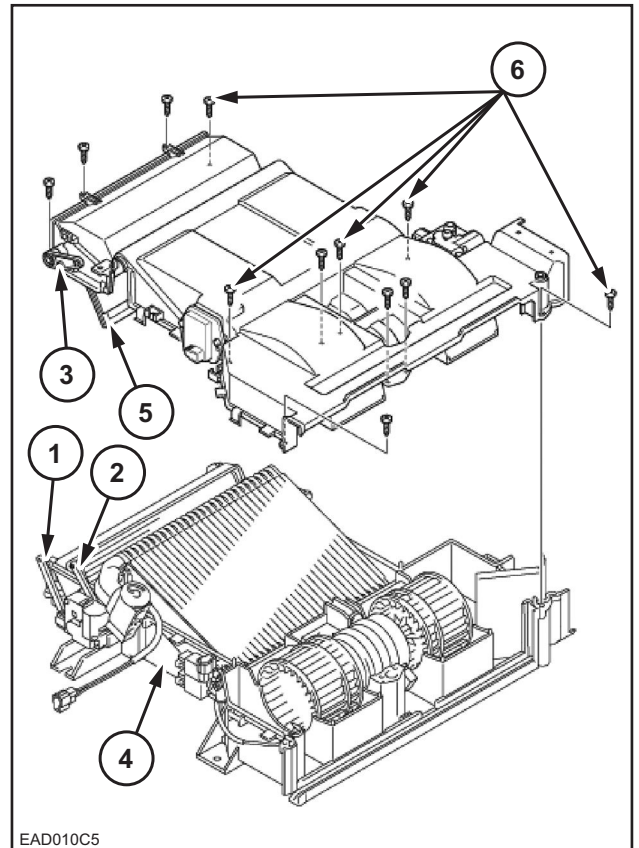


2. Remove the 10 Phillips screws (6) that are used on the bottom (4) and the top of (5) the unit case.

- While being careful not to let the thermistor harness get caught by the case, pull the top of the unit case (5) upwards to remove it.

Screw size

Phillips screws (3): M5 x 16 (0.630)(T1)



### Replacement of Blower Motor

**⚠ Caution**

Do not remove the fan from the blower motor.

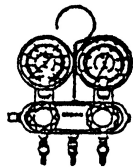

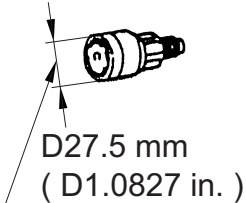
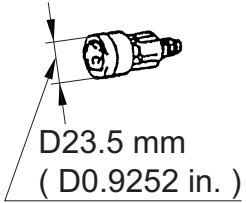

1. Remove the connector (2) connected to the blower motor (1) and remove the blower motor (1) from the bottom of the unit case (3).
- The installation procedure is the reverse of the removal procedure.

## R. ELECTRICAL PARTS

### Operation Chart

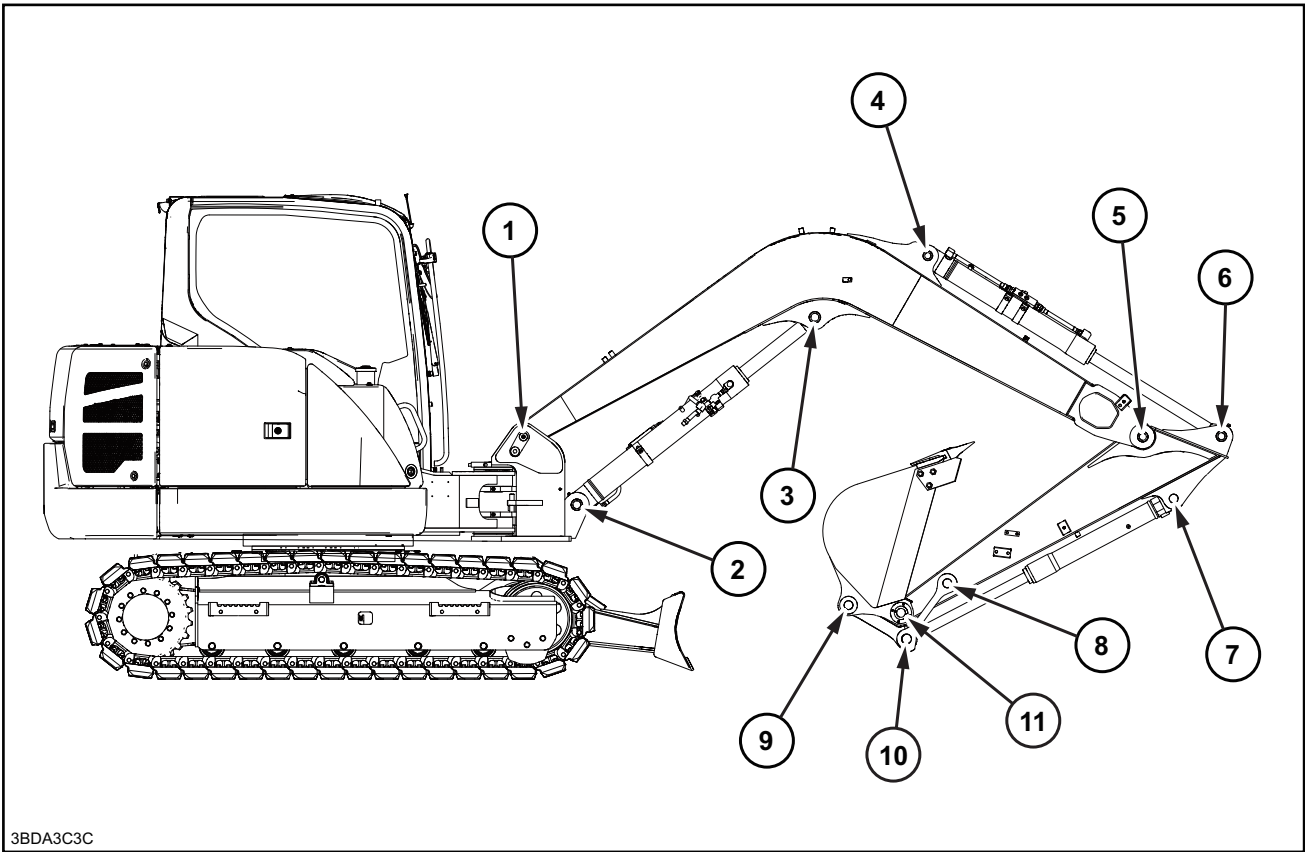
Vacuuming operation	Vacuuming start	30 min. or longer (750 mmHg or less)
	↓	
	Vacuuming stop	Let sit for 5 min.
	↓	
	Airtightness check	Gauge display abnormality (connectors check and repair)
Refrigerant filling operation	↓	
	Refrigerant filling	Fill with refrigerant gas up to a gauge pressure of 14.21525 psi.
	↓	
	Gas leak check	
	↓	
	Refrigerant filling	

