CX130C Tier 4
Crawler Excavators

Service Manual

Print No. 84592788B

CASE
CONSTRUCTION

CONTENTS

Main Equipment Table

	Weight or Q'ty
Bolt	184
Nut	184
500G with hole	760.4 kg (1676.40 lb)
Link	1 set
Shoe	46
Bolt	184
Nut	184
600G with seal	852.4 kg (1879.23 lb)
Link	1 set
Shoe	46
Bolt	184
Nut	184
700G with seal	1008.8 kg (2224.04 lb)
Link	1 set
Shoe	46
Bolt	184
Nut	184

Upper Component

Swing Unit

Swing motor assembly		
Swing motor		
	Manufacturer	Hyest Corporation Ltd.
	Motor type	Fixed displacement piston motor
		With parking brake
	Intake amount	65 cm^3/rev
	Operating pressure	27.9 MPa (4046.997 psi)
	Operating flow	130 L/min (34.343 gpm)
	Mechanical brake torque	336.1 N· m (247.937 lbf· ft)min.
	Brake off pressure	2.9 MPa (420.656 psi)max.
	Relief valve set pressure	27.9 MPa (4046.997 psi) at 108 L/min (28.531 gpm) 27.3 MPa (3959.965 psi) at 40 L/min (10.567 gpm)
Swing reduction gear		
	Reduction gear type	Planetary gear 2-stage reduction gear
	Reduction ratio	17.03
Dry weight		99 kg (218.259 lb)
Turntable bearing		
	Number of teeth	98
	Weight	177.7 kg (391.7635 lb)
Counterweight		
	Weight	2200 kg (4850.195 lb)

Engine-related

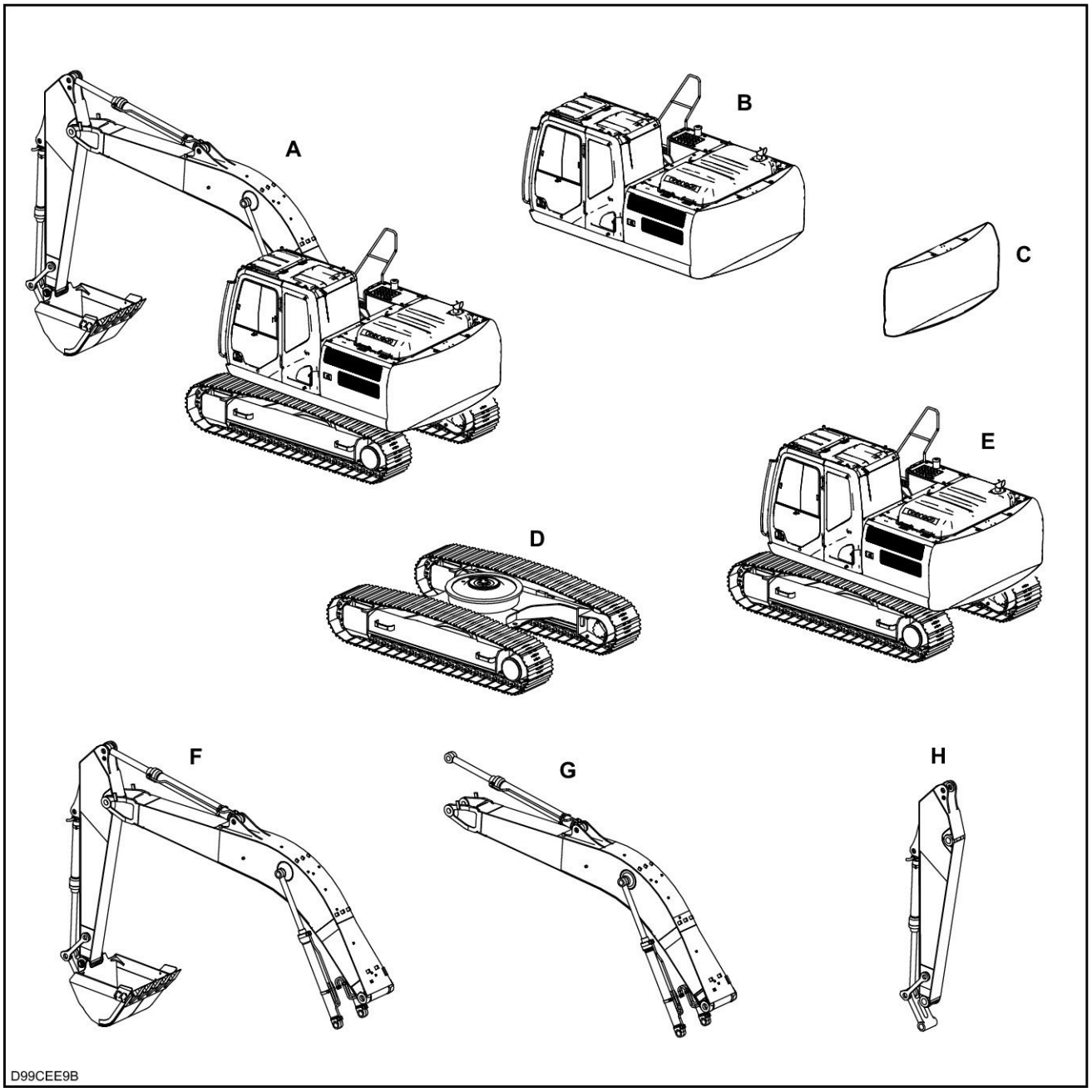
Engine

Engine model name	Isuzu 4JJ1X diesel engine
Engine type	4-cycle, water-cooled, overhead camshaft type straight cylinder, direct fuel injection type (electronic control)
Number of cylinders-bore-stroke	4 - D95.4 mm (3.7559 in) - 104.9 mm (4.1299 in)
Total displacement	2.999 L (0.79227 gal)
Compression ratio	17.5
Rated output	74.9 kW / 2000 min^{-1} (100.443 HP / 2000 rpm)
Maximum torque	359 N· m / about 1600 min^{-1} (264.83 lbf· ft / about 1600 rpm)
Fuel consumption ratio	224 g/kW· h at 2000 min^{-1}
Engine dry weight	about 333 kg (about 734.143 lb)

Main Unit Weight

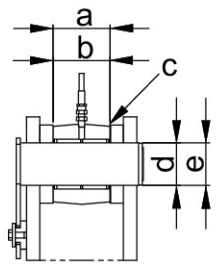
CX130C/CX130C NLC

Divided Weight (standard specifications)



Code	Component name	Weight	
		kg	lb
A	Operating weight	12846	28320.73
B	Upper component (including counterweight and turntable bearing)	6387	14080.998
C	Counterweight	2218	4889.879
D	Lower component (with grouser shoe)	4121	9085.297
E	Main unit weight	10530	23214.798
F	Attachments	2263	4989.087
G	Boom (including cylinders)	1277	2815.318
H	Arm (including cylinders and linkage)	584	1287.506

4. Boom and Arm Cylinder Installation Section



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Part name	Code	Measurement dimensions		Standard value		Usage limits		Judgment	Solution
		(mm)	(in)	(mm)	(in)	(mm)	(in)		
Boom	a			99	3.898	105	4.134	Acceptable/ Unacceptable	Replacement
Arm cylinder (foot section)	b			98	3.858	96	3.78	Acceptable/ Unacceptable	Replacement
Clearance	c			0.5-2.0	0.02-0.079	Shim adjustment	Shim adjustment	Acceptable/ Unacceptable	Adjustment with shims
Pin	d	D	D	D70	D2.765	D69	D2.717	Acceptable/ Unacceptable	Replacement
Bushing (arm cylinder)	e	D	D	D70	D2.765	D71.5	D2.815	Acceptable/ Unacceptable	Replacement

Bolt Size and Torque Table

Special Torque Settings

Code	Retightening location		Bolt nominal diameter	Wrench		Tightening torque [N· m]	Tightening torque [lbf· ft]
1*	Travel motor		M16	24 mm	0.945 in	267 - 312	196.96 - 230.16
2*	Drive sprocket		M16	24 mm	0.945 in	267 - 312	196.96 - 230.16
3*	Take-up roller		M16	24 mm	0.945 in	267 - 312	196.96 - 230.16
4*	Upper roller		M16	24 mm	0.945 in	267 - 312	196.96 - 230.16
5*	Lower roller		M16	24 mm	0.945 in	267 - 312	196.96 - 230.16
6*	Track guard		M16	24 mm	0.945 in	267 - 312	196.96 - 230.16
7	Shoe		M16	24 mm	0.945 in	373 - 451	275.16 - 332.69
8	Counterweight		M27	41 mm	1.614 in	1078 - 1274	795.23 - 939.82
9	Turntable bearing		M16	24 mm	0.945 in	280 - 312	206.55 - 230.16
10*	Swing unit		M16	24 mm	0.945 in	280 - 312	206.55 - 230.16
11*	Engine	Mount	M16	24 mm	0.945 in	264.9 - 313.9	195.414 - 231.560
13*		Rear bracket	M12	19 mm	0.748 in	109 - 127	80.41 - 93.69
14	Radiator		M12	19 mm	0.748 in	63.8 - 73.6	47.06 - 54.29
15*	Hydraulic pump	Pump	M16	14 mm hexagon socket head	0.551 in hexagon socket head	223 - 247	164.50 - 182.21
16*	Hydraulic oil tank		M16	24 mm	0.945 in	232.4 - 276	171.44 - 203.60
17*	Fuel tank		M16	24 mm	0.945 in	232.4 - 276	171.44 - 203.60
18*	Control valve		M16	24 mm	0.945 in	267 - 312	196.97 - 230.15
19*	Center joint	Lock bar	M12	19 mm	0.748 in	88.3 - 107	65.14 - 78.93
20*		Joint	M12	19 mm	0.748 in	109 - 127	80.41 - 93.68
21	Cab		M16	24 mm	0.945 in	149 - 173	109.92 - 127.62
22			M10	17 mm	0.669 in	19.6 - 29.4	14.459 - 21.688

⚠ CAUTION

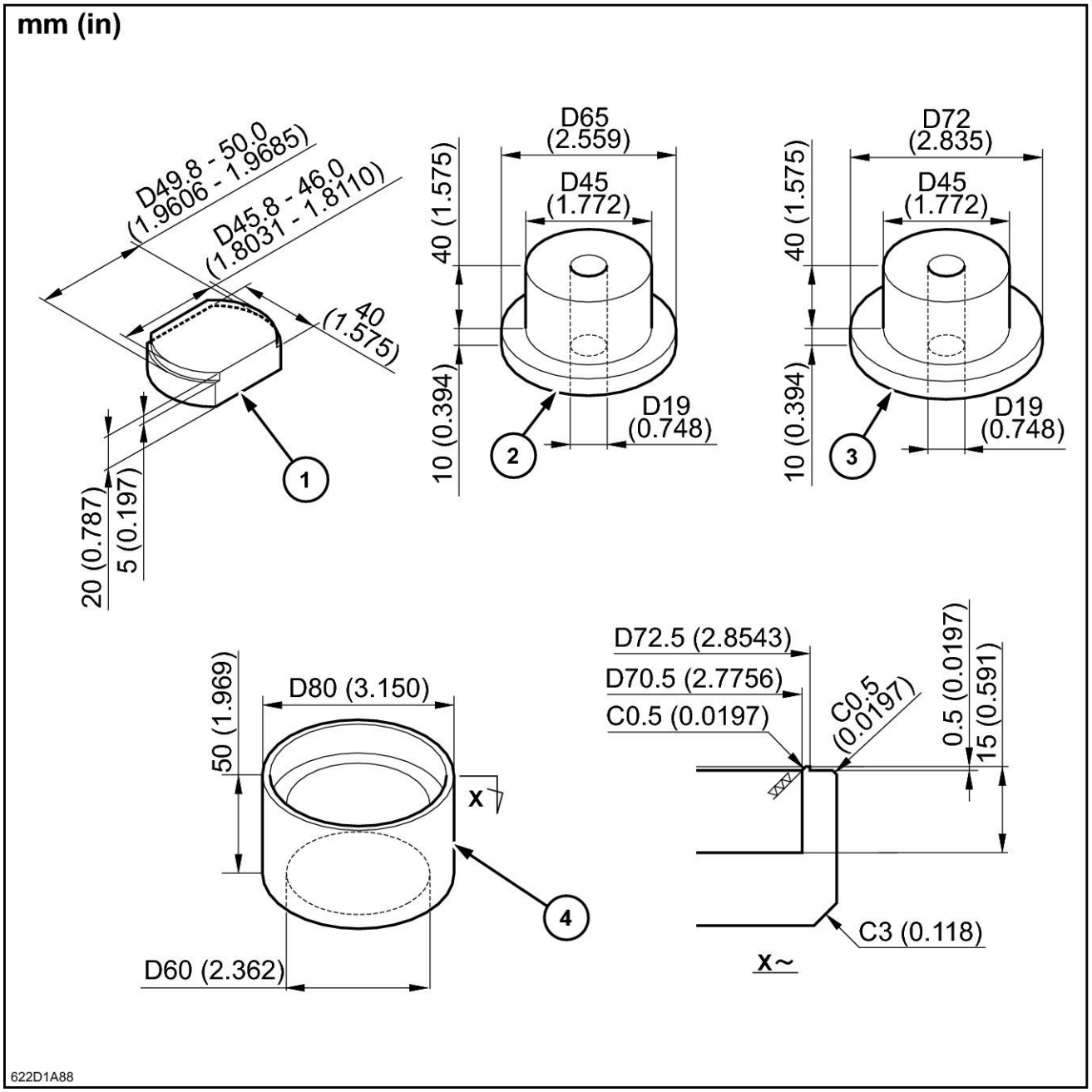
For items marked with *, always apply Loctite #262 or the equivalent and tighten to the specified torque. The tightening torque in kgf•m is determined with N· m ÷ 9.8 (lbf· ft ÷ 7.2).

New Machine Performance Judgment Table

Item				Unit	Reference value
8	Travel speed (6 m {19.69 ft} travel speed)	Forwards and backwards	High speed	sec/6 m (sec/19.69 ft)	3.3 - 4.3
				km/h (mile/h)	5.2 - 6.2 (3.2312 - 3.8525)
			Low speed	sec/6 m (sec/19.69 ft)	5.4 - 7.4
				km/h (mile/h)	2.9 - 3.9 (1.8020 - 2.4233)
9	Travel sprocket speed (10 rotations)		High speed	sec	10.7 - 14.7
			Low speed		18.7 - 22.7
10	Travel turning amount (20 m {65.62 ft} travel meandering amount)	Forwards and backwards	High speed	mm (in)	1000 (39.370) Max.
			Low speed		1000 (39.370) Max.
11	Shoe tension amount			mm (in)	290 - 310 (11.418 - 12.204)
12	Travel motor leakage amount			L/min (gpm)	15 (3.963)
13	Swing ball race bearing movement distance		Up and down	mm (in)	1.1 (0.0433)Max.
			Left and right		3.8 (0.1496)Max.
14	Bucket tip movement amount		Left and right	mm (in)	61 (2.402)Max.
15	Recoil spring dimensions		Compression ratio	mm (in)	556 (21.890)
			Free		634 (24.961)
16	Coil resistance of each solenoid valve	Coil resistance temperature 20°C (68.0 °F)	Travel high speed	Ω	40
			Boosted pressure		
			Swing brake		
			Lever lock		
			Power save		
17	Milli- amp for hydraulic pump electromagnetic proportional valve	No load	SP mode	mA	566 - 606
			H mode		550 - 590
			A mode		550 - 590
		2nd pump relief	SP mode	mA	580 - 620
			H mode		580 - 620
			A mode		580 - 620

Upper Roller Special Tool

CX130C



Code	Order No.	Jig name	Remarks
1		Bushing removal jig	
2		Bushing press-fit jig 1	
3		Bushing press-fit jig 2	
4		Floating seal installation jig	

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CONTENTS

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

Removal and Installation of Oil Cooler

⚠ WARNING

- **Keep away from fire.**

⚠ CAUTION

- **Be sure to stop the engine before beginning work.**
- **Be sure to inspect the wire rope and other lifting equipment before beginning work.**
- **Do not stand or pass under the suspended load.**

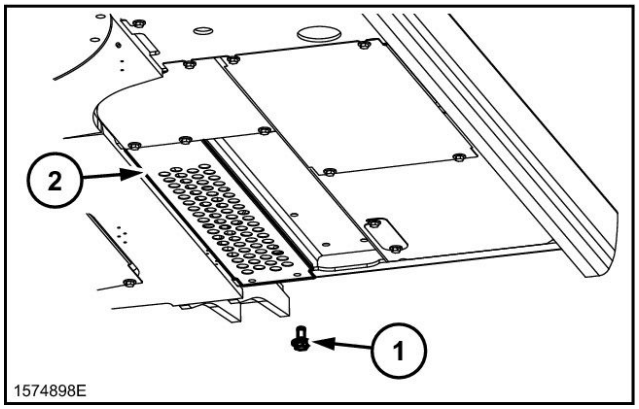
Items to prepare

- Wrenches [7 mm (0.276 in), 13 mm (0.512 in), 19 mm (0.748 in)]
- Hexagon wrench [6 mm (0.236 in)]
- Pliers
- Screwdriver
- Eyebolts x 2
- Shackles (with the required lifting capacity) x 2
- Wire rope (with the required breaking load)
- Liftcrane (with the required lifting capacity)
- Cap
- Waste oil can
- Rag
- Cleaning fluid
- Wood planks, etc.

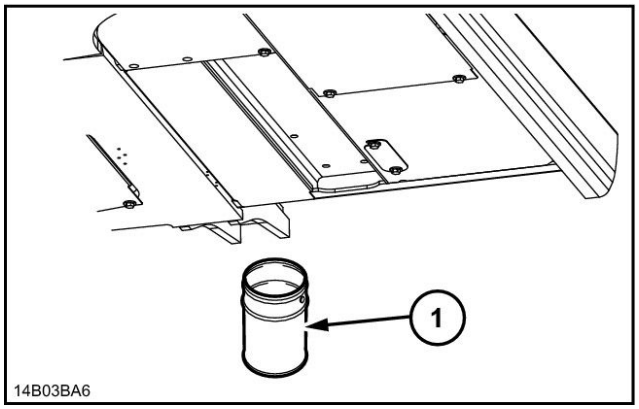
Removal of Oil Cooler

- Drain the hydraulic oil from the hydraulic oil tank. See Draining Oil from Hydraulic Oil Tank for details of the procedure.

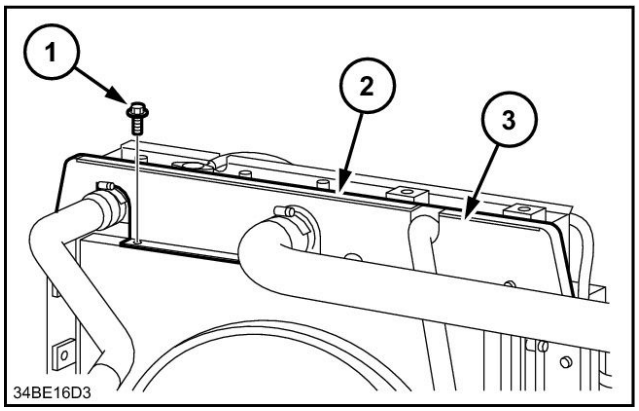
1. Use a wrench [19 mm (0.748 in)] to remove the 3 bolts (1), and then remove the under cover (2).



2. Prepare the waste oil can (1).



3. Use a wrench [13 mm (0.512 in)] to remove the 5 bolts (1), and then remove the cover (2) (3).



Section

2006

Removal and Installation of Engine Hood

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Primary specifications

Electrical system main specifications

Generator	
Item	**Specifications**
Isuzu parts number	8980921122
Nominal output	: 24 V / 50 A
Rated rotation count	: 5000 r/min
Regulator type	IC type
Regulated voltage	: 28 to 29 V
Weight	: 9.1 kg {20.1 lb}

Starter		
Type (Manufacturer)		Hitachi
Rating	Voltage	: 24 V
	Output	: 4 kW
	Time	: 30 s
Number of pinion teeth		11
Rotational direction (facing the pinion)		Right
Weight (Approx.)		: 6.3 kg {13.9 lb}
No-load characteristics	Current/voltage	: less than 120 A / 23 V
	Revolution speed	: more than 3500 r/min
Load characteristics	Current/voltage	: less than 250 A / 18.6 V
	Torque	: more than 13.2 N· m {more than 1.3 kgf· m}
	Revolution speed	: more than 1590 r/min
Locking characteristics	Current/voltage	: less than 1100 A / 10 V
	Torque	: more than 47 N· m {more than 4.8 kgf· m}

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

Assembly of Cylinder Head

1. Oil seal installation

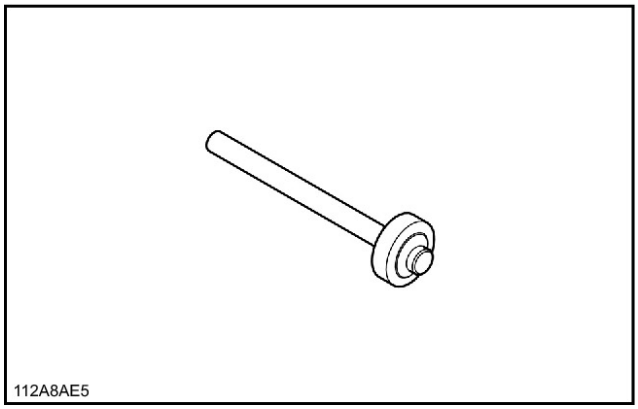
   1) Install the oil seal to cylinder head using special tool.

   ANNOTATION:

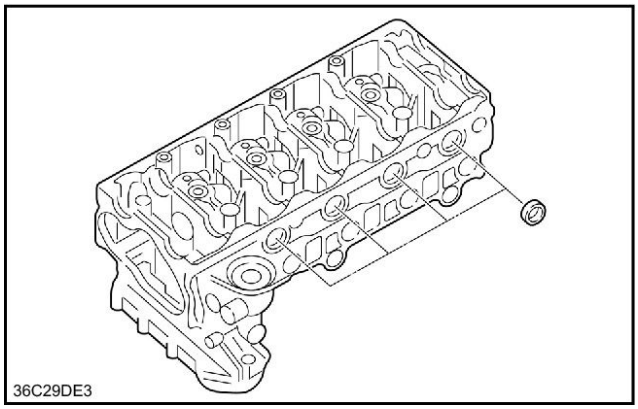
   - *Install to the injection pipe insertion surface using an oil seal installer.*
   - *Uniformly tap the seal so that it is not slanted.*

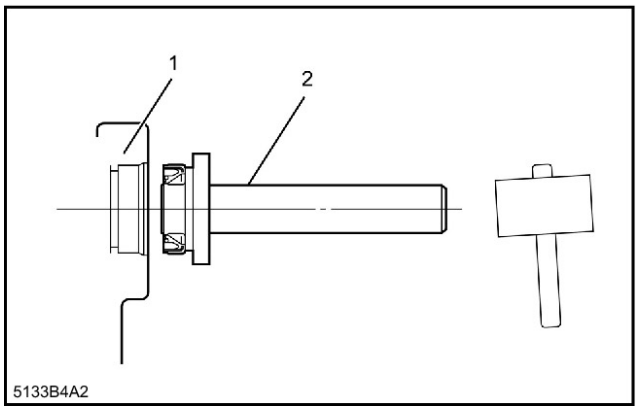
   ⚠ CAUTION

   - **Be careful not to damage the lip section.**



SST: 5-8840-2820-0 - oil seal installer





1 Cylinder head
2 Oil seal installer

2. Valve guide Installation

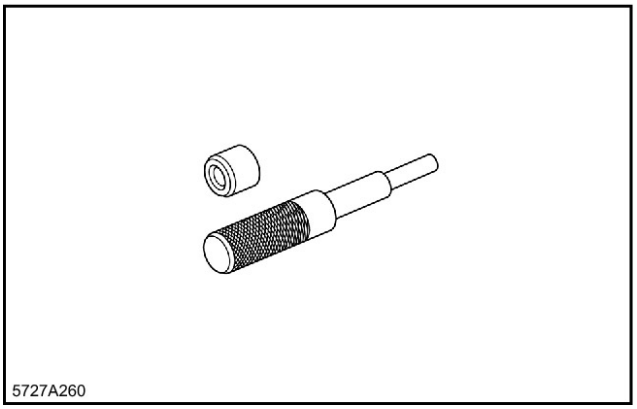
   1) Install the valve guide to the cylinder head using special tool.

   ANNOTATION:

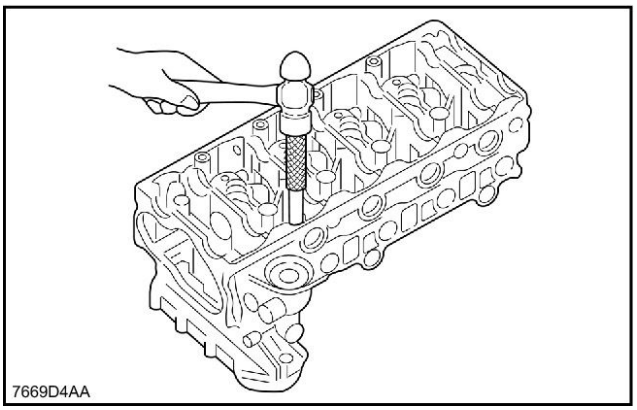
   - *Using a valve guide installer, tap in the valve guide from the upper surface side of the cylinder head.*

   ⚠ CAUTION

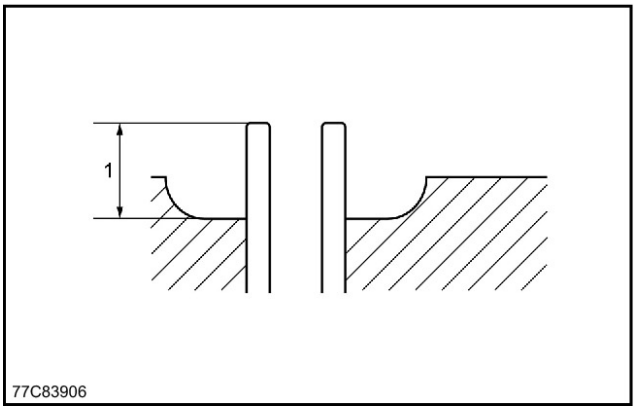
   - **When replacing the valve guide, replace with the valve as a set.**



SST: 5-8840-2816-0 - valve guide remover and installer



valve stem height: 12.5 - 12.7 mm {0.4921 - 0.5000 in}



1 The height from the upper surface of the cylinder head to the end surface of the valve guide

3. Valve stem oil seal Installation

ANNOTATION:

- *Push the priming pump 10 times to 15 times to feed fuel into the supply pump.*
- *or less, after starting the engine*

9) Start the engine and put it into an idling state.

ANNOTATION:

- *Idle for 5 seconds.*

> ⚠ **CAUTION**
>
> - **Do not rev the engine.**

10) Adjust the engine speed.

ANNOTATION:

- *Slowly increase the engine speed and maintain for 3 seconds.*
- *After completion of the above operation, operate at maximum revolutions on the side of the machine and repeat the operation of revving to the maximum speed multiple times.*

> ⚠ **CAUTION**
>
> - **If air removal operations are insufficient, due to the possibility of engine trouble, make sure to follow all procedures.**

40. Battery ground cable Connect

1) Connect the battery ground cable to the battery.

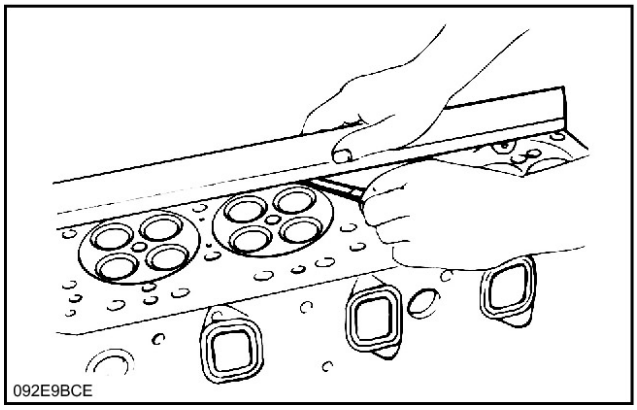
Inspection

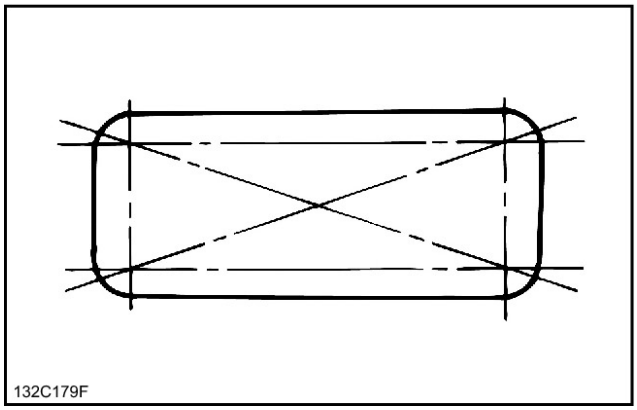
1. Cylinder head assembly Inspection

1) Measure the deformation using a feeler gauge.

