CX235C SR
Tier 4
Crawler Excavator

SERVICE MANUAL

Part number 84577150
1st edition English
February 2012

CASE

Specifications

Performance

Standard weight	11.2 kN (2518.291 lbf)	
Swing speed	11.8 min^{-1} (11.8 rpm)	
Travel speed	Low speed 3.2 km/h (1.9884 mile/h)	
	High speed 5.0 km/h (3.1069 mile/h)	
Maximum pulling force	200 kN (44969.48 lbf)	
Grade ability	70 % (35 ˚)	
Ground pressure	58 kPa (8.41 psi) [600 mm (23.622 in) grouser shoe]	50 kPa (7.25 psi) [700 mm (27.559 in) grouser shoe]
	44 kPa (6.38 psi) [800 mm (31.496 in) grouser shoe]	

Main Unit Dimensions

Main unit length	4700 mm (185.039 in)
Main unit width	2990 mm (117.717 in)
Upper swing body width	2990 mm (117.717 in)
Cab width	1060 mm (41.732 in)
Main unit height	3090 mm (121.654 in)
Swing radius (rear end)	1790 mm (70.472 in)
Swing body rear section bottom height	1020 mm (40.157 in)
Distance between tumblers	3370 mm (132.677 in)
Overall track length	4180 mm (164.567 in)
Overall track width	2800 mm (110.236 in)
Distance between tracks	2200 mm (86.614 in)
Track shoe width	600 mm (23.622 in) [options 700 mm (27.559 in), 800 mm (31.496 in)]
Minimum ground clearance	440 mm (17.323 in) (to bottom of lower frame)

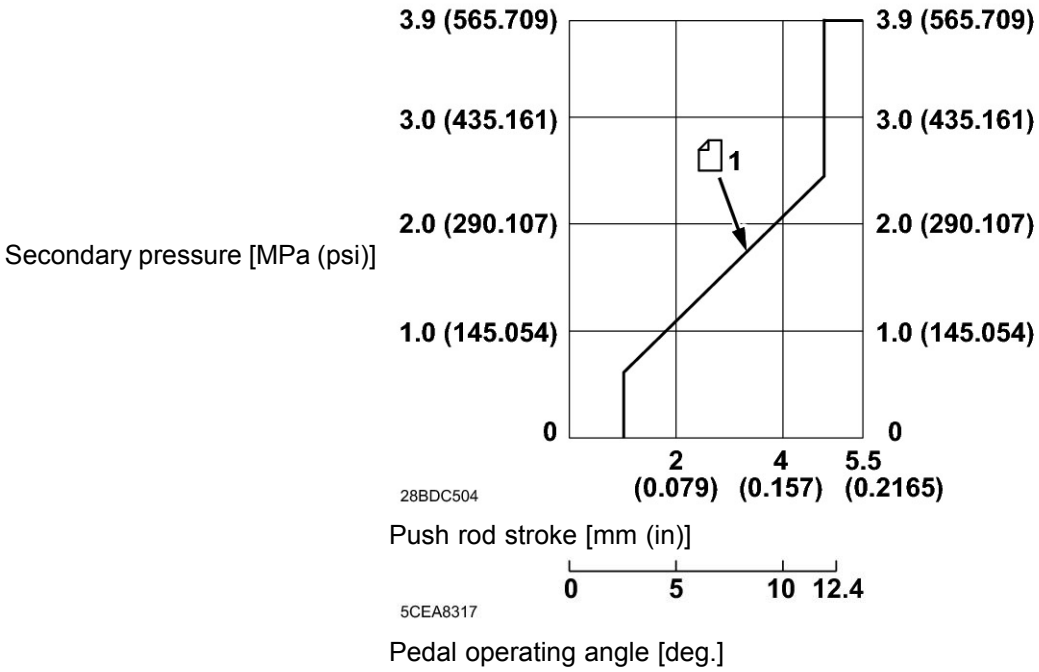
Engine

Name	Isuzu 4HK1X diesel engine
Model	4-cycle, water-cooled, overhead camshaft type, common rail system (electronic control), cooled EGR, with turbocharger (variable displacement type), DPD system
No. of cylinders - bore x stroke	4 - D115 mm (4.528 in) x 125 mm (4.921 in)
Total stroke volume	5.193 L (1.37188 gal)
Maximum torque	621 N· m/1500 min^{-1} (458.10 lbf· ft/1500 rpm)
Starter	24 V 5.0 kW reduction type
Charging generator	24 V 50 A AC type
Battery	12 V 92 Ah/5 HR x 2

Cooling System

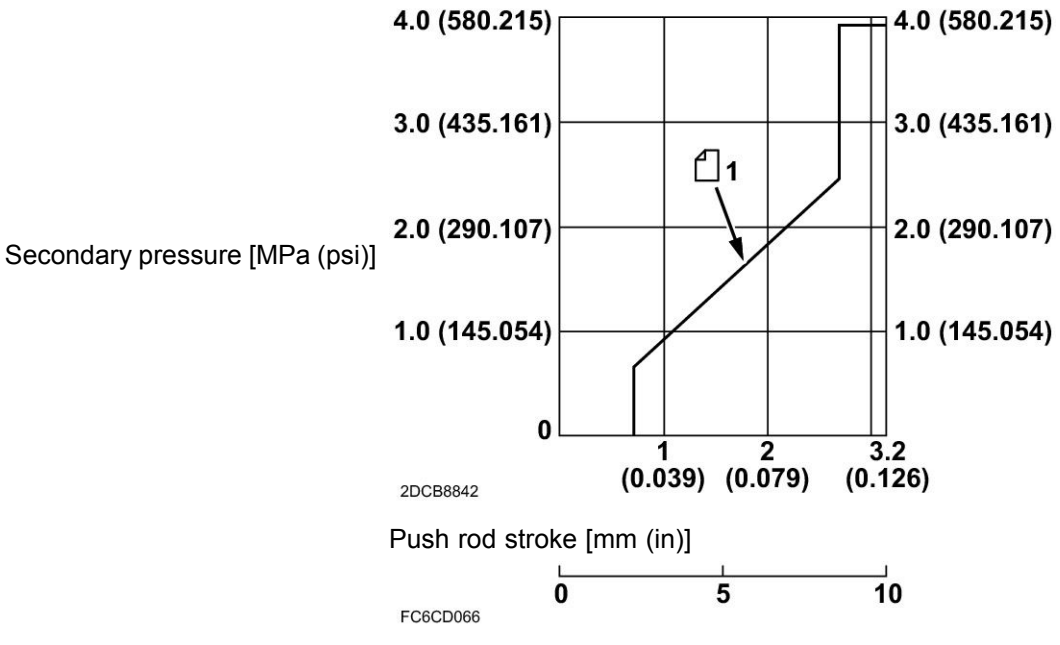
Fan type	D650 mm (25.591 in), 7 blades, suction
Radiator	
Fin type	Wavy
Fin pitch	1.75 mm (0.06890 in)
Oil cooler	
Fin type	Wavy
Fin pitch	1.75 mm (0.06890 in)
Intercooler	
Fin type	Triangular straight
Fin pitch	1.75 mm (0.06890 in)
Fuel cooler	
Fin type	Wavy
Fin pitch	2.0 mm (0.0787 in)

Travel Remote Control Valve Control Diagram



1 Secondary pressure

Blade Remote Control Valve Control Diagram

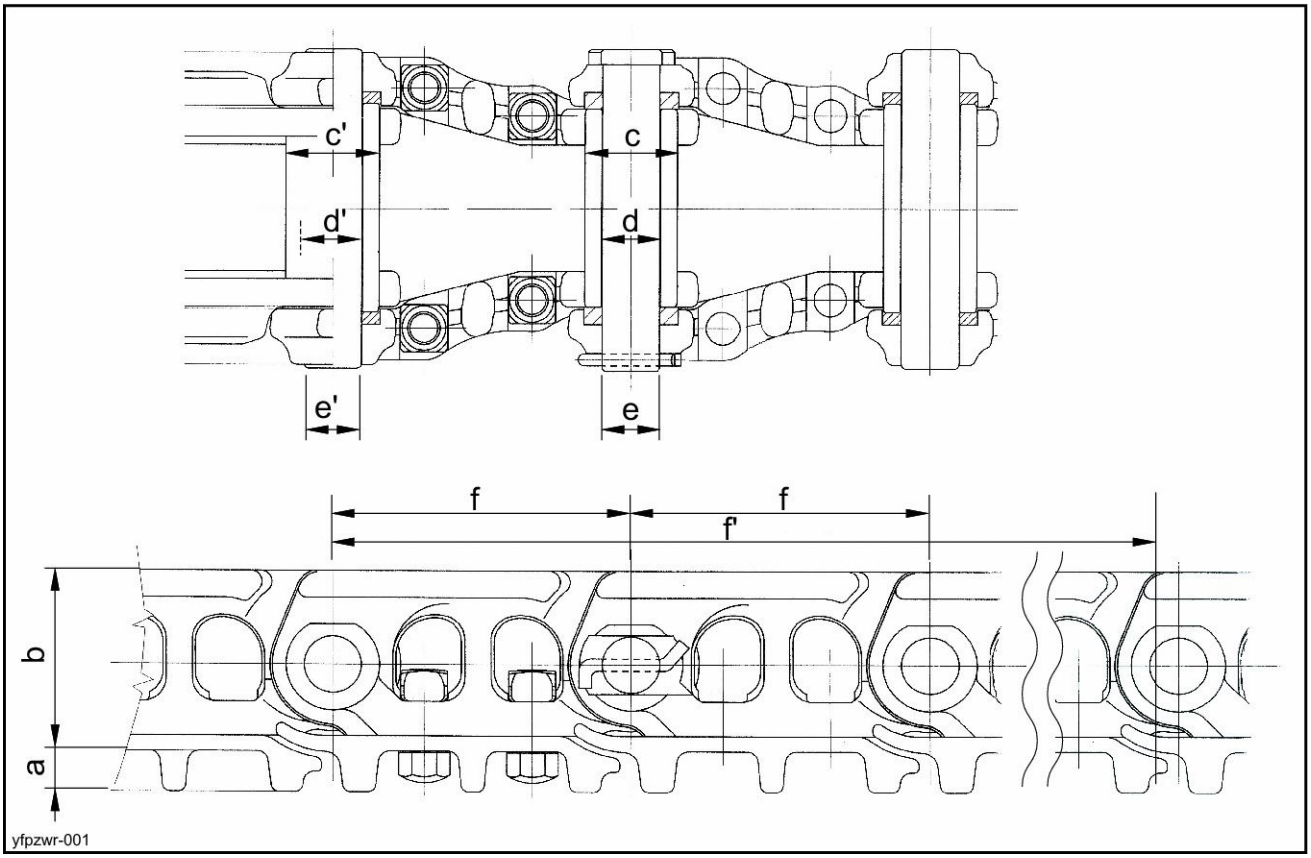


1 Secondary pressure

Cushion Valve (heat circuit, with shuttle valve)

Manufacturer	Yanagisawa Seiki MFG. Co., Ltd.
Port size	G 3/8 (A - P ports)

Track Shoe (grouser shoe)



Part name	Code	Measurement dimensions [mm (in)]	Standard value [mm (in)]	Usage limits [mm (in)]	Judgment	Solution
Shoe plate	a		36 (1.417)	30 (1.181)	Acceptable/ Unacceptable	Replacement
Link	b		106 (4.173)	101 (3.976)	Acceptable/ Unacceptable	Cladding by welding or replacement
Master bushing	c	D	D58.72 (2.31181)	D57.5 (2.2638)	Acceptable/ Unacceptable	Replacement
	d	D	D37.3 (1.4685)	D38.3 (1.5079)	Acceptable/ Unacceptable	
Master pin	e	D	D36.6 (1.4409)	D35.5 (1.3976)	Acceptable/ Unacceptable	Replacement
Link pitch (4-link portion)	f		190 (7.480)	193.7 (7.6260)	Acceptable/ Unacceptable	Replacement
	f'		760 (29.921)	774.9 (30.5079)	Acceptable/ Unacceptable	
Track bushing	c'	D	D58.72 (2.31181)	D57.5 (2.2638)	Acceptable/ Unacceptable	Replacement
	d'	D	D37.3 (1.4685)	D38.3 (1.5079)	Acceptable/ Unacceptable	
Track pin	e'	D	D36.65 (1.44291)	D35.5 (1.3976)	Acceptable/ Unacceptable	Replacement

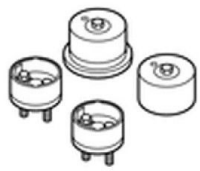
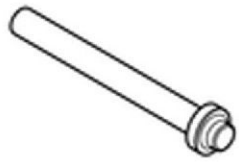
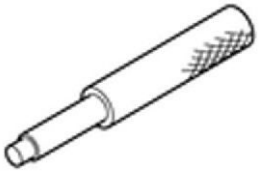
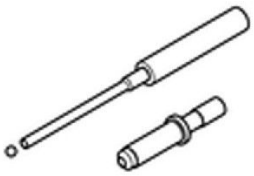
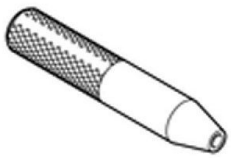
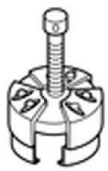
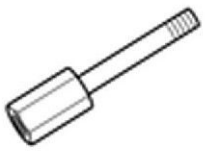
84577150 - February 2012

84577150 - February 2012

CASE SPECIAL TOOLS

Isuzu Engine Special Tools

4HK1-6HK1 Tier 4 Isuzu Engine

Illustration	Isuzu Reference	CASE Tool Number	Description
	8-9439-6856-0	380001712	Oil seal setting tool kit
	5-8840-2627-0	380001719	Oil seal Installer
	5-8840-2623-0	380001720	Remover; Nozzle sleeve
	5-8840-2624-0	380001721	Installer; Nozzle sleeve
	5-8840-2626-0	380001722	Installer; Bridge guide
	5-8840-2360-0	380002574	Slinger puller
	5-8840-2826-0	380002601	Fuel Injector Remover
	5-8840-0019-0	380002602	Sliding Hammer

Removal and installation of the fuel cooler engine inter-cooler radiator and oil cooler

Installation of Fuel Cooler

Perform the reverse of the removal procedure.
After connecting the hoses, carefully check for any fuel leaks.
When installing the bolts, tighten them to the specified torque.
If the torque is not specified for a bolt or other part, see the Bolt Size and Torque Table.

Removal and Installation of Engine Intercooler

> ⚠ **CAUTION**
>
> - **Be sure to stop the engine before beginning work.**
> - **As the fuel hose will be removed, strictly prohibit open flames.**

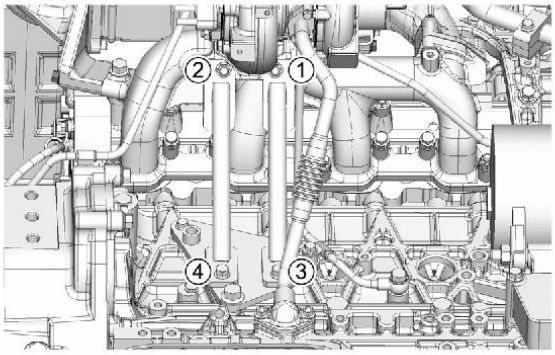
Items to prepare

- Wrenches [8 mm (0.315 in), 17 mm (0.669 in)]
- Flathead screwdriver
- Cap
- Rag
- Cleaning fluid

4) Securely tighten the exhaust manifold stay to the cylinder block and the turbocharger assembly.
Tightening torque : 52 N· m { 5.3 kgf· m / 38 lb· ft } Nut
Tightening torque : 50 N· m { 5.1 kgf· m / 37 lb· ft } Bolt

ANNOTATION:

- *Tightening order*



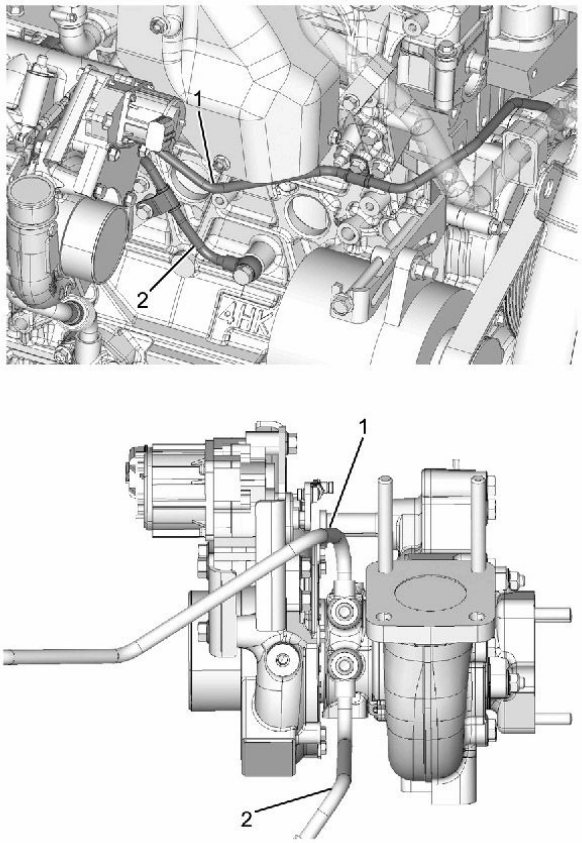
gbh4sv-011

5) Connect the water feed pipe to the turbocharger assembly.

> ⚠ **CAUTION**
>
> - **Use new gaskets.**

Tightening torque : 35 N· m { 3.5 kgf· m / 25 lb· ft } Eyebolt
Tightening torque : 14 N· m { 1.4 kgf· m / 119 lb· in } Clip

6) Connect the water return pipe to the turbocharger assembly.



gbh4sv-012

1	Water return pipe
2	Water feed pipe

Tightening torque : 35 N· m { 3.5 kgf· m / 25 lb· ft } Eyebolt

7) Connect the oil return pipe to the turbocharger assembly.

> ⚠ **CAUTION**
>
> - **Use new gaskets.**

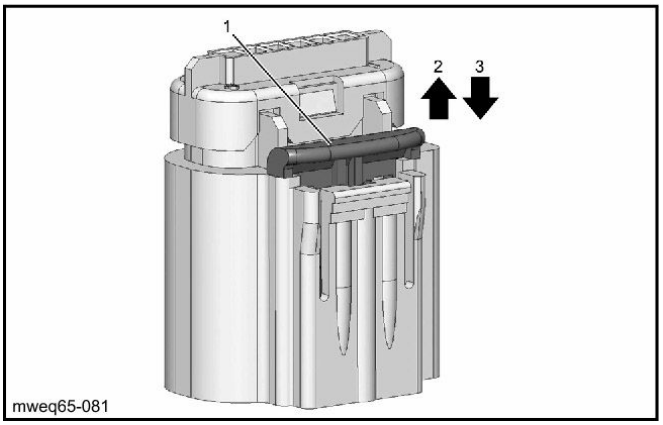
Tightening torque : 9 N· m { 0.9 kgf· m / 78 lb· in }

84577150 - February 2012
2007-2

2) Disengage the harness connector from the intake throttle valve.

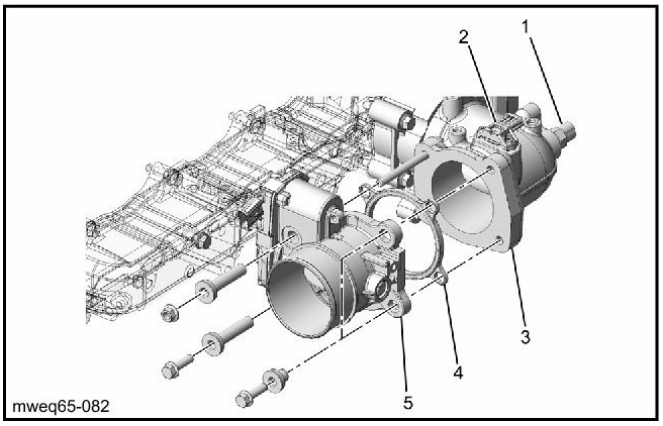
ANNOTATION:

- *Pull the lock operation portion to release the lock.*



1	Lock operation section
2	Lock release
3	Lock

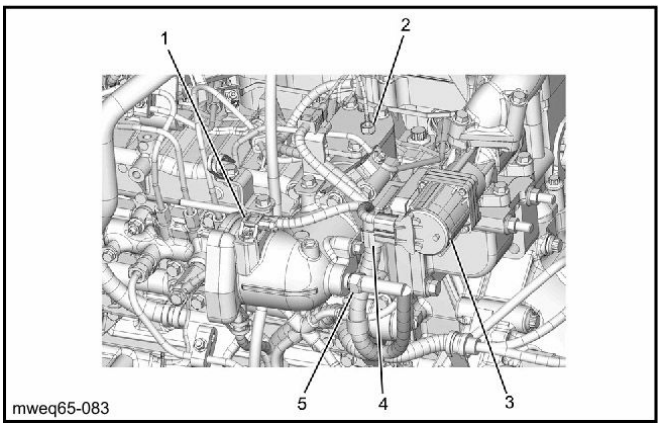
3) Remove the intake throttle valve from the inlet pipe.



1	Boost temperature sensor
2	Boost sensor
3	Inlet pipe
4	Gasket
5	Intake throttle valve

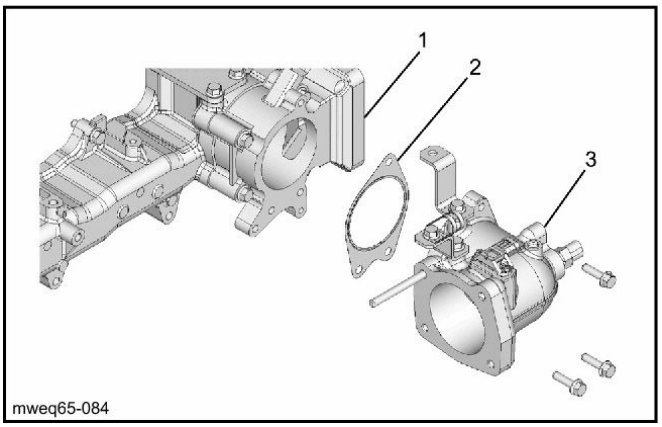
9. Inlet pipe Removal

1) Disengage the harness connector from the boost sensor.
2) Disconnect the harness connector from the boost temperature sensor.
3) Disengage the harness connector from the EGR valve.
4) Disconnect the harness connector from the IMT sensor.
5) Remove the harness clip from the inlet pipe.



1	Boost sensor
2	IMT sensor
3	EGR valve
4	Harness clip
5	Boost temperature sensor

6) Remove the inlet pipe from the case.

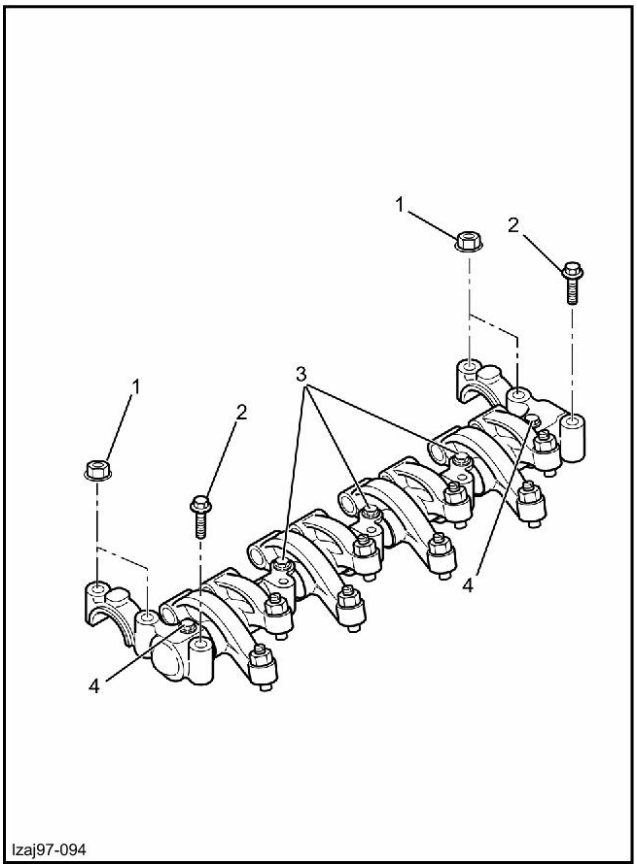


1	Case
2	Gasket
3	Inlet pipe

10. Oil level gauge guide tube Removal

1) Remove the oil level gauge from the oil level gauge guide tube.
2) Disengage the oil level gauge guide tube from the cylinder head cover.
3) Disengage the oil level gauge guide tube from the case.

Rocker arm shaft tightening torque		
Parts		**Tightening torque**
No.3	Bolt	: 56 N・m {5.7 kgf・m / 41 lb・ft}
No.4	Bolt	: 27 N・m {2.8 kgf・m / 20 lb・ft}



1	Nut
2	Bolt
3	Bolt
4	Bolt

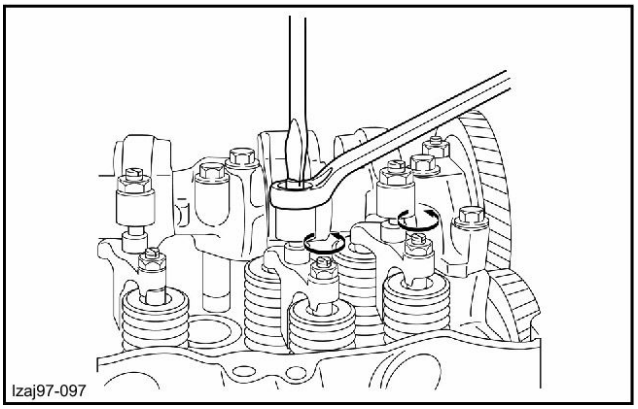
5. Rocker arm shaft Adjustment

ANNOTATION:

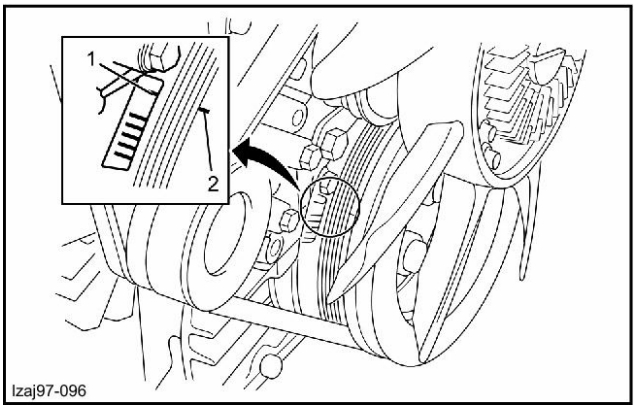
- *Valve clearance adjustment*

⚠ CAUTION

- **Adjust the valve clearance while cool.**
- **Loosen all adjust screws before adjustment.**



1) Align 1st cylinder to the compression top dead center.



