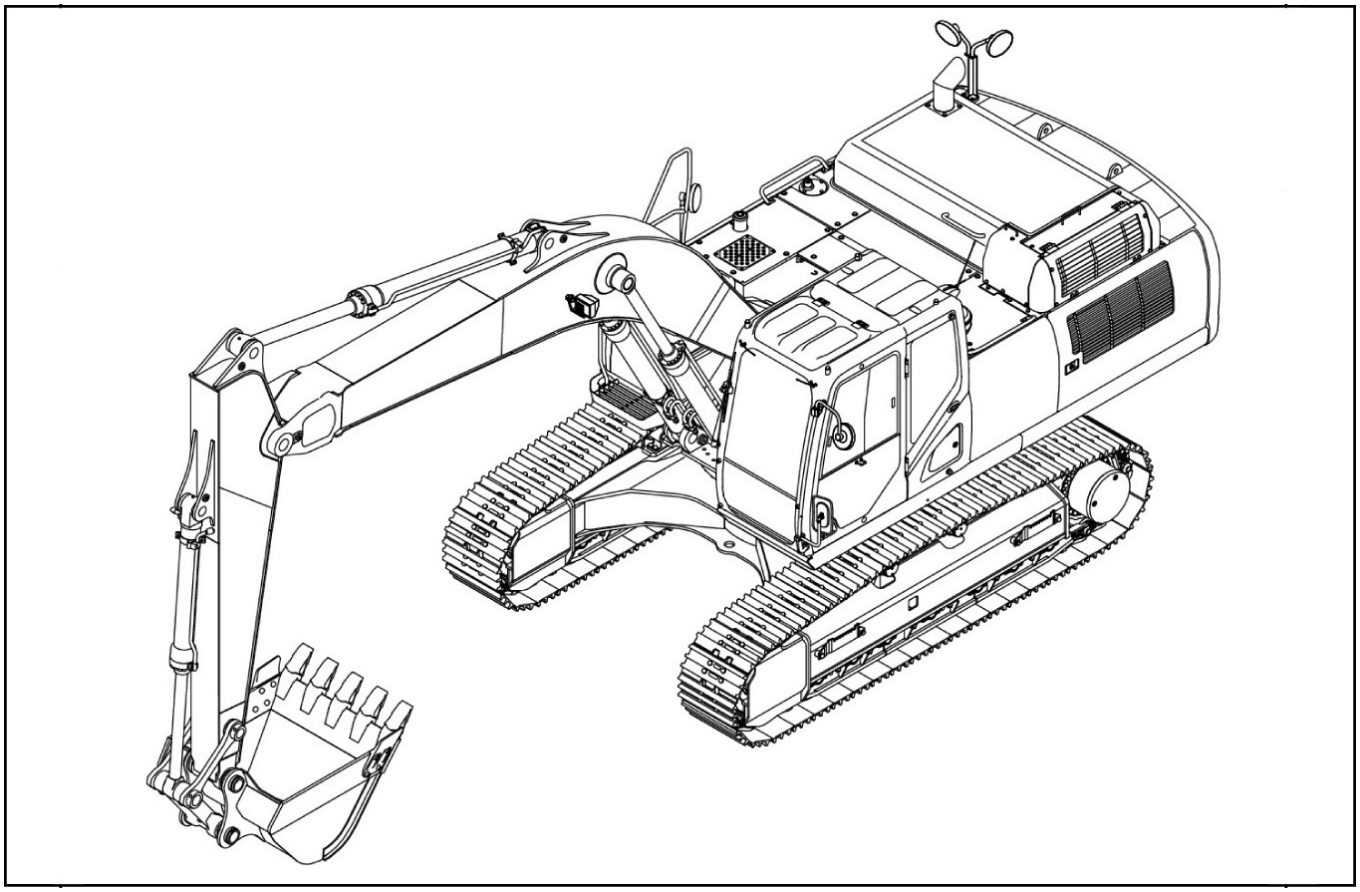
CASE CONSTRUCTION

SERVICE MANUAL

Lep 84420825B EN



CX300C Tier 4
Crawler Excavator

Issue date June 2011

Control-related

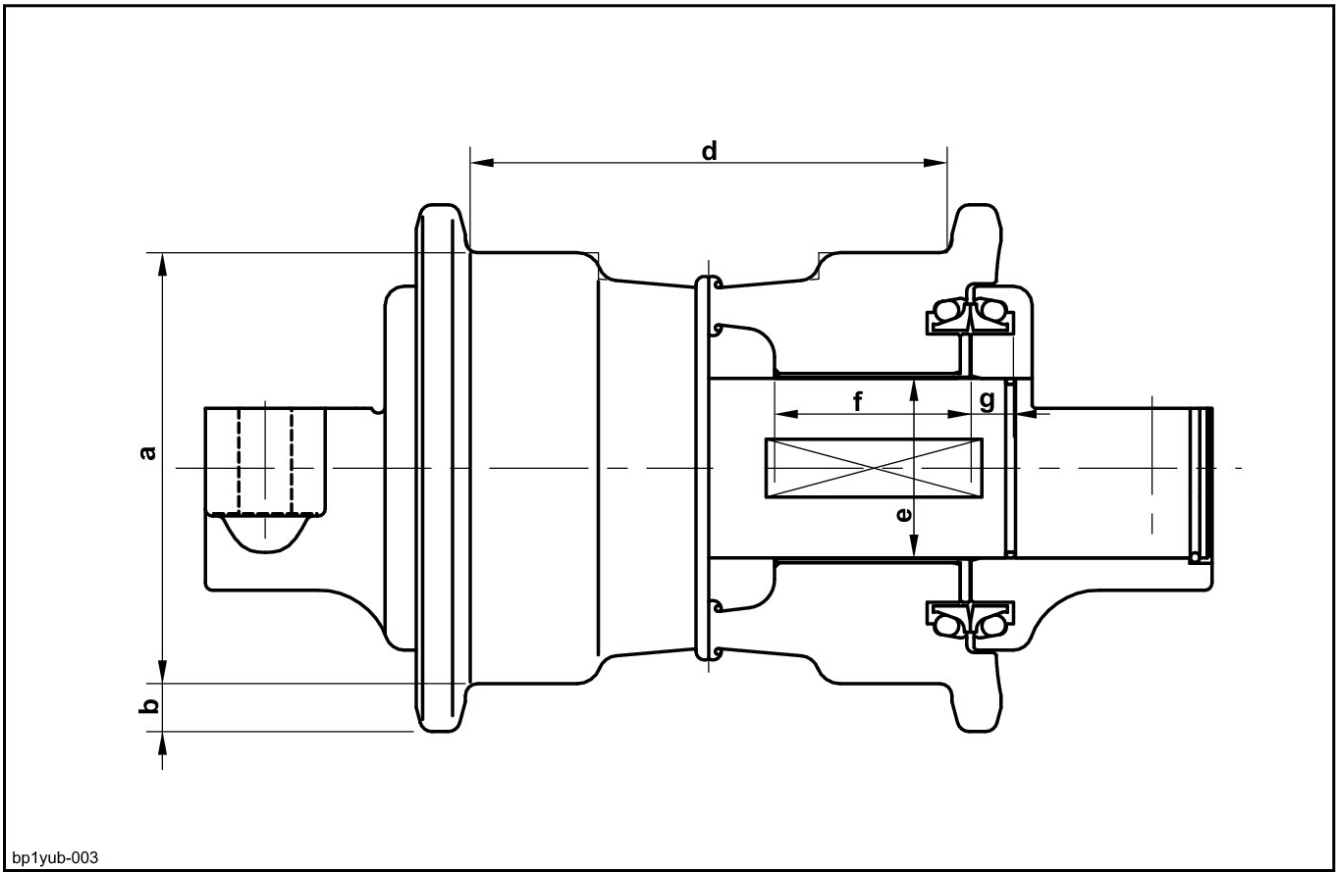
Control Valve

		(STD)	(with 2nd option add-on valve)
Manufacturer		KYB Corporation	
Maximum flow		243 L/min (at 1800 min^{-1})	
Overload set pressure		29.4 MPa boom down	
		39.2 MPa boom up, arm, bucket	
Main relief set pressure		34.3 MPa	
	(at boosting)	37.3 MPa	
Foot relief set pressure		2.55 MPa	
Function		Straight travel circuit	
		Boom-up/arm 2 pumps internal flow	
		Boom and arm load holding circuit	
		Boom-down regenerative circuit	
		Bucket-close regenerative circuit	
		Arm-in forced regenerative circuit	
		Swing priority variable orifice	
		2 pumps flow (external flow merging)	
Weight		200 kg	208 kg

Solenoid Valve (5 stack)

Manufacturer			Yuken Kogyo Co., Ltd.
Valve specifications			
	Maximum flow		P → B 25 L/min Other 5 L/min
	Rated pressure		4.5 MPa
	Port size	G3/8	P.T.B. port
		G1/4	C1, C2, C3, C4, C5 ports
Solenoid specifications			
	Operating voltage		DC 20 - 32 V
	Power consumption		17 W max.
Weight			6.7 kg

Lower Roller



* See the gauge list for measurement gauges.

Part name	Code	Measurement dimension (mm)	Standard value (mm)	Usage limit (mm)	Judgment	Solution
Track roller	a	D	D180	D168	Acceptable/ Unacceptable	Cladding by welding or replacement
	b		20	16	Acceptable/ Unacceptable	
	d		203	211	Acceptable/ Unacceptable	
Shaft	e	D	D75	D74	Acceptable/ Unacceptable	Replacement
Bushing	e	D	D75	D76	Acceptable/ Unacceptable	Replacement
	f		D82	D81	Acceptable/ Unacceptable	
Collar	g		17.7	17.2	Acceptable/ Unacceptable	Replacement

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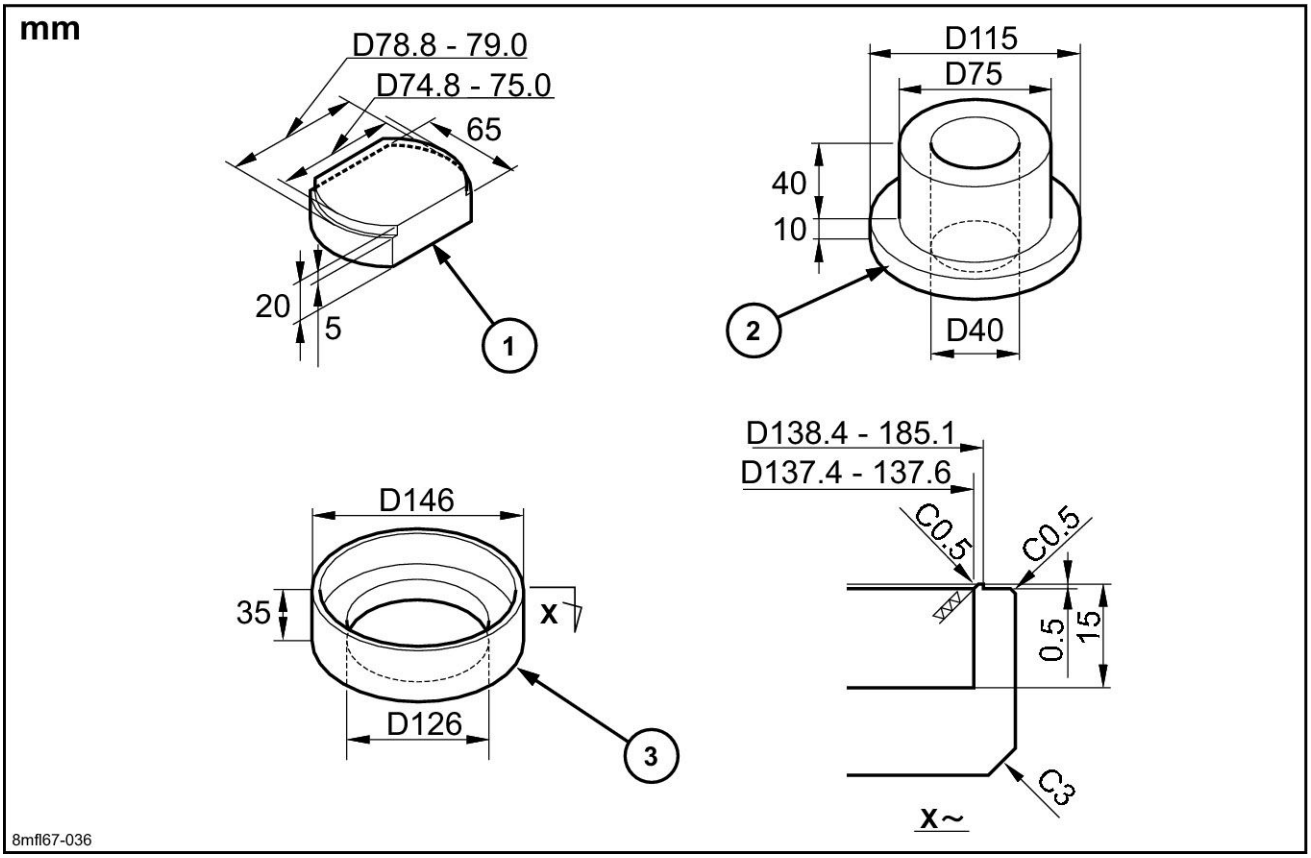
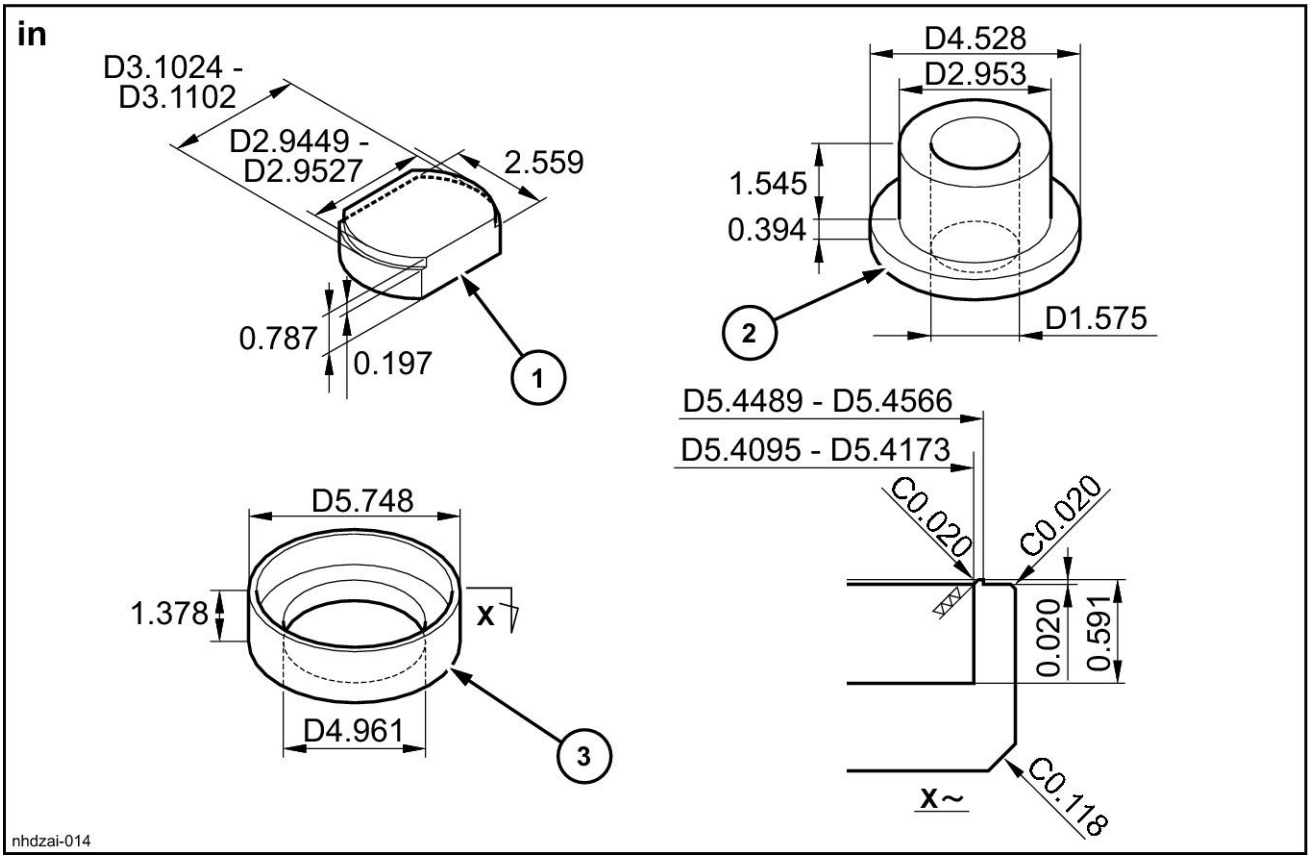
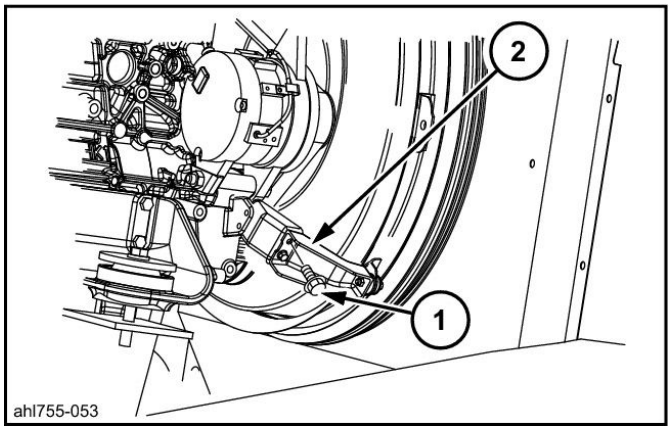
Lower Roller Special Tool

CX300C

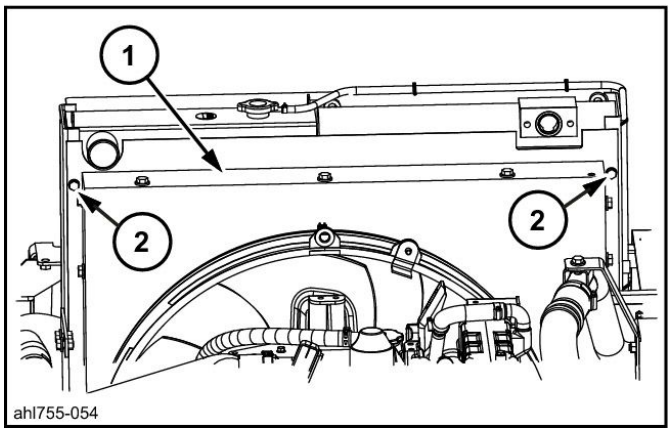




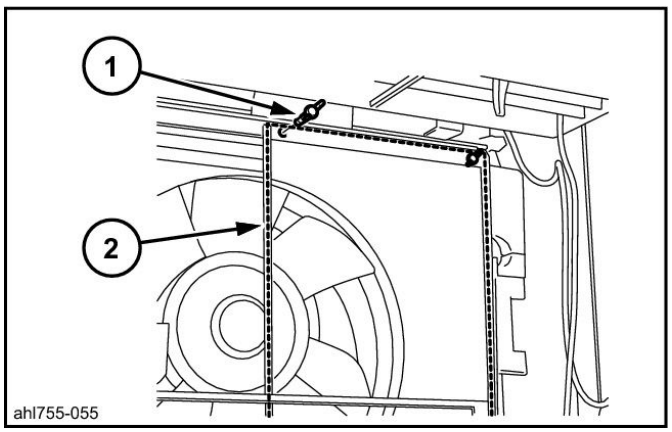
15. Use a wrench (13 mm) to remove the 3 bolts (1), and then remove the brackets (2).



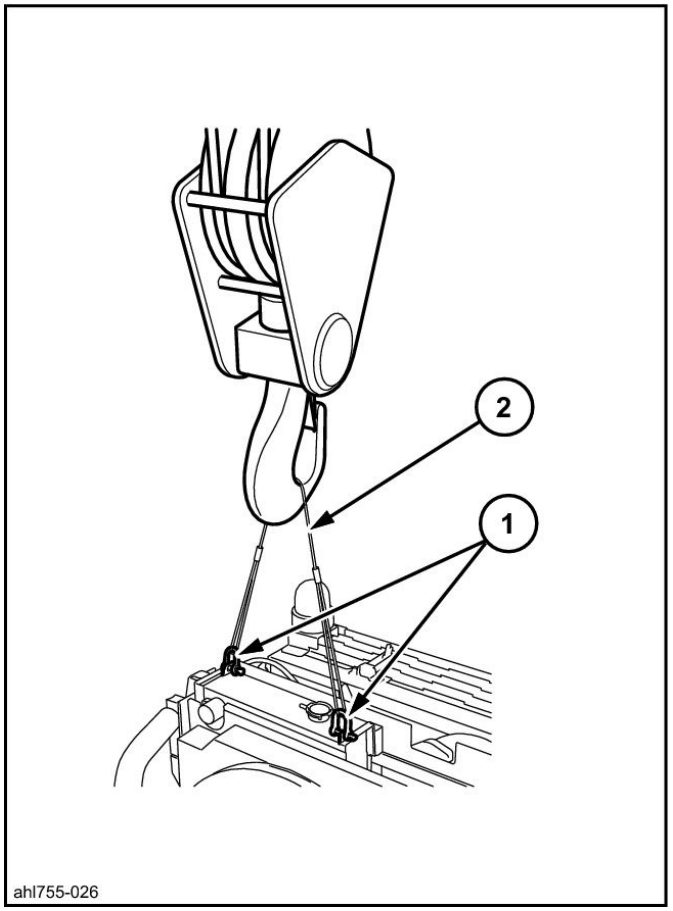
16. Use a box wrench (12 mm) to remove the 5 bolts (2) from the fan shroud (1), and then move the fan shroud (1) towards the engine.



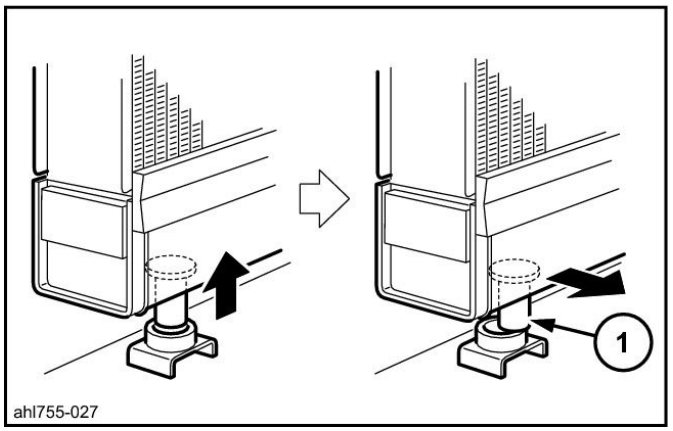
17. Remove the 2 butterfly bolts (1), and then remove the front anti-insect net (2).



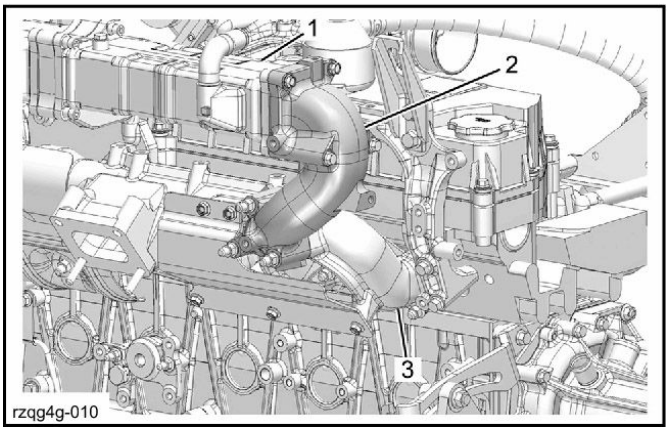
18. Install the 2 shackles (1) to the top of the radiator, and then use the wire rope (2) and liftcrane to lift the radiator.



19. Lift until the fixtures (1) at the bottom of the radiator become disconnected.



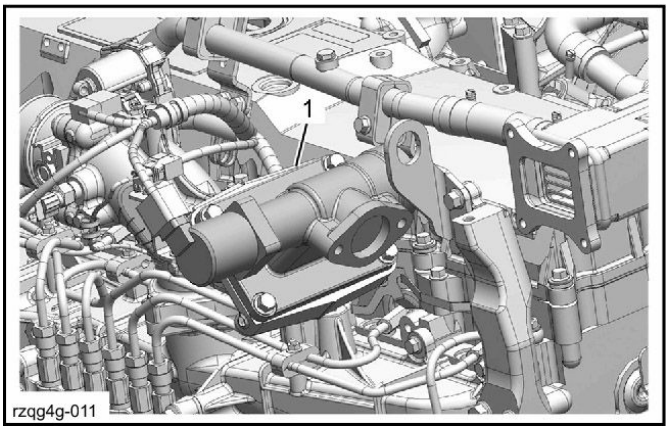
9) Remove the EGR pipe A from the exhaust manifold.



1	EGR cooler A
2	EGR pipe A
3	Exhaust manifold

4. EGR valve Removal

1) Disengage the harness connector from the EGR valve.
2) Remove the EGR valve from the inlet pipe.

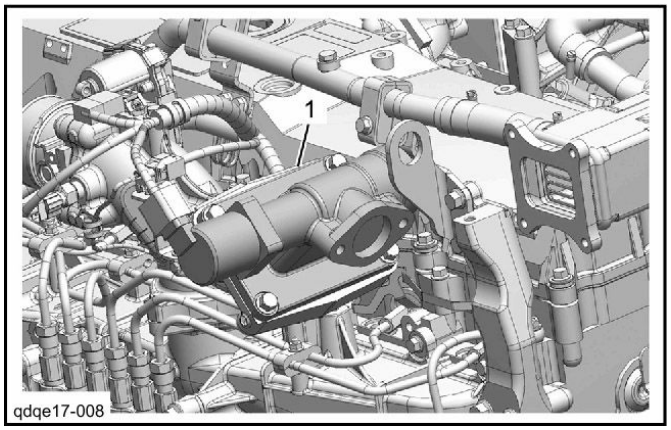


1	EGR valve

EGR valve Installation

1. EGR valve Installation

1) Install the EGR valve to the inlet pipe. Tightening torque : 46 N· m { 4.7 kgf· m / 33.9 lb· ft }

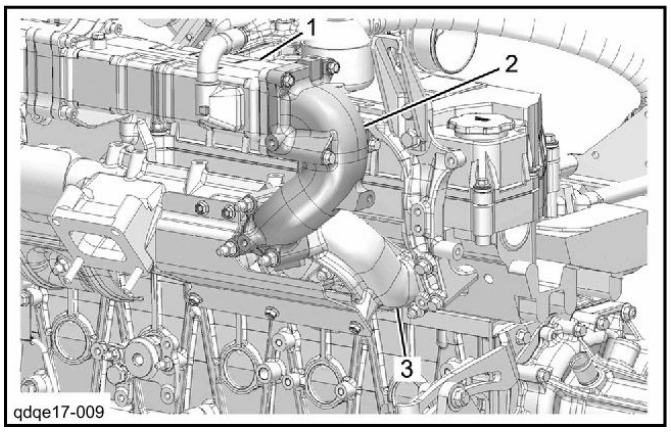


1	EGR valve

2) Connect the harness connector to the EGR valve.

2. EGR cooler Installation

1) Temporarily tighten the EGR pipe A to the exhaust manifold.
2) Temporarily tighten the EGR cooler A to the EGR pipe A.



1	EGR cooler A
2	EGR pipe A
3	Exhaust manifold

3) Temporarily tighten the EGR cooler bracket A to the EGR cooler A.
4) Temporarily tighten the EGR cooler B to the EGR cooler A.
5) Temporarily tighten the EGR bracket C to the EGR cooler B.

Primary specifications

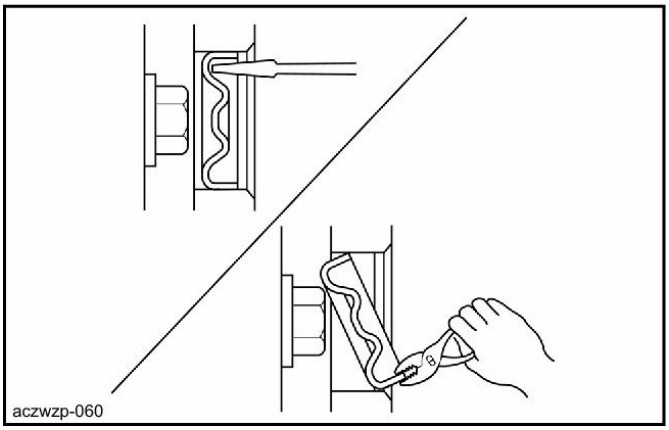
Electrical system main specifications

Generator		
Item	**Specifications**	
Manufacturer name	Mitsubishi Electric Corporation	
Isuzu parts number	1-81200-633-0	1-81200-603-2
Manufacturer type	A009TU3782	A004TU6285
Nominal voltage	24V	
Output current	90 A	50 A
Rated rotation count	500 min^{-1} {5000 rpm}	
Output current/voltage	114 A/27 V/5000 min^{-1} {5000 rpm}	50 A/27 V/5000 min^{-1} {5000 rpm}
No-load voltage	24 V/900 min^{-1} {900 rpm}	
Rotational direction	Clockwise direction	
Polarity	(-)	
Pulley diameter (P.C.D)	: 90.0 mm {3.54 in}	: 80.0 mm {3.15 in}

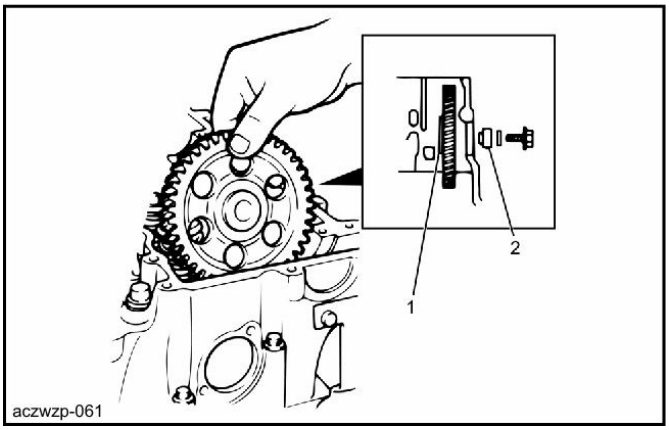
Starter		
Item		**Specifications**
Manufacturer		Mitsubishi Electric Corporation
Isuzu parts number		181100-4140
Manufacturer code number		M008T60971
Output		24 V/5.0 kW
Rating		30 sec
York outer diameter		: 85.0 mm {3.35 in}
Rotational direction		Right
Protection type		Dust proof, drip proof
Low speed mechanism		Inner contact gear
Weight		: 7.2 kg {15.9 lb}
Pinion	Module	3
	Pressure angle	14.5
	Number of teeth	11
	Gear ratio {ring gear/pinion gear}	12.8 {129/11}
No load	Voltage	23 V
	Current	85 A or less
	Rotational speed	3,300 min^{-1} {3,300 rpm} or more
Restraint	Voltage	9 V
	Current	1,400 or less
	Torque	88 N・m {9kgf・m} or more
Pinion/engaged voltage		16.0 V or less

Glow plug	
Item	**Type**
Preheat device model	Glow plug
Glow plug rated voltage/current	23 V/3.5 A

2) Remove the idle gear C cover from the cylinder head assembly using the pliers.



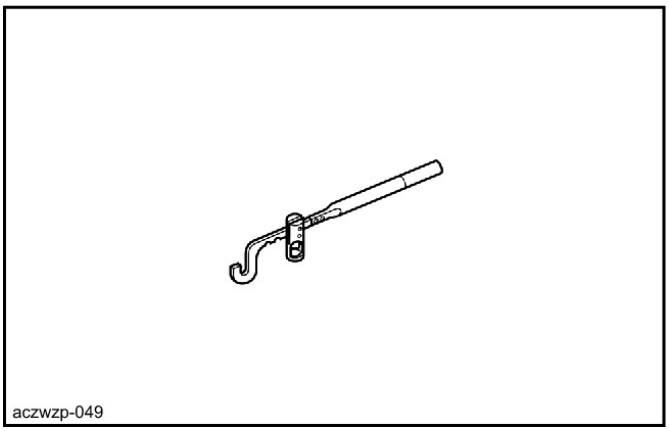
3) Remove the idle gear C from the cylinder head assembly.



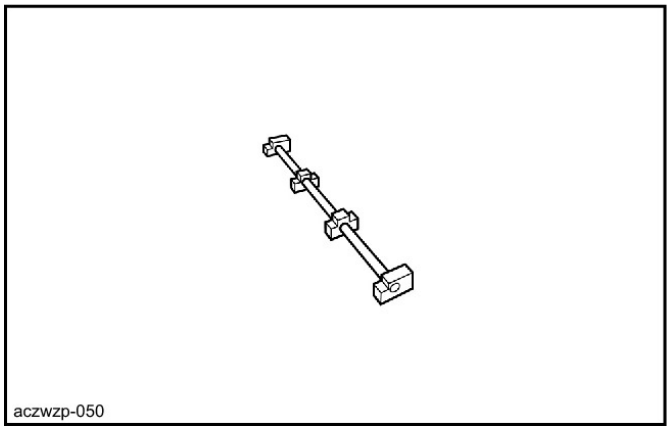
1	Idle gear C
2	Idle gear shaft

10. Valve spring Removal

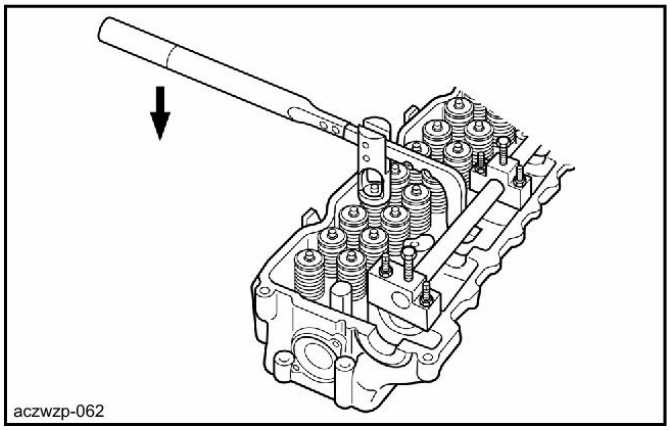
1) Press the valve spring using the special tool.



Special tool: remover, valve spring (refer to section 1003)



Special tool: pivot ASM (refer to section 1003)



2) Remove the split collar from the spring seat.
3) Remove the special tool from the cylinder head assembly.
4) Remove the valve spring seat from the valve spring.
5) Remove the valve spring from the cylinder head assembly.

ANNOTATION:

- *Store the removed valve springs according to the cylinders.*

11. Inlet valve Removal

1) Remove the inlet valve from the cylinder head assembly.

ANNOTATION:

- *Organize the removed valve according to the cylinders.*

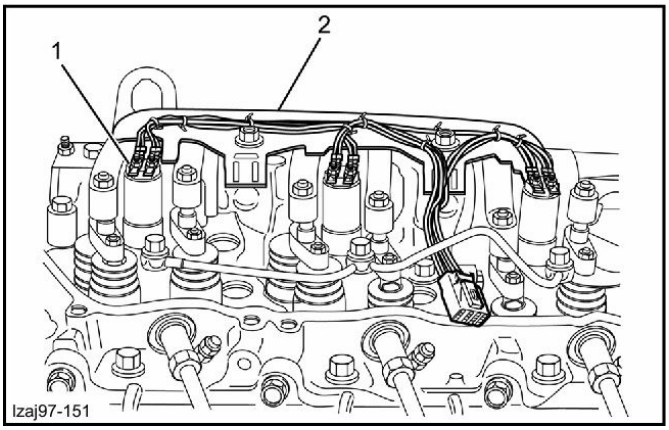
12. Exhaust valve Removal

1) 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 : 22 N· m {2.2 kgf· m / 16 lb· ft}

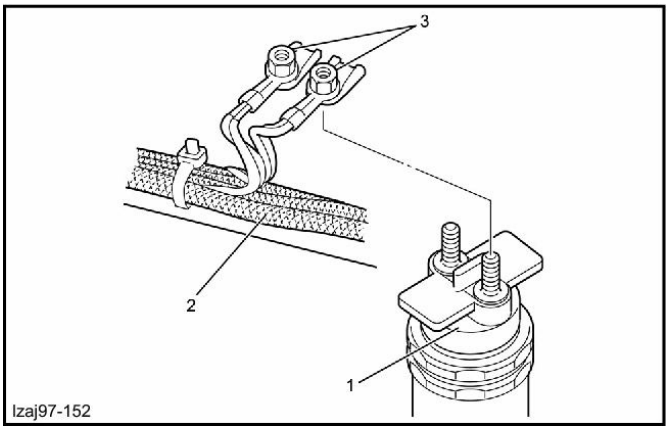


1	Injector harness terminal
2	Injector harness bracket

2) Connect the injector harness to the injector.

⚠ CAUTION

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



1	Injector
2	Injector harness
3	Terminal nut

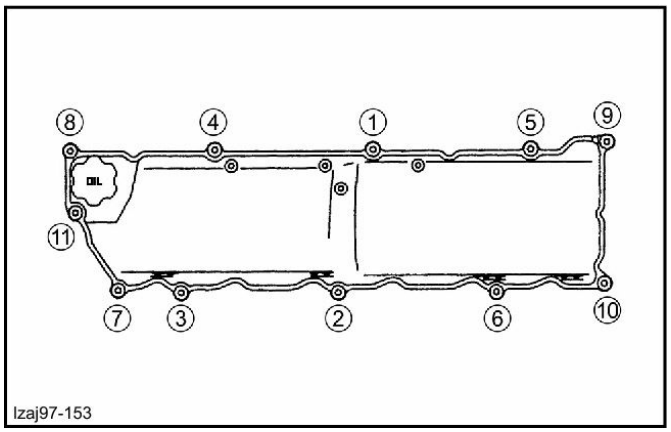
3) Install the connector to the lower cover.
Tightening torque : 2 N· m {0.2 kgf· m / 18 lb· in}

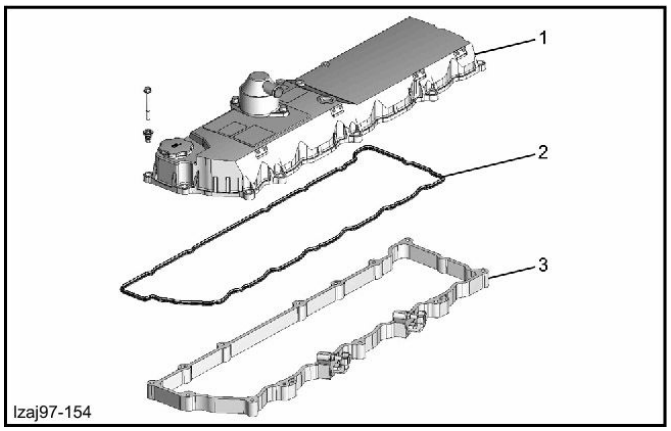
14. Cylinder head cover Installation

1) Align the head cover gasket to the cylinder head cover.
2) Install the cylinder head cover to the lower cover.
Tightening torque : 13 N· m {1.3 kgf· m / 115 lb· in}

ANNOTATION:

- *Referring to the tightening order in the diagram, temporarily tighten all bolts and then completely tighten them.*





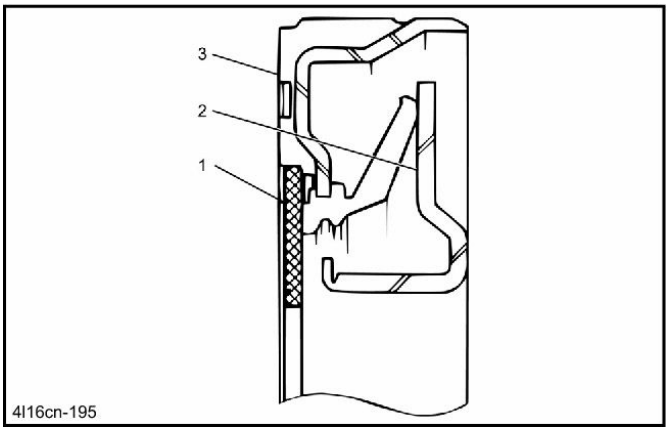
1	Cylinder head cover
2	Head cover gasket
3	Lower cover

3) Connect the ventilation hose to the air breather.

15. Inlet pipe Installation

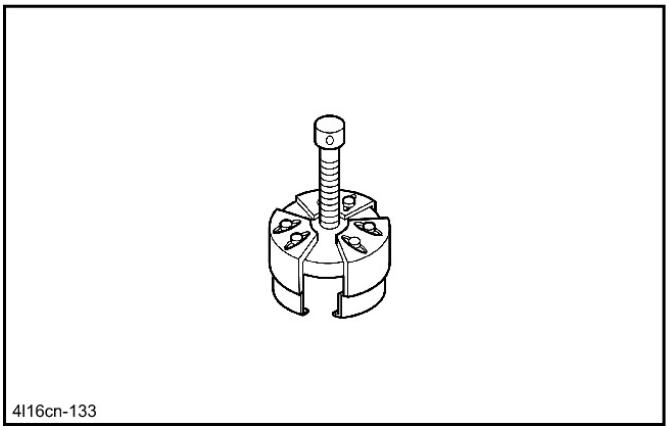
1) Remove the crankshaft front oil seal from the timing gear case.

> ⚠ **CAUTION**
>
> - **Be careful not to damage the oil seal press-fitting surface of the timing gear case.**



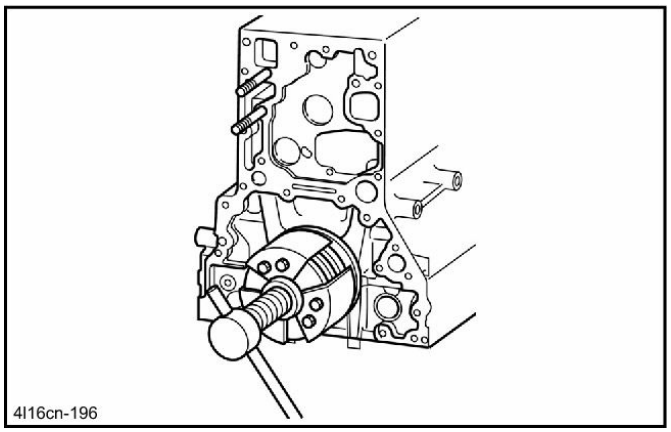
1	Felt
2	Slinger
3	Crankshaft front oil seal

2) Remove the slinger from the crankshaft using the special tool.



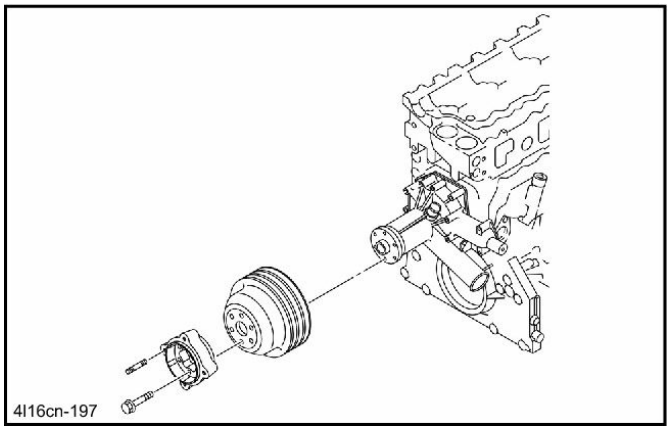
Special tool: rear oil seal remover (refer to section 1003)

> ⚠ **CAUTION**
>
> - **When replacing the oil seal, replace the slinger.**

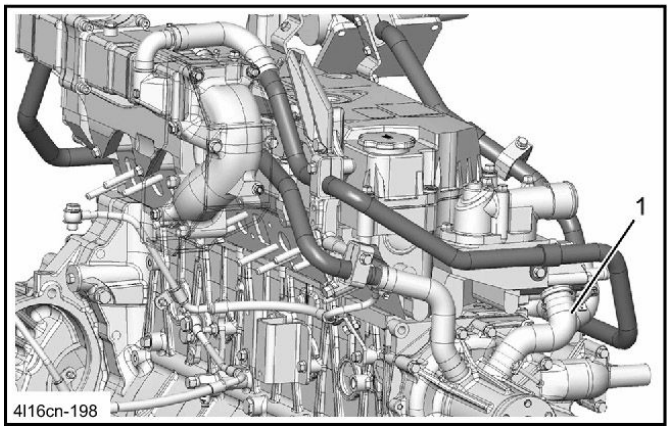


10. Water pump assembly Removal

1) Remove the fan pulley from the water pump assembly.



2) Remove the water bypass hose from the water pump assembly and the water duct.



1	Water bypass hose

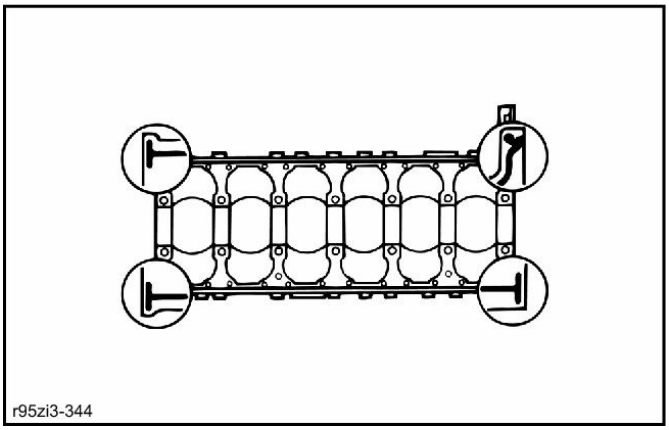
3) Remove the water hose from the EGR cooler water pipe and the water pump assembly.
4) Remove the water pump assembly from the gear case cover cover.

11. Cover of gear case cover Removal

1) Remove the adjust plate from the gear case cover cover.
2) Remove the gear case cover cover from the cylinder block.

12. Turbocharger assembly Removal

Bead hight : 3 - 4 mm {0.118 - 0.157 in}



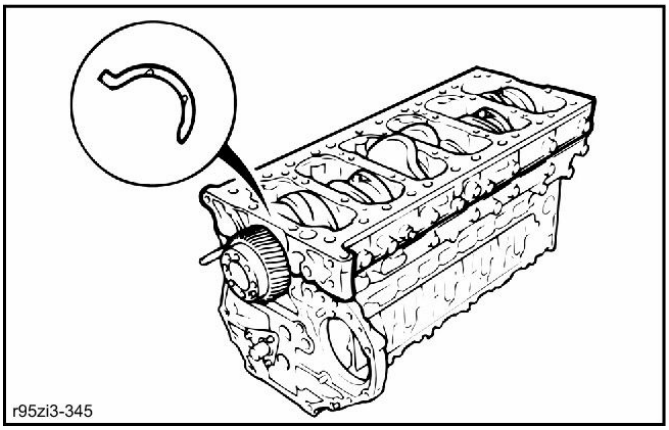
⚠ CAUTION

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

13) Put the crankcase on the cylinder block.

⚠ CAUTION

- **Be careful not to let the thrust bearing fall.**



14) Apply the disulfide molybdenum grease to the bolt.

ANNOTATION:

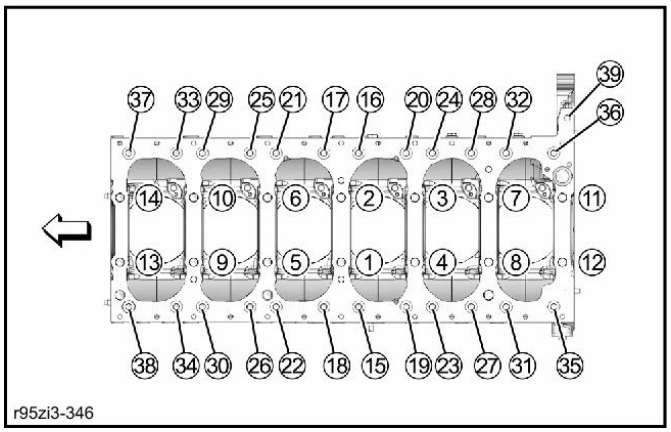
- *Apply to the threaded portion and seat surface on the M14 bolt for crankcase installation.*

⚠ CAUTION

- **Do not apply grease to the M10 bolt.**

ANNOTATION:

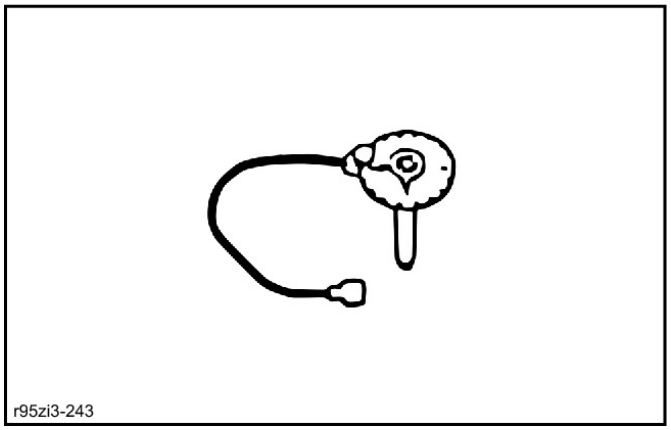
- *Tightening order*



15) Tighten the bolt using the torque wrench.
Tightening torque : 98 N· m {10.0 kgf· m / 72 lb· ft} M14 bolt

16) Tighten the bolt using the torque wrench.
Tightening torque : 132 N· m {13.5 kgf· m / 97 lb· ft} M14 bolt

17) Tighten the bolt using the special tool.



Special tool: angle gauge (refer to section 1003)
Tightening angle : 30 ° M14 Bolt

18) Tighten the bolt using the torque wrench.
Tightening torque : 37 N· m {3.8 kgf· m / 27 lb· ft} M10 bolt

19) Tighten the bolt using the torque wrench.
Tightening torque : 142 N· m {14.5 kgf· m / 105 lb· ft} Check the tightening M14 bolt

⚠ CAUTION

- **Confirm that the crankshaft turns smoothly after tightening the bolts.**

6. Piston Installation

1) Install the connecting rod bearing to the connecting rod.

2) Apply the engine oil to the connecting rod bearing.

⚠ CAUTION

- **Apply engine oil only to the internal diameter of the connecting rod bearing.**

3) Apply the engine oil to the piston ring.

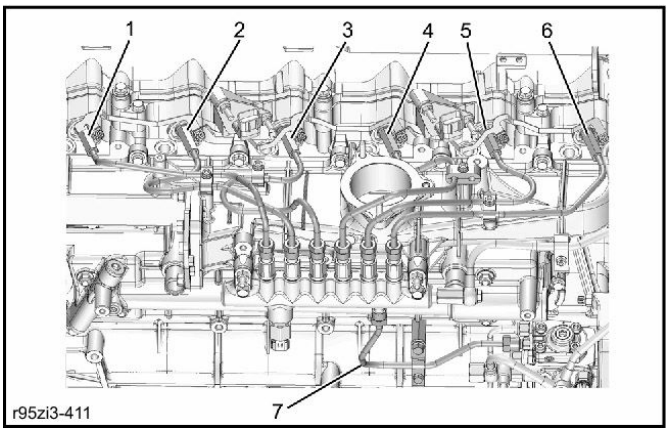
6) Install the injector leak-off pipe to the injector.

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

Tightening torque : 14 N· m {1.4 kgf· m / 126 lb· in}

32. Injection pipe Installation

1) Securely tighten the injection pipe to the injector.
Tightening torque : 44 N· m {4.5 kgf· m / 32.5 lb· ft}
2) Securely tighten the injection pipe to the common rail assembly.
Tightening torque : 44 N· m {4.5 kgf· m / 32.5 lb· ft}
3) Install the clip to the inlet cover.
Tightening torque : 6 N· m {0.6 kgf· m / 53.1 lb· in}

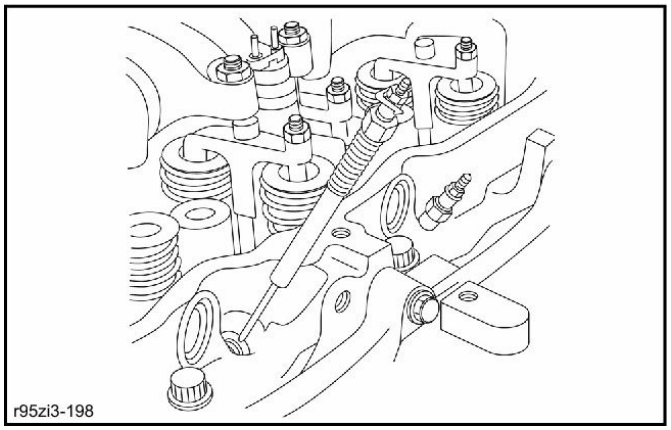


1	No.1 injection pipe
2	No.2 injection pipe
3	No.3 injection pipe
4	No.4 injection pipe
5	No.5 injection pipe
6	No.6 injection pipe
7	Fuel pipe

33. Glow plug Installation

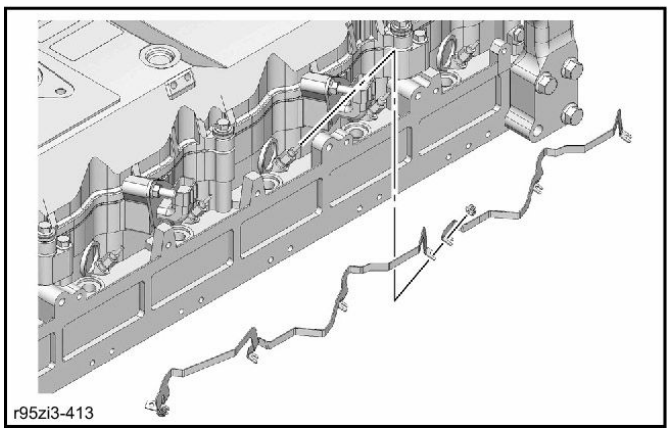
1) Install the glow plug to the cylinder head assembly.
Tightening torque : 20 N· m {2.0 kgf· m / 14.8 lb· ft}

> ⚠ **CAUTION**
>
> - **Be careful not to exceed the specified torque when tightening.**



2) Install the glow plug connector to the glow plug.
Tightening torque : 1 N· m {0.1 kgf· m / 8.9 lb· in}

> ⚠ **CAUTION**
>
> - **Confirm that the glow plug connector does not interfere with the surrounding parts.**



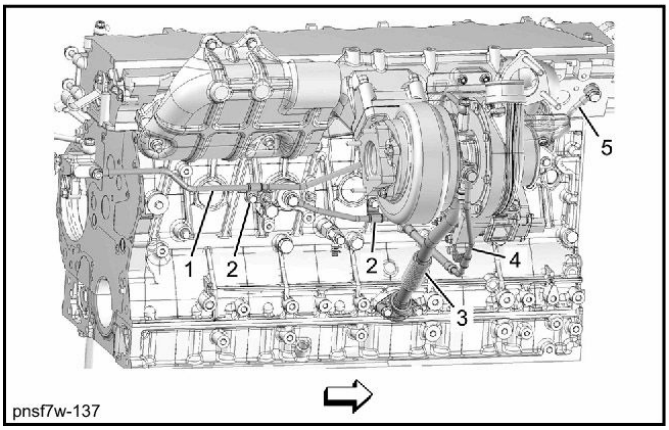
34. Injector harness Installation

11) Remove the water feed pipe from the cylinder block.

ANNOTATION:

- *Remove the clip.*

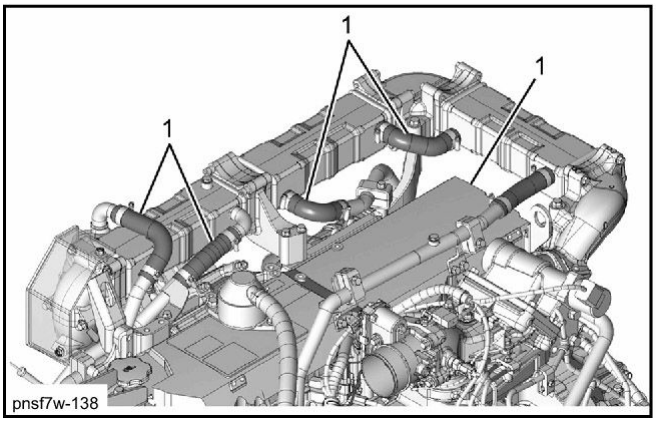
12) Disengage the harness connector from the turbocharger assembly.
13) Remove the turbocharger assembly from the exhaust manifold.



1	Oil feed pipe
2	Clip
3	Oil return pipe
4	Water feed pipe
5	Water return pipe

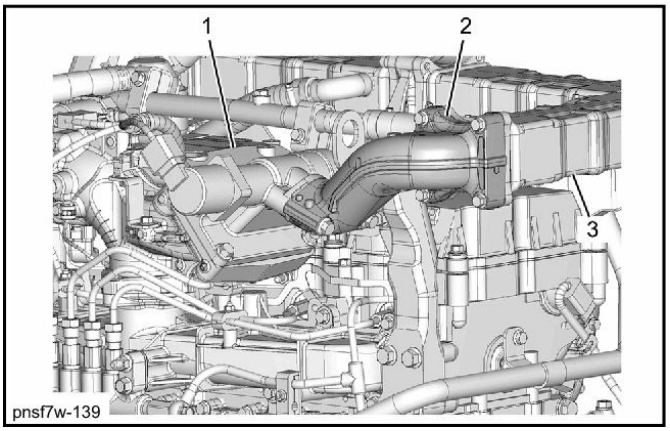
6. EGR cooler Removal

1) Disengage the water rubber hose from the EGR cooler.



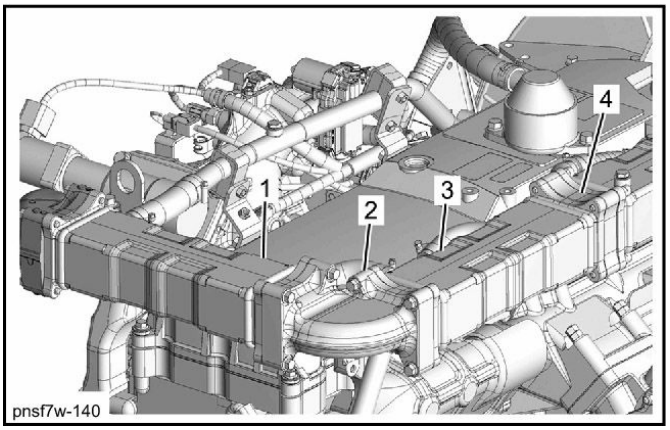
1	Water rubber hose

2) Remove the EGR pipe B from the EGR valve and the EGR cooler C.



1	EGR valve
2	EGR pipe B
3	EGR cooler C

3) Remove the EGR cooler C from the EGR bracket C.
4) Remove the EGR bracket C from the EGR cooler B.
5) Remove the EGR cooler B from the EGR cooler bracket A.
6) Remove the EGR cooler bracket A from the EGR cooler A.

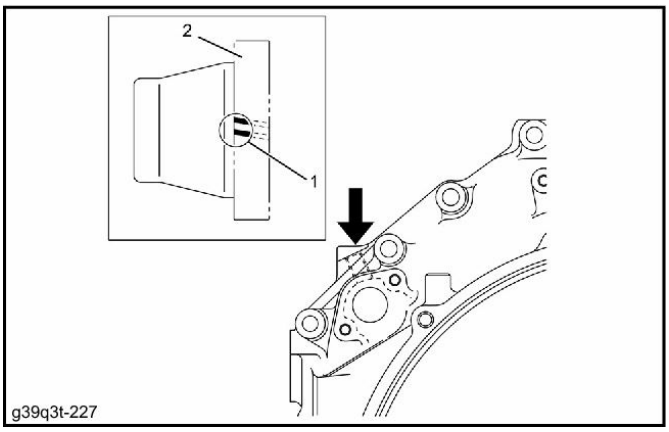


1	EGR cooler C
2	EGR bracket C
3	EGR cooler B
4	EGR cooler bracket A

3) Align the fuel supply pump to the cylinder block.

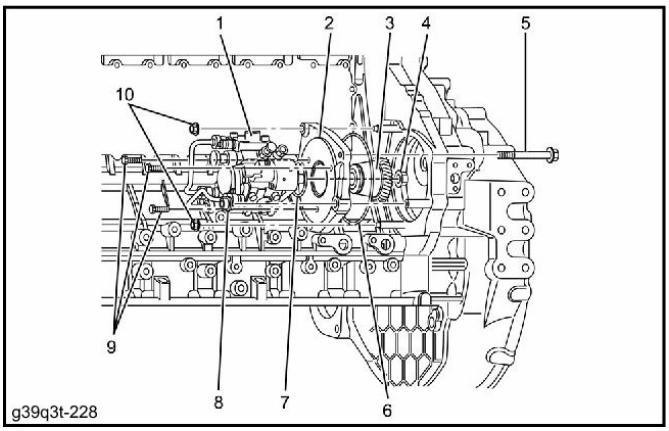
ANNOTATION:

- *Confirm that the white paint can be seen through the timing confirmation hole on the top surface of the flywheel housing.*



1	Confirmation hole
2	Supply pump gear

4) Install the fuel supply pump to the cylinder block.
Tightening torque: 75 N· m {7.6 kgf· m / 55 lb· ft} No.5 in the diagram
Tightening torque: 75 N· m {7.6 kgf· m / 55 lb· ft} No.8 in the diagram
Tightening torque: 51 N· m {5.2 kgf· m / 38 lb· ft} No.10 in the diagram



1	Fuel supply pump
2	Bracket
3	Gear
4	Nut
5	Bolt
6	O-ring
7	O-ring
8	Nut
9	Bolt
10	Nut

5) Connect the harness connector to the fuel supply pump.

10. Cylinder head assembly Installation

⚠ CAUTION

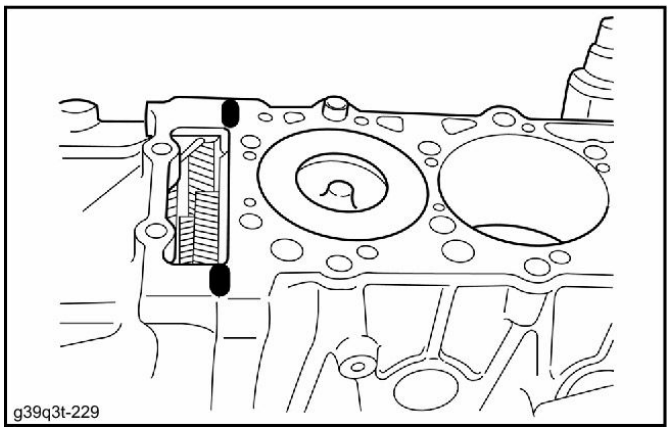
- **Clean the aligning surface of the cylinder head and cylinder block before installing the cylinder head assembly.**
- **Be careful not to damage the cylinder head and cylinder block while cleaning.**

1) Apply the liquid gasket to the cylinder block.

ANNOTATION:

- *Use ThreeBond 1207B.*

Bead width: 3.0 mm {0.1181 in}
Bead height: 2.0 mm {0.0787 in}



⚠ CAUTION

- **After applying liquid gasket, install the cylinder head within 5 minutes.**

2) Install the cylinder head gasket to the cylinder block.

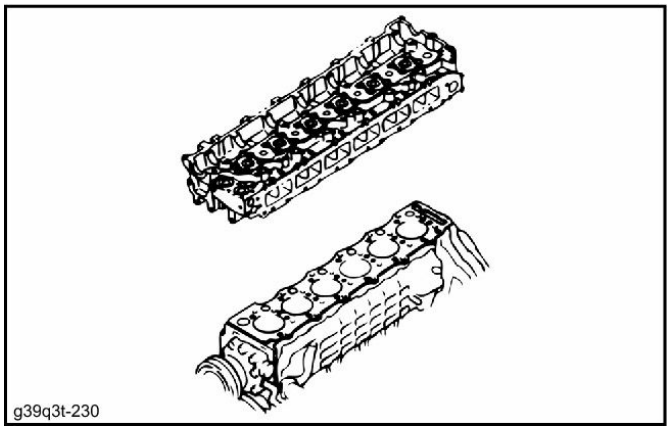
⚠ CAUTION

- **Use a new cylinder head gasket.**

3) Install the cylinder head assembly to the cylinder block.

⚠ CAUTION

- **Be careful not to damage the cylinder head gasket.**



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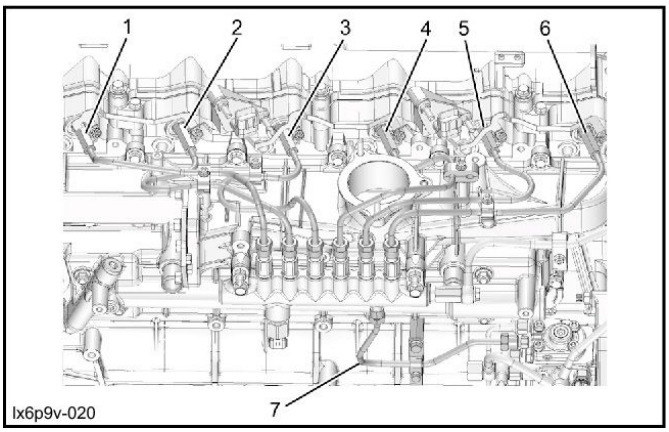


1	No.1 injection pipe
2	No.2 injection pipe
3	No.3 injection pipe
4	No.4 injection pipe
5	No.5 injection pipe
6	No.6 injection pipe
7	Fuel pipe

10. Fuel pipe Removal
    1) Remove the fuel pipe from the fuel supply pump and the common rail assembly.

       ANNOTATION:

       - *Remove the clip.*

       ⚠ CAUTION

       - **Do not reuse the removed fuel pipe.**

11. Fuel leak off pipe assembly Removal
    1) Disengage the fuel leak-off pipe from the cylinder head.
    2) Remove the fuel leak-off pipe from the fuel supply pump.

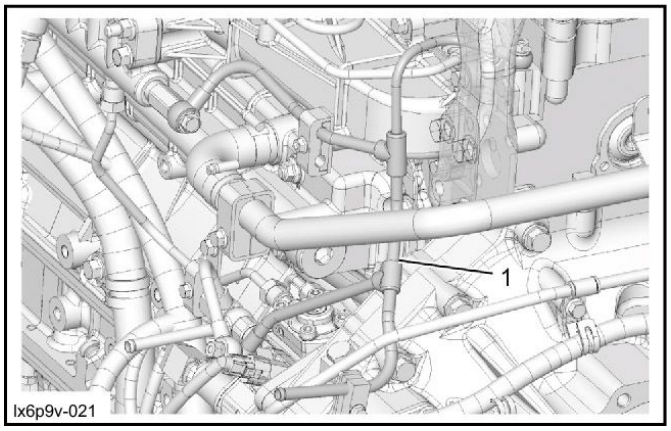
       ANNOTATION:

       - *Remove the eyebolt tightened together with the fuel feed pipe.*

    3) Disengage the fuel leak-off pipe from the common rail assembly.
    4) Remove the fuel leak-off pipe from the inlet pipe.

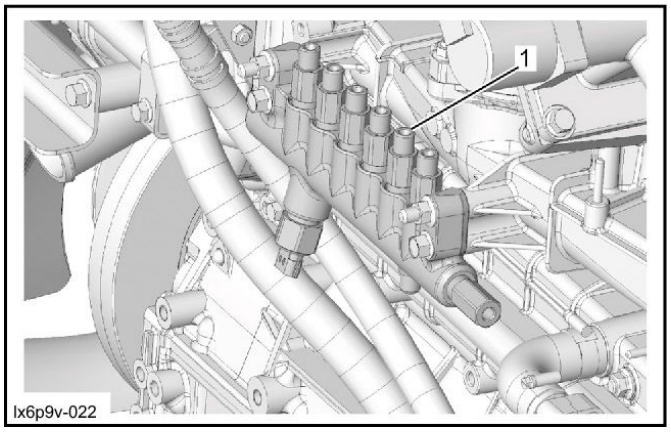
       ANNOTATION:

       - *Remove the clip.*



1	Fuel leak-off pipe

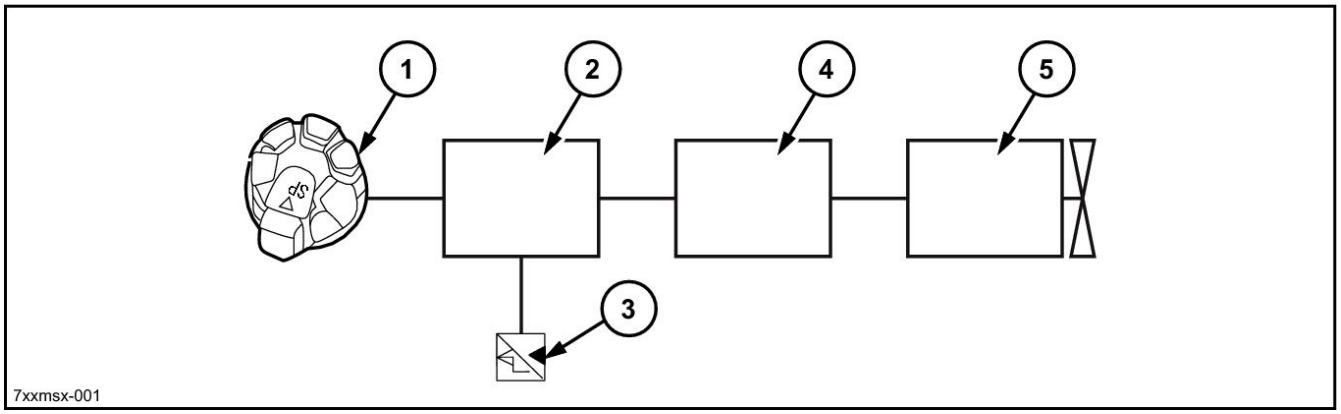
12. Common rail assembly Removal
    1) Disengage the harness connector from the fuel pressure sensor.
    2) Remove the common rail assembly from the inlet cover.



1	Common rail assembly

Idle up

Purpose
Raises the engine speed and maintains mechanical speed.



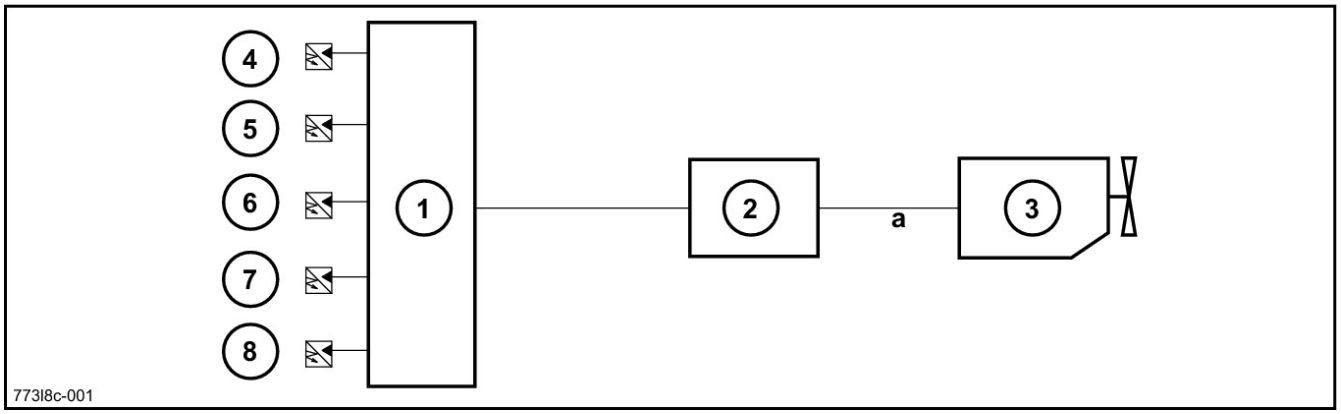
1	Throttle volume	3	Pressure sensor (travel)	5	Engine
2	Computer A	4	ECM		

a	Engine speed

1. Operation conditions for idle up
   Operation starts when all the conditions below are satisfied.
   1) Travel operation is performed. (Travel pressure sensor ON)
2. End conditions for idle up
   Operation ends under the following conditions.
   1) The work mode is a mode other than SP mode.
   2) A travel operation is not performed.

Auto Energy Save

Purpose
Reduces the engine speed when machine operations are not being performed.(Energy saving)



1	Computer A	4	Pressure sensor (P1)	7	Pressure sensor (swing)
2	ECM	5	Pressure sensor (P2)	8	Pressure sensor (upper)
3	Engine	6	Pressure sensor (N2)		

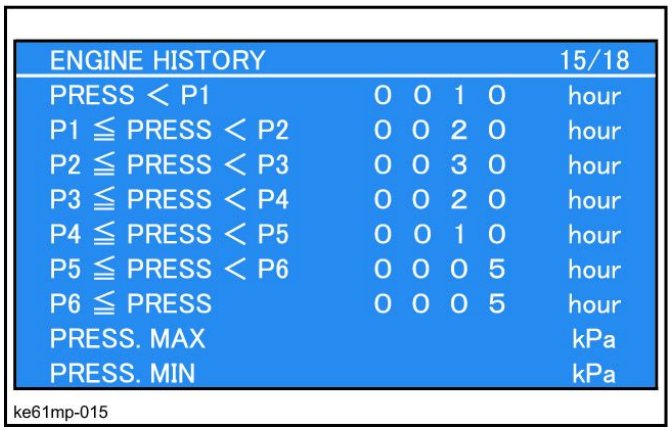
a	Engine speed control

Operation explanation

1. Operation conditions for auto energy save.
   1) When a machine operation is not being performed.
2. End conditions for auto energy save.
   1) When a machine operation is performed.

* When control is established at the same time as boom down energy save, the control that reduces the engine speed the most is prioritized.

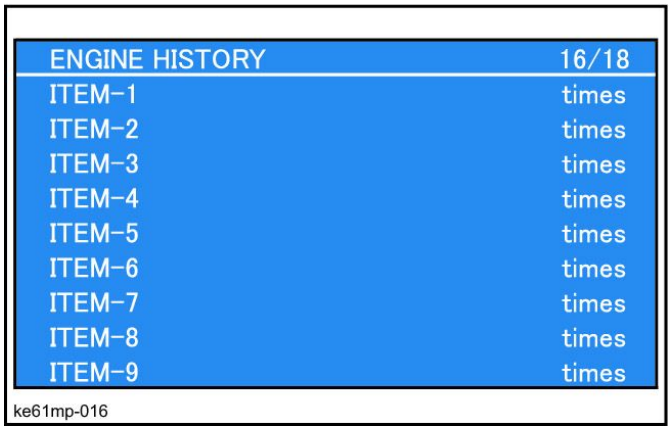
15. Supply pump inlet pressure distribution



ke61mp-015

PRESS. < P1	hour	P < -40
P1 ≤ PRESS. < P2	hour	-40 ≤ P < -30
P2 ≤ PRESS. < P3	hour	-30 ≤ P < -20
P3 ≤ PRESS. < P4	hour	-20 ≤ P < -10
P4 ≤ PRESS. < P5	hour	-10 ≤ P < 0
P5 ≤ PRESS. < P6	hour	0 ≤ P < 10
P6 ≤ PRESS.	hour	10 ≤ P
PRESS. MAX	kPa	Maximum pressure
PRESS. MIN	kPa	Minimum pressure

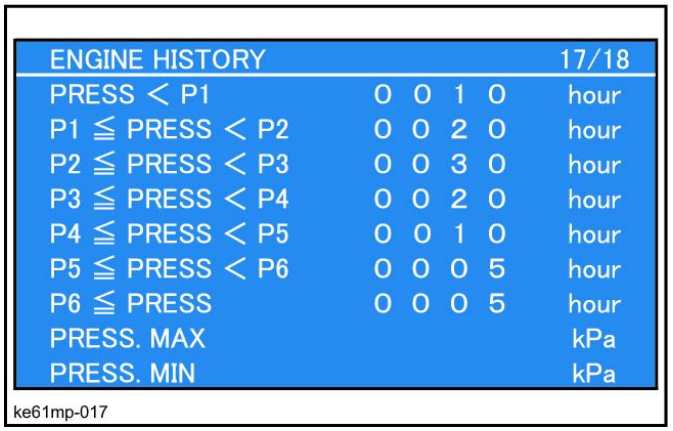
16. Hot shutdown



ke61mp-016

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

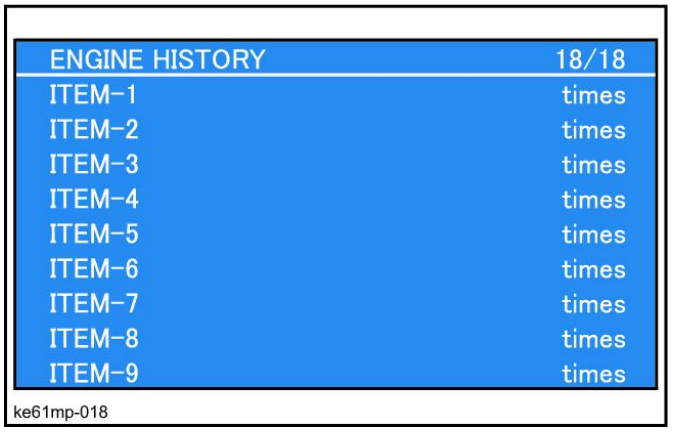
17. DPD differential pressure distribution



ke61mp-017

PRESS. < P1	hour	P < 0
P1 ≤ PRESS. < P2	hour	0 ≤ P < 5
P2 ≤ PRESS. < P3	hour	5 ≤ P < 10
P3 ≤ PRESS. < P4	hour	10 ≤ P < 15
P4 ≤ PRESS. < P5	hour	15 ≤ P < 20
P5 ≤ PRESS. < P6	hour	20 ≤ P < 25
P6 ≤ PRESS.	hour	25 ≤ P
PRESS. MAX	kPa	Maximum pressure
PRESS. MIN	kPa	Minimum pressure

18. DPD regeneration count



ke61mp-018

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

To switch to a page from 1 to 18, press the monitor switch  while the ENGINE HISTORY screen is displayed and select the desired page.

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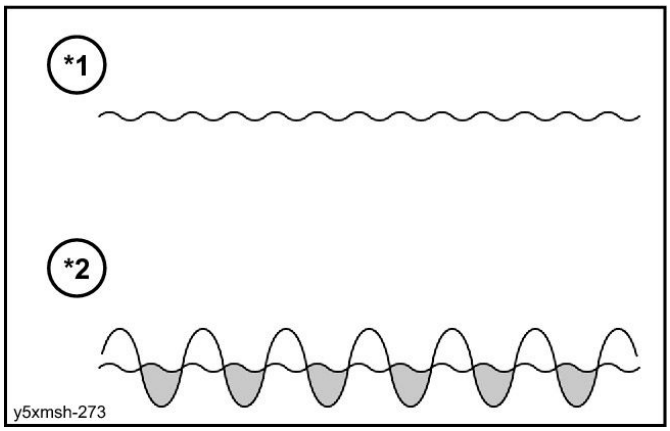
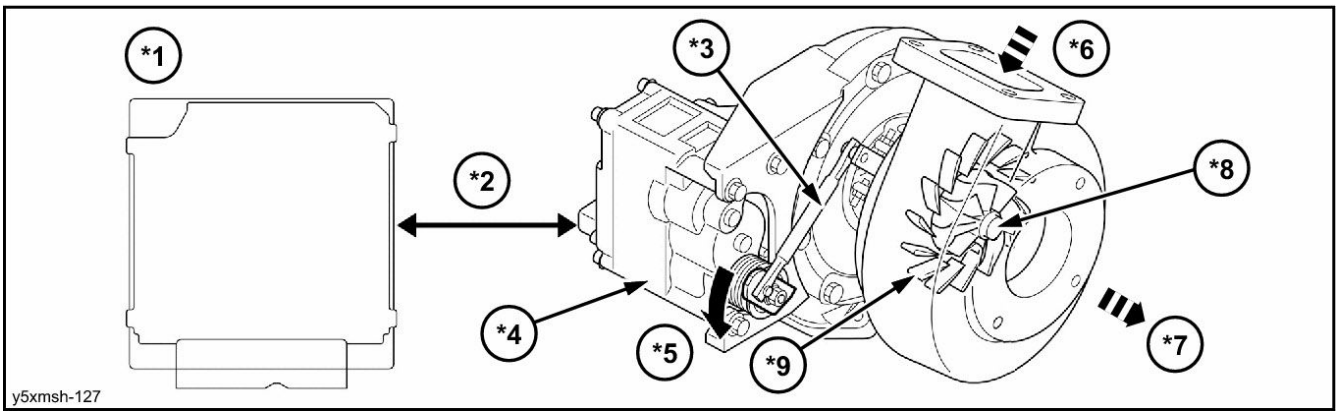
*1	Intake throttle position sensor	*7	Engine speed	*13	Exhaust
*2	EGR valve	*8	Engine load	*14	Intake throttle valve
*3	EGR position sensor	*9	Outlet port coolant	*15	Boost temperature sensor
*4	ECM	*10	Inlet port coolant	*16	Boost sensor
*5	ITA/MAF sensor	*11	EGR cooler		
*6	Intake air	*12	IMT sensor		

EGR and turbine noise
Some engines may generate high frequency noise due to the turbine rotation.
This high frequency noise can be muted using an appropriate silencer.
For some OEMs which use in residential areas is not assumed, the silencer for muting the high frequency noise may be omitted from the specifications, leaving the noise.
The high frequency noise tends to become lower while controlling the EGR and louder when EGR control is not provided.



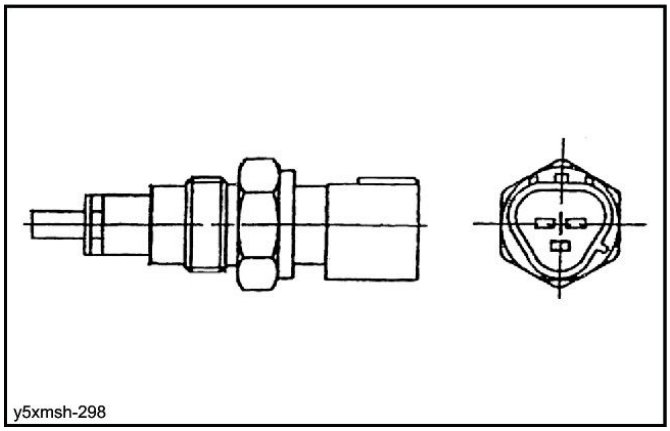
*1	Without EGR
*2	Wiht EGR

Turbocharger control
The turbocharger is a system that provides efficient supercharge to archive the turbo effect by overcoming the turbo's weakness of low exhaust energy during low engine revolution.
The turbocharger optimizes the turbine revolution by varying the nozzle opening angle within the turbine housing to adjust the turbo inlet area according to the revolution and load of the engine and control the supercharging pressure.
The ECM sends the target nozzle opening angle based on the information from each sensor to the turbocharger through CAN communication to control the boost pressure properly in accordance with the engine load requirements.
The turbocharger drives the actuator based on the information received from the ECM and controls the nozzle opening angle through the control rod.

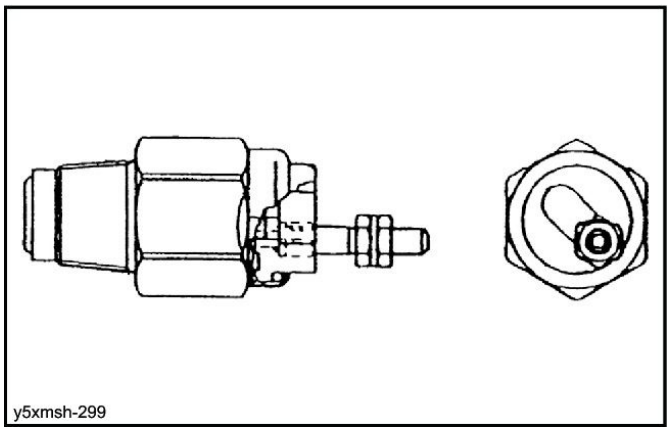


*1	ECM	*4	Actuator with built-in ECU	*7	Exhaust gas outlet
*2	CAN communication	*5	Nozzle closing direction	*8	Turbine wheel
*3	Control rod	*6	Exhaust gas inlet	*9	Nozzle

Water temperature sensor
Water temperature sensor is installed on the engine block, and the thermistor changes the resistance value according to the temperature change.
The resistance value becomes smaller when the engine coolant temperature is high, and the value becomes larger when the engine coolant temperature is low.
The ECM applies 5 V to the water temperature sensor through the pull-up resistor, and calculates the engine coolant temperature from changes in the voltage.
This value is used in various control mechanisms, such as for fuel injection control.
The voltage becomes higher when the resistance is higher, and it becomes lower when the resistance is lower.



Overheat switch
The overheat switch is installed on the water outlet pipe, and is turned ON when the engine coolant temperature exceeds 105 °C (221 °F).



Crankshaft position sensor
The crankshaft position sensor is installed on the flywheel housing and the CKP signal is generated every time when the protruding section of the flywheel passes the sensor.
The ECM determines the cylinder and specifies the crank angle using the CMP signal input from the camshaft position sensor, and uses the information for the fuel injection control and calculation of the engine RPM.
While this control is usually performed using the CKP signal, the CMP signal is used instead when the crankshaft position sensor is faulty.

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Special tool: connector test adapter kit
(refer to section 1003)

Commercial electronic equipment

Commercial electronic equipment refers to commercially available electronic equipment attached to the unit after it has been shipped from the factory.

Be careful, as such accessories are not taken into particular consideration at the machine design stage.

Commercial electronic equipment may cause malfunctions in the electronic control system, even if the equipment is properly attached.

This includes equipment not connected to the electronic system of the machine, such as mobile telephones and radios.

Therefore, when diagnosing power train problems, confirm whether such commercial electronic equipment is attached first and then remove them from the machine if such equipment is attached.

If the problem has not been resolved after removing the equipment, perform the diagnosis using the regular procedure.

⚠ CAUTION

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

Welding operation for the actual unit

When performing welding to the actual unit, make sure to disconnect the battery in prior to the operation.

Current that occurred during welding may lead to failure and/or damage to the electronic control system.

Damage caused by electrostatic discharge

As the electronic components used in the electronic control system are designed to operate at extremely low voltages, they can be easily damaged by electrostatic discharge, and some types of electronic components can be damaged by static electricity of 100 V or less, which cannot be felt by a person.

Note that a voltage of 4000 V is required for a person to be able to detect electrostatic discharge.

There are various ways a person can build up an electrostatic charge.

The most common way to build up an electrostatic charge is through methods based on friction or induction.

An example of when a person builds an electrostatic charge by friction is when he/she slides across the seat of the machine.

A person wearing insulated shoes can build an electrostatic charge by induction if he/she momentarily touches the ground while standing near a highly charged object. A charge of the same polarity flows out, and with a highly opposing polarity, that person becomes charged.

As static electricity causes damage, be cautious when handling or testing electronic components.

⚠ CAUTION

- **To prevent damage due to electrostatic discharge, do not touch the connector pins of the ECM or the electronic components soldered onto the circuit board of the ECM.**
- **To prevent damage due to electrostatic discharge, do not open the packaging of a replacement part until installation preparation for the replacement part is completed.**
- **To prevent damage due to electrostatic discharge, connect the part packaging to a properly working ground connection of the actual unit before removing the part from its packaging.**
- **To prevent damage due to electrostatic discharge, when handling a part while sliding across the seat, sitting down from a standing position, or walking a certain distance, touch a properly working ground connection before attaching the part.**

Fuel injection system

Fuel piping

⚠ WARNING

The high pressure pipe and injector pipe in the fuel system should not be reused.
When it is once removed, make sure to replace it with new one.

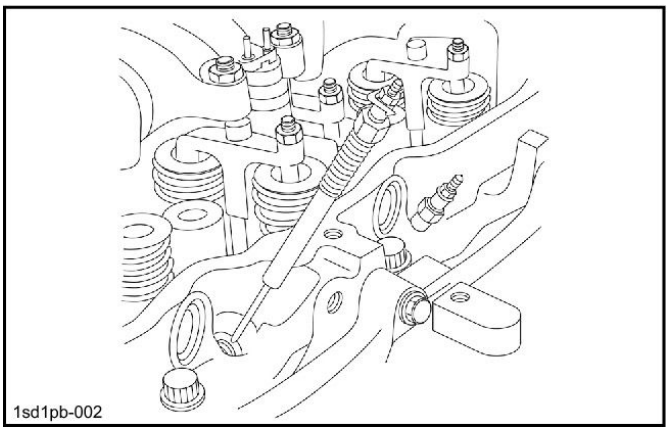
The pressure limiter or fuel pressure sensor should not be replaced individually.

When a failure is found, the common rail assembly and all fuel pipes should be replaced.

Glow plug Installation

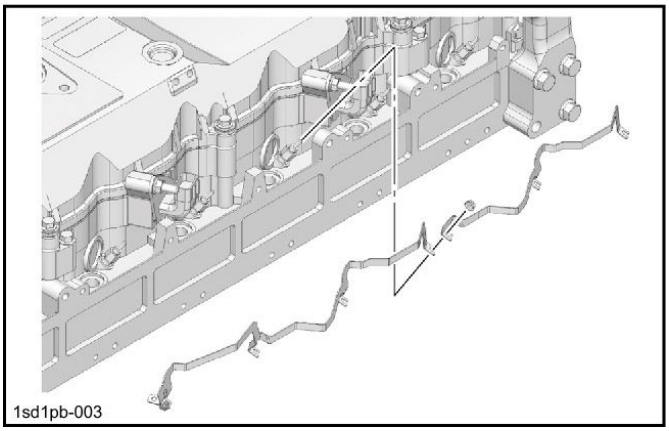
1. Glow plug Installation
   1) Install the glow plug to the cylinder head assembly.
   Tightening torque : 20 N· m { 2.0 kgf· m / 14.8 lb· ft }

> ⚠ **CAUTION**
>
> - **Be careful not to exceed the specified torque when tightening.**

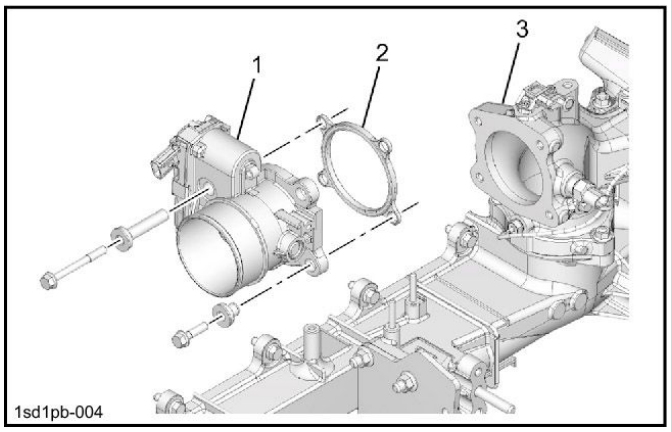


   2) Install the glow plug connector to the glow plug.
   Tightening torque : 1 N· m { 0.1 kgf· m / 8.9 lb· in }

> ⚠ **CAUTION**
>
> - **Confirm that the glow plug connector does not interfere with the surrounding parts.**



2. Intake throttle valve Installation
   1) Install the intake throttle valve to the inlet pipe.
   Tightening torque : 24 N· m { 2.4 kgf· m / 17.7 lb· ft }

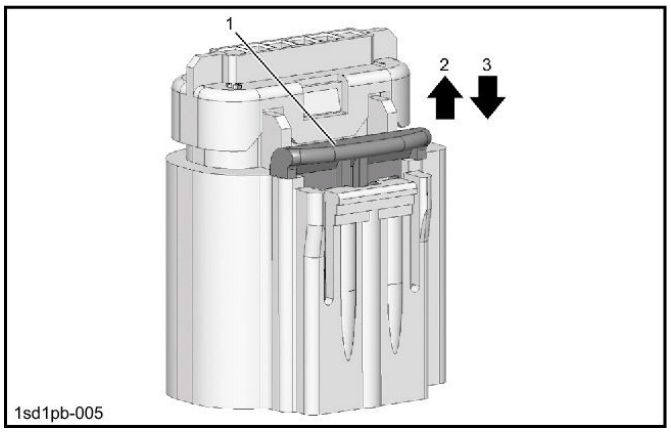


1	Intake throttle valve
2	Gasket
3	Inlet pipe

   2) Install the air duct to the intake throttle valve.
   3) Connect the harness connector to the intake throttle valve.

ANNOTATION:

- *After connecting the harness connector, press in the lock operation portion to lock.*



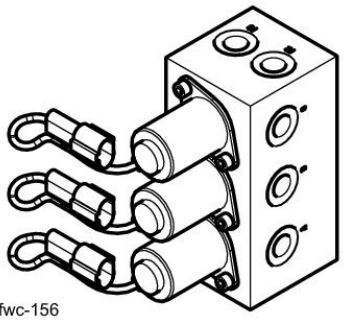
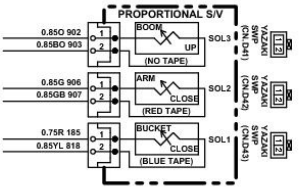
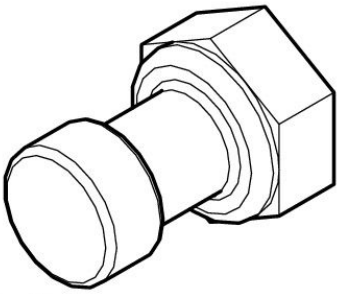
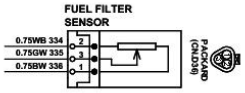
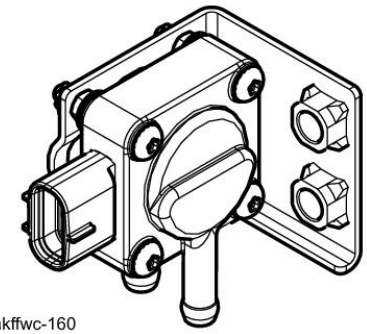
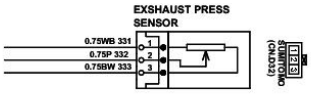
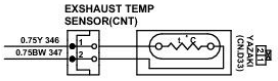
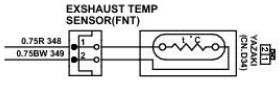
1	Lock operation section
2	Lock release
3	Lock

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

Electrical Equipment Layout Diagram

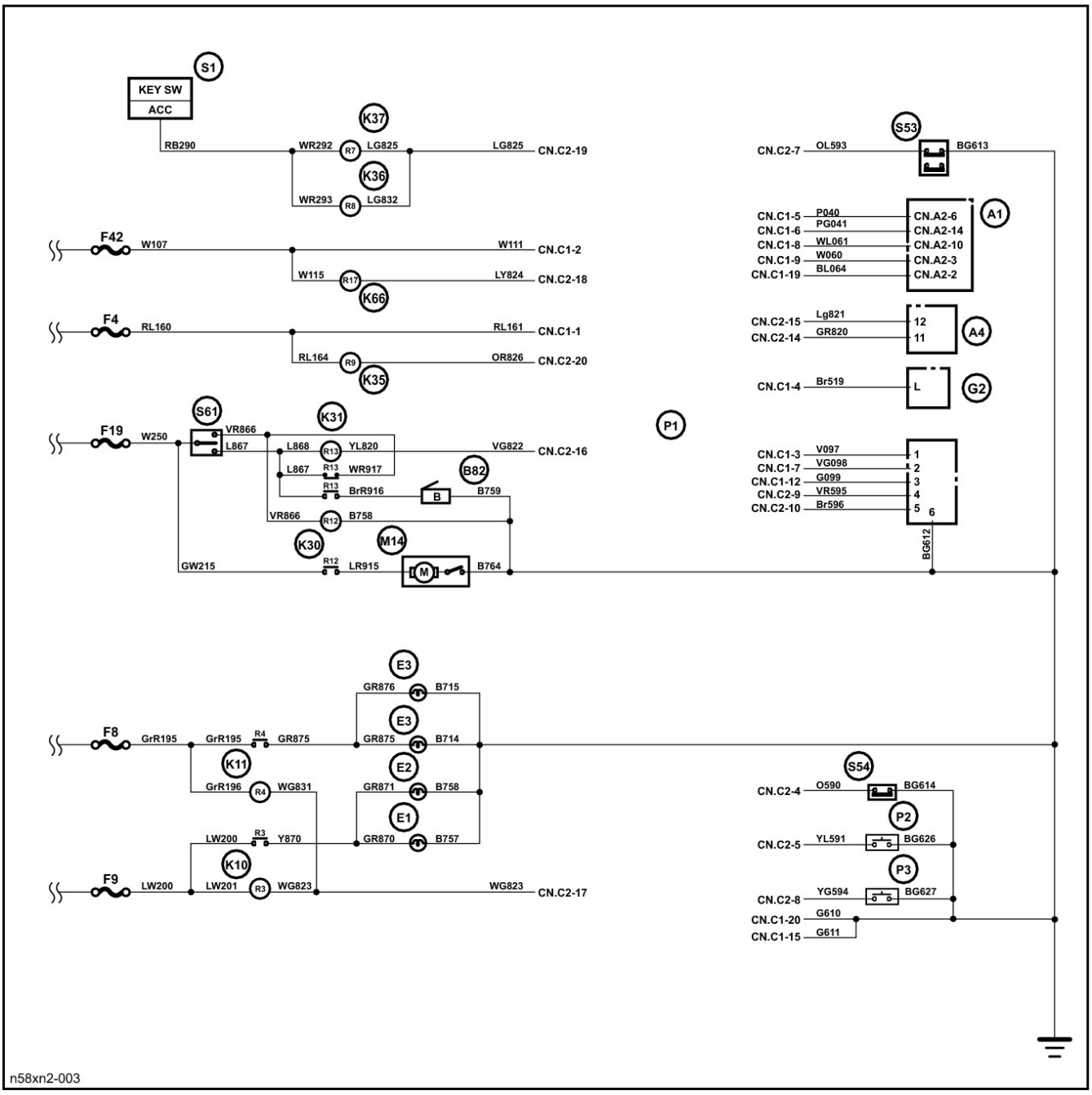
1	Cup holder	5	Throttle volume	9	Air conditioner control panel
2	Starter switch	6	Tilt lever right	10	Engine emergency stop switch
3	Rocker switch space	7	Tilt lever left	11	Gate lever
4	Radio	8	Ashtray		

Electrical Equipment Layout Diagram

Name	Shape	Circuit	Remarks
3 stack proportional valve (boom up, arm in, bucket close)	 akffwc-156	 akffwc-157	Sumitomo part No.; KHJ23870
Fuel filter sensor (Isuzu)	 akffwc-158	 akffwc-159	Sumitomo part No.; KHH13230
DPF exhaust gas pressure differential pressure sensor (Isuzu)	 akffwc-160	 akffwc-161	Isuzu part No.; 897360-3682 Sumitomo part No.; KHH13330
DPF temperature sensor (Isuzu) (center)	 akffwc-162	 akffwc-163	Isuzu part No.; 898004-3300 Sumitomo part No.; KHH13360
DPF temperature sensor (Isuzu) (front)	 akffwc-162	 akffwc-170	Isuzu part No.; 898004-3290 Sumitomo part No.; KHH13350

Sequence Circuit Diagram

Monitor



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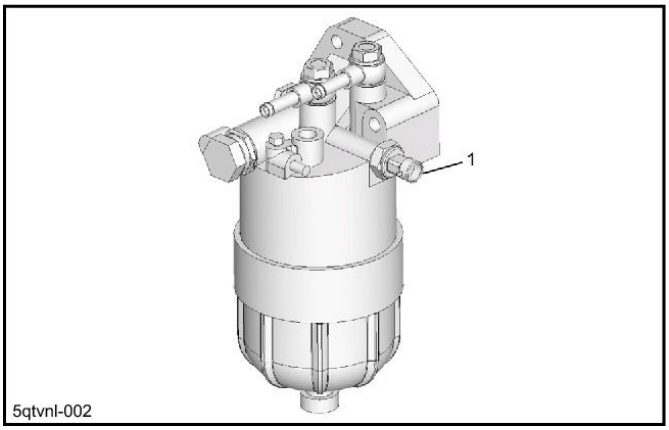
Fuel filter pressure sensor Installation

1. Fuel filter pressure sensor Installation
   1) Install the fuel filter pressure sensor to the fuel filter.

      ⚠ CAUTION

      - **After cleaning the threaded portion of the fuel filter body, install it.**

      Tightening torque : 12 N· m {1.2 kgf· m / 106.2 lb· in}
   2) Connect the harness connector to the fuel filter pressure sensor.



1	Fuel filter pressure sensor

   3) Start the engine.

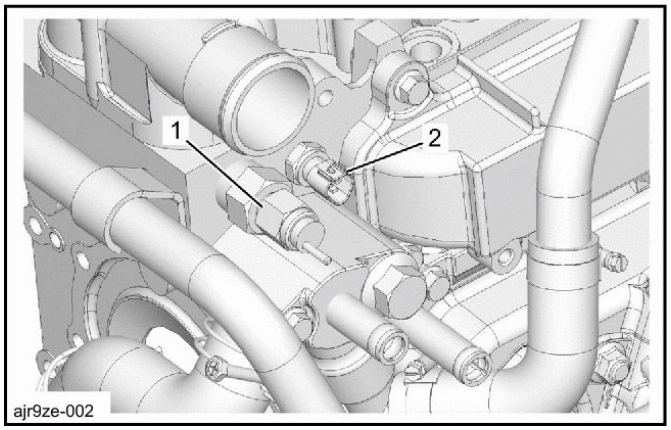
      ANNOTATION:

      - *Check that there is no fuel leaks.*
      - *Confirm that DTC has not yet been detected.*

Removal and Installation of Engine coolant temperature sensor

Engine coolant temperature sensor Removal

1. Engine coolant temperature sensor Removal
   1) Disengage the harness connector from the engine coolant temperature sensor.
   2) Remove the engine coolant temperature sensor from the cylinder head assembly.



1	Overheat switch
2	Water temperature sensor

15) If the harness connector and each circuit are normal, replace the fuel pressure sensor.
Refer to "1.Engine 1C.Fuel System(6HK1X) Common rail assembly Removal".
Refer to "1.Engine 1C.Fuel System(6HK1X) Common rail assembly Installation".

ANNOTATION:

- *Do not replace the fuel pressure sensor separately.*
  When a problem is found, replace the common rail assembly.

16) If the fuel rail pressure sensor display is within the standard range, start the engine.
17) Perform the injector stop test with the trouble diagnosis scan tool.
18) Command each injector OFF, and confirm that the engine RPM changes on each injector.
19) If any injector does not change the engine RPM when OFF is instructed, replace the relevant injector.
Refer to "1.Engine 1C.Fuel System(6HK1X) Injector Removal".
Refer to "1.Engine 1C.Fuel System(6HK1X) Injector Installation".
20) When the injector has been replaced, set the injector ID code on the ECM.
21) Inspect to see if there is clogging with the fuel system between the fuel tank and the fuel supply pump.
22) If a problem is discovered, repair the clogging of the fuel system.
23) Inspect the fuel hose between the fuel tank and the fuel supply pump for a cut and crack.
24) If a problem is discovered, replace the fuel hose.

ANNOTATION:

- *The fuel hose between the fuel tank and the fuel supply pump becomes negative pressure state when the engine is running.*
- *When the fuel hose is not connected securely, the air can enter.*
- *When the engine RPM or the engine load increases while the air has intruded in the fuel system, fluctuation in the common rail pressure is caused, and DTC P0087 may be detected.*

25) Check that an appropriate clamp is used between the fuel tank and the fuel supply pump.
26) If a problem is discovered, replace the clamp.
27) Operate the priming pump until the handle becomes heavy.

ANNOTATION:

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

28) Start the engine.
29) Inspect the high-pressure side of the fuel system and check for fuel leak between the fuel supply pump and common rail.

ANNOTATION:

- *The fuel may leak to the bottom section of the cylinder head cover from the high pressure hose inlet.*
- *The engine oil level increases when the fuel leaks to the bottom portion of the cylinder head cover.*
- *Inspect for fuel leaks into the engine oil.*

30) If fuel leak if found, fix the problem.
31) Turn OFF the starter switch.
32) Remove the fuel hose on the fuel supply pump side from the fuel filter.

ANNOTATION:

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

33) Connect the pressure gauge between the fuel filter and the removed fuel hose.

ANNOTATION:

- *Confirm that the fuel system is connected securely.*

34) Remove the air using the priming pump, and crank the engine for the specified period of time or shorter.
Specified time: 5 s

ANNOTATION:

- *Repeat this until the engine starts.*

35) Leave the engine idling for the specified period of time or longer.
Specified time: 1 min
36) While keeping the engine rotating at the specified engine RPM for the specified period of time, check the pressure gauge.
Specified time: 1 min
Rotational speed: 2500 min^{-1} {2500 r/min}
37) Check if the pressure gauge shows a negative pressure value at or above the standard value during inspection.
Specified value: 17.0 kPa {128 mmHg / 5 inHg}

ANNOTATION:

- *Fuel clogging is checked with the negative pressure amount in the fuel system.*

38) If the negative pressure is at or above the standard value, inspect to see if there is damage or twisting with the fuel system between the fuel supply pump and the fuel tank.
39) If a problem is discovered, repair the fuel system.
40) Inspect the fuel tank bent hose.
41) If a problem is discovered, repair the bent hose.

- *The DTC set on a sensor which shares this circuit may be detected.*

17) If a problem is discovered, repair the GND circuit.
18) Inspect to see if there is an open circuit or high resistance in the signal circuit between the ECM and the fuel temperature sensor.
19) If a problem is discovered, repair the signal 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(6HK1X) ECM Removal".
    Refer to "1.Engine 1J.Electrical(6HK1X) 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 P0183 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.

ANNOTATION:

- *Run the engine for 3 minutes or longer.*

5) Use the trouble diagnosis scan tool to confirm that a DTC has not been detected.

DTC P0192 (Flash Code 245) Fuel Rail Pressure Sensor Circuit Low

1. DTC P0192 Priority DTC
   DTC P0641
2. DTC P0192 Diagnostics

1) Turn OFF the starter switch.
2) Disconnect the harness connector from the fuel pressure sensor.
3) Check the fuel rail pressure sensor display with the trouble diagnosis scan tool.
   Voltage : 4.5 V
4) If it is at or below the standard value, inspect to see if there is a short circuit to the GND with the signal circuit between the ECM and the fuel pressure sensor.
5) If a problem is discovered, repair the signal circuit.
6) Measure the voltage between the fuel pressure sensor 5 V power supply circuit and normal GND.
   Voltage : 4.5 V
7) If it is at or above the standard value, inspect to see if there is a contact failure with the fuel pressure sensor harness connector.
8) If a problem is discovered, repair the harness connector.
9) If the harness connector is normal, replace the fuel pressure sensor.
   Refer to "1.Engine 1C.Fuel System(6HK1X) Common rail assembly Removal".
   Refer to "1.Engine 1C.Fuel System(6HK1X) Common rail assembly Installation".

   ANNOTATION:

   - *Do not replace the fuel pressure sensor separately. When a problem is found, replace the common rail assembly.*

10) Inspect to see if there is an open circuit or high resistance with the 5 V power supply circuit between the ECM and fuel pressure sensor.

    ANNOTATION:

    - *The fuel pressure sensor shares the 5 V power supply circuit with other sensors.*
    - *The DTC set on a sensor which shares this circuit may be detected.*

11) If a problem is discovered, repair the 5 V power supply circuit.
12) Inspect the ECM harness connector for a contact failure.
13) If a problem is discovered, repair the harness connector.
14) If the harness connector is normal, replace the ECM.
    Refer to "1.Engine 1J.Electrical(6HK1X) ECM Removal".
    Refer to "1.Engine 1J.Electrical(6HK1X) ECM Installation".
15) Set the injector ID code on the ECM.
16) Perform the unit difference learning of the fuel supply pump to the ECM.

17) Turn ON the starter switch.
18) Turn the starter switch OFF for 30 seconds.

ANNOTATION:

- *The starter switch must be once turned ON and then turned OFF before clearing the DTC.*

19) Clear the DTC using the trouble diagnosis scan tool.
20) Turn the starter switch OFF for 30 seconds or longer.
21) Start the engine.
22) Use the trouble diagnosis scan tool to check if a DTC has been detected.
23) If a DTC has been detected, replace the ECM.
Refer to "1.Engine 1J.Electrical(6HK1X) ECM Removal".
Refer to "1.Engine 1J.Electrical(6HK1X) ECM Installation".
24) Set the injector ID code on the ECM.
25) Perform the unit difference learning of the fuel supply pump to the ECM.

3. DTC P0638 Confirm Resolution

1) Turn ON the starter switch.
2) Turn the starter switch OFF for 30 seconds or longer.

ANNOTATION:

- *The starter switch must be once turned ON and then turned OFF before clearing the DTC.*

3) Clear the DTC using the trouble diagnosis scan tool.
4) Turn the starter switch OFF for 30 seconds or longer.
5) Start the engine.
6) Perform a test-run with the intake throttle solenoid drive duty of 20% or above.
7) Use the trouble diagnosis scan tool to confirm that a DTC has not been detected.

DTC P0641 (Flash Code 55) Sensor Reference Voltage 1 Circuit

1. DTC P0641 Diagnostics

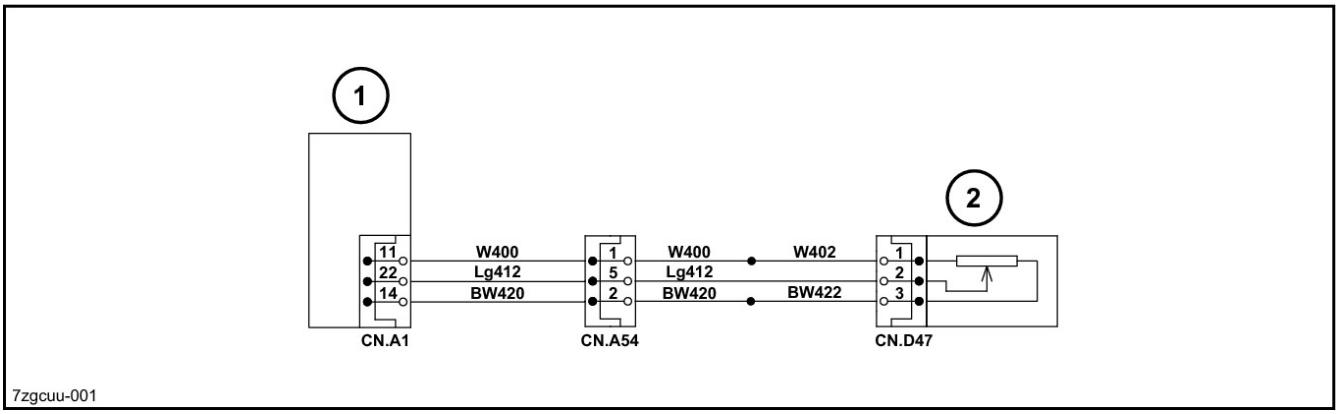
1) Turn OFF the starter switch.
2) Disconnect the harness connector from the accelerator position sensor.
3) Turn ON the starter switch.
4) Measure the voltage between the 5 V power supply terminal and GND of the accelerator position sensor harness connector.
Voltage : 5.5 V
5) If it is at or above the standard value, inspect to see if there is a short circuit to the battery or ignition power supply with the accelerator position sensor 5 V power supply circuit between the ECM and the accelerator position sensor.
6) If a problem is discovered, repair the accelerator position sensor 5 V power supply circuit.
7) Inspect to see if there is a short circuit to the battery or ignition power supply with the crankshaft position sensor 5 V power supply circuit between the ECM and the crankshaft position sensor.
8) If a problem is discovered, repair the crankshaft position sensor 5 V power supply circuit between the ECM and the crankshaft position sensor.
9) Inspect to see if there is a short circuit to the battery or ignition power supply with the fuel pressure sensor 5 V power supply circuit between the ECM and the fuel pressure sensor.
10) If a problem is discovered, repair the fuel pressure sensor 5 V power supply circuit.
11) If it is at or below the standard value, measure the voltage between the 5 V power supply circuit and GND of the accelerator position sensor harness connector.
Voltage : 4.5 V
12) If it is at or above the standard value, replace the accelerator position sensor.
13) If it is at or below the standard value, turn the starter switch OFF.
14) Disconnect the harness connector from the crankshaft position sensor.
15) Turn ON the starter switch.
16) Measure the voltage between the accelerator position sensor 5 V power supply circuit and GND of the accelerator position sensor harness connector.
Voltage : 4.5 V
17) If it is at or above the standard value, replace the crankshaft position sensor. Refer to "1.Engine 1B.Mechanical(6HK1X) CKP sensor Removal".
Refer to "1.Engine 1B.Mechanical(6HK1X) CKP sensor Installation".
18) If it is at or below the standard value, turn the starter switch OFF.
19) Disconnect the harness connector from the fuel pressure sensor.
20) Turn ON the starter switch.

4) Perform a test-run.
5) Use the trouble diagnosis scan tool to confirm that a DTC has not been detected.

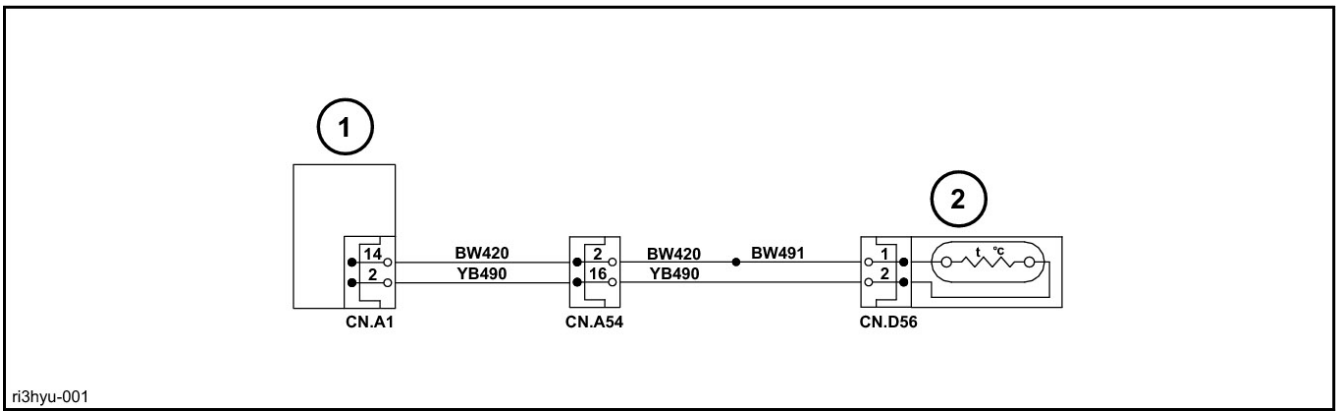
DTC P2229 (Flash Code 71) Barometric Pressure Circuit High

1. DTC P2229 Priority DTC
   P0651
2. DTC P2229 Diagnostics
   1) Turn OFF the starter switch.
   2) Disconnect the harness connector from the atmospheric pressure sensor.
   3) Check the atmospheric pressure sensor display with the trouble diagnosis scan tool.
      Voltage : 0.1 V
   4) If it is at or above the standard value, inspect the signal circuit between the ECM and the atmospheric pressure sensor.
      - There should be no short to the battery or ignition power supply.
      - There should be no short to the 5 V power supply.
   5) If a problem is discovered, repair the signal circuit.
   6) Connect the test light between the atmospheric pressure sensor GND circuit and battery power supply.
   7) If the test light comes on, inspect the atmospheric pressure sensor harness connector for a contact failure.
   8) If a problem is discovered, repair the harness connector.
   9) If the harness connector is normal, replace the atmospheric pressure sensor.
   10) If the test light does not come on, inspect to see if there is an open circuit or high resistance with the GND circuit between the ECM and the atmospheric pressure sensor.
   11) If a problem is discovered, repair the GND circuit.
   12) Inspect the ECM harness connector for a contact failure.
   13) If a problem is discovered, repair the harness connector.
   14) If the harness connector is normal, replace the ECM.
      Refer to "1.Engine 1J.Electrical(6HK1X) ECM Removal".
      Refer to "1.Engine 1J.Electrical(6HK1X) ECM Installation".
   15) Set the injector ID code on the ECM.
   16) Perform the unit difference learning of the fuel supply pump to the ECM.
3. DTC P2229 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.

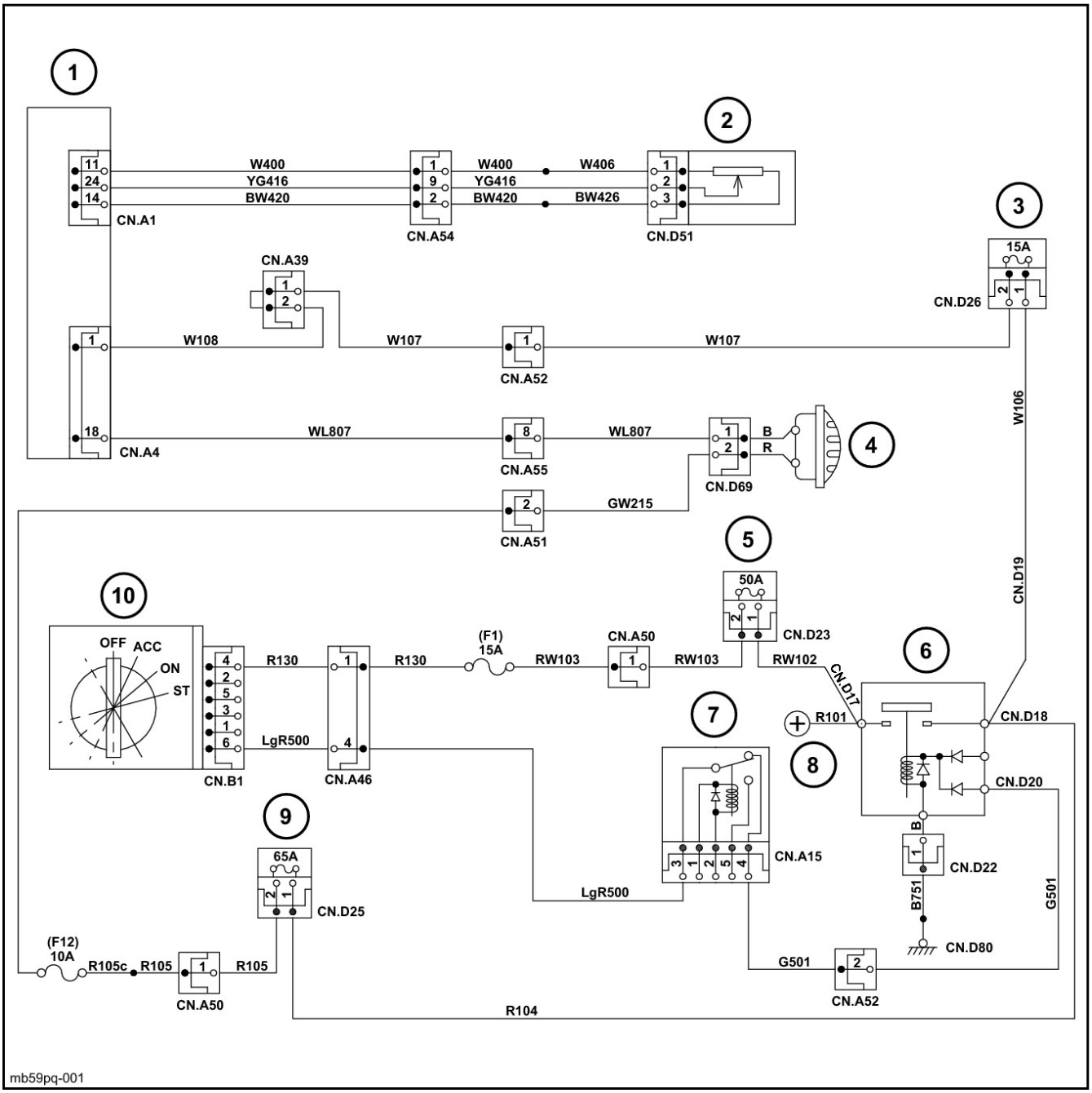
Step	Action	Standard value	Yes	No
10	1. Turn the key switch ON. 2. Measure the voltage between the ground and terminal 1 of the CN. D47 harness side. Is it about 5 V?	About 5 V	Go to Step 11	W400 or W402 harness defect (disconnection). Repair or replace
11	1. Measure the voltage between the ground and terminal 2 of the CN. D47 harness side. Is it 0.25 V or higher?	0.25 V or higher	Computer A defect. Replace	Lg412 harness defect (disconnection). Repair or replace



1	COMPUTER A
2	PRESS. SENSOR (N1)



1	COMPUTER A
2	HYD. OIL TEMP SENSOR



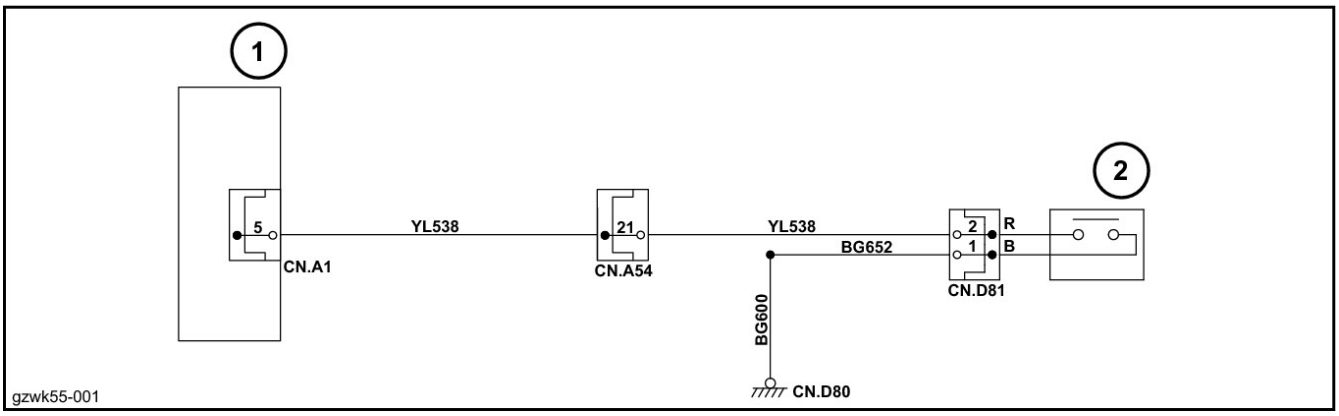
1	COMPUTER A	5	BACK UP FUSIBLE LINK	9	FUSIBLE LINK FUSE BOX
2	PRESS. SENSOR (PILOT TRAVEL)	6	RELAY BATTERY	10	KEY SWITCH
3	FUSE CONT	7	RELAY KEY ON		
4	TRAVEL ALARM 24 V, 107 dB	8	BATTERY (24 V)		

Diagnostic Trouble Code: 7248 Arm-in Proportional Valve Signal Abnormality

Step	Action	Standard value	Yes	No
1	1. Turn the key switch ON. 2. Check whether diagnostic trouble code: 7248 is displayed. Is diagnostic trouble code: 7248 displayed?		Go to Step 2	
2	1. Inspect the connection status of each connector. 2. Check whether diagnostic trouble code: 7248 is displayed. Is diagnostic trouble code: 7248 displayed?		Go to Step 3	
3	1. Reset the diagnostic trouble code on the service support DIAG screen. 2. Check whether diagnostic trouble code: 7248 is displayed. Is diagnostic trouble code: 7248 displayed?		Go to Step 4	Go to Step 5.
4	Inspect for shorts. 1. Turn the key switch OFF and disconnect CN. D42. 2. Inspect for continuity between the ground and terminal 1 of the CN. D42 harness side. Is there continuity?		G906 harness defect (short). Replace	Computer B defect. Replace
5	Inspect the arm-in proportional valve. 1. Turn the key switch OFF. 2. Disconnect CN. D42. 3. Inspect for continuity between terminals 1 and 2 of the CN. D42 arm-in proportional valve side. Is there continuity?		Go to Step 6	Arm-in proportional valve defect. Replace
6	Inspect for disconnection. 1. Disconnect CN. A56. 2. Inspect for continuity between terminal 1 of the CN. D42 female side and terminal 4 of the CN. A56 female side. Is there continuity?		Go to Step 7	G906 harness defect (disconnection) between CN. A56 and CN. D42. Repair or replace
7	Inspect for continuity between terminal 2 of the CN. D42 female side and terminal 12 of the CN. A56 female side. Is there continuity?		Go to Step 8	GB907 harness defect (disconnection) between CN. A56 and CN. D42. Repair or replace
8	1. Disconnect CN. A7. 2. Inspect for continuity between terminal 4 of the CN. A56 male side and terminal 3 of the CN. A7 female side. Is there continuity?		Go to Step 9	G906 harness defect (disconnection) between CN. A56 and CN. A7. Repair or replace
9	Inspect for continuity between terminal 12 of the CN. A56 male side and terminal 6 of the CN. A7 female side. Is there continuity?		Computer B defect. Replace	GB907 harness defect (disconnection) between CN. A56 and CN. A7. Repair or replace

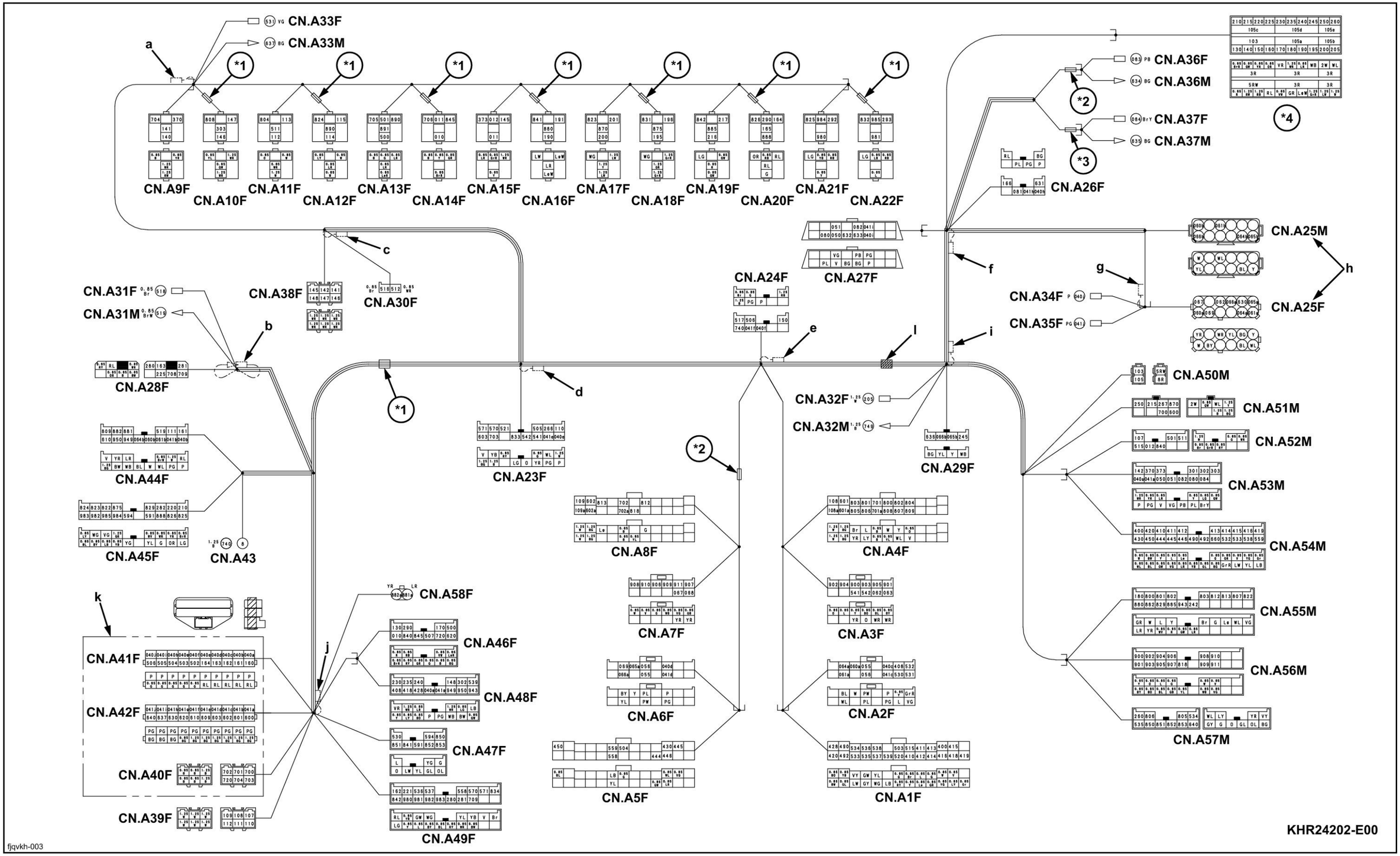
Diagnostic Trouble Code: 7424 Return Filter Clogging (breaker specifications)

Step	Action	Standard value	Yes	No
1	1. Check that the "HYD. OIL FILTER" display appears. 2. Replace the return filter. 3. Turn the key switch ON. 4. Check whether diagnostic trouble code: 7424 is displayed. Is diagnostic trouble code: 7424 displayed?		Go to Step 2	
2	1. Inspect the connection status of each connector and ground. 2. Check whether diagnostic trouble code: 7424 is displayed. Is diagnostic trouble code: 7424 displayed?		Go to Step 3	
3	Inspect the return filter clog switch. 1. Turn the key switch OFF and disconnect CN. D81. 2. Inspect for continuity between terminals 1 and 2 of the CN. D81 return filter clog switch side. Is there continuity?		Computer A defect. Replace	Return filter clog pressure switch defect. Replace

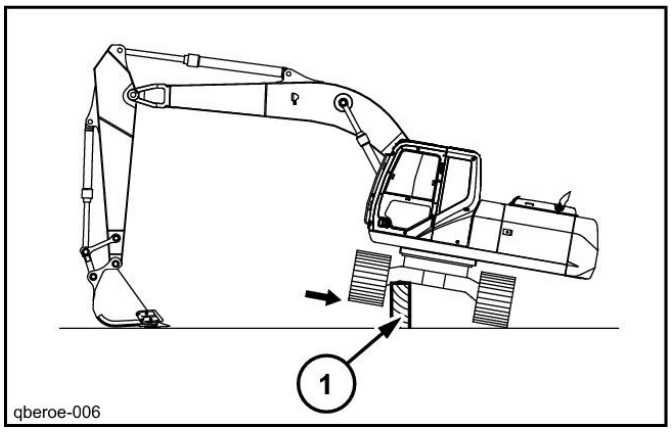


1	COMPUTER A
2	PRESS. SWITCH (FILTER INDICATOR)

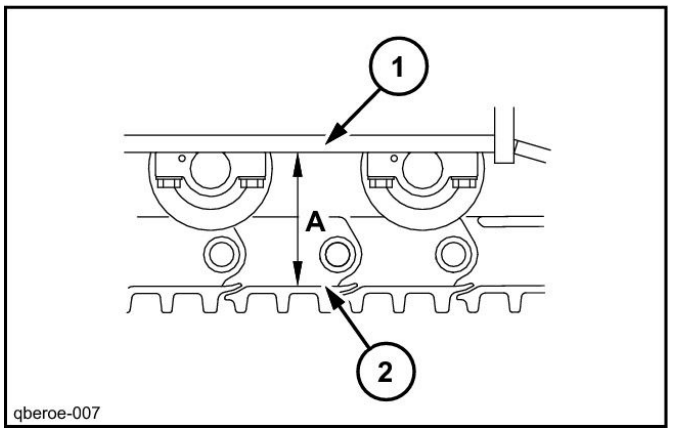
Cab Main Harness



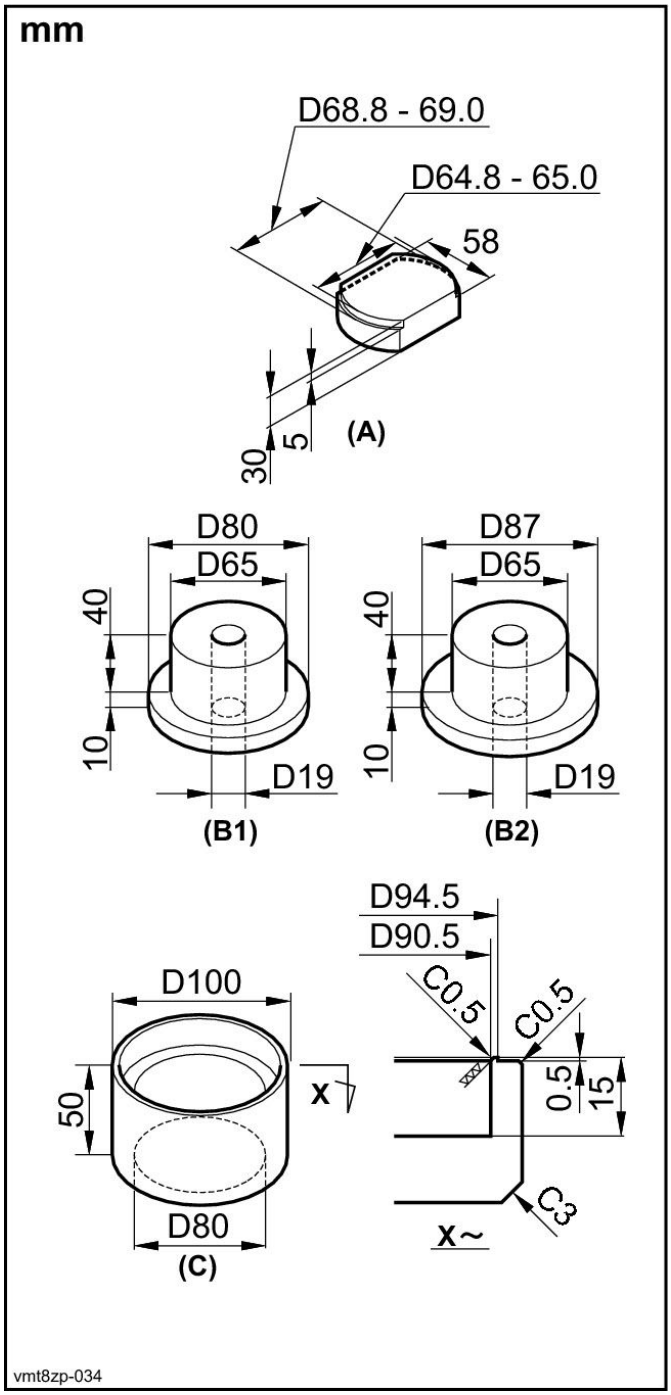
6. To adjust the track shoe tension, raise the lower side frame with a wood plank (1) or other device as shown in the diagram.



7. Adjust the tension so that the distance indicated with A between the frame bottom (1) of the center area of the lower side frame and the lowest hanging part of the top of the shoe plate (2) is 330 - 360 mm.



Jig Dimension Diagram



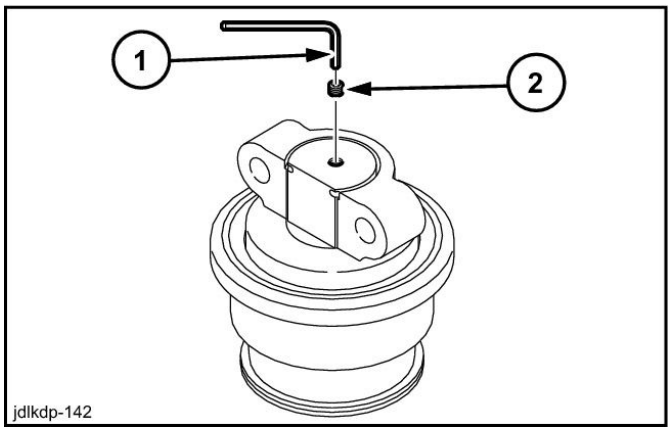
A	Bushing removal jig
B1	For bushing press-fit jig (7)

B2	For bushing press-fit jig (9)
C	Floating seal installation jig

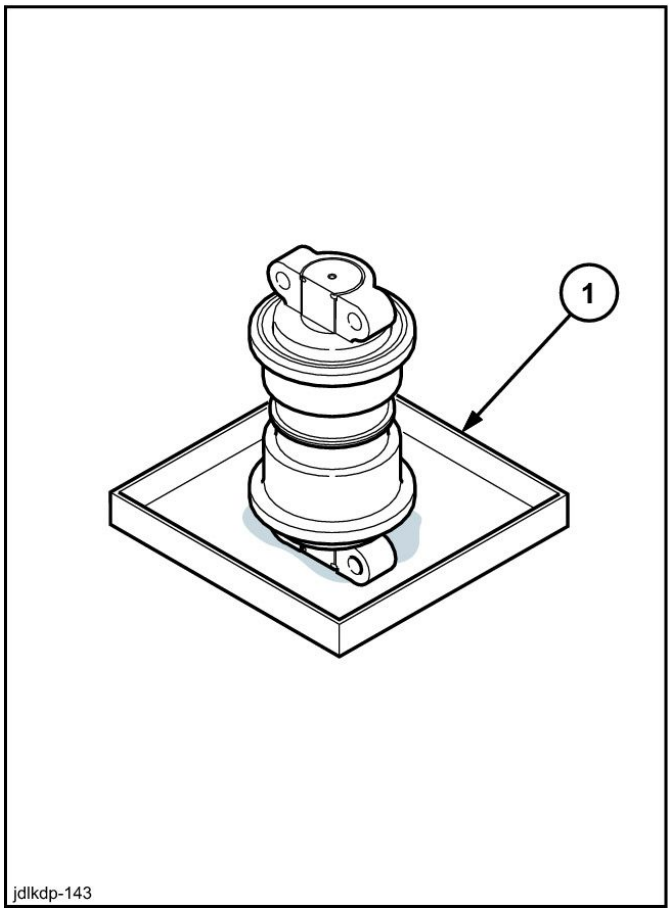
A	Bushing removal jig
B	Bushing press-fit jig
C	Floating seal installation jig

Disassembly Procedures

1. Stand the roller vertically and use a hexagon wrench (6 mm) (1) to remove the plug (2).
   - The plug is coated with seal nylon, which comes off when the plug is removed.
     To reuse the plug, using seal tape is necessary.



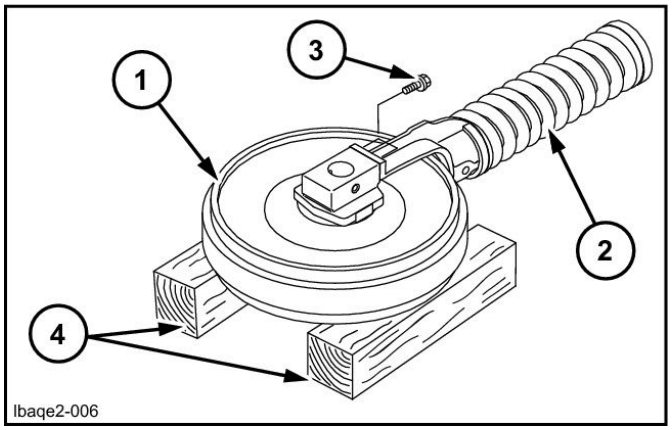
2. Face down the part of the roller from which the plug was removed and empty the oil from within the roller.
   - It may take a few hours to completely empty the oil.
   - Place an oil pan (1) underneath to catch the oil.
   - Securely fasten so that the roller does not fall over.



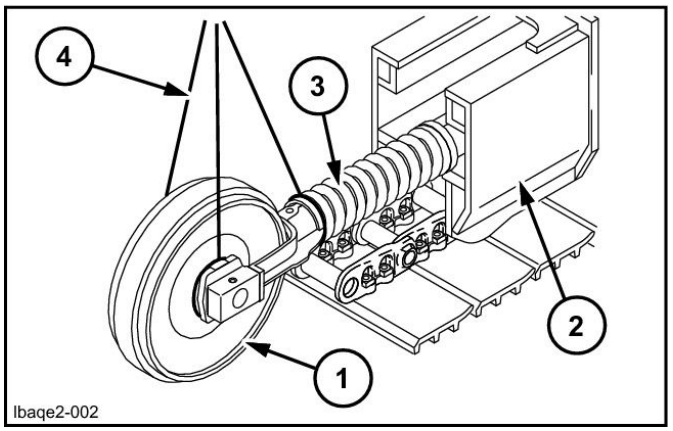
3. Remove the wire clip (1).

Installation of Take-up Roller

1. Place the take-up roller (1) and recoil spring assembly (2) onto wood planks (4) as in the diagram. Use a wrench (24 mm) to fasten the take-up roller (1) and recoil spring assembly (2) with the bolt (3).
   At this time, be sure to coat the bolt with Loctite #262.
   Installation bolt tightening torque: 267 - 312 N·m

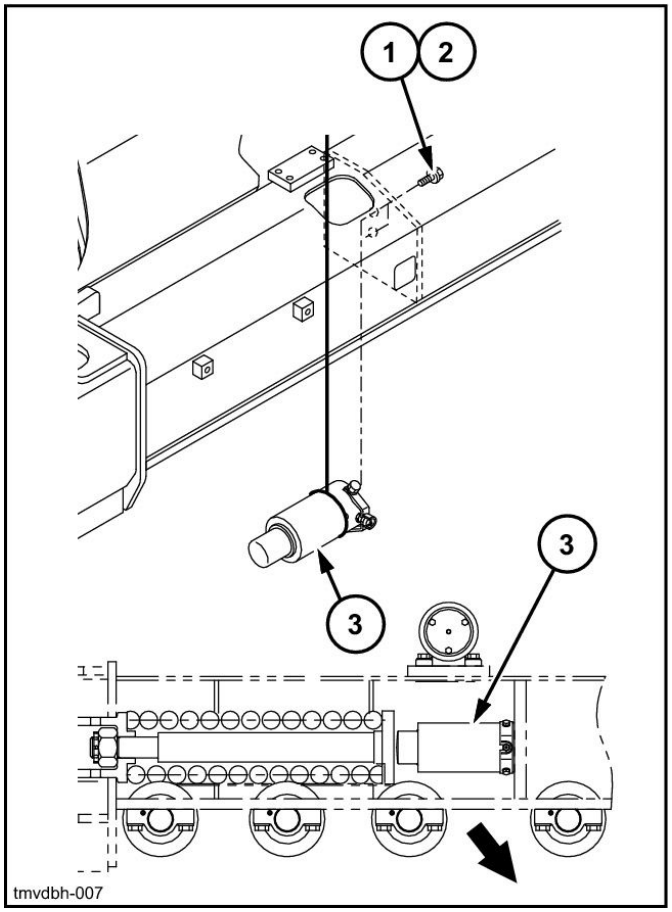


2. Install the lifting equipment (4) on the take-up roller (1) and recoil spring assembly (3) as in the diagram, lift them up with the liftcrane, and insert them into the side frame (2).
   Push in with the crowbar until the recoil spring assembly contacts the grease cylinder.



3. Install the shoe assembly.
   For details on installation, see the "Removal and Installation of Shoe Assembly" procedure.

6. Use a wrench or box wrench (24 mm) to remove the bolt (1) and washer (2), and then remove the grease cylinder (3).
   Lower the liftcrane as is to lower to under the frame, and then take out from between the lower rollers.



Installation of grease cylinder

To install, perform the reverse of the removal procedure.
Grease cylinder installation bolt tightening torque: 267 - 312 N· m
When installing bolts, coat the threaded sections with Loctite #262.

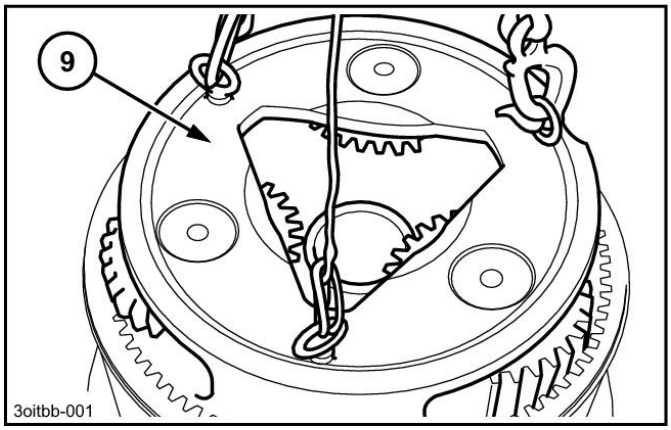
Removal of carrier 2 assembly

1. Remove the sun gear 2 (15).

> ⚠ **CAUTION**
>
> **Be very careful not to get hands stuck between gears.**

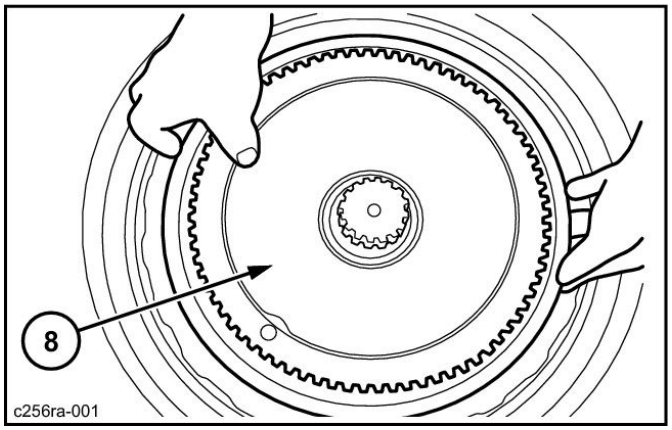
2. Install 3 M10 eyebolts on carrier 2 (9), then remove the carrier 2 assemblies (9, 10, 11, 12, 13, 14).

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

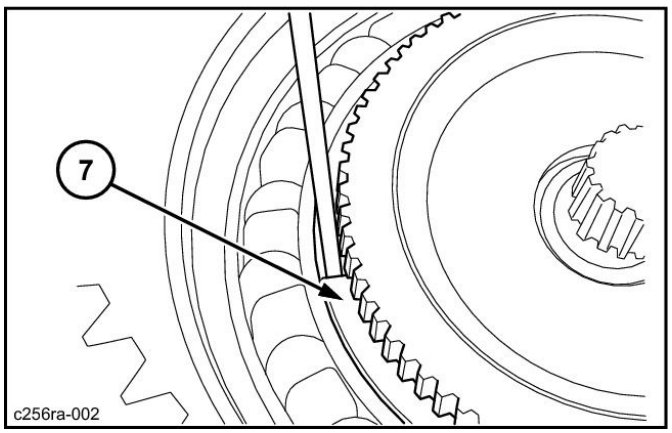


Removal of housing assembly

1. Remove the support ring (8).

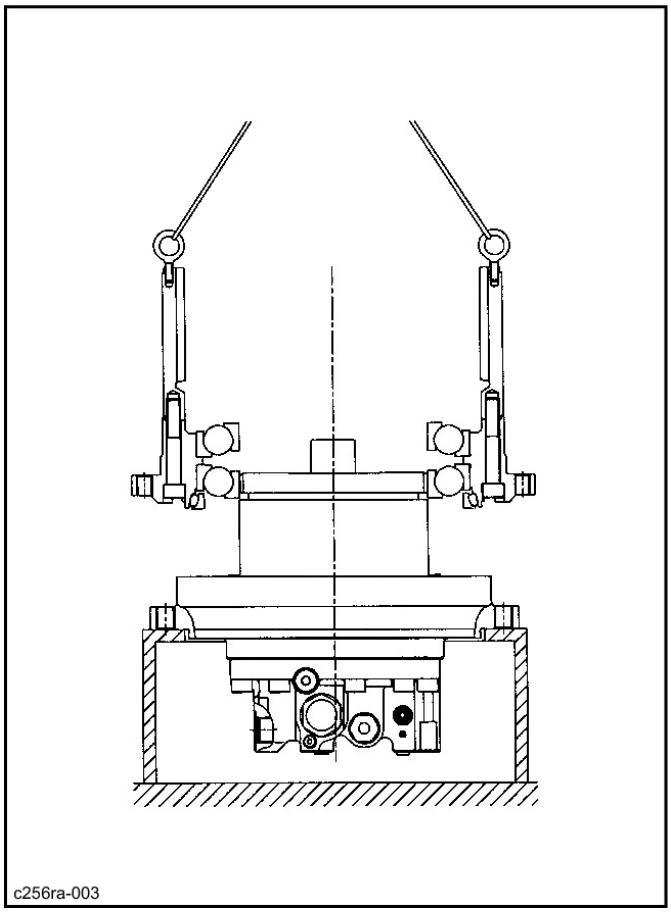


2. Place a screwdriver or other tool on the divided surface of the lock washer (7) and strike the tool with a hammer to remove the lock washer (7).



3. Install 3 M10 eyebolts into the M10 threaded holes on the ring gear (3) at approximately the same distance apart, and remove the housing assembly (ring gear (3), housing (1), bearing (2), floating seal (5), hexagon socket head bolt M18 x 110 (4)) while lifting it in a horizontal position.

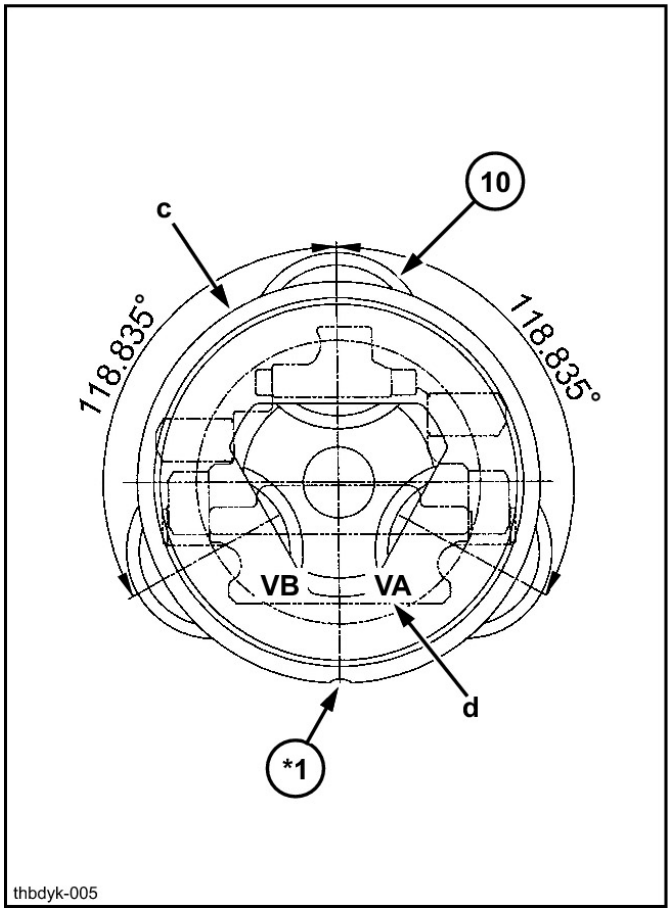
> ⚠ **CAUTION**
>
> - **Be very careful not to get hands stuck between parts or drop the suspended parts on feet.**
> - **Lift the part in a horizontal position.**



2. Insert the sun gear 2 (15).

> ⚠ **CAUTION**
>
> **Be very careful not to get hands stuck between gears.**

- The carrier 2 assembly is assembled at the position indicated in "carrier 2 (c) installation direction" to improve oil lubrication, so be sure to observe this procedure.



Carrier 2 installation direction

d	Motor port
*1	Notching V into carrier 2

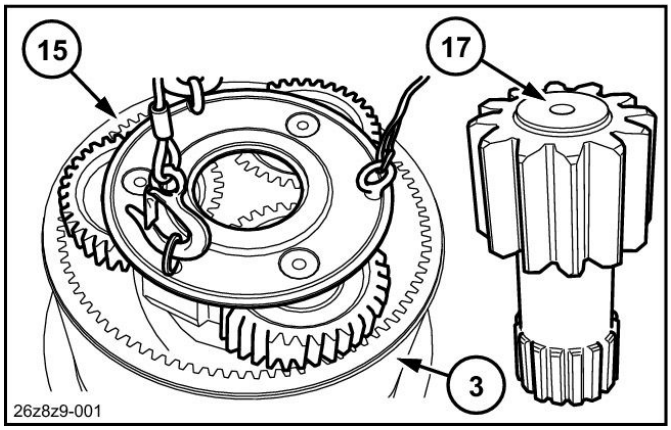
Installation of carrier 1 assembly

1. Install and suspend 3 M10 eyebolts to the carrier 1 assembly, insert it into the ring gear (3), rotate the planetary gear 1 (17) by hand to align it, and then have the gear mesh with the sun gear 2 (15).

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

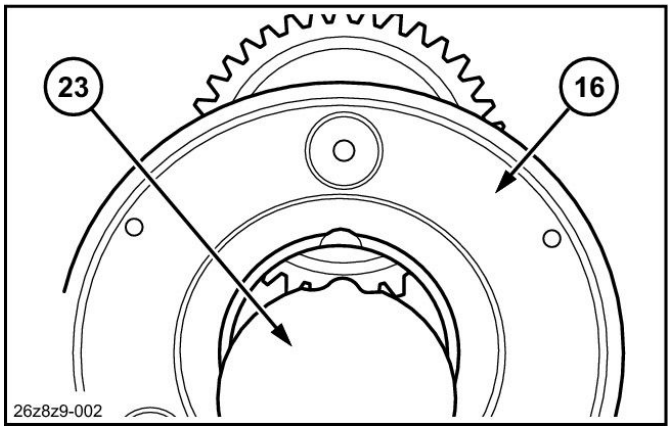
2. After making sure that the coupling (See the motor parts Operator's Manual.) is at the end of the motor shaft, insert the sun gear 1 (22).

> ⚠ **CAUTION**
>
> **Be very careful not to get hands stuck between gears.**



Installation of carrier 1 assembly

3. Install the thrust plate (23) on the carrier 1 (16).
   - Face the sharp edge toward the cover (24) side.



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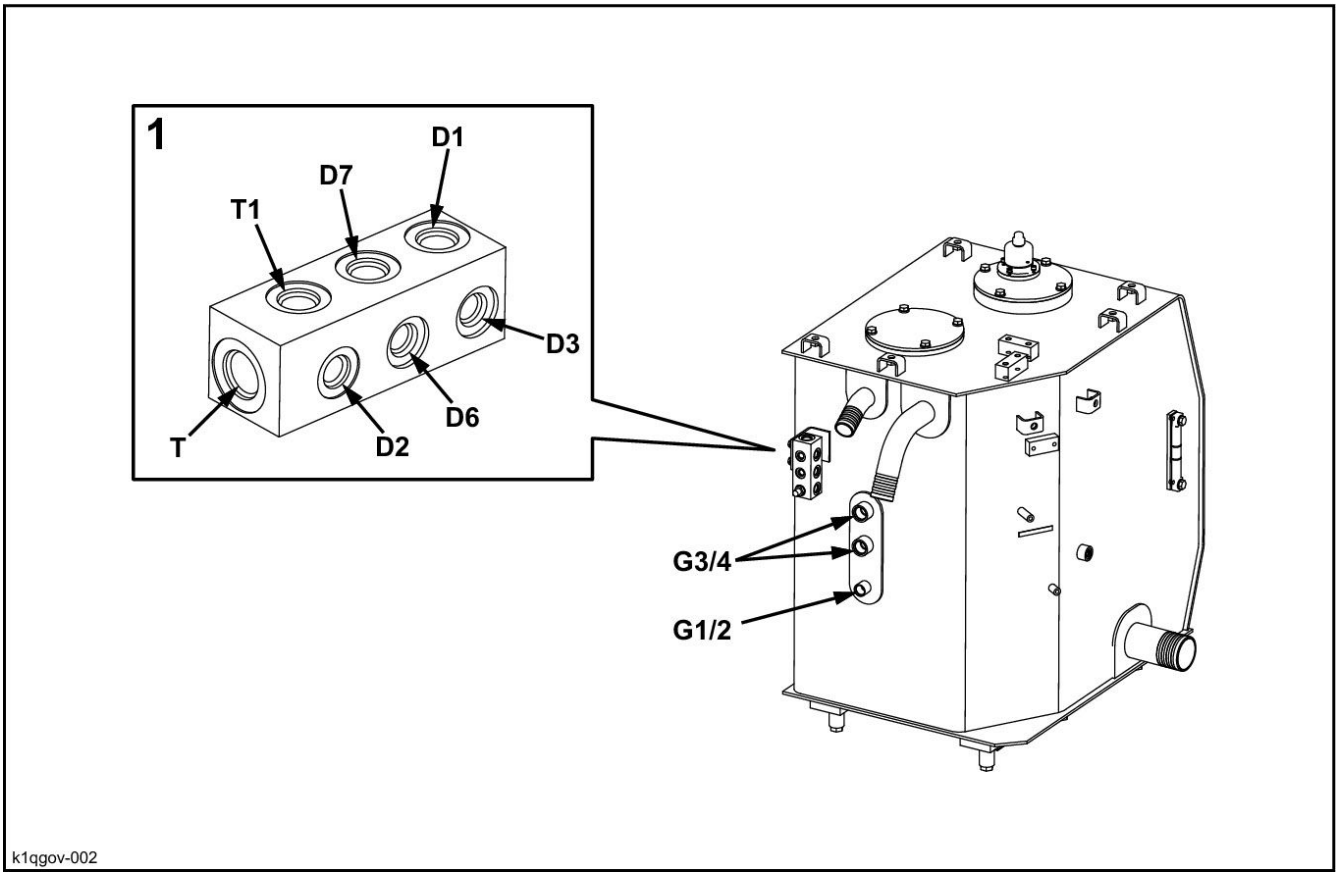
Port Diagram

Manifold (hydraulic oil tank section)

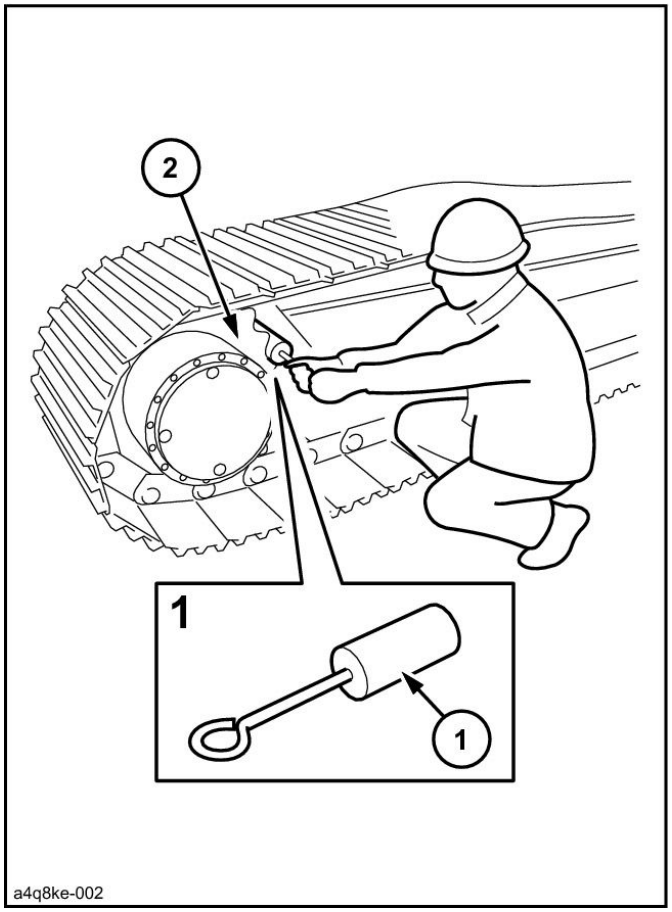


Port	Port size
D1	G3/8
D2	G1/4
D3	G1/4
D6	G1/4
T	G1/2
T1	G3/8
D7	G3/8

B.Travel pressure measurement

1. Install the stopper (1) on the crawler sprocket section (2) and lock the travel motor.
2. Measure with the following operations.

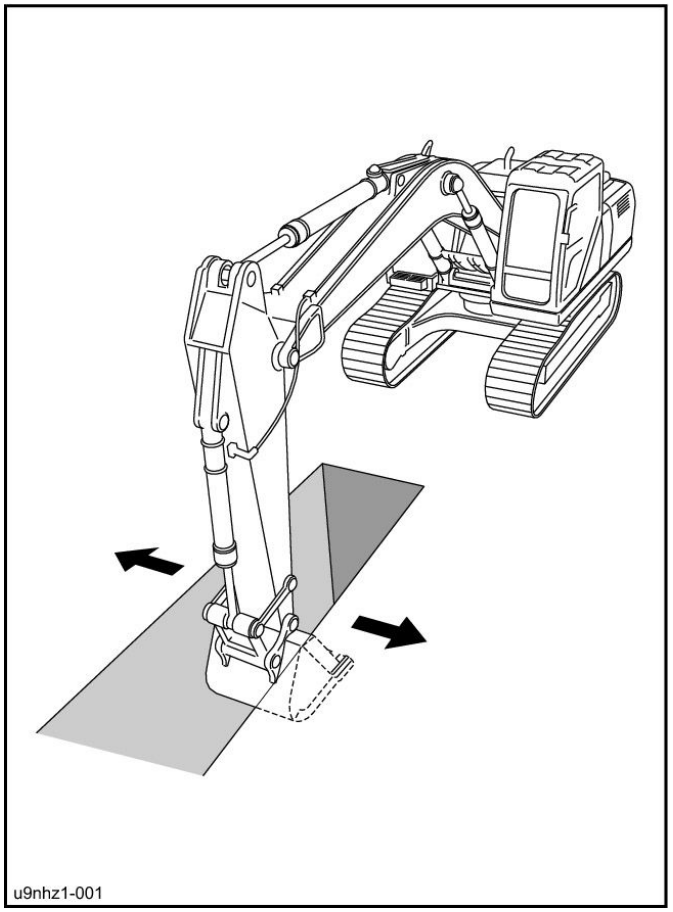
Engine speed	1900 min^{-1}
Work mode	SP mode (1st speed)
Lever operation	Travel relief
Oil temperature	45 - 55 °C
Measuring port	Left travel: P1 port
	Right travel: P2 port
Set pressure	34.3 MPa



Swing Pressure Measurement

1. Do not let the bucket move even if swing pressure is relieved with a swing operation such as digging a hole.
2. Measure with the following operations.

Engine speed	1900 min^{-1}
Work mode	SP mode
Lever operation	Swing relief
Oil temperature	45 - 55°C
Measuring port	P1 port
Set pressure	29.4 MPa



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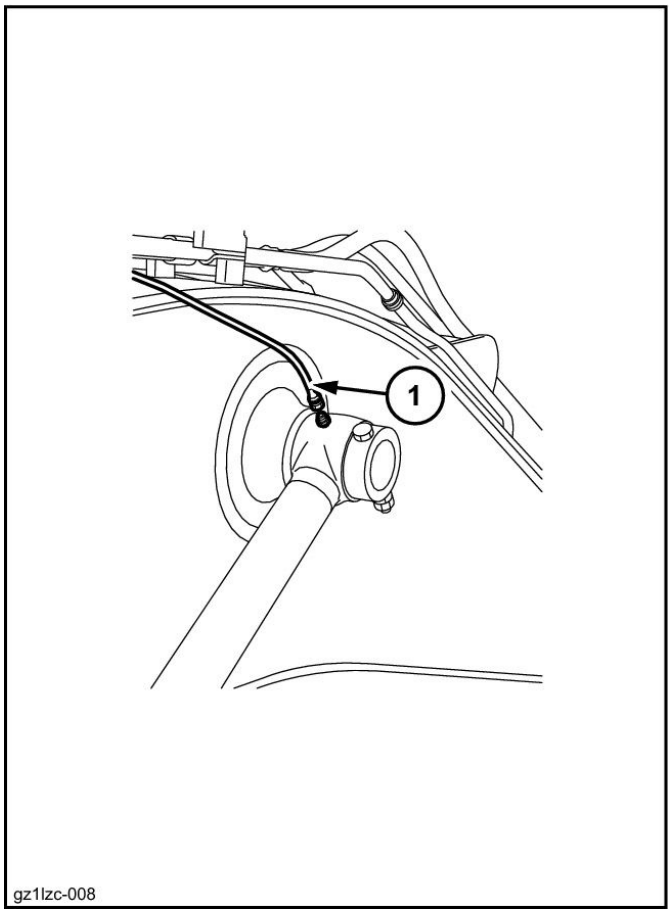
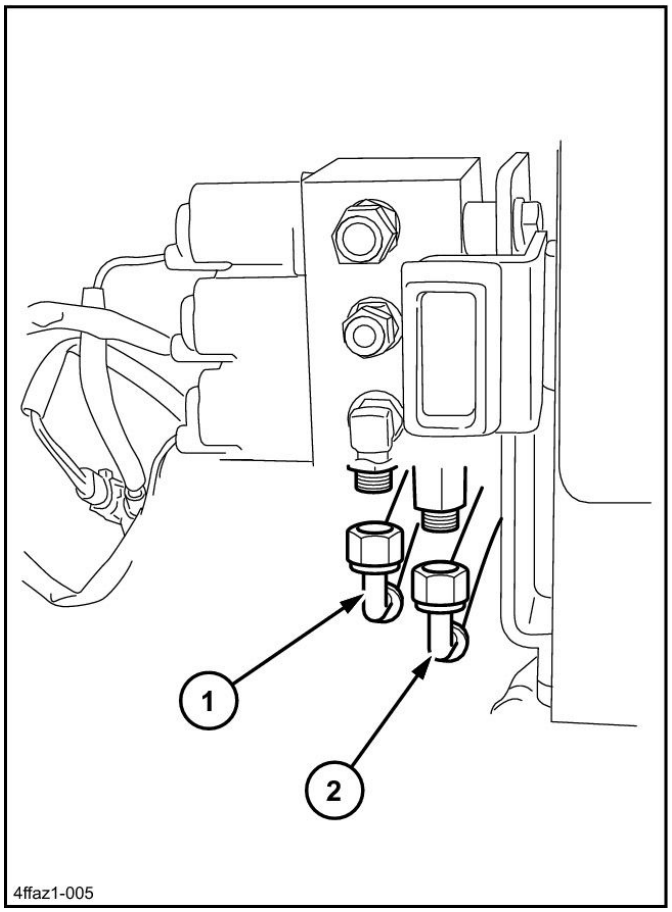
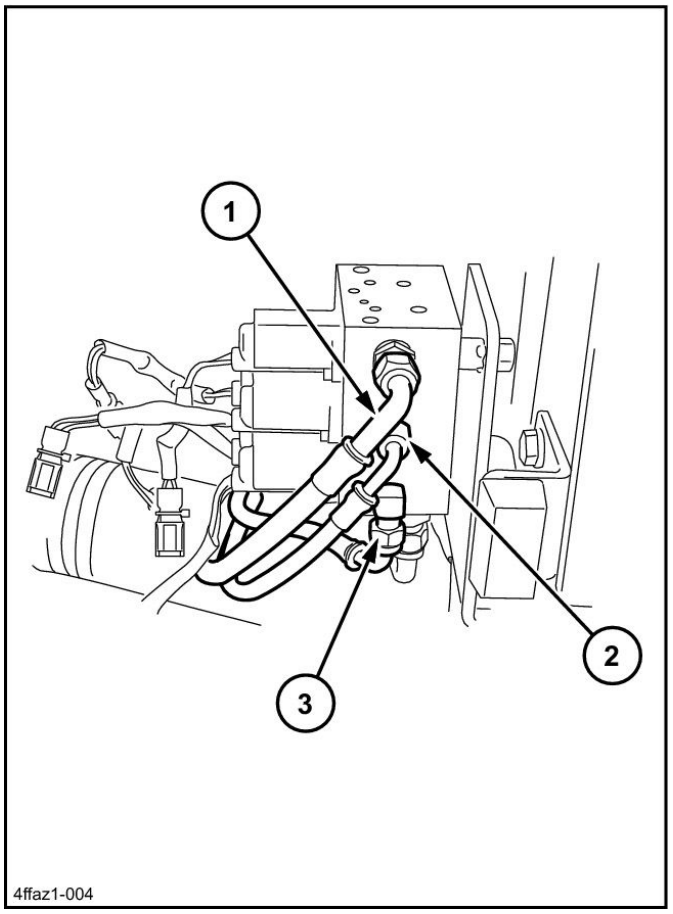
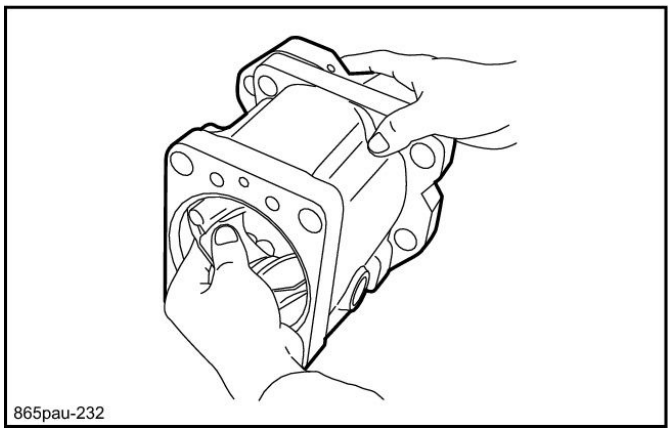

1
gz1lzc-008

3. Use a wrench (22 mm) to install the hoses (1) (2).

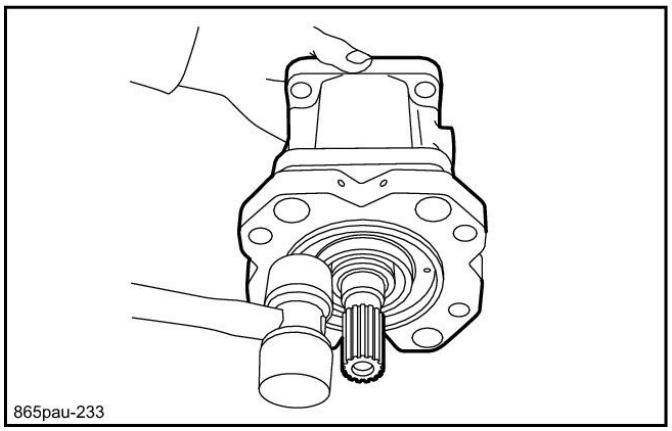


4. Use wrenches (19 mm, 22 mm) to install the hoses (1) (2) (3).

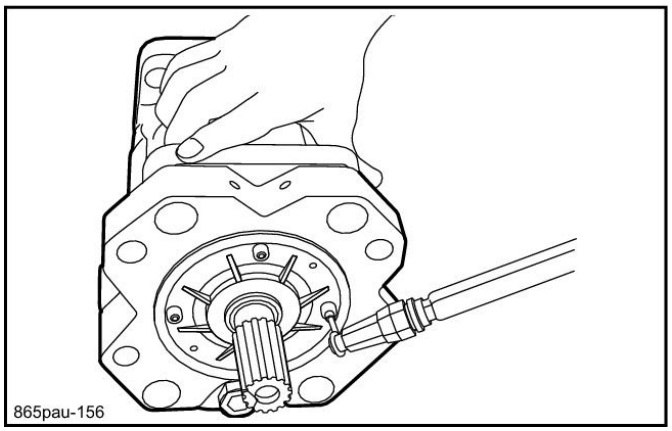




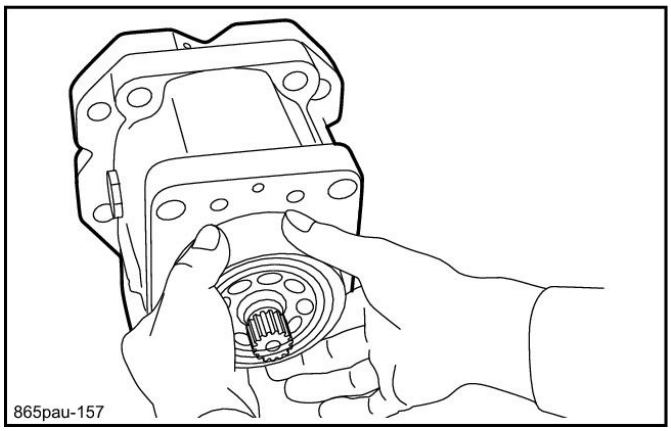
9. Install the drive shaft (111) with a bearing (123), bearing spacers (127), and stop ring (824) attached to the swash plate support board (251).
   - Do not strike the drive shaft with a hammer, etc.
   - Lightly strike the outside ring of the bearing with a plastic hammer to install it, and use a steel rod, etc. to tightly insert it all the way in.



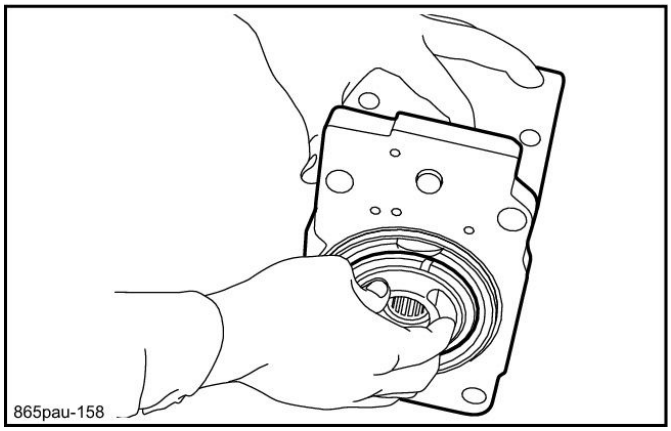
10. Attach the seal cover (F) (261) to the pump casing (271), and secure with the hexagon socket head bolts (406).
    - Apply a thin layer of grease to the oil seal inside the seal cover (F).
    - Be careful not to damage the oil seal when attaching it.



11. Assemble the piston cylinder subassembly [cylinders (141), pistons (151, 152), holder plates (153), spherical bushings (156), spacers (158), cylinder springs (157)], and then insert it into the pump casing in alignment with the phase of the splines of the spherical bushings and cylinder blocks.



12. Install into the valve block (312) while aligning the valve plate (313) with the pin (885).
    - Be careful not to mistake the suction and discharge directions of the valve plates.



13. Install the valve block (312) into the pump casing (271) and tighten it with the hexagon socket head bolts (401).
    - Assembly is easier when starting with the rear side pump.
    - Install the valve block in the correct direction. (Install the valve block so that the regulator faces up and the suction flange faces right when looking at the valve block from the front.)
    - Insert the 1st gear into the valve block beforehand and couple it with the drive shaft joint section spline.

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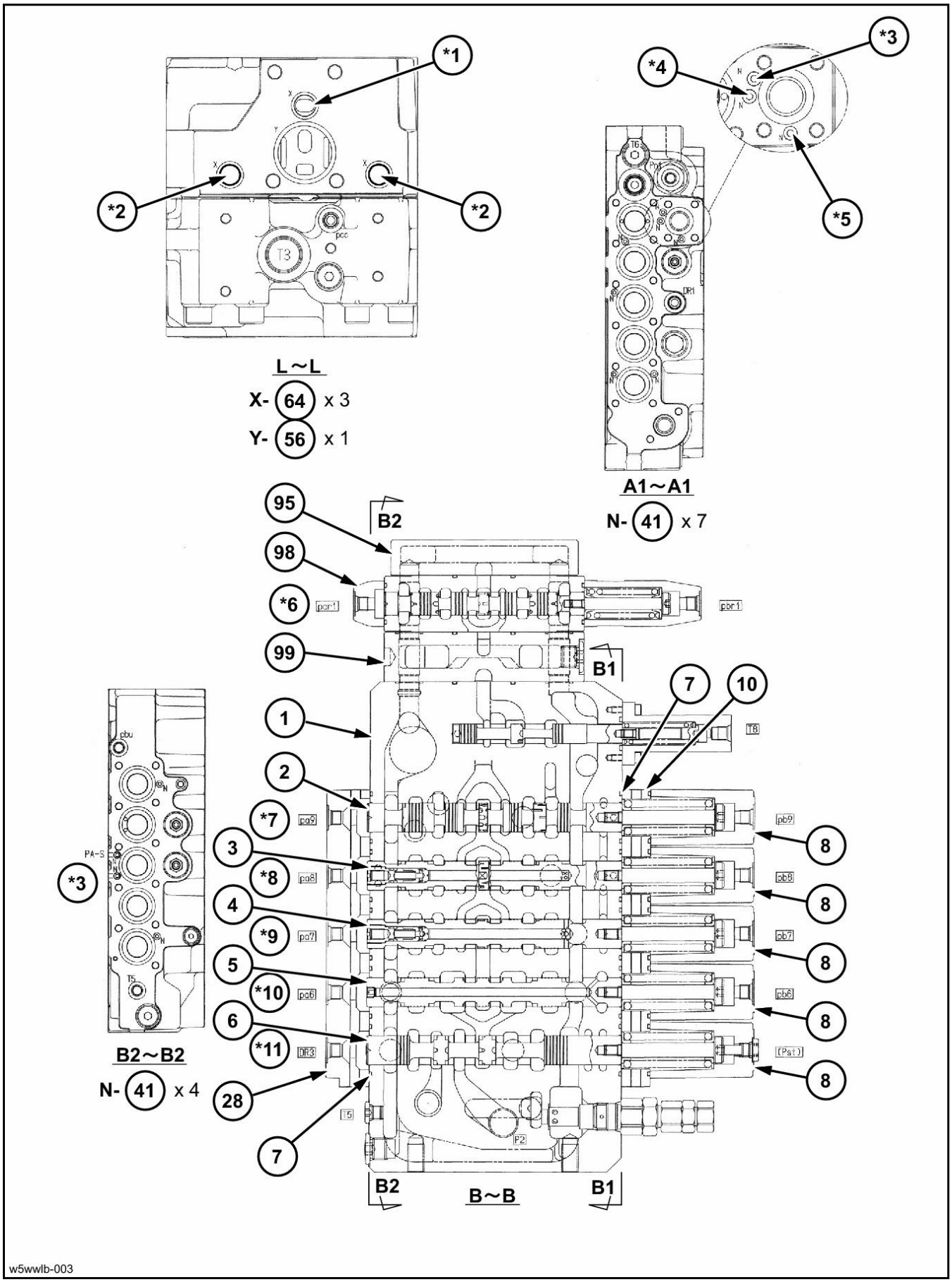

*1
*2
*2
T3
pcc
L~L
X- 64 x 3
Y- 56 x 1
*3
*4
*5
T6
Pm1
DR1
A1~A1
N- 41 x 7
95
B2
98
*6
pcr1
pbr1
99
B1
7
10
1
T8
2
*7
pa9
pb9
8
3
*8
pa8
pb8
8
4
*9
pa7
pb7
8
5
*10
pa6
pb6
8
6
*11
DR3
(Pst)
8
28
7
T5
P2
B2
B~B
B1
pbu
PA-S
*3
T5
B2~B2
N- 41 x 4
w5wwlb-003

Procedures for Operation/Assembly and Disassembly of Hydraulic Cylinder

Handling Precautions

Precautions for Installing the Cylinder on the Machine Body

- When installing the cylinder on the machine body or removing it from the machine body, secure the piston rod at the fully retracted position, check safety, and suspend.

> ⚠ **CAUTION**
>
> **Never suspend the cylinder from the line section. This would not only pose the danger of falling but could also damage the cylinder.**
> **Use a band to secure the piston rod in the fully retracted state.**
> **If the piston rod is not in the fully retracted state, it could be easily damaged. This could create the need for repair or make the piston rod unusable.**
> **Also, not securing the piston rod is dangerous because the piston rod might fly out unexpectedly.**

- Do not weld after the cylinder has been mounted on the machine body.

> ⚠ **CAUTION**
>
> **Electric welding on the cylinder or even at a position separated from the cylinder can generate a spark within the cylinder and damage parts.**
> **This could cause extensive damage, making it necessary to replace parts or replace the cylinder.**

- When painting the machine body, mask the piston rod and wiper ring.

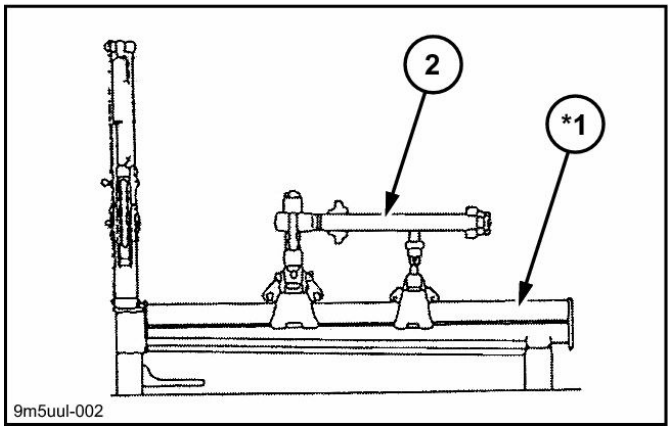
> ⚠ **CAUTION**
>
> **If the cylinder is operated with paint sticking to the piston rod surface and the wiper ring, the wiper ring does not function adequately, greatly interfering with cylinder functions. For example, dirt and paint from the outside may get into the cylinder easily and damage seal parts and cause an oil leak.**

- Clean the cylinder before installing it.

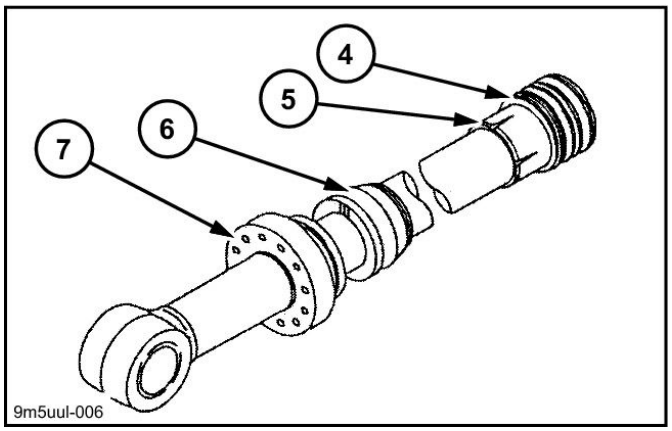
Procedures for Operation/Assembly and Disassembly of Hydraulic Cylinder

Piston Rod Assembly

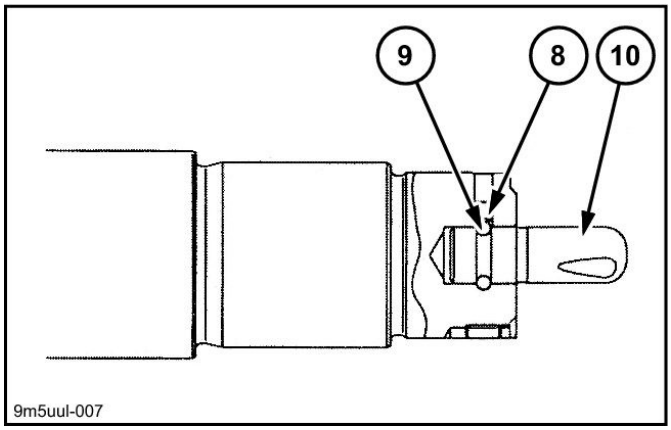
1. Set the piston rod assembly (2) on the stand (*1).



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

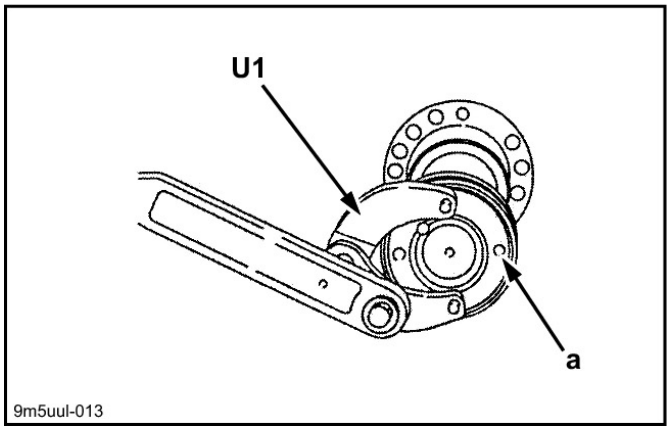


5. Set the cushion plunger (10) on the piston rod, install the 12 balls (9), and then secure with the cap (8).
   - Arm cylinder only
6. Assemble the piston assembly (4) with the procedure below.
   - When reusing the rod and piston assembly (4) Thoroughly clean and remove all shavings and debris.



   1) Screw in the piston assembly (4) and use tool U1 to tighten the piston assembly (4) until it matches the position of the screw threaded hole.
      - Use a file to remove burrs and barbs on the thread section.
   2) Tighten the screw (3).

      Tightening torque: 58.85 - 73.55 N·m



a 2-D10 notch hole

   3) Use a punch (*3) to caulk the threaded section at 4 locations.
      - When using new parts for the rod and/or piston assembly (4) Mark the cushion plug position on the end surface of the rod with bottom cushion.

Causes of Trouble and Countermeasures

It is not easy to discover trouble locations.
A few problems that may sometimes occur are listed in the table below.
Repairs are difficult, so refer to the possible causes and solutions in the table.
The table below shows general symptoms, suggested causes, and also solutions.
However, the cause of machine problems are often not rooted in just a single part. Problems are often due to the relationship of one part with another.
Also keep in mind that solutions other than those listed in the table may sometimes be necessary.
The numbers in parentheses after the part names are the codes indicated in "Attached diagram 1 Remote control valve assembly cross-section diagram".
The table below does not include all possible causes and countermeasures.
Further investigation of problems and causes should be done by an experienced and qualified repair person, as necessary.

Symptom	Cause	Solution
Secondary pressure is not rising.	1. Insufficient primary pressure 2. Secondary pressure spring (241) is broken or worn. 3. The gap between spool (201) and the casing (101) is abnormally large. 4. There is backlash in the handle section.	1. Maintain primary pressure. 2. Replace it with new part. 3. Replace the remote control valve as one unit. 4. Assemble and disassemble and/or replace the handle section.
Secondary pressure is unstable.	1. Sliding parts are sticking. 2. Tank line pressure is variable. 3. Air is getting into lines.	1. Repair the sticking sections. 2. Return directly to the oil tank. 3. Perform operation several times and let out air.
Secondary pressure is high.	1. Tank line pressure is high. 2. Sliding parts are sticking.	1. Return directly to the oil tank. 2. Repair the sticking sections.

Procedures for Assembly and Disassembly of Travel Remote Control Valve

Causes of Trouble and Countermeasures and Cross-section Diagram

It is not easy to discover trouble locations.
A few problems that may occur are listed in the table below.
Repairs are difficult, so refer to the possible causes and solutions in the table.
The table below shows general symptoms, suggested causes, and also solutions.
However, the cause of machine problems are often not rooted in just a single part. Problems are often due to the relationship of one part with another.
Also keep in mind that solutions other than those listed in the table may sometimes be necessary.
The numbers in parentheses after the part names are the codes indicated in "Attached diagram 1 Remote control valve assembly cross-section diagram".
Also, the table below does not include all possible causes and countermeasures.
Further investigation of problems and causes should be done by an experienced and qualified repair person, as necessary.

Symptom	Cause	Solution
Secondary pressure is not rising.	1. Insufficient primary pressure 2. Secondary pressure spring (324) is worn. 3. The gap between spool and the casing is abnormally large. 4. There is backlash in the operation section.	1. Maintain primary pressure. 2. Replace it with new part. 3. Replace spool and casing assembly. 4. Disassemble and assemble or replace operation section parts.
Secondary pressure is unstable.	1. Sliding parts are sticking. 2. Tank line pressure is variable. 3. Air is getting into lines.	1. Repair the sticking sections. 2. Return directly to the oil tank. 3. Perform operation several times and let out air.
Secondary pressure is high.	1. Tank line pressure is high. 2. Sliding parts are sticking.	1. Return directly to the oil tank. 2. Repair the sticking sections.
Damping is not working.	1. Air is gathering in the piston chamber. 2. Sliding parts are sticking. 3. Damping springs (336) (337) are worn. 4. The gap between piston (224) and the casing is abnormally large. 5. There are check valve operation problems. 6. The piston metering hole is abnormally large.	1. Perform operation several times and let out air. 2. Repair the sticking sections. 3. Replace it with new part. 4. Replace piston and casing assembly. 5. Disassemble and adjust the check valve section. 6. Replace piston.
Damping torque is high.	1. Sliding parts are sticking. 2. Piston metering hole is clogged.	1. Repair the sticking sections. 2. Repair or replace piston.

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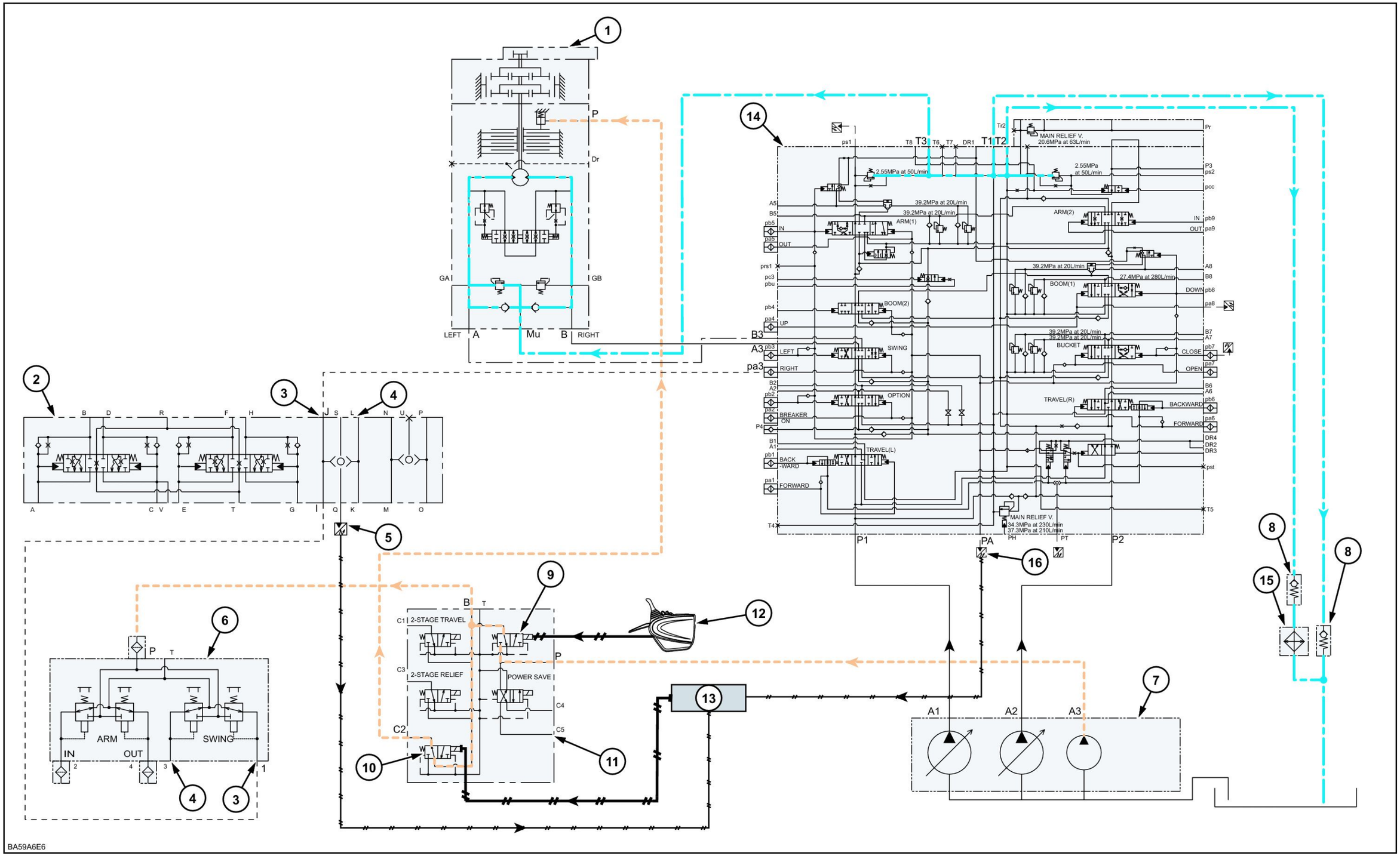
Swing brake circuit



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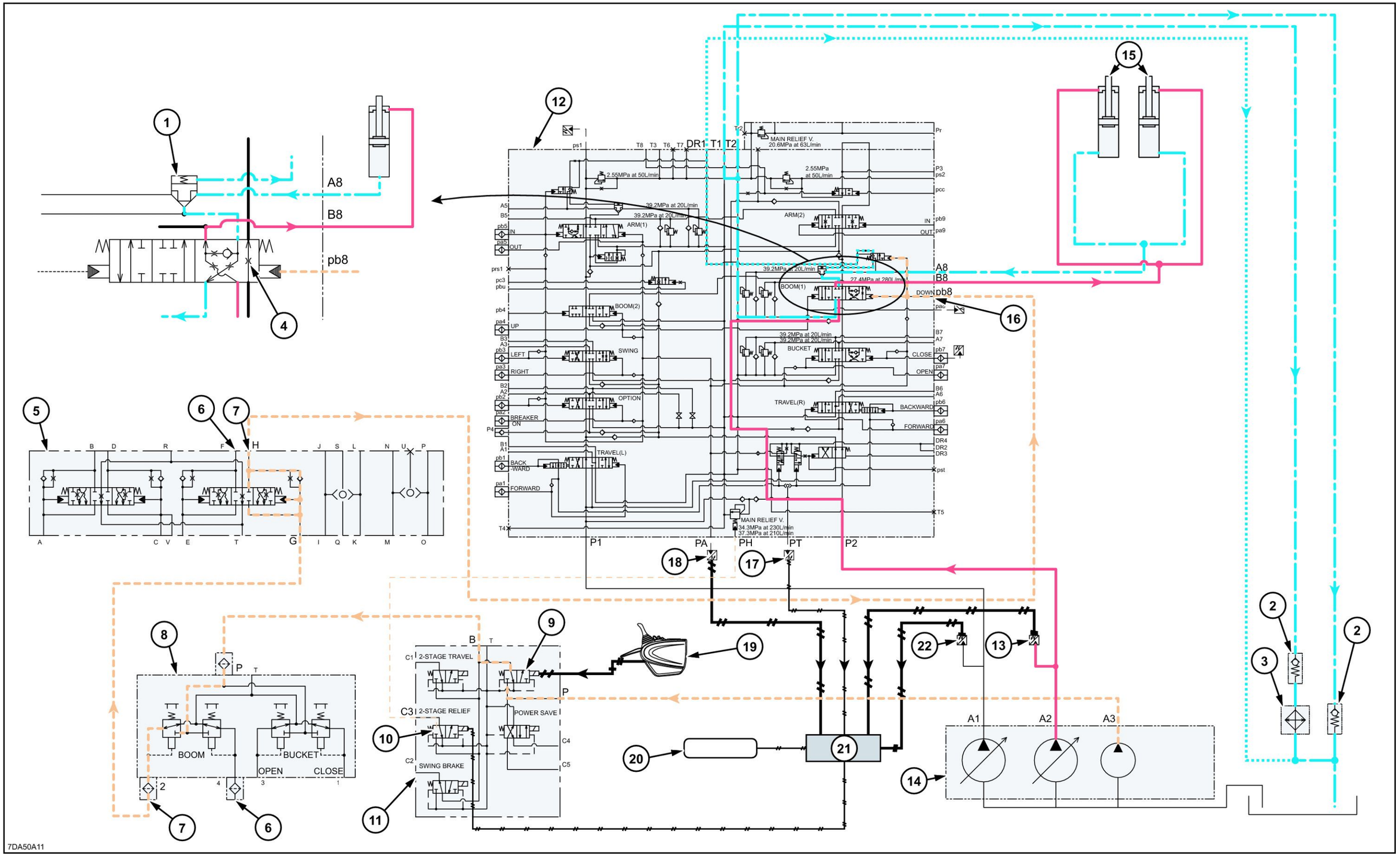
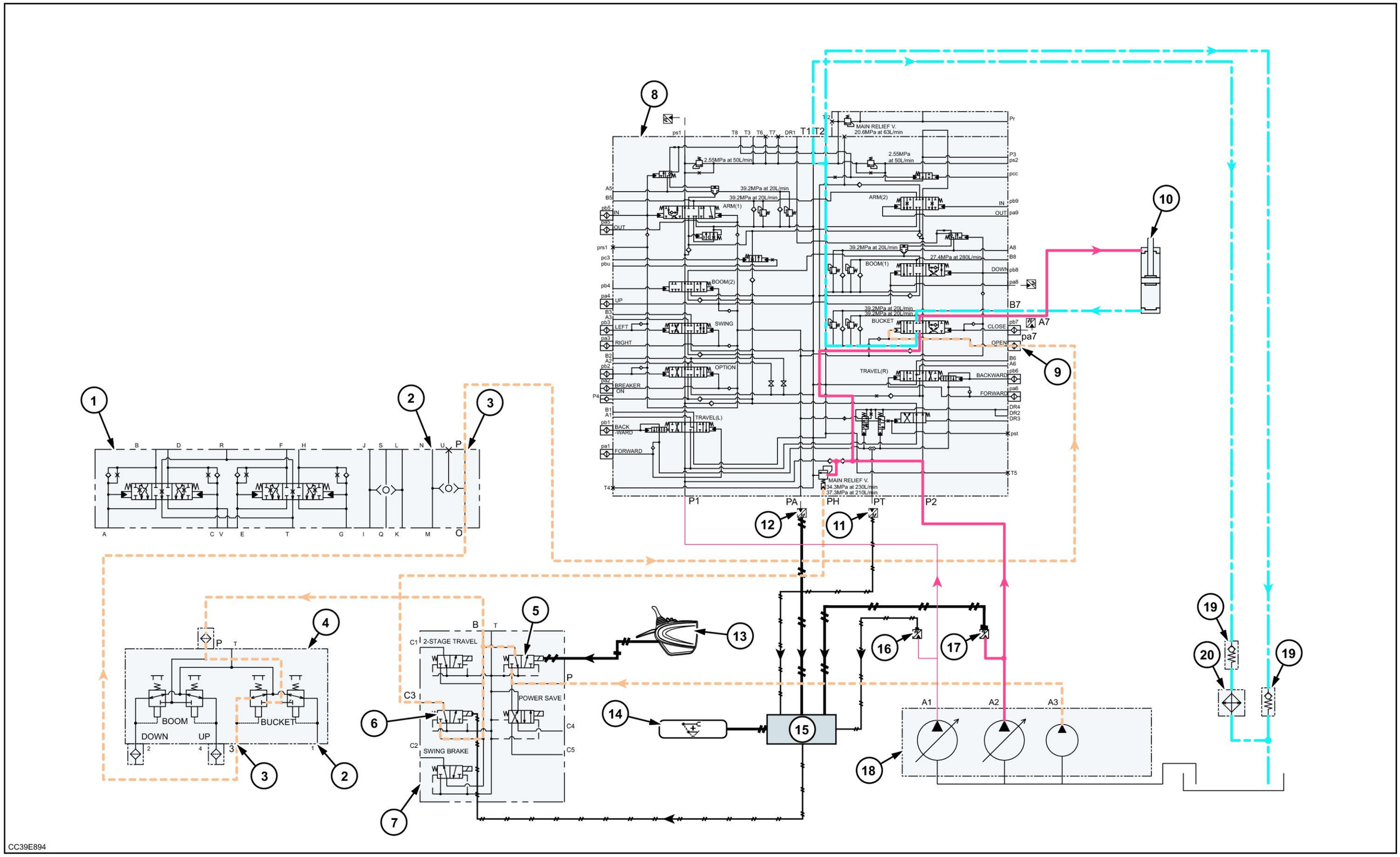
Boom-down tilting prevention circuit

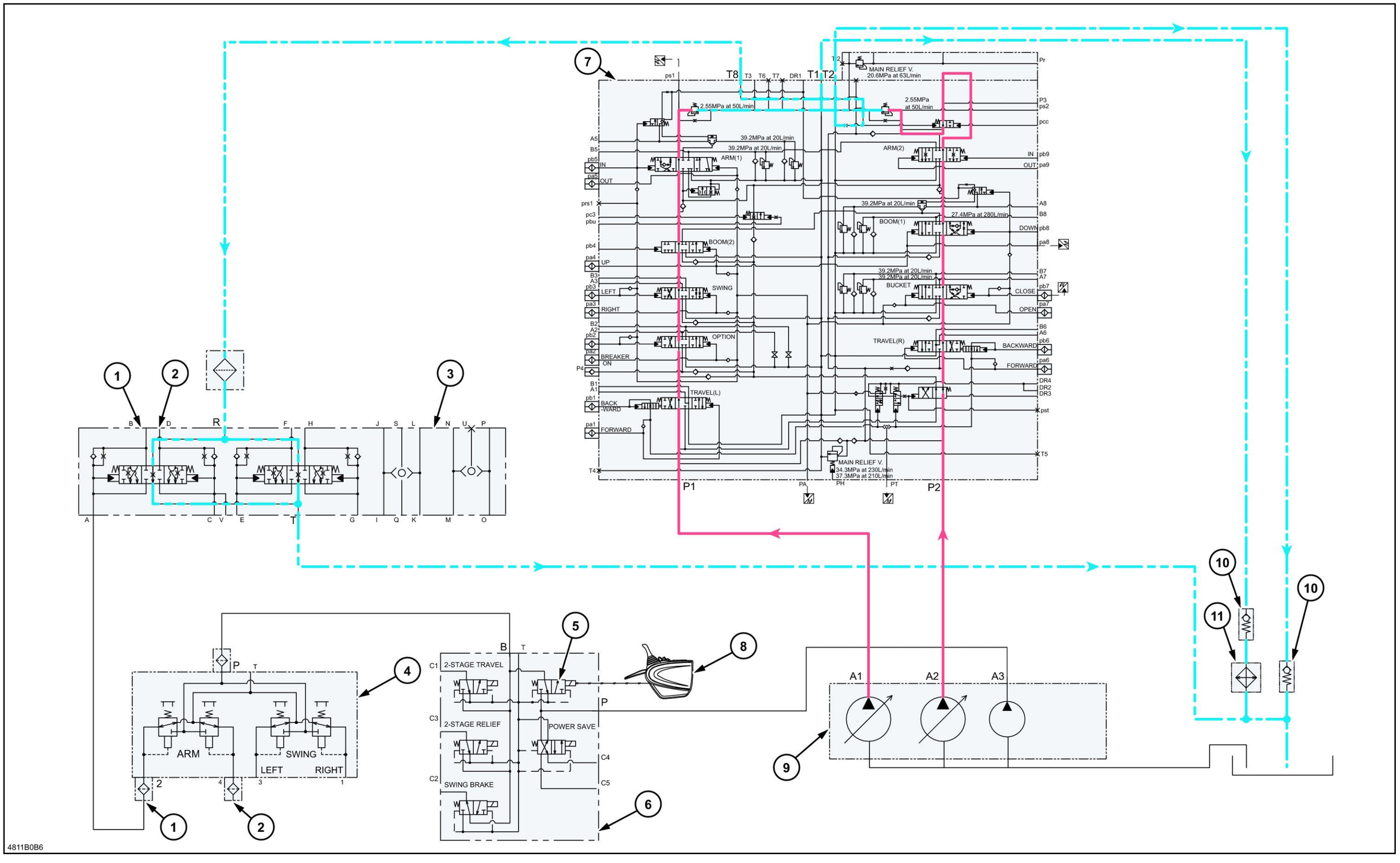


Bucket Circuit

Bucket-open circuit



Heat circuit (lever in neutral)



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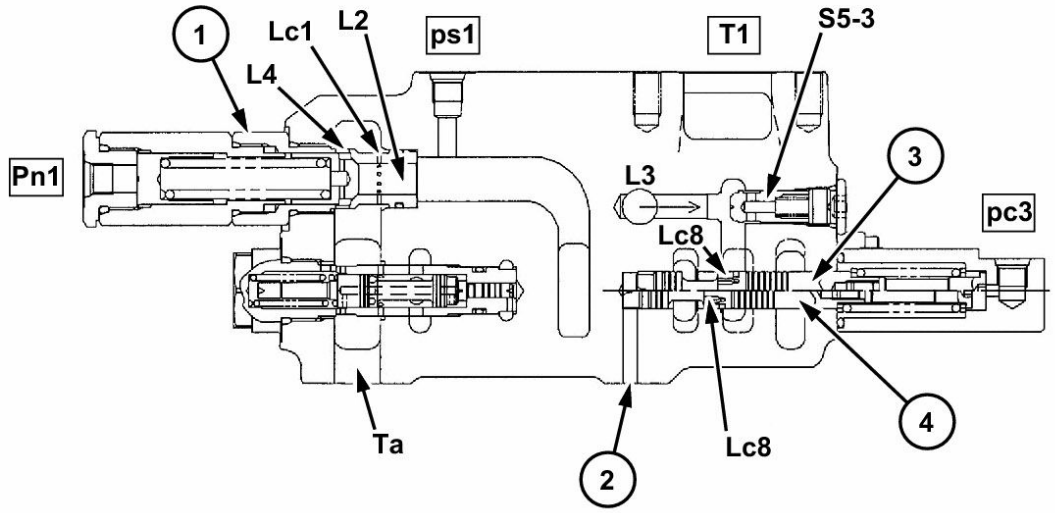
3	Boom 2	8	Attachment 2	13	Bucket
4	Swing	9	Inlet	14	Straight travel
5	Option	10	Attachment 1	15	Low-pressure relief valve (R)

a	(Section 5)	f	P1 side	k	(Section 7)
b	(Section 4)	g	(Section R2)	l	(Section 6)
c	(Section 3)	h	(Section R1)	m	(Section ST)
d	(Section 2)	i	(Section 9)	n	P2 side
e	(Section 1)	j	(Section 8)		

7) Arm parallel orifice [Fig. 16]
Metering by the spool is installed in the arm 1 parallel path of this valve to control the quantity of oil fed to arm 1 for compound operations.
The oil fed from the arm 1 (Section 5) parallel path (L3) pushes open the poppet (S5-3) and passes through the variable metering spool orifice (Lc8), then is connected to path (L5).
Here, the quantity metered by the orifice (Lc8) is adjusted by pressurizing the pilot port (Pbu).



[Fig.16]

1	Low-pressure relief valve (L)	3	For boom up (for Pbu pressurization)
2	Pbu signal path	4	For neutral

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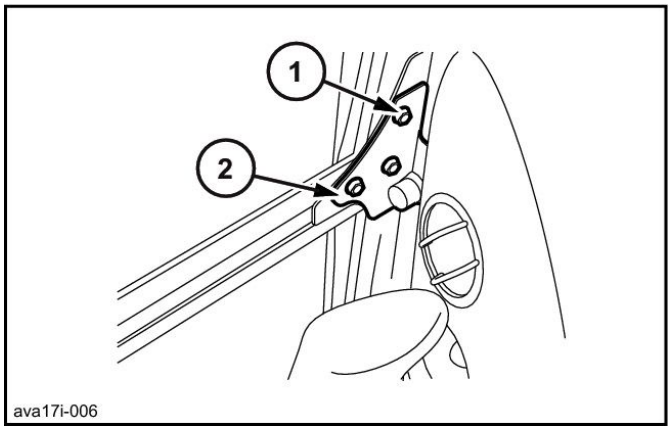
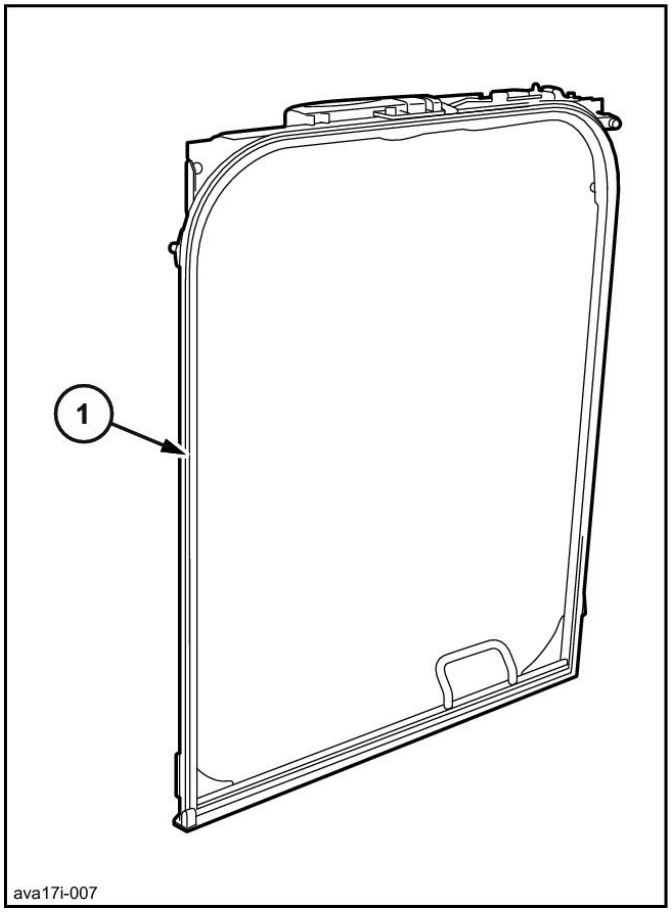
9005C-2

6. Use a wrench (10 mm) 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



7. Remove the cab front glass (1).

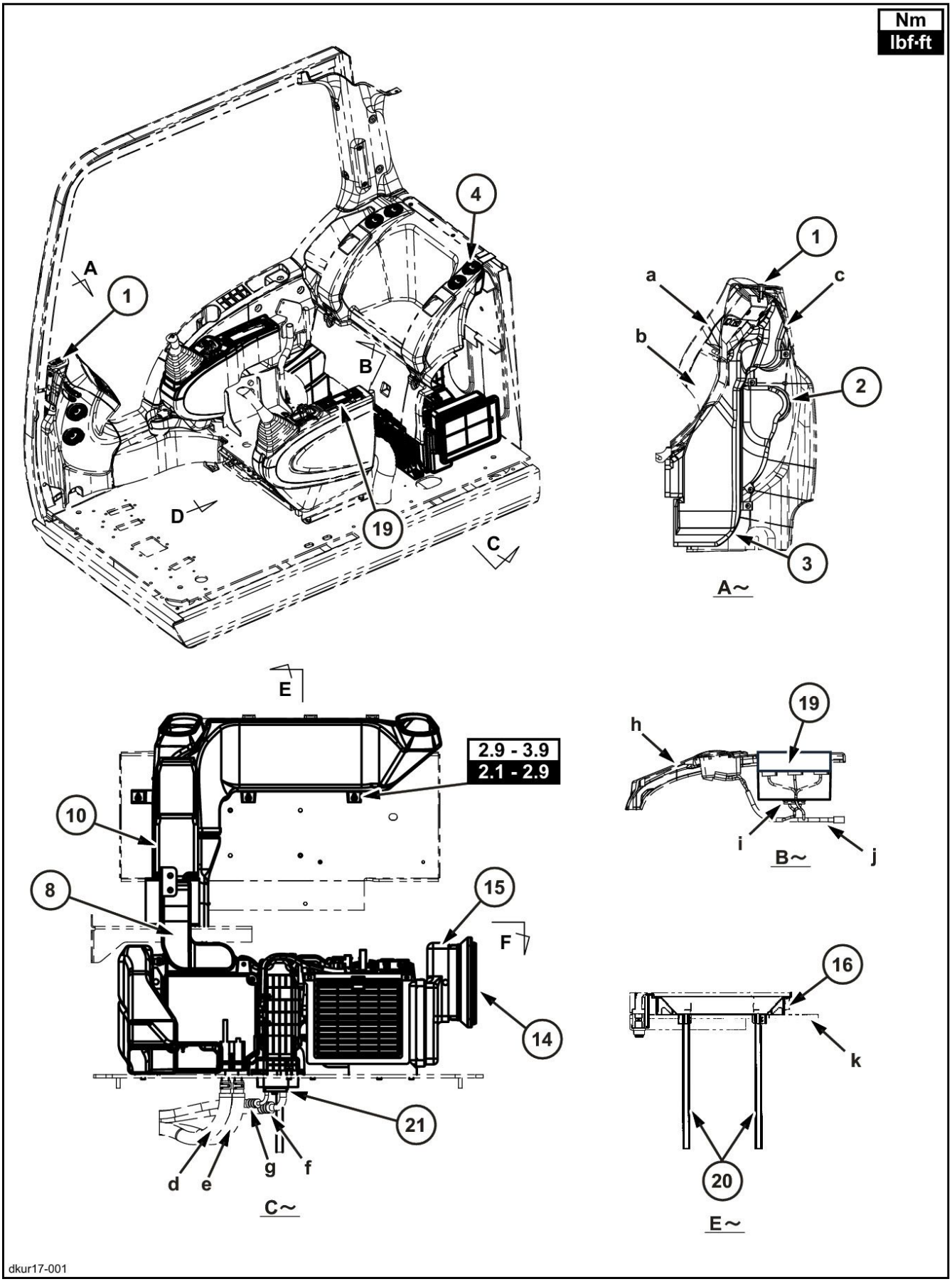


Installation of Cab Front Glass

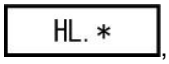
To install, perform the reverse of the removal procedure. Tighten bolts being installed to the specified torque. If the torque is not specified, see the "Tightening Torque" section.

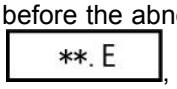
Air Conditioner Overall Diagram

Cab



Monitor Mode

1. Summary explanation
   Monitor mode is a mode for understanding abnormalities in the operation panel itself or in other control.
   The system goes into monitor mode when there is the special switch input below on the operation panel.
2. Starting monitor mode
   When the air conditioner is operating with basic control, if the operation panel ON/OFF switch closed path continues for 1 sec. while the refresh/recirculate select switch closed path is ongoing, monitor mode is started.
3. Monitor contents
   1) LCD segment diagnosis
      When monitor mode is entered, the target LCD lights up for 1 sec.
      An LCD with trouble does not light up.
   2) Sensor diagnosis
      The detection value (AD value or °C) for each sensor is displayed.
   3) Coolant temperature signal recognition value
      This displays the reception status for the coolant temperature signal sent from the vehicle.
4. Display contents in monitor mode
   In monitor mode, the data (detection value for each sensor, coolant temperature signal recognition, etc.) is displayed in the 3-digit of the 7-segment display for the temperature setting.
   The data displayed is selected with the blower UP/DOWN switches and AUTO switch.
   The blower UP/DOWN switches move the display on the dedicated monitor mode 7-segment display through 16 displays, 0 - F, and the corresponding data is displayed.(Table A)
   Hexadecimal data display and decimal data display can be selected with the AUTO switch. Only for the coolant temperature signal recognition value, the value detected immediately before entry into monitor mode is displayed.
   The difference between hexadecimal data and decimal data is indicated by the 3rd-digit of the 7-segment display for the temperature setting. For hexadecimal data, "H" is displayed there and for decimal data, numbers (0 - 9) are displayed there.
   1) Hexadecimal display
      AD values 00H - FFH are displayed.
      When the AD value corresponds to that in Table B (or Table C for the solar radiation sensor), this indicates a disconnection or short.
      In the hexadecimal display, when the value of a sensor changes in monitor mode, the hexadecimal display changes with it.
      If the display before entering monitor mode was 

      , the error judgment value is displayed. (In other words, the detected value before the abnormality was detected) In the same way, if the display before entering monitor mode was 

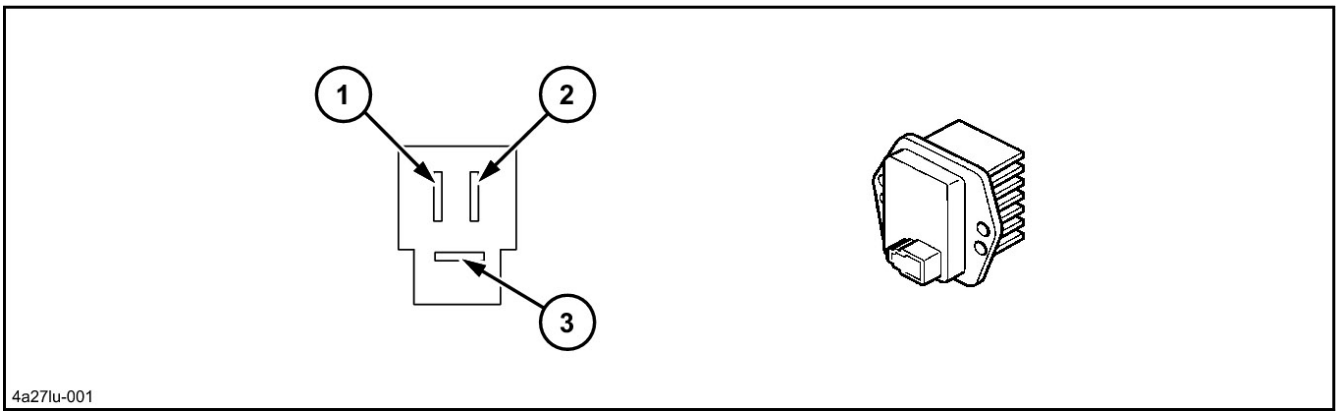
      , the display becomes **.E and the error judgment value is displayed.
   2) Decimal display
      Decimal display is used from -99.9 °C to 99.9 °C.
      Also, the "-" minus display is displayed on the left side of the 3 digit segment.
5. Air conditioner operation in monitor mode
   When the system enters monitor mode, all output (operation) through control is stopped and until monitor mode is ended, operations and settings of basic control through all the switches are not possible.
6. Ending monitor mode
   In monitor mode, if the operation panel ON/OFF switch closed path continues for 1 sec. while the refresh/recirculate select switch closed path is ongoing, monitor mode is ended and the system returns to the basic control state.
   The same also occurs if the vehicle main key power supply is switched OFF.

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

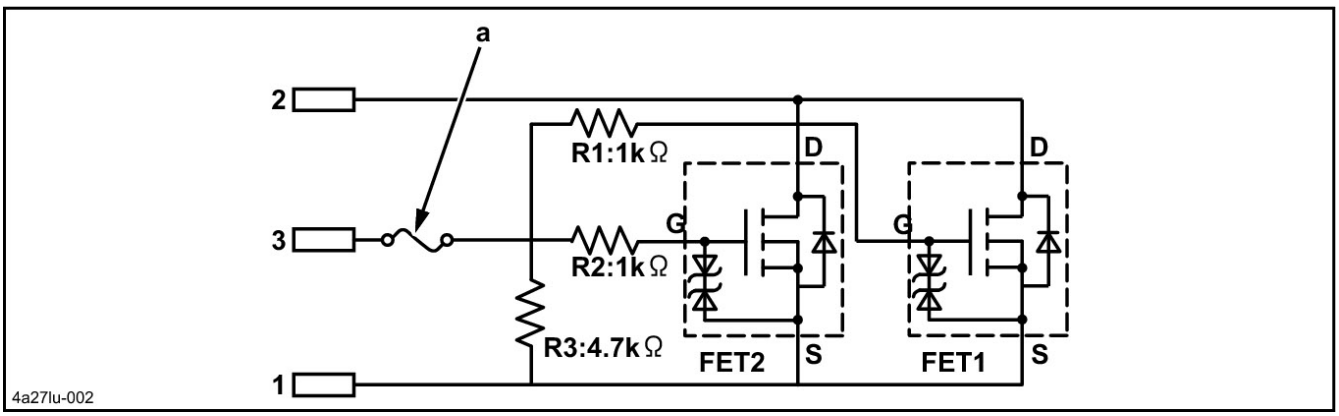
Blower Amp

The power transistor receives the base current from the control unit and changes the speed of the fan motor.

Blower amp inspection
The blower amp can be easily judged by removing the blower amp connector and checking for continuity across the blower amp terminals.



	Terminal No.			Continuity
	1	2	3	
Tester	+	---	-	Yes (4.7 kΩ)
	-	+	---	No
	+	-	---	Yes (diode parallel forward direction)



a	Temperature fuse: 132 - 138 °C

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