

CX17C
Mini Excavator

SERVICE MANUAL

Part number 51679665
English
October 2019

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CASE
CONSTRUCTION

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⚠ WARNING

Burn hazard!

Hot coolant can spray and scald if you remove the radiator or deaeration tank cap while the system is hot. To remove the cap: allow the system to cool, turn the cap to the first notch, and wait for all pressure to release. Remove the cap only after all pressure has released.

Failure to comply could result in death or serious injury.

W0367A

⚠ WARNING

Escaping fluid!

Hydraulic fluid or diesel fuel leaking under pressure can penetrate the skin and cause infection or other injury. To prevent personal injury: Relieve all pressure before disconnecting fluid lines or performing work on the hydraulic system. Before applying pressure, make sure all connections are tight and all components are in good condition. Never use your hand to check for suspected leaks under pressure. Use a piece of cardboard or wood for this purpose. If injured by leaking fluid, see your doctor immediately.

Failure to comply could result in death or serious injury.

W0178A

⚠ WARNING

Chemical hazard!

When handling fuel, lubricants, and other service chemicals, follow the manufacturer's instructions. Wear Personal Protective Equipment (PPE) as instructed. Do not smoke or use open flame. Collect fluids in proper containers. Obey all local and environmental regulations when disposing of chemicals.

Failure to comply could result in death or serious injury.

W0371A

Conversion factors

Unit conversion rate

Gravitational unit	- x → ← ÷ -	SI unit
kgf	9.807	N
lbf	4.448	N
kgf·cm	0.0981	N·m
lbf·ft	1.356	N·m
lbf·in	0.113	N·m
kgf/cm ²	0.0981	MPa
atm	0.1013	MPa
lbf/in ²	0.0069	MPa
mm Hg	133.3	Pa
in Hg	3386	Pa
kgf· m/s	0.00981	kW
lbf·ft/s	0.00136	kW
PS	0.7355	kW
HP	0.746	kW
kgf·m	9.807	J
kcal	4186	J
kgf·s/cm ²	98067	Pa·s
cP	0.001	Pa·s
P	0.1	Pa·s
cSt	1 x 10 ⁻⁶	m ² /s
St	0.0001	m ² /s

Length

Millimeters to inches

mm	In.	mm	In.	mm	In.	mm	In.
1	0.0394	26	1.0236	51	2.0079	76	2.9921
2	0.0787	27	1.0630	52	2.0472	77	3.0315
3	0.1181	28	1.1024	53	2.0866	78	3.0709
4	0.1575	29	1.1417	54	2.1260	79	3.1102
5	0.1969	30	1.1811	55	2.1654	80	3.1496
6	0.2362	31	1.2205	56	2.2047	81	3.1890
7	0.2756	32	1.2598	57	2.2441	82	3.2283
8	0.3150	33	1.2992	58	2.2835	83	3.2677
9	0.3543	34	1.3386	59	2.3228	84	3.3071
10	0.3937	35	1.3780	60	2.3622	85	3.3465
11	0.4331	36	1.4173	61	2.4016	86	3.3858
12	0.4724	37	1.4567	62	2.4409	87	3.4252
13	0.5118	38	1.4961	63	2.4803	88	3.4646
14	0.5512	39	1.5354	64	2.5197	89	3.5039
15	0.5906	40	1.5748	65	2.5591	90	3.5433
16	0.6299	41	1.6142	66	2.5984	91	3.5827
17	0.6693	42	1.6535	67	2.6378	92	3.6220
18	0.7087	43	1.6929	68	2.6772	93	3.6614
19	0.7480	44	1.7323	69	2.7165	94	3.7008
20	0.7874	45	1.7717	70	2.7559	95	3.7402
21	0.8268	46	1.8110	71	2.7953	96	3.7795
22	0.8661	47	1.8504	72	2.8346	97	3.8189
23	0.9055	48	1.8898	73	2.8740	98	3.8583
24	0.9449	49	1.9291	74	2.9134	99	3.8976
25	0.9843	50	1.9685	75	2.9528	100	3.9370

Hydraulic contamination

Contamination in the hydraulic system is a major cause of the malfunction of hydraulic components. Contamination is any foreign material in the hydraulic oil.

Contamination can enter the hydraulic system in several ways:

- When you drain the oil or disconnect any line
- When you disassemble a component
- From normal wear of the hydraulic components
- From damaged seals or worn seals
- From a damaged component in the hydraulic system

All hydraulic systems operate with some contamination. The design of the components in this hydraulic system permits efficient operation with a small amount of contamination. An increase in this amount of contamination can cause problems in the hydraulic system.

The following list includes some of these problems:

- Cylinder rod seals that leak
- Control valve spools that do not return to neutral
- Movement of control valve spools is difficult
- Hydraulic oil that becomes too hot
- Pump gears, housing, and other parts that wear rapidly
- Relief valves or check valves held open by dirt
- Quick failure of components that have been repaired
- Slow cycle times are slow. The machine does not have enough power.

If your machine has any of these problems, check the hydraulic oil for contamination.

There are two types of contamination: microscopic and visible.

Microscopic contamination occurs when very fine particles of foreign material are suspended in the hydraulic oil. These particles are too small to see or feel. Microscopic contamination can be found by identification of the following problems or by testing in a laboratory.

Examples of problems caused by microscopic contamination:

- Cylinder rod seals that leak
- Control valve spools that do not return to neutral
- The hydraulic system has a high operating temperature

Visible contamination is foreign material that can be found by sight, touch, or odor. Visible contamination can cause a sudden failure of components.

Examples of problems caused by visible contamination:

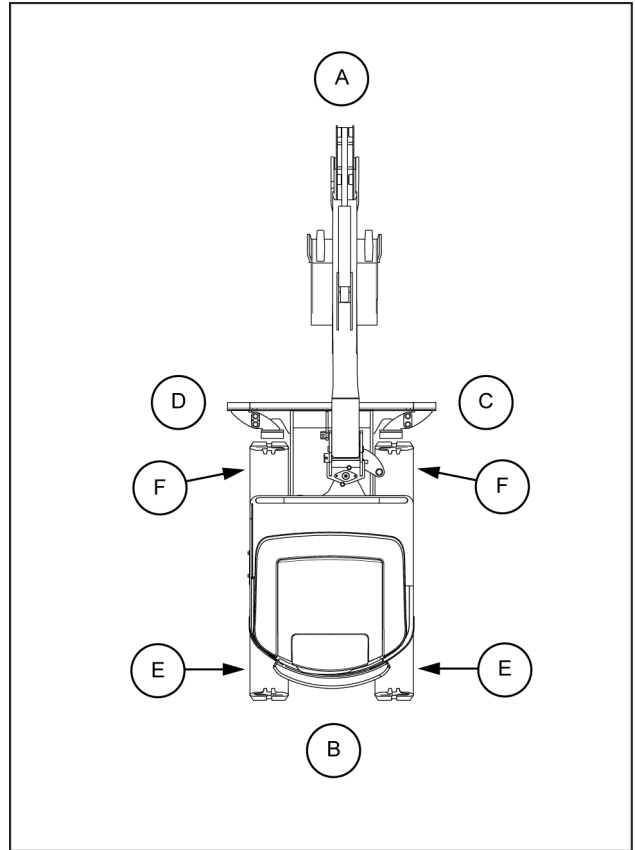
- Particles of metal or dirt in the oil
- Air in the oil
- Dark or thick oil
- Oil with an odor of burned oil
- Water in the oil

If you find contamination, use a portable filter to clean the hydraulic system.

Product identification - Machine orientation

The terms "Right-hand", "Left-hand", "Front" and "Rear" are used in this manual to indicate the sides as they are seen from the operator's seat when the travel motors are positioned at the rear and the operator is facing the direction in which the machine advances (forward).

- A. Front
- B. Rear
- C. Right-hand side
- D. Left-hand side
- E. Travel motor
- F. Idler wheel



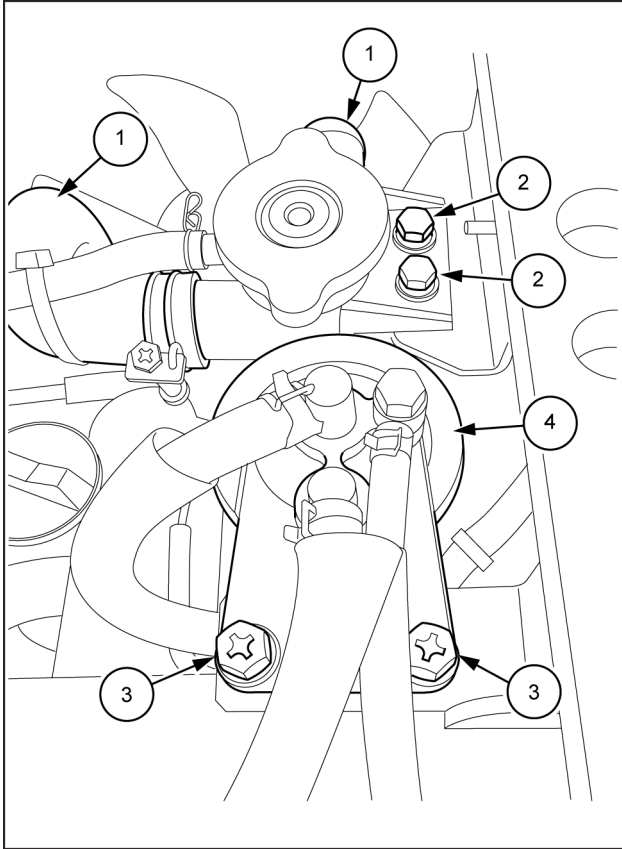
SMIL16MEX2251BB 1

Engine - Engine and crankcase

Item		Factory Specification	Allowable Limit
• Crank gear to oil pump drive gear	• Backlash	0.0410 – 0.123 mm (0.00161 – 0.00484 in)	0.15 mm (0.0059 in)
Idle gear	Side Clearance	0.20 – 0.51 mm (0.0079 – 0.0201 in)	0.80 mm (0.0315 in)
Camshaft	Side Clearance	0.15 – 0.31 mm (0.0059 – 0.012 in)	0.50 mm (0.020 in)
	Alignment	–	0.01 mm (0.0004 in)
Cam height	Intake and exhaust	26.88 mm (1.058 in)	26.83 mm (1.056 in)
Camshaft journal to cylinder block bore	Oil Clearance	0.050 – 0.091 mm (0.0020 – 0.0036 in)	0.15 mm (0.0059 in)
• Camshaft journal	• Outer diameter	32.934 – 32.95 mm (1.297 – 1.297 in)	–
• Cylinder block bore	• Inner diameter	33.000 – 33.025 mm (1.2992 – 1.3002 in)	–
Idle gear shaft to idle gear bushing	Oil Clearance	0.020 – 0.084 mm (0.0008 – 0.0033 in)	0.10 mm (0.0039 in)
• Idle gear shaft	• Outer diameter	19.967 – 19.980 mm (0.7861 – 0.7866 in)	–
• Idle gear bushing	• Inner diameter	20.000 – 20.051 mm (0.7874 – 0.7894 in)	–
Piston pin bore	Inner diameter	20.000 – 20.013 mm (0.7874 – 0.7879 in)	20.05 mm (0.7894 in)
Piston pin to small end bushing	Oil clearance	0.014 – 0.038 mm (0.0006 – 0.0015 in)	0.10 mm (0.0039 in)
• Piston pin	• Outer diameter	20.002 – 20.011 mm (0.7875 – 0.7878 in)	–
• Small end bushing	• Inner diameter	20.025 – 20.040 mm (0.7884 – 0.7890 in)	–
Piston pin to small end bushing (spare parts)	Oil clearance	0.015 – 0.075 mm (0.0006 – 0.0030 in)	0.15 mm (0.0059 in)
• Small end bushing	• Inner diameter	20.026 – 20.077 mm (0.7884 – 0.7904 in)	–
Piston ring gap	Top ring	0.15 – 0.30 mm (0.0059 – 0.0118 in)	1.25 mm (0.0492 in)
	Second ring	0.35 – 0.50 mm (0.0138 – 0.0197 in)	1.25 mm (0.0492 in)
	Oil ring	0.15 – 0.35 mm (0.0059 – 0.0138 in)	1.20 mm (0.0472 in)
Piston ring to piston ring groove			
• Second ring	• Clearance	0.0900 – 0.120 mm (0.00354 – 0.00472 in)	0.15 mm (0.0059 in)
• Oil ring	• Clearance	0.040 – 0.080 mm (0.0016 – 0.0031 in)	0.15 mm (0.0059 in)
Connecting Rod	Alignment	–	0.05 mm (0.0020 in)
Crankshaft	Side clearance	0.15 – 0.35 mm (0.0059 – 0.014 in)	0.50 mm (0.020 in)
	Alignment	–	0.02 mm (0.0008 in)
Crankpin to crankpin bearing	Oil Clearance	0.020 – 0.051 mm (0.0008 – 0.0020 in)	0.15 mm (0.0059 in)
• Crankpin	• Outer diameter	33.959 – 33.975 mm (1.337 – 1.338 in)	–
• Crankpin bearing	• Outer diameter	33.995 – 34.010 mm (1.3384 – 1.3390 in)	–

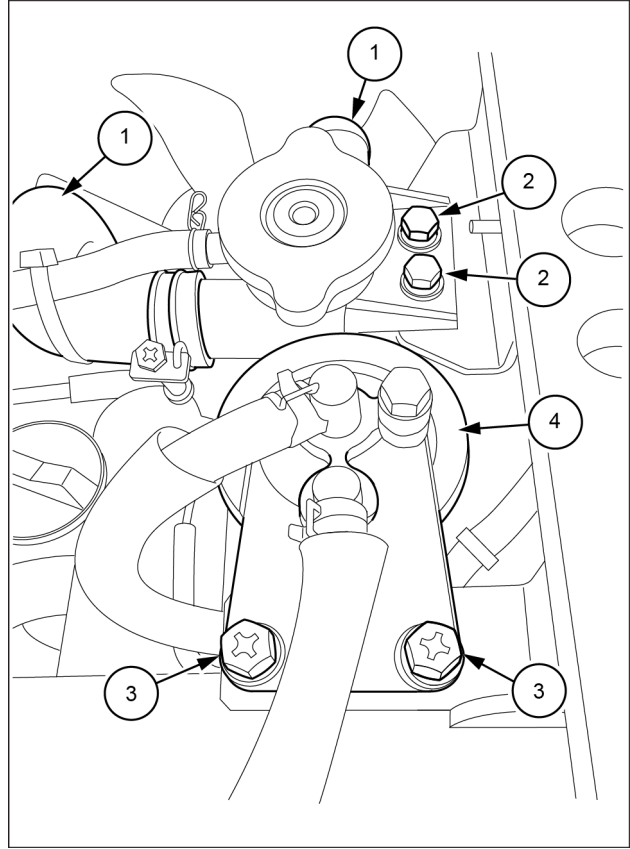
26. Depending on the fuel filter configuration refer to figure 8 or figure 9 to perform the following steps.

- Use a wrench [**13 mm**] to remove the two bolts (2) and then remove the filling hoses (1) of the radiator from the support.
- Use a wrench [**13 mm**] to remove the two bolts (3) and then remove the fuel filter (4) from the support.



SMIL17MEX0267BB 8

NOTE: first configuration.



SMIL19MEX0605BB 9

NOTE: second configuration.

36. Install the radiator (refer to **Radiator - Install (10.400)**).
37. Install the pump (refer to **Pump - Install (35.106)**).
38. Install the operator seat base trim panel (refer to **Operator seat base trim panel - Install - Platform (90.160)**).
39. Install the operator seat (refer to **Operator seat - Install (90.120)**).
40. Install the canopy (refer to **Canopy assembly - Install (90.114)**).
41. Install the engine access door (refer to **Engine hood - Install (90.105)**).
42. Install the side panels (refer to **Side panels - Install (90.100)**).

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TECHNICAL DATA

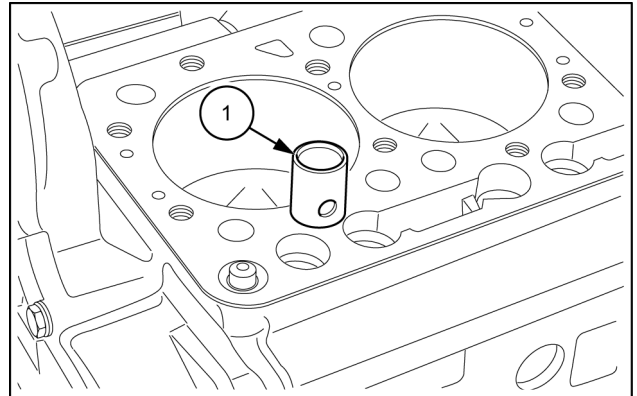
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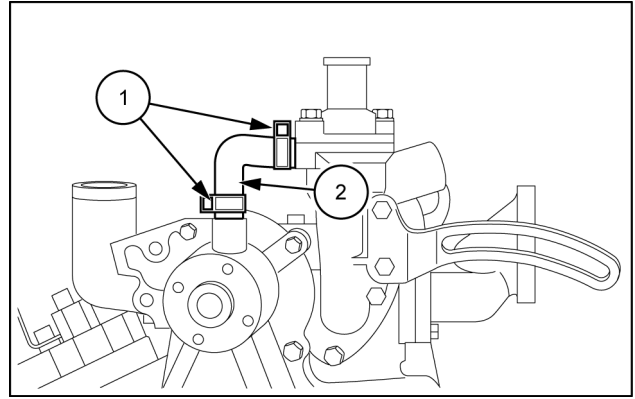
Camshaft Tappets - Remove

1. Remove the cylinder head (refer to **Cylinder heads - Disassemble (10.101)**).
2. Remove the tappets (1) from the crankcase.



SMIL17MEX0528AB 1

7. Install the water return pipe (2) by means of clamps (1).



SMIL17MEX0526AB 4

Rocker arm and push rod

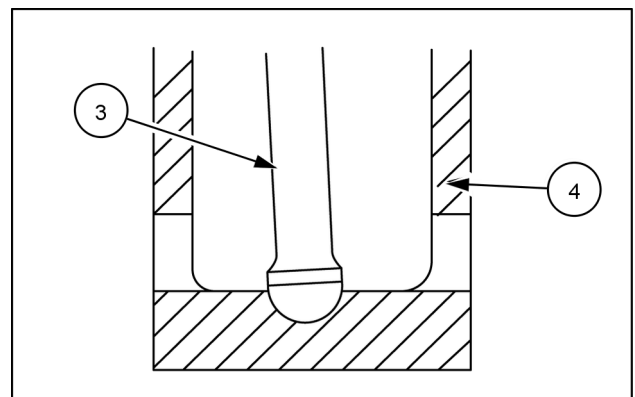
1. Insert the push rods (3) onto the tappets (4). Check that the push rods ends are properly engaged with the dimples.

NOTICE: after installing the rocker arm, be sure to adjust the valve clearance (refer to **Valves - Check (10.101)**).

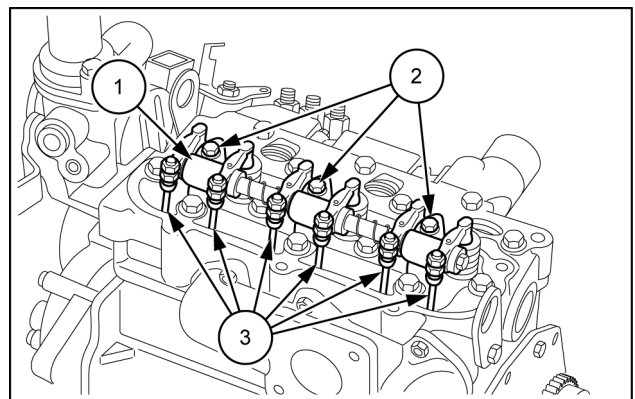
2. Install the rocker arm assembly (1).
3. Install the rocker arm bracket screws (2).

Tightening torque:

9.81 – 11.20 N·m (7.24 – 8.26 lb ft)



SMIL16MEX0788AB 5



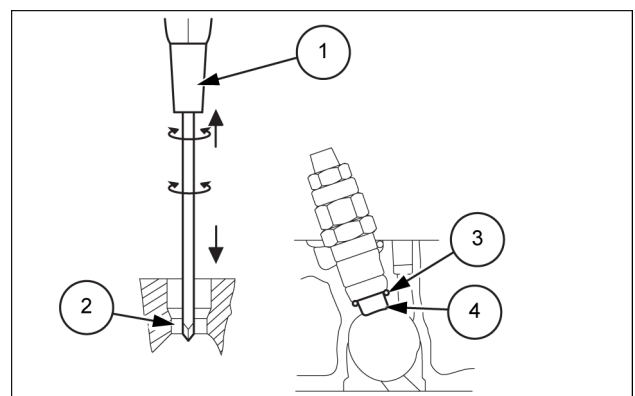
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Nozzle heat seal service installing procedure

NOTICE: after the removal of the injection nozzle for cleaning or service, replace the heat seal (4) and the gasket (3).

NOTE: use a phillips screwdriver (1) with a diameter bigger than the heat seal hole (approximately 6 mm (0.2 in)).

1. By means of a screwdriver, drive a new gasket (3) and a new heat seal (4) into the heat seal hole (2).

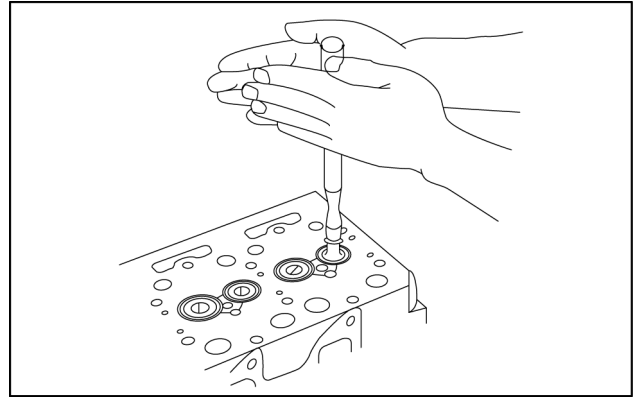


SMIL16MEX0786AB 7

Valve lapping

1. Apply compound evenly to the valve lapping surface.
2. Insert the valve into the valve guide. Lap the valve onto its seat with a valve flapper or screwdriver.
3. After lapping the valve, wash the compound away and apply oil, then repeat valve lapping with oil.
4. Apply prussian blue to the contact surface to check the seated rate. If it is less than **70%**, repeat valve lapping again.

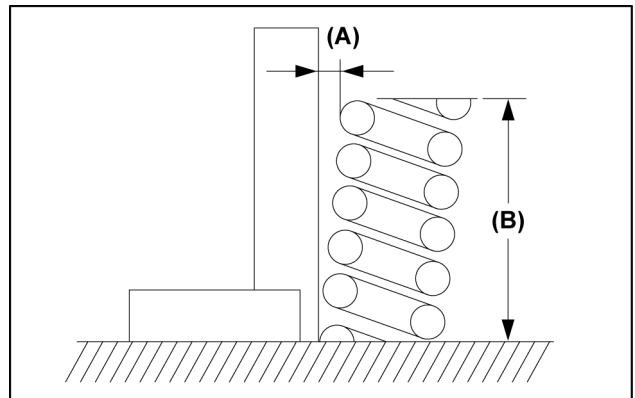
NOTE: when valve lapping is performed, be sure to check the valve recessing and adjust the valve clearance after assembling the valve.



