

470X3

Excavator

SERVICE MANUAL

WLSM4706-08LX

Jun. 2018

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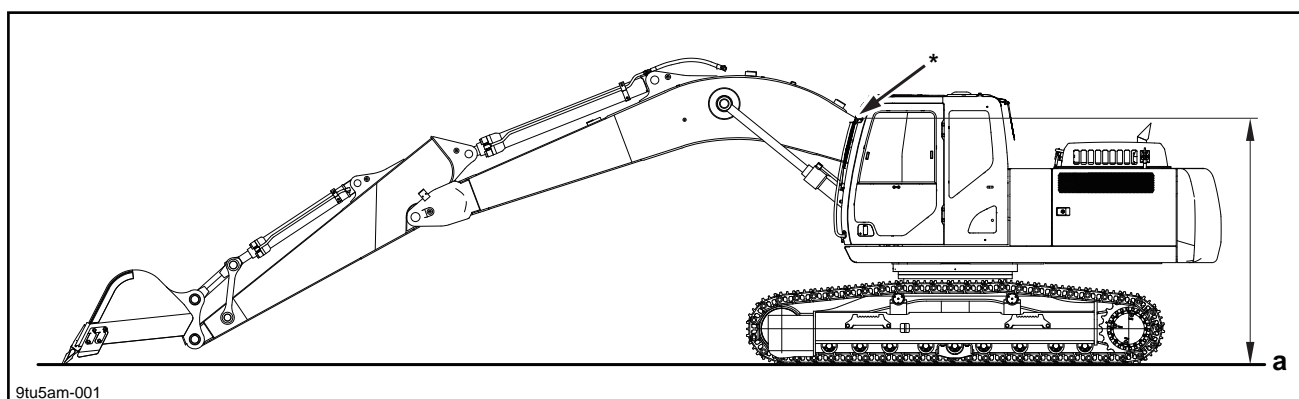
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[2] Boom position

Warning

- If the machine has been modified so that the boom position has been lowered, the machine will not satisfy the ROPS criteria.
- It is necessary to consult with us if it is possible that the boom's position has been lowered by modification.
- The extent to which a boom position has moved cannot be determined in the same way for all machines.



a	Ground point
---	--------------

With the tip of the bucket in contact with the ground surface at maximum work radius, if the position (* in the diagram) that overlaps with the cab when viewed from the side is markedly lower than that of a standard machine (standard arm), the machine will not satisfy the ROPS criteria.

Also, with a machine body with a cab mounted that can withstand up to 31 tons, the effect of mounting a 24 ton machine, which is near the restriction weight, and a 21 ton machine to the same cab will not be the same.

3. Prohibited items

- Modifications that reduce the strength of a platform that has a cab with a ROPS mounted to it. (Actions or modifications that reduce the functionality of the anchoring part at the left-rear of the cab)
- Modifications that effect the strength of the ROPS of a cab.

Modification prohibited (red part)	All modifications (grinding, welding, drilling holes, removing, etc.) are prohibited.
Modification permitted under conditions (gray part)	Removal of parts is prohibited. Bar welding and making holes (up to diameter 20 mm (0.787 in.)) by drilling are possible.

Code	Part name	Code	Part name	Code	Part name
1	Casing	22	D-ring (small diameter)	43	O-ring
2	NPT1/16 plug	23	D-ring (large diameter)	44	Check valve
3	Expansion plug	24	Rear cover	45	Check valve spring
4	Oil seal	25	NPT 1/16 plug (mec)	46	M6 orifice
5	Circle R retaining ring	26	Spool assembly	47	O-ring
6	Tilting piston	27	Spring receiver	48	M6 orifice
7	Tilting piston seal	28	Spring	49	O-ring
8	Steel ball	29	M42 plug	50	O-ring
9	Shaft	30	O-ring	51	Bearing
10	Bearing	31	Pilot spool	52	Shim
11	Pivot	32	Pin	53	Parallel pin
12	Shoe plate	33	Spring receiver	54	Valve plate
13	Cylinder block	34	Spring	55	Brake spring
14	Cylinder spring	35	Pilot valve plug	56	Hexagon socket head bolt
15	Spring receiver	36	O-ring	57	Overload valve
16	Spherical joint	37	Joint	58	Hexagon socket head bolt
17	Shoe retainer	38	G1/4 plug	59	Coupling
18	Piston assembly	39	O-ring 1B P11	60	C-shaped retaining ring for hole
19	Separator plate	40	Orifice (brake valve)	61	G1/2 plug
20	Friction plate	41	Orifice spring (brake valve)	62	O-ring
21	Brake piston	42	G1/8 plug	63	O-ring

■ Summary explanation of component parts

The motor is made up of the following main components.

- Rotary group producing rotational force
- Parking brake that prevents self-travel when the machine is parked
- Variable mechanism section that switches the motor capacity between high and low
- Overload relief valve installed to the rear cover
- Brake valve section (counter balance valve) that plays a critical role in controlling the hydraulic circuits

■ Rotary group

The cylinder block (13) is fit into the teeth grooves on the spline of the shaft (9), which is supported at both ends by the bearings (10), (51). This cylinder block (13) is pressed against the rear cover (24) together with the valve plate (54) by the cylinder spring (14).

The nine piston assemblies (18) slide along the surface of the shoe plate (12) while moving in and out of the cylinder block (13). There are static pressure bearings at the end surface of the piston assembly (18) shoe to reduce the sliding resistance. The spring force of the cylinder spring (14) is transmitted through the spring receiver (15), spherical joint (16), and shoe retainer (17) to press the end surface of the piston assembly (18) against the shoe plate (12) so that the piston moves without separating from the surface of the shoe plate (12).

■ Parking Brake

A separator plate (19) and friction plate (20) are fit into the spline groove around the outer edge of the cylinder block (13) in an alternating pattern and are pressed against the casing (1) by the 14 brake springs (55) via the brake piston (21).

■ Variable Capacity Mechanism Section

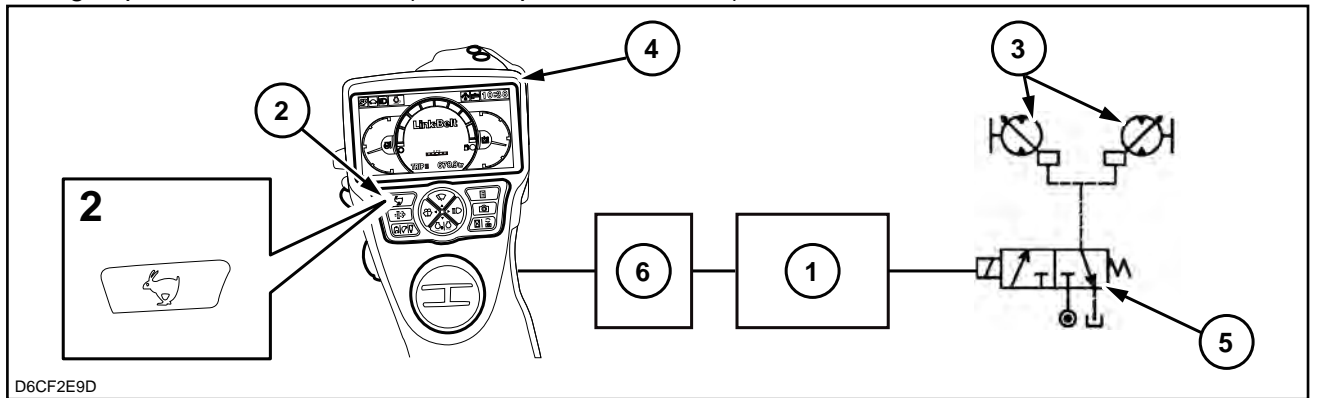
This section comprises the pivot (11), which is fit into the 2 semispherical indentations on the shoe plate (12) and support the shoe plate (12), the tilting piston (6), which revolves the shoe plate (12) around the pivot (11), the tilting stopper (1-1), which supports this revolution at the determined position, the pilot valve section, which brings the pressure oil to the tilting piston (6) according to the external command, and the 3 check valves (44), which take out and send to the pilot valve section the highest of the 3 pressures among the external command pilot pressure, the motor inlet pressure, and the motor outlet pressure.

Basic Functions

Travel Speed Selection

Purpose

The travel motor tilting angle is changed by switching the travel speed between low speed and high speed with the switch. (Travel speed switchover)

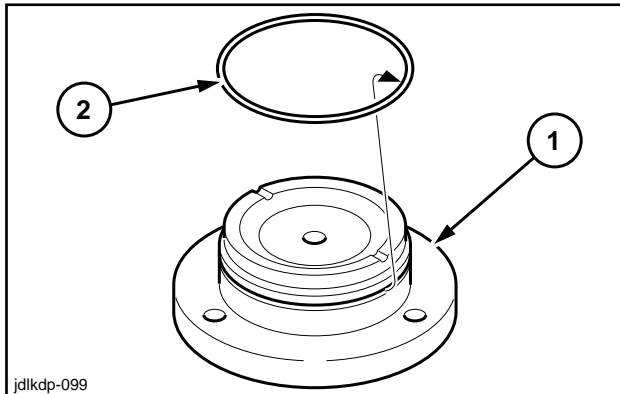


1	Computer A	3	Travel motor	5	Travel 2-speed select solenoid
2	Travel 2-speed select switch	4	Monitor	6	Computer B

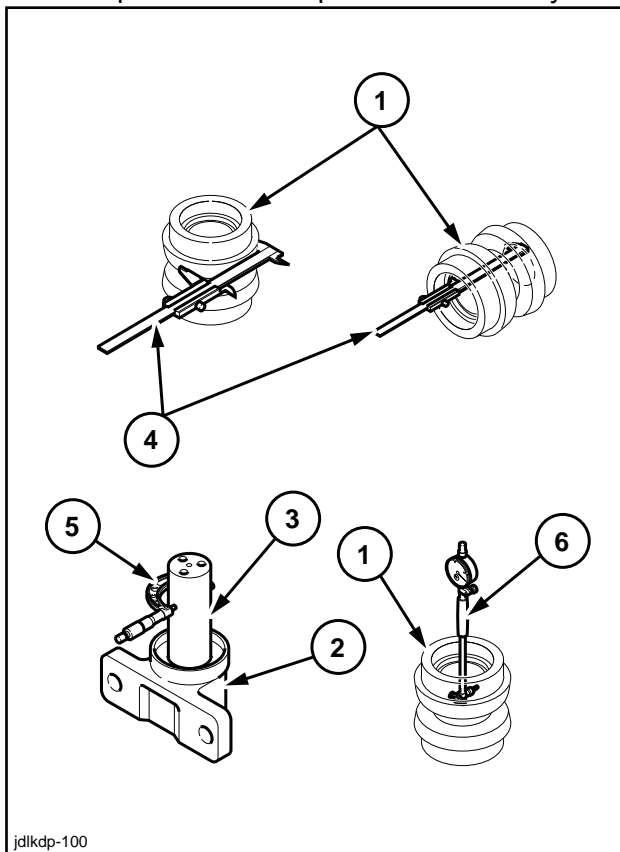
Operation explanation

- [1] When the key is turned ON, the travel 2-speed select solenoid turns OFF and the travel mode icon on the monitor is set to low speed.
- [2] When the travel 2-speed select switch is pressed, the travel 2-speed select solenoid turns ON and the travel mode icon on the monitor is set to high speed.
- [3] When the travel 2-speed select switch is pressed again, the travel 2-speed select solenoid turns OFF and the travel mode icon on the monitor is set to low speed.

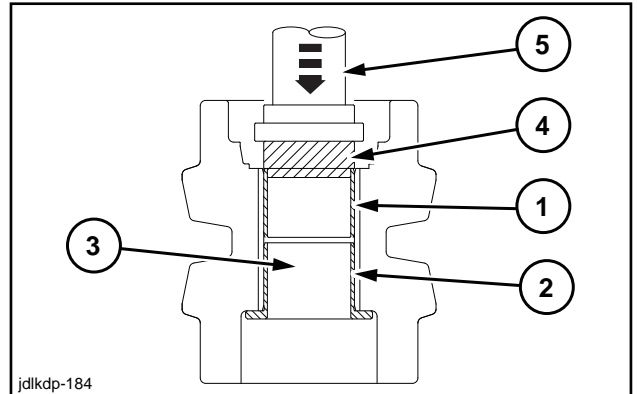
8. Remove the O-ring (2) on the cover (1) side.
- Check whether the O-ring is twisted. If it is twisted, replace it with a new one.



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

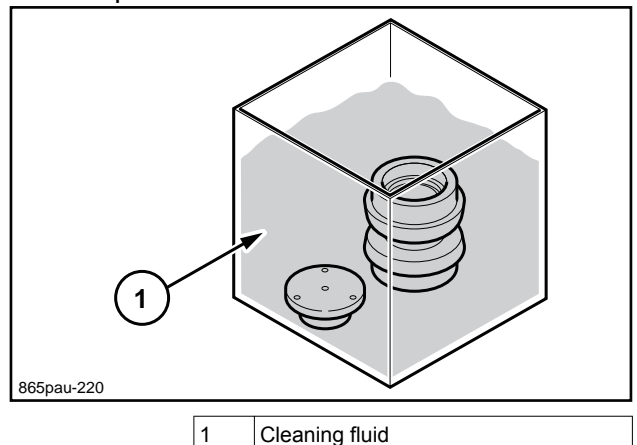


10. When replacing bushings (1) (2), use jig A (4) to restrain it from the side where the shaft (3) was removed and press it out with a pressing machine (5).

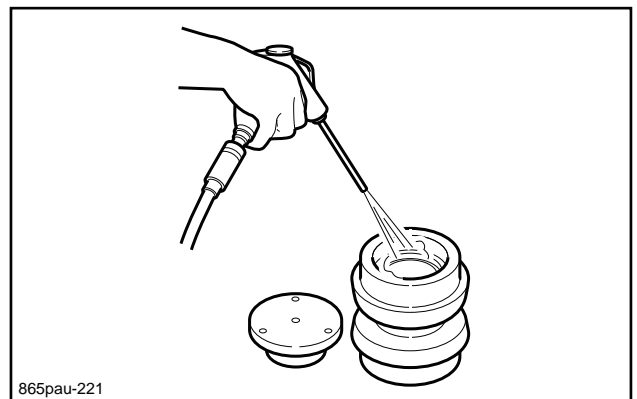


Assembly Procedures

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.

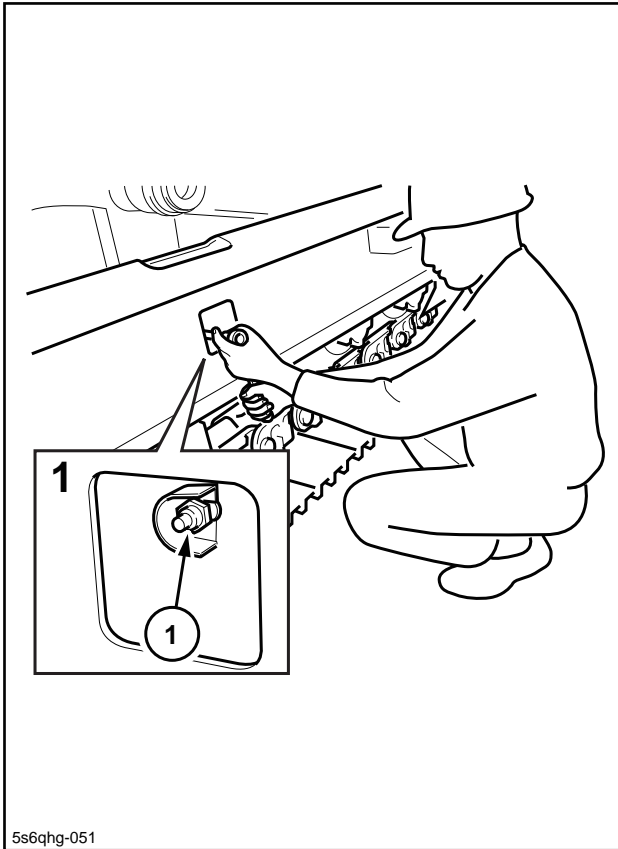


2. After cleaning the parts, air blow them to remove any remaining cleaning fluid or debris.

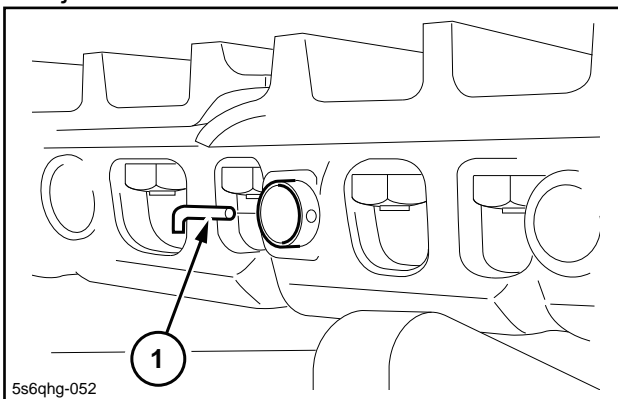


3. If the bushing (1) was removed during disassembly, put it into the roller (2). Face up the thrust plate installation side, restrain from above using jig B2 (3), and push in with the pressing machine (4).

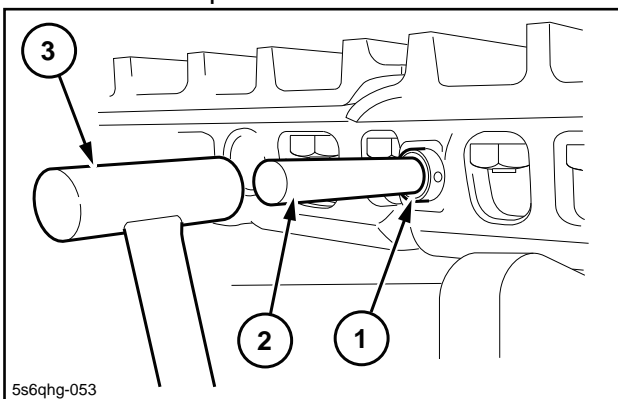
Tightening torque for installation: 49.0 - 68.6 N·m (36.147 - 50.605 lbf·ft.)



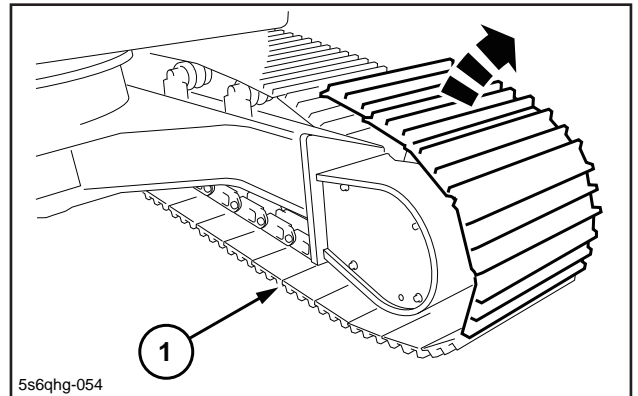
4. Pull out the S-pin (1) from the rear of the joint section.



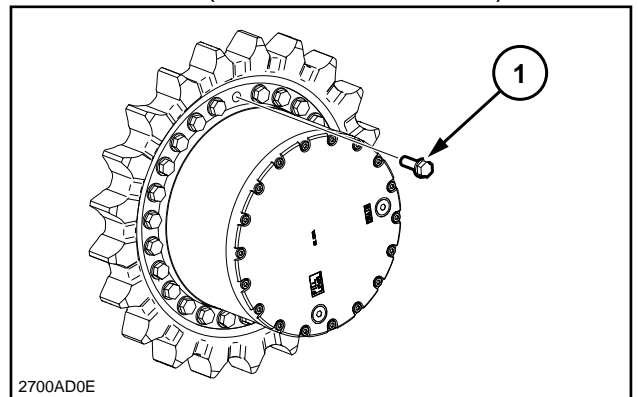
5. Place a striking jig (2) against the master pin (1) and hit it with a hammer (3) to push the master pin out.



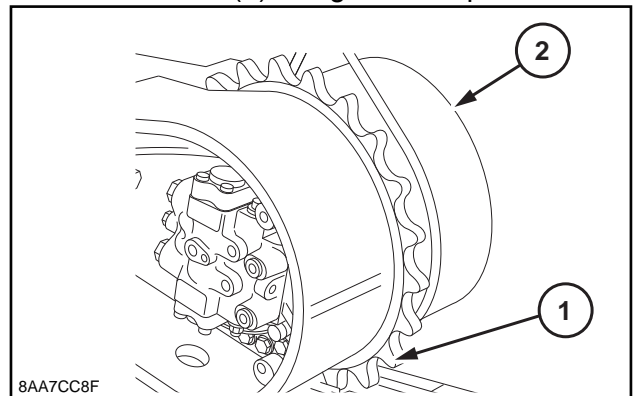
6. Open the shoe (1) to the rear.



7. Use the wrench [36 mm (1.417 in.)] to remove the 24 bolts (1).
Tightening torque for installation: 900 - 1051 N·m (663.92 - 775.31 lbf·ft.)



8. Remove the drive sprocket (1) from the travel motor (2) using a wire rope.



Installation of Drive Sprocket

To install, perform the reverse of the removal procedure.

- Tightening torque M24: 900 - 1051 N·m (663.92 - 775.31 lbf·ft.)

Removal and Installation of Center Joint

⚠ Caution

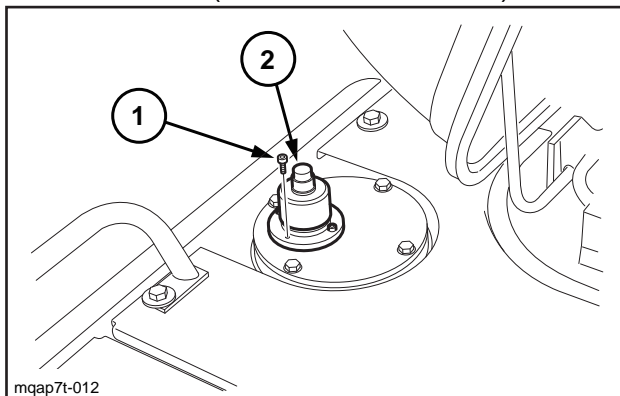
- Be sure to stop the engine before beginning work.
- Be sure to inspect the wire rope or other lifting equipment before beginning work.
- Do not let anyone go under a suspended load.

Items to prepare

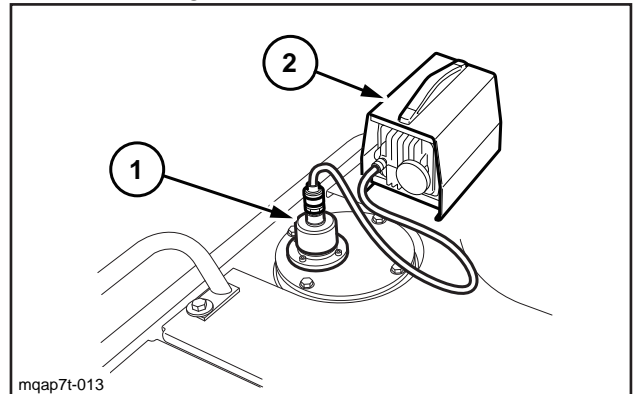
- Wrenches [19 mm (0.748 in.), 27 mm (1.063 in.), 41 mm (1.614 in.)]
- Hexagon wrenches [5 mm (0.197 in.), 8 mm (0.315 in.)]
- Box wrench [19 mm (0.748 in.)]
- Specialty adapter for vacuum pump connection
- Vacuum pump (vacuum pump power supply)
- Extension cable
- Marking pen
- Cap
- Plug
- Wire rope (with the required breaking load)
- Liftcrane (with the required lifting capacity)
- Wood planks, etc.
- Rag
- Cleaning fluid

Removal of Center Joint

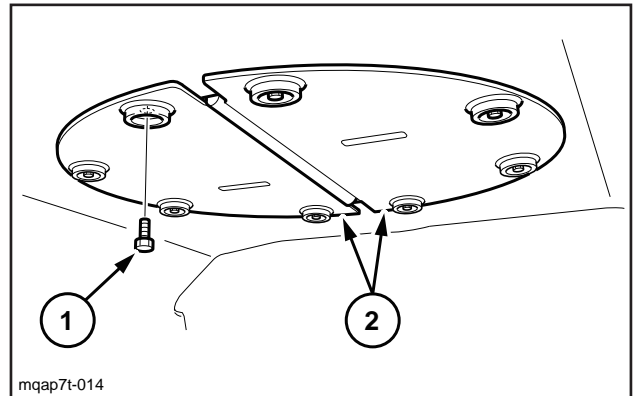
1. Use a hexagon wrench [5 mm (0.197 in.)] to remove the 4 bolts (1), and then remove the air breather (2) on the hydraulic tank. Tightening torque for bolt installation: 2.94 - 4.90 N·m (2.1689 - 3.6146 lbf·ft.)



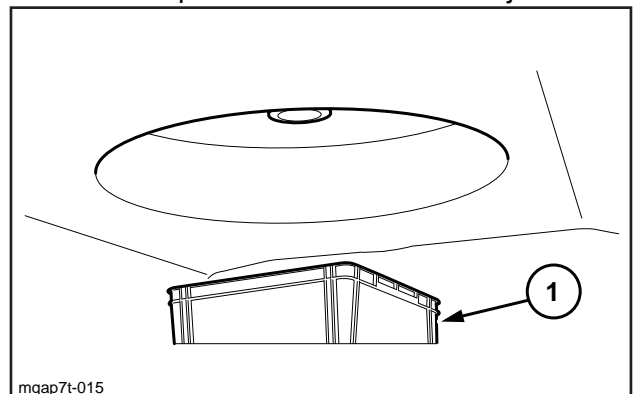
2. Install the specialty adapter (1) to the area where the air breather is removed, and set the vacuum pump (2). Create negative pressure in the hydraulic tank using the vacuum pump.

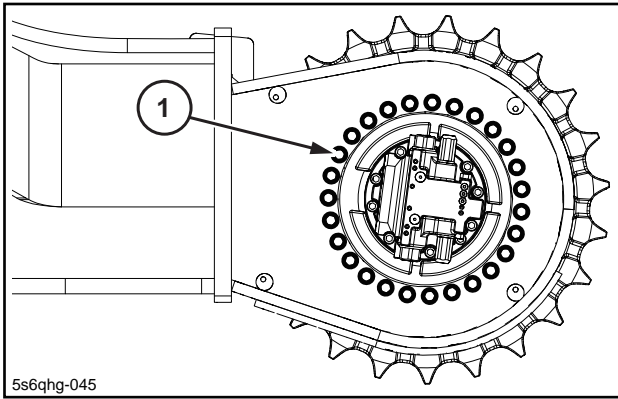


3. Use a box wrench [19 mm (0.748 in.)] to remove the 8 bolts (1), and then remove the lower under cover (2).

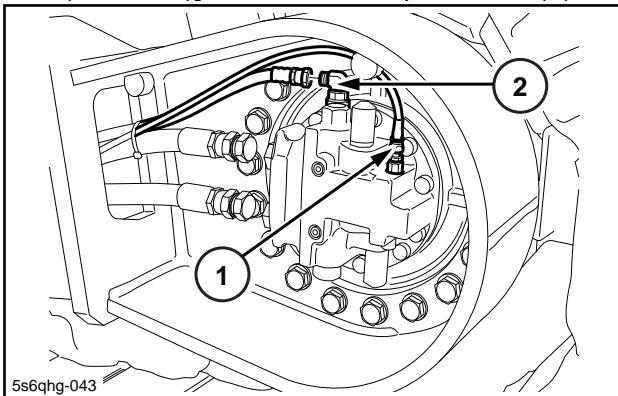


4. Prepare a waste oil can (1) to receive the oil that spills out under the center joint.

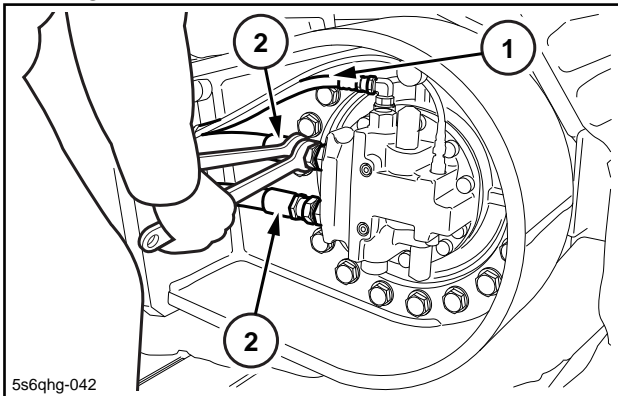




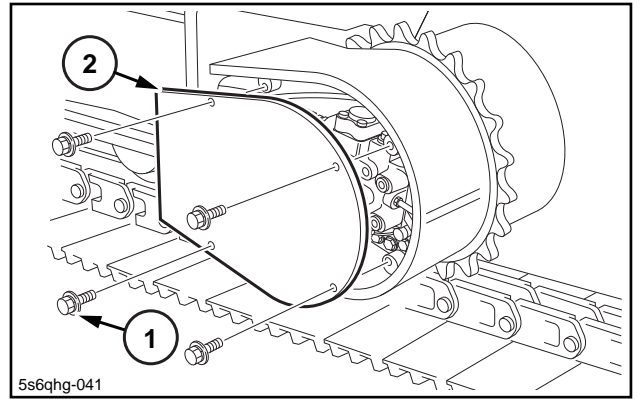
3. Use a wrench [27 mm (1.063 in.)] to install the elbow (2), and use a wrench [19 mm (0.748 in.)] to connect the pilot hose (1).



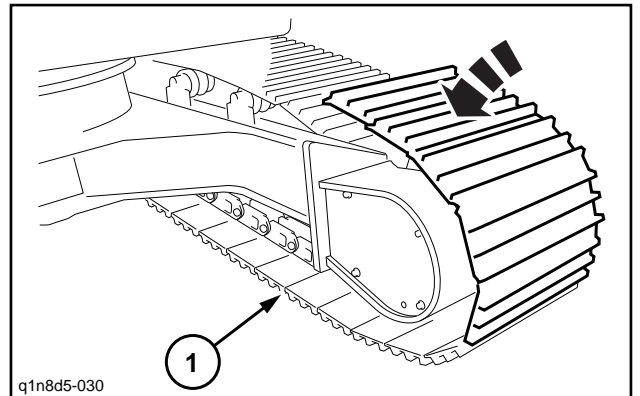
4. Use wrenches [27 mm (1.063 in.) for drain hose, 41 mm (1.614 in.) for high-pressure hose] to connect the drain hose (1) and high-pressure hose (2).



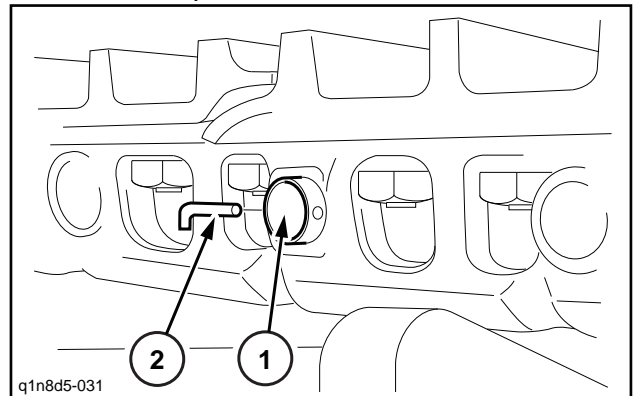
5. Use a wrench [19 mm (0.748 in.)] to install the cover (2) with 4 bolts (1).
Installation bolt tightening torque: 63.7 - 73.5 N·m (46.991 - 54.220 lbf·ft.)



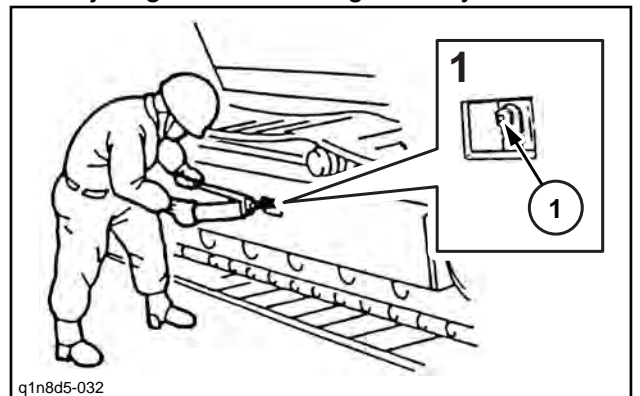
6. Wrap the shoe (1).

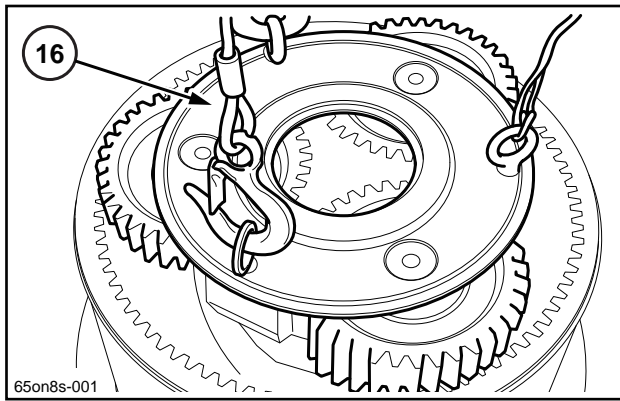


7. Insert the master pin (1).
Insert the S-pin (2) and bend it so that it cannot slip out.



8. Tighten the check valve (1).
While monitoring the track shoe tension, inject grease into the grease cylinder.





Removal of carrier 2 assembly

1. Remove the sun gear 2 (15).

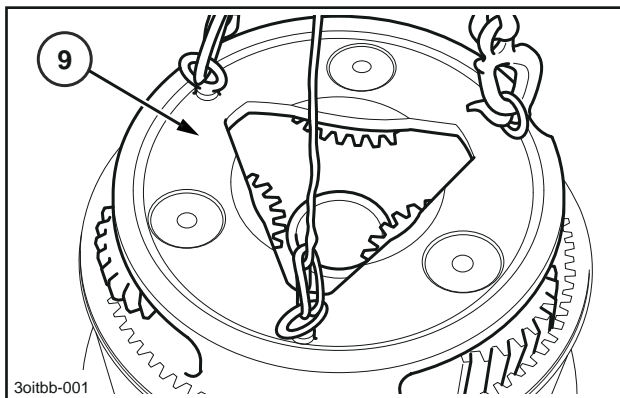
⚠ Caution

Be very careful not to get hands stuck between gears.

2. Install 3 M10 eyebolts on carrier 2 (9), then remove the carrier 2 assemblies (9, 10, 11, 12, 13, 14).

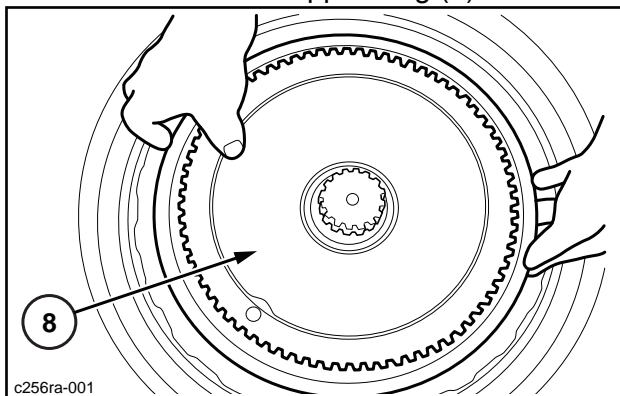
⚠ Caution

- Be very careful not to get hands stuck between parts or drop the suspended parts on feet.
- Lift the part in a horizontal position.

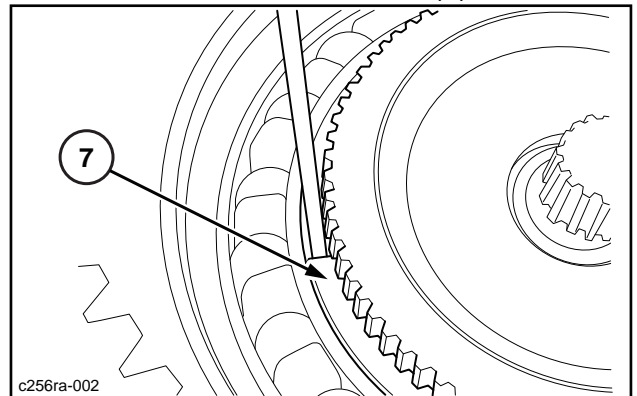


Removal of housing assembly

1. Remove the support ring (8).



2. Place a screwdriver or other tool on the divided surface of the lock washer (7) and strike the tool with a hammer to remove the lock washer (7).

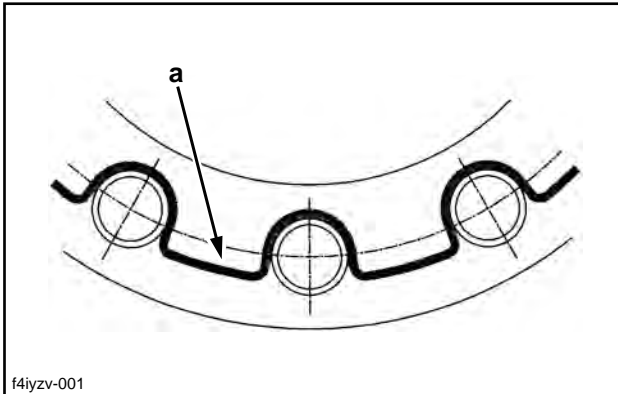


3. Install 3 M12 eyebolts into the M12 threaded holes on the ring gear (3) at approximately the same distance apart, and then remove the housing assembly (ring gear (3), housing (1), bearing (2), floating seal (5), and hexagon socket head bolt M20 x 120 (4)) while lifting it in a horizontal position.

⚠ Caution

- Be very careful not to get hands stuck between parts or drop the suspended parts on feet.
- Lift the part in a horizontal position.

2. Install 3 M24 eyebolts on the housing (1) and lift with a wire, align the reference marks, and install onto the ring gear (3).



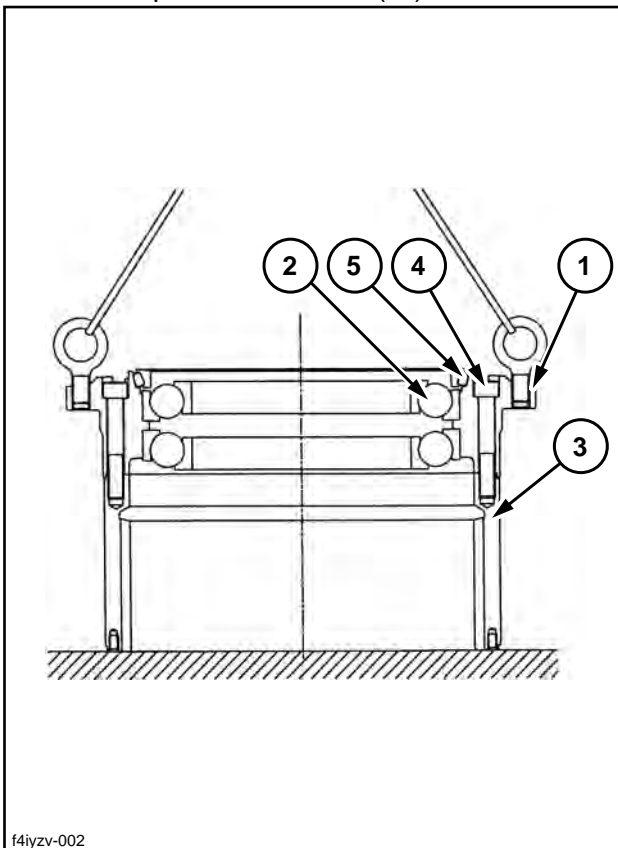
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Applying Loctite to the housing end surface

Caution

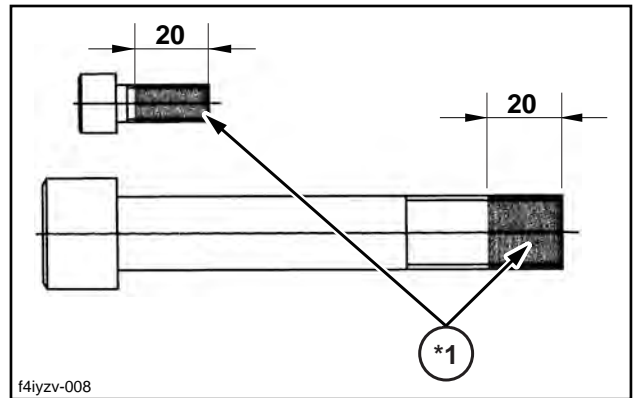
- Be very careful not to get hands stuck between parts or drop the suspended parts on feet.
- Lift the part in a horizontal position.

3. Coat the 25 M20 x 120 hexagon socket head bolts (4) with Loctite #242, and then tighten the bolts to the tightening torque of 307.542 - 372.606 lbf-ft.
 - Soak the first 0.787 in. from the bolt tip in Loctite #242.(*1)



f4iyzv-002

Assembly of the housing assembly



f4iyzv-008

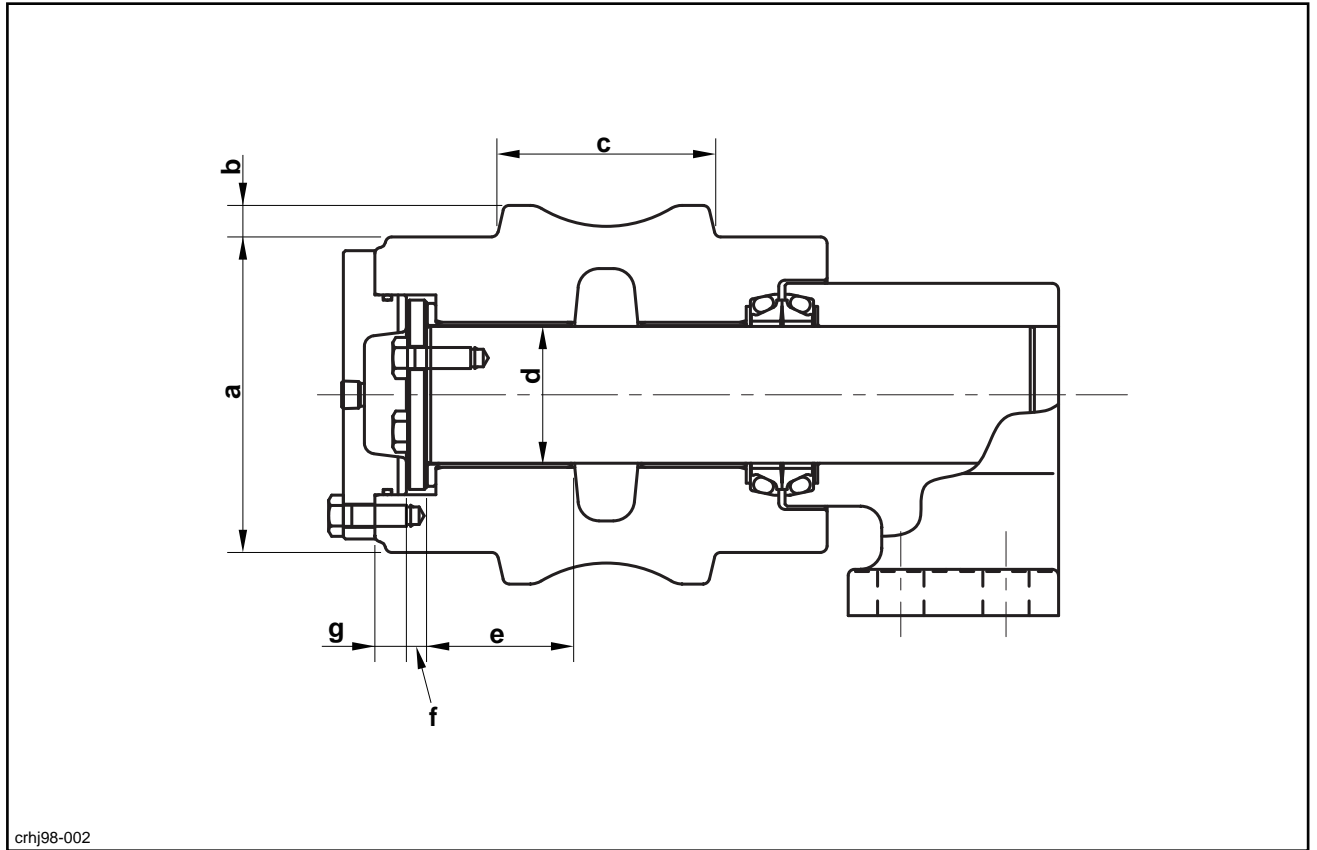
Method of applying Loctite #242

Determining the thickness of the angular bearing shim

- This needs to be performed when replacing the motor (casing), housing (1), (angular) bearing (2), or lock washer (7). Otherwise use the previous shim (6) as is.
1. Press the outer races of the 2 bearings (2) into the housing (1).
 2. Press the inner races of the 2 bearings (2) evenly and measure the inner race installation width (A).
 - Before measuring the inner race installation width, rotate the bearings at least 5 times to stabilize them.
 3. Measure the bearing installation width (B) of the motor casing.
 4. Measure the lock washer groove width (C) of the motor casing.
 5. Measure the lock washer (7) thickness (D).
 - Use the average of the measurements of the 4 orthogonally intersecting points on the circumference. Measure the dimensions with a precision of 0.01 mm.
 6. When the thickness of the used shim (6) is S, gap X is as follows.

$$X = (B + C) - (A + D + S)$$
 7. In the case of this unit, select 1 shim so that gap X is -0.00314 in - 0.00079 in. ((+) indicates a gap and (-) indicates pressing.)

Upper Roller



crhj98-002

* See the gauge list for measurement gauges.

Part name	Code	Measurement dimension [mm (in.)]	Standard value [mm (in.)]	Usage limit [mm (in.)]	Judgment	Solution
Carrier roller	a	D	D150 (D5.906)	D138 (D5.433)	Acceptable/Unacceptable	Clad by welding or replace.
	b		15 (0.591)	-	Acceptable/Unacceptable	
	c		104 (4.094)	-	Acceptable/Unacceptable	
Shaft	d	D	D65 (D2.559)	D64 (D2.520)	Acceptable/Unacceptable	Replace.
Bushing	d	D	D65 (D2.559)	D66 (D2.598)	Acceptable/Unacceptable	Replace.
Bushing	e		69 (2.717)	68 (2.677)	Acceptable/Unacceptable	Replace.
Thrust plate	f		9 (0.354)	8.5 (0.3346)	Acceptable/Unacceptable	Replace.

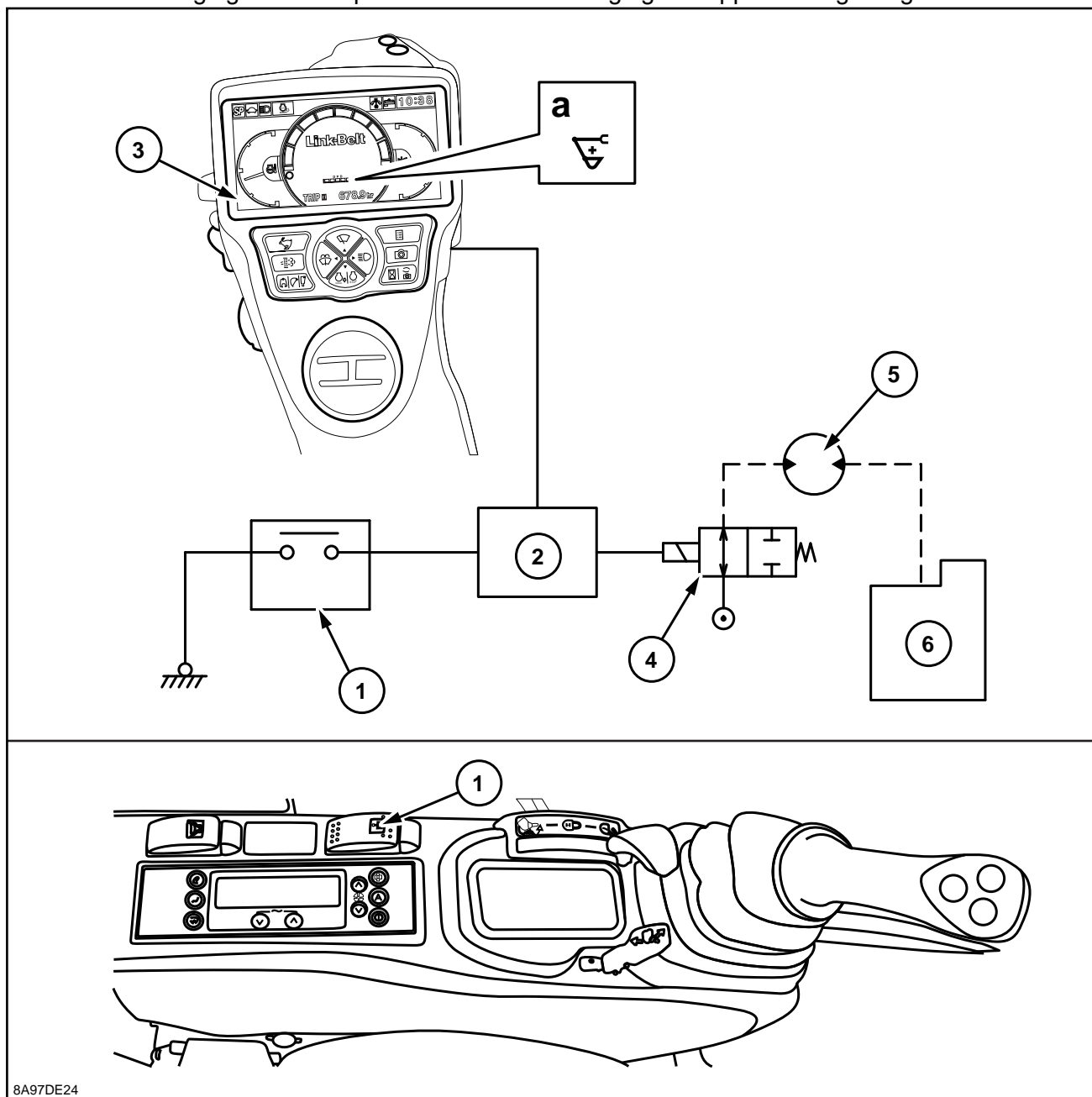
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Free Swing (option)

Purpose

Prevents swinging of the suspended load while swinging is stopped during lifting work.



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

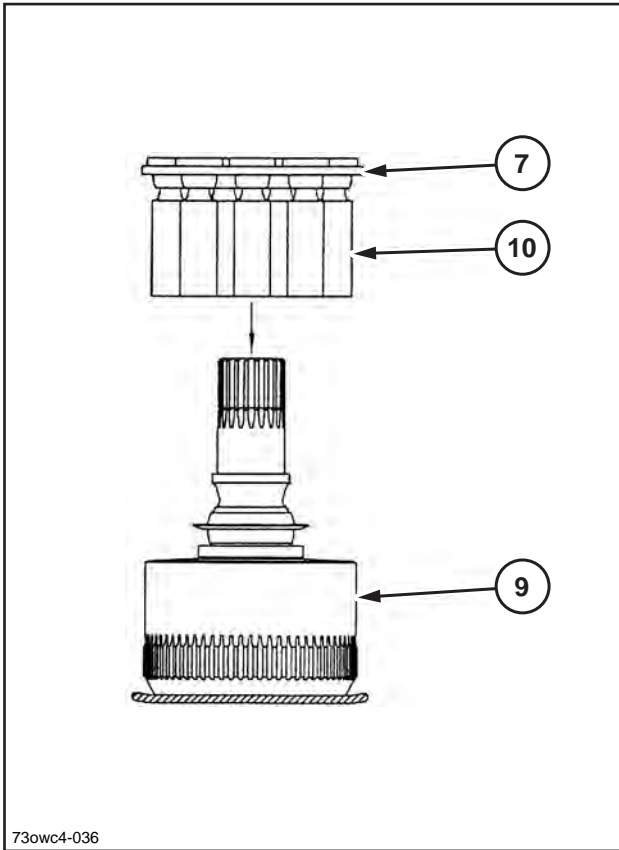
[1] Free swing operation condition

a. When the free swing switch is pressed.

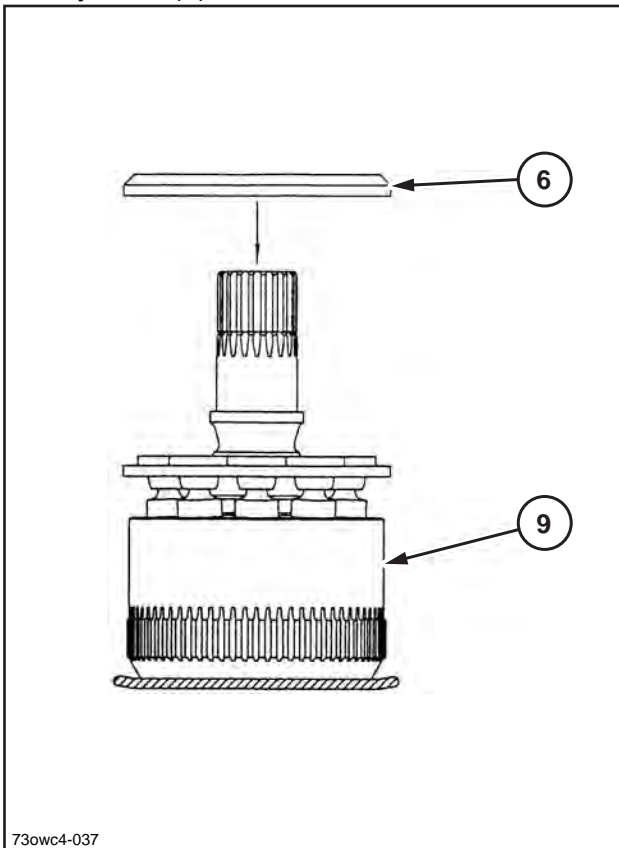
- * The free swing is disabled during a swing lock.
- * The free swing icon is displayed on the monitor.

[2] Free swing end condition

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

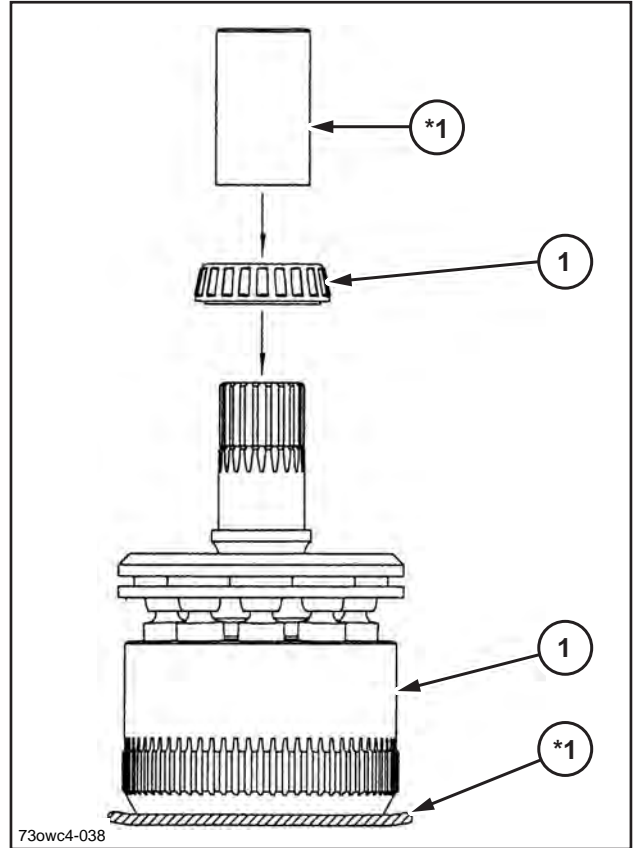


3. Apply hydraulic oil to the shoe sliding surfaces of the piston assemblies (10), and then install the cam plate (6) on the cylinder (9).



4. Use the press-fit jig 1 (*2) to install the tapered roller bearing (4) inner race on the cylinder (9) with a hand press, etc.

- When press fitting, use a soft rag (*3) under the cylinder end surface to prevent scratching.

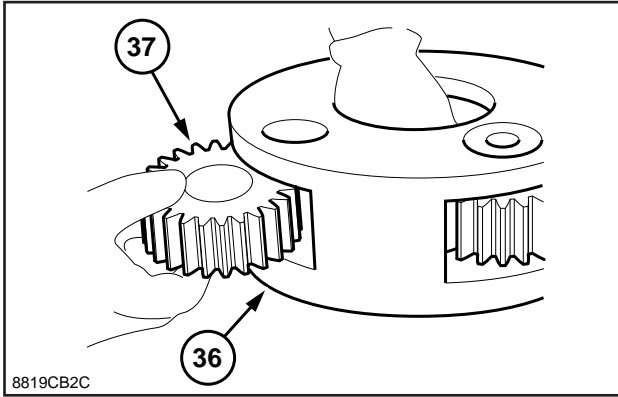


5. Clean the inner race installation section (*4) of the cylinder (9), lightly apply sealant (Loctite 515, 518, or the equivalent) after degreasing, and use the press-fit jig 1 (*5) to install the cleaned and degreased inner race (2). Next, install the retaining ring (1).

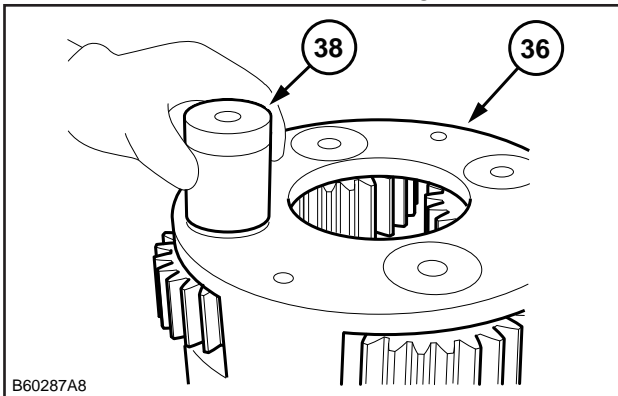
- Be careful not to let sealant adhere to the roller of the tapered roller bearing (4).
- Thoroughly wipe off any sealant coming out from in between the inner race (2) and tapered roller bearing (4).

[2] Assembly of the planetary carrier No. 2 subassembly (6)

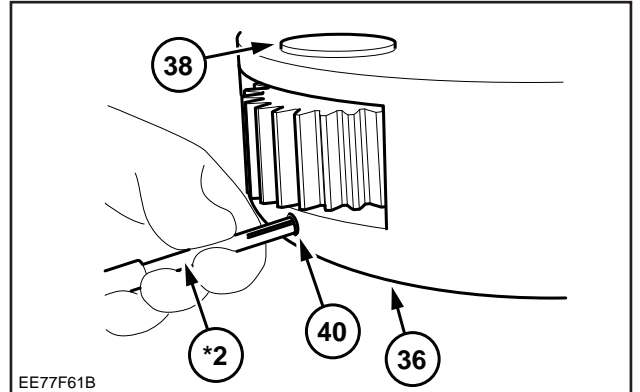
- a. Slide the planetary gear No.2 (37) and side plate No.2 (39) from the side of the planetary carrier No.2 (36), and place at the specified position.



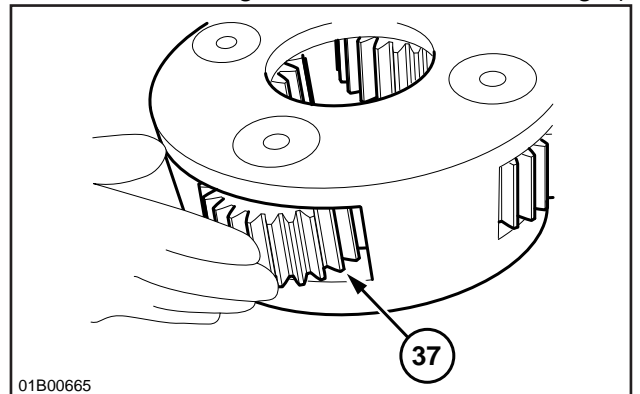
- b. Insert the planetary pin No.2 (38) from the pin hole on the upper side of planetary carrier No.2 (36). At this time, insert while being careful with the insertion direction of the planetary pin No. 2 (38) and the planetary carrier No. 2 (36) spring pins.



- c. Check that the spring pin insertion holes of the planetary carrier No.2 (36) and planetary pin No.2 (38) match, and then use a jig (*2) to hammer the part while paying attention to the direction (joint facing upward) and depth [1 mm (0.039 in.)] of the spring pin 10 x 40 (40). After hammering, use a punch to punch at a position about 1 mm (0.039 in.) from the spring pin hole, and then perform caulking by deforming the spring pin hole.



- d. Rotate the planetary gear No.2 (37) by hand and check that there is no rotation unevenness or catching.
- If there is any rotation unevenness or catching, disassemble according to "Disassembly of the planetary carrier No.2 subassembly" and reassemble using this procedure.
 - When reassembling, assemble using a new pin for the spring pin 10 x 40 (40). (Using the spring pin from before disassembly can reduce the holding force and result in damage.)



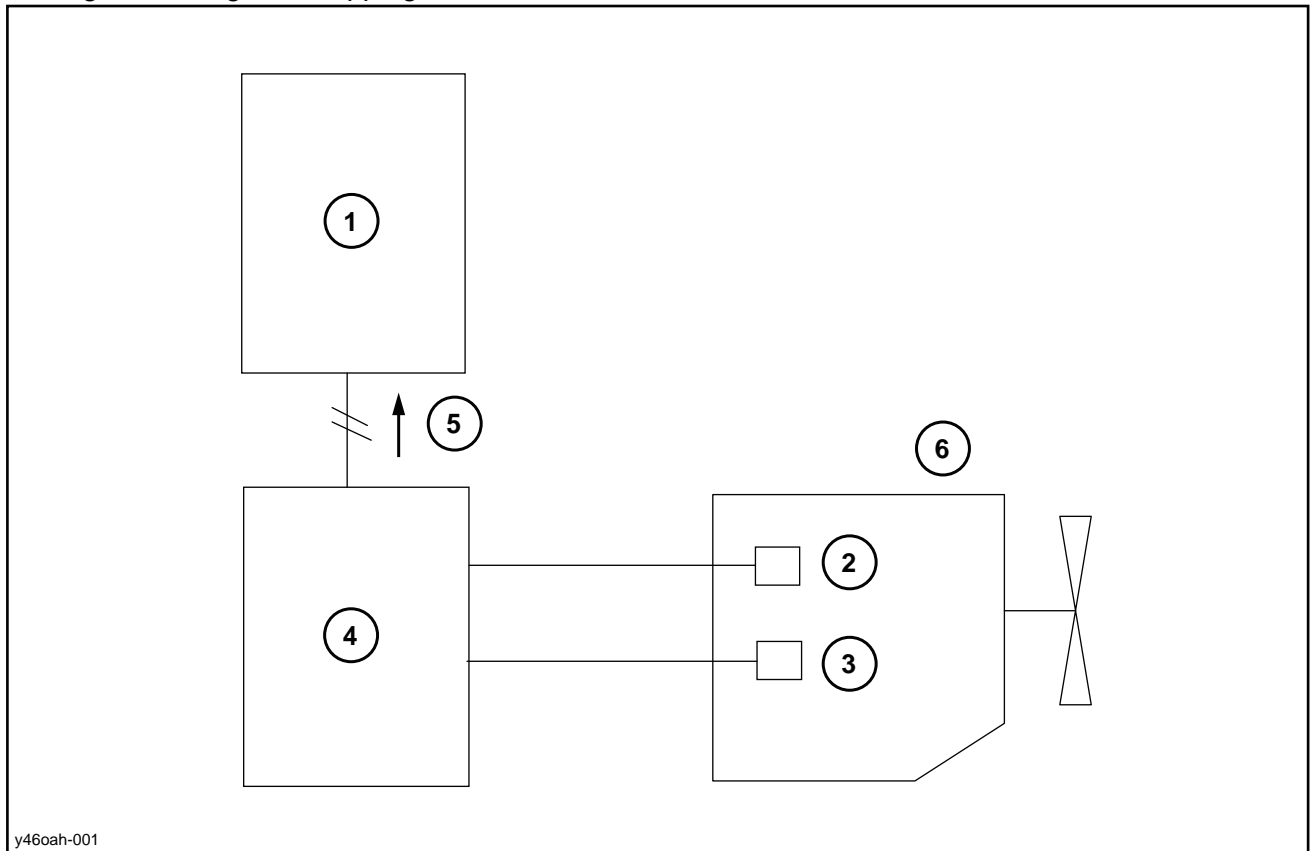
Perform steps [1] - [4] at 4 locations to complete operations.

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Engine Start/Stop Control

Purpose
Engine starting and stopping

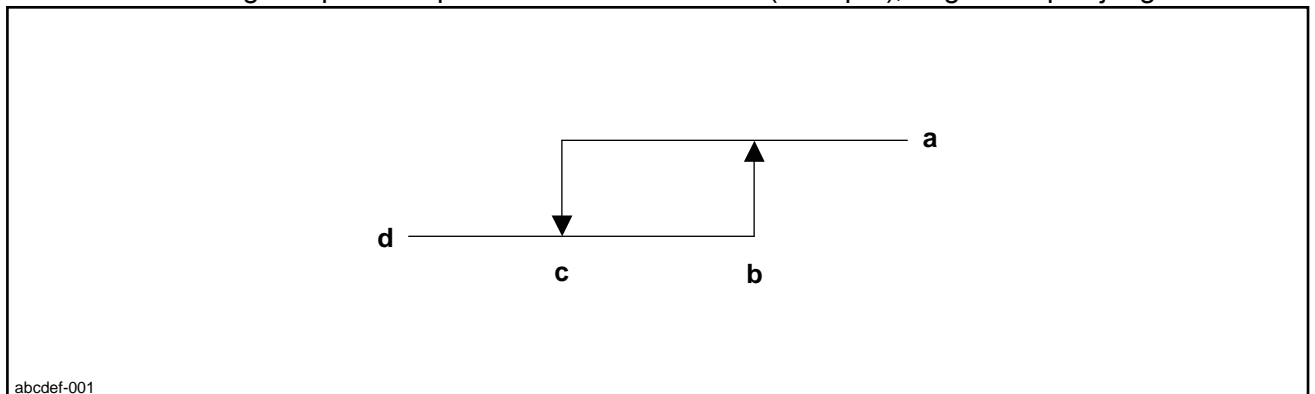


y46oah-001

1	Computer A	3	Crank sensor	5	Speed
2	Cam sensor	4	ECM	6	Engine

Operation explanation

- [1] Start the engine.
- [2] When the engine speed rises to 500 min^{-1} (500 rpm) or higher, engine start is judged.
- [3] Stop the engine.
- [4] When the engine speed drops to less than 200 min^{-1} (200 rpm), engine stop is judged.



abcdef-001

a	Start	c	200 min^{-1} (200 rpm)
b	500 min^{-1} (500 rpm)	d	Stop

Operation explanation

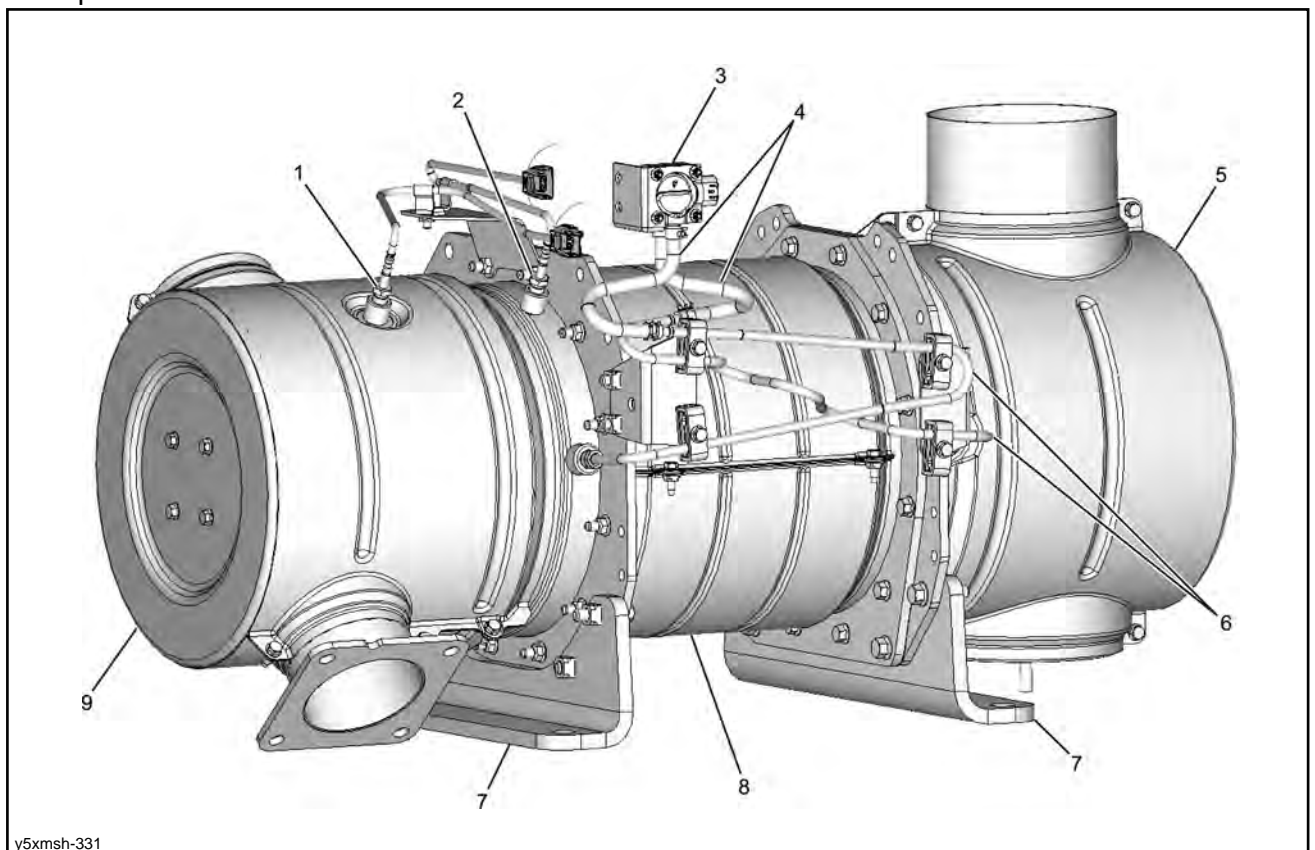
- [1] When all the following conditions are detected, quick warm up is started.
- The engine is starting up.
 - The engine warm up is not being performed (step 1: low idle 5 min.)
 - The machine is not being operated (upper, swing, travel, option 1, or option 2).
 - The outside temperature must be equal to or lower than -59.0°F.
 - The coolant temperature must be higher than 32.0°F and lower than 176.0°F.
 - The sensors (P1, upper, swing, travel, option (1 or 2) are not abnormal.
 - DPD regeneration must not be being performed.
- [2] This control can be deactivated on the Setup/Parameters screen.
- [3] When the engine starts, the speed incrementally increases according to the diagram below if the coolant temperature is lower than 122.0°F (When the coolant temperature is equal to or higher than 122.0°F, normal idle start).
- [4] When quick warm up is started, the system sets the pump flow proportional valve current value to minimum flow (740 mA).
- [5] Then, 1 sec. later, the system sets the boom 2 proportional valve current value to 540 mA.
An icon that indicates the quick warm up start is displayed on the monitor for 2 sec.
- [6] Then, 1 sec. later, when the system detects the below event (a) for 20 sec. or more, it raises the boom 2 proportional valve target current value at a rate of 2 mA/20s.
When the system detects the event (b), it sets the boom 2 proportional valve target current value to 540 mA.
Also, if the system does not detect any event, it keeps the current boom 2 proportional valve target current value.
- (a) P1 pressure < 1450.54 psi
(b) P1 pressure > 2175.81 psi
- [7] If the system does not detect either of the conditions in [2] above, it ends or stops the quick warm up.

- [4] If the ECM judges that manual regeneration is necessary, the system receives the signal for the manual regeneration request, then waits for the manual regeneration request from the operator.
- The amber lamp flashes for 10 sec. (2-second cycle)
The message "PUSH DPD SWITCH TO ACTIVATE" is displayed on the monitor,
 - The operator presses the DPD switch during this period.
 - If the DPD switch is not pressed for 10 sec. or more, the amber lamp is turned OFF and the system goes back to automatic regeneration stopped status.
(After this, perform the same process as manual regeneration from step 2.)
- [5] Set the engine speed to 1000 rpm and start the manual regeneration.
- [6] Starting manual regeneration: The computer starts the controls below when all the conditions above are satisfied.
- The amber DPD lamp lights up.
 - The buzzer sounds for 2 sec.
 - The DPD gage is switched from accumulation amount display to regeneration progress display.
 - The messages "DPD RE-GEN" and "HOT EXHAUST" are displayed in rotation.
 - The computer A drives DPD relay and sends a DPD regeneration signal to ECM.
 - Auto idle/Idling stop control is stopped.
 - Hydraulic assisting load control is started (for raising exhaust temperature).
- [7] Stopping manual regeneration: When the operations below are performed, the ECM regeneration prohibit signal is sent and the automatic regeneration is stopped
While stopped, the amber DPD lamp flashes.
The message "PUSH DPD SWITCH" is displayed.
The DPD gage is switched from regeneration progress display to accumulation amount display.
Auto idle/Idling stop control is started.
To restart the regeneration, remove the cause of stopping, then press the DPD switch.
- The regeneration is stopped when the gate bar limit switch is turned ON (hydraulic operation possible).
 - The regeneration is stopped if the DPD switch on the monitor is pressed during automatic regeneration.
 - The regeneration is stopped if the exhaust gas temperature reaches 752.0 °F or higher.
 - When trouble occurs in the hydraulic assist proportional valve.
 - When the throttle is operated.
- [8] Ending manual regeneration: The system receives the signal for ending the manual regeneration and ends the control.
- Amber DPD lamp is turned OFF.
 - The DPD gage is switched from regeneration progress display to accumulation amount display.
 - The messages "DPD RE-GEN" and "HOT EXHAUST" disappear.
 - Auto idle/idling stop control is started.
- [9] Regeneration hydraulic load assist: When performing manual regeneration, a load is applied to the pump to raise the exhaust temperature.
- The computer sets the pump flow proportional valve to the minimum flow of 740 mA.
 - 1 sec. later, the computer sets the boom 2 proportional valve to the maximum load of 600 mA.
 - 1 sec. later, the computer sets the pump flow proportional valve to 600 mA.
 - 30 sec. later, the computer controls the pump flow proportional valve so that the DPD exhaust gas temperature (before DOC) is constantly at 518.0 °F. (gradually drops at the rate of 50 mA/sec. Update period 15 sec., Update width 5 mA)

1	Turbine housing	5	Compressor housing	9	Seal ring
2	Heat protector	6	Seal plate	10	Turbine shaft
3	Floating metal piece	7	Compressor impeller		
4	Oil thrower	8	Seal ring		

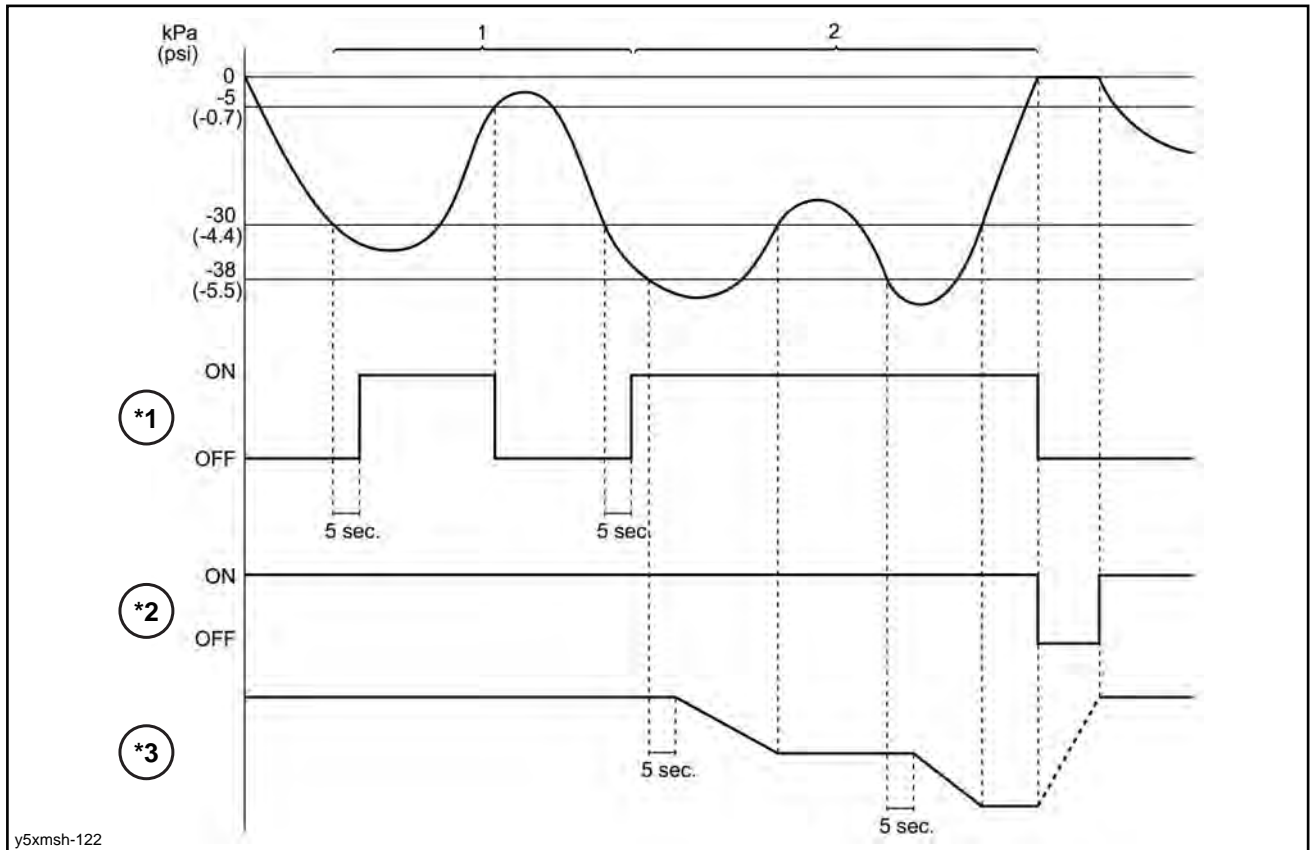
[6] Exhaust system

The DPD main unit consists of the filter section, oxidizing catalyst, and silencer section. It cleans the exhaust gas. The collected PM is combusted to regenerate the filter. This happens when a pressure difference between before and after the DPD is detected and when the system is operated for a certain amount of time.



y5xmsh-331

1	Exhaust gas temperature sensor 1	4	Differential pressure sensor hose	7	Bracket
2	Exhaust gas temperature sensor 2	5	Silencer	8	Filter assembly
3	DPD differential pressure sensor	6	Differential pressure pipe	9	Oxidation catalyst assembly



y5xmsh-122

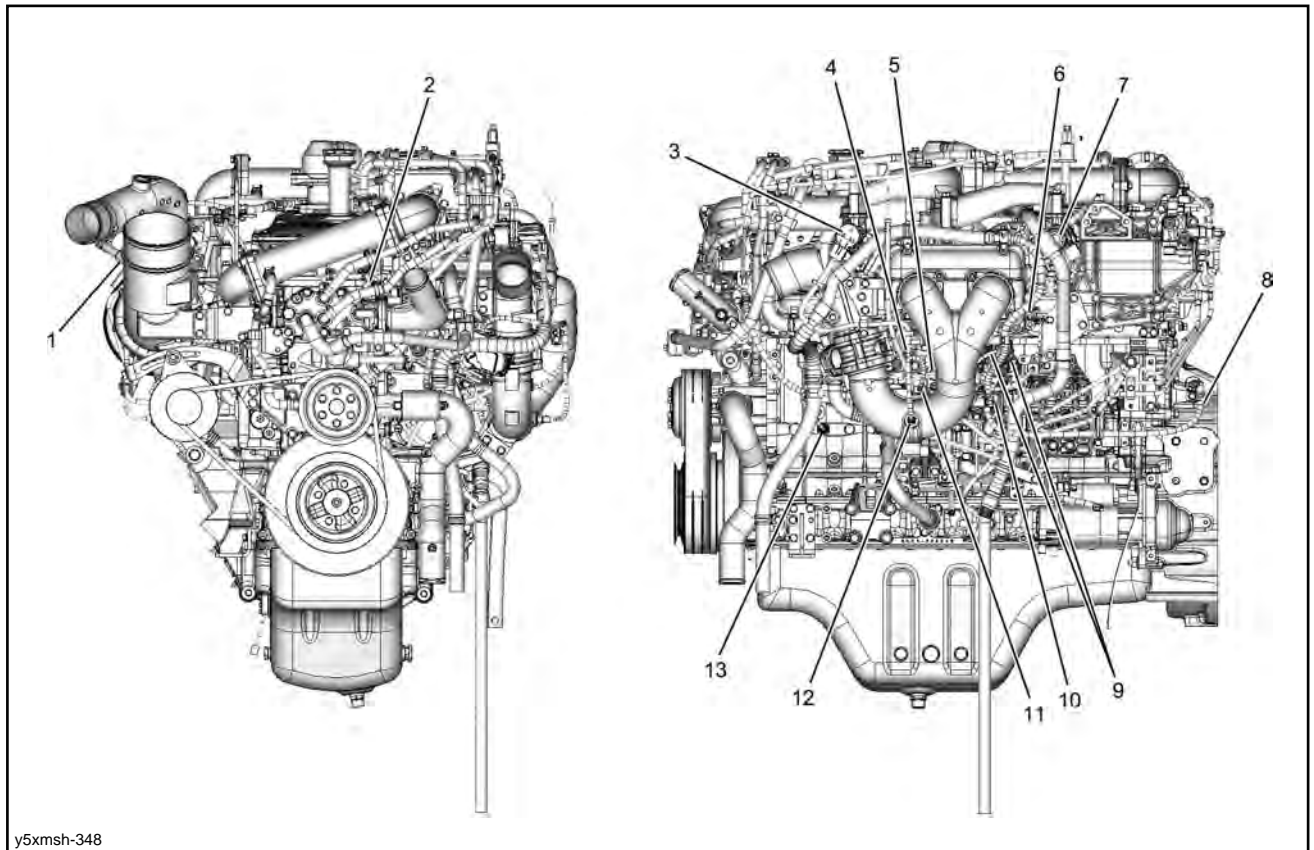
*1	Warning
*2	Starter switch
*3	Engine speed (min ⁻¹)
1	1st stage
2	2nd stage

Fuel system air bleeding

Place a suitable drain pan under the air bleed plug. Sufficiently loosen the fuel filter air bleed plug and operate the priming pump until fuel begins to spill out from the air removal pipe. Tighten the plug, and then operate until priming pump operation becomes too hard.

Note

- For a machine with multiple fuel filters mounted, bleed the air from the fuel tank side for each filter in order.



y5xmsh-348

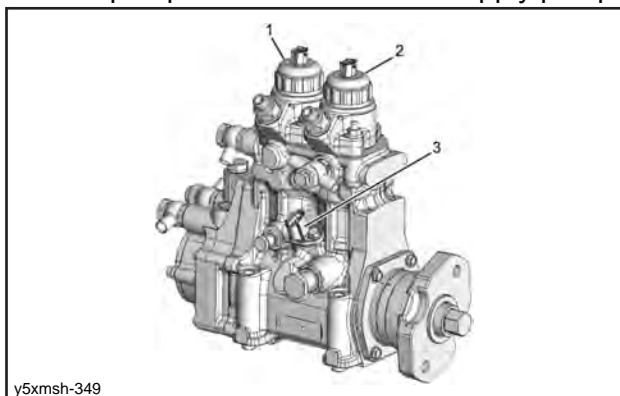
1	MAF sensor	6	IMT sensor	11	Boost sensor
2	Coolant temperature sensor	7	EGR valve 1	12	Boost temperature sensor
3	EGR valve 2	8	CKP sensor	13	Oil pressure sensor
4	Fuel pressure sensor	9	PCV		
5	Fuel temperature sensor	10	CMP sensor		

Supply pump

The supply pump uses the force of the engine speed to raise the fuel pressure and pressure feed fuel to the common rail. The PCV, CMP sensor, and feed pump are installed on the supply pump.

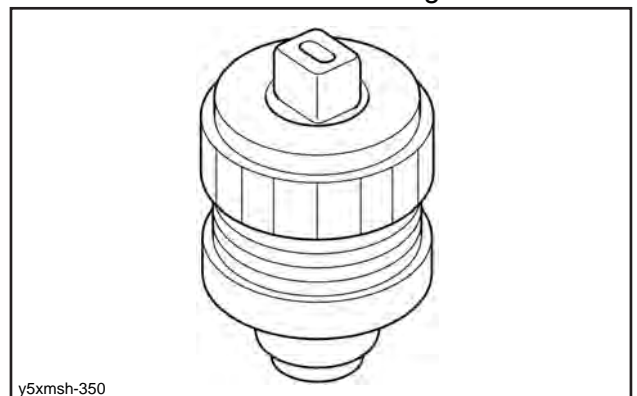
PCV

The PCV is installed on the supply pump and controls the pumping of fuel to the common rail. The ECM controls the electrified time to the PCV and controls the fuel discharge volume.



y5xmsh-349

1	PCV1
2	PCV2
3	CMP sensor



y5xmsh-350

Pin No.	Terminal name	Connection
116	-	-
117	SP-12V	MAF sensor power supply
118	-	-
119	PG-SIGN	GND
120	-	-
121	IS-ENGSTP	Engine stop switch signal
122	IS-DPDREG	DPD switch
123	OS-OVRL	Engine overrun lamp
124	OS-OILPL	Engine hydraulic pressure lamp
125	OS-BOOSTL	Boost temperature sensor pilot lamp
126	OS-OVHL	Overheat lamp
127	OS-OPL1	-
128	OS-OPL1	Tachometer
129	OS-DPDREG	DPD regeneration lamp
130	OS-DIAGL	Monitor
131	OS-EGRTL	EGR gas temperature lamp
132	CC-CAN-L	CAN-Low
133	PS-+B	Power supply
134	IS-IGKEY	Starter switch ON signal
135	SG-5VRT2	Barometric pressure sensor GND
136	OS-MAINR	ECM main relay signal
137	PG-CASE	GND
138	-	-
139	PS-MAFBAT	Dropping resistor
140	IS-SWHI1	-
141	IS-DIAG	Diagnostic switch signal
142	IS-MEMCL	Memory clear switch signal
143	IS-DGSEL	Diagnostic switch signal
144	IS-SWHI2	-
145	OS-GLOWL	Glow lamp
146	OS-OPL2	-
147	OS-FIPRESSL	Fuel filter clog lamp
148	OS-THLL	Fuel temperature lamp
149	OS-DPDSL	DPD lamp
150	OS-HOUR	Hour meter relay
151	-	-
152	OS-STARTR	Starter cut relay
153	OS-GLOWR	Glow relay
154	CC-CAN-H	CAN-High

Functional Inspection

Inspection of the scan tool power circuit system

1. Inspection of the scan tool power circuit system Description of Function
The Electronic Control Module (ECM) and other Electronic Control Unit (ECU) communicate with the trouble diagnosis scan tool via the Data Link Connector (DLC).
The power voltage of the trouble diagnosis scan tool is supplied by the battery or AC power.

Caution

- Draw power for the trouble diagnosis scan tool from the battery or AC power.
- The power supply voltage is the same as the battery voltage of the actual unit.

2. Inspection of the scan tool power circuit system Inspection
Inspection when the trouble diagnosis scan tool does not power on

- [1] Inspect the battery voltage of the actual unit using the Digital Multi-Meter (DMM).
Standard value : 18V
- [2] Charge or replace the battery if it is below the standard value.
- [3] Check that the battery cable of the trouble diagnosis scan tool does not have a defective connection.
- [4] Repair the connection if a problem is discovered.
- [5] Check that the battery cable of the trouble diagnosis scan tool does not have an open or short circuit.
- [6] Request repair of the battery cable if a problem is discovered.

Inspection of the starter circuit system

1. Inspection of the starter circuit system description of Function
The ECM turns on the starter relay when the starter switch is placed to the START position.
When the starter relay is turned ON, the starter is activated to start the engine.
2. Inspection of the starter circuit system inspection

Inspection when the starter does not operate

- [1] Turn the emergency stop switch to OFF.

Note

- If the machine does not have an emergency stop switch setting, do not perform this operation.

- [2] Check the Diagnostic Trouble Code (DTC).

Note

- If DTC P0117, P0340, P0341, P0651, P0685 or P0687 is detected, inspect the applicable DTC.

- [3] Turn OFF the starter switch.

- [4] Remove the starter cut relay.

- [5] Inspect the starter cut relay.

- Check the continuity between the terminals on the switch side.

Values: less than 100 Ω

- [6] Replace the relay if a problem is discovered.

- [7] Remove the starter relay.

- [8] Inspect the starter relay.

- Connect the battery between the coil side terminals to check continuity between switch terminals.

Values: less than 100 Ω

- [9] Replace the relay if a problem is discovered.

- [10] Inspect the starter switch start signal circuit.

- There should be no open circuit or high resistance between the starter switch and the ECM.

Values: less than 100 Ω

- There should be no short circuit with GND between the starter switch and the ECM.

Values: more than 10 MΩ

- [11] Repair the circuit if a problem is discovered.

- [12] Inspect the starter circuit.

- There should be no open circuit between the starter switch and the starter cut relay.

- There should be no open circuit between the starter cut relay and the starter relay.

Removal and Installation of Engine Assembly

⚠ Warning

- Keep away from flames.
- Be sure to release hydraulic pressure before beginning work.
- The air conditioner circuit is filled with high-pressure gas, gas may spray out dangerously when loosening lines.
- Do not use flames near the battery or expose it to sparks.

⚠ Caution

- Be sure to stop the engine before beginning work.
- Be sure to inspect the wire rope or other lifting equipment before beginning work.
- Do not let anyone go under a suspended load.

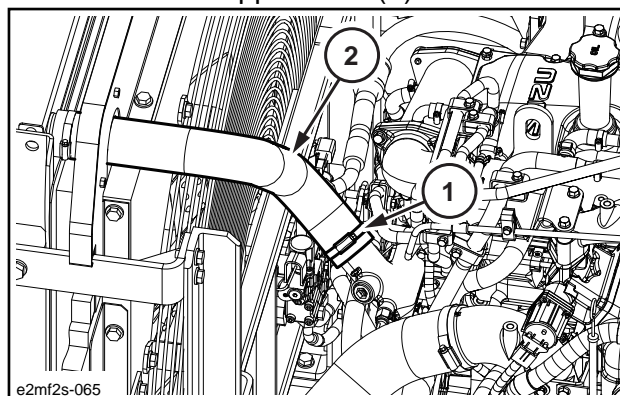
Items to prepare

- Wrenches [7 mm (0.276 in.), 8 mm (0.315 in.), 13 mm (0.512 in.), 17 mm (0.669 in.), 19 mm (0.748 in.), 36 mm (1.417 in.)]
- Box wrench [41 mm (1.614 in.)]
- Shackle (with the required lifting capacity) x 2
- Wire rope (with the required breaking load)
- Liftcrane (with the required lifting capacity)
- Marking pen
- Cap
- Plug
- Waste oil can
- Rag
- Cleaning fluid
- Wood planks, etc.

Removal of Engine Assembly

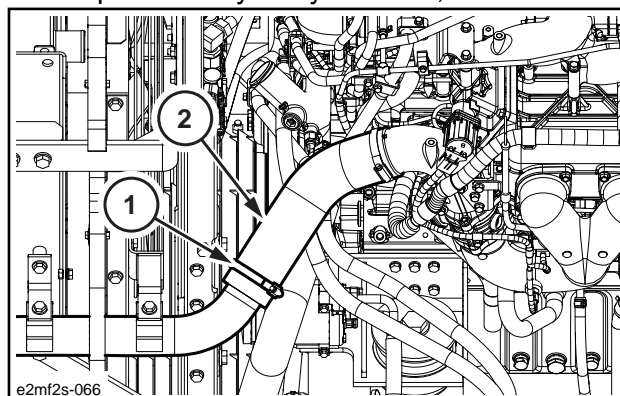
1. Drain the engine oil. (For details, see "Engine Oil Replacing".)
2. Drain the radiator coolant. (For details, see "Removal and Installation of Radiator".)
3. Remove the engine hood. (For details, see "Removal and Installation of Engine Hood".)
4. Remove the muffler. (For details, see "Removal and Installation of Muffler".)
5. Remove the hydraulic pump. (For details, see "Removal and Installation of Hydraulic Pump".)

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



7. Use a wrench [8 mm (0.315 in.)] to loosen the hose band (1) on the intercooler, and then remove the hose (2).

- Use caps to cover the lines and hoses to prevent any entry of water, dust or dirt.



8. Remove the hose band (1), and then remove the heater hose (2). Install caps or plugs to the engine and hoses to prevent any entry of water, dust or dirt.

Removal and Installation of Hydraulic Drive Fan

Job code **HWRA01**

Warning

- Do not remove the radiator cap when the coolant in the radiator is hot. Hot liquid may spray out.

Caution

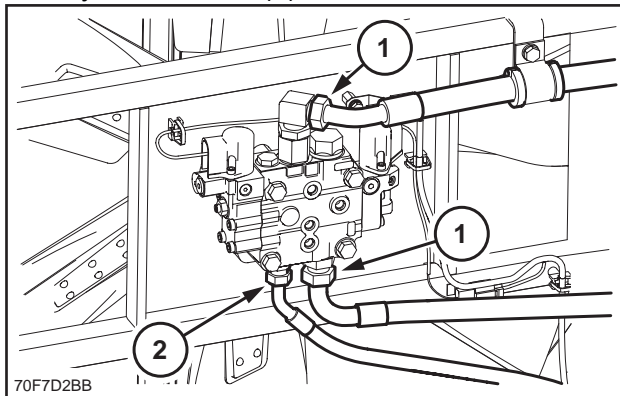
- Be sure to release hydraulic pressure before beginning work.
- Be sure to stop the engine before beginning work.

Items to prepare

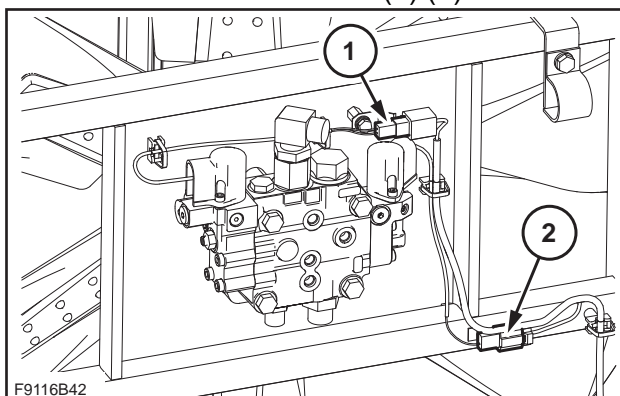
- Wrenches [17 mm (0.669 in.), 19 mm (0.748 in.), 24 mm (0.945 in.), 27 mm (1.063 in.), 36 mm (1.417 in.)]
- Loctite #262

Removal of Hydraulic Drive Fan

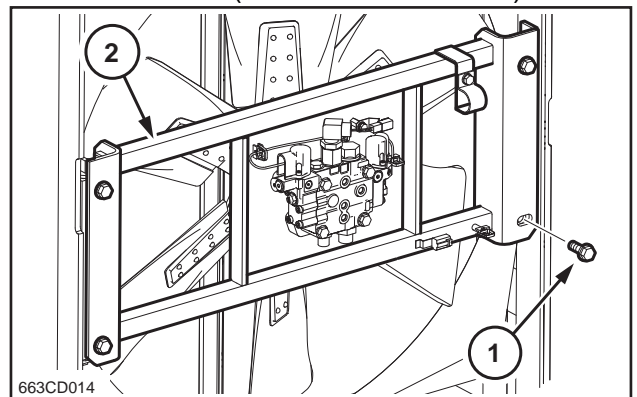
- Remove the fan guard. (For details, see "Removal and Installation of Radiator".)
- Use a wrench [36 mm (1.417 in.)] to remove the 2 hydraulic hoses (1) and use a wrench [27 mm (1.063 in.)] to remove the hydraulic hose (2).



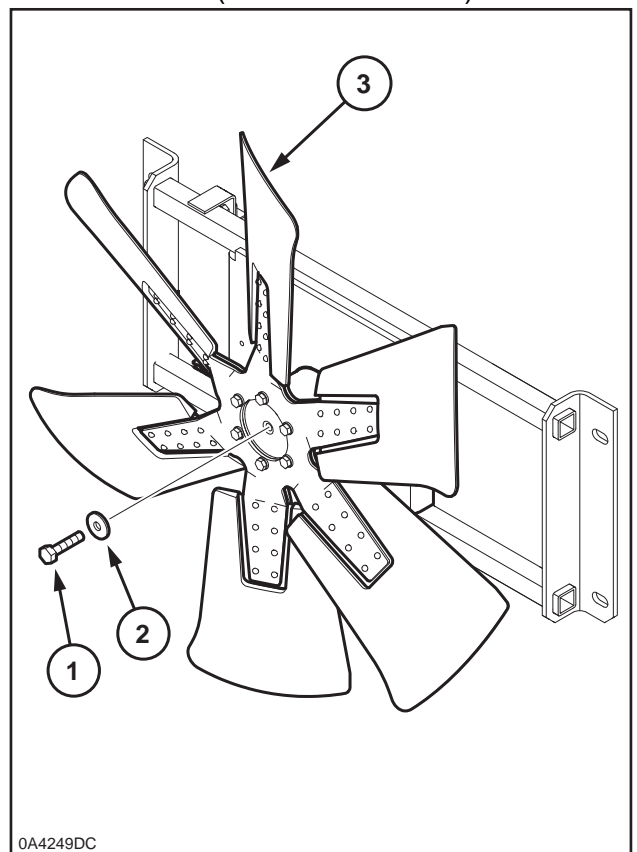
- Remove the connectors (1) (2).



- Use a wrench [24 mm (0.945 in.)] to remove the 4 bolts (1), and then remove the fan motor bracket (2).
Tightening torque for bolt installation: 144.2 - 171.6 N·m (106.37 - 126.59 lbf·ft)



- Use a wrench [17 mm (0.669 in.)] to remove the bolt (1) and washer (2), and then remove the cooling fan (3).
Tightening torque for bolt installation: 68.7 - 73.5 N·m (50.68 - 54.22 lbf·ft)



- Use a wrench [19 mm (0.748 in.)] to remove the 4 bolts (1) and 4 washers (2), and then remove the fan motor (3).
Tightening torque for bolt installation: 78.5 - 98.1 N·m (57.91 - 72.37 lbf·ft)

Removal and Installation of Cylinder head cover

Cylinder head cover Removal

1. Coolant drain

⚠ Warning

- Do not loosen the radiator cap when the coolant is hot.
- Steam and boiling water may burst out and cause burns, so make sure that the engine has cooled off.

[1] Drain the coolant from the radiator.

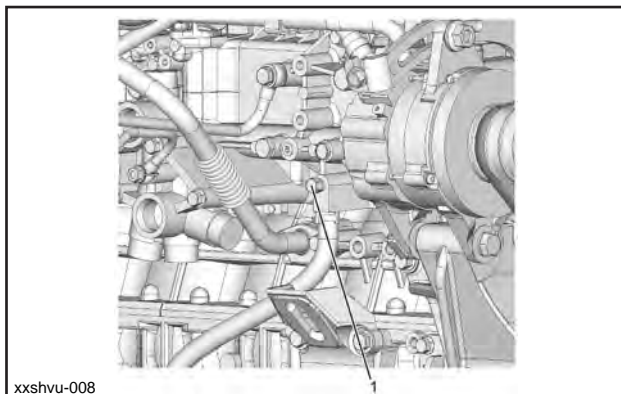
⚠ Caution

- After draining the coolant, tighten the drain plug.

[2] Drain the coolant from the engine assembly.

Note

- Loosen the drain plug on the cylinder block side.



xxshvu-008

1	Drain plug
---	------------

2. EGR cooler water hose removal

[1] Remove the EGR cooler water hose from the EGR cooler.

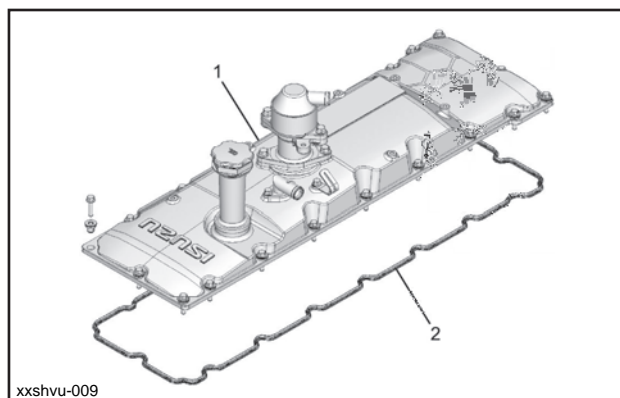
3. Ventilation hose disconnect

[1] Disengage the ventilation hose from the air breather.

4. Cylinder head cover removal

[1] Remove the cylinder head cover from the camshaft carrier.

[2] Remove the gasket from the cylinder head cover.



xxshvu-009

1	Cylinder head cover
2	Gasket

Cylinder head cover Installation

1. Cylinder head cover installation

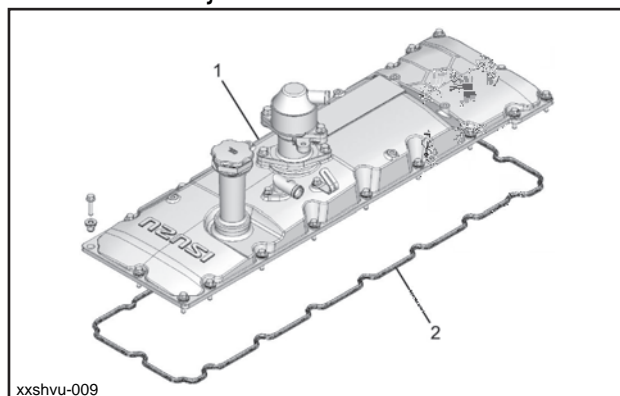
[1] Install the gasket to the cylinder head cover.

⚠ Caution

- If the gasket has looseness or a slant, repair it before installation.

[2] Install the cylinder head cover to the camshaft carrier.

Tightening torque: 15 N · m {1.5 kgf · m / 11 lb · ft}



xxshvu-009

1	Cylinder head cover
2	Gasket

2. Ventilation hose connect

[1] Connect the ventilation hose to the air breather.

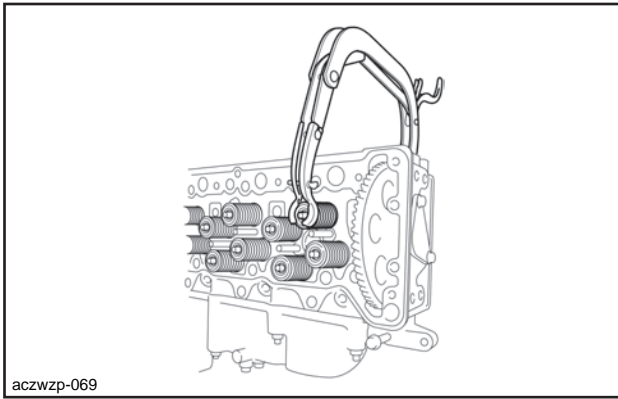
3. EGR cooler water hose installation

[1] Install the EGR cooler water hose to the EGR cooler.

4. Coolant filling

[1] Replenish the coolant with the radiator.

[2] Loosen the plug using the wrench.



[4] Remove the special tool from the cylinder head assembly.

Note

- After removing the special tool, lightly tap the top of the valve stem to stabilize the split collar.

8. Exhaust manifold installation

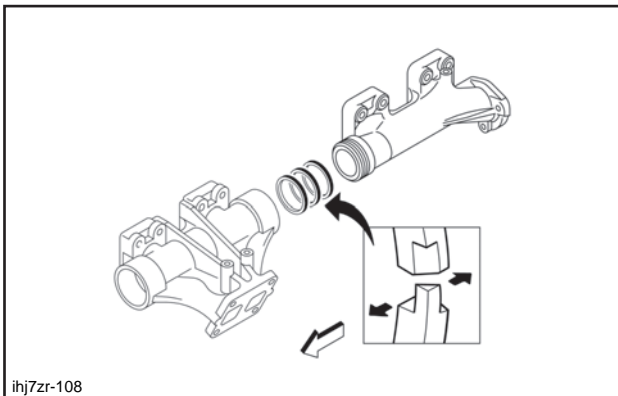
[1] Install the seal ring to the exhaust manifold.

Note

- Shift the joint positions by 120 degrees for installation.

⚠ Caution

- Pay attention to the directionality of the seal ring.



[2] Install the gasket to the cylinder head assembly.

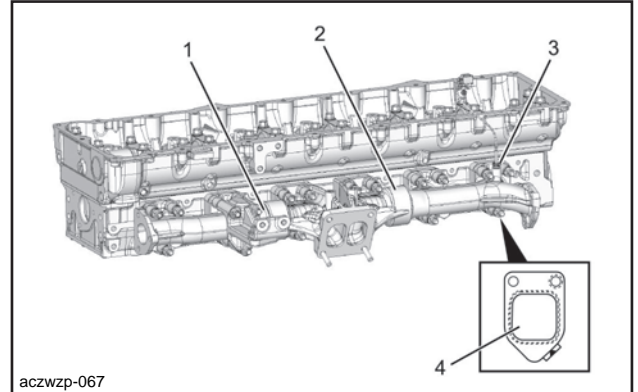
⚠ Caution

- Install it with the molybdenum coating facing the outside and the protruding portion on the lower right side.

[3] Install the exhaust manifold to the cylinder head assembly.

Note

- Refer to the diagram below to collectively tighten the bracket.



1	Bracket
2	Exhaust manifold
3	-
4	Gasket

Note

- Tighten each flange in the order of 3rd, 4th, 2nd, 5th, 1st, and 6th cylinder.

Tightening torque: 54 N · m {5.5 kgf · m / 40 lb · ft}

9. Inlet cover installation

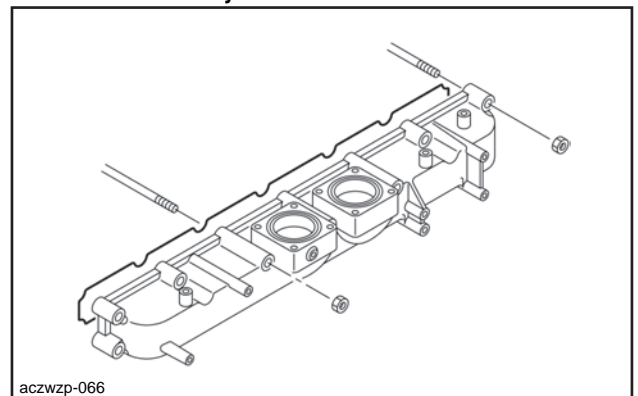
[1] Install the gasket to the inlet cover.

⚠ Caution

- Be sure they do not fall off.

[2] Install the inlet cover to the cylinder head assembly.

ighting torque: 45 N · m {4.6 kgf · m / 33 lb · ft}



10. Idle gear C installation

[1] Apply the engine oil to the idle gear shaft.

Note

- Procedure for complete tightening

⚠ Caution

- Make sure to follow the installation procedure. Otherwise, a gas leak or excessive stress may occur causing parts damage.

[7] Securely tighten the EGR cooler to the EGR valve duct.

Note

- Completely tighten the EGR cooler C and the EGR cooler D to the EGR valve duct.

Tightening torque: 50 N · m {5.1 kgf · m / 37 lb · ft} 1 in the diagram

[8] Securely tighten the EGR cooler to the EGR cooler.

Note

- Tighten the connections between the EGR cooler A and the EGR cooler C and between the EGR cooler B and the EGR cooler D at the respective specified torque.

Tightening torque: 50 N · m {5.1 kgf · m / 37 lb · ft} 2 in the diagram

[9] Securely tighten the EGR cooler to the EGR duct.

Tightening torque: 50 N · m {5.1 kgf · m / 37 lb · ft} 3 in the diagram

[10] Temporarily tighten the EGR duct to the exhaust manifold.

Tightening torque: 50 N · m {5.1 kgf · m / 37 lb · ft} 4 in the diagram

[11] Securely tighten the EGR valve duct to the EGR valve.

Tightening torque: 44 N · m {4.5 kgf · m / 32 lb · ft} 5 in the diagram

[12] Securely tighten the EGR valve duct to the EGR mixing chamber.

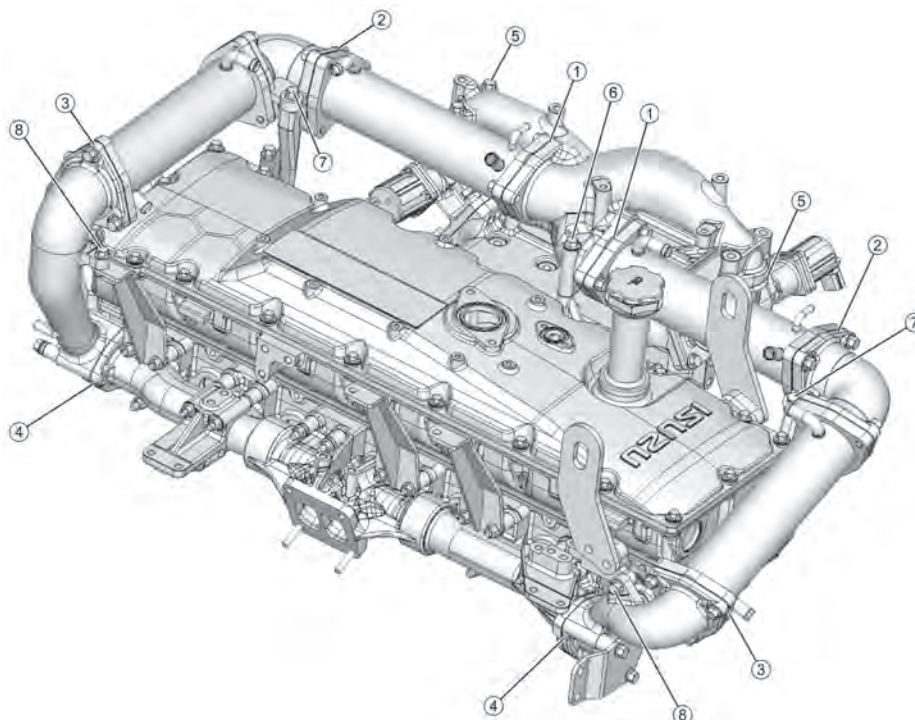
Tightening torque: 44 N · m {4.5 kgf · m / 32 lb · ft} 6 in the diagram

[13] Securely tighten the EGR cooler to the EGR cooler bracket.

Tightening torque: 50 N · m {5.1 kgf · m / 37 lb · ft} 7 in the diagram

[14] Completely tighten the EGR duct to the bracket.

Tightening torque: 50 N · m {5.1 kgf · m / 37 lb · ft} 8 in the diagram

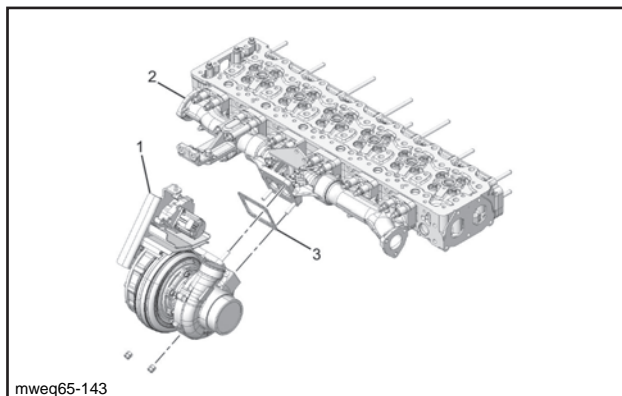


Izaj97-196

1	Water return pipe
2	Oil return pipe
3	Feed oil pipe
4	Water feed pipe

33. Turbocharger assembly removal

- [1] Remove the turbocharger assembly from the exhaust manifold.
- [2] Remove the gasket from exhaust manifold.



1	Turbocharger
2	Exhaust manifold
3	Gasket

⚠ Caution

- Put a seal on every part to prevent foreign materials from getting into the turbocharger.

34. Oil filter removal

Note

- Remove it if it is installed to the engine.
- Varies depending on the machine.

- [1] Remove the oil filter from the bracket.
- [2] Remove the bracket from the oil cooler assembly.

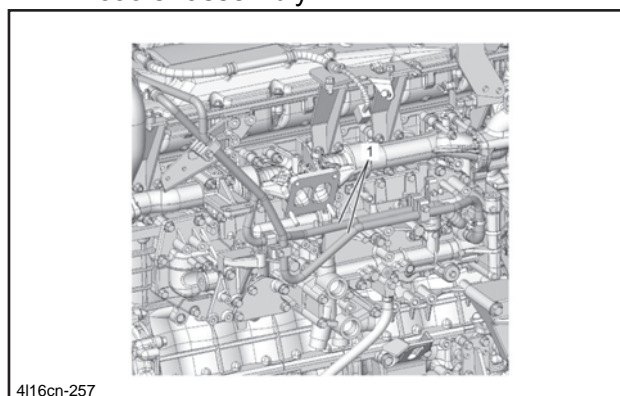
35. Oil cooler assembly removal

- [1] Disconnect the water hose from the oil cooler assembly.

Note

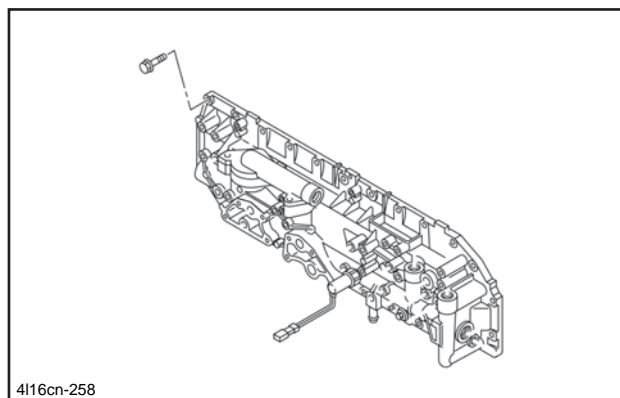
- Disconnect all hoses connected to the oil cooler assembly.

- [2] Disconnect the water pipe from the oil cooler assembly.



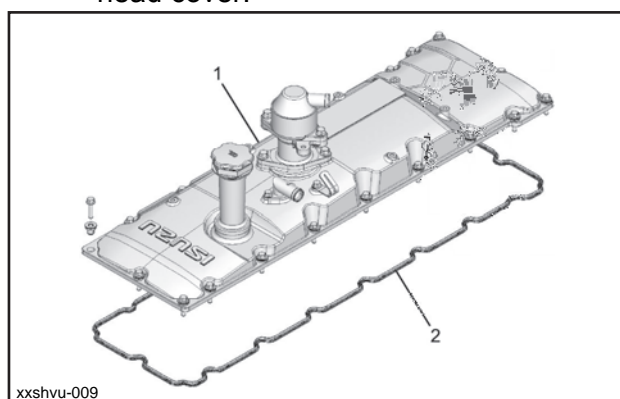
1	EGR cooler water pipe
---	-----------------------

- [3] Remove the oil cooler from the cylinder block.



36. Cylinder head cover removal

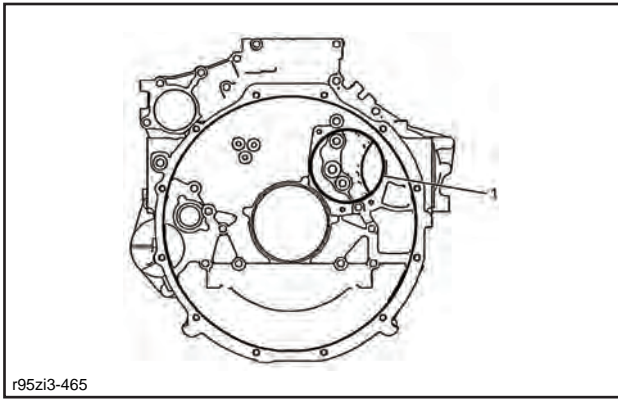
- [1] Remove the cylinder head cover from the camshaft carrier.
- [2] Remove the gasket from the cylinder head cover.



1	Cylinder head cover
2	Gasket

37. Glow plug removal

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



r95zi3-465

- 1 O-ring

7. Crankshaft rear oil seal installation

[1] Apply the engine oil to the crankshaft rear oil seal.

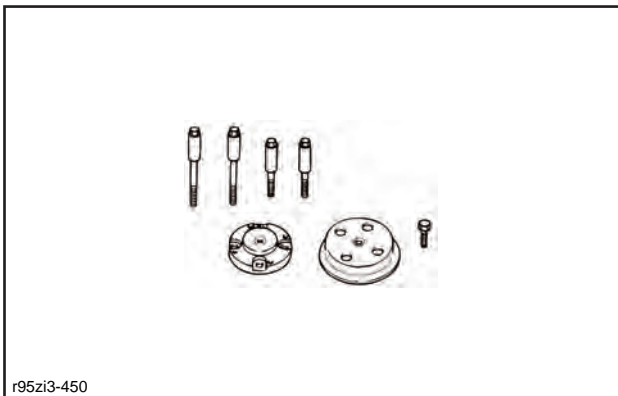
Note

- Apply lightly to the outer circumference of the oil seal.

[2] Install the crankshaft rear oil seal to the flywheel housing using the special tool.

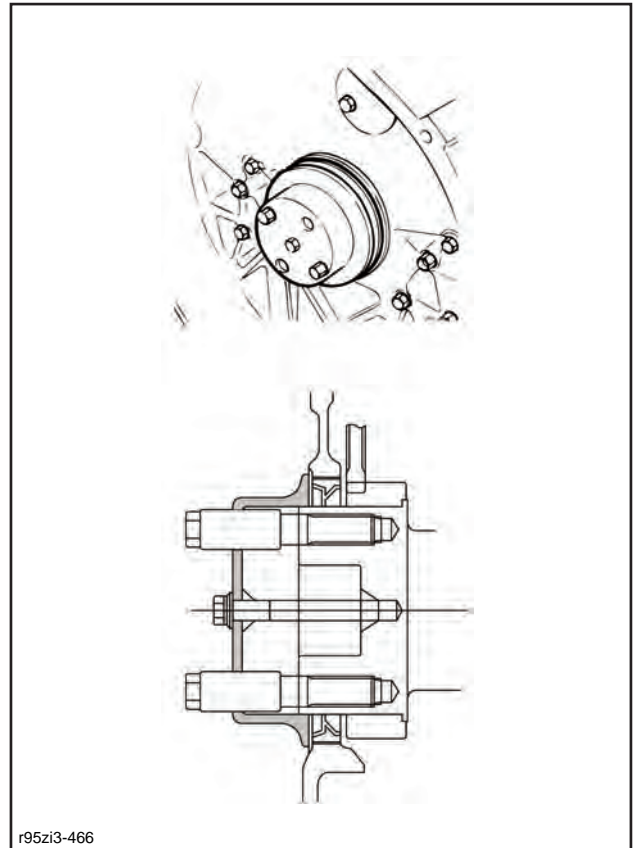
Note

- Install the oil seal and slinger at the same time without disassembling them.



r95zi3-450

SST: 1-8522-0057-0 - oil seal setting tool



r95zi3-466

Note

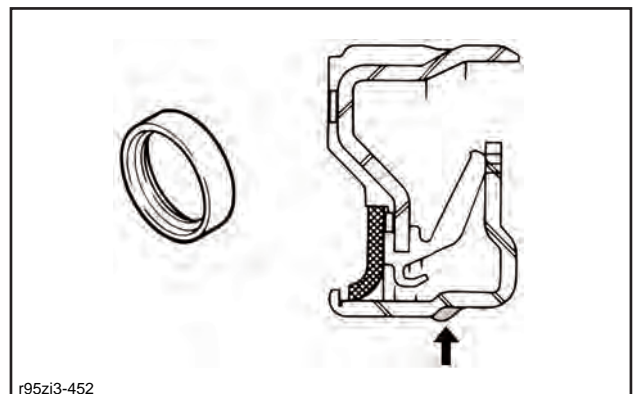
- Thoroughly wipe off oil that flows out after fitting the oil seal.
- When installing the oil seal, refer to the table for the specified installation locations with classification by colors.

Crankshaft oil seal identification color

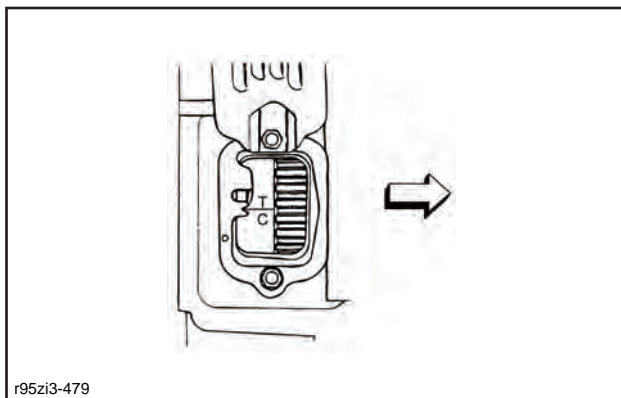
Front-side slinger	Silver
Rear-side slinger	Gray

⚠ Caution

- If flaws are found on the crankshaft, apply ThreeBond 1207C to the area shown in the diagram.



r95zi3-452

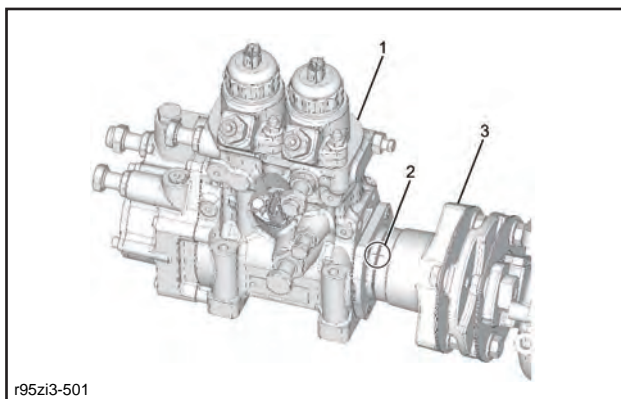


r95zi3-479

[2] Align the fuel supply pump with the supply pump coupling assembly.

Note

- Refer to the diagram to align the markings on the pump and the flange.



r95zi3-501

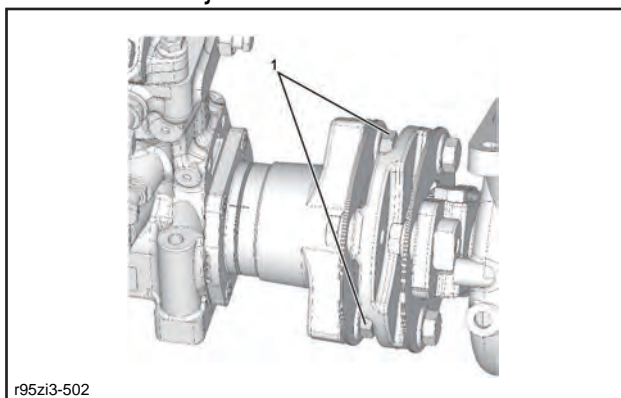
1	Fuel supply pump
2	Marked line
3	Coupling flange

[3] Install the bolts to the supply pump coupling assembly.

Note

- Refer to the diagram to install the 2 coupling bolts.

Tightening torque: 91 N · m {9.3 kgf · m / 67 lb · ft}



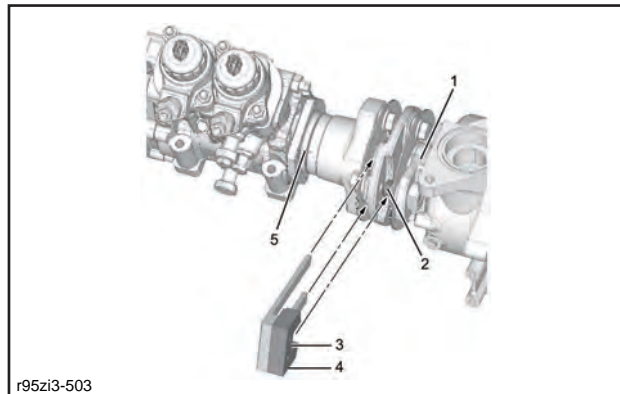
r95zi3-502

1	Coupling bolt
---	---------------

[4] Install the special tool to the supply pump coupling assembly.

Note

- Install so that its indent section contacts the coupling half bolt.



r95zi3-503

1	Coupling cotter bolt
2	Coupling half bolt
3	Indent section
4	Coupling setting tool
5	Stamping line

[5] Temporarily tighten the bolt onto the supply pump coupling assembly.

Note

- Insert a flat-blade screwdriver between the coupling and the bearing case.
- Temporarily tighten the cotter bolt with the coupling laminate attached to the special tool.

⚠ Caution

- Be careful not to damage the oil seal of the bearing case with the screwdriver.

[6] Remove the special tool from the supply pump coupling assembly.

Note

- Remove the special tool after confirming that they are firmly attached.

[7] Securely tighten the bolt onto the supply pump coupling assembly.

⚠ Caution

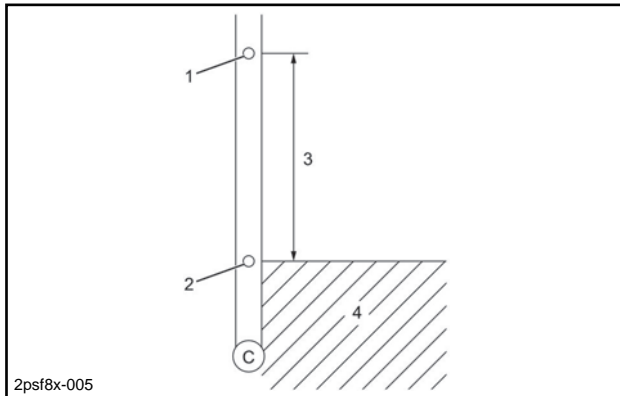
- Confirm that the laminate of the coupling has no bending before securely tightening the cotter bolt.

Tightening torque: 91 N · m {9.3 kgf · m / 67 lb · ft}

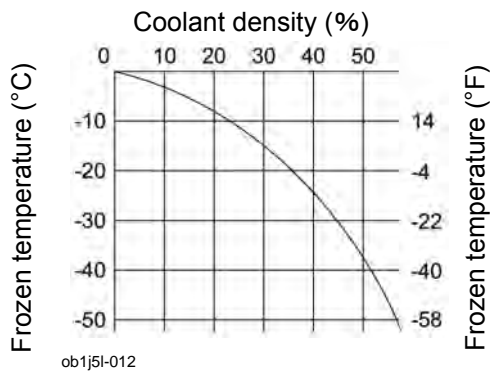
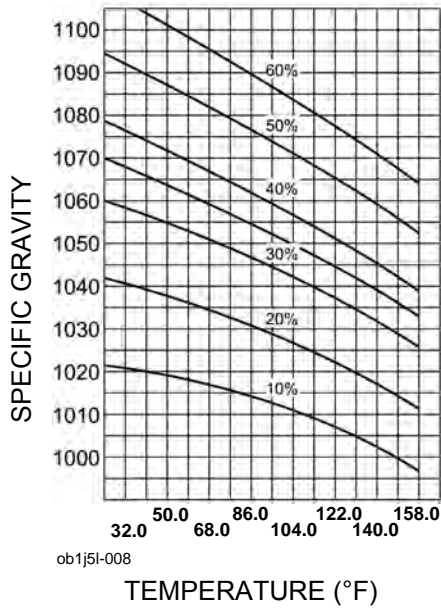
[4] Inspect the engine oil.

Note

- Check the engine oil remaining on the oil level gauge to inspect the engine oil level.



1	MAX
2	MIN
3	Acceptable oil amount
4	Requires replenishment



[2] Inspect the cap.

Note

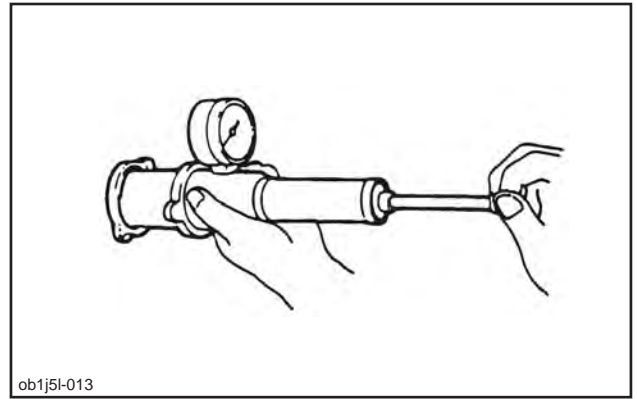
- Inspect the condition of the negative pressure valve located at the center of the radiator cap valve seat side.
- If the valve seat is not operating smoothly because of rust, filth, etc., clean or replace the radiator cap.

[3] Inspect the cap using a radiator cap tester.

Note

- Inspect the open valve pressure of the radiator cap using a radiator cap tester.

Radiator cap operating pressure		
Standard value	Positive pressure	: 61.8 to 71.6 kPa {0.63 - 0.73 kgf/cm ² / 9 to 10 psi}
	Negative pressure	: 4.9 kPa {0.05 kgf/cm ² / 1 psi}



Note

- Replace the sub-tank cap if the open valve pressure is not at the standard value.

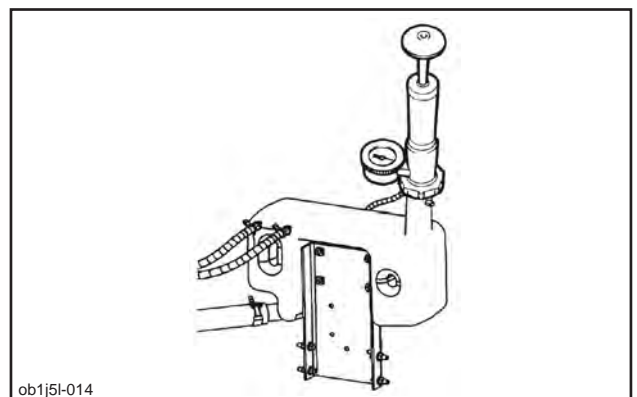
[4] Inspect coolant using a radiator cap tester.

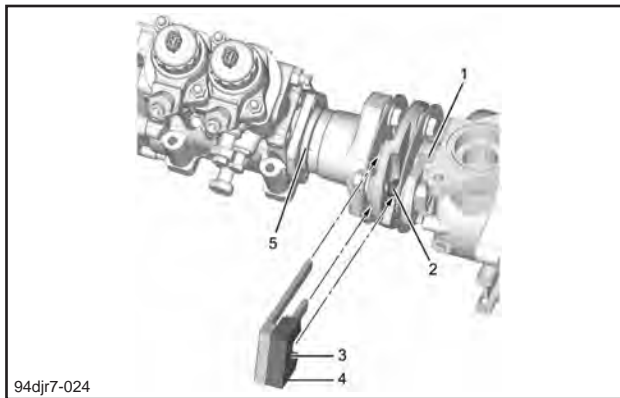
Note

- Inspect the sections listed in the table for coolant leakage using a radiator cap tester.

Inspection pressure: 88 kPa {0.90 kgf/cm² / 12.8 psi}

Coolant leakage inspection sections	Radiator
	Water pump
	Radiator upper hose
	Radiator lower hose
	Heater hose
	Water pipe
	Water rubber hose
Sub-tank	





1	Coupling cotter bolt
2	Coupling half bolt
3	Indent section
4	Coupling setting tool
5	Stamping line

[5] Temporarily tighten the bolt onto the supply pump coupling assembly.

Note

- Insert a flat-blade screwdriver between the coupling and the bearing case.
- Temporarily tighten the cotter bolt with the coupling laminate attached to the special tool.

Caution

- Be careful not to damage the oil seal of the bearing case with the screwdriver.

[6] Remove the special tool from the supply pump coupling assembly.

Note

- Remove the special tool after confirming that they are firmly attached.

[7] Securely tighten the bolt onto the supply pump coupling assembly.

Caution

- Confirm that the laminate of the coupling has no bending before securely tightening the cotter bolt.

Tightening torque: 91 N · m {9.3 kgf · m / 67 lb · ft}

[8] Securely tighten the bolt onto the supply pump coupling assembly.

Note

- Securely tighten the coupling half bolt.

Tightening torque: 91 N · m {9.3 kgf · m / 67 lb · ft}

Caution

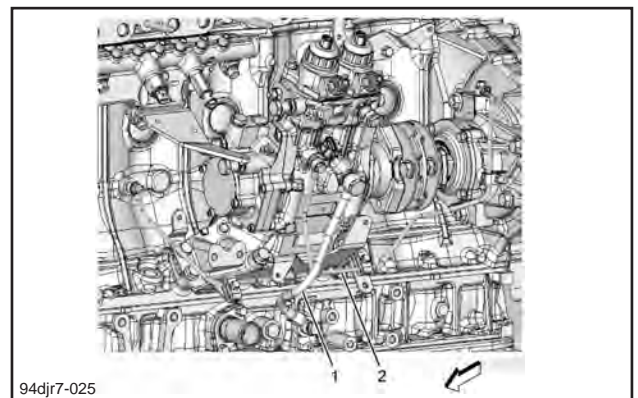
- After completely tightening each bolt, confirm that the marking lines are aligned.

[9] Install the oil feed pipe to the fuel supply pump.

Oil feed pipe tightening torque	
Parts	Tightening torque
Fuel supply pump side	: 7.38 lbf · ft {1.0 kgf · m / 89 lb · in}
Cylinder block side	: 20 N · m {2.0 kgf · m / 15 lb · ft}

[10] Install the oil return pipe to the fuel supply pump.

Oil return pipe tightening torque	
Parts	Tightening torque
Fuel supply pump	: 17 N · m {1.7 kgf · m / 13 lb · ft}
Cylinder block side	: 41 N · m {4.2 kgf · m / 30 lb · ft}



1	Oil return pipe
2	Oil feed pipe

4. Fuel pipe installation

[1] Temporarily tighten the fuel pipe to the fuel supply pump and the fuel filter.

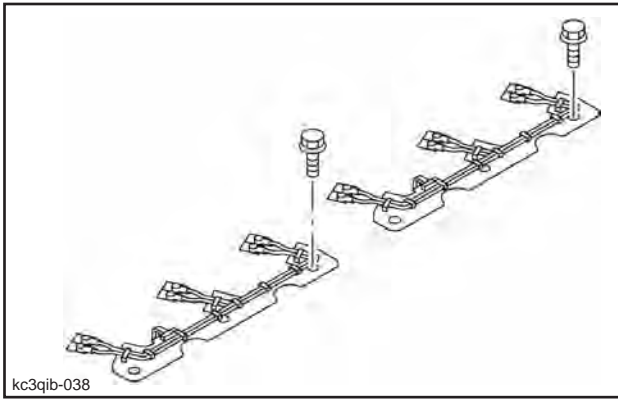
Caution

- Use new fuel pipes.

[2] Securely tighten the fuel pipe onto the fuel supply pump.

Tightening torque: 17 N · m {1.7 kgf · m / 13 lb · ft} Fuel temperature sensor adapter

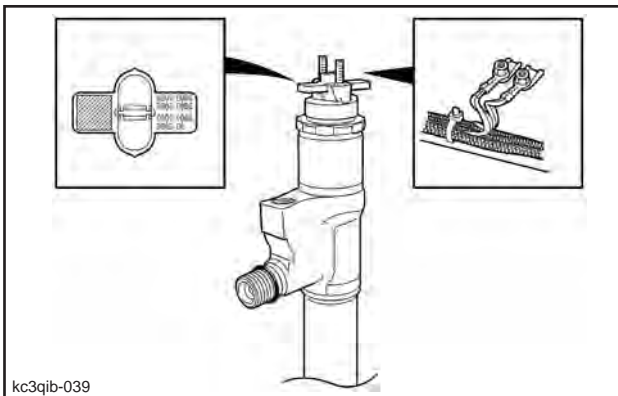
[3] Securely tighten the fuel pipe onto the fuel filter.



[3] Install the harness to the injector.
Tightening torque: 1.48 lbf · ft {0.2 kgf · m / 18 lb · in}

Caution

- Strictly conform to the specified torque to avoid over-tightening of nuts, which may cause damage.



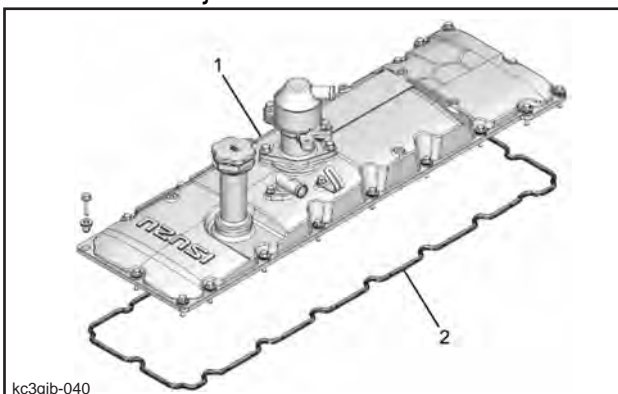
5. Cylinder head cover installation

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

Caution

- If the gasket has looseness or a slant, repair it before installation.

[2] Install the cylinder head cover to the camshaft carrier.
Tightening torque: 15 N · m {1.5 kgf · m / 11 lb · ft}



1	Cylinder head cover
2	Gasket

6. Injection pipe installation

[1] Install the injection pipe to the injector and common rail assembly.

Caution

- Use new injection pipes.

Note

- Alternately tighten the injection pipe sleeve nuts on the injector side and the common rail side in a few steps.

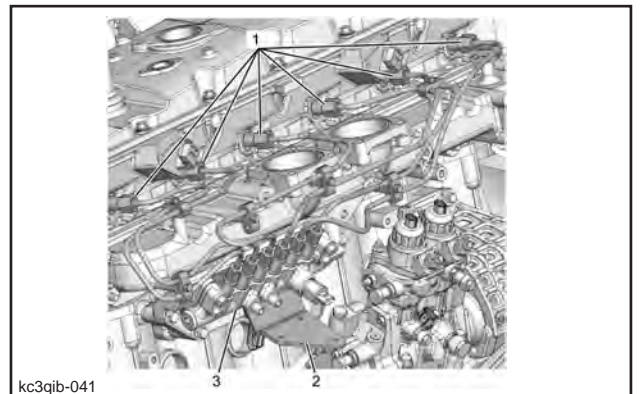
Tightening torque: 44 N · m {4.5 kgf · m / 32 lb · ft}

[2] Install the clip to the injection pipe.

Tightening torque: 6.64 lbf · ft {0.9 kgf · m / 80 lb · in}

Caution

- If the rubber is cracked or damaged, do not reuse it.



1	Injection pipe
2	Bracket
3	Common rail assembly

7. Ventilation hose installation

[1] Connect the ventilation hose to the air duct.

[2] Connect the ventilation hose to the cylinder head cover.

8. EGR valve installation

[1] Install the lead valve to the EGR mixing chamber.

Tightening torque: 7.38 lbf · ft {1.0 kgf · m / 89 lb · in}

[2] Install the gasket to the EGR mixing chamber.

When receiving the machine from the customer at the service factory, the failure symptoms and the data on occurrence of failure must be confirmed with the customer based on the engine control check sheet.

- Failure symptoms may not be reproduced at the service garage.
- The customer's complaint may not always be a malfunction.
- When failure conditions are not correctly reported to the person in charge of repair, unnecessary man-hours for repair may result.
- The check sheet assists in onboard diagnosis, repair, and repair confirmation at the vehicle servicing station.



bq75cc-007

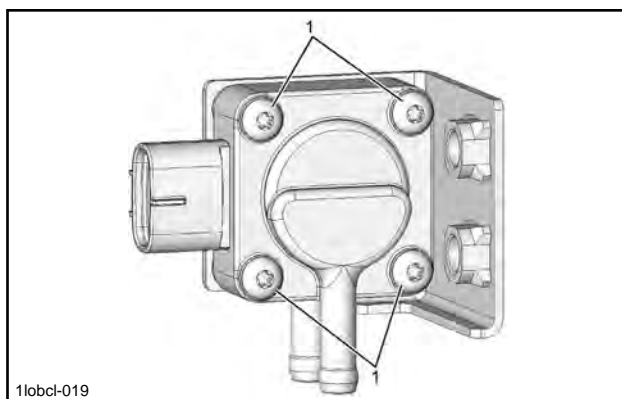
1	Failure symptoms
2	Failure frequency/failure conditions

Exhaust differential pressure sensor Installation

1. Exhaust differential pressure sensor safety Information

Caution

- Do not use a tool which causes vibrations such as an impact wrench when installing and removing the exhaust differential pressure sensor.
- Do not reuse the exhaust differential pressure sensor which has been subjected to shock such as being dropped.
- Install or remove the exhaust differential pressure sensor together with the bracket.
- Be sure not to loosen the 4 screws installed on the exhaust differential pressure sensor.
- Replace the exhaust differential pressure sensor if the 4 screws installed on the DPD differential pressure sensor have been loosened.



1 Screw

2. Exhaust differential pressure sensor installation

Caution

- Before performing work, be sure to check the exhaust differential pressure sensor precautions.

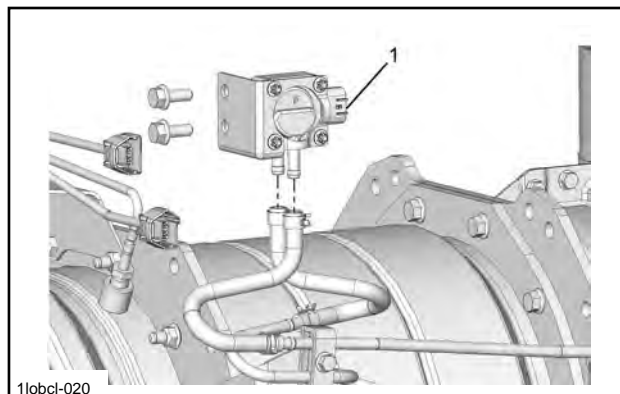
[1] Install the exhaust differential pressure sensor to the DPD assembly.

[2] Connect the harness connector to the exhaust differential pressure sensor.

[3] Connect the differential pressure hose to the exhaust differential pressure sensor.

Caution

- Be careful not to mistake the connecting position of the differential pressure hose.
- Since the differential pressure sensor may malfunction if exhaust gas leaks from the joint sections, confirm that there is no exhaust gas leakage after the engine starts.



1 Exhaust differential pressure sensor

Exhaust differential pressure sensor Inspection

1. Exhaust differential pressure sensor inspection

Caution

- Perform 0-point correction when replacing the exhaust differential pressure sensor.
- Perform 0-point correction when the exhaust differential pressure sensor is at room temperature.
- Do not perform 0-point correction within two hours after regenerating DPD.

Note

- 0-point correction

[1] Turn OFF the starter switch.

[2] Turn ON the starter switch.

Caution

- Do not start the engine.

Starter switch ON time: more than 40 s

[3] Turn OFF the starter switch.

Starter switch OFF time: more than 15 s

Diagnostic Trouble Code 0089 Fuel Rail Pressure Regulator Characteristic Error

1. Diagnostic trouble code prior to diagnostic trouble code 0089
Diagnostic trouble code 0192
Diagnostic trouble code 0193
2. Diagnostic trouble code 0089 - diagnosis
 - [1] Inspect the connection of the harness connector of the fuel pressure sensor.
 - [2] If a problem is found, repair the harness connector.
 - [3] Inspect the installation of the supply pump.
See "Installation of Fuel Supply Pump".
 - [4] If a problem is found, repair the installation of the supply pump.
 - [5] Inspect for any crushing or clogging in all fuel pipes.
 - [6] If a problem is found, repair the fuel pipe.
 - [7] Inspect whether the fuel filter has a problem.
 - [8] If a problem is found, replace the fuel filter.
 - [9] Start the engine.
 - [10] Idle the engine and check the amount of fuel correction with the trouble diagnosis scan tool.
Standard value: (-4) - 4 mm³/st
 - [11] If the amount of fuel correction is outside the standard range, inspect and clean the cylinder injector with the problem.
 - [12] If a problem is found, replace the injector.
See "Removal of Injector".
See "Installation of Injector".
 - [13] When replacing an injector, set the injector ID code.
 - [14] Check the indicated actual fuel rail pressure data with the trouble diagnosis scan tool.
 - [15] Test the operation and check that the indicated data does not exceed the standard value.
Standard value: -2 - 2 MPa (-20 - 20 kgf/cm²/-290 - 290 psi)
 - [16] If it is outside the standard range, turn the starter switch OFF.
 - [17] Disconnect the harness from the fuel pressure sensor.

- [18] Measure the voltage between the power supply terminal of the harness connector on the common rail pressure sensor side and body ground.
Standard value: 5.0 V
- [19] If it is outside the standard range, turn the starter switch OFF.
- [20] Disconnect the ECM harness.
- [21] Connect a test cable with fuse between the terminals on the common rail pressure sensor harness connector side.

Note

- Signal 1 - power supply, signal 1 - ground, power supply - ground

- [22] Measure the resistance between the harness connector terminals on the ECM side.

Note

- Signal 1 - power supply, signal 1 - ground, power supply - ground

Standard value: 0.5 Ω

- [23] Disconnect the test cable with fuse on the common rail pressure sensor harness connector side.
- [24] Measure the resistance between the harnesses of the harness connectors on the common rail pressure sensor side and ECM side.
Standard value: ∞ Ω
- [25] If it is outside the standard range, check the actual fuel rail pressure with the trouble diagnosis scan tool.
Standard value: 0 MPa (0 kgf/cm²/0 psi)
- [26] Bleed the air out of the fuel line.
- [27] Turn the starter switch OFF and wait at least 30 sec.
- [28] Start the engine.
- [29] Use the trouble diagnosis scan tool to check the indicated actual fuel rail pressure during idling.
Standard value: -2 - 2 MPa (-20 - 20 kgf/cm²/-290 - 290 psi)
- [30] If the indicated data is outside the standard range, inspect the fuel pressure sensor.
- [31] If a problem is found, replace the fuel pressure sensor.
- [32] Inspect the fuel pipe for fuel leaks.

- [18] Inspect for a disconnection or high resistance in the ground circuit between the ECM and fuel temperature sensor.
 - [19] If a problem is found, repair the ground circuit.
 - [20] Turn the starter switch OFF.
 - [21] Disconnect the harness connector of the ECM.
 - [22] Inspect for a contact defect in the harness connector of the ECM.
 - [23] If a problem is found, repair the harness connector.
 - [24] Replace the ECM.
 - [25] Set the injector ID code and Q resistance compensation data in the ECM.
3. Diagnostic trouble code 0183 - check if symptom has disappeared
- [1] Display RESET on the service support screen on the monitor and reset FAULTY HISTORY.
See "Service Support - RESET Screen List".
 - Note that all the generated diagnostic trouble codes will be cleared.
 - [2] Turn the starter switch OFF for 30 sec. or longer.
 - [3] Start the engine.
 - [4] Test the operation.
 - [5] Display FAULTY HISTORY on the service support screen on the monitor and check that no diagnostic trouble code has been detected.
See "Service Support - FAULTY HISTORY".

Diagnostic Trouble Code 0192 Fuel Rail Pressure Sensor System Low Input

1. Diagnostic trouble code prior to diagnostic trouble code 0192
Diagnostic trouble code 0641
2. Diagnostic trouble code 0192 - diagnosis
 - [1] Turn the starter switch OFF.
 - [2] Disconnect the harness connector from the fuel pressure sensor.
 - [3] Check the value indicated on the fuel rail pressure sensor with the trouble diagnosis scan tool.
Standard value: 4.5 V
 - [4] If it is below the standard value, inspect for a short circuit to ground in the signal circuit between the ECM and fuel pressure sensor.
 - [5] If a problem is found, repair the signal circuit.
 - [6] Measure the voltage between the fuel pressure sensor 5 V power supply circuit and normal ground.
Standard value: 4.5 V
 - [7] If it exceeds the standard value, inspect for a contact defect in the harness connector of the fuel pressure sensor.
 - [8] If a problem is found, repair the harness connector.
 - [9] If the harness connector is normal, replace the fuel pressure sensor.
- [10] Inspect for a disconnection or high resistance in the 5 V power supply circuit between the ECM and fuel pressure sensor.

Note

- The fuel pressure sensor shares use of the 5 V power supply circuit with other sensors.
- A diagnostic trouble code may be detected for the sensors sharing use of this circuit.

- [11] If a problem is found, repair the 5 V power supply circuit.
- [12] Inspect for a contact defect in the harness connector of the ECM.
- [13] If a problem is found, repair the harness connector.
- [14] If the harness connector is normal, replace the ECM.
- [15] Set the injector ID code and Q resistance compensation data in the ECM.

- [12] Check whether the barometric pressure indicated in MACHINE STATUS on the service support screen on the monitor is within the standard range.
See "Service Support - MACHINE STATUS".

Note

- Normally, the barometric pressure indicated in MACHINE STATUS is close to the surrounding barometric pressure.

- [13] If the indicated barometric pressure is within the standard range, inspect the boost sensor system.
See "Inspection of Boost Sensor".

- [14] If there is a problem in the inspection result of the boost sensor, replace the boost sensor.
See "Removal of Boost Sensor".
See "Installation of Boost Sensor".

- [15] If the indicated barometric pressure is outside the standard range, inspect the barometric pressure sensor system.

- [16] If there is a problem in the inspection result of the barometric pressure sensor, replace the barometric pressure sensor.

- [17] Inspect for a contact defect in the harness connector of the ECM.

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

3. Diagnostic trouble code 0234 - check if symptom has disappeared

- [1] Display RESET on the service support screen on the monitor and reset FAULTY HISTORY.

See "Service Support - RESET Screen List".

- Note that all the generated diagnostic trouble codes will be cleared.

- [2] Turn the starter switch OFF for 30 sec. or longer.

- [3] Start the engine.

- [4] Test the operation.

- [5] Display FAULTY HISTORY on the service support screen on the monitor and check that no diagnostic trouble code has been detected.
See "Service Support - FAULTY HISTORY".

Diagnostic Trouble Code 0237 Boost Sensor Circuit Low Input

1. Diagnostic trouble code prior to diagnostic trouble code 0237

Diagnostic trouble code 1655

2. Diagnostic trouble code 0237 - diagnosis

- [1] Turn the starter switch OFF.

- [2] Disconnect the harness connector of the boost sensor.

- [3] Measure the voltage between the 5 V power supply circuit and normal ground.

Standard value: 4.9 V

- [4] If it is below the standard value, inspect for a disconnection or high resistance in the power supply circuit between the ECM and boost sensor.

- [5] If a problem is found, repair the power supply circuit.

- [6] Connect a test cable with fuse between the power supply circuit and signal circuit.

- [7] Check the data indicated on the boost pressure sensor with the trouble diagnosis scan tool.

Standard value: 4.9 V

- [8] If the indicated data exceeds the standard value, inspect for a contact defect in the harness connector of the boost sensor.

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

- [10] If the harness connector is normal, replace the boost sensor.

See "Removal of Boost Sensor".

See "Installation of Boost Sensor".

- [11] If the indicated data is below the standard value, inspect the signal circuit between the ECM and boost sensor.

Note

- There must be no disconnection or high resistance between the ECM and boost sensor.
- There must be no short circuit to ground between the ECM and the boost sensor.

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

- [13] Turn the starter switch OFF.

- [14] Disconnect the harness connector of the ECM.

Diagnostic Trouble Code 042D Exhaust Temperature Sensor 2 System High Input

1. Diagnostic trouble code prior to diagnostic trouble code 042D
Diagnostic trouble code 0697
2. Diagnostic trouble code 042D - diagnosis
 - [1] Turn the starter switch OFF.
 - [2] Disconnect the harness connector of exhaust gas temperature sensor 2.
 - [3] Turn the starter switch ON.
 - [4] Measure the voltage between the signal circuit and normal ground.
Standard value: 4.8 V
 - [5] If the voltage value exceeds the standard value, inspect for a short to the battery or ignition power supply circuit in the signal circuit between the ECM and exhaust gas temperature sensor 2.
 - [6] If a problem is found, repair the signal circuit.
 - [7] If the voltage value is below the standard value, connect a test cable with fuse between the signal circuit and ground circuit.
 - [8] Check the data indicated on exhaust gas temperature sensor 2 (before oxidation catalyst) with the trouble diagnosis scan tool.
Standard value: 0.1 V
 - [9] If the indicated data is below the standard value, inspect for a short to the 5 V power supply circuit in the signal circuit between the ECM and exhaust gas temperature sensor 2.
 - [10] If a problem is found, repair the signal circuit.
 - [11] Inspect for a contact defect in the harness connector of the exhaust gas temperature sensor 2.
 - [12] If a problem is found, repair the harness connector.
 - [13] If the harness connector of the exhaust gas temperature sensor 2 is normal, replace the exhaust gas temperature sensor 2.
See "Removal of Exhaust Gas Temperature Sensor".
See "Installation of Exhaust Gas Temperature Sensor".
 - [14] Connect a test cable with fuse between the signal circuit and normal ground.
 - [15] Check the data indicated on exhaust gas temperature sensor 2 (before oxidation catalyst) with the trouble diagnosis scan tool.
Standard value: 0.1 V
 - [16] If it exceeds the standard value, inspect for a disconnection or high resistance in the signal circuit between the ECM and exhaust gas temperature sensor 2.
 - [17] If a problem is found, repair the signal circuit.
 - [18] Inspect for a disconnection or high resistance in the ground circuit between the ECM and exhaust gas temperature sensor 2.
 - [19] If a problem is found, repair the ground circuit.
 - [20] Turn the starter switch OFF.
 - [21] Disconnect the harness connector of the ECM.
 - [22] Inspect for a contact defect in the harness connector of the ECM.
 - [23] If a problem is found, repair the harness connector.
 - [24] Replace the ECM.
 - [25] Set the injector ID code and Q resistance compensation data in the ECM.
3. Diagnostic trouble code 042D - check if symptom has disappeared
 - [1] Display RESET on the service support screen on the monitor and reset FAULTY HISTORY.
See "Service Support - RESET Screen List".
 - Note that all the generated diagnostic trouble codes will be cleared.
 - [2] Turn the starter switch OFF for 30 sec. or longer.
 - [3] Start the engine and warm it up until the coolant temperature reaches the standard value.
Standard value: 80°C (176°F)
 - [4] While using the trouble diagnosis scan tool to check the data indicated on the exhaust gas temperature sensor 2 (before oxidation catalyst), repeatedly rev the engine to raise the engine speed.

Diagnostic Trouble Code 1063 Fuel Rail Pressure Regulator PCV2 Drive Circuit Abnormality

1. Diagnostic trouble code 1063 - diagnosis
 - [1] Inspect the ECM power supply circuit.
 - [2] If a problem is found, repair the power supply circuit.
 - [3] Inspect the ECM ground circuit.
 - [4] If a problem is found, repair the ground circuit.
 - [5] Inspect the connection of the ECM connector.
 - [6] If a problem is found, repair the ECM connector.
 - [7] Replace the ECM.
See "Removal of ECM".
See "Installation of ECM".
 - [8] Set the injector ID code and Q resistance compensation data in the ECM.
2. Diagnostic trouble code 1063 - check if symptom has disappeared
 - [1] Display RESET on the service support screen on the monitor and reset FAULTY HISTORY.
See "Service Support - RESET Screen List".
 - Note that all the generated diagnostic trouble codes will be cleared.
 - [2] Turn the starter switch OFF for 30 sec. or longer.
 - [3] Start the engine.
 - [4] Test the operation.
 - [5] Display FAULTY HISTORY on the service support screen on the monitor and check that no diagnostic trouble code has been detected.
See "Service Support - FAULTY HISTORY".

Diagnostic Trouble Code 1093 Fuel Rail Pressure Low Pressure Error

1. Diagnostic trouble code prior to diagnostic trouble code 1093
Diagnostic trouble code 0192
Diagnostic trouble code 0193
2. Diagnostic trouble code 1093 - diagnosis
 - [1] Inspect whether the fuel pipe from the fuel tank to the injectors has a problem.

Note

- There must be no fuel leaks from the fuel pipes and no crushed or clogged fuel pipes.

- [2] If a problem is found, repair the fuel leak or fuel pipe.
- [3] Start the engine.
- [4] Rev the engine, and inspect for a fuel leak from the high-pressure fuel line.
- [5] If a problem is found, repair the fuel leak in the high-pressure fuel pipe.
- [6] Start the engine.
- [7] Check the amount of fuel correction during idling with the trouble diagnosis scan tool.
Standard value: (-4) - 4 mm³/st
- [8] Replace the injectors that are outside the standard range.
See "Removal of Injector".
See "Installation of Injector".
- [9] When replacing an injector, set the injector ID code in the ECM.
- [10] Start the engine.
- [11] With the engine idling, disconnect the harness from PCV1.

Note

- When you disconnect the harness from PCV1, diagnostic trouble code 0091 is set, so after the inspection is complete, clear the diagnostic trouble code.

- [12] Check if the engine stalls.
- [13] If the engine stalls, replace the fuel supply pump.
- [14] Connect the harness to PCV1.
- [15] Start the engine.

Diagnostic Trouble Code 1655 Sensor Voltage System Error

1. Diagnostic trouble code 1655 - diagnosis

- [1] Turn the starter switch OFF.
- [2] Disconnect the harness connector of the DPD differential pressure sensor.
- [3] Turn the starter switch ON.
- [4] Measure the voltage between the DPD differential pressure sensor 5 V power supply circuit and normal ground.
Standard value: 4.5 - 5.5 V
- [5] If it exceeds the standard value, replace the DPD differential pressure sensor.
See "Removal of DPD Differential Pressure Sensor".
See "Installation of DPD Differential Pressure Sensor".

Note

- Zero-point calibration must be performed after replacing the DPD differential pressure sensor.

- [6] Turn the starter switch OFF.
- [7] Disconnect the harness connector of the DPD exhaust gas temperature sensor.
- [8] Turn the starter switch ON.
- [9] Measure the voltage between the signal circuit of the DPD exhaust gas temperature sensor and normal ground.
Standard value: 4.5 - 5.5 V
- [10] If it exceeds the standard value, replace the DPD exhaust gas temperature sensor.
- [11] Turn the starter switch OFF.
- [12] Disconnect the harness connector of the fan drive.
- [13] Turn the starter switch ON.
- [14] Measure the voltage between the fan drive 5 V power supply circuit and normal ground.
Standard value: 4.5 - 5.5 V
- [15] If it is within the standard range, replace the fan drive.
- [16] Turn the starter switch OFF.
- [17] Disconnect the harness connector of the IAT sensor.
- [18] Turn the starter switch ON.
- [19] Measure the voltage between the IAT sensor signal circuit and normal ground.
Standard value: 4.5 - 5.5 V

- [20] If it exceeds the standard value, replace the IAT sensor.
- [21] Turn the starter switch OFF.
- [22] Disconnect the harness connector of the exhaust gas temperature sensor.
- [23] Turn the starter switch ON.
- [24] Measure the voltage between the exhaust gas temperature sensor signal circuit and normal ground.
Standard value: 4.5 - 5.5 V
- [25] If it exceeds the standard value, replace the exhaust gas temperature sensor.
- [26] Inspect the 5 V power supply circuit 8 between the ECM and electronic control fan speed sensor.

Note

- There must be no short circuit to ground between the ECM and electronic control fan speed sensor.
- There must be no short to the battery or ignition power supply circuit between the ECM and the electronic control fan speed sensor.

- [27] If a problem is found, repair the 5 V power supply circuit 8.
 - [28] Replace the ECM.
 - [29] Set the injector ID code and Q resistance compensation data in the ECM.
2. Diagnostic trouble code 1655 - check if symptom has disappeared
- [1] Display RESET on the service support screen on the monitor and reset FAULTY HISTORY.
See "Service Support - RESET Screen List".
 - Note that all the generated diagnostic trouble codes will be cleared.
 - [2] Turn the starter switch OFF for 30 sec. or longer.
 - [3] Start the engine.
 - [4] Test the operation.
 - [5] Display FAULTY HISTORY on the service support screen on the monitor and check that no diagnostic trouble code has been detected.
See "Service Support - FAULTY HISTORY".

- [14] Inspect for a contact defect in the harness connector of the ECM.
 - [15] If a problem is found, repair the harness connector.
 - [16] Replace the ECM.
 - [17] Set the injector ID code and Q resistance compensation data in the ECM.
3. Diagnostic trouble code 2455 - check if symptom has disappeared
- [1] Display RESET on the service support screen on the monitor and reset FAULTY HISTORY.
See "Service Support - RESET Screen List".
 - Note that all the generated diagnostic trouble codes will be cleared.
 - [2] Turn the starter switch OFF for 30 sec. or longer.
 - [3] Start the engine.
 - [4] Test the operation.
 - [5] Display FAULTY HISTORY on the service support screen on the monitor and check that no diagnostic trouble code has been detected.
See "Service Support - FAULTY HISTORY".

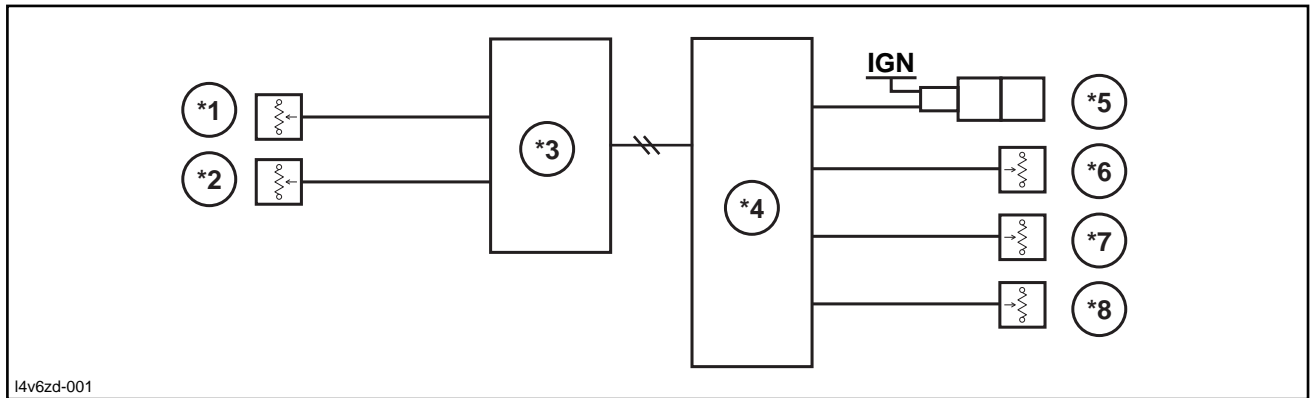
Diagnostic Trouble Code 2456 DPD Differential Pressure Sensor Learning Position Error

- 1. Diagnostic trouble code prior to diagnostic trouble code 2456
Diagnostic trouble code 2454
Diagnostic trouble code 2455
 - 2. Diagnostic trouble code 2456 - diagnosis
 - [1] Turn the starter switch OFF.
 - [2] Disconnect the harness connector from the DPD differential pressure sensor.
 - [3] Inspect for a contact defect in the harness connector of the DPD differential pressure sensor.
 - [4] If a problem is found, repair the harness connector.
 - [5] Disconnect the harness connector from the ECM.
 - [6] Inspect for a contact defect in the harness connector of the ECM.
 - [7] If a problem is found, repair the harness connector.
 - [8] Inspect for high resistance in the circuit between the ECM and DPD differential pressure sensor.
 - [9] If a problem is found, repair the circuit.
 - [10] If the circuit is normal, replace the DPD differential pressure sensor.
See "Removal of the DPD Differential Pressure Sensor".
See "Installation of the DPD Differential Pressure Sensor".
 - [11] Perform zero-point calibration when replacing the DPD differential pressure sensor.
See "DPD Differential Pressure Sensor Inspection".
3. Diagnostic trouble code 2456 - check if symptom has disappeared
- [1] Display RESET on the service support screen on the monitor and reset FAULTY HISTORY.
See "Service Support - RESET Screen List".
 - Note that all the generated diagnostic trouble codes will be cleared.
 - [2] Turn the starter switch OFF for 30 sec. or longer.
 - [3] Turn the starter switch ON for 30 sec. while checking for the diagnostic trouble code on the monitor screen.
See "Basic Functions - Diagnostic Trouble Code Indicator".

J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

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J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)



*1	P2 pressure sensor	*4	Computer B	*7	Arm-in pressure sensor
*2	Travel pressure sensor	*5	Arm-in reverse proportional valve	*8	Bucket-close pressure sensor
*3	Computer A	*6	Boom-up pressure sensor		

Operation explanation

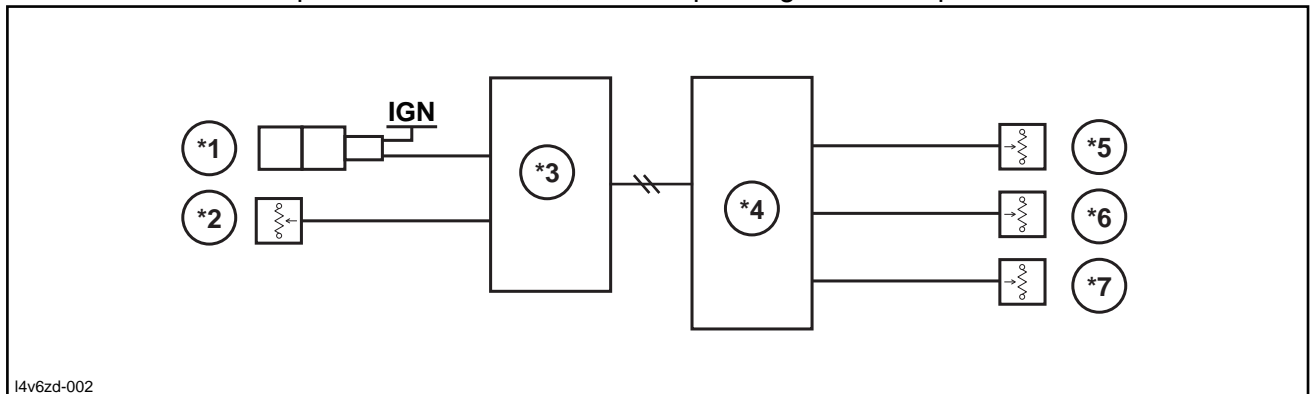
- The operator operates the shovel.
- The system judges the operator status.
- When the system judges that digging operation is being performed, it cancels the arm 2 control.
- When the operator stops arm-in full lever operation or performs travel, the system controls arm 2.

Boom 2 control

In leveling work, the boom spool is pressed back to reduce P1-arm bottom pressure loss and to allow more flow to the arm and bucket.

Configuration

- When the output current is raised, the force pushing back the spool is increased.



*1	Boom-up proportional valve	*4	Computer B	*7	Bucket-close pressure sensor
*2	Travel pressure sensor	*5	Boom-up pressure sensor		
*3	Computer A	*6	Arm-in pressure sensor		

Operation explanation

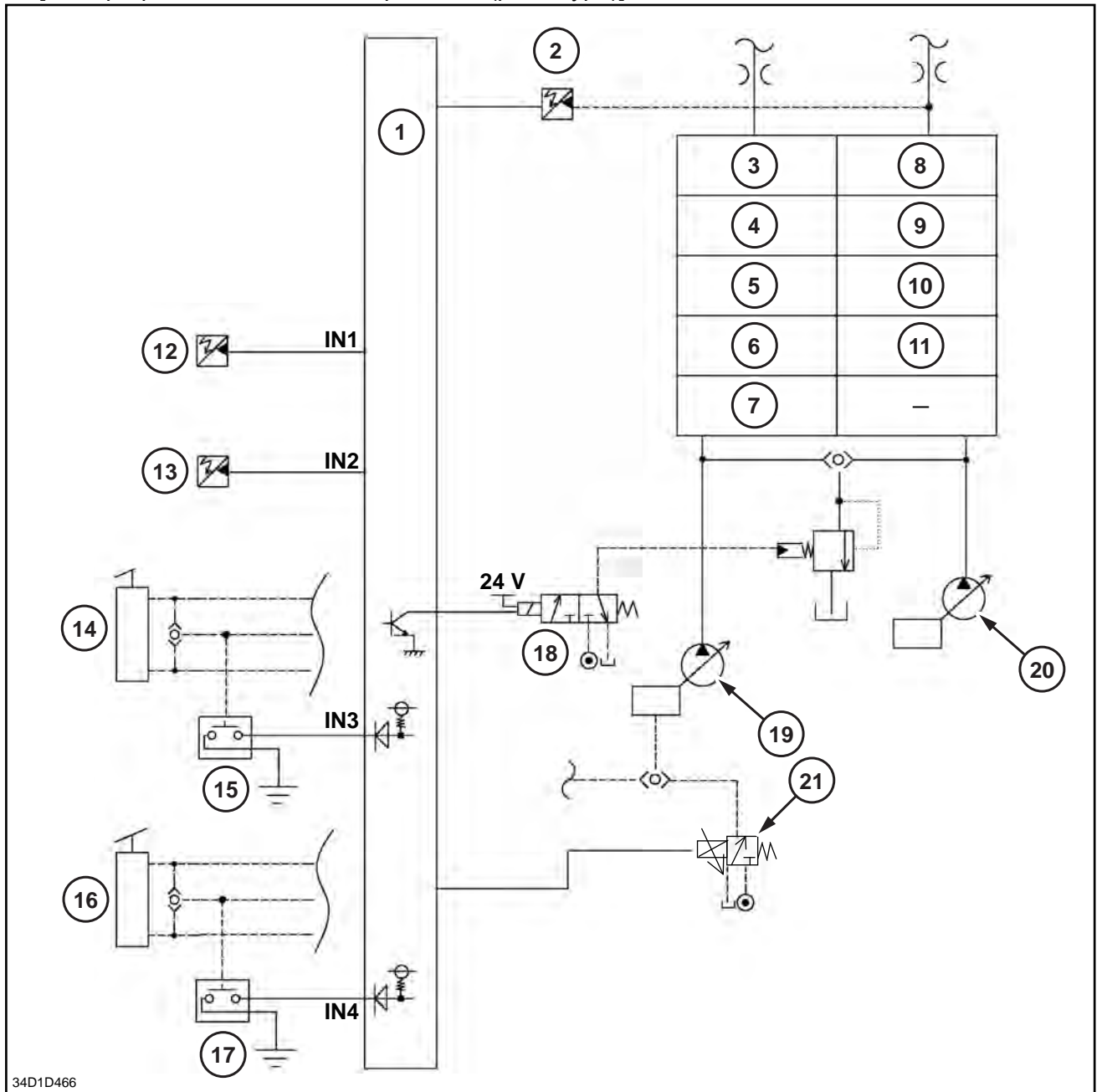
- The operator operates the shovel.
- The system judges the operator status.
- When the system judges that digging operation is being performed, it controls boom 2-down proportional valve.
- When the operator stops arm-in full lever operation or performs travel, the system controls boom 2-down proportional valve.

Bucket control

Option line control

1. Configuration

[Multi-purpose circuit with 2nd option line (pedal type)]



34D1D466

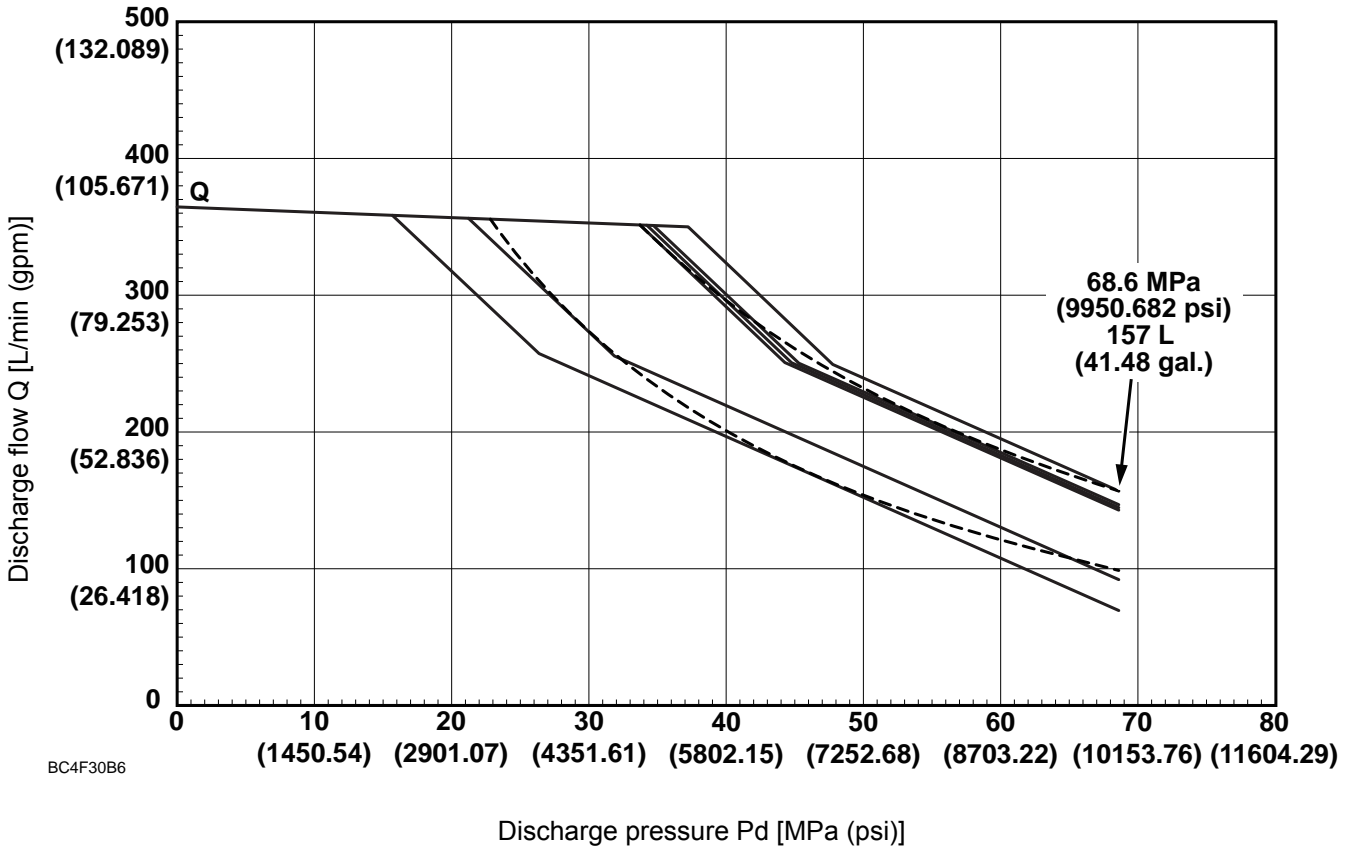
1	Computer A	8	Arm (2)	15	Option pressure switch
2	N2 pressure sensor	9	Boom (1)	16	2nd option pedal
3	Arm (1)	10	Grapple	17	2nd option pressure switch
4	Boom (2)	11	Travel (right)	18	Pressure boost solenoid
5	Swing	12	Swing pressure sensor	19	P1 pump
6	Option 1	13	Travel pressure sensor	20	P2 pump
7	Travel (left)	14	Option pedal	21	P1 flow control proportional valve

* There are 2 operating methods: the pedal type and the knob switch type. With either type, when the pedal or knob switch is operated, the switch input port (IN3, IN4 = IN4, IN5 of "Option select and operating method") is the same. (In other words, there is no need to be aware of the difference in operating method.)

- The explanation below uses the pedal method.

Hydraulic Device

Pump P-Q Diagram



J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

1	Variable arm regeneration orifice	6	Travel	11	Boom 1
2	Arm 1	7	Attachment 2	12	Bucket
3	Boom 2	8	Attachment 1	13	Travel
4	Swing	9	Neutral cut	14	Straight travel
5	Reserve	10	Arm 2		

[2] Signal, straight travel signal control valve, plate assembly [Fig. 3]

There are 2 signals, (a) (b) below. The pilot signal for each spool for which a lever is operated is used to generate the pressure that is output.

The straight travel signal control valve integrates each signal pressure and controls straight travel spool switchover.

Also, the plate assembly has a function for picking up the pilot pressures with the built-in shuttle.

a. Travel signal (PT)

The highest of the pilot pressures applied to the travel section 1 (pa1, pb1) and travel section 6 (pa6, pb6) is selected and output to the PT port.

Therefore, when the travel spool is in the neutral position (no-load pilot pressure), no pressure is generated at the PT port.

b. Front signal (PA)

The highest of the pilot pressures (pa2 - 9, pb2 - 9) applied to sections 2 - 9 that use the pressure oil from the P1 and P2 pumps, except for the travel sections, is selected and output to the PA port. (Note 1)

Therefore, when all the spools are in the neutral position (no-load pilot pressure), no pressure is generated at the PA port.

Note: 1

When an add-on (main pump add-on) is used through the feed from P2, the branches for the add-on pilot signals par1 and pbr1 are connected to the respective main unit valves, prs1 and prs2 ports, and thus incorporated in the front signal PA selection area.

Be careful. If the above line connection is not done, the PA pressure will not rise through add-on selection.

Also, when using 2 main pump add-ons, set the circuit so that the maximum of the add-on pilot pressures (par1 and 2, pbr1 and 2) can be taken out as desired and connect to either prs1 or prs2.

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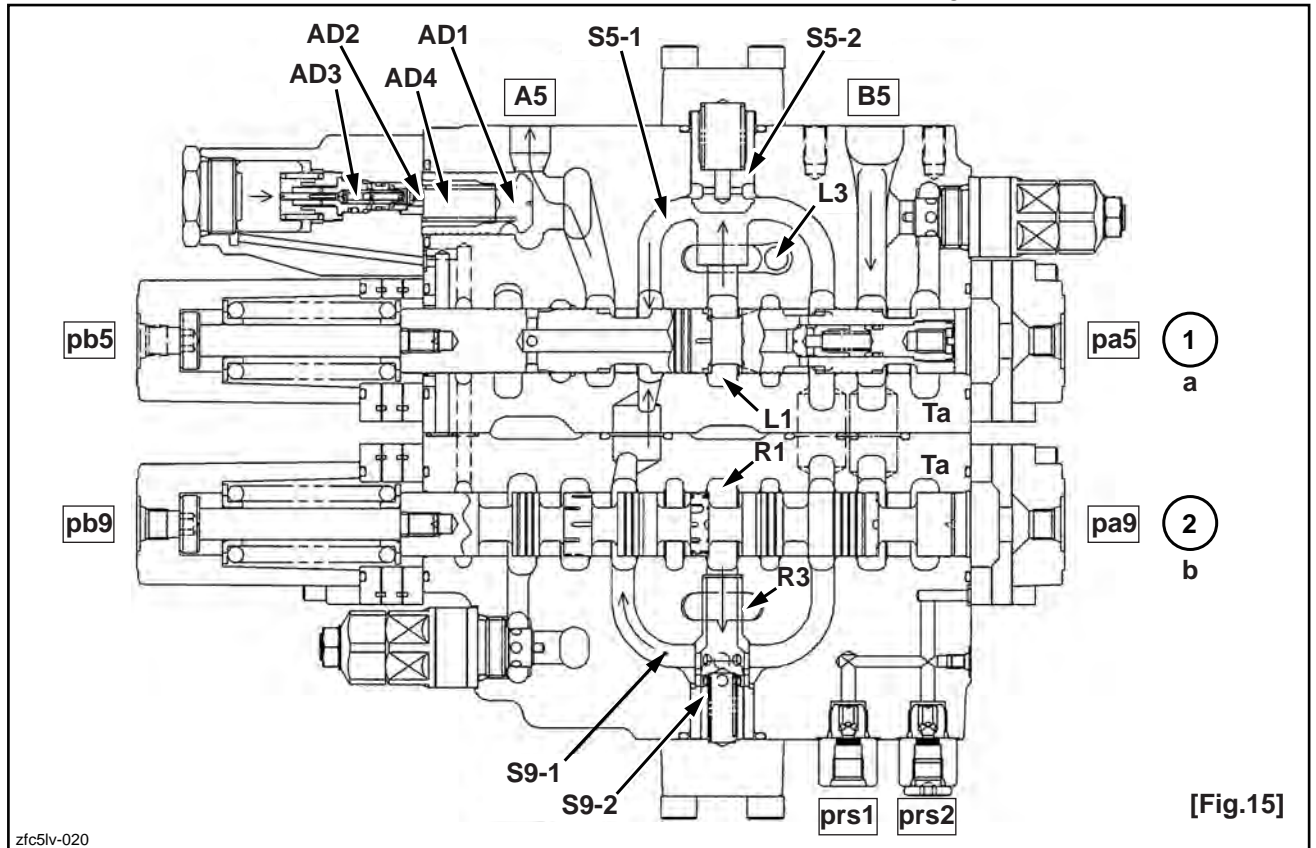
J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

d. Arm out (2 pumps flow) [Fig. 15]

When the arm 1 spool is switched by pressurizing from the arm 1 (section 5) pilot port Pa5, the oil fed from the P1 port flows from the neutral path (L1) through the load check valve (S5-2), path (S5-1), and the spool neck section, and into the A5 port.

When the arm 2 spool is switched by also pressurizing the arm 2 (section 9) pilot port pa9, the oil fed from the P2 port flows from the neutral path (R1) through the load check valve (S9-2) and path (S9-1), merges into the arm 1 section path (S5-1) and heads toward the A5 port through the arm 1 spool neck section.

The return oil from the B5 port returns to the tank path (Ta) through the spool neck section.



Arm out (2 pumps flow)

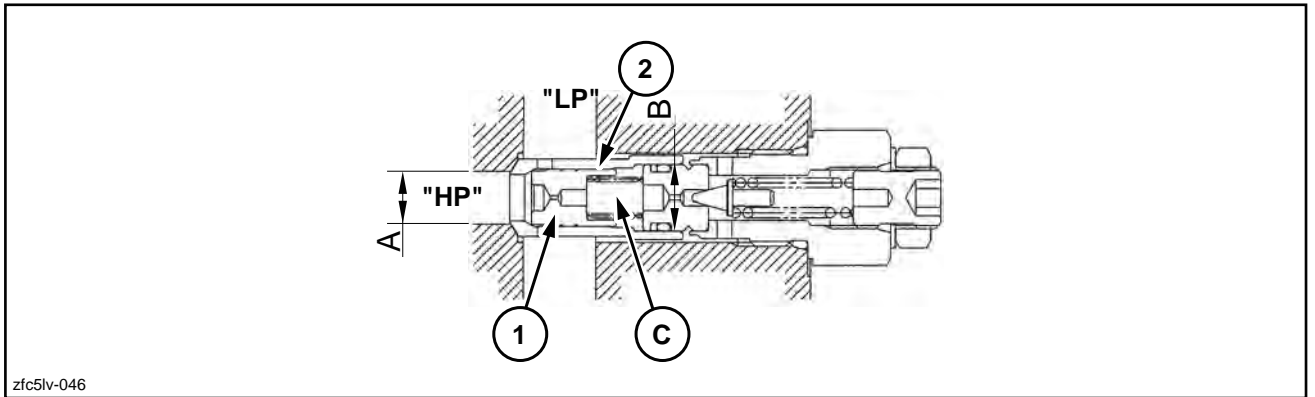
1	Arm 1
2	Arm 2

[4] Add-on main relief valve

a. Add-on main relief valve operation

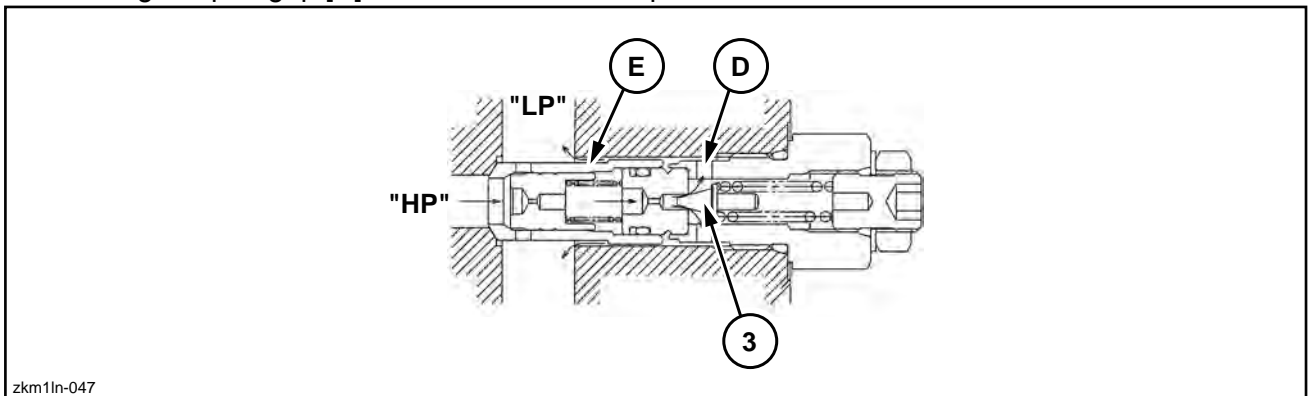
This relief valve is incorporated between the neutral path "HP" and the tank path "LP". The oil passes through the metering hole of the main poppet [1] and charges the interior space [C].

Also, the sleeve [2] and the main poppet [1] seat securely operating on the different surface areas "A" and "B".

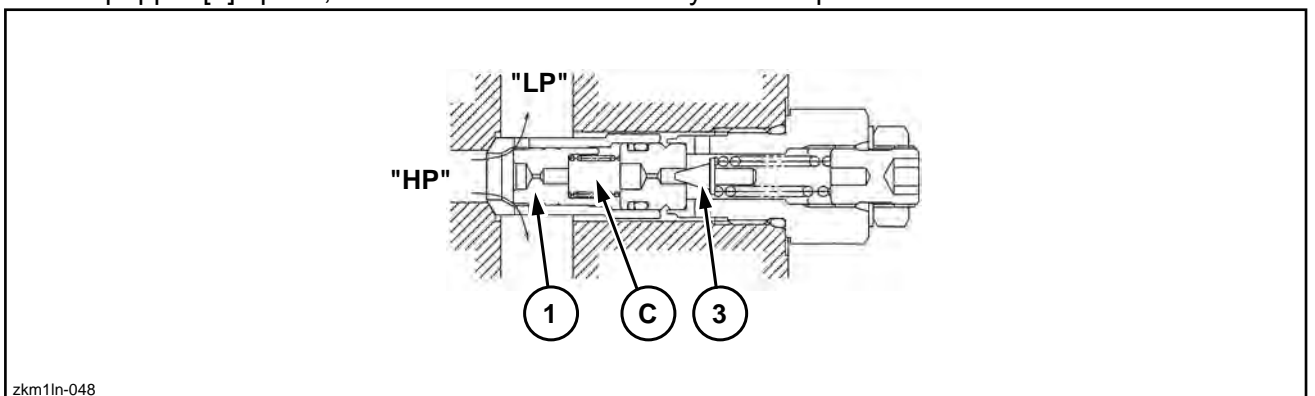


b. When the neutral path "HP" pressure reaches the set pilot spring force, the pilot poppet [3] opens.

The oil flows around the pilot poppet [3], passes from the notch hole [E] and through the ring-shaped gap [D] and is led to the tank path "LP".



c. Because the pilot poppet [3] has opened, the interior space [C] pressure drops and the main poppet [1] opens, so the "HP" oil flows directly into the path "LP".



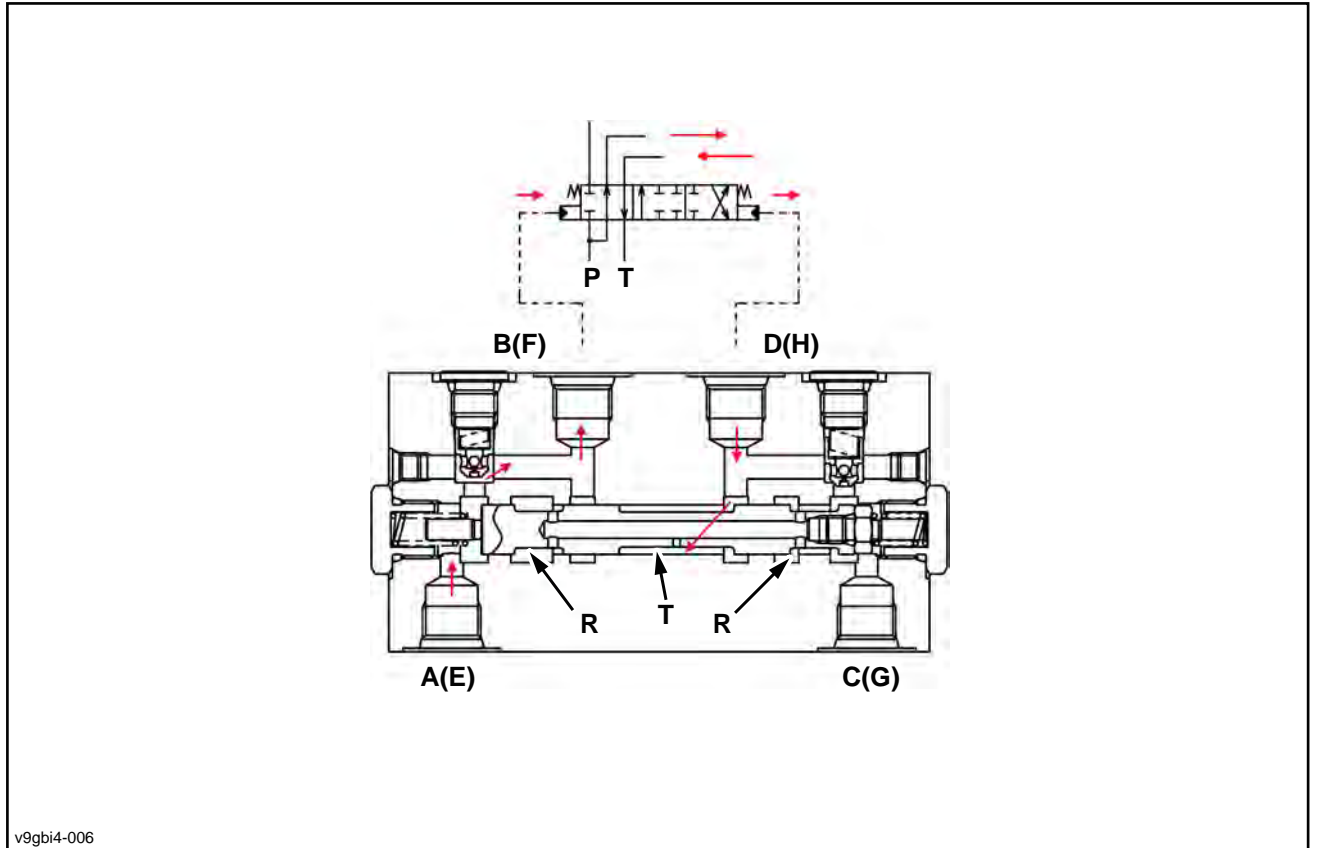
Operation Explanation

1. Normal operation

The pressure oil fed from the pilot operation valve to the A port (or C, E, or G port) pushes up the check plunger and is sent to the B port (or D, F, or H port).

The pressure oil that has passed through the B port operates on the control valve spool and operates the actuator.

The oil pushed out from the control valve spool passes through the D port (or B, F, or H port) and flows out to the T port.



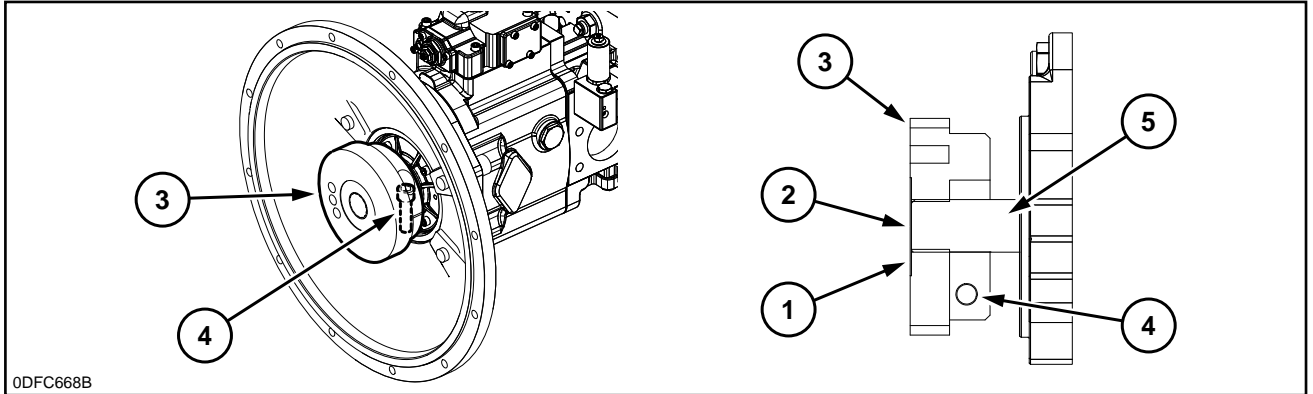
Installation of Pump Coupling

1. Assembling the coupling hub to the pump input shaft

[1] Position so that the hub end surface (counterbore surface) (1) and spline shaft end surface (2) are flush.

[2] Fasten the coupling hub (3) to the pump input shaft (5) with the hexagon socket head bolt M16 (4).

• Tightening torque: 295 N·m (217.62 lbf-ft.)



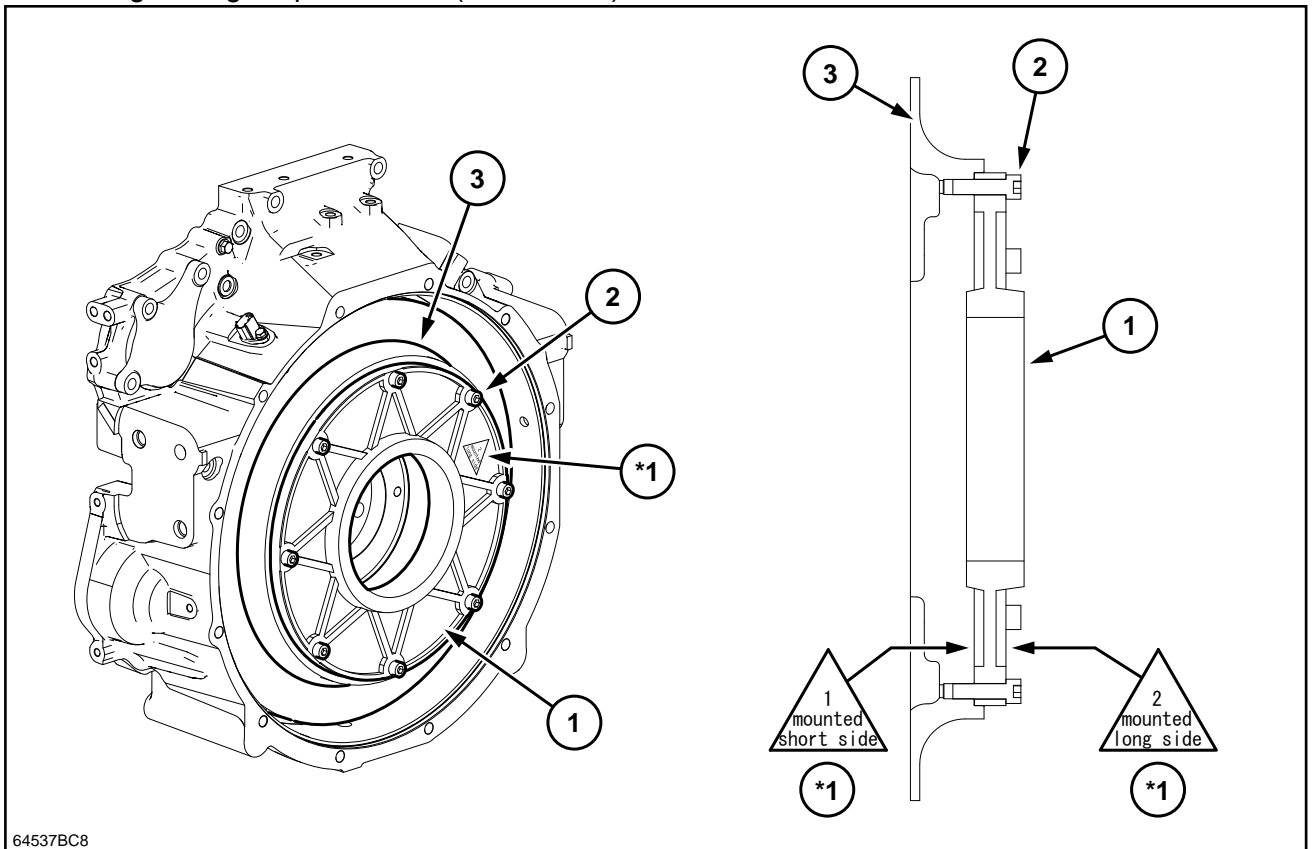
2. Assembling the flange to the engine flywheel

[1] Apply Loctite #262 to the flywheel (3) thread hole.

[2] Fasten the pump coupling (1) to the engine flywheel (3) with 8 hexagon socket head bolts M10 (2).

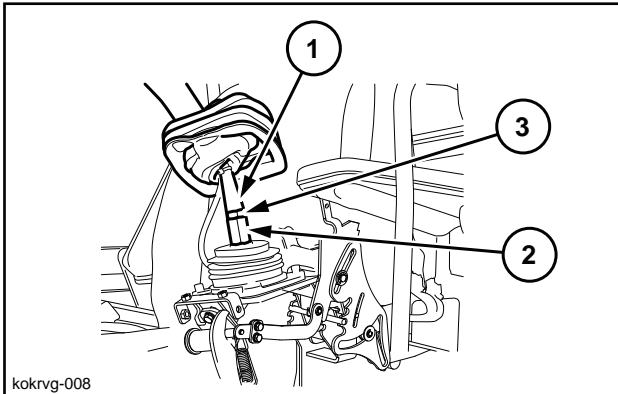
• Be sure to install the pump coupling (1) in the correct direction referring to the stamp (*1) on it.

• Tightening torque: 49 N·m (36.15 lbf-ft.)

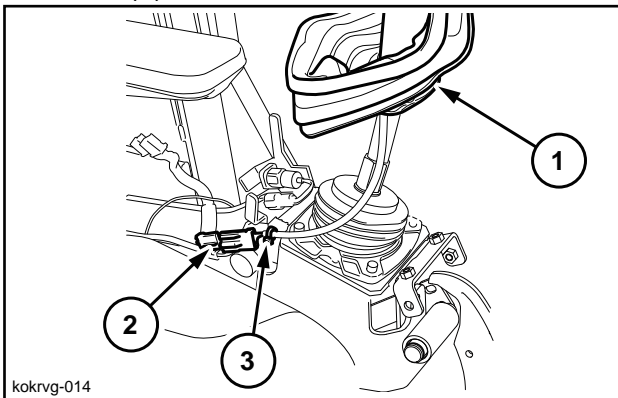


J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

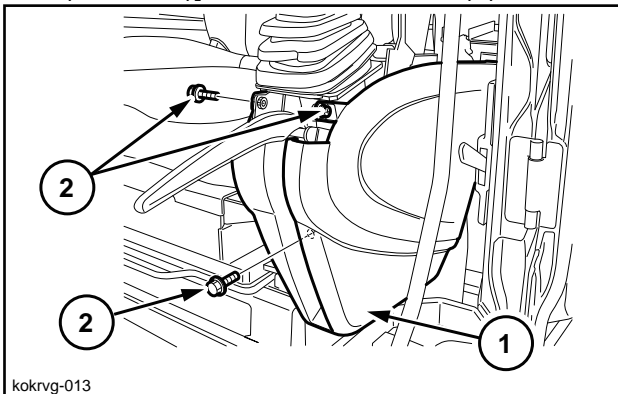
6. While securing the nut (2) with a wrench [22 mm (0.866 in.)], tighten the lock nut (3) with a wrench [19 mm (0.748 in.)] to mount the control lever (1).



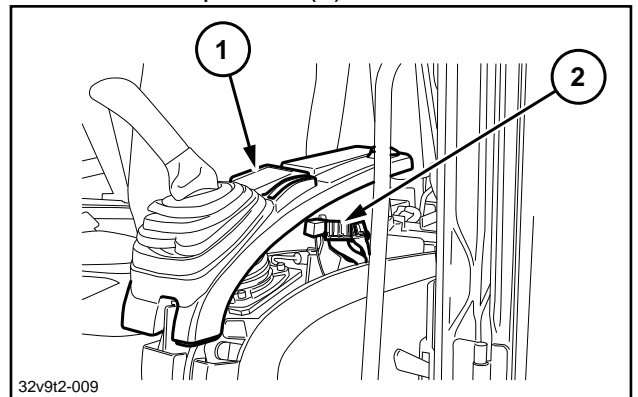
7. Connect the horn switch connector (2), bundle it with a wire band (3), and put the boot (1) on the control lever.



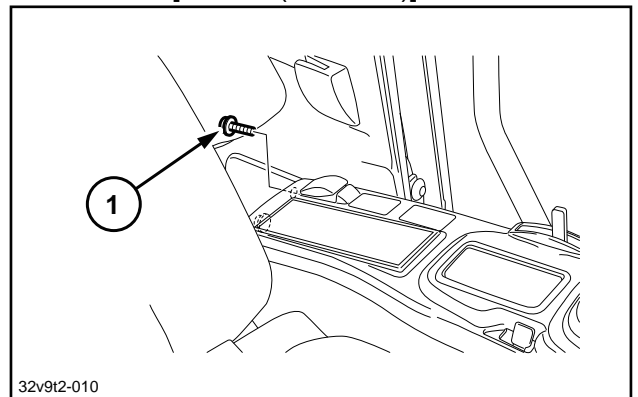
8. Tighten the 5 bolts (2) with a Phillips screwdriver or a box wrench [10 mm (0.394 in.)] to mount the cover (1).



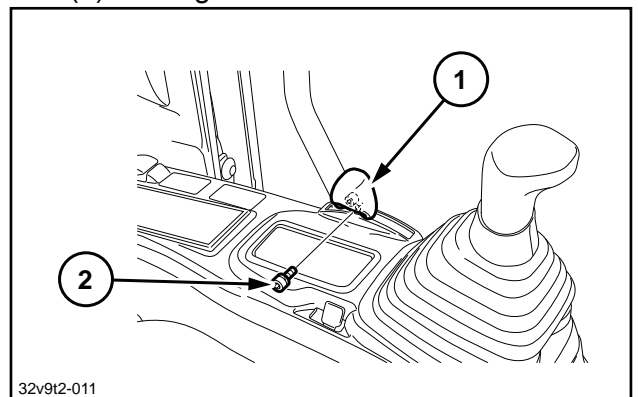
9. Connect the 3 connectors (2) to mount the console top cover (1).



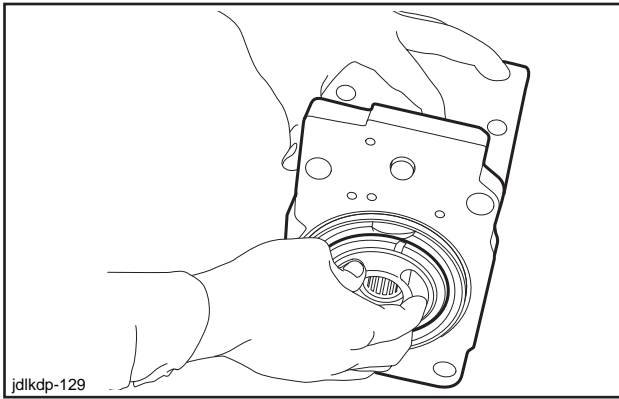
10. Tighten the 2 screws (1) of the console top cover with a Phillips screwdriver or a box wrench [10 mm (0.394 in.)].



11. Tighten the 2 bolts (2) with a hexagon wrench [5 mm (0.197 in.)] to mount the grip (1) of the gate lock lever.



J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)



13. If necessary, remove the stopper (L) (534), stopper (S) (535), servo piston (532), and tilting pin (531) from the pump casing (271), and remove the needle bearing (124) and 1st gear (116) from the valve block (312).

- To avoid damaging the head of the tilting pin, use a jig when removing it.
- Loctite has been applied to the section where the tilting pin and the servo piston are bonded, so be careful not to damage the servo piston.
- Try to avoid removing the needle bearings unless they are at the end of their service life.
- Do not loosen the hexagon nuts of the valve block or swash plate support board. This changes the flow setting.

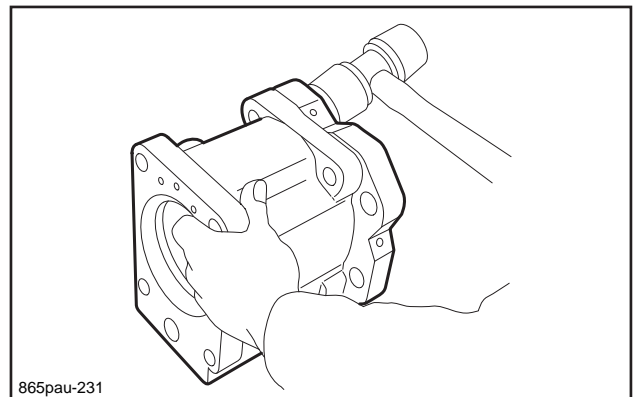
Assembly Procedures

The assembly procedure is the reverse of the disassembly procedure. However, follow the precautions below.

1. Be sure to repair any parts damaged during disassembly, and prepare replacement parts in advance.
2. Thoroughly clean all parts with cleaning oil and air blow them before assembly.
3. Be sure to apply clean hydraulic oil to sliding parts and bearings before assembly.
4. As a rule, replace all O-rings, oil seals, and other seal parts with new parts.
5. Use a torque wrench to tighten all installation bolts and plugs to the torque specified in "Maintenance Standards."
6. Be careful not to mix up the pump parts for the front and rear.

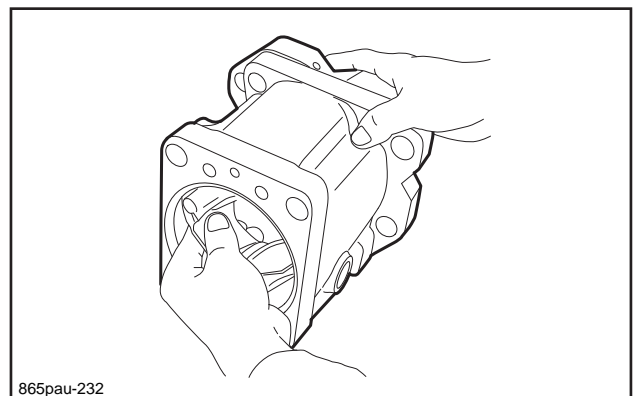
7. Install the swash plate support board (251) on the pump casing (271) by lightly striking it with a hammer.

- If the servo pistons, tilting pin, stoppers (L), and stoppers (S) have been removed, install these parts on the pump casings in advance.
- To avoid damaging the heads of the tilting pins and the feedback pins, use a jig when tightening the servo pistons and tilting pins. Also be sure to apply Loctite (moderate strength) to the threaded sections.



8. Face down the regulator installation surface of the pump casing, insert the tilting bushing of the swash plate onto the tilting pin (531), and correctly mount the swash plate (212) and swash plate support board (251).

- Use the fingertips of both hands to check that the swash plate moves smoothly.
- Coat the swash plates, swash plate support boards, and all sliding sections with grease for easier installation of the drive shaft.



Procedures for Assembly and Disassembly of Control Valve

Disassembly

Cautions for disassembly

1. On level ground, bring all the operating machines into contact with the ground. When doing this, have the main machine in a horizontal position. Check that the machine is in such a state that it will not travel or swing on its own. Then stop the engine and bleed out the pressure from each actuator.

Caution

Do not replace a valve assembly or disassemble a valve with pressure remaining in the system. This would be dangerous. High-pressure oil might spray out or parts might suddenly come out. For disassembly, bring the bucket to the ground and adequately bleed out any pressure in the circuits.

2. Bleed the air pressure from the tank.
3. Clean well around the location to be disassembled and keep foreign matter from getting into the valve during disassembly.
4. Identify disassembled parts with shipping tags to show their position for re-assembly.
5. Do not reuse any disassembled seals (O-rings, backup rings). Replace them with new ones.
6. The spool was selected to fit with the valve housing and sleeve, so do not replace the spool.

Disassembly procedure

Removal of long cap and pull out of main spool

1. Loosen the hexagon socket head bolts (74) [8 mm (0.315 in.) hexagon socket diameter] for the 9 caps (8) and the 1 cap (9), and remove them. When pulling out the spool only, do not loosen the M6 screws on the plate except for the 4 hexagon socket head bolts (75) and the 1 hexagon socket head bolt (94) fastening the plate assemblies.
2. Loosen and remove the plugs (91) [19 mm (0.748 in.) hexagon diameter] attached to the ports as necessary.
3. Remove the O-rings (7) (1 in each section) from the plate assemblies (10) and (11).

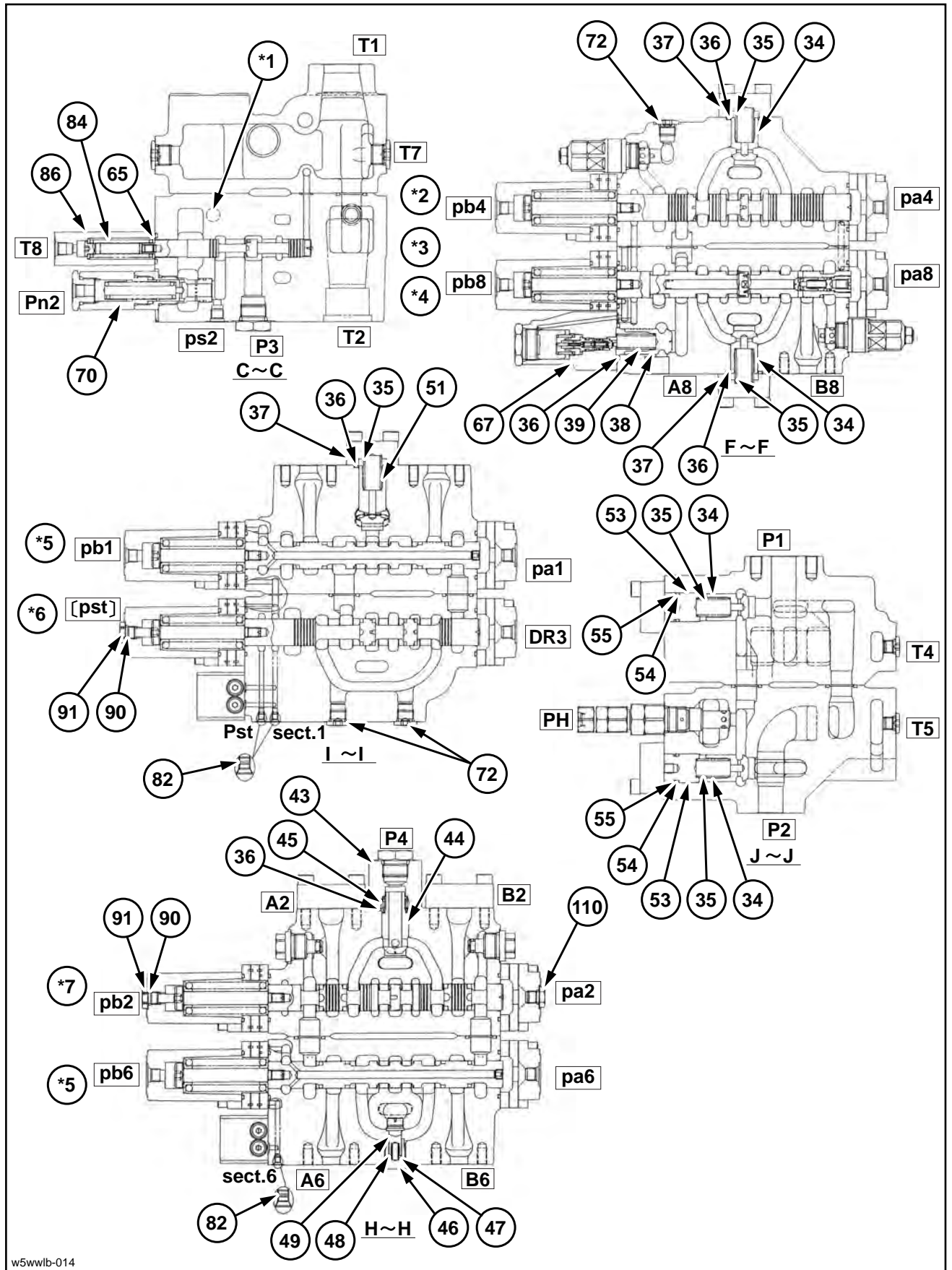
4. Pull out each spool from the valve housing still in the sub-assembly state.

Caution

1. When pulling out the spool, be careful not to cause any dents or scratches.
2. Identify each spool with a shipping tag so that there will be no mistake about their positions when they are re-assembled.

5. Loosen and remove the hexagon socket head bolts (75) [8 mm (0.315 in.) hexagon socket diameter] and hexagon socket head bolts (94) [5 mm (0.197 in.) hexagon socket diameter] those fastens the plate assemblies (10), (11), (28) and (29) to the housing. Remove the plate assemblies still in the assembly state. Do not disassemble them.
6. Loosen and remove the plugs (91) [19 mm (0.748 in.) hexagon socket diameter] as necessary.
7. Remove the O-rings (7) and (41) from the valve housings (1) and (13).

J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)



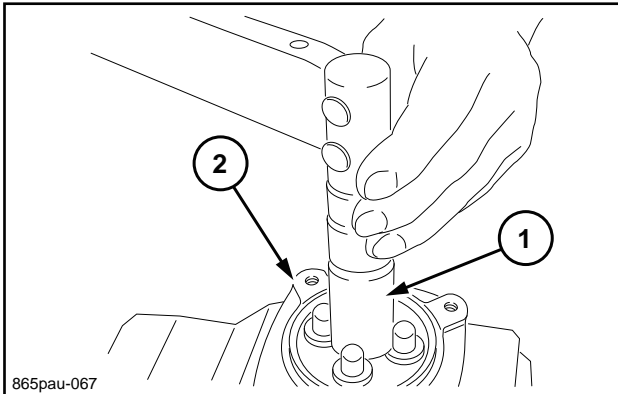
w5wwlb-014

*1	Tank	*4	Boom 1	*7	Reserve
*2	Boom 2	*5	Travel		
*3	Up ⇄ Down	*6	Straight travel		

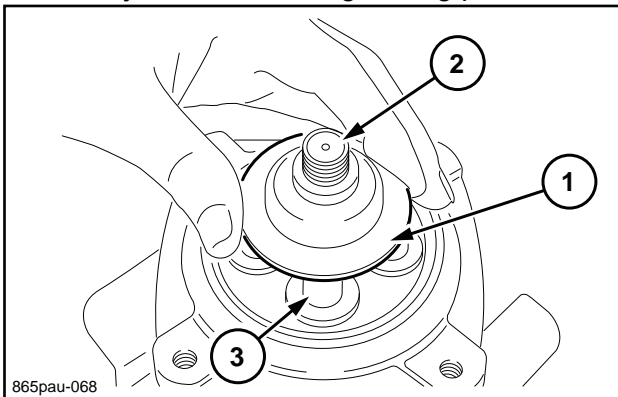
J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

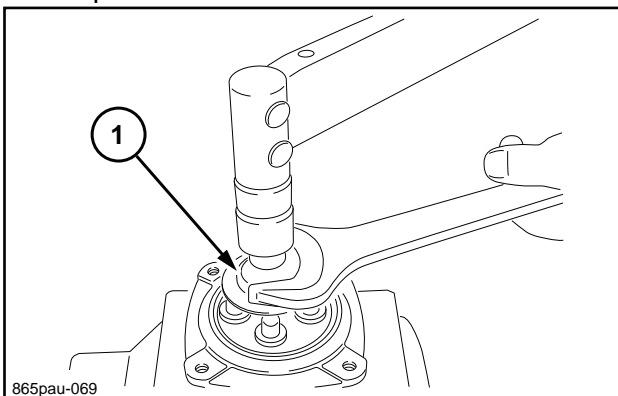
10. Use a jig, and tighten the joint (1) to the casing (2) to the specified torque.
Tightening torque: 44.2 - 50.0 N·m
(32.606 - 36.884 lbf · ft.)



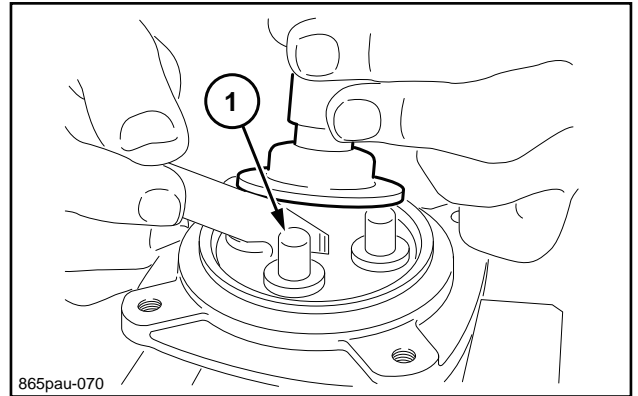
11. Install the disk (1) onto the joint (2).
- Screw the disk in until it is equally touching each of the 4 push rods (3). Secondary pressure will cause faulty operation of the machine if the disk is screwed in too much, so pay attention to adjustment of the tightening position.



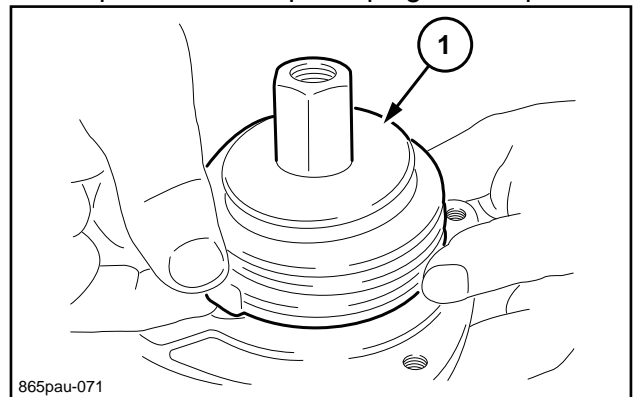
12. Install the adjusting nut, use a wrench on the bolt width of the disk (1) to secure it, and tighten the adjusting nut to the specified torque.
- Tightening torque: 63.7 - 73.5 N·m
(46.991 - 54.220 lbf · ft.)
 - During tightening, do not move the disk position.



13. Apply grease to the rotating section of the joint and to the top of the push rods (1).

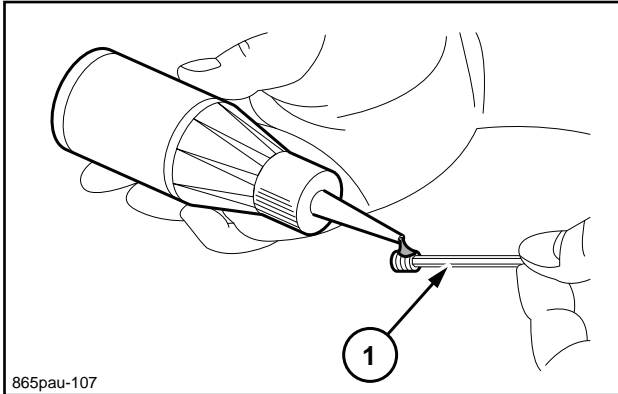


14. Install the bellows (1).
- Be careful not to tear the bellows.
 - Inject vapor corrosion inhibitor into each port, and then place plugs in the ports.

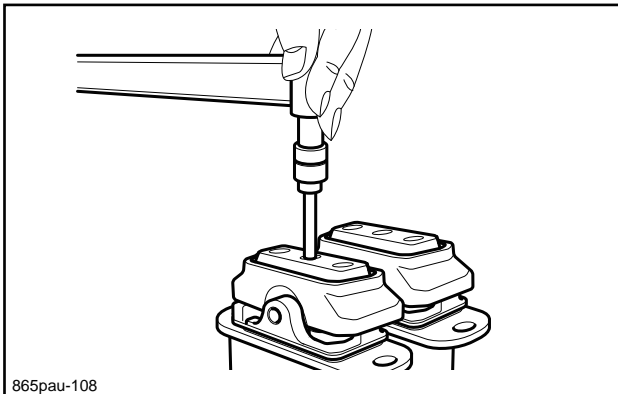


J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

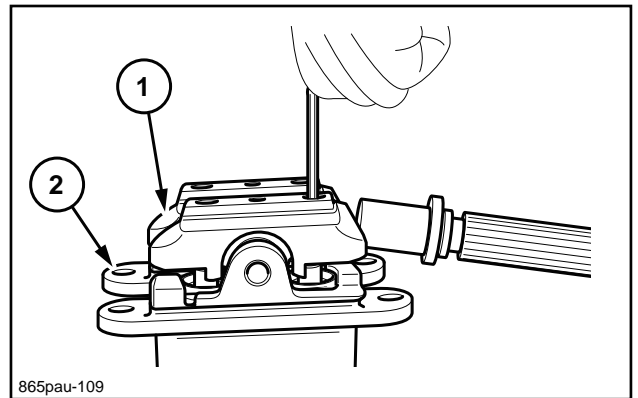
22. Apply Loctite #241 or the equivalent to the surfaces of the hexagon socket head locking screws (1).



23. Tighten the hexagon socket head locking screws to the specified torque.
- Hexagon socket head locking screw tightening torque: 5.9 - 7.9 N·m (4.353 - 5.827 lbf · ft.)

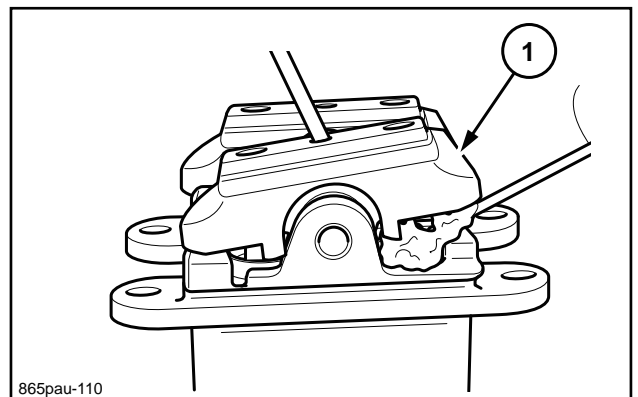


24. Adjust the height of the locking screws so that the top surface of the cams (1) and the bottom surface of the covers (2) are parallel, and tighten the lock nuts to the specified torque after rotating the cams left and right to check if there is any neutral backlash.
- Even if the push rods are pressed in too much by the locking screws, backlash during neutral will occur. Use caution as this may cause sudden movement when starting the engine.
- Locking screw tightening torque: 29.9 - 36.7 N·m (22.057 - 27.073 lbf · ft.)



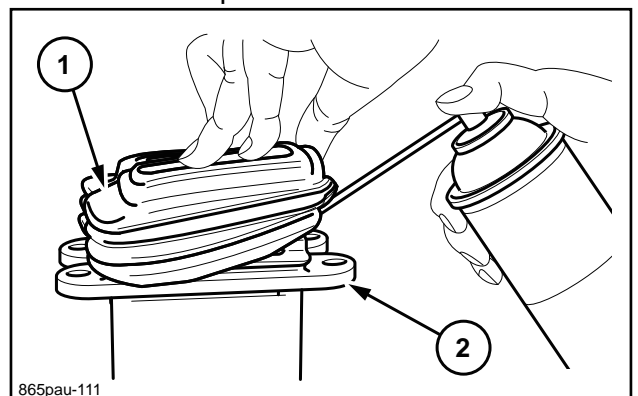
25. Tilt the cams (1) and fill the grease cups of the plugs with grease while coating the top of the push rods with grease.

- For grease application and filling, use a flat object made of soft material so as to not scratch the push rod or plug surfaces.

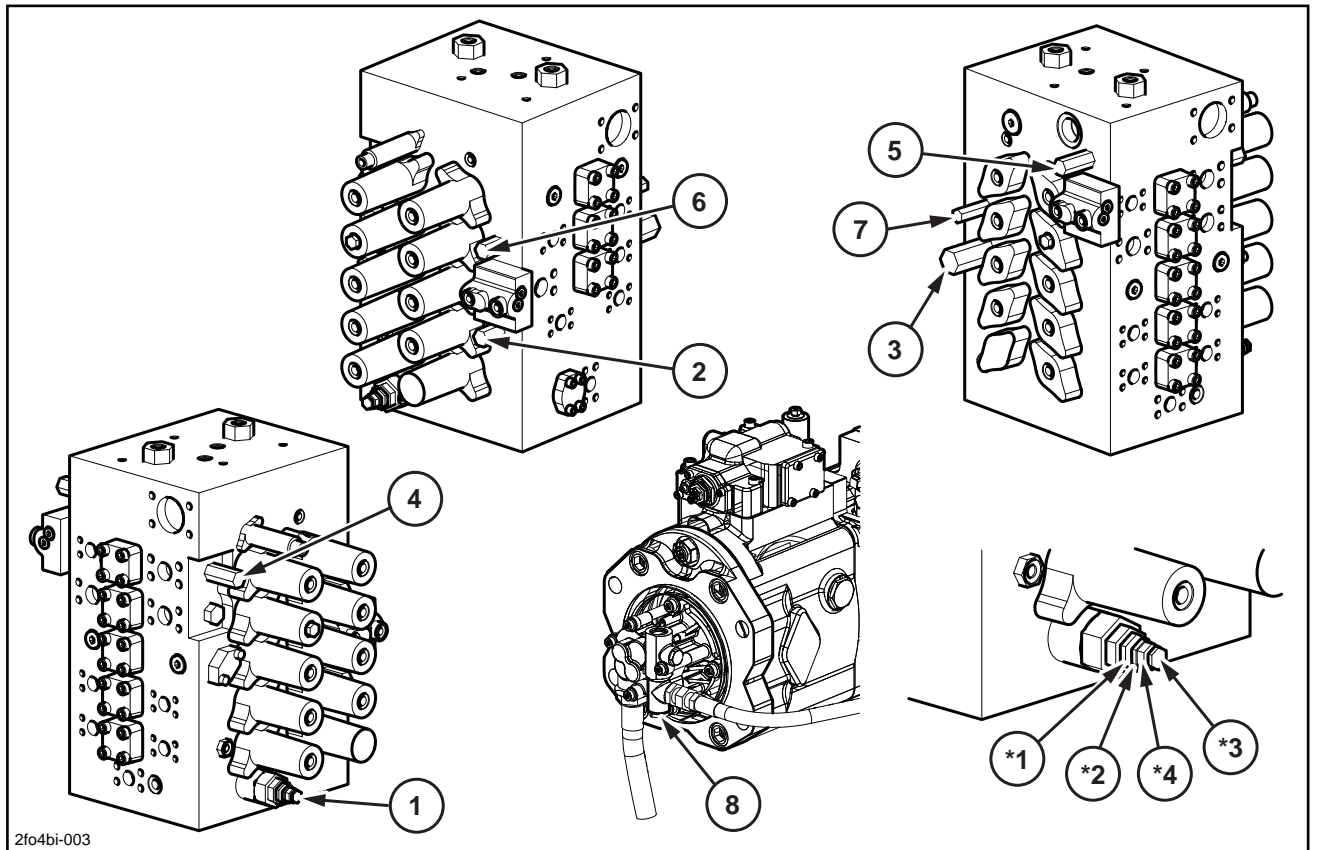


26. After mounting the top end of the bellows (1) on the cams, mount the bottom end into the grooves on the covers (2).

- Before mounting the bottom end of the bellows into the grooves of the covers, spray anti-rust oil on the parts within the bellows.
- Be careful that the bellows are properly mounted in the grooves and not twisted, as this may reduce anti-rust and anti-moisture protection.



J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

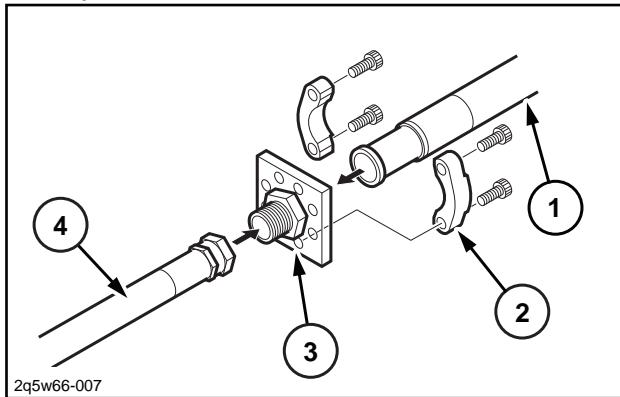


Detailed diagram of main relief valve adjustment locations

*1	Boosted pressure lock nut
*2	Boosted pressure adjusting screw
*3	Standard pressure adjusting screw
*4	Standard pressure lock nut

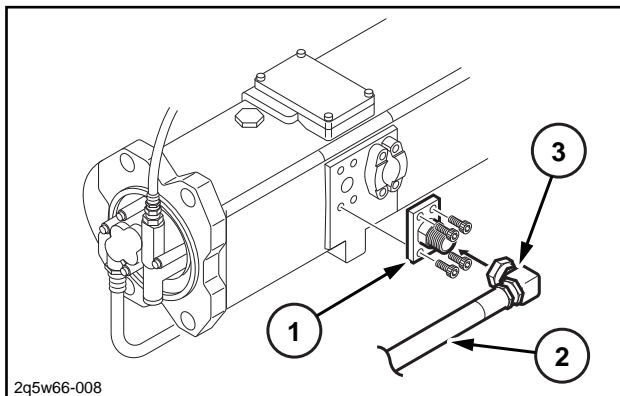
J. HYDRAULIC EQUIPMENT (PUMP, OPERATION SYSTEM VALVE)

8. Use the split flange (2) to install the adaptor (flange type 3) on the tip of the hydraulic hose (1) removed in 7..



4 Hydraulic hose

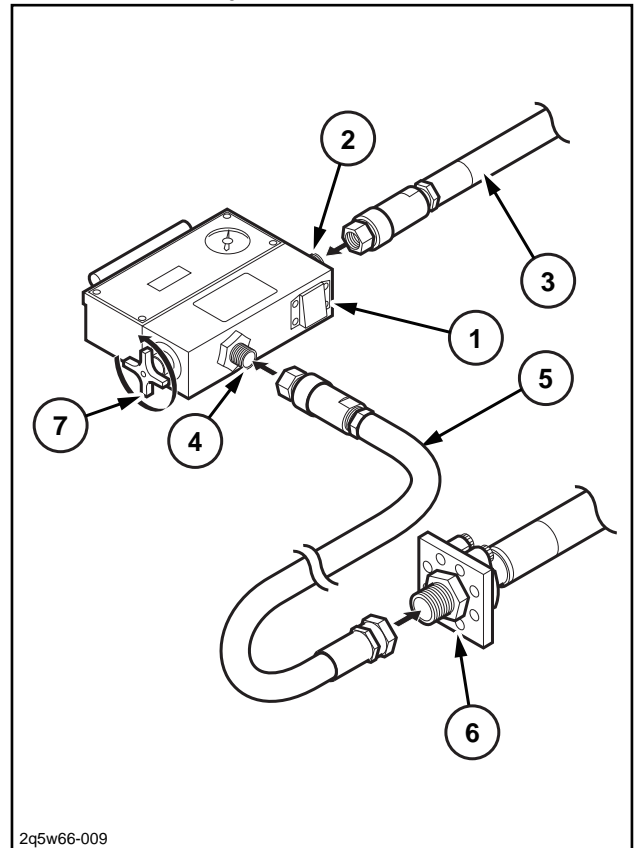
9. Install the adaptor (1) at the position from which the hydraulic hose was removed. If necessary, install an "elbow adaptor" (3) on the (prepared) hydraulic hose (2) connected to the flow meter IN side.








10. Install the hydraulic hose (3) on the flow meter (1) IN side(2), then fasten with the spanner.
Install the (prepared) hydraulic hose (5) on the flow meter (1) OUT side (4), then fasten with the spanner.
Installs the adapter (6) to have installed in opposite in 8..

- * When connecting, always check the connection positions.
- * Always have the metering valve (7) fully open.

Remove the vavuum pump and re-install the hydraulic oil tank the same way it was. Install pressure gauges on P1 and P2.(See "Main Pressure Measurement".)
Open the engine hood.(See "Main Pressure Adjustment".)



11. Remove the cover.
12. Remove the pilot hose for the boosted pressure signal, then plug the hose side. (See "Main Relief Pressure Adjustment".)
This completes the preparation for flow measurement.

	Pressure line		Pilot tank line
	Tank line		Electric line
	Pilot pressure line		

1	Travel motor	7	Travel high speed	13	Oil cooler
2	Travel high-speed select switch	8	Lever lock	14	Backward left
3	Computer A	9	5 stack solenoid valve	15	Forward left
4	Control valve	10	Console lever lock switch	16	Backward right
5	Travel (left)	11	Hydraulic pump	17	Forward right
6	Travel (right)	12	Travel remote control valve		

As an example, this section explains the forward travel operation.

The travel motor 2-stage tilting angle is a large tilting side.

Even if the travel switch is set to the high-speed side, switching the key switch OFF and then ON again always returns the system to this state.

By operating the travel remote control valve to the forward side, the pilot pressure oil is fed to the control valve pb1 port and switches the left travel spool to the forward side.






At the same time, the oil is also fed to the pb6 port to switch the right travel spool to the forward side.

The discharge oil from hydraulic pump A1 enters the control valve P1 port and the discharge oil from hydraulic pump A2 enters the control valve P2 port.

Each flows to the respective travel motor and causes forward travel through the left and right travel spools being switched.

The return oil from the travel motor goes through the left and right travel spools and returns to the hydraulic oil tank.

The travel high-speed solenoid valve goes OFF, the travel motor P port oil connects with the tank line, and the travel motor tilting angle moves to the large tilting side.

	Pressure line		Pilot tank line
	Tank line		Electric line
	Pilot pressure line		

1	Swing motor	7	Swing	13	Control valve
2	Cushion valve	8	Lever lock	14	Upper pilot pressure sensor
3	Right swing	9	Swing brake	15	Hydraulic pump
4	Left swing	10	5 stack solenoid valve	16	Oil cooler
5	Swing pilot pressure sensor	11	Console lever lock switch		
6	Remote control valve (arm, swing)	12	Computer A		

When the engine is started and the swing lever is in neutral, the swing brake solenoid valve comes ON (24 V input), the pressure to the swing motor P port is cut, and the swing parking brake works.

When the lever operation raises the reading to 0.5 MPa (72.527 psi) or higher at the pressure sensor in the swing pilot line, the output from computer A to the swing brake solenoid valve goes OFF, the swing motor P port pressure rises, the swing parking brake is released, and swing becomes possible.

As an example, this section explains the right swing operation.

By carrying out the right swing operation on the remote control valve, the pilot pressure oil is fed to the control valve pa2 port via the shuttle valve and switches the swing spool to the right swing side.

At the same time, computer A detects the swing pilot pressure sensor signal, judges that there is a swing operation, the electrical signal output from computer A goes OFF, and the swing brake solenoid valve is switched.

The pilot pressure oil is fed to the swing motor P port from the swing brake solenoid valve C2 port to release the swing parking brake.

The discharge oil from hydraulic pump A1 enters the control valve P1 port and is fed from the parallel oil path to the swing spool.

Switching the spool lets the oil flow into the swing motor B port and the right swing operation is carried out.

The pressurized oil from the swing motor A port goes through the swing spool and returns to the hydraulic oil tank.

When this is followed by an attachment operation, the pilot pressure is detected by the control valve PA port pressure sensor and the swing parking brake continues to be released.

After the swing operation ends, if about 5 sec. pass with no upper operation, the swing brake solenoid valve output from computer A comes ON and the swing parking brake works again.

After the swing ends, if this is followed by an upper operation or there is an upper operation within about 5 sec., when about 1 sec. passes after the end of the upper operation, the swing parking brake works again.






The swing parking brake is also released for independent upper operations and when about 1 sec. passes after the end of the upper operation, the swing parking brake works again.

Key switch	Swing pilot pressure sensor	Upper pilot pressure sensor	Swing brake solenoid valve	Swing motor mechanical brake
OFF	0 MPa (0 psi)	0 MPa (0 psi)	OFF	ON
ON	0 MPa (0 psi)	0 MPa (0 psi)	ON	ON
ON	0.5 MPa (72.527 psi) or greater	0 MPa (0 psi)	OFF	OFF
ON	0 MPa (0 psi)	0.5 MPa (72.527 psi) min.	OFF	OFF
ON	0.5 MPa (72.527 psi) min.	0.5 MPa (72.527 psi) min.	OFF	OFF

Pilot pressure sensor judgment standard

Operation is judged when at 0.5 MPa (72.527 psi) or above.

Non-operation is judged when at 0.3 MPa (43.516 psi) or below.

	Pressure line		Pilot tank line
	Tank line		Electric line
	Pilot pressure line		

1	Arm cylinder	9	Control valve	17	Computer A
2	Arm (in)	10	Load holding valve check valve	18	P1 pressure sensor
3	Arm (out)	11	Arm (1)	19	P2 pressure sensor
4	Cushion valve	12	Arm (2)	20	Hydraulic pump
5	Remote control valve (arm, swing)	13	Travel pilot pressure sensor	21	Oil cooler
6	Lever lock	14	Upper pilot pressure sensor	22	Arm HBCV
7	Boost pressure relief	15	Console lever lock switch		
8	5 stack solenoid valve	16	Monitor display		

By moving the remote control valve to the arm-out side, the pilot pressure oil is fed via the cushion valve to the control valve pb5 port and pb9 port and switches the arm (1) and (2) spools to the out side.






The discharge oil from hydraulic pump A1 enters the control valve P1 port and is fed from the center bypass oil path to the arm (1) spool.

The discharge oil from hydraulic pump A2 enters the control valve P2 port, flows from the center bypass oil path and through the arm (2) spool and merges downstream of the arm (1) spool.

Switching the arm spool lets the oil flow through the load holding valve check valve and into the arm cylinder rod side, carrying out the arm-out operation.

When the circuit has an HBCV, switching the arm spool lets the oil flow through the load holding valve check valve to push open the arm cylinder HBCV check valve and flow into the rod side, carrying out the arm-out operation.






The arm cylinder bottom side return oil goes through the arm (1) and (2) spools and returns to the hydraulic oil tank.

	Pressure line		Pilot tank line
	Tank line		Electric line
	Pilot pressure line		

1	Arm (in)	6	Remote control valve (arm, swing)	11	Arm (2)
2	Arm (out)	7	Lever lock	12	Console lever lock switch
3	Cushion spool	8	5 stack solenoid valve	13	Hydraulic pump
4	Orifice	9	Control valve	14	Oil cooler
5	Cushion valve	10	Arm (1)		

When the remote control valve arm-out operation is returned to neutral, the oil pushed out from the control valve pb5 and pb9 ports flows to the cushion valve D port through the cushion orifice and returns from the remote control valve to the hydraulic oil tank.

Through this orifice, the arm spool moves to the neutral position without returning sharply, so the cushioning is improved.

	Pressure line		Pilot tank line
	Tank line		Electric line
	Pilot pressure line		

1	Control valve	6	Computer A	11	Option remote control valve
2	Hydraulic fork	7	Lever lock	12	Pressure switch
3	Travel pilot pressure sensor	8	5 stack solenoid valve	13	Oil cooler
4	Upper pilot pressure sensor	9	Console lever lock switch		
5	Monitor display	10	Hydraulic pump		

As an example, this section explains the case in which the hydraulic fork attachment is used.

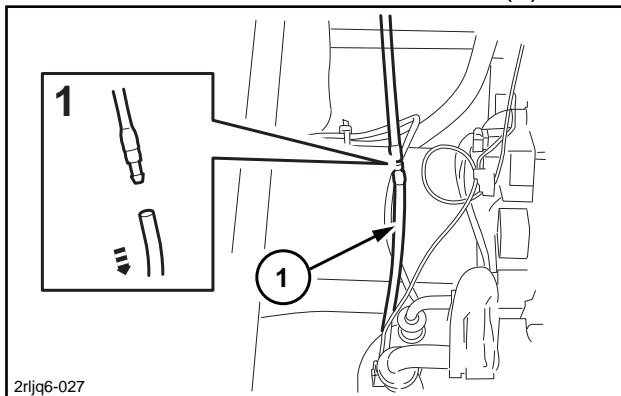
By operating the option remote control valve to the fork close side, the pilot pressure oil is fed to the control valve pb4 port and switches the option spool to the close side.

The discharge oil from hydraulic pump A1 enters the control valve P1 port, is fed from the parallel oil path to the option spool, flows into the hydraulic fork because of the option spool switching and operates to the close side.

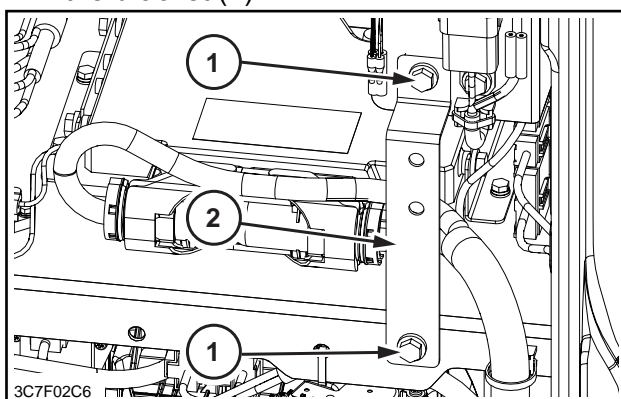
At this time, the option pilot pressure switch signal is detected and the auto idle function is released.

The return oil from the hydraulic fork goes through the option spool and returns to the hydraulic oil tank.

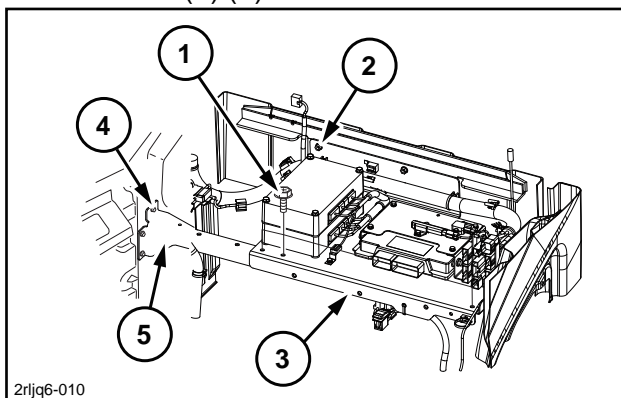
10. Disconnect the washer fluid hose (1).



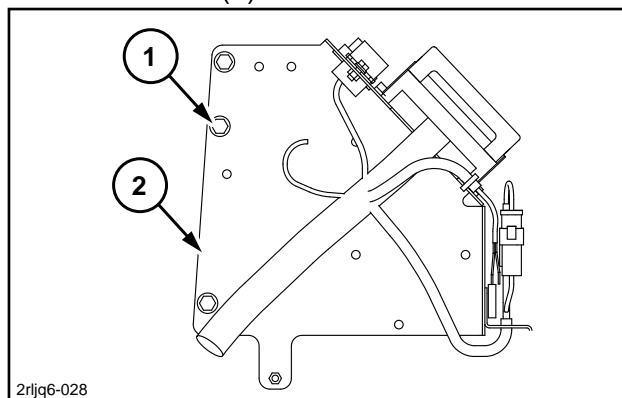
11. Use a wrench [13 mm (0.512 in.)] to remove the 2 bolts (1), and then remove the bracket (2).



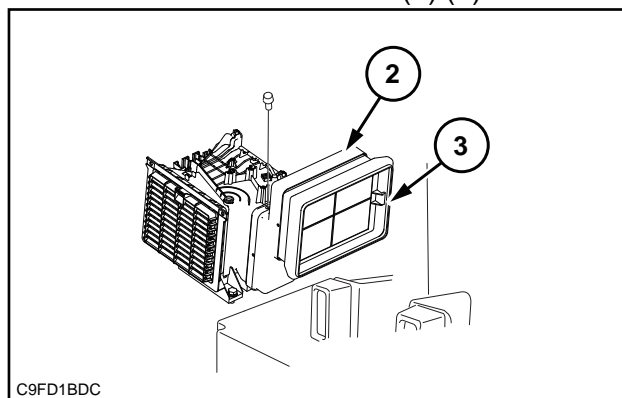
12. Use a wrench [13 mm (0.512 in.)] to remove the 4 bolts (1), use a wrench [12 mm (0.472 in.)] to remove the 3 bolts (4) and 2 nuts (2), and then remove the rear brackets (3) (5).



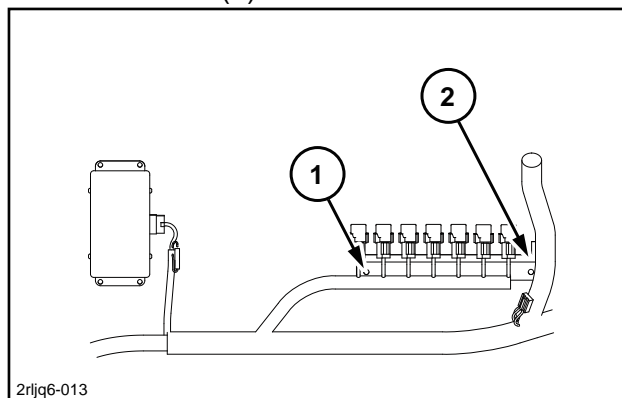
13. Use a wrench [13 mm (0.512 in.)] to remove the 3 bolts (1), and then remove the bracket (2).



14. Use a flathead screwdriver or longnose pliers to remove the 1 clip (1), and then remove the suction ducts (2) (3).



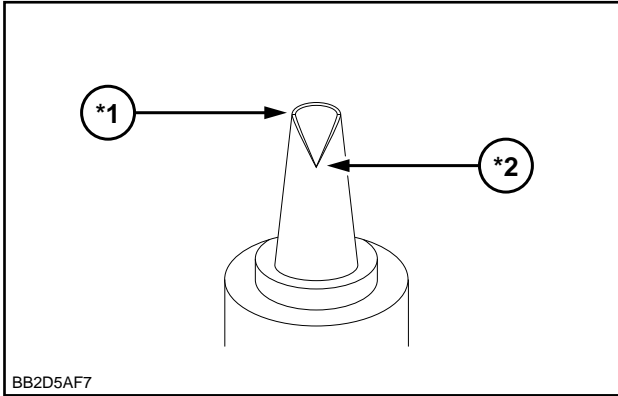
15. Use a wrench [10 mm (0.394 in.)] to remove the 2 bolts (1), and then remove the bracket (2).



[2] Apply the adhesive (equivalent to #560 (Sunstar Engineering Inc.)) on the door at 4 places.

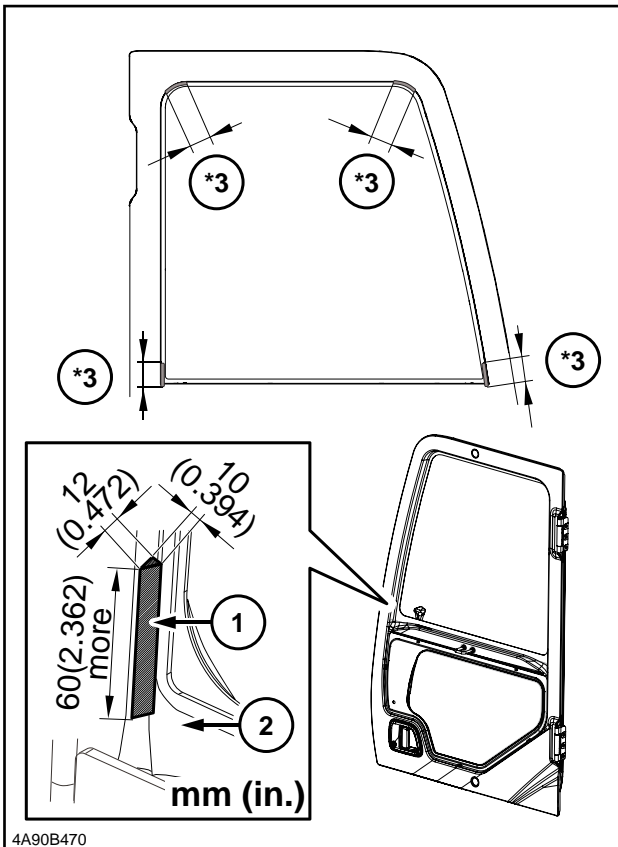
Note

Cut the nozzle of the adhesive container as shown in the following figure.



BB2D5AF7

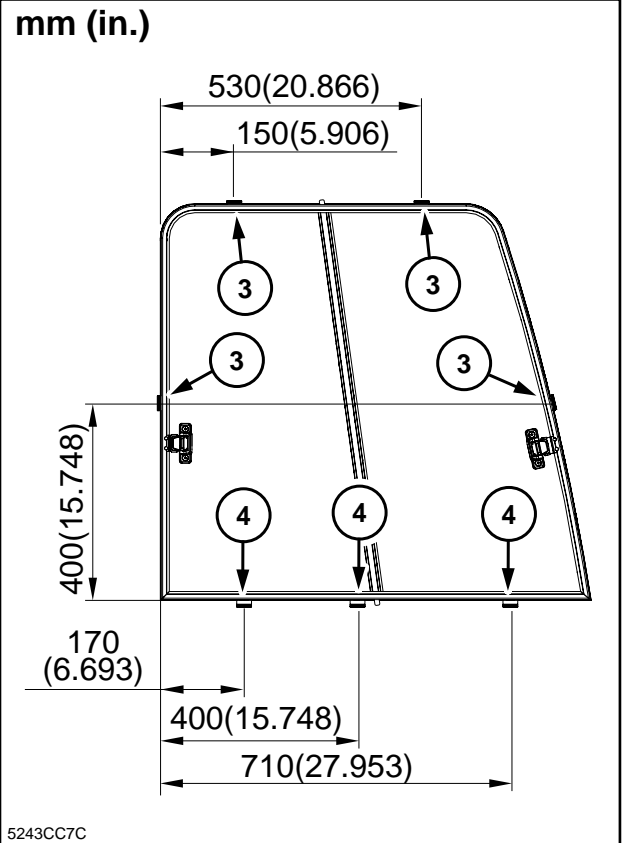
*1	Diameter 10 mm (0.394 in.) Cut in a circular shape.
*2	Depth 12 mm (0.472 in.) Cut in a V-shape.



4A90B470

*3	Adhesive application locations
1	Adhesive
2	Door

[3] Affix the spacers (3) and (4) at the locations shown in the following figure.



5243CC7C

3	Spacer (Small)
4	Spacer (Large)

[4] Adhere the sash to the door.

Caution

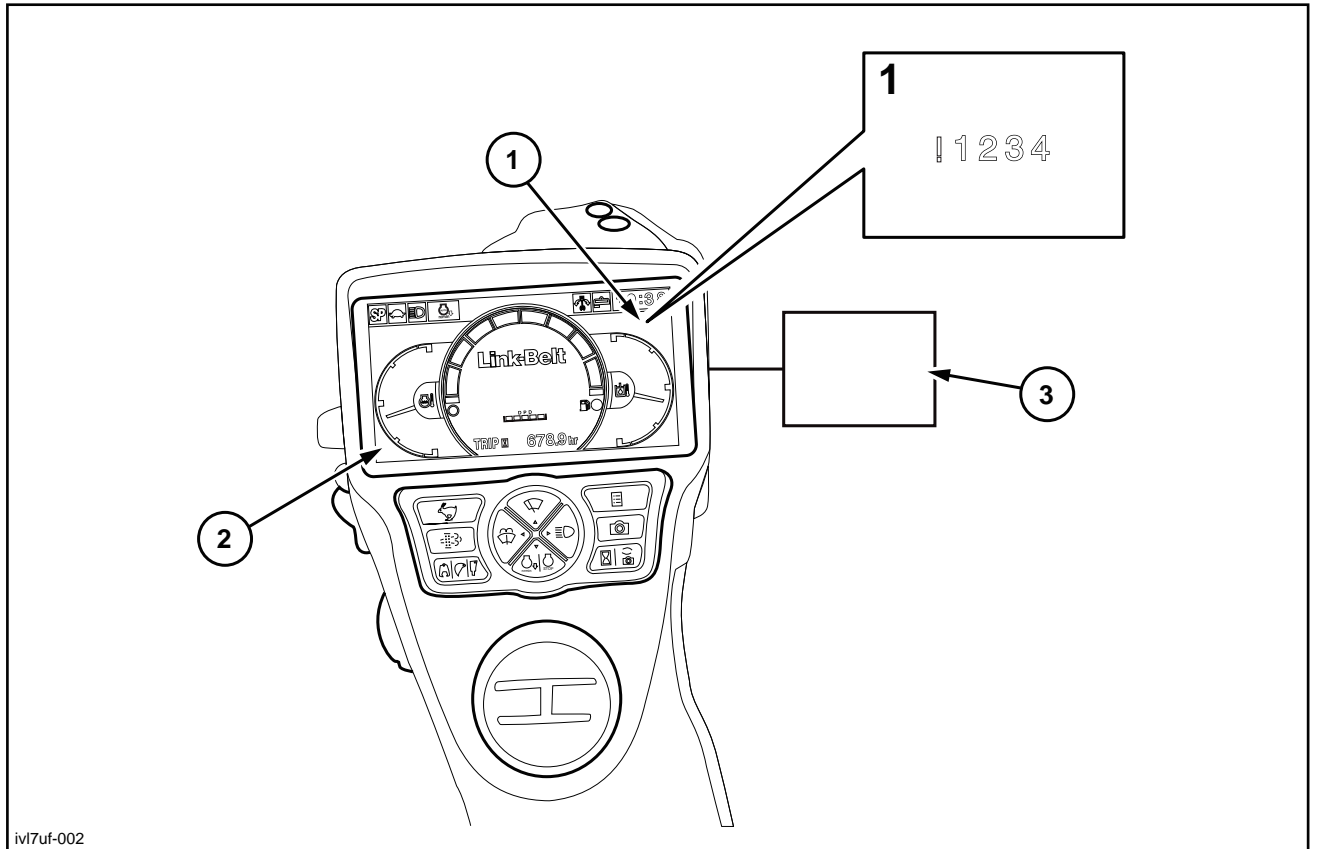
Adhere the sash to the door in a period of 5 minutes or less from starting to apply the adhesive.

If not done so, drying of the surface, weakening of adhesion strength, or failure to adhere may occur.

Diagnostic Trouble Code Indicator

Purpose

Displays a diagnostic trouble code on the monitor when trouble occurs. (Makes troubleshooting easier)



iv17uf-002

1	Diagnostic trouble code
2	Monitor
3	Computer A

Operation explanation

[1] If trouble occurs, the "!" symbol and the diagnostic trouble code are displayed in the top right of the monitor.

- When multiple cases of trouble occur, they are displayed in turn at 5-second intervals.
- There is no limit for number of items that can be displayed.
- Even when the fuel display is ON, the trouble display is prioritized.

[2] When the trouble is resolved, the trouble diagnosis code goes off.

Clock

Purpose

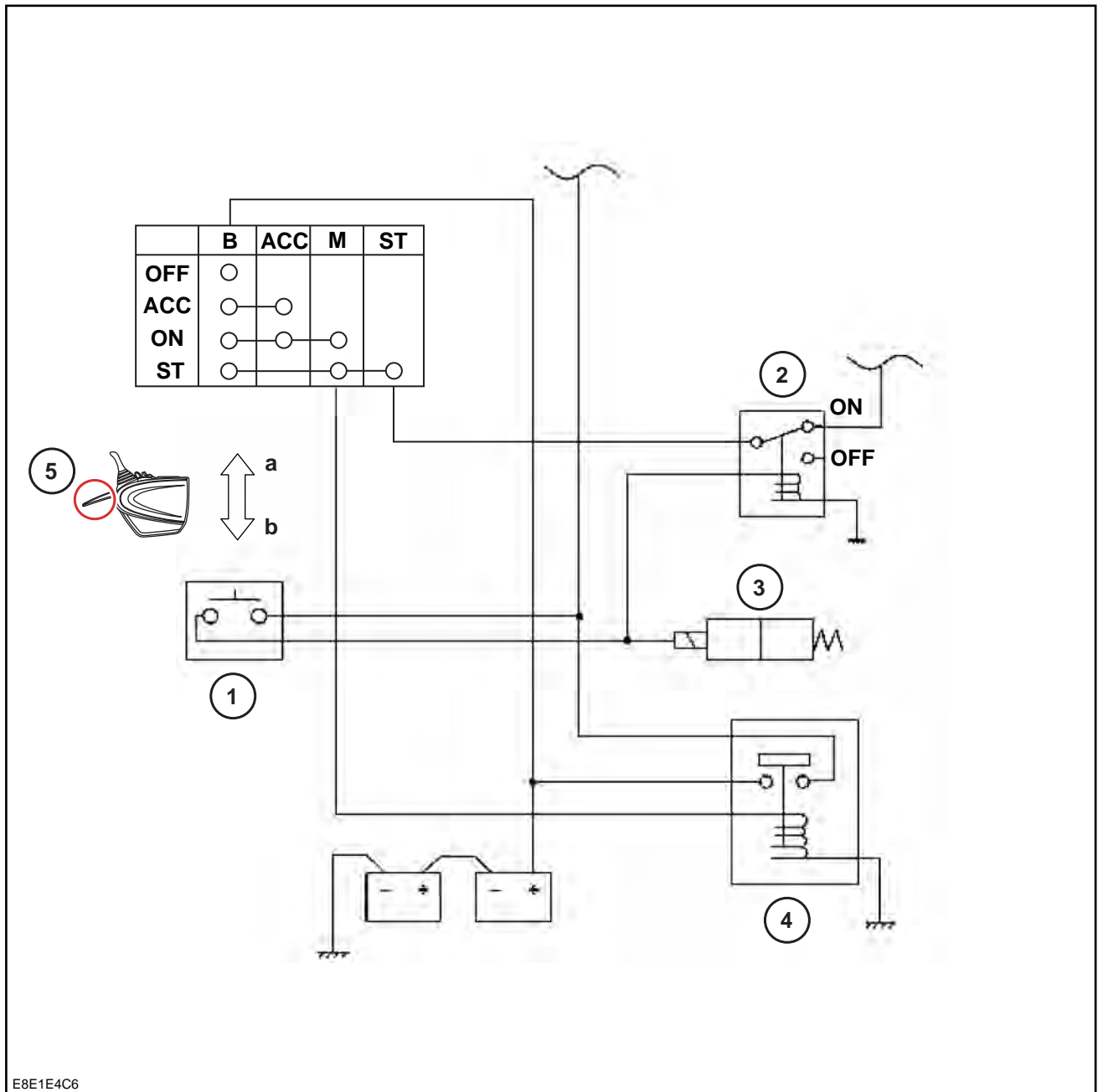
Displays the time on the monitor.

Operation explanation

- The time is always displayed on the monitor.
- When the power is switched OFF, the time is not displayed on the monitor, but the clock continues to operate. (Because it uses power from the battery)

Safety

Lever Lock



E8E1E4C6

a	Down (OFF)
b	Up (ON)

1	Gate lock limit switch	3	Lever lock solenoid	5	Gate lever
2	Starter cut relay	4	Battery relay		

Operation explanation

When the battery relay is excited by the key being switched ON, the power enters the lever lock limit switch.

When the gate lever is raised, the lever lock switch (limit switch) comes ON and the lever lock solenoid is operated. (For details on neutral start control, see the neutral start operation explanation.)

PRESS. MAX	psi	Maximum pressure
PRESS. MIN	psi	Minimum pressure

8. Boost pressure distribution

ENGINE HISTORY			8/18
PRESS < P1	0 0 1 0	hour	
P1 ≤ PRESS < P2	0 0 2 0	hour	
P2 ≤ PRESS < P3	0 0 3 0	hour	
P3 ≤ PRESS < P4	0 0 2 0	hour	
P4 ≤ PRESS < P5	0 0 1 0	hour	
P5 ≤ PRESS < P6	0 0 0 5	hour	
P6 ≤ PRESS	0 0 0 5	hour	
PRESS. MAX		kPa	
PRESS. MIN		kPa	

ke61mp-008

PRESS. < P1	hour	P < 0
P1 ≤ PRESS. < P2	hour	0 ≤ P < 150
P2 ≤ PRESS. < P3	hour	150 ≤ P < 300
P3 ≤ PRESS. < P4	hour	300 ≤ P < 450
P4 ≤ PRESS. < P5	hour	450 ≤ P < 600
P5 ≤ PRESS. < P6	hour	600 ≤ P < 750
P6 ≤ PRESS.	hour	750 ≤ P
PRESS. MAX	kPa	Maximum pressure
PRESS. MIN	kPa	Minimum pressure

9. Load ratio distribution

ENGINE HISTORY			9/18
RATIO < R1	0 0 1 0	hour	
R1 ≤ RATIO < R2	0 0 2 0	hour	
R2 ≤ RATIO < R3	0 0 3 0	hour	
R3 ≤ RATIO < R4	0 0 2 0	hour	
R4 ≤ RATIO < R5	0 0 1 0	hour	
R5 ≤ RATIO < R6	0 0 0 5	hour	
R6 ≤ RATIO	0 0 0 5	hour	

ke61mp-009

RATIO < R1	hour	R < 30
R1 ≤ RATIO < R2	hour	30 ≤ R < 40
R2 ≤ RATIO < R3	hour	40 ≤ R < 50
R3 ≤ RATIO < R4	hour	50 ≤ R < 60
R4 ≤ RATIO < R5	hour	60 ≤ R < 70
R5 ≤ RATIO < R6	hour	70 ≤ R < 80
R6 ≤ RATIO	hour	80 ≤ R

10. SP mode load ratio distribution

ENGINE HISTORY			10/18
RATIO < R1	0 0 1 0	hour	
R1 ≤ RATIO < R2	0 0 2 0	hour	
R2 ≤ RATIO < R3	0 0 3 0	hour	
R3 ≤ RATIO < R4	0 0 2 0	hour	
R4 ≤ RATIO < R5	0 0 1 0	hour	
R5 ≤ RATIO < R6	0 0 0 5	hour	
R6 ≤ RATIO	0 0 0 5	hour	

ke61mp-010

RATIO < R1	hour	R < 30
R1 ≤ RATIO < R2	hour	30 ≤ R < 40
R2 ≤ RATIO < R3	hour	40 ≤ R < 50
R3 ≤ RATIO < R4	hour	50 ≤ R < 60
R4 ≤ RATIO < R5	hour	60 ≤ R < 70
R5 ≤ RATIO < R6	hour	70 ≤ R < 80
R6 ≤ RATIO	hour	80 ≤ R

11. H mode load ratio distribution

ENGINE HISTORY			11/18
RATIO < R1	0 0 1 0	hour	
R1 ≤ RATIO < R2	0 0 2 0	hour	
R2 ≤ RATIO < R3	0 0 3 0	hour	
R3 ≤ RATIO < R4	0 0 2 0	hour	
R4 ≤ RATIO < R5	0 0 1 0	hour	
R5 ≤ RATIO < R6	0 0 0 5	hour	
R6 ≤ RATIO	0 0 0 5	hour	

ke61mp-011

RATIO < R1	hour	R < 30
R1 ≤ RATIO < R2	hour	30 ≤ R < 40
R2 ≤ RATIO < R3	hour	40 ≤ R < 50
R3 ≤ RATIO < R4	hour	50 ≤ R < 60
R4 ≤ RATIO < R5	hour	60 ≤ R < 70
R5 ≤ RATIO < R6	hour	70 ≤ R < 80
R6 ≤ RATIO	hour	80 ≤ R

COMMUNICATION

1. Communication between the computer B and each device

COMMUNICATION		1 / 2
CONTROLLER - A	<input checked="" type="radio"/>	
CONTROLLER - B	<input type="radio"/>	
CONTROLLER - C	<input checked="" type="radio"/>	
CONTROLLER - S / T	<input checked="" type="radio"/>	
ECM	<input checked="" type="radio"/>	
MONITOR	<input checked="" type="radio"/>	
SERVER	<input type="radio"/>	
AIR CONDITIONER	<input checked="" type="radio"/>	

83890671

<input checked="" type="radio"/>	ON
<input type="radio"/>	OFF

CONTROLLER-A	Communication with computer A	
CONTROLLER-B	Communication with computer B	Always OFF
CONTROLLER-C	Communication with computer C	Material handler model
CONTROLLER-S/T	Communication with computer S or T	Japan only
ECM	Communication with ECM	
MONITOR	Communication with monitor (RS232C, CAN)	
SERVER	Communication with GPS system server	Japan only
AIR CONDITIONER	Communication with AC amplifier	

2. Communication between the computer B and each device

COMMUNICATION		2 / 2
FMS MODULE	<input type="radio"/>	
SERVICE TOOL	<input type="radio"/>	

844267C1

<input checked="" type="radio"/>	ON
<input type="radio"/>	OFF

FMS MODULE	Communication with fuel density transducer	Japan only
SERVICE TOOL	Communication with TEPROS or EST	

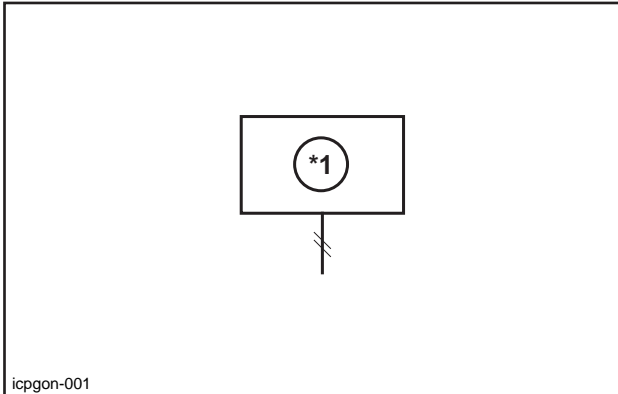
Clock Adjustment

Summary

Adjust the clock that is displayed on the monitor.

- See the page for information on the clock.

Configuration



icpgon-001

*1	Color monitor
----	---------------

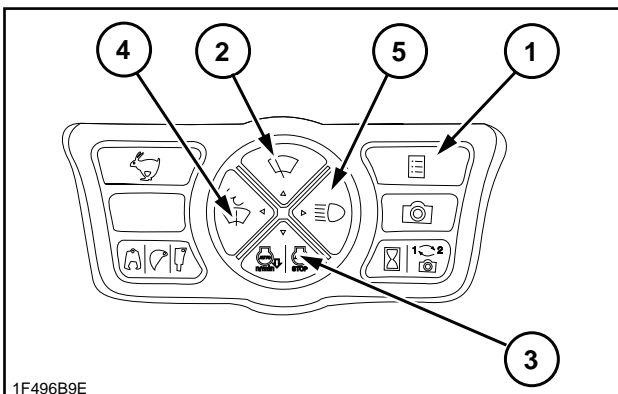
Operation explanation

- [1] The system will display "--:--" on the monitor when the key is turned ON.
- [2] The operator sets the time using the "CLOCK ADJUST" function on the menu screen.
Move the cursor left to right, and change the time by moving up and down, and press the menu switch to confirm the values.

- [3] The system displays the time on the monitor.
 - The clock data is stored in the monitor, so the data remains stored even if Computer B is replaced.
 If the monitor is replaced, the time must be set again.

How to adjust the clock

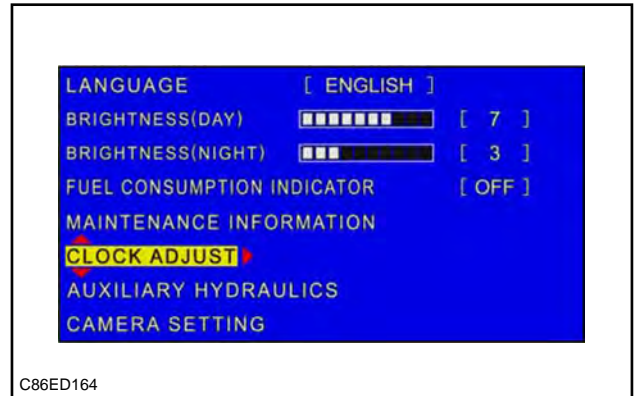
1. Press button (1) to display the menu screen.



1F496B9E

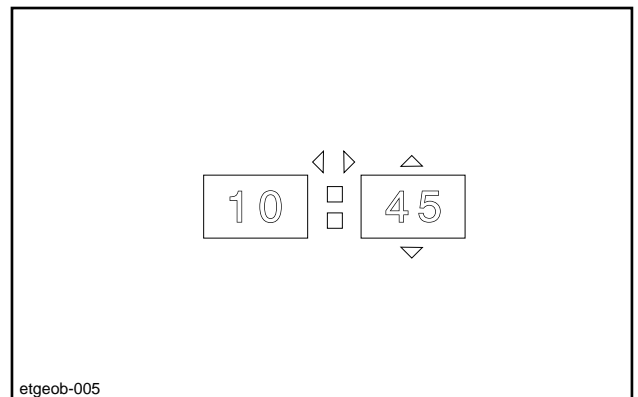
2. Press either button (2) or (3) to select "CLOCK ADJUST" on the menu screen.

3. Press button (5).



C86ED164

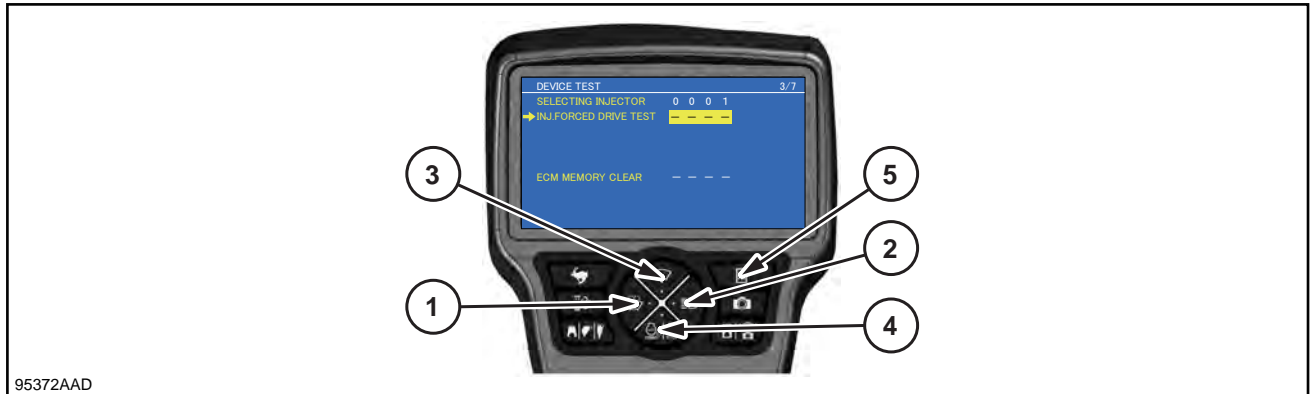
4. Press the button to set the time.
 - Press either (2) or (3) to switch between hour and minute.
 - Press either (4) or (5) to increase or decrease the number.
5. Press button (1) to return to the menu screen.



etgeob-005

■Injector Forced Drive Test

Purpose: To check the intake operation.



95372AAD

Procedure

-Condition for the test-

With the key ON and engine stopped.

Common rail pressure is less than 5 MPa (725.27 psi).

[1] Select the forced drive injector.

Select "SELECTING INJECTOR" (injector select) with switches (3) and (4).

Press switches (1) and (2) to set the injector number.

[2] Test execution

Select "INJ.FORCED DRIVE TEST" (injector forced drive test) with switches (3) and (4).

Hold down switch (2) for 2 sec., then "- - - -" changes to "+ + + +" and the test starts.

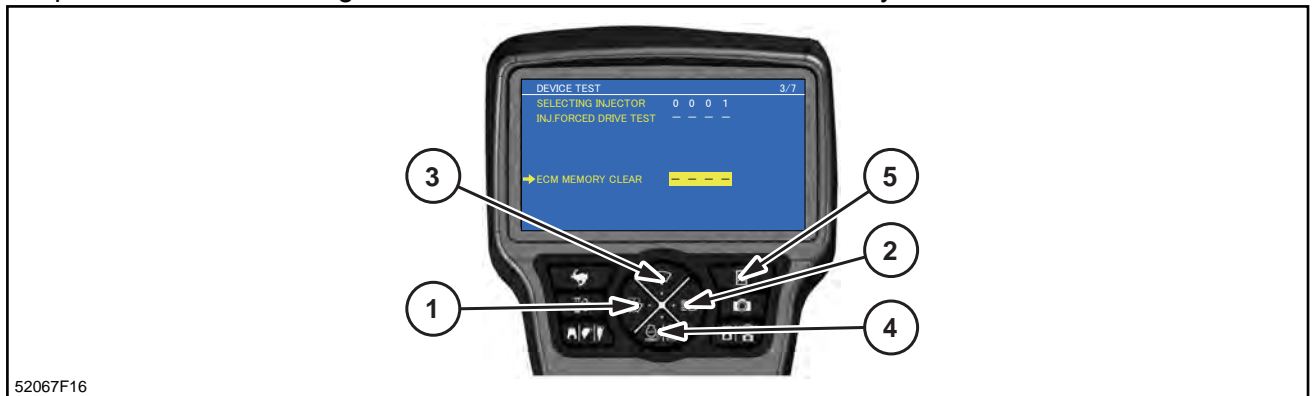
The test will be continued for 10 sec.

[3] Test finish

After 10 sec., the engine automatically returns to normal state.

■ECM Memory Clear

Purpose: To reset the diagnosis mode and to delete the DTC history in the ECM



52067F16

Procedure

-Condition for the test-

With the key ON and engine stopped

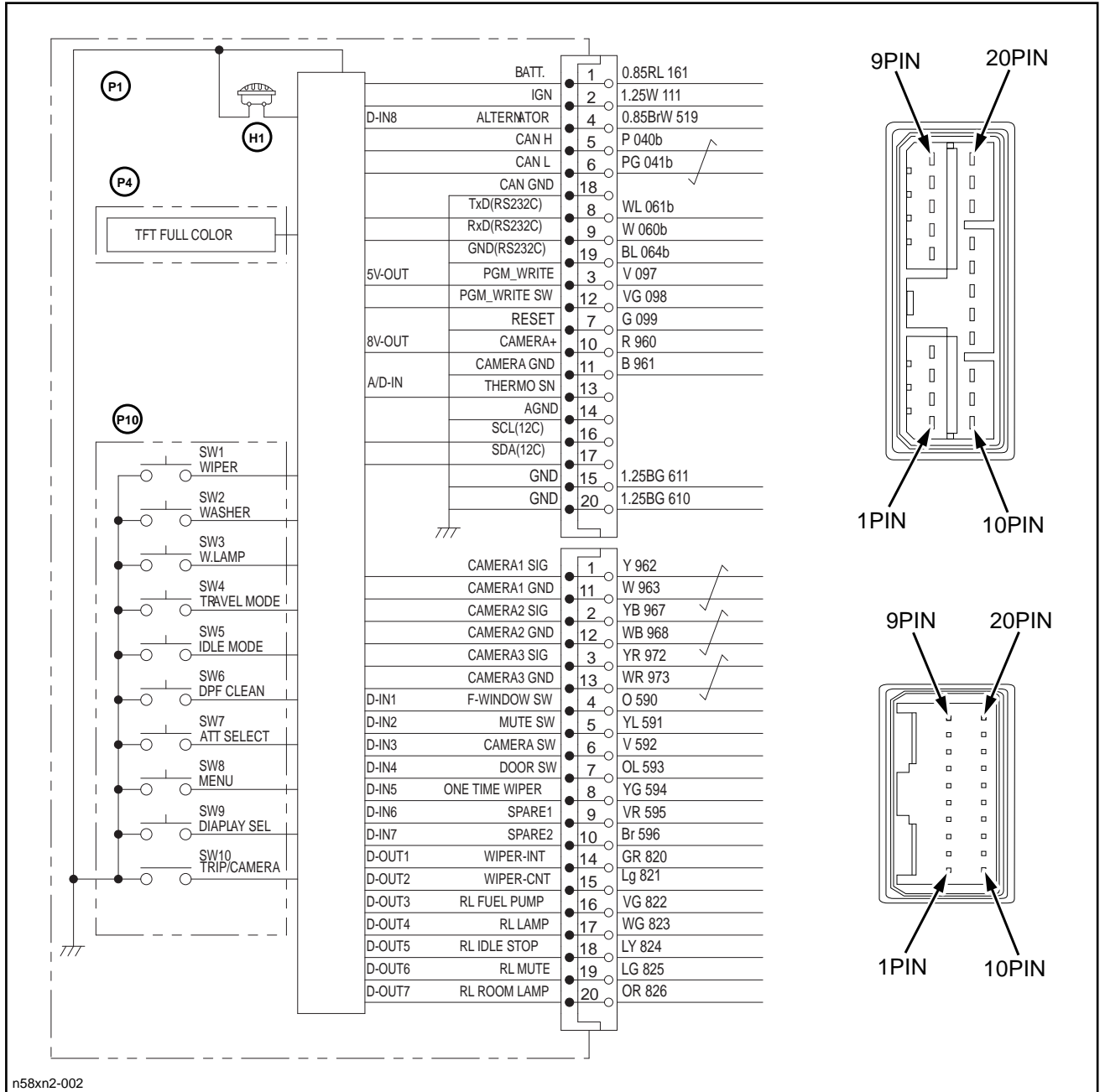
[1] Execution

Select "ECM MEMORY CLEAR" with switches (3) and (4).

Hold down switch (2) for 2 sec., then "- - - -" changes to "+ + + +" and returns to "- - - -" automatically.

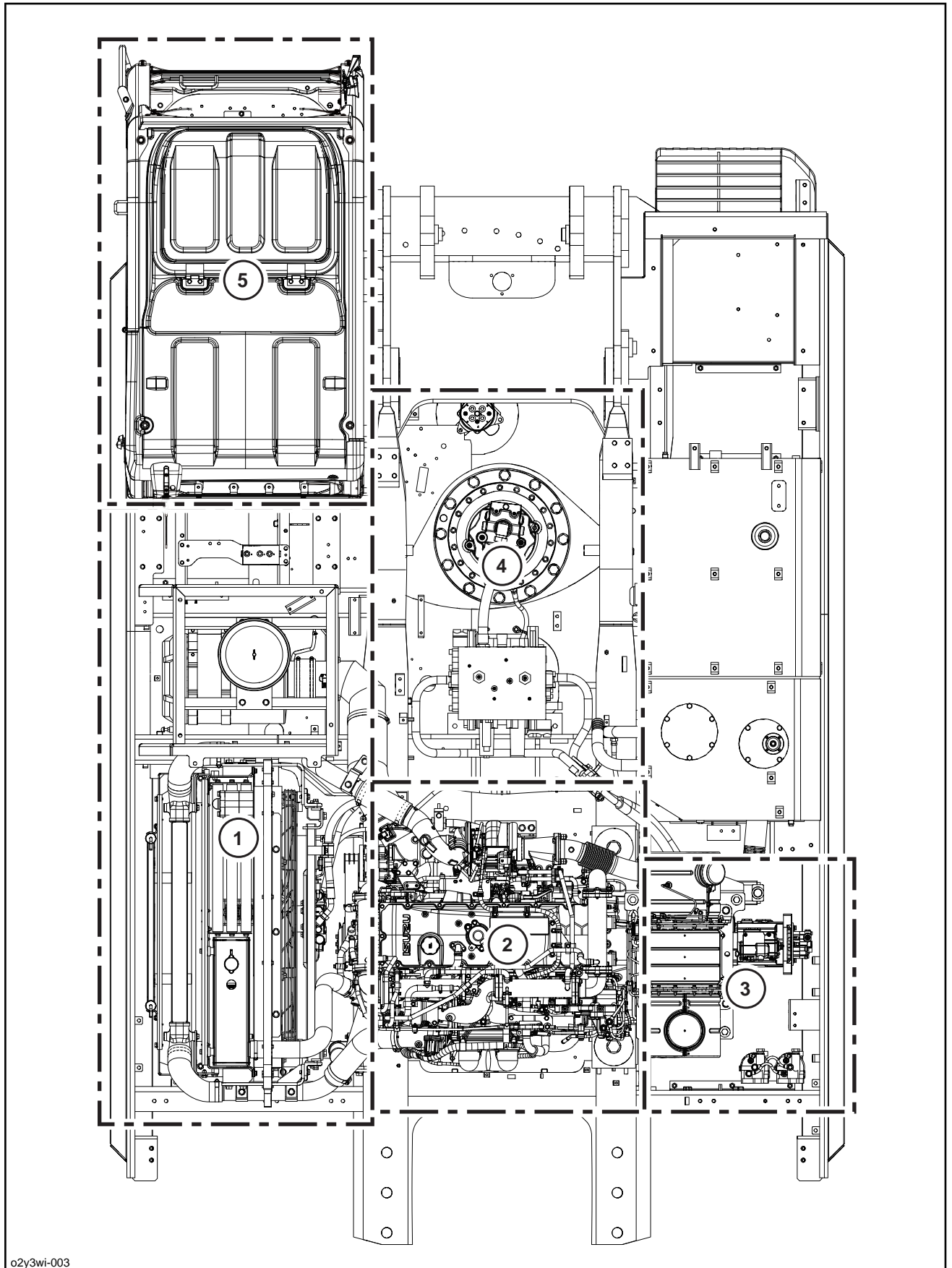
Turn OFF the key, then "ECM MEMORY CLEAR" is executed and the DTC history in the ECM is deleted.

Monitor



Electrical Equipment Layout Diagram

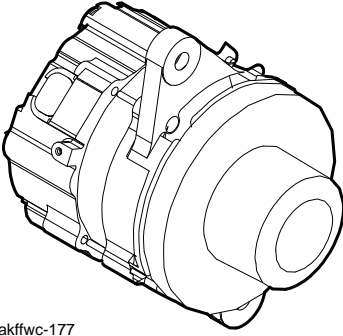
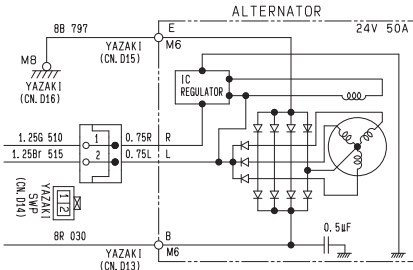
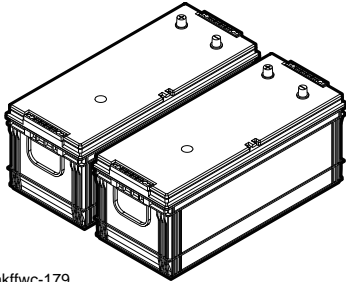
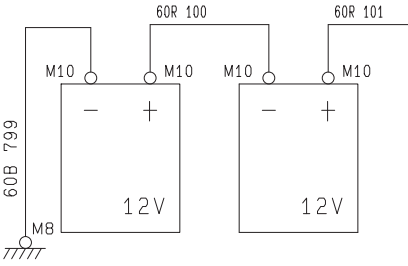
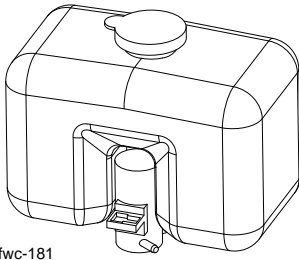
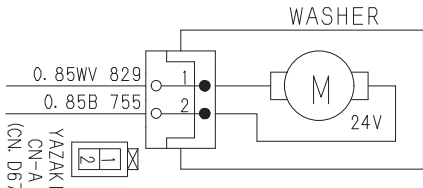
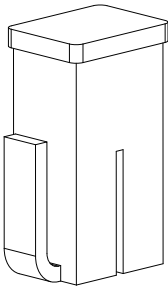
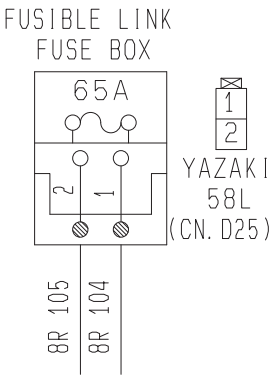
Overall View



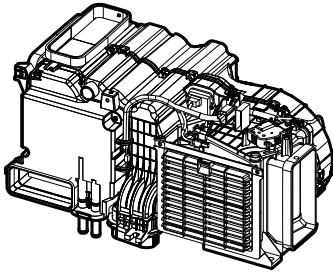
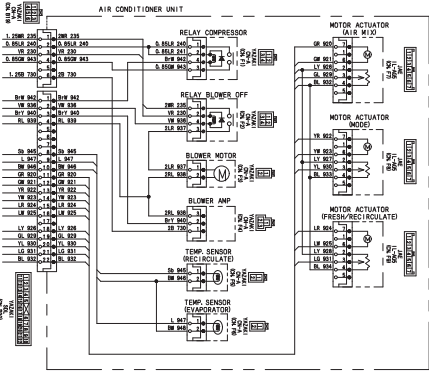
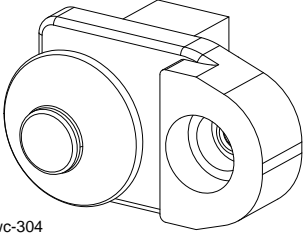
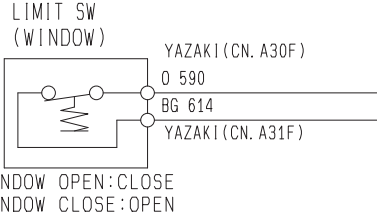
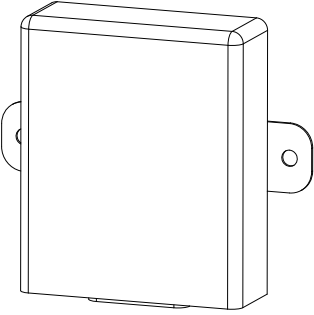
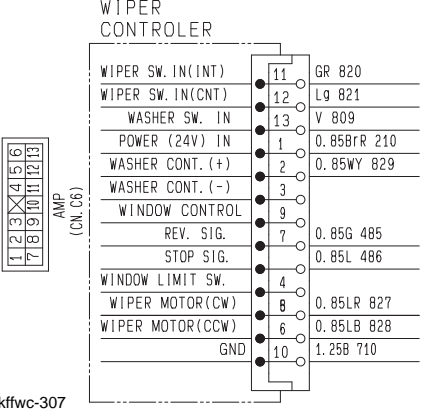
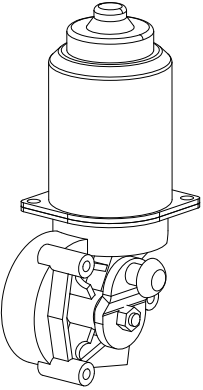
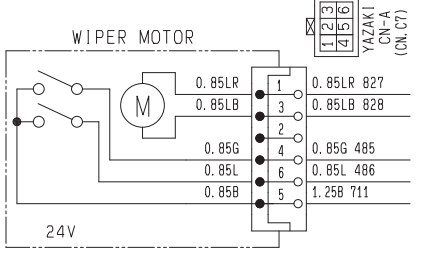
o2y3wi-003

1	Main unit left side (radiator chamber)	3	Main unit right side (pump chamber)	5	In Cab
2	Engine	4	Main unit center section		

R. ELECTRICAL PARTS

Name	Shape	Circuit	Remarks
Alternator	 <p>akffwc-177</p>	 <p>akffwc-178</p>	<p>Model; 50 A - 24 V Isuzu part No.; 181200-6037</p>
Battery	 <p>akffwc-179</p>	 <p>akffwc-180</p>	<p>Model; 180G51 Sumitomo part No.; KHR4197</p>
Washer motor	 <p>akffwc-181</p>	 <p>akffwc-345</p>	<p>Sumitomo part No.; KHR2261 (tank + motor)</p>
Fusible link (fuse box)	 <p>akffwc-183</p>	 <p>akffwc-184</p>	<p>Model; 65 A Sumitomo part No.; KHR1592</p>

R. ELECTRICAL PARTS

Name	Shape	Circuit	Remarks
Air conditioner unit	 <p style="text-align: center;">akffwc-302</p>	 <p style="text-align: center;">akffwc-373</p>	Sumitomo part No.; KHR27160
Limit switch (front window) (door)	 <p style="text-align: center;">akffwc-304</p>	 <p style="text-align: center;">akffwc-305</p>	Sumitomo part No.; KHN26000
Wiper controller	 <p style="text-align: center;">akffwc-306</p>	 <p style="text-align: center;">akffwc-307</p>	Sumitomo part No.; KHN3392
Wiper motor	 <p style="text-align: center;">akffwc-308</p>	 <p style="text-align: center;">akffwc-309</p>	Sumitomo part No.; KHN25780

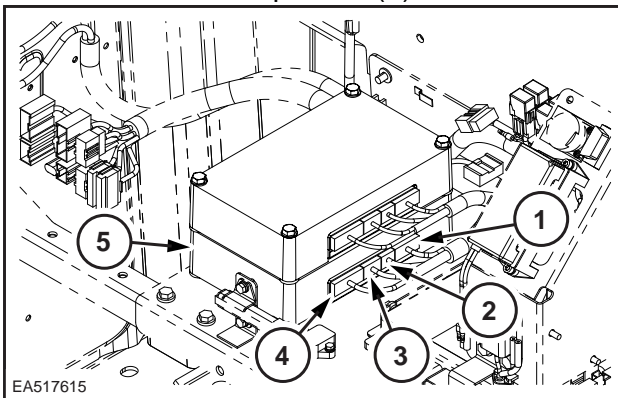
Removal and Installation of Computer A

Items to prepare

- Wrench [13 mm (0.512 in.)]

Removal of Computer A

1. Detach the battery ground cable from the battery.
2. Remove the rear trim.
See "Removal and Installation of Cab Assembly".
3. Remove the computer B.
See "Removal and Installation of Computer B".
4. Remove the connectors (1) (2) (3) (4) and remove the computer A (5).



Installation of Computer A

1. To install, perform the reverse of the removal procedure.

3. Manual control

[1] When operation of the blow mode select switch is recognized, the blow mode motor actuator is driven to attain the output shaft angle below and the display is switched too.






Each time operation of the switch is recognized, the display switches MODE 1 → MODE 2 → MODE 3 → MODE 4 → MODE 1 →...

However, if this switch is pressed during auto control, auto control is ended and the diffuser is fixed at its current position.

[2] MODE 5 in the table below only occurs when operation of the DEF select switch is recognized.

After that, when operation of the blow mode select switch is recognized, the blow mode becomes the one that was in effect just before operation of the DEF select switch was recognized.

Also, even if the DEF switch is pressed again during this mode, the mode is not canceled.

Blow mode	MODE 1	MODE 2	MODE 3	MODE 4	MODE 5
Blow mode motor actuator degree of opening	90°	67°	48°	26°	0°
Panel display	FACE 	VENT 	B/L 	FOOT 	DEF 

4. Blow mode control priority order

The priority order for auto control and manual control is as follows.

Priority order	Control
1	Manual control
2	Auto control

■Refresh/Recirculate Switch Motor Actuator Control

1. Recirculate mode

In refresh mode, when it is recognized that the refresh/recirculate select switch on the operation panel has been closed, the system goes into recirculate mode. At this time, the display switches to recirculate and the motor actuator operates to the refresh angle (damper angle) of 0° (motor actuator angle 90°).

2. Refresh mode

In recirculate mode, when it is recognized that the refresh/recirculate select switch on the operation panel has been closed, the system goes into refresh mode. At this time, the display switches to refresh and the refresh/recirculate switch motor actuator operates to the refresh angle.

[1] Refresh mode I

When blow mode control is manual and is set to B/L or FOOT, the set temperature is set to 32°C (89.6°F) (HOTMAX), and air flow control is manual and is set to Hi, the refresh angle (damper angle) operates to 67° (motor actuator angle 48°).

[2] Refresh mode II

When in a mode other than refresh mode I, the refresh angle (damper angle) operates to 30° (motor actuator angle 0°).

3. Operation stop judgment

[1] The operating motor actuator stops when the current position comes within the target position range.

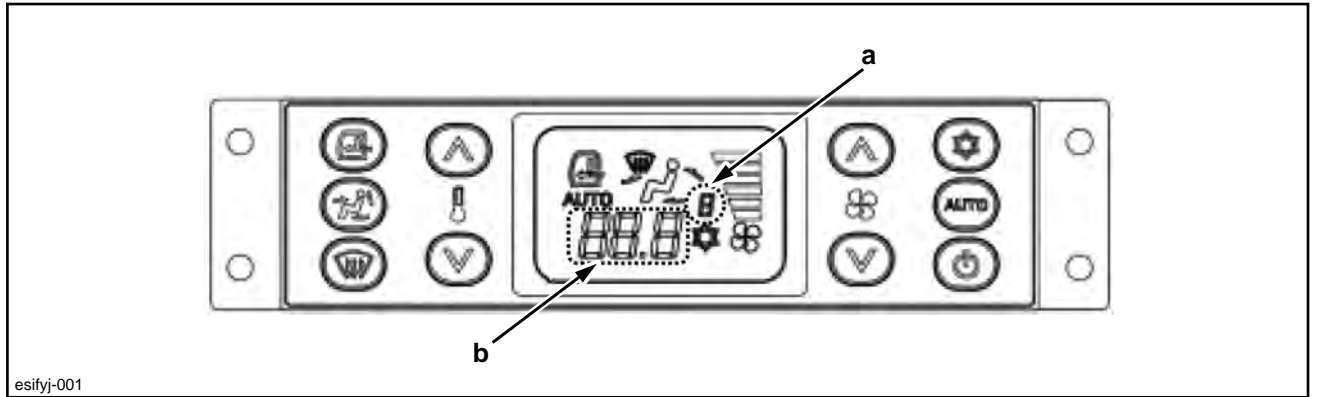
[2] The stopped motor actuator operates when the current position goes beyond the target position range.

Self-diagnosis Function with Panel Display

Abnormality Display and Self-check Procedures



Motor actuator and sensor abnormalities can be checked on the panel display.

■Abnormality Display Position



esifyj-001

a	This segment display appears only in the monitor mode.
b	3 digit segment

Abnormalities are indicated with the numbers and letters displayed on the 3 digit segment display and a flashing  or .

■Explanation of Abnormality Display

■Motor Actuator Abnormality

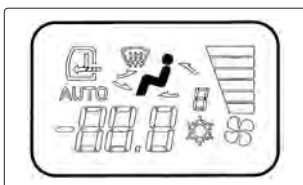
1. HL.E displayed on 3 digit segment display



mhs6vk-001

Indicates that the air mix motor actuator harness is disconnected or air mix motor actuator connector is disconnected. This is also displayed when the air mix motor actuator is locked due to air mix motor actuator abnormality and link abnormality.

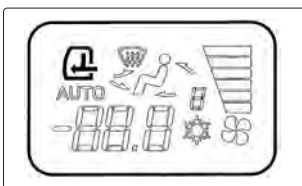
2. flashes



mhs6vk-002

Indicates that the blow mode motor actuator harness is disconnected or blow mode motor actuator connector is disconnected.

3. or flashes



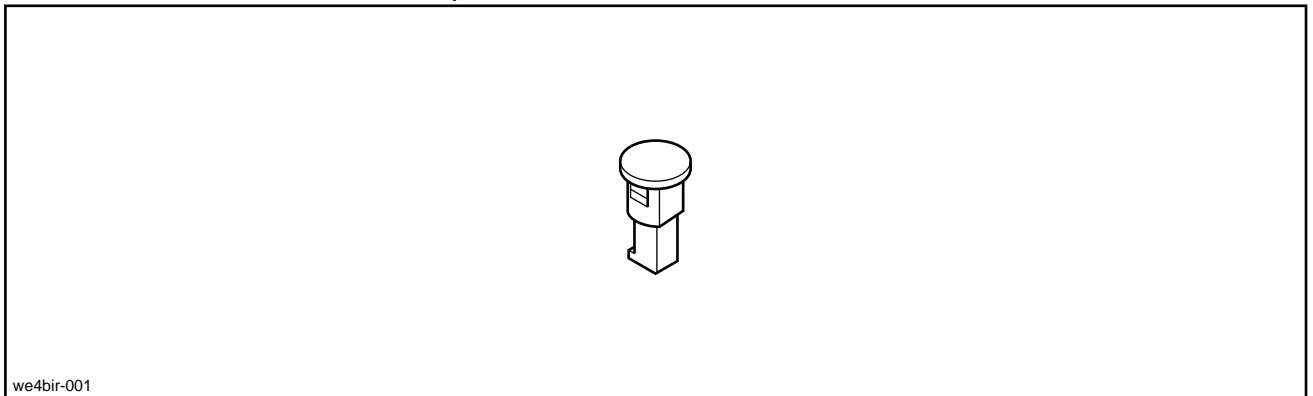
mhs6vk-003

Indicates that the inside/outside air motor actuator harness is disconnected or inside/outside air motor actuator connector is disconnected.

1. With the cooling cycle stopped, remove the connector from the switch and check for continuity between the switch side connector terminals using the tester.
If there is continuity, the switch is normal. [When the outside air temperature is 0°C (32.0°F) or higher]
2. Connect the gauge manifold high-pressure side hose to the high-pressure side charge port.
With the cooling cycle operating, the condenser front surface is covered with a plate shaped object and the high pressure rises.
If the compressor stops around 3.14 MPa (455.4685 psi), the switch is normal.
3. With the refrigerant removed, check for continuity between the switch side connector terminals using the tester.
If there is no continuity, the switch is normal.

Solar Radiation Sensor

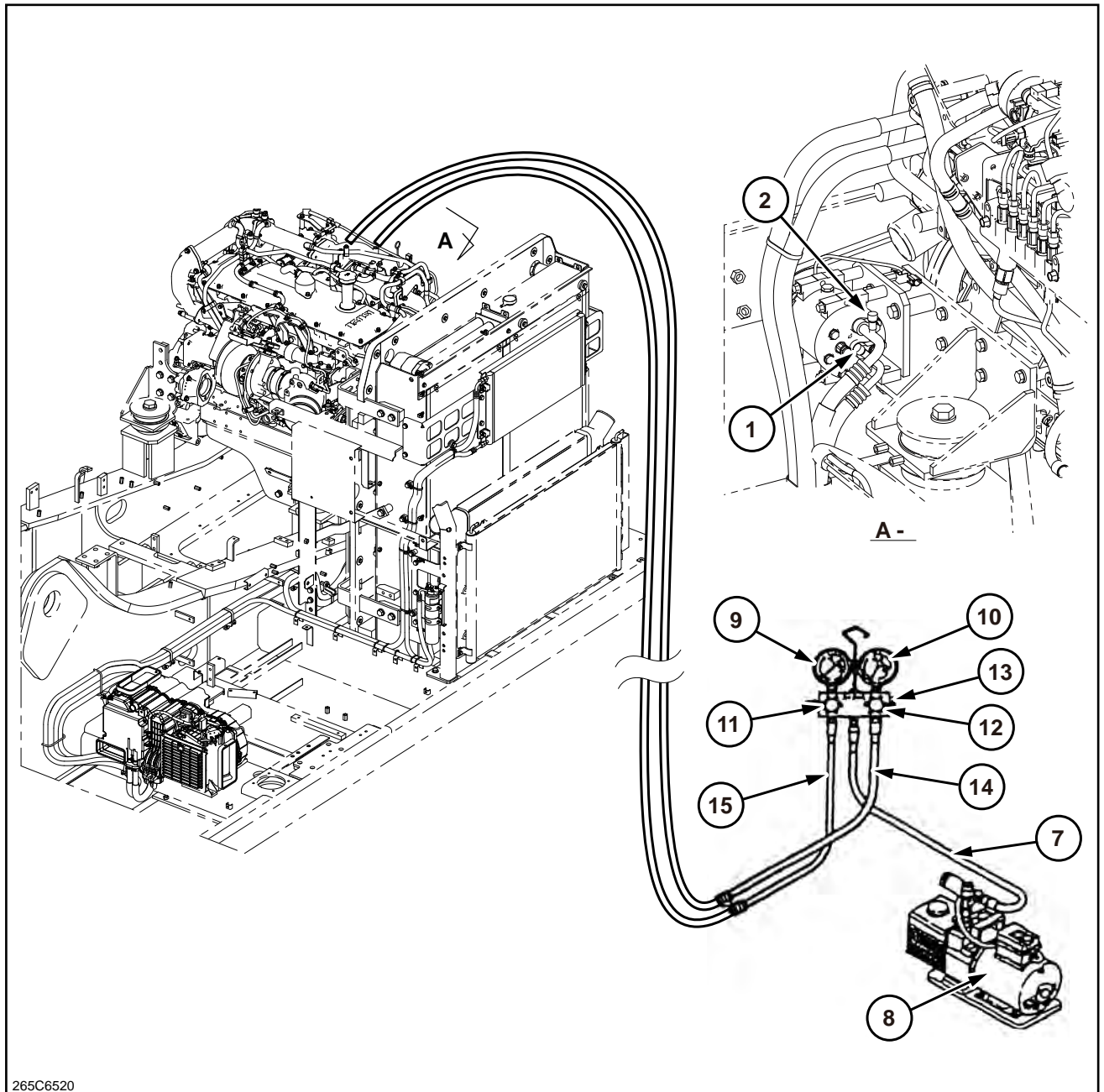
This is the air conditioner solar radiation correct sensor. It detects the strength of sunlight with a photodiode, converts it into milli-amp and sends that to the controller.



- Solar radiation sensor inspection method
Disconnect the solar radiation sensor connector from the harness and measure the voltage between the sensor side connector terminals using the tester's voltage measurement mode.
The voltage must be different when light is striking the photoreceiver section and when it is not.
(The voltage is about 0 V when absolutely no light is striking the photoreceiver.)

 **Caution**

Always measure with the tester in voltage measurement mode (V mode).
Measuring in resistance mode (Ω mode) would destroy the sensor.



265C6520

9	Low-pressure gauge
10	High-pressure gauge

Vacuuming

1. Open the high-pressure valve (HI) (12) and low-pressure valve (LO) (11) of the gauge manifold (13).
2. Turn the vacuum pump (8) switch on and vacuum for at least 30 min.
3. After the prescribed vacuuming time has elapsed (degree of vacuuming achieved: -750 mmHg or less), close the gauge manifold (13) high-pressure valve (12) and low-pressure valve (11).
4. Next, turn the vacuum pump (8) switch off.
5. Perform a check of air-tightness.

Let the gauge manifold (13) sit for at least 5 min. with the high-pressure valve (12) and low-pressure valve (11) closed, and check that the gauge indicator does not go back to 0. If the gauge indicator starts to swing back to 0, this indicates there is a leak. Tighten the line connections, perform vacuuming again, and check to see if there is still a leak.

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Removal and Installation of Bucket Cylinder

Job code **VDCY01**

⚠ Caution

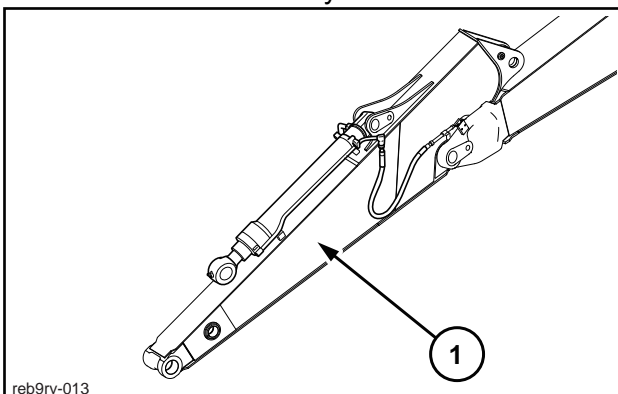
- Stop the machine on a level location with good footing.
- Be sure to stop the engine before beginning work.
- When working together with others, always be sure to exchange signals and pay adequate attention to safety.
- Always wear protective gear (protective eyewear and safety shoes, etc.) when working with a hammer.
- Be sure to inspect the nylon sling and other lifting equipment before beginning work.
- Do not let anyone go under a suspended load.

Items to prepare

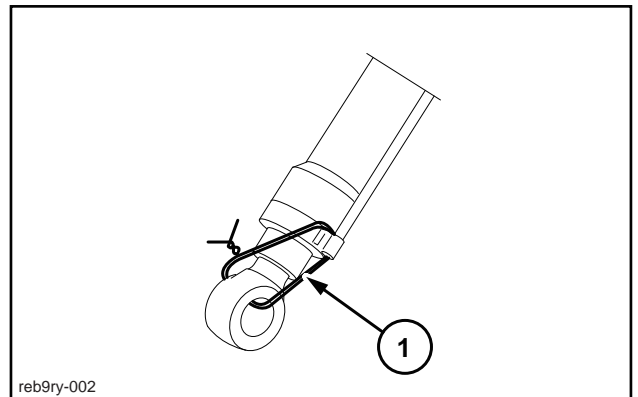
- Wrench [30 mm (1.181 in.)]
- Hexagon wrench [8 mm (0.315 in.)]
- Hammer
- Striking rod
- Liftcrane (with the required lifting capacity)
- Nylon sling (with the required lifting capacity)
- Grease
- Rag
- Cleaning fluid
- Crosstie
- Wires

Removal of Bucket Cylinder

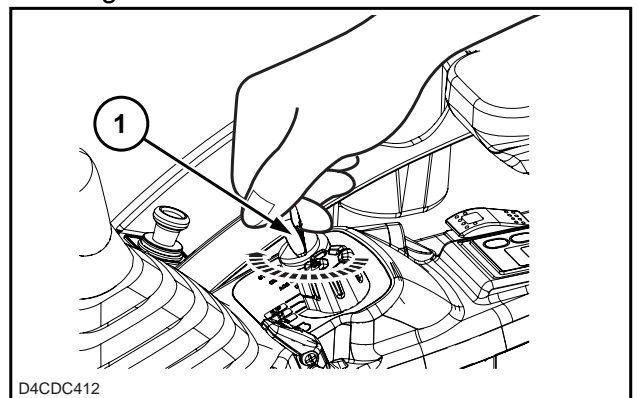
- Remove the bucket. (For details, see "Removal and Installation of Bucket".)
 - Remove the bucket link. (For details, see "Removal and Installation of Bucket Link".)
1. Bring the arm (1) top in contact with the ground.
Retract the bucket cylinder rod.



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



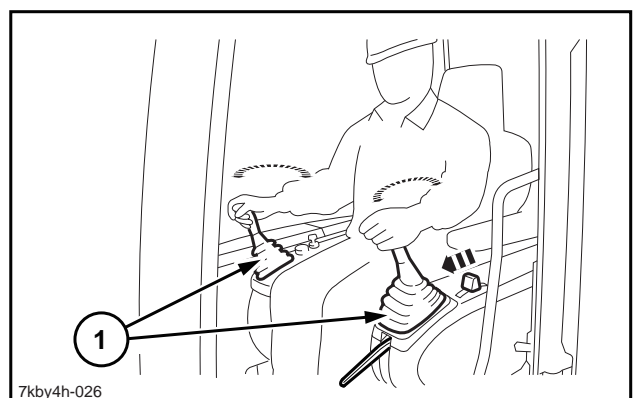
3. Turn the key switch (1) OFF and stop the engine.



4. Turn the key switch ON again, and then turn the control levers (1) about 10 times to bleed out any pressure.

⚠ Caution

Do not operate the bucket at this time.



5. Move the travel lever (1) back and forth about 5 times to bleed off the pressure. Return the key switch to OFF.

Procedures for Operation/Assembly and Disassembly of Hydraulic Cylinder

Specifications and Structure Diagram (including the assembly diagram and parts table)

In this manual, explanations use a product with a typical structure for a construction machine hydraulic cylinder. (KCH-6 model)

For details on the specifications and structure of the product being used, see the attached structural diagram.

Basic functions

Hydraulic cylinders are a type of hydraulic actuator.

A hydraulic cylinder converts the energy of pressure supplied from the hydraulic pump into a large force of linear motion. By operating the hydraulic pressure direction switchover valve, one can switch the direction of operation between extension and retraction.

This linear motion with large force and the switchover of the operation direction are the basic functions.

Function of Each Location

This manual explains the functions of each section of the cylinder using a product with a typical structure.

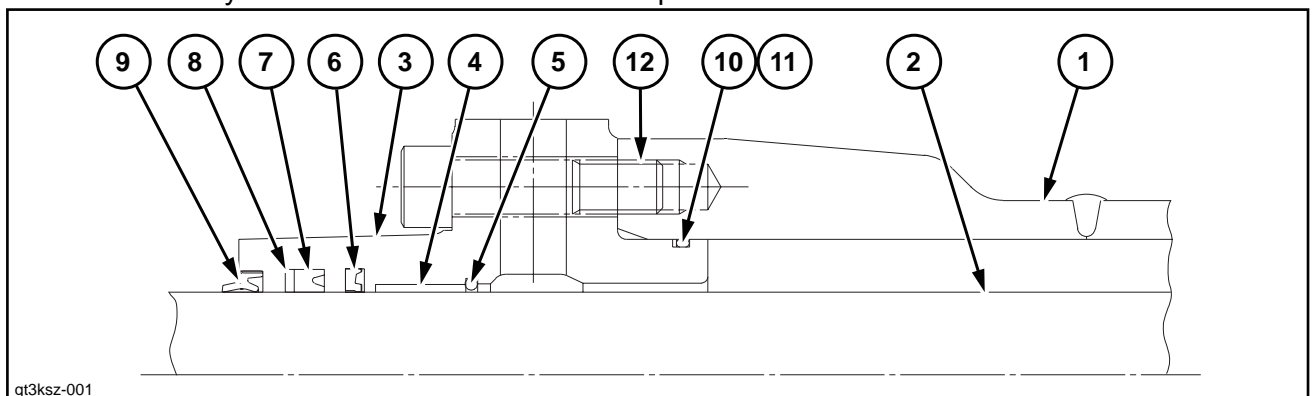
There may be some slight differences with the product being used, but the functions are the same.

■ **Cylinder Head Assembly**

The cylinder head assembly has the function of bearing the piston rod (2) by the bushing (4) being press fit into the inner diameter of the cylinder head (3).

The seal system of the inner diameter of the cylinder head prevents oil from leaking to the outside and prevents foreign matter from getting into the cylinder.

The cylinder head assembly also has the function of supplying and discharging high-pressure oil from inside the cylinder tube to the retraction side port.



1	Cylinder tube	5	O-ring	9	Wiper ring
2	Piston rod	6	Buffer ring	10	O-ring
3	Cylinder head	7	U-ring	11	Backup ring
4	Bushing	8	Backup ring	12	Installation bolt

• **Bushing**

The bushing is press fit to the inside surface of the cylinder head (3) and touches the piston rod (2).

Together with the slide rings (18) (19) on the outer circumference of the piston, the bushing divides the lateral load applied to the cylinder and moves linearly relative to the piston rod. Furthermore, it supports one end of the piston rod and has the function of minimizing eccentricity which has a negative impact on the sealing.

• **Buffer ring**

The buffer ring (6) has the function of buffering the pressure and heat applied on the U-ring (7) by the hydraulic oil to improve durability.

• **U-ring and backup ring**

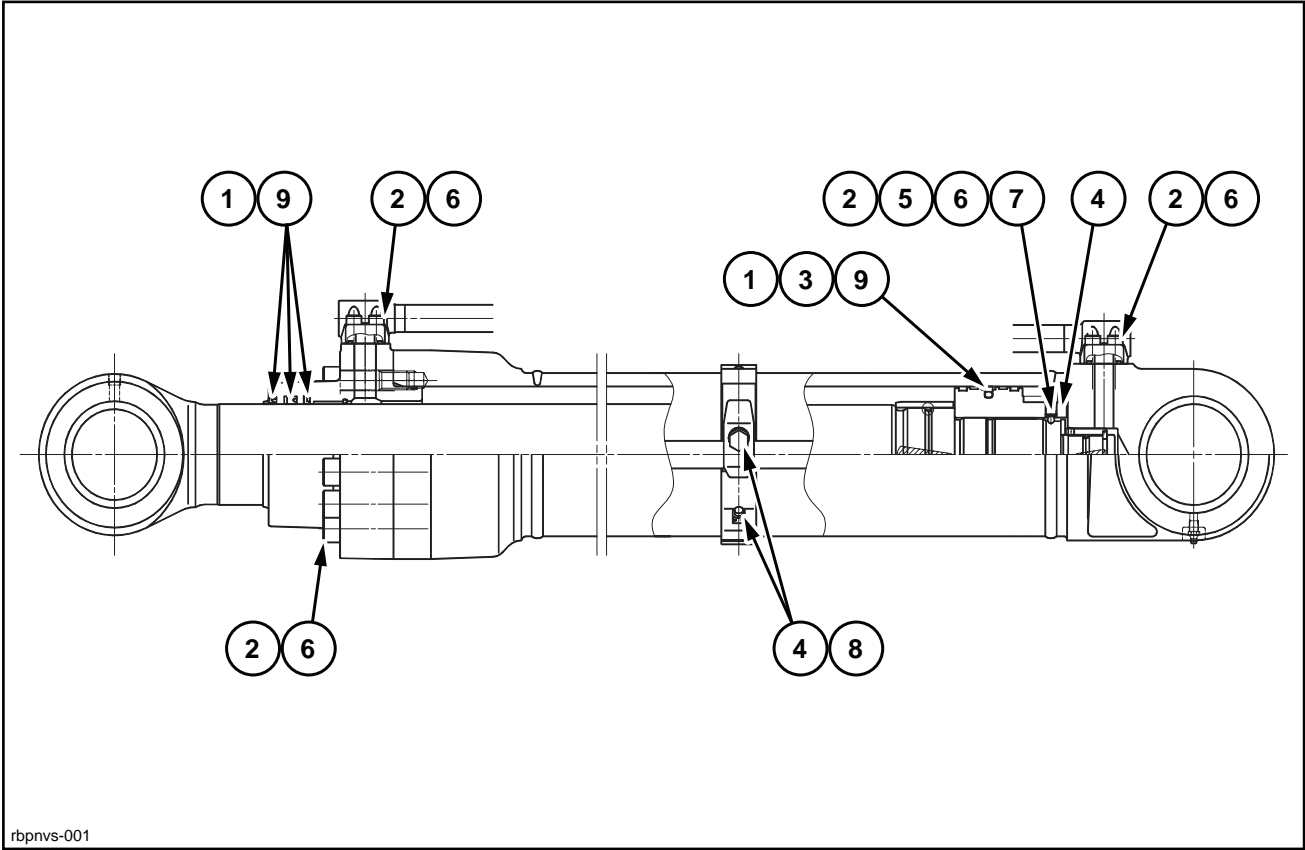
The U-ring (7) seals the pressure oil within the cylinder.

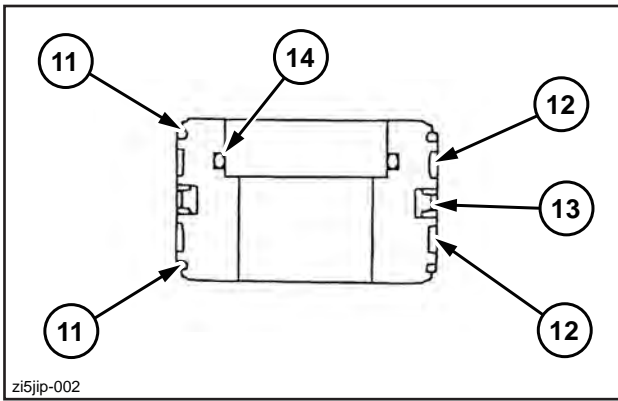
Oil leak amount unit: ml/10 min.						
Internal leak inspection	Inner diameter mm (in.)	Oil leak amount	Inner diameter mm (in.)	Oil leak amount	Inner diameter mm (in.)	Oil leak amount
	32 (1.259)	0.4	100 (3.937)	4.0	160 (6.299)	10.0
	40 (1.574)	0.6	125 (4.921)	5.6	180 (7.086)	12.6
	50 (1.968)	1.0	140 (5.511)	6.0	200 (7.874)	15.6
	63 (2.480)	1.6			220 (8.661)	20.0
	80 (3.149)	2.3			250 (9.842)	22.0

1	Oil ring
a	Acceptable
b	Not acceptable

Required Tool

- General Tool

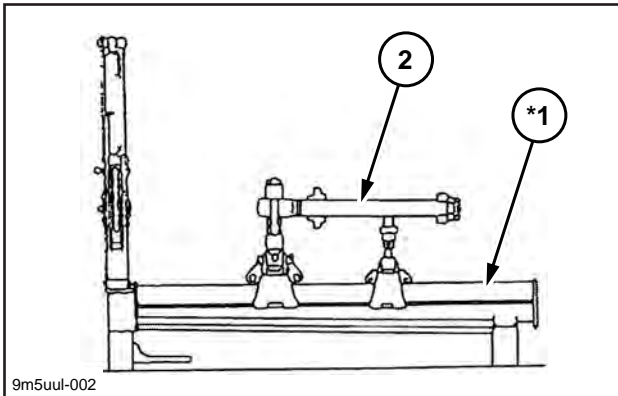




zi5jip-002

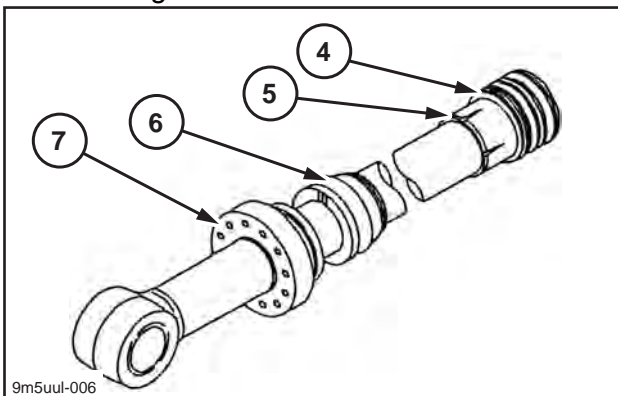
■Piston Rod Assembly

1. Set the piston rod assembly (2) on the stand (*1).



9m5uul-002

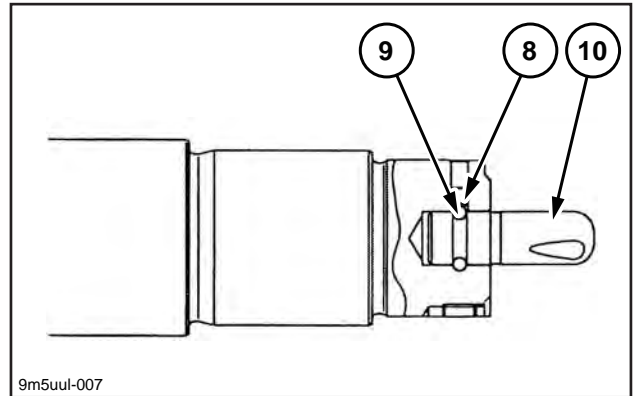
2. Install the head assembly (7).
3. Attach the O-ring and backup ring to the collar (6) and install it.
 - Boom cylinder
 - Arm cylinder
 - Bucket cylinder
4. Install the plunger (5).
 - Boom cylinder
 - Arm cylinder
 - Bucket cylinder
 - Check that the top of the plunger has slight backlash.



9m5uul-006

5. Set the cushion plunger (10) on the piston rod, install the 12 balls (9), and then secure with the cap (8).
 - Arm cylinder only

6. Assemble the piston assembly (4) with the procedure below.
 - When reusing the rod and piston assembly (4) Thoroughly clean and remove all shavings and debris.

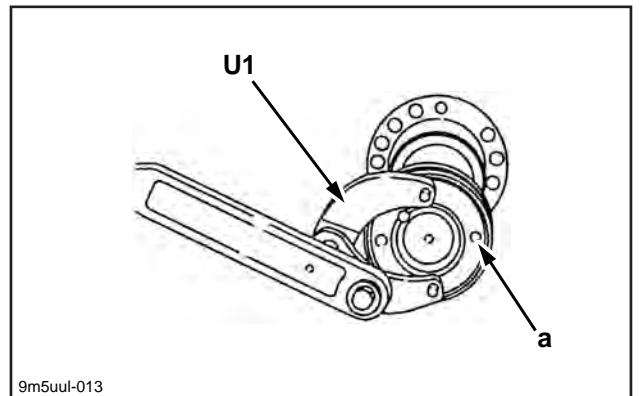


9m5uul-007

- [1] Screw in the piston assembly (4) and use tool U1 to tighten the piston assembly (4) until it matches the position of the screw threaded hole.
 - Use a file to remove burrs and barbs on the thread section.

- [2] Tighten the screw (3).

Tightening torque: 43.4130 - 54.2570 lbf · ft

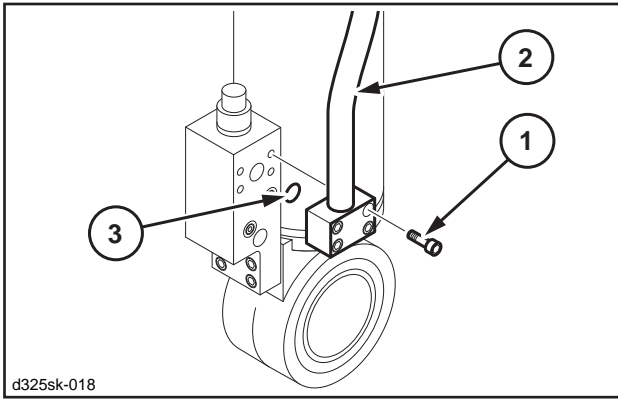


9m5uul-013

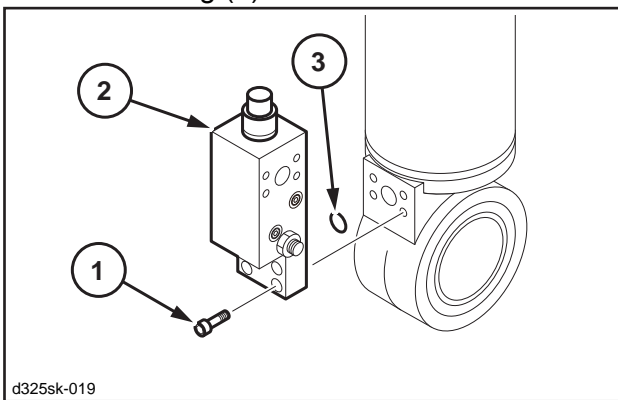
a 2-D10 notch hole

- [3] Use a punch (*3) to caulk the threaded section at 4 locations.

- When using new parts for the rod and/or piston assembly (4) Mark the cushion plug position on the end surface of the rod with bottom cushion.
- Arm cylinder only

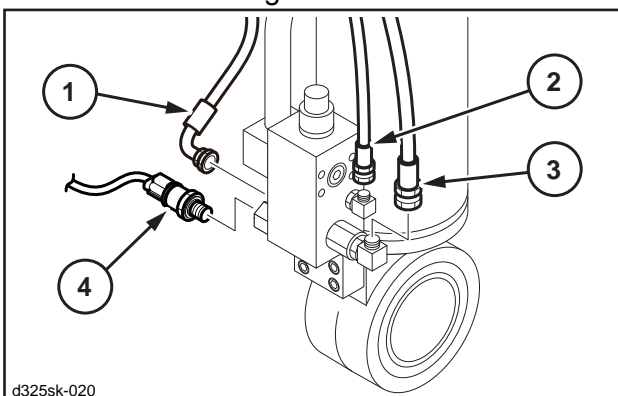


3. Use a hexagon wrench (0.394 in.) to remove the 4 hexagon socket head bolts (1), and then remove the boom HBCV (2) and O-ring (3).



4. Use wrenches (0.748 in., 0.866 in.) to remove the hoses from the cab side boom HBCV (1) (2) (3) as in Step 1, and use a wrench (1.063 in.) to remove the boom bottom pressure sensor (4).

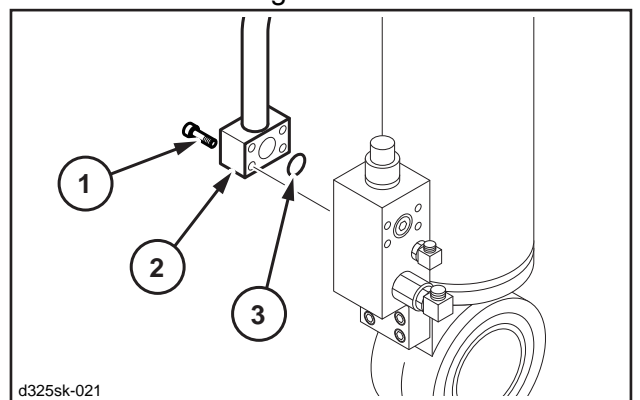
- Mark the HBCV and hoses so that the connectors match at the time of assembly.
- Use caps or plugs to cover the HBCV and lines to prevent any entry of water, dust or dirt.
- Clean the HBCV and lines by spraying them with a parts cleaner to prevent scratches and prevent dirt from accumulating on the connectors.



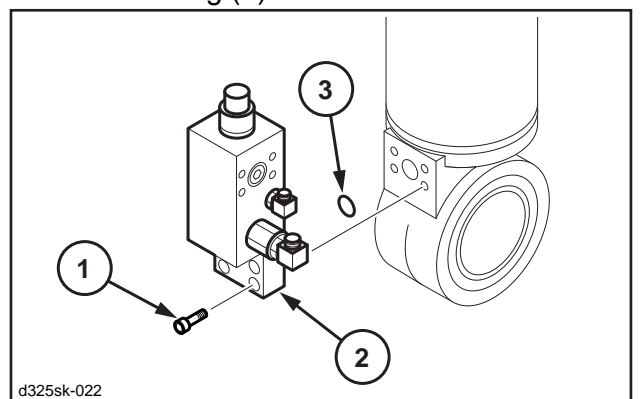
1	Pilot hose (use 0.748 in. wrench)
2	Drain hose (use 0.866 in. wrench)
3	Drain hose (use 0.866 in. wrench)

5. Use a hexagon wrench (0.394 in.) to remove the 4 hexagon socket head bolts (1), and then remove the line (2) and O-ring (3).

- Use caps or plugs to cover the HBCV and lines to prevent any entry of water, dust or dirt.
- Clean the HBCV and lines by spraying them with a parts cleaner to prevent scratches and prevent dirt from accumulating on the connectors.



6. Use a hexagon wrench (0.394 in.) to remove the 4 hexagon socket head bolts (1), and then remove the boom HBCV (2) and O-ring (3).



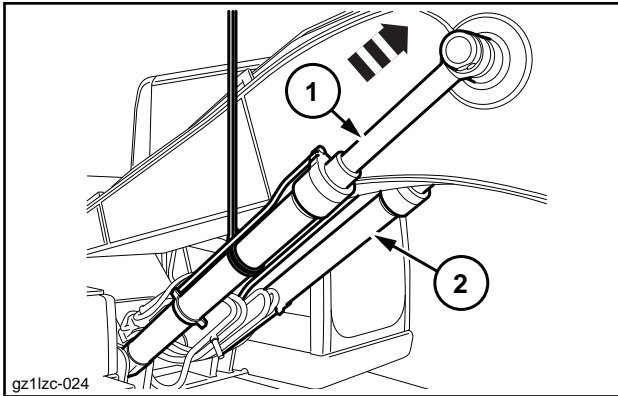
Installation of Boom HBCV

1. Set the O-ring (3) on the boom HBCV (2), and then install with 4 hexagon socket head bolts (1).

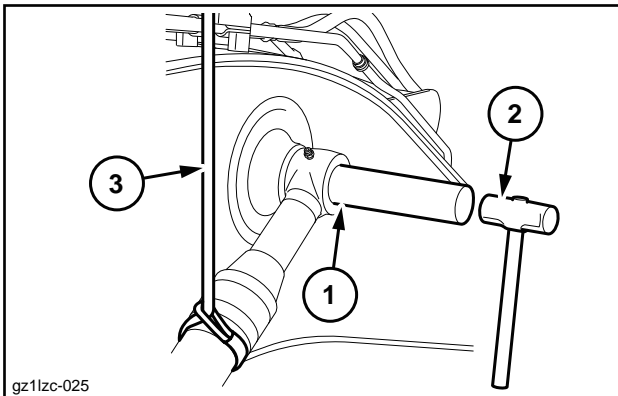
- The O-ring cannot be reused. Replace with a new part.

Tightening torque: 55.253 - 81.071 lbf-ft

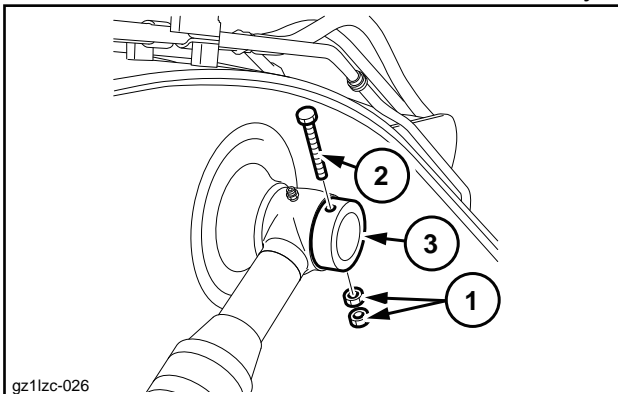
8. Start the engine, move the boom up at idle, and extend the boom cylinder (1) (2) rods.



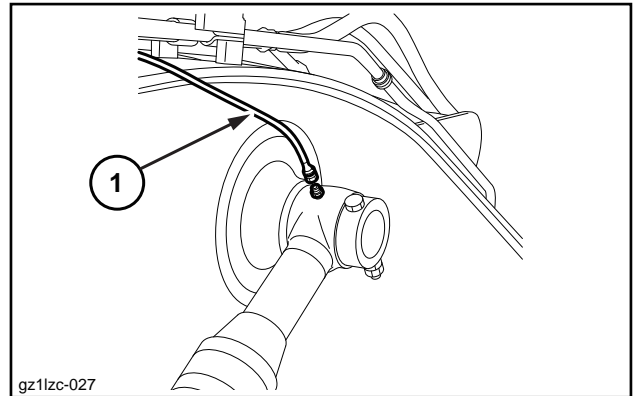
9. Use a hammer (2) to push in the pin (1). Use a liftcrane and nylon slings (3) to hold the boom cylinders (right) (left) so that they does not fall.



10. Use a wrench (1.417 in.) to install the double nuts (1) and bolt (2), and install the fastening ring (3). Also, install the cab side in the same way.

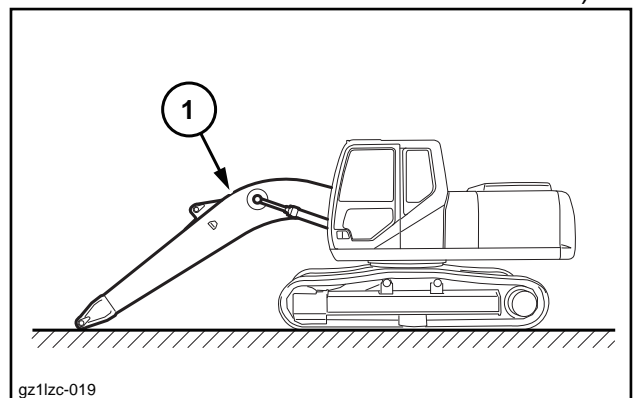


11. Use a wrench (0.748 in.) to install the grease hoses on the right and left sides (1).

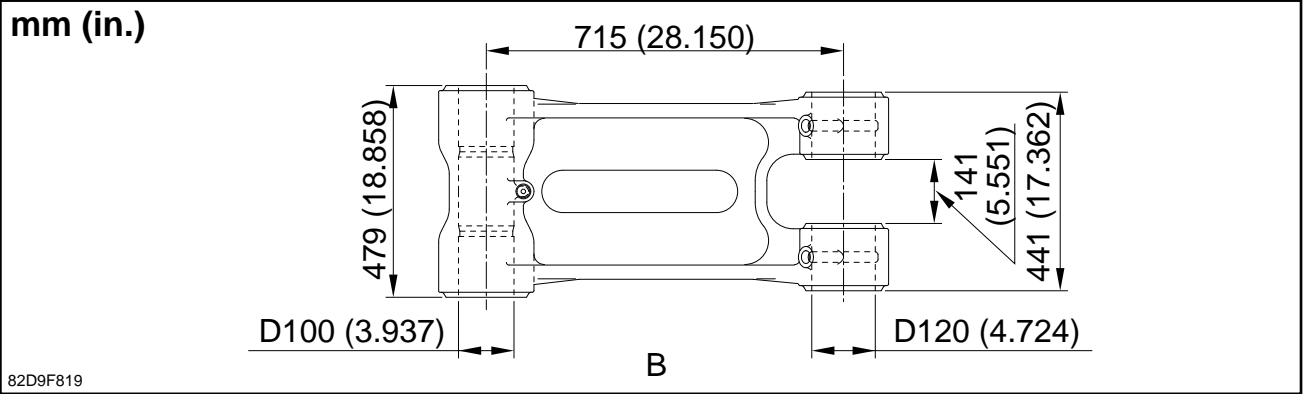


12. Bring the boom (1) top in contact with the ground.

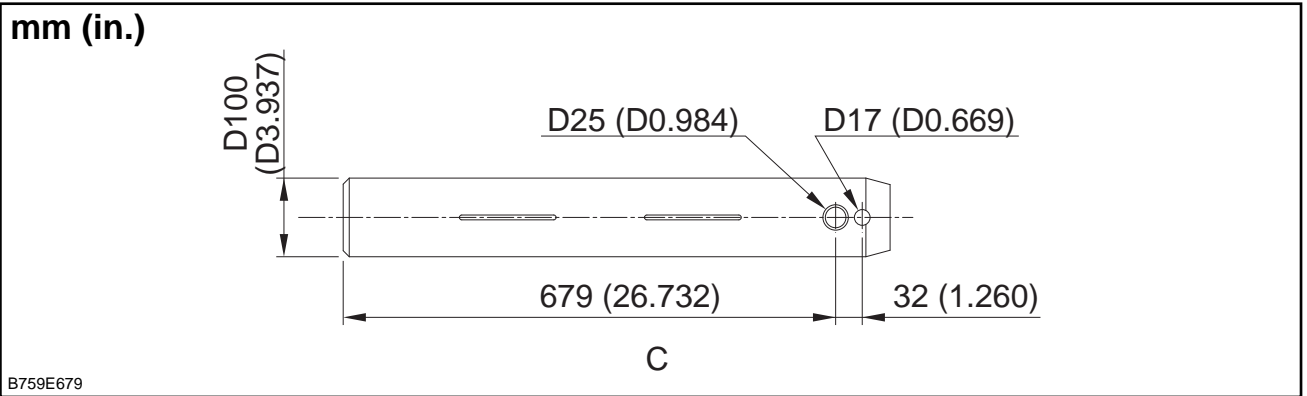
- When installing the boom cylinder too, see "Removal and Installation of Boom Cylinder".
- Install the arm. (For details, see "Removal and Installation of Arm".)
- Install the arm cylinder. (For details, see "Removal and Installation of Arm Cylinder".)
- Install the bucket cylinder. (For details, see "Removal and Installation of Bucket Cylinder".)
- Install the bucket link. (For details, see "Removal and Installation of Bucket Link".)
- Install the bucket. (For details, see "Removal and Installation of Bucket".)



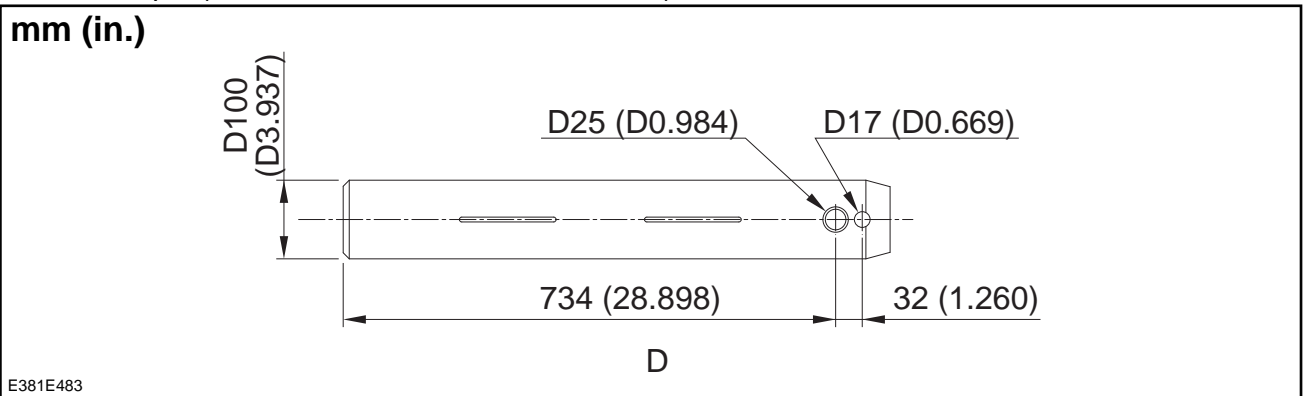
Bucket link



Bucket pin (bucket and bucket link connection section)



Bucket pin (bucket and arm connection section)



Z. OTHER

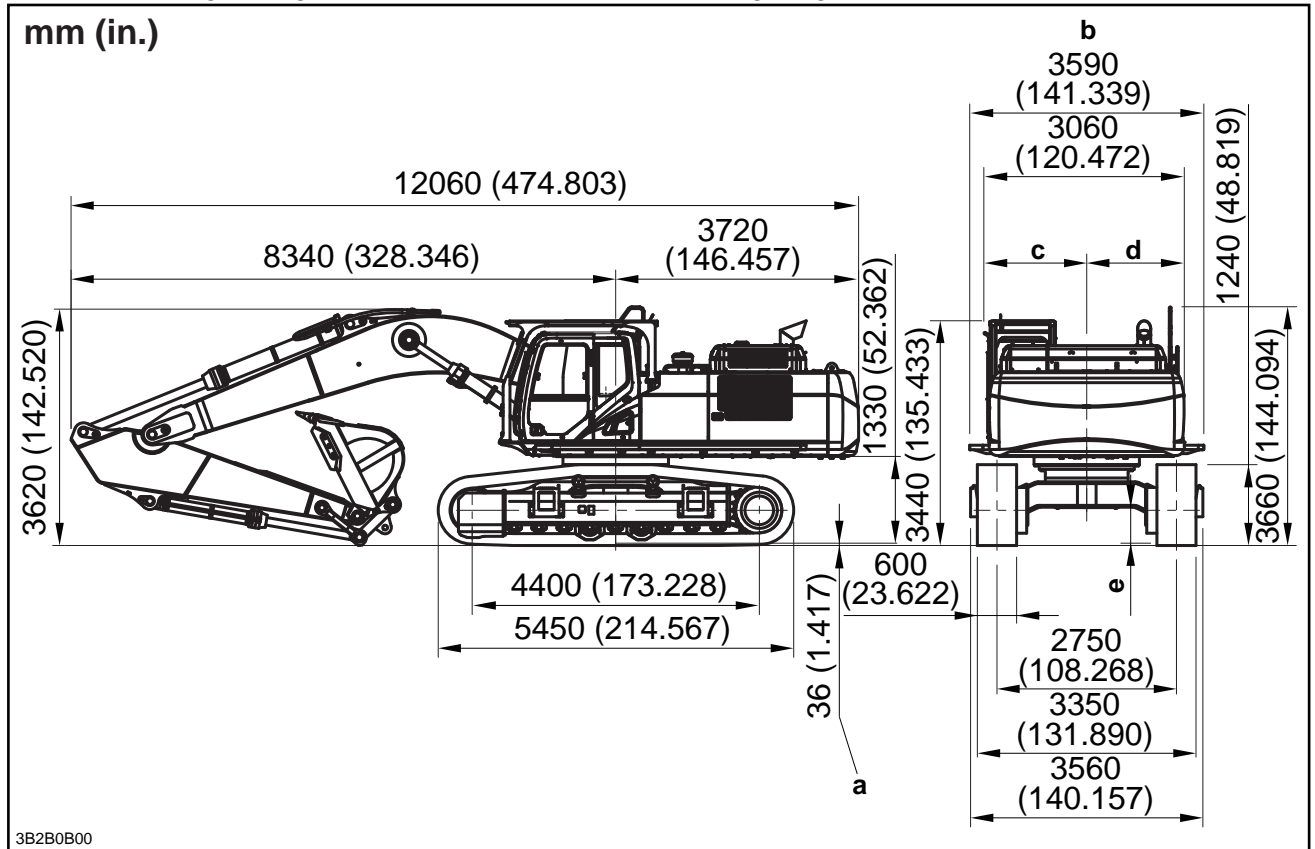
Overall View

470X3

Standard Arm [3.38 m (11.0892 ft.)]

Note: 1. Numbers are subject to change without notice due to design change or other reason.

Note: 2. The diagrams give values that include the shoe lug height (a) [36 mm (1.417 in.)].



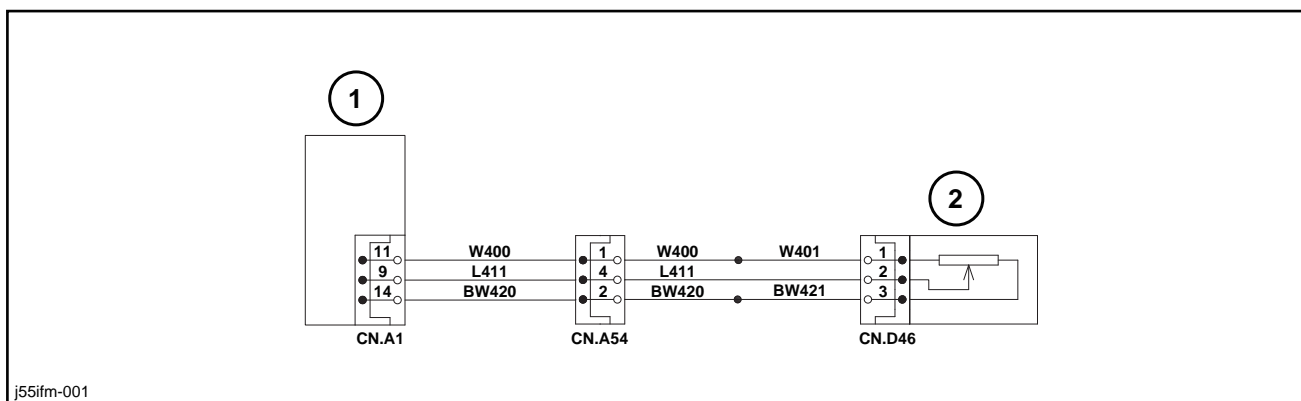
b	With catwalk - option	d	1490 (58.661)
c	1570 (61.811)	e	540 (21.260)

Z. OTHER

a	Minimum swing radius
b	Swing center
c	Swing radius (rear end)
d	Grouser shoe lug height

		Item	Unit	Standard value	
3	min., no load	Bucket cylinder extension	mm (in.)	20 (0.787) max.	
		Tooth tips (drift)		250 (9.843) max.	
4	Attachment speed	Boom (bucket open)	sec	Up [stroke 941 mm (37.047 in.)]	3.9 - 5.1
				Down [stroke 941 mm (37.047 in.)]	3.0 - 4.2
		Arm		Open	3.0 - 4.0
				Close	4.0 - 5.0
		Bucket		Open	2.5 - 3.5
				Close	3.9 - 5.1
	Attachment speed (for large soil amount)	Boom (bucket open)	sec	Up [stroke 941 mm (37.047 in.)]	4.0 - 5.2
				Down [stroke 941 mm (37.047 in.)]	3.5 - 4.7
		Arm		Open	3.0 - 4.2
				Close	3.9 - 5.1
		Bucket		Open	2.5 - 3.7
				Close	4.2 - 5.4
5	Swing speed (1 revolution)	Left and right	sec/rev	6.1 - 7.1	
			min ⁻¹ (rpm)	8.4 - 9.6 (8.4 - 9.6)	
6	Swing brake angle (180°)	Left and right	deg	50° max.	
7	Swing motor leakage amount	When stalling or at very slow speeds	L/min (gpm)	2.50 (0.66044) max.	
			min ⁻¹	300 (300)	
			MPa	9.8 (1421.526)	
8	Travel speed [6 m (19.69 ft.) travel speed]	Forwards and backwards	High speed	sec/6 m (sec/19.69 ft.)	3.6 - 4.6
				km/h (mile/h)	4.7 - 5.9 (2.9205 - 3.6660)
			Low speed	sec/6 m (sec/19.69 ft.)	6.2 - 7.4
				km/h (mile/h)	2.8 - 3.6 (1.7399 - 2.2369)
9	Travel sprocket speed (10 rotations)	High speed	sec	15.0 - 19.0	
				Low speed	27.1 - 31.1
10	Travel deviation amount [20 m (65.62 ft.) off travel amount]	Forwards and backwards	mm (in.)	High speed	1000 (39.370) max.
				Low speed	1000 (39.370) max.
11	Shoe tension [Lift up the side frame on each side (left and right) to measure]		mm (in.)	350 - 370 (13.780 - 14.567)	
12	Travel motor leakage amount	When stalling or at very slow speeds	1st speed	L/min (gpm)	3.0 (0.7925) max.
				min ⁻¹	1000 (1000)
				MPa	6.9 (1000.870)
13	Swing ball race Bearing movement	Up and down	mm (in.)	2.5 (0.0984) max.	
		Left and right		6.0 (0.2362) max.	

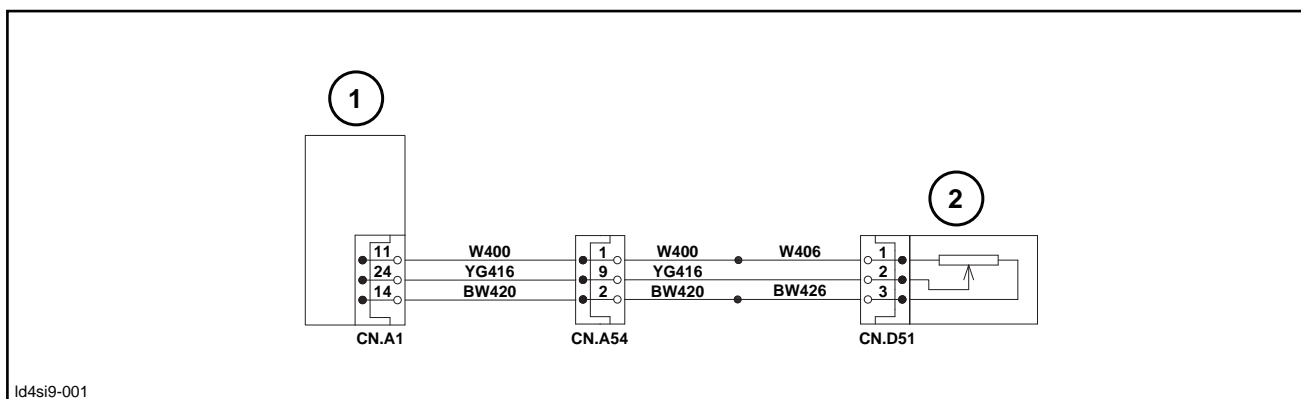
Step	Action	Standard value	Yes	No
10	1. Turn the key switch ON. 2. Measure the voltage between the ground and terminal 1 of the CN.D46 harness side. Is it about 5 V?	About 5 V	Go to Step 11	W400 or W401 harness defect (disconnection). Repair or replace
11	1. Measure the voltage between the ground and terminal 2 of the CN.D46 harness side. Is it 0.25 V or higher?	0.25 V or higher	Go to Step 12	L411 harness defect (disconnection). Replace
12	1. Connect CN.D46. 2. Check whether diagnostic trouble code: 7001 is displayed. Is diagnostic trouble code: 7001 displayed?		Computer A defect. Replace	



j55ifm-001

1	Computer A
2	Pressure sensor (P2)

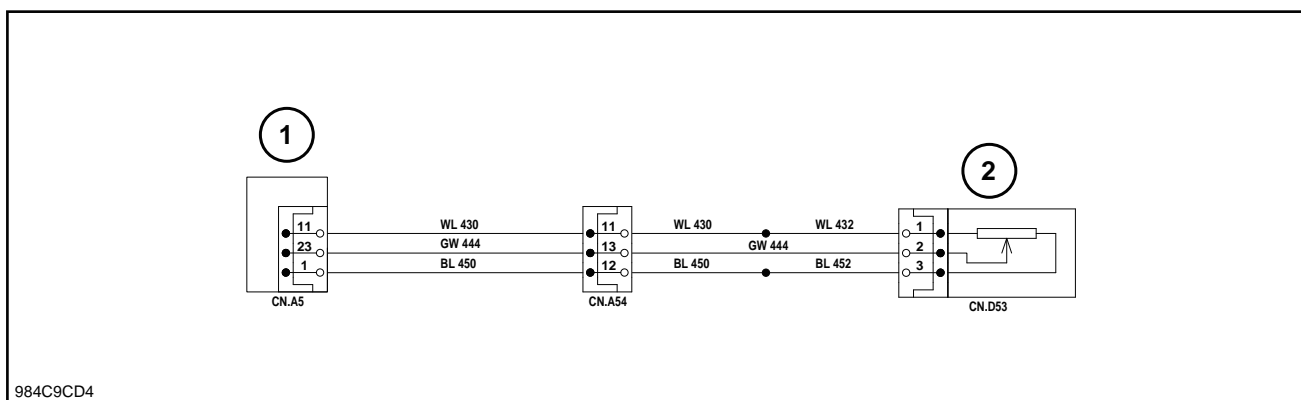
Step	Action	Standard value	Yes	No
10	1. Turn the key switch ON. 2. Measure the voltage between the ground and terminal 1 of the CN.D51 harness side. Is it about 5 V?	About 5 V	Go to Step 11	W400 or W406 harness defect (disconnection). Repair or replace
11	1. Measure the voltage between the ground and terminal 2 of the CN.D51 harness side. Is it 0.25 V or higher?	0.25 V or higher	Go to Step 12	YG416 harness defect (disconnection). Repair or replace
12	1. Connect CN.D51. 2. Check whether diagnostic trouble code: 7022 is displayed. Is diagnostic trouble code: 7022 displayed?		Computer A defect. Replace	



Id4si9-001

1	Computer A
2	Pressure sensor (pilot travel)

Step	Action	Standard value	Yes	No
10	1. Turn the key switch ON. 2. Measure the voltage between the ground and terminal 1 of the CN.D53 harness side. Is it about 5 V?	About 5 V	Go to Step 11	WL432 or WL430 harness defect (disconnection). Repair or replace
11	1. Measure the voltage between the ground and terminal 2 of the CN.120 harness side. Is it 0.25 V or higher?	0.25 V or higher	Computer B defect. Replace	GW444 harness defect (disconnection). Repair or replace



984C9CD4

1	Computer B
2	Pressure sensor (boom up)

1	Computer A	6	Crank angle sensor (MRE)	11	Relay battery
2	Engine computer	7	Fuse computer	12	Fusible link; Backup
3	Pressure sensor (swing pilot)	8	Power save	13	Fusible link; Fuse box
4	Pressure sensor (upper pilot)	9	Relay battery	14	Key switch
5	Pressure sensor (travel pilot)	10	Battery (24 V)	15	Computer B
				a	CAN communication

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