SERVICE MANUAL

E145C EVO

Crawler Excavator

Part number 48034213
English
June 2016

NEW HOLLAND CONSTRUCTION

	Safety glass for all windows	
	Shock-less cab suspension by 4-point fluid mounting	
	Sliding front window with auto lock	
	Built-in type full-color LCD monitor display	
	Membrane switch on monitor display	
	Windshield wiper & washer	
	AM/FM Radio with auto-tuner	
	Floor mat	
	Polycarbonate roof hatch & Sun shade	
	Auto air-conditioner	
	Top guard OPG level 1 (in CAB structure)	
	Roll - over protective structure (ROPS)	
Operator's seat		
	Low frequency mechanical suspension with helical springs and double acting hydraulic damper.(Achieves ISO7096 in category EM6)	
	With following features	
	Manual weight adjustment	Backrest angle adjustment
	Seat height adjustment	Adjustable pivoting armrests
	Adjustable headrest	Retractable seat belt
	Adjustable lumbar support	Control consoles adjust independently of seat
Others		
	Rear view mirror (Cab side & Right side)	

Undercarriage

Travel motor		Variable displacement axial piston motor
Brake		Mechanical disc brake
Hydraulic service brake		Brake valve
Final drive		Planetary gear reduction
Travel speeds	High	**5.6 km/h** (**3.480 mph**) (Automatic travel speed shifting)
	Low	**3.4 km/h** (**2.113 mph**)
Drawbar pull		**116 kN** (**26077.837 lb**)
Number of carrier rollers (each side)		1
Number of carrier rollers (each side)		7
Number of shoes (each side)		43
Type of shoe		Triple grouser shoe
Link pitch		**171.5 mm** (**6.752 in**)
Width of shoe		**600 mm** (**23.622 in**) (S.T.D)
Grade-ability		**70 %** (**35 °**)

Dozer blade

Width of blade	**2590 mm** (**101.969 in**)
Height of blade	**570 mm** (**22.441 in**)
Max. lift above ground	**515 mm** (**20.3 in**)
Min. drop below ground	**520 mm** (**20.472 in**)

Mass

Operating mass	**13500 kg** (**29762.41 lb**)
with **2.50 m** (**8.2021 ft**) Arm, **0.5 m³** Bucket, **600 mm** (**23.622 in**) grouser shoe, operator, lubricant, coolant and full fuel tank	
Shipping mass	**12900 kg** (**28439.63 lb**)
Operating mass - (operator mass [**75 kg** (**165.35 lb**)]) + **90 %** of fuel mass + bucket mass [**400 kg** (**881.85 lb**)])	
Counter weight mass	**2200 kg** (**4850.17 lb**)
Ground pressure	**0.036 MPa** (**5.2218 psi**)

Gallons (U.S) to liters

U.S-.gal.	0	1	2	3	4	5	6	7	8	9	U.S-.gal.
	liters	liters	liters	liters	liters	liters	liters	liters	liters	liters	
----		3.7853	7.5707	11.3560	15.1413	18.9266	22.7120	26.4973	30.2826	34.0680	----
10	37.8533	41.6386	45.4239	49.2093	52.9946	56.7799	60.5653	64.3506	68.1359	71.9213	10
20	75.7066	79.4919	83.2772	87.0626	90.8479	94.6332	98.4186	102.2039	105.9892	109.7745	20
30	113.5599	117.3452	121.1305	124.9159	128.7012	132.4865	136.2718	140.0572	143.8425	147.6278	30
40	151.4132	155.1985	158.9838	162.7691	166.5545	170.3398	174.1251	177.9105	181.6958	185.4811	40
50	189.2665	193.0518	196.8371	200.6224	204.4078	208.1931	211.9784	215.7638	219.5491	223.3344	50
60	227.1197	230.9051	234.6904	238.4757	242.2611	246.0464	249.8317	253.6170	257.4024	261.1877	60
70	264.9730	268.7584	272.5437	276.3290	280.1143	283.8997	287.6850	291.4703	295.2557	299.0410	70
80	302.8263	306.6116	310.3970	314.1823	317.9676	321.7530	325.5383	329.3236	333.1090	336.8943	80
90	340.6796	344.4649	348.2503	352.0356	355.8209	359.6063	363.3916	367.1769	370.9622	374.7476	90
100	378.5329	382.3182	386.1036	389.8889	393.6742	397.4595	401.2449	405.0302	408.8155	412.6009	100

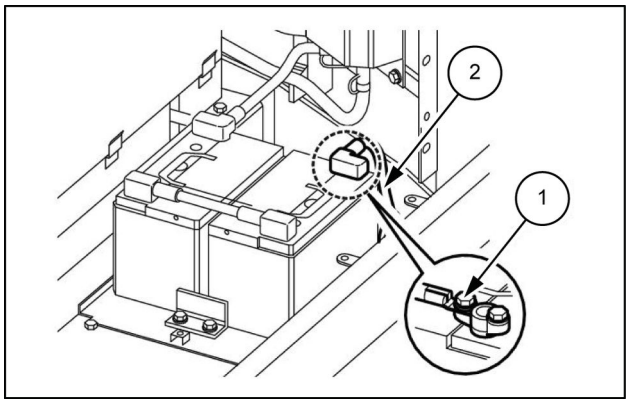
Liters to gallons (U.S)

liters	0	1	2	3	4	5	6	7	8	9	liters
	U.S.gal.	U.S.gal.	U.S.gal.	U.S.gal.	U.S.gal.	U.S.gal.	U.S.gal.	U.S.gal.	U.S.gal.	U.S.gal.	
----		0.2642	0.5284	0.7925	1.0567	1.3209	1.5851	1.8492	2.1134	2.3776	----
10	2.6418	2.9060	3.1701	3.4343	3.6985	3.9627	4.2268	4.4910	4.7552	5.0194	10
20	5.2836	5.5477	5.8119	6.0761	6.3403	6.6044	6.8686	7.1328	7.3970	7.6612	20
30	7.9253	8.1895	8.4537	8.7179	8.9820	9.2462	9.5104	9.7746	10.0388	10.3029	30
40	10.5671	10.8313	11.0955	11.3596	11.6238	11.8880	12.1522	12.4164	12.6805	12.9447	40
50	13.2089	13.4731	13.7372	14.0014	14.2656	14.5298	14.7940	15.0581	15.3223	15.5865	50
60	15.8507	16.1148	16.3790	16.6432	16.9074	17.1716	17.4357	17.6999	17.9641	18.2283	60
70	18.4924	18.7566	19.0208	19.2850	19.5492	19.8133	20.0775	20.3417	20.6059	20.8700	70
80	21.1342	21.3984	21.6626	21.9268	22.1909	22.4551	22.7193	22.9835	23.2476	23.5118	80
90	23.7760	24.0402	24.3044	24.5685	24.8327	25.0969	25.3611	25.6252	25.8894	26.1536	90
100	26.4178	26.6820	26.9461	27.2103	27.4745	27.7387	28.0028	28.2670	28.5312	28.7954	100

Engine - Remove

1. Use a wrench [**17 mm**] to remove the bolt **(1)**, and then remove the battery cable **(2)** on the negative side.
   - After removing the terminal and harness, secure them so that they do not interfere with the frame and other parts.
     Also, cover with a rubber cap to protect against sparks.

     Tightening torque for bolt installation: **10.6 - 13.0 N·m** (**7.82 - 9.59 lb ft**).



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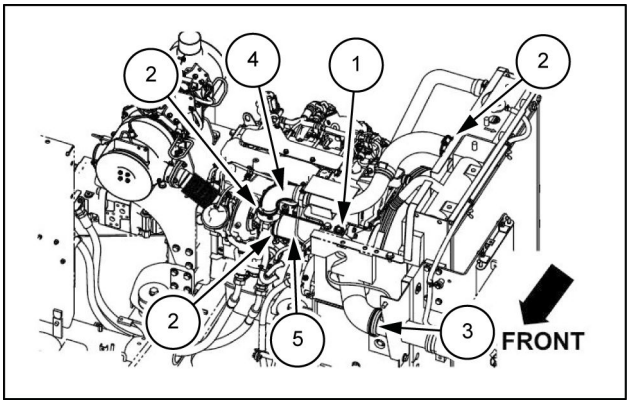
2. Remove the counterweight.
   For details, see **Counterweight - Remove (39.140)**.
3. Remove the muffler.
   For details, see **Exhaust muffler - Remove (10.254)**.
4. Remove the pump.
   For details, see **Pump - Remove (35.106)**.
5. Use a wrench [**19 mm**] to remove the bolt **(1)**, use a wrench [**7 mm**] to loosen the hose bands **(2)** and **(3)**, and then remove the intercooler hose (high-temperature side) **(4)** and hose **(5)** from the air cleaner.

   Tightening torque for band **(2)** installation: **8.8 - 9.8 N·m** (**6.49 - 7.23 lb ft**)

   Tightening torque for band **(3)** installation: **6.3 - 7.3 N·m** (**4.65 - 5.38 lb ft**)



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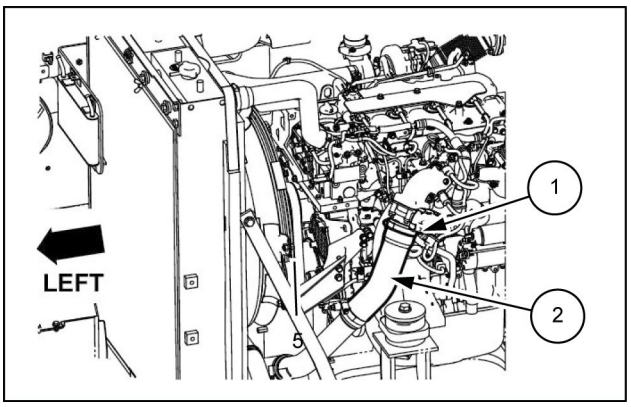
6. Loosen the hose bands **(1)**, and then remove the intercooler hose (low-pressure side) **(2)**.

   Tightening torque for hose band **(2)** installation: **8.8 - 9.8 N·m** (**6.49 - 7.23 lb ft**)



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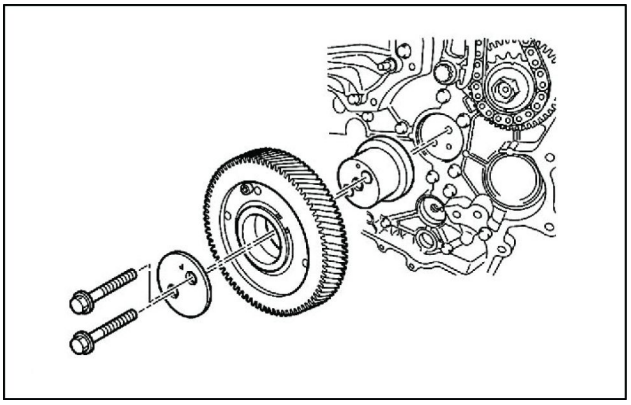
Crank gear removal

1. Remove the crank gear from the crankshaft.

Idle gear A removal

1. Remove the idle gear A from the idle gear A shaft.
   - Remove idle gear A, idle gear A flange, and idle gear A shaft.



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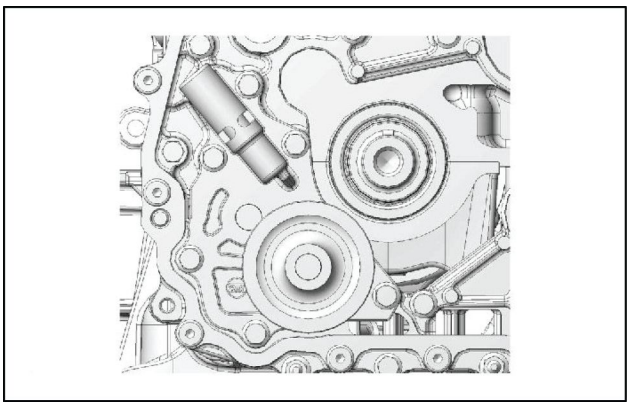
Oil pump assembly removal

1. Remove the oil pump assembly from the timing gear case.



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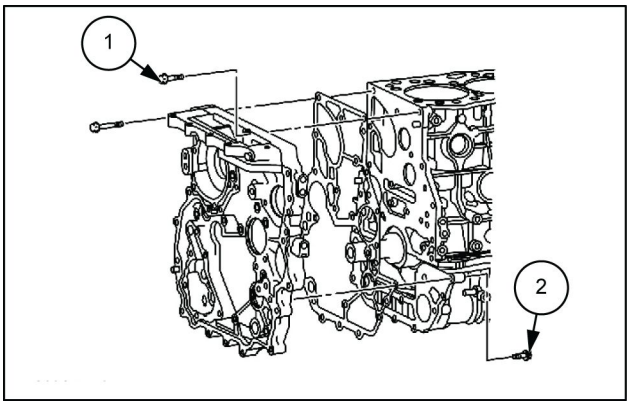
Timing gear case removal

1. Remove the timing gear case from the cylinder block.
   - Install bolt **(1)** in the diagram to the inside of timing gear case and bolt **(2)** from the crankcase side.

NOTICE: *Be sure to remove the bolts.*

2. Remove the gasket from the cylinder block.



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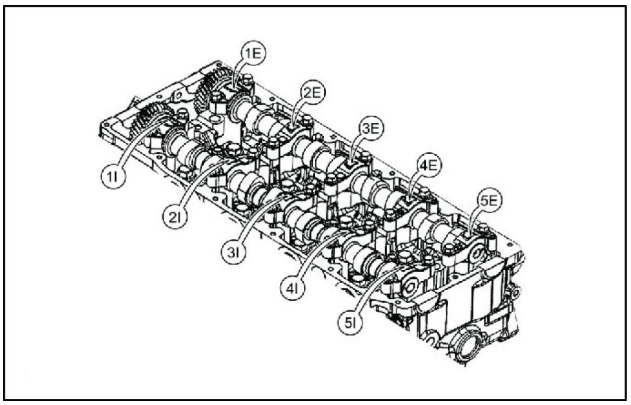
3. Install the camshaft bearing cap to the cylinder head.
   - Apply engine oil to the journal section of the cylinder head.
   - Face the bearing cap front mark to the engine front side, and assemble in numbered order to the cylinder head.



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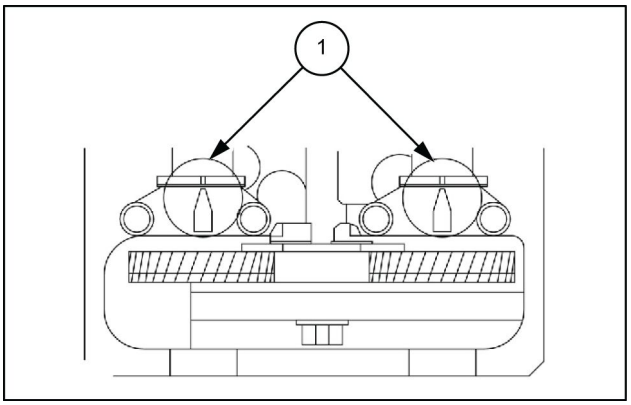
   - Confirm that the alignment marks **(1)** of the camshaft bearing cap and the camshaft are aligned.



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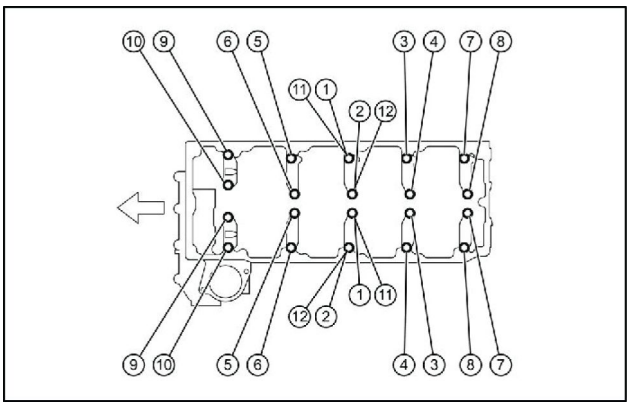
4. Apply the engine oil to the bolt.
   - Apply engine oil to the threaded portion and tighten the bearing cap.
   - Tighten the bearing cap to the specified torque in the order shown in the diagram.

     Tightening torque: **18 N·m** (**13 lb ft**)



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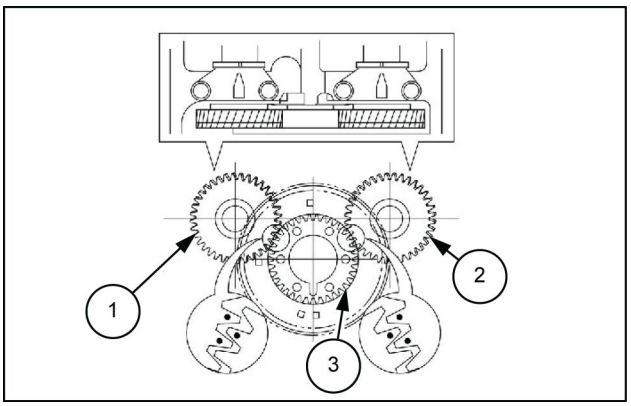
   - After rotating the crankshaft 720˚, the marks on the collared end of the crankshaft and that of the bearing cap should align.

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



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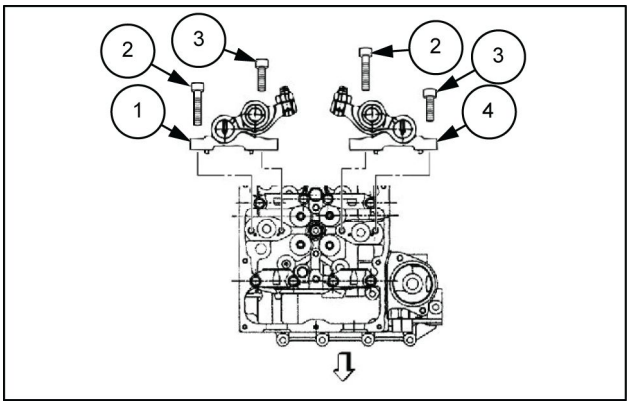
Rocker arm shaft assembly removal

1. Remove the rocker arm shaft assembly from the cylinder head.
   1. Exhaust rocker arm shaft assembly
   2. Bolt
   3. Bolt
   4. Inlet rocker arm shaft assembly

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



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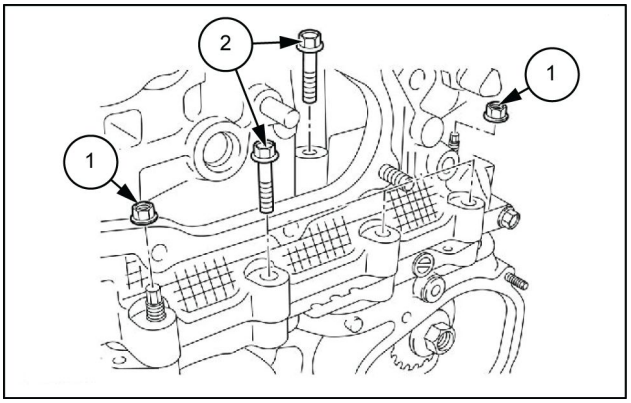
Cylinder head assembly removal

1. Remove the bolt **(2)** from the timing gear case.
2. Remove the nut **(1)** from the timing gear case.
3. Loosen the bolt using a wrench.

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

NOTICE: *Do not reuse the bolts.*



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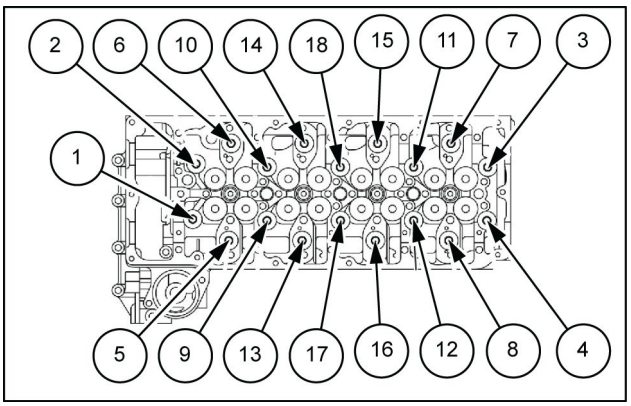
4. Remove the cylinder head from the cylinder block.

NOTE: *Remove with the inlet manifold.*



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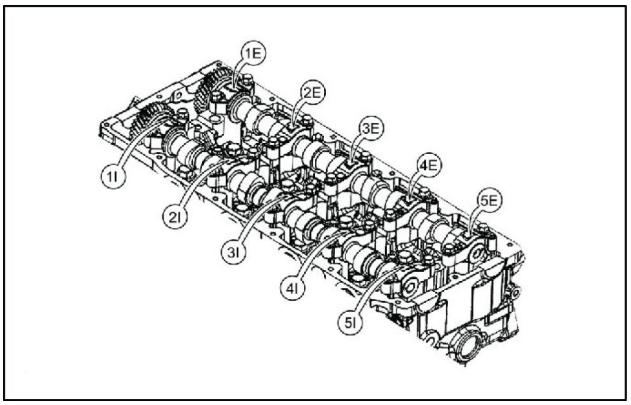
Cylinder head gasket removal

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

NOTICE: *Do not reuse the gasket.*

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



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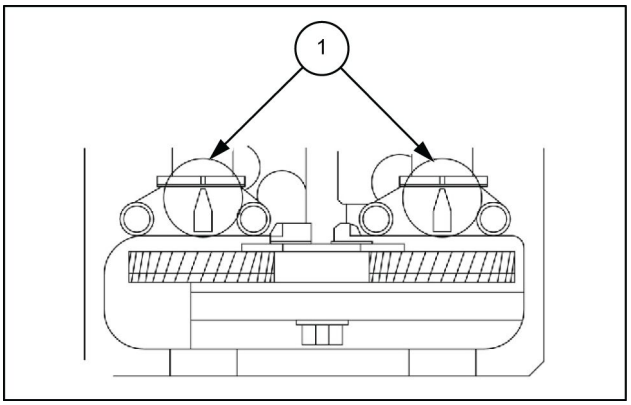
   - Confirm that the alignment marks **(1)** of the camshaft bearing cap and the camshaft are aligned.



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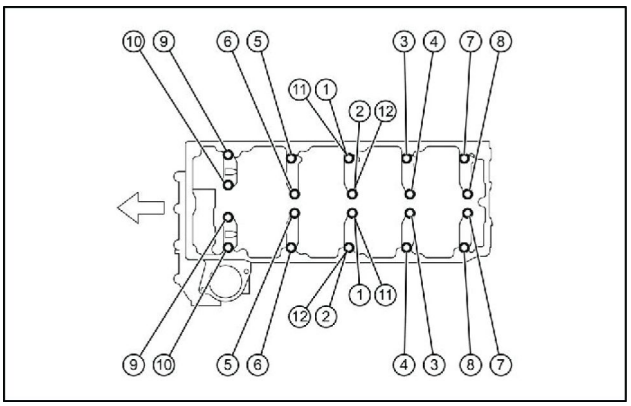
4. Apply the engine oil to the bolt.
   - Apply engine oil to the threaded portion and tighten the bearing cap.
   - Tighten the bearing cap to the specified torque in the order shown in the diagram.

     Tightening torque: **18 N·m** (**13 lb ft**)



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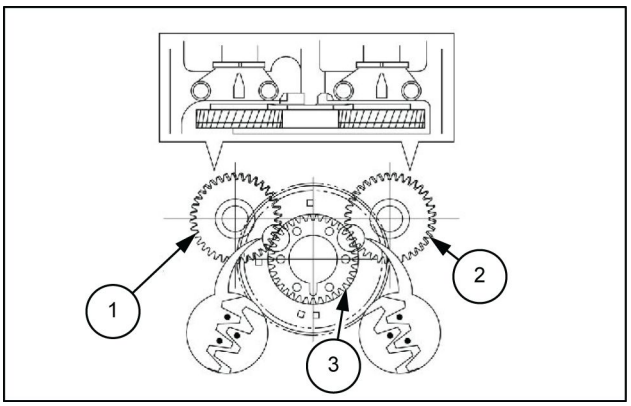
   - After rotating the crankshaft 720˚, the marks on the collared end of the crankshaft and that of the bearing cap should align.

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



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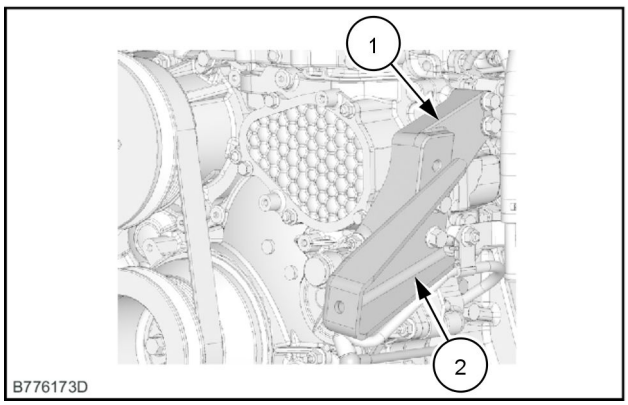
Gear case cover removal

1. Remove the bracket from the gear case and vacuum pump.

NOTE: *Remove the left fan shroud bracket* ***(1)*** *and fan shroud stay* ***(2)****.*



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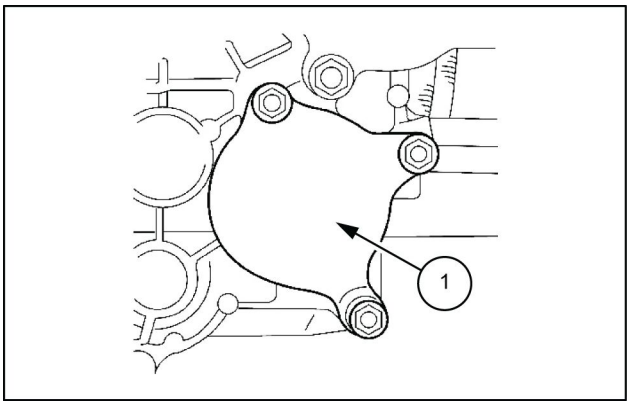
2. Remove the cover from the gear case cover.
   1. Power steering pump hole cover



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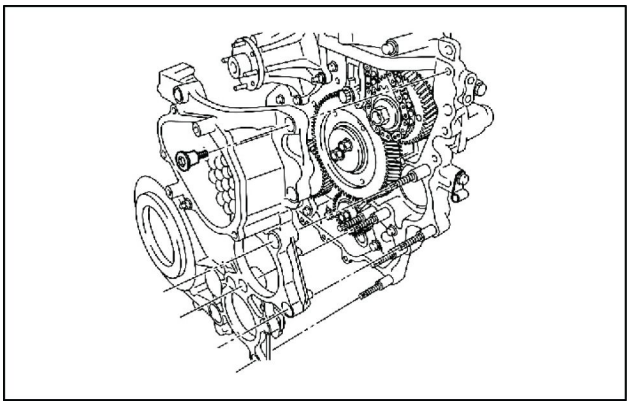
3. Remove the gear case cover from the gear case.



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Crank gear removal

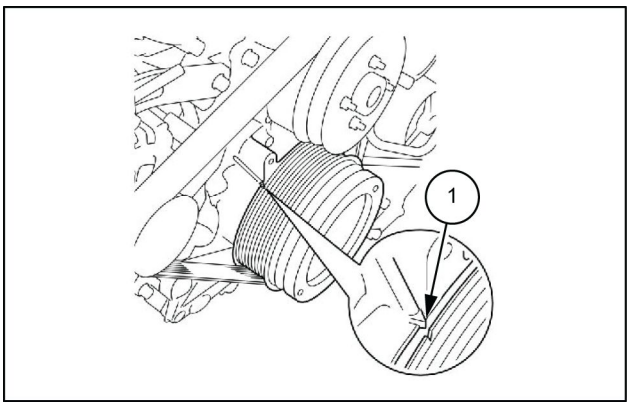
1. Remove the crank gear from the crankshaft.

Camshaft - Install

Camshaft preparing

1. Set the No. 1 cylinder to the compression top dead center.

NOTE: *Turn the crankshaft forward and set the No. 1 cylinder to the compression top dead center.*
Use a mirror to find the No. 1 cylinder compression top dead center set position ***(1)****.*



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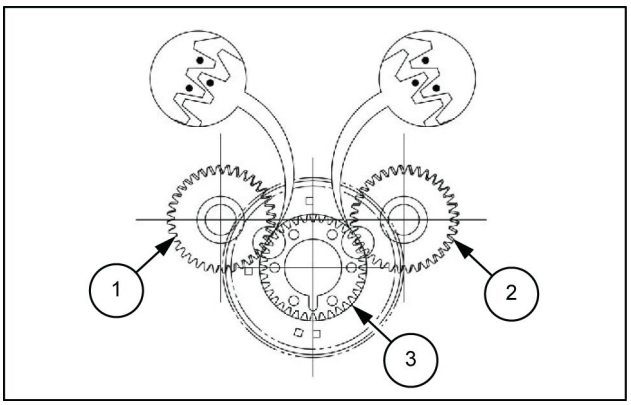
Camshaft installation

1. Align the camshaft gear with the alignment mark.
   - As indicated in the diagram, align the alignment marks of the inlet camshaft gear **(2)** and the exhaust camshaft gear **(1)**, as well as the alignment mark of idle gear D **(3)**.
2. Install the camshaft to the cylinder head.



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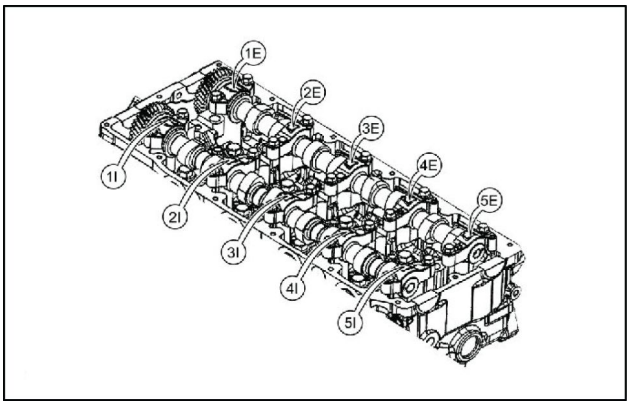
3. Install the camshaft bearing cap to the cylinder head.
   - Apply engine oil to the journal section of the cylinder head.
   - Face the bearing cap front mark to the engine front side, and assemble in numbered order to the cylinder head.



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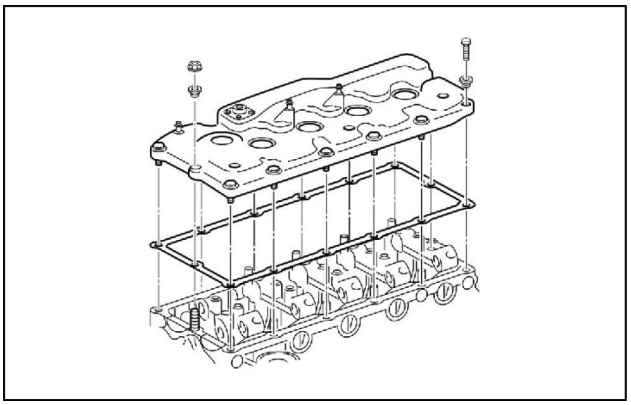
Cylinder head cover removal

1. Remove the cylinder head cover from the cylinder head.

NOTICE: *Do not damage the oil seal lip section with the injector connector.*

NOTE: *Move the head cover to the left side of the engine and lift it up to remove.*



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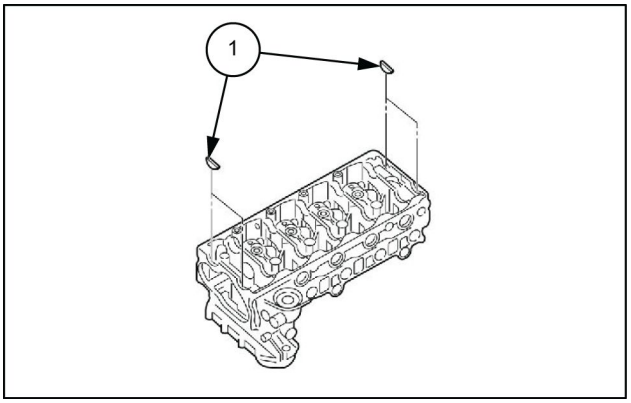
Cam end gasket removal

1. Remove the cam end gasket **(1)** from the cylinder head.

NOTE: *Thoroughly remove the liquid gasket remaining on the cylinder head.*



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Oil seal removal

1. Remove the oil seal from the cylinder head cover.

NOTE: *When removing the oil seal from the cylinder head cover, remove it from under the cylinder head cover.*

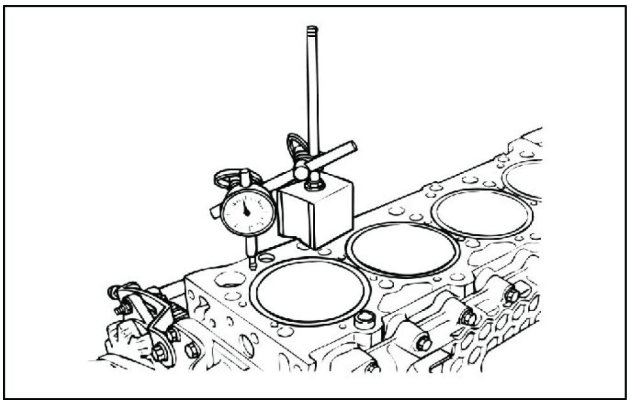
Cylinder head - Install

Cylinder head gasket preparation

1. Select the cylinder head gasket.
   - Measure the piston head protrusion to select the cylinder head gasket grade.
   - Remove scale deposits on the top surface of the cylinder block and carbon buildup on the piston head.
2. Use a dial gauge to measure the piston.
   - Measure the piston head protrusion.

NOTICE: *Make all the measuring points as close to the cylinder block as possible.*
The difference of the protrusions between the pistons must be the standard value or below.
If the piston protrusion is outside the standard range, perform disassembly and assembly.

Specified value: **0.05 mm** (**0.0020 in**) or less



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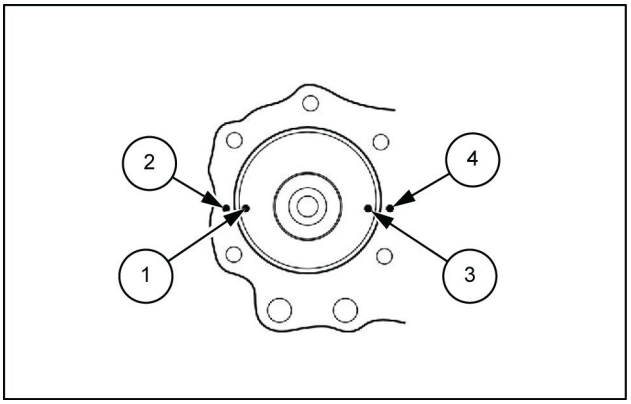
1. Measurement location
2. Measurement location
3. Measurement location
4. Measurement location



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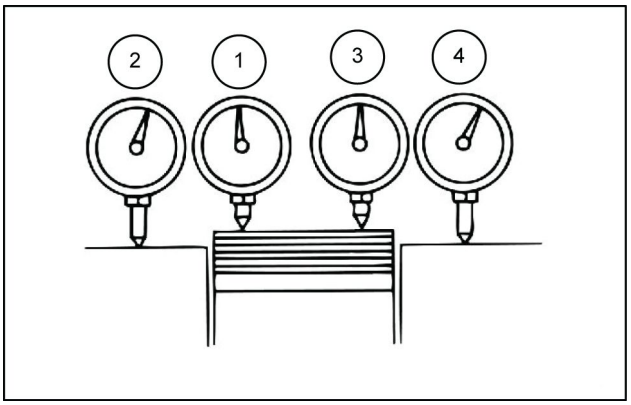
1. Measurement location
2. Measurement location
3. Measurement location
4. Measurement location



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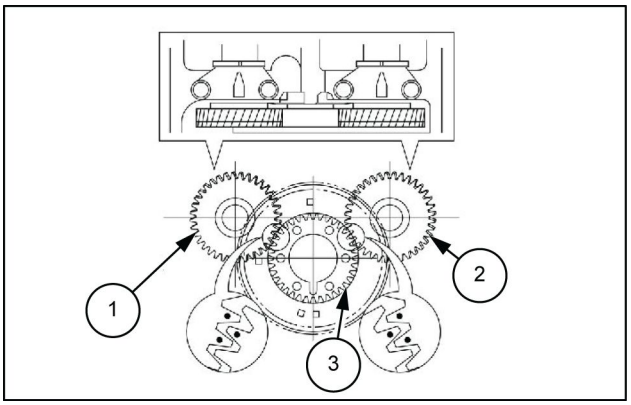
- After rotating the crankshaft 720˚, the marks on the collared end of the crankshaft and that of the bearing cap should align.

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

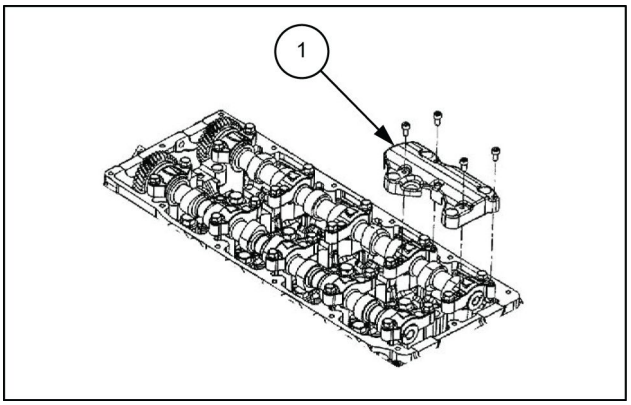


LPIL12CX00646AB 11

Baffle plate installation

1. Install the baffle plate **(1)** to the cylinder head.

   Tightening torque: **10 N·m** (**7 lb ft**)

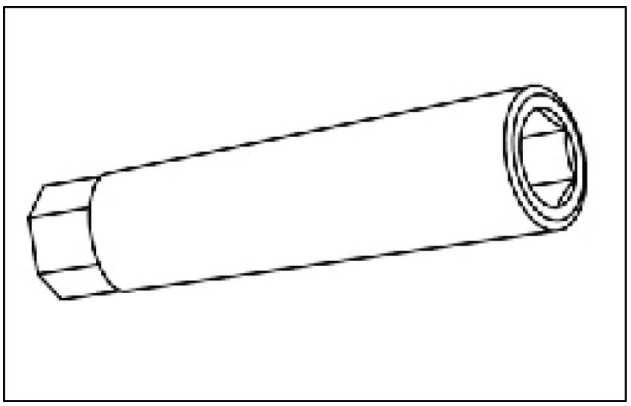


LPIL12CX00651AB 12

Rocker arm adjustment

1. Loosen the adjust screw using special tool.

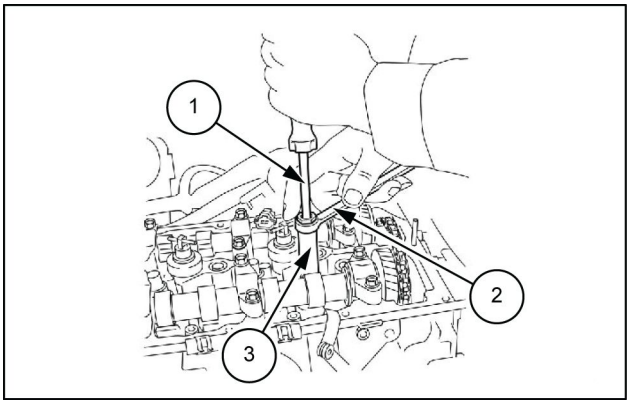
   Special tool: Valve clearance adjust nut wrench (Refer to **Crankshaft - Special tools (10.103)**)



LPIL12CX00647AA 13

- Use the adjust nut wrench **(3)** to loosen each adjust screw of the rocker arm.

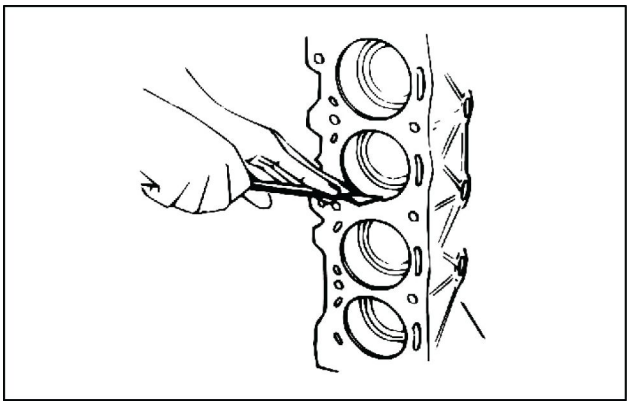
1. Driver
2. Ring spanner



LPIL12CX00648AB 14

3. Clean the cylinder liner using a scraper.
   - Remove carbon from the top of the cylinder bore using a scraper.
4. Remove the piston from the cylinder block.
   - Pull out the piston and connecting rod to the cylinder head side.

NOTICE: *Be careful not to damage the oil jet and cylinder block when pushing out the connecting rod.*



LPIL12CX00767AA 65

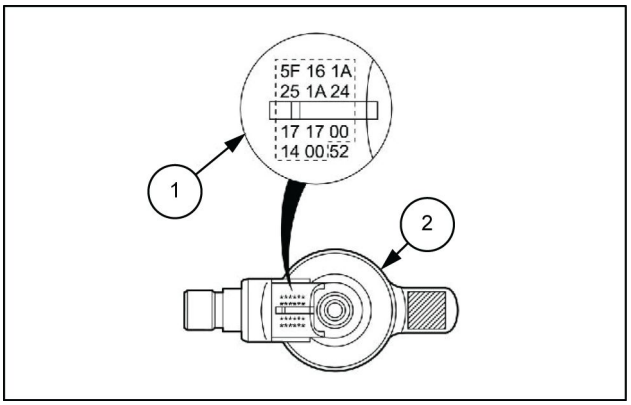
Connecting rod bearing removal

1. Remove the connecting rod bearing from the connecting rod.

NOTE: *When reusing bearings, sort them in the order of cylinders so that they do not get mixed up with bearings from other cylinders.*

4. Temporarily tighten the injector **(1)** to the cylinder head.
   - Install and temporarily tighten the injector **(1)**, injector clamp, and clamp bolt to the cylinder head.
   - When installing the injector **(1)** to the cylinder head, confirm that the injector gasket is installed to the injector **(1)**.

NOTICE: *When replacing the injector, record the injector ID code **(2)** of the new injector.*
Record the 24 letters on the injector ID plate.



LPIL12CX00655AB 72

Injection pipe installation

NOTICE: *When high-pressure lines in the fuel system are removed, always replace them with new lines.*
Reusing them causes damaged seal surfaces and fuel leaks.

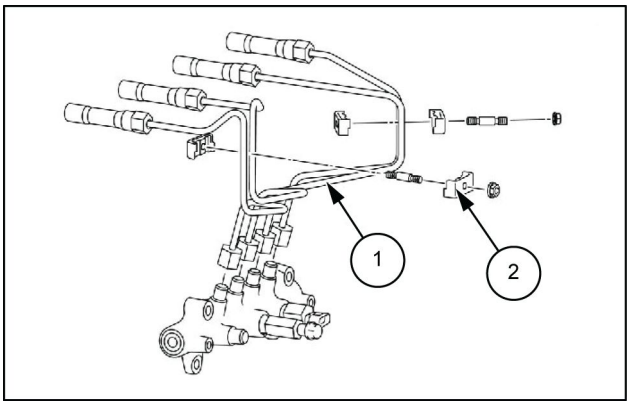
1. Temporarily tighten the injection pipe **(1)** to the injector and common rail assembly.
   - Apply engine oil to the threaded portion of the sleeve nut on the injector side of the injection pipe **(1)** and the O-ring of the injector.
   - When installing, do not damage the injector sleeve gasket.
   - Using an open-end wrench, lightly tighten the sleeve nut on the common rail side until it is firmly attached.
   - 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.
   - Tighten the injector clamp **(2)** bolt to the specified torque.

     Tightening torque: **26 N·m** (**19 lb ft**)
3. Securely tighten the injection pipe **(1)** to the injector.
   - Tighten the sleeve nut on the injector side of the injection pipe **(1)** to the specified torque.

     Tightening torque: **30 N·m** (**22 lb ft**)
4. Securely tighten the injection pipe **(1)** to the common rail assembly.
   - Tighten the sleeve nut on the common rail side of the injection pipe **(1)** to the specified torque.

     Tightening torque: **25 N·m** (**18 lb ft**)

     Tightening torque: **7.8 N·m** (**5.753 lb ft**) clamp nut



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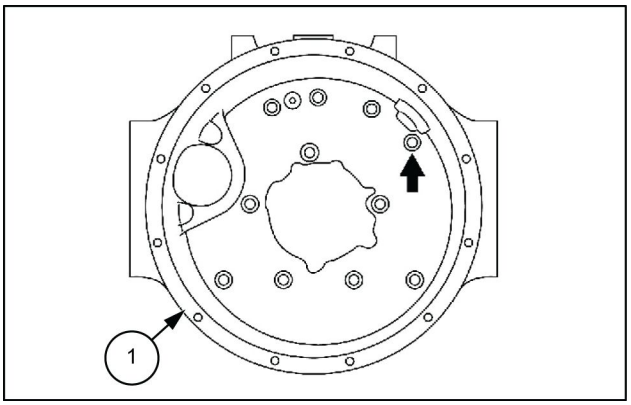
Flywheel housing removal

1. Remove the flywheel housing **(1)** from the crankcase.
   - Loosen the bolt indicated with arrows using a tool while holding down the nut on the opposite side.



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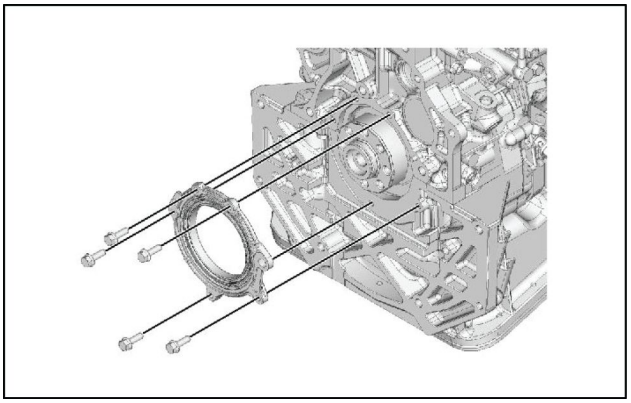
Oil seal retainer removal

1. Remove the oil seal retainer from the cylinder block and crankcase.
   - Remove the retainer with the oil seal on.



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7. Install the bearing cap on the cylinder block.

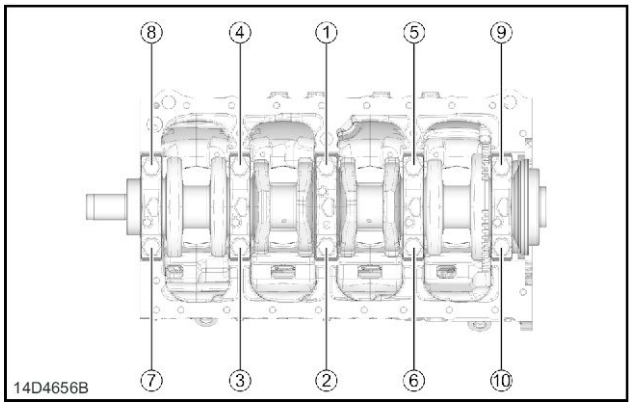
   Tightening torque: **166 N·m** (**122.44 lb ft**)

NOTE: *After temporarily tightening the bolts, tighten to the specified torque in the order shown in the diagram.*

NOTICE: *Do not rotate the crankshaft after the bolts are tightened.*

8. Remove the bearing cap from the cylinder block.

NOTE: *Loosen the bolts and gently take out the bearing cap.*



14D4656B 3

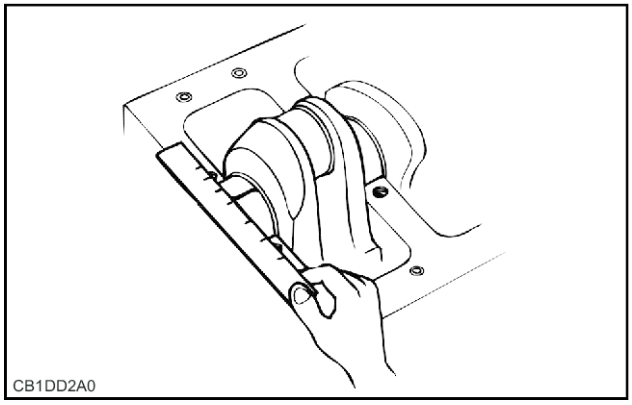
9. Use a plastigauge to measure the oil clearance.

   Standard value: **0.032 - 0.077 mm** (**0.0013 - 0.0030 in**)

   Limit value: **0.11 mm** (**0.0043 in**)

NOTE: *Measure the widest part of the plastigauge that was crushed when tightening the bearing cap.*
Determine the oil clearance at the journal section.

NOTE: *If the oil clearance exceeds the limit value, replace all the main bearing or crankshaft as a set.*
Remove the plastigauge from the bearing and crankshaft.



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Crankshaft inspection

1. Inspect the crankshaft.

NOTE: *Inspect the crank journal and crank pin surfaces for wear and damage.*
Inspect the oil seal installation surface for excessive wear and damage.
Inspect the oil port for clogging.

Crankshaft measurament

2. Place the crankshaft on the V block.

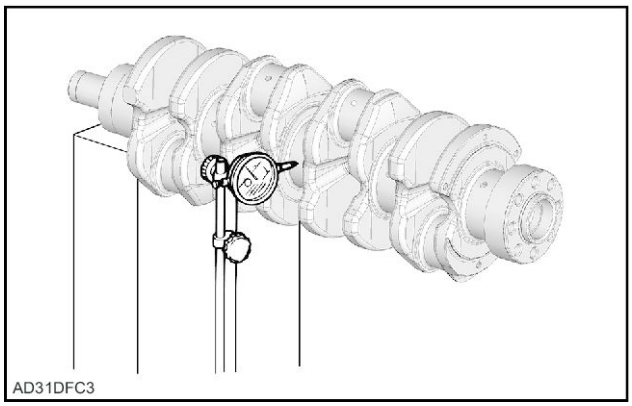
NOTE: *Carefully set the crankshaft.*

3. Use a dial gauge to measure the runout.

   Standard value: **0.05 mm** (**0.0020 in**) max

NOTE: *Slowly rotate the crankshaft and measure the run-out.*

NOTE: *Measure the outer diameter of the journal and pin sections and calculate the difference between the maximum and minimum lengths.*
Measure at 4 locations each for journal section and pin section.



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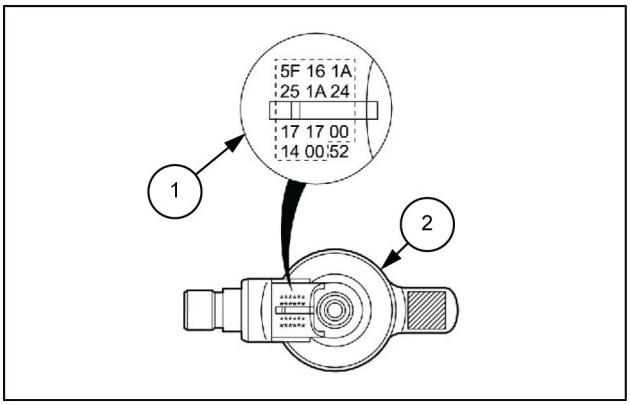
4. Temporarily tighten the injector **(1)** to the cylinder head.
   - Install and temporarily tighten the injector **(1)**, injector clamp, and clamp bolt to the cylinder head.
   - When installing the injector **(1)** to the cylinder head, confirm that the injector gasket is installed to the injector **(1)**.

NOTICE: *When replacing the injector, record the injector ID code **(2)** of the new injector.*
Record the 24 letters on the injector ID plate.



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Injection pipe installation

NOTICE: *When high-pressure lines in the fuel system are removed, always replace them with new lines.*
Reusing them causes damaged seal surfaces and fuel leaks.

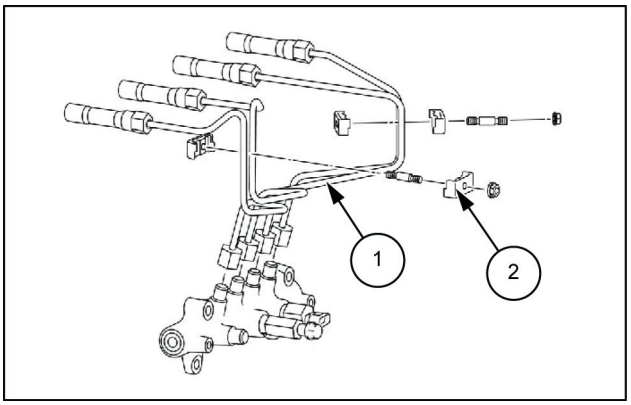
1. Temporarily tighten the injection pipe **(1)** to the injector and common rail assembly.
   - Apply engine oil to the threaded portion of the sleeve nut on the injector side of the injection pipe **(1)** and the O-ring of the injector.
   - When installing, do not damage the injector sleeve gasket.
   - Using an open-end wrench, lightly tighten the sleeve nut on the common rail side until it is firmly attached.
   - 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.
   - Tighten the injector clamp **(2)** bolt to the specified torque.

     Tightening torque: **26 N·m** (**19 lb ft**)
3. Securely tighten the injection pipe **(1)** to the injector.
   - Tighten the sleeve nut on the injector side of the injection pipe **(1)** to the specified torque.

     Tightening torque: **30 N·m** (**22 lb ft**)
4. Securely tighten the injection pipe **(1)** to the common rail assembly.
   - Tighten the sleeve nut on the common rail side of the injection pipe **(1)** to the specified torque.

     Tightening torque: **25 N·m** (**18 lb ft**)

     Tightening torque: **7.8 N·m** (**5.753 lb ft**) clamp nut



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Fuel filters - Disassemble

Fuel safety information

CAUTION:

- Oil leaks can cause a fire. Therefore, after the work and inspection, wipe off any spilled fuel and check for any leaks after starting the engine.

Disassembly of fuel filter

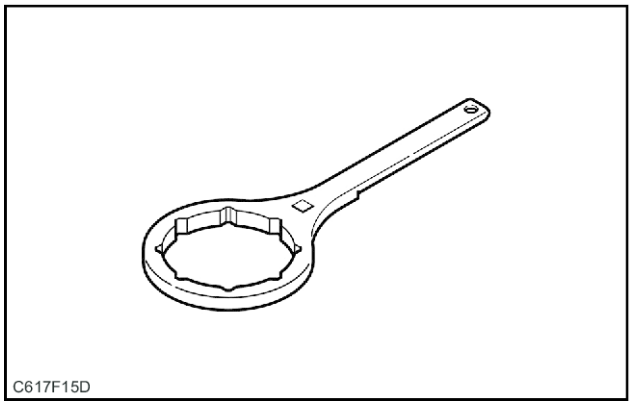
NOTICE: *Be careful not to let the dirt get in the filter during work.*

1. Prepare the drain pan.
2. Drain the fuel from the case.

NOTE: *Loosen the drain plug.*

3. Use the special tool to remove the case from the fuel filter body.

   Special tool: Filter wrench (Refer to **Crankshaft - Special tools (10.103)**)



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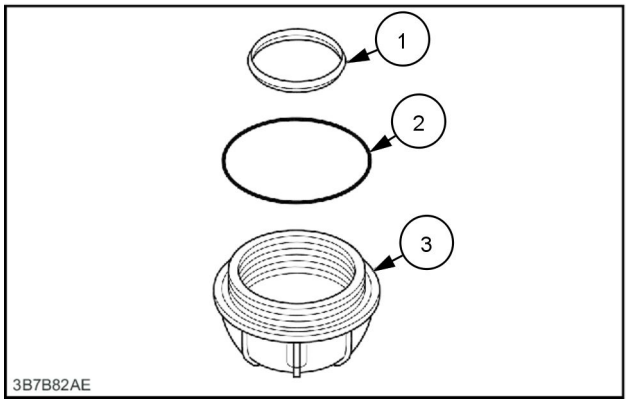
1. Level ring
2. O-ring
3. Case



3B7B82AE 2

Common rail - Remove

Injector safety information

NOTICE: *The fuel system holes and gaps that form the fuel path, including inside the injectors, are manufactured to high precision.*
After removing parts, always place caps or covers to prevent entry of foreign matter as it could cause a malfunction.

Battery ground cable disconnect

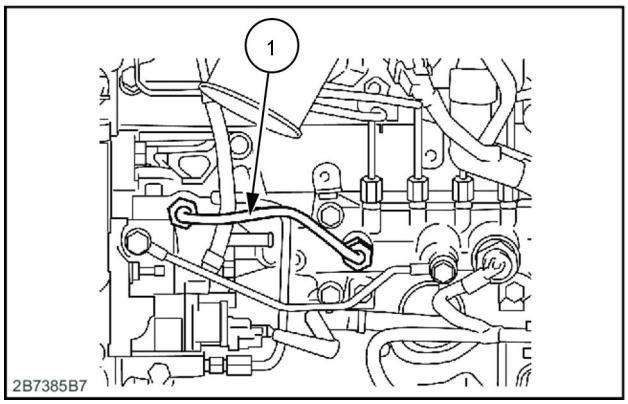
1. Disconnect the battery ground cable from the battery.

NOTICE: *Do not disconnect the battery cable for* ***1 min*** *after turning OFF the ignition switch.*

Fuel pipe removal

2. Remove the fuel pipe **(1)** from the fuel supply pump and common rail assembly.

NOTICE: *The fuel pipe cannot be reused.*



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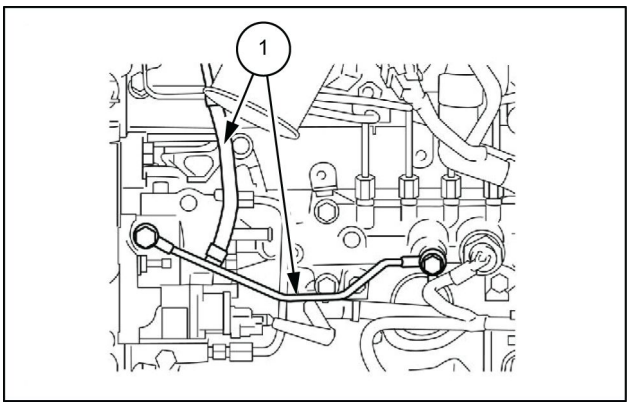
Leak-off pipe removal

1. Remove the fuel leak-off pipe **(1)** from the fuel supply pump and common rail assembly.

NOTE: *Do not reuse the gasket.*



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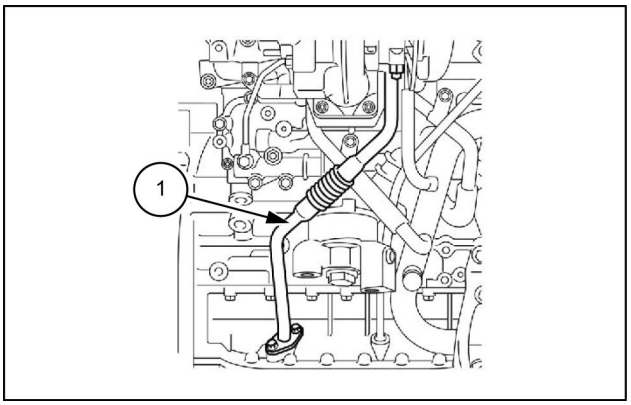
5. Disconnect the oil return pipe **(1)** from the turbocharger assembly.
6. Remove the oil return pipe **(1)** from the crankcase.



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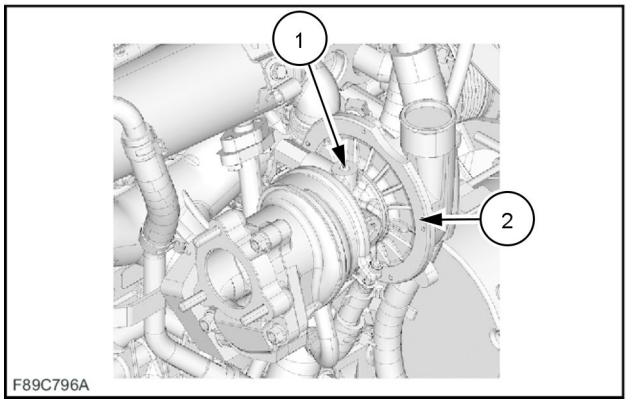
7. Remove the turbocharger assembly **(2)** from the exhaust manifold.

NOTE: *Do not reuse the gasket.*



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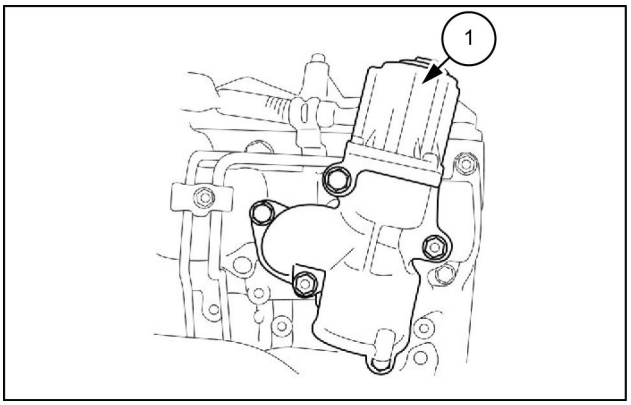
Exhaust Gas Recirculation (EGR) valve - Install

1. Install the EGR valve **(1)** to the inlet manifold.

   Tightening torque: **27 N·m** (**20 lb ft**)

2. Connect the harness connector to the EGR valve **(1)**.



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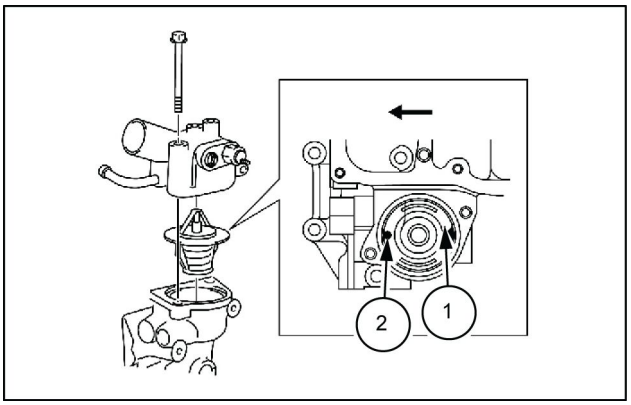
Battery ground cable connect

1. Connect the battery ground cable to the battery.

Coolant thermostat - Install

1. Install the thermostat **(1)** to the cylinder head assembly.

NOTE: *Install the jiggle valve* ***(2)*** *to face the engine front side.*



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Water outlet pipe installation

1. Install the water outlet pipe to the cylinder head assembly.

   Tightening torque: **25 N·m** (**18.44 lb ft**)

2. Connect the radiator upper hose to the water outlet pipe.

Coolant filling

1. Replenish the radiator assembly with coolant.

Battery ground cable connect

1. Connect the battery ground cable to the battery.

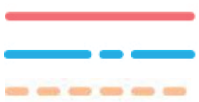
Coolant filling

1. Replenish the radiator assembly with coolant.

Battery ground cable connect

1. Connect the battery ground cable to the battery.

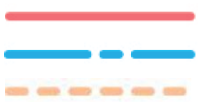
1 Swing motor
2 Center joint
3 Control valve



Pressure line
Tank line
Pilot pressure line

Pilot tank line
Electric line

1. Cushion valve
2. Boom (up)
3. Boom (down)
4. Boom cylinder
5. Load holding valve check
6. Bleed-off
7. Check A
8. Back pressure check valve
9. Remote control valve (boom, bucket)
10. Lever lock
11. Pressure boost relief
12. 4 stack solenoid valve
13. Control valve
14. Upper pilot pressure sensor
15. Travel pilot pressure sensor
16. Console lever lock switch
17. Monitor display
18. Computer A
19. P1 pressure sensor
20. P2 pressure sensor
21. Hydraulic pump
22. Check valve
23. Oil cooler



Pressure line
Tank line
Pilot pressure line

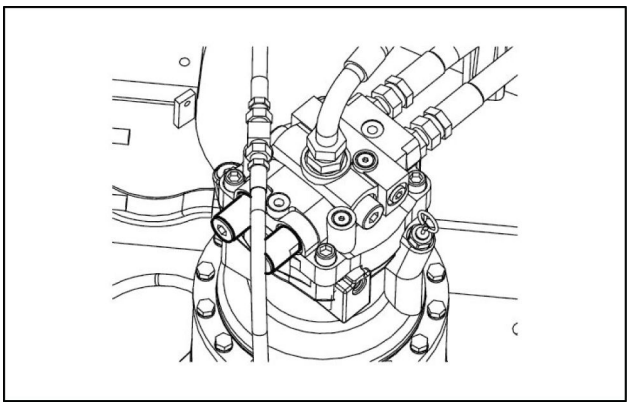
Pilot tank line
Electric line

1. Travel motor
2. Travel remote control valve
3. Travel high speed
4. Console lever lock switch
5. 4 stack solenoid valve
6. Travel mode select switch
7. Computer A
8. Control valve
9. Travel pilot pressure sensor
10. Hydraulic pump
11. Horsepower control proportional valve
12. Oil cooler
13. Check valve

a. High flow

Measuring port	P1 port
Measurement pressure	**27.9 MPa** (**4047 psi**)

8. Using the swing pressure measurement procedure for reference, lock the swing, and check the swing pressure.
   Check the currently set pressure.
   The number of shims for adjustment is determined by the difference between the current pressure and the set pressure.
9. Remove the swing motor port relief assembly from the motor main unit.
   - When removing both sides at the same time, mark the assemblies so that they can be re-assembled on the correct sides.
     Fasten the port relief assembly with a vise table, take-off the cap, then remove the piston, liner, spacer, poppet, shim, and spring.
10. Remove the poppet and spring and add (or remove) one or more shims between the spring and spacer. Find the number of shims in Step **[Invalid Reference]**. After adjusting the shims, install the poppet, spring, spacer, shims, piston, and liner in the sleeve.
    Fasten the sleeve on the vise table and install the cap.
    Cap tightening torque: **156.9 N·m** (**115.72 lb ft**).



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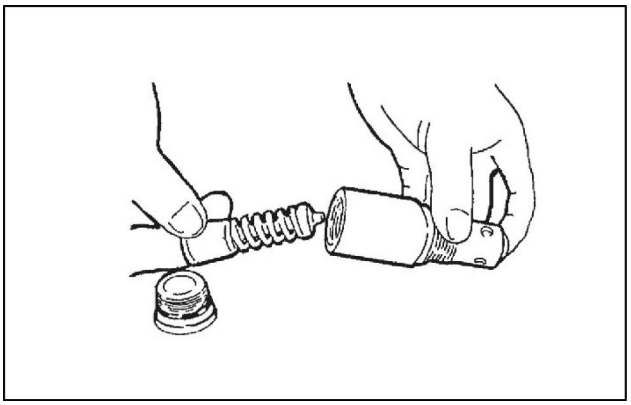

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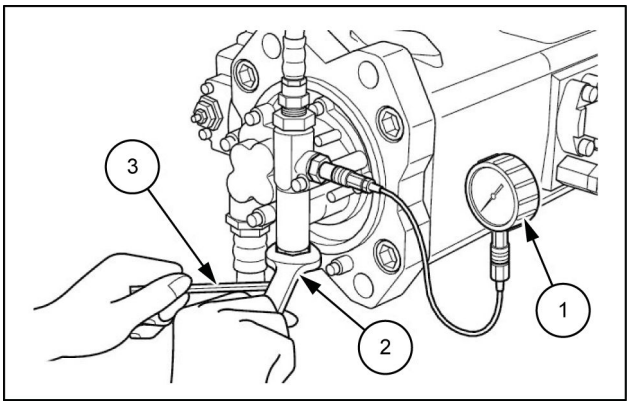
Pilot Pressure Adjustment

1. Install the pressure gauge **(1)**.
   While holding the plug with a wrench [**24 mm**] **(2)**, adjust with a hexagon wrench [**6 mm**] **(3)**.

Engine speed	**2000 RPM**
Lever operation	Neutral
Measuring port	P3
Set pressure	Max. **3.92 MPa** (**568.6 psi**)



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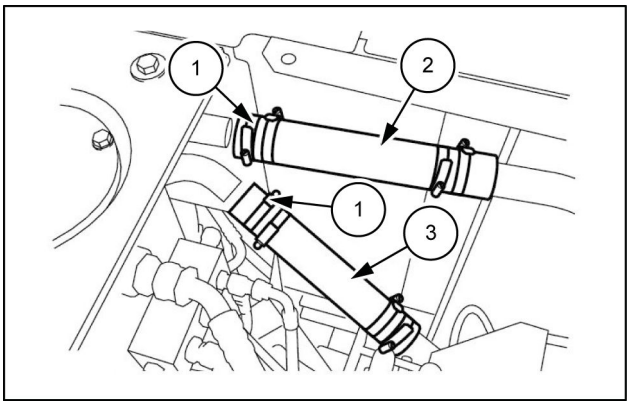
9. Use a wrench [**7 mm**] to loosen the hose bands **(1)**, and then remove the drain hoses **(2)** and **(3)**.
   - Use caps to cover the lines to prevent any entry of water, dust or dirt.



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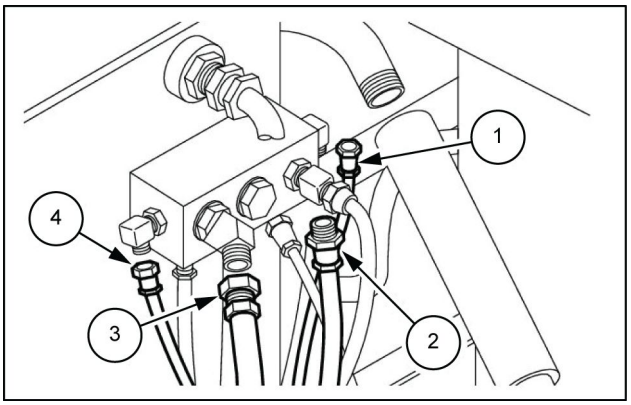
10. Use wrenches [**19 mm**, **22 mm**, **27 mm**] to remove the drain hoses.
    - Mark the hydraulic oil tank and hoses so that the connectors match at the time of assembly.
    - Attach caps or plugs to the hydraulic oil tank and hoses to prevent any entry of water, dust or dirt.
    - Clean the hydraulic oil tank and hoses by spraying them with a parts cleaner to prevent scratches and prevent dirt from accumulating on the connectors.

    1. Drain hose [use **22 mm** wrench]
    2. Drain hose [use **22 mm** wrench]
    3. Drain hose [use **27 mm** wrench]
    4. Drain hose [use **19 mm** wrench]
    5. Drain hose [use **22 mm** wrench]
    6. Drain hose [use **19 mm** wrench]
    7. Drain hose [use **19 mm** wrench]
    8. Drain hose [use **19 mm** wrench]
    9. Drain hose [use **27 mm** wrench]



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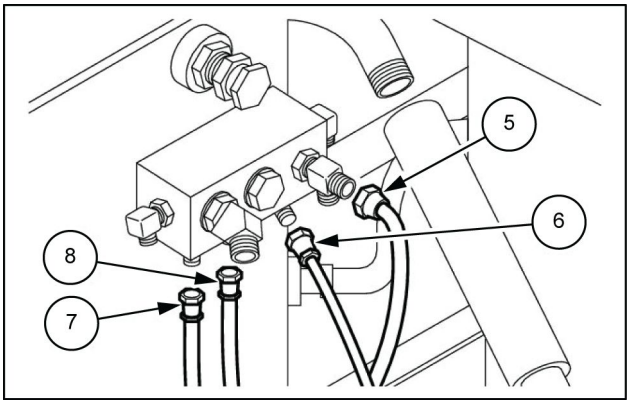

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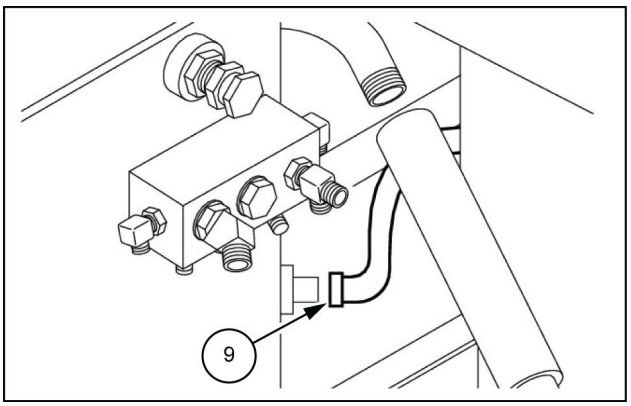

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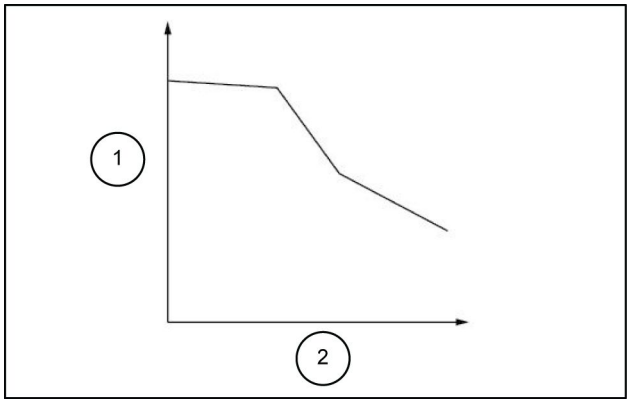
Low tilting (low flow) command priority mechanism

1. Discharge volume Q
2. Discharge pressure (1.33P1 + 0.67P2)



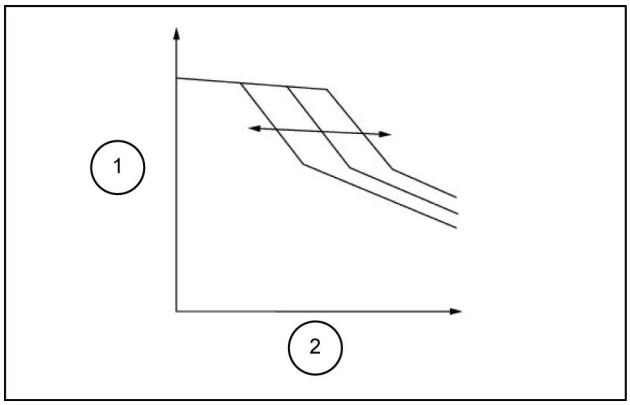
SMIL13CEX0977AA 3

The flow control and the horsepower control tilting command is transmitted to the feedback lever and spool via the large openings [C and F sections] of lever 1 and lever 2, but since the C and F sections have a structure in which a pin D4 projects into a large hole D8, the pin **(897)** only contacts the lever that makes the tilting smaller and the D8 hole for the lever on the side that has the larger tilting command state is free rather than being in contact with the pin **(897)**.

This type of mechanical selection method gives priority to flow control and horsepower control commands with low tilting.

Power shift control (decreased horsepower control)

1. Discharge volume Q
2. Discharge pressure (P1 + P2)

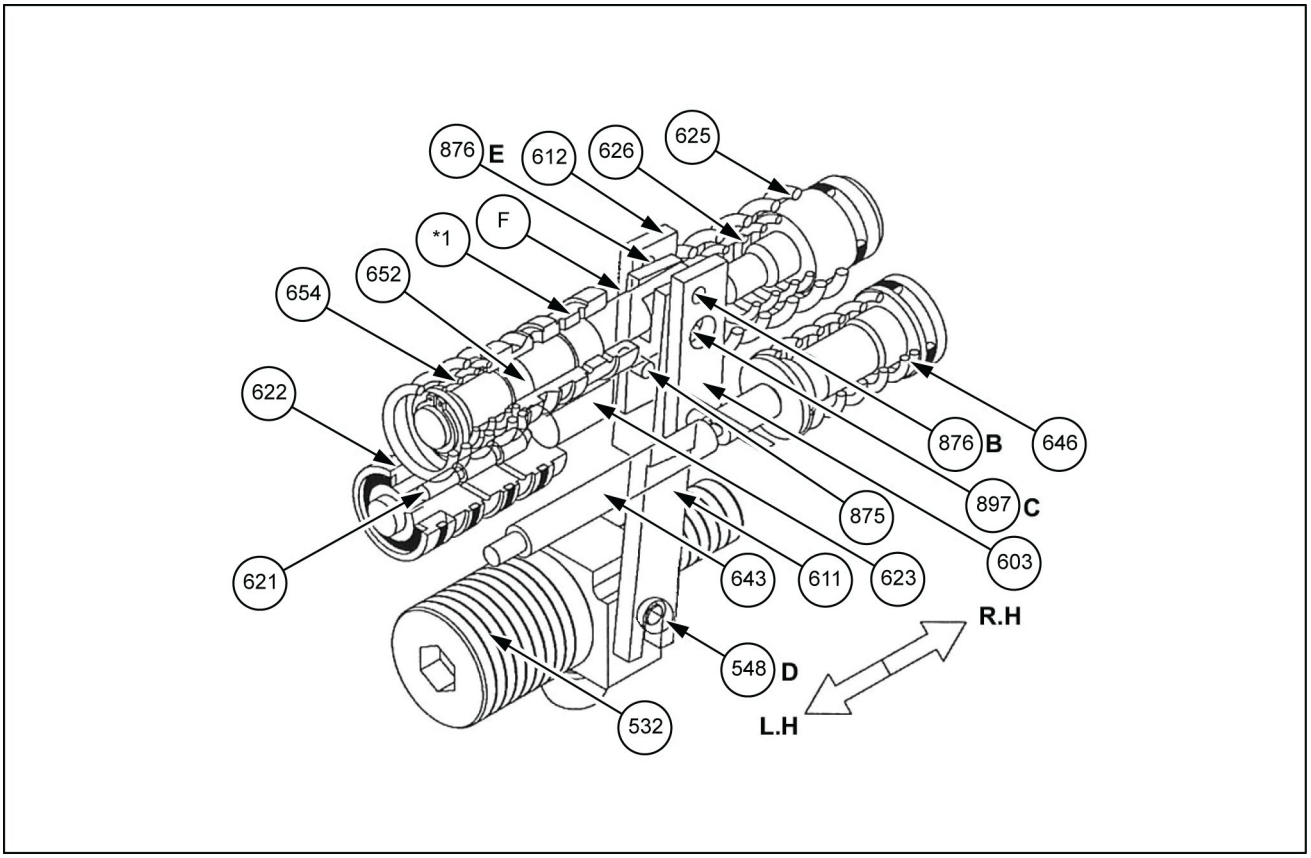


LPIL12CX02774AB 4

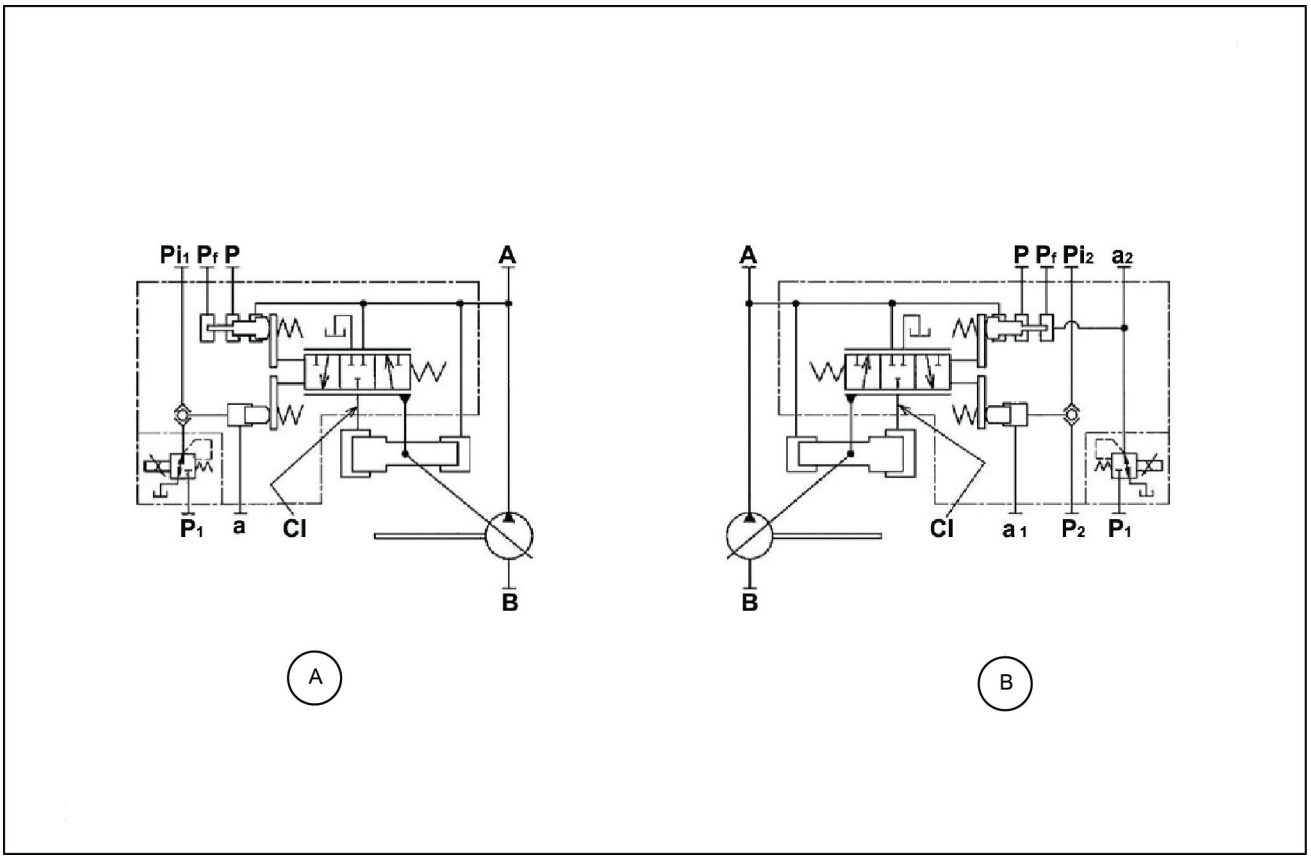
Use the power shift pressure Pf to arbitrarily control the pump set horsepower. (See the Discharge pressure (P1 + P2))

When the power shift pressure Pf increases, the compensation rod **(623)** is moved to the right via the pin **(898)** and the compensation piston **(621)**, so the pump tilting angle and the horsepower setting are reduced in the same way as was explained with the overload prevention operation of horsepower control.

By contrast, as the power shift pressure Pf decreases, the horsepower setting increases.



LPIL12CX02775FB 1

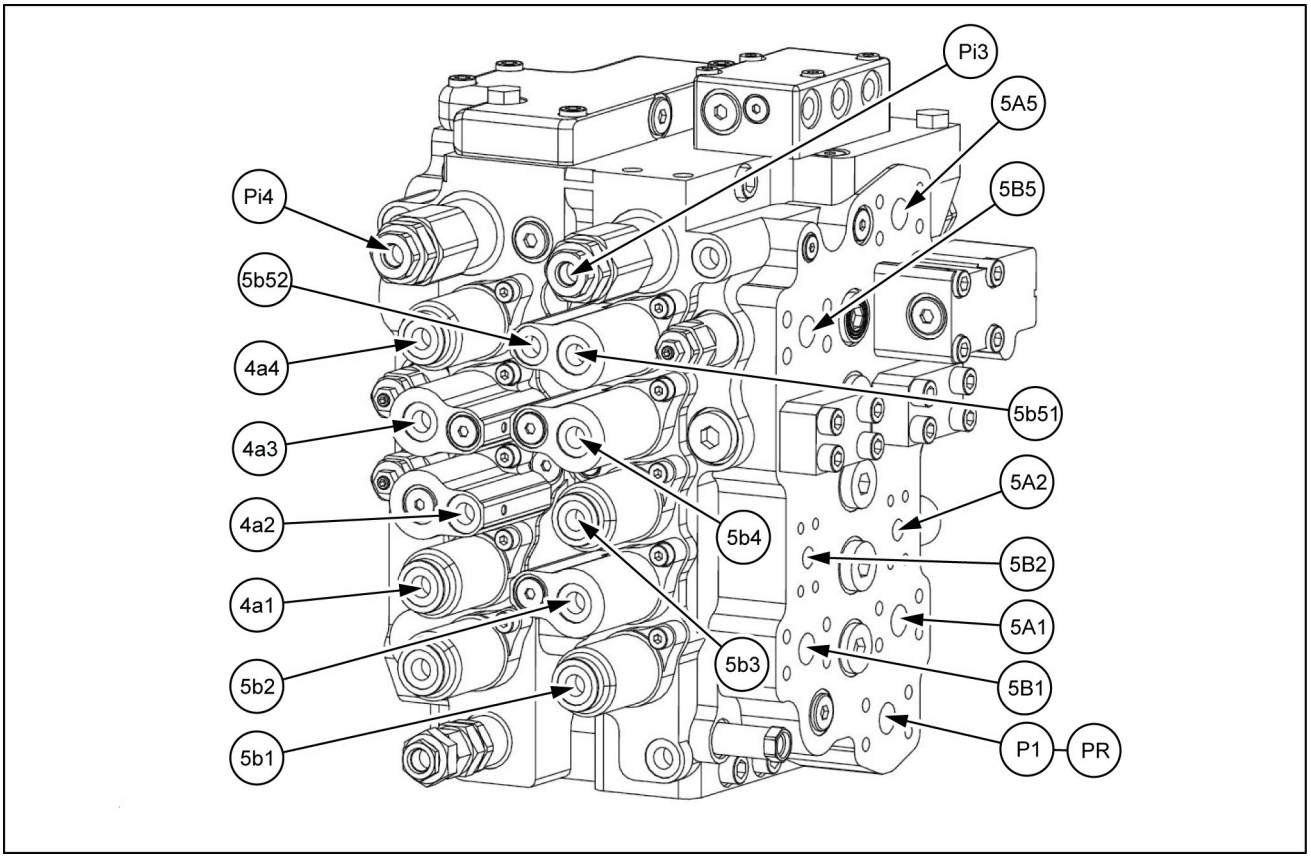


LPIL12CX02080FB 2

Regulator operation explanation diagram

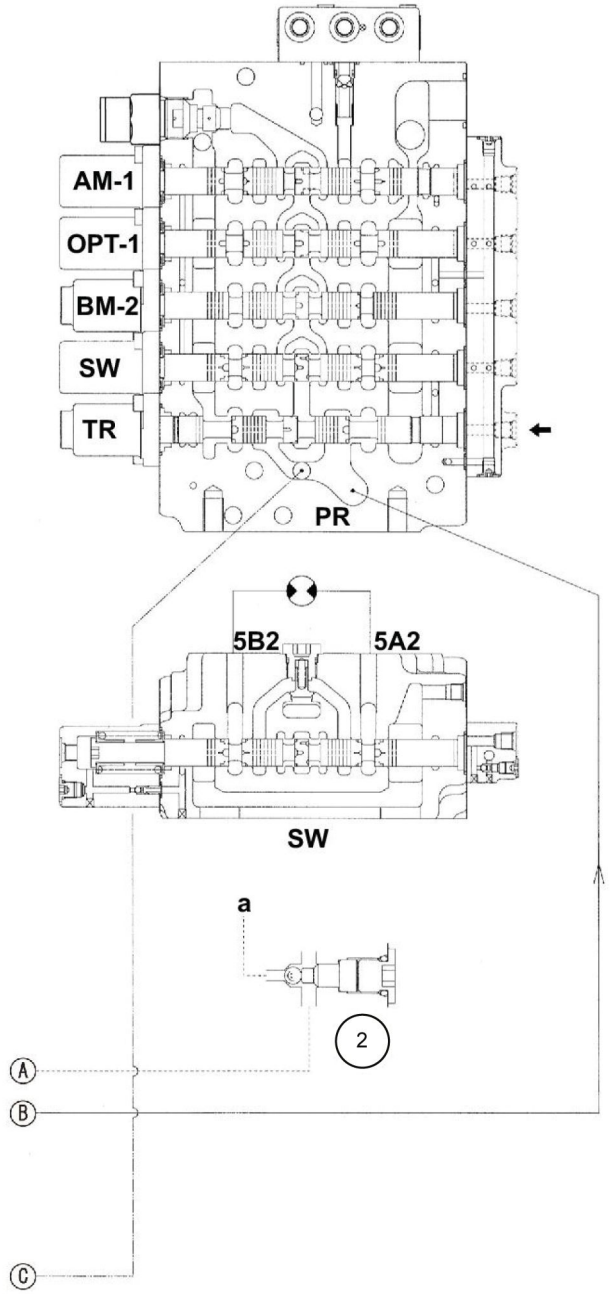
A. Front side regulator

B. Rear side regulator



LPIL12CX01285FB 2

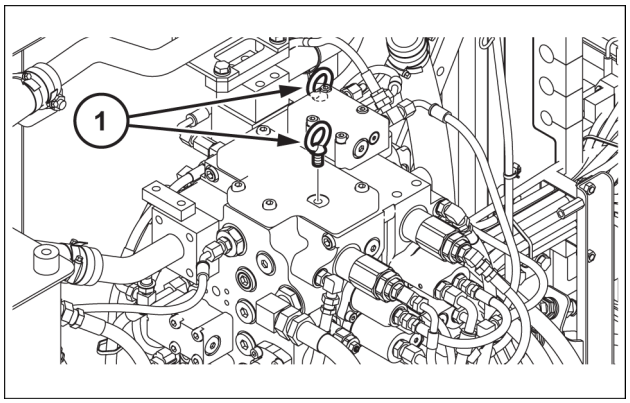
Port	Port size	Port name
5b52	G1/4	Arm 1-in pilot line
5b51	G1/4	Arm 1-in pilot line
4a4	G1/4	Arm 2-in pilot line
4a3	G1/4	Bucket-close pilot line
4a2	G1/4	Boom-down pilot line
4a1	G1/4	Right travel forward pilot line
5b4	G1/4	Option pilot line
5b3	G1/4	Boom 2-up pilot line
5b2	G1/4	Right swing pilot line
5b1	G1/4	Left travel backward pilot line
Pi4	G1/4	Negative control power save signal
Pi3	G1/4	Negative control power save signal
5A5	*3/4 SAE standard pressure	Arm-out line
5B5	*3/4 SAE standard pressure	Arm-in line
5A2	*1/2 SAE standard pressure	Swing left line
5B2	*1/2 SAE standard pressure	Swing right line
5A1	*3/4 SAE standard pressure	Left travel forward line
5B1	*3/4 SAE standard pressure	Left travel backward line
P1 (PR)	*3/4 SAE high pressure	Pressure line
The port size with * indicates the flange size.		



LPIL12CX02209HB 4

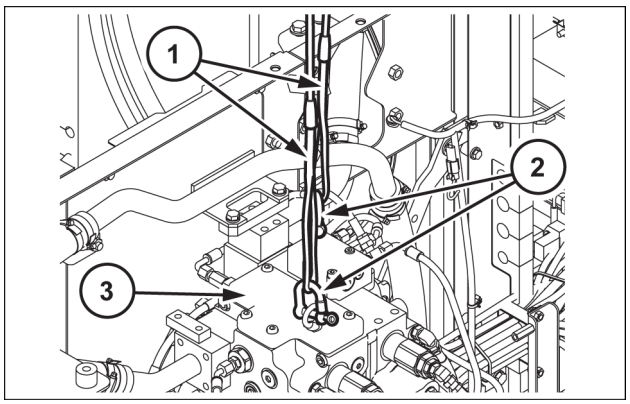
1. Parallel path
2. Ball check
3. Straight travel signal switchover spool
4. Straight travel switchover valve

13. Attach the 2 eyebolts **(1)** (M12) to the control valve.



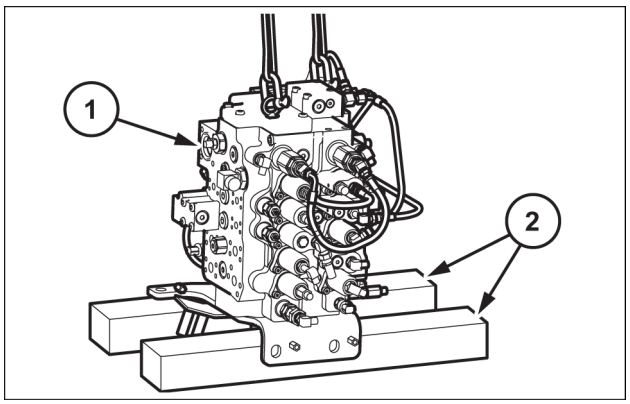
SMIL15CEX4402AB 12

14. Attach shackles **(1)** to the eyebolts, and lift the control valve **(3)** with a lifting equipment and wire ropes **(2)**.



SMIL15CEX4403AB 13

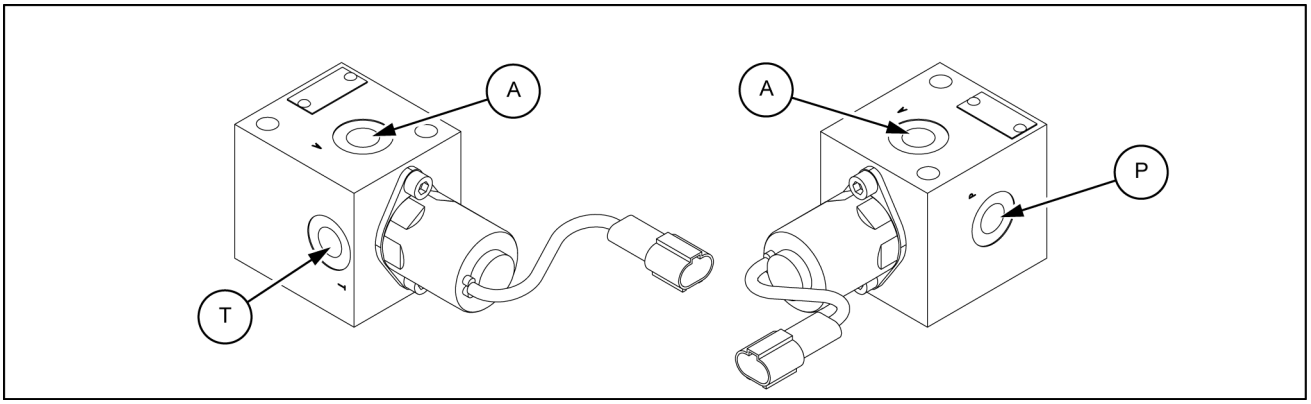
15. Settle the control valve **(1)** on a wood plank **(2)** or other block.



SMIL15CEX4404AB 14

Pressure-reducing valve - Overview

Reducing valve (single)

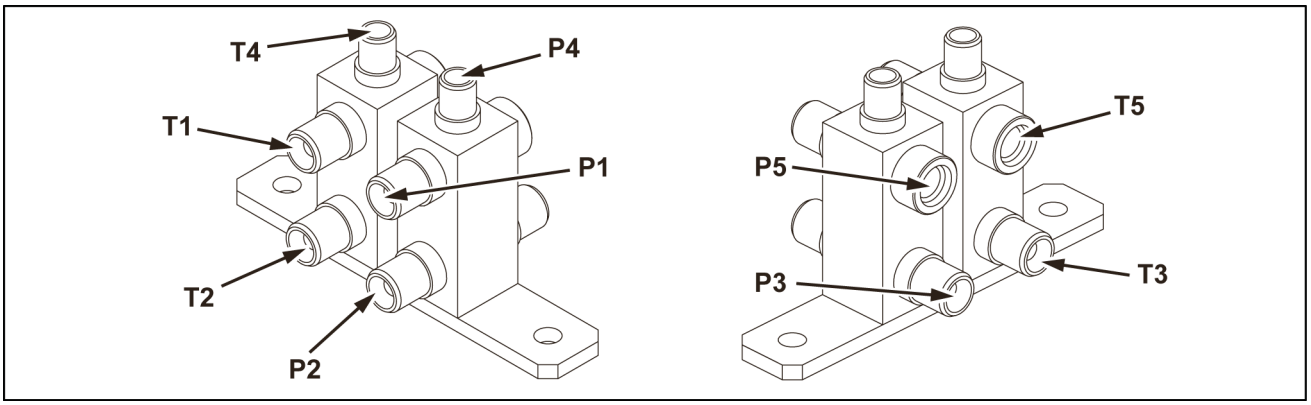


SMIL14CEX4797EB 1

Port	Port name	Port size
A	Boom (2)	**G1/4**
P	Pressure	**G1/4**
T	Return	**G1/4**

Drainage block - Overview

Manifold under cab



SMIL14CEX3580EA 1

Port	Port size	Port	Port size
P1	**G3/8**	T1	**G3/8**
P2	**G3/8**	T2	**G3/8**
P3	**G3/8**	T3	**G3/8**
P4	**G1/4**	T4	**G1/4**
P5	**G1/4**	T5	**G1/4**

Cushion valve - Assemble

This valve has a structure that forms small gaps.

It is precision processed and the parts are carefully selected and fit together, so do not disassemble it as much as possible.

If assembly and disassembly is unavoidable, pay attention to the following. (The product warranty may be invalidated.)

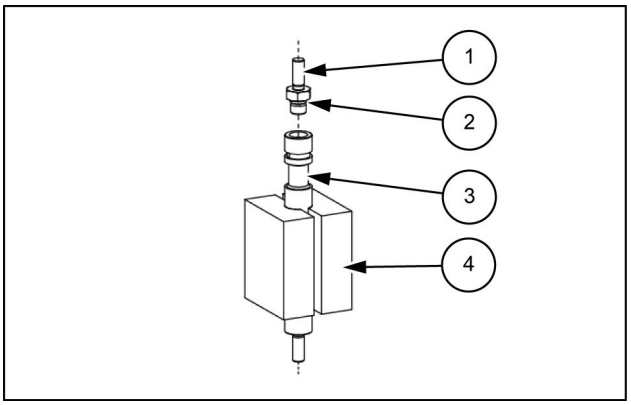
- Only assemble in a clean location with minimal dirt.
- Use only clean tools and cleaning oil and handle them with care.
- Clean the disassembled parts and prepared parts.
- Study the internal structure before starting the work and prepare the parts required by the disassembly objective and scope.

Reverse operation spool section

1. Assemble the cap screw **(1)** with O-ring **(2)** on the spool **(3)**.
   - Tightening torque: **9.8 - 14.7 N·m** (**7.23 - 10.84 lb ft**)

   ⚠ CAUTION:

   Use a piece of wood (jig) **(4)** to prevent scratches.

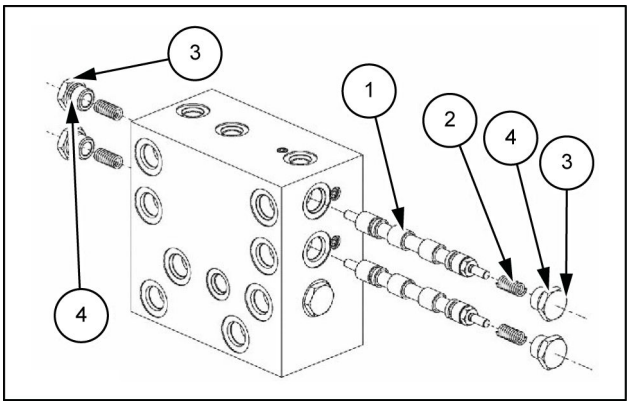


LPIL12CX01885AB 1

2. Insert the spool assemblies **(1)** assembled in Step **1** into the body.
   - Insert the springs **(2)** and assemble the plugs **(3)** with the O-rings **(4)** attached.
   - Tightening torque: **39.2 - 49.0 N·m** (**28.91 - 36.14 lb ft**)

   ⚠ CAUTION:

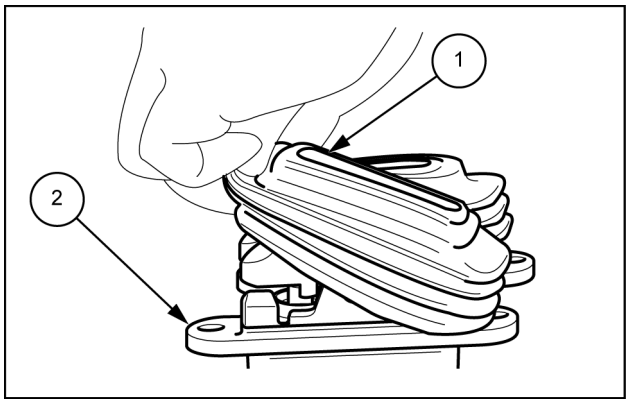
   The spool assemblies are symmetrical left/right, so the insertion direction does not matter.



LPIL12CX01888AB 2

Pedal control - Disassemble

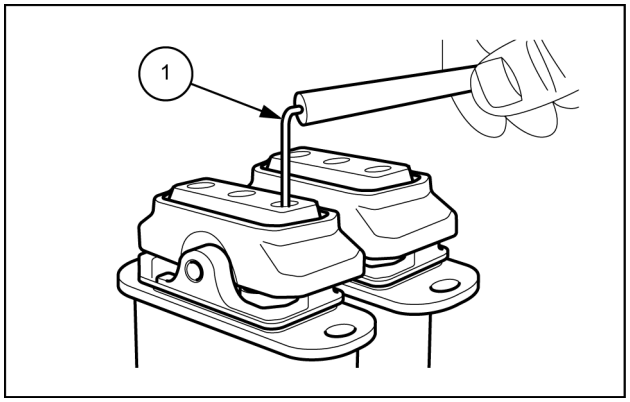
1. Use a shock plate to secure the remote control valve in a vise, and then remove the bellows **(1)** from the cover **(2)**.
   - Be careful not to tear the bellows.



SMIL14CEX1449AB 1

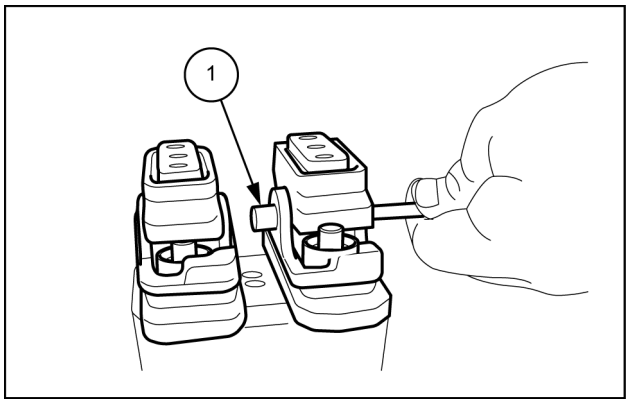
2. Use a hexagon wrench **(1)** on the hexagon socket head locking screws to loosen them.

   Be careful, as application of **LOCTITE® 241** makes the loosening torque high.



SMIL14CEX1450AB 2

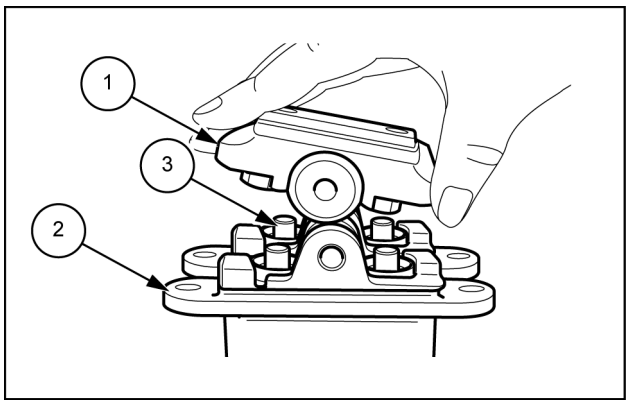
3. Place a round rod [D **8 mm** (**0.315 in**) or less] against one end of the cam shaft **(1)** and lightly strike it with a hammer to remove the shaft.



SMIL14CEX1451AB 3

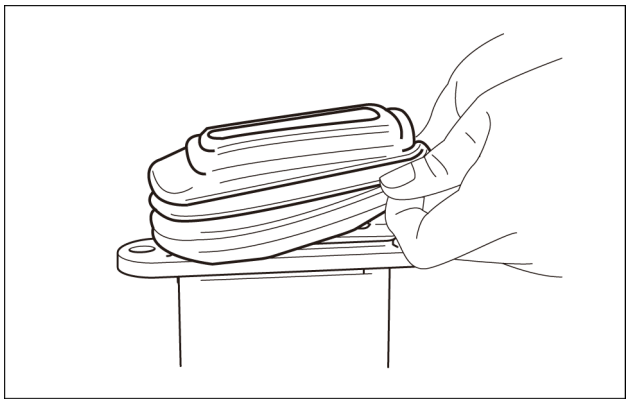
4. Remove the cams **(1)** as an assembly with the locking screws and lock nuts attached.

   Record the positions of the cams in relation to the covers **(2)**.
   - Be careful when removing, as the push rods **(3)** may fly off.



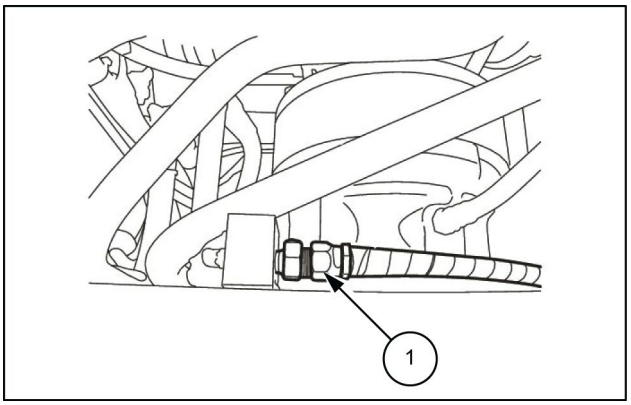
SMIL14CEX1452AB 4

Make sure that the bellows are properly mounted in the groove and not twisted, as this may reduce anti-dust and anti-moisture protection.



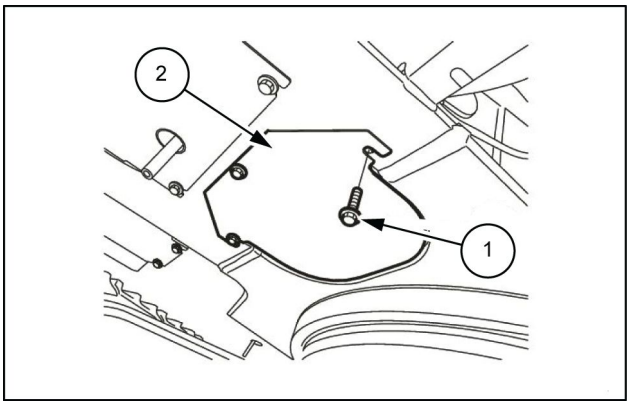
SMIL15CEX3786AB 13

5. Use a wrench [**19 mm**] to remove the grease hose **(1)** that feeds grease to the swing motor reduction gear bearing.



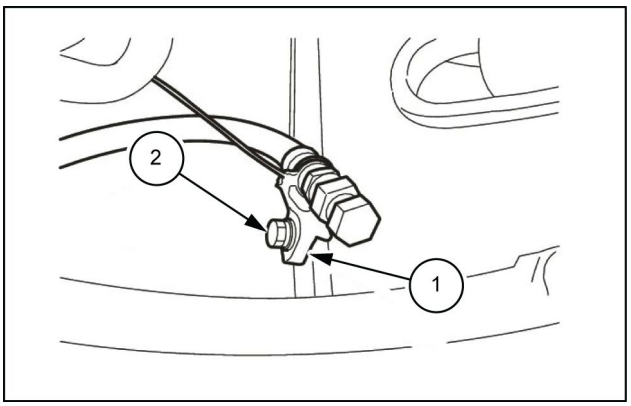
LPIL12CX01429AB 5

6. Use a wrench [**19 mm**] to remove the 3 bolts **(1)**, and then remove the under cover **(2)**.
   - Tightening torque for bolt installation: **63.7 - 73.5 N·m** (**46.983 - 54.211 lb ft**)



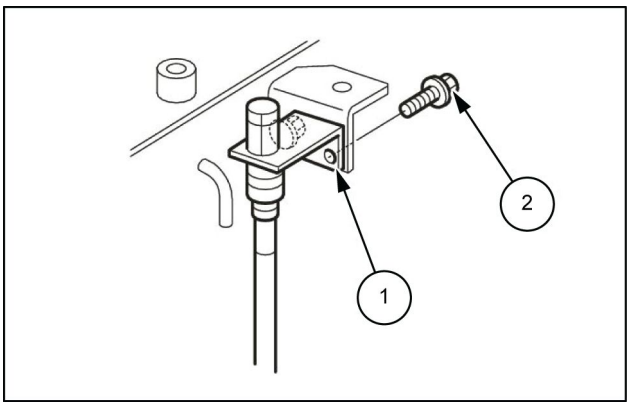
LPIL12CX01430AB 6

7. Use a wrench [**13 mm**] to remove the bolt **(2)** on the clamp **(1)** for the hose.



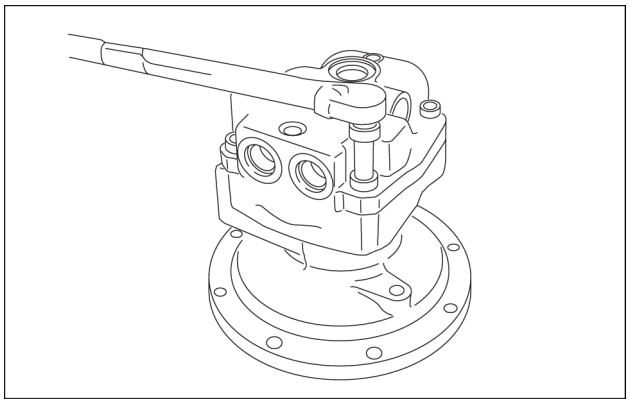
LPIL12CX01431AB 7

8. Use a wrench [**13 mm**] to remove the 2 bolts **(2)** from the bracket **(1)** for the feed port hose.



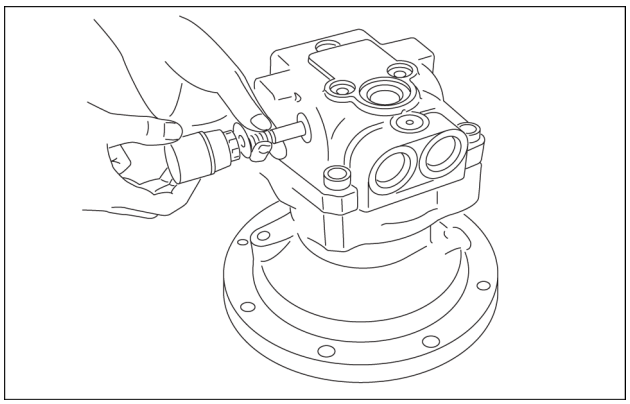
SMIL13CEX0045AB 8

21. Tighten the tightening bolts **(36)** [**12 mm** hexagon diameter] between the cover **(32)** and housing **(26)** to a tightening torque of **156.9 N·m** (**115.7 lb ft**)



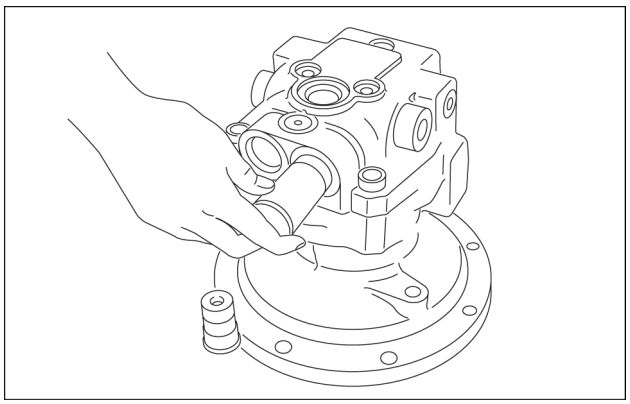
SMIL15CEX4802AA 21

22. Installation of make-up
Install the checks **(37)** and springs **(38)** on the cover **(32)** and tighten the caps **(39)** [**14 mm** hexagon diameter] to a tightening torque of **137.3 N·m** (**101.3 lb ft**).



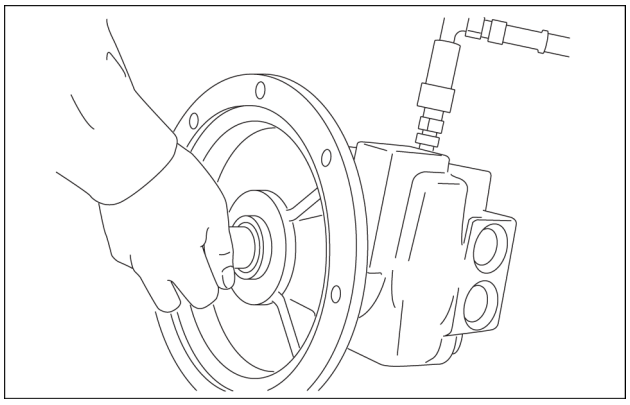
SMIL15CEX4803AA 22

23. Installation of relief assembly
Install the relief assemblies **(34)** [**14 mm** hexagon diameter] to the covers **(17)** tightened to a tightening torque of **78.5 N·m** (**57.9 lb ft**).
    - Be careful with the installation direction.

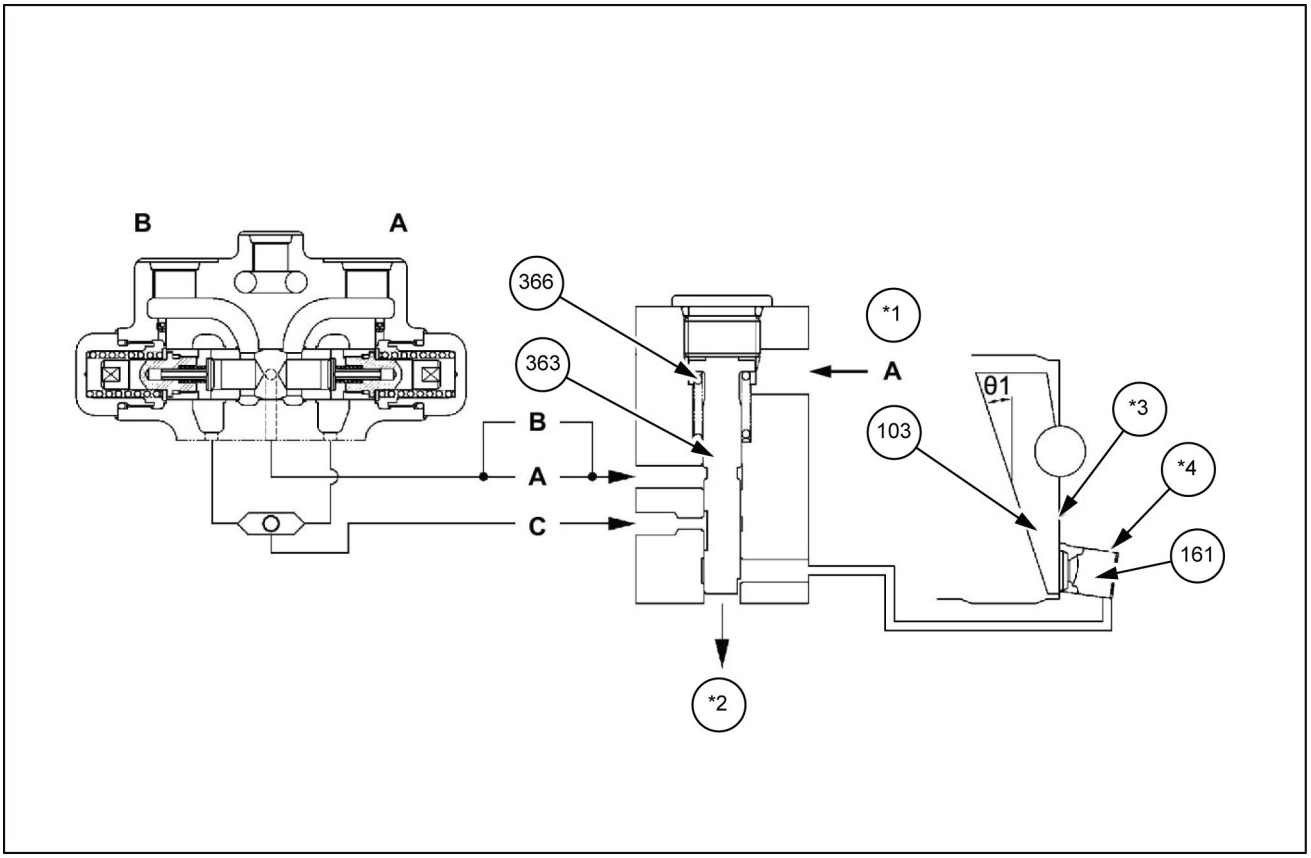


SMIL15CEX4804AA 23

24. Assembly confirmation
Open the inlet and outlet ports and apply **2.94 MPa** (**426.45 psi**) pilot pressure to the brake release port (be careful as oil will come out from the motor drain port at this time), and check that the output shaft rotates smoothly more than once at a torque of **39.2 N·m** (**28.912 lb ft**). There is an assembly problem if it does not rotate, so disassemble the swing unit again and inspect it.



SMIL15CEX4805AA 24



LPIL12CX02791FB 13

*1. Pilot pressure

*2. Drain

*3. Y surface

*4. W chamber

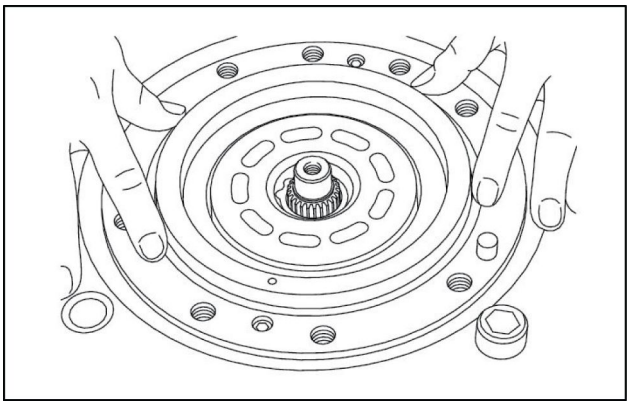
Reduction gear

The rotational movement of the hydraulic motor shaft is transmitted to the 1st-stage sun gear 1 **(4)** spline coupled with the shaft **(102)**.

At this time, the 1st-stage planetary gear 1 **(5)** is meshed with the sun gear 1, and the planetary gear 1 meshes with the hub **(1)** while rotating and rotates in orbit around the hub. This orbital movement rotates the 2nd-stage sun gear 2 **(8)** coupled to carrier 1 **(3)** and carrier 1 fixed to the planetary gear 1.

This rotation is transmitted to the hub (ring gear) through the 2nd-stage planetary gear 2 **(9)** fit into the carrier 2 **(7)** that is spline coupled with the spindle **(2)**, and this becomes the reduction gear output rotation. (Rotation is also transmitted from the 1st-stage planetary gear 1)

2. Remove the O-rings **(135)** and **(139)** from the piston **(112)**.
   - Do not reuse the removed O-rings **(135)** and **(139)**.

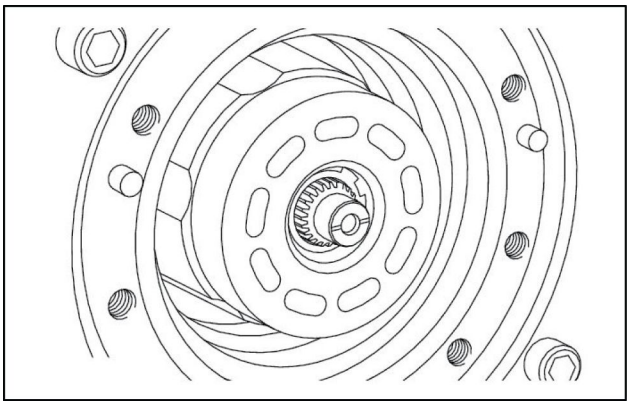


LPIL12CX02438AA 33

Disassembly of hydraulic motor parts

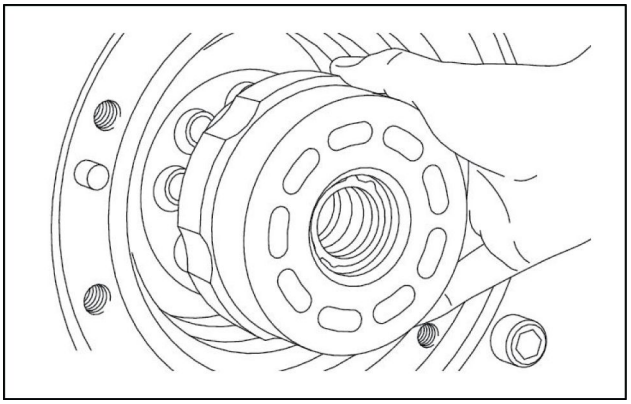
- Oil will spill out when the travel motor is turned sideways, so place a container under the travel motor.

1. Tilt the travel motor **90 °** .
2. Drain the oil inside the travel motor.
3. Remove the 4 partner plates **(116)** and 3 friction plates **(115)**.



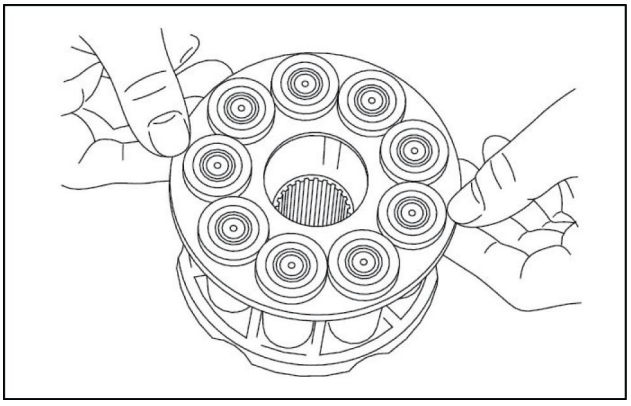
LPIL12CX02439AA 34

4. Hold the cylinder block **(104)** with one hand and rotate it alternately 2 - 3 times to detach the shoes **(106)** attached to the swash plate **(103)**.
   - If the cylinder block is removed as is, the parts attached to the cylinder block (pistons **(105)**, shoes) will become detached from the cylinder block and fall inside the spindle **(2)** because the shoe is attached to the swash plate.
5. Remove the cylinder block **(104)** from the shaft **(102)**.



LPIL12CX02440AA 35

6. Remove the piston assemblies (pistons **(105)**, shoes **(106)**) from the cylinder block **(104)**.
   - When removing the piston assembly, hold the retainer plate **(107)** with both hands and remove the pistons **(105)** and shoes **(106)** together.
     The pistons **(105)** and shoes **(106)** are pressed and held together at the spherical hole sections of the pistons. Pistons **(105)** and shoes **(106)** cannot be separated without damaging the shoes **(106)**. When replacement is necessary, replace them as 1 set. (referred to as piston assembly in the right side figure)



LPIL12CX02441AA 36

Travel motor - Preliminary test

Initial pre-conditioning operation

Slowly operate the machine and perform air-bleeding for inside the motor circuit and inside the line according the Operator's Manual for the Machine Main Unit.

First, perform an operation check by repeating “C direction rotation and stopping and A direction rotation and stopping” a number of times at low-speed rotation.

At this time, remaining air inside the circuit may cause abnormal noises from the valves, etc. The abnormal noises will stop as air is bled out while operation is done repeatedly at low speed.

If abnormal noises go away through repeated operation over a while, there is no problem with the motor and it can be used as is.

If operation is done repeatedly and abnormal noises do not stop, there is an abnormality within the motor and it should be replaced.

Check for the presence of oil leaking from the motor, line port sections, each line and each piece of equipment. When oil leaking has been confirmed, retighten the bolts and line joints at the location where the leak is occurring to the specified torque.

After checking is completed, raise the pressure and perform load operation, and check that no abnormal noises or vibrations, etc. are occurring in the motor.

NOTICE: *When tightening lines, etc. after confirming oil leaking, make sure to have operation of hydraulic devices stopped.*

NOTICE: *Make sure that the operating pressure on the motor is low when checking for oil leaking.*
If the operating pressure is high and there is oil leaking, there is the danger of oil spraying out.

Performance confirmation test

After the travel motor maintenance is complete, perform a performance confirmation test according to the procedure below.

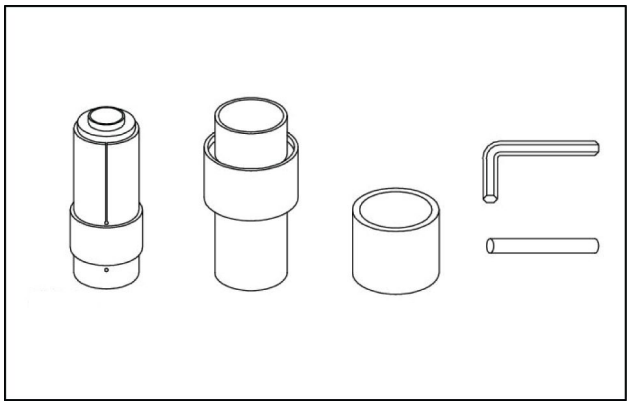
Required instruments and tools

Name	Quantity
For pressure gauge [**3.43 MPa** (**498 psi**)]	2
For measuring cylinder [**5 l** (**1.32 US gal**)]	1
Stop watch	1

Special jig

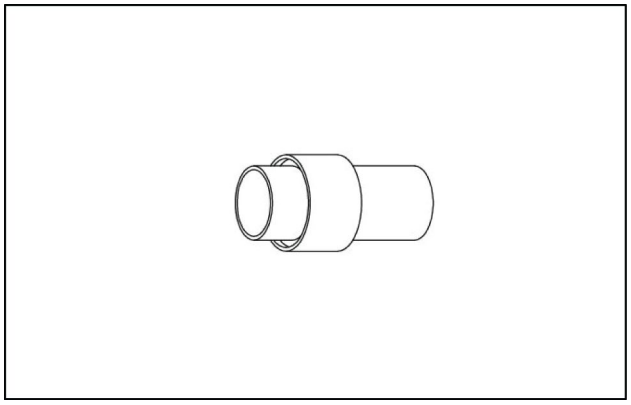
Cylinder assembly requires the following special jigs:

For bushing removal and press fitting



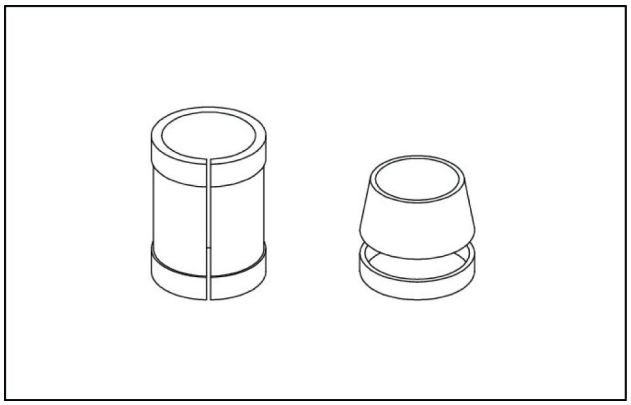
LPIL12CX02045AA 11

For wiper ring press fitting



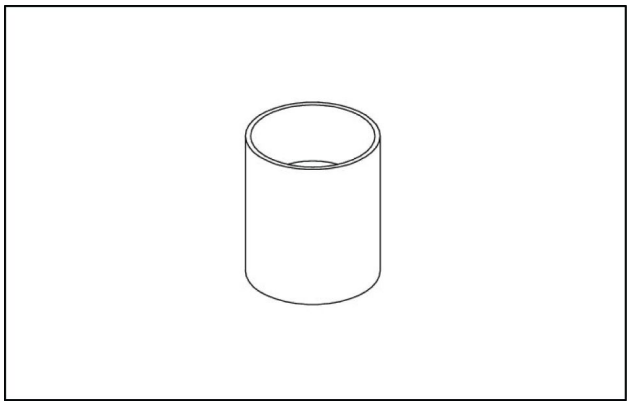
LPIL12CX02046AA 12

Seal ring insertion jig



LPIL12CX02047AA 13

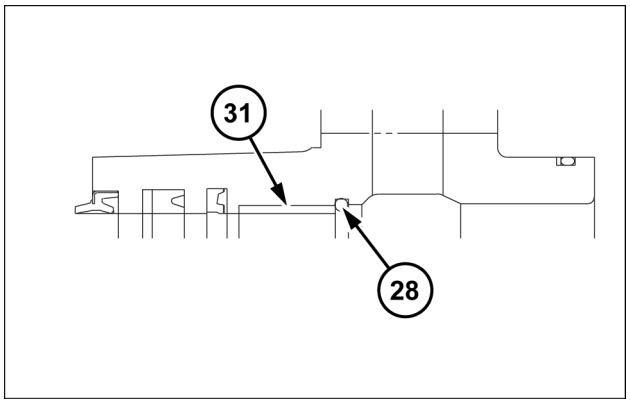
Seal ring calibration jig



LPIL12CX02048AA 14

Disassembly of bushing

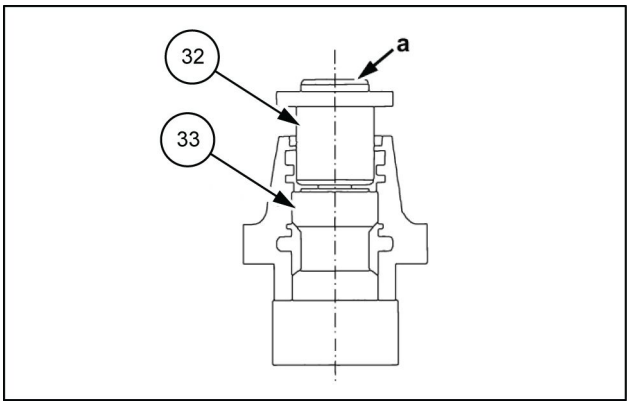
1. Raise the snap ring **(28)** with a screwdriver, and then remove it from the cylinder head.
2. For the bushing **(33)**, use the bushing removal jig **(32)** as in the diagram on the right and press out the bushing with a press.



SMIL15CEX1763AB 13

31. Bushing

a. Press with the press.



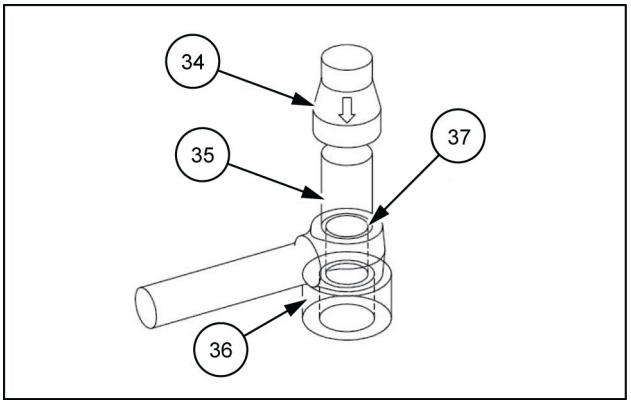
LPIL12CX02062AB 14

Removal of pin bushing

1. Remove the wiper ring **(24)** from the tube and piston rod. Remove it by using a screwdriver in the same manner as for the cylinder head.
2. Use the metal block **(35)** to remove the pin bushing **(37)**.

34. Press

36. Jig

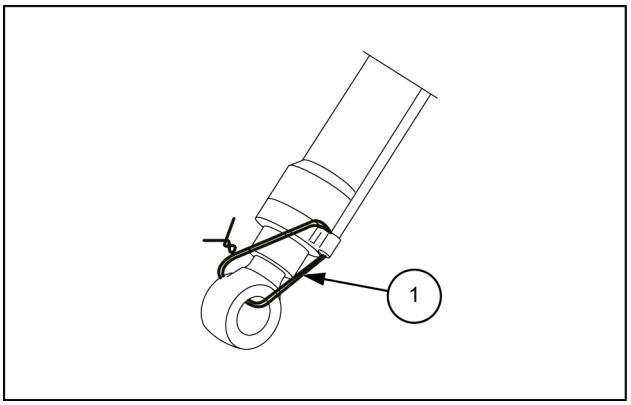


LPIL12CX02063AB 15

Cleaning and storage

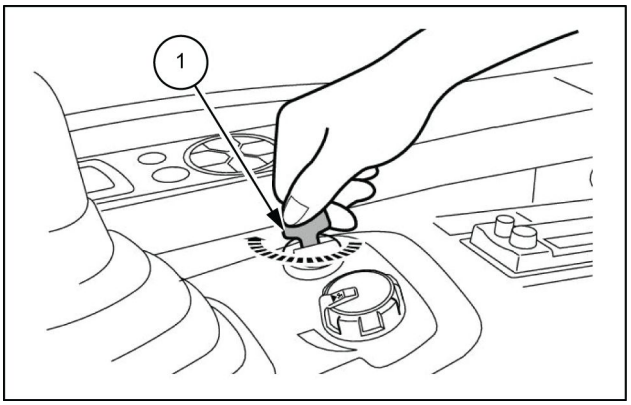
Clean the removed parts with white kerosene, and then apply hydraulic oil, cover the parts, and store them.
If they are left disassembled, there is a danger of their collecting rust and dust and not being able to function adequately after they are assembled again.

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



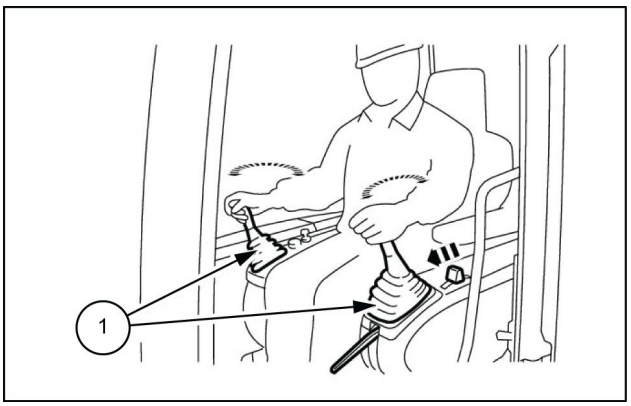
SMIL14CEX4814AB 5

6. Turn the key switch **(1)** “OFF” and stop the engine.



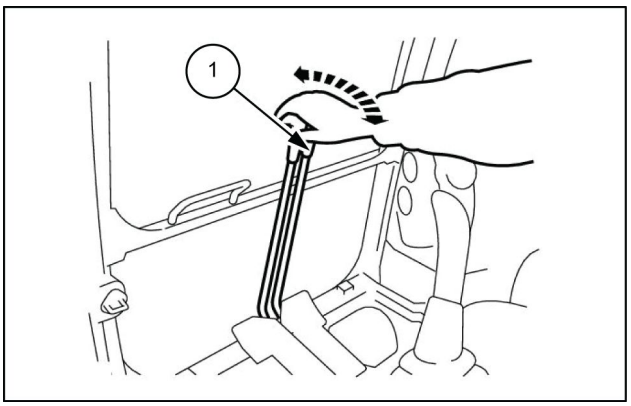
LPIL12CX01551AB 6

7. Switch the key switch “ON” again, and then turn the control lever **(1)** about 10 times to bleed out any pressure.
   Do not operate the arm at this time.



LPIL12CX01552AB 7

8. Move the travel lever **(1)** back and forth about 5 times to bleed off the pressure.
   Switch the key switch “OFF”.



LPIL12CX01553AB 8

Contents

Frames and ballasting - 39

Ballasts and supports - 140

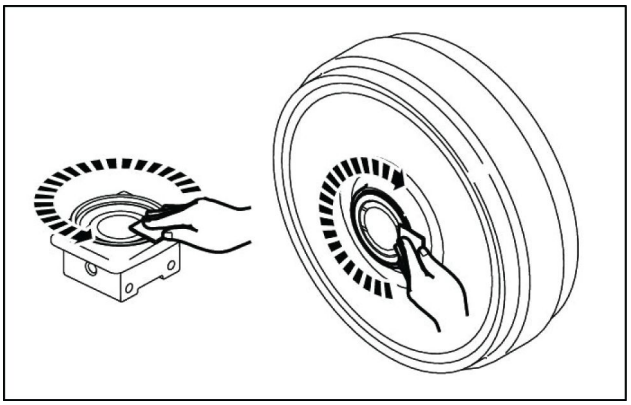
SERVICE

Index

Tracks and track suspension - 48

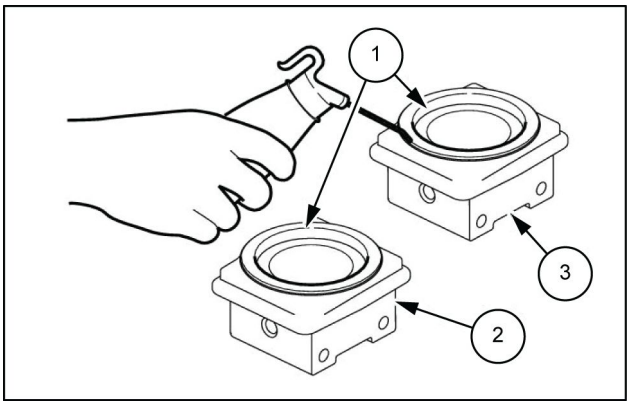
Tracks - 100

7. Use a special fiber cloth to thoroughly wipe the sliding surface of the floating seal to prevent any dust or scratches.



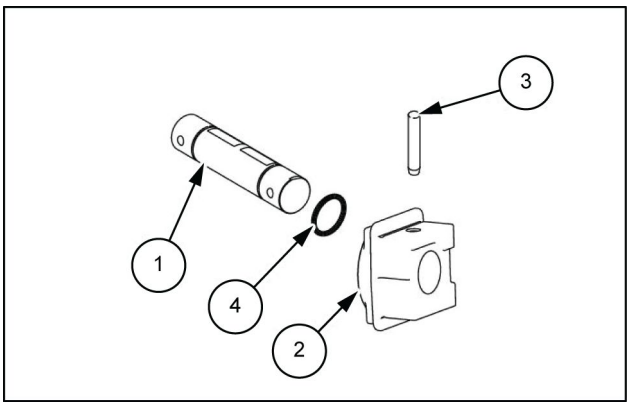
LPIL12CX01189AA 7

8. Apply engine oil to the floating seals **(1)** on the hubs **(2)** and **(3)**.



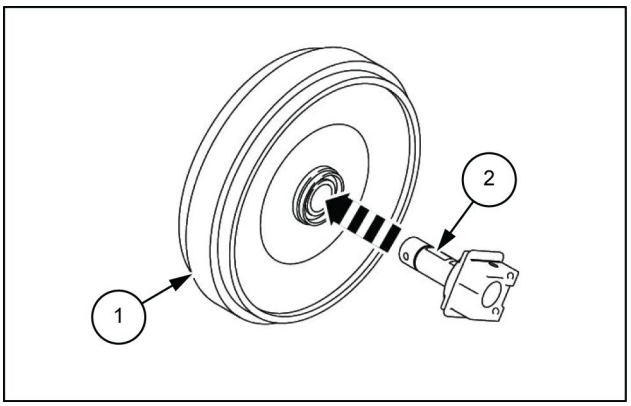
LPIL12CX01190AB 8

9. Install the O-ring **(4)** to the shaft **(1)**, and then install the shaft to the hub **(2)** and fasten it with the hub pin **(3)**.



LPIL12CX01191AB 9

10. Install the shaft **(2)** to the roller **(1)**.

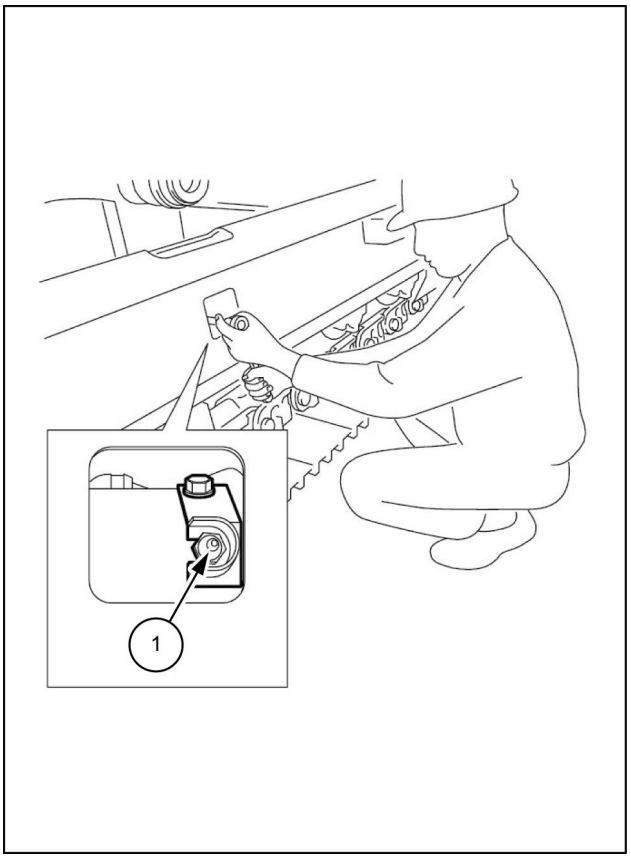


LPIL12CX01192AB 10

Track support roller - Remove

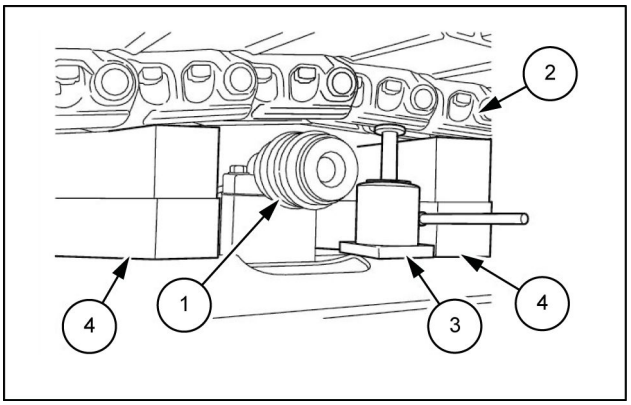
1. Use a box wrench [**19 mm**] to loosen the check valve **(1)** to release grease, and then loosen the track shoe tension.
   Do not loosen the check valve all at once.
   Loosen it slowly while monitoring the grease output and shoe loosening.
   Use a rag to catch grease that trickles out of the check valve.

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



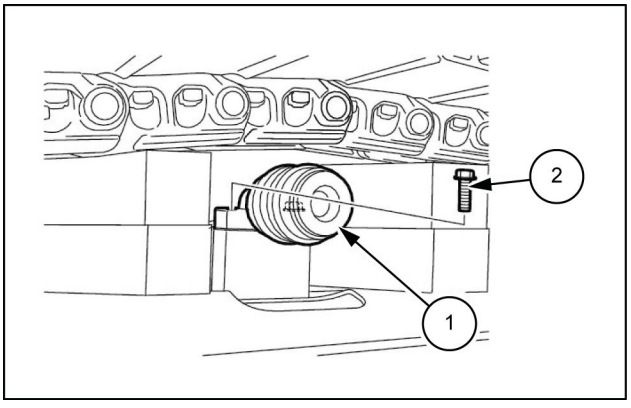
LPIL12CX01237BB 1

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



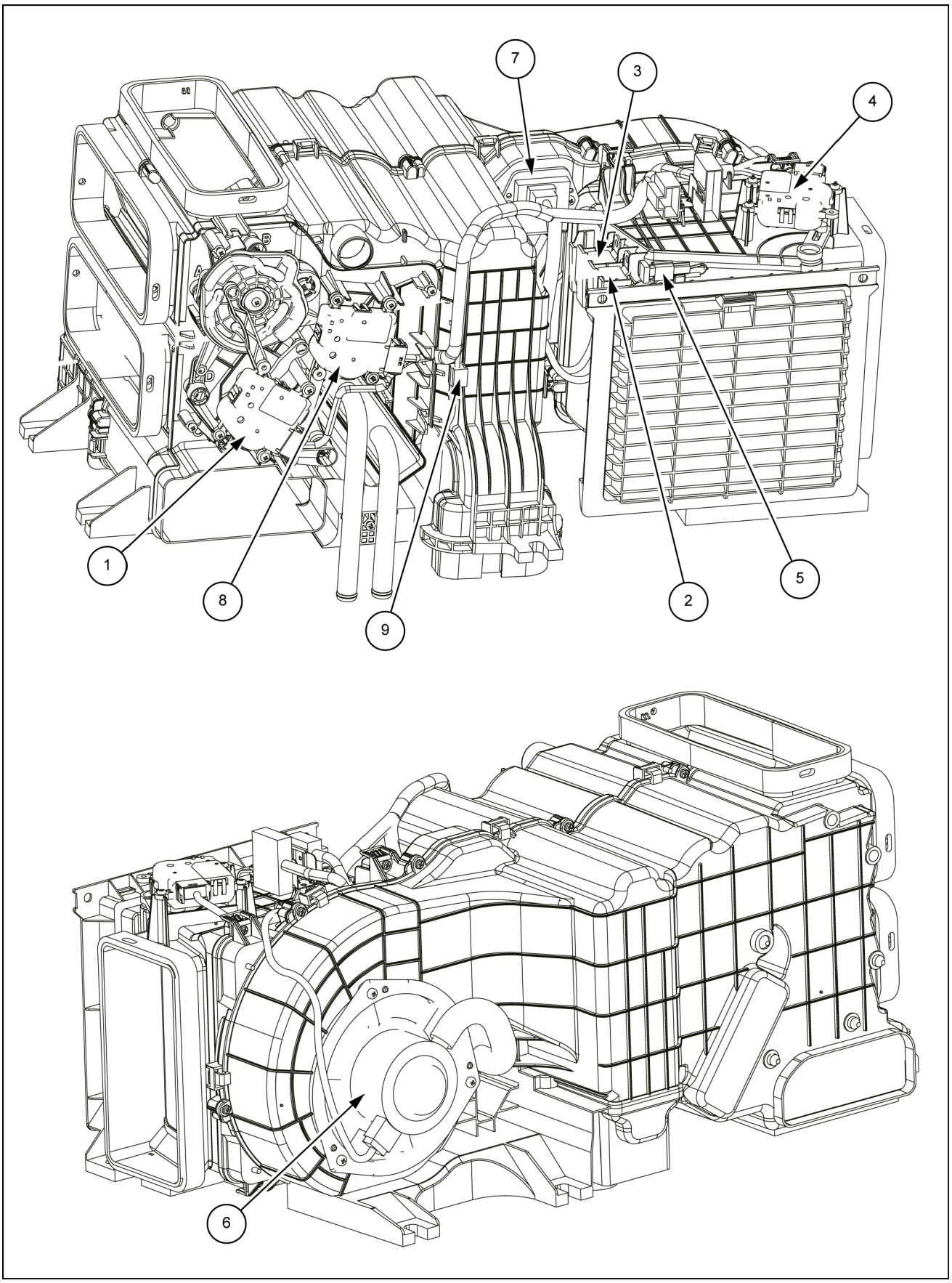
LPIL12CX01238AB 2

3. Use a box wrench **24 mm** to remove the 2 bolts **(2)**, and then remove the upper roller **(1)**.



LPIL12CX01239AB 3

Air conditioning - Overview - Air conditioner unit



SMIL14CEX1892HB 1

Contents

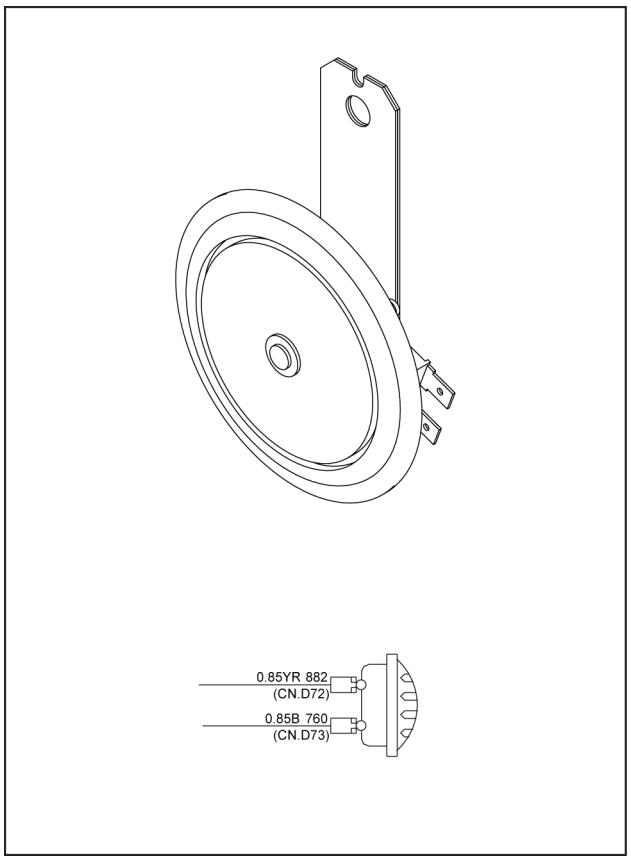
Electrical systems - 55

Electrical system - 000

Horn (HIGH)

Part No.: KHR21440

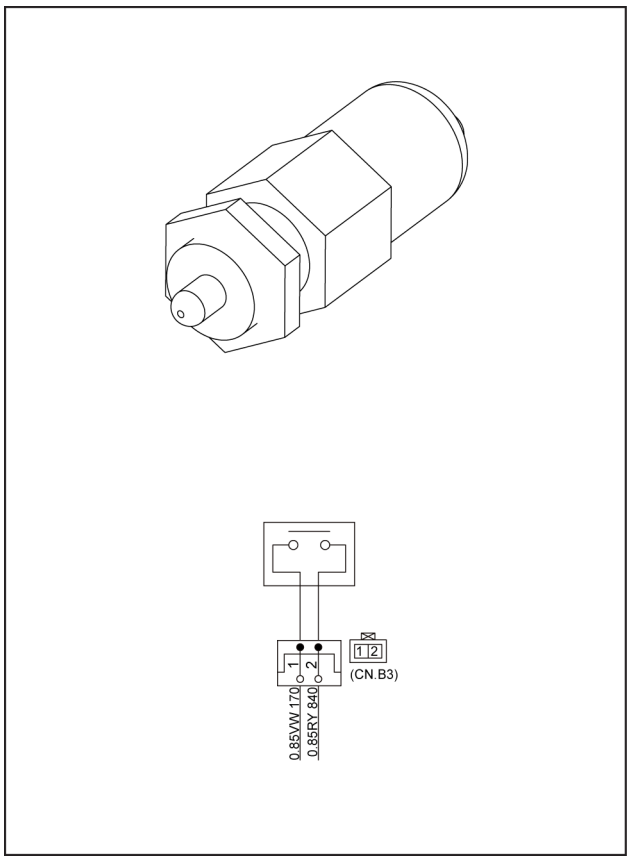
Basic frequency: **415 Hz**



SMIL15CEX7590BA 57

Gate lock limit switch

Part No.: KHR14930



SMIL15CEX7591BA 58

F14	Fuse **10 A**: DC/DC converter	X33	Lifting equipment connector
F15	Fuse **5 A**: air conditioner heater unit	X34	Fan reverse connector
F16	Fuse **15 A**: air conditioner blower	X36	**12 V** output (for radio)
F17	Fuse **5 A**: air conditioner compressor	X37	Wire harness indicator jumper
F18	Fuse **10 A**: spare	X38	Free swing connector
F19	Fuse **15 A**: fuel feed pump	X45	Air suspension seat
F20	Fuse **10 A**: option line	X56	Beacon connector
F41	Fusible link **50 A**: backup	X74	Diagnostic switch connector
F42	Fuse **15 A**: cont	X76	Free swing solenoid valve connector
F43	Fusible link **65 A**: fuse box	X77	HBCV pressure sensor connector
F44	Fusible link **50 A**: safety RL	K103	Air conditioner compressor relay
F46	Fuse **15 A**; F7 (ROOM LAMP & RADIO)	X78	Beacon connector (for crane)
G1	Battery	X82	Beacon switch connector
G2	Alternator	Y2	Pilot pressure solenoid valve (blue tape)
H2	Travel alarm	Y3	Swing brake solenoid valve (pink band)
H1	Audible warning device	Y4	Second stage travel solenoid valve (red tape)
H4	Speaker right	Y5	Second stage relief solenoid valve (yellow tape)
H5	Speaker left	Y7	Main pump power proportional solenoid valve
H9	Alarm **24 V**, **107 dB**	Y8	Air conditioner magnet clutch
H10	Camera 1 (rear)	Y9	Option 2 speed solenoid (blue tape)
H11	Camera 2 (right side)	Y11	Main pump flow proportional solenoid valve
K2	Glow plug relay	Y23	Option 1 knob (R) - Right solenoid valve (blue tape)
K3	Horn relay	Y24	Option 1 knob (R) - Left solenoid valve (red tape)
K7	Battery relay	Y25	Option 2 knob (L) - Right solenoid valve (blue tape)
K10	Working light relay (upper structure/boom)	Y26	Option 2 knob (L) - Left solenoid valve (red tape)
K11	Working light relay (cab)	Y27	Option select solenoid valve (red tape)
K17	Blower off relay	Y35	Suction control valve (SCV)
K30	Refuel pump relay	Y62	Option press. proportional solenoid valve
K31	Refuel pump stop relay	Y63	INJ1 (No. 1)
K34	Starter cut relay	Y64	INJ2 (No. 3)
K35	Room lamp relay	Y65	INJ3 (No. 4)
K36	Left speaker relay	Y66	INJ4 (No. 2)
K37	Right speaker relay	Y67	Option select solenoid valve (blue tape)
K63	ECM relay	Y68	Option 2 speed solenoid valve (red tape)
K64	Key ON relay		

Contents

Electrical systems - 55

Harnesses and connectors - 100

FUNCTIONAL DATA

Wiring harnesses

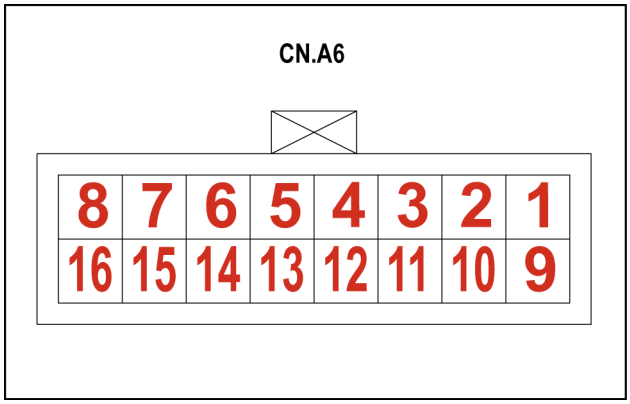
Wiring harnesses - Electrical schematic sheet 15 - Engine-refuel pump

Type	Components	Connectors/link	Description
Sensor	B83		Pressure sensor
Sensor	B84		Pressure sensor (pilot bucket close)
Sensor	B85		Pressure sensor (pilot boom up)
Alarm	H9		Alarm
Relay	K30		Refuel pump relay
Relay	K31		Refuel pump stop relay
Motor	M14		Fuel feed pump motor
Switch	S61		Refuel pump switch
Connector	CN.D53	**CN.D53**	Pressure sensor (pilot boom up)
Connector	CN.D54	**CN.D54**	Pressure sensor (pilot bucket close)
Connector	CN.D55	**CN.D55**	Pressure sensor (pilot bucket close)
Connector	CN.D76	**CN.D76**	
Connector	CN.D81-1	**CN.D81-1**	Refuel pump relay
Connector	CN.D81-2	**CN.D81-2**	Refuel pump stop relay
Connector	CN.D81-3	**CN.D81-3**	Fuel feed pump motor
Connector	CN.D81-4	**CN.D81-4**	Refuel pump switch
Connector	CN.D81-5	**CN.D81-5**	
Connector	CN.D81-6	**CN.D81-6**	Alarm
Connector	CN.D81-7	**CN.D81-7**	Alarm

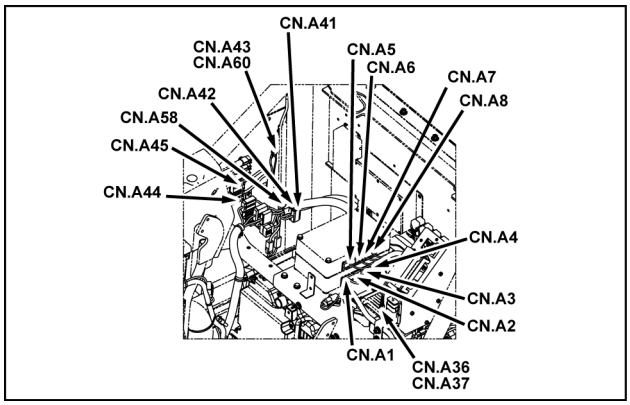
Wiring harnesses - Electrical schematic sheet 30 - Main cab-relays

Type	Components	Connectors/link	Description
Relay	K3		Horn relay
Relay	K10		Working light (upperstructure / attachment) relay
Relay	K11		Working light (cab) relay
Relay	K35		Room lamp relay
Relay	K36		Speaker left relay
Relay	K37		Speaker right relay
Relay	K77		Beacon relay
Connector	CN.A16	**CN.A16**	Relay horn
Connector	CN.A17	**CN.A17**	Relay lamp: upper
Connector	CN.A18	**CN.A18**	Relay lamp: cab
Connector	CN.A19	**CN.A19**	Relay beacon
Connector	CN.A20	**CN.A20**	Relay room lamp
Connector	CN.A21	**CN.A21**	Relay speaker:R
Connector	CN.A22	**CN.A22**	Relay speaker:L
Connector	CN.A23	**CN.A23**	To controller C
Connector	CN.A51	**CN.A51**	
Connector	CN.A55	**CN.A55**	

CONNECTOR CN.A6 - CONTROLLER B (Male)



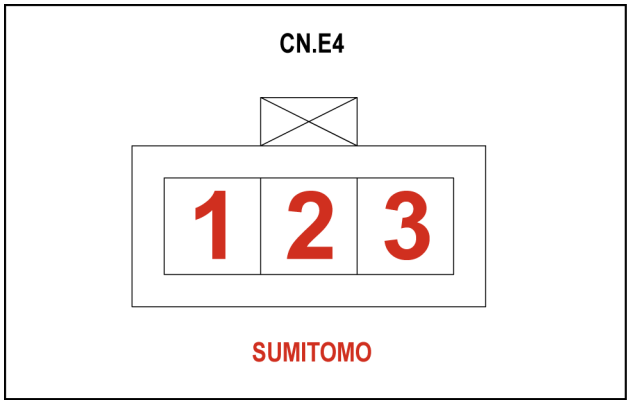
SMIL15CEX9246AA 11



SMIL15CEX9239AA 12

Pin	From	Wire	Description	Color-Size	Frame
2	CN.A25-M-P-8	69A		BY	**SHEET 21**
3	CN.A25-M-P-1	065A		Y	
4	CN.A2-P-12	56		PL	**SHEET 20**
6	CN.A41-M-P-4	040D		P	**SHEET 23**
10	CN.A25-M-P-3	066A		YL	**SHEET 21**
12	CN.A2-P-4	55		PW	**SHEET 20**
14	CN.A42-M-P-4	041D		PG	**SHEET 23**

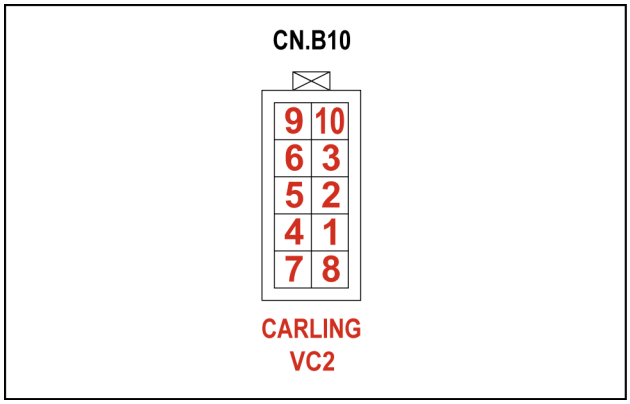
CONNECTOR CN.E4 - CRANK ANGLE SENSOR (Male)



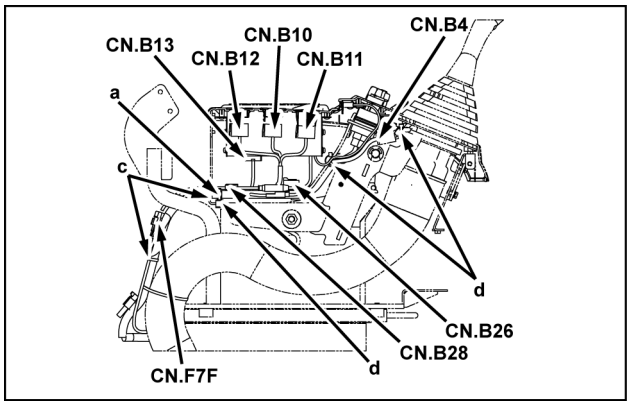
SMIL15CEX9413AA 55

Pin	From	Wire	Description	Color-Size	Frame
1	CN.D7-M-P-4	310A		VW-0.75	**SHEET 08**
2	CN.D7-M-P-1	312B		G-0.75	
3	CN.D7-M-P-2	311B		GrB- 0.75	

CONNECTOR CN.B10 - BEACON (Male)



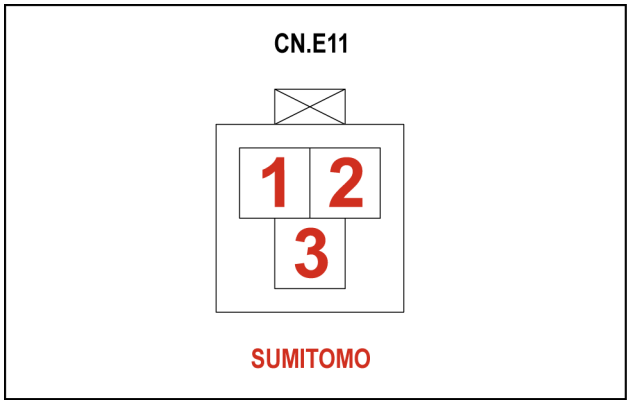
SMIL15CEX9323AA 21



SMIL15CEX9314AA 22

Pin	From	Wire	Description	Color-Size	Frame
2	SP-720B-P-X	722		B-0.85	**SHEET 31**
3	CN.A49-M-P-9	842B		LG-0.85	**SHEET 33**

CONNECTOR CN.E11 - WATER TEMPERATURE SENSOR (Male)



SMIL15CEX9416AA 55

Pin	From	Wire	Description	Color-Size	Frame
1	CN.D10-F-P-5	340A		L -0.75	**SHEET 08**
2	SP-343-P-X	343C		G -0.75	
3	CN.D10-F-P-6	XXB		R -0.75	

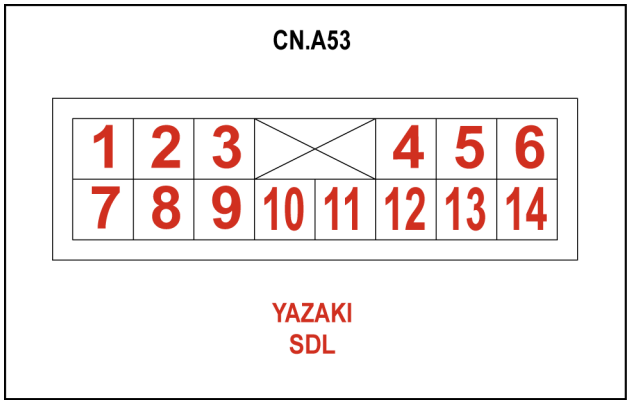
CONNECTOR CN.C20 - CAMERA 3 (BLUE TAPE) (Male)

Pin	From	Wire	Description	Color-Size	Frame
1	SP-960A-P-X	970		R	**SHEET 38**
2	SP-961A-P-X	971		B	
3	CN.C4-F-P-3	972A		YR	**SHEET 24**
4	CN.C4-F-P-13	973A		WR	

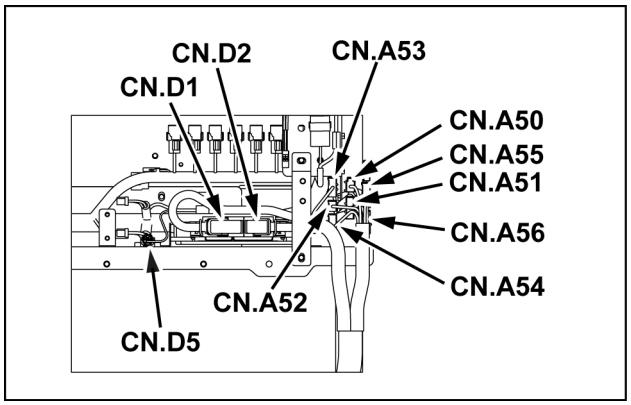
CONNECTOR CN.A37 - MEMORY CLEAR (Female)

Pin	From	Wire	Description	Color-Size	Frame
1	CN.A53-F-P-13	084A		BrY	**SHEET 06**

CONNECTOR CN.A53 (Female)



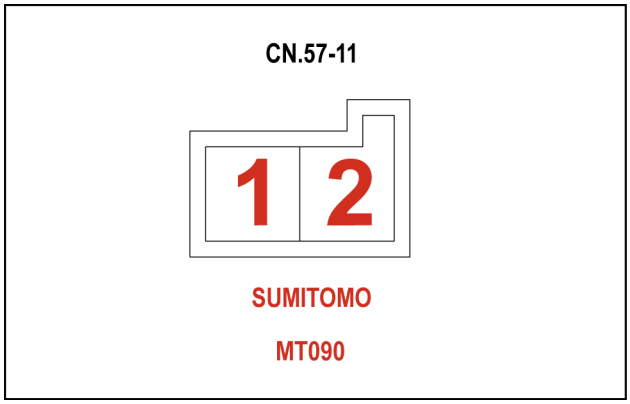
SMIL15CEX9335AA 7



SMIL15CEX9333AA 8

Pin	From	Wire	Description	Color-Size	Frame
1	CN.A38-M-P-2	142G		WR-1.25	**SHEET 28**
2	CN.A09-P-1	370B		YR-0.85	**SHEET 29**
3	CN.A15-P-2	373A		LR-0.85	
4	SP-011-P-X	301A		BrR-0.85	
5	CN.A48-F-P-5	302A		LG-0.85	**SHEET 34**
6	CN.A10-P-5	303		GW-0.85	**SHEET 29**
7	CN.A41-M-P-1	040A		P	**SHEET 23**
8	CN.A42-M-P-1	041M		PG	
9	CN.A27-M-P-6	050E		V	**SHEET 27**
10	CN.A27-M-P-14	051E		VG	
11	SP-082C-P-X	082A		PB	
12	SP-080B-P-X	080A		PL	
13	CN.A37F-P-1	084A		BrY	

CONNECTOR CN.57-11

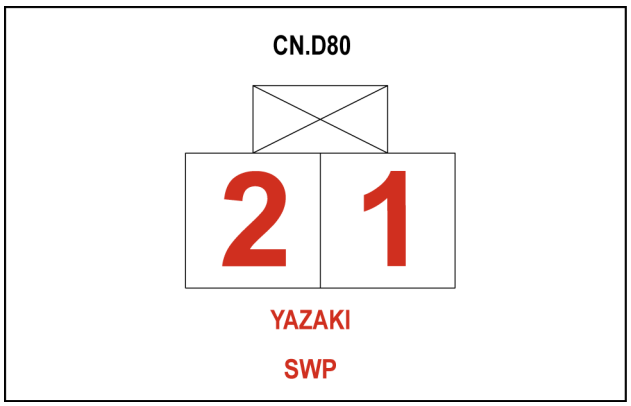


SMIL15CEX9455AA 54

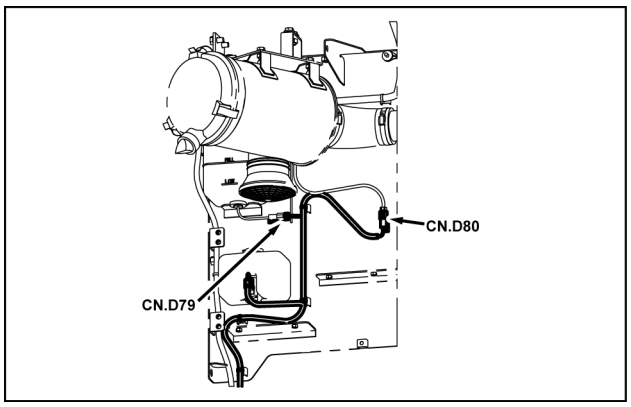
Pin	From	Wire	Description	Color-Size	Frame
1	SP-854A-P-X	860		GL	**SHEET 18**
2	SP-535D-P-X	535E		GY	

Wire connectors - Component diagram 08

CONNECTOR CN.D80 - AIR CLEANER PRESSURE SWITCH (Male)



SMIL15CEX9397AA 1



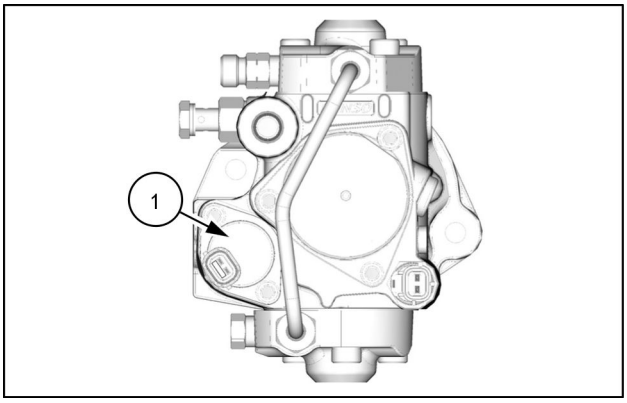
SMIL15CEX9395AA 2

Pin	From	Wire	Description	Color-Size	Frame
1	S62-P-IN	650A		Y-1.25	**SHEET 13**
2	S62-P-OUT	533B		Y-1.25	

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

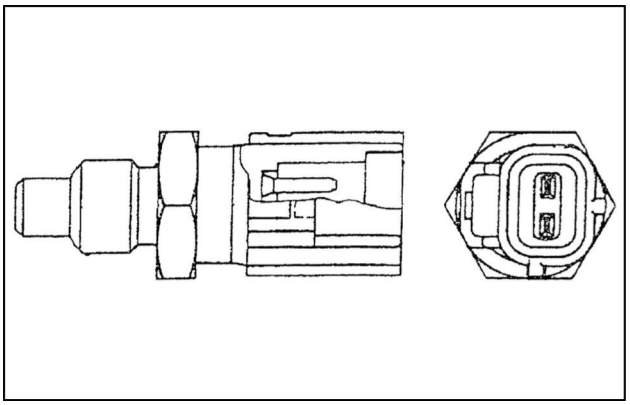


SMIL15CEX7792AB 3

Fuel temperature sensor

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

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

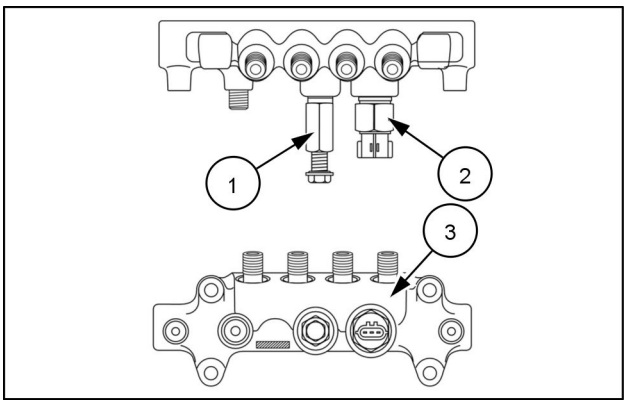


SMIL14CEX3995AA 4

Common rail (fuel rail)

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

1. Pressure limiter
2. Fuel pressure sensor
3. Common rail



SMIL15CEX7793AB 5

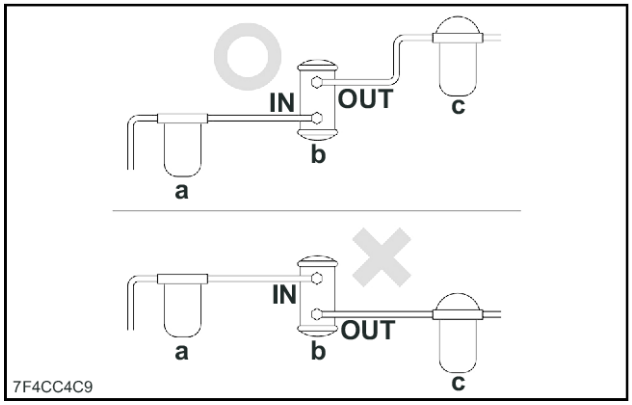
Index

Electrical systems - 55

Engine control system - 015

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 there is improper connection of the connector. Especially for CKP sensor and CMP sensor.
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.
Whether the structure allows for air deposit due to layout of the fuel filter **(c)**, pre-filter **(a)** and electromagnetic pump **(b)**.
Check whether they are arranged to prevent air accumulation as Isuzu genuine pre-filters **(a)** do not have any plugs for air removal. Also check whether the inlet and outlet of the electromagnetic pump **(b)** have an appropriate layout. Fix layouts which have the electromagnetic pump **(b)** inlet on the upper side or have an outlet toward the motion direction of the machine.
Abnormalities of the air intake system parts.
Abnormalities of the exhaust system parts.



7F4CC4C9 1

Diagnostic aids

Fuel cut-off, fuel freezing, air entering fuel line, filter abnormality, line abnormality, fuel quality, fuel tank and other fuel system abnormalities
Filter clogging, intake air line abnormality and other intake air system abnormalities

Supply pump abnormality
The diagnostic trouble code for nonpressure fuel feeding of supply pump is diagnosed while the engine is running.
Accordingly, if the engine does not start due to nonpressure fuel feeding caused by a supply pump abnormality, no diagnostic trouble code is detected.

Pressure limiter operation/internal seal deterioration and other common rail abnormalities

Injector abnormality, fuel not injected

System down due to malfunctions.

Engine abnormality caused by seizing, compression pressure deficiency and other mechanical troubles

ACG failure.

Troubles related to the hydraulic pump and other device on the machine

Effect of wireless devices, lights, or other electrical components installed after purchase

ECM failure.

1. Rectifier
2. Field coil
3. Stator
4. Bearing
5. Pulley
6. Front bracket
7. Rotor
8. Rear bracket
9. Regulator
10. Bearing

Contents

Electrical systems - 55

Fuel injection system - 010

Index

Electrical systems - 55

Fuel injection system - 010

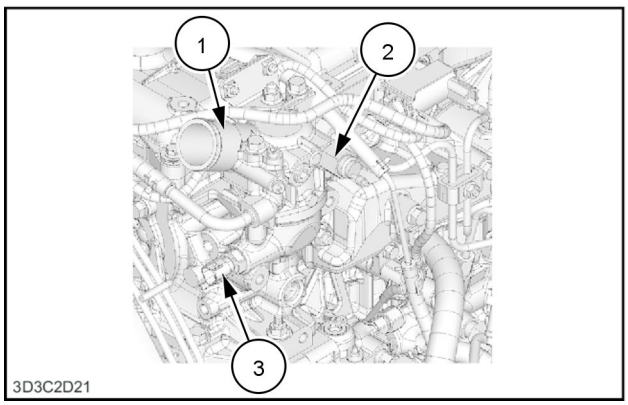
Coolant high temperature sensor - Install

1. Install the overheat switch on the water outlet pipe **(1)**.

   Tightening torque: **31 N·m** (**22.86 lb ft**)

2. Connect the harness connector to the overheat switch **(2)**.

   3. Coolant temperature sensor



3D3C2D21 1

Contents

Electrical systems - 55

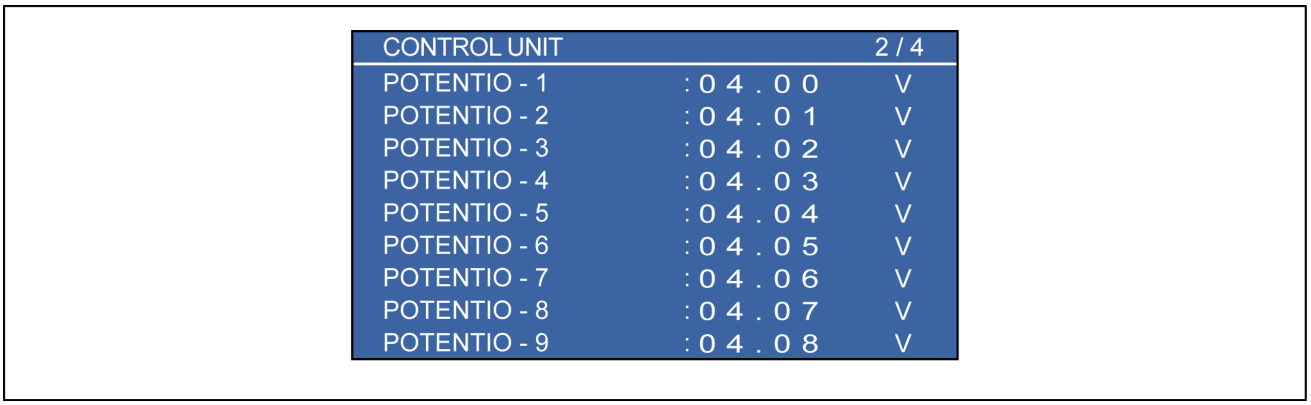
Cab controls - 512

FUNCTIONAL DATA

SERVICE

DIGITAL OUT-2	1	Battery relay
	2	2 pumps flow solenoid
	3	Option return line switch solenoid
	4	Travel alarm
DIGITAL OUT-3	1	
	2	Window washer signal
	3	-
	4	-
DIGITAL OUT-4	1	-
	2	-
	3	-
	4	-

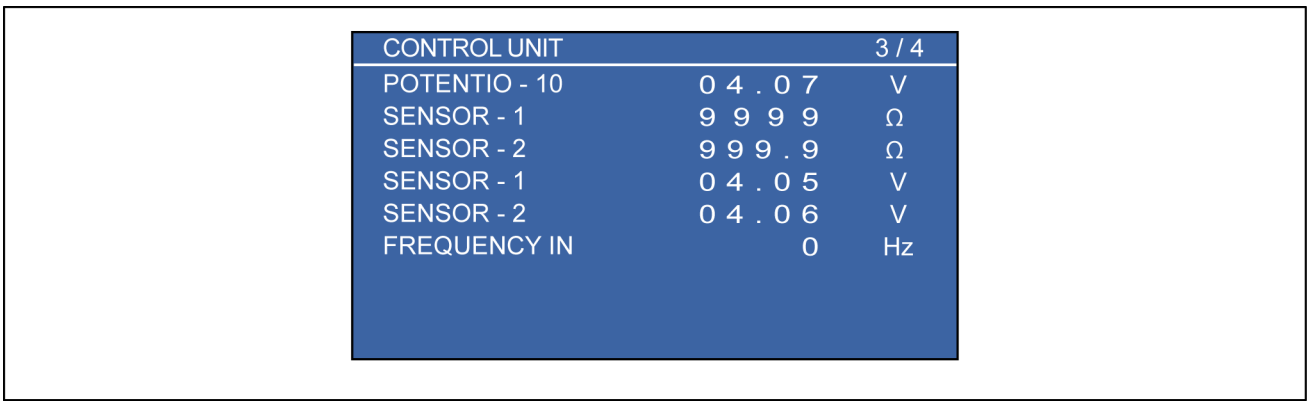
Sensor input



SMIL14CEX0538EA 3

POTENTIO-1	V	P1 pump pressure sensor
POTENTIO-2	V	P2 pump pressure sensor
POTENTIO-3	V	N1 pump pressure sensor
POTENTIO-4	V	N2 pump pressure sensor
POTENTIO-5	V	Swing pilot pressure sensor
POTENTIO-6	V	Upper pilot pressure sensor
POTENTIO-7	V	Travel pilot pressure sensor
POTENTIO-8	V	Fuel filter clog sensor
POTENTIO-9	V	Engine throttle switch

Sensor input



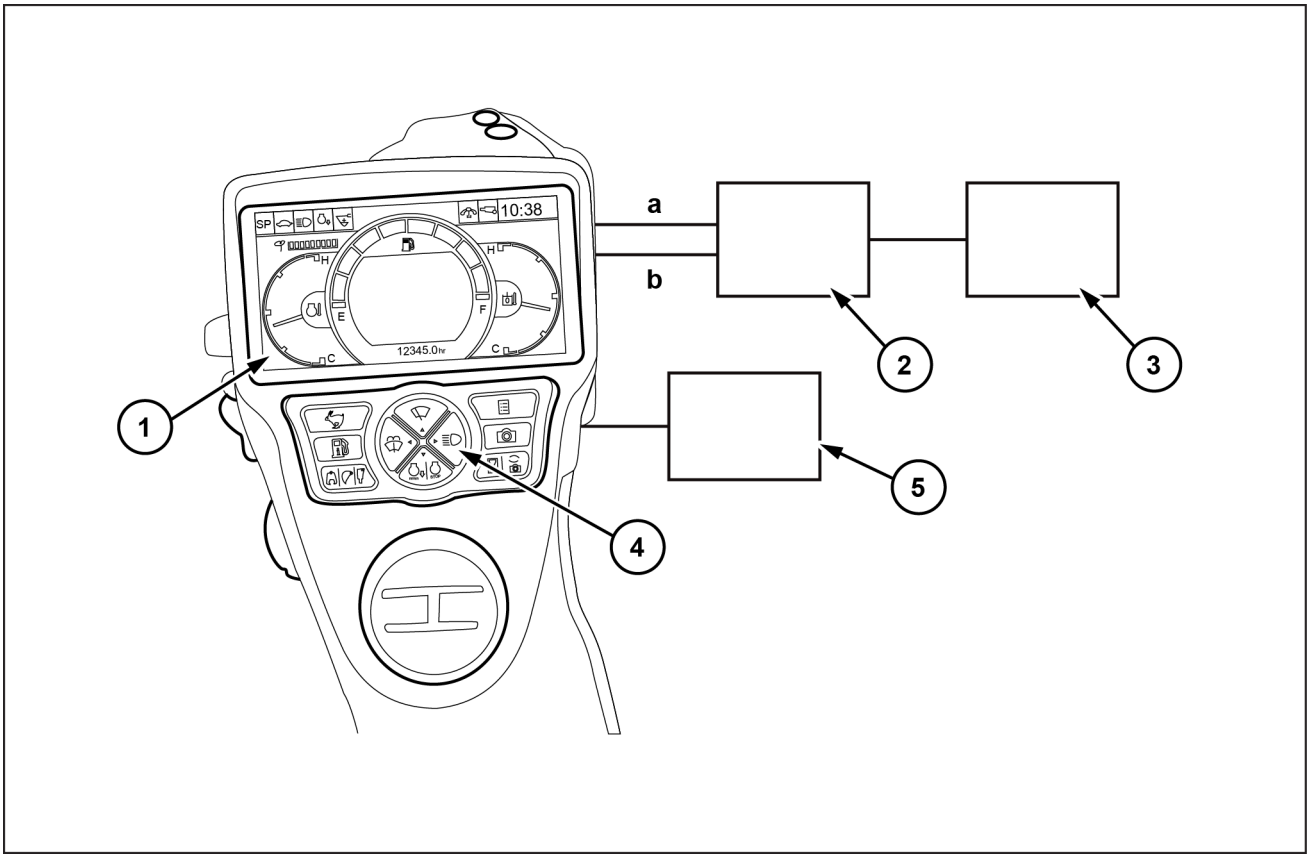
SMIL14CEX0539EA 4

POTENTIO-10	V	Overload pressure sensor (Europe and Japan only)
SENSOR-1	Ω	Hydraulic oil temperature sensor
SENSOR-2	Ω	Fuel level sensor

Instrument cluster - Dynamic description - Monitor display dimming

Purpose

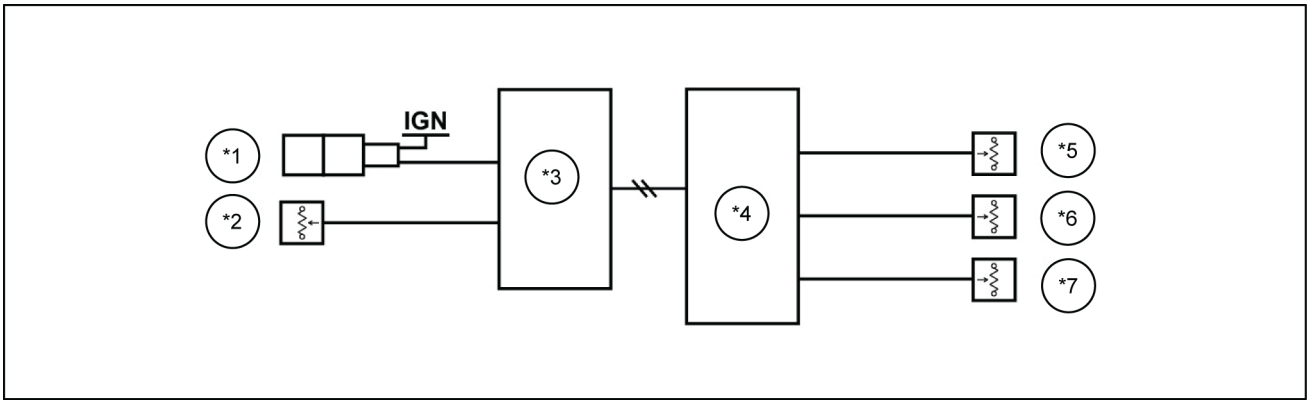
Adjusts the brightness of the backlight through operation that is linked to the working light and solar radiation sensor.



SMIL15CEXZ398FB 1

1. Monitor
2. Computer A
3. Solar radiation sensor
4. Working light switch
5. Working light relay

a. Dimming level automatic adjustment by solar radiation sensor
b. Working light linked dimming by working light relay



LPIL12CX01018EB 2

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

Operation

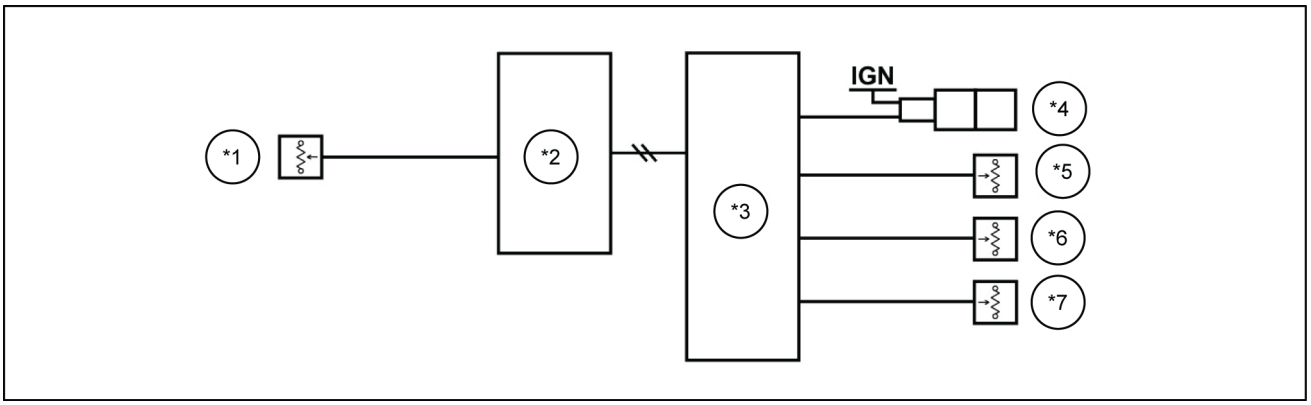
1. The operator operates the shovel.
2. The system judges the operator status
3. When the system judges that digging operation is being performed, it controls boom 2- down proportional valve.
4. When the operator stops arm-in full lever operation or performs travel, the system controls boom 2-down proportional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

Bucket control

Mostly in the second half of leveling and when collecting dirt and sand during digging, the spool opening is opened so that a larger volume can flow.

Configuration

The larger the output current, the more the secondary pressure output is suppressed.

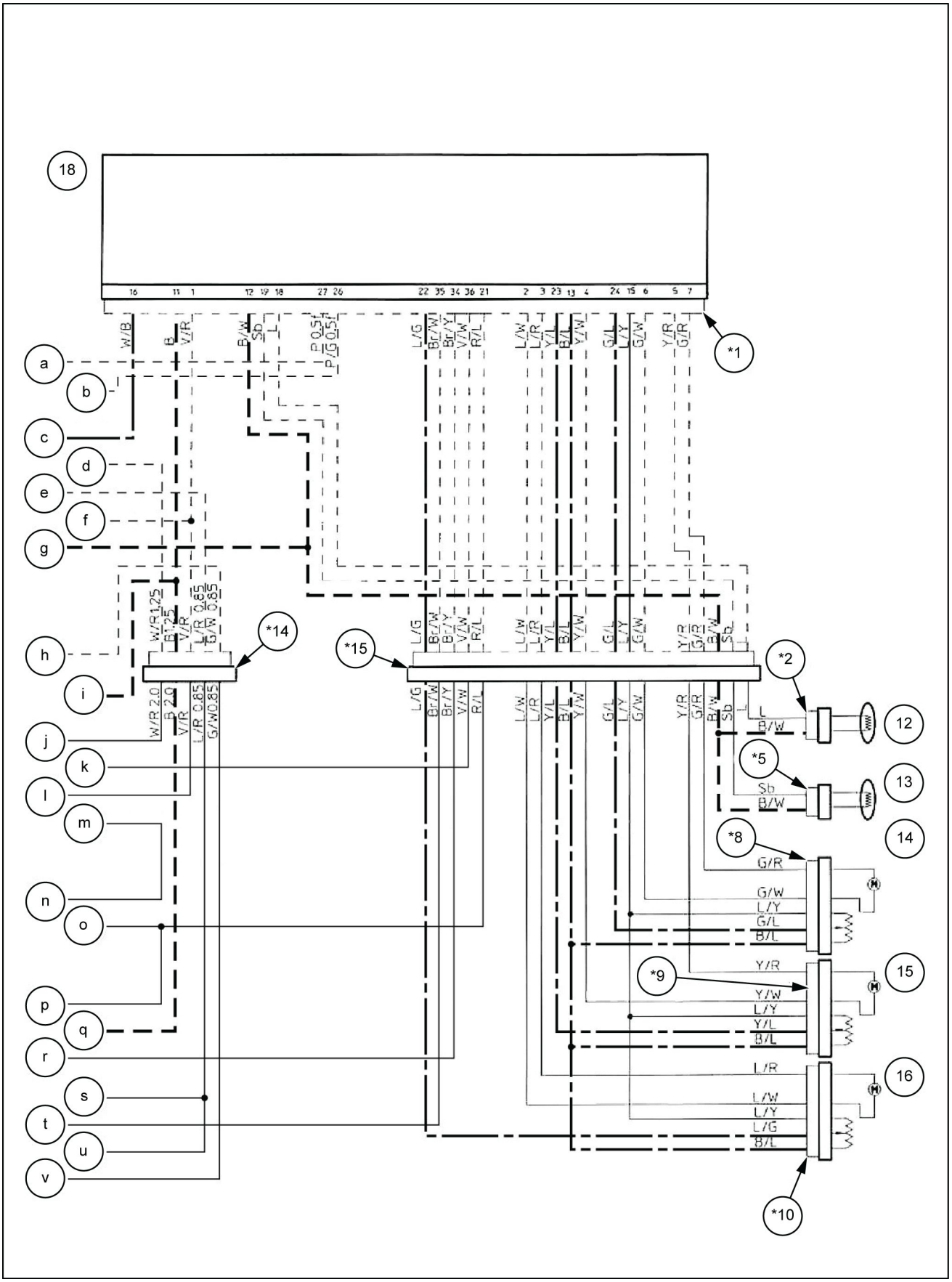


LPIL12CX01019EB 3

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

Operation explanation

1. The operator operates the shovel.



LPIL12CX05117HB 2

Wiper relays - Prepare

Items to prepare:

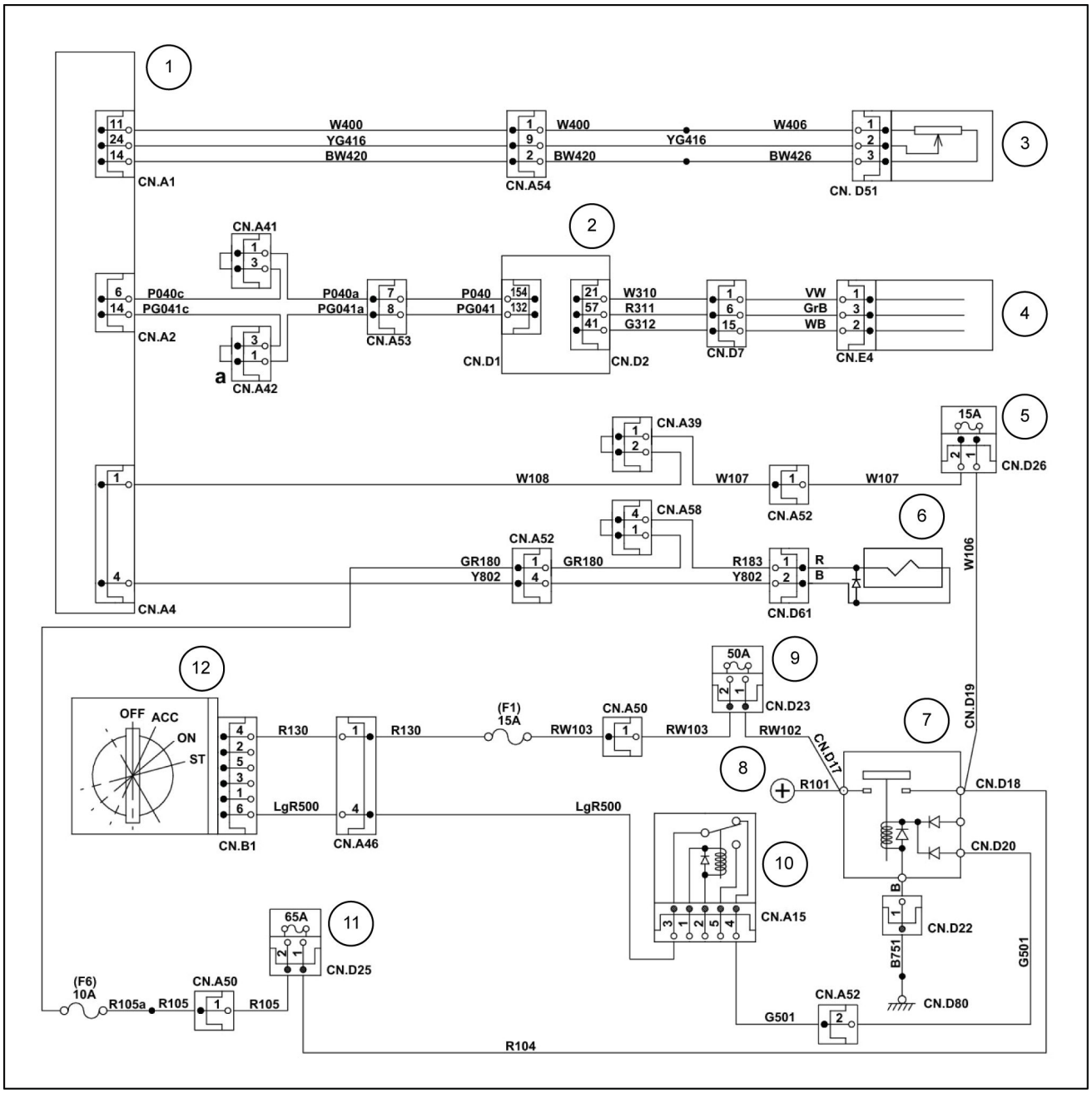
- Wrench [**10 mm**]
- Box wrench [**10 mm**]
- Phillips Screw driver
- Screw driver

7201-Travel high-speed solenoid signal abnormality

Control Module : MCM

Solution:

1. Use the below image for the fault code resolution process:



LPIL12CX00897GB 1

1. Computer A
2. Engine computer
3. Travel pilot pressure sensor
4. Crank angle sensor
5. Fuse computer
6. 2 stage travel solenoid valve
7. Relay battery
8. Battery **24 V**
9. Fuse key
10. Relay key switch turned ON
11. Fusible link fuse box
12. Key switch

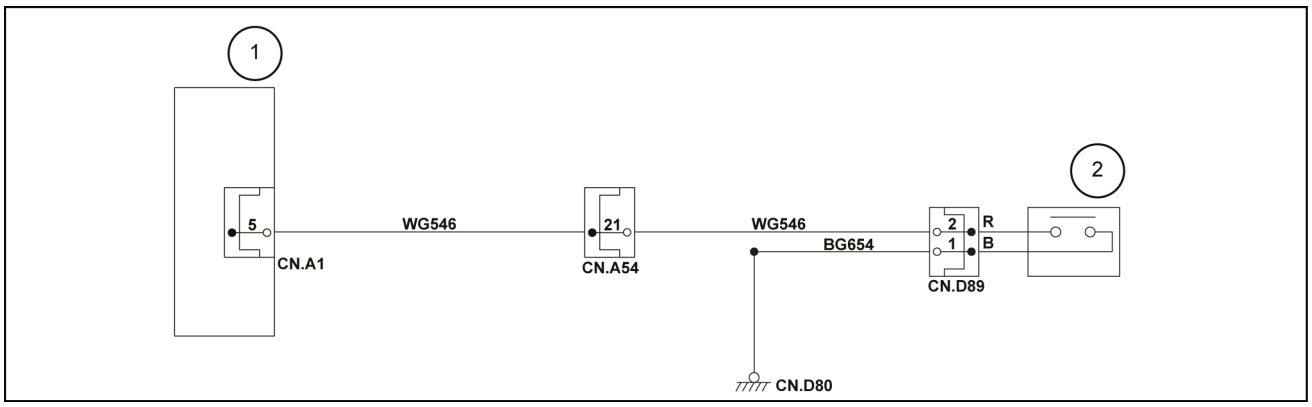
a. CAN communication

7428-Fuel filter water level

Control Module : MCM

Solution:

1. Use the below image for the fault code resolution process:



SMIL15CEX3295EB 1

1. Computer A
2. Level switch

Check that the “FUEL FILTER” display appears.

Drain the fuel filter.

Turn the key switch ON.

Check for the diagnostic trouble code 7428.

A. If diagnostic trouble code 7428 is displayed, proceed to Step **2**.

2. Inspect the connection status of each connector. Make sure that all the connectors are secured.

A. If diagnostic trouble code 7428 is displayed, proceed to Step **3**.

3. Turn the key switch OFF and disconnect the fuel filter water level switch connector **CN.D89**.

Inspect for continuity between the terminals 1 and 2 of the fuel filter water level switch connector **CN.D89** fuel filter water level switch side.

A. If there is no continuity, replace the fuel filter water level switch **(2)**.

B. If there is continuity, replace computer A **(1)**.

Wiring harnesses - Electrical schematic sheet 11 (55.100)

Wiring harnesses - Electrical schematic sheet 06 (55.100) Wiring harnesses - Electrical schematic sheet 10 (55.100)

P0335-Crankshaft position sensor circuit

Control Module : ECM

Solution:

1. Check and diagnose the trouble code setting conditions before you proceed with the diagnostics code P0335.

   Diagnostic trouble codes P0016, P0336, P0340 and P1655 are not set.
   The CMP sensor signal pulse is detected.
   While the engine is running, the ECM detects that the CKP sensor signal pulse is not generated.

2. Check and diagnose the below fault codes before you proceed with the diagnostics code P0335.

   Diagnostic trouble code P0340
   Diagnostic trouble code P1655

3. Turn OFF the starter switch.

   Disconnect the harness connector **CN.E4** from the crankshaft position sensor.

   Turn ON the starter switch.

   Measure the voltage between the **5 V** power supply circuit and normal GND of the crankshaft position sensor harness connector **CN.E4**.

   If the reading is less than or equal to the **4.5 V**, inspect to see if there is an open circuit or high resistance with the **5 V** power supply circuit between the ECM and the crankshaft position sensor.

   A. If a problem is found, repair the **5 V** power supply circuit.

   B. If there are no problems, proceed to Step **4**.

4. Measure the voltage between the signal circuit and normal GND of the crankshaft position sensor harness connector **CN.E4**.

   If the reading is more than or equal to the **5.5 V**, inspect to see if there is a short circuit to the battery or ignition power supply with the signal circuit between the ECM and the crankshaft position sensor.

   NOTE:
   - *There must be no disconnection or high resistance.*
   - *There must be no short circuit to GND.*

   A. If a problem is found, repair the signal circuit.

   B. If there are no problems, proceed to Step **5**.

5. Measure the voltage between the signal circuit of the crankshaft position sensor harness connector **CN.E4** and a normal GND again.

   If the reading is less than or equal to **4.5 V**, inspect the **5 V** power supply circuit between the ECM and the crankshaft position sensor.

   A. If a problem is found, repair the signal circuit.

   B. If there are no problems, proceed to Step **6**.

6. Measure the voltage between the **5 V** power supply circuit and GND circuit of the crankshaft position sensor harness connector **CN.E4**.

   If the reading is more than or equal to **4.5 V**, inspect to see if there is poor connection with the crankshaft position sensor harness connector **CN.E4**.

   A. If a problem is found, repair the harness connector **CN.E4**.

Disconnect the harness connector **CN.E6** from the boost sensor.

Turn ON the starter switch.

Measure the voltage between the throttle position sensor **5 V** power supply circuit and GND of the throttle position sensor harness connector **CN.B2**.

A. If it is greater than or equal to **4.5 V**, replace the boost sensor. (Refer to " **Boost pressure sensor - Remove (55.014)**" and " **Boost pressure sensor - Install (55.014)**")

B. If it is less than or equal to **4.5 V**, inspect for a short circuit to GND in the throttle position sensor **5 V** power supply circuit between the ECM and throttle position sensor.
If a problem is found, repair the throttle position sensor **4.5 V** power supply circuit.

8. Inspect for a short circuit to the GND in the fuel filter pressure sensor **5 V** power supply circuit between the ECM and fuel filter pressure sensor.

   A. If a problem is found, repair the fuel filter pressure sensor 5 V power supply circuit.

   B. If there are no problems, proceed to Step **9**.

9. Inspect for a short circuit to the GND in the boost sensor **5 V** power supply circuit between the ECM and boost sensor.

   A. If a problem is found, repair the boost sensor **5 V** power supply circuit.

   B. If there are no problems, proceed to Step **10**.

10. Replace the ECM. (Refer to " **Engine Control Unit (ECU) - Remove (55.015)**" and " **Engine Control Unit (ECU) - Install (55.015)**").
Set the injector identification code and the engine number on the ECM.

11. Confirm resolution:

    1. Clear the diagnostic trouble code using the trouble diagnosis scan tool.

    2. Turn the starter switch OFF for **1 min** or longer.

    3. Start the engine.

    4. Perform a test-run under the conditions for running the Diagnostic Trouble Code.

    NOTE: *The setting conditions such as engine operating hours or coolant temperature depend on the diagnostic trouble code.*

    5. Use the trouble diagnosis scan tool to confirm that a diagnostic trouble code has not been detected.
    Conditions for setting the Diagnostic Trouble Codes such as engine run time or coolant temperature, etc., vary depending on the Diagnostic Trouble Codes.

Wiring harnesses - Electrical schematic sheet 09 (55.100) Wiring harnesses - Electrical schematic sheet 07 (55.100) Wiring harnesses - Electrical schematic sheet 14 (55.100) Wiring harnesses - Electrical schematic sheet 20 (55.100)

P20DF-Fuel filter clog sensor error (abnormally low voltage)

Control Module : ECM

Solution:

1. Check and diagnose the trouble code setting conditions before you proceed with the diagnostics code P20DF.

   Diagnostic trouble code P060B is not detected.
   The ECM detects that the fuel filter pressure sensor voltage is **0.1 V** or lower for **5 s**.

2. Check and diagnose the below fault codes before you proceed with the diagnostics code P20DE.

   Diagnostic trouble code P0641

3. Turn OFF the starter switch.

   Measure the voltage between the **5 V** power supply circuit of the harness connector of the fuel filter pressure sensor and normal ground.

   If the voltage is equal or less than **4.5 V**, inspect for a disconnection or high resistance in the 5 V power supply circuit between the ECM and fuel filter pressure sensor.

   Start the engine.

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

   A. If a problem is found, repair the **5 V** power supply circuit.

   B. If there are no problems, proceed to Step **4**.

4. Connect a test cable with fuse between the **5 V** power supply circuit of the harness connector of the fuel filter pressure sensor and signal circuit.

   Check the value indicated on the fuel filter pressure sensor (clog) with the trouble diagnosis scan tool.

   If the voltage is equal or more than **4.5 V**, inspect for a contact defect in the harness connector of the fuel filter pressure sensor.

   A. If a problem is found, repair the harness connector.

   B. If the harness connector is normal,replace the fuel filter pressure sensor. (Refer to " **Fuel filter restriction sensor - Remove (55.010)**" and " **Fuel filter restriction sensor - Install (55.010)**")
   Proceed to Step **5**.

5. Inspect the signal circuit between the ECM and fuel filter pressure sensor.

   NOTE:
   • There must be no disconnection or high resistance.
   • There must be no short circuit to ground.

   A. If a problem is found, repair the signal circuit.

   B. If there are no problems, proceed to Step **6**.

6. Inspect for a contact defect in the ECM harness connector **CN.D1-02**.

   A. If a problem is found, repair the harness connector **CN.D1-02**.

   B. If the harness connector **CN.D1-02** is normal,replace the ECM. (Refer to " **Engine Control Unit (ECU) - Remove (55.015)**" and " **Engine Control Unit (ECU) - Install (55.015)**").

7. Set the injector identification code and the engine number on the ECM.

A. If the voltage exceeds **1.5 - 3.5 V**, replace the ECM. (Refer to " **Engine Control Unit (ECU) - Remove (55.015)**" and " **Engine Control Unit (ECU) - Install (55.015)**").

7. Set the injector identification code and the engine number on the ECM.
8. Turn OFF the starter switch.

   Connect the harness connector to the control unit of the actual unit.

   Turn ON the starter switch.

   Measure the voltage between the CAN- High terminal and GND of the termination resistor harness connector. **CN.D4**

   Measure the voltage between the CAN- Low terminal and GND the termination resistor harness connector **CN.D4**.

   A. If the voltage exceeds **1.5 - 3.5 V**, replace the ECM. (Refer to " **Engine Control Unit (ECU) - Remove (55.015)**" and " **Engine Control Unit (ECU) - Install (55.015)**").
9. Set the injector identification code and the engine number on the ECM.
10. Turn OFF the starter switch.

    Connect the harness connector to the control unit of the actual unit.

    Turn ON the starter switch.

    Measure the voltage between the CAN- High terminal and GND of the termination resistor harness connector. **CN.D4**

    Measure the voltage between the CAN- Low terminal and GND of the termination resistor harness connector **CN.D4**.

    A. If the voltage exceeds **1.5 - 3.5 V**, replace the control unit of the machine.

    B. If the voltage is within **1.5 - 3.5 V**, replace the termination resistor.
11. Confirm resolution:

    1. Clear the Diagnostic Trouble Code using the trouble diagnosis scan tool.

    2. Turn the starter switch OFF for **1 min** or longer.

    3. Start the engine.

    4. Perform a test-run under the conditions for running the Diagnostic Trouble Code.

    5. Use the trouble diagnosis scan tool to confirm that a Diagnostic Trouble Code has not been detected. Conditions for setting the Diagnostic Trouble Codes such as engine run time or coolant temperature, etc., vary depending on the Diagnostic Trouble Codes.

Wiring harnesses - Electrical schematic sheet 05 (55.100) Wiring harnesses - Electrical schematic sheet 06 (55.100) Wiring harnesses - Electrical schematic sheet 07 (55.100) Wiring harnesses - Electrical schematic sheet 08 (55.100)

11. Use wrenches [**19 mm**, **36 mm**] to remove the hoses **(1)**, **(2)**, **(3)**, **(4)**, **(5)** and **(6)**.
    - Mark the hoses and lines so that the connectors match at the time of installation.
    - Use caps or plugs to cover the hoses and lines to prevent any entry of water, dust or dirt.
    - Clean the hoses and lines by spraying them with a parts cleaner to prevent scratches and prevent dirt from accumulating on the connectors.

    (1) Bucket hose [use **36 mm** wrench]

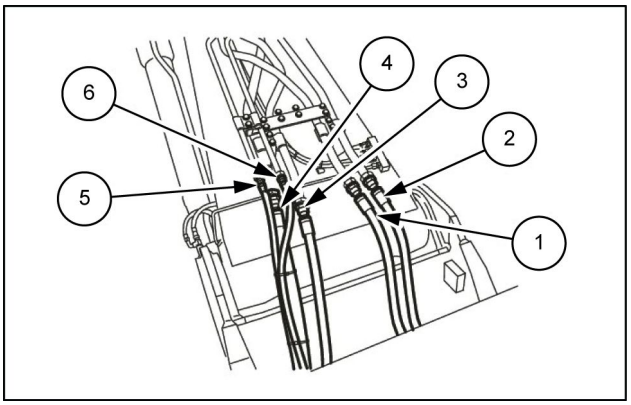
    (2) Bucket hose [use **36 mm** wrench]

    (3) Arm hose [use **36 mm** wrench]

    (4) Arm hose [use **36 mm** wrench]

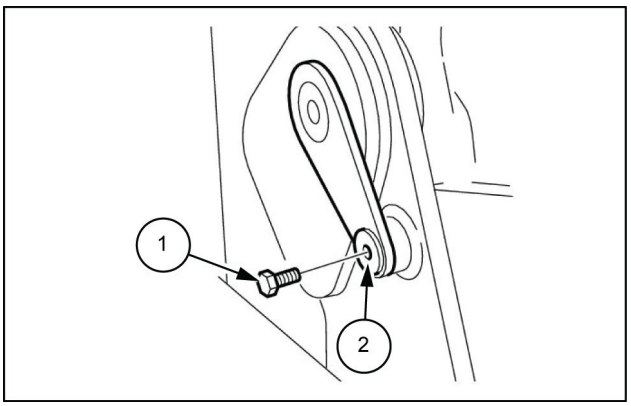
    (5) 2nd option hose [use **19 mm** wrench]

    (6) 2nd option hose [use **19 mm** wrench]



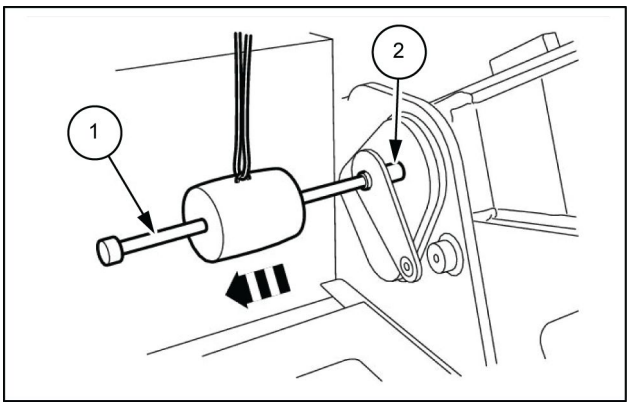
SMIL13CEX0162AB 11

12. Use a wrench [**24 mm**] to remove the bolt **(1)** and washer **(2)**.



SMIL13CEX1080AB 12

13. Use a slide hammer **(1)** [**36 mm**] to remove the pin **(2)**.



SMIL13CEX1081AB 13

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