SMIL16MEX0852AA 10

Free length and tilt of valve spring

1. Measure the free length (**B**) of valve spring with vernier calipers. If the measurement is less than the allowable limit, replace it.
2. Put the valve spring on a surface plate, place a square on the side of the valve spring.
3. Check to see if the entire side is in contact with the square. Rotate the valve spring and measure the maximum tilt (**A**). If the measurement exceeds the allowable limit, replace it.
4. Check the entire surface of the valve spring for scratches. If there is any problem, replace it.



SMIL16MEX0853AA 11

Allowable limit of the tilt (**A**):

1.2 mm (0.047 in)

Free length (**B**)

Factory specification: **31.3 – 31.8 mm (1.23 – 1.25 in)**

Allowable limit: **28.40 mm (1.12 in)**

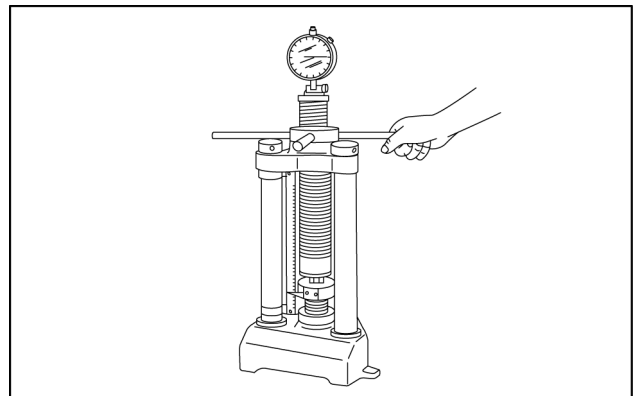
Valve spring setting load

1. Place the valve spring on a tester and compress it to the same length it is actually compressed in the engine.
2. Read the compression load on the gauge.
3. If the measurement is less than the allowable limit, replace it.

Setting load / Setting length

Factory specification: **65 N (14.6 lb) / 27 mm (1.1 in)**

Allowable limit: **55 N (12.4 lb) / 27 mm (1.1 in)**



SMIL16MEX0854AA 12

Install small end bushing

1. Clean a new small end bushing and bore, and apply engine oil to them.
2. Using a small end bushing replacing tool, press fit a new bushing (service parts) taking due care to see that the connecting rod oil hole matches the bushing hole.

Oil clearance between piston pin and small end bushing (spare parts)

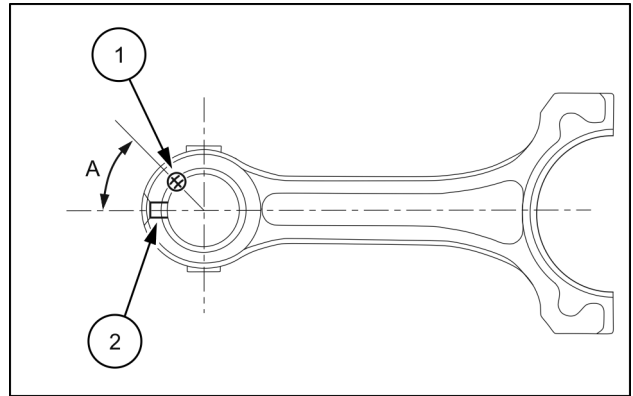
Factory specification: **0.015 – 0.075 mm**
(**0.0006 – 0.0030 in**)

Allowable limit: **0.15 mm (0.0059 in)**

Small end bushing inner diameter (spare parts)

Factory specification: **20.026 – 20.077 mm**
(**0.7884 – 0.7904 in**)

1. Seam (A) 0.79 rad (45°)
2. Oil Hole



SMIL16MEX0869AB 4

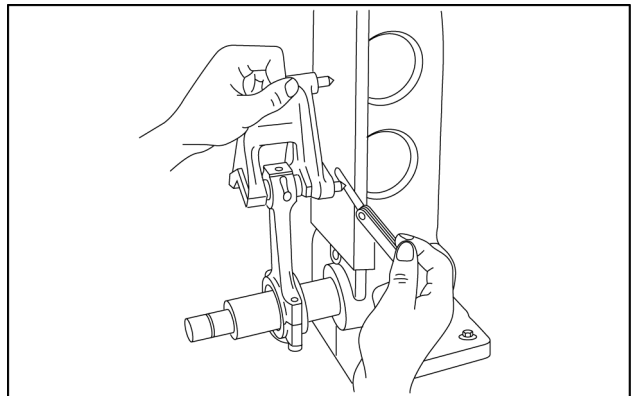
Connecting rod alignment

NOTE: since the inner diameter of the connecting rod small end bushing is the basis of this check, check bushing for wear beforehand.

1. Install the piston pin into the connecting rod.
2. Install the connecting rod on the connecting rod alignment tool.
3. Put a gauge over the piston pin, and move it against the face plate.
4. If the gauge does not fit squarely against the face plate, measure the space between the pin of the gauge and the face plate.
5. If the measurement exceeds the allowable limit, replace the connecting rod.

Connecting rod alignment

Allowable limit: **0.05 mm (0.002 in)**

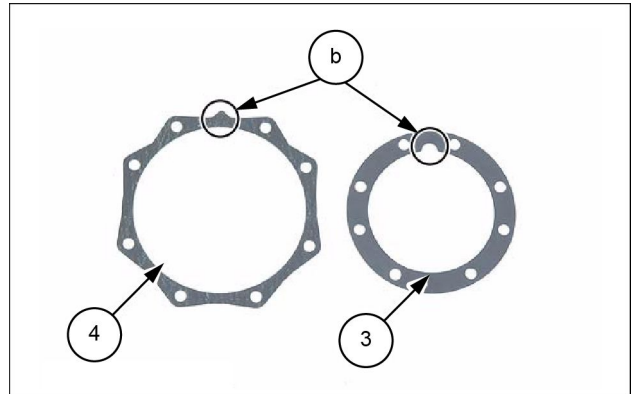


SMIL16MEX0870AA 5

Bearing case cover

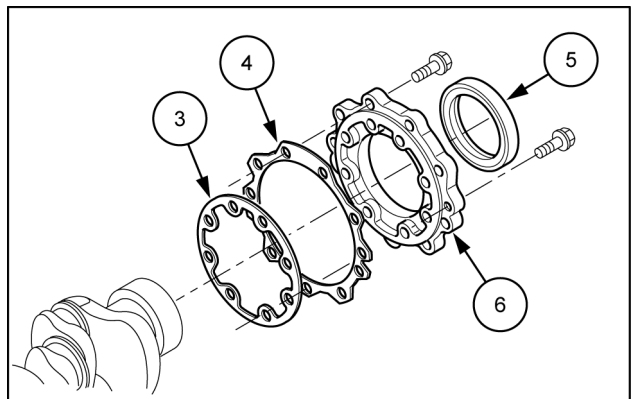
1. Fit the bearing case gasket (3) and the bearing case cover gasket (4). Make sure of the gasket correct position.

(b) Upside



SMIL17MEX0612AB 8

2. Install the bearing case cover (6) in the upward position marked as "UP" on the casting.
3. Apply engine oil to the oil seal (5) lip. Make sure that the oil seal is not rolled during the installation.

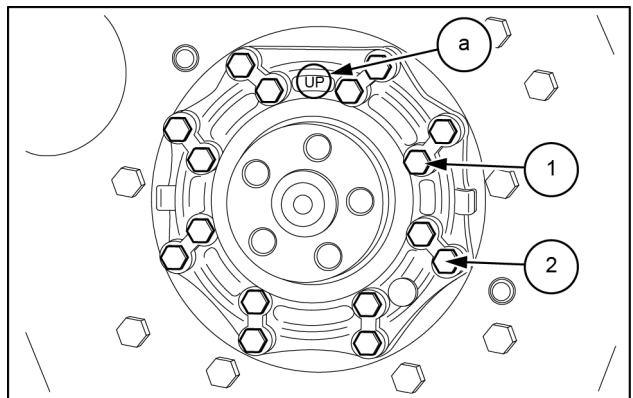


SMIL16MEX0827AB 9

4. Tighten the bearing case cover mounting screws (1) (outside) and (2) (inside) with even force on the diagonal line.

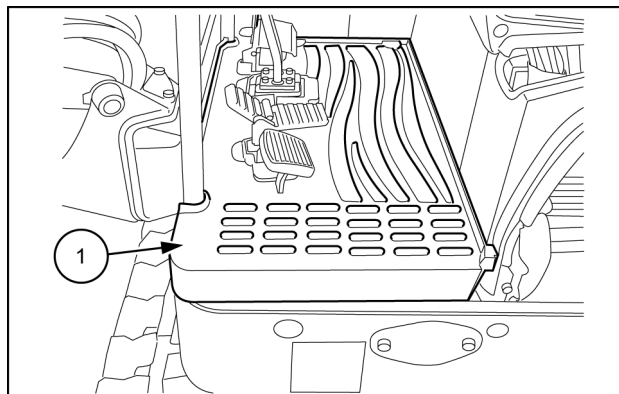
Tightening torque:

9.81 – 11.2 N·m (7.24 – 8.26 lb ft)



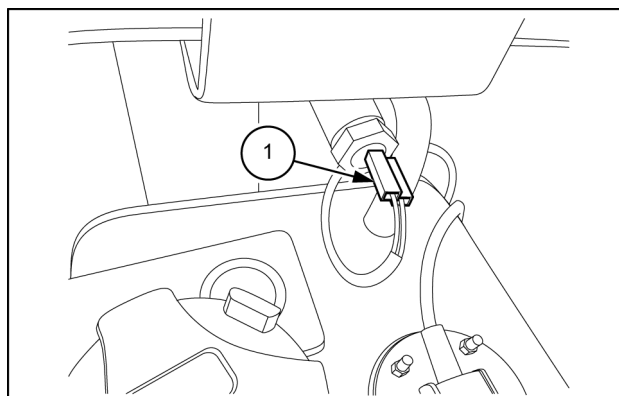
SMIL16MEX0826AB 10

1. Set the battery disconnect switch to O position (OFF position) to cut off any power supply in the electrical system of the machine (refer to **Mechanical battery isolator - Dynamic description (55.302)**).
2. Remove the Right-hand side panels (refer to **Side panels - Remove (90.100)**).
3. Remove the floor mat (1).



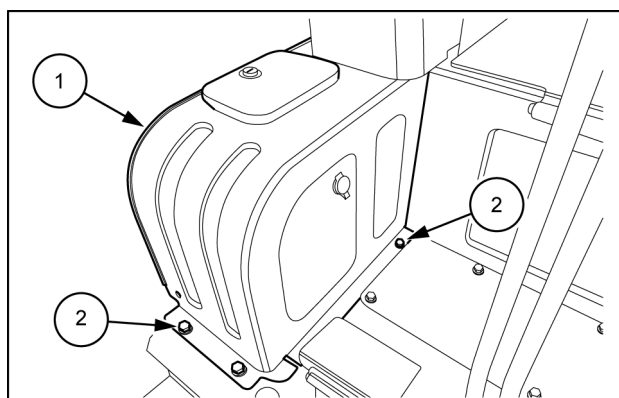
SMIL17MEX0207AB 1

4. Disconnect the electrical connector CN-139 (1) from the cover tanks.



SMIL17MEX0208AB 2

5. Use a wrench [17 mm] to remove the three bolts (2) and then remove the cover tanks (1).



SMIL17MEX0209AB 3

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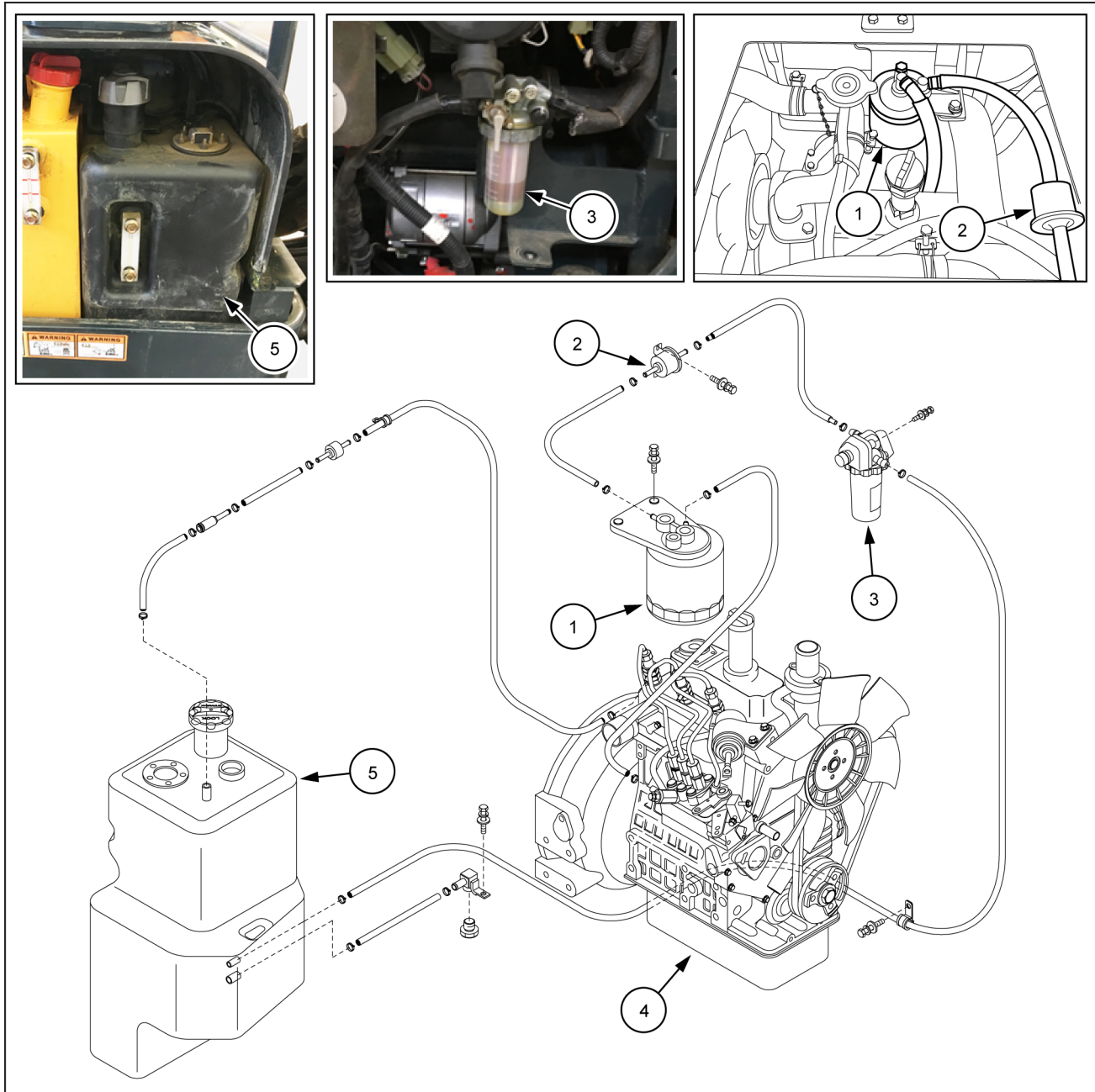
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Engine - Fuel injection system



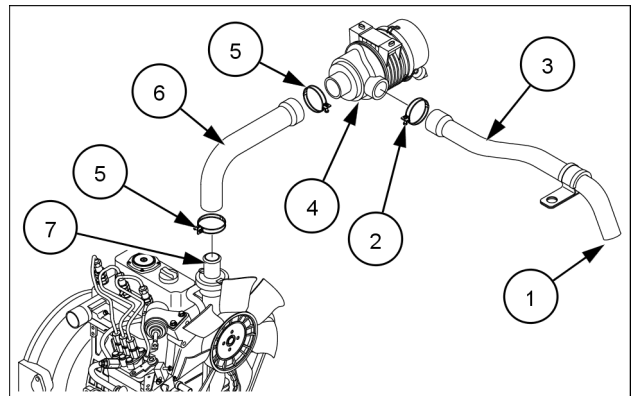
SMIL19MEX0621G 2

Second configuration

Component	Reference
1. Fuel filter	Fuel filters - Replace (10.206)
2. Fuel feed pump	—
3. Fuel-water separator filter	Fuel-water separator filter - Replace (10.206)
4. Engine	Engine - Overview (10.001)
5. Fuel tank	—

Intake manifold - Replace - Hoses

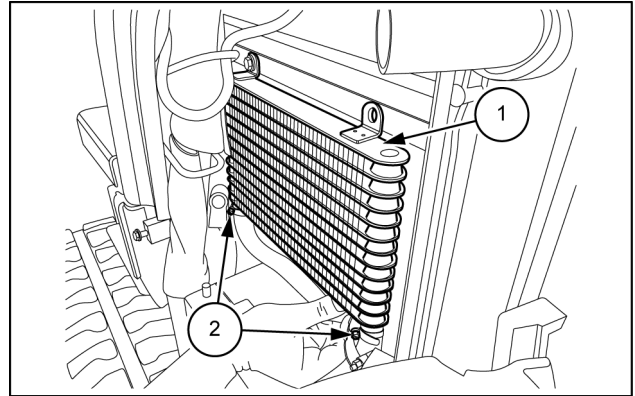
1. Loosen the clamp (2).
2. Remove the intake air hose (3) with the clamp (2) from the air cleaner (4).
3. Replace with a new intake air hose (3) and new clamp (2).
4. Tighten the clamp (2).
5. Loosen the clamps (5).
6. Remove the intake air hose (6) with the clamps (5) from the air cleaner (4), and the intake manifold (7).
7. Replace with a new intake air hose (6) and new clamps (5).
8. Tighten the clamps (5).



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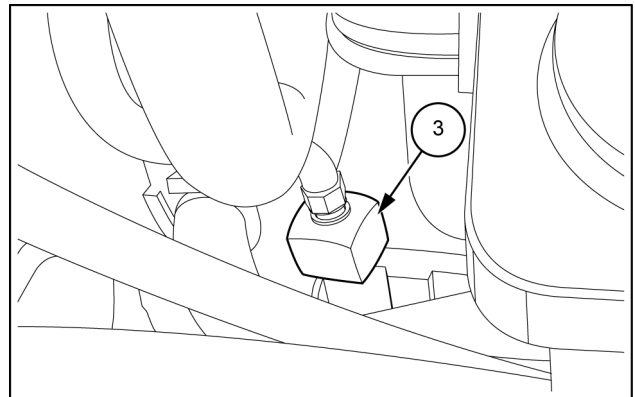
NOTE: to prevent serious damage to the engine, keep out any dust inside the intake air line.

1. Remove the left-hand side panels (refer to **Side panels - Remove (90.100)**).
2. Remove the battery.
3. Remove the counterweight (refer to **Counterweight - Remove (39.140)**).
4. Place a receptacle of a suitable capacity under the hydraulic oil cooler (1).
5. Remove the two clamps (2), disconnect the two hoses from the hydraulic oil cooler (1) and drain the fluid.
6. Remove the hydraulic oil cooler (1).



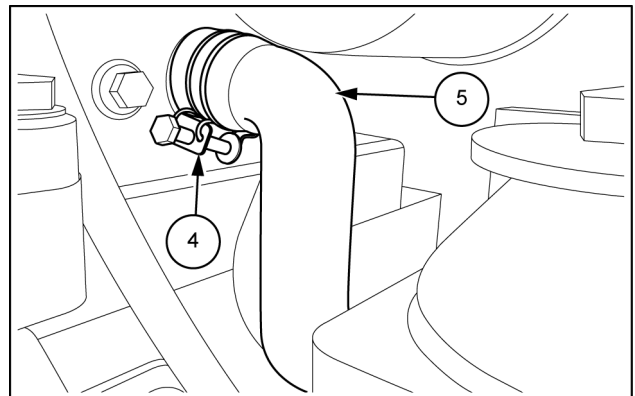
SMIL17MEX0656AB 1

7. Place a receptacle of a suitable capacity under the drain plug (3).
8. Remove the plug and drain the fluid.
9. Remove the clamp that fix the drain hose, then remove the drain hose.



SMIL17MEX0657AB 2

10. Use a wrench [10 mm] to remove the clamp (4), then disconnect the hose (5).

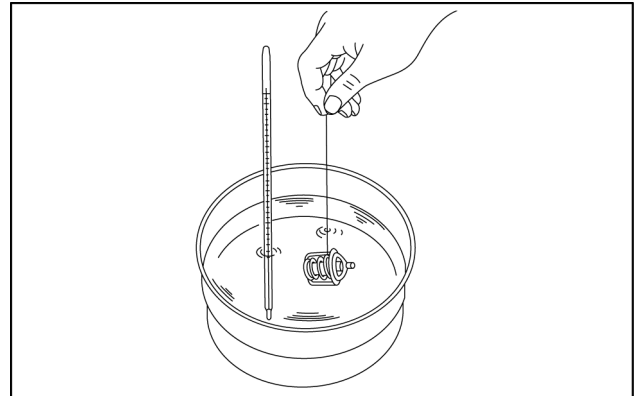


SMIL17MEX0658AB 3

Coolant thermostat - Test

Thermostat valve opening temperature

1. Suspend the thermostat in the water by a string with its end inserted between the valve and seat.
2. Heating the water gradually, read the temperature when the valve opens and leaves the string.
3. Continue heating and read the temperature when the valve opens approximately **8 mm (0.3 in)**.
4. If the measurement is not within the factory specifications, replace the thermostat.



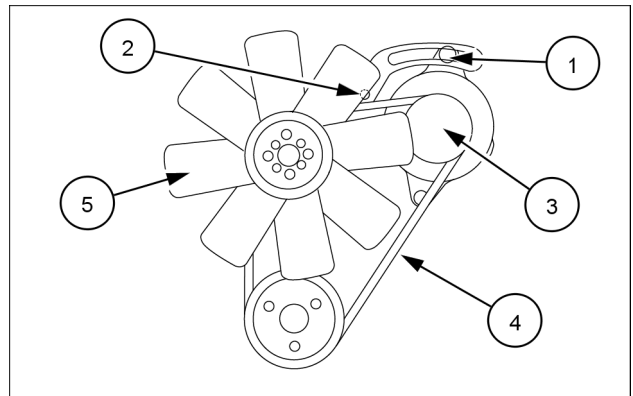
SMIL16MEX0769AA 1

Thermostat's valve opening temperature	Factory specification	69.5 – 72.5 °C (157.1 – 162.5 °F)
Temperature at which thermostat completely opens	Factory specification	85 °C (185 °F)

Belt - Replace

1. Loosen the adjusting bolt **(1)** and the mounting bolt **(2)**.
2. Lightly tighten the adjusting bolt **(1)** until its seating face touches.
3. Remove the belt **(4)** from the pulleys to pull it out from the radiator fan **(5)**.
4. Insert the new belt from the radiator fan **(5)** to mount it by aligning it to groove of each pulley. Rotate the alternator **(3)** to obtain the correct value of tension.
5. Tighten the adjusting bolt **(1)** and the mounting bolt **(2)**.