1	Front cover marking
2	0 degree marking on the crankshaft damper

2) Prepare the feeler gauge.
Thickness : 0.4 mm {0.0157 in} 2 pieces

ANNOTATION:

- *Insert the thickness gauge between the rocker arm and bridge cap.*

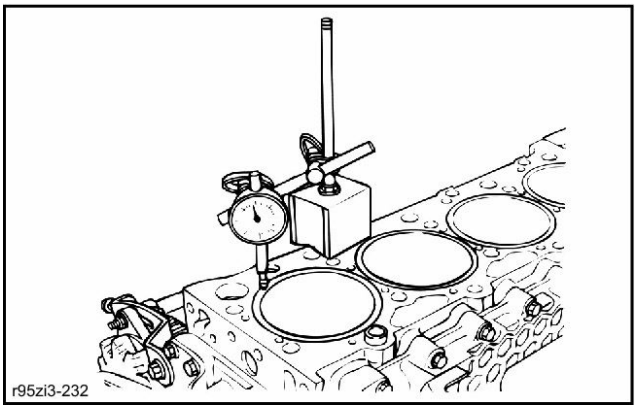
84577150 - February 2012

> ⚠ **CAUTION**
>
> - **After replacing the cylinder liner, be sure to measure the protrusion amount of the cylinder liner.**

4) Measure the cylinder liner using the dial gauge.
Specified value : 0.05 - 0.10 mm (0.00197 - 0.00394 in) Protrusion amount of cylinder liner
Limit : 0.03 mm (0.00118 in) less than

ANNOTATION:

- *The limit value indicates the difference in the protrusion amounts with the adjacent cylinder liner.*

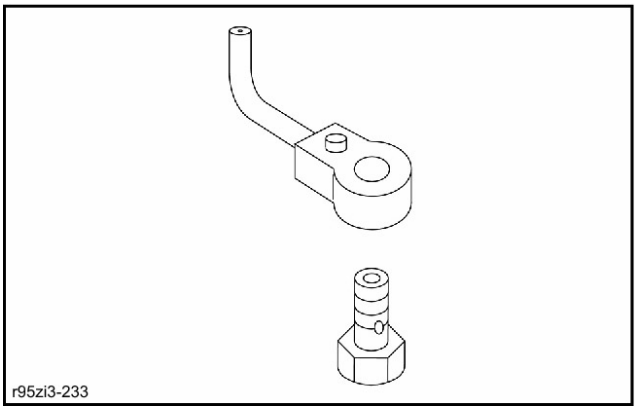


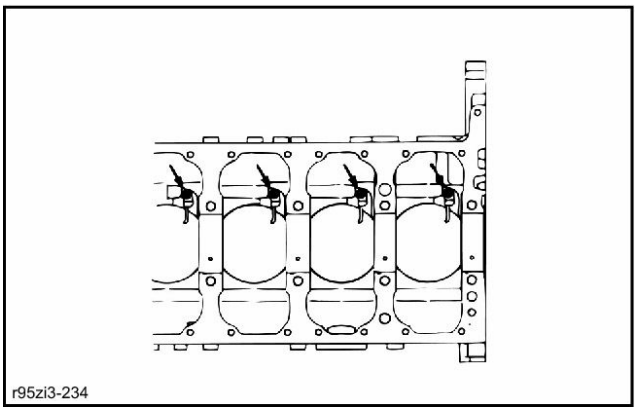
3. Piston oil jet Installation

1) Install the piston oil jet to the cylinder block.

> ⚠ **CAUTION**
>
> - **Be careful not to deform or damage the nozzle part of the piston oil jet.**

Tightening torque : 21 N･m {2.1 kgf･m / 15 lb･ft}





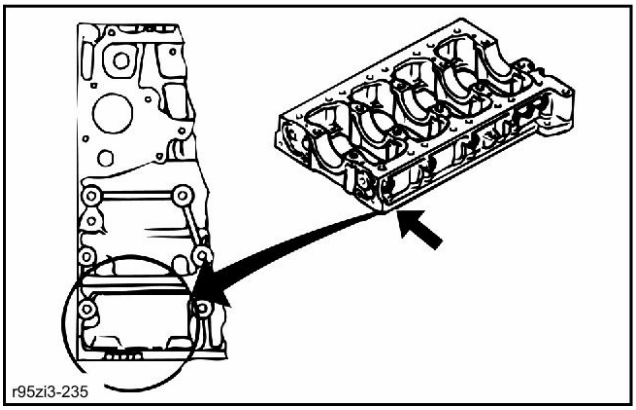
4. Crankshaft bearing Preparation

> ⚠ **CAUTION**
>
> - **When replacing the crankshaft bearing, select the crankshaft bearing following the procedure below.**

1) Check marking of the crankcase.

ANNOTATION:

- *The marking on the crankcase indicates the inner diameter grade of the cylinder block journal section.*
- *Grade indications are lined up as No.1, 2, 3, 4, 5 from the left when looking at the marking section from the front side.*

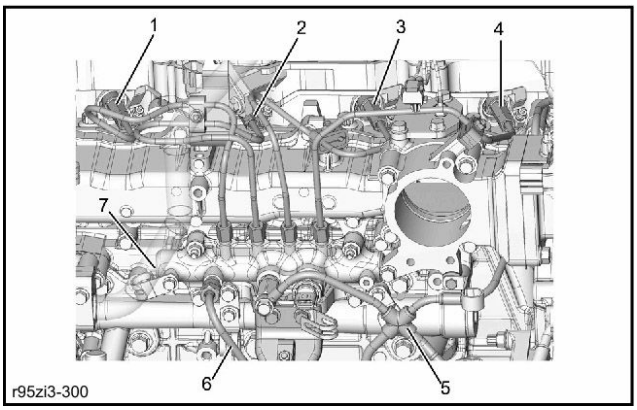


2) Check the marking on the crankshaft.

ANNOTATION:

- *The marking on the crankshaft indicates the outer diameter grade of the journal section.*
- *Grade indications are lined up as No.1, 2, 3, 4, 5 from the left when looking at the marking section from the front side.*

3) Install the clip to the bracket.
Tightening torque : 6 N· m {0.6 kgf· m / 4.43 lbf· ft}



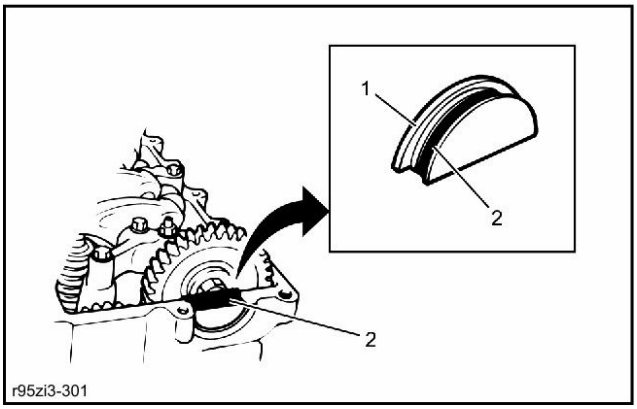
1	No.1 injection pipe
2	No.2 injection pipe
3	No.3 injection pipe
4	No.4 injection pipe
5	Fuel leak-off pipe
6	Fuel pipe
7	Common rail assembly

32. Lower cover Installation

1) Apply the liquid gasket to the rubber plug.

ANNOTATION:

- *Apply ThreeBond 1207B.*



1	Rubber plug
2	Liquid gasket

⚠ CAUTION

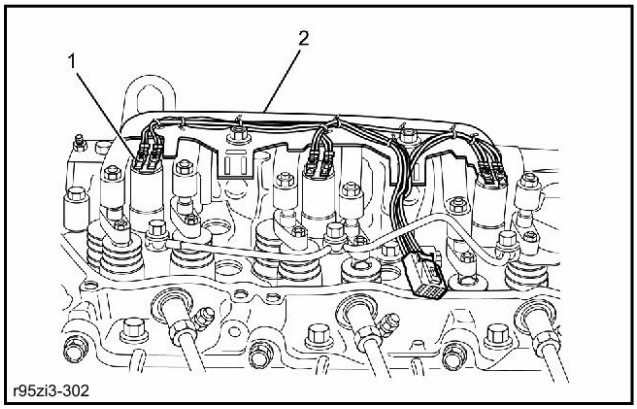
- **After applying the liquid gasket, install the lower cover within 5 minutes.**

2) Install the rubber plug to the cylinder head assembly.
3) Install the gasket to the lower cover.
4) Install the lower cover to the cylinder head assembly.
Tightening torque : 18 N· m {1.8 kgf· m / 13 lb· ft}
5) Install the injector harness to the cylinder head assembly.

ANNOTATION:

- *Tighten the bolts on the bracket and install the injector harness together with the bracket.*

Tightening torque : 48 N· m {4.9 kgf· m / 35 lb· ft}

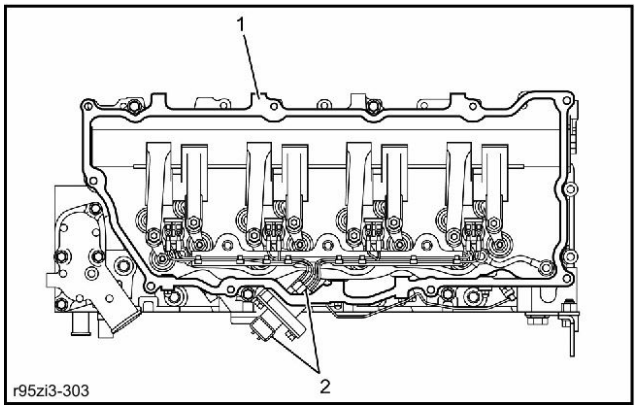


1	Injector harness terminal
2	Injector harness bracket

6) Connect the injector harness to the injector.
Tightening torque : 2 N· m {0.2 kgf· m / 1.48 lbf· ft

⚠ CAUTION

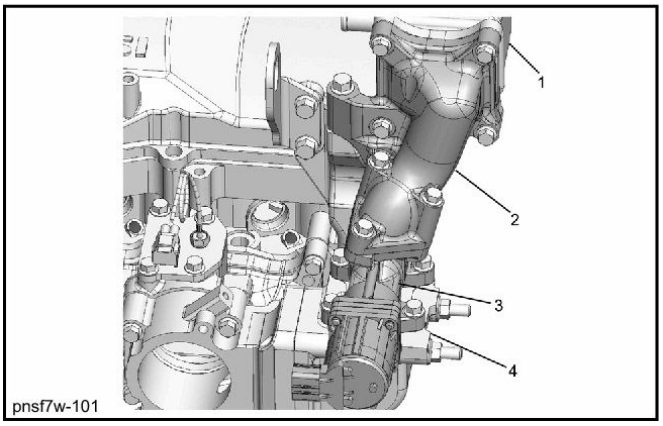
- **Be careful not to damage the injector side stud bolts.**



1	Lower cover
2	Connector

7) Install the connector to the lower cover.
Tightening torque : 2 N· m {0.2 kgf· m / 1.48 lbf· ft}

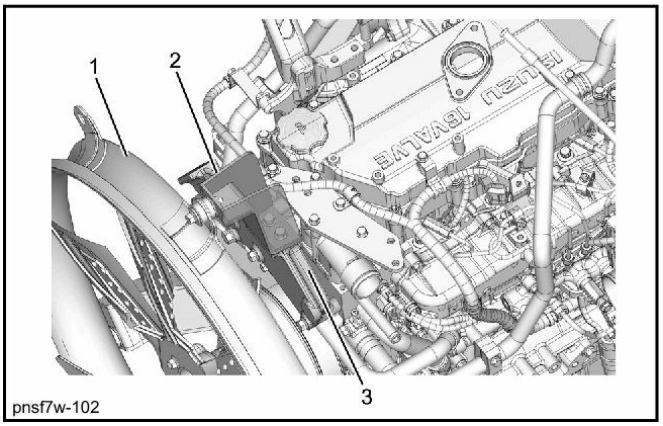
2) Remove the EGR valve from the EGR pipe D.



1	EGR cooler C
2	EGR pipe C
3	EGR valve
4	EGR pipe D

8. EGR cooler water pipe Removal

1) Remove the fan guide stay from the fan guide and the fan guide bracket.
2) Remove the fan guide bracket from the cylinder head assembly.

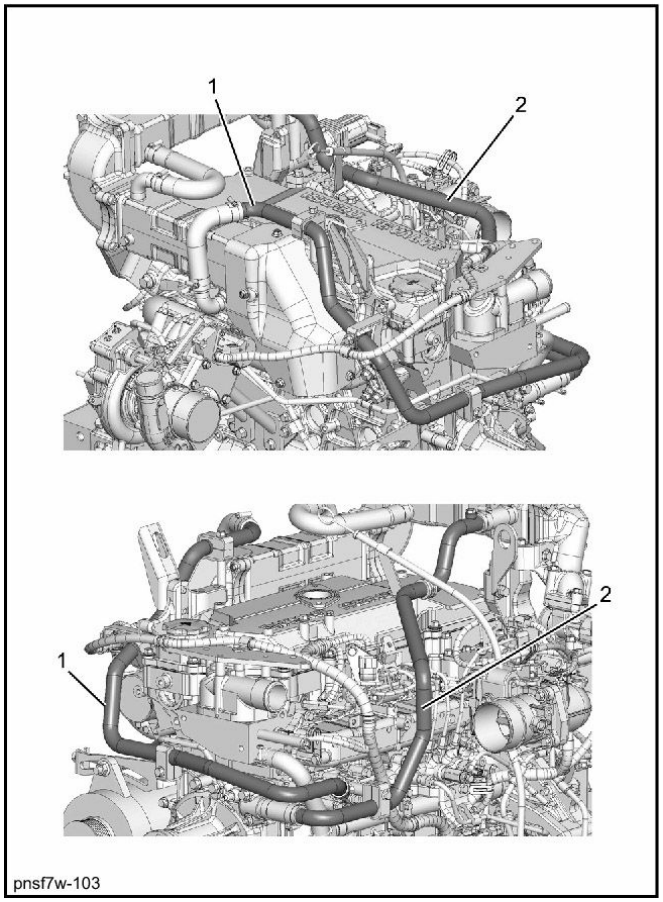


1	Fan guide
2	Fan guide stay
3	Fan guide bracket

3) Disengage the radiator upper hose from the water outlet pipe.
4) Remove the EGR cooler water pipe from the engine assembly.

ANNOTATION:

- *Remove the EGR cooler water feed pipe and EGR cooler water return pipe.*



1	EGR cooler water feed pipe
2	EGR cooler water return pipe

9. Intake throttle valve Removal

1) Remove the air duct from the intake throttle valve.

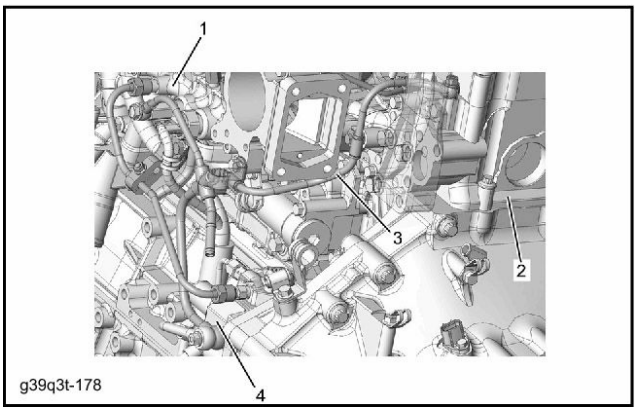
3) Temporarily tighten the fuel leak-off pipe to the fuel supply pump.

ANNOTATION:

- *Tighten the fuel feed pipe together.*

> ⚠ **CAUTION**
>
> - **Use new gaskets.**

4) Securely tighten the fuel leak-off pipe to the cylinder head assembly.
Tightening torque: 12 N· m { 1.3 kgf· m / 8.85 lbf· ft }
5) Securely tighten the fuel leak-off pipe to the common rail assembly.
Tightening torque: 24 N· m { 2.4 kgf· m / 17.70 lb· ft }
6) Securely tighten the fuel leak-off pipe to the fuel supply pump.
Tightening torque: 24 N· m { 2.4 kgf· m / 17.70 lb· ft }
7) Install the clip to the fuel leak-off pipe.
Tightening torque : 8 N· m {0.8 kgf· m / 5.90 lbf· ft }



1	Common rail assembly
2	Cylinder head assembly
3	Fuel leak-off pipe
4	Fuel supply pump

17. Fuel pipe Installation

1) Install the fuel pipe to the fuel supply pump and the common rail assembly.

> ⚠ **CAUTION**
>
> - **Use new fuel pipes.**

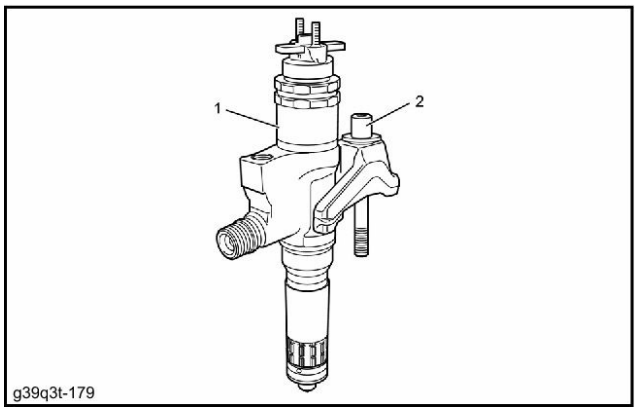
Tightening torque: 44 N· m { 4.5 kgf· m / 32.46 lb· ft }
2) Install the clip to the bracket.
Tightening torque: 9 N· m { 0.9 kgf· m / 6.64 lbf· ft }

18. Injector Installation

> ⚠ **CAUTION**
>
> - **When reusing an injector, do not change the installation position.**

1) Apply the engine oil to the bolt.
2) Temporarily tighten the injector to the cylinder head assembly.

> ⚠ **CAUTION**
>
> - **Be extremely careful not to damage the injector nozzle.**



1	Injector
2	Installation bolt

3) Temporarily tighten the injection pipe to the injector.
4) Temporarily tighten the injection pipe to the common rail assembly.
5) Securely tighten the injector to the cylinder head assembly.
Tightening torque: 30 N· m { 3.1 kgf· m / 22.13 lb· ft }
6) Install the injector leak-off pipe to the injector.

> ⚠ **CAUTION**
>
> - **Use new gaskets.**

Tightening torque: 14 N· m { 1.4 kgf· m / 10.33 lbf· ft }

19. Injection pipe Installation

1) Securely tighten the injection pipe to the injector.
Tightening torque: 30 N· m { 3.0 kgf· m / 22.13 lb· ft }
2) Securely tighten the injection pipe to the common rail assembly.
Tightening torque: 25 N· m { 2.5 kgf· m / 18.44 lb· ft }

7. Battery ground cable Connect
   1) Connect the battery ground cable to the battery.

Inspection

1. Water pump assembly Inspection
   1) Inspect the water pump assembly.

      ANNOTATION:

      - *Cracks and damage on the water pump body*
      - *Cracks and corrosion on the impeller*
      - *Water leak from the seal unit*

      ⚠ CAUTION

      - **If any abnormality is found in the inspection, replace the water pump assembly.**

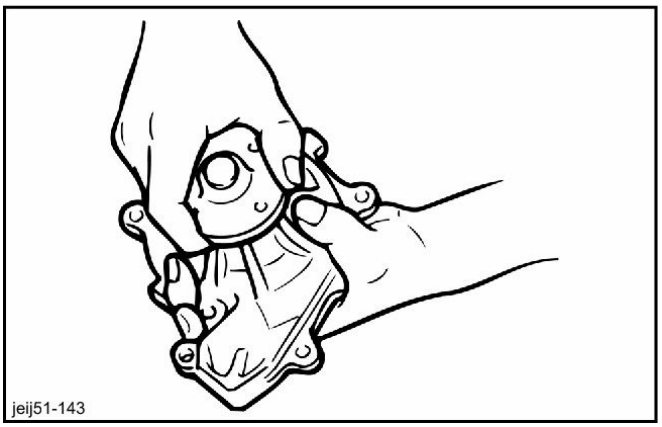
   2) Inspect the bearing unit.

      ANNOTATION:

      - *Rotate the fan while pushing the fan center to the radius direction and inspect for any significant looseness or abnormal sounds.*

      ⚠ CAUTION

      - **If any abnormality is found in the inspection, replace the water pump assembly.**


jeij51-143

84577150 - February 2012

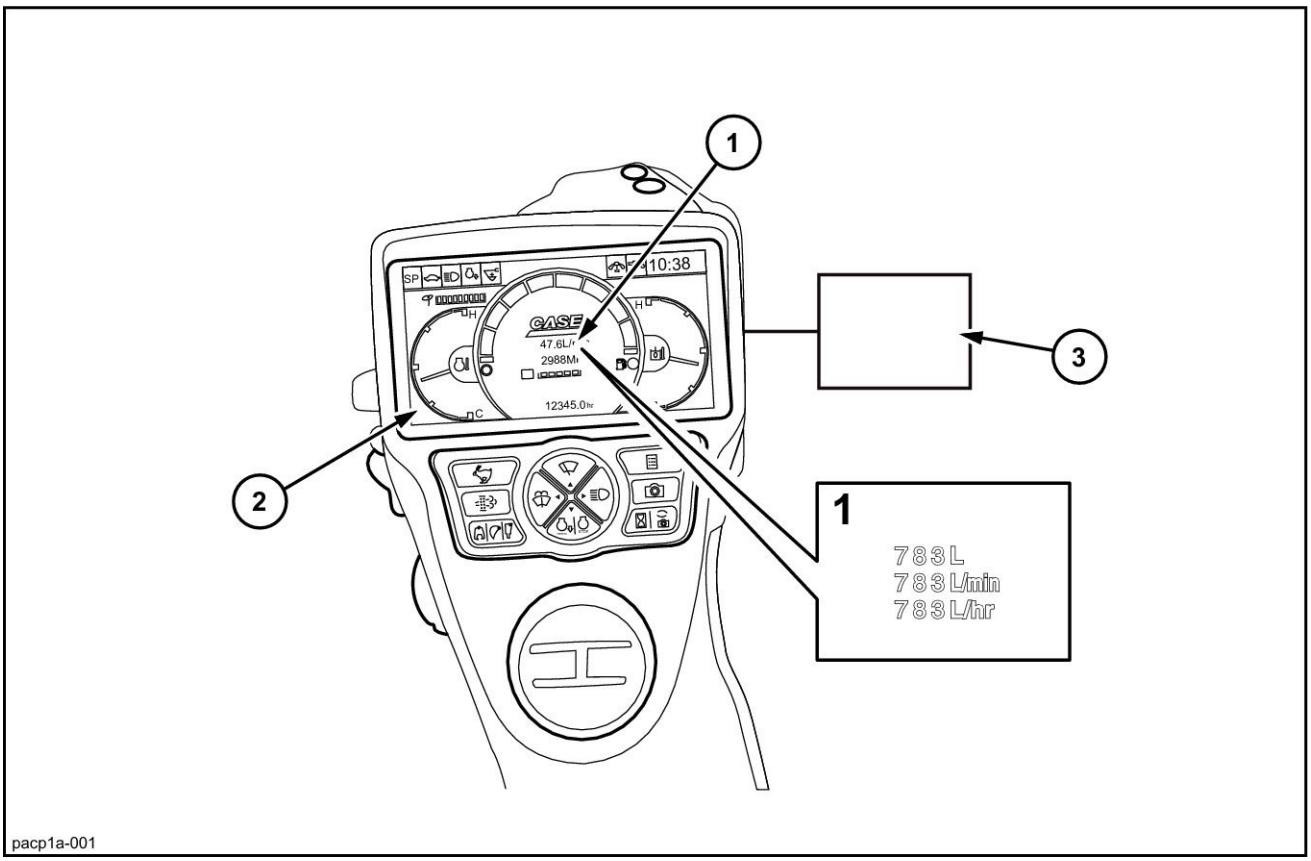
Clock

Purpose
Displays the time on the monitor.
Operation explanation

- The time is always displayed on the monitor.
- The clock continues to operate, without display, when the key is turned OFF. (Because it uses power from the battery)

Fuel economy gauge

Purpose
Displays the fuel economy on the monitor.



1	Fuel economy gauge
2	Monitor
3	Computer A

Operation explanation

1. The fuel economy gauge is displayed on the monitor after the key is turned ON.
2. When trouble occurs, the fuel economy gauge goes off and the diagnostic trouble code is displayed.
3. When the trouble is recovered from, the diagnostic trouble code goes off and the fuel economy gauge is displayed again.

Operation

1. Manual switchover (main mode)
   The operator can select 1 of the following work modes by turning the throttle volume.
   For the correspondence between the throttle volume detents and the work modes, see the attached table.

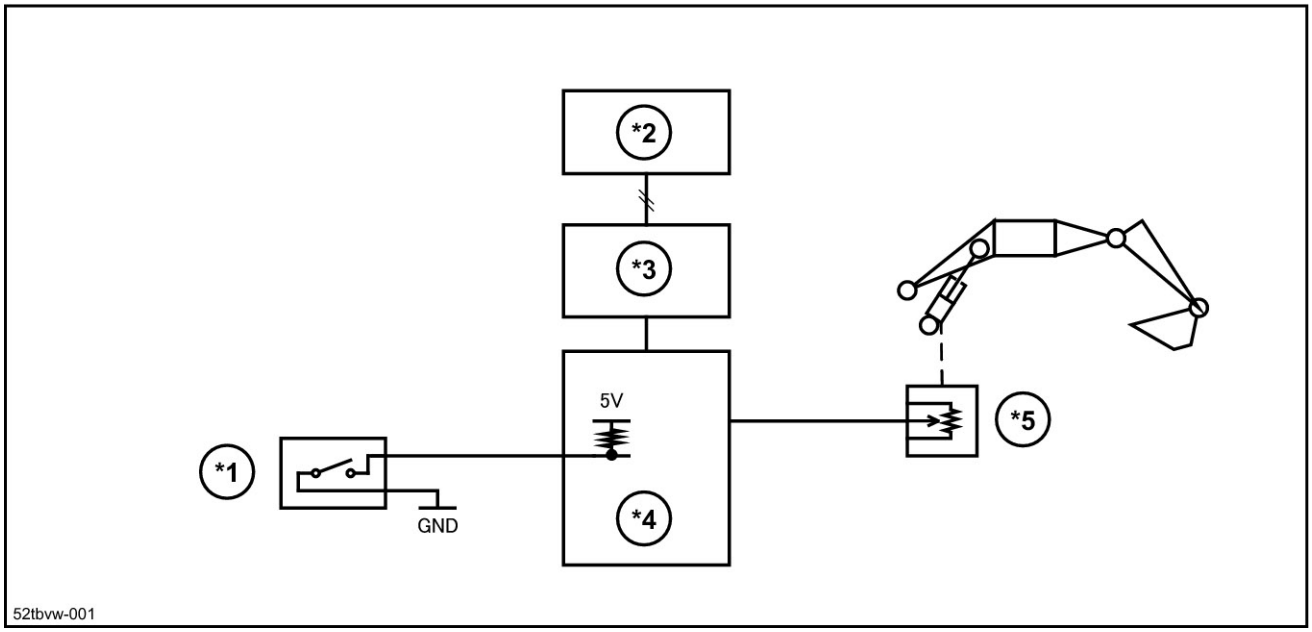
Mode	Aim	Display	Monitor buzzer
① SP mode	Speed emphasis	SP	The buzzer buzzes twice when this is selected.
② H mode	Balances speed and fuel economy	H	The buzzer buzzes once when this is selected.
③ A mode	Fuel economy emphasis	A	No buzzing

2. Automatic switchover (submode)
   Each of the three main modes that can be selected manually has two submodes (high and low).
   These submodes are switched automatically based on the sensor input values.

   * For the high and low milli-amp, see the explanation in “Pump Horsepower Boost Control“ on the next page.