### Tools

No.	Part name	Q'ty	Shape	Application
1	Gauge manifold	1	 <small>ijjccq-001</small>	
2	Charging hose	3	 <small>ijjccq-002</small>	Red: high-pressure side Blue: low-pressure side Yellow: vacuum pump side
3	Quick joint	1	 D27.5 mm ( D1.0827 in. ) <small>9F8194C8</small>	
4	Quick joint	1	 D23.5 mm ( D0.9252 in. ) <small>B5F541CD</small>	Low-pressure side
5	T joint	1	 <small>ijjccq-005</small>	For service can valve

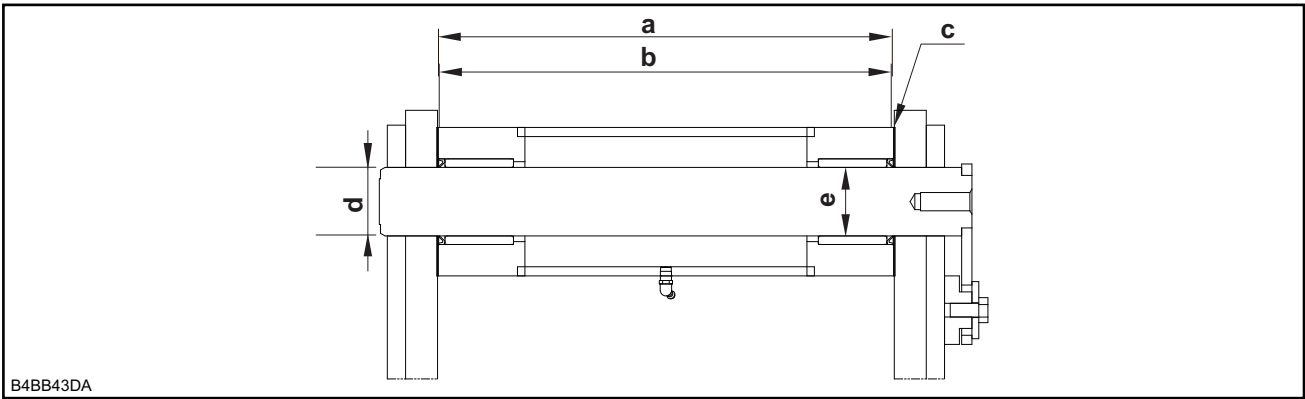
**Maintenance Standards**

**Attachment (backhoe)**



V. ATTACHMENTS

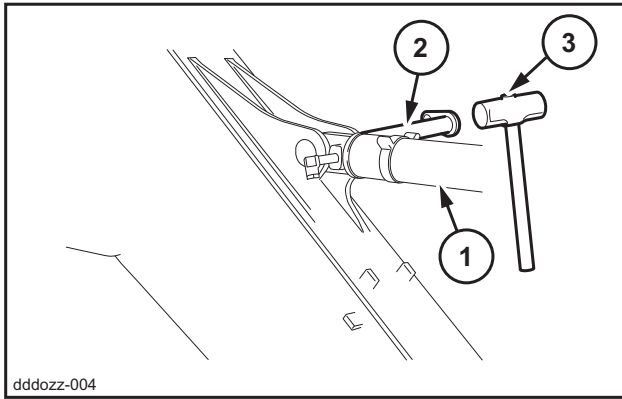
1. Boom and Swing Bracket Installation Section