Deflection (A)	Factory specification	7.0 – 9.0 mm (0.28 – 0.35 in) - 98 N (22 lb)
-----------------------	-----------------------	---

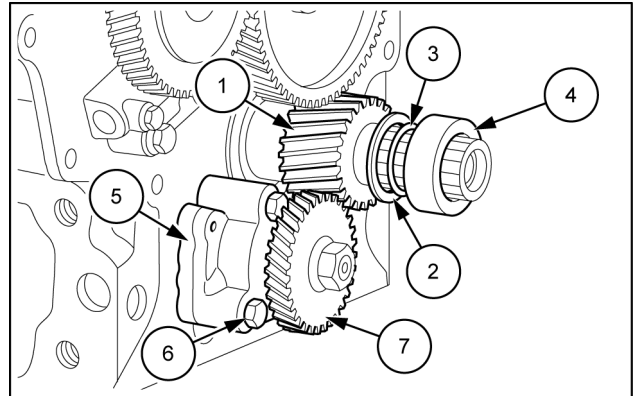


SMIL16MEX0419AA 1

6. After adjustment, run the engine in idling speed for approximately **5 min**, and then stop the engine to re-check tension of the belt.

Engine oil pump - Remove

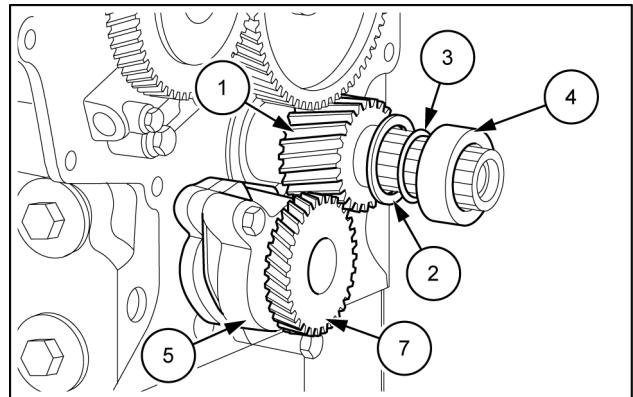
1. Remove the timing gear housing (refer to **Timing gear housing - Remove (10.102)**).
2. Remove the oil pump gear (7).
3. Remove the oil pump mounting screw (6) and the oil pump (5).
4. Remove the collar (4), O-ring (3) and crankshaft oil slinger (2).
5. Remove the crankshaft gear (1).



SMIL17MEX0555AB 1

One-side maintenance type model

1. Remove the oil pump mounting screw (6) and the oil pump (5) with the oil pump gear (7).
2. Remove the collar (4), O-ring (3) and crankshaft oil slinger (2).
3. Remove the crankshaft gear (1).



SMIL17MEX0556AB 2

Contents

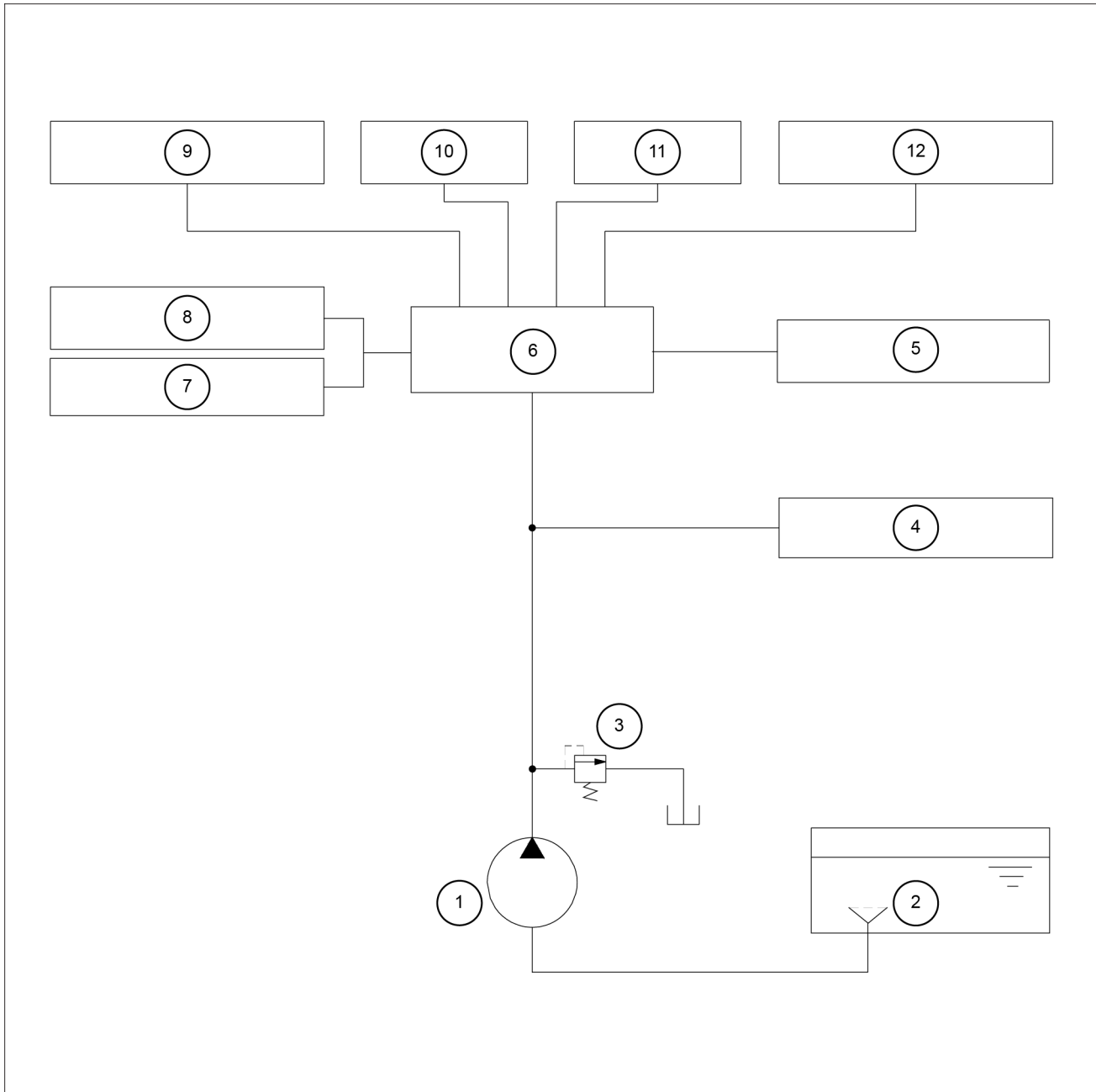
Hydraulic systems - 35

[35.000] Hydraulic systems.....	35.1
[35.300] Reservoir, cooler, and filters.....	35.2
[35.106] Variable displacement pump	35.3
[35.359] Main control valve	35.4
[35.357] Pilot system	35.5
[35.355] Hydraulic hand control	35.6
[35.356] Hydraulic foot control.....	35.7
[35.352] Hydraulic swing system	35.8
[35.353] Hydraulic travel system	35.9
[35.354] Hydraulic central joint	35.10
[35.735] Track frame widening system	35.11
[35.736] Boom hydraulic system	35.12
[35.737] Dipper hydraulic system.....	35.13
[35.738] Excavator and backhoe bucket hydraulic system.....	35.14
[35.734] Tool quick coupler hydraulic system	35.15
[35.360] Hammer and rotating bucket hydraulic system	35.16
[35.739] Swing arm hydraulic system	35.17
[35.741] Dozer blade cylinders	35.18

PILOT CIRCUIT

The pilot pump (1) is provided with relief valve (3), receives the oil from the hydraulic oil tank through the suction filter (2).

The discharged oil from the pilot pump (1) flows to the remote control valves, the solenoid valve assemblies, the swing parking brake (5), the main control valve (7) and the safety lock solenoid valve (6).



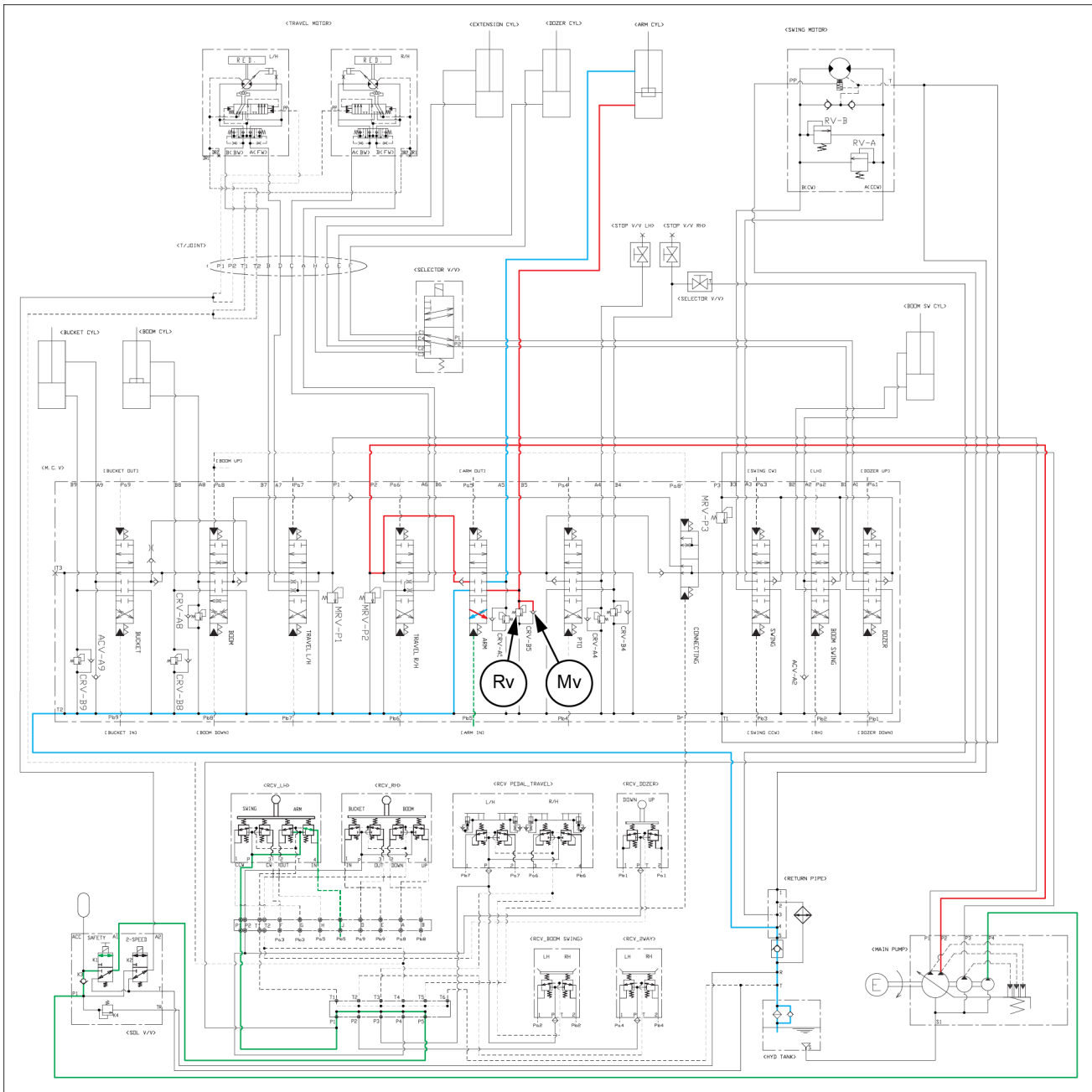
SMIL17MEX0119GB 4

- | | |
|---|---|
| 1. Pilot pump | 7. Main control valve |
| 2. Suction filter | 8. Remote control valve (boom swing pedal) |
| 3. Relief valve - 30 bar (435 psi) | 9. Remote control valve (left-hand lever) |
| 4. Travel speed solenoid valve | 10. Remote control valve (travel pedal) |
| 5. Swing parking brake | 11. Remote control valve dozer |
| 6. Safety lock solenoid valve | 12. Remote control valve (right-hand lever) |

Hydraulic systems - Hydraulic schema - Arm circuit

Arm roll in circuit

When the left-hand control lever is pulled back, the arm spools in the main control valve are moved to the roll in position by the pilot oil pressure from the remote control valve. The oil from the P2 pump flows into the main control valve and then goes to the large chamber of arm cylinder. At the same time, the oil from small chamber of arm cylinder returns to the hydraulic oil tank through the arm spool in the main control valve. When this happens, the arm rolls in. The cavitation and excessive pressure in the bottom of the arm cylinder is also prevented by the check valve and the relief valve in the main control valve.



SMIL18MEX0778GB 1

- Pressure line
- Tank line
- Pilot pressure line
- - - Secondary pilot pressure line

Mv. Check valve

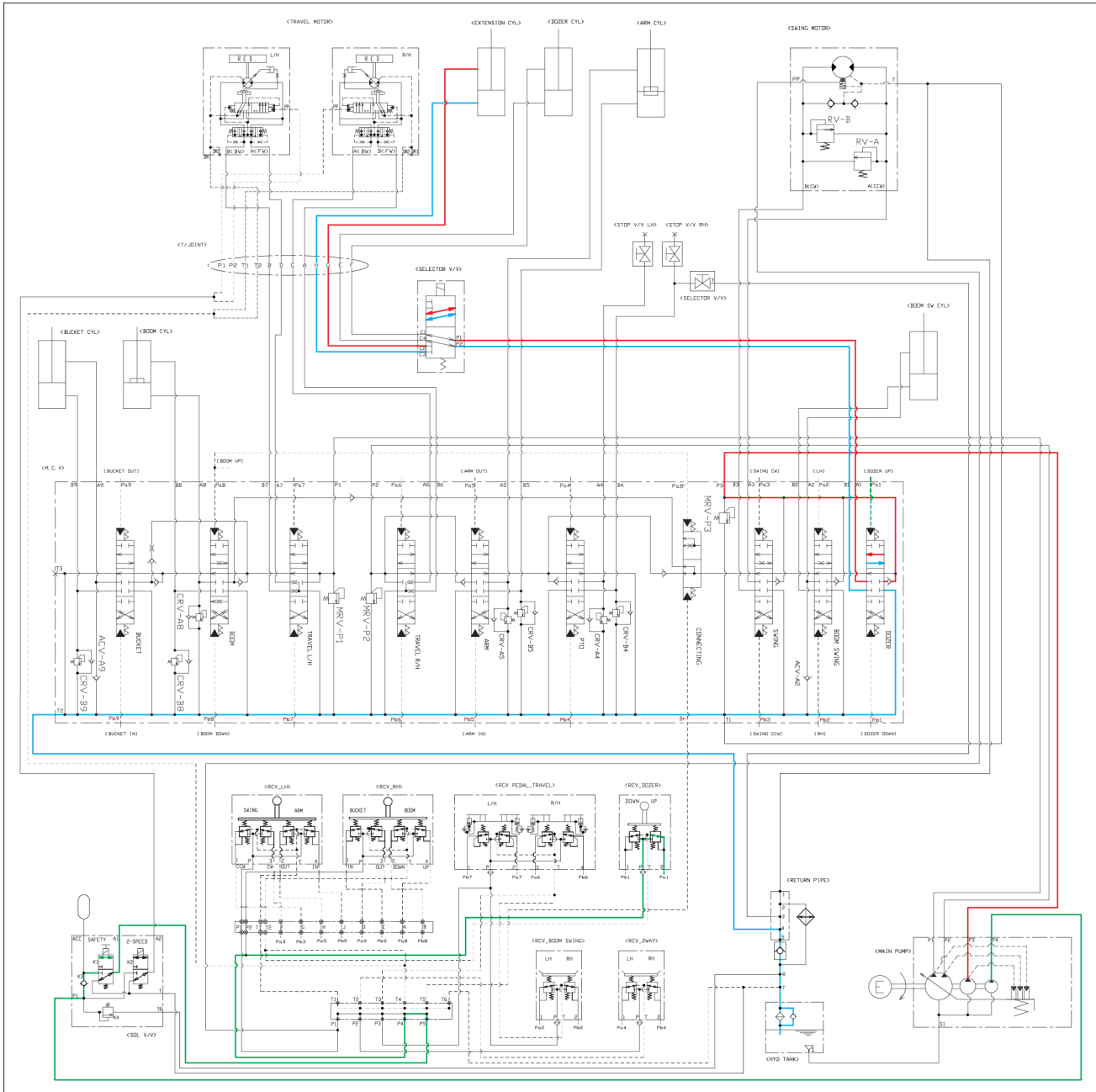
Rv. Relief valve

Hydraulic systems - Hydraulic schema - Track frame widening circuit

Crawler tracks retract circuit

With the switch on the right-hand console and the pilot selector valve in the crawler tracks widening position.

When the dozer control lever is pulled back, the dozer spool in the main control valve is moved to the dozer up position by the pilot oil pressure from the remote control valve. The oil from the P3 pump flows into the main control valve and then goes to the small chamber of extension cylinders through the pilot selector valve. At the same time, the oil from the large chamber of extension cylinders returns to the hydraulic oil tank through the dozer spool in the main control valve. When this happens, the crawler tracks goes retract.



SMIL18MEX0853GA 1

- Pressure line
- Pilot pressure line
- Tank line
- - - Secondary pilot pressure line

Hydraulic systems - Service instruction - Troubleshooting

Hydraulic oil foaming

1. Drop the hydraulic oil sample on hot plate.
 - A. If the oil foams come up, water is mixed. Put hydraulic oil still, separate water and dispose it or replace hydraulic oil.
 - B. If the oil foams do not come up, air is intruded. Check suction line and return line and eliminate the air intruding source.

Contents

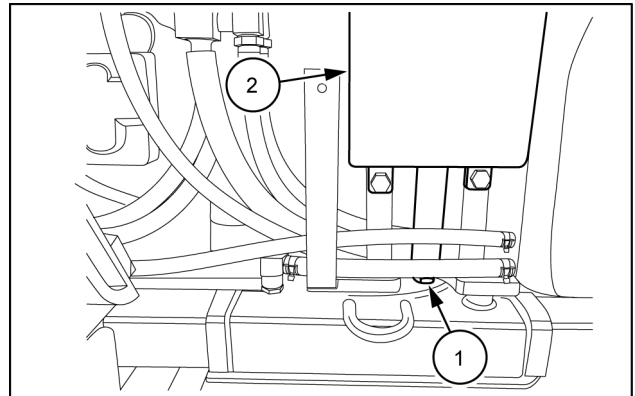
Hydraulic systems - 35

Reservoir, cooler, and filters - 300

SERVICE

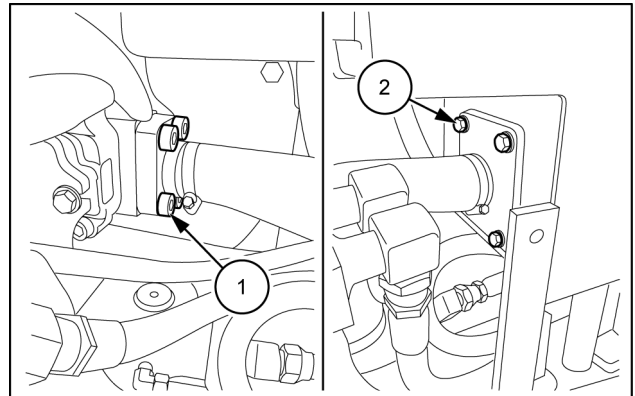
Oil reservoir	
Remove	3
Install	8
Oil cooler/Heat exchanger	
Remove	11
Install	12

1. Release the pressure in the hydraulic system (refer to **Hydraulic systems - Service instruction - Releasing pressure (35.000)**).
2. Set the battery disconnect switch to O position (OFF position) to cut off any power supply in the electrical system of the machine (refer to **Mechanical battery isolator - Dynamic description (55.302)**).
3. Remove the right-hand side panels (refer to **Side panels - Remove (90.100)**).
4. Remove the engine access door (refer to **Engine hood - Remove (90.105)**).
5. Remove the counterweight (refer to **Counterweight - Remove (39.140)**).
6. Place a receptacle of a suitable capacity under the drain plug (1).
7. Use a wrench [**22 mm**] to remove the drain plug (1) located at the bottom of the reservoir (2) and drain the hydraulic oil.
 - Hydraulic oil tank capacity: **13.0 L (3.4 US gal)**
8. After draining, close the drain plug (1).



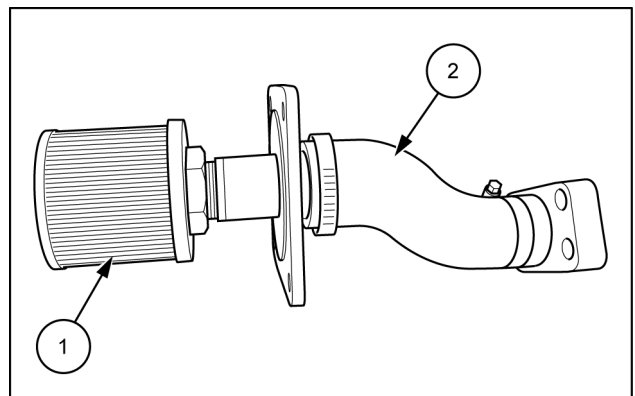
SMIL17MEX0215AB 1

9. Use a wrench [**13 mm**] to remove the four bolts (2) from the hydraulic oil reservoir.
10. Use a hexagon wrench [**8 mm**] to remove the four bolts (1) from the hydraulic pump.



SMIL17MEX0220AB 2

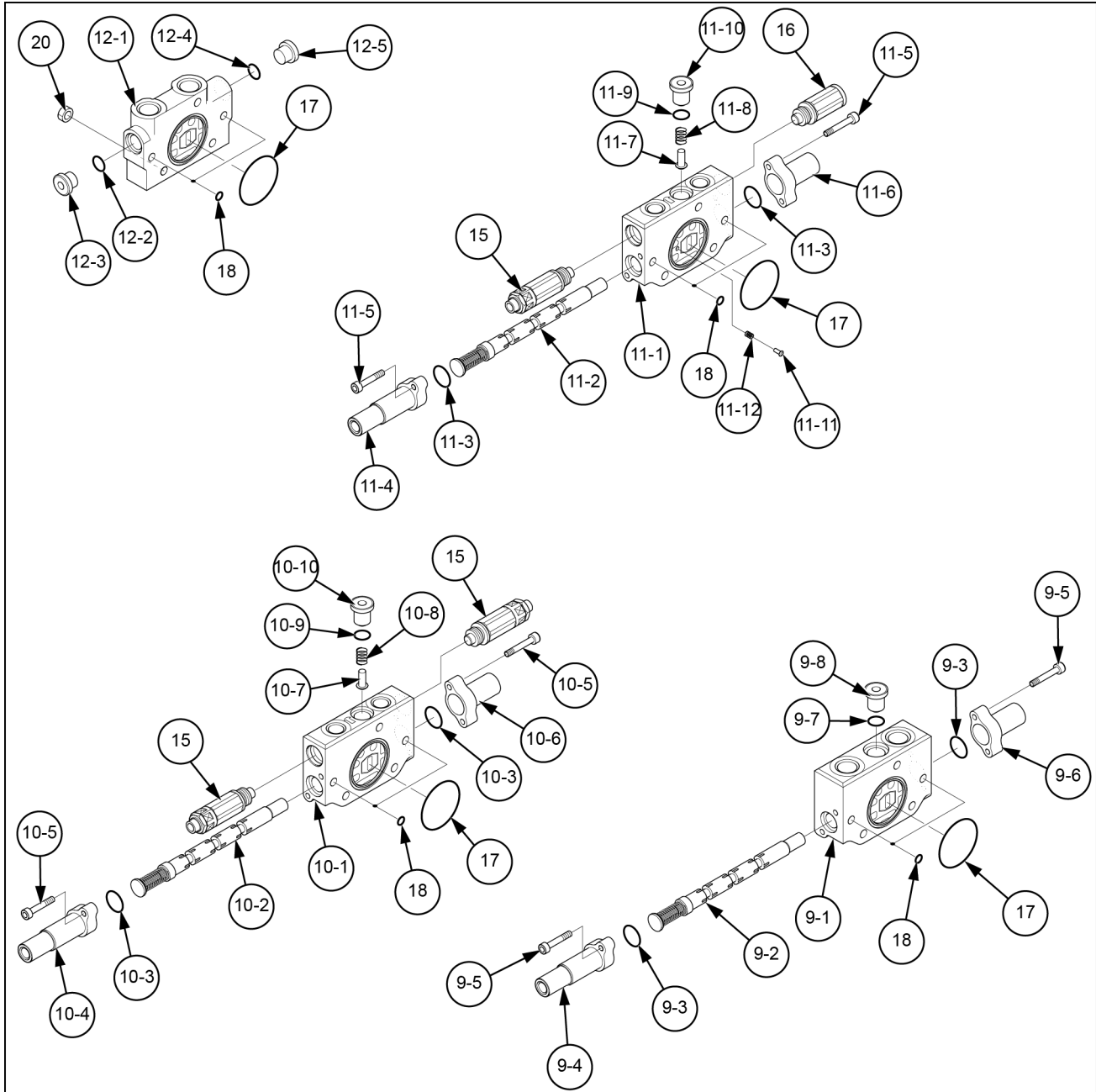
11. Remove the suction hose (2) with the hydraulic filter (1).