ANNOTATION:

- *Use a feeler gauge and a simple straight ruler to measure cylinder head deformation.*
- *As shown in the diagram, measure the four sides and the diagonal line.*
- *Replace if the limit is exceeded.*





specified value: 0.05 mm {0.0020 in} or less
Limit: 0.20 mm {0.0079 in}

> ⚠ **CAUTION**
>
> - **Do not polish the cylinder head bottom surface.**

ANNOTATION:

- *Measure the height of the cylinder head.*

specified value: 143.4 mm {5.6457 in}

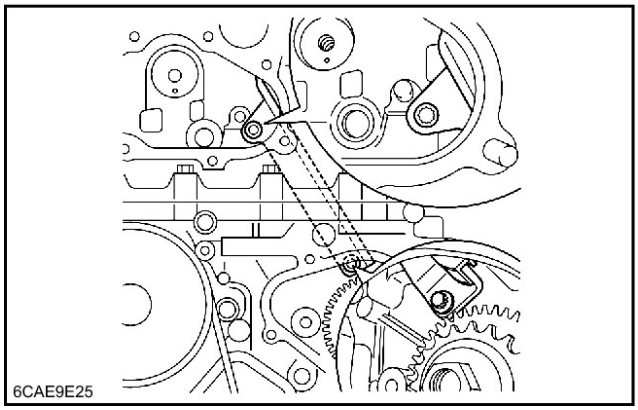
1) Remove the timing chain from the sprocket.

ANNOTATION:

- *Remove from the supply pump sprocket.*

35. Timing chain guide removal

1) Remove the timing chain guide from the cylinder head.

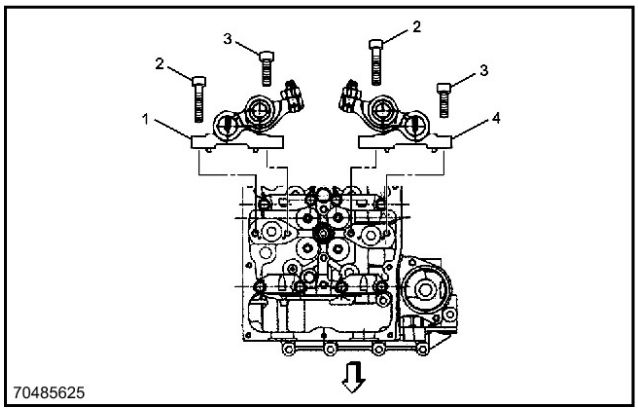


36. Rocker arm shaft assembly removal

1) Remove the rocker arm shaft assembly from the cylinder head.

ANNOTATION:

- *If reusing the rocker arm shaft assembly, install it to its original position.*

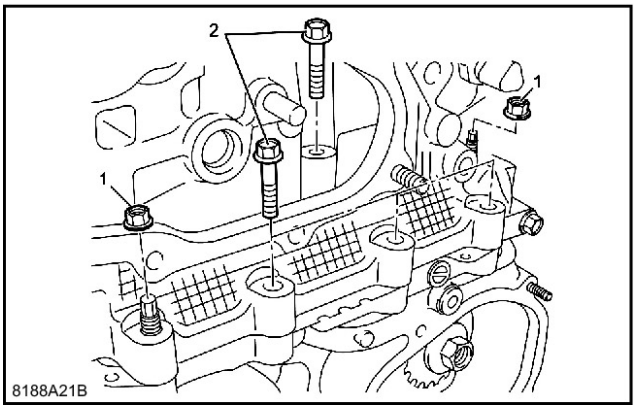


1	Exhaust rocker arm shaft assembly
2	Bolt
3	Bolt
4	Inlet rocker arm shaft assembly

37. Cylinder head assembly Removal

1) Remove the bolt from the timing gear case.

2) Remove the nut from the timing gear case.



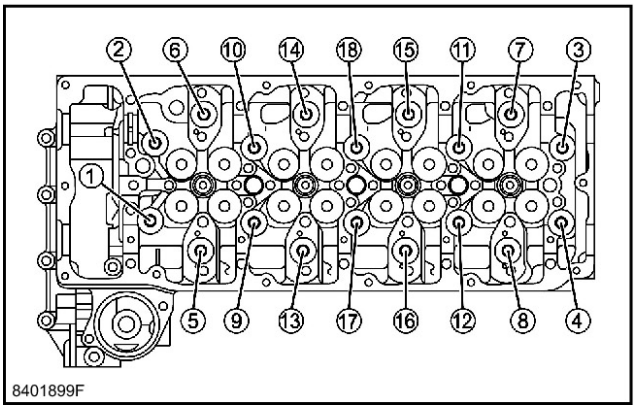
1	Nut
2	Bolt

3) Loosen the bolt using a wrench.

ANNOTATION:

- *Loosen and remove the cylinder head bolts in the order shown in the diagram.*

> ⚠ **CAUTION**
>
> - **Do not reuse the bolt.**



4) Remove the cylinder head from the cylinder block.

ANNOTATION:

- *Remove with the inlet manifold.*

38. Cylinder head gasket removal

1) Remove the cylinder head gasket from the cylinder head.

> ⚠ **CAUTION**
>
> - **Do not reuse the gasket.**

⚠ CAUTION

- **Do not reuse the crankshaft pulley bolt or washer.**

1) Apply the engine oil to the bolt.

ANNOTATION:

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

2) Install the crankshaft pulley to the crankshaft.

ANNOTATION:

- *Tighten at the specified torque in the order of the numbers in the diagram.*

Tightening torque: 30 N· m {3.1 kgf· m / 22 lb· ft}

3) Tighten the bolt using special tool.
specified angle: 180 °

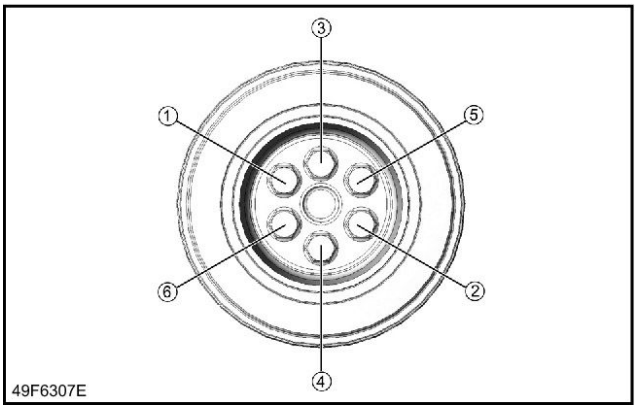
ANNOTATION:

- *Tighten again at the specified angle in the order shown in the diagram.*

specified angle: 60 °

⚠ CAUTION

- **The total rotational angle for the 2nd and 3rd times will be between 240° and 270°.**



19. Common rail assembly Installation

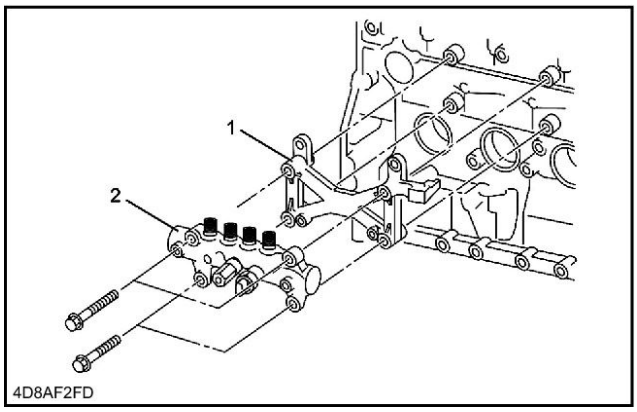
1) Install the common rail assembly to the cylinder block.

⚠ CAUTION

- **When installing the common rail assembly, do not clutch and raise up the pressure sensor.**
- **Take care not to damage the connector unit of the pressure sensor.**

ANNOTATION:

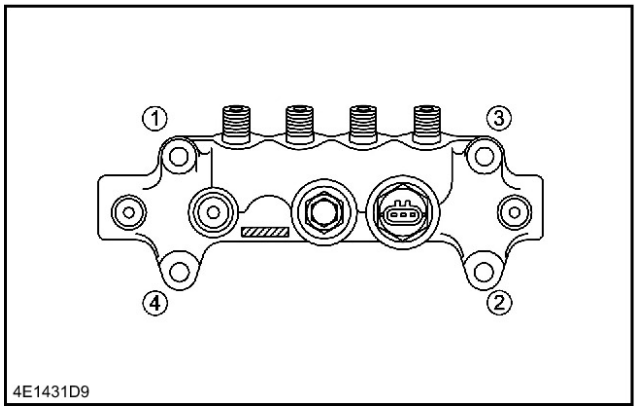
- *Install the common rail bracket at the same time.*



1	Common rail bracket
2	Common rail assembly

ANNOTATION:

- *Tighten bolts in the order shown in the diagram.*



Tightening torque: 25 N· m {2.5 kgf· m / 18 lb· ft}

20. Fuel supply pump installation

1) Install the O-ring to the fuel supply pump.

ANNOTATION:

- *Apply soapy water to the O-ring and install the O-ring to the supply pump.*

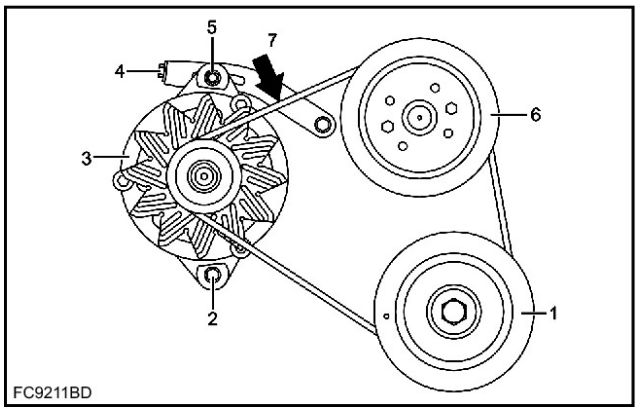
2) Install the fuel supply pump to the timing gear case.

⚠ CAUTION

- **When installing the fuel supply pump, do not hold the high pressure pipe of the pump as a handle.**
- **Ensure the O-ring does not protrude.**

ANNOTATION:

- *Confirm that the supply pump camshaft key is at a horizontal position on the right side.*



1	Crankshaft pulley
2	Installation bolt
3	Generator
4	Adjust bolt
5	Lock nut
6	Fan pulley
7	Inspection position for belt flex amount

⚠ CAUTION

- **Always take care to set the correct tension as belt service life may be shortened or the belt squeaking may occur if tension is inadequate.**

ANNOTATION:

- *After adjustment, tighten the adjust plate lock bolt and mounting bolt at the bottom side of the generator to the specified torque.*

Tightening torque: 51 N· m {5.2 kgf· m / 38 lb· ft} M10 bolt, M10 nut
Tightening torque: 25 N· m {2.5 kgf· m / 18 lb· ft} M8 bolt, M8 nut

ANNOTATION:

- *When installing a new belt, initial elongation of the belt occurs.*
- *Adjust the belt according to the adjustment method below in order to settle the belt in the pulley groove when installing a new belt or when readjusting the belt tension.*
- *Follow the specified method to adjust the belt tension.*
- *Start and idle the engine for 5 minutes or more to settle the belt.*
- *Stop the engine and readjust the belt tension to the specified value.*

65. Engine oil filling

1) Replenish the engine with engine oil.

ANNOTATION:

- *Recheck the tightening of the oil pan drain plug.*

66. Coolant filling

1) Replenish the radiator assembly with coolant.

67. Fuel Air bleed

ANNOTATION:

- *Before starting the engine*

1) Prepare the pan.

ANNOTATION:

- *Place an appropriate pan under the fuel filter.*

2) Turn the plug.

ANNOTATION:

- *Sufficiently loosen the air removal plug.*

3) Operate the priming pump.

ANNOTATION:

- *Operate the priming pump 20 times or more until fuel spills out around the plug.*

4) Close the plug.
5) Operate the priming pump.

ANNOTATION:

- *Operate the priming pump 10 times or more until it is completely filled with fuel.*
- *Wait for approximately 1 minute after operating the priming pump.*

6) Drain air from the fuel filter assembly.

ANNOTATION:

- *Sufficiently loosen the air removal plug.*

7) Close the plug.

ANNOTATION:

- *Sufficiently tighten the air bleeding plug to the fuel filter.*

⚠ CAUTION

- **Tighten the air removal plug and then completely wipe away any excess fuel in the vicinity.**

8) Operate the priming pump.

ANNOTATION:

- *Push the priming pump 10 times to 15 times to feed fuel into the supply pump.*
- *or less, after starting the engine*

9) Start the engine and put it into an idling state.

ANNOTATION:

- *Idle for 5 seconds.*

⚠ CAUTION

- **Do not rev the engine.**

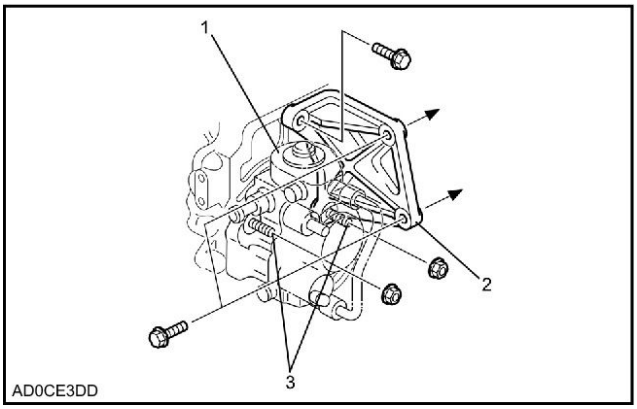
10) Adjust the engine speed.

ANNOTATION:

2) Remove the supply pump bracket from the cylinder block.
3) Remove the fuel supply pump from the timing gear case.

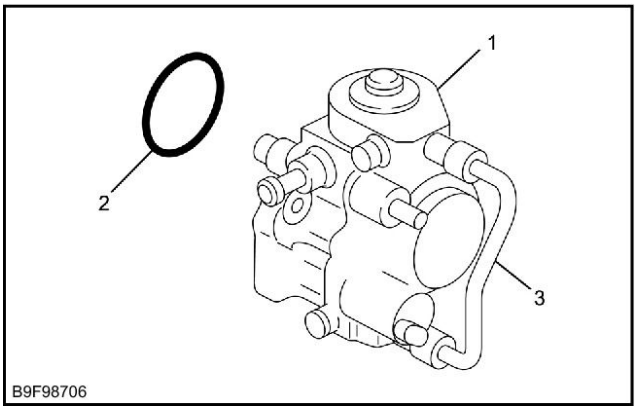
ANNOTATION:

- *When removing the fuel supply pump, do not hold the high pressure pipe of the pump instead of the handle.*



1	Fuel supply pump
2	Supply pump bracket
3	Stud bolt

4) Remove the O-ring from the fuel supply pump.



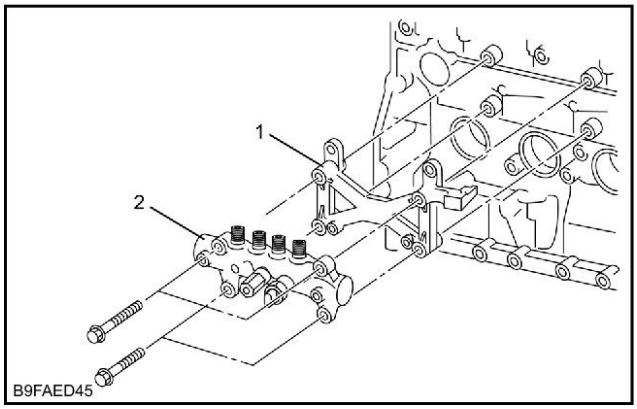
1	Fuel supply pump
2	O-ring
3	High pressure pipe

47. Common rail assembly Removal

1) Remove the common rail assembly from the cylinder block.

ANNOTATION:

- *Remove the common rail bracket at the same time.*



1	Common rail bracket
2	Common rail

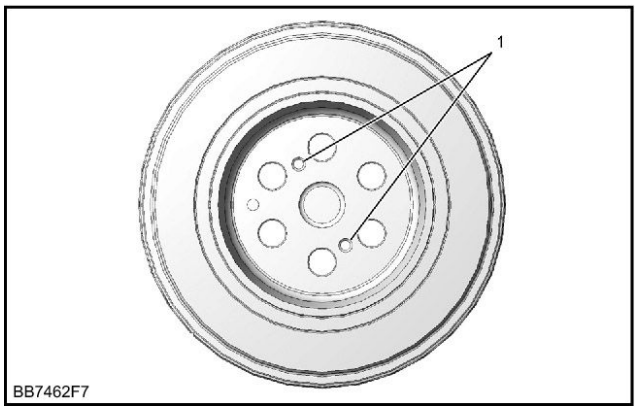
48. Crankshaft pulley Removal

1) Remove the crankshaft pulley from the crankshaft.

> ⚠ **CAUTION**
>
> - **Do not reuse the crankshaft pulley bolt or washer.**

ANNOTATION:

- *When fastening, remove using the removal bolt hole of the crankshaft pulley.*



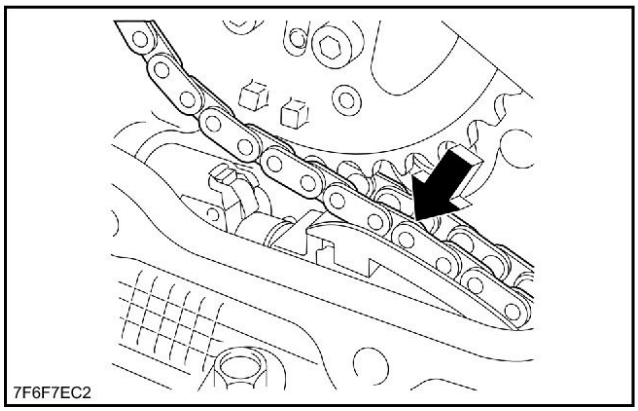
1	Removal bolt hole

ANNOTATION:

3) Disconnect the hook from the pin.

ANNOTATION:

- *Lightly push the area indicated with an arrow in the diagram.*
- *The hook of the tensioner opens, the plunger pushes the tension lever, and the chain is pulled.*



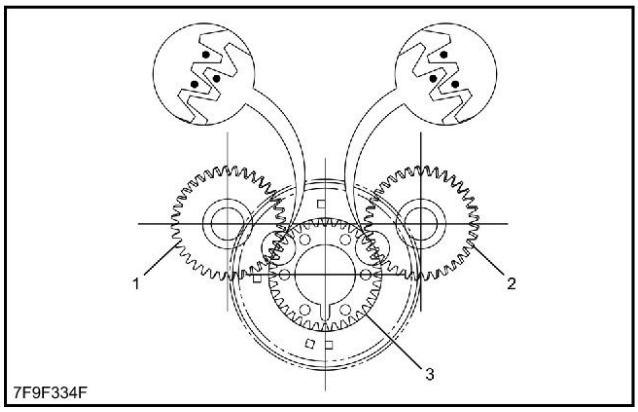
33. Camshaft Installation

1) Align the camshaft gear with the alignment mark.

ANNOTATION:

- *As indicated in the diagram, align the alignment marks of the inlet camshaft gear and the exhaust camshaft gear, as well as the alignment mark of idle gear D.*

2) Install the camshaft to the cylinder head.

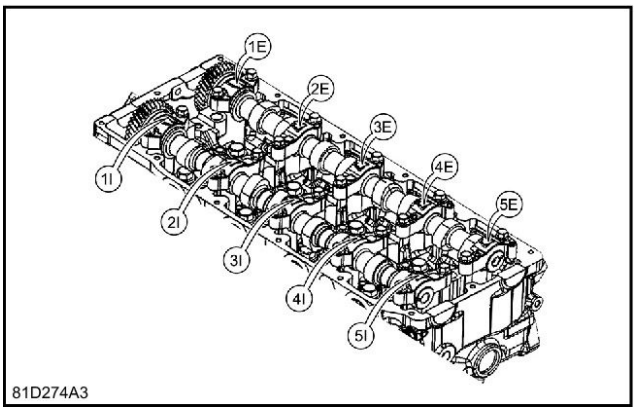


1	Exhaust camshaft gear
2	Inlet camshaft gear
3	Idle gear D

3) Install the camshaft bearing cap to the cylinder head.

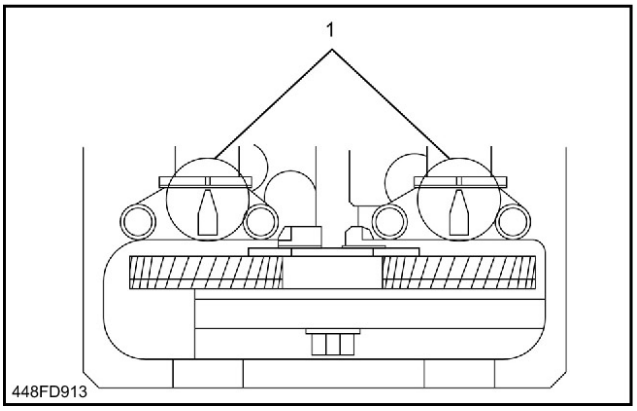
ANNOTATION:

- *Apply engine oil to the journal section of the cylinder head.*
- *Face the bearing cap front mark to the engine front side, and assemble in numbered order to the cylinder head.*



ANNOTATION:

- *Confirm that the alignment marks of the camshaft bearing cap and the camshaft are aligned.*



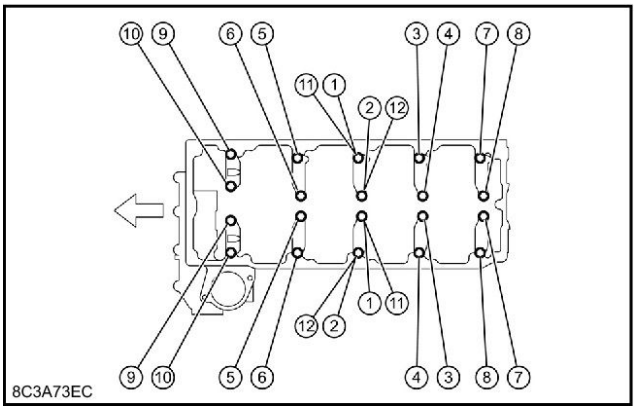
1	Alignment mark

4) Apply the engine oil to the bolt.

ANNOTATION:

- *Apply engine oil to the threaded portion and tighten the bearing cap.*
- *Tighten the bearing cap to the specified torque in the order shown in the diagram.*

Tightening torque: 18 N· m {1.8 kgf· m / 13 lb· ft}



5) Remove the bolt from the camshaft gear.

ANNOTATION:

Inspection

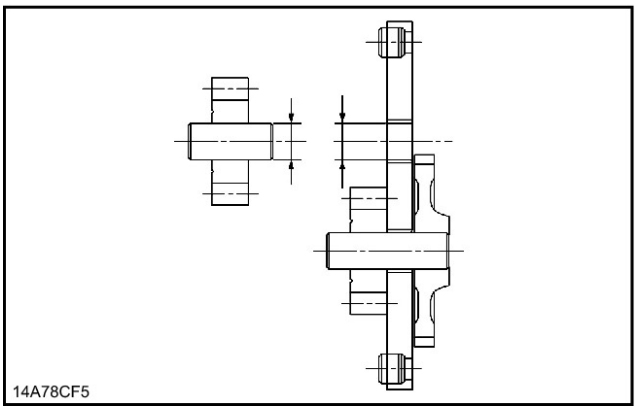
1. Oil pump assembly Inspection

   1) Measure the oil pump gear using a micrometer.

   ANNOTATION:

   - *When assembling, measure the gap between the gear shaft outer diameter and the bushing.*
   - *Measure the outer diameter of the gear shaft.*
   - *Gear shaft outer diameter*

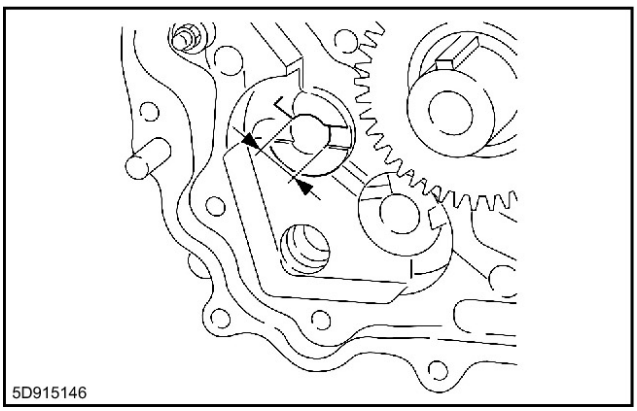
   specified value: 15.989 - 16.000 mm {0.6295 - 0.6299 in}
   Limit: 15.900 mm {0.6260 in}



   ANNOTATION:

   - *Use a dial gauge to measure the inner diameter of the oil pump body and gear case bushing.*
   - *When the gap between the gear shaft and the bushing exceeds the limit, replace the oil pump assembly.*
   - *Gap between the driven gear shaft and the bushing*

   specified value: 0.04 - 0.07 mm {0.0016 - 0.0028 in}
   Limit: 0.20 mm {0.0079 in}



   2) Measure the oil pump gear using a micrometer.

   ANNOTATION:

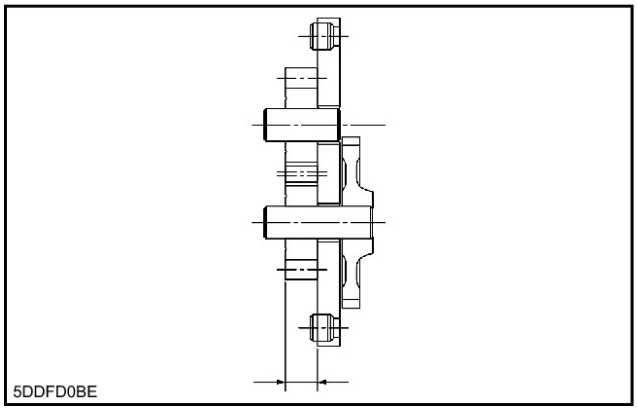
   - *Measure the gap between the side of the pump gear and the oil pump room.*

   specified value: 14.500 - 14.527 mm {0.5709 - 0.5719 in}

   ANNOTATION:

   - *Measure the width of the pump gear.*
   - *Gear width*

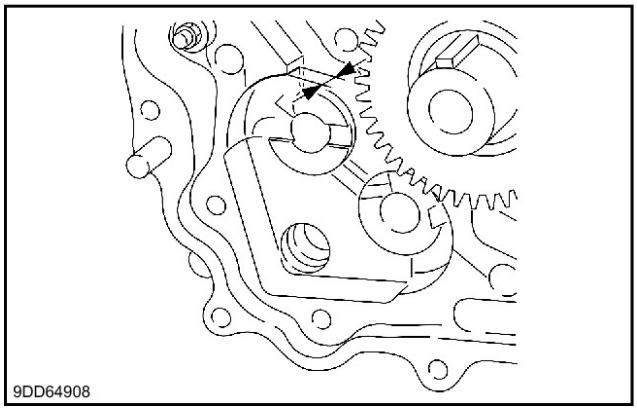
   specified value: 14.5 mm {0.5709 in}



   ANNOTATION:

   - *Measure the depth of the oil pump room.*
   - *Depth of the oil pump room of the gear case*

   specified value: 14.500 - 14.527 mm {0.5709 - 0.5719 in}



   ANNOTATION:

   - *Gap between the side of the pump gear and the oil pump room*

   specified value: 0.065 - 0.109 mm {0.0026 - 0.0043 in}
   Limit: 0.20 mm {0.0079 in}

Removal of Exhaust Manifold

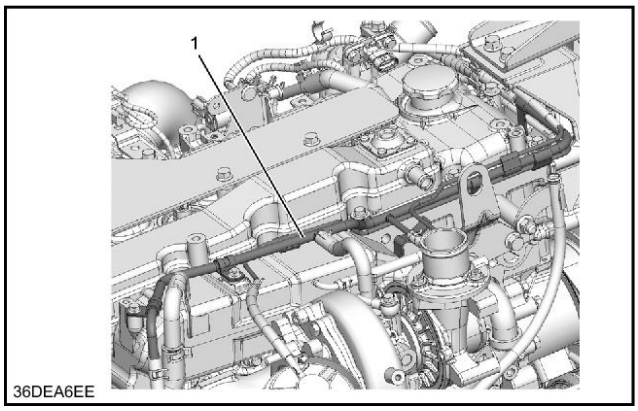
1. Battery ground cable Disconnect
   1) Disconnect the battery ground cable from the battery.
2. Coolant Drain
   1) Drain coolant from the radiator.