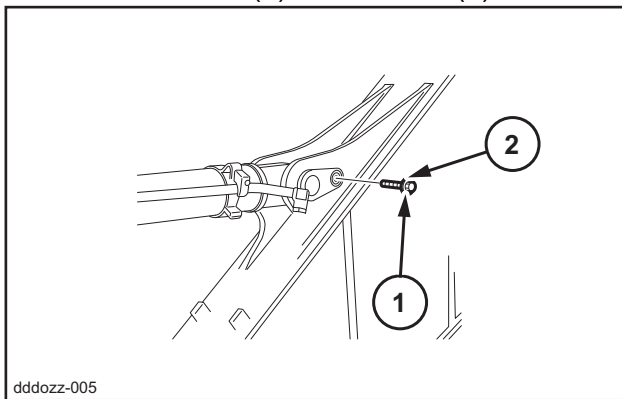
Part name	Code	Measurement dimension		Standard value		Usage limit		Judgment	Action
		(mm)	(in.)	(mm)	(in.)	(mm)	(in.)		
Swing bracket	a			400	15.748	410	16.142	Acceptable/ Unacceptable	-
Boom	b			399	15.709	397	15.630	Acceptable/ Unacceptable	Replacement
Clearance	c			1.0 - 3.5	0.039 - 0.138	Shim adjustment	Shim adjustment	Acceptable/ Unacceptable	Adjustment with shims

## V. ATTACHMENTS

---

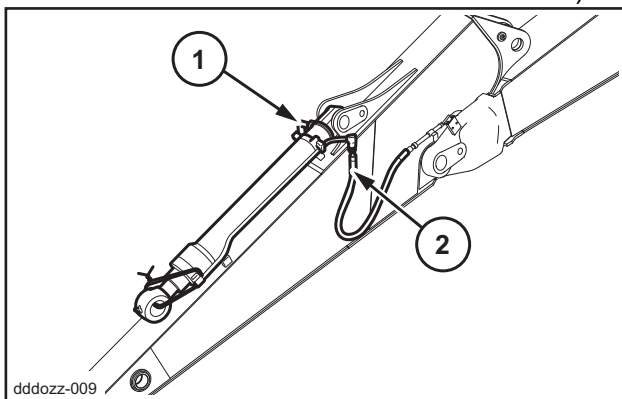


5. Use a wrench [ 19 mm ( 0.748 in ) ] to install the bolt (1) and washer (2).

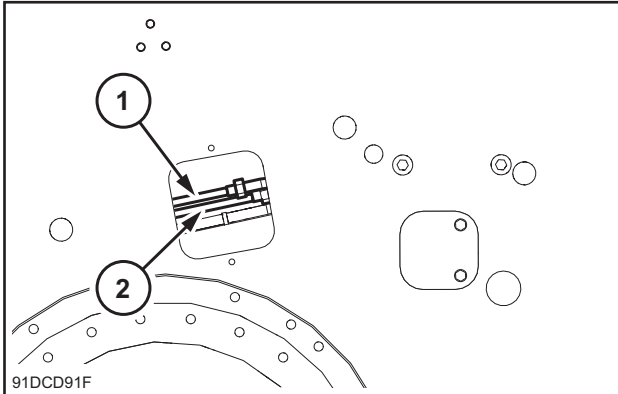


6. Use 2 wrenches [ 36 mm ( 1.417 in ) ] to install the hoses (1) (2).

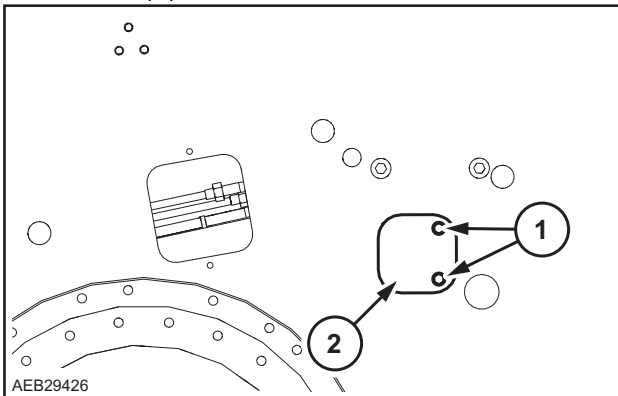
- Install the bucket link. (For details, see "Removal and Installation of Bucket Link".)
- Install the bucket. (For details, see "Removal and Installation of Bucket".)