Overload Warning

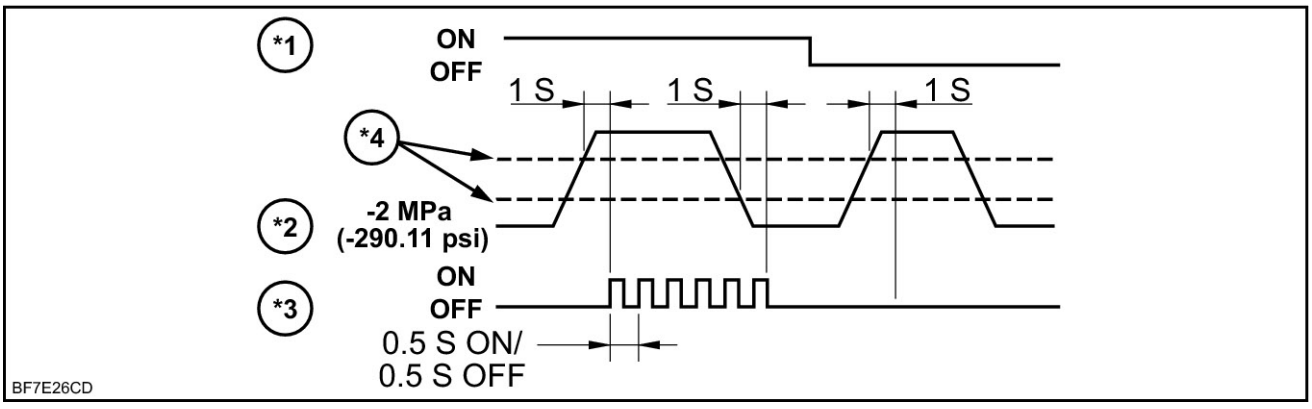
Summary
Overload warning device for lifting work with shovel
If the bottom pressure of the boom cylinder exceeds the stipulated pressure, it is judged that there is a danger of the machine falling over and the monitor buzzer sounds (overload warning).
Configuration



*1	Overload switch	*3	Computer B	*5	Overload pressure sensor
*2	Color monitor	*4	Computer A		

Operation explanation

1. When the overload switch is turned ON, the buzzer sound starts and stops according to the conditions below. When the overload switch is OFF, the buzzer does not sound.
   1) Overload warning start: The boom bottom pressure is greater than or equal to the set pressure continuously for 1 sec.
   2) Overload warning stop: The boom bottom pressure is less than or equal to the set pressure -2 MPa (-290.11 psi) continuously for 1 sec.
2. The alarm pattern is a 1-second cycle - ON for 0.5 sec. and OFF for 0.5 sec.



*1	Overload switch	*3	Monitor buzzer
*2	Boom bottom pressure	*4	Set pressure

3. Display: The warning is only given with the monitor buzzer.
   The lamps etc. do not illuminate.

End Attachment

Option line control

1. Configuration
   [Multi-purpose circuit with 2nd option line]

Manual Regeneration

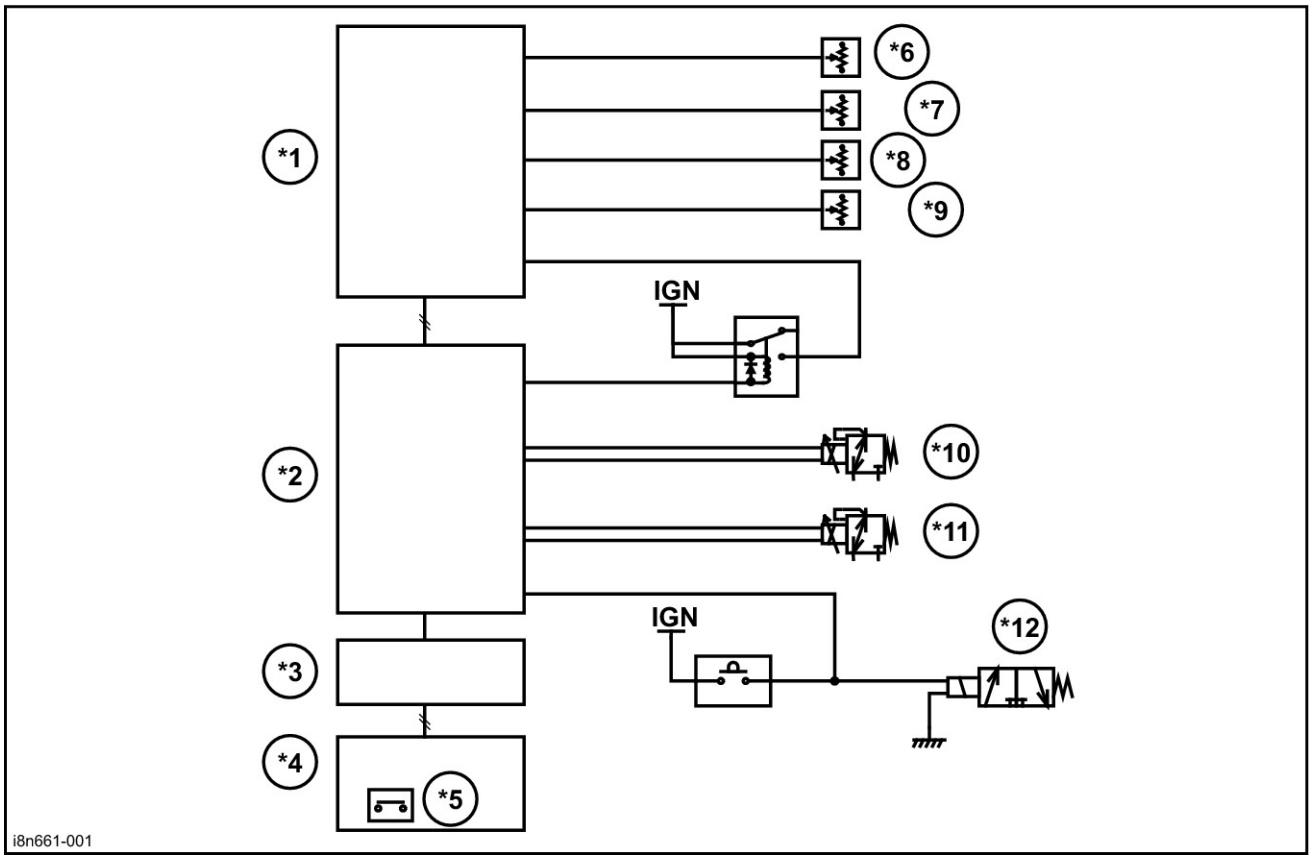
Summary

If automatic regeneration is incomplete or the amount of accumulated PM is large, the ECM requests manual regeneration.

The machine cannot be operated during manual regeneration.

The computer controls the regeneration assist load.

Configuration



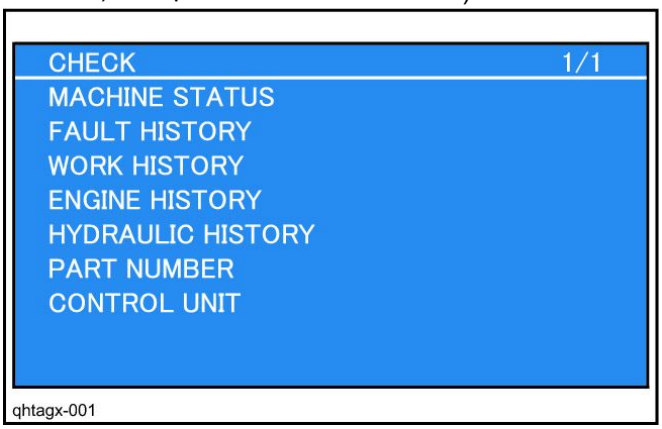
*1	ECM	*5	DPD SW	*9	DPD Prerss sensor
*2	CONT_A	*6	Water Temp. sensor	*10	Pump Flow P-S/V
*3	CONT_B	*7	DPD(CT) Temp. sensor	*11	Boom2 P-S/V
*4	MONITOR	*8	DPD(FT) Temp. sensor	*12	Lever lock S/V

Operation explanation

1. Requesting manual regeneration: When the manual regeneration request comes from the ECM to the computer, it displays the following items on the monitor.
   - Flashes the DPD amber lamp (2-second cycle at first, high-speed 0.6-second cycle afterward)
   - Displays the "PUSH DPD SWITCH TO ACTIVATE" message.
2. Manual regeneration start conditions: When the following conditions are all met and the DPD switch is pressed, the computer sets the engine speed to 1000 min^{-1} (1000 rpm) and starts manual regeneration.
   - The gate bar limit switch is OFF (hydraulic operation is disabled).
   - The engine coolant temperature is at least 70 °C (158.0 °F) but less than 100°C (212.0°F).
   - There is no sensor or DPD related abnormality.
   - When released, automatically goes to 1000 min^{-1} (1000 rpm).
3. Start of manual regeneration: If the conditions above are met, Computer A starts the following control.
   - Lights the DPD amber lamp.
   - Sets off the buzzer for 2 sec..
   - Switches the DPD gauge from accumulated amount display to regeneration progress display.
   - Displays the "AUTO DPD RE-GEN" and "CAUTION! HOT EXHAUST" messages alternating.
   - Computer A drives the DPD relay and sends the DPD regeneration signal to the ECM.
   - Stops the auto idle/idle stop control.

CHECK Screen List

In CHECK mode, in addition to the machine status (milli-amp, oil pressures, temperatures, etc.), it is possible to check sensor and switch input/output states, as well as the angle, load ratio and work radius, etc. at the applied machine (liftcrane specifications machine, lifting magnet machine).



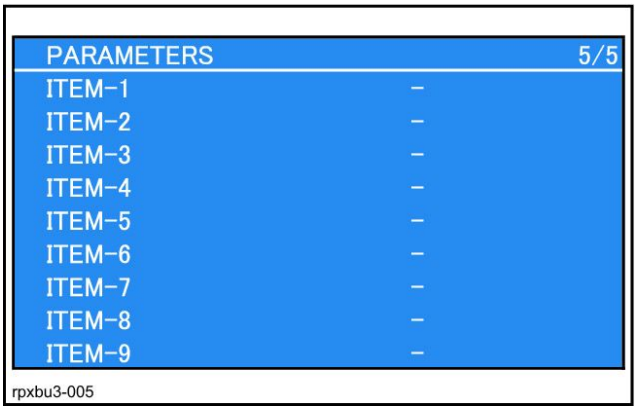
1	Section

For the CHECK mode section types and their contents, see the separate sheet.

By pressing  and  on the monitor, MACHINE STATUS, FAULT HISTORY, etc. can be selected.

Detailed data for the selected item can be seen by pressing  .

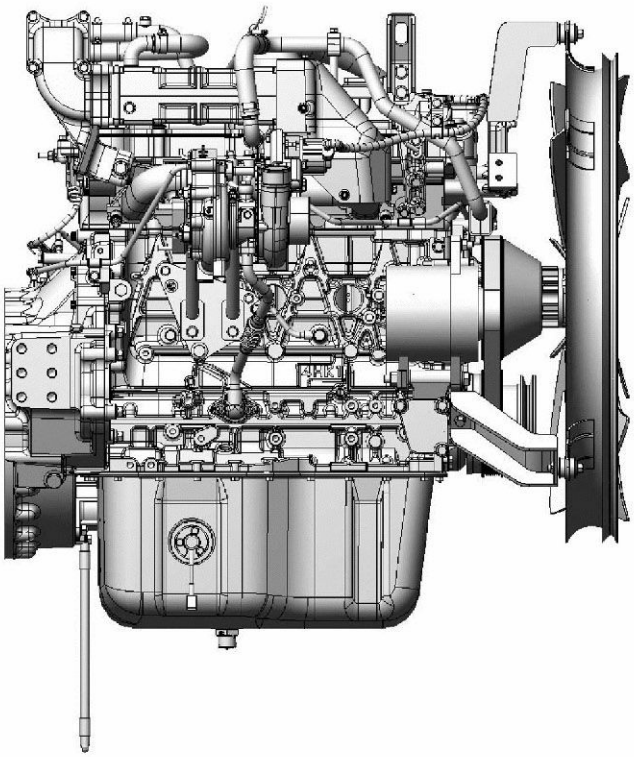
5.



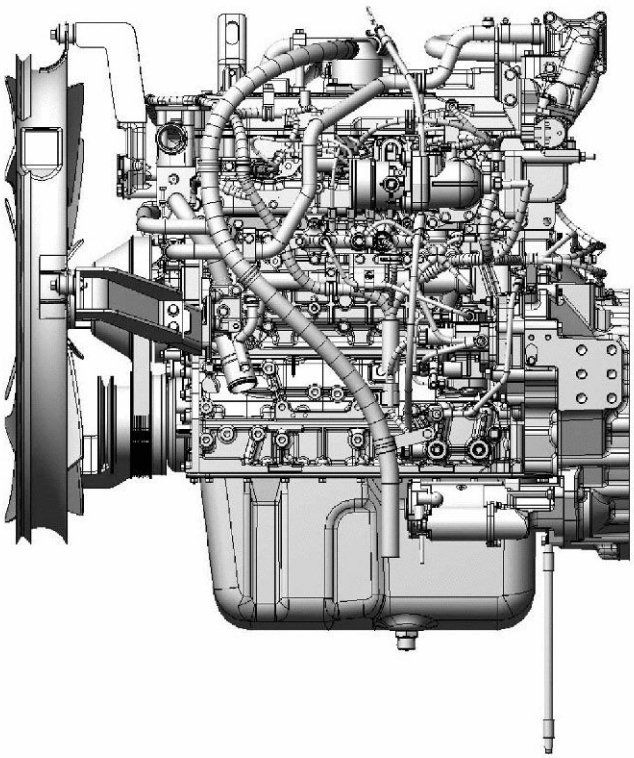
ITEM-1	-	-
ITEM-2	-	-
ITEM-3	-	-
ITEM-4	-	-
ITEM-5	-	-
ITEM-6	-	-
ITEM-7	-	-
ITEM-8	-	-
ITEM-9	-	-

2. Function, Structure, Operation

1) Engine structural diagram



y5xmsh-180



y5xmsh-181

10) Engine control system

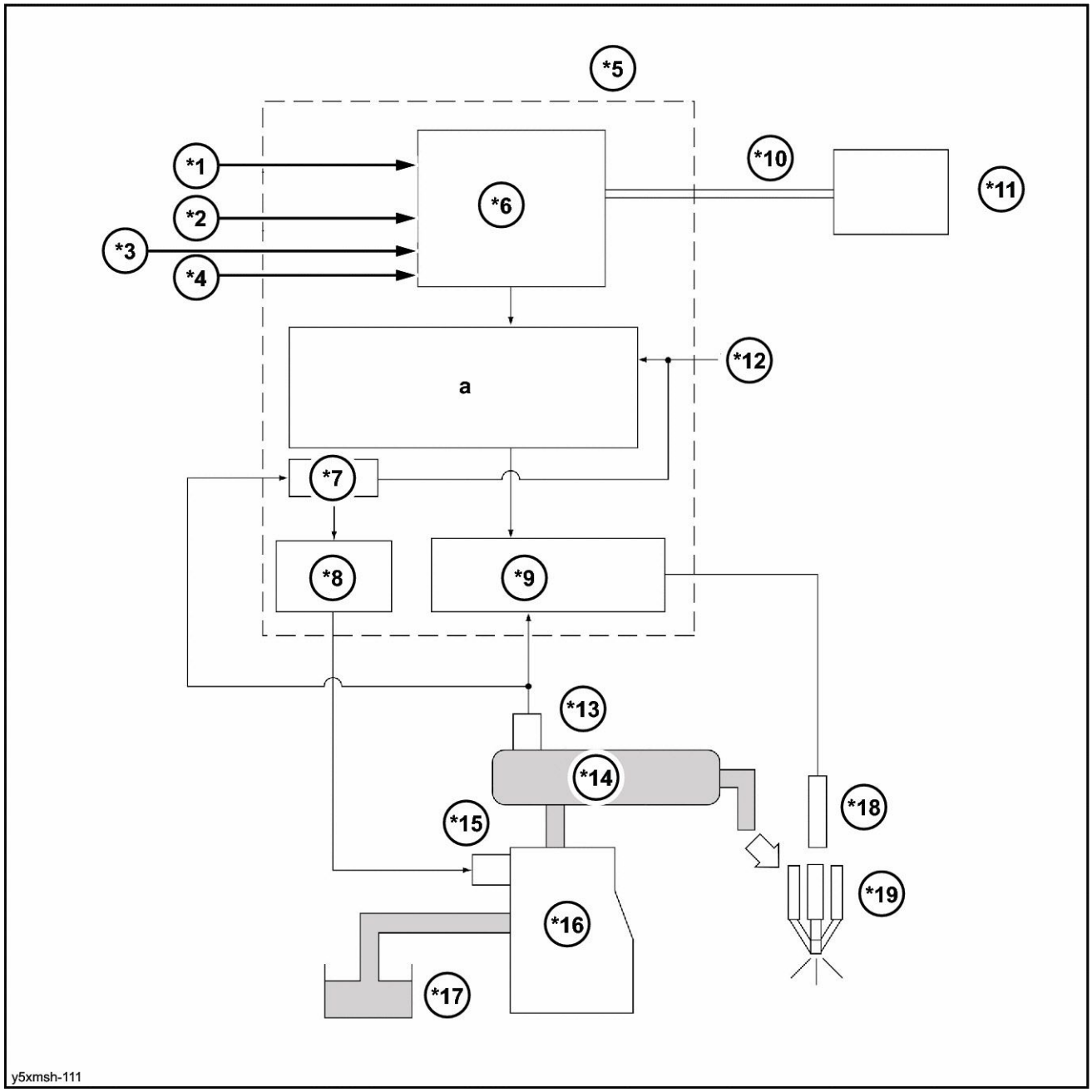
Engine control system overview and implementation

The engine control system is an electronic control system that controls the engine to be always in the optimal combustion state according to the driving condition, and consists of the electronic control fuel injection system, EGR, and idling control.

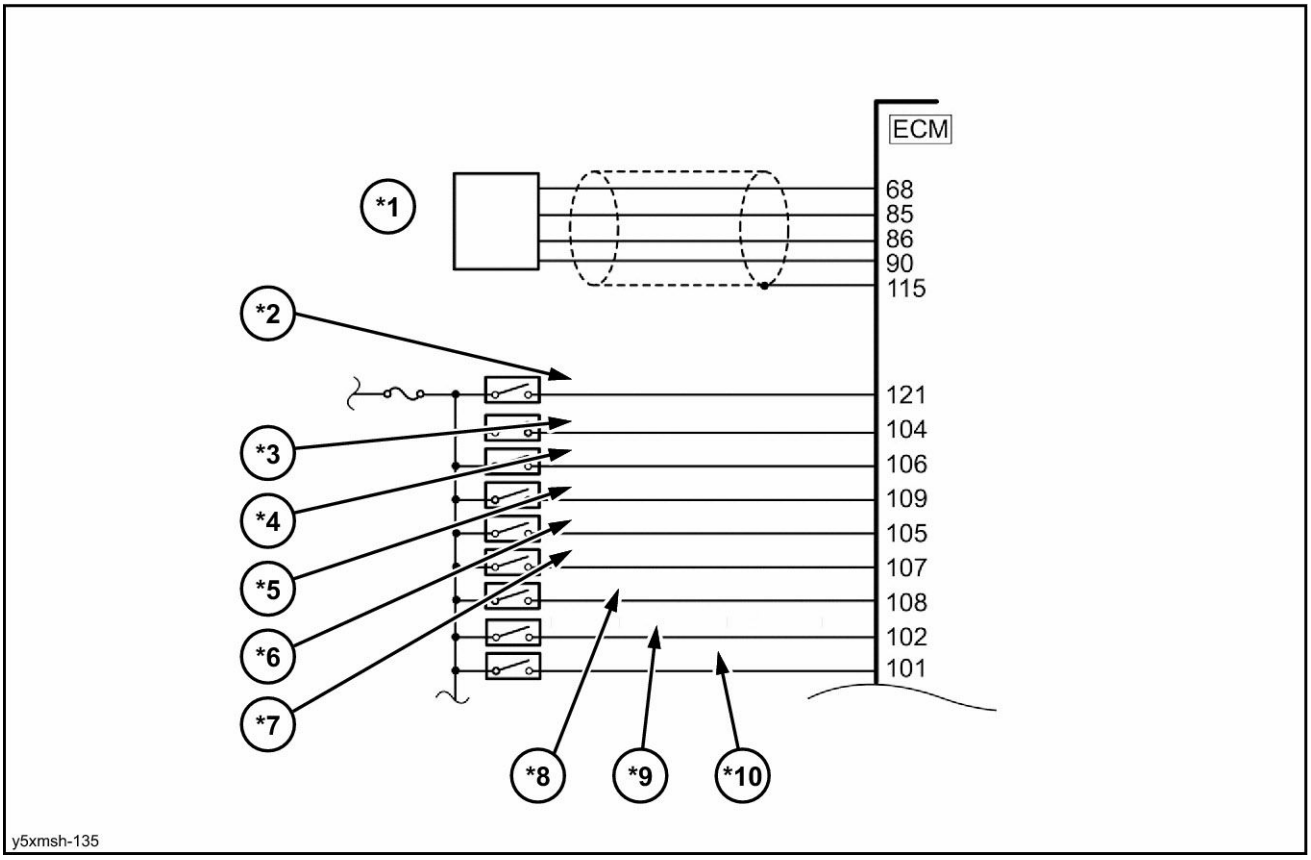
Also, besides controlling the engine, the engine control system has the QOS system, engine RPM signal output, self-diagnosing function, and CAN communication SAE J1939/21 and SAE J1939/11 system control functions.

System control schematic

The specifications vary depending on the actual unit, so refer to the manual of the actual unit.



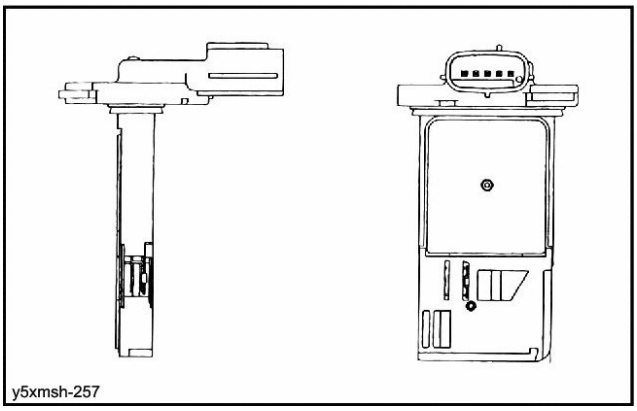
Mode map switch control



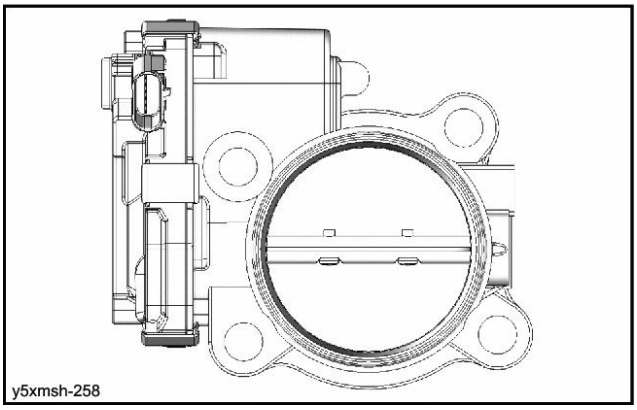
*1	Accelerator position sensor	*5	Idle down switch	*9	Reguration mode switch
*2	Engine stop switch	*6	Mode map switch 0	*10	Load advance switch
*3	Idling selector switch	*7	Mode map switch 1		
*4	Idle up switch	*8	Mode map switch 2		

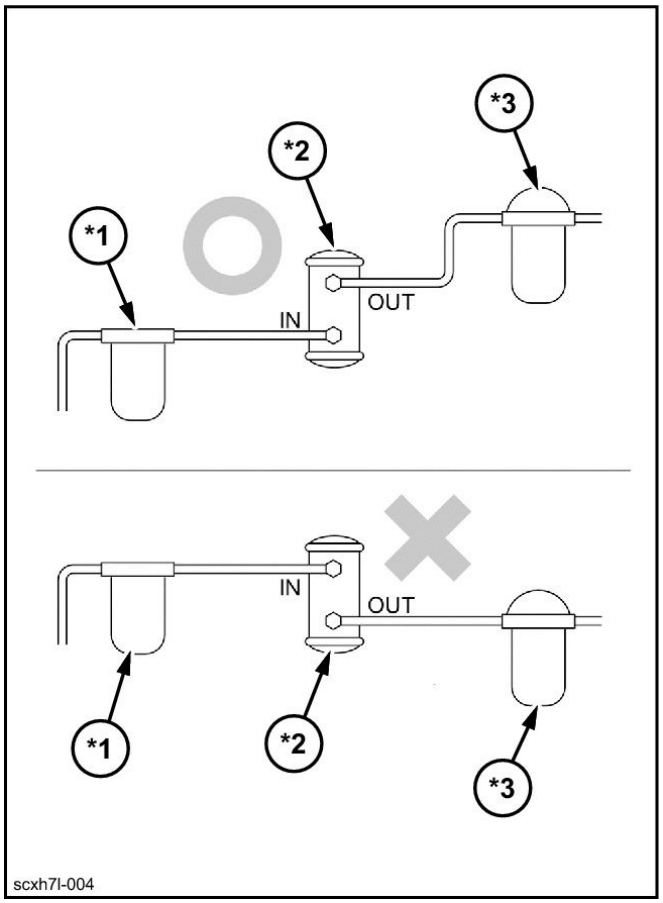
Operation mode	**Outer switch**			**Control**
	MAP0	**MAP1**	**MAP2**	
H	OFF	OFF	OFF	Basic operations
	OFF	ON	ON	
	ON	ON	ON	
S	ON	OFF	OFF	Maximum rotation count control #1
L	OFF	ON	OFF	Maximum rotation count control #2
I	OFF	OFF	ON	Constant rotation operation #1
B	ON	ON	OFF	Maximum rotation count control #3
LM	ON	OFF	ON	Constant rotation operation #2

Intake air temperature and mass air flow sensors
Intake air temperature sensor
The intake air temperature sensor is installed on the duct between the air cleaner and turbocharger.
The intake air temperature sensor is variable resistance inside the mass air flow sensor to measure the temperature of air taken into the engine.
When the intake air temparture sensor is cold, the resistance of the sensor is high.
When the air temperature rises, the resistance of the sensor becomes low.
For high sensor resistance, the ECM detects a high voltage of the signal circuit.
For low sensor resistance, the ECM detects a low voltage of the signal circuit.
Mass air flow sensor
The mass air flow sensor measures the amount of air taken into the engine, and it is installed on the duct between the air cleaner and turbocharger.
The mass air flow sensor consists of the mass air flow sensor and intake air temperature sensor to measure some of air flowing in the duct.
A small amount of air taken into the engine indicates deceleration or idle RPM.
A large amount of air indicates acceleration or high load.



Intake throttle valve
The intake throttle valve is installed on the inlet of the inlet manifold.
The ECM controls the opening angle of the intake throttle valve according to the condition of engine operation.
The motor inside the intake throttle valve is controlled based on the duty ratio signals sent from the ECM.
The opening angle of the intake throttle valve is adjusted when the duty ratio is changing from 0 % to the appropriate ratio.
The valve closes when the du%ty signal increases, and the valve opens when the duty signal decreases.
The opening angle of the intake throttle valve is detected by the position sensor.
The position sensor outputs the signal representing the intake throttle valve opening angle.
The ECM detects a low signal voltage when the opening angle is small or the valve is at the closed position.
Also, the ECM detects a high signal voltage when the opening angle is large.