> ⚠ **CAUTION**
>
> - **Do not loosen or remove the radiator cap when the coolant is hot.**
> - **Steam and boiling water can burst out, possibly causing burns or heat related injuries.**
> - **When opening the radiator cap, place a thick cloth over the cap when the coolant is cooled, and turn it gradually to release the pressure before opening it.**

ANNOTATION:

- *Loosen the water drain plug on the rear right side of the engine, as well as the radiator drain plug.*
- *Completely drain the coolant.*
- *After completely draining the coolant, securely tighten the drain plug.*

3. Water pipe removal
   1) Remove the water pipe from the engine assembly.



1	Water pipe

ANNOTATION:

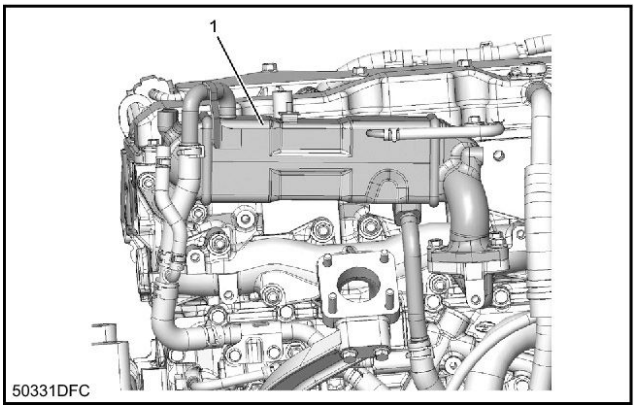
- *Because the plastic pipe is easily damaged during hose removal, do not remove from the side of the plastic pipe if possible.*

4. EGR cooler Removal
   1) Remove the EGR cooler from the exhaust manifold and cylinder head assembly.

ANNOTATION:

- *Remove the IN side and OUT side of the rubber hose for the water pipe and remove the EGR cooler and gasket.*

> ⚠ **CAUTION**
>
> - **Do not hold the water pipe section when removing the EGR cooler.**

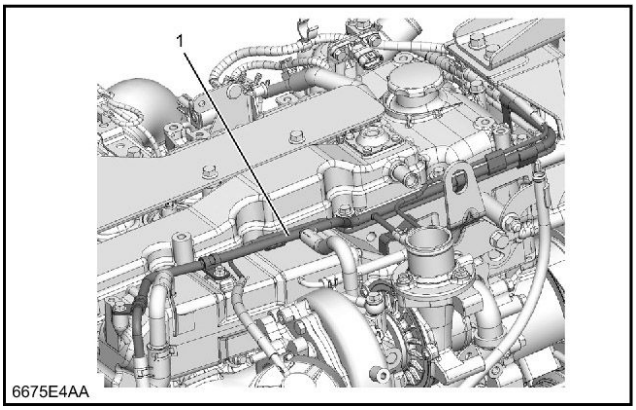


1	EGR cooler

ANNOTATION:

- *Because the plastic pipe is easily damaged during hose removal, do not remove from the side of the plastic pipe if possible.*

5. Turbocharger assembly Removal
   1) Remove the return hose from the water pipe.



1	Water pipe

   2) Remove the water feed pipe from the oil cooler assembly.

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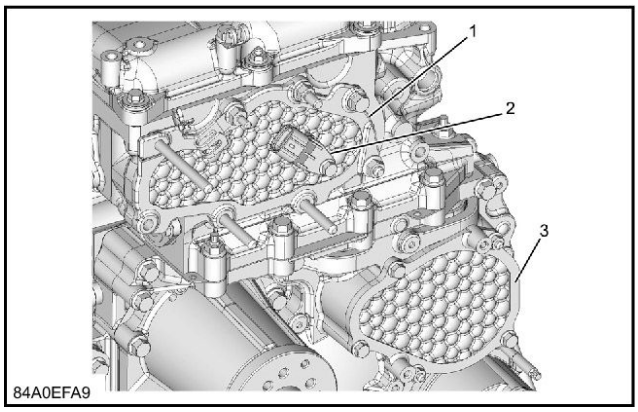
2) Install the timing chain lower cover to the gear case cover.
Tightening torque: 10 N· m {1.0 kgf· m / 7.38 lbf· ft}



1	Timing chain upper cover
2	CMP sensor
3	Timing chain lower cover

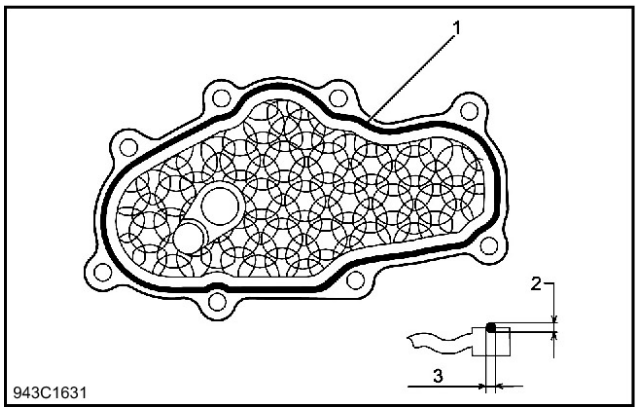
11. Timing chain upper cover installation

1) Apply liquid gasket to the timing chain upper cover.

ANNOTATION:

- *Apply ThreeBond 1207B.*

> ⚠ **CAUTION**
>
> - **Install the cover within five minutes of applying liquid gasket.**



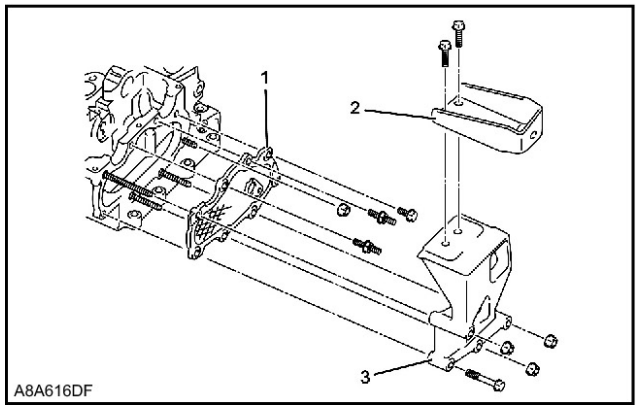
1	Liquid gasket
2	2
3	2 - 2.5 mm {0.0787 - 0.0984 in}

2) Install the timing chain upper cover to the cylinder head.

ANNOTATION:

- *Apply Loctite 262 to the threaded portion on the cylinder head side.*

Tightening torque: 25 N· m {2.5 kgf· m / 18 lb· ft}



1	Timing chain upper cover
2	Fan shroud bracket
3	Fan shroud stay

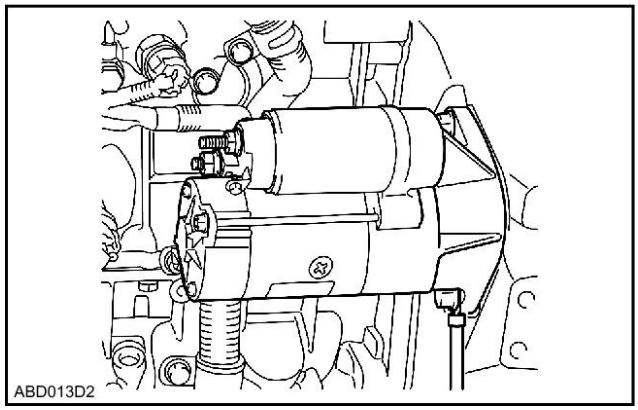
12. Starter motor installation

1) Install the starter motor to the flywheel housing.

ANNOTATION:

- *Install the earth cable at the same time.*

Tightening torque: 97 N· m {9.9 kgf· m / 72 lb· ft}



2) Connect the S-terminal to the starter motor.
3) Connect the B-terminal to the starter motor.

13. Cam end gasket installation

1) Install the cam end gasket to the cylinder head.

ANNOTATION:

- *Apply liquid gasket, ThreeBond 1207B to the area 2 indicated in the diagram with a width of 2.0 - 3.0 mm {0.0787 - 0.1181 in} and install to the cylinder head.*

- *Tighten the sleeve nuts on the injector side until they can no longer be turned by hand.*

2) Securely tighten the injector to the cylinder head.

ANNOTATION:

- *Tighten the injector clamp bolt to the specified torque.*

Tightening torque: 26 N· m {2.7 kgf· m / 19 lb· ft}

3) Securely tighten the injection pipe to the injector.

ANNOTATION:

- *Tighten the sleeve nut on the injector side of the injection pipe to the specified torque.*

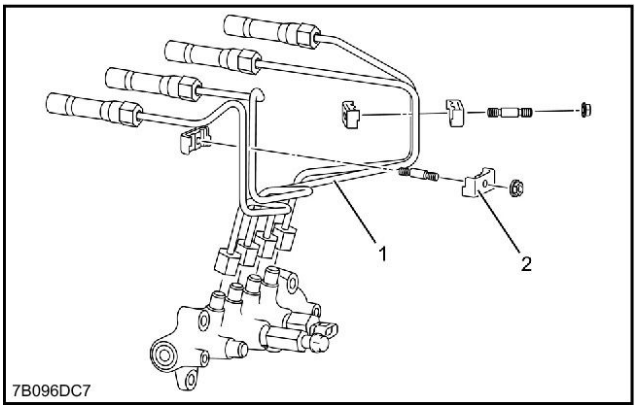
Tightening torque: 30 N· m {3.1 kgf· m / 22 lb· ft}

4) Securely tighten the injection pipe to the common rail assembly.

ANNOTATION:

- *Tighten the sleeve nut on the common rail side of the injection pipe to the specified torque.*

Tightening torque: 25 N· m {2.5 kgf· m / 18 lb· ft}
Tightening torque: 7.8 N· m {0.8 kgf· m / 5.754 lbf· ft} Clamp nut



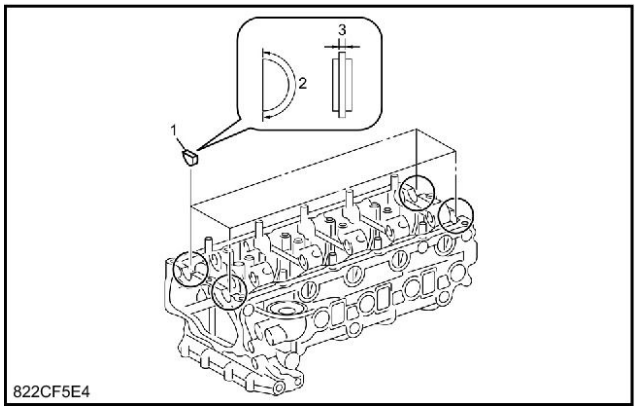
1	Injection pipe
2	Clamp

3. Cam end gasket installation

1) Install the cam end gasket to the cylinder head.

ANNOTATION:

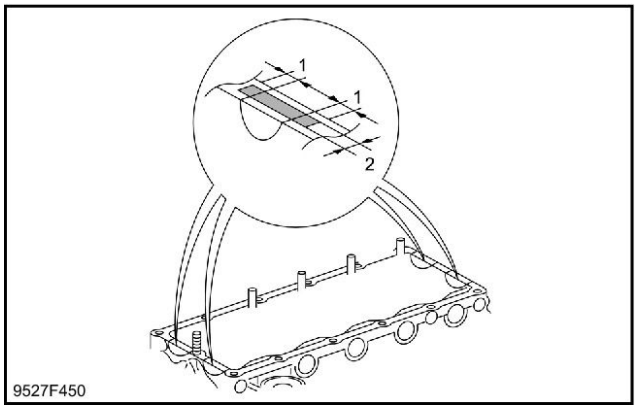
- *Apply liquid gasket, ThreeBond 1207B to the area 2 indicated in the diagram with a width of 2.0 - 3.0 mm {0.0787 - 0.1181 in} and install to the cylinder head.*



1	Cam end gasket
2	Liquid gasket application area
3	Bead width

ANNOTATION:

- *Apply liquid gasket, ThreeBond 1207B as shown in the diagram.*



1	3.0 - 5.0 mm {0.1181 - 0.1969 in}
2	3.0 - 5.0 mm {0.1181 - 0.1969 in}

4. Cylinder head cover Installation

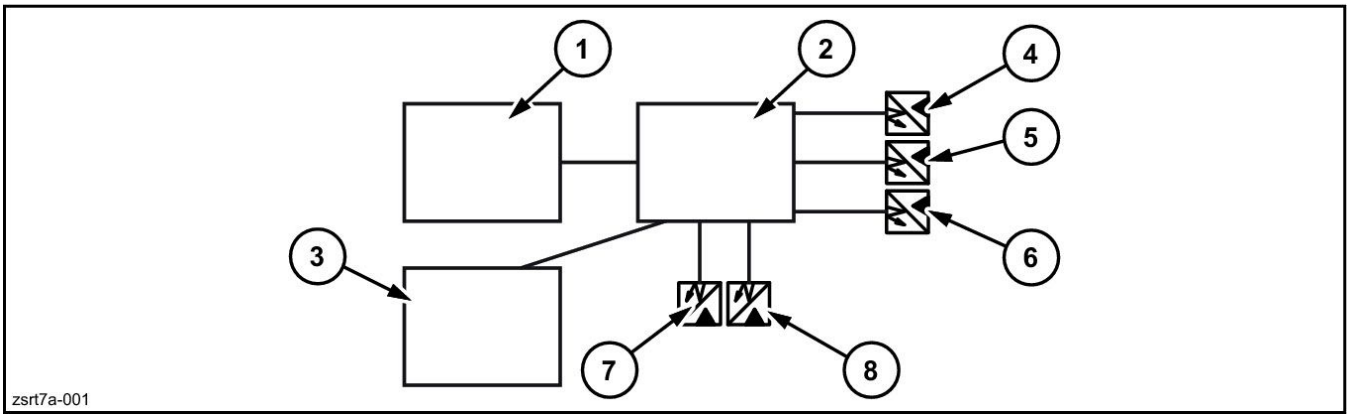
1) Install the cylinder head cover to the cylinder head.
Tightening torque: 10 N· m {1.0 kgf· m / 7.38 lbf· ft}

2) Connect the PCV hose to the cylinder head cover.

Idling Start

Purpose

When the engine starts, the engine speed starts in low idle regardless of the throttle volume position.(Warm-up operation, engine protection)



1	Throttle volume	4	Pressure sensor (upper)	7	Pressure sensor (option 1)
2	Computer A	5	Pressure sensor (swing)	8	Pressure sensor (option 2)
3	One-touch idle switch	6	Pressure sensor (travel)		

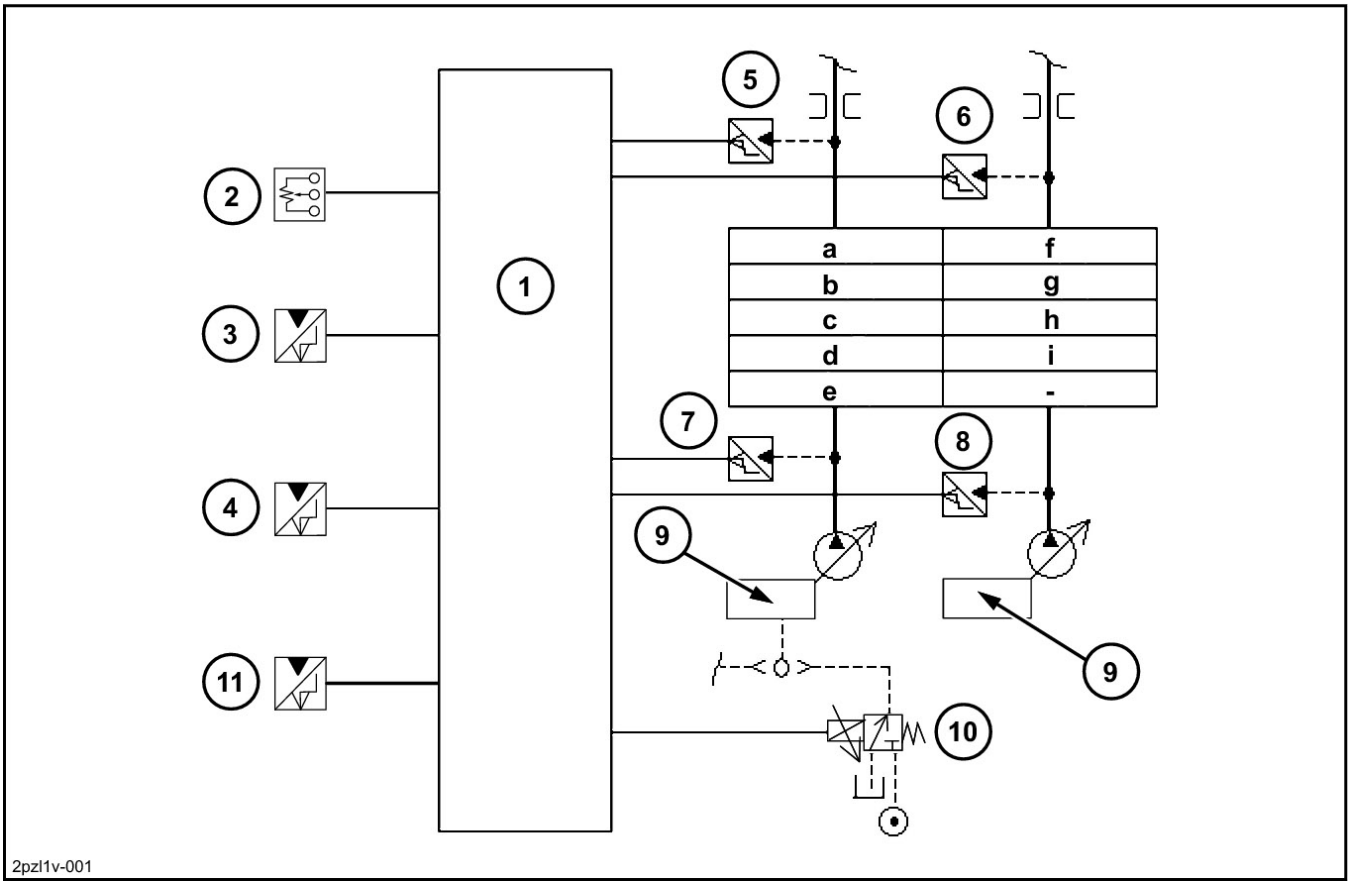
Operation explanation

1. Idling start operation condition
   Because idling start is a warm-up operation, it operates when the engine is started.
2. Idling start end conditions
   The operation ends under the following conditions.
   1) When an operation lever is operated.(When one of the following pressure sensors is turned ON: upper, swing, travel, option 1, or option 2)
   2) When the throttle volume is operated.
   3) When the one-touch idle switch is pressed.

Operability

Swing Speed Limit

Purpose
When the pump flow rises during a swing operation, the swing speed increases.
To prevent this, control of the pump flow is performed.(Swing speed control)



1	Computer A	5	Pressure sensor (N1)	9	Regulator
2	Throttle volume	6	Pressure sensor (N2)	10	P1 flow control proportional valve
3	Pressure sensor (travel)	7	Pressure sensor (P1)		
4	Pressure switch (option 1)	8	Pressure sensor (P2)		

a	Arm (1)	d	Option 1	g	Boom (1)
b	Boom (2)	e	Travel (left)	h	Bucket
c	Swing	f	Arm (2)	i	Travel (right)

Operation explanation

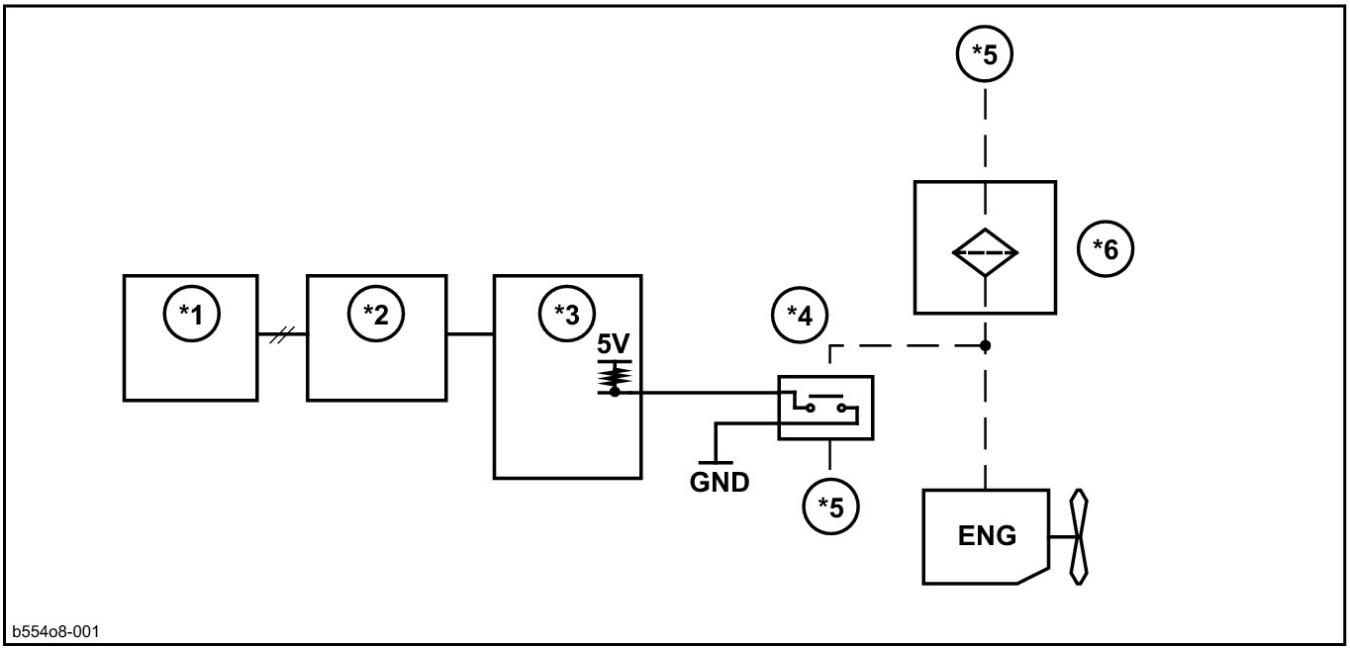
1. Operation conditions for swing speed limit control
   Control is executed when all the conditions below are satisfied.
   1) Independent swing operation (swing pressure sensor ON)
   2) When travel or option operations are not being performed (travel and option pressure sensors OFF)
   3) Work mode is SP or H mode(except CX350C/CX370C/350X3)
2. Swing speed limit end conditions
   The operation ends under the following conditions.
   1) Ends immediately after a travel or option operation is performed (travel or option pressure sensor ON).
   2) Ends gradually after an attachment operation is performed (upper pressure sensor ON).

Air Filter Clog

Summary

If clogging occurs in the air cleaner filter, a message is displayed on the monitor giving the diagnostic trouble code and the warning buzzer sounds.

Configuration

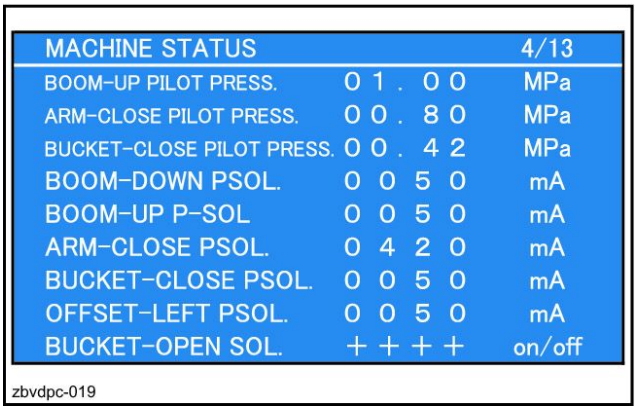


*1	Color monitor	*3	Computer A	*5	Barometric pressure
*2	Computer B	*4	Clog sensor	*6	Air cleaner

Operation explanation

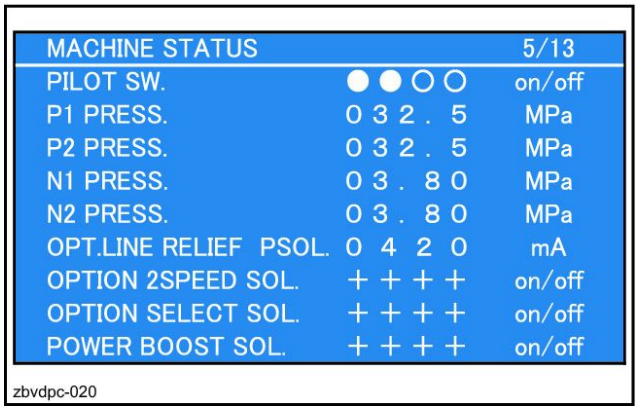
1. When the clog detection pressure switch comes ON, Computer A detects the clog and sends a command to the monitor via Computer B
2. Clog detection starts 10 sec. after the engine starts.
3. When the clog switch comes ON, Computer A detects this.
   If the contact point is ON continuously for 1 sec., the return filter is judged to be clogged.
4. When the monitor receives the filter clog command, it carries out the following operations.
   - Message: "AIR FILTER" is displayed.
     Even after the coolant level is restored to normal, the "LOW COOLANT" message remains displayed while the key is ON.
   - Diagnostic Trouble Code: "7424" is displayed.
     Even after the coolant level is restored to normal, the "LOW COOLANT" message remains displayed while the key is ON.
   - Monitor buzzer: The buzzer sounds at the same time that the message is displayed and the buzzer automatically stops after 5 sec.

4. Pressure and solenoid



BOOM-UP PILOT PRESS.	MPa (psi)	Boom-up pilot pressure
ARM-CLOSE PILOT PRESS.	MPa (psi)	Arm-in pilot pressure
BUCKET-CLOSE PILOT PRESS.	MPa (psi)	Bucket-close pilot pressure
P.SOL;BOOM-DOWN	mA	Boom-down solenoid
P.SOL;BOOM-UP	mA	Boom-up solenoid
P.SOL;ARM-CLOSE	mA	Arm-in solenoid
P.SOL;BUCKET-CLOSE	mA	Bucket-close solenoid
P.SOL;OFFSET-LEFT	mA	Offset left solenoid
SOL;BUCKET OPEN	on/off	Bucket-open solenoid

5. Pressure and solenoid



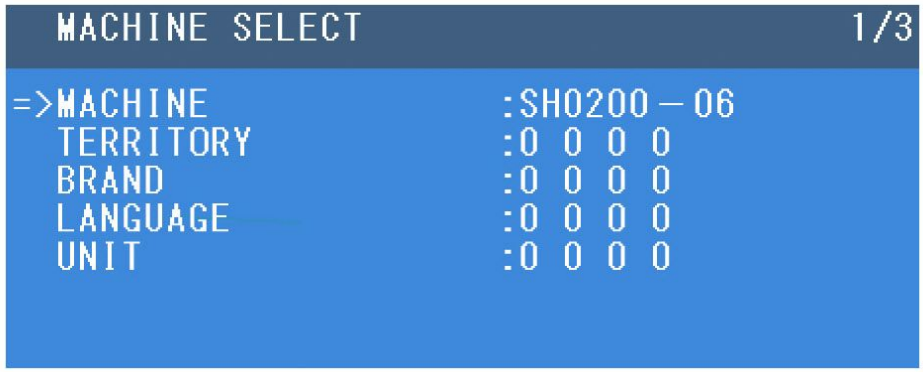
PILOT SW.	on/off	Pilot switch
P1 PRESS.	MPa (psi)	Pump 1; Discharge pressure
P2 PRESS.	MPa (psi)	Pump 2; Discharge pressure
N1 PRESS.	MPa (psi)	Pump 1; Negative control pressure
N2 PRESS.	MPa (psi)	Pump 2; Negative control pressure
P.SOL;OPT.LINE RELIEF	mA	Option line solenoid
SOL;OPTION 2SPEED	on/off	2 pumps flow solenoid
SOL;OPTION SELECT	on/off	Option selection solenoid
SOL;POWER BOOST	on/off	Power boost solenoid

Setting

Model Select

Summary
The model information is input to set the control parameters specific to the model.
Configuration

- Screen



klmyhj-001

Operation explanation
Move up and down to move the cursor, left and right to select a model, set the throttle to H mode, and decide with the menu switch.

- · Reset by holding down the left and right. (The display changes to "?" for all items.)

* From Ver. 1.8.6
Without a reset, only the LANGUAGE and UNIT can be changed.
Other changes always require a complete reset.

Setting items, values and details
Select "SET UP" on the service screen and input the following items.
The setting item values and setting details are given below.

Explanation of item

Page	Item name	Explanation	Remarks
1	MACHINE	Model	
	TERRITORY	Destination	
	BRAND	Brand	
	LANGUAGE	Language	
	UNIT	Unit	0: {MPa, °C}, 1: {psi, °F}, 2: {kgf/cm^2, °C}
		-	
		-	
		-	
		-	
		-	
2		-	
	OVERLOAD WARNING	Load warning	
	ANTI INTERFERENCE	Interference prevention	Not currently supported
	ATT. TYPE	Attachment type	Used for interference prevention·crane·overload warning
	OPTION LINE	Option Line	
	GENERATOR	Lifting magnet	Not currently supported
		-	
		-	
		-	

and the fuel injector that injects the fuel in the form of a fine mist. Each of these are controlled by the ECM based on various signals to control the injection timing and injection amount in accordance with the driving condition.

Fuel injector

The fuel injector has adopted the 8-hole nozzle, and adjusts the fuel injection amount and injection timing by opening or closing the electromagnetic valve on the injector head portion.

The ECM corrects variation in the fuel injection amount from fuel injector to fuel injector in accordance with the ID code data in the memory. When adjusting the fuel injector, the ID code data must be recorded in the ECM.

Fuel filter with sedimenter

The fuel filter with sedimenter removes the water by using the difference in the relative density between diesel oil and water, and notifies the operator through the indicator when it becomes full of water.

Preheat system

The preheat system consists of the ECM, glow relay, glow plug and glow indicator light. The preheat system is activated when the engine coolant temperature is low to help engine start.

Lubricating system

It uses and oil filter with a full-flow bypass, and cools down the pistons using the water-cooled oil cooler and the oil jet.

DPD

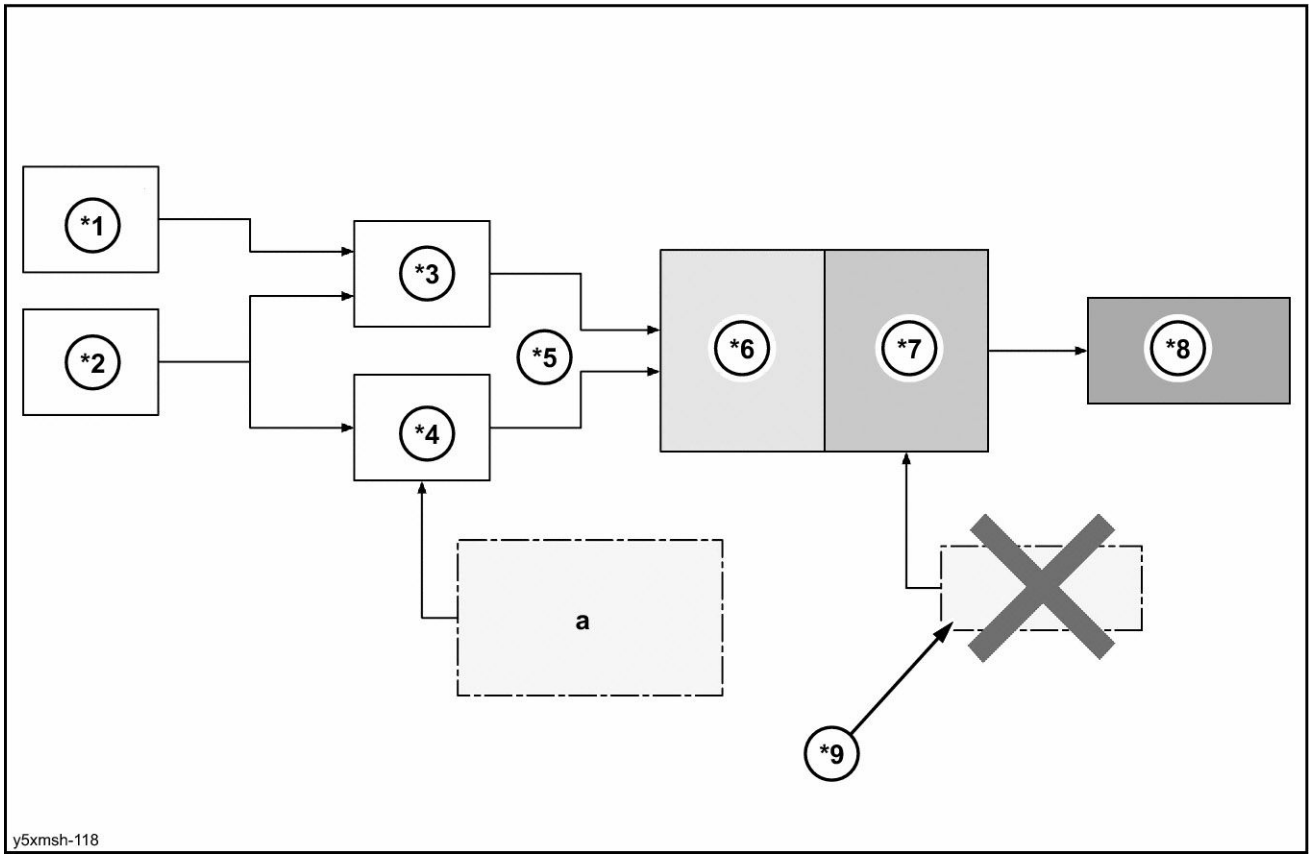
An integrated DPD oxidation catalyst is installed for reducing exhaust gas.

Electronic control fuel injection system

This is the system in which the ECM obtains information such as the engine rpm and engine load and sends the electrical signals based on the information to the supply pump, injectors, etc. to properly control the fuel injection amount and injection timing for each cylinder.

Injection amount control

To make the injection amount optimal, the fuel injection amount is controlled by regulating the injector based on mainly the signals from the engine RPM and throttle opening angle or the instructed rotation from the control unit in the machine.

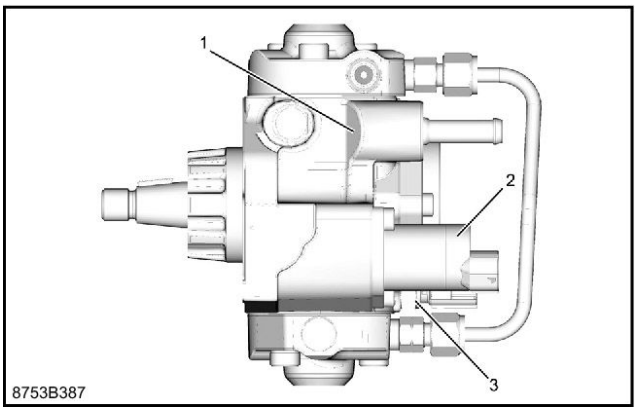


a	• Boost press. • Coolant temp. • Barometric press.

*1	Throttle pedal position	*4	Maximum fuel injection quantity	*7	Fuel injection quantity correction
*2	Engine speed	*5	Reduction rate	*8	Injector ON time determination
*3	Basic fuel injection quantity	*6	Final fuel injection quantity	*9	Cylinder by cylinder correction

Supply pump

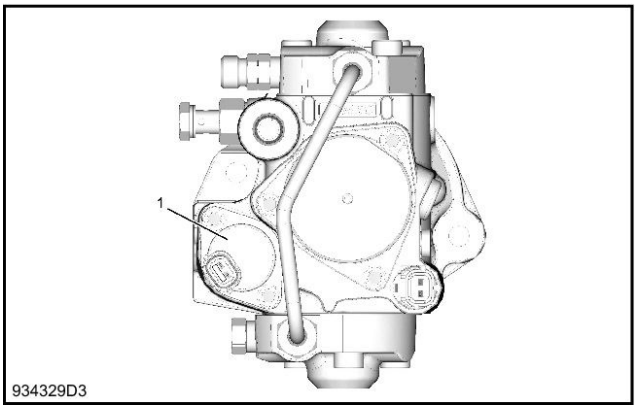
The supply pump highly pressurizes the fuel using the engine torque, and force-feeds the fuel to the common rail. Also, the suction control valve, fuel temperature sensor, feed pump, etc, are installed on the supply pump.



1	Feed pump
2	Suction control valve
3	Fuel temperature sensor

Suction control valve

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



1	Suction control valve

Pin No.	Pin name	Connection
110	CC-ISOCAN-H	ISO CAN-High
111	PS-+B	Battery power source
112	SG-5VRT3	DPD differential pressure sensor, fuel filter pressure sensor, exhaust gas temperature sensor 1, exhaust gas temperature sensor 2 GND
113	SG-12VRT	MAF sensor GND
114	OS-MAINR	ECM main relay control
115	SG-SLD1	Throttle position sensor shield
116	IA-EVRV	Vacuum sensor signal
117	SP-12V	Mass air flow sensor power source
118	-	-
119	PG-SIGN	Signal GND
120	-	-
121	IS-ENGSTP	Engine stop switch signal
122	IS-DPDREG	DPD switch
123	OS-OVRL	Engine overrun light
124	OS-OILPL	Engine oil pressure light
125	OS-BOOSTL	Boost temperature sensor pilot light
126	OS-OVHL	Overheat light
127	-	-
128	OF-TACHO	Tachometer
129	OS-DPDREG	DPD regeneration light
130	OS-DIAGL	Diagnosis light
131	-	-
132	CC-CAN-L	CAN-Low
133	PS-+B	Battery power source
134	IS-IGKEY	Starter switch ON signal
135	SG-5VRT2	Barometric pressure sensor GND
136	OS-MAINR	ECM main relay control
137	PG-CASE	ECM case GND
138	OP-EVRV	Turbocharger control solenoid drive
139	PS-MAFBAT	Dropping resistor
140	-	-
141	IS-DIAG	Diagnostic switch signal
142	IS-MEMCL	Memory clear switch signal
143	IS-DGSEL	Diagnostic switch signal
144	-	-
145	OS-GLOWL	Glow light
146	-	-
147	OS-FIPRESSL	Fuel filter clogging light
148	OS-THLL	Fuel temperature light
149	OS-DPDSL	DPD light
150	OS-HOUR	Hour meter relay
151	-	-
152	OS-STARTR	Starter cut relay
153	OS-GLOWR	Glow relay
154	CC-CAN-H	CAN-High

Engine Output Deficiency

1. Insufficient engine output Description of Symptom
   The engine output is lower than expected, the output does not change when the throttle lever is lifted up, the operation is not effective.
2. Insufficient engine output Diagnostics

   - Preliminary inspection
     Before using this section, perform a functional inspection and OBD system check to check all of the following.
     The ECM and monitor are operating correctly.
     Check DTC.
     The scan tool data is in the normal range of operation values.
     Check the machine status, and locate the appropriate symptom.
     Check with the customer whether they are using the specified engine oil and fuel.
     Since there are various possible causes of insufficient output, investigate on the association between the engine body and the machine thoroughly.
     Check in which operation the insufficient output occurs.
     If the symptom of insufficient output contains hesitation and lug-down, it is associated with control of the machine, so contact the machine manufacturer.
     If a trouble diagnosis scan tool is available, the engine output at the rated point can simply be checked by checking the boost at the rated point.
   - Visual inspection
     Careful visual inspection is required for several symptom procedures. This can lead to correcting a problem without further inspections, and can save valuable time.
     The inspection includes the following.
     Whether the air cleaner element is clean and free from clogging.
     Correct wiring connections, tightening, and disconnection.
     Whether the power of any commercial accessories is being taken from the ECM power.
     Whether the ECM ground is clean and securely installed in the correct location.
     Correct connections, cracks, and twists in the pipes and hoses related to fuel, air or oil. Extensively check for any leaks or blockage.
     Whether there is any fuel leaks or pipe damage in the fuel system.
     Increase of resistance due to failure of air intake system parts, especially dirty or clogged air cleaner element and collapsing of air intake pipe
     Exhaust system parts abnormalities
   - Diagnostic aids
     Fuel out, fuel freezing, mixture of air into the fuel piping, filter defect, pipe defect, fuel quality and failure of fuel system such as fuel tank
     Air intake system abnormalities such as clogged filter and air intake piping failure
     Exhaust system abnormalities such as exhaust pipe failure
     Sensor input circuit system abnormalities such as throttle position sensor and harness failure
     Switch input circuit system abnormalities
     Engine unit abnormalities such as compression pressure, valve clearance, turbocharger, supply pump, injector, common rail, and other mechanical failure, etc.
     Failure related to machine measurement devices such as oil pressure pump
     Effect of post-installed accessories such as wireless devices and lights, etc.
     Inspect the connector for connection failures and the harness for abnormalities such as abrasions or bends. Inspect that the wire inside the harness has not caused a short circuit with other circuits.
     Perform inspections for functional diagnosis, and confirm the operation and control of each part. Repair if abnormalities are found.
     Decrease of output by fuel flow rate limitations due to overheating
     Insufficient output by fuel flow rate limitations for highland driving

1. Maintenance precautions

   1) Precautions on maintenance
   To prevent the engine from being damaged and to ensure the reliability of engine performance, be careful of the following points when performing maintenance works.
   When placing the engine on the ground, make sure that the bearing surface of the oil pan does not directly contact the ground.
   Use an appropriate wood frame, to support the engine at the engine foot portion and the flywheel housing portion.
   There is only a small gap between the oil pan and oil pump strainer, so be careful not to damage the oil pan and oil strainer.

   - While the air duct or air cleaner is removed, cover the open section of the intake to prevent foreign matters from entering the cylinder.
     If a foreign matter enters the cylinder, it may seriously damage the cylinder when the engine starts.
   - When maintaining the engine, be sure to disconnect the negative battery Failure to do this may cause the harness or electrical components to be damaged.
     If energizing is required for inspection, be careful not to cause a short.
   - Before assembly, apply the engine oil to the slide contact surface of the engine.
     This work ensures appropriate lubrication when first starting the engine.
   - When the valve train component, piston, piston ring, connecting rod, connecting rod bearing, and/or crankshaft journal bearing are removed, line them up in the correct order so that their original positions are clear.
   - When installing, install it in the same position as when it was removed.
   - When assembling the engine, replace the gasket, oil seal, and O-ring with new ones.
   - For a component with the liquid gasket applied, carefully remove the old liquid gasket and clean the component so that no oil, water, and/or dust remain.
     Then, apply the specified liquid gasket to each part before assembling.
   - Be sure to assemble components within 5 minutes of applying the liquid gasket.
     If 5 minutes have passed, remove the old liquid gasket and apply liquid gasket again.
   - When assembling or installing a component, make sure to tighten them at the specified torque to ensure secure installation.
     Important precautions for handling this engine
     The holes and gaps in the fuel system including inside the injector where the fuel passes through are manufactured with high precision. Therefore, these are extremely sensitive to any foreign matter, and may be severely damaged due to foreign matter accidentally intruded. For this reason, extreme care must be taken to prevent any foreign matter from entering. When performing maintenance on the fuel system, take extreme care to prevent any foreign matter from entering the system.
   - Before starting maintenance, clean the fuel line and its surroundings.
   - Be sure to wash your hands before starting Do not put on cotton work gloves.
   - When the fuel hose or fuel pipe is removed, cover the opening with a plastic bag and fix it with a piece of tape.
   - When the high-pressure piping of the fuel system is removed, be sure to replace it with a new If it is reused, the sealing surface may be damaged to cause fuel leakage.
   - When replacing the fuel hose and/or fuel pipe, do not unpack new components before starting installation.
   - When the fuel pipe, injection pipe, fuel injector, fuel supply pump, and/or common rail are removed, seal each opening immediately.
   - Store the eyebolt and gasket in a clean parts box with a cover so that foreign matter does not attach to them.
   - Fuel leakage may cause a fire. Therefore, be sure to wipe spilled fuel after completing the maintenance work and confirm that there is no fuel leakage before starting the engine.

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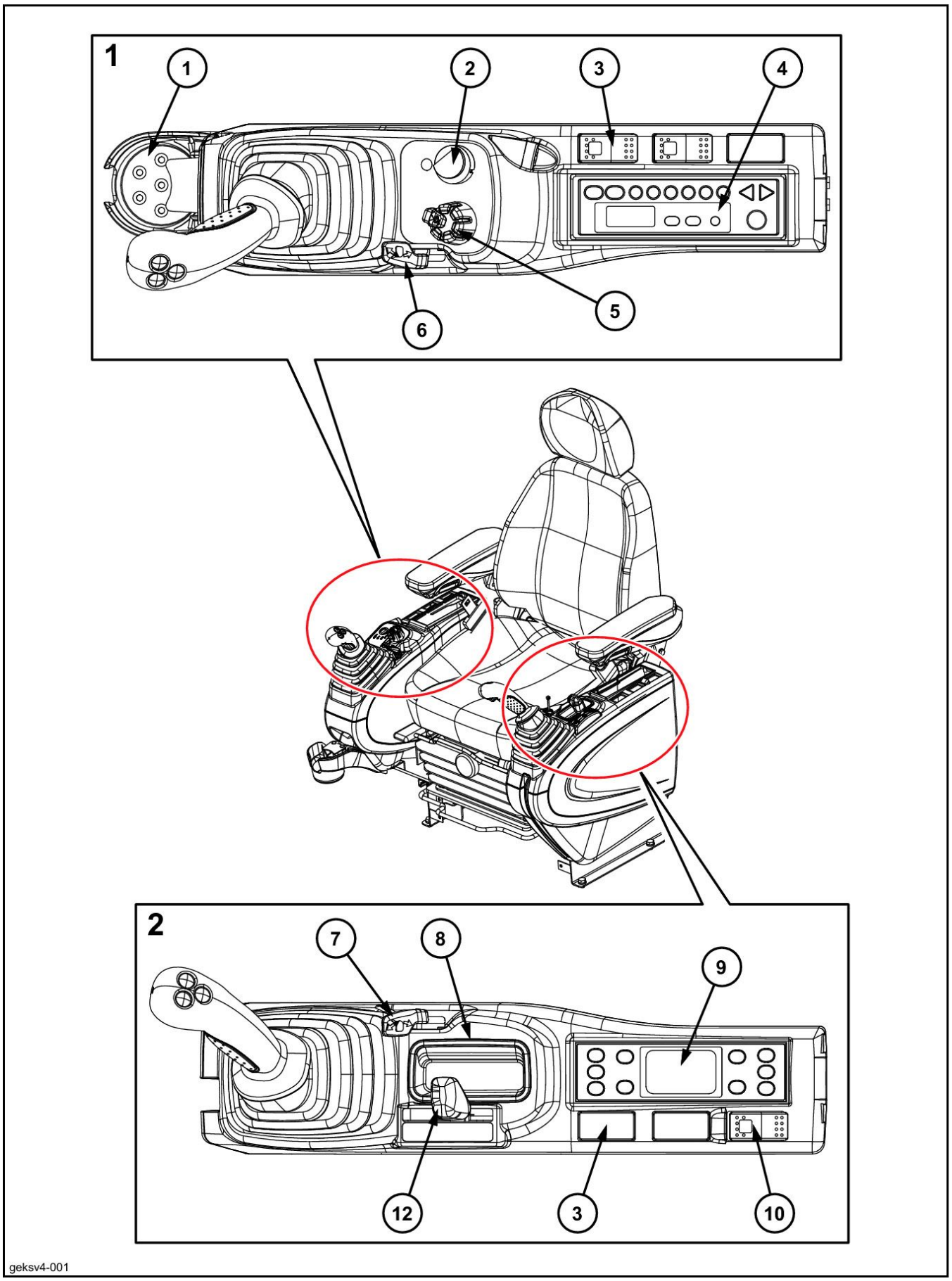
Electrical Equipment Layout Diagram

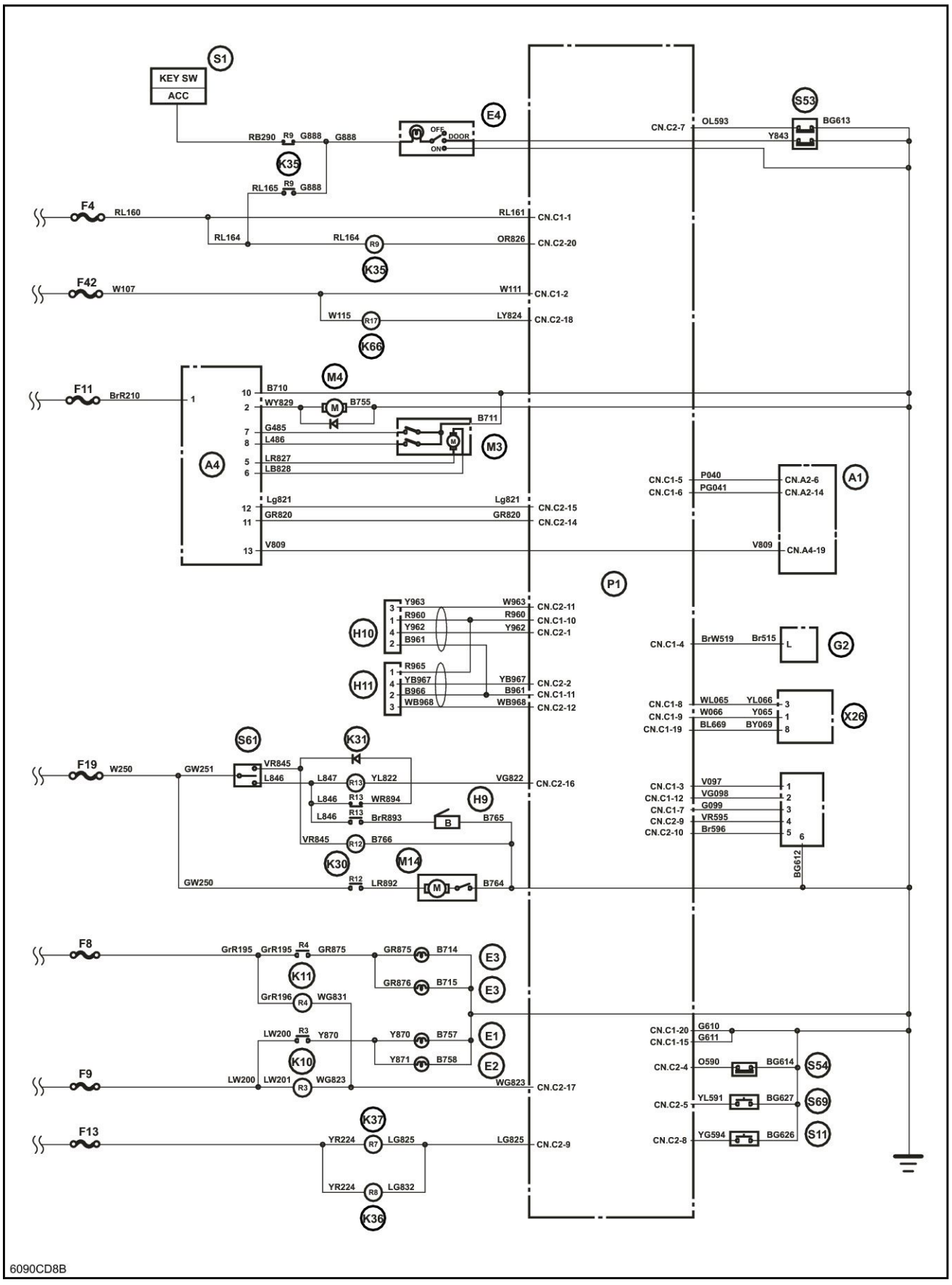
Layout Around Operator Seat



Electrical Equipment Layout Diagram

Sequence Circuit Diagram

Monitor



Main Unit-side DTC List

DTC	Trouble mode
7605	ECM Mismatch
7606	EEPROM Data Abnormality
7607	Computer C Communication Abnormality

Removal and Installation of Suction Control Valve

Removal of Suction Control Valve

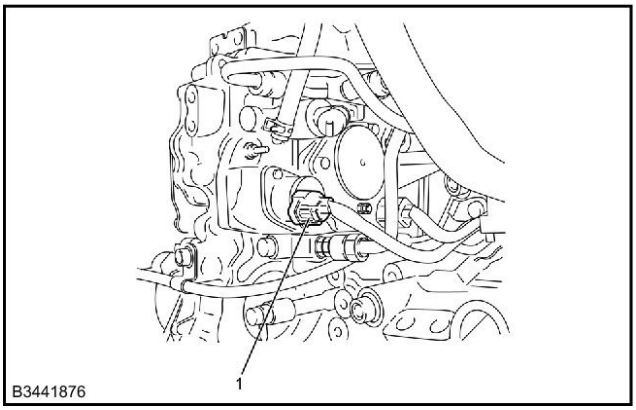
1. Suction control valve safety information

> ⚠ **CAUTION**
>
> - **Add cleaning agent to the steam cleaner and thoroughly clean the sensor and supply pump areas.**
> - **Completely remove moisture with an air blower.**
> - **Start work after checking that all foreign material has been removed.**
> - **After starting the engine, check to be sure that there is no fuel leaking.**
> - **After replacing any valve, use the scan tool to verify that the trouble code has been cleared and that operation is normal.**

2. Injector safety information

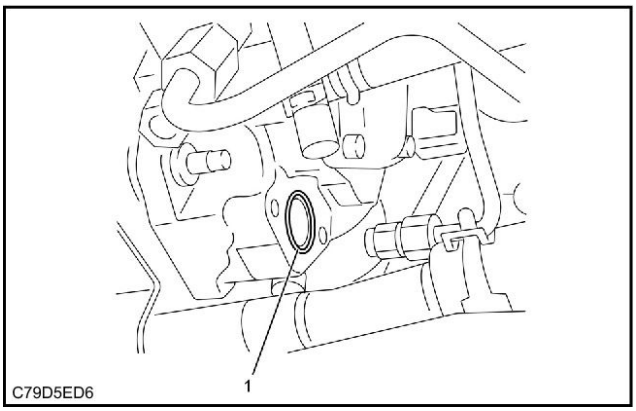
> ⚠ **CAUTION**
>
> - **Including the inside of the injector, the holes and gaps that are to be used as the fuel paths for the fuel system have an extremely precise finish.**
> - **Because there is the possibility of damage due to foreign material contamination, cover the cap after removing parts, etc., to prevent the intrusion of foreign material.**

3. Battery ground cable Disconnect
   1) Disconnect the battery ground cable from the battery.
4. Suction control valve Removal
   1) Disconnect the harness connector from the suction control valve.



1	Harness connector

   2) Remove the suction control valve from the fuel supply pump.
   3) Remove the O-ring from the fuel supply pump.



1	O-ring

> ⚠ **CAUTION**
>
> - **Do not reuse removed O-rings.**

DTC P0123 (Flash Code 43) Throttle Position Sensor Circuit High

1. DTC P0123 Priority DTC
   DTC P1655
2. DTC P0123 Diagnostics
   1) Turn OFF the starter switch.
   2) Disconnect the harness connector from the intake throttle valve.
   3) Check the intake throttle position sensor display with the trouble diagnosis scan tool.
      Voltage: 0.1 V
   4) If the reading is more than or equal to the specified value, inspect the signal circuit between the ECM and the intake throttle position sensor.

      ANNOTATION:

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

   5) If a problem is found, repair the signal circuit.
   6) Inspect the intake throttle valve harness connector for poor connections.
   7) If a problem is found, repair the harness connector.
   8) If the harness connector is normal, replace the intake throttle valve.
   9) Inspect to see if there is an open circuit or high resistance in the GND circuit between the ECM and the intake throttle position sensor.

      ANNOTATION:

      - *The intake throttle position sensor shares the GND circuit with other sensors.*
      - *The DTC set on a sensor which shares this circuit may be detected.*

   10) If a problem is found, repair the GND circuit.
   11) Check the ECM harness connector for poor connections.
   12) If a problem is found, repair the harness connector.
   13) If the harness connector is normal, replace the ECM.
   14) Set the injector ID code on the ECM.
   15) Perform the unit difference learning of the fuel supply pump to the ECM.
3. DTC P0123 Confirm Resolution
   1) Clear the DTC using the trouble diagnosis scan tool.
   2) Turn OFF the starter switch 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 P0182 (Flash Code 211) Fuel Temperature Sensor Circuit Low

1. DTC P0182 Priority DTC
   DTC P1655
2. DTC P0182 Diagnostics
   1) Turn OFF the starter switch.
   2) Disconnect the harness connector from the fuel temperature sensor.
   3) Check the fuel temperature sensor display with the trouble diagnosis scan tool.
      Voltage: 4.5 V
   4) If the reading is more than or equal to the specified value, replace the fuel temperature sensor.
      Refer to "Removal of Fuel Supply Pump".
      Refer to "Installation of Fuel Supply Pump".

      ANNOTATION:

      - *Do not replace the fuel temperature sensor separately. If a problem is found, replace the fuel supply pump.*

   5) Inspect to see if there is a short circuit to the GND with the signal circuit between the ECM and fuel temperature sensor.
   6) If a problem is found, repair the signal circuit.
   7) Inspect the ECM harness connector for poor connections.
   8) If a problem is found, repair the harness connector.
   9) If the harness connector is normal, replace the ECM.
   10) Set the injector ID code on the ECM.
   11) Perform the unit difference learning of the fuel supply pump to the ECM.
3. DTC P0182 Confirm Resolution
   1) Clear the DTC using the trouble diagnosis scan tool.
   2) Turn OFF the starter switch 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 P0604 (Flash Code 153) Internal Control Module Random Access Memory (RAM) Error

1. DTC P0604 Diagnostics
    1) Replace the ECM.
    2) Set the injector ID code on the ECM.
    3) Perform the unit difference learning of the fuel supply pump to the ECM.
2. DTC P0604 Confirm Resolution
    1) Clear the DTC using the trouble diagnosis scan tool.
    2) Turn OFF the starter switch 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 P0606 (Flash Code 51) ECM/PCM Processor

1. DTC P0606 Diagnostics
    1) Replace the ECM.
    2) Set the injector ID code on the ECM.
    3) Perform the unit difference learning of the fuel supply pump to the ECM.
2. DTC P0606 Confirm Resolution
    1) Clear the DTC using the trouble diagnosis scan tool.
    2) Turn OFF the starter switch 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.

21) If the injector harness tightening nut is loose, tighten it.
22) Inspect to see if any foreign matter is attached to the injector terminal.
23) If any foreign matter is attached to the injector terminal, remove it.
24) Inspect the injector harness intermediate harness connector for poor connections.
25) If a problem is found, repair the intermediate harness connector.
26) Check if insulation resistance of the first cylinder and fourth cylinder injector is at or above the specified value.
Resistance: 1.0 Ω
27) If the reading is less than or equal to the specified value, replace the relevant injector.
Refer to "Removal of Injector".
Refer to "Installation of Injector".
28) Set the injector ID code on the ECM.
29) If the reading is more than or equal to the specified value, repair or replace the injector harness.

2. DTC P2146 Confirm Resolution

1) Clear the DTC using the trouble diagnosis scan tool.
2) Turn OFF the starter switch for 30 seconds or longer.
3) Start the engine.
4) Use the trouble diagnosis scan tool to confirm that a DTC has not been detected.

DTC P2149 (Flash Code 159) Fuel Injector Group 2 Supply Voltage Circuit

1. DTC P2149 Diagnostics

1) Turn OFF the starter switch.
2) Disconnect the harness connector from the cylinder head injector harness intermediate connector.
3) Turn ON the starter switch.
4) Measure the voltage between the solenoid control circuit and GND.

ANNOTATION:

- *Solenoid control circuit and GND of the second cylinder injector*
- *Solenoid control circuit and GND of the third cylinder injector*

Voltage: 12.0 V

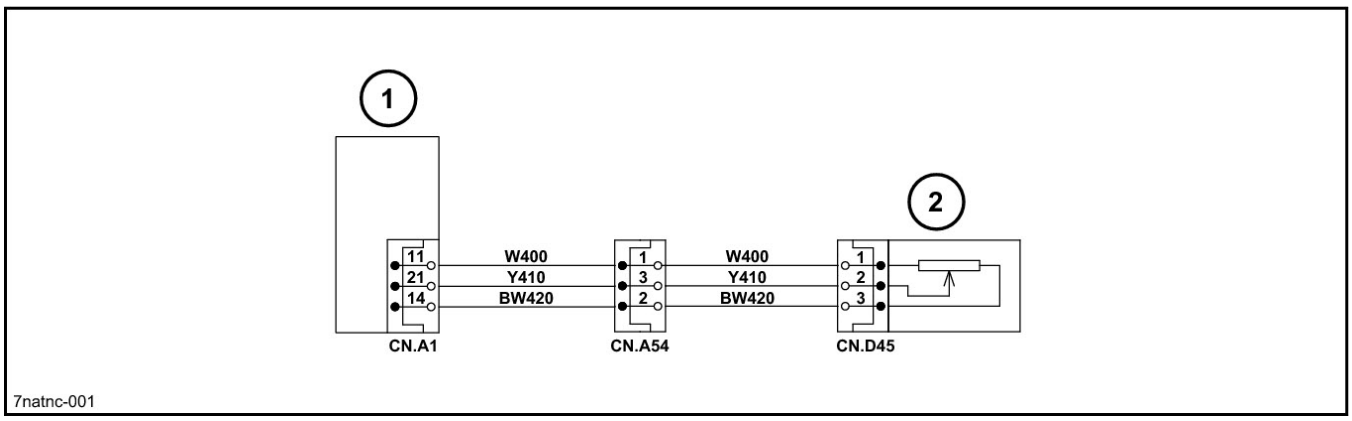
5) If the reading is less than or equal to the specified value, inspect to see if there is a short circuit to the GND with the control circuit between the ECM and injector harness intermediate connector.
6) If a problem is found, repair the control circuit.
7) Inspect the charge voltage circuit between the ECM and the injector harness intermediate connector.

ANNOTATION:

- *No short circuit to the battery or ignition power is present.*
- *No short circuit to GND is present.*

8) If a problem is found, repair the charge voltage circuit.
9) If the charge voltage circuit between the ECM and the injector harness intermediate connector is normal, replace the ECM.
10) Set the injector ID code on the ECM.
11) Perform the unit difference learning of the fuel supply pump to the ECM.
12) Inspect the injector harness intermediate connector for poor connections.
13) If a problem is found, repair the injector harness intermediate connector.
14) Disconnect the harness connector from the ECM.
15) Inspect the ECM harness connector for poor connections.
16) If a problem is found, repair the harness connector.
17) Inspect to see if there is an open circuit or high resistance with the charge voltage circuit between the ECM and the injector harness intermediate connector.
18) If a problem is found, repair the charge voltage circuit.
19) Remove the cylinder head cover.
Refer to "Cylinder head cover Removal".
20) Inspect the injector harness tightening nut for looseness.

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



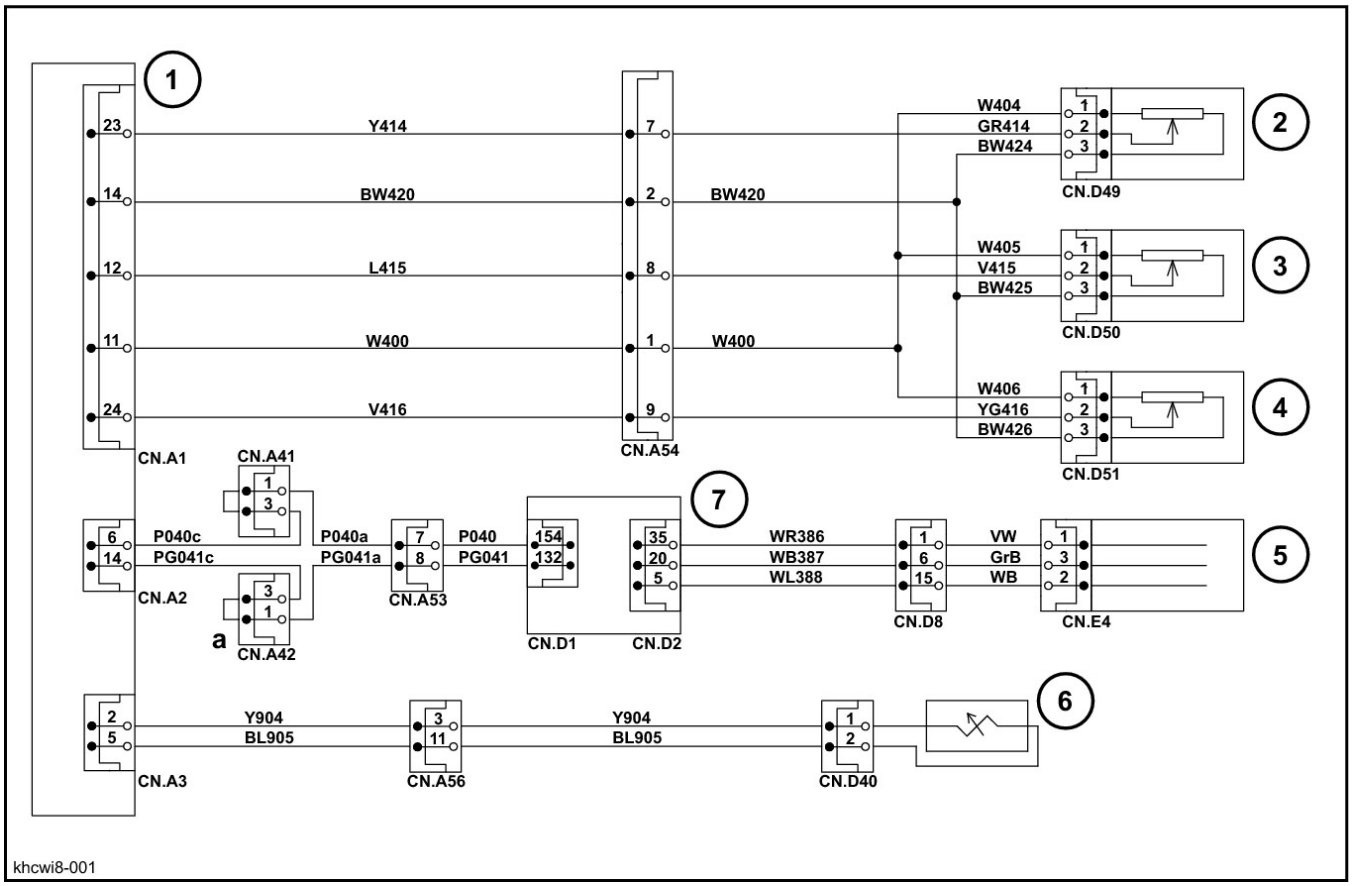
1	COMPUTER A
2	PRESS. SENSOR (P1)

Diagnostic Trouble Code: 7023 Arm-in Pressure Sensor Signal Abnormality

Step	Action	Standard value	Yes	No
1	1. Turn the key switch ON. 2. Check whether diagnostic trouble code: 7023 is displayed. Is diagnostic trouble code: 7023 displayed?		Go to Step 2	
2	1. Inspect the connection status of each connector. 2. Check whether diagnostic trouble code: 7023 is displayed. Is diagnostic trouble code: 7023 displayed?		Go to Step 3	
3	1. Check the arm-in pressure sensor voltage on the service support screen. Is it 4.75 V or higher?	4.75 V or higher	Go to Step 4	When 0.25 V or lower, go to Step 7
4	Inspect for shorts to the power supply 1. Turn the key switch OFF and disconnect CN. D54. 2. Turn the key switch ON. 3. 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 5	WL430 harness defect (short). Replace
5	1. 1. Measure the voltage between the ground and terminal 2 of the CN. D54 harness side. - Is it 4.75 V or lower?	4.75 V or lower	Go to Step 6	YG445 harness defect (short). Replace
6	1. 1. Measure the voltage between the ground and terminal 3 of the CN. D54 harness side. - Is it 0.25 V or lower?	0.25 V or lower	Computer B defect. Replace	BL450 harness defect (short). Replace
7	1. Inspect the arm-in pressure sensor. 2. Turn the key switch OFF. 3. Disconnect CN. D54. 4. Measure the resistance between terminals 1 and 3 of the CN. D54 arm-in pressure sensor side. Is it about 10 kΩ?	About 10 kΩ	Go to Step 8	Arm-in pressure sensor defect. Replace
8	Inspect for shorts to ground and disconnections. 1. Inspect for continuity between the ground and terminal 1 of the CN. D54 harness side. 2. Inspect for continuity between the ground and terminal 2 of the CN. D54 harness side. Is there continuity?		WL430 or YG445 harness defect (short). Replace	Go to Step 9
9	1. Inspect for continuity between the ground and terminal 3 of the CN. D54 harness side. Is there continuity?		Go to Step 10	BL450 harness defect (disconnection). Repair or replace

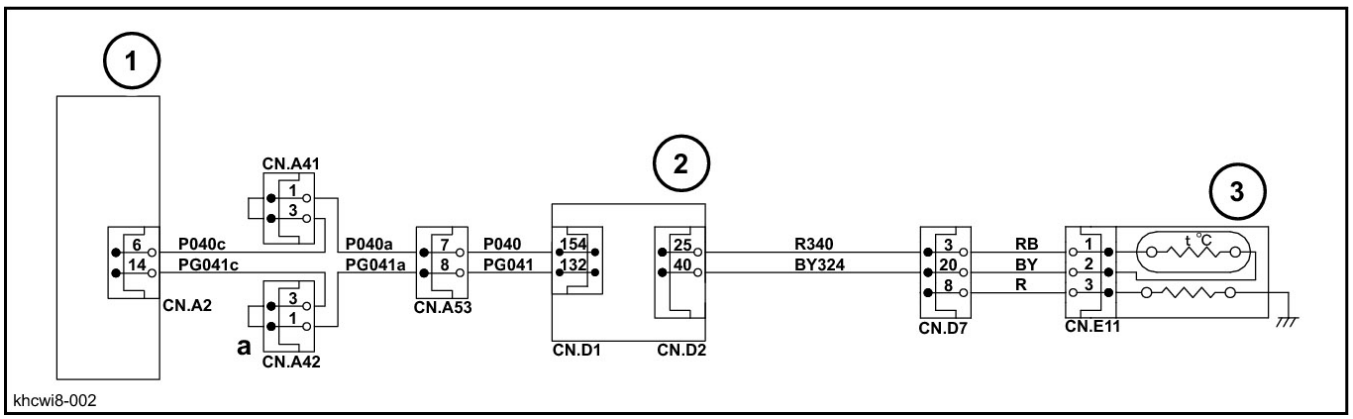
Diagnostic Trouble Code: 7201 Travel High-speed Solenoid Signal Abnormality

Step	Action	Standard value	Yes	No
1	1. Turn the key switch ON. 2. Check whether diagnostic trouble code: 7201 is displayed. Is diagnostic trouble code: 7201 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: 7201 is displayed. Is diagnostic trouble code: 7201 displayed?		Go to Step 3	
3	Inspect the travel high-speed solenoid. 1. Turn the key switch OFF and disconnect CN. D61. 2. Measure the resistance between terminals 1 and 2 of the CN. D61 travel high-speed solenoid side. Is it 34 Ω - 47 Ω?	34 Ω - 47 Ω	Go to Step 4	Travel high-speed 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. D61 harness side. Is it 0 V?	0 V	Go to Step 5	L801 harness defect (short). Replace
5	1. Turn the key switch OFF. 2. Inspect for continuity between the ground and terminal 1 of the CN. D61 harness side. Is there continuity?		R183, GR180, R105a, R104, or R105 harness defect (short). Replace	Go to Step 6
6	Inspect for disconnection. Inspect for continuity between the ground and terminal 2 of the CN. D61 harness side. Is there continuity?		Go to Step 7	L801 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. D61 harness side. Is it 24 V?	24 V	Computer A defect. Replace	R183, GR180, R105a, R104, or R105 harness defect (disconnection). Repair or replace



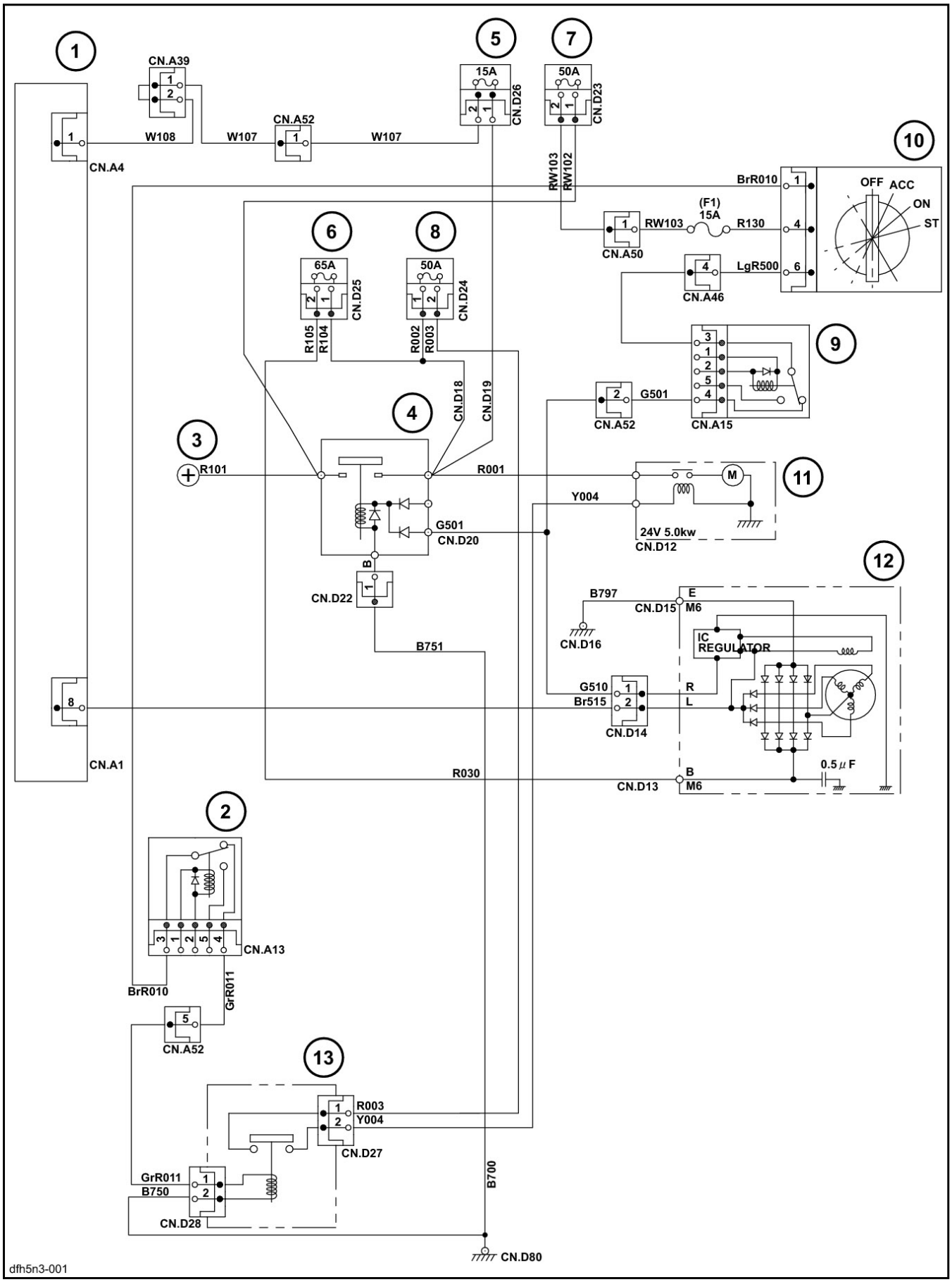
1	COMPUTER A	4	PRESS. SENSOR (PILOT TRAVEL)	7	ENGINE COMPUTER
2	PRESS. SENSOR (PILOT SWING)	5	CRANK ANGLE SENSOR		
3	PRESS. SENSOR (PILOT UP-PER)	6	P1 FLOW		

a	CAN COMMUNICATION



1	COMPUTER A	3	WATER TEMP. SENSOR
2	ENGINE COMPUTER		

Main Unit-side Trouble



Data Reference Values

The purpose of data list is for checking the status of the machine and each equipment.
This data is used in trouble diagnosis by comparing the each machine data with standard values, and checking whether the vehicle data is temporarily or always different from the reference values.
This display menu is subject to change without notice.

Non-operational P rotation

Data display items	**Units**	**Idling speed reference value Varies according to the machine conditions.**
Battery voltage	V	27.7 - 28.4
Target engine rpm	min^{-1} (rpm)	800 (800)
Engine rpm	min^{-1} (rpm)	799 - 801 (799 - 801)
Throttle switch position sensor 1 (APP1)	V	0.0
Throttle switch position sensor 2 (APP2)	V	0.0
Throttle switch position (APP)	%	0
Fuel rail pressure sensor	V	1.4
Fuel rail pressure feedback		Feedback mode
Coolant temperature sensor	V	0.6
Coolant temperature	°C (°F)	70 - 73 (158.1 - 163.4)
Intake temperature sensor	V	2.1 - 2.2
Intake air temperature	°C (°F)	31 (87.8)
Fuel temperature sensor	V	1.0 - 1.1
Fuel temperature	°C (°F)	51 - 52 (123.9 - 125.6)
Barometric pressure sensor	V	1.9
Atmospheric pressure	kPa (psi)	97 - 99 (14.08 - 14.36)
Boost temperature sensor voltage	V	3.8 - 3.9
Boost pressure sensor	kPa (psi)	101 (14.65)
Vacuum sensor	V	
Boost pressure	kPa (psi)	
No.1 cylinder fuel correction amount	mm^3/st	-
No.2 cylinder fuel correction amount	mm^3/st	-
No.3 cylinder fuel correction amount	mm^3/st	-
No.4 cylinder fuel correction amount	mm^3/st	-
Engine mode		Fuel mode
EGR valve 1 drive duty	%	0
EGR position 1	ON/OFF	The polarity of either of 1, 2 or 3 is reversed. (E.g.: 1=ON, 2=ON, 3=OFF)
EGR position 2	ON/OFF	The polarity of either of 1, 2 or 3 is reversed. (E.g.: 1=ON, 2=ON, 3=OFF)
EGR position 3	ON/OFF	The polarity of either of 1, 2 or 3 is reversed. (E.g.: 1=ON, 2=ON, 3=OFF)
Ignition switch	ON/OFF	ON
Starter switch	ON/OFF	OFF
Glow relay	ON/OFF	OFF ON immediately after the starter switch is turned ON.
Q adjustment compensation data 1		- This differs depending on the machine
Q adjustment compensation data 2		- This differs depending on the machine
Q adjustment compensation data 3		- This differs depending on the machine

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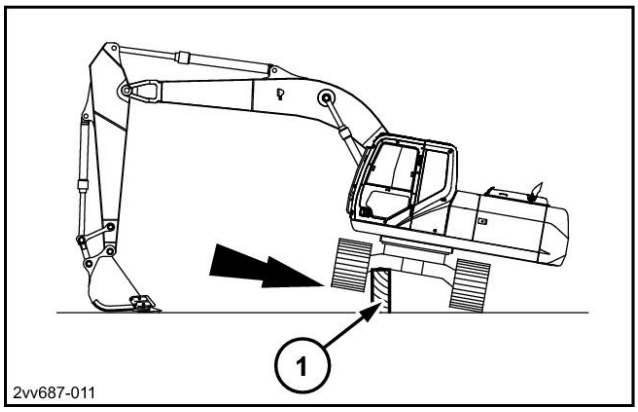
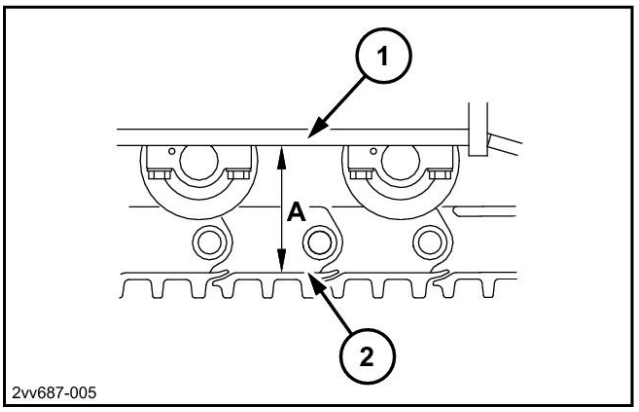
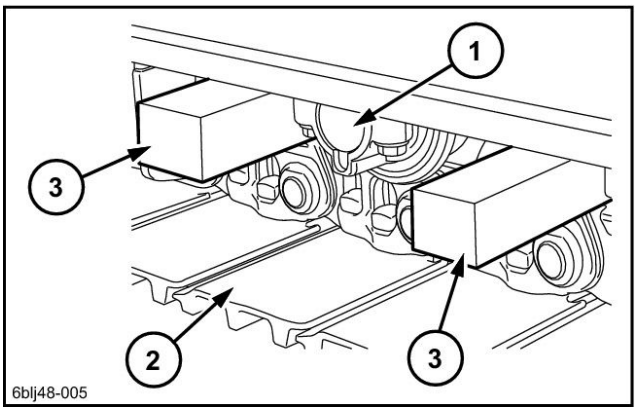
4. To adjust the track shoe tension, raise the lower side frame as shown in the diagram.
   Place a wood plank (1) under the lower frame to prevent falling.



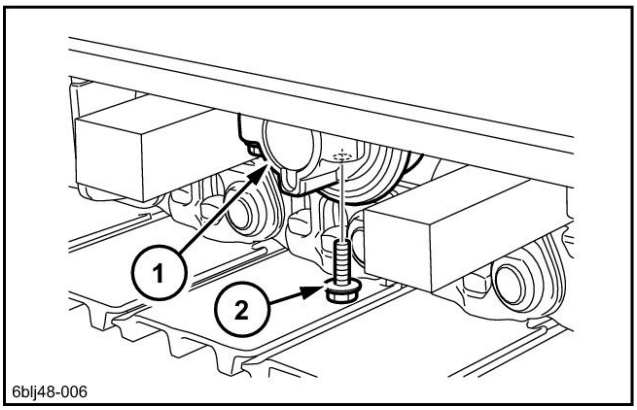
5. Adjust the tension so that the distance indicated with A between the frame bottom (1) of the center area of the lower side frame and the lowest hanging part of the top of the shoe plate (2) is 290 - 310 mm (11.417 - 12.205 in).



3. If it is impossible to insert wood planks (3) under the lower frame, insert wood planks (3) between the side frame and the link shoe (2) to separate the link shoe and lower roller (1) by about 15 mm (0.591 in).

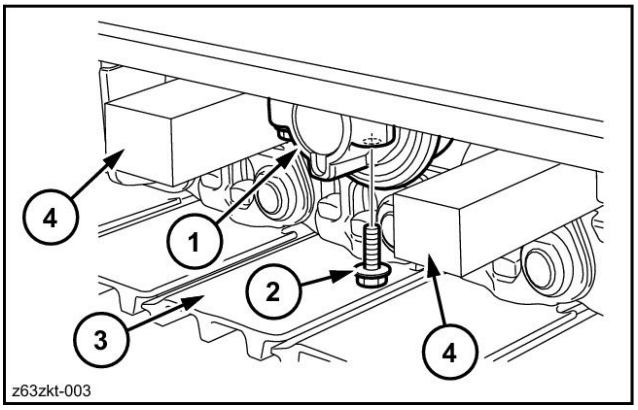


4. Use a box wrench [24 mm (0.945 in)] to remove the 4 bolts (2), then remove the lower roller (1).

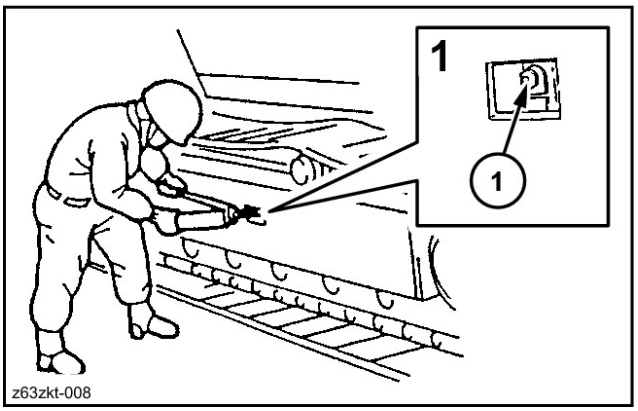


Installation of Lower Roller

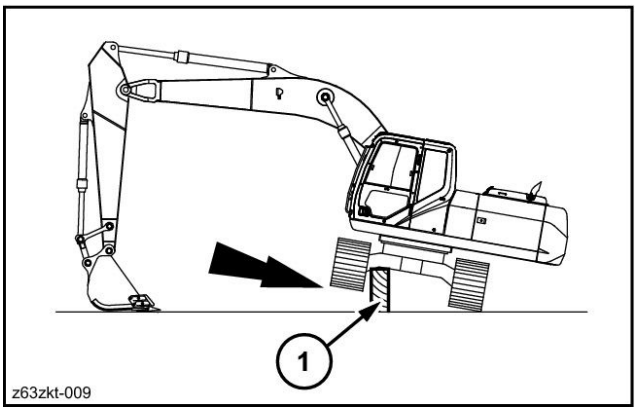
1. Insert wood planks (4) between the side frame and the link show (3), use a box wrench [24 mm (0.945 in)] to install 4 bolts (2) and then install the lower roller (1).
   - Bolt (2) tightening torque: tightening torque: 267 - 312 N·m (196.96 - 230.16 lbf·ft)



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

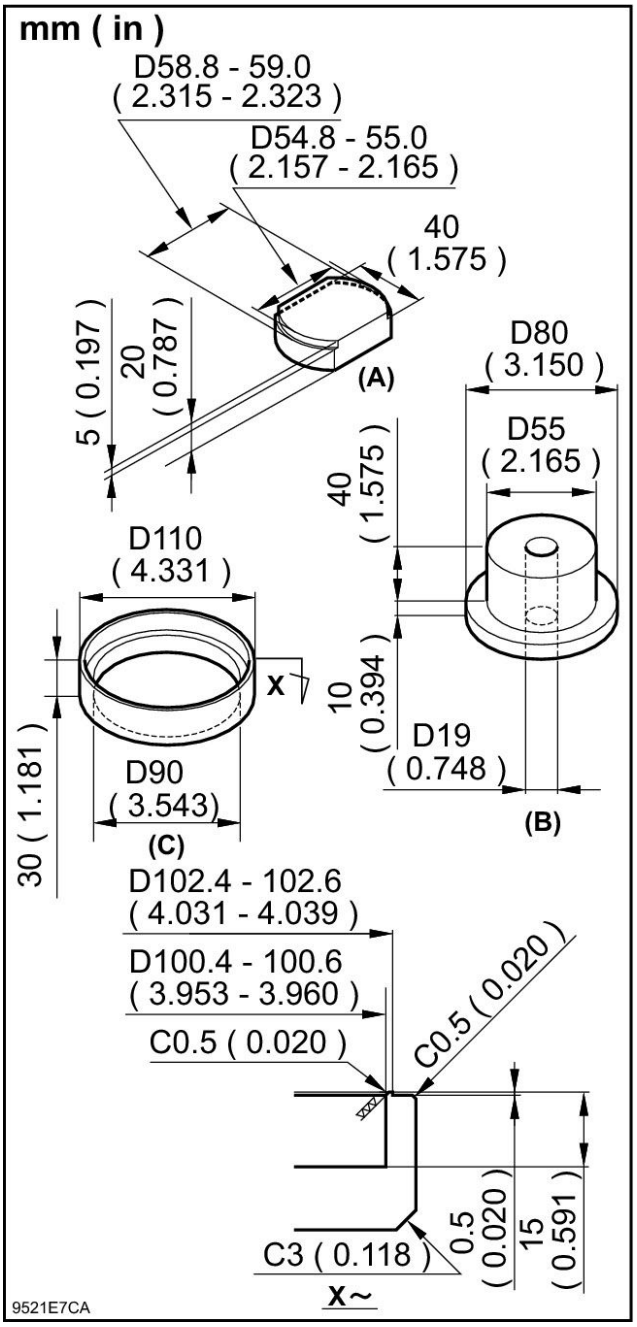


3. When adjusting the track shoe tension, raise the lower side frame as shown in the diagram.
   Place a wood plank (1) under the lower frame to prevent falling.



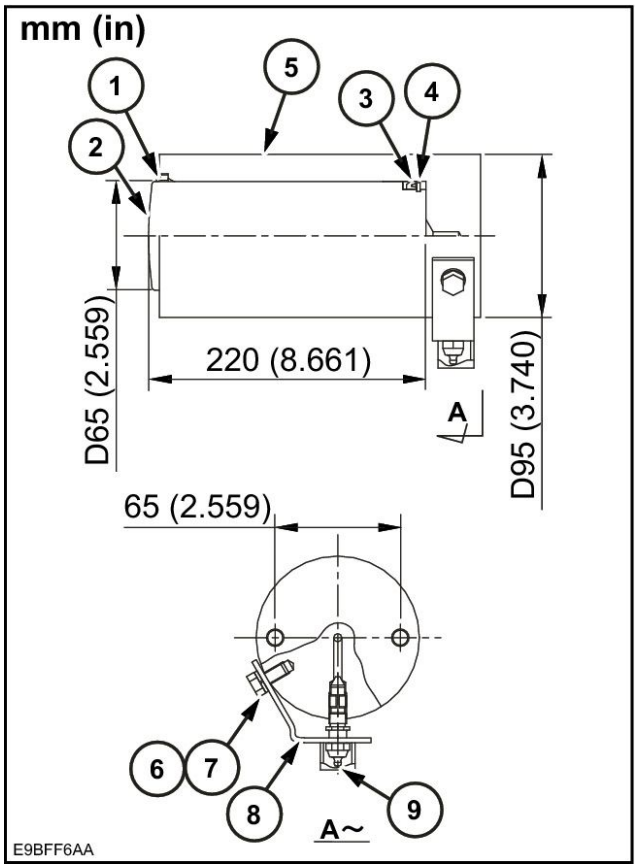
CONTENTS

Jig Dimension Diagram

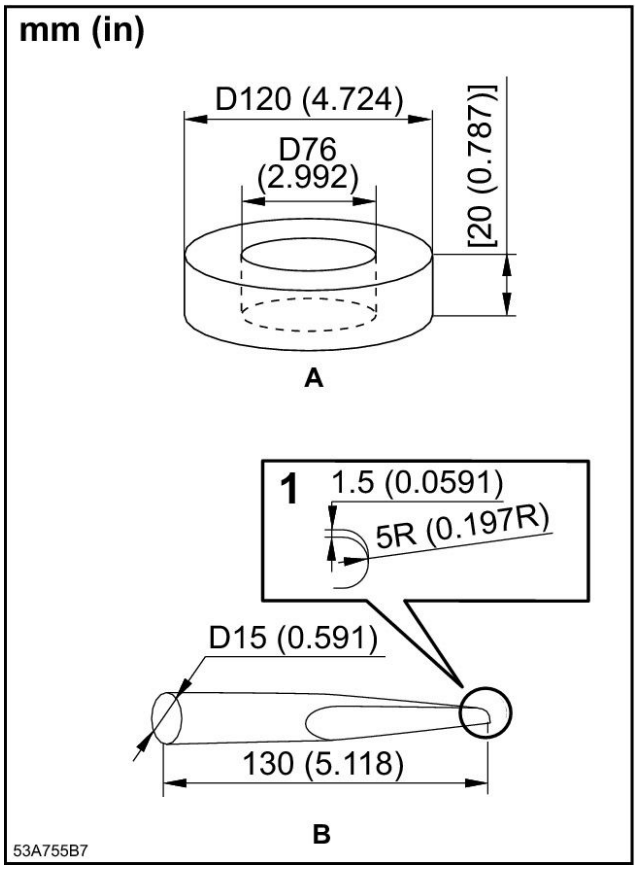


A	Bushing removal jig
B	Bushing press-fit jig
C	Floating seal installation jig

Dimension diagram



Jig dimension diagram



Secondary Materials

The equipment and materials required for the assembly and disassembly of this motor are indicated in Table 2.

Applicable part (usage or part no.)	Name	Type and standards	Q'ty
Product assembly and disassembly	General work platform		1 set
Cleaning the product and each part	Cleaning tank	Rough cleaning and finish cleaning	1 set
24, 104, 149	Press work platform	24: Press capability of 9800 N (2203.51 lbf) or higher104: Press capability of 1960 N (440.70 lbf) or higher149: Press capability of 1960 N (440.70 lbf) or higher	1 se
149	Heating tank	Temperature raising capability of 100 °C (212.0 °F) or higher Volume 500 x 500 x 500 or higher	1 set
Drying of each part after disassembly and cleaning	Compressed air	Pressure 0.29 - 0.49 MPa (42.0656 - 71.0762 psi)	

Part number	Part name	Symptom	Reference value (standard dimensions)	Permissible limit value (judgment value)
(323) (363)	Spool	• Uneven wear on outer circumference. • Scratches on outer circumference.	–	–
(381)	Piston	• Scratches on outer circumference.	_	_

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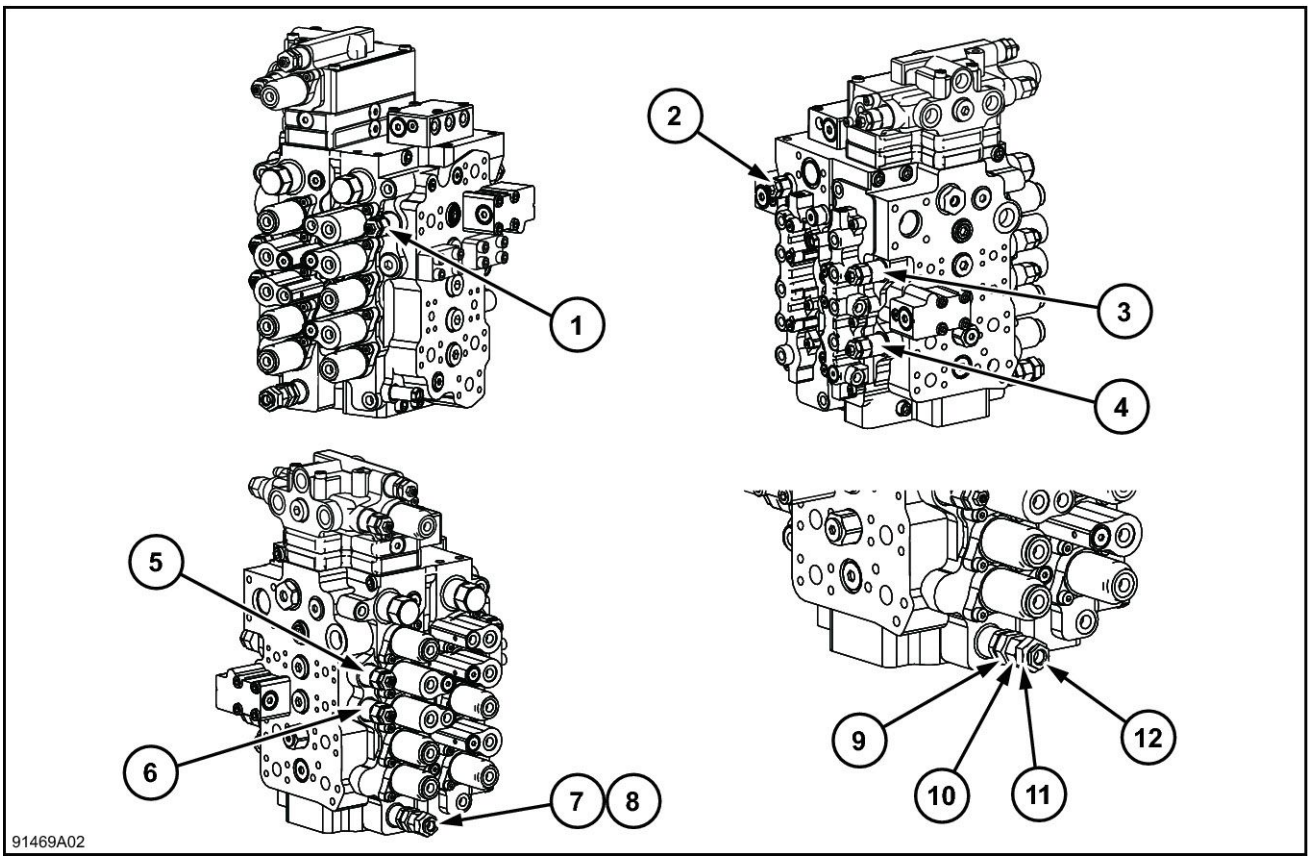
Port Diagram

Relief Valve (blade)



Detailed diagram of main relief valve adjustment

1	Arm in	5	Bucket close	9	Pressure boost lock nut
2	Arm out	6	Boom down	10	Pressure boost adjusting screw
3	Bucket open	7	Main a (normal use)	11	Standard lock nut
4	Boom up	8	Main b (boosted pressure)	12	Standard pressure adjusting screw

Section

8001C

Pump P-Q Diagram

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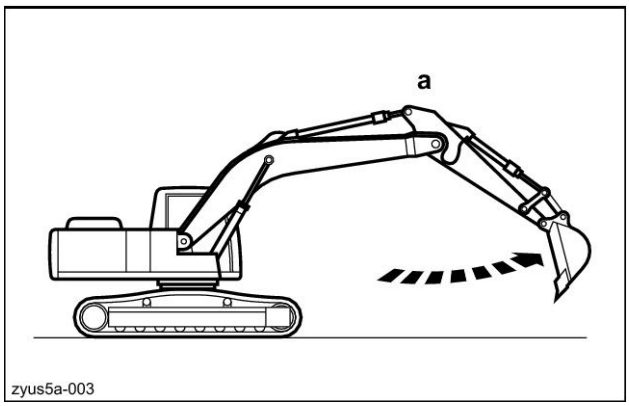
Attachment pressure measurement

Example: Arm-out pressure measurement
Measure with the following operations.

Engine speed	2000 min^{-1} (2000 rpm)
Work mode	SP mode
Lever operation	Arm-out relief

Oil temperature	45 - 55 °C (113.1 - 131.0 °F)
Measuring port	1 pump: P1 port
	2 pumps: P2 port
Set pressure	Boosted pressure: 36.3 MPa (5265.448 psi)
	Standard: 34.3 MPa (4975.341 psi)



a Arm-out relief

When the attachment operates, since the pressure boost operates automatically, the pressure resulting from the pressure boost setting can be checked for about 8 sec.

After 8 sec.or more, the standard set pressure can be checked.
Measure relieving each cylinder with the arm out/in, the bucket open/close, and the boom up.

Lever operation	Arm out	Arm in	Bucket open	Bucket close	Boom up	Boom down
Engine speed	2000 min^{-1} (2000 rpm)					
Work mode	SP mode					
Oil temperature	45 - 55 °C (113.1 - 131.0 °F)					
1 pump flow measuring port	P1	P1	P2	P2	P2	P2
2 pumps flow measuring port	P2	P2	No	No	P1	P1
Pressure boost	36.3 MPa (5265.448 psi)					32.3 MPa (4685.234 psi)
Standard pressure	34.3 MPa (4975.341 psi)					32.3 MPa (4685.234 psi)

Section

8001F

Drain Volume Measurement Procedures

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Section

8004

Removal and Installation of Control Valve

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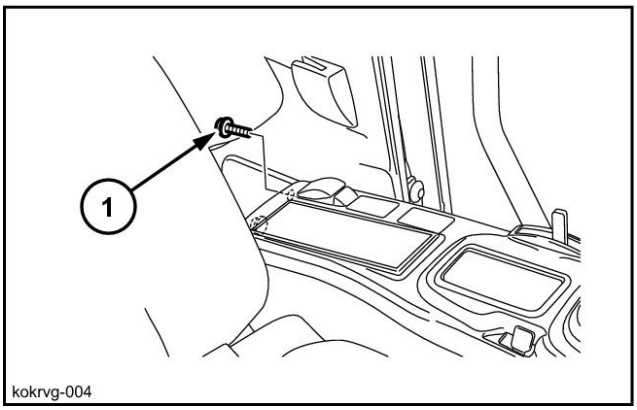
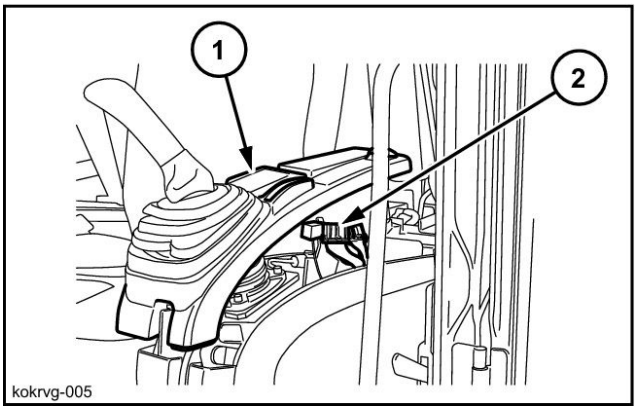
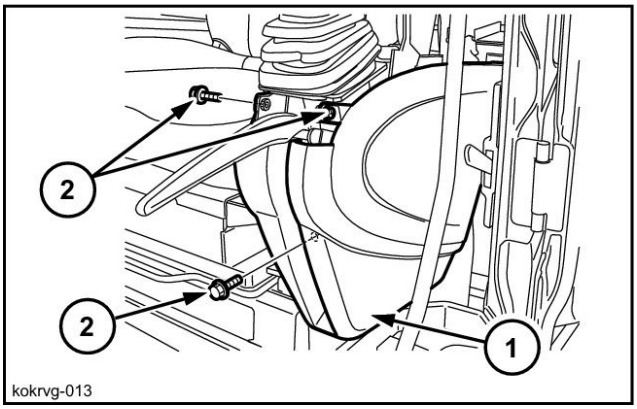
4. Use the Phillips screwdriver to remove the 2 screws (1) of the console top cover.



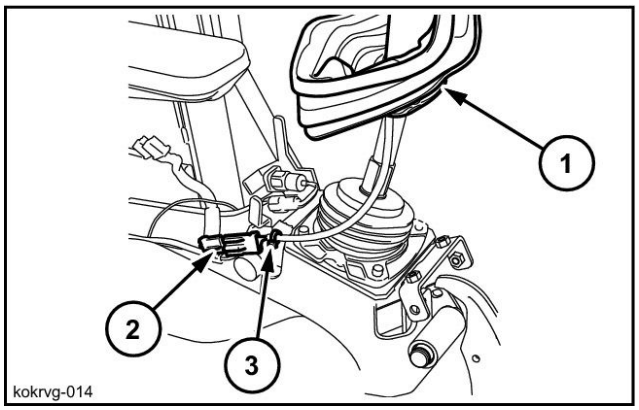
5. Remove the connectors (2) and remove the console top cover (1).



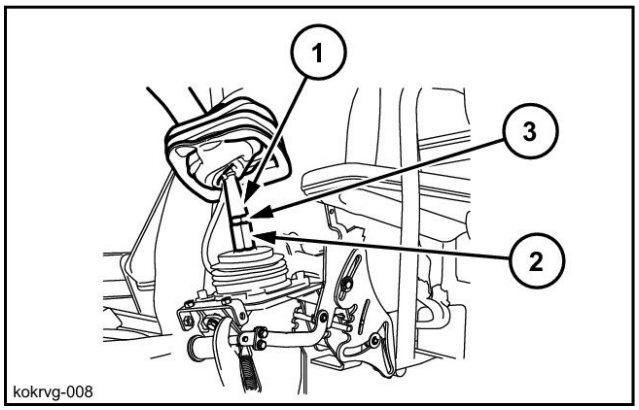
6. Use the Phillips screwdriver or box wrench [10 mm (0.394 in)] to remove the 5 bolts (2), then remove the cover (1).



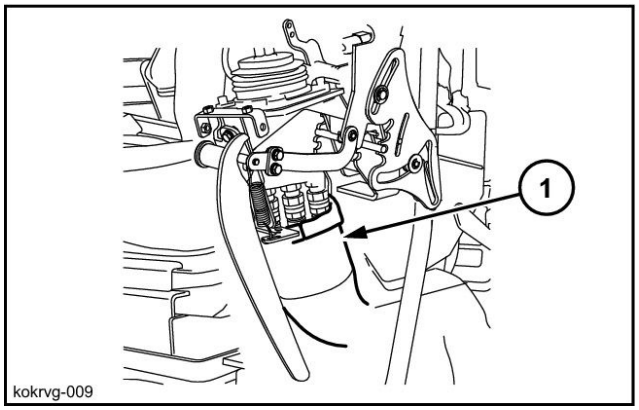
7. Roll up the boot (1) of the control lever, remove the connector (2) of the horn switch, and cut the wire band (3).



8. While securing the nut (2) with a wrench [22 mm (0.866 in)], use a wrench [19 mm (0.748 in)] to remove the lock nut (3) and remove the control lever (1).



9. Roll back the hose cover (1).



10. Use a wrench [19 mm (0.748 in), 22 mm (0.866 in)] to remove the 6 hoses (1).

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

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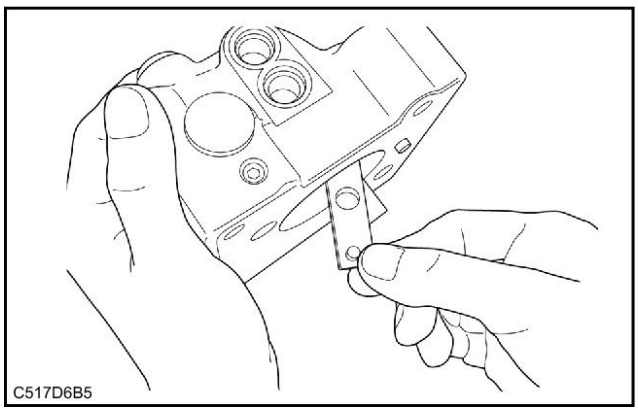
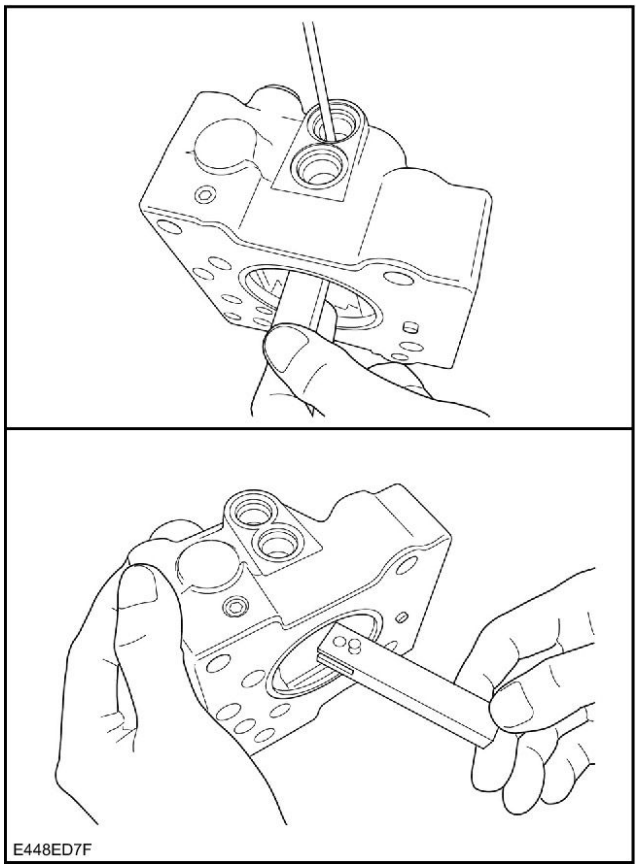
8010-2

8. Remove the lever (2) (613). Do not pull out the pins (875).
   - These can be easily removed by using a pair of tweezers.



9. Pull out the pins (874) and remove the feedback lever (611).
   - Use a fine steel rod to push out the pins (874) (pin diameter φ5) from above without touching the lever (1) (612).

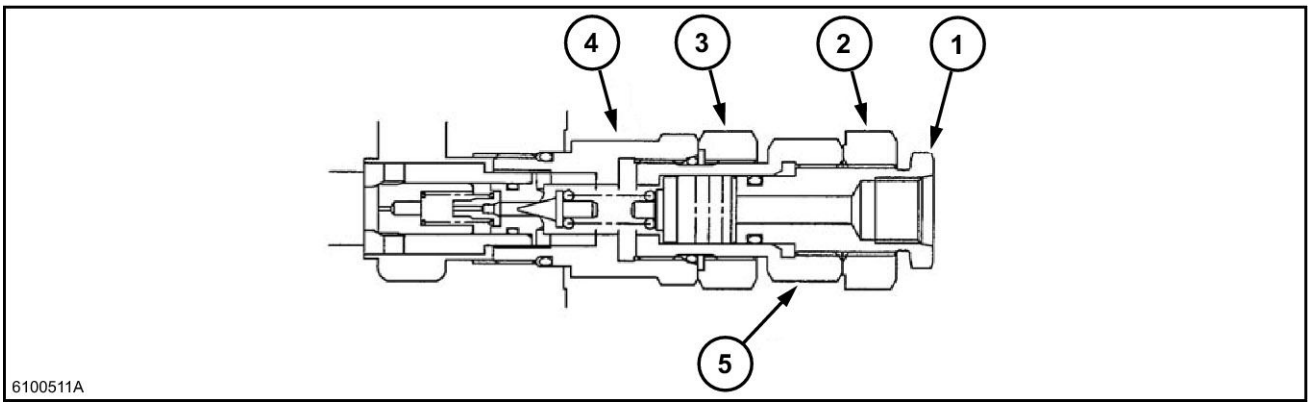


10. Remove the lever (1) (612). Do not pull out the pins (875).
11. Pull out the pilot piston (643) and spool (652).
12. Pull out the piston case (622), compensation piston (621), and compensation rod (623).
    - The piston case (622) can be removed by pushing out the compensation rod (623) from the opposite side of the piston case (622).
13. For the KR76-9Y2C-V, remove the hexagon socket head bolt (436) and remove the pilot cover A (641). Remove the electromagnetic proportional pressure reducing valve (079).
    For the KR76-9X2D-V, remove the hexagon socket head bolt (436) and remove the pilot cover B (641). Next, remove the hexagon socket head bolts (439) and remove the valve casing (656). Remove the electromagnetic proportional pressure reducing valve (079).
    - Be careful not to damage the connector section of the electromagnetic proportional pressure reducing valve (079).

    This completes the disassembly of the regulator main units.

> ⚠ **CAUTION**
>
> **The component parts are small, so be very careful not to lose them.**

Pressure setting



- If a mistake is made with the relief valve set pressure, this can damage hydraulic devices or invite danger. Never raise pressure above the set amount for each model.

1. High-pressure setting
   1) Rotate (right rotation) the sleeve (5) and adjust pressure while watching the pressure gauge.
      - 1/4 of a rotation changes the pressure about 10 MPa (1450.54 psi).
        The sensitivity of relief is very strong, so do not suddenly tighten the relief valve for any reason.
   2) Secure the sleeve (5) after pressure setting, and tighten it with the hexagon nut (3).
      Tightening torque: 60 N· m (44.26 lbf· ft)
      - Operate the plunger and check the set pressure.
2. Low-pressure setting
   1) After the above mentioned high-pressure setting, adjust the pressure while loosening the adjusting screw (1) (left rotation).
   2) Secure the adjusting screw (1) after pressure setting, and tighten it with the hexagon nut (2).
      Tightening torque: 60 N· m (44.26 lbf· ft)
      - Operate the plunger and check the set pressure.

Section

8012

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

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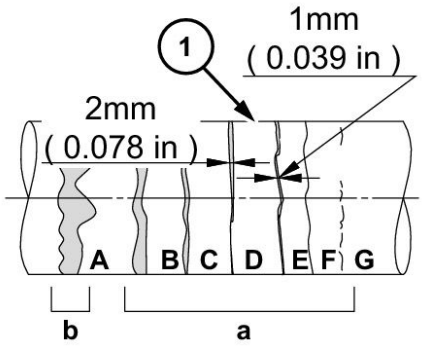
Inspection after Assembly

Dimension inspection	Check the maximum retracted length and stroke as instructed on the diagram.
Pressure withstand inspection	Check for looseness, permanent deformation, and external leaks when the test pressure instructed on the diagram is applied to each stroke end for at least 3 min.
External leak inspection	Check the amount of oil leak at the rod section. • Judgment value for rod section oil leak amount Move the piston rod back and forth 20 times with the oil at a temperature from 20 °C - 40 °C (68.0 °F - 104.0 °F), then judge by the state of the oil ring formed on the rod surface. If the oil ring is in a broken down A state, this is judged to be trouble. See "Trouble Diagnostics" for information on how to solve this.  B0A5F38D

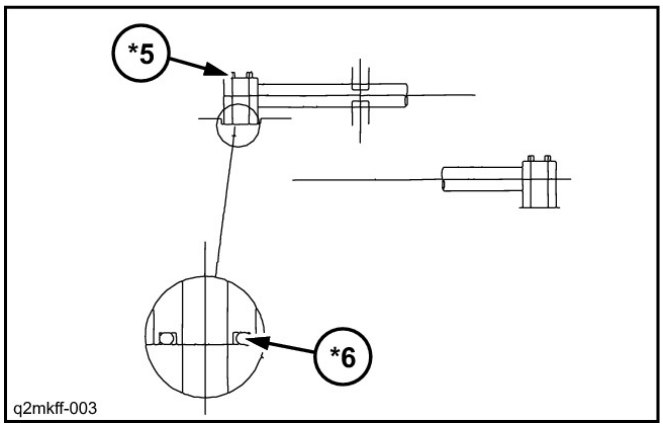
Internal leak inspection

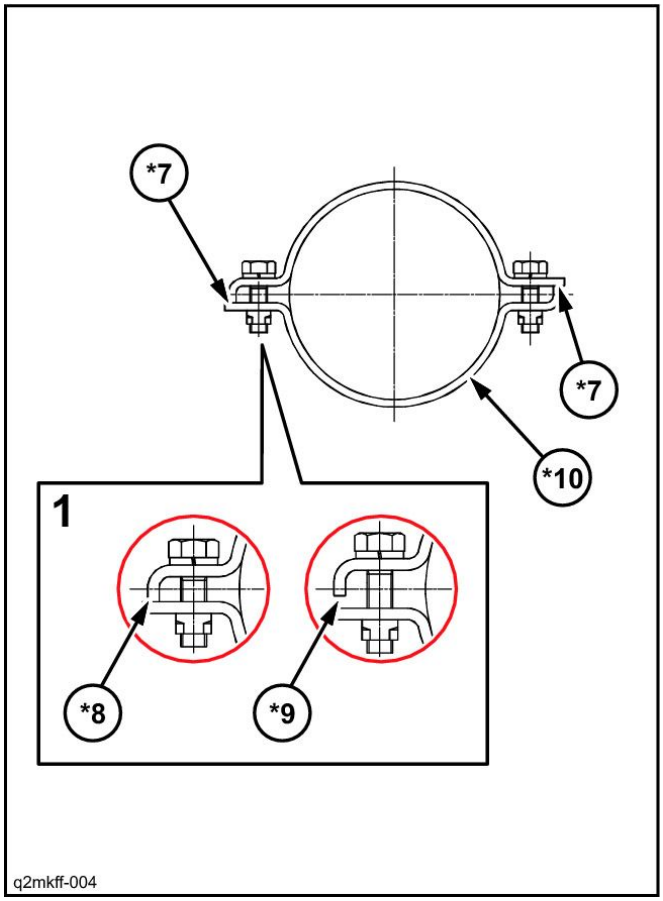
Oil leak amount unit: ml/10 min.

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

1	Oil ring

a	Acceptable
b	Not acceptable





*5	Tighten the bolts.
*6	Be careful about the O-rings.
*7	No abutment opening gap
*8	Normal: OK
*9	There is a gap: Not OK
*10	Band for securing the line

⚠ CAUTION

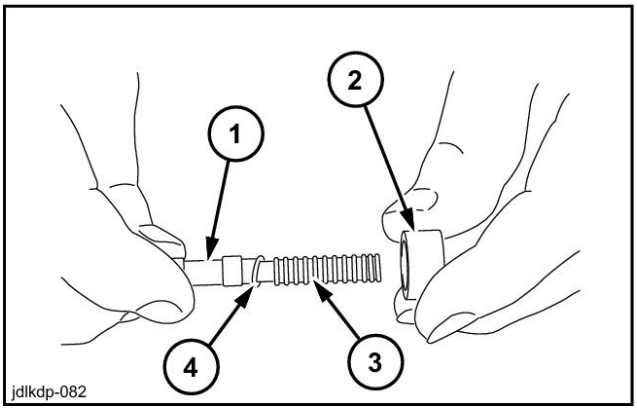
When installing the cylinder lines and the machine body rubber hoses, nipples, etc., assemble securing the cylinder line port section with a wrench.
If one tightens without securing the port section, the line may bend, oil may leak, and the machine body may get in the way.

Test Operation

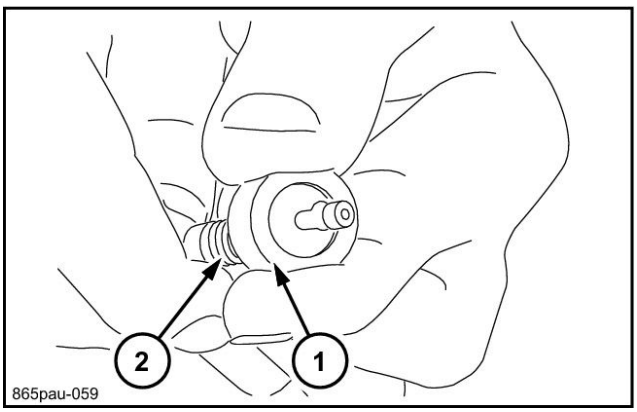
1. In order to fill the inside of the cylinder with oil, after it is installed on the machine body, move the cylinder through its full stroke slowly 8 times or more. If the cylinder is suddenly moved from the start, the hydraulic oil may be aerated.
2. If the cylinder has air bleeding, pressurize so that the air bleed side is the pressure side (return oil side) and bleed off the air.
3. Apply oil and grease to the pins at both ends.

Assembly Procedures

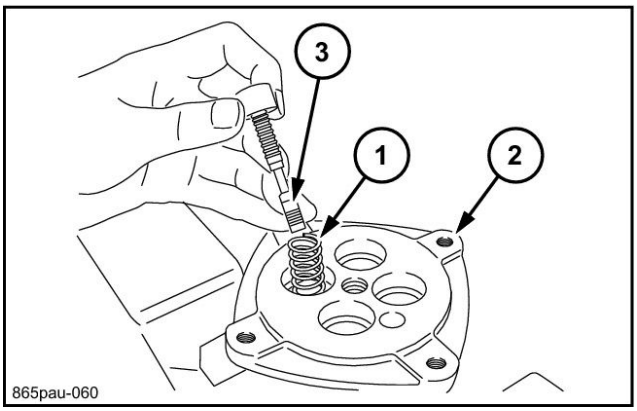
1. Insert washer (4), secondary pressure spring (3) and spring seating (2) onto each of the spool (1) in that order.



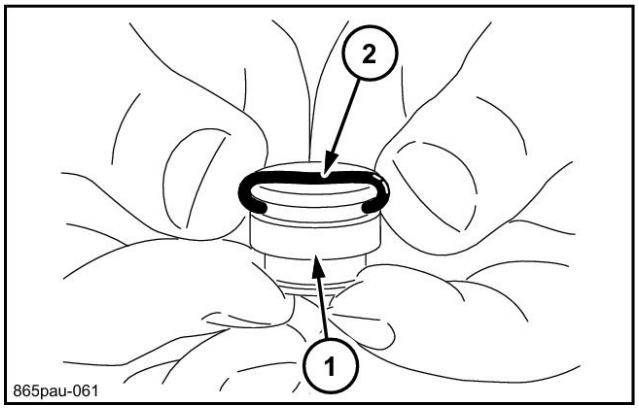
2. Press in the spring seating (1) and move it to the side while bending the secondary pressure spring (2) to pass the seating over the larger hole and install it on each of the spools.
   - Do not press in the spring seating by 6 mm (0.236 in) or more.



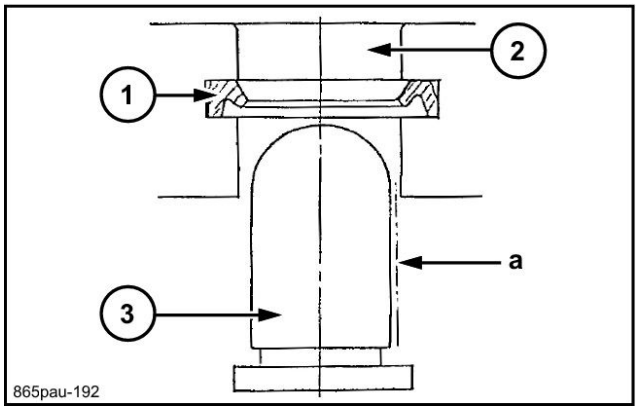
3. Install the return springs (1) in the casing (2). Install the pressure reducing valve assembly (3) in the casing (2).
   - Install them in the positions they were in before disassembly.



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

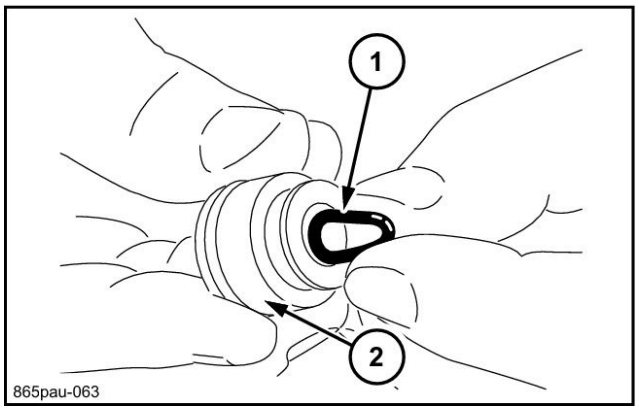


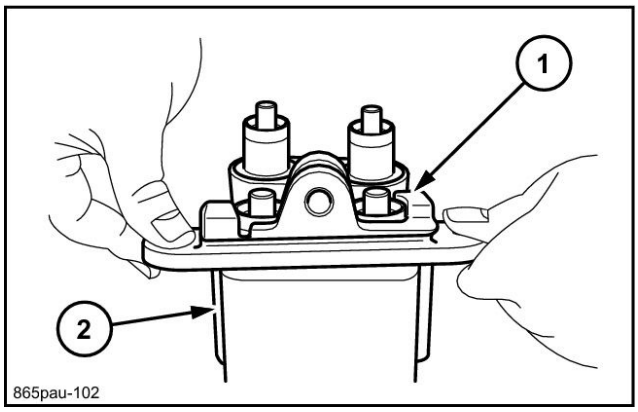
5. Install seal (1) on the plug (2).
   - Install so that the seal lips are as shown in the diagram below.



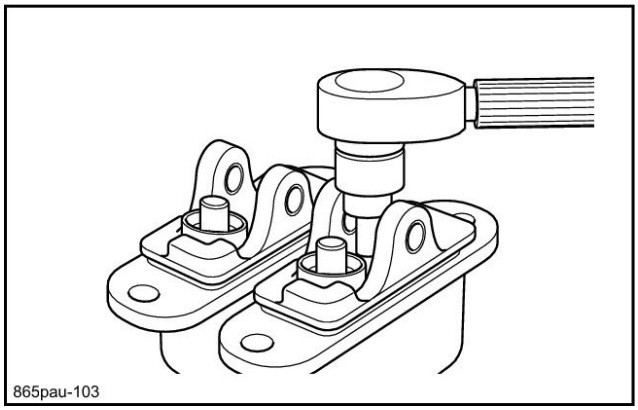
3	Push rod

a	Hydraulic oil application

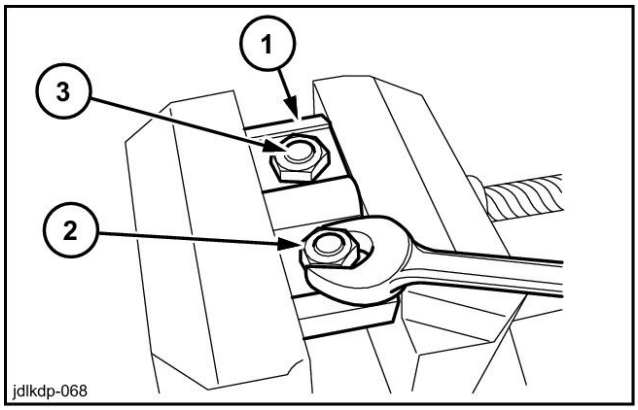




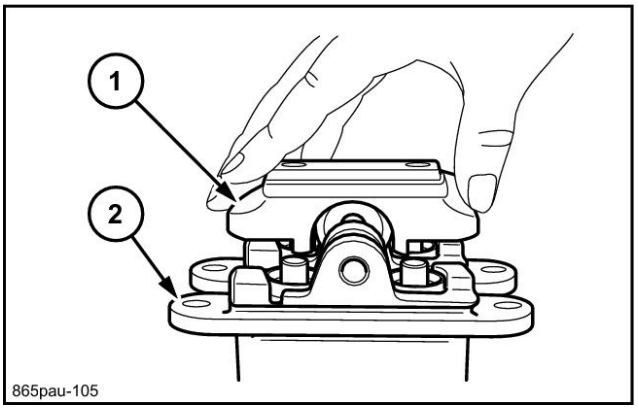
18. Tighten the hexagon socket head bolts to the specified torque.
    - Be careful that the cover is horizontal.
    - Hexagon socket head bolt tightening torque: 45.2 - 64.8 N·m (33.344 - 47.802 lbf· ft)



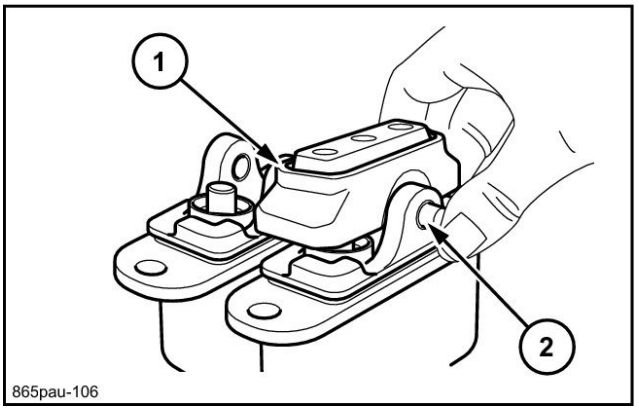
19. Temporarily install the locking screws (3) and lock nuts (2) on the cams (1).



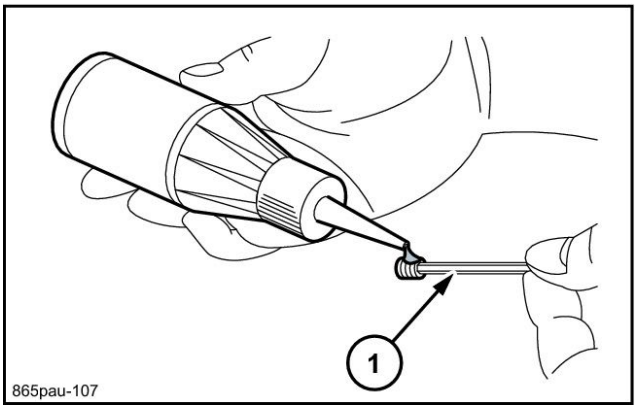
20. Install the cams (1) on the covers (2).
    - Install them in the positions they were in before disassembly.



21. While holding the cams (1), insert the cam shafts (2) from the outside.



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



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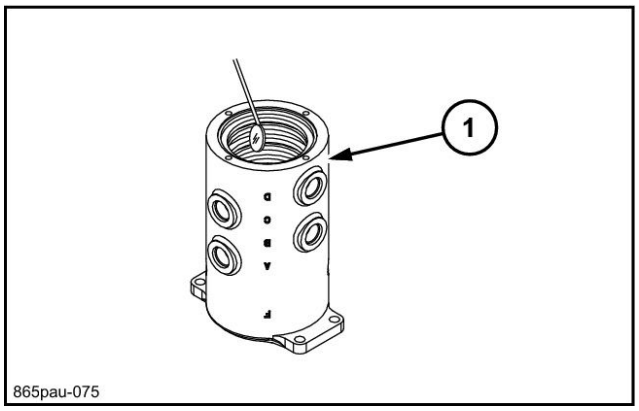
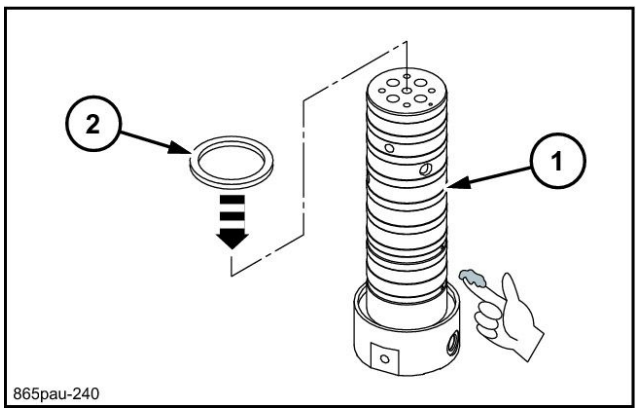
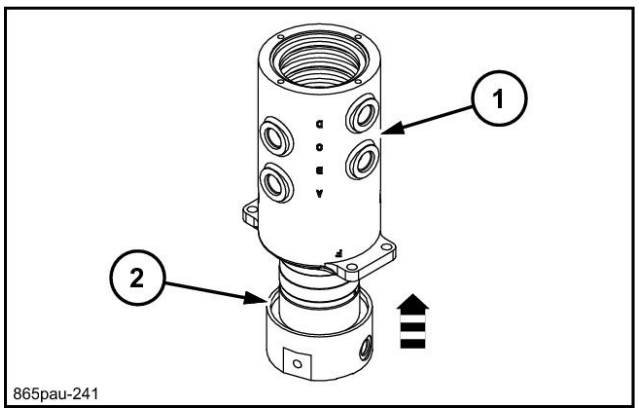
5. After installing the O-ring and packing rings on the rotor (1), use the mirror to check for any parts that are sticking out or are twisted.
   Also, check for installation mistakes.
   After checking, coat with grease. After coating with grease, check again for any parts sticking out, etc.



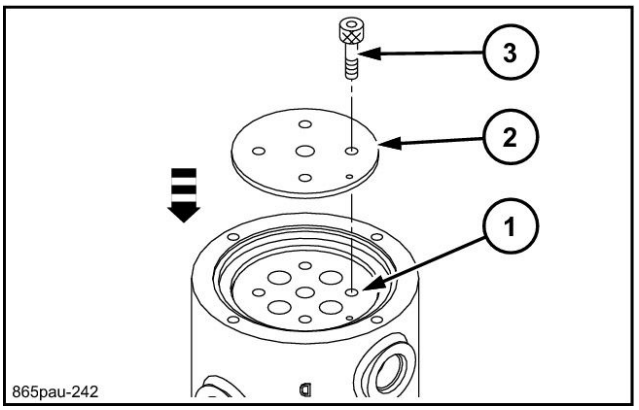
6. Install the V-ring (2) on the axle (1) and coat sufficiently with grease.
   Be careful that no water or dirt gets into the grease.
   - Use a new V-ring (2).



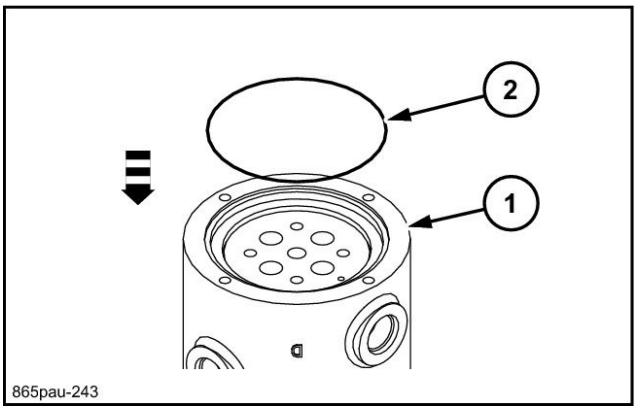
7. Install the axle (2) on the rotor (1).
   Set in a way that the V-ring will not be cut or damaged.



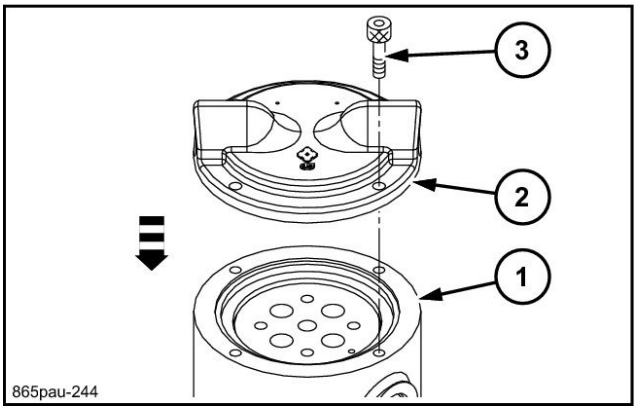
8. Using a hexagon wrench [6 mm (0.236 in)], coat the hexagon socket head bolts (3) with Loctite, install the thrust plate (2) on the axle (1), and tighten to the specified tightening torque.
   - Bolt (3) tightening torque: 31.4 - 37.3 N·m (23.164 - 27.515 lbf· ft)



9. Install the O-ring (2) on the rotor (1).
   - Use new O-ring (2).

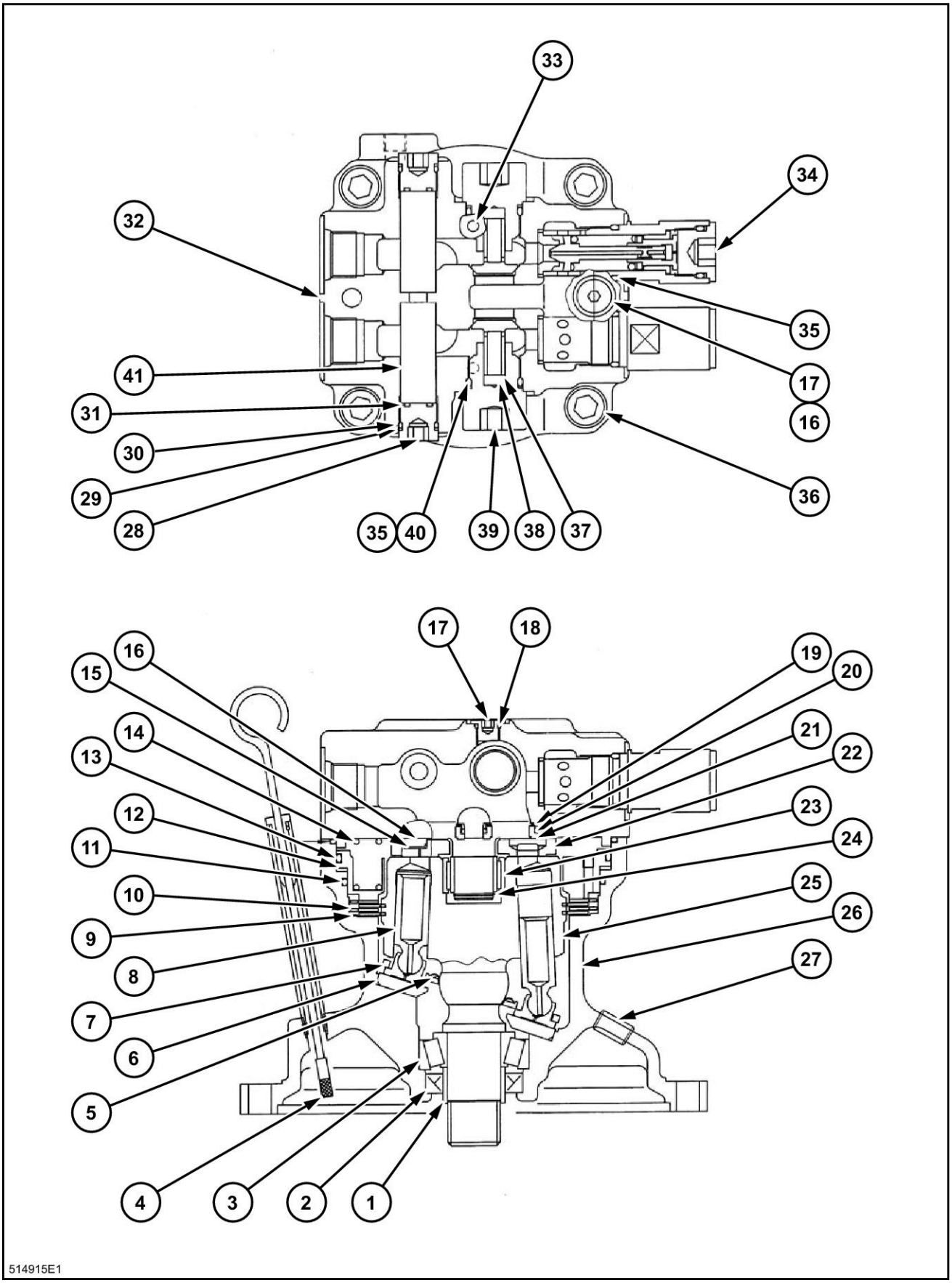


10. Using a hexagon wrench [6 mm (0.236 in)], coat the hexagon socket head bolts (3) with Loctite #262, install the cover (2) on the rotor (1), and tighten to the specified tightening torque.
    - Bolt (3) tightening torque: 31.4 - 37.3 N·m (23.164 - 27.515 lbf· ft)



This completes the assembly.

Swing Motor Internal Structure Diagram



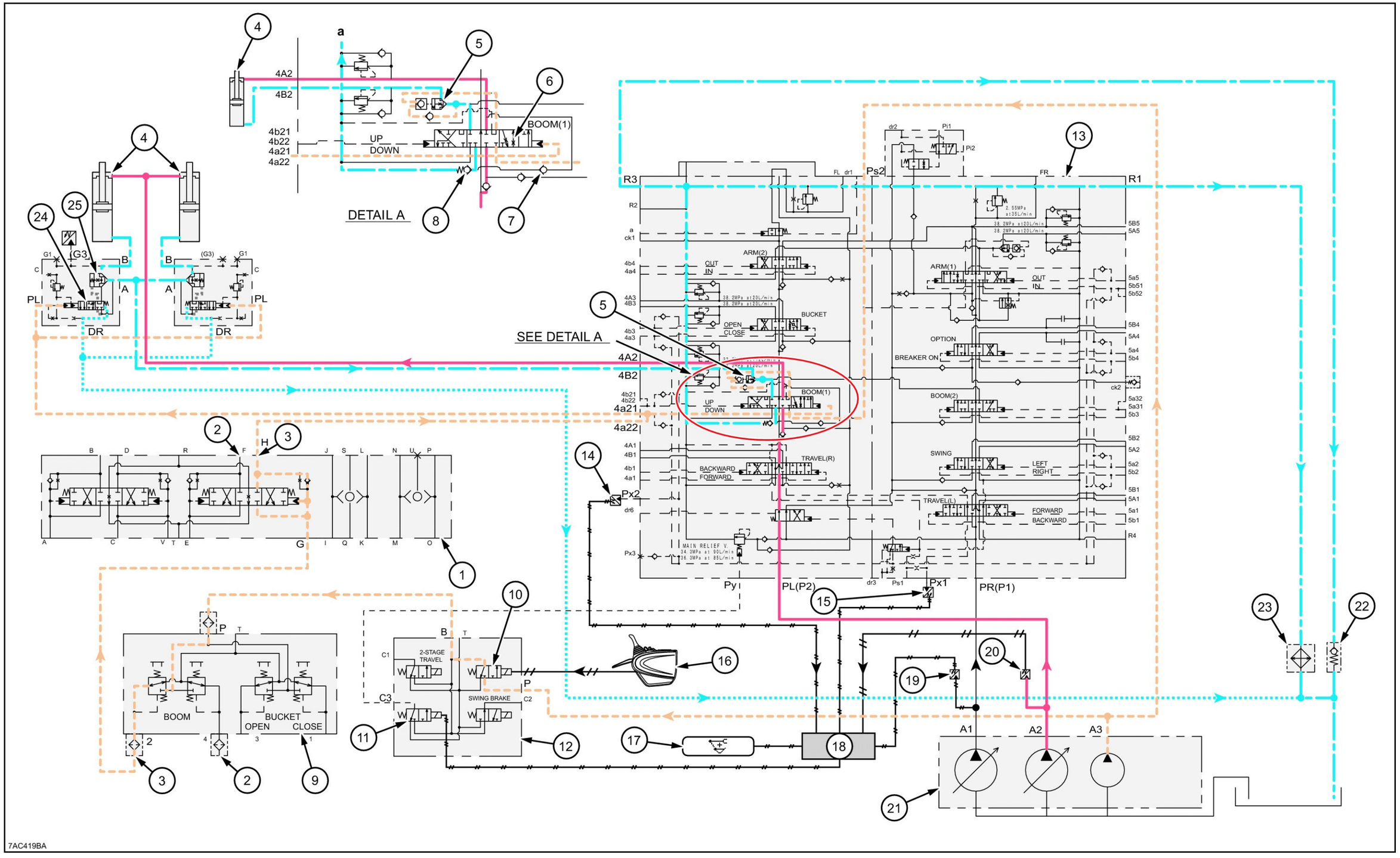
Explanation of Hydraulic Circuit and Operations (standard model)

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

1	Swing motor	9	Computer A	17	Swing brake
2	Arm (in)	10	Hydraulic pump	18	4 stack solenoid valve
3	Arm (out)	11	Control valve	19	Oil cooler
4	Right swing	12	Upper pilot pressure sensor	20	Check valve
5	Left swing	13	Orifice	21	Cut valve
6	Cushion valve	14	Arm cylinder	22	Arm pressure sensor
7	Swing pilot pressure sensor	15	Console lever lock switch		
8	Remote control valve (arm, swing)	16	Lever lock		

The swing pilot pressure is fed to the 5b2 port via the cushion valve and holds the swing spool to the right side. The discharge oil from hydraulic pump A1 enters the control valve PR (P1) port and is fed from the parallel oil path to the swing spool and arm (1) spool. By metering the parallel oil path to arm (1), for arm and swing simultaneous operation, the swing pressure is boosted to secure the swing force for pressing digging.
As an example, this section explains the right-swing and arm-in operation.
By moving the remote control valve to the right swing side, the pilot pressure oil is fed via the cushion valve to the control valve 5b2 port and switches the spool to the right swing side.
At this time, by moving the remote control valve to the arm-in side, the pilot pressure oil is fed via the cushion valve to the control valve 5b52 port and switches the spool to the arm-in side.
The pilot pressure oil from the control valve 5b52 port separated internally is fed from the 5b51 port to the 4a41 port and switches the arm (2) spool to the in side.
The discharge oil from hydraulic pump A1 enters the control valve PR (P1) port and is fed from the parallel oil path to the swing spool. Switching the spool lets the oil flow into the swing motor B port and the right swing operation is carried out.
The discharge oil from hydraulic pump A2 enters the control valve PL (P2) port, is fed from the center bypass oil path to the arm (2) spool, and merges upstream of the arm (1) spool. Switching the spool lets the oil flow into the arm cylinder bottom and the arm-in operation is carried out.
When the right swing and arm-in operations are carried out at the same time, the orifice on the control valve PR (P1) port parallel oil path narrows, so the pressure is boosted to secure the swing force for pressing digging.
The arm cylinder with HBCV holds its stop position even when the arm stops and the engine stops.

Boom-down Regenerative Circuit (with HBCV)



Explanation of Hydraulic Circuit and Operations (standard model)

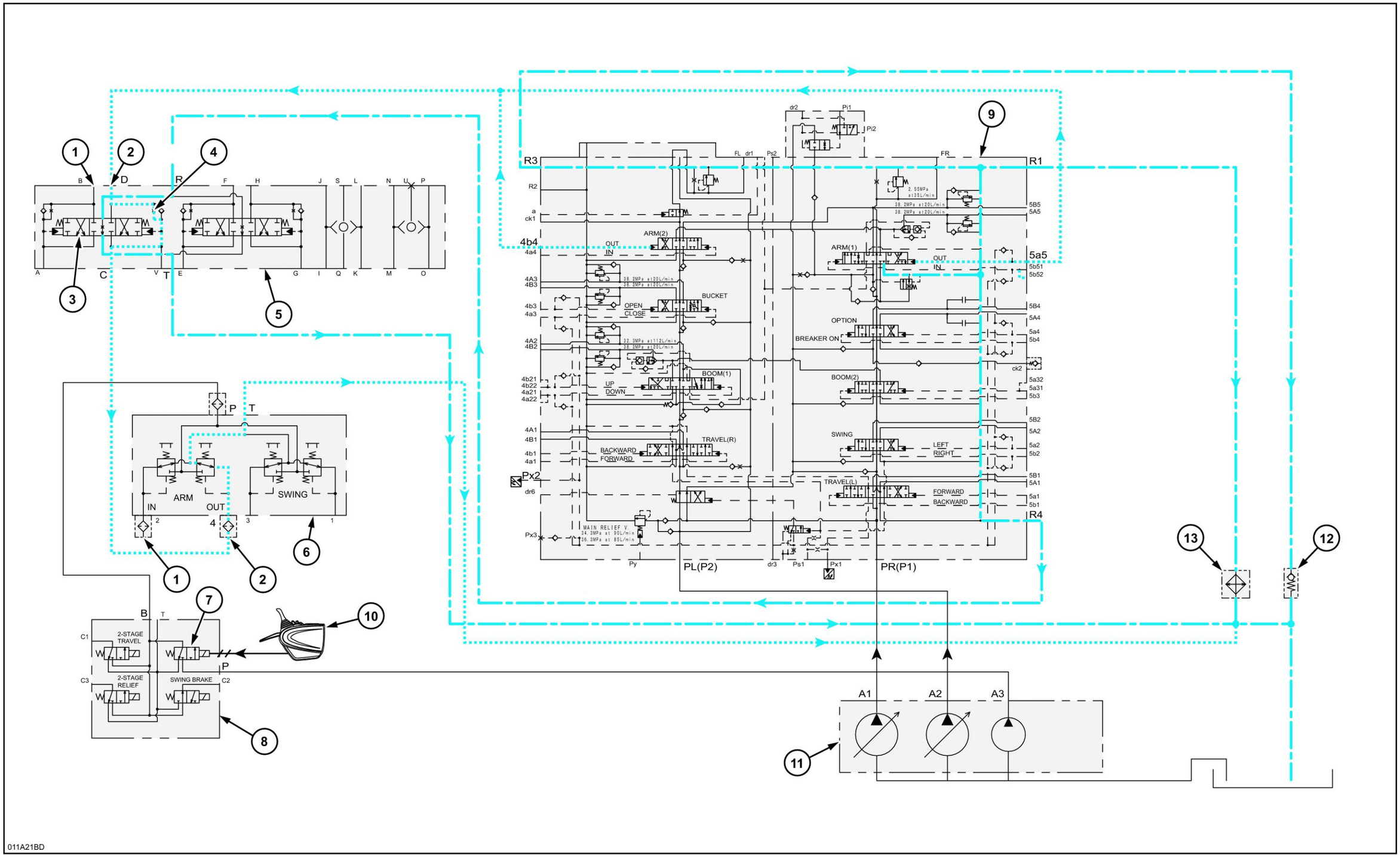
Pressure line
Tank line
Pilotpressure line
Pilot tank line
Electric line

a To tank line

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

When the remote control valve arm operation lever is in neutral, the oil at the arm cylinder rod side is sealed by the load holding valve check valve, reducing internal leakage from the main spool and reducing the natural drop of the arm.
By moving the remote control valve to the arm-in side, the pilot pressure oil is fed via the cushion valve to the control valve 5b52 port and 4a41 port and switches the arm (1) and (2) spools to the in side.
The discharge oil from hydraulic pump A1 enters the control valve PR (P1) port and is fed from the center bypass oil path to the arm (1) spool. The discharge oil from hydraulic pump A2 enters the control valve PL (P2) port, flows from the center bypass oil path and through the arm (2) downstream arm merge oil path and merges downstream of the arm (1) spool.
Switching the arm spool lets the oil flow into the arm cylinder bottom side and the arm-in operation is carried out.
At the same time, the pilot pressure oil from the Ps2 port operates on the load holding valve poppet and the poppet opens.
In this way, the load holding valve check valve spring chamber oil is connected to the tank line through the load holding valve poppet, the spring chamber pressure drops, and the load holding valve check valve is opened.
The arm cylinder rod side pressurized oil goes through the load holding valve check valve and the arm (1) spool and returns to the hydraulic oil tank.

Cushion Circuit (arm-out operation stopped)



Explanation of Hydraulic Circuit and Operations (option)

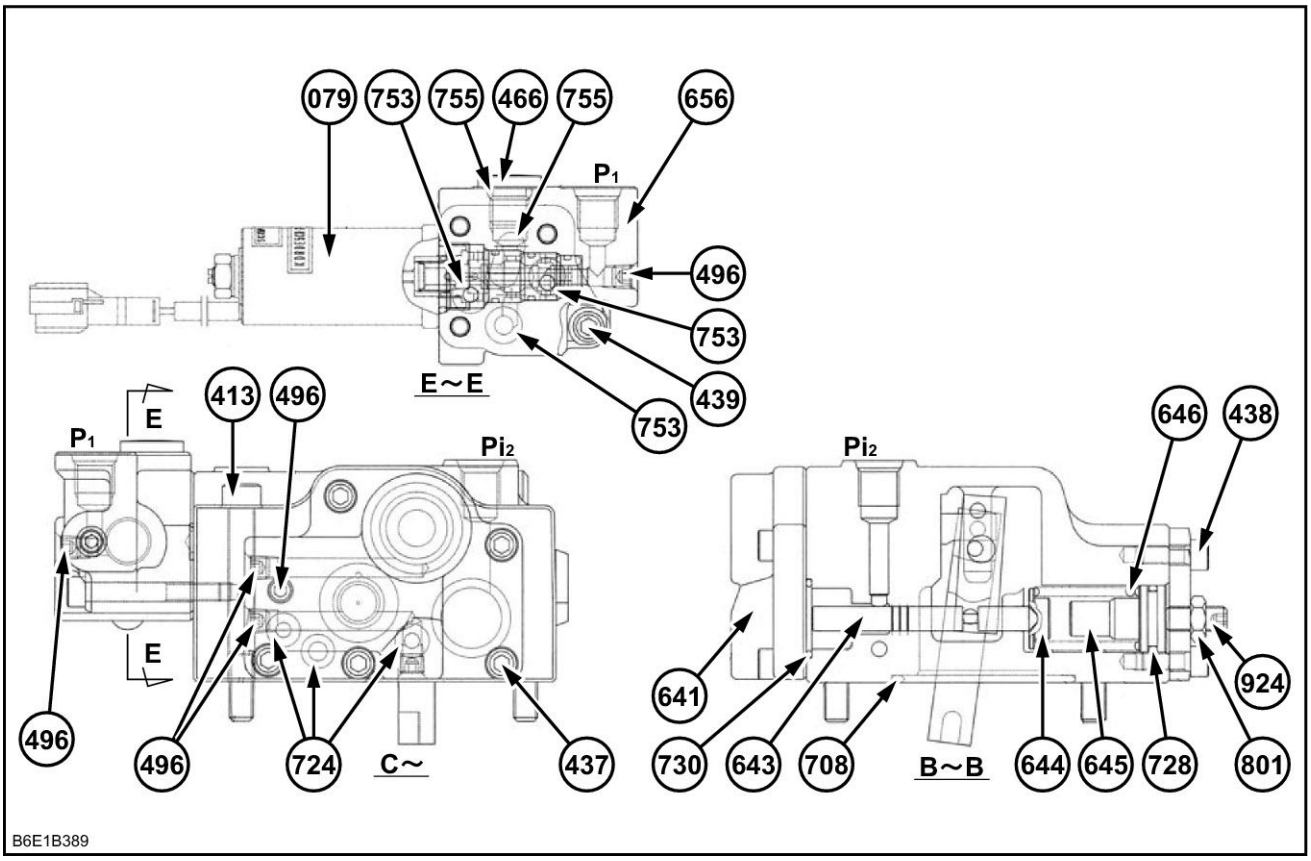
Pressure line
Tank line
Pilot pressure line
Pilot tank line
Electric line

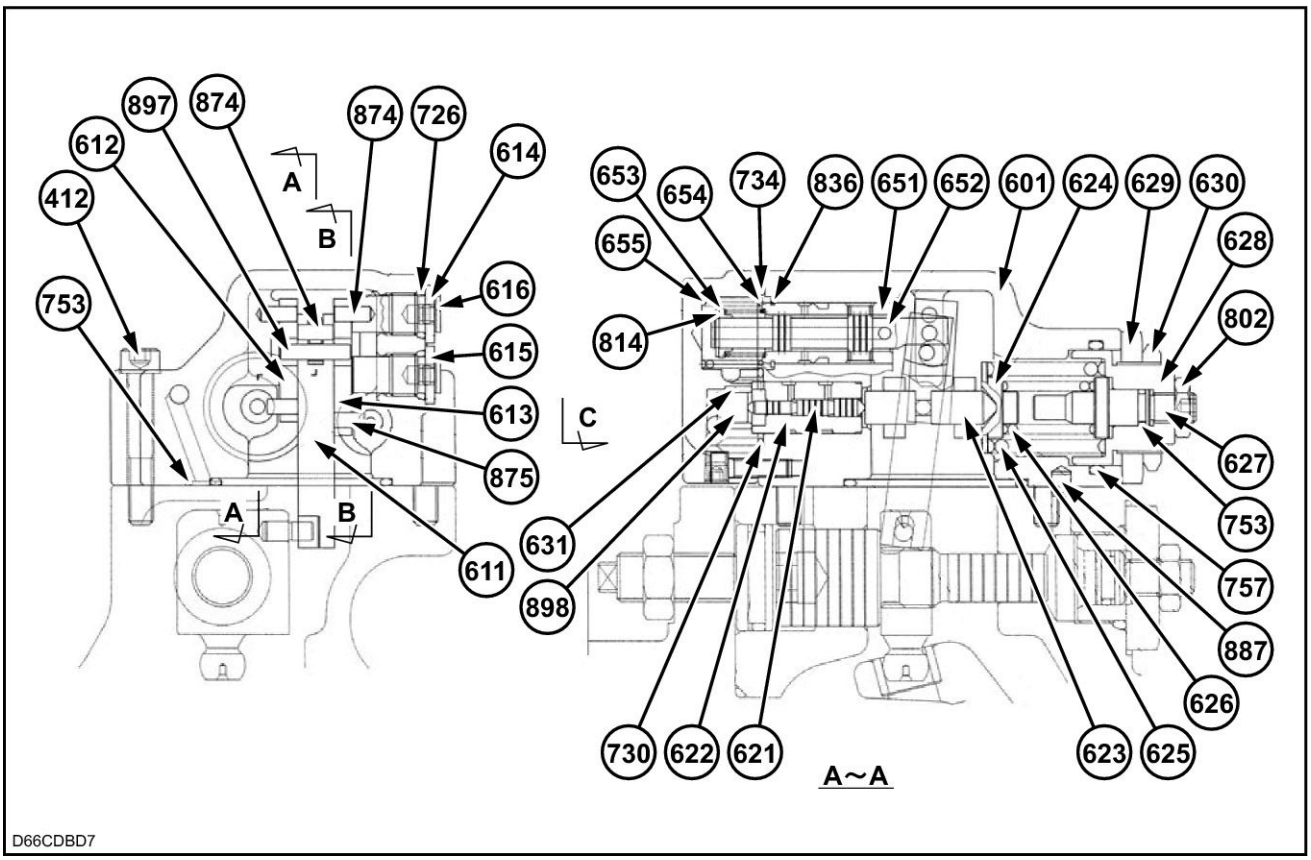
a Swing right
b Swing left

1	Control valve	6	Console lever lock switch	11	Computer A
2	Stop valve	7	2nd option remote control valve	12	4th pump
3	Upper pilot pressure sensor	8	Hydraulic rotation fork	13	Hydraulic pump
4	Lever lock	9	2nd option pilot pressure switch	14	Check valve
5	4 stack solenoid valve	10	Monitor display	15	Oil cooler

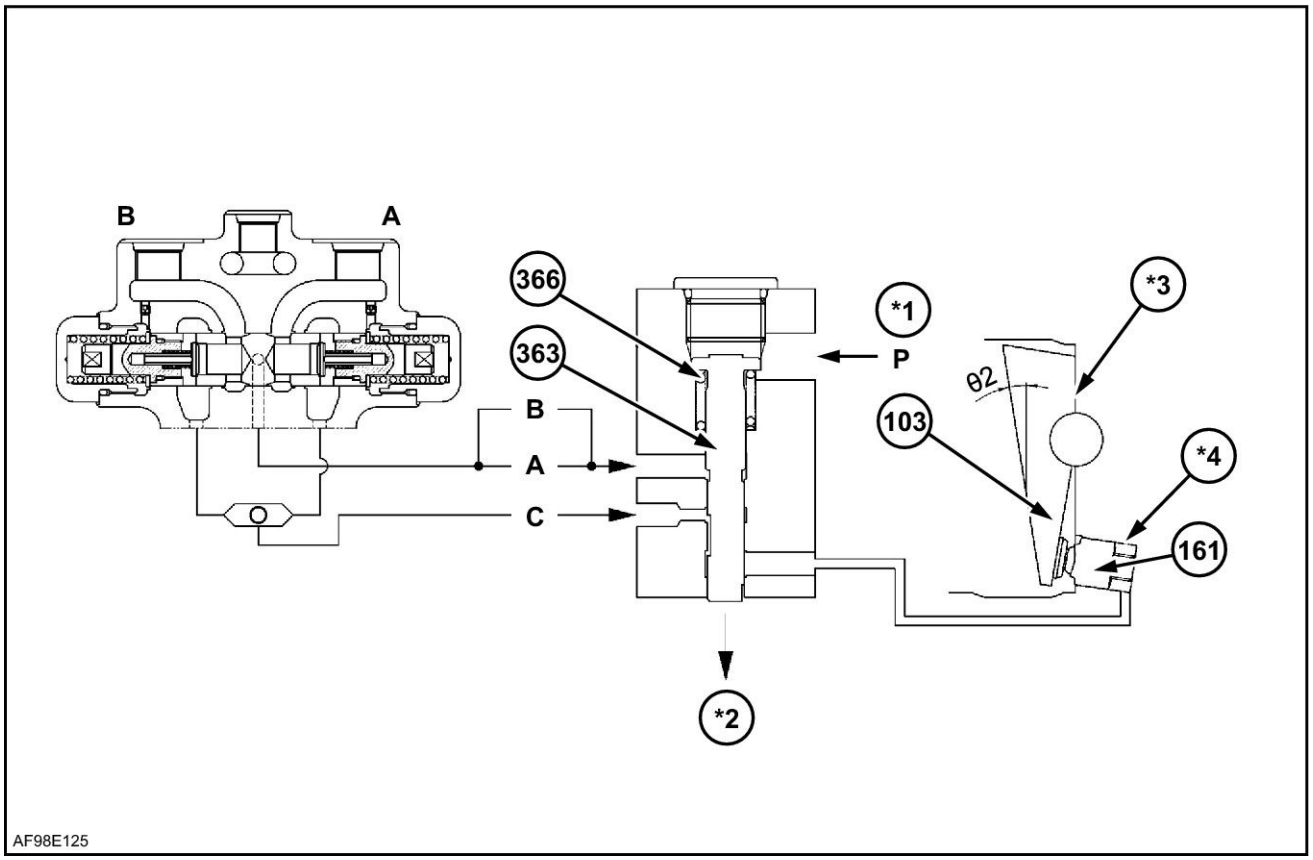
As an example, this section explains the case in which the hydraulic rotation fork attachment is used.
By operating the 2nd option remote control valve to the right swing side, the pilot pressure oil is fed to the control valve 4a5 port.
The 4th hydraulic pump OUT discharge oil is fed to the control valve P3 port, goes through the 2nd option spool and flows to the hydraulic rotation fork to operate to the right swing side.
The return oil from the hydraulic rotation fork goes through the 2nd option spool and returns to the hydraulic oil tank.
The oil in the 2nd option drain line returns to the hydraulic oil tank without going through the control valve.
2nd option spool port relief valve pressure becomes the hydraulic rotation fork set pressure.

Rear Side Regulator Internal Structure Diagram





2. During high-speed mode
   When pilot pressure has been fed from the P port, this pressure overcomes the spring (366) force and pressurized oil from the A port or B port and the valve (363) is pushed downwards and the C port pressurized oil passes through the valve to the chamber w.
   The piston (161) is pushed upwards and held until the swash plate (103) touches the surface x.
   At this time, the swash plate moves to its minimum tilting angle θ2, the hydraulic motor stroke volume lowers to the minimum, and high-speed rotation begins.



*1	Pilot pressure
*2	Drain
*3	Y surface
*4	W chamber

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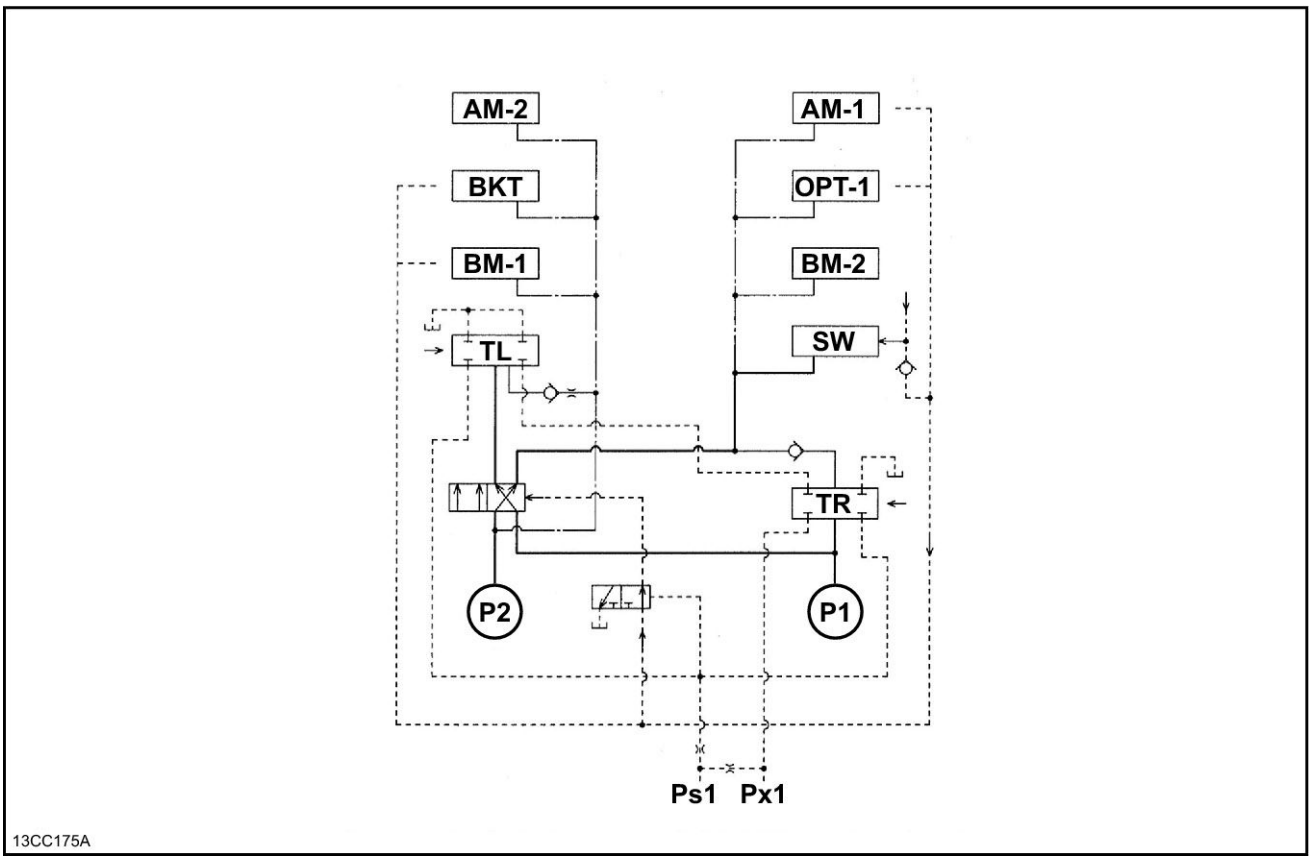
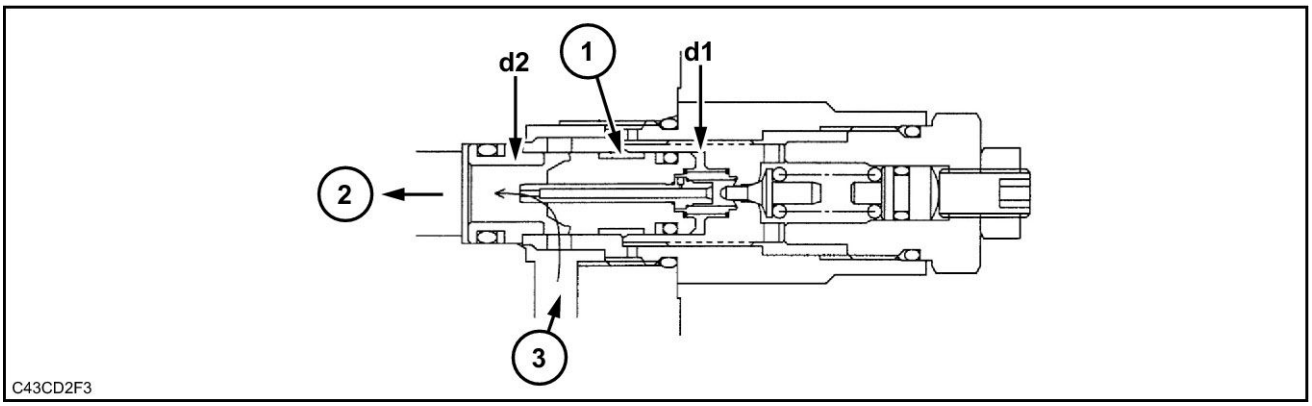
2. When, for example, a swing operation is performed from the straight travel state (See diagram 5.)
   When the swing plunger is operated, the operation pilot pressure goes through the straight travel signal switchover spool and enters the straight travel switchover valve pilot chamber. Therefore, the straight travel switchover plunger switches, the PR port is connected to the left and right travel plunger feed paths, and the PL port is connected to the left and right parallel paths.
   Accordingly, the oil flowing in from the P1 pump drives the left and right travel motors with equal speed and the oil flowing in from the P2 pump is fed from the parallel path for the valve to the swing motor and can drive this motor.
   Also, orifice a entering the travel plunger from the PL port-side parallel feed path turns the excess swing oil to left and right travel, and this prevents sudden changes in vehicle speed.



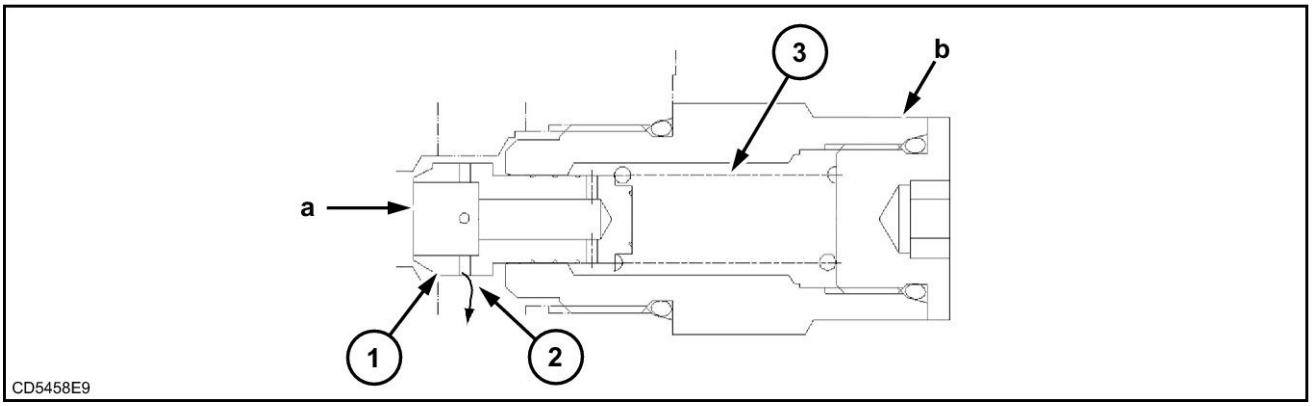
2. Make-up operation
   Because d1 becomes greater than d2, normally the cylinder port pressure is higher than the tank pressure, so main poppet B is securely seated.
   When the cylinder port pressure drops (and approaches negative pressure) and the cylinder port pressure becomes less than the tank pressure, main poppet B opens after receiving tank pressure proportional to the difference in surface areas of d1 and d2, the oil flows from the tank path to the cylinder port, and this prevents cavitation.



1	Main poppet B	3	Tank path
2	Cylinder port		

Foot relief valve

1. Because the load on spring C is extremely small, the oil from the center bypass path opens the poppet and flows into the tank path.[Check valve operation]



1	Poppet	3	Spring C
2	Tank path		

a	From center bypass path
b	Hexagonal opposite: 36 mm (1.417 in) Tightning torque: 80 N · m (59.02 lbf · ft)

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

Structure

The structure of the remote control valve is as shown in the Structural Diagram. There is a longitudinal axial hole in the casing and the pressure reduction valve is installed in it.
The pressure reduction valve comprises the spool (201), secondary pressure setting spring (241), return spring (221), spring seating (216), and washer 2 (217).
The secondary pressure setting spring (241) is set so that the secondary pressure calculation is 0.5 - 1 MPa (72.527 - 145.05 psi) (depending on the model). The spool (201) is pressed against the push rod (212) by the return spring (221).
When the push rod (212) is pushed down by tilting the handle or another operation, the spring seating goes down at the same time and the secondary pressure setting spring (241) setting is changed.
The casing (101) has the oil inlet (primary pressure) port P and the outlet (tank) port T and, furthermore, the secondary pressure is taken out from the ports 1, 2, 3, 4.

Function

1. Basic functions
   The remote control valve is for controlling the control valve spool stroke quantity, direction, etc. This is done by operating the pilot valve output pressure on the control valve spool end section.
   In order to satisfy this function, the remote control valve is made up of the following elements.

   1) Inlet port (P) to which the oil is fed from the hydraulic pump
   2) Multiple output ports (1, 2, 3, 4) for operating the feed pressure from the inlet port on the control valve spool end
   3) Tank port (T) required for controlling the above output pressure
   4) Spool connecting the output port to the inlet port or tank port
   5) Mechanical means including a spring operating on the above spool in order to control the output pressure

2. Main part functions
   The function of the spool (201) is to switch the oil path either to have the hydraulic pressure fed from the hydraulic pump received by the P port and lead the P port pressure oil to the output ports (1, 2, 3, 4) or to lead the output port pressure oil to the T port. The output pressure operating on this spool (201) is determined by the secondary pressure setting spring (241).
   In order to change the deflection quantity of the secondary pressure setting spring (241), the push rod (212) is inserted into the plug (211) in such a way that it can slide.
   The return spring (221) operates on the casing (101) and spring seating (216) and operates to return the push rod (212) in the displacement zero direction regardless of the output pressure and makes the spool (201) neutral return reliable. It also has the effect of a counter-force spring for giving an operator an appropriate operation feel.

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