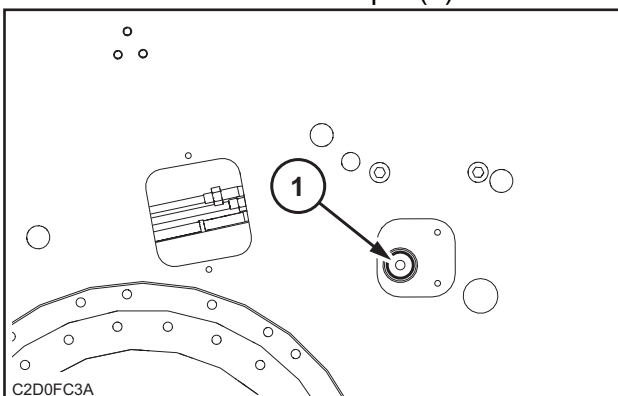
6. Use 2 wrenches [27 mm (1.063 in.)] to remove the hoses (1) (2).
- Use caps or plugs to cover the hoses and lines to prevent any entry of water, dust or dirt.
  - Clean the hoses and lines by spraying them with a parts cleaner to prevent scratches and prevent dirt from accumulating on the connectors.



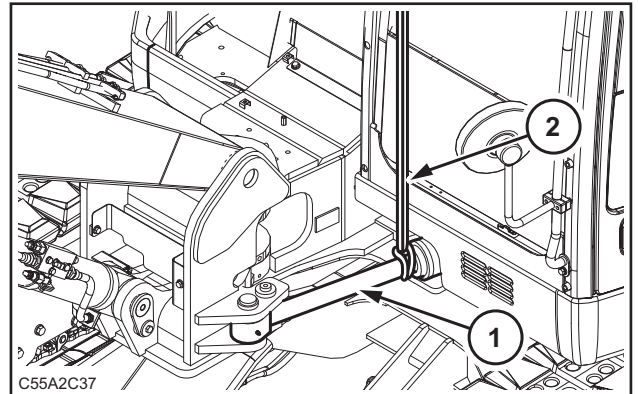
7. Use a wrench [19 mm (0.748 in.)] to remove the 2 bolts (1), then remove the cover (2).



8. Pull out the attachment pin (1).



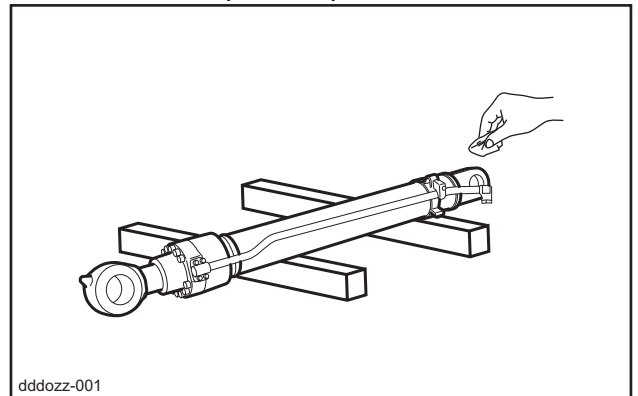
9. Use a liftcrane and nylon sling (2) to lift up the boom swing cylinder (1) and pull it out from under the cab, then place it on the cross-tie.



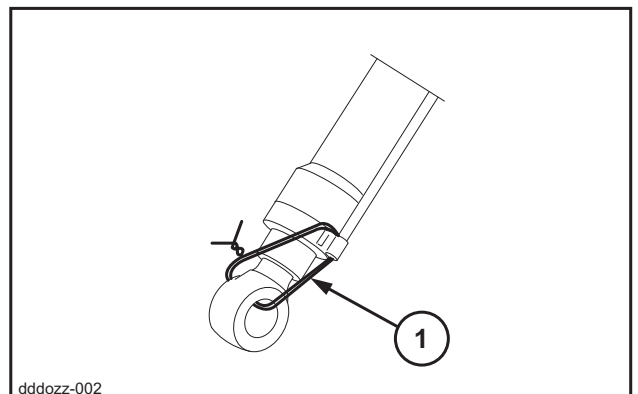
### Installation of Boom Swing Cylinder

- Tighten lines and bolts being installed to the specified torque.
- When the torque is not specified, check the "Bolt Size and Torque Table".

1. Clean each pin and pin hole.



2. Tie the cylinder rod with wire (1) so that it cannot come out.



3. Use a liftcrane and nylon sling (2) to lift the boom swing cylinder (1).
- Wrap the nylon sling to prevent it from crushing.

## V. ATTACHMENTS

L1	Maximum retracted length 548 - 552 mm (21.730 - 21.570 in.)
L2	Stroke 178.8 - 181.3 mm (7.039 - 7.138 in.)