*1	Pre fuel filter
*2	Electromagnetic pump
*3	Fuel filter

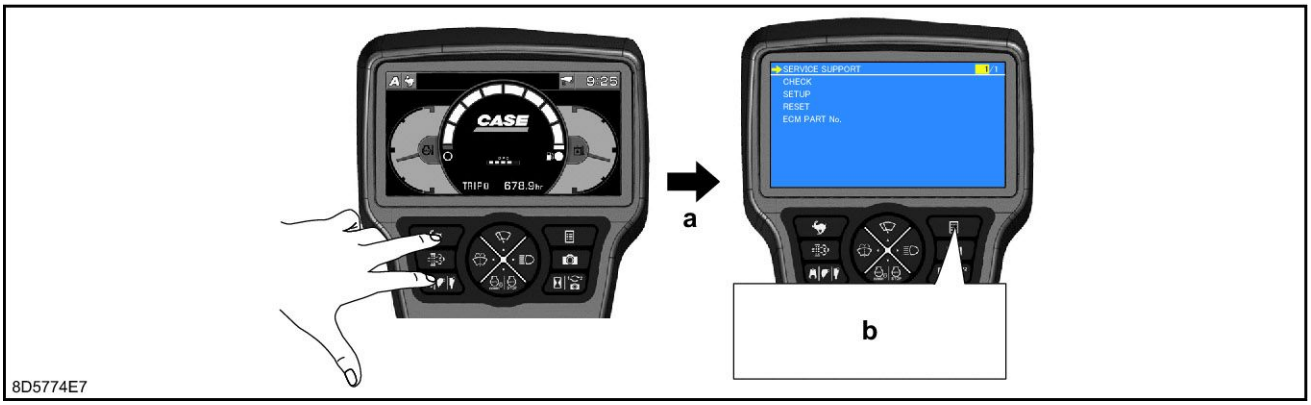
- Diagnostic aids
  Fuel system abnormalities such as fuel running out, fuel freezing, mixture of air into the fuel piping, filter abnormalities, piping abnormalities, fuel quality, fuel tank, etc.
  Air intake system abnormalities such as filter clogging, air intake piping abnormalities, etc.
  Use of low-viscosity fuel such as kerosene causes wear on the supply pump plunger and may result in the discharge abnormalities and cause start failure.
  In such cases, replacement of the supply pump is required.
  When a start failure has occurred, check with the customer about the fuel used.
  If low-viscosity fuel such as kerosene has been used, instruct the customer not to use low-viscosity fuel because the malfunction recurs even after replacing the supply pump.
  A mixed oil biofuel containing long-term storage fuel and organic substances is easily oxidizable.
  An oxidized fuel causes wear on the camshaft related parts in the supply pump and may result in start failure due to discharge abnormalities.
  In such cases, replacement of the supply pump is required.
  Since the replacement of the supply pump due to the use of mixed oil biofuel containing long-term storage fuel and organic substances is at the customer's expense, instruct the customer not to use mixed oil biofuel containing long-term storage fuel and organic substances.
  When using fuel with a high water content, add the larger sedimenter to the pre-fuel filter to prevent water from entering into the fuel system.
  Abnormalities of the supply pump, non-pressure fuel supply
  The ECM determination of the supply pump non-pressure fuel supply DTC will not be detected unless a condition continues for 3 seconds or more in which the engine revolution speed is 900 r/min and the absolute pressure is below 15 MPa {153 kgf/cm^2 / 2175 psi}.
  Therefore, the DTC will not be detected when the engine does not start with non-pressure fuel supply due to the supply pump abnormalities.

ANNOTATION:

- *Since the crankshaft position sensor abnormalities will not be diagnosed unless cranking is performed 14 revolutions or more, crank for more than 14 seconds at 60 r/min or more.*

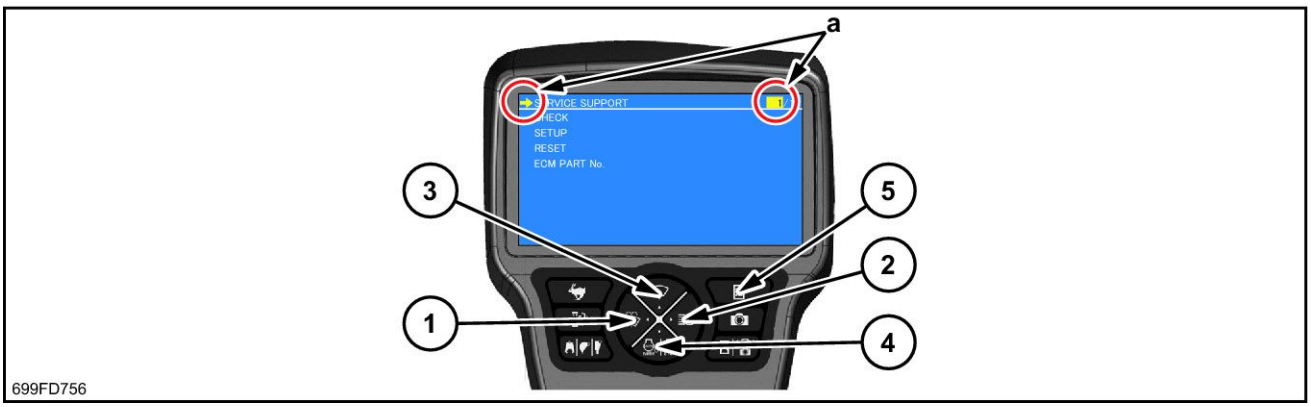
Service Monitor

How to get into “Service Screen”



a	Hold 3 sec.
b	Click Menu button, Then back to Main Screen.

General Operation on Service Monitor



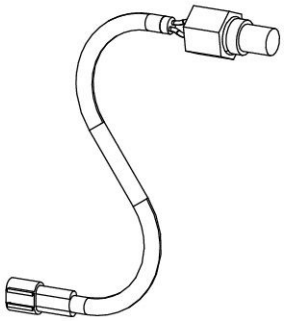
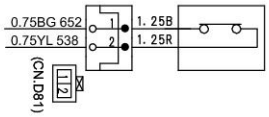
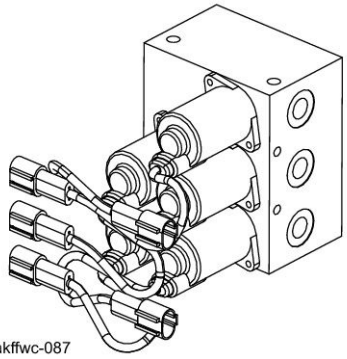
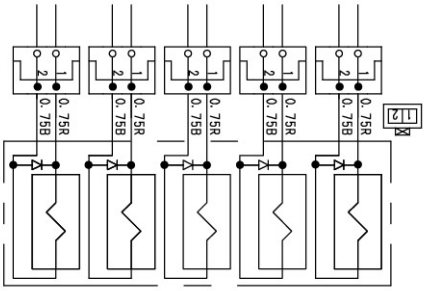
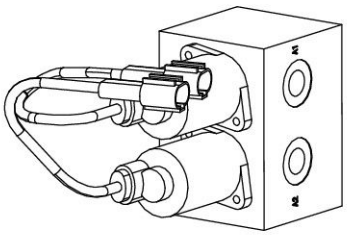
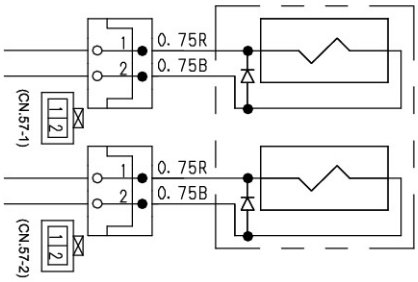
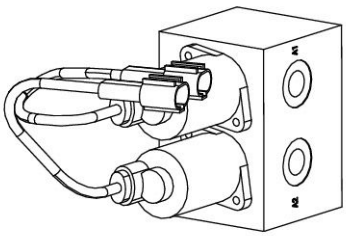
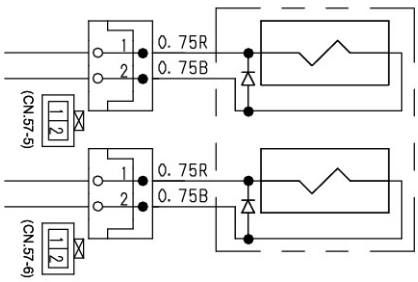
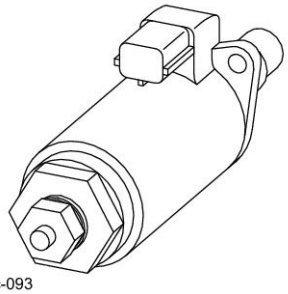
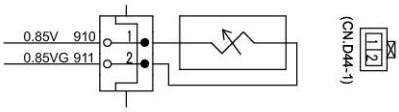
1, 2	Numerical change, Movement of the page	5	Back to the previous screen
3, 4	Movement of the cursor		

a	Yellow Allow and High-light means "Selected".

Electrical Equipment Layout Diagram

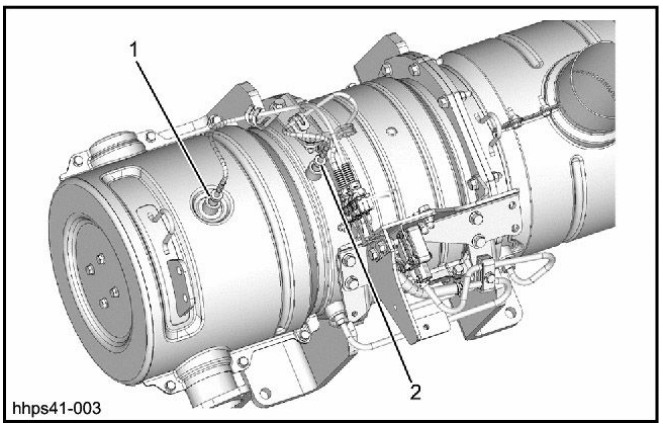
1	Air cleaner sensor	6	Fusible link (IGN) 65 A	11	Battery relay
2	Air cleaner	7	Fuse: +B 50 A	12	Battery
3	Shuttle valve	8	Fuse: ST 50 A	13	Receiver dryer sensor
4	Swing pilot pressure sensor	9	Fuse: Computer 15 A	14	Washer motor
5	Glow relay	10	Starter relay		

Electrical Equipment Layout Diagram

Name	Shape	Circuit	Remarks
Pressure switch (filter)	 akffwc-085	 22FF7A12	Sumitomo part No.; KHR14470
5 stack solenoid valve	 akffwc-087	 akffwc-088	Sumitomo part No.; KHJ14520
2 stack solenoid valve (knob switch type)	 akffwc-089	 akffwc-090	Sumitomo part No.; KHJ14780
2 stack solenoid valve (pedal type)	 akffwc-091	 akffwc-092	Sumitomo part No.; KHJ14000
P1 flow control proportional valve	 akffwc-093	 2DD04781	Sumitomo part No.; TIP0002128

Engine-side DTC List

P code	-
P0685	ECM main relay control system low input
P0687	ECM main relay control system high input
P0697	Sensor voltage system error
P1093	Fuel rail pressure low pressure error
P1112	Boost temperature sensor system low input
P1113	Boost temperature sensor system high input
P1261	Injector group 1 voltage control system error
P1262	Injector group 2 voltage control system error
P1293	Fuel filter pressure sensor system low input
P1294	Fuel filter pressure sensor system high input
P1404	EGR close position characteristics error
P1455	DPD restriction 2
P1471	DPD regeneration error
P1621	Control module EEPROM error
P1655	Sensor voltage system error
P2146	Injector group 1 supplied voltage system error
P2149	Injector group 2 supplied voltage system error
P2228	Atmospheric pressure sensor system low input
P2229	Atmospheric pressure sensor system high input
P242F	DPD restriction
P2452	DPD differential pressure sensor system error
P2453	DPD differential pressure sensor system characteristics error
P2454	DPD differential pressure sensor system low input
P2455	DPD differential pressure sensor system high input
P2456	DPD differential pressure sensor learning position error
P2458	DPD regeneration time error
U0001	CAN bus communication error
U0073	Control module communication error
U0101	TCM communication error
U0110	Turbocharger control module communication error
U0411	Turbocharger control module signal error



1	Exhaust gas temperature sensor 1
2	Exhaust gas temperature sensor 2

ANNOTATION:

- *Start the engine after assembling each part, and check for gas leaks from each joint and for vibration.*

Exhaust gas temperature sensor Inspection

1. Exhaust gas temperature sensor Inspection
   1) Measure the resistance using the circuit tester.

      ANNOTATION:

      - *The reference values for the sensor*

      characteristics are indicated in the diagram.

temperature	Resistance value
: 1000.0 °C (1832.00 °F)	: 115.00 - 127.00 Ω
: 950.0 °C (1742.00 °F)	: 130.00 - 143.00 Ω
: 900.0 °C (1652.00 °F)	: 147.00 - 163.00 Ω
: 850.0 °C (1562.00 °F)	: 167.00 - 187.00 Ω
: 800.0 °C (1472.00 °F)	: 192.00 - 219.00 Ω
: 750.0 °C (1382.00 °F)	: 226.00 - 258.00 Ω
: 700.0 °C (1292.00 °F)	: 267.00 - 309.00 Ω
: 650.0 °C (1202.00 °F)	: 333.00 - 360.00 Ω
: 600.0 °C (1112.00 °F)	: 406.00 - 442.00 Ω
: 550.0 °C (1022.00 °F)	: 504.00 - 552.00 Ω
: 500.0 °C (932.00 °F)	: 640.00 - 709.00 Ω
: 450.0 °C (842.00 °F)	: 835.00 - 937.00 Ω
: 400.0 °C (752.00 °F)	: 1130.00 - 1280.00 Ω
: 350.0 °C (662.00 °F)	: 1590.00 - 1850.00 Ω
: 300.0 °C (572.00 °F)	: 2360.00 - 2830.00 Ω
: 200.0 °C (392.00 °F)	: 6230.00 - 7830.00 Ω
: 150.0 °C (302.00 °F)	: 11900.00 - 16300.00 Ω
: 100.0 °C (212.00 °F)	: 27600.00 - 41200.00 Ω
: 50.0 °C (122.00 °F)	: 82000.00 - 137000.00 Ω

DTC U0110 (Flash Code 87) Lost Communication with VNT System

1. DTC U0110 Priority DTC
   DTC P0045
   DTC U0001
2. DTC U0110 Diagnostics
   1) Turn OFF the starter switch.
   2) Remove the harness connector from the turbo control unit.
   3) Turn ON the starter switch.
   4) Measure the voltage between the CAN-High circuit and GND of the turbo control unit harness connector.
   5) Measure the voltage between the CAN-High circuit and GND of the turbo control unit harness connector.
      Voltage : 1.5 - 3.5 V
   6) If it is outside the standard range, inspect to see if there is an open circuit or high resistance with the CAN-High circuit between the turbo control unit and the ECM.
   7) If a problem is discovered, repair the CAN-High circuit.
   8) Inspect to see if there is an open circuit or high resistance with the CAN-Low circuit between the turbo control unit and the ECM.
   9) If a problem is discovered, repair the CAN-Low circuit.
   10) Inspect the turbo control unit harness connector for a contact failure.
   11) If a problem is discovered, repair the harness connector.
   12) Replace the turbo control unit.
3. DTC U0110 Confirm Resolution
   1) Clear the DTC using the trouble diagnosis scan tool.
   2) Turn the starter switch OFF for 30 seconds or longer.
   3) Start the engine.
   4) Perform a test-run.
   5) Use the trouble diagnosis scan tool to confirm that a DTC has not been detected.

DTC P0112 (Flash Code 22) Intake Air Temperature Sensor Circuit Low

1. DTC P0112 Priority DTC
   DTC P0641
2. DTC P0112 Diagnostics
   1) Turn OFF the starter switch.
   2) Disconnect the harness connector from the intake air temperature sensor.
   3) Check the intake air temperature sensor display with the trouble diagnosis scan tool.
      Voltage : 4.5 V
   4) If it is at or above the standard value, replace the intake air temperature sensor.
   5) Inspect to see if there is a short circuit to the GND with the signal circuit between the ECM and the intake air temperature sensor.
   6) If a problem is discovered, repair the signal circuit.
   7) Turn OFF the starter switch.
   8) Disconnect the harness connector from the ECM.
   9) Inspect the ECM harness connector for a contact failure.
   10) If a problem is discovered, repair the harness connector.
   11) If the harness connector is normal, replace the ECM.
      Refer to "1.Engine 1J.Electrical(4HK1X) ECM Removal".
      Refer to "1.Engine 1J.Electrical(4HK1X) ECM Installation".
   12) Set the injector ID code on the ECM.
   13) Perform the unit difference learning of the fuel supply pump to the ECM.
3. DTC P0112 Confirm Resolution
   1) Clear the DTC using the trouble diagnosis scan tool.
   2) Turn the starter switch OFF for 30 seconds or longer.
   3) Start the engine.
   4) Perform a test-run.
   5) Use the trouble diagnosis scan tool to confirm that a DTC has not been detected.

ECM and the exhaust gas temperature sensor 1.

ANNOTATION:

- *The exhaust gas temperature sensor 1 shares the GND circuit with other sensors.*
- *The DTC may be detected on a sensor which shares this circuit.*

19) If a problem is discovered, repair the GND circuit.
20) Inspect the ECM harness connector for a contact failure.
21) If a problem is discovered, repair the harness connector.
22) If the harness connector is normal, replace the ECM.
Refer to "1.Engine 1J.Electrical(4HK1X) ECM Removal".
Refer to "1.Engine 1J.Electrical(4HK1X) ECM Installation".
23) Set the injector ID code on the ECM.
24) Perform the unit difference learning of the fuel supply pump to the ECM.

3. DTC P0428 Confirm Resolution

1) Clear the DTC using the trouble diagnosis scan tool.
2) Turn the starter switch OFF for 30 seconds or longer.
3) Start the engine and warm it up until the coolant temperature exceeds the standard value.
Specified value : 70 °C {158 °F}
4) Repeatedly rev the engine in neutral to increase the engine rpm while checking the exhaust temperature sensor (in front of the filter) display with the trouble diagnosis scan tool.
5) Use the trouble diagnosis scan tool to confirm that the exhaust temperature sensor (before the filter) display does not exceed the standard value.
Voltage : 4.8 V
6) Use the trouble diagnosis scan tool to confirm that a DTC has not been detected.

DTC P0522 (Flash Code 294) Oil Pressure Sensor Circuit Low

1. DTC P0522 Priority DTC
DTC P0697
2. DTC P0522 Diagnostics

1) Turn OFF the starter switch.
2) Disconnect the harness connector from the oil pressure sensor.
3) Turn ON the starter switch.
4) Measure the voltage between the 5 V power supply circuit and normal GND of the oil pressure sensor harness connector.
Voltage : 4.5 V
5) If it is at or below the standard value, inspect to see if there is an open circuit or high resistance with the 5 V power supply circuit between the ECM and the oil pressure sensor.
6) If a problem is discovered, repair the 5 V power supply circuit.
7) Connect the test cable with fuse between the 5 V power supply circuit and signal circuit of the oil pressure sensor harness connector.
8) Check the oil pressure sensor display with the trouble diagnosis scan tool.
Voltage : 4.5 V
9) If it is at or above the standard value, inspect to see if there is a contact failure with the oil pressure sensor harness connector.
10) If a problem is discovered, repair the harness connector.
11) If the harness connector is normal, replace the oil pressure sensor.
Refer to "1.Engine 1E.Lubrication(4HK1X) Oil pressure sensor Removal".
Refer to "1.Engine 1E.Lubrication(4HK1X) Oil pressure sensor Installation".
12) Inspect the signal circuit between the ECM and the oil pressure sensor.

- There should be no open circuit or high resistance.
- There should be no short to GND.

13) If a problem is discovered, repair the signal circuit.
14) Inspect the ECM harness connector for a contact failure.
15) If a problem is discovered, repair the harness connector.
16) If the harness connector is normal, replace the ECM.
Refer to "1.Engine 1J.Electrical(4HK1X) ECM Removal".
Refer to "1.Engine 1J.Electrical(4HK1X) ECM Installation".
17) Set the injector ID code on the ECM.
18) Perform the unit difference learning of the fuel supply pump to the ECM.

3. DTC P0522 Confirm Resolution

1) Clear the DTC using the trouble diagnosis scan tool.
2) Turn the starter switch OFF for 30 seconds or longer.

34) Use the trouble diagnosis scan tool to check if the exhaust differential pressure data display is at or below the standard value.
Specified value: 7.5 kPa {0.08 kgf/cm2 / 1.1 psi}
35) If it is at or above the standard value, replace the DPD filter.
Refer to "1.Engine 1G.Exhaust(4HK1X) DPD assembly Disassembly".
Refer to "1.Engine 1G.Exhaust(4HK1X) DPD assembly Reassembly".
36) If the DPD filter has been replaced, use the trouble diagnosis scan tool to perform DPD regeneration data reset.
37) When a DTC has been detected, clear it using the trouble diagnosis scan tool.
38) Turn the starter switch OFF for 30 seconds or longer.
39) Perform the DPD forced slow regeneration with the trouble diagnosis scan tool.

ANNOTATION:

- *After the DPD forced slow regeneration is completed, replace the engine oil.*

40) Check the exhaust temperature (before the filter) display with the trouble diagnosis scan tool.
41) Confirm that the exhaust temperature is at or below the standard value.
Specified value: 130 °C {266 °F}
42) If it is at or above the standard value, idle the engine until it falls to or below the standard value.
43) Check the exhaust differential pressure display when the exhaust temperature (in front of the filter) display has reached the standard value with the engine revolution increased to the maximum revolution speed without load.
Specified value: 150 °C {302 °F}
44) Use the trouble diagnosis scan tool to check if the exhaust differential pressure display is at or below the standard value.
Specified value: 1.8 kPa {0.02 kgf/cm2 / 0.3 psi}
45) If it is at or above the standard value, perform ash removal.
Refer to "1.Engine 1G.Exhaust(4HK1X) DPD assembly Inspection".

2. DTC P1455 Confirm Resolution

1) Turn ON the starter switch.
2) Use the trouble diagnosis scan tool to confirm that a DTC has not been detected.

DTC P1471 (Flash Code 149) DPD Insufficient Regeneration

1. DTC P1471 Diagnostics

1) Inspect the DPD differential pressure sensor hose.

- There should be no incorrect piping or disconnection.

2) If a problem is discovered, repair the hose.
3) Inspect the DPD differential pressure sensor.

- DPD differential pressure sensor unit should not be damaged.
- There should be no dirt or foreign matter blocking the DPD differential pressure sensor entrance.
- There should be no detection error or slow response from the DPD differential pressure sensor.

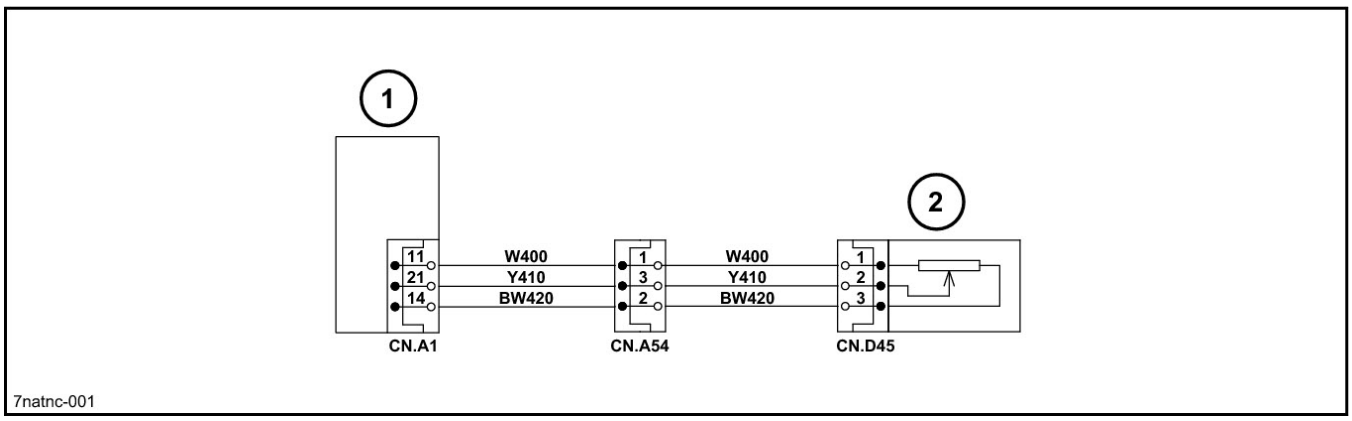
4) If a problem is discovered, replace the DPD differential pressure sensor.
Refer to "1.Engine 1G.Exhaust(4HK1X) Exhaust differential pressure sensor Removal".
Refer to "1.Engine 1G.Exhaust(4HK1X) Exhaust differential pressure sensor Installation".
5) When the DPD differential pressure sensor has been replaced, perform the 0-point correction.
Refer to "1.Engine 1G.Exhaust(4HK1X) Exhaust differential pressure sensor Inspection".
6) Inspect the exhaust system.

- There should be no absence or damage of the exhaust pipe gasket.
- There should be no exhaust gas leak from the exhaust system.
- The exhaust system should not be modified.

7) If a problem is discovered, repair or replace the exhaust system.
8) Inspect the exhaust gas temperature sensor.
Refer to "1.Engine 1G.Exhaust(4HK1X) Exhaust gas temperature sensor Inspection".
9) If a problem is discovered, replace the exhaust gas temperature sensor.
Refer to "1.Engine 1G.Exhaust(4HK1X) Exhaust gas temperature sensor Removal".
Refer to "1.Engine 1G.Exhaust(4HK1X) Exhaust gas temperature sensor Installation".
10) Inspect the air cleaner element.
Refer to "1.Engine 1F.Induction(4HK1X) Air cleaner element Inspection".
11) If a problem is discovered, replace the air cleaner element.
12) Inspect the air intake system.

- There should be no crush, limited flow, or damage of the duct between the air cleaner and intake manifold.
- The intake system should not be modified.
- There should be no air leak with the intake system.