SMIL17MEX0221AB 3

Inspection of assembling

1. After completed the assembling of pump, make sure that pump shaft rotates smoothly by hand.

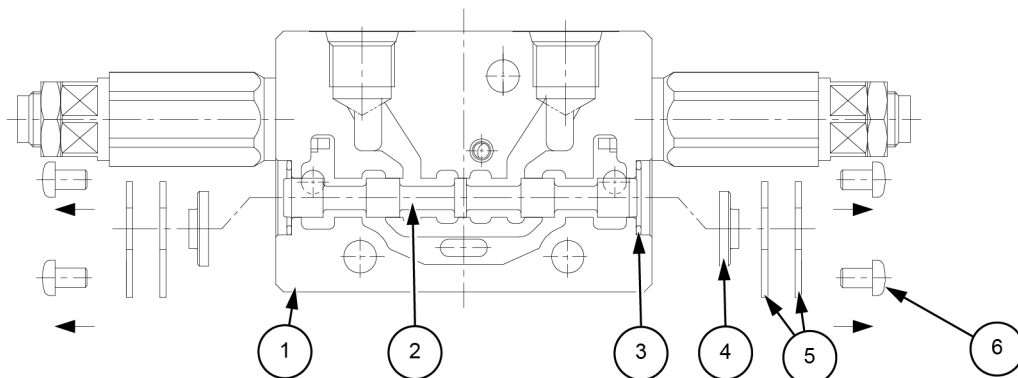


SMIL17MEX1046GB 3

P1, P2 inlet component

The draw-out procedures for P1, P2 inlet component spool are as follows.

1. Loosen and remove the two M5 cross recessed head screws **(6)** by using screwdriver for cross.
2. Remove the two seat plates **(5)**, and pull a seat plate **(4)** out by using tweezers.
3. A reverse-side also similarly pull out the two seat plates **(5)** and a seat plate **(4)**.
4. With a spool **(2)** exposed, pull out a spool by magnet.



SMIL17MEX1048FB 2

Hydraulic systems - Main control valve

Component	Inspection result	Action
Block	Existence of scratch, rusting or corrosion.	In case of damage in following section, replace parts. Sliding sections of casing fore and spool, especially land sections applied with holded pressure. Seal pocket section where spool is inserted. Seal section of port where O-ring contacts. Seal section of each relief valve for main, travel, and port. Other damages that may damage normal functions.
Spool	Existence of scratch, gnawing, rusting or corrosion.	Replacement when its outside sliding section has scratch (especially on seals-contacting section).
	O-ring seal sections at both ends.	Replacement when its sliding section has scratch.
	Insert spool in casing hole, rotate and reciprocate it.	Correction or replacement when O-ring is damaged or when spool does not move smoothly.
Poppet	Damage of poppet or spring.	Correction or replacement when sealing is incomplete.
	Insert poppet into casing and function it.	Normal when it can function lightly without being caught.
Around spring	Rusting, corrosion, deformation or breaking of spring, spring seat, plug or cover.	Replacement for significant damage.
Around seal for spool	External oil leakage.	Correction or replacement.
	Rusting, corrosion or deformation of seal plate.	Correction or replacement.
Main relief valve and port relief valve	External rusting or damage.	Replacement.
	Contacting face of valve seat.	Replacement when damaged.
	Contacting face of poppet.	Replacement when damaged.
	Abnormal spring.	Replacement.
O-rings, back up rings and seals.	Replacement.	

Spool installing procedures (except P1, P2 inlet component)

Taking the dozer spool as an example, the installing procedures are as follows.

1. After checking whether there is no dust in the spool sleeves of the body and/or spool assembly and O-ring **(3)** is securely installed with that the flange bottom of the body, insert the dozer spool assembly into spool sleeve of the body with attention on the position and direction.
 - Then, apply little hydraulic fluid to spool before the insertion.

NOTE: carefully insert spool assembly into the spool sleeve horizontally.

If it is hard to insert, forcible insertion could cause impressions on spool sleeves and/or spools, resulting in malfunction.

NOTE: if you feel any feeling of wrongness such as catches or strong resistance, pull it out once to check whether there is the adhesion of dust or the development of flaw or burr. If there are flaws or burrs, there could be malfunction so that replace body and spool in set.

When there is no feeling of wrongness, check for any heavy movement or a feeling of catches.

2. With pilot cover **(4)** being pressed in a direction from the spring side of spool assembly to the flange of body, tighten bolt with washers **(5)** with specified torque by using **4 mm** hexagonal wrench.
3. The other spools can be assembled in the same manner.

Pilot solenoid valve block - Remove

⚠ WARNING

Avoid injury!

Shut off the engine, remove the key, and make sure all machine motion stops before you service the machine.

Failure to comply could result in death or serious injury.

W1128B

⚠ WARNING

Avoid injury!

Use Personal Protective Equipment (PPE), including protective goggles, gloves, and safety footwear.

Failure to comply could result in death or serious injury.

W1036A

⚠ WARNING

Burn hazard!

Before performing any service on the hydraulic system, you must allow it to cool. Hydraulic fluid temperature should not exceed 40 °C (104 °F).

Failure to comply could result in death or serious injury.

W0241A

⚠ WARNING

Escaping fluid!

Hydraulic fluid or diesel fuel leaking under pressure can penetrate the skin and cause infection or other injury. To prevent personal injury: Relieve all pressure before disconnecting fluid lines or performing work on the hydraulic system. Before applying pressure, make sure all connections are tight and all components are in good condition. Never use your hand to check for suspected leaks under pressure. Use a piece of cardboard or wood for this purpose. If injured by leaking fluid, see your doctor immediately.

Failure to comply could result in death or serious injury.

W0178A

⚠ WARNING

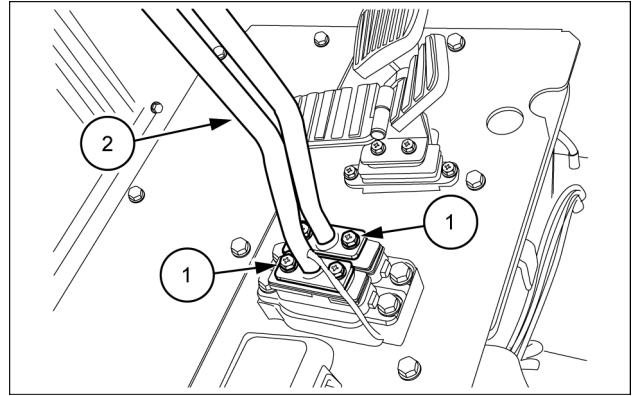
Chemical hazard!

When handling fuel, lubricants, and other service chemicals, follow the manufacturer's instructions. Wear Personal Protective Equipment (PPE) as instructed. Do not smoke or use open flame. Collect fluids in proper containers. Obey all local and environmental regulations when disposing of chemicals.

Failure to comply could result in death or serious injury.

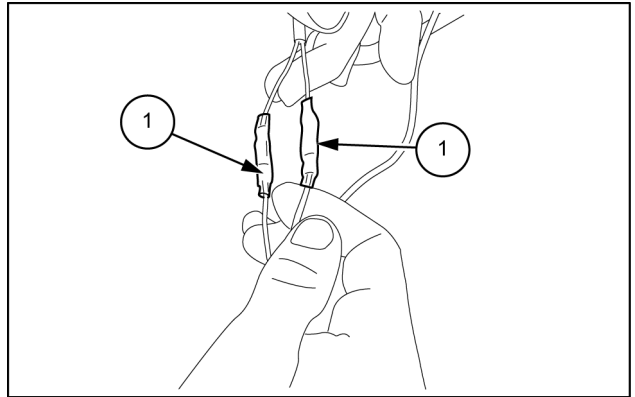
W0371A

8. Install the travel control levers (2) and then use a wrench [13 mm] to remove the four bolts (1).



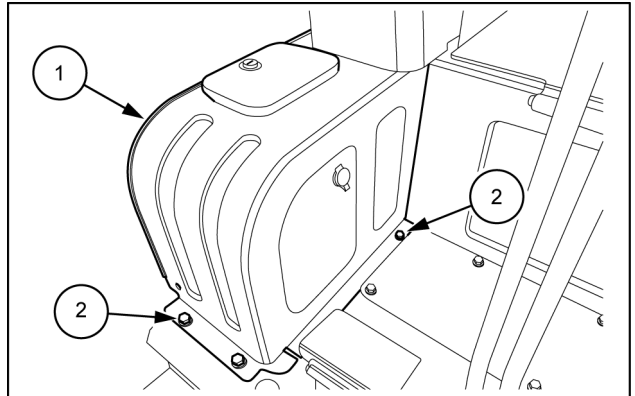
SMIL17MEX0287AB 4

9. Connect the electrical connectors (1) of the travel mode selector switch.



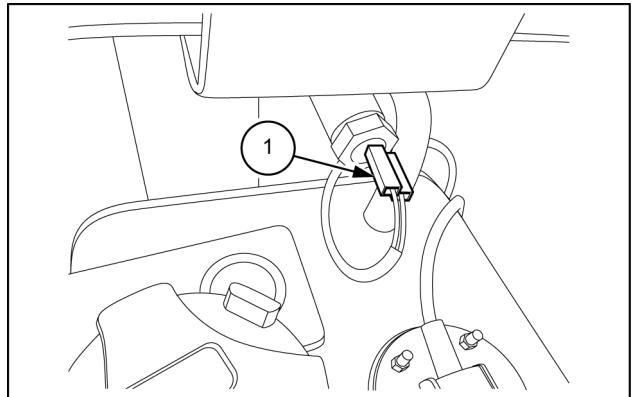
SMIL17MEX0286AB 5

10. Install the cover (1) of the tanks and then use a wrench [17 mm] to tighten the three bolts (2).



SMIL17MEX0209AB 6

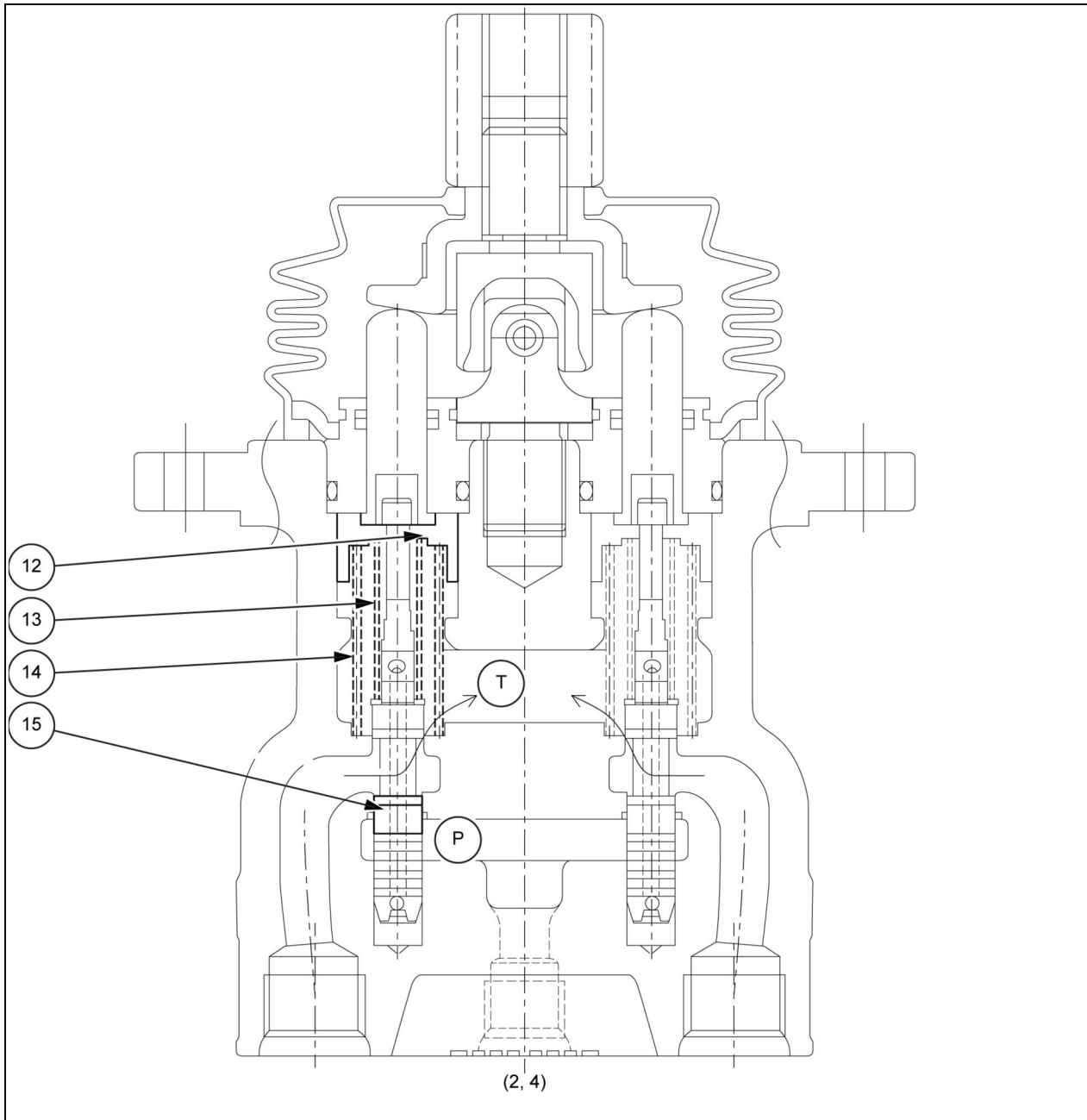
11. Connect the electrical connector CN-139 (1) on the cover of the tanks.



SMIL17MEX0208AB 7

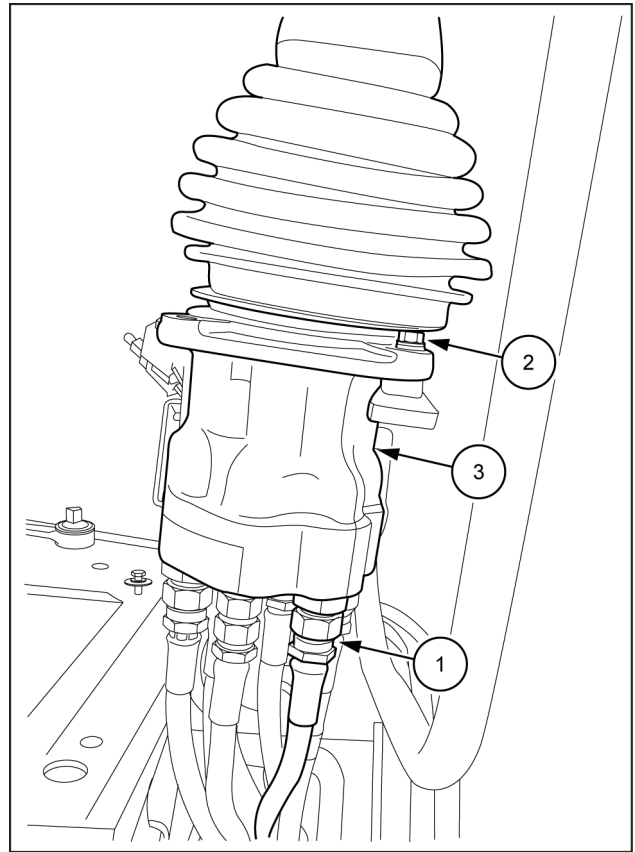
When the handle is in neutral (See Fig. 2)

The force of the secondary pressure setting spring (13) that determines the remote control valve output pressure does not operate on the spool (15). Therefore, the spool (15) is pushed up by the return spring (14) (spring seating (12)) and the output ports (2, 4) are connected with the T port. Therefore, the output pressure is the same as the tank pressure.



SMIL16MEX0318GB 2

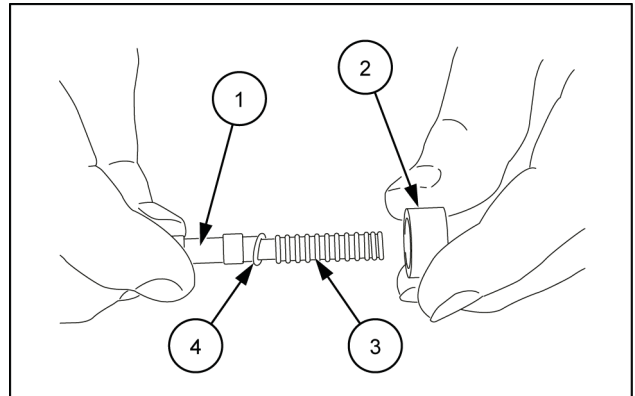
9. Use a wrench [**10 mm**] to remove the three screws (**3**) and then remove the left-hand control lever (**2**) from the bracket.
10. Use a wrench [**19 mm**] to remove the six hoses (**1**) from the left hand control lever (**2**).
 - Mark the hand control valve fittings and the hoses so that the connectors match at the time of assembly.
 - Clean the hand control valve fittings and hoses by spraying them with a parts cleaner to prevent scratches and prevent dirt from accumulating on the connectors.
 - Use caps and plugs to cover the hand control valve fittings and hoses to prevent any entry of water, dust or dirt.



SMIL17MEX0285BB 4

Hand control - Assemble

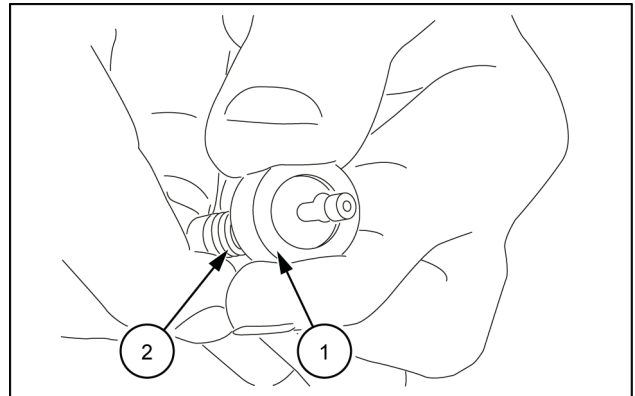
1. Insert the washer (4), the secondary pressure spring (3), and the spring seating (2) onto each of the spools (1) in that order.



SMIL14CEX1584AB 1

2. Press in the spring seating (1) and move it to the side while bending the secondary pressure spring (2) to pass the seating over the larger hole and install it on each of the spools.

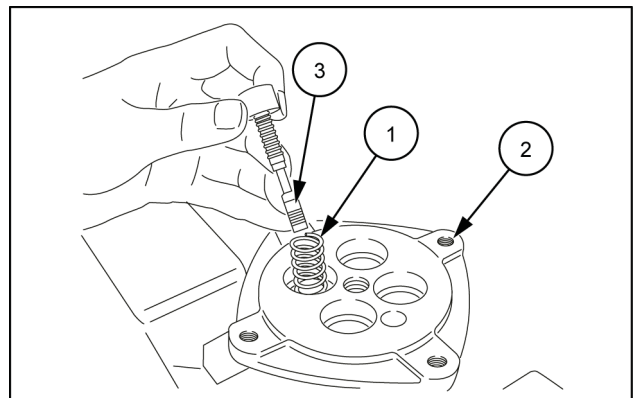
NOTICE: do not press in the spring seating by 6 mm (0.236 in) or more.



SMIL14CEX1585AB 2

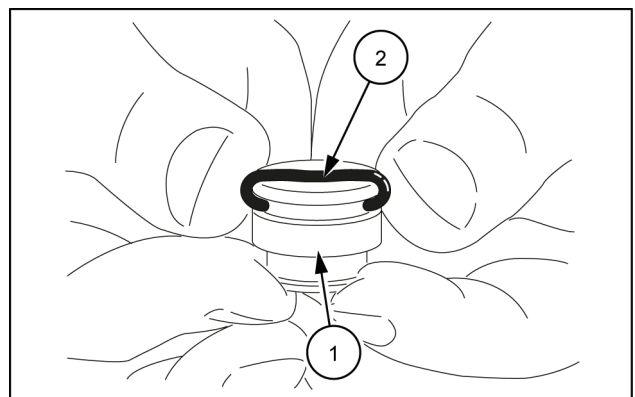
3. Install the return springs (1) in the casing (2).
Install the pressure reducing valve assemblies (3) in the casing (2).

NOTICE: install them in the positions they were in before disassembly.



SMIL14CEX1586AB 3

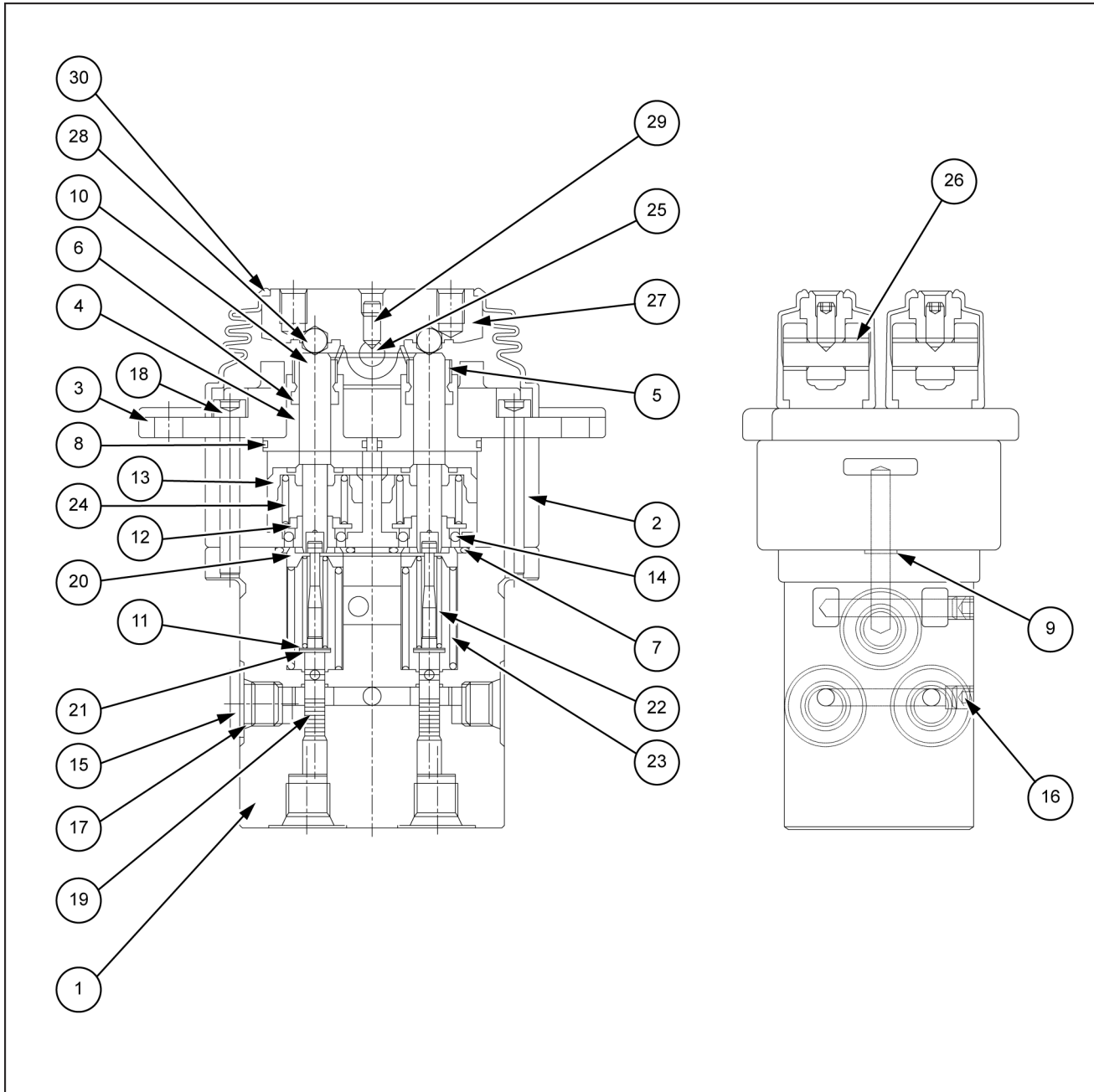
4. Install the O-ring (2) on the plug (1).



SMIL14CEX1587AB 4

Pedal control - Sectional view

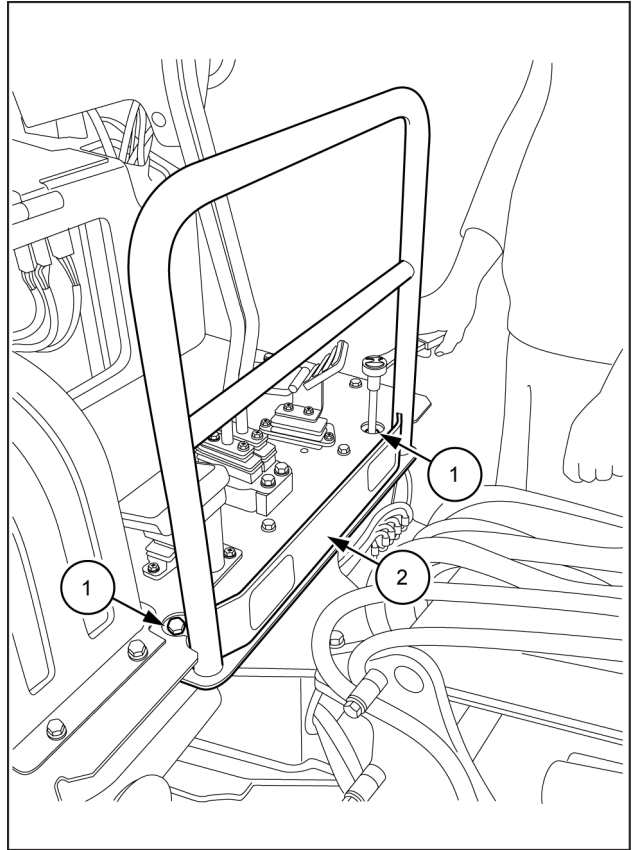
Remote control valve (travel)



SMIL16MEX0264GB 1

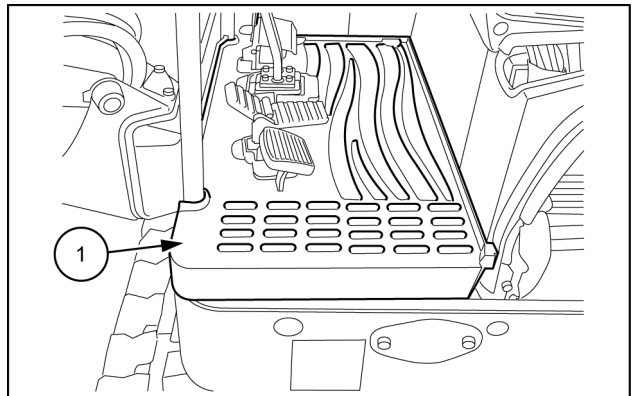
- | | | | | | |
|-----|------------|-----|--------------------------|-----|-----------------|
| 1. | Casing 1 | 11. | Shim | 21. | Washer |
| 2. | Casing 2 | 12. | Spring seat | 22. | Spring |
| 3. | Cover | 13. | Piston | 23. | Spring |
| 4. | Plug | 14. | Steel ball | 24. | Spring |
| 5. | Grease cap | 15. | Plug | 25. | Cam shaft |
| 6. | Packing | 16. | Plug | 26. | Bushing |
| 7. | O-ring | 17. | O-ring | 27. | Cam |
| 8. | O-ring | 18. | Hexagon socket head bolt | 28. | Steel ball |
| 9. | O-ring | 19. | Spool | 29. | Adjusting screw |
| 10. | Push rod | 20. | Spring seat | 30. | Bellows |

10. Install the front-guard **(2)** and then use a wrench [**19 mm**] to remove the two bolts **(1)**.



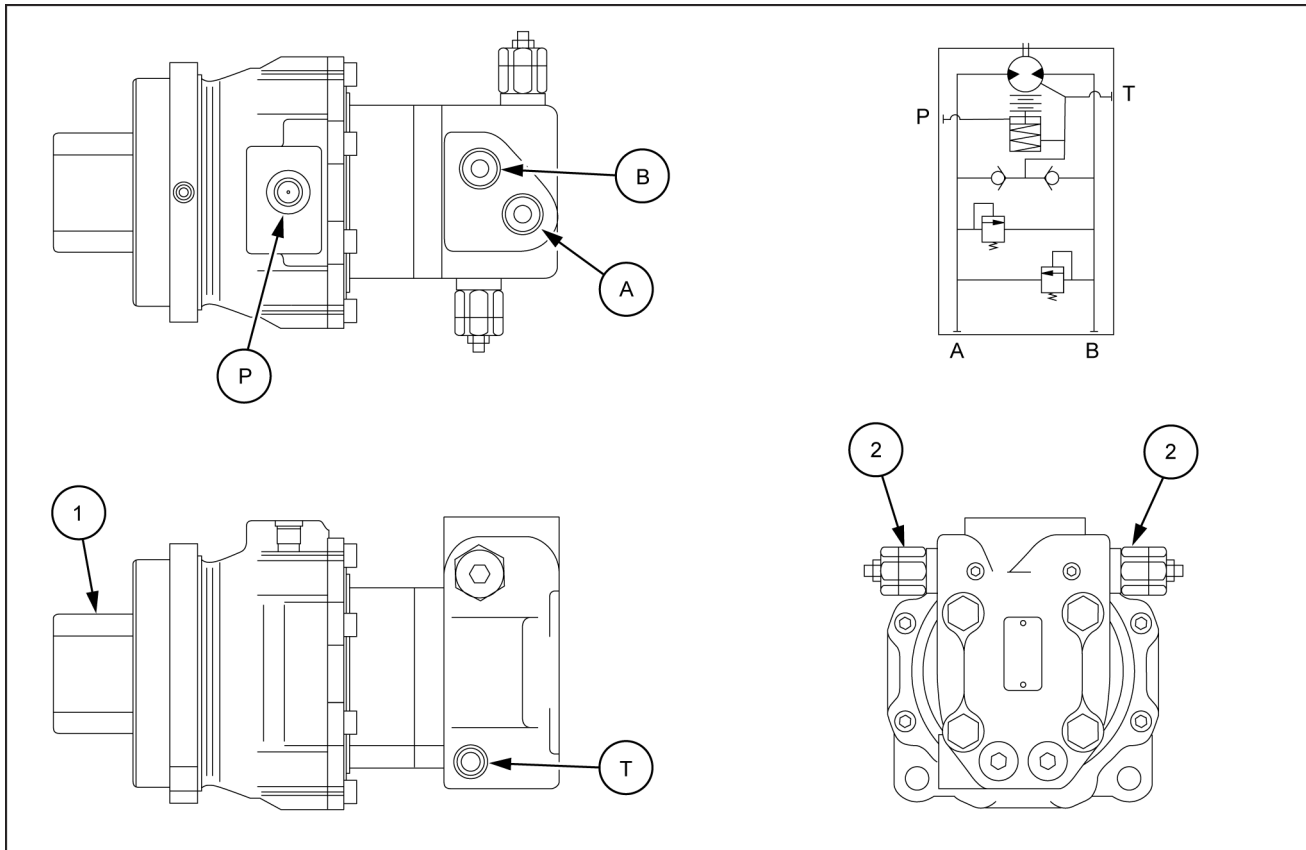
SMIL17MEX0238BB 8

11. Install the floor mat **(1)**.
12. Refill the hydraulic oil.
13. Install the right-hand side and the left-hand-side panels (refer to **Side panels - Install (90.100)**).



SMIL17MEX0207AB 9

Hydraulic swing system - Overview - With parking brake



SMIL18MEX0753FB 1

1. Output shaft
2. Relief valve

Port	Port name	Port size
A	Main port	G 3/8
B	Main port	G 3/8
T	Drain port	G 3/8
P	Pilot port	G 1/4

Hydraulic swing system - Install

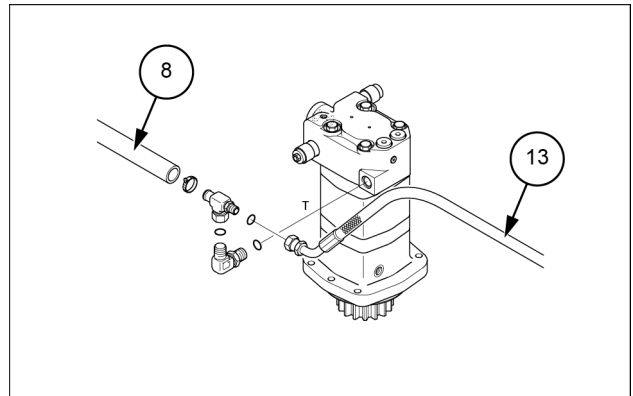
1. Sling the hydraulic swing unit.

Weight: **15.0 kg (33.1 lb)**

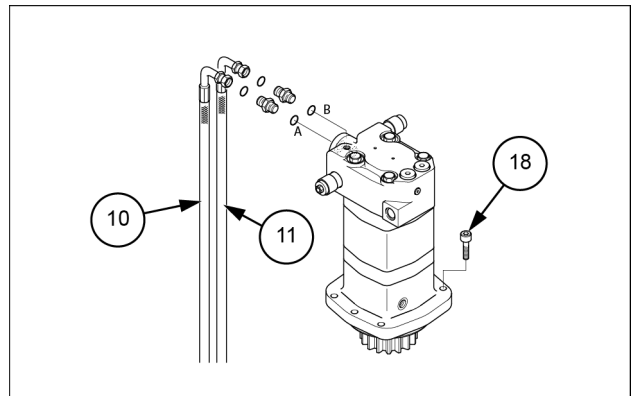
2. Install the hydraulic swing unit by means of the bolts **(18)** M14x2.

Tightening torque: **206.1 N·m (152.0 lb ft)**

3. Connect the hose assembly **(8)**, **(10)**, **(11)**, and **(13)**.
4. Bleed the air from the hydraulic swing unit.
 - Remove the air vent plug.
 - Pour in hydraulic oil until it overflows from the port.
 - Tighten plug lightly.
 - Start the engine, run at low idling and check oil come out from plug.
 - Tighten plug fully.

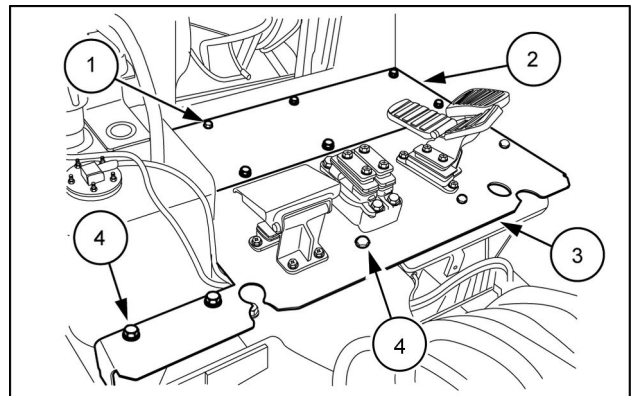


SMIL17MEX1062AB 1



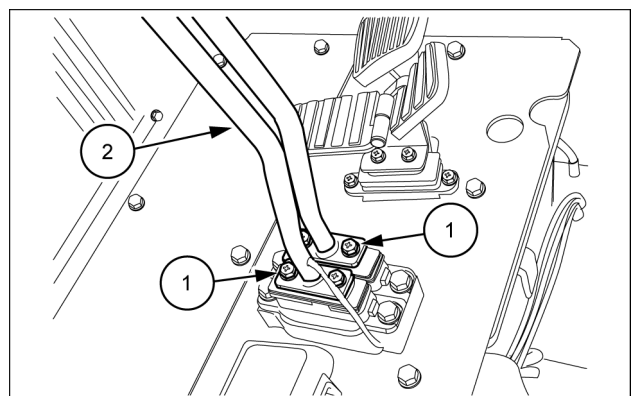
SMIL17MEX1061AB 2

5. Install the front bottom plate **(3)** and then use a wrench [**17 mm**] to tighten the five bolts **(4)**.
6. Install the rear bottom plate **(2)** and then use a wrench [**17 mm**] to tighten the seven bolts **(1)**.



SMIL17MEX0288AB 3

7. Install the travel control levers **(2)** and then use a wrench [**13 mm**] to remove the four bolts **(1)**.



SMIL17MEX0287AB 4

Swing reduction motor - Prepare for disassemble and assemble

⚠ WARNING

Crushing hazard!

The lifting systems must be operated by qualified personnel who are aware of the correct procedures to follow. Make sure all lifting equipment is in good condition, and all hooks are equipped with safety latches.

Failure to comply could result in death or serious injury.

W0256A

⚠ WARNING

Chemical hazard!

When handling fuel, lubricants, and other service chemicals, follow the manufacturer's instructions. Wear Personal Protective Equipment (PPE) as instructed. Do not smoke or use open flame. Collect fluids in proper containers. Obey all local and environmental regulations when disposing of chemicals.

Failure to comply could result in death or serious injury.

W0371A

General precautions

1. Cleanliness is extremely important when repairing a hydraulic motor.
2. Work in a clean area.
3. Before disconnecting the lines, clean the port area of the motor thoroughly.
4. Use a wire brush to remove foreign material and debris from around the exterior joints of the motor.

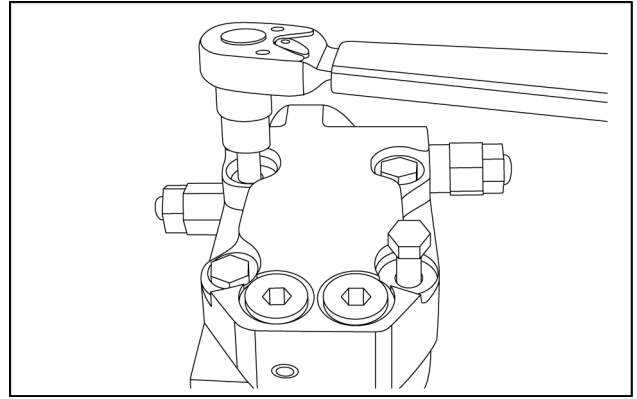
NOTE: Don't disassemble the pinion gear and valve housing assembly if not necessary.

Items to prepare

Tool name	Information
Torque wrench	9.8 – 97.6 N·m (7.2 – 72.0 lb ft)
Socket	9/16" (or 14 mm)
Hexagon socket	5 mm, 8 mm
Snap ring pliers	-
Screwdriver	-
Plastic hammer	-
Press machine	-

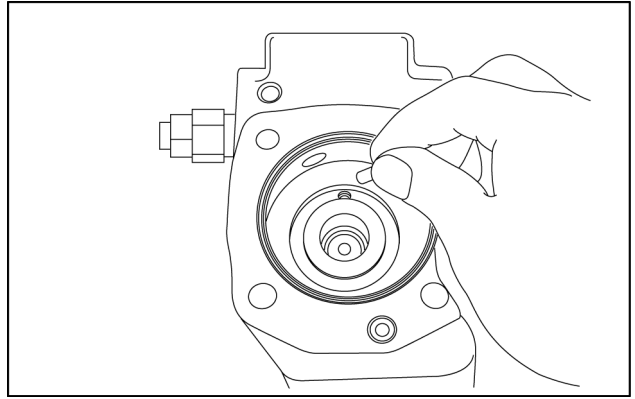
19. Install the four hexagon bolts (47).

Tightening torque: **51.0 N·m (37.6 lb ft)**



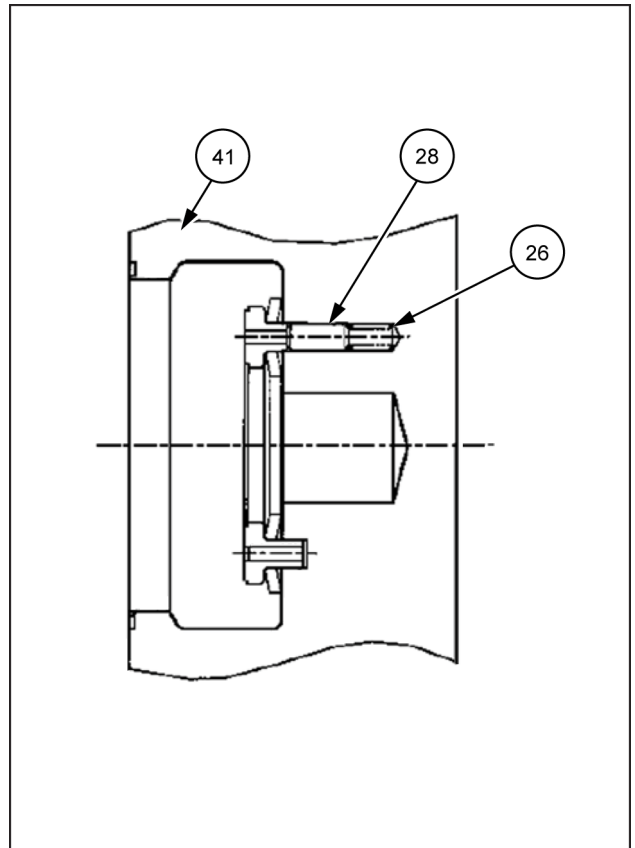
SMIL17MEX0916AA 22

20. Install spring **(26)** (in the hole located in the bore of the valve housing).
Install pin in the same holes.



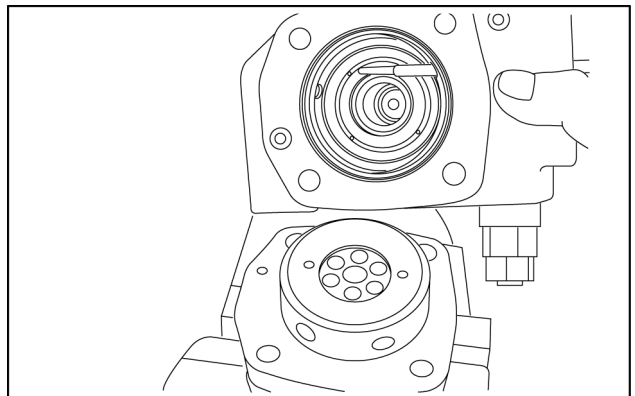
SMIL17MEX0914AA 20

21. Align the pin grooves in the balancing plate with the pins **(28)** in the bore of the valve housing **(41)**.
Install the balancing plate in the valve housing **(41)**.



SMIL18MEX0197BB 21

22. Install the valve housing assembly.
Insert a screw driver through port of valve housing to apply pressure to the side of balancing plate assembly. Hold plate in position until you install housing.



SMIL17MEX0915AA 22

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2 Speed motor operation

The swash plate (3), which has surface (7) and (4) in the opposite side to the shoe sliding surface (2), is supported by the 2 balls (6) which are fixed to the body 2 (5).

Since the balls (6) are located in the eccentric position, in the low speed range (position A), the surface (7) is faced to the body 2 (5) by the oil pressure in the piston (1) and the spring (9) force in the cylinder barrel (8).

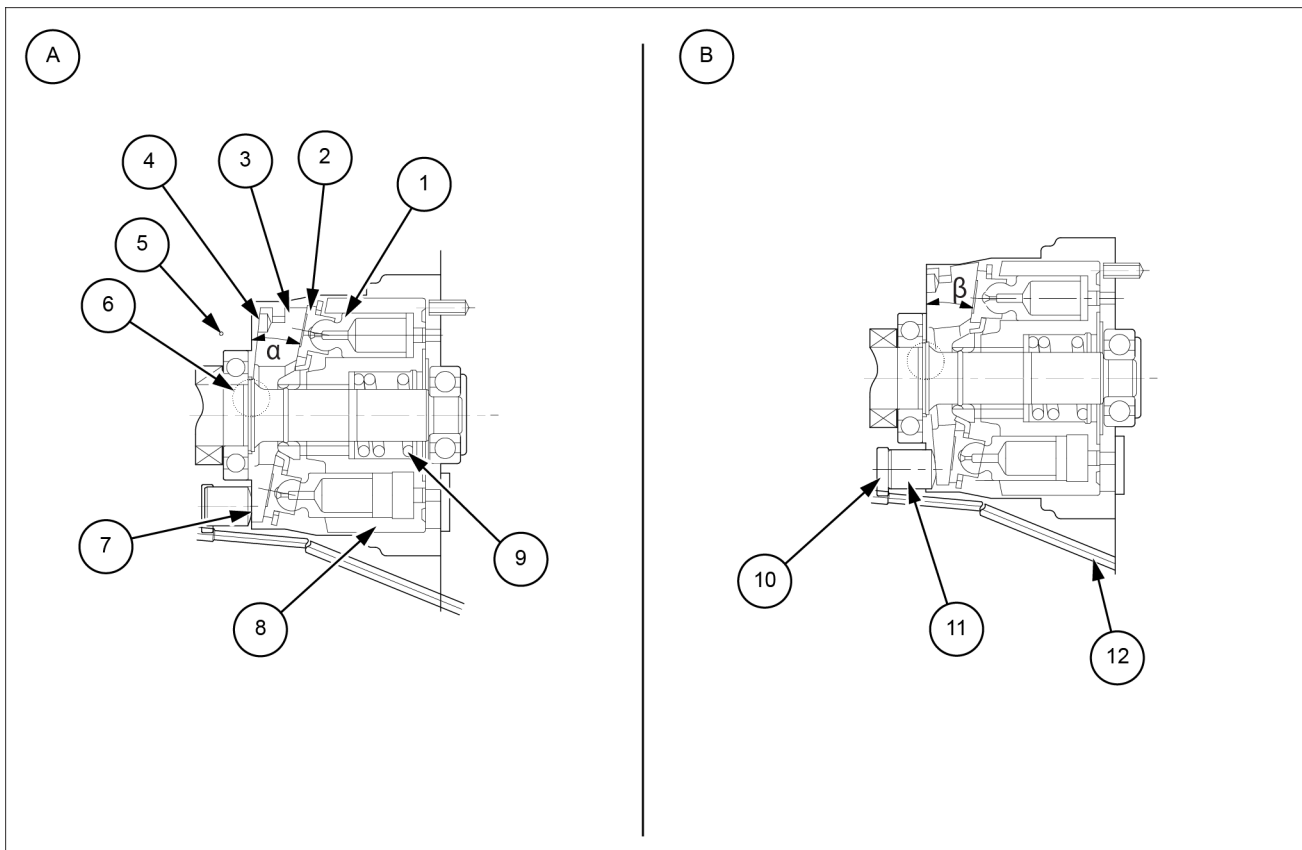
The swash plate angle is α (maximum capacity).

When the pressurized oil is supplied to the (PP) port, the two-speed spool moves to the high position (position B) and the pressurized oil (12) of inlet is led to the control chamber (10) through the two-speed spool.

The control piston (11) moves forward until the surface (4) of the swash plate (3) is in contact with the body 2 (5), and the swash plate (3) angle becomes β .

The capacity of the hydraulic motor is made small. The pressurized oil of the (PP) port is shut off (or the engine is stopped), the two-speed spool moves to the low position.

And the control chamber (10) is led to the tank port through the two-speed spool and the swash plate (3) position comes to the low speed by the spring force.



SMIL17MEX0974FB 3

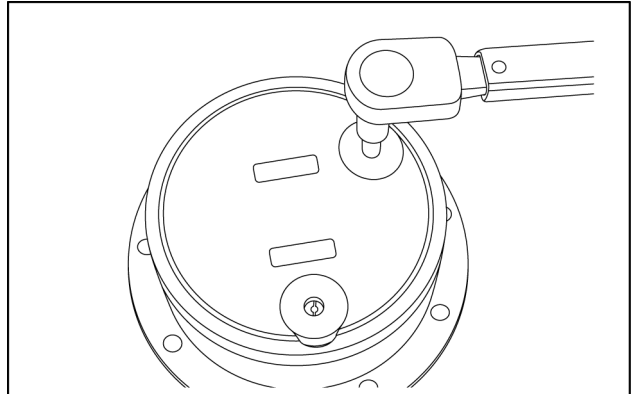
- | | |
|-----------------------------------|-----------------------------------|
| 1. Piston | 7. Surface of the swash plate (3) |
| 2. Shoe | 8. Cylinder barrel |
| 3. Swash plate | 9. Spring |
| 4. Surface of the swash plate (3) | 10. Control chamber |
| 5. Body 2 | 11. Control piston |
| 6. Ball | 12. Pressurized oil |

Travel reduction gear - Disassemble

1. Remove the two plugs (PF3/8).

Hexagon size: **8 mm**

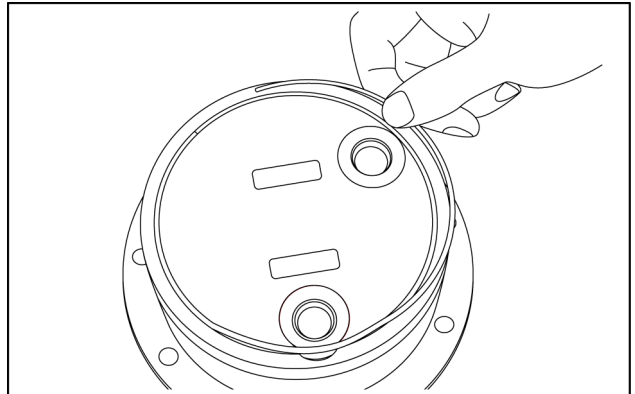
NOTE: remove the plug of *LEVEL* side first



SMIL17MEX0917AA 1

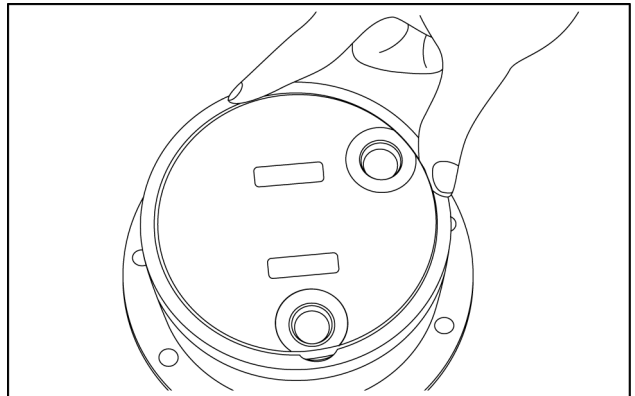
2. Remove the snap ring.

NOTE: put the screwdriver into the notch of the body, and then pull the snap ring.



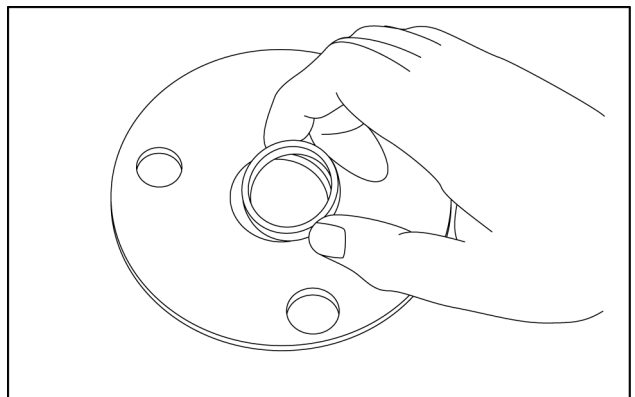
SMIL17MEX0918AA 2

3. Remove the cover.



SMIL17MEX0919AA 3

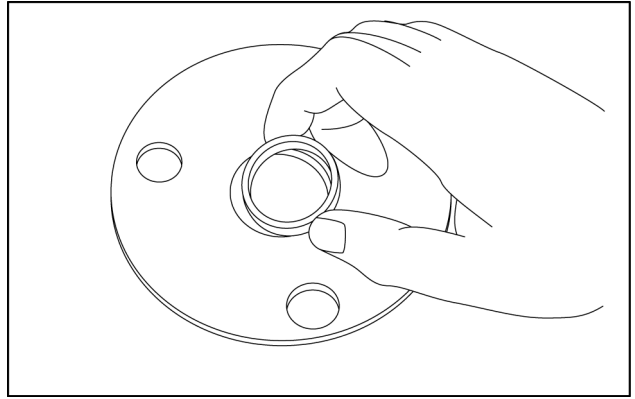
4. Remove the slide ring from the cover.



SMIL17MEX0920AA 4

14. Place the slide ring onto the cover.

NOTE: apply grease to the slide ring to prevent it dropping out.

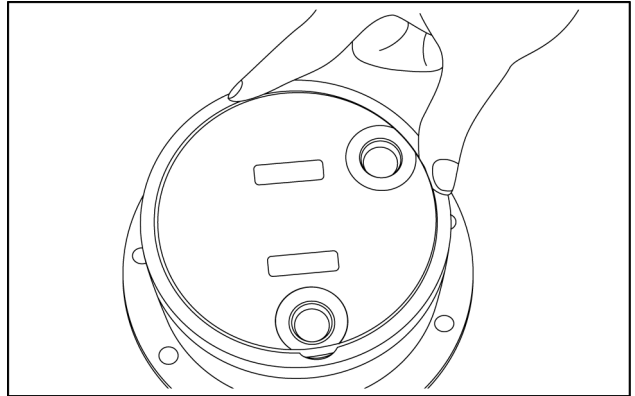


SMIL17MEX0920AA 22

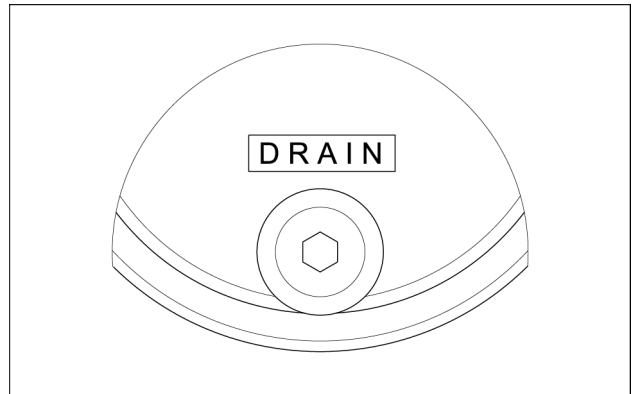
15. Fill **0.33 L (0.09 US gal)** gear oil in the body and insert cover.

NOTE: pay attention not to damage the O-ring.

NOTE: the "DRAIN" side tapped hole should be aligned with notches of the body.



SMIL17MEX0919AA 23



SMIL17MEX1077AA 24

Hydraulic systems - Hydraulic travel system

Part	Check	Standard	Action
Springs	Surface	No crack	Replace
O-rings	Surface and hardness	No damage, deformation, and hardening	Replace

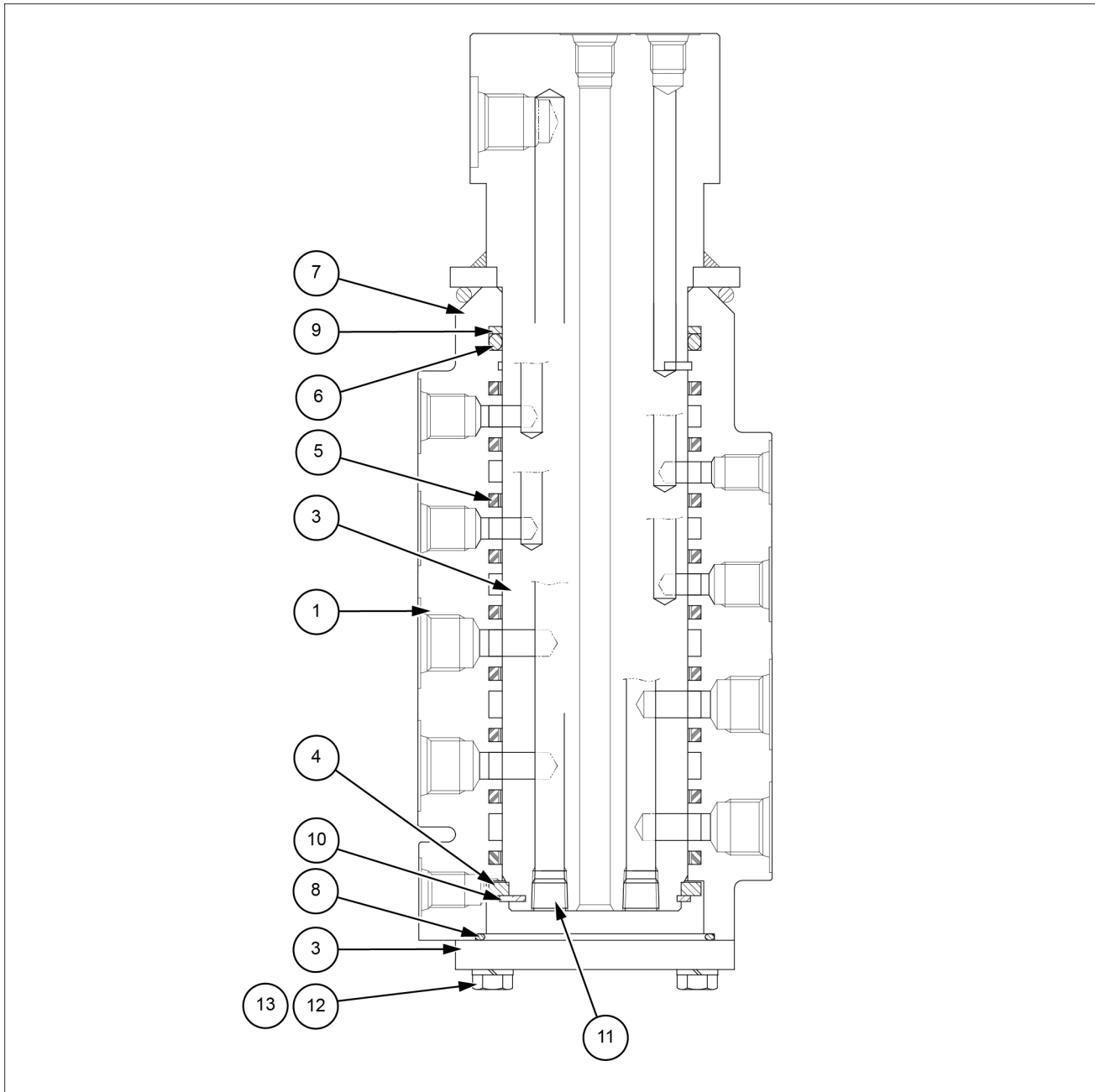
Travel motor - Service instruction - Troubleshooting

Abnormally low travel motor speed

1. Check the lower speed (bucket or arm).
 - A. If the lower speed is within the standard value, proceed to step 2.
 - B. If the lower speed is not within the standard value, proceed to step 3.

NOTE: for the standard value, see **Bucket cylinder - Test (35.738)** and **Dipper cylinder - Test (35.737)**.
2. Check the control valve spool in terms of over positively changing.
 - A. If the control valve has changed over positively, proceed to step 4.
 - B. If the control valve has not changed over positively, proceed to step 5.
3. Check the variation of the left-hand and right-hand travel speeds when travel relief valves are exchanged.
 - A. If the left-hand and right-hand travel speeds change over when travel relief valves are exchanged, the travel relief valve is faulty. Disassemble and repair or replace it.
 - B. If the left-hand and right-hand travel speeds do not change over when travel relief valves are exchanged, the hydraulic pump is broken. Disassemble and repair it.
4. Check the variation of the left-hand and right-hand travel speeds when the left-hand and right-hand travel brake valves are exchanged.
 - A. If the left-hand and right-hand travel speeds do not change when the left-hand and right-hand travel brake valves are exchanged, proceed to step 6.
 - B. If the left-hand and right-hand travel speeds change when the left-hand and right-hand travel brake valves are exchanged, the brake valve is defective. Disassemble and repair or replace it.
5. Check the spool in terms of movement by hand when it is cut off from control spool.
 - A. If the spool can be moved lightly by hand, the control system is faulty. Disassemble, inspect and repair it.
 - B. If the spool cannot be moved lightly by hand, the control valve spool is stuck. Disassemble and repair it.
6. Check the variation of the symptom when the relief valves in the left-hand and right-hand travel motors are exchanged.
 - A. If the symptom does not change, proceed to step 7.
 - B. If the symptom does change, the relief valve built in the travel motor is faulty. Disassemble and repair it.
7. Measure the leak rate of the travel motor.
 - A. If the drain rate of the travel motor is within the standard value, proceed to step 8.
 - B. If the drain rate of the travel motor is not within the standard value, the travel motor is faulty. Disassemble and repair it.
8. Check the variation of the travel speed when the parking brake spring in the slower travel motor is removed.
 - A. If the travel speed does change, the parking brake of the travel motor is not released properly. Disassemble and clean the pilot piping.

Hydraulic swivel - Sectional view



SMIL17MEX1082GB 1

- | | | | |
|----|--------------|-----|---------------|
| 1. | Hub | 8. | O-ring |
| 2. | Shaft | 9. | Back-up ring |
| 3. | Cover | 10. | Retainer ring |
| 4. | Spacer | 11. | Plug |
| 5. | Slipper seal | 12. | Hexagon bolt |
| 6. | O-ring | 13. | Spring washer |
| 7. | O-ring | | |

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Track frame widening system - 735

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Track widening cylinder - Install	9
Track widening cylinder - Remove	5
Track widening cylinder - Test	12

Boom cylinder - Remove

⚠ WARNING

Avoid injury!

Shut off the engine, remove the key, and make sure all machine motion stops before you service the machine.

Failure to comply could result in death or serious injury.

W1128B

⚠ WARNING

Pressurized system!

Before attempting any service procedure, it is your responsibility to know the number of accumulators on the machine, and the correct procedure for releasing the pressure of each accumulator.

Failure to comply could result in death or serious injury.

W0136A

⚠ WARNING

Crushing hazard!

The lifting systems must be operated by qualified personnel who are aware of the correct procedures to follow. Make sure all lifting equipment is in good condition, and all hooks are equipped with safety latches.

Failure to comply could result in death or serious injury.

W0256A

⚠ WARNING

Heavy objects!

Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders.

Failure to comply could result in death or serious injury.

W0398A

⚠ WARNING

Burn hazard!

Before performing any service on the hydraulic system, you must allow it to cool. Hydraulic fluid temperature should not exceed 40 °C (104 °F).

Failure to comply could result in death or serious injury.

W0241A

⚠ WARNING

Escaping fluid!

Hydraulic fluid or diesel fuel leaking under pressure can penetrate the skin and cause infection or other injury. To prevent personal injury: Relieve all pressure before disconnecting fluid lines or performing work on the hydraulic system. Before applying pressure, make sure all connections are tight and all components are in good condition. Never use your hand to check for suspected leaks under pressure. Use a piece of cardboard or wood for this purpose. If injured by leaking fluid, see your doctor immediately.

Failure to comply could result in death or serious injury.

W0178A

⚠ WARNING

Chemical hazard!

When handling fuel, lubricants, and other service chemicals, follow the manufacturer's instructions. Wear Personal Protective Equipment (PPE) as instructed. Do not smoke or use open flame. Collect fluids in proper containers. Obey all local and environmental regulations when disposing of chemicals.

Failure to comply could result in death or serious injury.

W0371A

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Boom hydraulic system - 736

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Hydraulic lines - Service instruction - Troubleshooting

Bucket operation malfunction

1. Measure the main control valve pilot pressure.
 - A. If the pilot pressure is within the standards level, proceed to step 2.
 - B. If the main control valve pilot pressure is not within the standards level, the pilot valve is faulty. Disassemble and repair it.
2. Check the variation of the symptom when the port relief valve is replaced with other valve.
 - A. If the symptom does not change, proceed to step 3.
 - B. If the symptom does change, the port relief valve is defective. Disassemble and repair or replace it.
3. Check the control valve spool in terms of movement by hand.
 - A. If the control valve spool can be moved smoothly by hand, the cylinder interior is broken. Disassemble and repair it.
 - B. If the control valve spool cannot be moved smoothly by hand, the control valve spool is stuck. Disassemble and repair it.

Solenoid valve - Remove - Quick coupler

⚠ WARNING

Avoid injury!

Shut off the engine, remove the key, and make sure all machine motion stops before you service the machine.

Failure to comply could result in death or serious injury.

W1128B

⚠ WARNING

Avoid injury!

Use Personal Protective Equipment (PPE), including protective goggles, gloves, and safety footwear.

Failure to comply could result in death or serious injury.

W1036A

⚠ WARNING

Burn hazard!

Before performing any service on the hydraulic system, you must allow it to cool. Hydraulic fluid temperature should not exceed 40 °C (104 °F).

Failure to comply could result in death or serious injury.

W0241A

⚠ WARNING

Escaping fluid!

Hydraulic fluid or diesel fuel leaking under pressure can penetrate the skin and cause infection or other injury. To prevent personal injury: Relieve all pressure before disconnecting fluid lines or performing work on the hydraulic system. Before applying pressure, make sure all connections are tight and all components are in good condition. Never use your hand to check for suspected leaks under pressure. Use a piece of cardboard or wood for this purpose. If injured by leaking fluid, see your doctor immediately.

Failure to comply could result in death or serious injury.

W0178A

⚠ WARNING

Chemical hazard!



When handling fuel, lubricants, and other service chemicals, follow the manufacturer's instructions. Wear Personal Protective Equipment (PPE) as instructed. Do not smoke or use open flame. Collect fluids in proper containers. Obey all local and environmental regulations when disposing of chemicals.

Failure to comply could result in death or serious injury.

W0371A

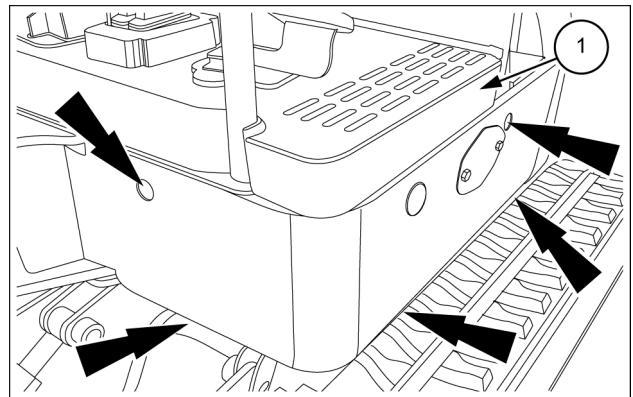
1. Release the pressure in the hydraulic system (refer to **Hydraulic systems - Service instruction - Releasing pressure (35.000)**).
2. Set the battery disconnect switch to O position (OFF position) to cut off any power supply in the electrical system of the machine (refer to **Mechanical battery isolator - Dynamic description (55.302)**).
3. Remove the right-hand and left-hand side panels (refer to **Side panels - Remove (90.100)**).
4. Drain the hydraulic oil.

 Pressure line


 Pilot pressure lines

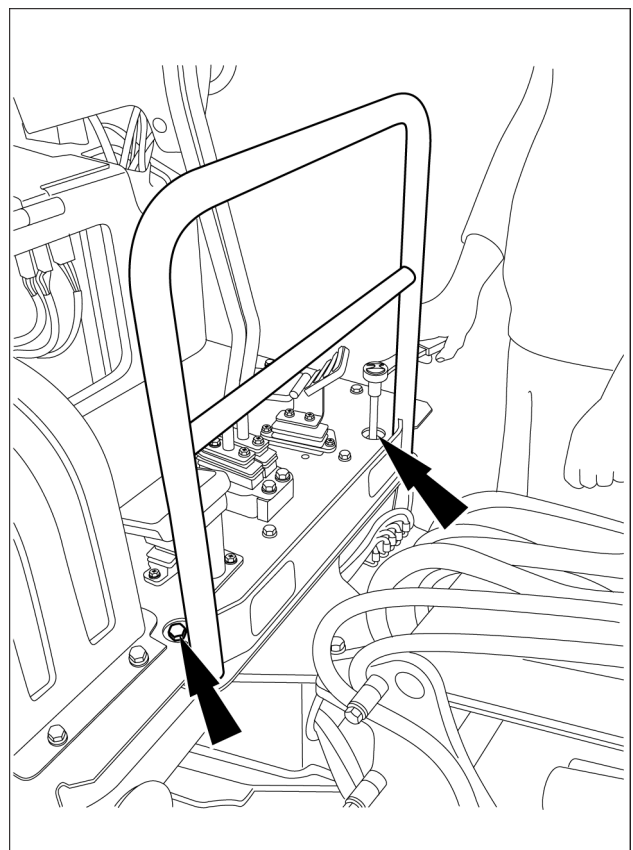
 Tank line

1. Release the pressure in the hydraulic system (refer to **Hydraulic systems - Service instruction - Releasing pressure (35.000)**).
2. Remove the floor mat (1).
3. Remove the protective caps from the lower left-hand side shield.
4. Use a wrench [**13 mm**] to unscrew completely the bolts and remove the lower left-hand side shield.



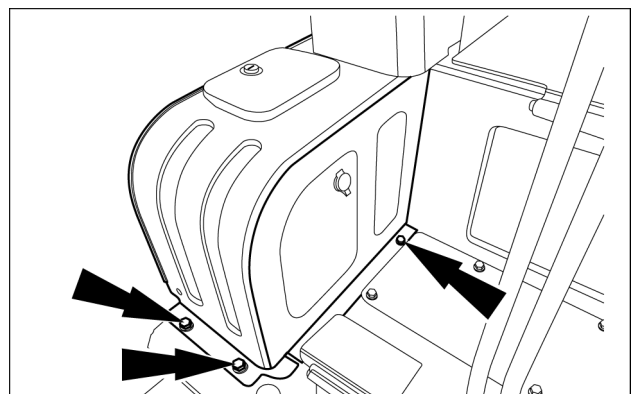
SMIL18MEX0763AB 1

5. Use a wrench [**19 mm**] to remove the two bolts and remove the front-guard.



SMIL18MEX0765BB 2

6. Use a wrench [**17 mm**] to remove the three bolts and remove the cover of the tanks.



SMIL18MEX0766AB 3

Swing cylinder - Assemble

1. To assemble the cylinder see **Boom cylinder - Assemble (35.736)** as reference.
2. Apply torques as follows.

Part name	Item	Size	Torque
Cylinder head	3	M60	421.4 – 519.5 N·m (310.8 – 383.2 lb ft)
Piston	12	M24	529.6 – 647.3 N·m (390.6 – 477.4 lb ft)
Set screw	18	M6	17.6 – 21.7 N·m (13.0 – 16.0 lb ft)

Blade lifting cylinder - Disassemble

To disassemble the cylinder see **Boom cylinder - Disassemble (35.736)** as reference.



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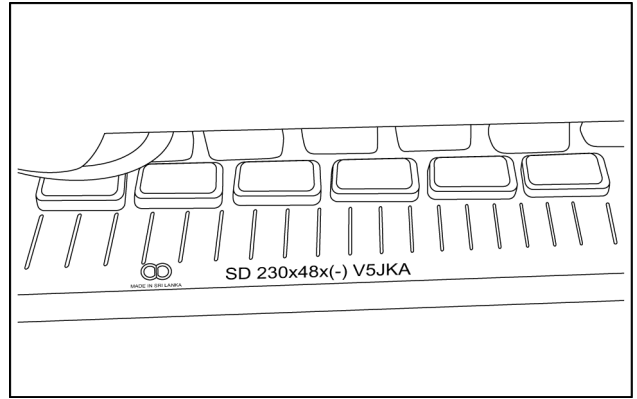
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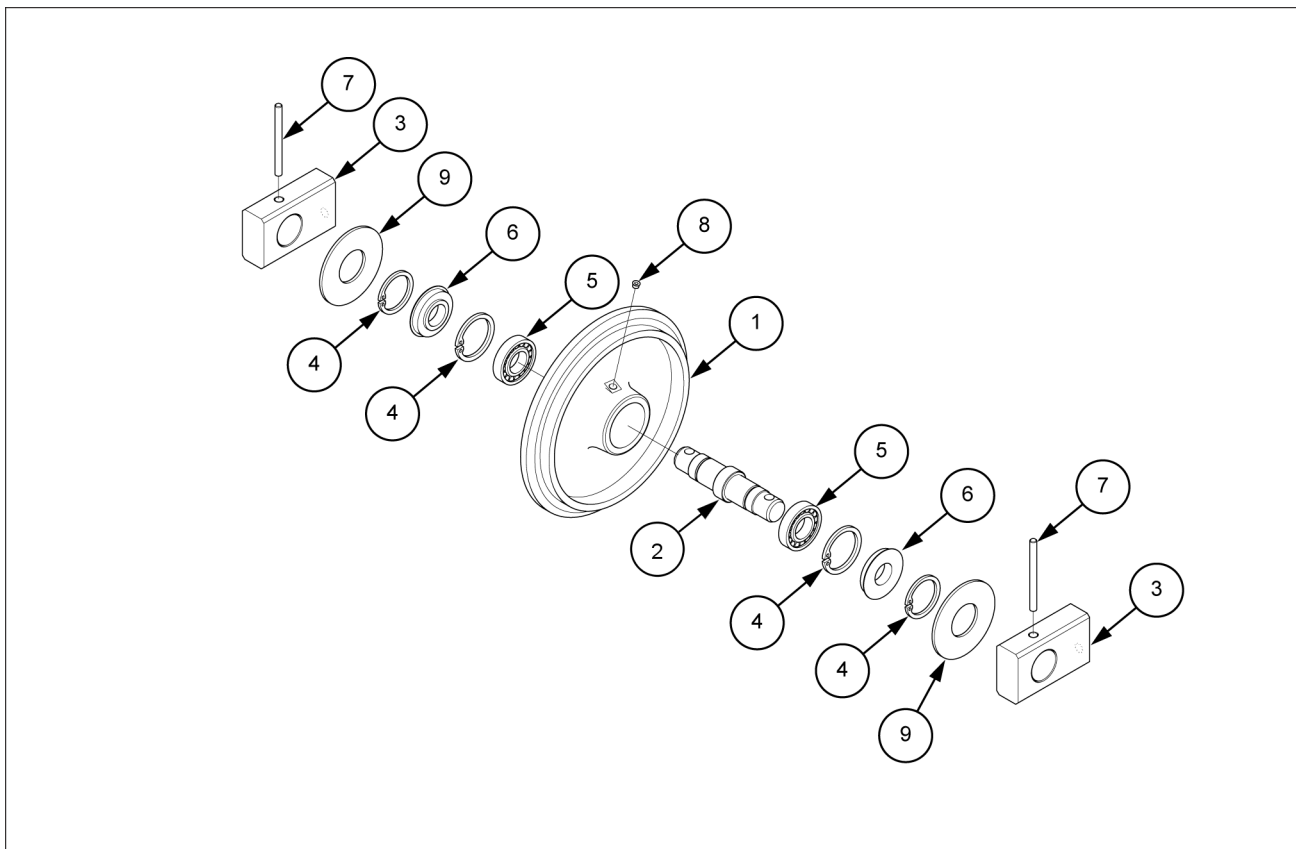
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In case the rubber track has the stamping that you can see in the figure aside, check the service limits as follows.



SMIL17MEX2813AA 2

Idler wheel - Exploded view



SML17MEX1173FB 1

- | | |
|-----------------|---------------|
| 1. Idler wheel | 6. Oil seal |
| 2. Shaft | 7. Spring pin |
| 3. Hub | 8. Plug |
| 4. Snap ring | 9. Plate |
| 5. Ball bearing | |

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Electrical system - Component identification - Fuel level sensor

Specification: –

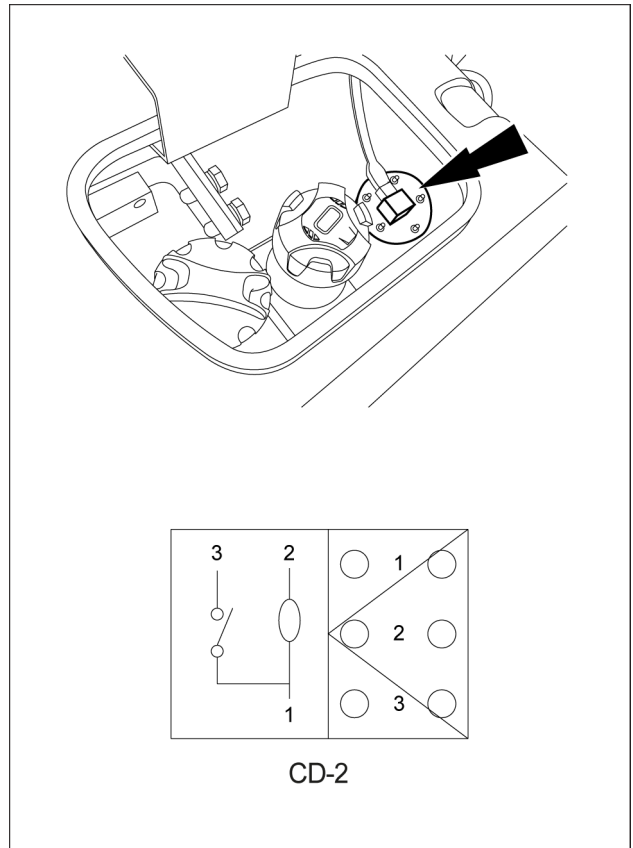
Check resistance:

Full: **30 Ω**

Low: **100 Ω**

Empty warning: **200 Ω**

Connector: **CD-2**

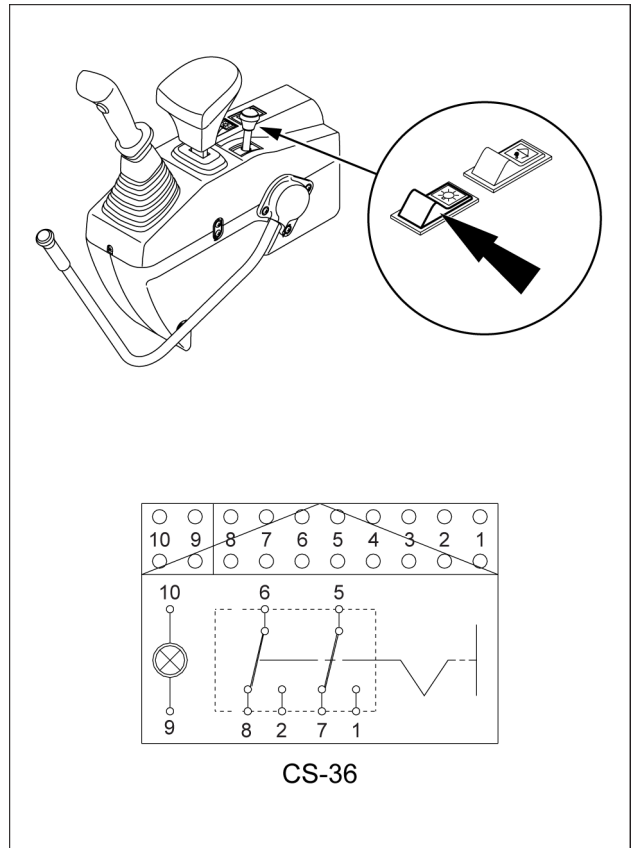


SMIL17MEX0370BB 1

Electrical system - Component identification - Work light switch

Specification: 12 V – 16 A

Connector: CS-36

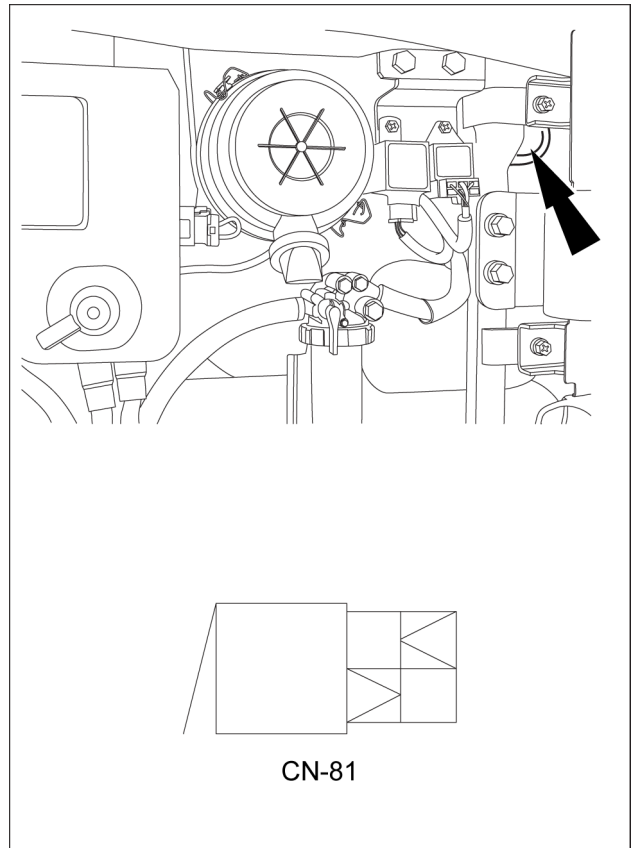


SMIL17MEX0389BB 1

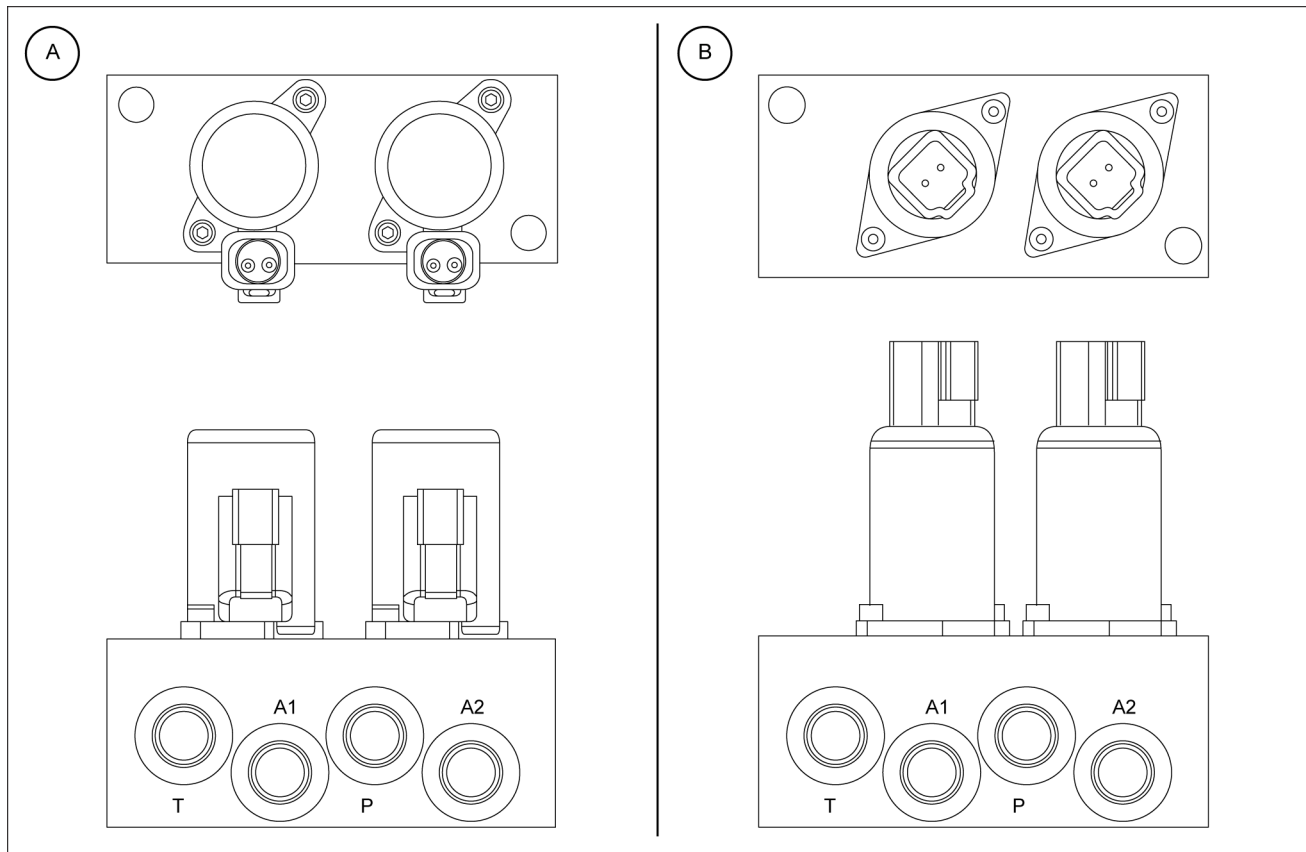
Electrical system - Component identification - Travel buzzer

Specification: **12 V**

Connector: **CN-81**



SMIL17MEX0384BB 1



SMIL18MEX0450FB 2

(A): EPPR valve type 1
(B): EPPR valve type 2

Electrical systems - Electrical system

Component	Connector	Connector type
Fuel level sensor	CD-2	AMP
Engine coolant temperature sensor	CD-8	AMP
Overheat switch	CD-9	AMP
Engine oil pressure switch	CD-18	–
Main harness - Left-hand console harness	CN-3	AMP
Main harness - Right-hand console harness	CN-4	AMP
Right-hand console harness - Main harness	CN-5	AMP
Fuse box	CN-36	–
Instrument cluster	CN-56	AMP
Quick coupler solenoid valve	CN-140	DEUTSCH
Glow timer relay	CR-24	YAZAKI
Quick coupler switch	CS-67	SWF

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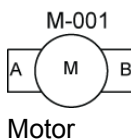
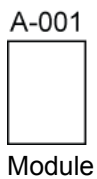
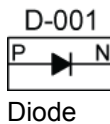
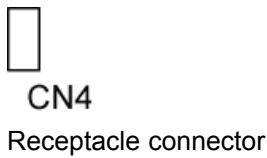
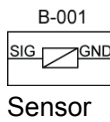
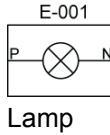
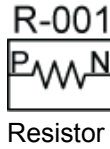
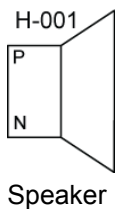
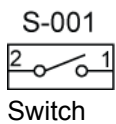
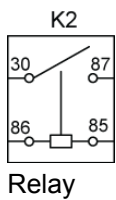
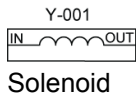
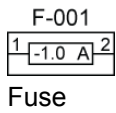
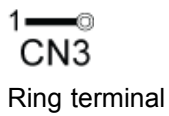
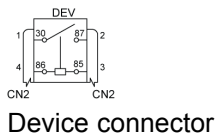
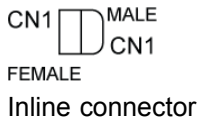
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Wiring harnesses - Electrical schematic sheet 01 - Legend

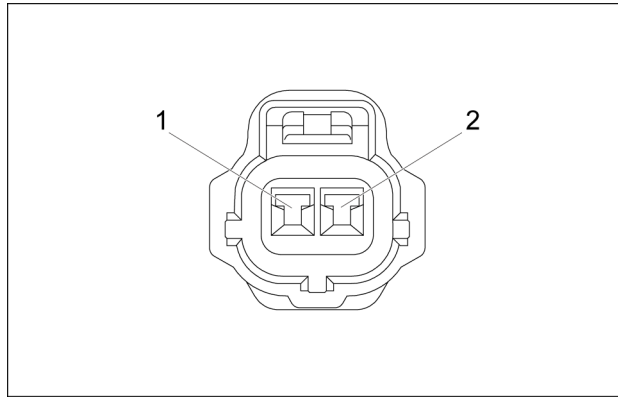
Schematic symbols



Wiring harnesses - Electrical schematic sheet 07 - Cluster and GPS telematics

Type	Components	Connectors/link
Buzzer	CN-26	CN-26 CONNECTOR : CLUSTER BUZZER
Cluster	CN-56	CN-56 CONNECTOR : CLUSTER
GPS telematics	CN-125	CN-125 CONNECTOR : GPS TELEMATICS
Connector	CN-126	CN-126 CONNECTOR : RC232 CONNECTOR

CONNECTOR CD-8: WATER TEMPERATURE SENSOR (Female)

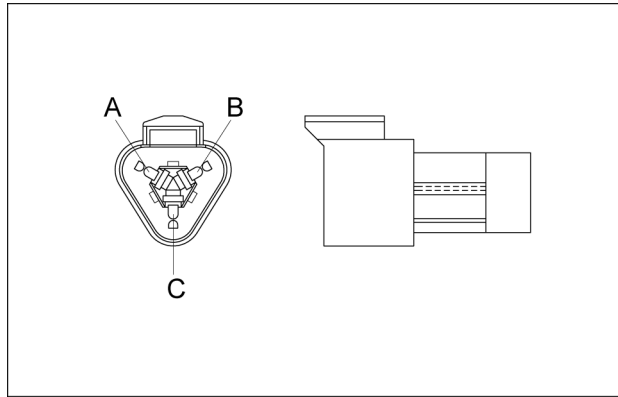


174374-3 2

Pin	From	Wire	Description	Color-Size	Frame
1	CN-5F-P-7	29		BR-0.85	SHEET 08 - Water temperature sensor and engine oil pressure sensor switch
2	SP70-P-X	GL		BK-0.85	

To locate the connector refer to **Harnesses and connectors - Component localization (55.100)**.

CONNECTOR CS-5: RCV HORN (Female)

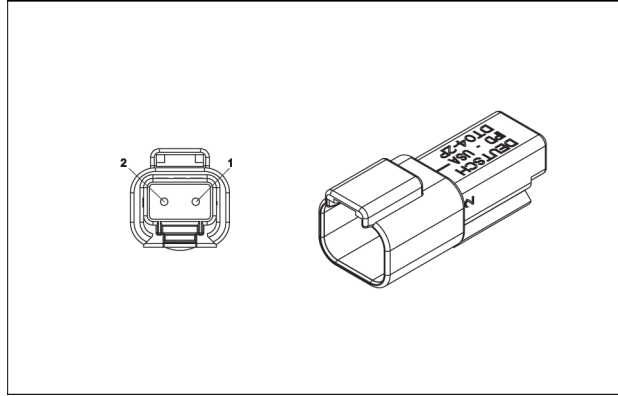


DT04-3P 14

Pin	From	Wire	Description	Color-Size	Frame
A	CN-4F-P-12	7D		OR-0.85	SHEET 06 - EXT. V/V switch, travel alarm and 12V socket
C	SP57-P-X	GH		BK-0.85	

To locate the connector refer to **Harnesses and connectors - Component localization (55.100)**.

CONNECTOR CN-140: TO FRAME QUICK COUPLER VALVE (HQ01 2-WAY OPTION) (Male)

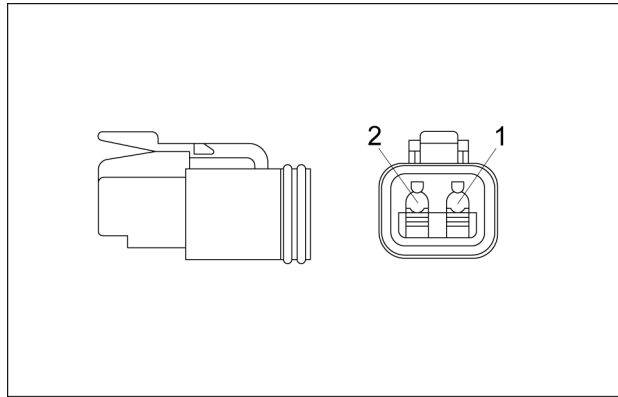


SMIL19MEX0401AA 10

Pin	From	Wire	Description	Color-Size	Frame
1	CN-140A-P-85	002		WH-0.75	SHEET 11 - Quick coupler option
2	CN-140A-P-87	001		WH-0.75	

To locate the connector refer to **Electrical system - Component identification - Frame-quick coupler valve connector (HQ01 2-way option) (55.000)**.