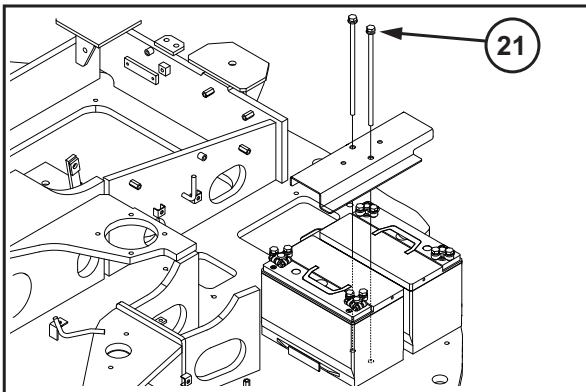
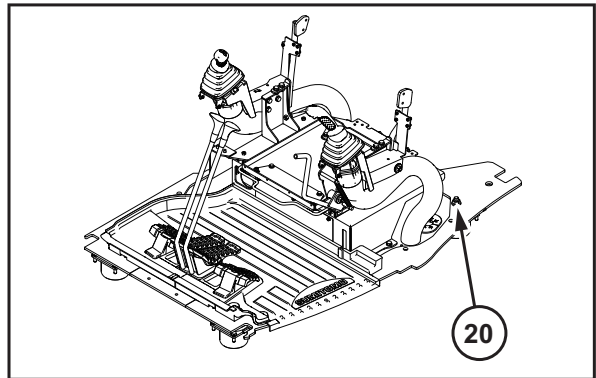
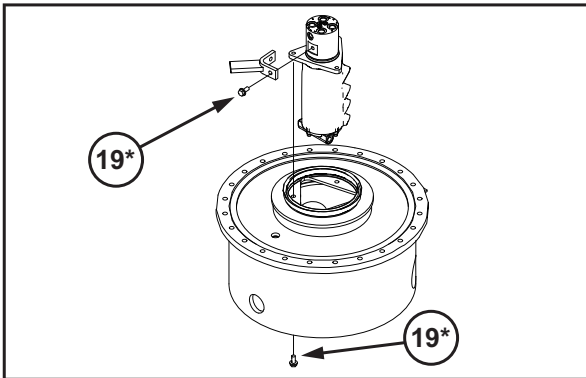
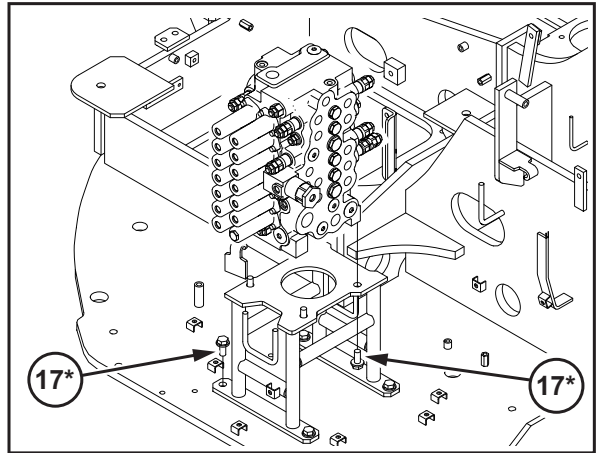
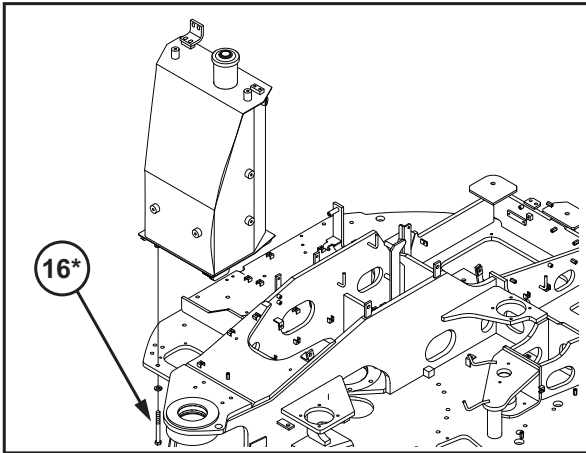
Code	kg	lb
a	45	99.208

Code	N·m	lbf·ft.	Code	N·m	lbf·ft.
b	834	614.7	e	72.6 - 80.2	53.557 - 59.162
c	2220	1636.1	f	16.3 - 18.1	12.025 - 13.352
d	26.5 - 36.5	19.530 - 36.500			

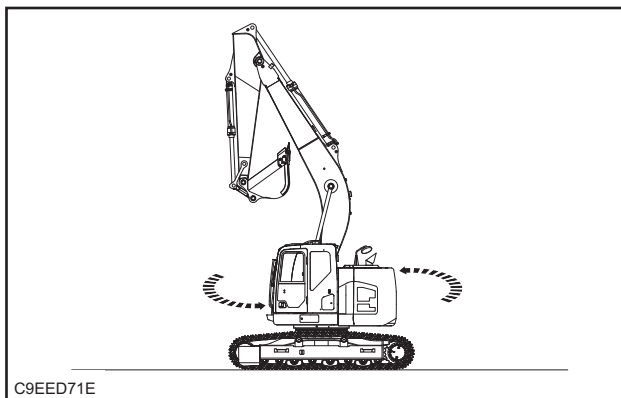
Code	mm	in.	Code	mm	in.
g	86	3.386	n	6	0.236
h	D70	D2.756	o	63	2.480
i	D110	D4.330	p	D70H8	D2.755905 - 2.560866
j	D132	D5.196	q	R60	R2.362
k	86	3.385	r	D55	D2.165
l	103	4.055	s	R55	R2.165
m	75	2.953	t	D133	D5.236