Step	Action	Standard value	Yes	No
11	1. Turn the key switch ON. 2. Measure the voltage between the ground and terminal 1 of the CN. D45 harness side. Is it about 5 V?	About 5 V	Go to Step 12	W400 or W401 harness defect (disconnection). Repair or replace
12	1. Measure the voltage between the ground and terminal 2 of the CN. D45 harness side. Is it 0.25 V or higher?	0.25 V or higher	Computer A defect. Replace	Y410 harness defect (disconnection). Replace



1	COMPUTER A
2	PRESS. SENSOR (P1)

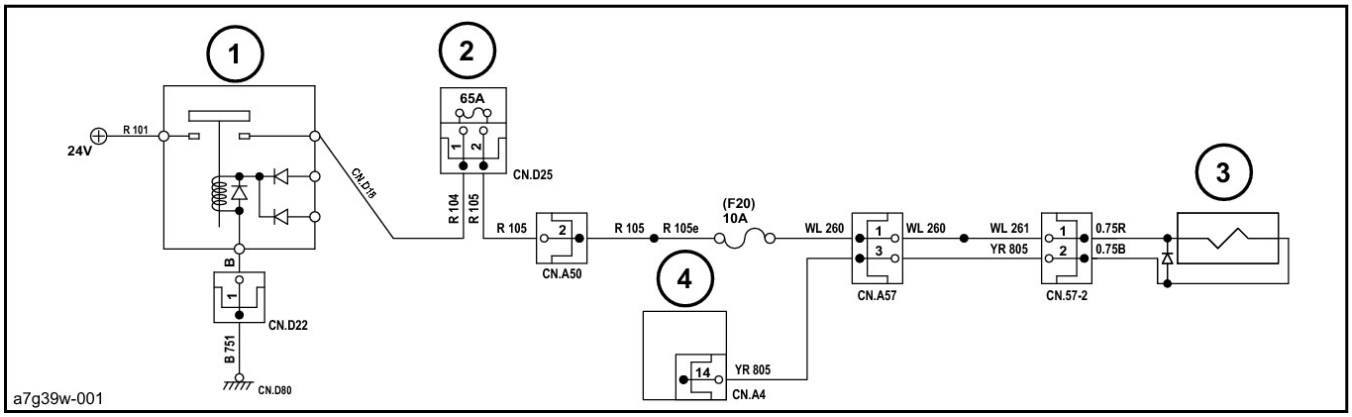
Step	Action	Standard value	Yes	No
10	1. Turn the key switch ON. 2. Measure the voltage between the ground and terminal 1 of the CN. D54 harness side. Is it about 5 V?	About 5 V	Go to Step 11	WL430 harness defect (disconnection). Repair or replace
11	1. Measure the voltage between the ground and terminal 2 of the CN. D54 harness side. Is it 0.25 V or higher?	0.25 V or higher	Computer B defect. Replace	YG445 harness defect (disconnection). Repair or replace

Diagnostic Trouble Code: 7202 Pressure Boost Solenoid Signal Abnormality

Step	Action	Standard value	Yes	No
1	1. Turn the key switch ON. 2. Check whether diagnostic trouble code: 7202 is displayed. Is diagnostic trouble code: 7202 displayed?		Go to Step 2	
2	1. Inspect the connection status of each connector. 2. Inspect the fusible link F1 (65 A) fuse and fuse box F13 (10 A) fuse to see if either is blown. 3. Check whether diagnostic trouble code: 7202 is displayed. Is diagnostic trouble code: 7202 displayed?		Go to Step 3	
3	Inspect the pressure boost solenoid. 1. Turn the key switch OFF and disconnect CN. D62. 2. Measure the resistance between terminals 1 and 2 of the CN. D62 pressure boost solenoid side. Is it 34 Ω - 47 Ω?	34 Ω - 47 Ω	Go to Step 4	Pressure boost solenoid defect. Replace
4	Inspect for shorts. 1. Turn the key switch ON. 2. Measure the voltage between the ground and terminal 2 of the CN. D62 harness side. Is it 0 V?	0 V	Go to Step 5	Y802 harness defect (short). Replace
5	1. Turn the key switch OFF. 2. Inspect for continuity between the ground and terminal 1 of the CN. D62 harness side. Is there continuity?		R183, GR180, R105, or R104 harness defect (short). Replace	Go to Step 6
6	Inspect for disconnection. Inspect for continuity between the ground and terminal 2 of the CN. D62 harness side. Is there continuity?		Go to Step 7	Y802 harness defect (disconnection). Repair or replace
7	1. Turn the key switch ON. 2. Measure the voltage between the ground and terminal 1 of the CN. D62 harness side. Is it 24 V?	24 V	Computer A defect. Replace	R183, GR180, R105, or R104 harness defect (disconnection). Repair or replace

Diagnostic Trouble Code: 7246 2 Pumps Flow Solenoid Signal Abnormality

Step	Action	Standard value	Yes	No
1	1. Turn the key switch ON. 2. Check whether diagnostic trouble code: 7246 is displayed. Is diagnostic trouble code: 7246 displayed?		Go to Step 2	
2	1. Inspect the connection status of each connector. 2. Inspect the fusible link F (65 A) fuse and fuse box F20 (10 A) fuse to see if either is blown. 3. Check whether diagnostic trouble code: 7246 is displayed. Is diagnostic trouble code: 7246 displayed?		Go to Step 3	
3	Inspect the 2 pumps flow solenoid. 1. Turn the key switch OFF and disconnect CN. 163. 2. Measure the resistance between terminals 1 and 2 of the CN. 163 2 pumps flow solenoid side. Is it 34 Ω - 47 Ω?	34 Ω - 47 Ω	Go to Step 4	2 pumps flow solenoid defect. Replace
4	Inspect for shorts. 1. Turn the key switch ON. 2. Measure the voltage between the ground and terminal 3 of the CN. 163 harness side. Is it 0 V?	0 V	Go to Step 5	YR805 harness defect (short). Replace
5	1. Turn the key switch OFF. 2. Inspect for continuity between the ground and terminal 1 of the CN. 163 harness side. Is there continuity?		WL260, WL261, or SR105 harness defect (short). Replace	Go to Step 6
6	Inspect for disconnection. Inspect for continuity between the ground and terminal 3 of the CN. 163 harness side. Is there continuity?		Go to Step 7	YR805 harness defect (disconnection). Repair or replace
7	1. Turn the key switch ON. 2. Measure the voltage between the ground and terminal 1 of the CN. 163 harness side. Is it 24 V?	24 V	Computer A defect. Replace	WL260, WL261, or SR105 harness defect (disconnection). Repair or replace

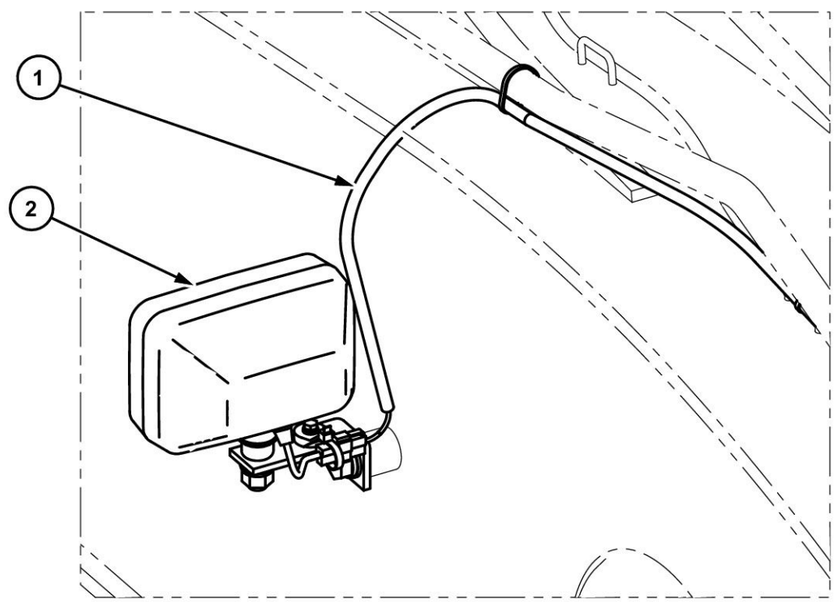


1	COMPUTER A	6	FUSIBLE LINK FUSE BOX	11	STARTER MOTOR
2	RELAY STARTER CUT	7	FUSIBLE LINK BACK UP	12	ALTERNATOR
3	BATTERY (24 V)	8	FUSIBLE LINK SAFETY RL	13	RELAY STARTER
4	RELAY BATTERY	9	RELAY KEY ON		
5	FUSE CONT	10	KEY SWITCH		

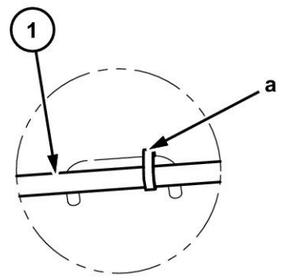
Diagnostic Trouble Code: 7614 Air Conditioner Panel Mismatch

Step	Action	Standard value	Yes	No
1	1. Turn the key switch ON. 2. Check whether diagnostic trouble code: 7614 is displayed. Is diagnostic trouble code: 7614 displayed?		Go to Step 2	
2	1. Check for an error on the service support model selection screen. Is the model selection screen correct?		Go to Step 3	Correctly set the model selection.
3	1. Check that the numbers of the installed air conditioner panels match the model number. Does the air conditioner panel number match the model?		Air conditioner panel defect. Replace	Replace with an air conditioner panel that matches the model.

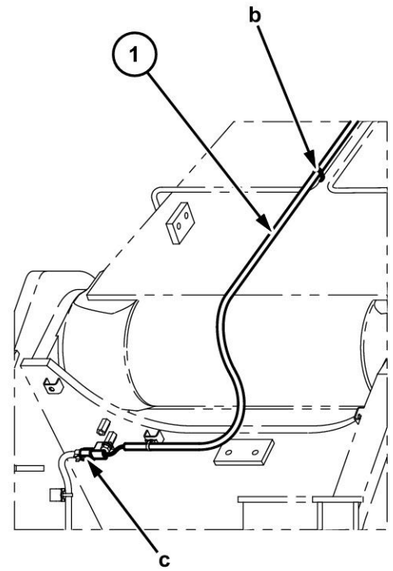
Attachments



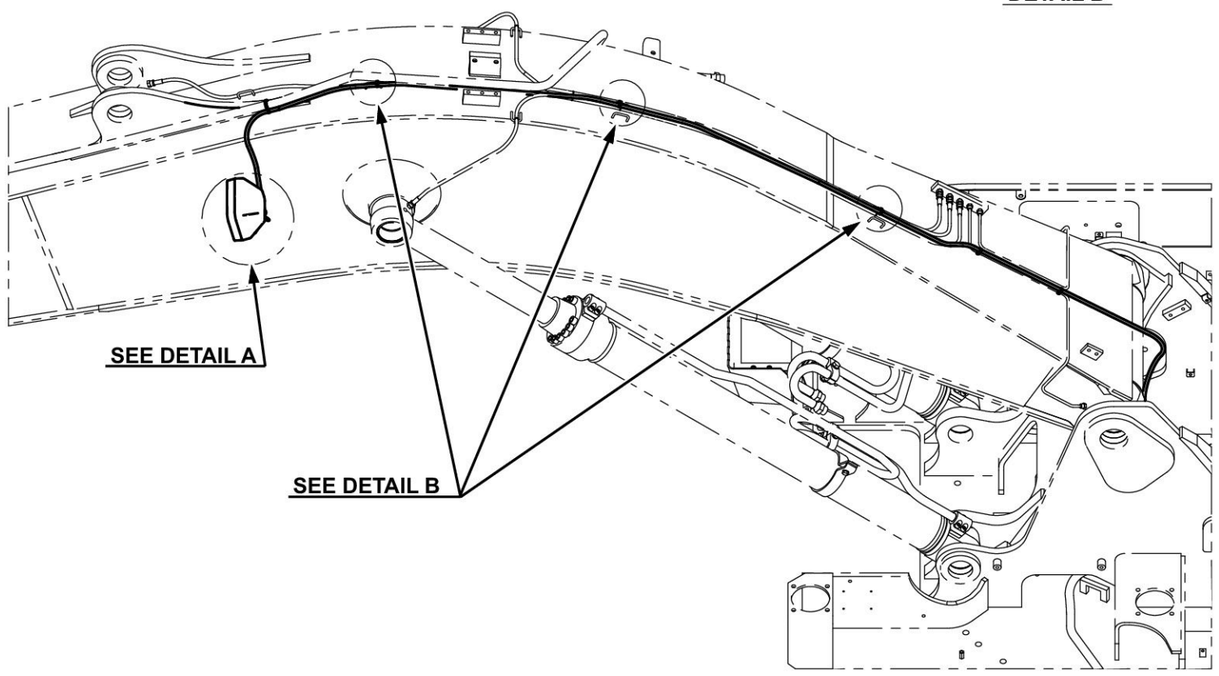
DETAIL A



DETAIL B



C~

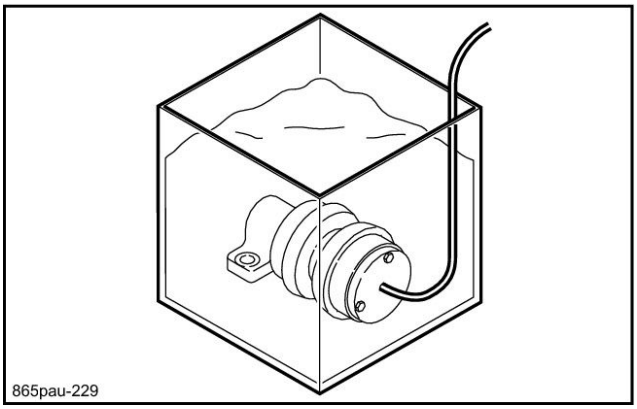


KRR19320-B00

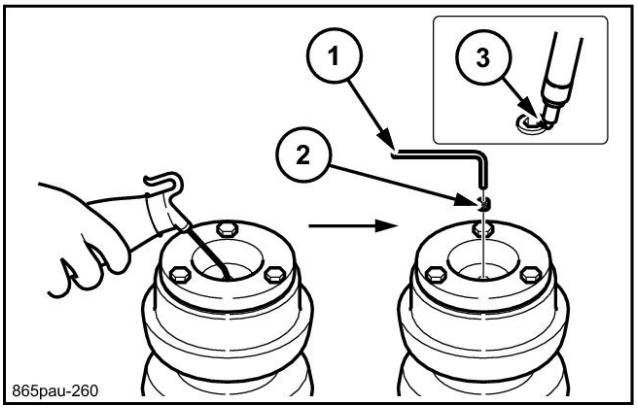
2F65F92E

84577150 - February 2012

13. Inject compressed air [0.2 MPa (29.011 psi)] from the oil fill port and immerse in water to check that there are no leaks.

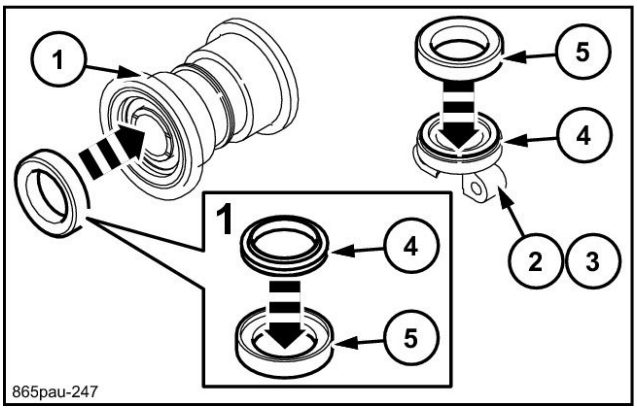


14. Inject engine oil (50 - 55 cc) into the roller. After filling the engine oil, use a hexagon wrench (1) to tighten the plug (2) (coated with seal nylon).
After tightening the bolts, mark them (3).
    - To reuse a plug, wrap it with seal tape.
      Plug (2) tightening torque: 24.5 N· m (18.073 lbf· ft)

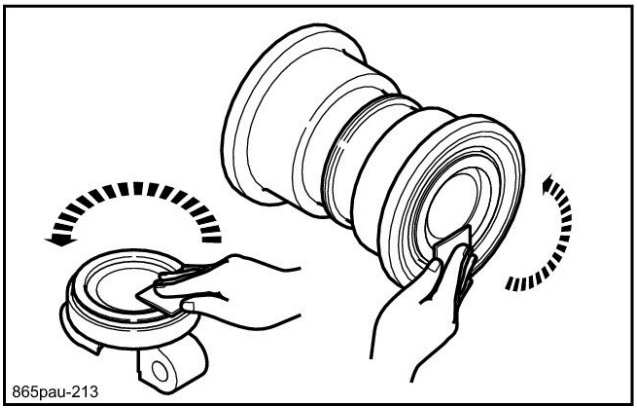


This completes the assembly.

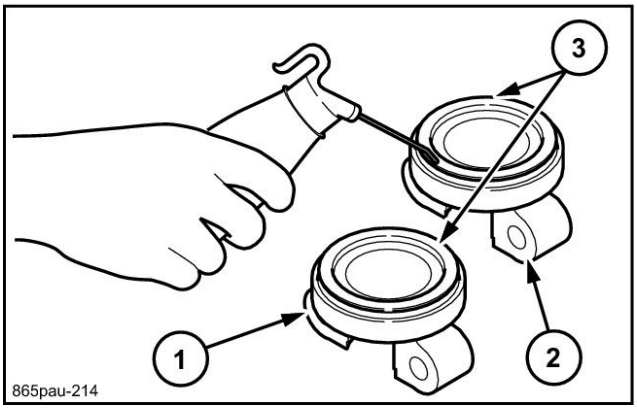
4. Use jig C (5) to push the floating seal (4) into the collars (2) (3) and roller (1) by hand.



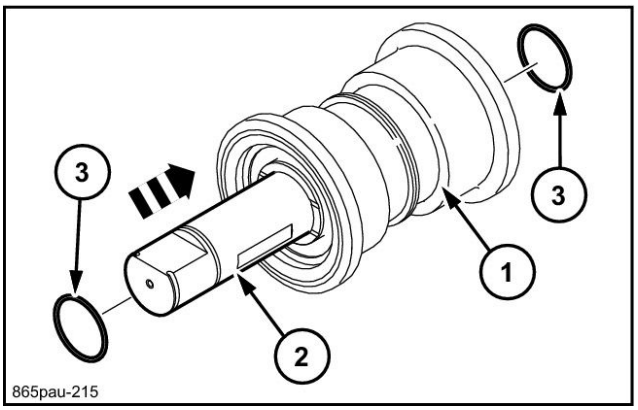
5. Use a special fiber cloth to wipe the surfaces of the floating seals so as to increase adhesion and prevent dust from entering.



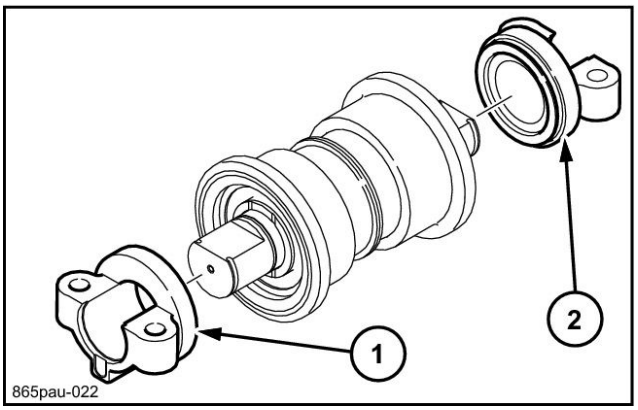
6. Apply gear oil to the floating seals (3) on the collars (1) (2).



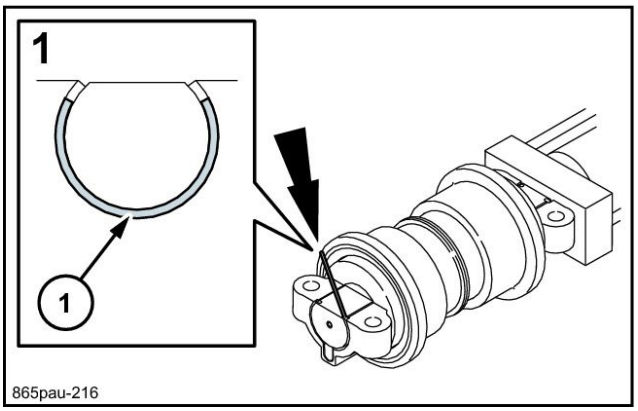
7. Attach O-rings (3) to the shaft (2) and mount into the roller (1).



8. Install the collars (1) (2) on both sides.



9. Attach the wire clip (1).
   - When attaching the wire clip, secure the roller main unit so that it does not roll.



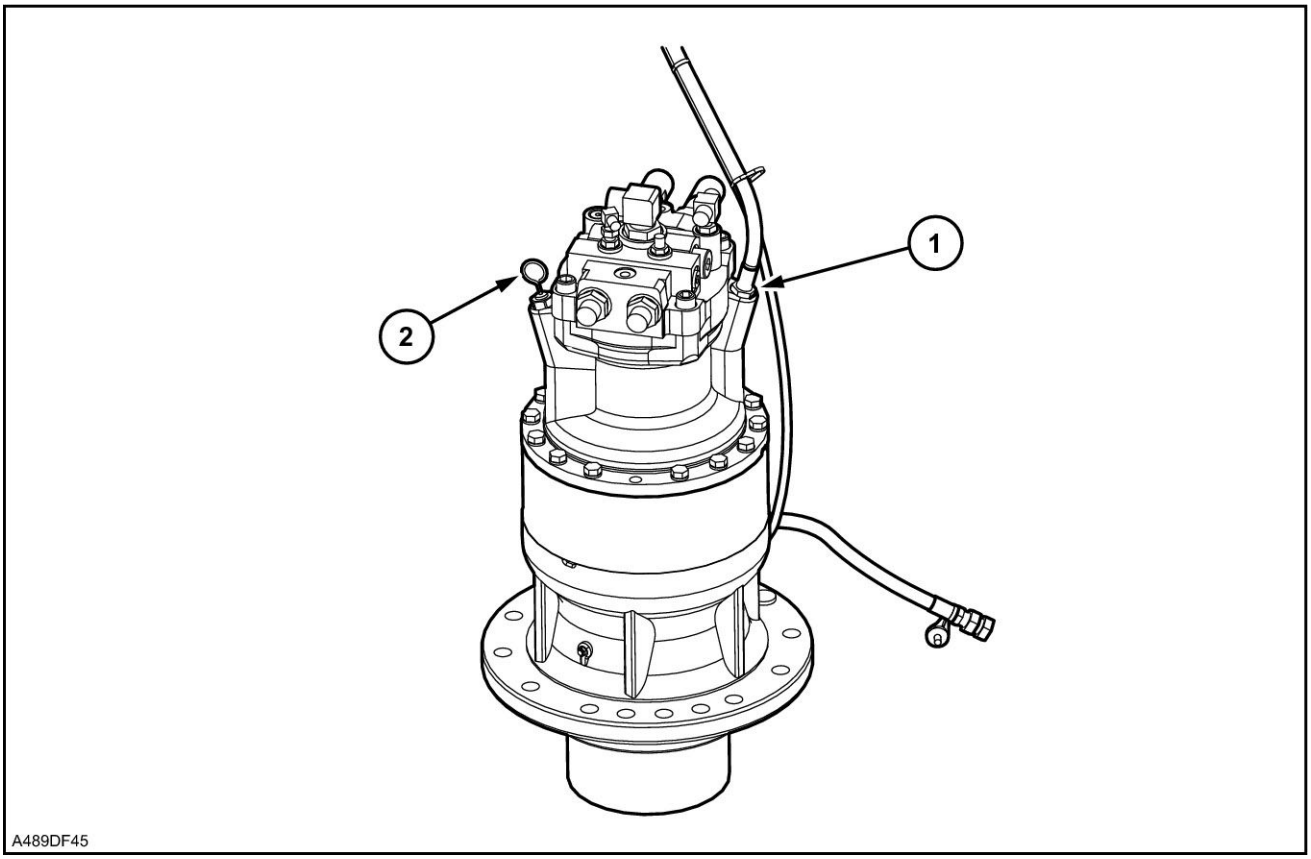
Applicable part	Inspection and measurement location	Permissible limit value	Repair, solution procedure
Flange (1-1)	2-speed piston hole inner diameter and piston assembly outer diameter	Gap 0.040 mm (0.001574 in)	Replace using the flange kit.
	2-speed piston hole inner diameter	1.2 a degree of roughness Or the surface is rough or there is scratching at least 0.02 mm (0.00078 in) deep.	
Thrust plate (26)	Thickness	Plate thickness 3.3 mm (0.1299 in) Plate thickness 2.5 mm (0.0984 in) Plate thickness 2.9 mm (0.1141 in) Plate thickness 2.0 mm (0.0787 in) Plate thickness 2.7 mm (0.1062 in) Or there is deep scratching on the sliding surface.	Replace the thrust plate.
Angular bearing (3)	Ball rotation surfaces	Flaking is occurring.	Replace the angular bearing.
	Operation	Abnormal noise or unsmooth rotation occurs with rotation.	
Floating seal (2)	Sliding surface	There is deep scratching that may cause oil leaking.	Replace the floating seal. When doing more disassembly beyond this, because oil leaking may occur due to the seal ring slide imprints not matching up of reused seals when reassembly is done, replace these seals before reassembly.
	O-ring	Cracking is occurring on the surface.	
Each O-ring		During disassembly	Replace each O-ring.

3. Relief valve troubleshooting

Trouble phenomenon	Suggested cause	Countermeasure and solution
The motor does not rotate or motor rotation is slow.	There is foreign matter caught between the poppet seat and poppet on the relief valve, which is causing seating problems, and high-pressure oil is leaking to the low-pressure side.	Perform disassembly and remove foreign matter. Perform reassembly after cleaning parts.
	The relief valve spring is damaged and high-pressure oil is leaking to the low-pressure side.	Replace the relief valve. Disassemble the motor and reassemble it after cleaning each part.
	The relief valve spring is worn and the set pressure is decreased, which causes the relief to operate at low pressure.	Replace the relief valve.
	There is foreign matter caught in the seat section of the free piston and base plate of the relief valve and the set pressure has decreased.	Remove the relief valve and remove foreign matter.
	There is foreign matter clogging the orifice set in the poppet of the relief valve, and the set pressure has decreased.	Remove the relief valve and remove foreign matter.
The motor does not stop or stopping is slow.	There is foreign matter caught between the poppet seat and poppet on the relief valve, which is causing seating problems, and the relief valve does not close.	Perform disassembly and remove foreign matter. Perform reassembly after cleaning parts.
	The relief valve spring is damaged and the relief does not close.	Replace the relief valve. Disassemble the motor and reassemble it after cleaning each part.
	The relief valve spring is worn and the set pressure has decreased, which has caused the brake force to decrease.	Replace the relief valve.
	There is foreign matter caught in the seat section of the free piston and base plate of the relief valve, and the set pressure and brake force have decreased.	Remove the relief valve and remove foreign matter.
	There is foreign matter clogging the orifice set in the poppet of the relief valve, and the set pressure and brake force have decreased.	Remove the relief valve and remove foreign matter.
Shock at stopping is high	There is foreign matter caught in the sliding section of the poppet and the poppet is not moving.	Replace the relief valve.
	There is foreign matter caught in the free piston and the piston is not moving.	Remove the relief valve and reassemble after removing foreign matter.
	The relief set pressure is too high.	Replace the relief valve.