CONNECTOR CN-264: EXT. V/V (Female)

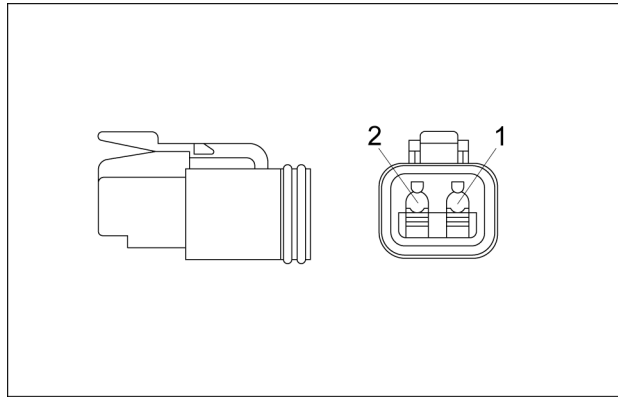


DT06-2S 8

Pin	From	Wire	Description	Color-Size	Frame
1	SP25-P-X	G2B		BK-0.85	SHEET 10 - Safety solenoid, travel solenoid and feed pump
2	CN-4M-P-6	20		RD-0.85	SHEET 06 - EXT. V/V switch, travel alarm and 12V socket

To locate the connector refer to **Harnesses and connectors - Component localization (55.100)**.

CONNECTOR CN-68: SAFETY SOLENOID V/V (Female)



DT06-2S 2

Pin	From	Wire	Description	Color-Size	Frame
1	SP23-P-X	G5A		BK-0.85	SHEET 10 - Safety solenoid, travel solenoid and feed pump
2	SP47-P-X	18B		BL-0.85	SHEET 04 - Quick coupler, work lamp and safety switch

To locate the connector refer to **Harnesses and connectors - Component localization (55.100)**.

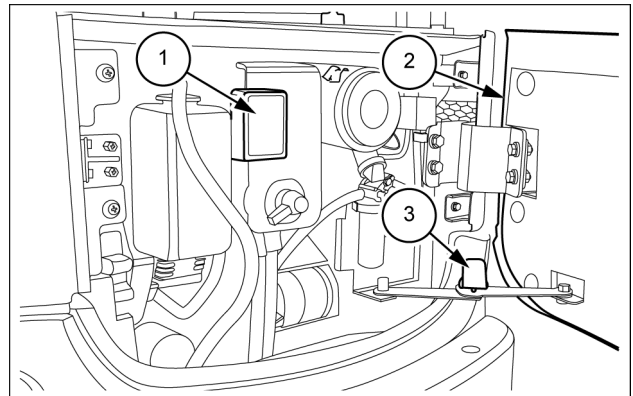
Fuse and relay box - Overview

1. Open the engine door (2) to access to the fuse box (1) and press the hook (3) until the door is completely secured.
The fuse box cover indicates the function and amperage of each fuse.

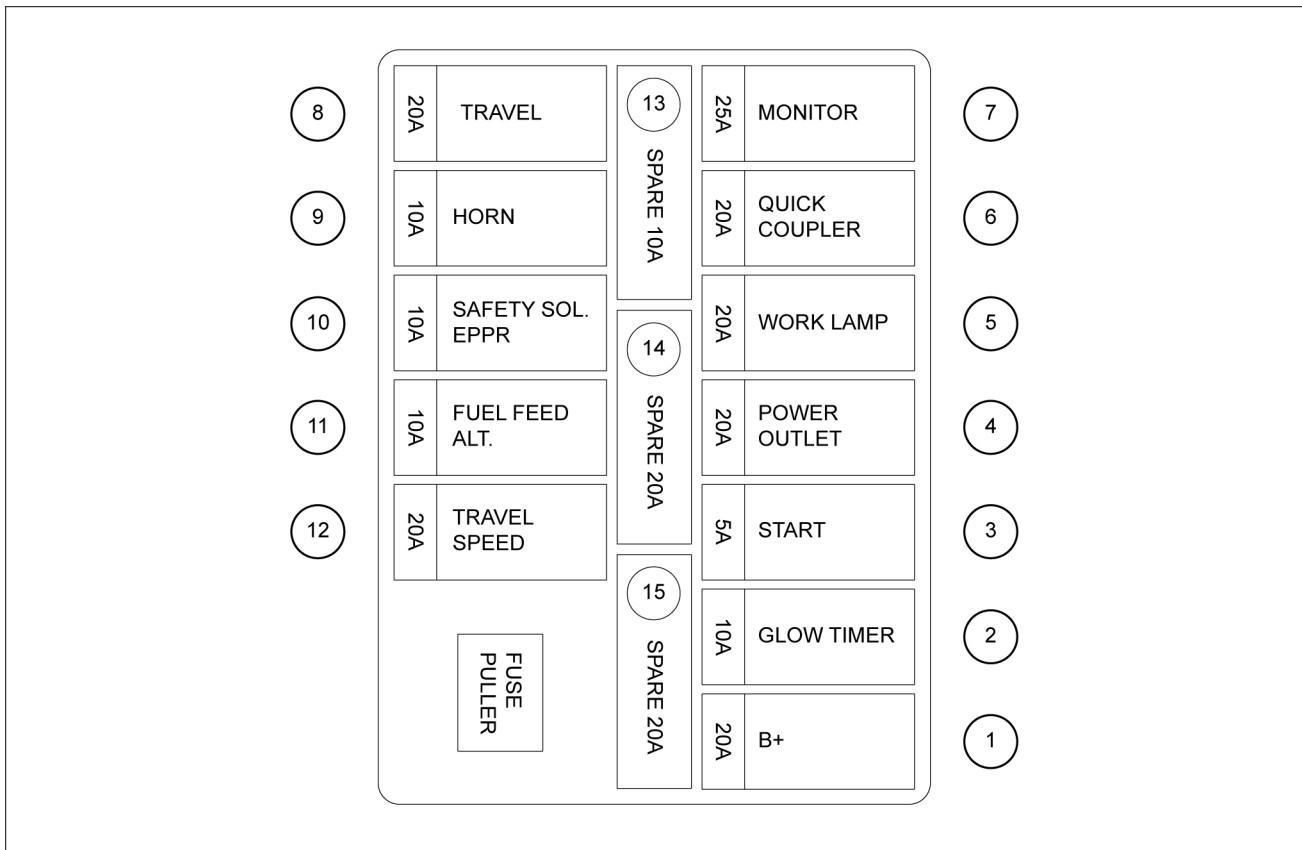
NOTICE: before changing fuses or relays, turn the starter key to the OFF position.

NOTICE: never replace a fuse with a fuse of a different amperage.

NOTE: use the provided fuse puller to remove and install the fuses.



SMIL17MEX0864AB 1



SMIL17MEX0865FB 2

(1) B+ 20 A	(9) Horn 10 A
(2) Glow timer 10 A	(10) Safety solenoid and EPPR 10 A
(3) Start 5 A	(11) Fuel feed and alternator 10 A
(4) Power outlet 20 A	(12) Travel speed 20 A
(5) Work lamp 20 A	(13) Spare 10 A
(6) Quick coupler 20 A	(14) Spare 20 A
(7) Monitor 25 A	(15) Spare 20 A
(8) Travel 20 A	

Engine starter - Test

Motor test

NOTICE: secure the starter to prevent it from jumping up and down while testing the motor.

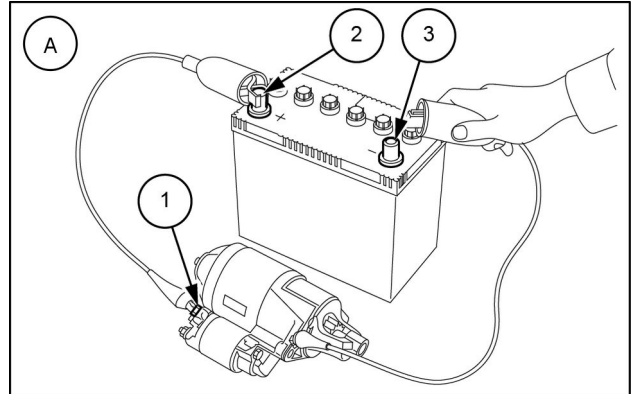
1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable from the battery.
3. Disconnect the leads from the starter B terminal.
4. Remove the starter from the engine.
5. Connect a jumper lead from the starter C terminal (1) to the battery positive terminal (2).
6. Connect a jumper lead momentarily between the starter's body and the battery negative terminal (3).
7. If the motor does not run, starter is failure. Repair or replace the starter.

NOTE: B terminal: It is the terminal which connects the cable from the battery to the starter.

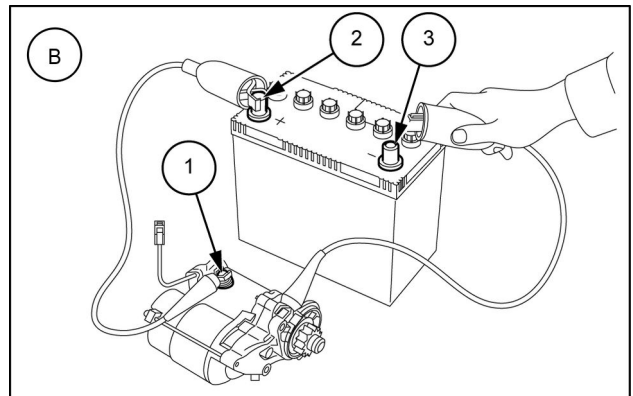
C terminal: It is the terminal which connects the cable from the motor to the magnet switch.

(A) Electromagnetic drive type

(B) Planetary gear reduction type



SMIL16MEX0772AB 1

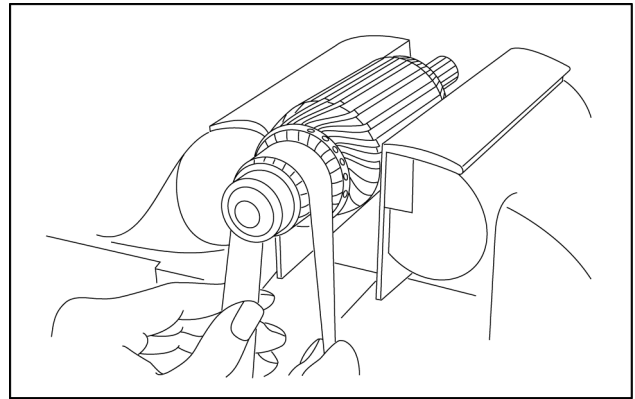


SMIL16MEX0773AB 2

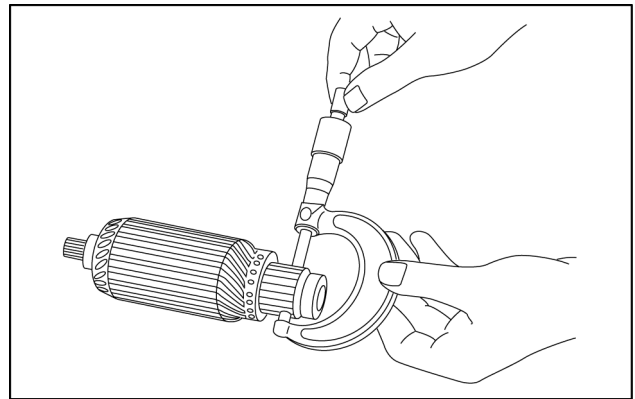
Commutator and mica

1. Check the contact of the commutator for wear, and grind the commutator with emery paper if it is slightly worn.
2. Measure the commutator outer diameter with an outside micrometer at several points.
3. If the minimum outer diameter is less than the allowable limit, replace the armature.
4. If the difference of the outer diameters exceeds the allowable limit, correct the commutator on a lathe to the factory specification.
5. Measure the mica undercut.
6. If the undercut is less than the allowable limit, correct it with a saw blade and chamfer the segment edges.
 1. Segment (a) Correct
 2. Depth of mica (b) Incorrect
 3. Mica

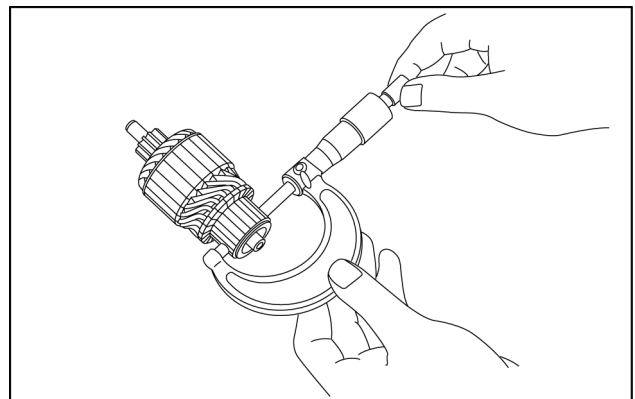
Commutator outer diameter	Factory specification	Electro-magnetic drive type	28.0 mm (1.10 in)
		Gear reduction type	30.0 mm (1.18 in)
	Allowable limit	Electro-magnetic drive type	27.0 mm (1.06 in)
		Gear reduction type	29.0 mm (1.14 in)



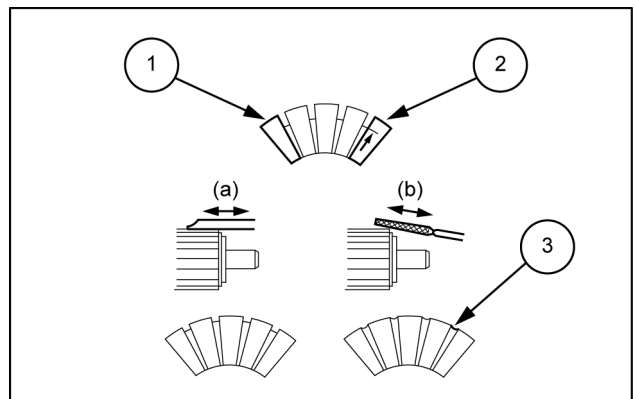
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SMIL16MEX0895AA 4



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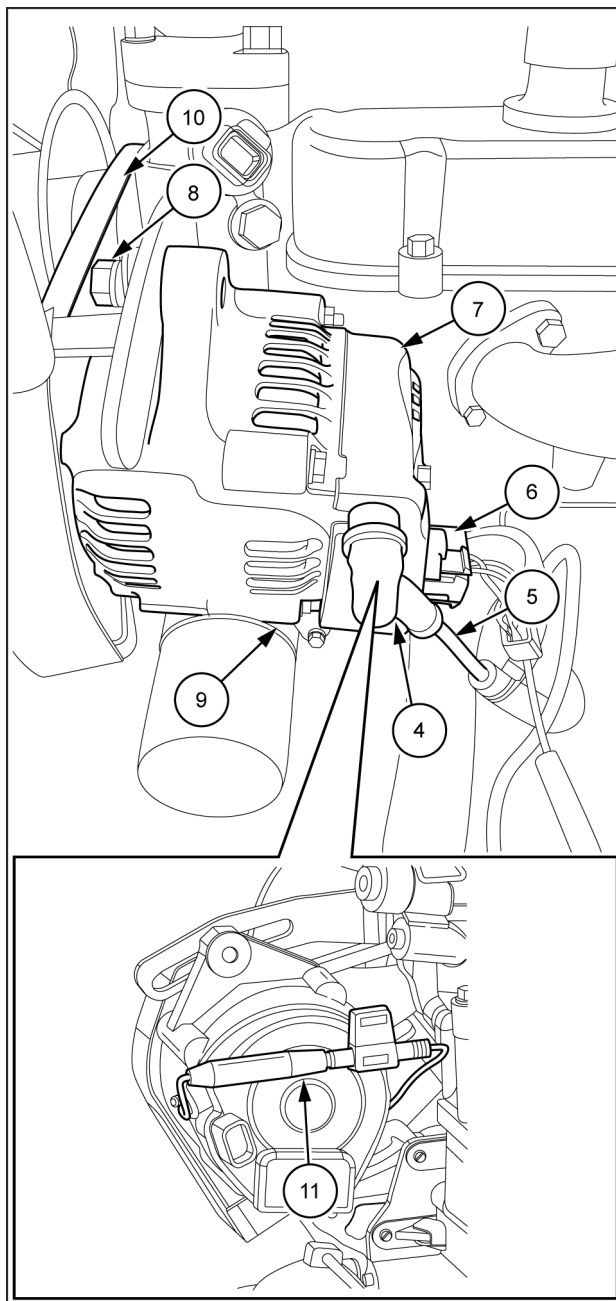
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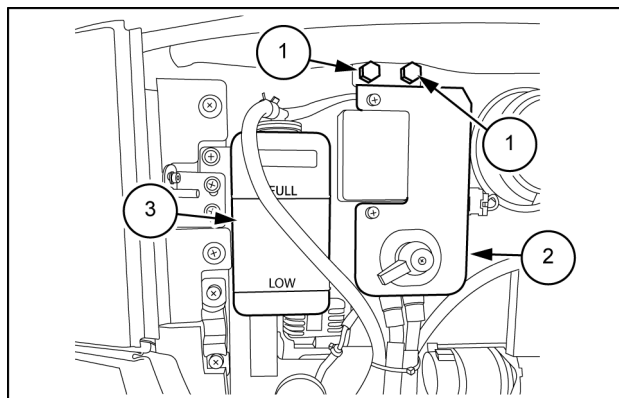
Alternator - Install

1. Install the alternator (7).
2. Install the bolt (8) and the nut (9).
3. Install the fan belt (10) on the alternator pulley and then adjust the tension of the belt (10) (refer to **Belt - Inspect (10.414)**).
4. Connect the wire (5) and the Transient Voltage Suppression TVS external harness (11), then fix them with nuts.
5. Insert the cap (4).
6. Connect the electrical connector (6) to the alternator (7).



SMIL18MEX0878CB 1

7. Install the engine coolant reservoir (3).
8. Engage the battery disconnect switch by means the two screws (1).
9. Close the engine access door.



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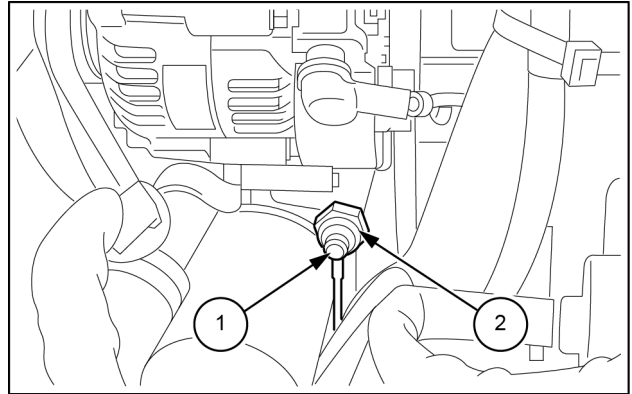
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Fuel tank system - 011

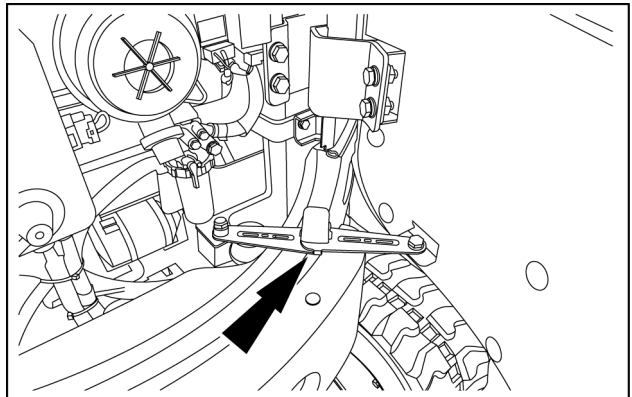
Fuel level sensor - Install	5
Fuel level sensor - Remove	3

Engine oil pressure sensor and switch - Install

1. Use a wrench to install the engine oil pressure switch (2).
2. Connect the wire to the engine oil pressure switch (2).
3. Use a wrench to install the nut (1).



4. Set the battery disconnect switch to I position (ON position).
5. Pull the hook in order to unlock the engine access door.
6. Use the handle and close the engine door firmly.
7. Use the starter key to lock the door.



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Boom - Remove

⚠ WARNING

Improper operation or service of this machine can result in an accident.
Raised equipment or machine movement without an operator can cause serious injury. Always do the following before performing any maintenance:
Park the machine on flat, level ground.
Lower the attachment to the ground.
Shut down the engine and remove the ignition key.
Lock the tracks.
Failure to comply could result in death or serious injury.

W0944D

⚠ WARNING

Improper operation or service of this machine can result in an accident.
Assign a supervisor to direct worksite operations. Agree on all safety measures, procedures, and suitable hand signals.
Failure to comply could result in death or serious injury.

W0287A

⚠ WARNING

Avoid injury!
Use Personal Protective Equipment (PPE), including protective goggles, gloves, and safety footwear.
Failure to comply could result in death or serious injury.

W1036A

⚠ WARNING

Crushing hazard!
The lifting systems must be operated by qualified personnel who are aware of the correct procedures to follow. Make sure all lifting equipment is in good condition, and all hooks are equipped with safety latches.
Failure to comply could result in death or serious injury.

W0256A

⚠ WARNING

Heavy objects!
Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders.
Failure to comply could result in death or serious injury.

W0398A

Dipper - Install

⚠ WARNING

Improper operation or service of this machine can result in an accident.
Raised equipment or machine movement without an operator can cause serious injury. Always do the following before performing any maintenance:
Park the machine on flat, level ground.
Lower the attachment to the ground.
Shut down the engine and remove the ignition key.
Lock the tracks.
Failure to comply could result in death or serious injury.

W0944D

⚠ WARNING

Improper operation or service of this machine can result in an accident.
Assign a supervisor to direct worksite operations. Agree on all safety measures, procedures, and suitable hand signals.
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W0287A

⚠ WARNING

Avoid injury!
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W1036A

⚠ WARNING

Crushing hazard!
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W0256A

⚠ WARNING

Heavy objects!
Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders.
Failure to comply could result in death or serious injury.

W0398A

5. Install the arm links (9). Insert the O-ring and the shims, and then push the pin (6) on the arm links (9) and the arm (8).

- When inserting the pin, be careful not to damage the installed O-rings or dust seals.

6. Install the bolt (5), and then use two wrenches [17 mm] to tighten the two nuts (7).

Tightening torque for bolt (5) and nuts (7) installation: **45.2 – 72.5 N·m (33.3 – 53.5 lb ft)**

NOTICE: pay attention to the bolt (5) head's direction.

7. Install the bucket link (4).

8. Insert the O-ring and the shim, and then push the pin (2) on the links (4) (9) and the bucket cylinder (10).

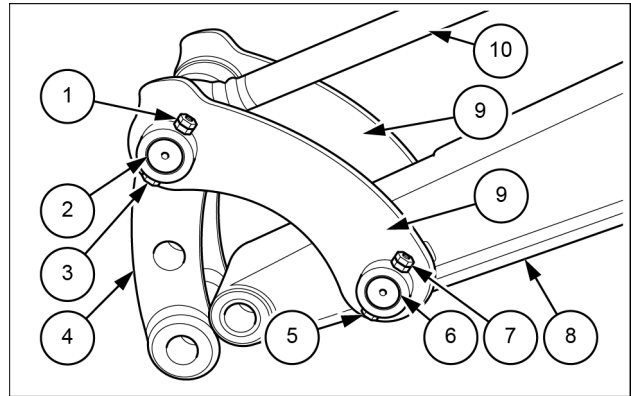
- When inserting the pin, be careful not to damage the installed O-rings or dust seals.

9. Install the bolt (3), and then use two wrenches [17 mm] to tighten the two nuts (1).

Tightening torque for bolt (3) and nuts (1) installation: **45.2 – 72.5 N·m (33.3 – 53.5 lb ft)**

NOTICE: pay attention to the bolt (3) head's direction.

10. Install the bucket (refer to **Bucket - Install (84.100)**).



SMIL17MEX0792AB 1

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