Code	Part name	Q'ty	Code	Part name	Q'ty
1	Tube subassembly	1	13	Nut	1
2	Rod subassembly	1	14	Locking screw	1
3	Cylinder head	1	15	Steel ball	1
4	Bushing	1	16	Pin bushing	2
5	U-ring	1	17	Wiper ring	4
6	Wiper ring	1	18	Pipe subassembly	1
7	O-ring	1	19	Plug	1
8	Backup ring	1	20	O-ring	2
9	O-ring	1	21	Pipe holder	1
10	Piston	1	22	Bolt subassembly	1
11	Seal ring assembly	1	23	Grease nipple	2
12	Slide ring	2			

Z. OTHER



92AEF38B



Swing (180°) Brake Angle

**Measurement method**

- [1] Engine high idle
- [2] Oil temperature is 45 °C - 55 °C (113.0 °F - 131.0 °F).
- [3] No load
- [4] Swing 180° and measure the flow angle after neutral braking

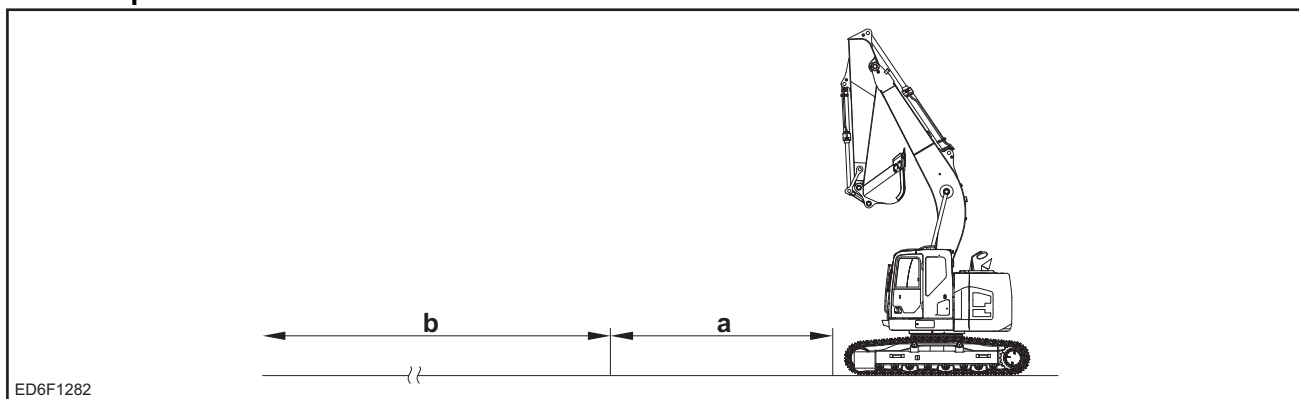
**Main unit posture: same as the swing speed**

Travel Speed

**Measurement method**

- [1] Engine high idle and oil temperature is 45 °C - 55 °C (113.0 °F - 131.0 °F) with no load.
- [2] Measure the required time to travel 6 m after a 4 - 5 m (13.13 - 16.40 ft) running start. If the off travel distance is 1 m or more, however, use the off travel distance as a reference value to correct the off travel, then measure the travel speed again.
- [3] Travelling should be done on concrete.
- [4] Conduct both high-speed and low-speed travelling.

**Main unit posture**



a	4 - 5 m (13.13 - 16.40 ft) Running start
b	6 m (19.69 ft) Travel

Off Travel Amount

**Measurement method**

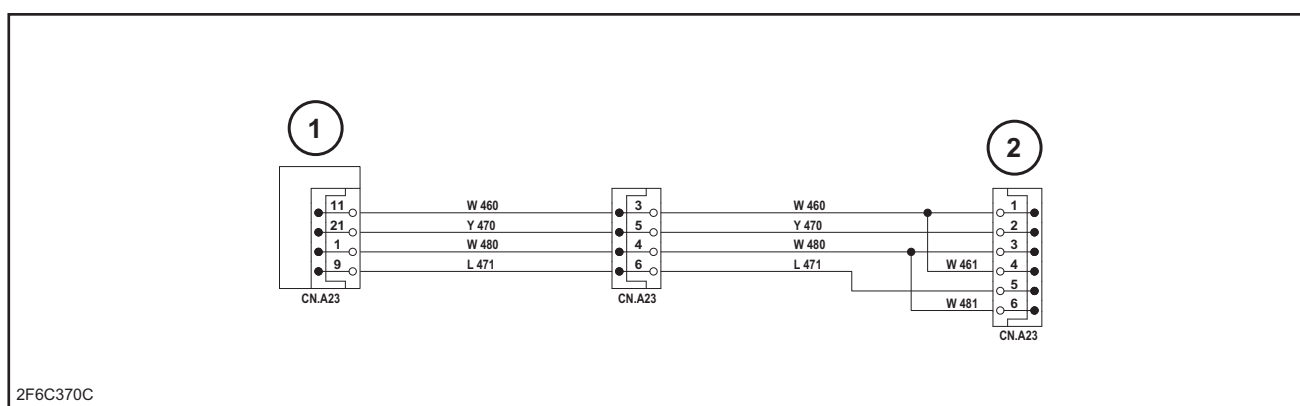
- [1] Engine high idle and oil temperature is 45 °C - 55 °C (113.0 °F - 131.0 °F) with no load.
- [2] Measure the required time to travel 20 m (65.62 ft.) after a 4 - 5 m (13.13 - 16.40 ft.) running start.