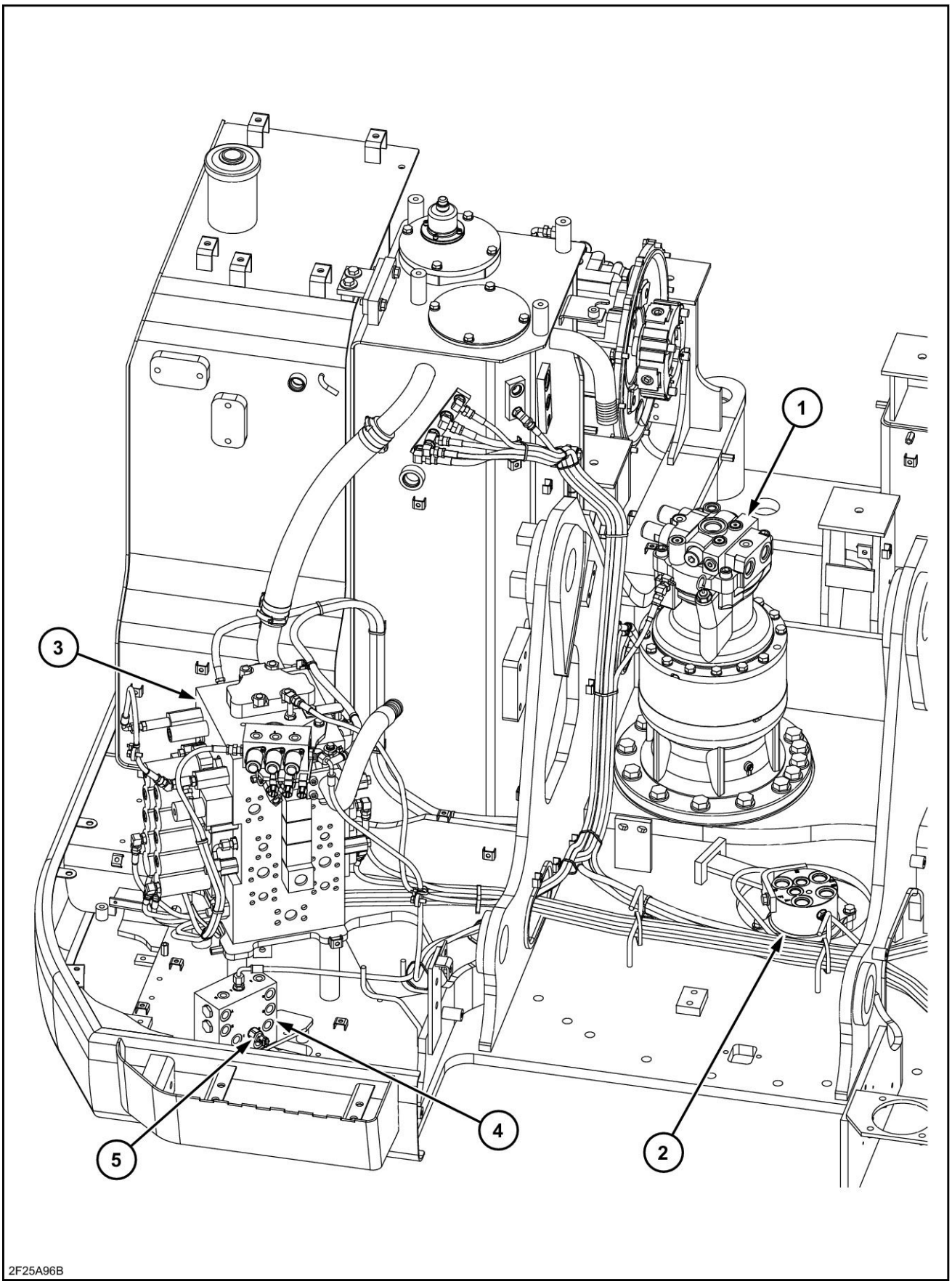
Installation of Swing Unit

1. To install, perform the reverse of the removal procedure.
   When installing the swing unit, be careful with the position of the knock pin.
   The tightening torque for the bolts for installing the swing unit on the swing frame is 539.4 - 629.6 N· m (397.910 - 464.448 lbf· ft).
2. Before driving, be sure to fill the inside of the motor casing with hydraulic oil from the oil fill port (1).
   Use the level gauge (2) to check that gear oil for the reduction gear is filled to the stipulated volume.



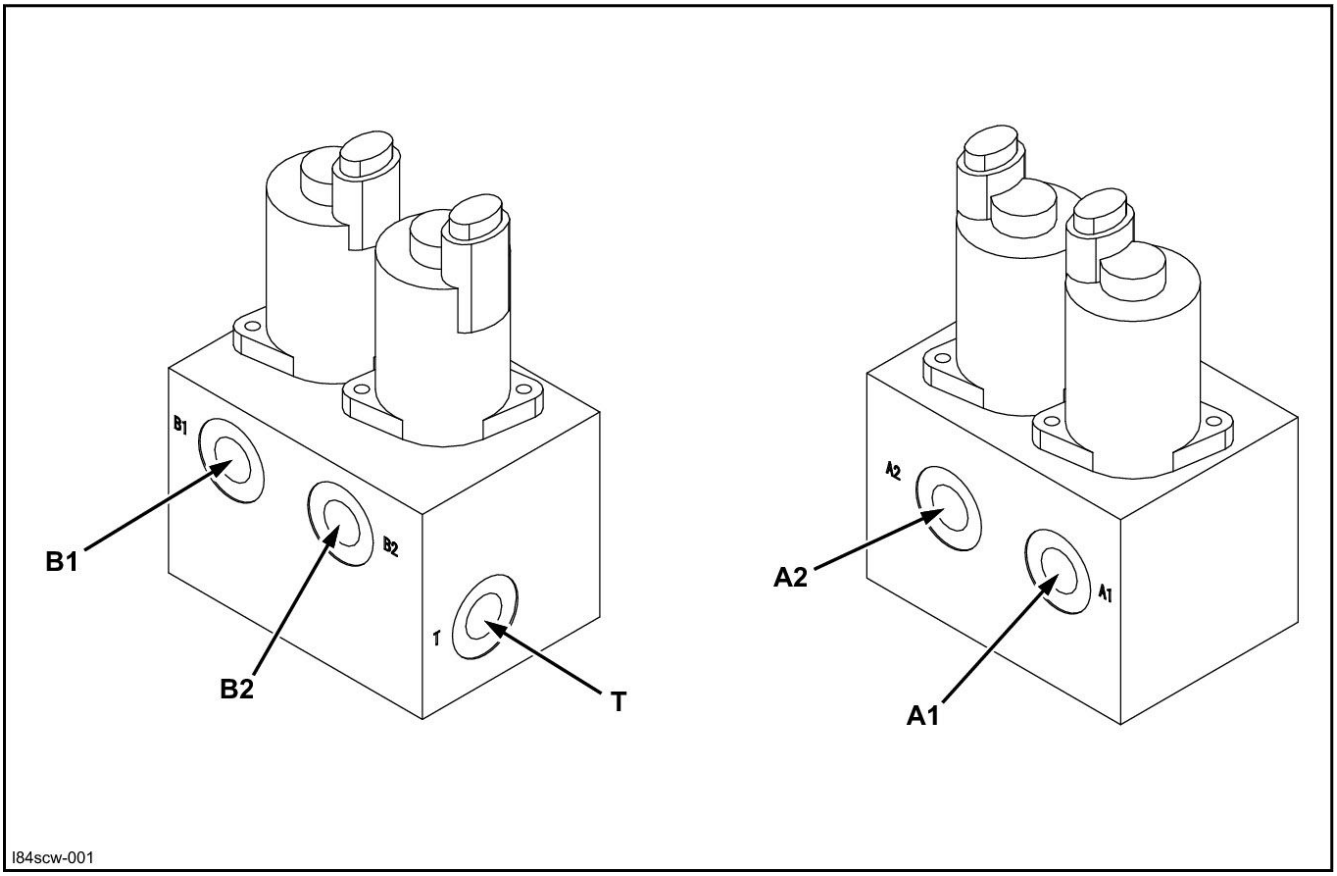
Overall view

SWING BODY CENTER SECTION HYDRAULIC EQUIPMENT



Port Diagram

2 Stack Solenoid Valve



B port side

A port side

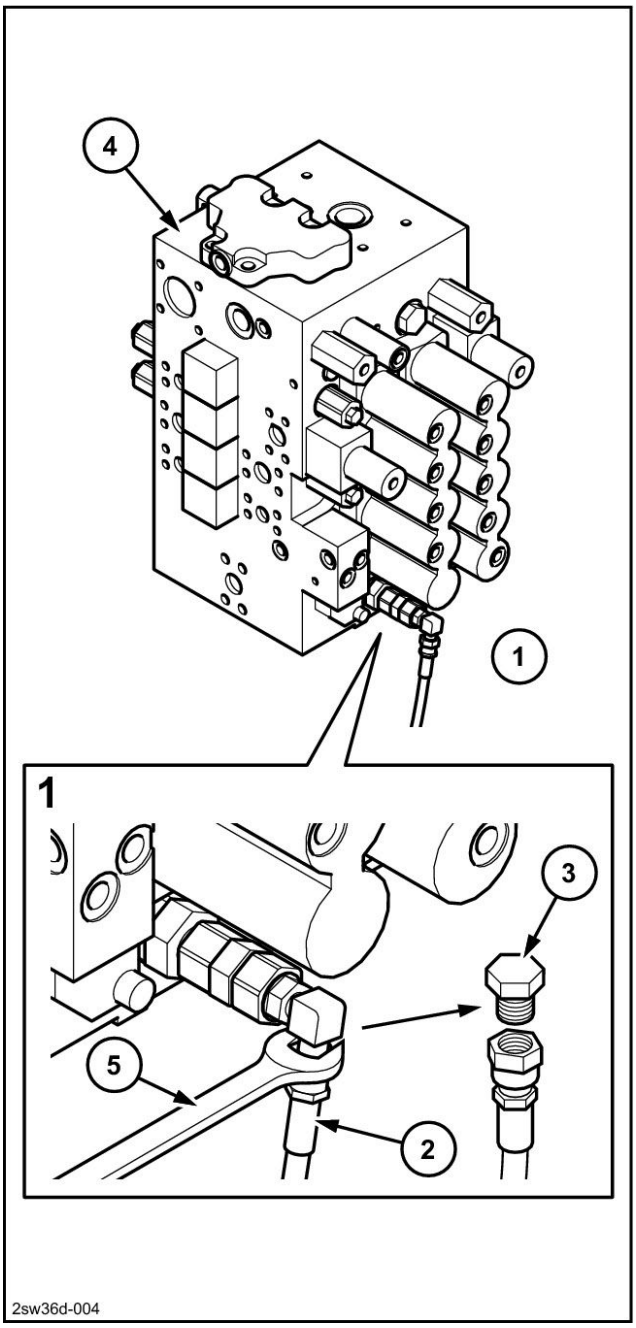
Port	Port size
A1	G1/4
B1	G1/4
A2	G1/4
B2	G1/4
T	G1/4

Main relief pressure adjustment

Engine speed	2000 min^{-1} (2000 rpm)
Work mode	SP mode
Lever operation	Arm-in relief
Oil temperature	45 (113.0) - 55 °C (131.0 °F)
Measuring port	P1 port
Measurement pressure	Boosted pressure:36.8 MPa (5337.98 psi)
	Standard:34.3 MPa (4975.34 psi)

Pressure per rotation of adjusting screw	Boosted pressure: 28.4 MPa (4119.52 psi)/rotation
	Standard: 21.3 MPa (3089.64 psi)/rotation

Before adjusting, remove the pilot hose for the pressure boost signal (2) connected to the main relief valve (1), then insert the plug (3) into the hose side.
The procedures for boosted pressure and standard pressure are different.

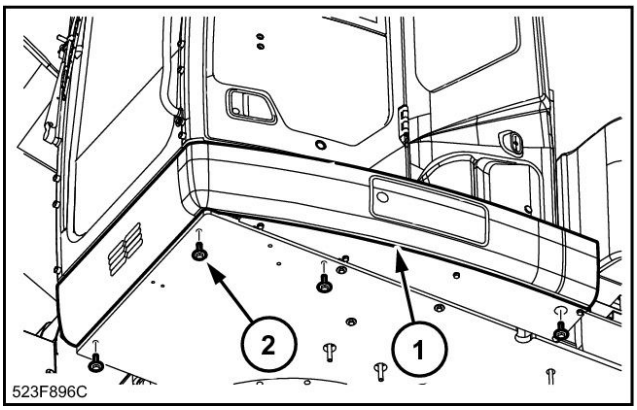


4	Control valve
5	Wrench [19 mm (0.748 in)]

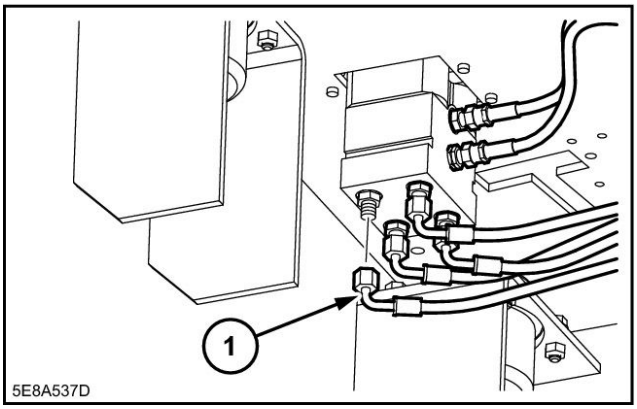
84577150 - February 2012

84577150 - February 2012

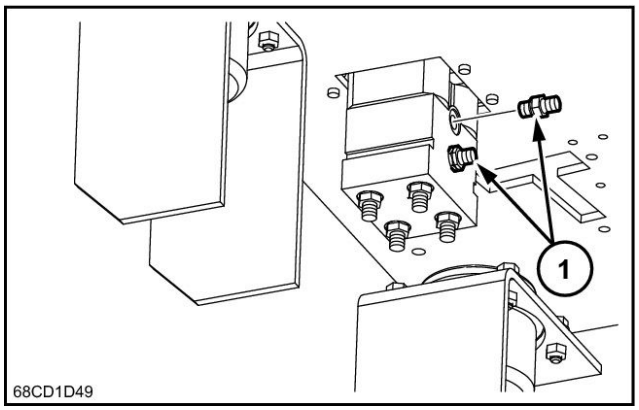
4. Use a wrench [17 mm (0.669 in)] to remove the 4 bolts (2), and then remove the side cover (1).



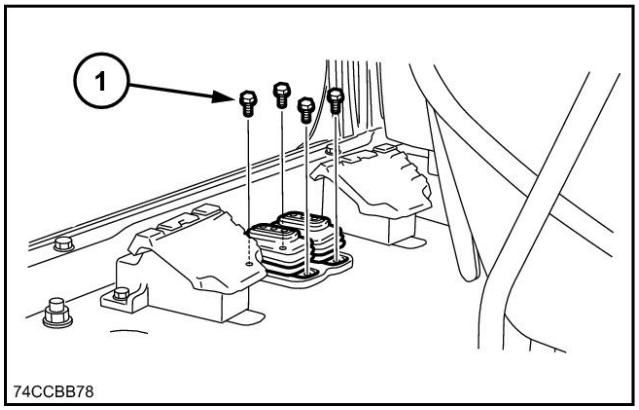
5. Use a wrench [19 mm (0.748 in)] to remove the 6 hoses (1).
   - Mark the valve and hoses so that the connectors match at the time of assembly.
   - Install caps or plugs to the valve and hoses to prevent any entry of water, dust or dirt.
   - Clean the valve and hoses by spraying with a parts cleaner to prevent scratches and prevent dirt from accumulating on the connectors.



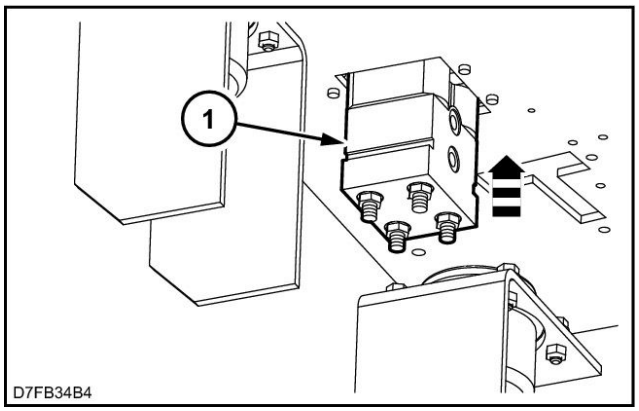
6. Use a wrench [19 mm (0.748 in)] to remove the 2 hose adapters (1).

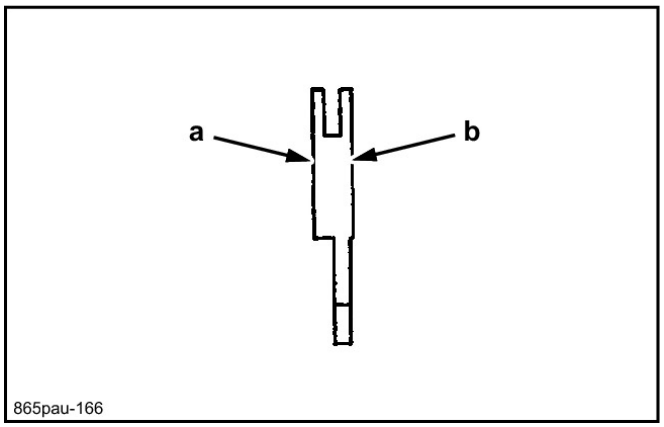


7. Use a wrench [17 mm (0.669 in)] to remove the 2 bolts (1) on both the left and right sides of the travel lever.



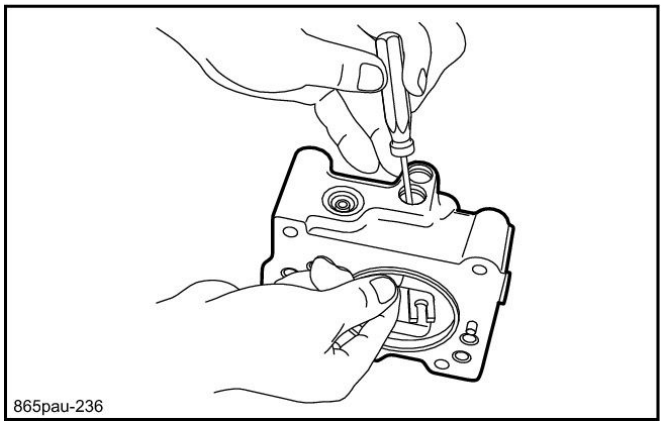
8. Pull up the travel remote control valve (1) into the cab, and then remove the travel remote control valve.



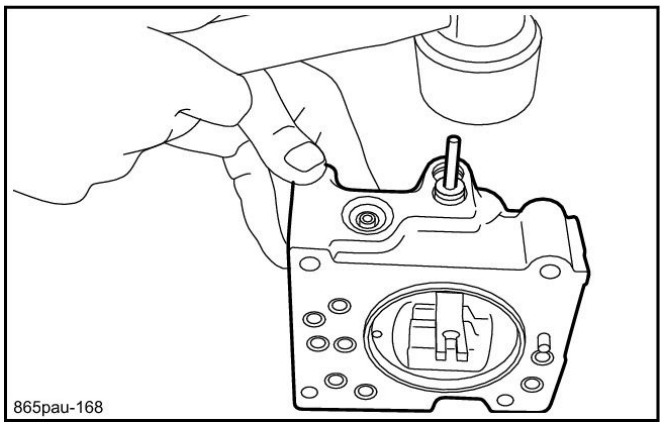


a	Lever (1) side
b	Lever (2) side (Fulcrum plug, adjusting plug side)

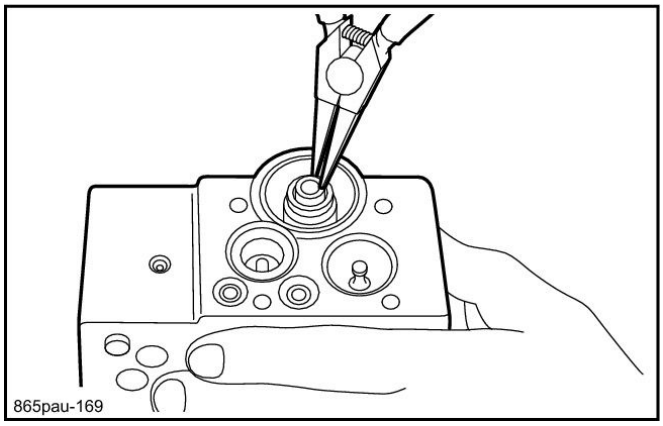
5. Install the pilot piston (643) into the flow control hole on the casing.
   - Check that the pilot piston slides smoothly without catching.
6. Insert the pin press fit in lever 2 (613) into the groove on the pilot piston, and assemble lever 2.



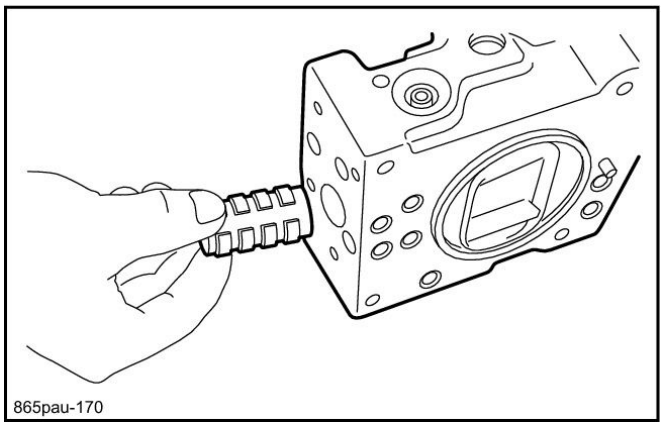
7. Assemble the fulcrum plug (614) and install the locking ring (858) so that the pins press fit in the fulcrum plug are inserted into the pin holes on lever 2.



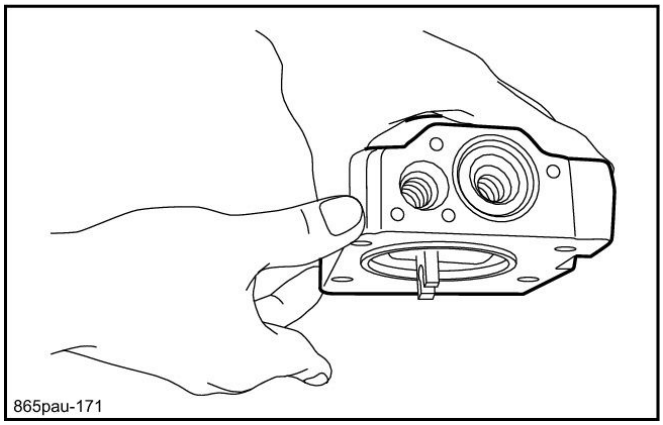
8. Insert the adjusting plug (615), and install the locking ring.
   - Be careful to insert the fulcrum plug and adjusting plug into the correct openings.
   - At this time, check that the backlash from the movement of the feedback lever is not too great and that the feedback lever does not catch on anything.
9. Install the return spring (654) and spring seating (653) into the spool hole, and install the stop ring (814).



10. Assemble the set spring (655) into the spool hole, assemble the compensation piston (621) and piston case (622) into the compensation hole, install the pilot cover (641), and tighten the hexagon socket head bolts (436, 438).



11. Install the spring seating (644), pilot spring (646), and adjusting ring (645) into the pilot hole, and install the spring seating (624), inner spring (626), and outer spring (625) into the compensation hole.
    - Be careful to install the spring seating in the correct direction.



(KR3K-9Y04-HV)
Front side regulator

(KR3K-9X04-HV)
Rear side regulator

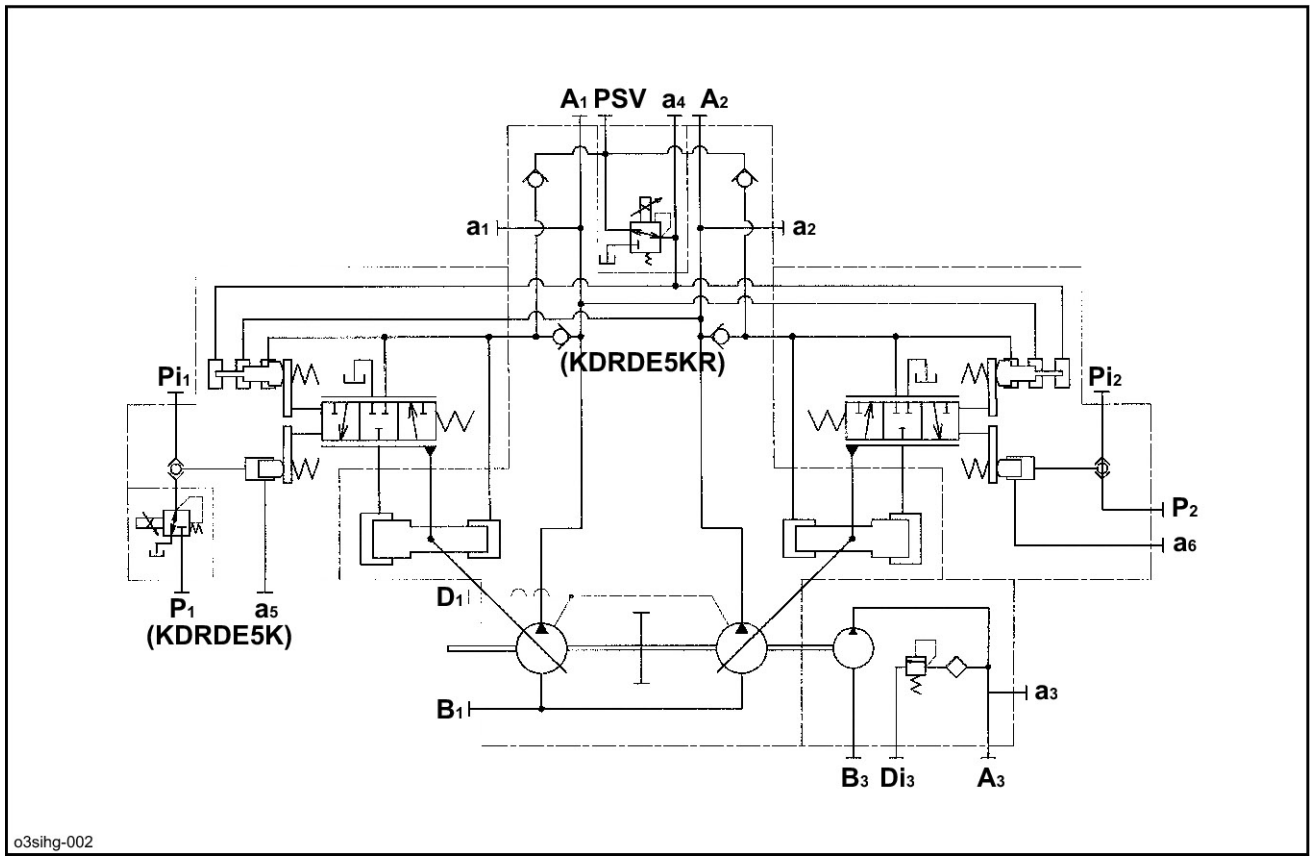
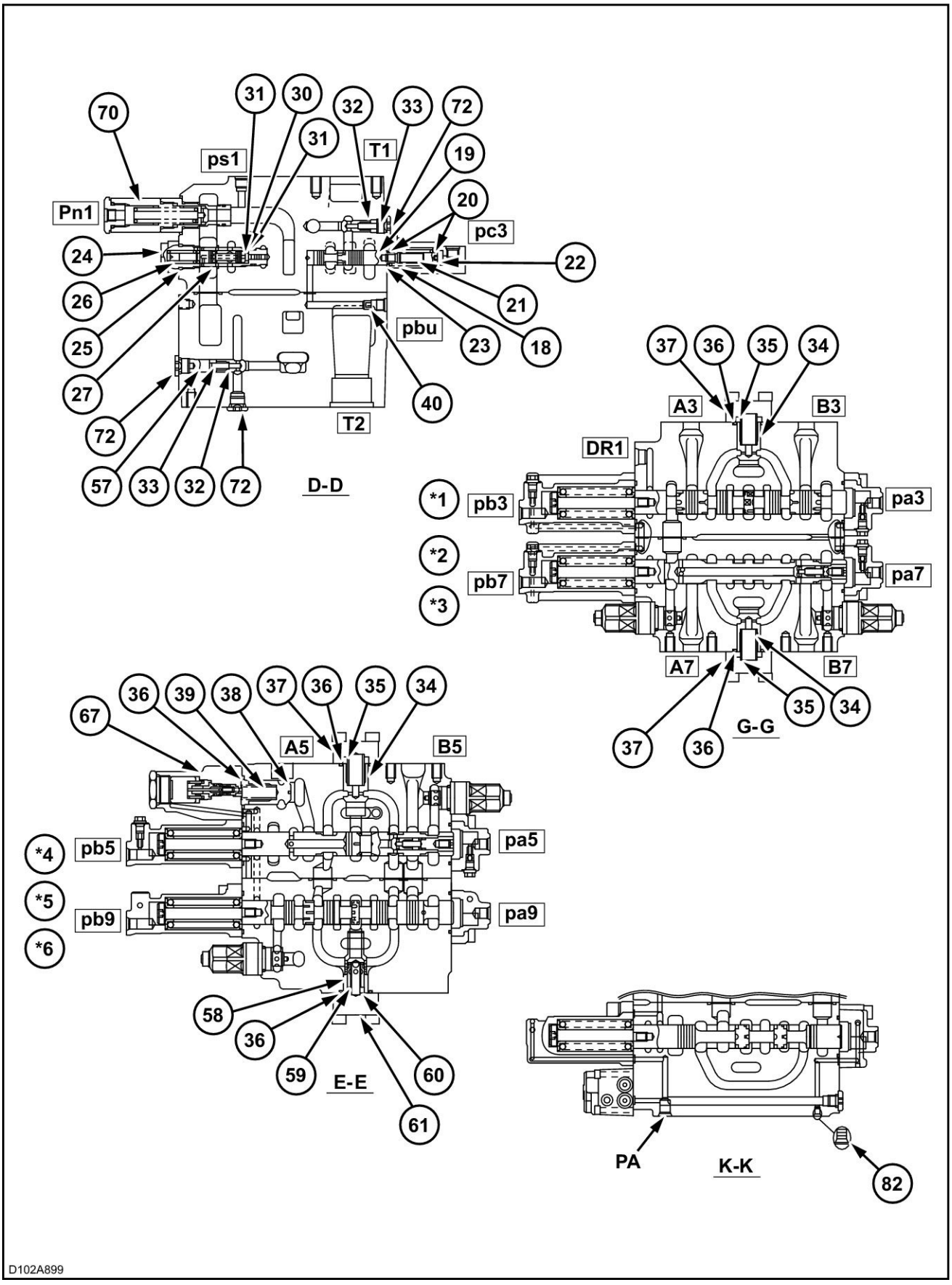


Diagram 1. Regulator operation explanation diagram



*1	SWING	*3	BUCKET	*5	OUT Û IN
*2	OPEN Û CLOSE	*4	ARM 1	*6	ARM 2

Procedures for Operation/Assembly and Disassembly of Hydraulic Cylinder (made by KYB)

Maintenance Inspection and Service

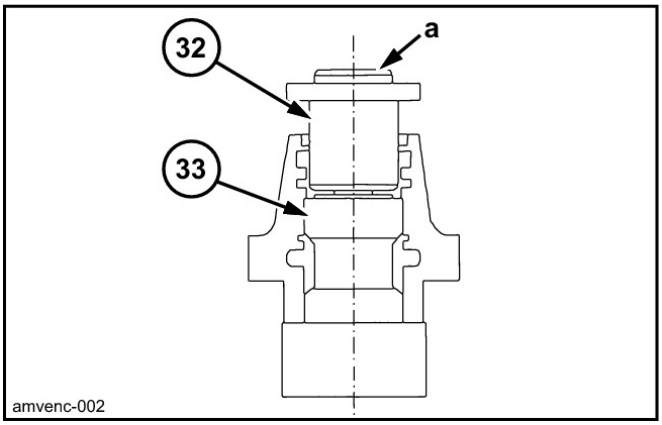
In order to ensure that hydraulic cylinders function properly for a long time, periodically carry out maintenance inspection and service based on the "Autonomous inspection table". Repair any trouble locations quickly based on the Trouble Diagnostics.

> ⚠ **CAUTION**
>
> **For periodic inspection and service, first work to prevent any hazard to operators. Strive to prevent hazards by working with an attitude based on good sense.**

Inspection and service location	Inspection and service detail	Daily	Monthly	Yearly	Remarks
Appearance	Is the cylinder clean (especially rod sliding sections)?	○			
	Is any oil leaking from line installation sections or other fixed sections?		○		
	Is there missing or peeling paint or rust?	○			
Operation	Is operation smooth and free of abnormal noise and any other abnormality?	○			
	Is the responsiveness good?	○			
	Is any oil leaking from sliding sections?	○			
	Are there internal leaks?			○	
	Is the operating pressure normal?		○		
	Is the overload relief valve set pressure normal?		○		
Hydraulic oil	Is hydraulic oil dirty or deteriorated?		○		
	Is hydraulic oil replaced periodically?			○	
	Are filters inspected periodically?		○		
Section for installation with main unit	Is the supply of grease to pins adequate?		○		
	Do pin sections have any abnormal noises or seizing?	○			
	Do pin sections have any backlash or wear?	○			
	Are pin seals normal?		○		
	Are any installation screws loose or fallen out?	○			
	Retighten installation screws.			○	
Piston rod section	Are sliding sections worn?			○	When leaving piston rod sliding sections exposed for long periods, apply anti-rust oil to the piston rod.
	Are sliding sections scratched or dented?	○			
	Is sliding section plating peeling off?	○			
	Are sliding sections bent?		○		
	Are there any welding section cracks or damage?	○			
Cylinder tube section (including line sections)	Are there any loose bolts or nuts (screws)?	○			
	Retighten installation screws (bolts and nuts (screws)).			○	
	Are there any welding section cracks or damage?	○			
	Are there large dents on the tube?	○			

Disassembly of Bushing

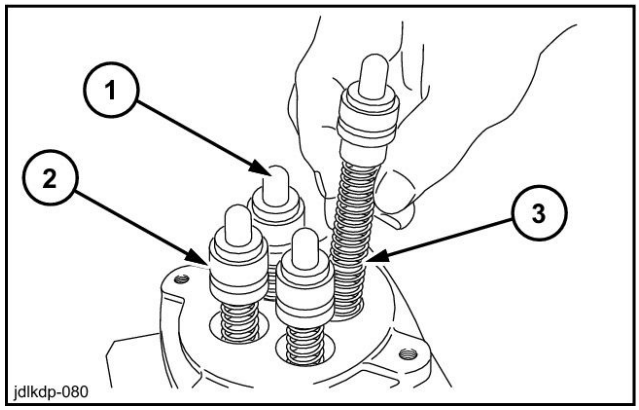
1. Raise the snap ring (28) with a screwdriver, and then remove it from the cylinder head.
2. For the bushing (33), use the bushing removal jig (32) as in the diagram on the right and press out the bushing with a press.



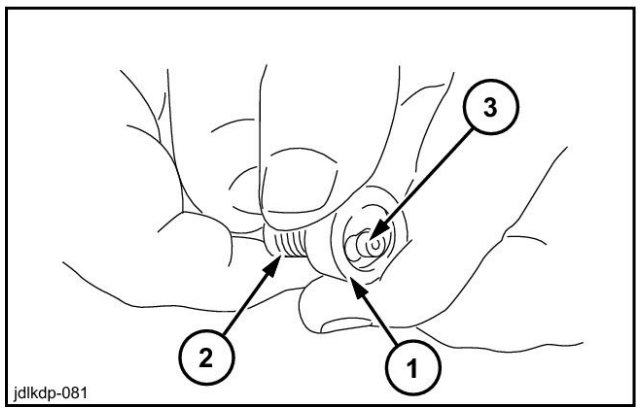
31	Bushing

a	Press with the press.

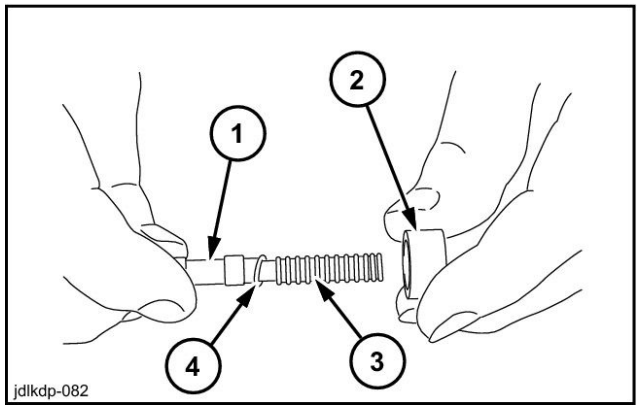
7. Remove the push rods (1), plugs (2), pressure reducing valve assembly, and the return springs (3) from the casing.
   - Record the relation of parts to the casing hole positions through marking, etc.



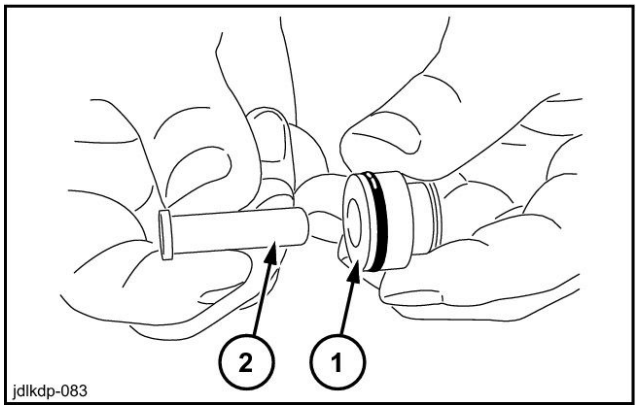
8. For disassembly of pressure reducing valve, press in the spring seating (1), move the spring seating to the side while bending the secondary pressure spring (2), and remove the spring from the spools (3) by passing through the larger hole.
   - Do not press in the spring seating by 6 mm (0.236 in) or more.



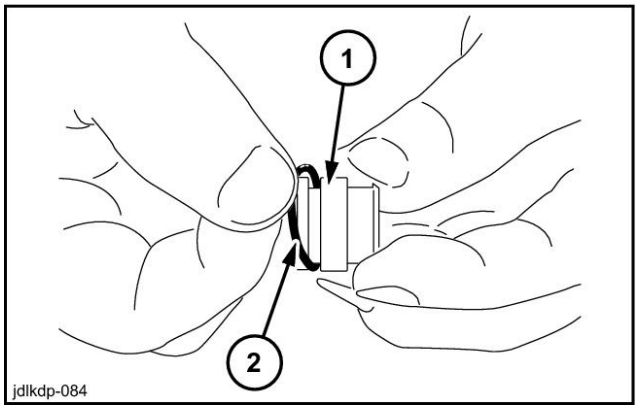
9. Separate the spool (1), spring seating (2), secondary pressure spring (3), and washer (4).
   - Be careful not to scratch the surface of the spools.
   - Handle as an assembly until assembly is performed.



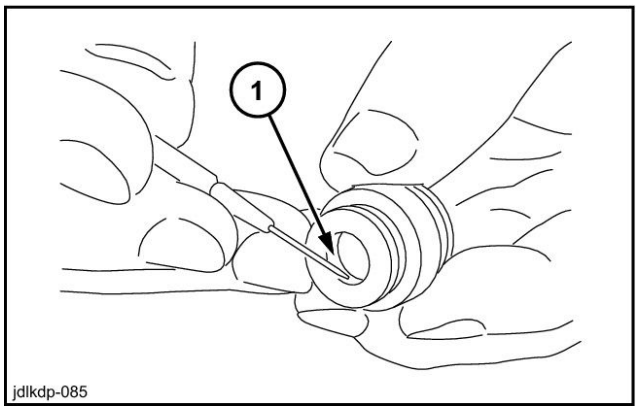
10. Remove push rods (2) from the plugs (1).



11. Remove the O-rings (2) from the plugs (1).
    - The O-ring cannot be reused.
      Replace it with new part.

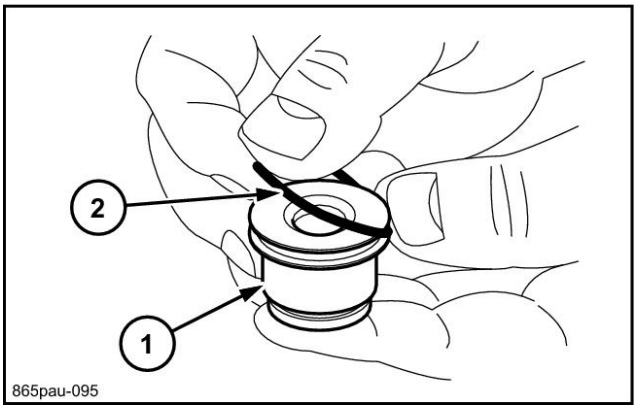


12. Remove the seal (1).
    Use a small flathead screwdriver, etc. to remove seals.
    - The seal cannot be reused.
      Replace it with new part.

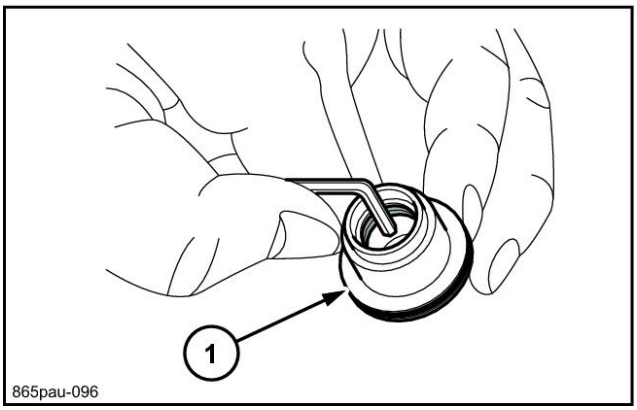


13. Cleaning parts
    Clean all parts by placing them in a rough cleaning container filled with white kerosene. (rough cleaning)
    Clean each part by placing it in a finish cleaning container filled with white kerosene, and thoroughly clean each part, including the interior, while slowly rotating the part. (finish cleaning)
    Use a clean rag to thoroughly remove any white kerosene stuck to parts.

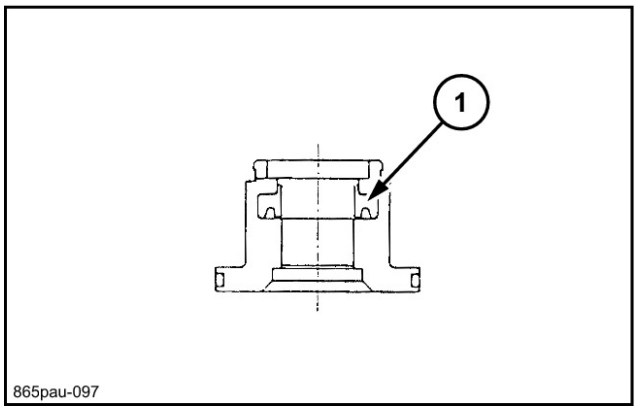
11. Install O-rings (2) on the plugs (1).



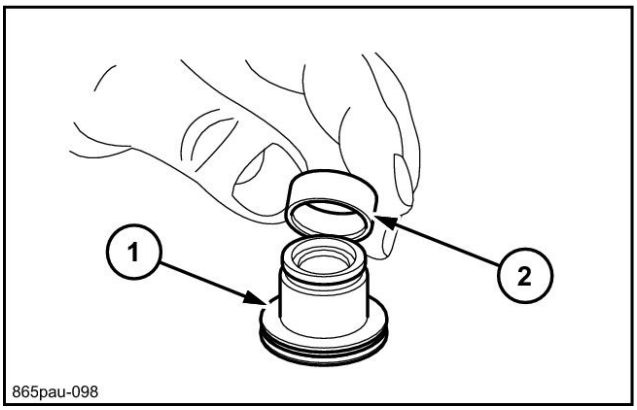
12. Install NHU packings into the plugs (1).



- When installing the NHU packings (1), be careful of the installation direction. (See the diagram.) Before installing NHU packings, apply a thin layer of grease.

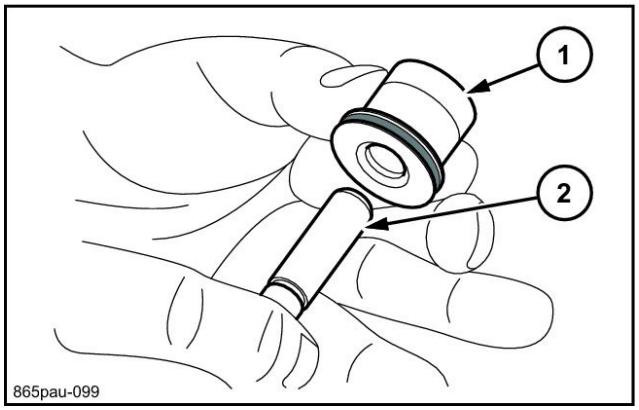


13. Install grease cups (2) into the plugs (1).

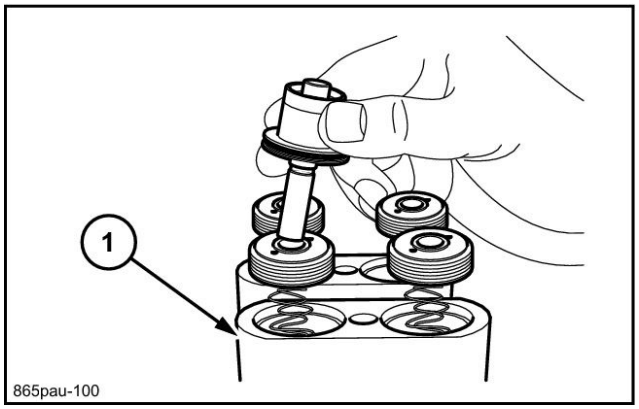


14. Install push rods (2) into the plugs (1).

- Before installing push rods, apply hydraulic oil to the rod surfaces.
  Do not press the rods in strongly, as this may damage the NHU packing lip sections.

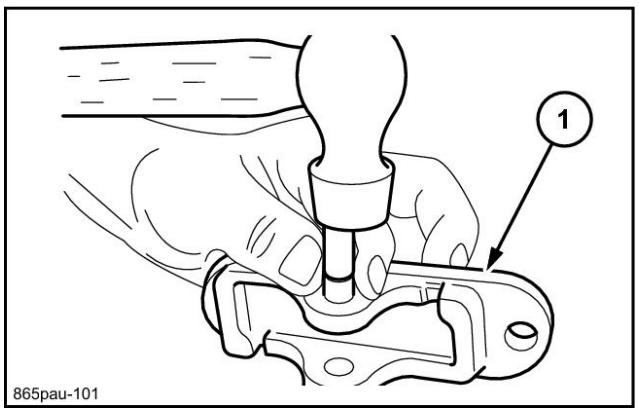


15. Install the push rod subassemblies assembled in steps 11), 12), 13), 14) above into the casing (1).



16. Use special tool 1 on the covers (1) to press down the bushings, and lightly strike the bushings with a hammer to press fit them.

- Be careful that the ends of the bushings do not stick out from within the cover.



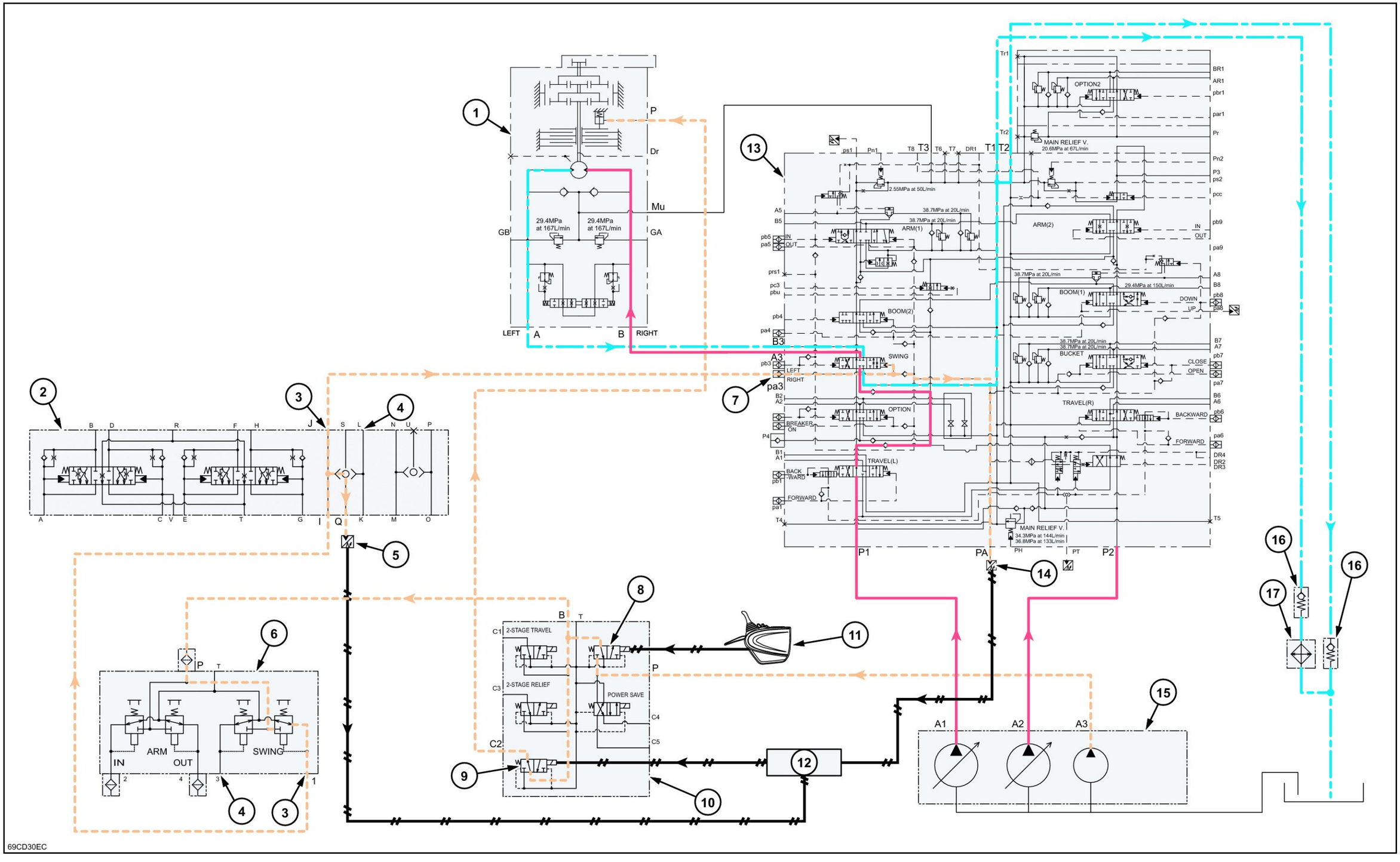
17. Install the covers (1) on the casing (2).

- Install them in the positions they were in before disassembly.
- Be careful of the cover rising up due to the damping springs.

Assembly and Disassembly of Center Joint

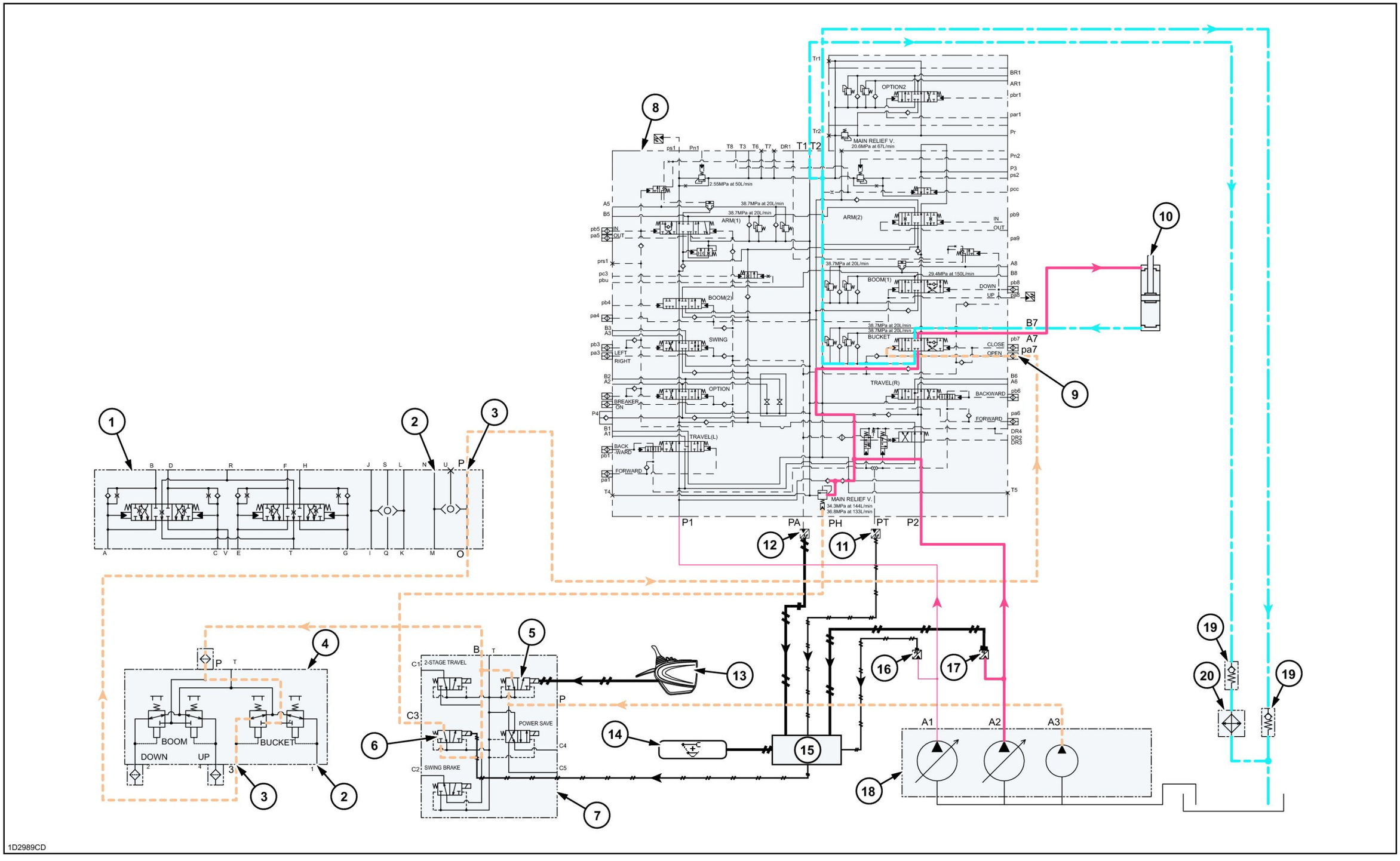
Code	Part name	Q'ty	Code	Part name	Q'ty
1	Inner race	1	23	Snap ring	1
2	Oil seal	1	24	Cylinder	1
3	Tapered roller bearing	1	25	Housing	1
4	Receiving spring	1	26	Collar	1
5	Cam plate	1	27	Snap ring	1
6	Return plate	1	28	Bypass valve assembly	2
7	Piston assembly	9	29	Backup ring	2
8	Friction plate	3	30	O-ring	4
9	Partner plate	3	31	O-ring	2
10	O-ring	1	32	Cover	1
11	Piston	1	33	Cap	1
12	O-ring	2	34	Relief assembly	2
13	Spring	20	35	O-ring	4
14	Piston	2	36	Hexagon socket head bolt	4
15	Parallel pin	3	37	Check valve	2
16	O-ring	3	38	Spring	2
17	Cap	2	39	Cap	2
18	Scrowave spring	4	40	Backup ring	2
19	Teflon ring	4	41	Level gauge assembly	1
20	Bushing	4	42	O-ring	1
21	Balance plate	1	43	Cap	1
22	Needle bearing	1			

Swing parking circuit (brake release)

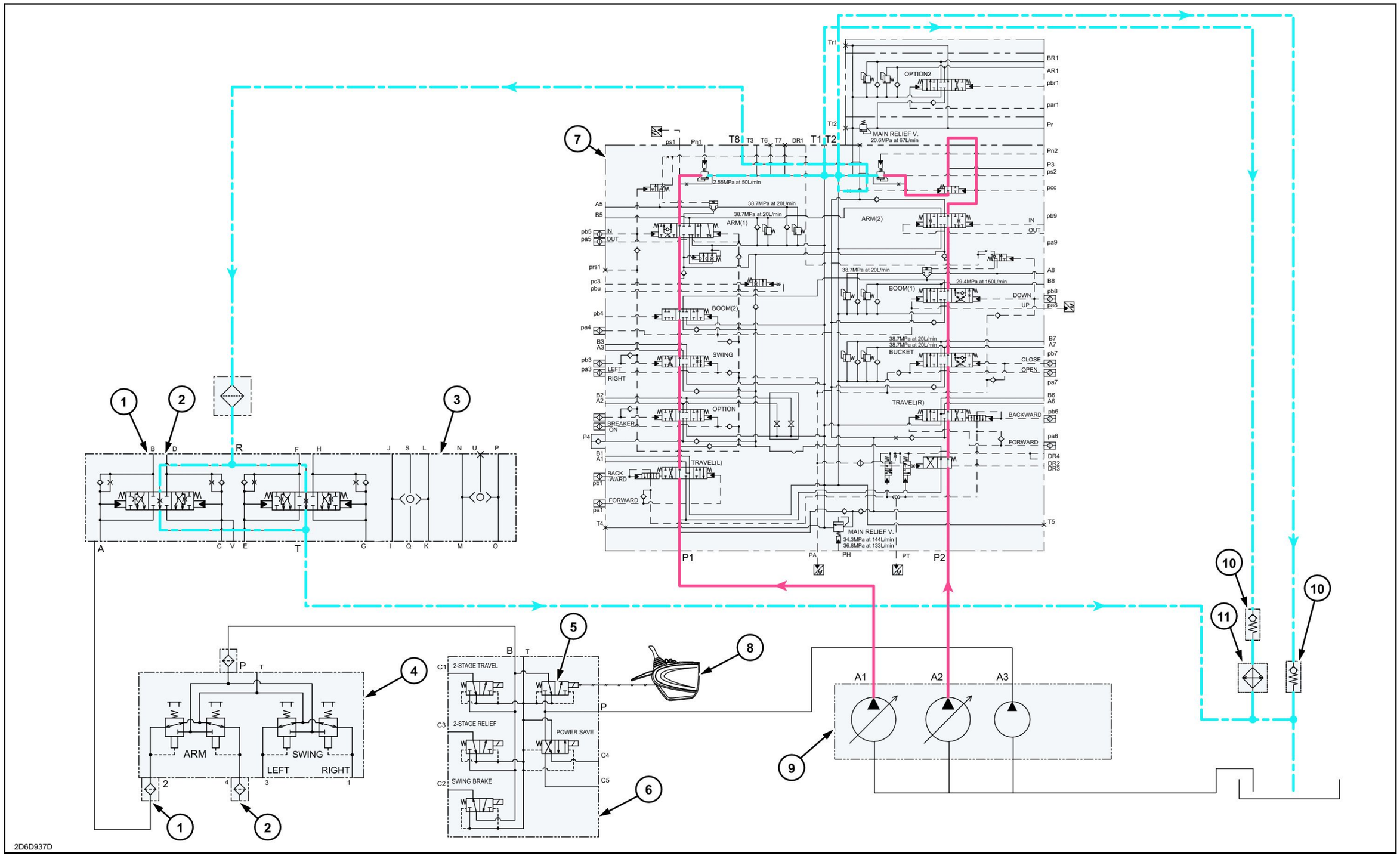


Bucket Circuit

Bucket-open circuit



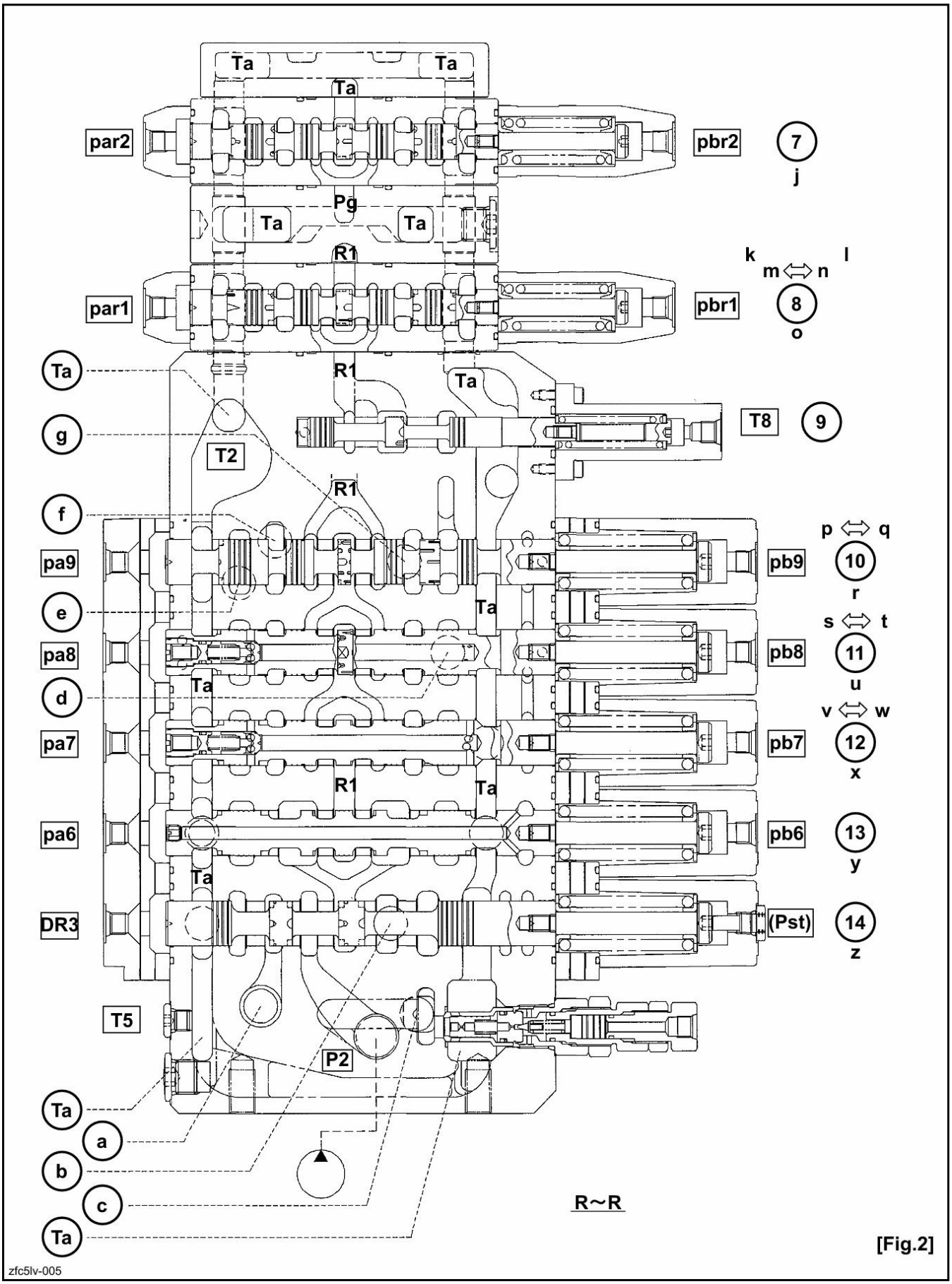
Heat circuit (lever in neutral)



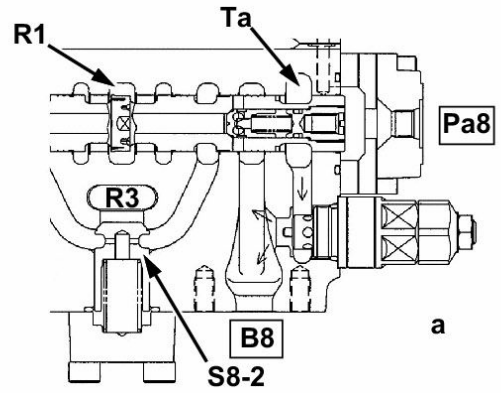
84577150 - February 2012

84577150 - February 2012

84577150 - February 2012


Ta
Ta
Ta
par2
pbr2
7
j
Pg
Ta
Ta
R1
k
m ⇔ n
l
par1
pbr1
8
o
Ta
R1
Ta
g
T2
T8
9
R1
f
p ⇔ q
pa9
pb9
10
r
Ta
e
s ⇔ t
pa8
pb8
11
u
Ta
d
v ⇔ w
pa7
pb7
12
x
R1
Ta
pa6
pb6
13
y
Ta
DR3
(Pst)
14
z
T5
P2
Ta
a
b
c
Ta
R~R
[Fig.2]
zfc5lv-005

2) Overload relief valve [Fig. 18]
There is an overload relief valve at the boom 1, arm 1, bucket, and add-on cylinder ports to prevent any abnormal rise in actuator pressure, for example due to an external force.
This relief valve is also equipped with a function for preventing cavitation (suction function) by taking in oil from the tank when the cylinder port pressure becomes negative pressure.



zfc5lv-050

[Fig.18]

a	Suction function Operating

84577150 - February 2012
8030E-2

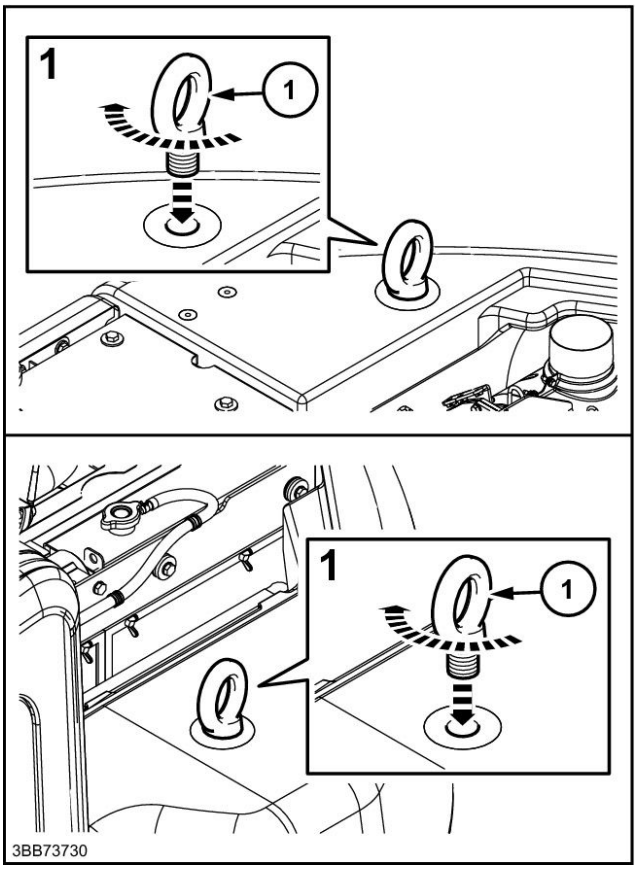
Structure and Operation Explanation of Travel Pilot Valve (remote control valve))

Pressure Reduction Valve Section

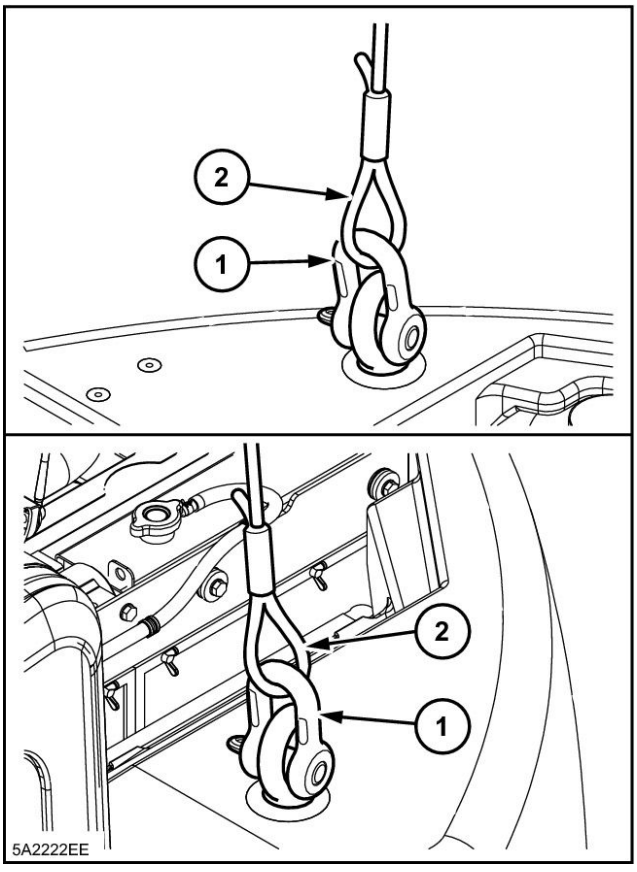
1. For the neutral state
   The spool (301) is pushed up by the return spring (335) via the spring seating (311) and washer 1 (215) and is in the neutral position shown in the assembly cross-section diagram.
   Therefore, since the output port is connected only to port T by the spool switching function, the pressure at output ports 1 and 2 is the same as the pressure at port T.
2. When the remote control valve operation section is tilted from the neutral state
   In the assembly cross-section diagram, when the cam (420) is rotated clockwise, the port 1 side push rod (214) is pushed down, the spool moves down via washer 1, the spring seating, the secondary pressure setting spring (324), washer 2 (217), and washer 3 (313), the port P and port 1 are connected, and the oil fed from the pilot pump flows to port 1 and generates pressure.
   When the port 1 pressure rises to the pressure equivalent to the secondary pressure setting spring force that has been set by tilting the operation section, the hydraulic pressure on the spool and the spring force come into balance and the port 1 output pressure is held constant. The port 2 spool stays in the neutral state and the oil from the control valve is discharged via port T.
   Some specifications are of the type that near the maximum angle of the operation section, a push rod directly touches the spool top section and forcibly pushes in the spool to connect port P and the output port so that they have the same pressure.

Operating Section Damping Mechanism Section

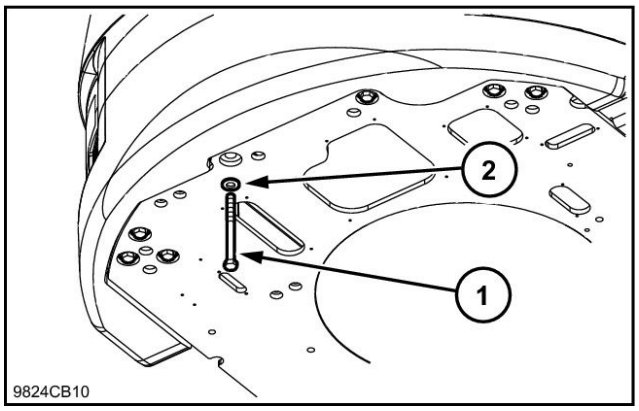
1. For the neutral state
   The push rod is pushed up by the damping springs (333, 337) via the piston (224) and is in the position shown in the assembly cross-section diagram.
2. When the operation section is tilted from the neutral state (See Damping operation explanation diagram (1).)
   In the assembly cross-section diagram, when the cam is rotated clockwise, the port 1-side push rod is pushed down and the piston moves down (2-1).
   At this time, the oil in the damping piston chamber is discharged from the piston metering hole and the pressure generated at this time generates damping force.
   On the other hand, the port 2-side push rod is moved up by the damping spring via the piston.
   At this time, the tank chamber oil is suctioned in through the 3 ball check sections made up of bushings (223) and steel balls (225) and into the damping piston chamber.
   The oil outside the piston chamber drains out from the path that leads from the casing top end section to port T.
3. When the operation section is tilted back from a full tilt (See Damping operation explanation diagram (2).)
   In the assembly cross-section diagram, after the cam is fully tilted clockwise then rotated counter-clockwise, the port 2-side push rod is pushed down and the piston moves down.
   At this time, as described above, the oil in the damping piston chamber is discharged from the piston metering hole and the pressure generated at this time generates damping force (3-1).
   On the other hand, the port 1-side push rod is moved up by the return spring (335) and the damping spring (3-2).
   At the same time, the tank chamber oil is suctioned in through the 3 ball check sections made up of bushings and steel balls and into the damping piston chamber (3-3).
   Also, the oil outside the piston chamber drains out from the path that leads from the casing top end section to the tank port (3-4).
   In other words, the structure is such that damping force works for either tilt operation, from the neutral position to the full tilt position or from the full tilt position to the neutral position.



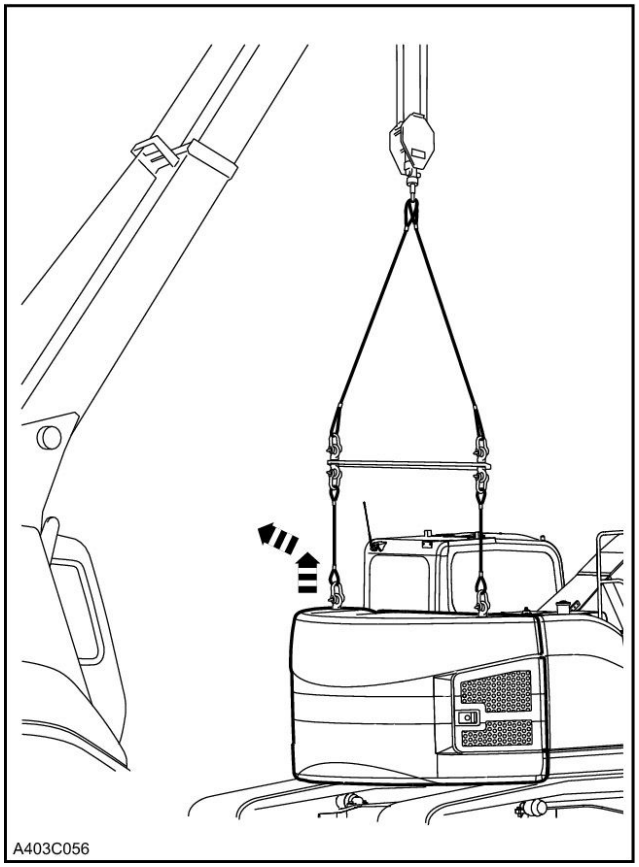
4. Connect the eyebolts to the shackles (1), and then use the wire ropes (2) and liftcrane to secure the counterweight so that it does not fall during removal and installation operations.



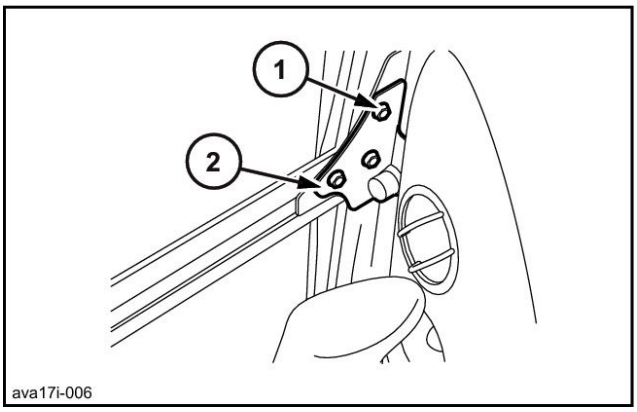
5. Use a box wrench [50 mm (1.969 in)] to remove the 7 bolts (1) and 7 washers (2) on the lower section of the counterweight.



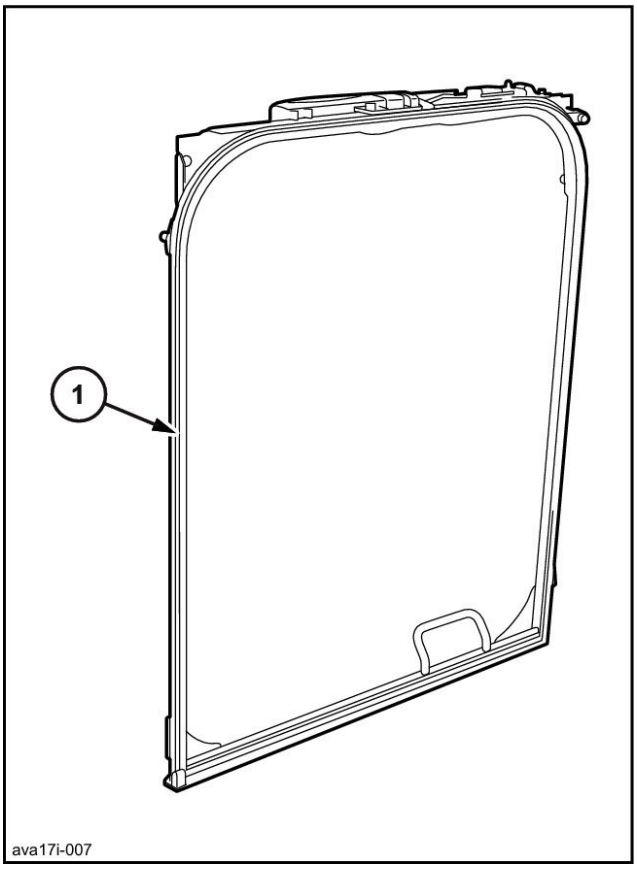
6. Use the wire ropes and liftcrane to lift and remove the counterweight.
   - Move the counterweight about 50 cm (19.685 in) to the rear while lifting it so that it does not interfere with the housing, engine parts and pipes.



6. Use a wrench [10 mm (0.394 in)] to remove the 3 bolts (1), and then remove the front glass right lower bracket (2).
   Tightening torque for bolt (1) installation: 880 - 1270 N· cm (77.90 - 112.42 lbf· in)



7. Remove the cab front glass (1).

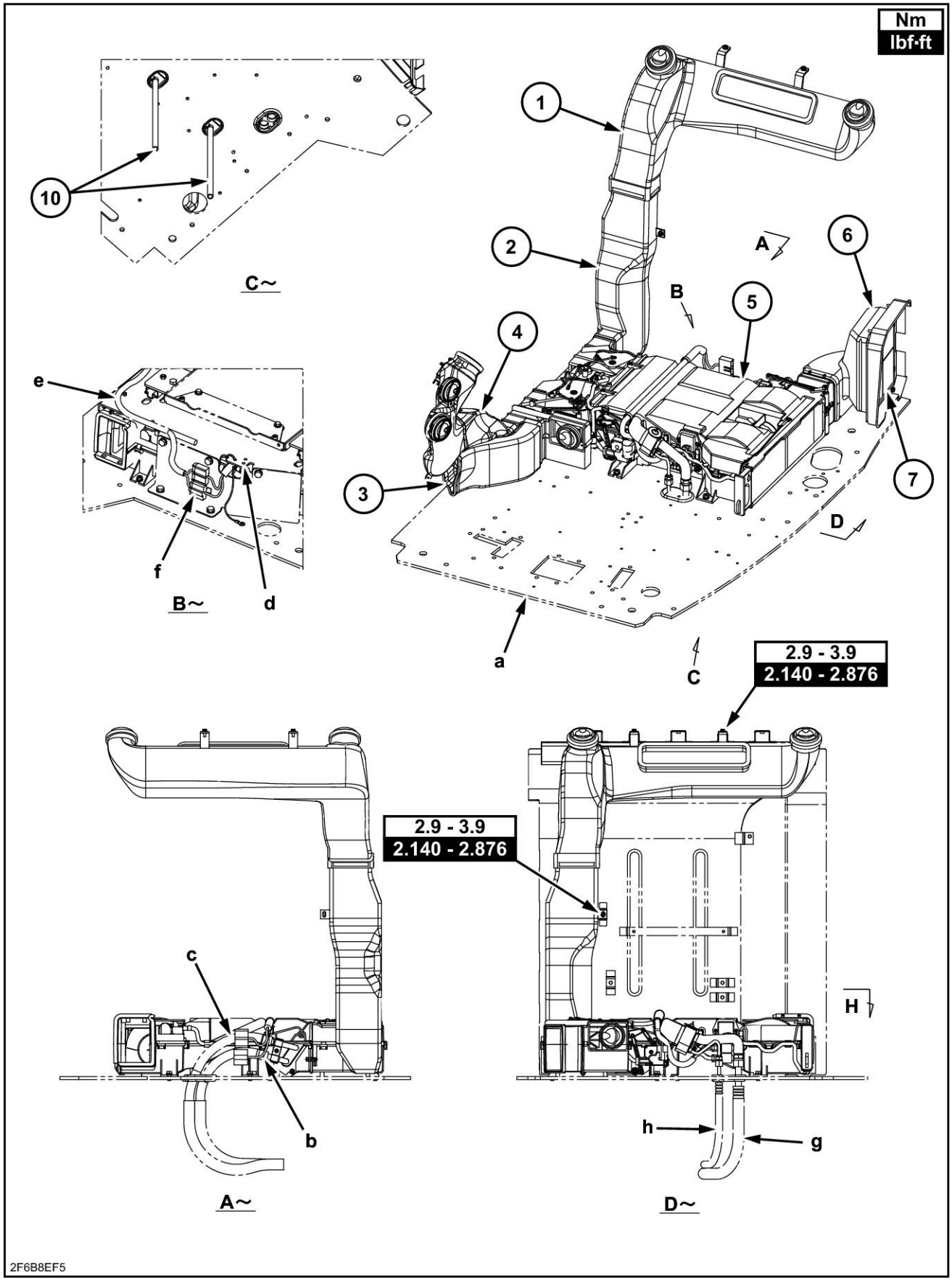


Installation of Cab Front Glass

To install, perform the reverse of the removal procedure. Tighten bolts being installed to the specified torque. If the torque is not specified, see the "Tightening Torque" section.

Air Conditioner Overall Diagram

Cab



1) Coolant temperature data abnormality
   Control the internal coolant temperature data to 45 °C (113.0 °F) (the temperature at which to avoid cold air prevention control).

< Sending mode: MONITOR DISPLAY ECU >

1) Open window signal data abnormality
   Perform control with the internal open window data closed.
2) Open door signal data abnormality
   Perform control with the internal open door data closed.

5) Alternate data (processing) up to initial normal reception

< Send node: ENGINE ECU >

1) Coolant temperature data abnormality
   Within 5 sec. after ignition is turned on: Perform control at 30 °C (86.0 °F) (the temperature at which to control cold air prevention)
   After 5 sec. after ignition is turned on: Perform control at 45 °C (113.0 °F) (the temperature at which to avoid cold air prevention control)

< Send node: MONITOR DISPLAY ECU >

1) Open window signal data abnormality
   Perform control with the internal open window data closed.
2) Open door signal data abnormality
   Perform control with the internal open door data closed.