- [3] Shoe tension amount should be standard.
- [4] Measure for both forward and backward traveling.
- [5] Measure for both high-speed and low-speed traveling.

**Main unit posture: same as with travel speed measurement.**

## Z. OTHER

Step	Action	Standard value	Yes	No
9	Is there continuity?		Go to Step 10	W480 harness defect (disconnection). Repair or replace.
10	1. Turn the key switch ON. 2. Measure the voltage between the ground and terminal 1 of the CN. A23 harness side. Is it about 5 V?	About 5 V	Go to Step 11	W460 harness defect (disconnection). Repair or replace.
11	1. Measure the voltage between the ground and terminal 2 of the CN. A23 harness side. Is it 0.25 V or higher?	0.25 V or higher	Computer C defect. Replace.	Y470 harness defect (disconnection). Repair or replace.

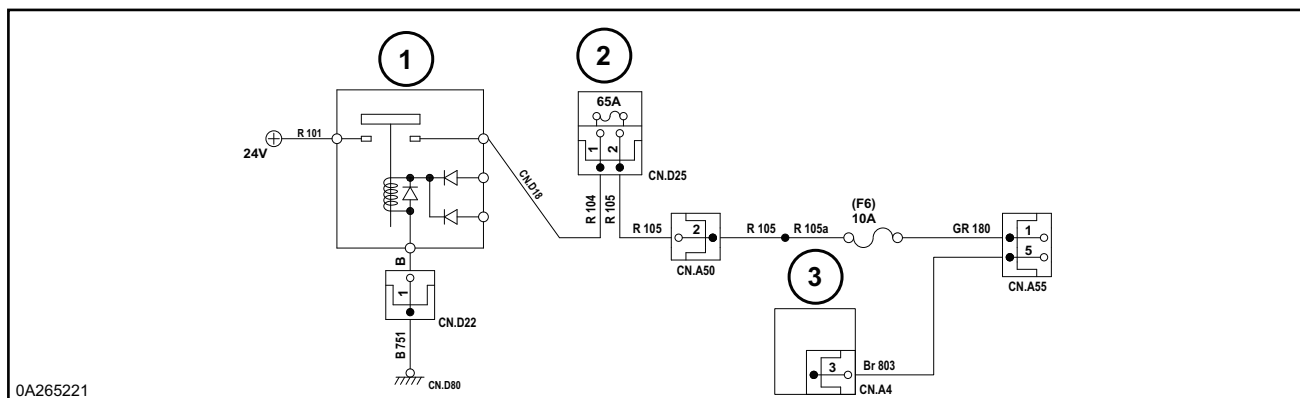


2F6C370C

1	Computer C
2	Pressure sensor (liftcrane)

### Diagnostic Trouble Code: 7040 Fuel Level Sensor Signal Abnormality

Step	Action	Standard value	Yes	No
1	1. Turn the key switch ON. 2. Check whether diagnostic trouble code: 7040 is displayed. Is diagnostic trouble code: 7040 displayed?		Go to Step 2	
2	1. Inspect the connection status of each connector and ground. 2. Check whether diagnostic trouble code: 7040 is displayed. Is diagnostic trouble code: 7040 displayed?		Go to Step 3	
3	1. Check the fuel level sensor resistance on the service support screen. Is it 100 $\Omega$ or higher?	100 $\Omega$ or higher	Go to Step 4	When 2 $\Omega$ or lower, go to Step 7
4	Inspect for disconnection. 1. Turn the key switch OFF and disconnect CN.D57. 2. Measure the resistance between terminals 1 and 2 of the CN.D57 fuel level sensor side. (See the Float position and resistance table.) Is it the standard value?		Go to Step 5	Fuel level sensor defect. Replace



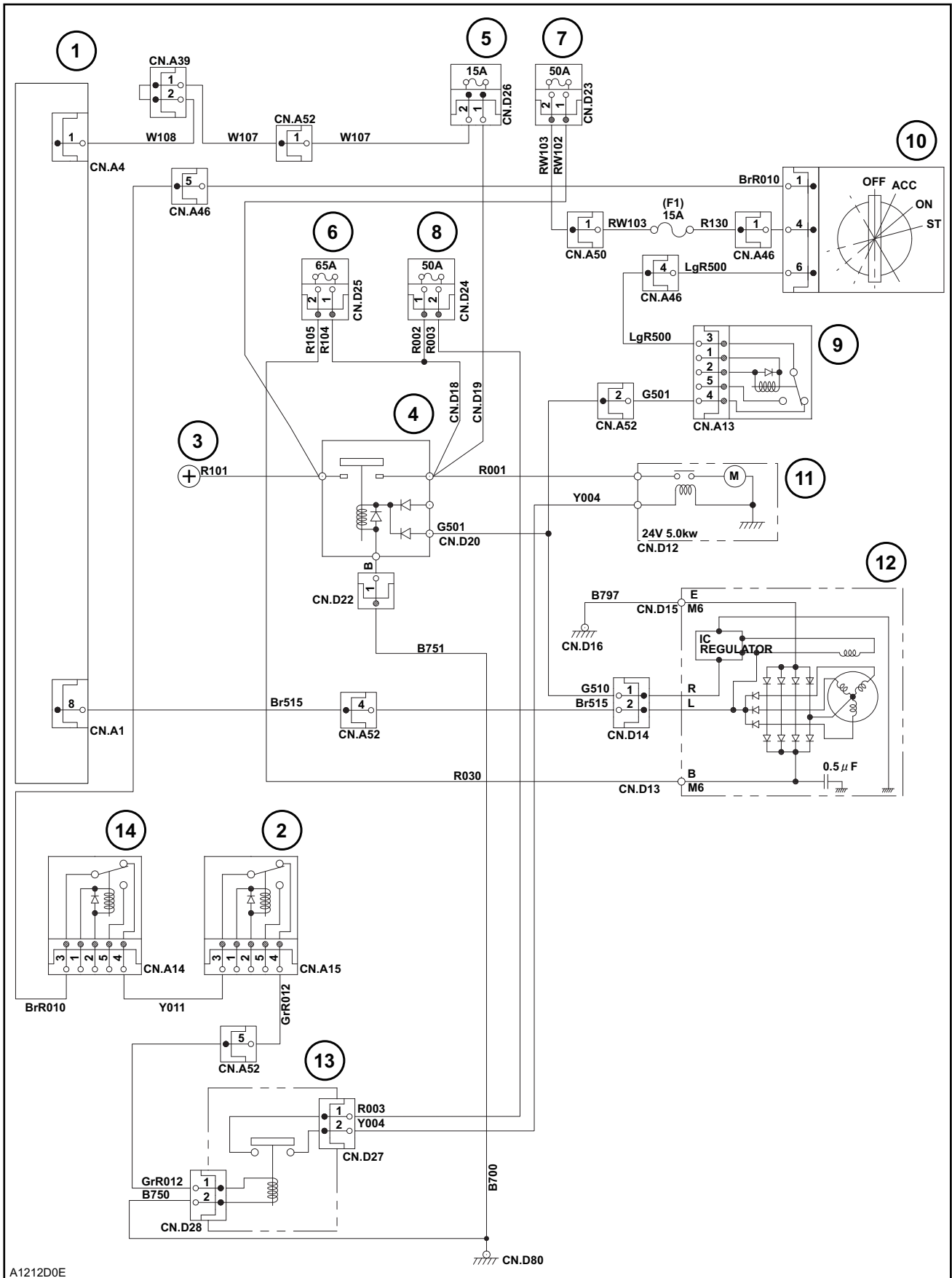
1	Relay battery	3	Computer A
2	Fusible link and fuse box		

### Diagnostic Trouble Code: 7210 Liftcrane Buzzer Signal Abnormality

Step	Action	Standard value	Yes	No
1	1. Turn the key switch ON. 2. Check whether diagnostic trouble code: 7210 is displayed. Is diagnostic trouble code: 7210 displayed?		Go to Step 2	
2	1. Inspect the connection status of each connector. 2. Inspect the fusible link CN.D25 (65 A) fuse and fuse box F20 (10 A) fuse to see if either is blown. Are 1 and 2 above both OK?		Go to Step 3	
3	Inspect the liftcrane buzzer. 1. Turn the key switch OFF and disconnect CN.A23. 2. Connect the terminal of the CN.A23 liftcrane buzzer side to the negative terminal of the battery and the terminal of the CN.A23 liftcrane buzzer side to the positive terminal, and inspect the operation of the liftcrane buzzer. Does the liftcrane buzzer sound?		Go to Step 4	Liftcrane buzzer defect. Replace
4	Inspect for shorts. 1. Turn the key switch ON. 2. Measure the voltage between the ground and terminal of the CN.A23 harness side. Is it 0 V?	0 V	Go to Step 5	G834 harness defect (short). Replace
5	1. Turn the key switch OFF. 2. Inspect for continuity between the ground and the terminal of the CN.A23 harness side. Is there continuity?		LW266, WL266, R101, R104 or R105 harness defect (short). Replace	Go to Step 6

Z. OTHER

# Z. OTHER



A1212D0E

1	Computer A	6	Fusible link; Fuse box	11	Starter motor
2	Relay starter cut	7	Fusible link; Backup	12	Alternator
3	Battery (24 V)	8	Fusible link; Safety relay	13	Relay starter
4	Relay battery	9	Relay; Key ON	14	Relay neutral start
5	Fuse computer	10	Key switch		

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: [www.heydownloads.com](http://www.heydownloads.com) by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL