

**CX210C**  
**CX220C**  
Crawler Excavator

**SERVICE MANUAL**

Part number 51572940

English

March 2019

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**CASE**  
CONSTRUCTION

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## INTRODUCTION

Membrane switch on monitor display	
Windshield wiper & washer	
AM/FM Radio with auto-tuner	
Floor mat	
Polycarbonate roof hatch & Sun shade	
Auto air conditioner	
Rain deflector	
Sun visor	
Top guard OPG level 1 (in CAB structure)	
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 linked to consoles
Adjustable headrest	Retractable seat belt
Adjustable lumbar support	Control consoles adjust independently of seat
Others	
Rear view mirror (Cab side x 1, Right side x 1, Back side x 2)	

### 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 <b>5.6 km/h (3.480 mph)</b> (Automatic travel speed shifting)
	Low <b>3.4 km/h (2.113 mph)</b>
Drawbar pull	<b>188 kN (42264.08 lb)</b>
Number of carrier rollers (each side)	2
Number of track rollers (each side)	7
Number of shoes (each side)	46
Type of shoe	Triple grouser shoe Link pitch
Link pitch	<b>190 mm (7.480 in)</b>
Width of shoe	<b>600 mm (23.622 in)</b> (standard)
Grade-ability	<b>70% ( 35°)</b>

### Mass

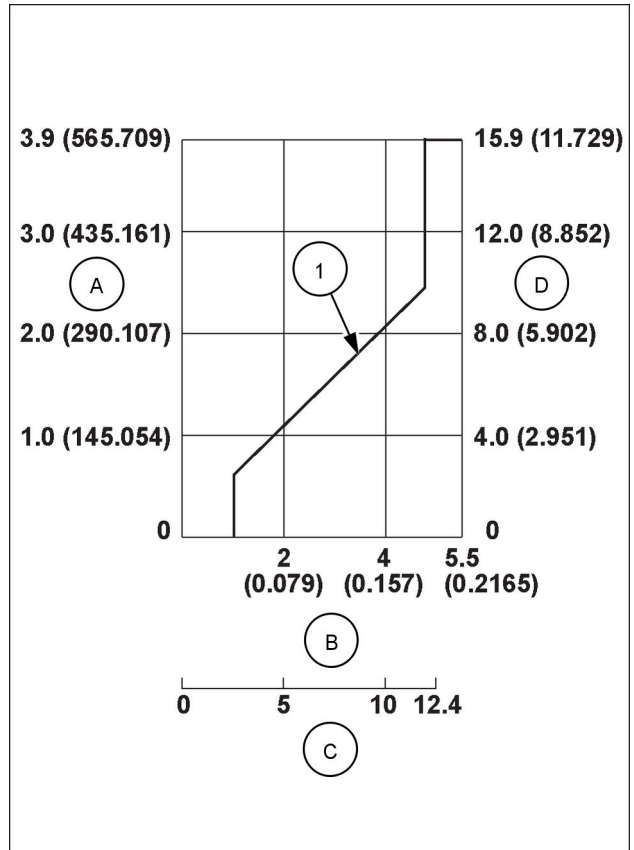
Operating mass	<b>20.600 kg (45.415 lb)</b>
with <b>2.94 m (9.6457 ft)</b> Arm, <b>0.8 m<sup>3</sup></b> Sumitomo Bucket, <b>600 mm (23.622 in)</b> grouser shoe, operator, lubricant, coolant and full fuel tank	
Shipping mass	<b>19.500 kg (42.990 lb)</b>
Operating mass - (operator mass [ <b>75 kg (165.347 lb)</b> ] + 90% of fuel mass + bucket mass [ <b>660 kg (1455.051 lb)</b> ])	
Counter weight mass	<b>4.100 kg (9.039 lb)</b>
Ground pressure	<b>0.046 MPa (6.67230 psi)</b>
with <b>2.94 m (9.6457 ft)</b> Arm, <b>0.8 m<sup>3</sup></b> Sumitomo Bucket, <b>600 mm (23.622 in)</b> grouser shoe	

### Digging force (with 0.8 m<sup>3</sup> Sumitomo Bucket) (ISO 6015)

	[ <b>2.94 m (9.6457 ft)</b> ] Arm	[ <b>2.40 m (7.8740 ft)</b> ] Arm	[ <b>1.90 m (6.2336 ft)</b> ] Arm
Arm digging force	<b>103 kN (23155.32 lb)</b>	<b>123 kN (27651.50 lb)</b>	<b>142 kN (31922.87 lb)</b>
With auto power up	<b>110 kN (24728.98 lb)</b>	<b>132 kN (29674.78 lb)</b>	<b>152 kN (34170.96 lb)</b>
Bucket digging force	<b>142 kN (31922.87 lb)</b>	<b>142 kN (31922.87 lb)</b>	<b>142 kN (31922.87 lb)</b>
With auto power up	<b>152 kN (34170.96 lb)</b>	<b>152 kN (34170.96 lb)</b>	<b>152 kN (34170.96 lb)</b>

**Travel remote control valve control diagram**

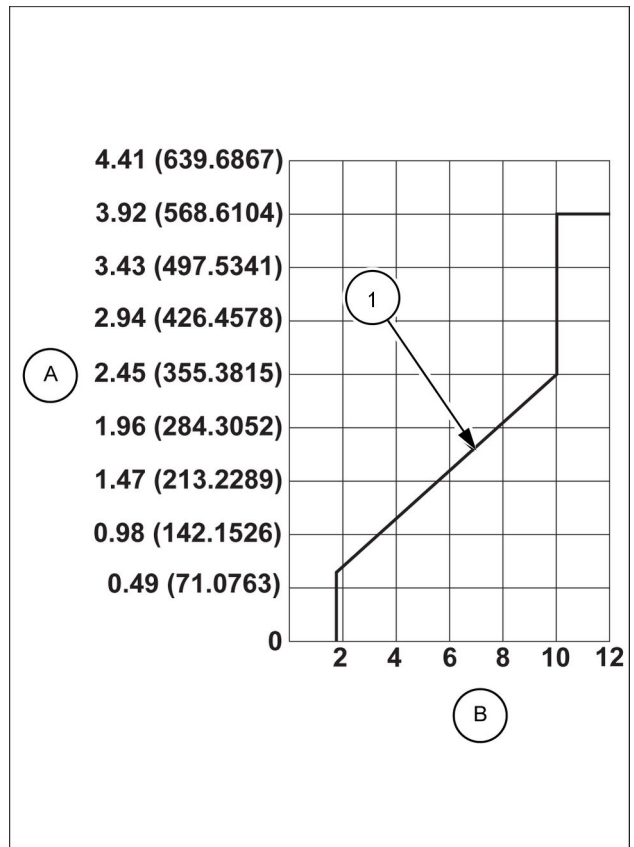
- A. Secondary pressure [MPa (psi)]
- B. Push rod stroke [mm (in)]
- C. Pedal operating angle [deg.]
- D. Operating torque [N·m (lbf·ft.)]
- 1 Secondary pressure



SMIL18CEX3814BB 3

**Option remote control valve control diagram**

- A. Secondary pressure [MPa (psi)]
- B. Operating angle [deg.]
- 1 Secondary pressure



SMIL15CEX1702BB 4

## Fluids and lubricants

CX220C Crawler excavator LC version (Tier 3) - Commonwealth of Independent States (CIS)	APAC
CX220C Crawler excavator NLC version (Tier 3) - Commonwealth of Independent States (CIS)	APAC

By using appropriate fluids and lubricants the excavator can operate in ambient temperatures ranging from **-20 °C (-4 °F)** to **25 °C (77 °F)**. Refer to the list of fluids and lubricants contained in this manual.

**NOTICE:** When operating the machine in ambient temperatures below **-20 °C (-4 °F)**, consult your **CASE CONSTRUCTION Dealer** for specific machine provision and for specific fluids and lubricants to be used.

**NOTICE:** When operating the machine in ambient temperatures above **25 °C (77 °F)**, the engine oil must be replaced with **SAE 15W-40**.

	Quantity		CASE CONSTRUCTION specification	Reference specification
Fuel tank	<b>410 L (108 US gal)</b>	—	—	GOST R52368 Type I
Engine oil	<b>23.1 L (6.1 US gal)</b>	<b>CASE AKCELA NO. 1™ ENGINE OIL</b>	MS 1121	<b>SAE 10W-30 API CI-4</b>
Swing reduction unit	<b>5 L (1.3 US gal)</b>	<b>CASE AKCELA GEAR LUBE 135 H EP 80W-90</b>	MS 1316	<b>SAE 80W/90 API GL-5</b>
Travel reduction unit	<b>5 L (1.3 US gal)</b>	<b>CASE AKCELA GEAR LUBE 135 H EP 80W-90</b>	MS 1316	<b>SAE 80W/90 API GL-5</b>
Engine coolant	<b>31 L (8.2 US gal)</b>	<b>CASE AKCELA ACTIFULL™ OT EXTENDED LIFE COOLANT CONCENTRATE (*)</b>	<b>MAT3624</b> Grade OAT-EG1	<b>ASTM D6210</b> TYPE I-FF
		<b>CASE AKCELA ACTIFULL™ OT EXTENDED LIFE COOLANT 50/50 PREMIXED</b>	<b>MAT3624</b> Grade OAT-EG2	<b>ASTM D6210</b> TYPE III-FF
Hydraulic oil tank (**)	<b>147 L (38.8 US gal)</b>	<b>CASE AKCELA HYDRAULIC LL 46</b>	—	<b>ISO 11158</b> L-HV46
Grease	—	<b>CASE AKCELA 251H EP MULTI-PURPOSE GREASE</b>	IH B-27 251H EP	<b>NLGI 2</b>

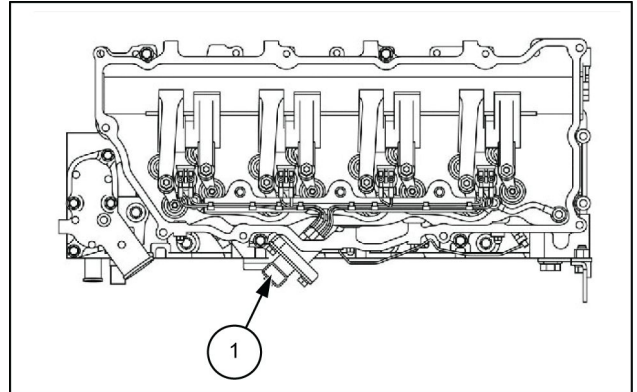
(\*) Concentrate antifreeze to be mixed 50/50 with distilled (deionized) water.

(\*\*) The total capacity of the hydraulic system is: **240 L (63.4 US gal)**

## Engine - Compression test

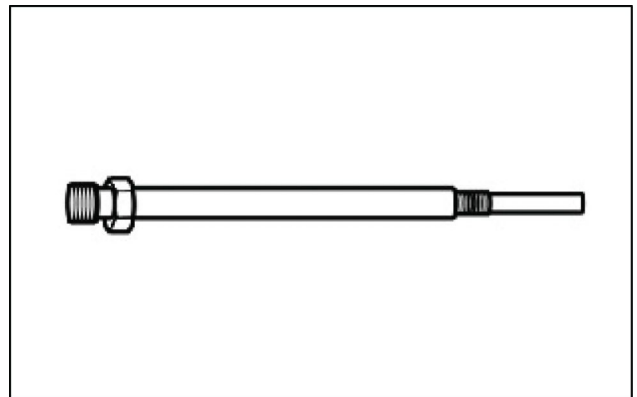
### Engine compression pressure inspection

- Warm-up the engine.
1. Remove the glow plug from the cylinder head assembly.
    - Remove all glow plugs.
  2. Remove the injector harness connector (1) from the lower cover.



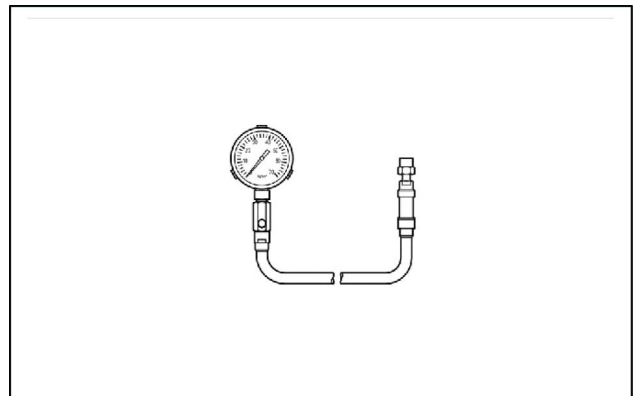
SMIL13CEX0801AB 1

3. Install the special tool on the cylinder head assembly.
  - Insert the compression gauge adapter into the installation hole of the glow plug to install the compression gauge.



LPIL12CX04447AA 2

- Measure the compression pressure.
- Rotate the starter, and read the indication of the compression pressure when the compression gauge needle stabilizes at approximately **200 RPM**.
- Measure the compression pressure of all cylinders.



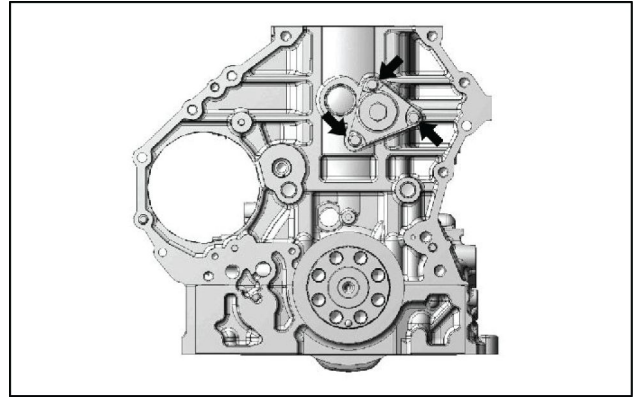
LPIL12CX04448AA 3

### Idle gear B installation

1. Install the idle gear B shaft to the cylinder block.

Tightening torque: **31 N·m (22.9 lb ft)**

2. Apply the engine oil to the idle gear B shaft.
3. Apply the engine oil to the idle gear B.



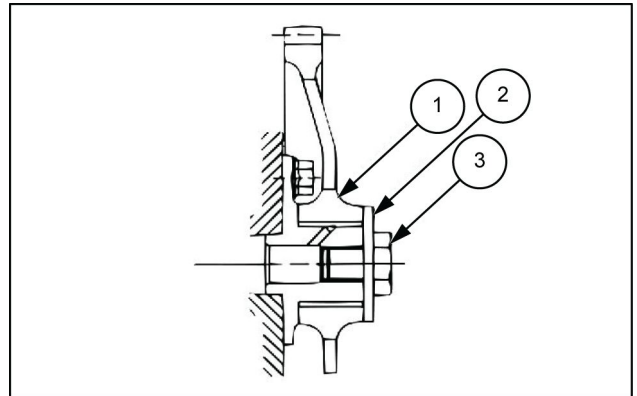
SMIL13CEX1647AA 23

4. Install the idle gear B (1) to the cylinder block.

Tightening torque: **110 N·m (81.1 lb ft)**

2. Thrust collar
3. Bolt

**NOTICE:** Confirm that the idle gear B (1) turns smoothly after installing.



SMIL13CEX1648AB 24

### Oil pump assembly installation

1. Install the oil pump to the cylinder block.

**NOTICE:** Use new gaskets.

Tightening torque: **31 N·m (22.9 lb ft)**

### Idle gear A installation

1. Align first cylinder to the compression top dead center.
2. Apply the engine oil to the idle gear A.
3. Install the idle gear A shaft to the idle gear A.
4. Align the idle gear A to alignment mark.
  - Align the L mark on the crank gear with the O mark on the idle gear A.
5. Apply the engine oil to the bolt.
  - Apply engine oil to the threaded portion and seat surface on the idle gear A installation bolt.
6. Install the idle gear A to the cylinder block.

Tightening torque: **133 N·m (98.10 lb ft)**

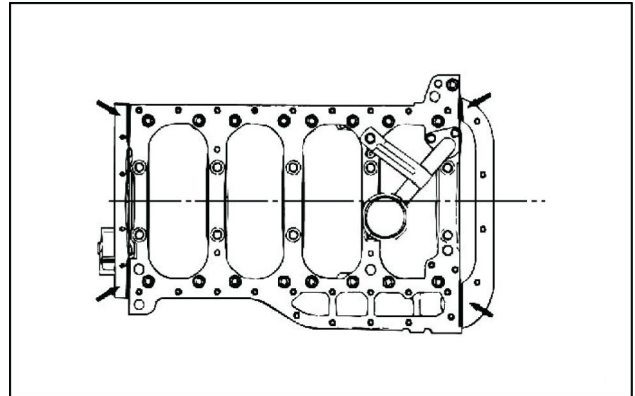
## Engine oil pan - Install

### Oil pan installation

1. Apply the liquid gasket to the crankcase.
  - Apply ThreeBond 1207B to each joint of the crankcase, flywheel housing and gear case.

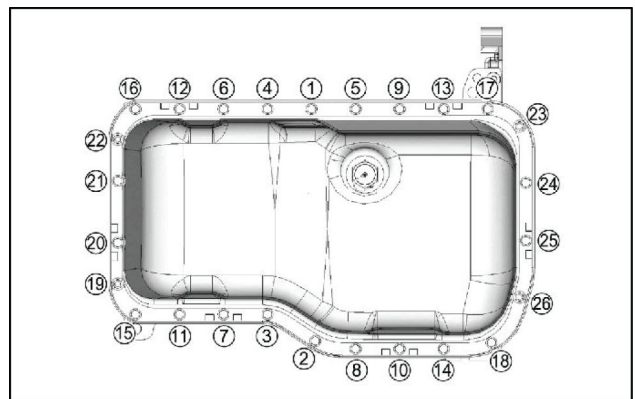
Bead width: **3.0 mm (0.1181 in)**

**NOTICE:** After applying the liquid gasket, install the oil pan within **5 min**.



SMIL13CEX1830AA 1

2. Install the gasket to the oil pan.
3. Install the oil pan to the crankcase.
  - Tightening torque: **26 N·m (19.18 lb ft)**
    - Tightening order
4. Connect the harness connector to the oil level switch.



SMIL13CEX1831AA 2

### Engine oil filling

1. Refill the engine assembly with the engine oil.

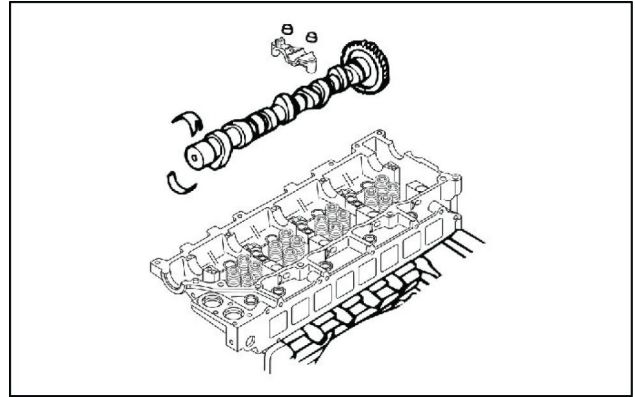
**NOTICE:** Check that the oil pan drain is tightened to the specified torque before refilling the engine oil.

### Battery ground cable connect

1. Connect the battery ground cable to the battery.

## Camshaft removal

1. Remove the camshaft bearing cap from the cylinder head assembly.
2. Remove the camshaft bearing from the camshaft bearing cap.
3. Remove the camshaft from the cylinder head.
4. Remove the camshaft bearing from the cylinder head assembly.
  - Temporarily assemble the removed caps and bearings in the original position to avoid a mix-up after the bearings have been inspected.



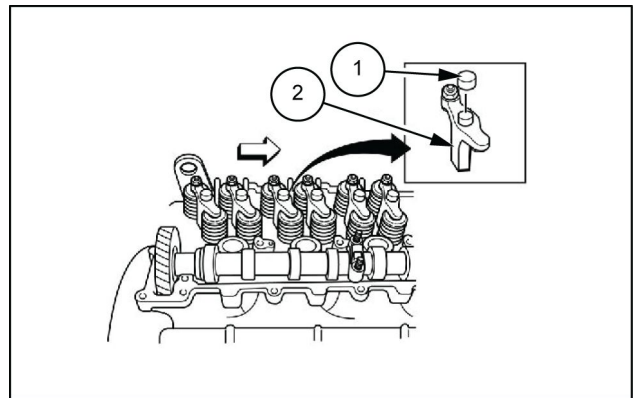
SMIL13CEX1497AA 26

## Bridge removal

1. Remove the bridge cap (1) from the bridge (2).

**NOTICE:** Be careful not to drop the bridge cap (1) into the engine.

2. Remove the bridge (2) from the bridge guide.
  - After removing, organize to avoid a mix-up with other installation locations.



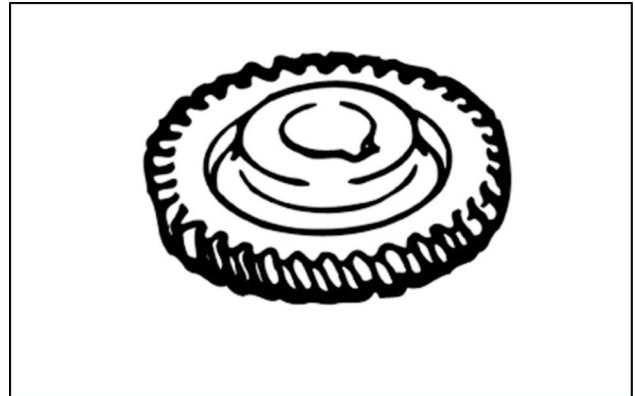
SMIL13CEX1498AB 27

## Camshaft - Inspect

### Camshaft gear inspection

1. Inspect the camshaft gear.

**NOTE:** Inspect gears for tooth contact, peeling and pitting, etc.



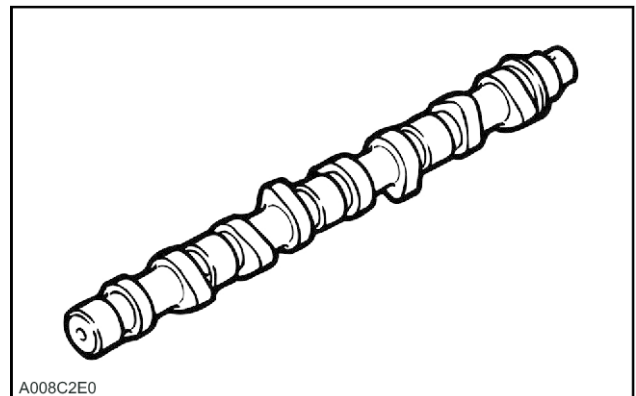
SMIL14CEX3388AA 1

### Camshaft inspection

1. Inspect the camshaft.

**NOTE:** Inspect the camshaft journal and cam sections for worn and damage.

2. If any abnormality is found in the inspection, replace the camshaft.



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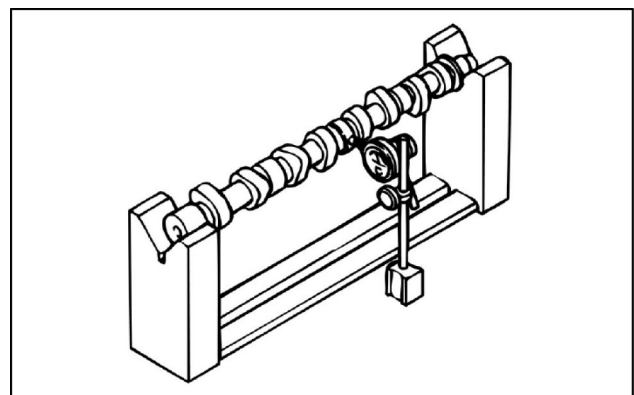
3. Put the camshaft on V-block.

**NOTE:** Hold the No.1 and No.5 journal sections using the V blocks.

4. Measure the camshaft using the dial gauge.

**NOTE:** To measure the fluctuation, attach the dial gauge to the No.3 journal section and gently turn the camshaft 360 degrees.

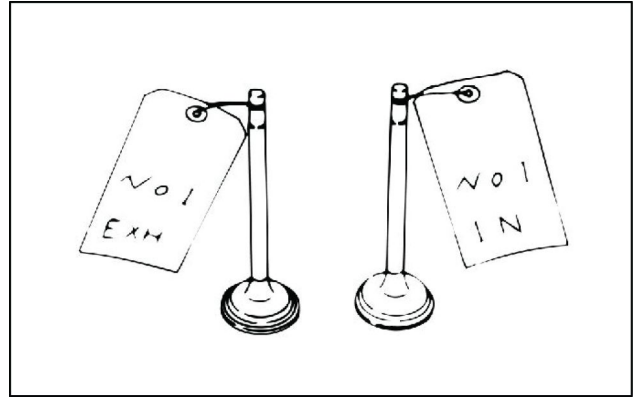
Limit: **0.05 mm (0.0020 in)**



SMIL14CEX5668AA 3

## Exhaust valve removal

1. Remove the exhaust valve from the cylinder head assembly.
  - Organize the removed valve according to the cylinders.



SMIL13CEX1170AA 14

## Valve stem oil seal removal

1. Remove the valve stem oil seal from the valve guide using the pliers.

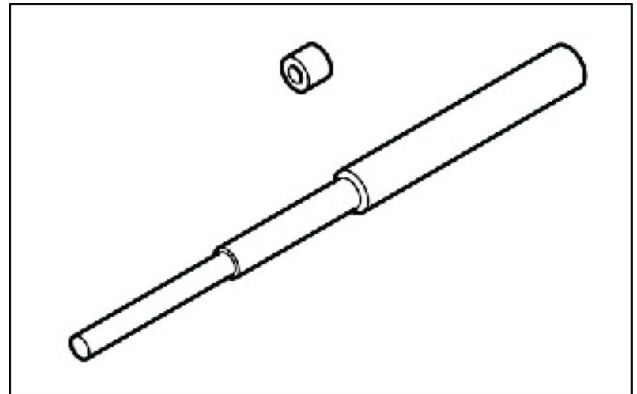
**NOTICE:** Do not reuse the valve stem oil seal.

2. Remove the valve spring seat from the cylinder head assembly.

## Valve guide removal

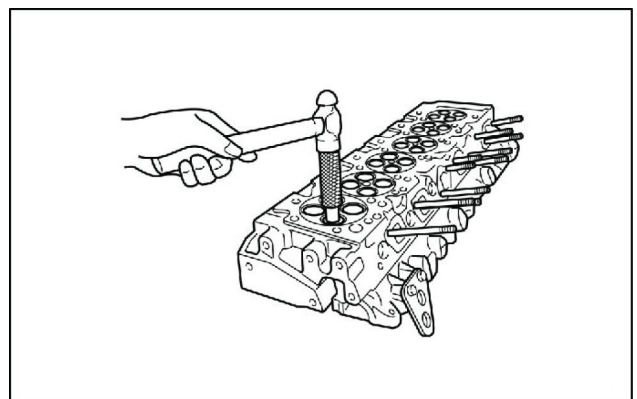
1. Remove the valve guide from the cylinder head assembly using the special tool.

Special tool: Valve guide replacer (Refer to **Cylinder head - Special tools (10.101)**)



SMIL13CEX1171AA 15

- Tap the valve guides out from the bottom surface of the cylinder head.



SMIL13CEX1172AA 16

## Valves Seal - Remove

### Battery ground cable disconnect

1. Disconnect the battery ground cable from the battery.

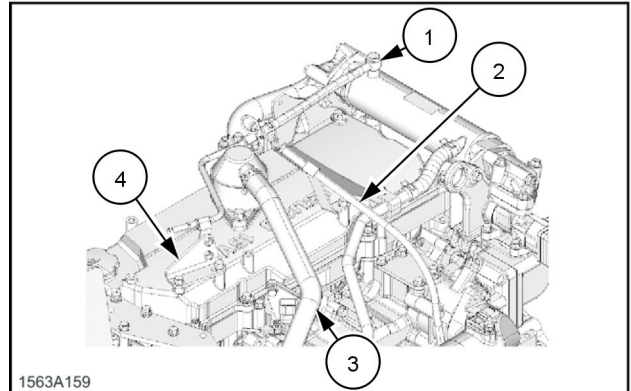
**NOTICE:** Do not disconnect the battery cable at least for **1 min** after turning the starter switch **OFF**.

### Ventilation hose disconnect

1. Remove the air leak pipe **(1)** from the bracket. **(4)**

**NOTICE:** The machines from some manufacturers do not have this installed.

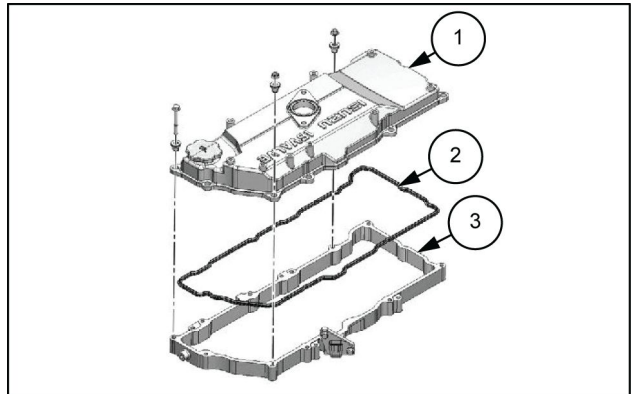
2. Remove the bracket **(4)** from the cylinder head cover.
3. Disconnect the ventilation hose **(3)** from the air breather.
  1. Air leak pipe
  2. Oil level gauge guide tube



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### Cylinder head cover removal

1. Remove the cylinder head cover **(1)** from the lower cover **(3)**.
2. Remove the head cover gasket **(2)** from the cylinder head cover **(1)**.



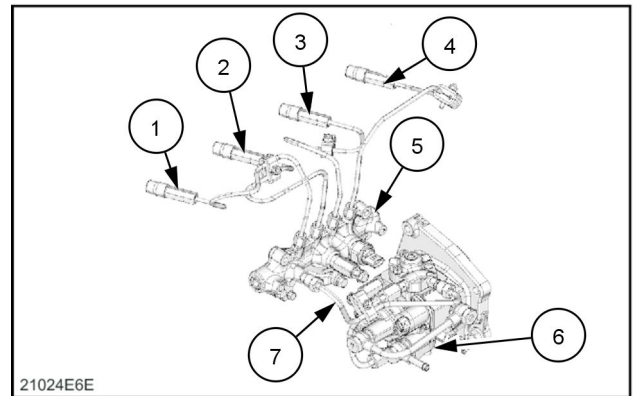
SMIL13CEX1491AB 2

## Injection pipe removal

1. Remove the clip from the bracket.
2. Remove the injection pipe from the injector and the common rail assembly (5).

**NOTICE:** Do not reuse the removed injection pipe. Seal the common rail and injector to prevent foreign material from entering.

1. Injection pipe 1
2. Injection pipe 2
3. Injection pipe 3
4. Injection pipe 4
6. Fuel supply pump
7. Fuel pipe



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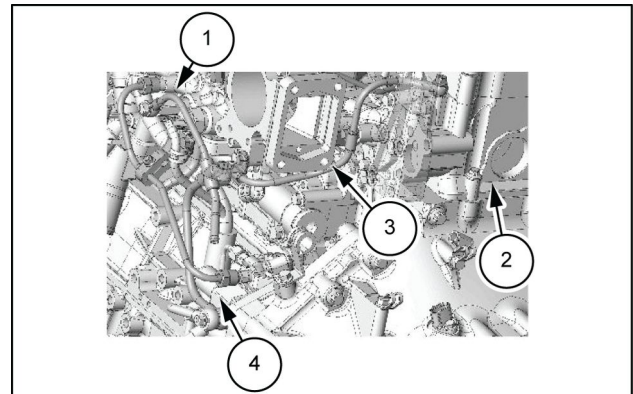
## Fuel pipe removal

1. Remove the fuel pipe from the fuel supply pump and the common rail assembly.
  - Remove the clip.

**NOTICE:** Do not reuse the gasket.

## Fuel leak off pipe assembly removal

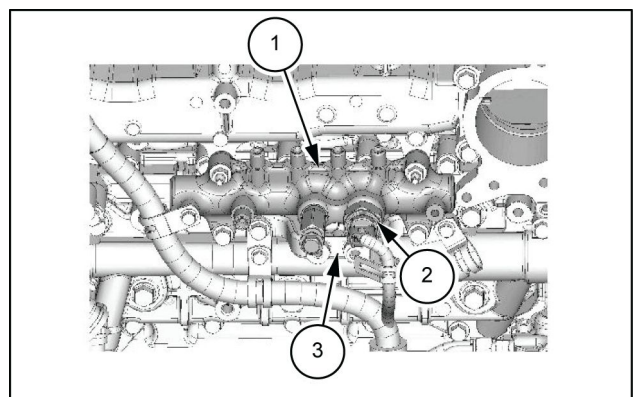
1. Disconnect the fuel leak-off pipe (3) from the cylinder head assembly (2).
2. Remove the fuel leak-off pipe (3) from the fuel supply pump (4).
  - Remove the eyebolt tightened together with the fuel feed pipe.
3. Disconnect the fuel leak-off pipe (3) from the common rail assembly (1).
4. Remove the fuel leak-off pipe (3) from the case.
  - Remove the clip.



SMIL13CEX1489AB 16

## Common rail assembly removal

1. Disconnect the harness connector from the fuel pressure sensor (2).
2. Remove the common rail assembly (1) from the inlet cover and the common rail bracket (3).
3. Remove the common rail bracket (3) from the oil cooler assembly.



SMIL13CEX1489AB 17

### Ventilation hose connect

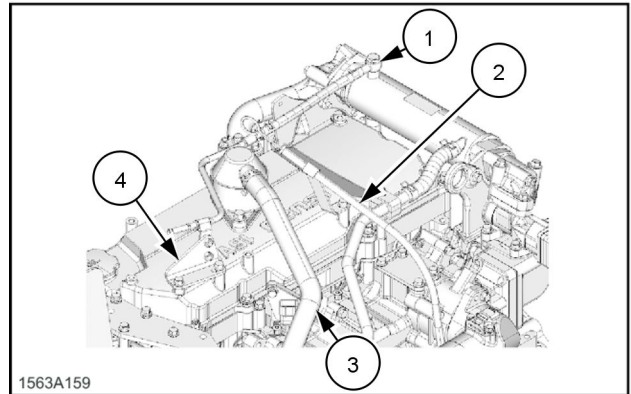
1. Connect the ventilation hose (3) to the air breather.
2. Install the air leak pipe (1) on the bracket (4) and EGR cooler.

**NOTICE:** The machines from some manufacturers do not have this installed.

Tightening torque: **24 N·m (18 lb ft)** bracket

Tightening torque: **22 N·m (16 lb ft)** EGR cooler

2. Oil level gauge guide tube



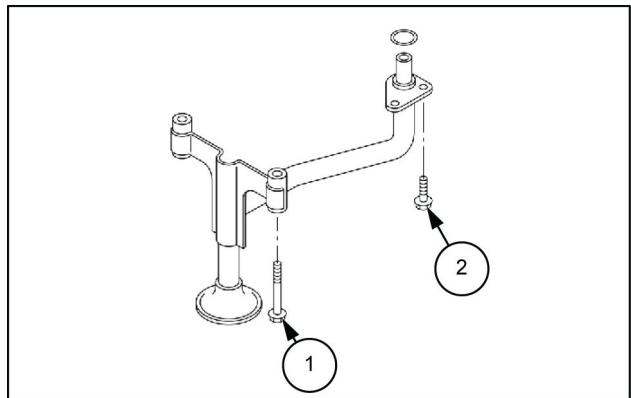
1563A159 44

### Oil strainer installation

1. Install the O-ring to the oil strainer.
2. Install the oil strainer to the crankcase.

Tightening torque: **31 N·m (23 lb ft)**

1. **M10** bolt
2. **M8** bolt



SMIL13CEX1653AB 45

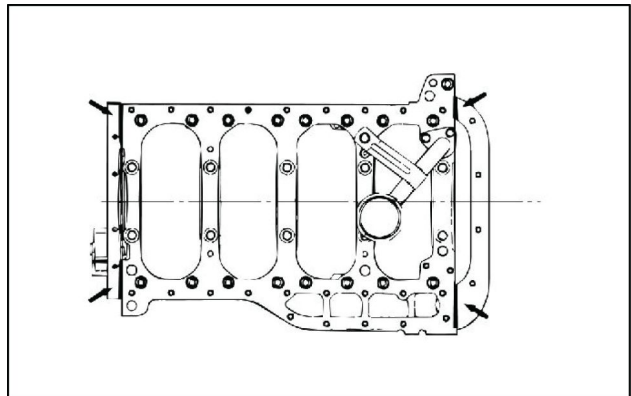
### Oil pan installation

1. Apply the liquid gasket to the crankcase.
  - Apply ThreeBond 1207B to each joint of the crankcase, flywheel housing and gear case.

Bead width: **3.0 mm (0.118 in)**

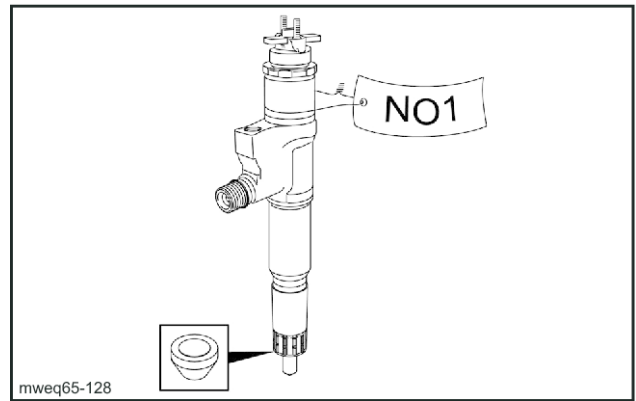
**NOTICE:** After applying the liquid gasket, install the oil pan within **5 min**.

2. Install the gasket to the oil pan.



SMIL13CEX1654AA 46

**NOTICE:** Store the injectors with tags showing the cylinder number so that the identification code plates on the top section of the injector are not mixed up.  
Be careful not to damage the injector injection port.

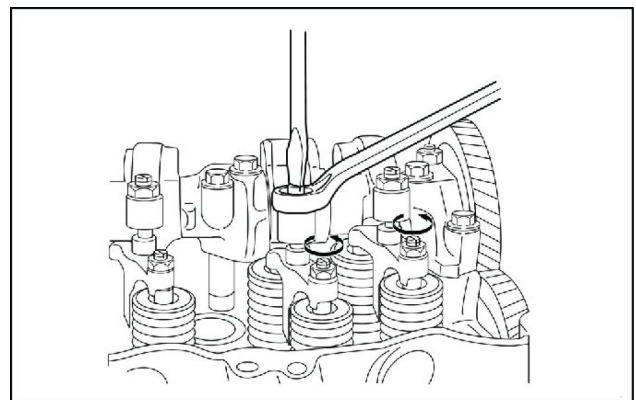


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### Rocker arm shaft removal

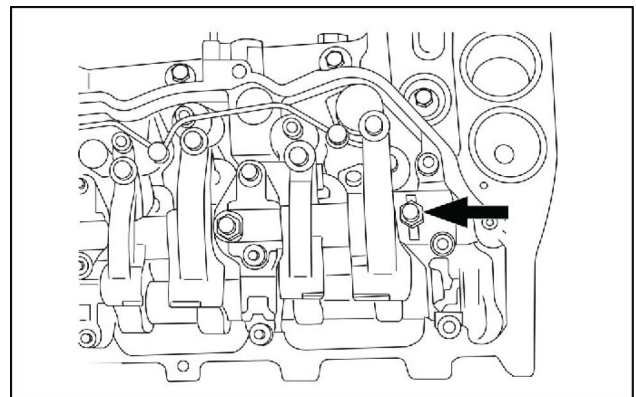
1. Loosen the adjust screw using the wrench.
  - Loosen all valve clearance adjustment screws.



SMIL13CEX1495AA 31

2. Remove the rocker arm shaft from the cylinder head assembly.
  - Evenly loosen the rocker arm shaft bracket and the rocker arm assembly bracket tightening bolts from both ends and remove them.

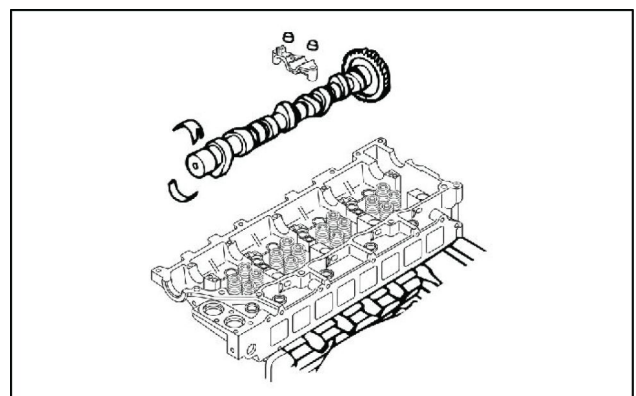
**NOTICE:** Be careful not to remove the bolt shown in the diagram.



SMIL13CEX1496AA 32

### Camshaft removal

1. Remove the camshaft bearing cap from the cylinder head assembly.
2. Remove the camshaft bearing from the camshaft bearing cap.
3. Remove the camshaft from the cylinder head.
4. Remove the camshaft bearing from the cylinder head assembly.
  - Temporarily assemble the removed caps and bearings in the original position to avoid a mix-up after the bearings have been inspected.



SMIL13CEX1497AA 33

3. Install the camshaft bearing to the cylinder head assembly.
4. Install the camshaft to the cylinder head assembly.
  - Mesh together the idle gear C and the camshaft gear so that the alignment mark on the camshaft gear matches the top surface of the cylinder head, and gently install the camshaft.
5. Check alignment mark of the camshaft gear.

**NOTICE:** Confirm that the alignment mark is not misaligned before installing the camshaft bearing cap. If the alignment mark is not at the correct position, reinstall the camshaft.

6. Apply the engine oil to the camshaft bearing.

**NOTE:** Apply engine oil to the sliding surface of the bearing.

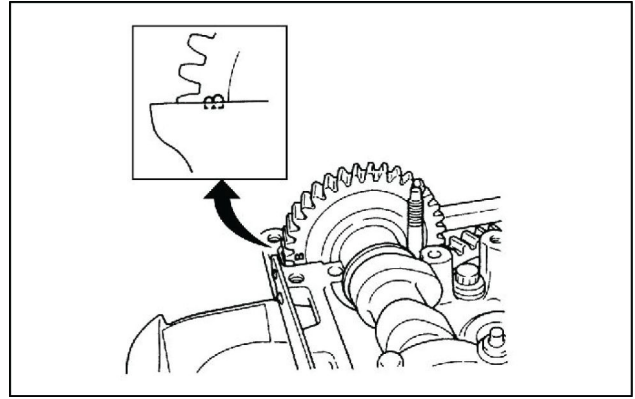
**NOTICE:** Apply engine oil after cleaning the bearing installation sections of the camshaft bearing and camshaft bearing cap.

7. Install the camshaft bearing to the camshaft bearing cap.

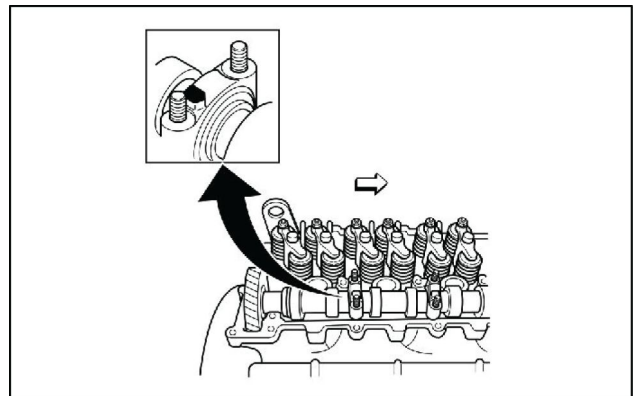
8. Install the camshaft bearing cap to the cylinder head assembly.

- Turn the camshaft bearing cap so that the arrow mark on the top surface faces the engine front side, and assemble in numerical order.

Tightening torque: **28 N·m (21 lb ft)** Engine oil application



SMIL13CEX1686AA 56



SMIL13CEX1687AA 57

### Rocker arm shaft installation

1. Apply the engine oil to the bracket.

**NOTE:** Apply to each sliding surface.

2. Apply the engine oil to the rocker arm.

**NOTE:** Confirm that the adjust screw is fully loosened.

3. Temporarily tighten the bolts (2), (3), and (4) to the cylinder head assembly.

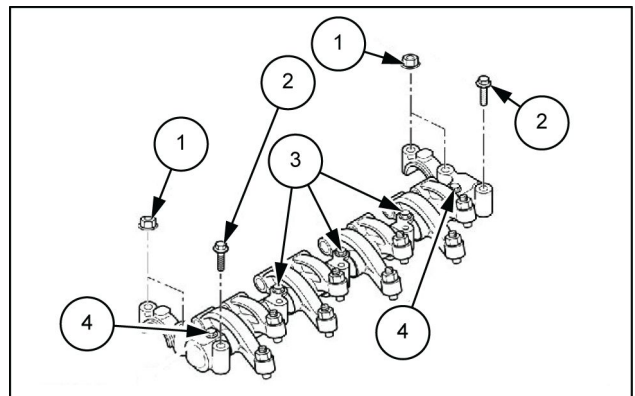
**NOTE:** Apply engine oil to the threaded portion of the bolts.

4. Temporarily tighten the nut (1) to the cylinder head assembly.

**NOTE:** Apply engine oil to the threaded portion of the nuts.

5. Securely tighten the rocker arm shaft to the cylinder head assembly.

**NOTE:** Hold the entire rocker arm shaft horizontally and gradually tighten it.



SMIL13CEX1688AB 58

## Fuel cooler - Prepare

### **⚠ 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

### **⚠ WARNING**

#### **Avoid injury!**

Shut off the engine, remove the key, and make sure all motion is stopped before servicing the machine.

Failure to comply could result in death or serious injury.

W1128A

### **⚠ 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

Items to prepare:

- Wrench [ 13 mm]
- Screwdriver
- Pliers
- Marking pen
- Cap
- Plug
- Rag
- Cleaning fluid
- Drip pan

## Common rail - Install

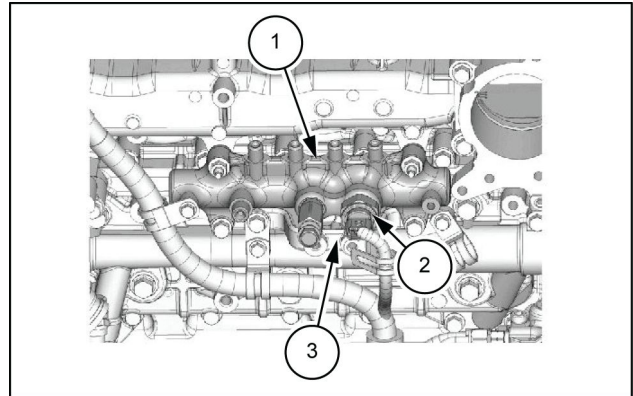
### Common rail assembly installation

1. Temporarily tighten the common rail bracket **(3)** to the oil cooler assembly.
  - The installation bolt and common rail assembly **(1)** are tightened together.
2. Align the common rail assembly **(1)** to the inlet cover.
3. Align the common rail assembly **(1)** with the common rail bracket **(3)**.
4. Temporarily tighten the nuts to the common rail assembly **(1)**.
  - The stud bolts of the inlet cover are tightened together.
5. Temporarily tighten the bolt to the common rail assembly **(1)**.
6. Securely tighten the nut to the common rail assembly **(1)**.
 

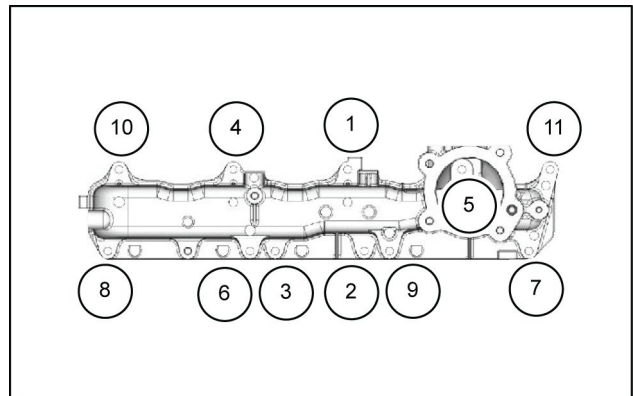
Tightening torque: **22 N·m (16 lb ft)**

  - Refer to the tightening order in the diagram if the inlet cover is removed.
7. Securely tighten the bolt to the common rail assembly **(1)**.
 

Tightening torque: **19 N·m (14 lb ft)**
8. Connect the harness connector to the fuel pressure sensor **(2)**.



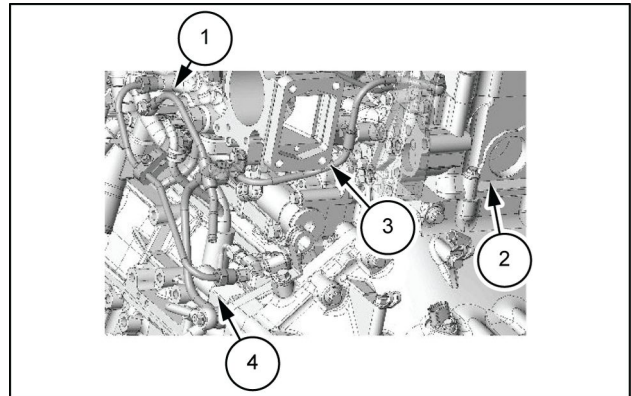
SMIL13CEX1694AB 1



SMIL13CEX1392AB 2

### Fuel leak off pipe assembly removal

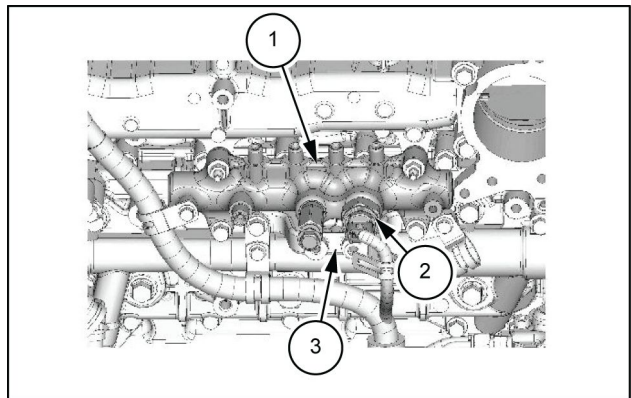
1. Disconnect the fuel leak-off pipe (3) from the cylinder head assembly (2).
2. Remove the fuel leak-off pipe (3) from the fuel supply pump (4).
  - Remove the eyebolt tightened together with the fuel feed pipe.
3. Disconnect the fuel leak-off pipe (3) from the common rail assembly (1).
4. Remove the fuel leak-off pipe (3) from the case.
  - Remove the clip.



SMIL13CEX1489AB 9

### Common rail assembly removal

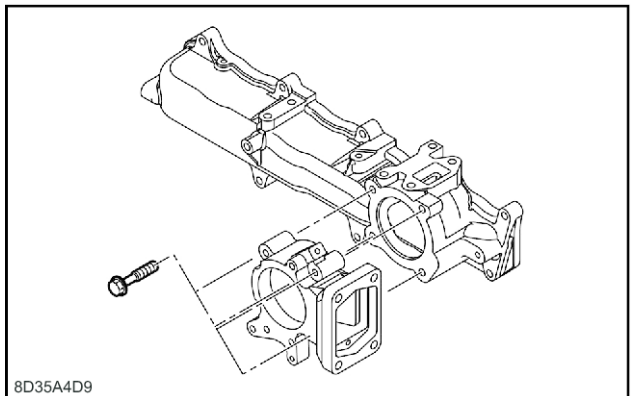
1. Disconnect the harness connector from the fuel pressure sensor (2).
2. Remove the common rail assembly (1) from the inlet cover and the common rail bracket (3).
3. Remove the common rail bracket (3) from the oil cooler assembly.



SMIL13CEX1490AB 10

### Inlet cover removal

1. Remove EGR pipe C from the case.
  - Remove the case from the inlet cover.



8D35A4D9 11



# Contents

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## Engine - 10

## Aftercooler - 310

### SERVICE

#### Aftercooler

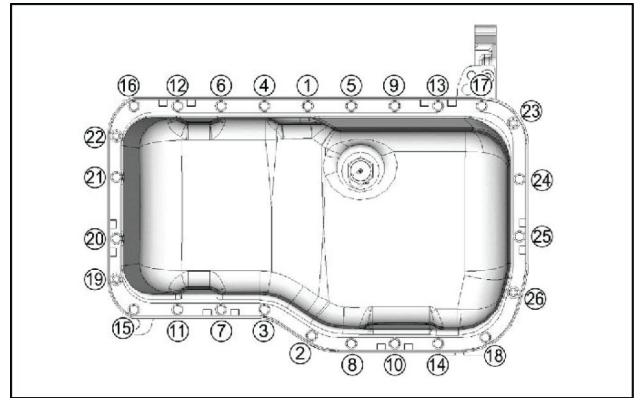
Prepare .....	3
Remove .....	4
Inspect .....	5
Install .....	6

3. Install the oil pan to the crankcase.

Tightening torque: **26 N·m (19 lb ft)**

- Tightening order

4. Connect the harness connector to the oil level switch.

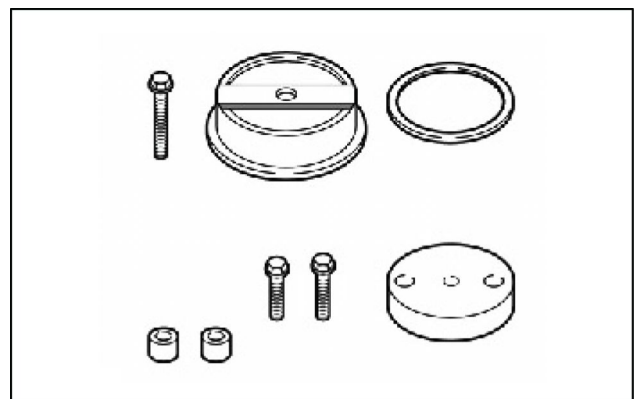


SMIL13CEX1655AA 7

### Crankshaft rear oil seal installation

1. Prepare the special tool.

- Install the crankshaft rear oil seal and slinger together.
- In order to install the crankshaft rear oil seal, use the one(s) in the following table from among the parts included in the kit.

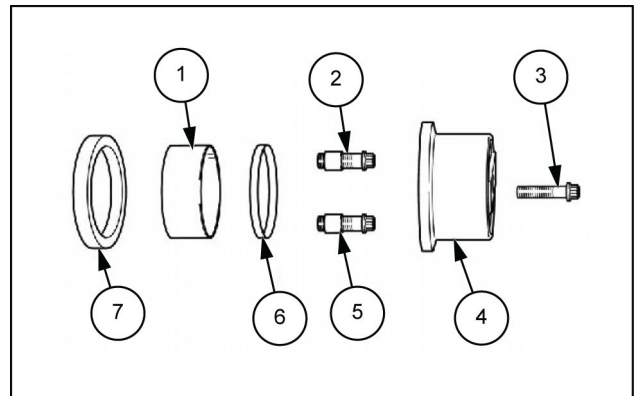


SMIL13CEX1656AA 8

Name	Part number
1. Adapter	5-8840-2709-0
2. Adapter tightening bolts	5-8840-2714-0
3. Center bolt	5-8840-2713-0
4. Sleeve	5-8840-9063-0
5. Collar	5-8840-2710-0
6. Adapter ring	5-8840-2711-0
7. Crankshaft rear oil seal	-

2. Apply the engine oil to the crankshaft rear oil seal.

**NOTICE:** Apply only to the lip section of the oil seal.



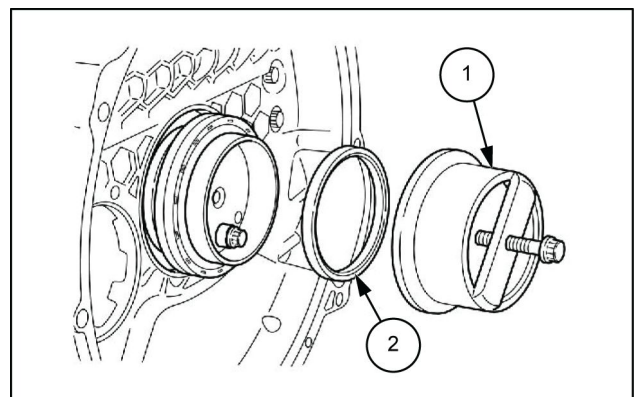
SMIL13CEX1657AB 9

3. Install the crankshaft rear oil seal to the adapter.

4. Install the adapter to the crankshaft.

5. Install the adapter ring (2) to the sleeve.

6. Install the sleeve (1) to the adapter.



SMIL13CEX1658AB 10

## Fuel leak off pipe assembly installation

1. Temporarily tighten the fuel leak-off pipe (3) to the cylinder head assembly (2).

**NOTICE:** Use new gaskets.

2. Temporarily tighten the fuel leak-off pipe (3) to the common rail assembly (1).

**NOTICE:** Use new gaskets.

3. Temporarily tighten the fuel leak-off pipe (3) to the fuel supply pump (4).
  - Tighten the fuel feed pipe together.

**NOTICE:** Use new gaskets.

4. Securely tighten the fuel leak-off pipe (3) to the cylinder head assembly (2).

Tightening torque: **27 N·m (19.91 lb ft)**

5. Securely tighten the fuel leak-off pipe (3) to the common rail assembly (1).

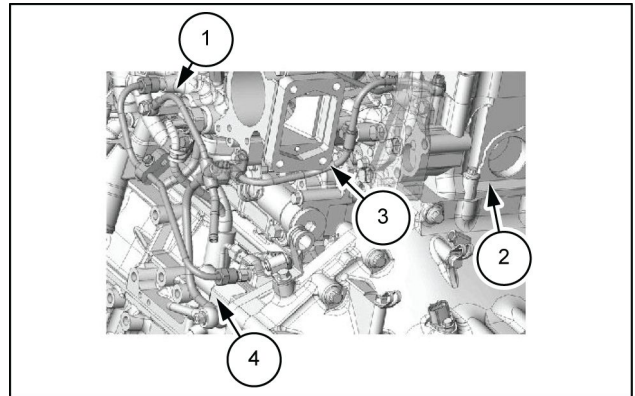
Tightening torque: **10 N·m (7 lb ft)**

6. Securely tighten the fuel leak-off pipe (3) to the fuel supply pump (4).

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

7. Install the clip to the fuel leak-off pipe (3).

Tightening torque: **8 N·m (5.90 lb ft)**



SMIL13CEX1695AB 13

## Fuel pipe installation

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

**NOTICE:** Use new fuel pipes.

Tightening torque: **44 N·m (32 lb ft)**

2. Install the clip to the bracket.

Tightening torque: **6 N·m (4.43 lb ft)**

## Injection pipe installation

1. Securely tighten the injection pipe to the injector.

Tightening torque: **30 N·m (22 lb ft)**

2. Securely tighten the injection pipe to the common rail assembly (5).

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

3. Install the clip to the bracket.

Tightening torque: **6 N·m (4.43 lb ft)**

1. Injection pipe 1

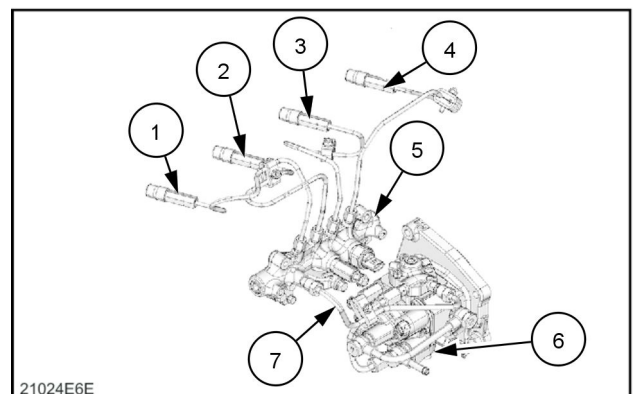
2. Injection pipe 2

3. Injection pipe 3

4. Injection pipe 4

6. Fuel supply pump

7. Fuel pipe



21024E6E

21024E6E 14

### SWING PRIORITY CIRCUIT

As an example, this section explains the right-swing and arm-in operations.

When the remote control valve (10) is operated to the right swing side, the pilot pressure oil is fed to the control valve (21) pa3 port via the shuttle valve (8), and switches the swing spool to the right swing side.

When the remote control valve (10) is operated to the arm-in side, the pilot pressure oil is fed to the control valve (21) pb5 and pb9 ports via the cushion valve (6) and switches the arm [1] [2] spools to the arm-in side.

At the same time, the pilot pressure oil from the shuttle valve (8) S port is fed to the control valve (21) Pc3 port to move the swing priority variable orifice (22) to the right side and hold it.

The discharge oil from the hydraulic pump (25) A1 enters the control valve (21) P1 port and is fed to the swing spool via the parallel oil path.

Switching the swing spool lets the pressure oil enter the swing motor (1) B port and the right swing operation is carried out. The discharge oil from the hydraulic pump (25) A2 enters the control valve (21) P2 port, is fed to the arm [2] spool via the parallel oil path, and merges upstream of the arm [1] spool.

Switching the arm [1] [2] spools lets the pressure oil enter the arm cylinder (15) bottom side, and the arm-in operation is carried out.

When the right swing and arm-in operations are carried out at the same time, the swing priority variable orifice (22) on the control valve (21) P1 port parallel oil path moves and is metered, so the pressure is boosted to secure the swing force for pressing digging.



- |                                       |  |
|---------------------------------------|--|
| 1. Swing motor                        | 15. Arm cylinder                       |
| 2. Arm (in)                           | 16. Arm [1]                            |
| 3. Arm (out)                          | 17. Swing                              |
| 4. Right swing                        | 18. Arm load holding valve spool       |
| 5. Left swing                         | 19. Arm load holding valve check valve |
| 6. Cushion valve                      | 20. Regeneration release valve         |
| 7. Swing pilot pressure sensor        | 21. Control valve                      |
| 8. Shuttle valve                      | 22. Swing priority variable orifice    |
| 9. Computer A                         | 23. Arm [2]                            |
| 10. Remote control valve (arm, swing) | 24. Upper pilot pressure sensor        |
| 11. Lever lock                        | 25. Hydraulic pump                     |
| 12. Swing brake                       | 26. Check valve                        |
| 13. 5 stack solenoid valve            | 27. Oil cooler                         |
| 14. Console lever lock switch         |  |

### BOOM 2 SPOOL STROKE CONTROL CIRCUIT

As an example, this section explains the boom-up + arm-in compound operation (leveling work).  
Increases the amount of oil fed to the arm by pushing back the boom [2] spool during digging operation.  
Improves operability and reduce the fuel consumption.

#### Boom-up + arm-in compound operation

When the remote control valve (12) is operated to the boom-up side, the pilot pressure oil is fed to Port pa4 (pa8) of the control valve (19) via the cushion valve (18) and switches the boom [1] [2] spools.

When the remote control valve (15) is operated to the arm-in side at the same time, the pilot pressure oil goes through the cushion valve (18) and branches off to Port pb5 and Port pb9 of the control valve (19).

The pressure oil that goes to Port pb5 switches the arm [1] spool and the pressure oil that goes to Port pb9 via the arm-in inverse proportional valve (8) switches the arm [2] spool.

The discharge oil from A1 of the hydraulic pump (24) flows into Port P1 of the control valve (19) and is fed to the boom [2] and arm [1] spools via the parallel oil path.

The pressure oil flows into the arm cylinder (11) bottom side through the arm [1] spool.

At this time, the pilot pressure oil from A3 of the gear pump on the hydraulic pump (24) is fed to pb4 of the control valve (19) through Port C of the boom-up inverse proportional valve (1) and pushes back the boom [2] spool.

This helps reduce the pressure losses between P1 of the control valve (19) and the arm cylinder (11) bottom, securing the flow to the arm side for the smooth arm-in operation.

The return oil on the arm cylinder (11) rod side returns to the hydraulic tank through the arm load holding valve check valve (25) and arm [1] spool.

The discharge oil from A2 of the hydraulic pump (24) flows into Port P2 of the control valve (19) and is fed to the boom [1] spool via the parallel oil path.

Switching the spool lets the oil flow into the boom cylinder (10) bottom side through the boom load holding valve check valve (26), and the boom-up operation is carried out.

The return oil on the boom cylinder (10) rod side returns to the hydraulic tank through the boom [1] spool.



- |   |   |
|---|---|
| 1. Boom-up inverse proportional valve   | 17. Arm (out)                           |
| 2. Travel pilot pressure sensor         | 18. Cushion valve                       |
| 3. Computer A                           | 19. Control valve                       |
| 4. Computer B                           | 20. Arm [1]                             |
| 5. Boom-up pressure sensor              | 21. Boom [2]                            |
| 6. Arm-in pressure sensor               | 22. Arm [2]                             |
| 7. Bucket-close pressure sensor         | 23. Boom [1]                            |
| 8. Arm-in inverse proportional valve    | 24. Hydraulic pump                      |
| 9. 3-stack proportional valve           | 25. Arm load holding valve check valve  |
| 10. Boom cylinder                       | 26. Boom load holding valve check valve |
| 11. Arm cylinder                        | 27. Lever lock solenoid                 |
| 12. Remote control valve (boom, bucket) | 28. 5-stack solenoid valve              |
| 13. Boom (down)                         | 29. Console lever lock switch           |
| 14. Boom (up)                           | 30. Monitor display                     |
| 15. Remote control valve (arm, swing)   | 31. Oil cooler                          |
| 16. Arm (in)                            | 32. Check valve                         |

## Hydraulic systems - Hydraulic schema - Horsepower boost circuits


CX220C Crawler excavator LC version (Tier 3) - Commonwealth of Independent States (CIS)	APAC
CX220C Crawler excavator NLC version (Tier 3) - Commonwealth of Independent States (CIS)	APAC

### ARM-IN HORSEPOWER BOOST CIRCUIT

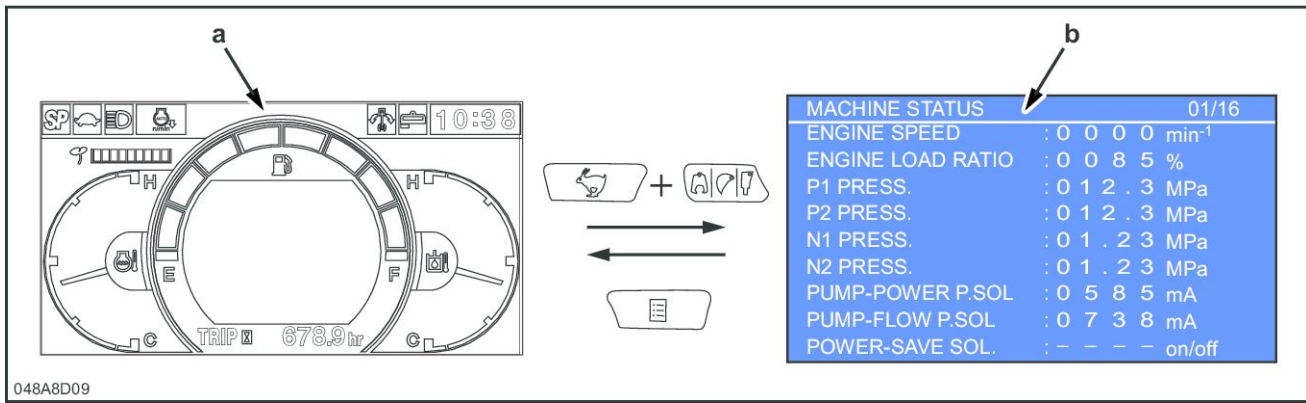
During an arm-in operation, the computer A (17) receives an electrical signal input from the arm pressure sensor (9), P1 pressure sensor (18), and P2 pressure sensor (19) and outputs a horsepower boost signal to the horsepower control proportional valve (24).

The horsepower control proportional valve (24) is switched by this horsepower boost signal and the discharge oil from the hydraulic pump (21) A1 and A2 is increased.

**NOTE:** The hydraulic pump shown is for the standard model.

	Pressure line		Pilot tank line
	Tank line		Electric line
	Pilot pressure line		Negative control line

- |                                      |   |
|--------------------------------------|---|
| 1. Arm (in)                          | 14. Upper pilot pressure sensor           |
| 2. Arm (out)                         | 15. Console lever lock switch             |
| 3. Cushion valve                     | 16. Monitor display                       |
| 4. Remote control valve (arm, swing) | 17. Computer A                            |
| 5. Lever lock                        | 18. P1 pressure sensor                    |
| 6. Pressure boost relief             | 19. P2 pressure sensor                    |
| 7. 5 stack solenoid valve            | 20. N2 negative control pressure sensor   |
| 8. Arm cylinder                      | 21. Hydraulic pump                        |
| 9. Arm pressure sensor               | 22. Check valve                           |
| 10. Control valve                    | 23. Oil cooler                            |
| 11. Arm [1]                          | 24. Horsepower control proportional valve |
| 12. Arm [2]                          | 25. Computer B                            |
| 13. Travel pilot pressure sensor     |   |



a. Normal screen

b. Service support screen

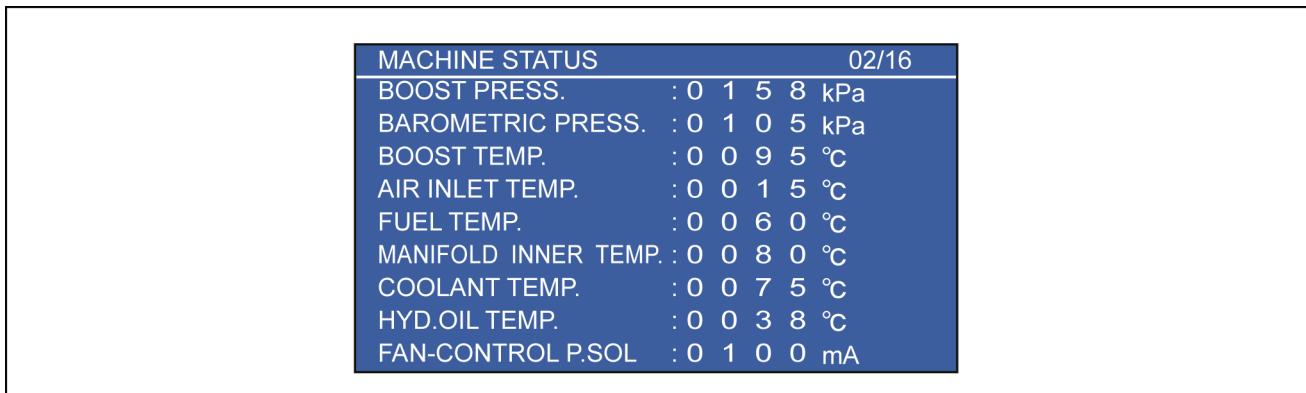
## PROCEDURES FOR MEASURING HYDRAULIC OIL TEMPERATURE FROM THE MONITOR DISPLAY

### Hydraulic oil temperature measurement method

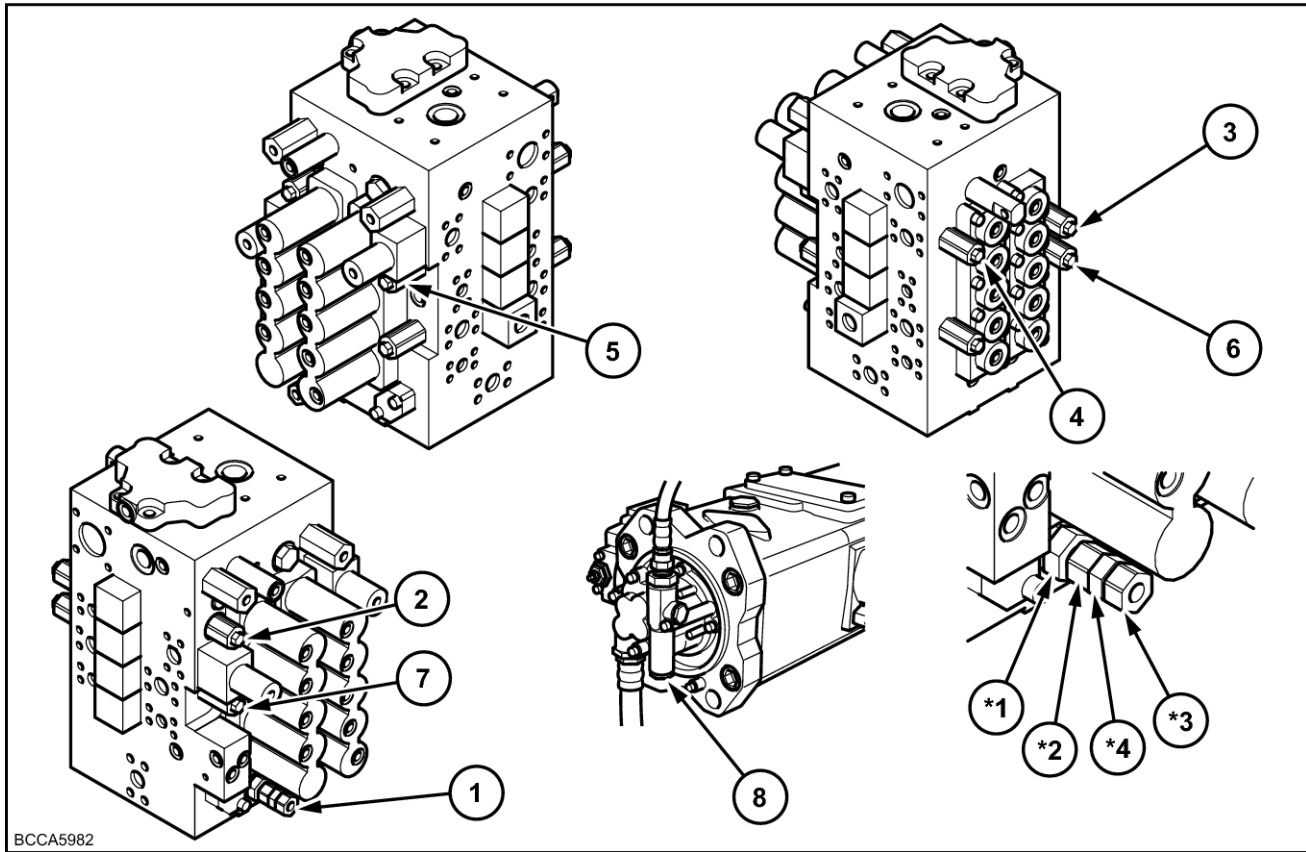
The hydraulic oil temperature can be measured from the monitor display.

### Operating method

1. If both the travel speed select switch and the attachment select switch on the switch panel are held down at the same time, the display switches to the service support screen.
2. Select "CHECK" on the service support screen.
3. Select "MACHINE STATUS" on the service support screen.
4. The hydraulic oil temperature is displayed in the "HYD.OIL TEMP" column.



SMIL15CEX3557EA 3



BCCA5982

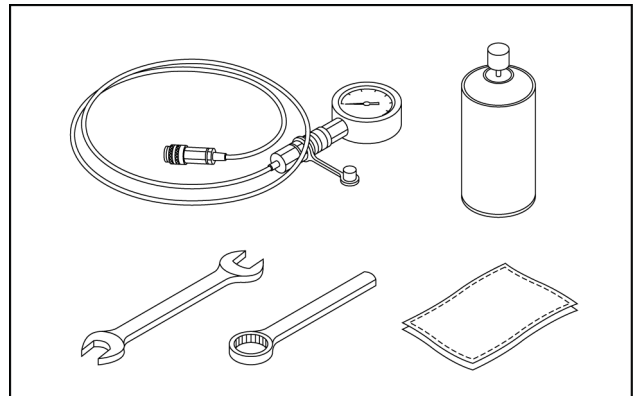
BCCA5982 6

- \*1. Pressure boost lock nut
- \*2. Pressure boost adjusting screw
- \*3. Standard pressure adjusting screw
- \*4. Standard lock nut

## PRESSURE MEASUREMENT PREPARATIONS

### 1. Items to prepare

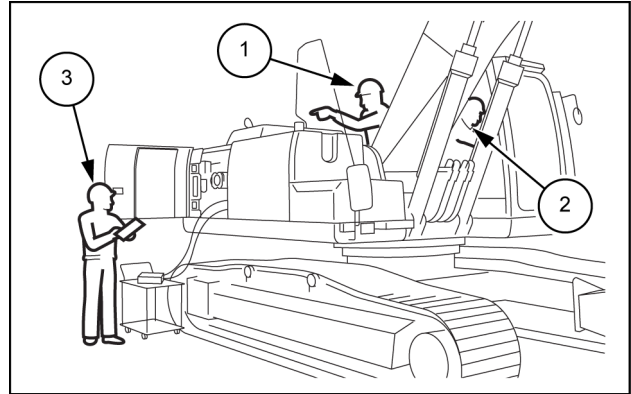
1. Pressure For **10 MPa (1450 psi)** (for pilot and negative control pressure measurement)  
For **60 MPa (8703 psi)** (for main pressure measurement)
2. Tools Wrench (closed wrench) **17 mm**  
Hexagon wrench **6 mm**
3. Others Rag  
Cleaning fluid



SMIL15CEX3560AA 7

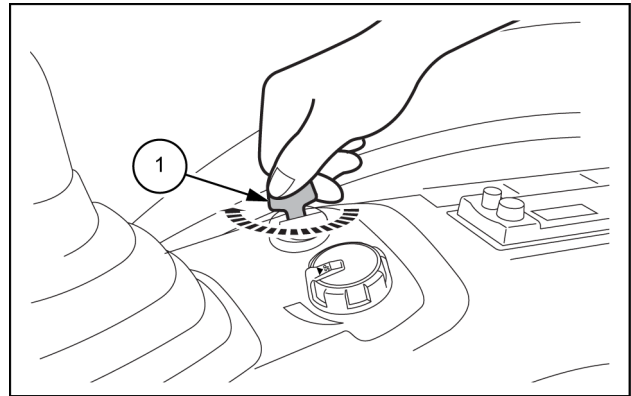
## Flow Measurement

1. Perform a flow measurement. When performing a flow measurement, position workers as shown in the figure. (Worker 1 **(1)** : Work instructor, in charge of pressure adjustment)  
(Worker 2 **(2)**: Operator)  
(Worker 3 **(3)**: In charge of measurement and recording of flow and pressure)



SMIL14CEX2119AB 11

2. The operator starts the engine following the work instructor's signal.
3. Check the hydraulic fluid temperature ( **50 °C (122 °F)**) on the monitor.  
Check whether the engine speed and the pump current are normal values.
4. The operator instructs the worker 1 to perform relief operation with the arm out.



SMIL14CEX2120AB 12

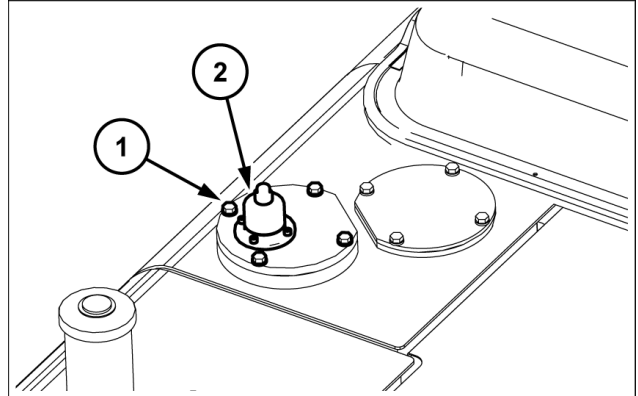
1. Ignition key
5. The worker 2 reduces the arm-out port relief. (Min: **24 MPa (3481 psi)** P1 + P2)
6. Start a flow measurement.
7. Perform relief operation with the arm out.
8. Measure data in increments of **2 MPa (290 psi)** ( P1 + P2).  
\* Perform the measurement up to **24 – 76 MPa (3481 – 11024 psi)**, and finish it when the highest pressure is reached.
9. Remove the flow meter.  
\* This is because the maximum pressure gauge of the flow meter exceeds the tolerance from **40 MPa (5802 psi)**.
10. Set the arm-in port relief valve to normal pressure again. (Refer to “ **Hydraulic systems - Pressure setting (35.000)**”)

## Oil reservoir - Remove

CX220C Crawler excavator NLC version (Tier 3) - Commonwealth of Independent States (CIS)

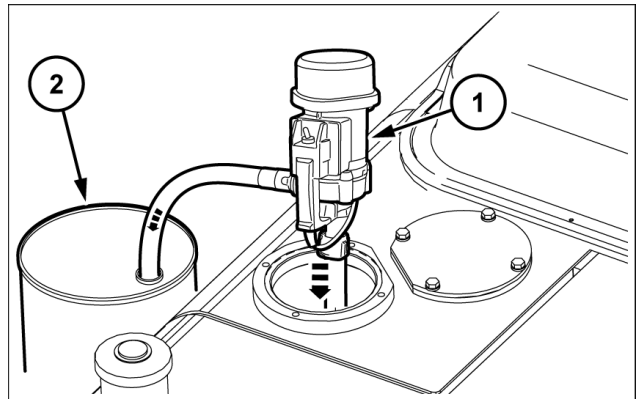
APAC

1. Use a wrench [ **17 mm** ] to remove the 4 bolts (1), and then remove the feed port cover (2).



SMIL18CEX4773AB 1

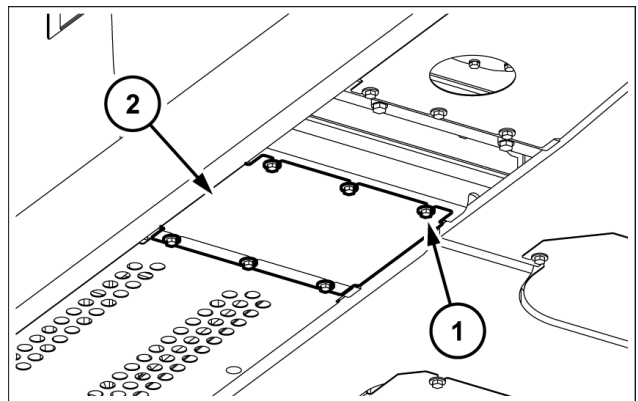
2. Insert the feed pump (1) into the feed port, and then operate the pump to transfer the oil inside the hydraulic tank to the waste oil tank (2).



SMIL18CEX4774AB 2

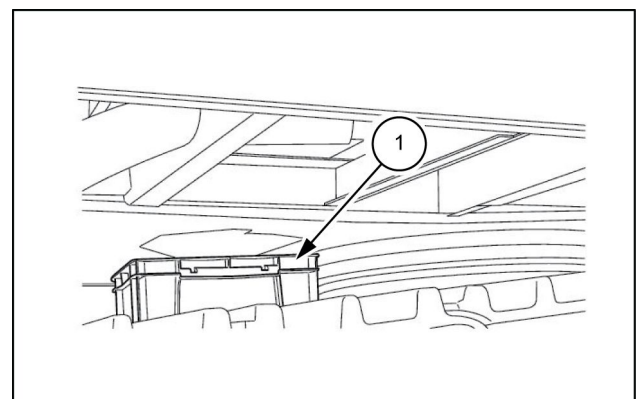
3. Use a wrench [ **19 mm** ] to remove the 6 bolts (1), and then remove the under cover (2).

Tightening torque for bolt installation: **63.7 – 73.5 N·m (46.98 – 54.21 lb ft)**



SMIL18CEX4775AB 3

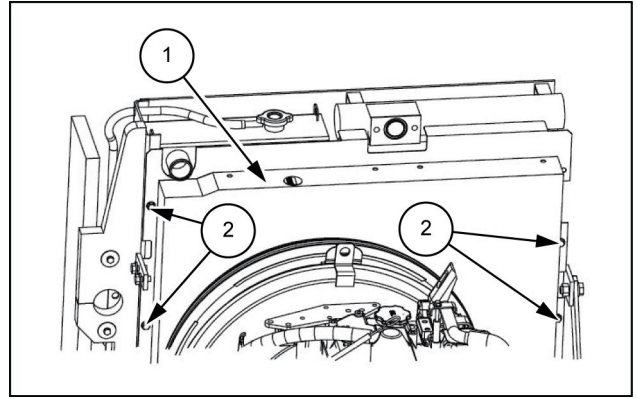
4. Prepare a waste oil can (1) under the hydraulic oil tank.



LPIL12CX04162AB 4

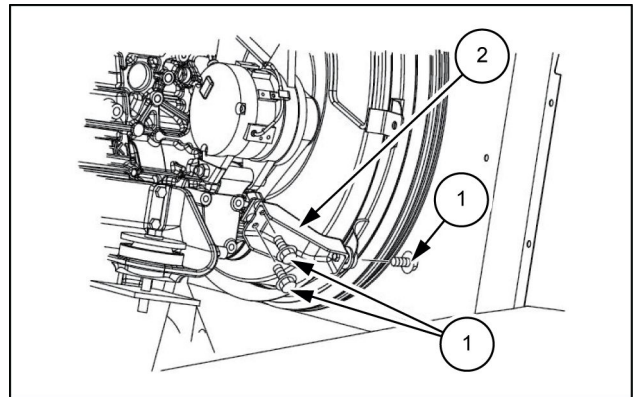
4. Use a box wrench [ **12 mm** ] to install the fan shroud ( **1** ) with the 8 bolts ( **2** ).

Bolt ( **2** ) tightening torque: **25.0 N·m (18.439 lb ft)**



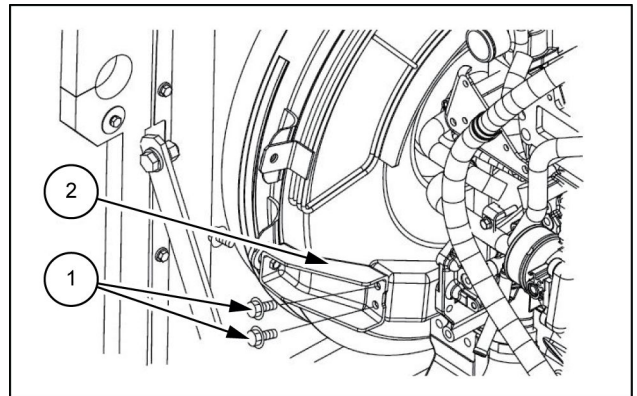
SMIL13CEX1272AB 4

5. Use a wrench [ **14 mm** ] to install the bracket ( **2** ) with the 3 bolts ( **1** ).



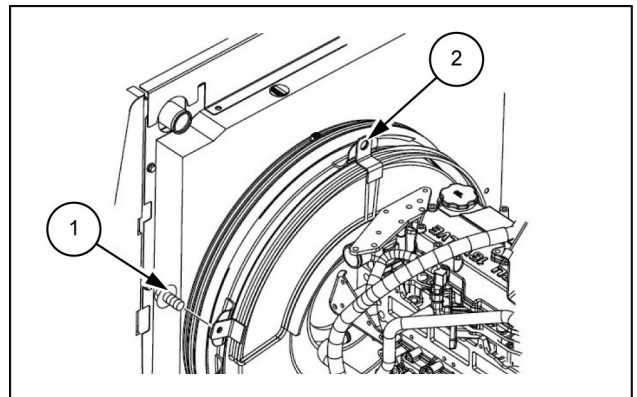
SMIL13CEX1271AB 5

6. Use a wrench [ **14 mm** ] to install the bracket ( **2** ) with the 3 bolts ( **1** ).



SMIL13CEX1270AB 6

7. Use a wrench [ **14 mm** ] to install the fan guard ( **2** ) with the 2 bolts ( **1** ).



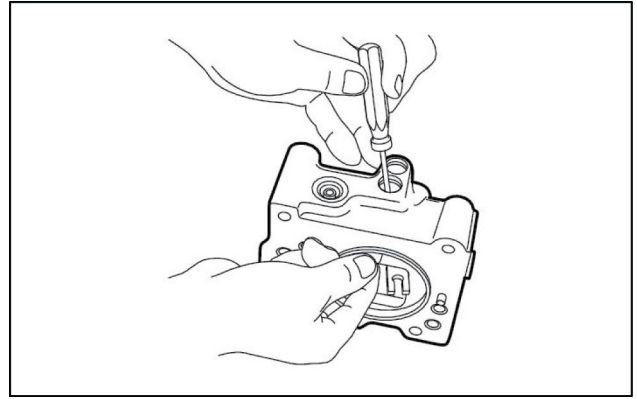
SMIL13CEX1269AB 7

Hydraulic systems - Variable displacement pump

Port	Port name	Port size
A1, A2	Discharge port	*SAE6000psi 3/4
B1	Suction port	*SAE2500psi 2-1/2
Dr	Drain port	G 3/4-20
P1	Proportional valve primary pressure port	G 1/4-13
P2	P2 port	G 1/4-13
Psv	Servo assist port	G 1/4-15
Pi1, Pi2	Negative control port	G 1/4-13
a1, a2, a4	Gauge port	G 1/4-15
a5 a6	Gauge port	G 3/8-17
a7 a8	Gear pump gauge port	G 1/4-15
A3	Gear pump discharge port	G 1/2-19
B3	Gear pump suction port	G 3/4-20.5

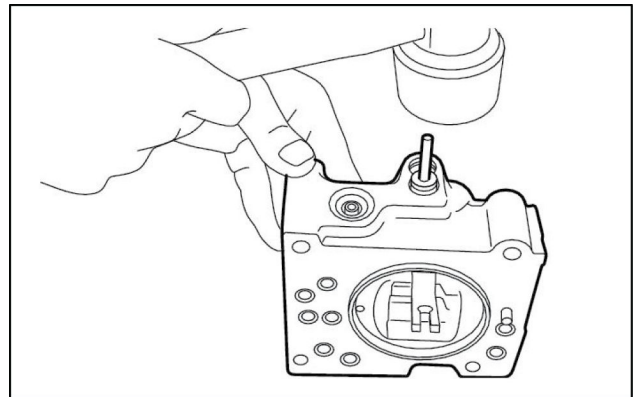
The port size with \* indicates the flange size.

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



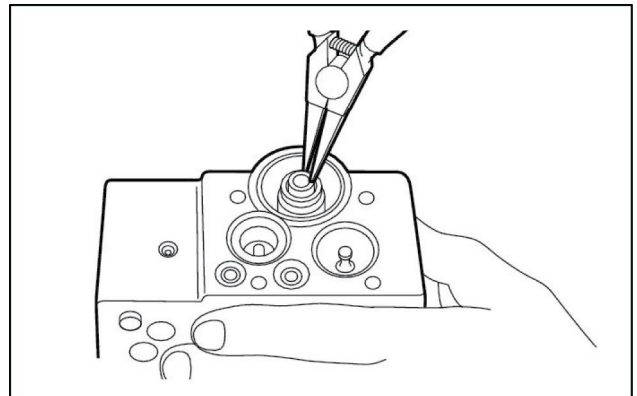
SMIL13CEX0969AA 3

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



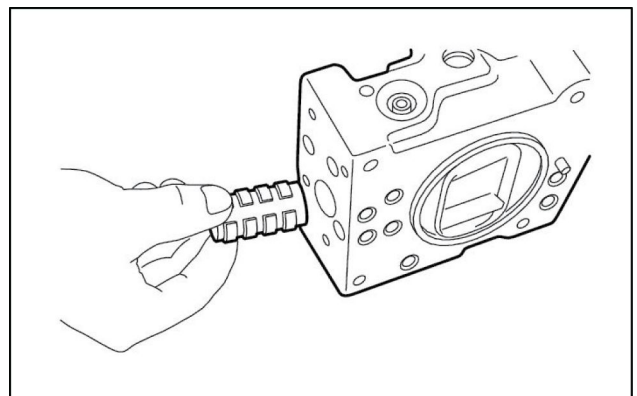
SMIL13CEX0970AA 4

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



SMIL13CEX0971AA 5

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



SMIL13CEX0972AA 6

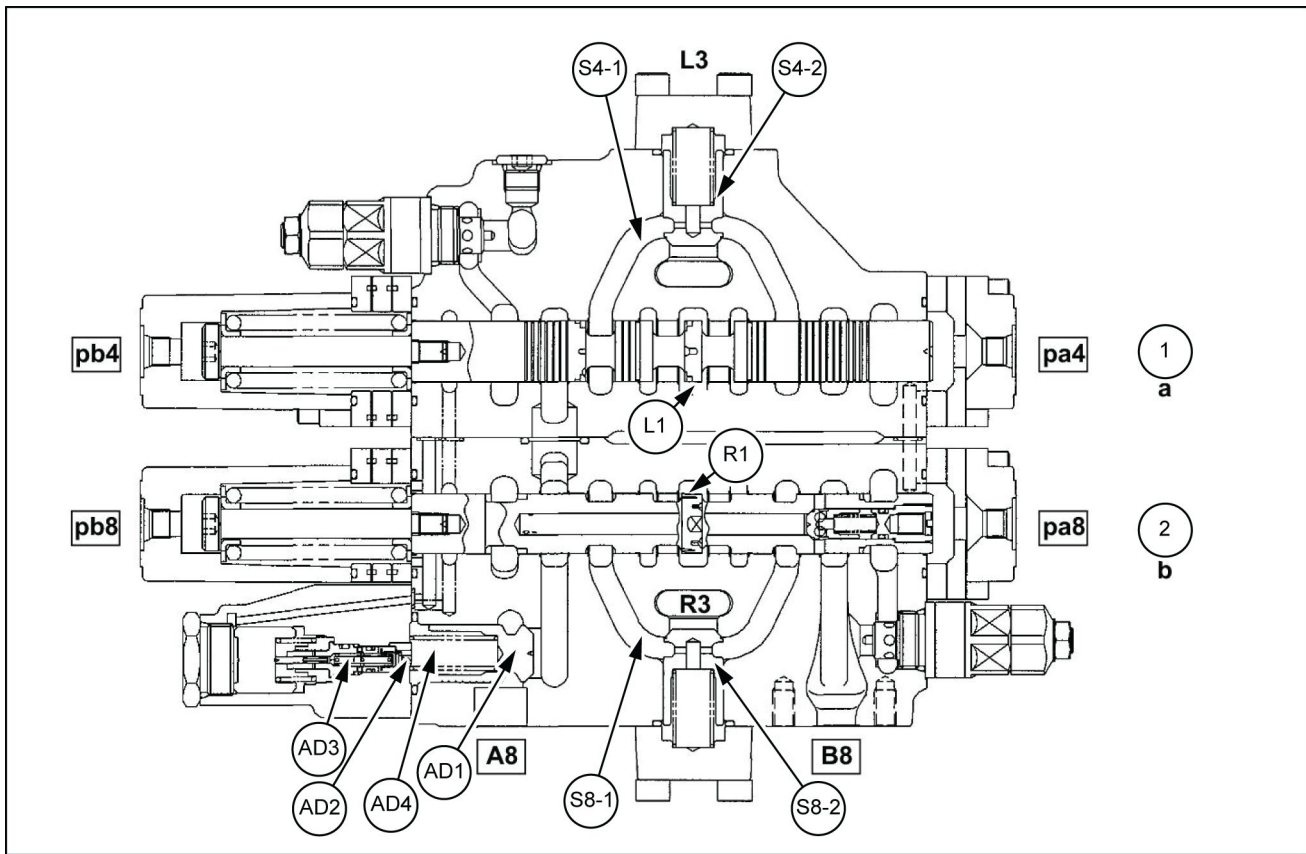
Hydraulic systems - Pump control valves

Code	Part name	Component: Part Number or type
050.	Shuttle valve subassembly (Quantity 1 set)	545 (Quantity 1), 546 (Quantity 1), 547 (Quantity 1)

- Regulator subassembly (Quantity 1)	651. Sleeve (Quantity 1)
412. Hexagon socket head bolt (Quantity 2)	652. Spool (Quantity 1)
413. Hexagon socket head bolt (Quantity 2)	653. Spring seating (Quantity 1)
436. Hexagon socket head bolt (Quantity 4)	654. Return spring (Quantity 1)
438. Hexagon socket head bolt (Quantity 8)	655. Set spring (Quantity 1)
466. VP plug (Quantity 1)	656. Blind cover (Quantity 1)
467. VP plug (Quantity 1)	708. O-ring (Quantity 1)
496. Insert plug (Quantity 6)	722. O-ring (Quantity 3)
545. Steel ball (Quantity 1)	724. O-ring (Quantity 9)
546. Seat 1 (Quantity 1)	725. O-ring (Quantity 1)
547. Seat 2 (Quantity 1)	727. O-ring (Quantity 1)
601. Casing (Quantity 1)	728. O-ring (Quantity 1)
611. Feedback lever (Quantity 1)	730. O-ring (Quantity 1)
612. Lever (1) (Quantity 1)	732. O-ring (Quantity 1)
613. Lever (2) (Quantity 1)	733. O-ring (Quantity 1)
614. Fulcrum plug (Quantity 1)	734. O-ring (Quantity 1)
615. Adjusting plug (Quantity 1)	735. O-ring (Quantity 1)
621. Compensation piston (Quantity 1)	753. O-ring (Quantity 1)
622. Piston case (Quantity 1)	755. O-ring (Quantity 3)
623. Compensation rod (Quantity 1)	756. O-ring (Quantity 1)
624. Spring seating (C) (Quantity 1)	763. O-ring (Quantity 1)
625. Outer spring (Quantity 1)	801. Hexagon nut (Quantity 1)
626. Inner spring (Quantity 1)	802. Hexagon nut (Quantity 1)
627. Adjusting ring (C) (Quantity 1)	814. Stop ring (Quantity 1)
628. Adjusting screw (C) (Quantity 1)	836. Retaining ring (Quantity 1)
629. Cover (C) (Quantity 1)	858. Locking ring (Quantity 2)
630. Lock nut (Quantity 1)	874. Pin (Quantity 1)
631. Pf sleeve (Quantity 1)	875. Pin (Quantity 2)
641. Pilot cover (Quantity 1)	876. Pin (Quantity 2)
643. Pilot piston (Quantity 1)	887. Pin (Quantity 1)
644. Spring seating (Q) (Quantity 1)	897. Pin (Quantity 1)
645. Adjusting ring (Q) (Quantity 1)	898. Pin (Quantity 1)
646. Pilot spring (Quantity 1)	924. Hexagon socket head locking screw (Quantity 1)

**Tightening torque**

Part	Screw size	Tightening torque
412. 413.	<b>M8</b>	<b>29 N·m (21.39 lb ft)</b>
436. 438.	<b>M6</b>	<b>12 N·m (8.85 lb ft)</b>
466.	<b>G1/4</b>	<b>36 N·m (26.55 lb ft)</b>
467.	<b>G3/8</b>	<b>74 N·m (54.58 lb ft)</b>
496.	<b>NPTF1/16</b>	<b>8.8 N·m (6.49 lb ft)</b>
630.	<b>M30 x 1.5</b>	<b>160 N·m (118.01 lb ft)</b>
801.	<b>M8</b>	<b>16 N·m (11.8 lb ft)</b>
802.	<b>M10</b>	<b>19 N·m (14.01 lb ft)</b>



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**Neutral**

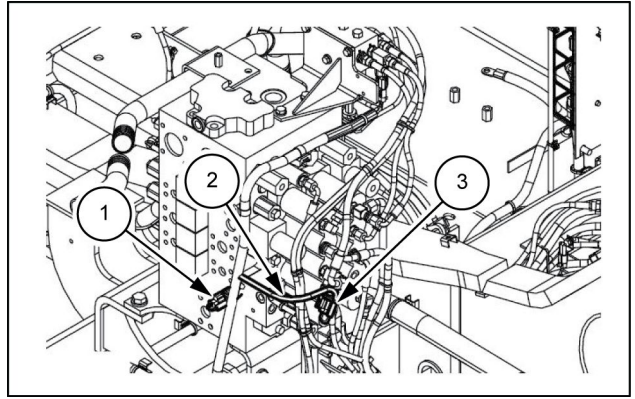
1. Boom 2 (a: Section 4)
2. Boom 1 (b: Section 8)

**B. Boom up (2 pumps flow) [Fig. 14]**

When the boom 1 spool is switched by pressurizing from the boom 1 (section 8) pilot port Pa8, the neutral path (R1) is closed. The oil fed from Port P2 flows into Port A8 through the parallel path (R3), the load check valve (S8-2), and spool neck section.

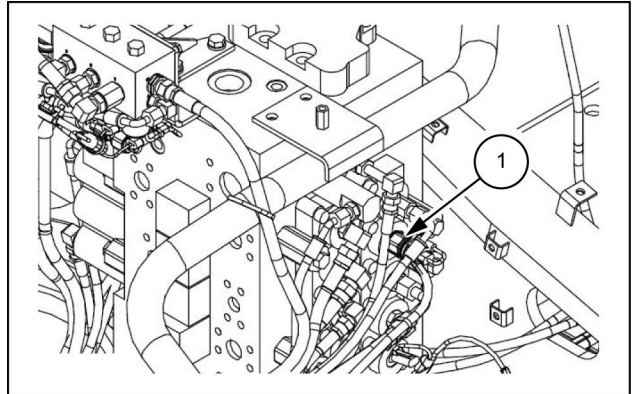
When the boom 2 spool is switched by pressurizing from the boom 2 (section 4) pilot port Pa4, the neutral path (L1) is closed. The oil fed from port P1 flows through the parallel path (L3), load check valve (S4-2), spool neck section, and path (4), and merges into port A8. The return oil returns to the tank path (Ta) through port B8 and spool neck section.

5. Remove the connectors **(1)**, **(2)** and **(3)** from the pressure sensor.



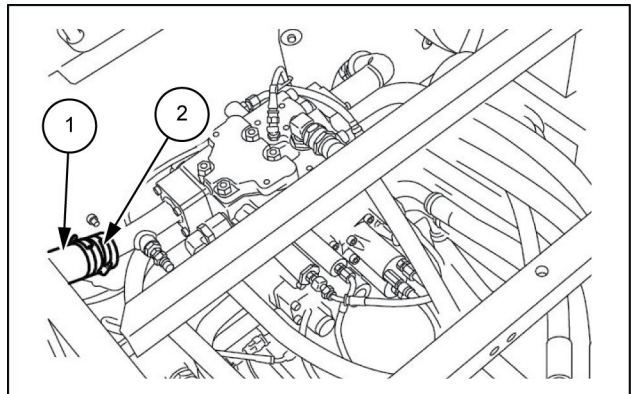
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6. Remove the connectors **(1)** from the pressure sensor.



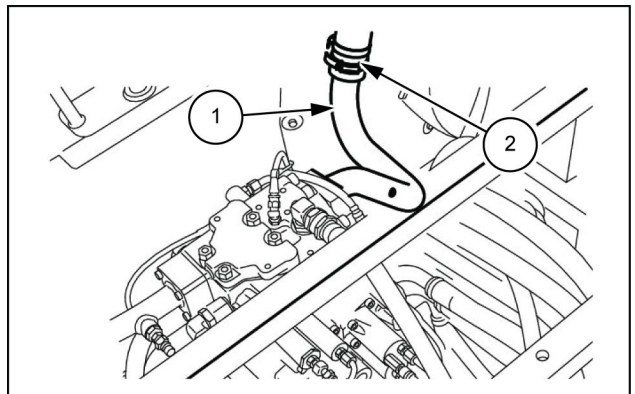
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7. Use a wrench [ **7 mm** ] to remove the hose band **(2)**, and then remove the low-pressure hose **(1)**.



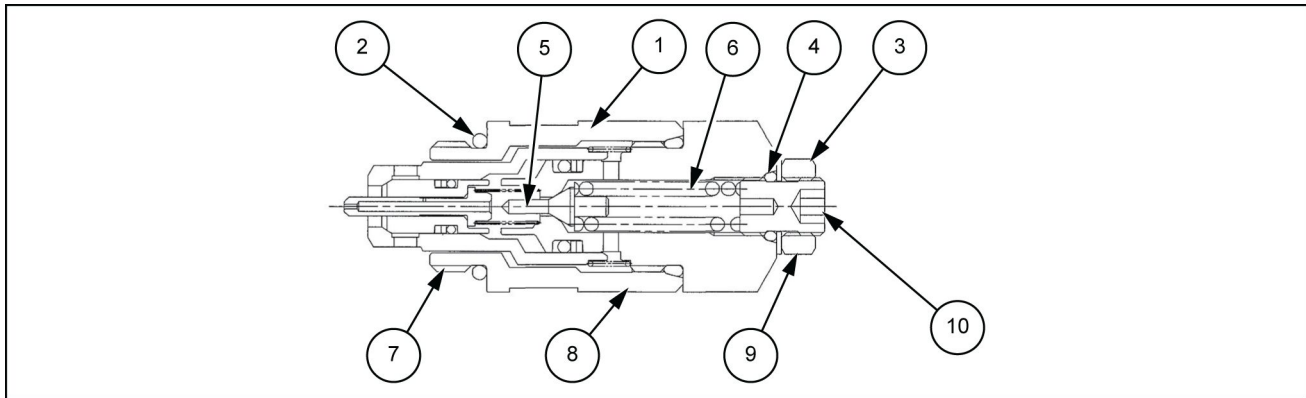
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8. Use a wrench [ **7 mm** ] to remove the hose band **(2)**, then remove the low-pressure hose **(1)**.



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## Overload relief valve



SMIL14CEX3650EB 2

- |                         |   |
|-------------------------|---|
| 1. Cap                  | 6. Spring   |
| 2. O-ring               | 7. 1-1/16-12UN-2A                                       |
| 3. Adjuster kit section | 8. Cap (hexagon diameter <b>31.75 mm (1.250 in)</b> )   |
| 4. O-ring               | 9. Lock nut (hexagon diameter <b>17 mm (0.669 in)</b> ) |
| 5. Poppet               | 10. Adjuster (hexagon diameter <b>6 mm (0.236 in)</b> ) |

This part is replaced as an assembly.

When replacing, loosen the cap **(1)** [ **31.75 mm (1.250 in)** hexagon socket diameter] with a wrench and remove the O-ring **(2)**.

Also, if oil leaks from the adjuster kit section, loosen the adjuster kit and replace the O-ring **(4)**.

**NOTICE:** Be careful disassembling the adjuster kit.  
The spring may make parts fly out and the poppet could be lost.

# Index

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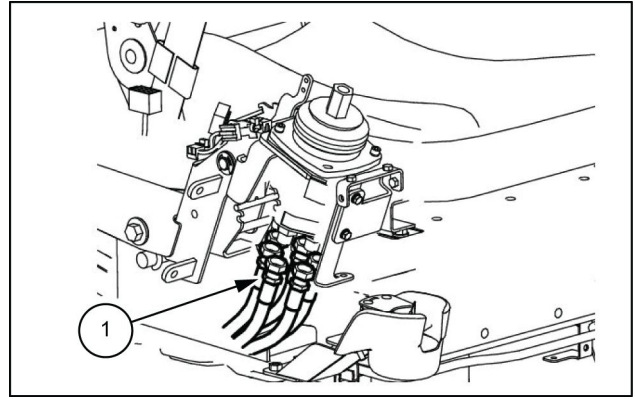
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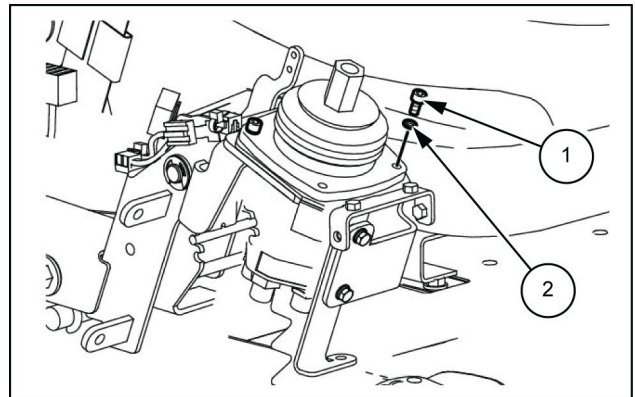
9. Use a wrench [ **22 mm** ] to remove the 6 hoses (1).

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



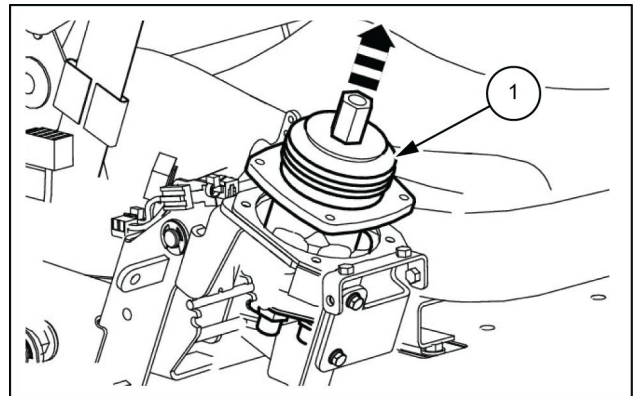
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10. Use the hexagon wrench [ **5 mm** ] to remove the 3 bolts (1) and 3 washers (2).



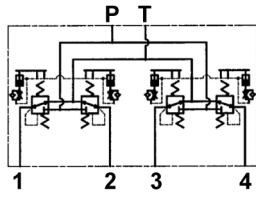
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11. Remove the joystick remote control valve (1).

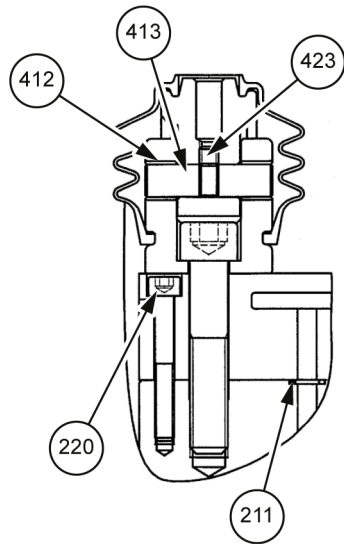
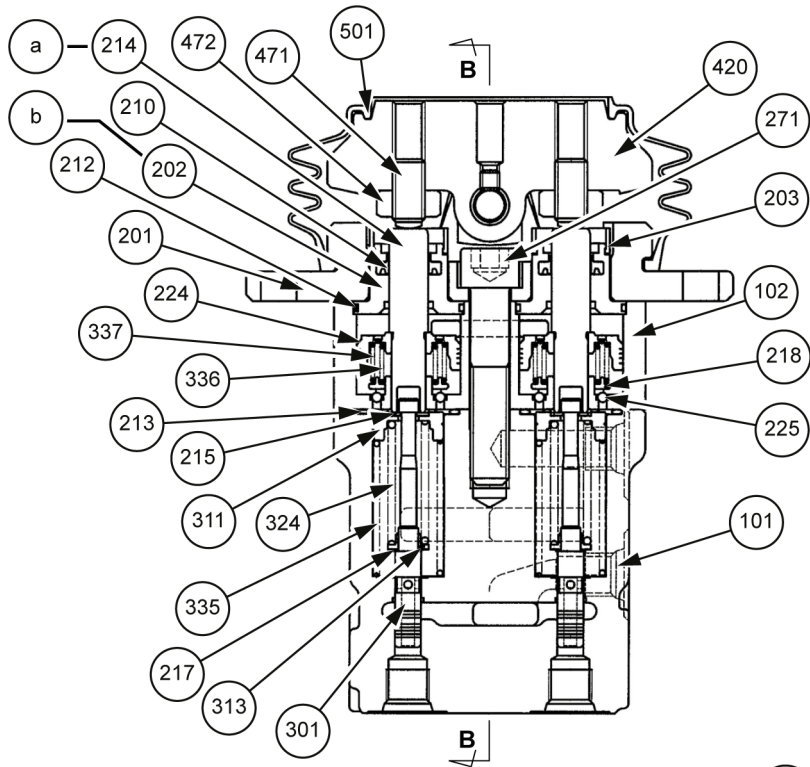


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## Pedal control - Sectional view



1



2

## Pedal control - Service instruction

### Causes of trouble and countermeasures

It is not easy to discover trouble locations.

A few problems that may occur are listed in the table “**Pedal control - Troubleshooting (35.356)**”.

Repairs are difficult, so refer to the suggested causes and solutions in the table “**Pedal control - Troubleshooting (35.356)**”.

The table “**Pedal control - Troubleshooting (35.356)**” shows general symptoms, suggested causes, and also actions.

However, the cause of machine problems are often not rooted in just a single part. Problems are often due to the relationship of one part with another.

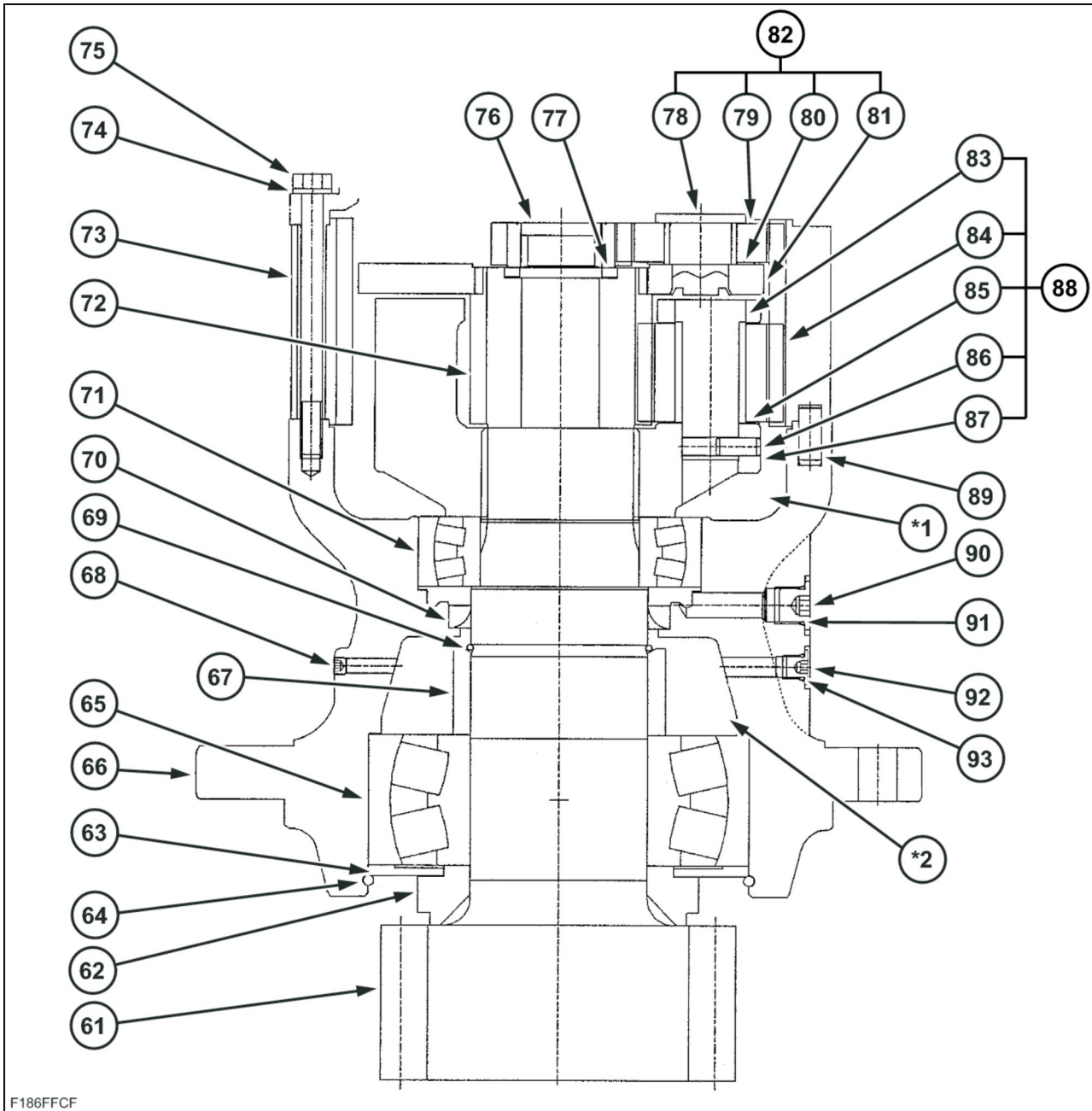
Also keep in mind that actions other than those listed in the table “**Pedal control - Troubleshooting (35.356)**” may sometimes be necessary.

The numbers in parentheses after the part names are the codes indicated in “**Pedal control - Sectional view (35.356)**”.

Also, the table below does not include all possible causes and countermeasures.

Further investigation of problems and causes should be done by an experienced and qualified repair person, as necessary.

## Swing reduction gear - Sectional view

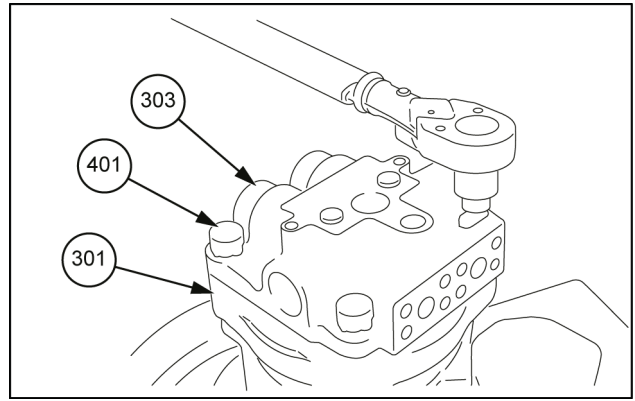


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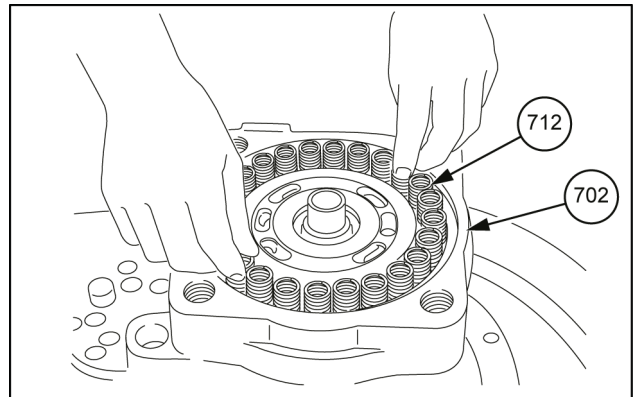
7. Remove valve plate B (131) from valve casing H0 (303).

- Do this carefully so as not to let valve plate B (131) fall from valve casing H0 (303). (Valve plate B (131) may be attached to the cylinder side.)
- When prying open the matching surface with a screwdriver, be careful not to scratch the surface.



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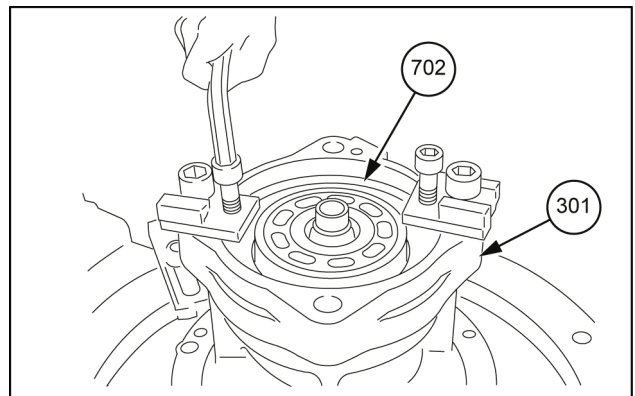
8. Take out the brake springs (712) from the brake piston (702).



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9. Use a jig and remove the brake piston (702) from casing JA1 (301).

- Apply the tips of the jig to the grooves of the brake piston, and pull straight up.

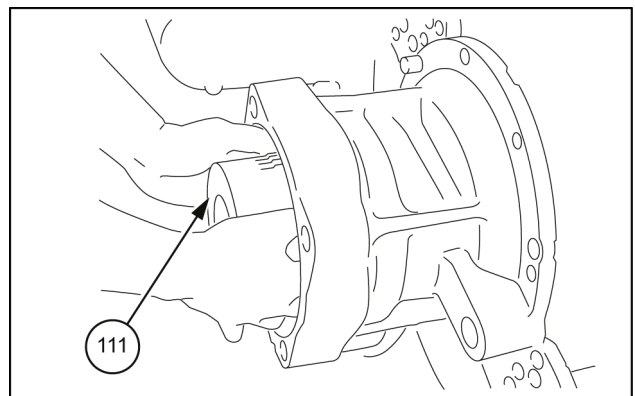


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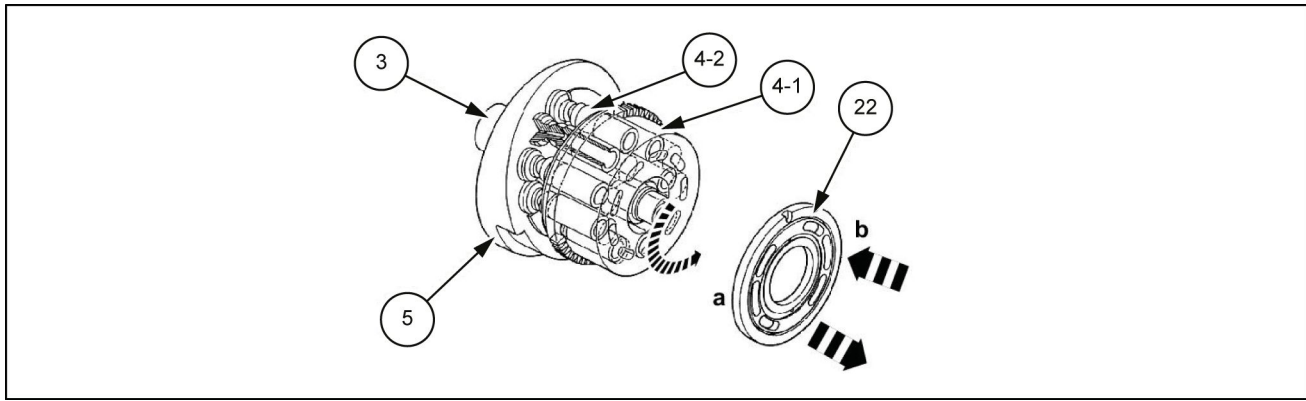
10. Reposition the motor on its side, and remove the cylinder (111) from the drive shaft.

Next, remove the pistons (121), holder plate (123), plate spring (114), and shoe plate (124).

- Be careful not to scratch the sliding surfaces of the cylinder (111), shoe (122), etc.



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**Piston motor structural diagram**

a. C port

b. B port

## Reduction gear

Fig. 16 shows a structural diagram of the reduction gear.

The reduction gear structure combines in two stages the simple planetary reduction gear system made up of the drive gear, sun gear, holder, planetary gear, and ring gear (with teeth cut in the inner diameter of the housing).

When pressure oil flows into the piston motor, the piston motor shaft rotates at high speed and power is input to the reduction gear section. In the reduction gear section, this high-speed rotation has its speed reduced in 2-stages by the simple planetary 2-stage reduction system. Low-speed, high-torque output is obtained from the rotation of the housing with ring gears (1-3), (2-3).

### 1. 1<sup>st</sup> stage reduction section operation

The 1<sup>st</sup> stage reduction section comprises the drive gear (1-1), planetary gear A (1-2), ring gear (1-3), holder (1-4), needle bearing (1-5), and inner race (1-6).

The planetary gear A (1-2) meshes with the drive gear (1-1). When the drive gear (1-1) rotates clockwise, the planetary gear A (1-2) rotates counter-clockwise. On the other hand, since it meshes with the ring gear, it kicks the tooth of the ring gear and tries to revolve clockwise around the circumference of the drive gear (1-1).

Because the planetary gear (1-2) is fixed in a state in which it rotates freely on the holder (1-4) via the needle bearing (1-5), this clockwise revolution movement is transmitted to the holder (1-4) and the holder (1-4) starts to rotate in the clockwise direction.

Also, since the holder (1-4) is spline coupled with the 2<sup>nd</sup> stage sun gear (2-1), this holder (1-4) rotation is transmitted to the 2<sup>nd</sup> stage sun gear (2-1).

### 2. 2<sup>nd</sup> stage reduction section operation

The 2<sup>nd</sup> stage reduction section comprises the sun gear (2-1), planetary gear B (2-2), ring gear (2-3), holder (2-4), needle bearing (2-5), and inner race (2-5).

The planetary gear B (2-2) meshes with the sun gear (2-1). When the sun gear (2-1) rotates clockwise, the planetary gear B (2-2) rotates counter-clockwise.

The planetary gear B (2-2) is fixed in a state in which it rotates freely on the holder (2-4) via the needle bearing (2-5). Furthermore, the holder (2-4) is coupled to the flange (5) by the bolts (3), (4) and the flange (5) is fastened to the frame of the machine main unit, so it cannot rotate.

Therefore, the planetary gear B (2-2) cannot revolve as in the 1<sup>st</sup> stage reduction section and rotates counter-clockwise at the position at which it was incorporated. Also, because the planetary gear B (2-2) is meshed with the ring gear, the counter-clockwise revolution of the planetary gear B (2-2) is transmitted to the ring gear and the ring gear is rotated counter-clockwise.

Through the above action, the housings (1-3) and (2-3) with the ring gear cut into their inner diameters receive the force of the planetary gears (2-2), (1-2) and rotate. This transmits power to the driven section of the machine main unit which is coupled with the housings (1-3) and (2-3).

## Travel motor - Inspect

### Motor parts maintenance standards

The table indicates maintenance standards for motor parts.

Check each part according to the motor parts maintenance standards in the table.

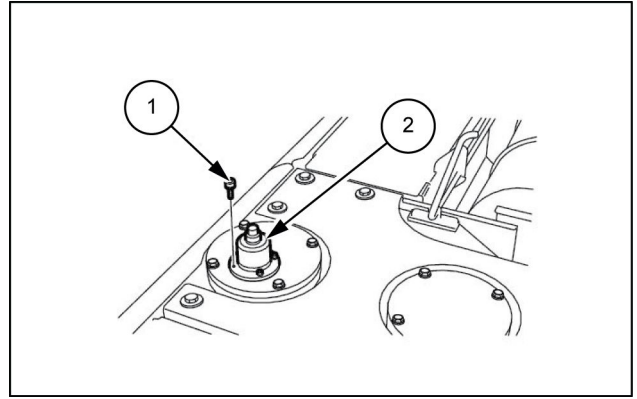
When a permissible limit has been exceeded or is near being exceeded, perform part repair or replacement according to repair and solution procedures.

Applicable part	Inspection and measurement location	Permissible limit value	Repair, solution procedure
Piston assembly (1-4-2)	Shoe sliding surface	0.8 a degree of roughness or the surface is rough or there is scratching at least <b>0.02 mm (0.00079 in)</b> deep	Lap the shoe sliding surface (No. 1000) If the scratching cannot be removed, replace the cylinder block assembly (1-4)
	Piston outer diameter	1.2 a degree of roughness or the surface is rough or there is scratching at least <b>0.02 mm (0.00079 in)</b> deep	Replace the cylinder block assembly (1-4)
	Piston outer diameters and cylinder block (4-1) bore inner diameters	Gap <b>0.060 mm (0.002362 in)</b>	
	Shoe ball backlash	<b>0.4 mm (0.0157 in)</b> of backlash	
Cylinder block (1-4-1)	Sliding surface against the valve plate	0.8 a degree of roughness or the surface is rough or there is scratching at least <b>0.02 mm (0.00079 in)</b> deep	Lap the sliding surface (No. 1000) If the scratching cannot be removed, replace the cylinder block assembly (1-4)
	Bore inner diameter	1.6 a degree of roughness or the surface is rough or there is scratching at least <b>0.02 mm (0.00079 in)</b> deep	Replace the cylinder block assembly (1-4)
	Bore inner diameter and piston assembly (4-2) outer diameter	Gap <b>0.060 mm (0.002362 in)</b>	
Cylinder block (1-4-1)	Shaft bonding section spline	Diameter between parts <b>38.749 mm (1.525551 in)</b> Diameter of measurement pin <b>Ø3.333 mm (0.131220 in)</b> [V1 = <b>2.80 mm (0.11024 in)</b> ] or breaking damage is occurring	Replace the cylinder block assembly (1-4)
Valve plate (1-21)	Sliding surface	0.8 a degree of roughness. There is scratching at least <b>0.02 mm (0.00079 in)</b> deep on the sliding surface. Or seizing is occurring. There is abnormal wear on the sliding surface	Lap the sliding surface (No. 1000) If the scratching cannot be removed, replace the valve plate (1-21)
Retainer plate (1-4-3) Retainer holder (1-4-4)	Sliding surface	0.8 a degree of roughness. There is scratching at least <b>0.02 mm (0.00079 in)</b> deep on the sliding surface. or seizing is occurring	Replace the retainer plate and retainer holder

## Travel motor - Troubleshooting

Problem	Possible Cause	Correction
<b>Piston motor troubleshooting</b> <b>The motor does not rotate</b>	There is an operation problem in a piece of equipment other than the piston motor or reduction gear	After investigating whether pressure is reaching the motor inlet side, investigate the causes of problems and countermeasures for each piece of equipment and perform inspection and repair
	If the cause is in the motor itself, there is dirt clogging an operation section or there is an operation problem	Perform disassembly and clean and remove dirt from parts before reassembling the motor If parts are damaged due to dirt, replace the parts
	Motor inlet side pressure is low	Operate the main relief valve of the circuit and raise the set pressure
	There is abnormal wear on the sliding sections of the piston motor and pressurized oil is escaping	Perform disassembly and replace abnormally worn parts After completely removing surface scratching, burrs, etc. and cleaning, perform reassembly
	Damage is occurring with the main parts of the piston motor. In this instance, abnormal noise is coming from the piston motor	Perform disassembly and replace damaged parts. Perform reassembly after cleaning parts
	The load on the piston motor is too large and the relief valve is operating	Investigate the load conditions and adjust the load to an amount appropriate to the set pressure of the relief valve
<b>Piston motor troubleshooting</b> <b>Motor rotation speed is insufficient</b>	The cause resides in the hydraulic pump, pressure control valve, flow control valve, etc. Required oil flow is not being supplied to the piston motor and rotation is insufficient	After investigating whether the required flow is being supplied to the piston motor inlet side, investigate the causes of problems and countermeasures for each piece of equipment and perform inspection and repair
	Pressurized oil is moving from the high-pressure side to the low-pressure side due to wear on the sliding sections of the piston motor (volume efficiency reduction), and speed is insufficient	Perform disassembly, investigate the status of wear on the sliding sections of the piston motor, and perform repair and replacement according to the maintenance standards
	There is looseness in the piston motor base plate fastening bolts. Internal leaking is increased and speed is insufficient	Retighten the base plate fastening bolts to the specified torque
<b>Piston motor troubleshooting</b> <b>Motor rotation variation is high</b>	There is wear on the sliding sections of the piston motor and high-pressurized oil is leaking and flowing out from the drain port, which is causing speed to greatly decrease and causing rotation variation	Perform disassembly, check the status of wear on the sliding sections, and perform repair or replacement according to the maintenance standards
	When going down an incline, the double counter balance valve is causing hunting and rotation variation	Perform disassembly, check the status of wear on the double counter balance valve, and perform repair or replacement according to the maintenance standards
<b>Piston motor troubleshooting</b> <b>Noise is high</b>	The shaft is touching driven parts due to problems with shaft core alignment, and this is producing noise	Make the shaft core alignment accurate
	There is wear or damage on the piston motor bearings or damage has occurred on springs, etc. and noise is being produced	Perform disassembly and replace damaged parts such as bearings or springs. Perform reassembly after cleaning parts
<b>Piston motor troubleshooting</b> <b>Oil leak</b>	There is looseness in bolts on matching surfaces, etc. and oil leaking is occurring	Retighten the fastening bolts the specified torque

8. Use a hexagon wrench [ **5 mm** ] to install the 4 bolts **(1)**, then install the air breather **(2)** on the hydraulic oil tank to the location from which the specialty adapter for the vacuum pump was removed.



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## Boom cylinder - Disassemble

### Drain the oil

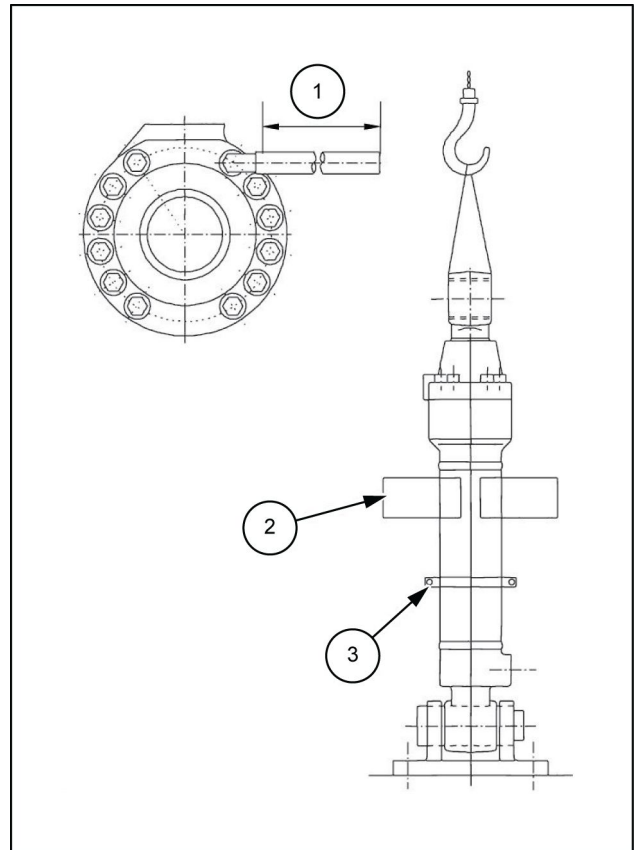
### Secure the cylinder

Secure the cylinder in a vertical or horizontal position. A vertical position makes assembly and disassembly easier. When securing the cylinder, use the bottom pin hole to stop rotation and secure the direction of the axis. (When securing the cylinder, if a line or the like interferes, remove it.)

### Removal of cylinder head

Use a hexagon wrench to loosen the cylinder head tightening bolts and remove them. Passing a pipe through the hexagon wrench as in the figure makes the work easier.

1. About **1.5 m (4.9 ft)**
2. Cylinder secured
3. Line band (removal is unnecessary when replacement is unnecessary.)

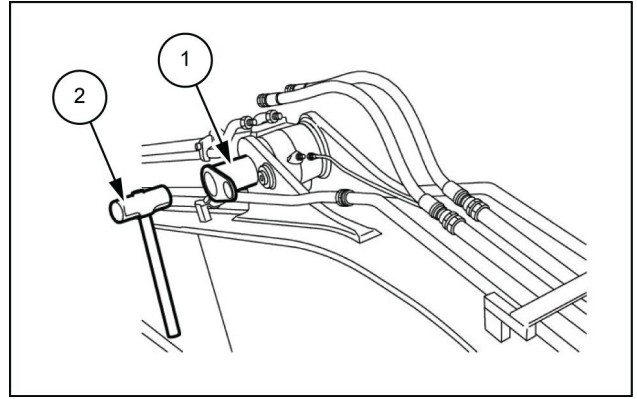


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<b>Seal ring insertion and calibration jig</b>	
<b>Applicable cylinder bore</b>	<b>Part number set</b>
<b>125 mm (4.921 in)</b>	3012J-51001
<b>130 mm (5.118 in)</b>	3013J-01001
<b>135 mm (5.314 in)</b>	3013J-51001
<b>140 mm (5.511 in)</b>	3014J-01001
<b>145 mm (5.708 in)</b>	3014J-51001
<b>150 mm (5.905 in)</b>	3015J-01001
<b>160 mm (6.299 in)</b>	3016J-01001
<b>170 mm (6.692 in)</b>	3017J-01001

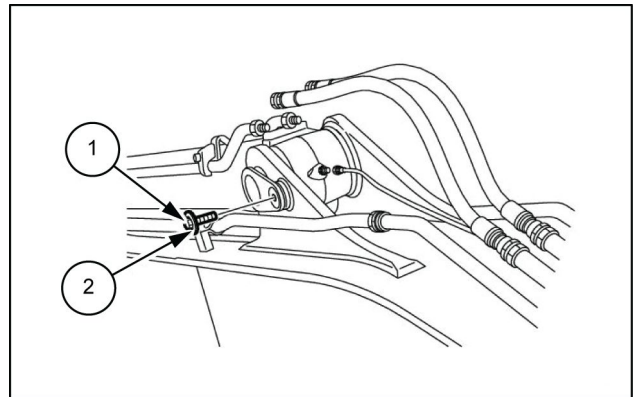
4. Align the arm cylinder with the boom and use a hammer (2) to push in the pin (1).

- If a pin is hard to insert, there is a load on the pin.
- When inserting the pin, be careful not to damage the installed dust seals.



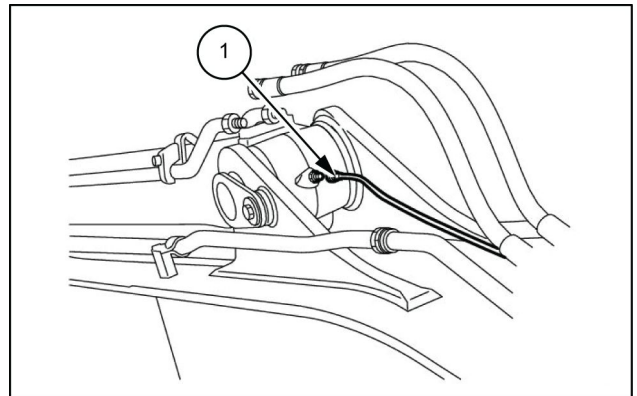
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5. Use a wrench [ 19 mm] to tighten the bolt (1) and washer (2).



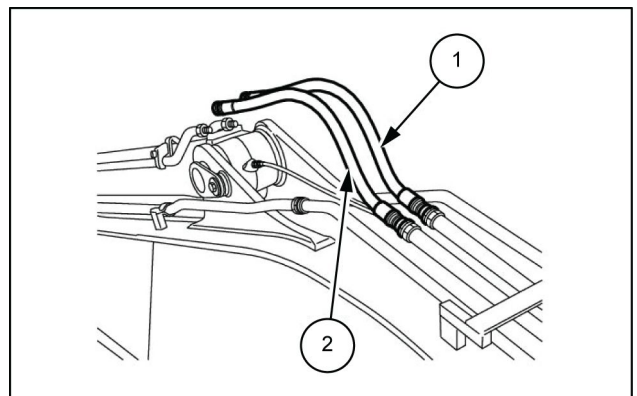
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6. Use a wrench [ 19 mm] to attach the grease hose (1).



LPIL12CX01564AB 6

7. Use a wrench [ 41 mm] to attach the hose (1) and use a wrench [ 36 mm] to attach the hose (2).



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## Bucket cylinder - Service instruction

Hydraulic cylinder trouble, countermeasure and solution.

It is not easy to discover trouble locations.

Refer to “ **Bucket cylinder - Troubleshooting (35.738)**” for general symptoms, suggested causes and also solutions.

For repairs, see the suggested causes and solutions in “ **Bucket cylinder - Troubleshooting (35.738)**”.

The cause of machine problems are often not rooted in just a single part. Problems are often due to the relationship of one part with another.

In some cases, solutions are required other than those given in “ **Bucket cylinder - Troubleshooting (35.738)**”.

In such a case, contact with our company to investigate the problem and its cause further and take appropriate measures.

Item	Symptom
1	Piston rod sliding section oil leak (For the judgment values, refer to “ <b>Bucket cylinder - Inspect (35.738)</b> ”)
2	Cylinder head matching section oil leak
3	Pipe and cylinder tube welding section oil leak
4	Operation defect

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##### Counterweight

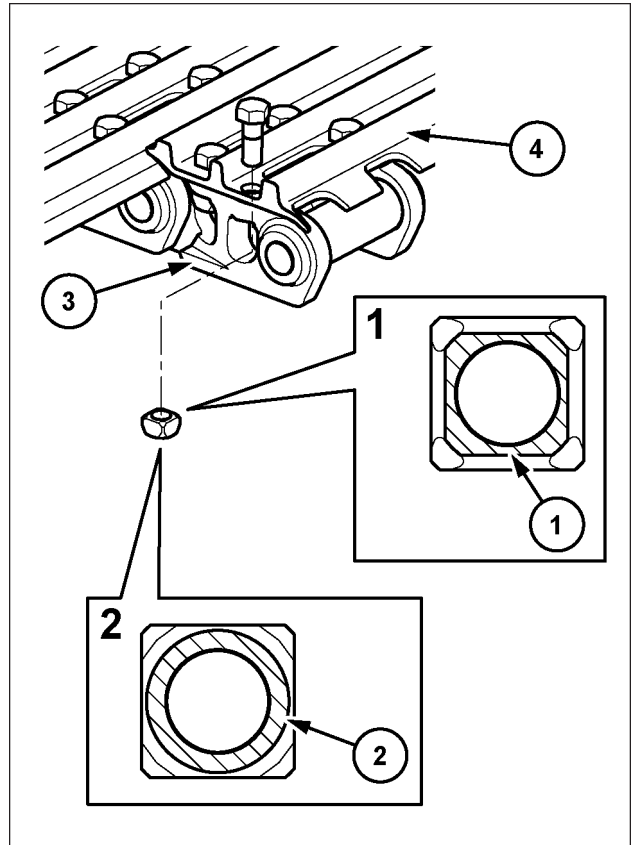
Prepare .....	3
Remove .....	4
Install .....	6

## Track chain - Service instruction - Shoe bolt

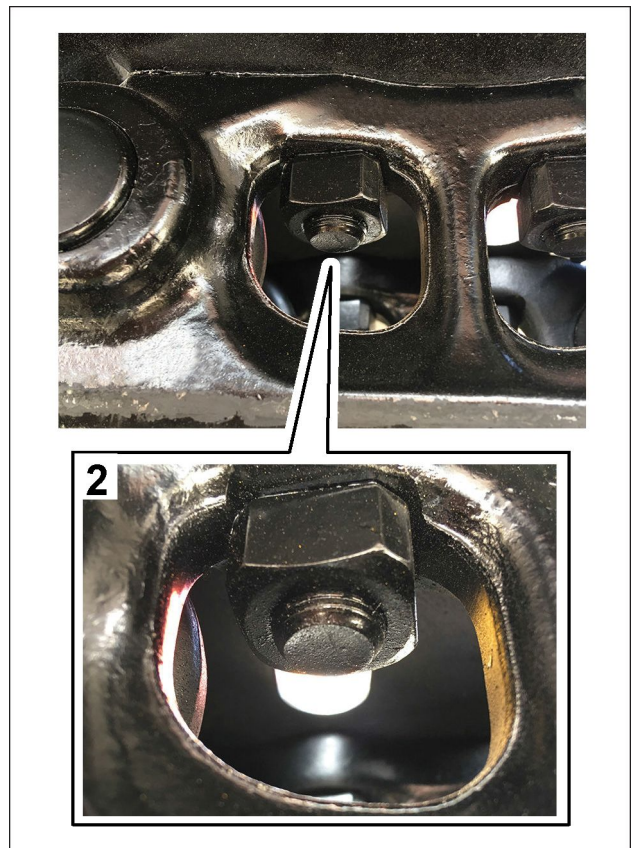
**NOTICE:** The shape of a shoe nut is different from that of a regular nut. When installing a shoe bolt, make sure that the shoe nut "surface with concentric circles" is facing outside.

**NOTICE:** When a shoe bolt and shoe nut become loose, install a new shoe bolt and shoe nut and tighten to the specified torque. If the shoe bolt and shoe nut are reused, they may become loose again.

1. Seating surface
2. Surface with concentric circles
3. Link
4. Shoe plate

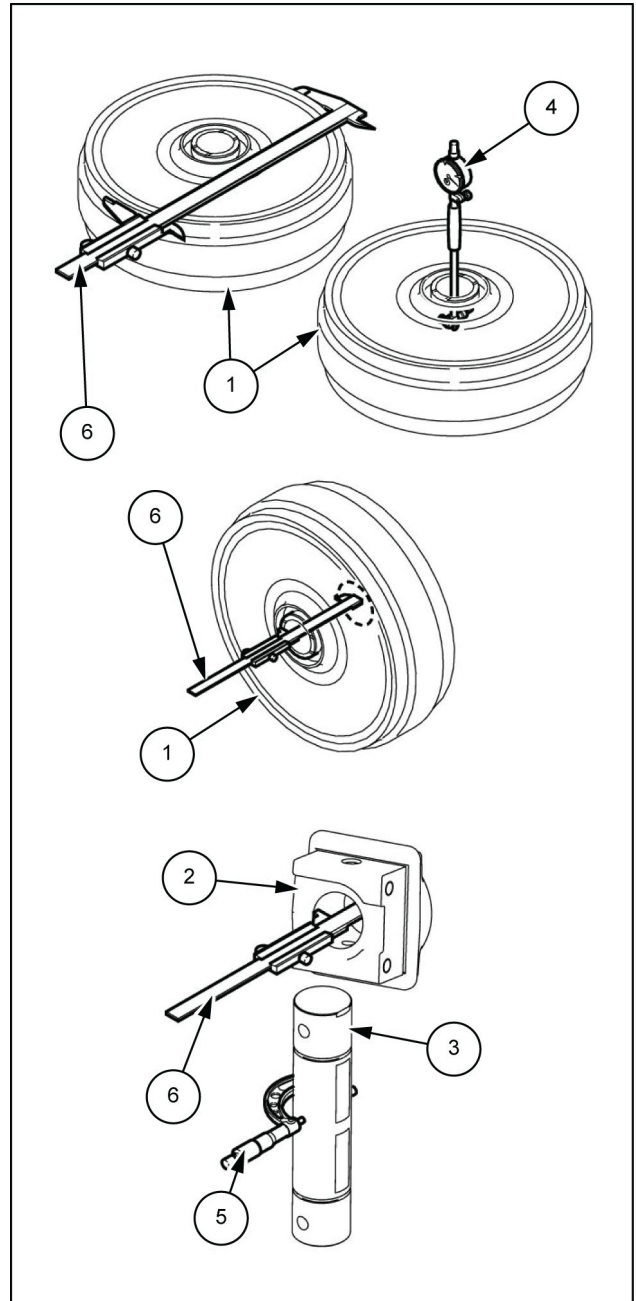


SMIL18CEX1245BA 1



SMIL18CEX1246B 2

9. Use a micrometer caliper (4), cylinder gauge (5), and caliper (6) to measure the roller (with bushing) (1), hub (2), and shaft (3) for wear and deformation. Replace with new parts as necessary.



LPIL12CX01180CB 9

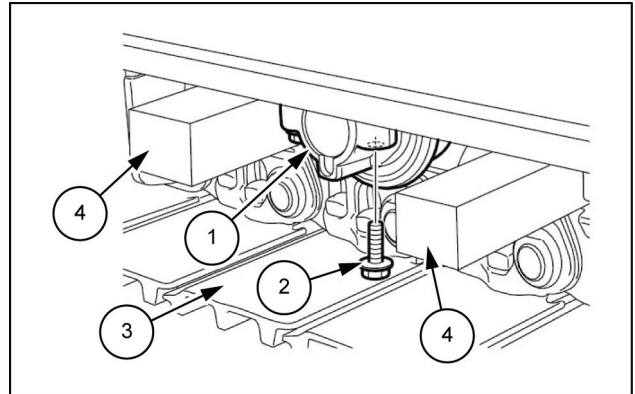
## Track roller - Install

CX220C Crawler excavator NLC version (Tier 3) - Commonwealth of Independent States (CIS)

APAC

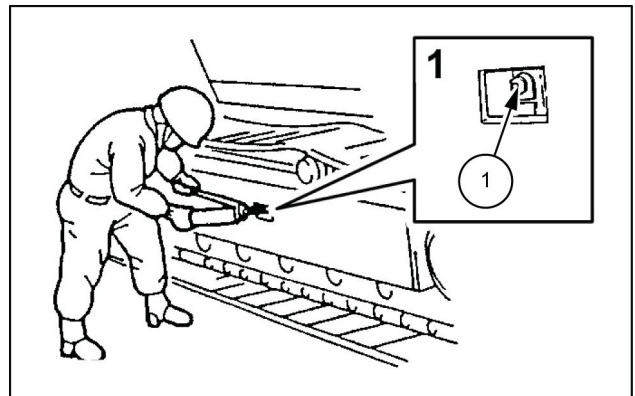
1. Insert wood planks (4) between the side frame and the link show (3), use a box wrench [ 27 mm] to install the lower roller (1) with 4 bolts (2).

- Bolt (2) tightening torque: **371 – 432 N·m (273.64 – 318.63 lb ft)**.



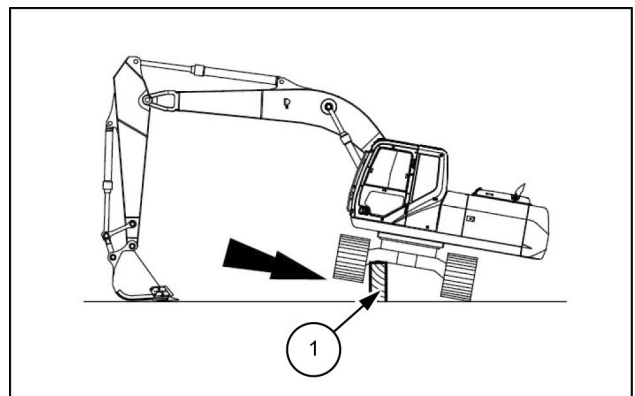
LPIL12CX01276AB 1

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



LPIL12CX01277AB 2

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



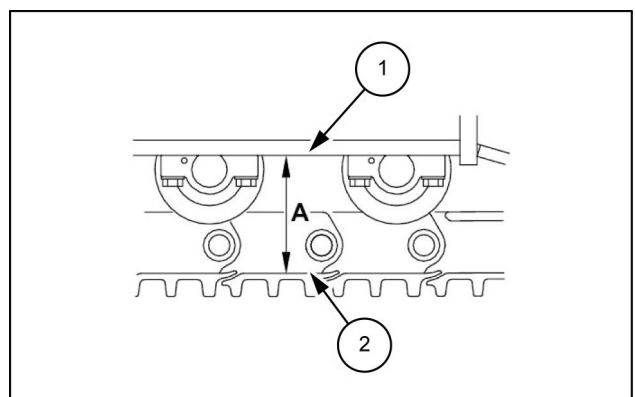
LPIL12CX01278AB 3

4. Adjust the tension so that the distance indicated with A between the lower frame (1) of the center area of the lower side frame and the lowest hanging part of the shoe plate (2) is as follows:

- Steel shoe: **300 – 330 mm (11.811 – 12.992 in)**
- Link chain: **290 – 310 mm (11.417 – 12.205 in)**

For solid ground, having slightly more tension than the value above (with less deflection) is the best.

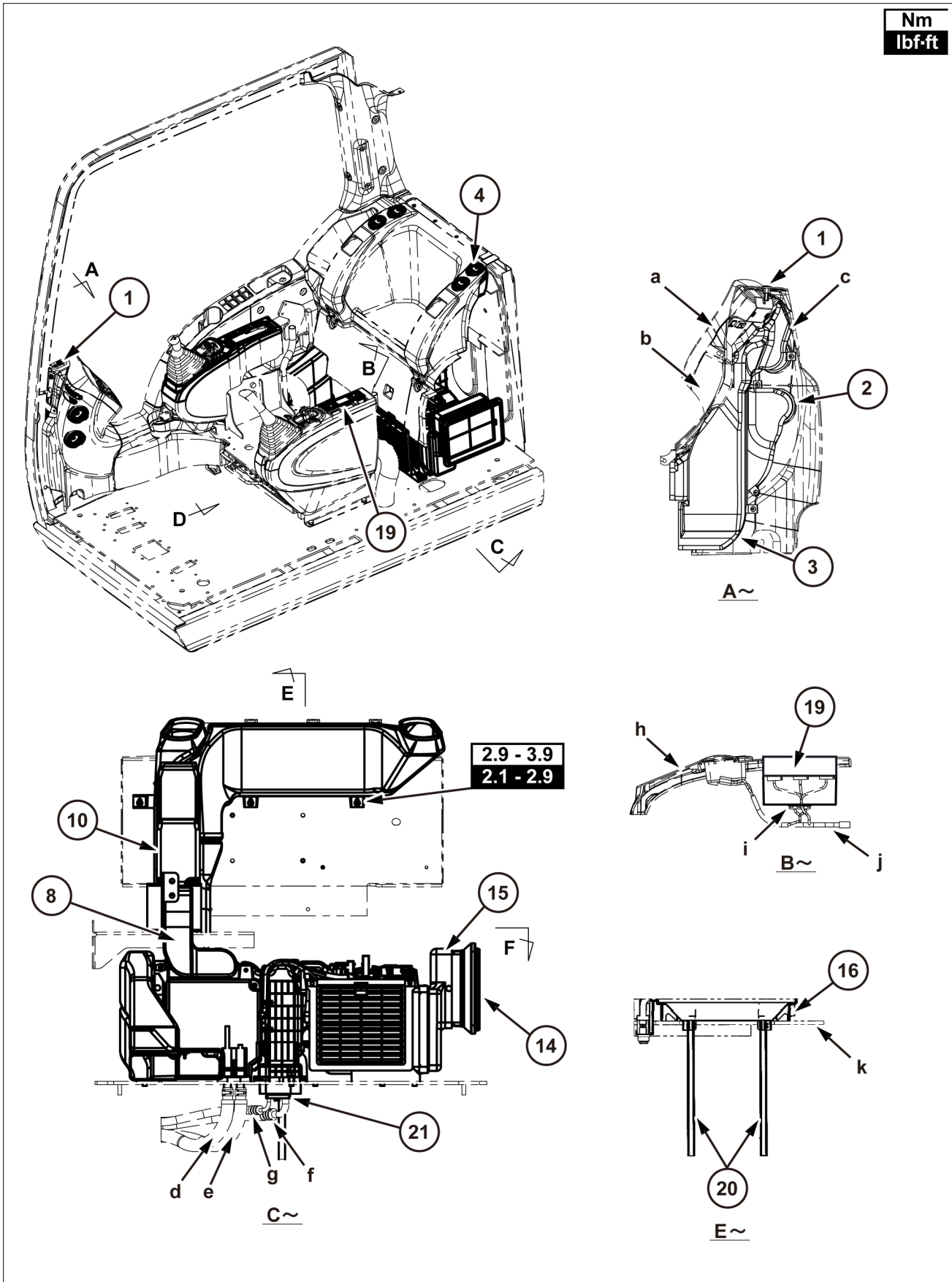
On the other hand, for weak ground or ground with sand, gravel, or cobble, having a little less tension than the value above (with more deflection) is the best.



LPIL12CX01279AB 4

# Air conditioning - Overview - Cab

Nm  
lbf-ft



SMIL15CEX3193HB 1

# Contents

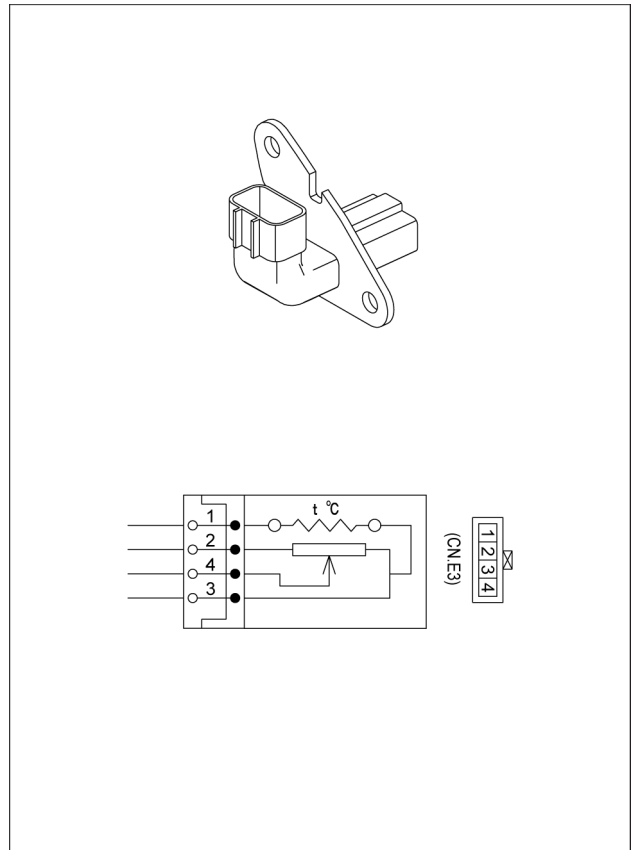
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## Electrical systems - 55

[55.000] Electrical system .....	55.1
[55.100] Harnesses and connectors.....	55.2
[55.525] Cab engine controls.....	55.3
[55.015] Engine control system.....	55.4
[55.201] Engine starting system .....	55.5
[55.301] Alternator.....	55.6
[55.302] Battery.....	55.7
[55.202] Cold start aid .....	55.8
[55.010] Fuel injection system.....	55.9
[55.014] Engine intake and exhaust system.....	55.10
[55.989] Exhaust Gas Recirculation (EGR) electrical system .....	55.11
[55.012] Engine cooling system .....	55.12
[55.013] Engine oil system .....	55.13
[55.640] Electronic modules .....	55.14
[55.512] Cab controls.....	55.15
[55.036] Hydraulic system control .....	55.16
[55.051] Cab Heating, Ventilation, and Air-Conditioning (HVAC) controls.....	55.17
[55.050] Heating, Ventilation, and Air-Conditioning (HVAC) control system.....	55.18

### Boost pressure and temperature sensor

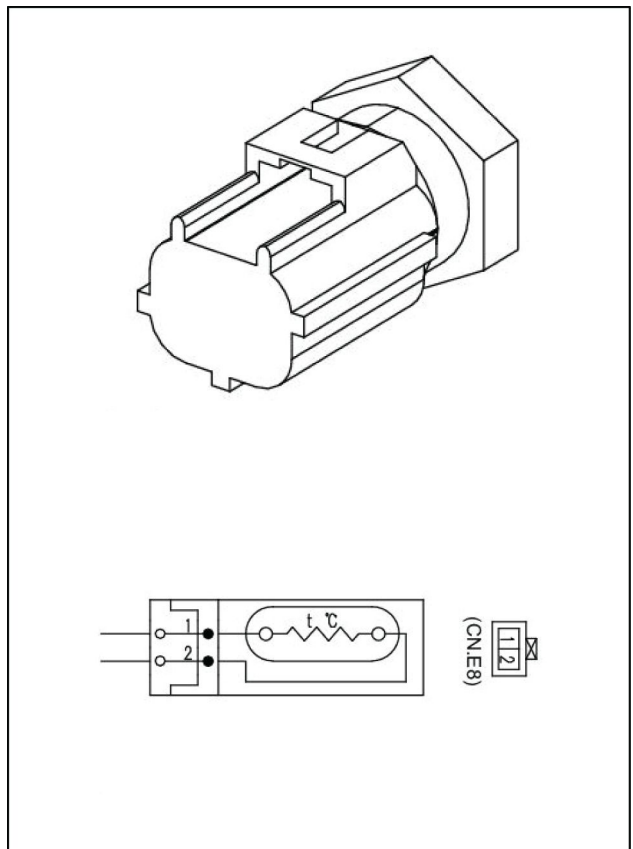
Isuzu part No.: 898121-6971



SMIL15CEX1715BA 22

### Fuel temperature sensor

Isuzu part No.: 898023-5810

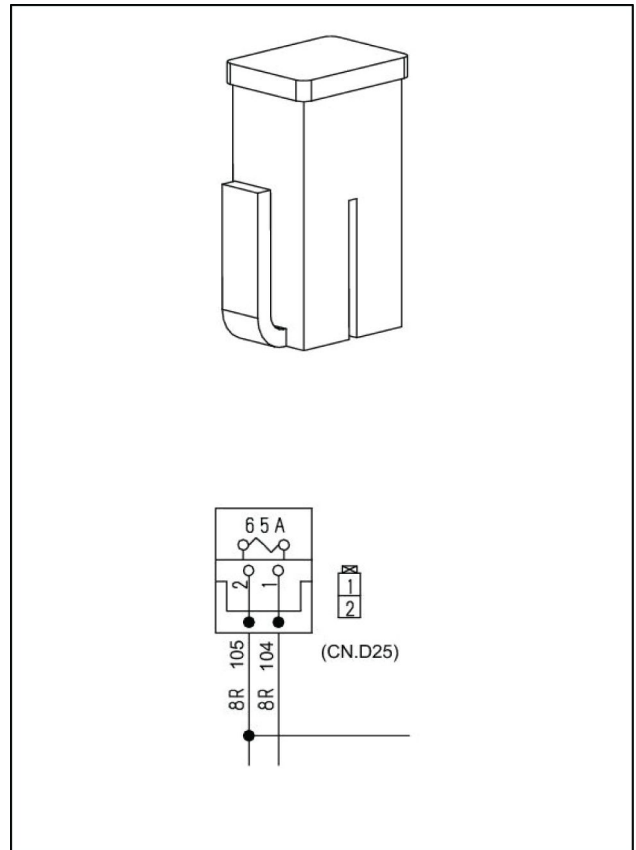


LPIL12CX00567BA 23

### Fusible link (fuse box)

Specification: **65 A**

Part No.: KHR1592

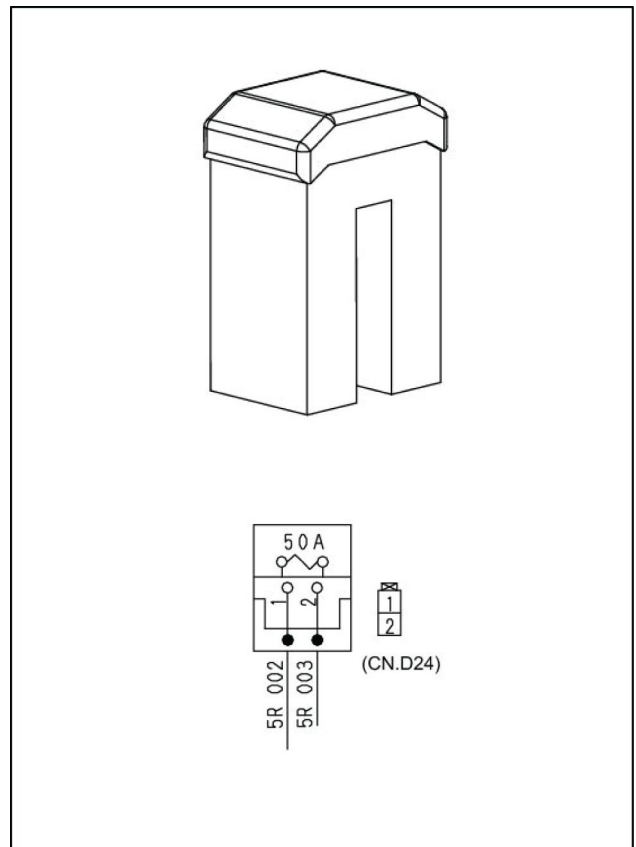


LPIL12CX00550BA 6

### Fusible link (safety relay)

Specification: **50 A**

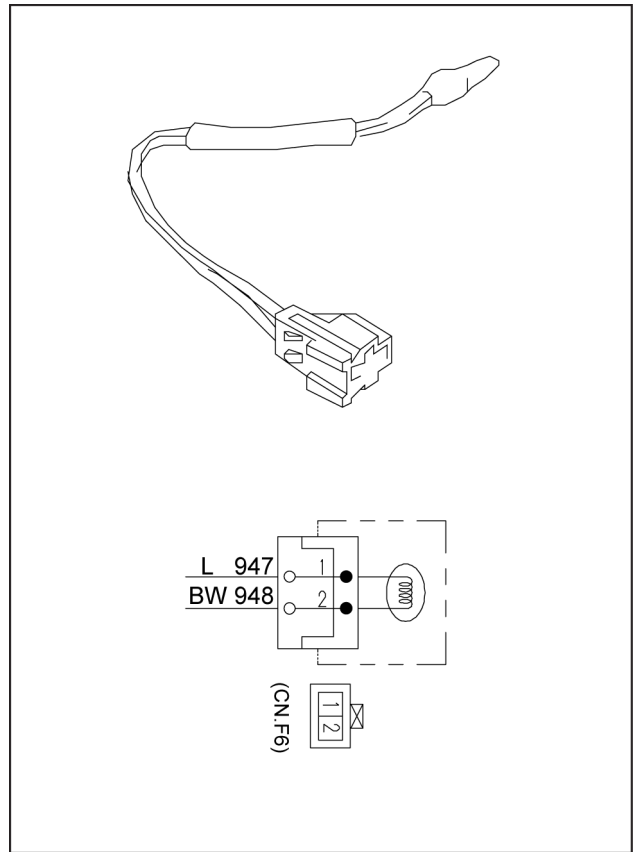
Part No.: KHR3850



LPIL12CX00551BA 7

### EVA sensor

Part No.: KHR27650

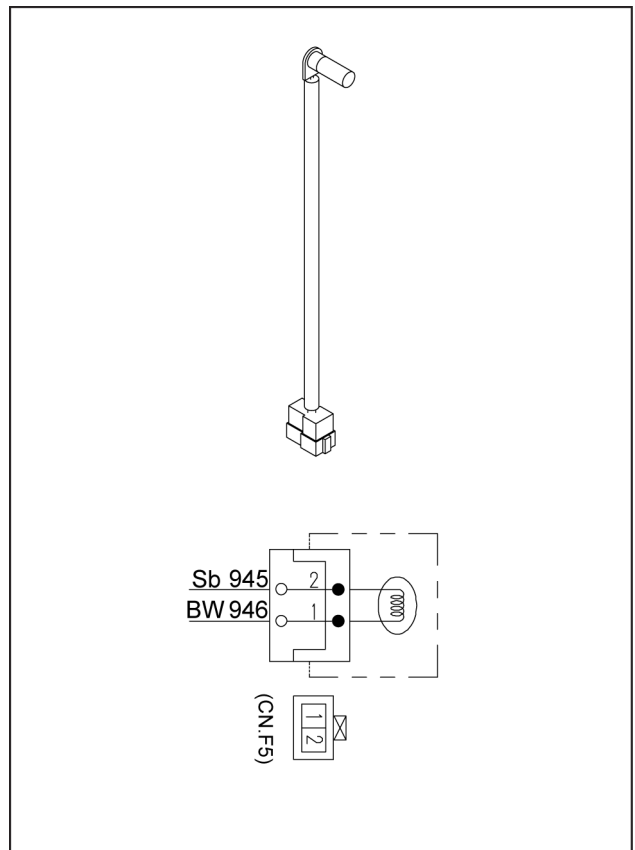


SMIL19CEX0009BA 74

### Interior temperature sensor

Name:

Part No.: KHR27490



SMIL19CEX0010BA 75



**Feed pump harness**

a. Fasten the connector with red tape.

- \*1. Alarm
- \*2. Plate position
- \*3. White adhesive tape

CN.175F	Diode	CN.G5F	Stop relay
CN.G3M	Frame main harness	CN.G6F	Switch
CN.G4F	Pump relay	CN.G7F	Feed pump

## Electrical system - Wiring schema

CX220C Crawler excavator LC version (Tier 3) - Commonwealth of Independent States (CIS)	APAC
---	------

- a. To housing frame
- b. To solenoid valve
- c. To pump
- d. Marking position (Align white tape on harness.)
- e. To engine connector
- f. To compressor

- \*1. Light wire harness (frame main) (KHR11160)
- \*2. ID: L
- \*3. ID: H

Code	Part name	Code	Part name
1	Battery cable (starter relay) (Quantity 1)	5	Electric horn (high) (Quantity 1)
2	Wire harness (frame main) (Quantity 1)	6	Pressure sensor [ <b>5 MPa (725.25 psi)</b> ] G1/4 (Quantity 7)

CN.A50	Cab main harness; A (2-pin)
CN.A51	Cab main harness; B (8-pin)
CN.A52	Cab main harness; C (8-pin)
CN.A53	Cab main harness; D (14-pin)
CN.A54	Cab main harness; E (22-pin)
CN.A55	Cab main harness; F (20-pin)
CN.A56	Cab main harness; G (18-pin)
CN.D1	ECM; 1 (81-pin)
CN.D2	ECM; 2 (40-pin)
CN.D5	Barometric pressure sensor; 3-pin
*CN.D16	Round terminal M8 (alternator ground)
CN.D41	Boom proportional valve; 2-pin (ID tape: None)
CN.D42	Arm proportional valve; 2-pin (ID tape: Red)
CN.D43	Bucket proportional valve; 2-pin (ID tape: Blue)
CN.D44	Option proportional valve harness; 2-pin (Fasten to harness with red tape.)
CN.D47	N1 pressure sensor; 3-pin
CN.D49	Swing pressure sensor; 3-pin
CN.D50	Upper pressure sensor; 3-pin
CN.D51	Travel pressure sensor; 3-pin (ID tape: Red)

### Main frame

#### NOTE:

1. When installing the ground terminals marked with \*, check that the frame seating surface is not coated. If the surface is coated, remove the coating before installation.
2. Adjust the clamp positions of the electrical wiring that comes out from connectors so that the wiring does not form sharp rounded shapes. [R = **10 mm (0.394 in)** or more]
3. Bunch and fasten the unused harness at the position marked with ▲ with the wire band.

- g. To starter motor
  - h. To alternator
  - i. Fasten together with the pilot control line.
  - j. Round terminal M8 (floor ground)
  - k. To inside the cab
  - l. Length from white tape on harness to rubber clamp: **270 – 290 mm (10.630 – 11.417 in)**
- \*4. Floor
  - \*5. In cab details

Code	Part name	Code	Part name
3	Ground wire (floor) (Quantity 1)	7	Working light <b>24 V x 70 W</b> (Quantity 1)
4	Electric horn (low) (Quantity 1)	8	Travel alarm (Quantity 1)

CN.D52	HBCV harness; 3-pin (Fasten to harness with red tape.)
CN.D53	Boom pressure sensor; 3-pin
CN.D54	Arm pressure sensor; 3-pin (ID tape: Red)
CN.D55	Bucket pressure sensor; 3-pin (ID tape: Blue)
CN.D57	Fuel level sensor; 2-pin
CN.D64	Free swing solenoid valve; 2-pin
CN.D65	Housing lamp; 2-pin
CN.D66	Boom lamp harness; 2-pin
CN.D67	Washer motor; 2-pin
CN.D69	Travel alarm; 2-pin (Fasten to harness with red tape.)
CN.D70F, D71F	Horn (low)
CN.D72F, D73F	Horn (high)
CN.D76	Feed pump harness; 3-pin (Fasten to harness with red tape.)
CN.D77	Receiver dryer; 2-pin
CN.D79	Reserve tank; 2-pin
*CN.D80	Round terminal M8 (floor ground, ground G1)
*CN.D81	Round terminal M8 (ground G2)
CN.D84	Filter indicator; 3-pin
CN.D88	Intake air temperature sensor; 2-pin

## Electrical system - Wiring schema

CX220C Crawler excavator NLC version (Tier 3) - Commonwealth of Independent States (CIS) APAC

- a. To housing frame
- b. To solenoid valve
- c. To pump
- d. Marking position (Align white tape on harness.)
- e. To engine connector
- f. To compressor

- \*1. Light wire harness (frame main) (KHR11160)
- \*2. ID: L
- \*3. ID: H

Code	Part name	Code	Part name
1	Battery cable (starter relay) (Quantity 1)	5	Electric horn (high) (Quantity 1)
2	Wire harness (frame main) (Quantity 1)	6	Pressure sensor [ <b>5 MPa (725.25 psi)</b> ] G1/4 (Quantity 7)

CN.A50	Cab main harness; A (2-pin)	CN.D52	HBCV harness; 3-pin (Fasten to harness with red tape.)
CN.A51	Cab main harness; B (8-pin)	CN.D53	Boom pressure sensor; 3-pin
CN.A52	Cab main harness; C (8-pin)	CN.D54	Arm pressure sensor; 3-pin (ID tape: Red)
CN.A53	Cab main harness; D (14-pin)	CN.D55	Bucket pressure sensor; 3-pin (ID tape: Blue)
CN.A54	Cab main harness; E (22-pin)	CN.D57	Fuel level sensor; 2-pin
CN.A55	Cab main harness; F (20-pin)	CN.D64	Free swing solenoid valve; 2-pin
CN.A56	Cab main harness; G (18-pin)	CN.D65	Housing lamp; 2-pin
CN.D1	ECM; 1 (81-pin)	CN.D66	Boom lamp harness; 2-pin
CN.D2	ECM; 2 (40-pin)	CN.D67	Washer motor; 2-pin
CN.D5	Barometric pressure sensor; 3-pin	CN.D69	Travel alarm; 2-pin (Fasten to harness with red tape.)
*CN.D16	Round terminal M8 (alternator ground)	CN.D70F, D71F	Horn (low)
CN.D41	Boom proportional valve; 2-pin (ID tape: None)	CN.D72F, D73F	Horn (high)
CN.D42	Arm proportional valve; 2-pin (ID tape: Red)	CN.D76	Feed pump harness; 3-pin (Fasten to harness with red tape.)
CN.D43	Bucket proportional valve; 2-pin (ID tape: Blue)	CN.D77	Receiver dryer; 2-pin
CN.D44	Option proportional valve harness; 2-pin (Fasten to harness with red tape.)	CN.D79	Reserve tank; 2-pin
CN.D47	N1 pressure sensor; 3-pin	*CN.D80	Round terminal M8 (floor ground, ground G1)
CN.D49	Swing pressure sensor; 3-pin	*CN.D81	Round terminal M8 (ground G2)
CN.D50	Upper pressure sensor; 3-pin	CN.D84	Filter indicator; 3-pin
CN.D51	Travel pressure sensor; 3-pin (ID tape: Red)	CN.D88	Intake air temperature sensor; 2-pin

### Main frame

#### NOTE:

1. When installing the ground terminals marked with \*, check that the frame seating surface is not coated. If the surface is coated, remove the coating before installation.
2. Adjust the clamp positions of the electrical wiring that comes out from connectors so that the wiring does not form sharp rounded shapes. [R = 10 mm (0.394 in) or more]

- g. To starter motor
- h. To alternator
- i. Fasten together with the pilot control line.
- j. Round terminal M8 (floor ground)
- k. To inside the cab
- l. Cut off the excess portion of the clamp.
- \*4. Floor
- \*5. In cab details
- \*6. Fuel tank

Code	Part name	Code	Part name
3	Ground wire (floor) (Quantity 1)	7	Working light <b>24 V x 70 W</b> (Quantity 1)
4	Electric horn (low) (Quantity 1)	8	Travel alarm (Quantity 1)

## Electrical system - Wiring schema

CX210C Crawler excavator Standard version (Tier 3) - Middle East and Africa market	MEA
CX220C Crawler excavator LC version (Tier 3) - Middle East and Africa market	MEA

- a. To housing frame
- b. To solenoid valve
- c. To pump
- d. Marking position (Align white tape on harness.)
- e. To engine connector
- f. To compressor

- \*1. Light wire harness (frame main) (KHR11160)
- \*2. ID: L
- \*3. ID: H

Code	Part name	Code	Part name
1	Battery cable (starter relay) (Quantity 1)	5	Electric horn (high) (Quantity 1)
2	Wire harness (frame main) (Quantity 1)	6	Pressure sensor [ <b>5 MPa (725.25 psi)</b> ] G1/4 (Quantity 7)

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CN.A51	Cab main harness; B (8-pin)
CN.A52	Cab main harness; C (8-pin)
CN.A53	Cab main harness; D (14-pin)
CN.A54	Cab main harness; E (22-pin)
CN.A55	Cab main harness; F (20-pin)
CN.A56	Cab main harness; G (18-pin)
CN.D1	ECM; 1 (81-pin)
CN.D2	ECM; 2 (40-pin)
CN.D5	Barometric pressure sensor; 3-pin
*CN.D16	Round terminal M8 (alternator ground)
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CN.D47	N1 pressure sensor; 3-pin
CN.D49	Swing pressure sensor; 3-pin
CN.D50	Upper pressure sensor; 3-pin
CN.D51	Travel pressure sensor; 3-pin (ID tape: Red)

### Main frame

#### NOTE:

1. When installing the ground terminals marked with \*, check that the frame seating surface is not coated. If the surface is coated, remove the coating before installation.
2. Adjust the clamp positions of the electrical wiring that comes out from connectors so that the wiring does not form sharp rounded shapes. [R = **10 mm (0.394 in)** or more]
3. Bunch and fasten the unused harness at the position marked with ▲ with the wire band.

- g. To starter motor
- h. To alternator
- i. Fasten together with the pilot control line.
- j. Round terminal M8 (floor ground)
- k. To inside the cab
- l. Length from white tape on harness to rubber clamp: **270 – 290 mm (10.630 – 11.417 in)**
- \*4. Floor
- \*5. In cab details

Code	Part name	Code	Part name
3	Ground wire (floor) (Quantity 1)	7	Working light <b>24 V x 70 W</b> (Quantity 1)
4	Electric horn (low) (Quantity 1)	8	Travel alarm (Quantity 1)

CN.D52	HBCV harness; 3-pin (Fasten to harness with red tape.)
CN.D53	Boom pressure sensor; 3-pin
CN.D54	Arm pressure sensor; 3-pin (ID tape: Red)
CN.D55	Bucket pressure sensor; 3-pin (ID tape: Blue)
CN.D57	Fuel level sensor; 2-pin
CN.D64	Free swing solenoid valve; 2-pin
CN.D65	Housing lamp; 2-pin
CN.D66	Boom lamp harness; 2-pin
CN.D67	Washer motor; 2-pin
CN.D69	Travel alarm; 2-pin (Fasten to harness with red tape.)
CN.D70F, D71F	Horn (low)
CN.D72F, D73F	Horn (high)
CN.D76	Feed pump harness; 3-pin (Fasten to harness with red tape.)
CN.D77	Receiver dryer; 2-pin
CN.D79	Reserve tank; 2-pin
*CN.D80	Round terminal M8 (floor ground, ground G1)
*CN.D81	Round terminal M8 (ground G2)
CN.D84	Filter indicator; 3-pin
CN.D88	Intake air temperature sensor; 2-pin

NOTE:

System trouble diagnosis type:

The system diagnosis method is a standardized method applied for repairing all electric/electronic systems.

Failures in electric/electronic systems often occur in the following steps unlike common actual unit failures.

Initial stage of failure

The failure occurs sporadically and for a short time, often times the driver does not notice it. At this stage, the customer's complaint is unclear, and the malfunction cannot be reproduced.

However, the ECM may have recorded the failure.

Past malfunction, past failures

Middle stage of failure

The failure occurs sporadically and for a short time, but may occur repeatedly at intervals, and occurs under specific conditions.

The customer complaint is clear, but the failure conditions are unclear.

Therefore, the person performing the diagnosis can reproduce the failure by understanding its conditions.

Intermittent failures, intermittent

Stage where failure is realistic

The occurrence of the failure is set, and the customer complaint is real and clear.

Therefore, the person performing the diagnosis can reproduce the failure.

However, there may sometimes be more than 2 causes for the failure.

Current malfunction, Current failures

## Diagnosis

Fully understand the description given by the customer using the Engine Control System Check Sheet.

- When questioning, do not ask randomly but focus on the system that is inferred to be defective based on the malfunction phenomenon.

Determine failure information accurately.

Have concrete understanding based on 5W1H.

Low air temperature, at start or on a steady basis, near the engine parts, metallic sound, etc.

Check points:

- Failure symptoms
- Month and date, Time, Frequency of occurrence
- Road conditions
- Working conditions, operation conditions, weather
- Feeling of symptom

**Wiring harnesses - Electrical schematic sheet 07 - Engine controller**

Type	Components	Connectors/link
	A2	
Connector	CN.D1-02	<b>CN.D1-02</b> CONNECTOR - ENGINE CONTROLLER
Connector	CN.D7	<b>CN.D7</b> CONNECTOR
Connector	CN.D8	<b>CN.D8</b> CONNECTOR
Connector	CN.D10	<b>CN.D10</b> CONNECTOR -

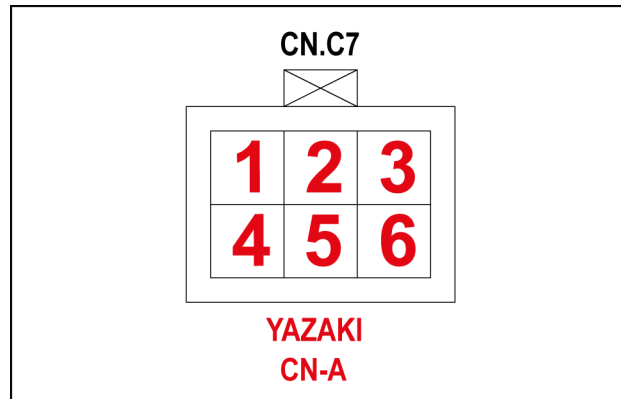
**Wiring harnesses - Electrical schematic sheet 24 - Main cab-lamp and speaker**

Type	Components	Connectors/link
Lamp	E3	
Lamp	E4	
Speaker	H4	
Speaker	H5	
Switch	S53	
Switch	S54	
Connector	CN.A26-1	<b>CN.A26-1</b> CONNECTOR - LAMP (CAB)
Connector	CN.A26-2	<b>CN.A26-2</b> CONNECTOR - LAMP (CAB)
Connector	CN.A27-1	<b>CN.A27-1</b> CONNECTOR - LAMP (CAB)
Connector	CN.A27-2	<b>CN.A27-2</b> CONNECTOR - LAMP (CAB)
Connector	CN.A28-1	<b>CN.A28-1</b> CONNECTOR - LAMP (CAB)
Connector	CN.A28-2	<b>CN.A28-2</b> CONNECTOR - LAMP (CAB)
Connector	CN.A29-1	<b>CN.A29-1</b> CONNECTOR
Connector	CN.A29-2	<b>CN.A29-2</b> CONNECTOR - LAMP (CAB)
Connector	CN.A30	<b>CN.A30</b> CONNECTOR - LIMIT SWITCH (WINDOW)
Connector	CN.A31	<b>CN.A31</b> CONNECTOR - LIMIT SWITCH (WINDOW)
Connector	CN.A45	<b>CN.A45</b> CONNECTOR
Connector	CN.C8	<b>CN.C8</b> CONNECTOR - ROOM LAMP
Connector	CN.C9	<b>CN.C9</b> CONNECTOR - LIMIT SWITCH (DOOR)
Connector	CN.C10	<b>CN.C10</b> CONNECTOR -
Connector	CN.C11	<b>CN.C11</b> CONNECTOR -
Connector	CN.C22	<b>CN.C22</b> CONNECTOR - ROOM LAMP
Connector	CN.C23	<b>CN.C23</b> CONNECTOR - LIMIT SWITCH (DOOR)
Connector	CN.C24	<b>CN.C24</b> CONNECTOR - SPEAKER RIGHT
Connector	CN.C25	<b>CN.C25</b> CONNECTOR - SPEAKER LEFT
Connector	CN.C32	<b>CN.C32</b> CONNECTOR - GROUND

## Wiring harnesses - Electrical schematic sheet 41 - Option line circuit - proportional lever type

Type	Components	Connectors/link
Solenoid	Y9	
Solenoid	Y27	
Solenoid	Y84	
Solenoid	Y85	
Solenoid	Y86	
Solenoid	Y87	
Solenoid	S100	
Solenoid	S101	
Solenoid	S102	
Solenoid	S103	
Connector	CN.57-1B	<b>CN.57-1B</b> CONNECTOR - OPTION SELECT SOLENOID VALVE
Connector	CN.57-2B	<b>CN.57-2B</b> CONNECTOR - OPTION 2 SPEED SOLENOID VALVE
Connector	CN.57-3A	<b>CN.57-3A</b> CONNECTOR - OPTION 1 LEVER UP PROPORTIONAL SOLENOID
Connector	CN.57-4A	<b>CN.57-4A</b> CONNECTOR - OPTION 1 LEVER DOWN PROPORTIONAL SOLENOID
Connector	CN.57-5A	<b>CN.57-5A</b> CONNECTOR - PRESSURE SWITCH (OPTION 1 LEVER UP)
Connector	CN.57-6A	<b>CN.57-6A</b> CONNECTOR - PRESSURE SWITCH (OPTION 1 LEVER DOWN)
Connector	CN.57-7A	<b>CN.57-7A</b> CONNECTOR - OPTION 2 LEVER UP PROPORTIONAL SOLENOID
Connector	CN.57-8A	<b>CN.57-8A</b> CONNECTOR - OPTION 2 LEVER DOWN PROPORTIONAL SOLENOID
Connector	CN.57-9A	<b>CN.57-9A</b> CONNECTOR - PRESSURE SWITCH (OPTION 2 LEVER UP)

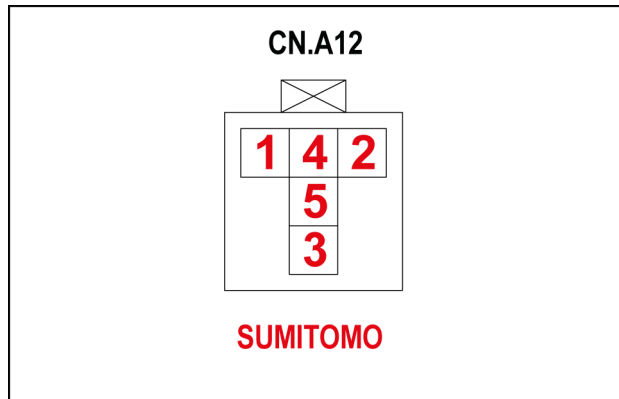
**CONNECTOR CN.C7 - WIPER MOTOR (Male)**



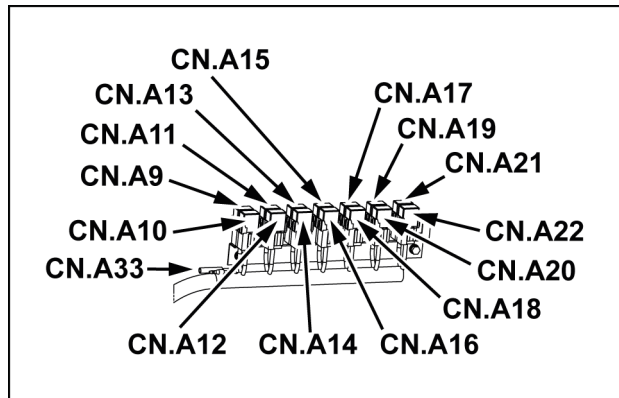
SMIL15CEX3874AA 42

Pin	From	Wire	Description	Color-Size	Frame
1	CN.C6-P-8	827		LR-0.85	<b>SHEET 23 - Main cab-wiper controller</b>
3	CN.C6-P-6	828		LB-0.85	
4	CN.C6-P-7	485		G-0.85	
5	SP-710-P-X	711		B-1.25	
6	CN.C6-P-5	486		L-0.85	

**CONNECTOR CN.A12 - RELAY IDLE STOP (Male)**



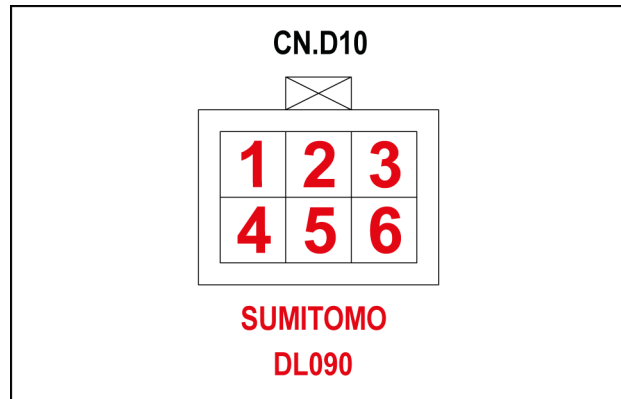
SMIL15CEX3912AA 5



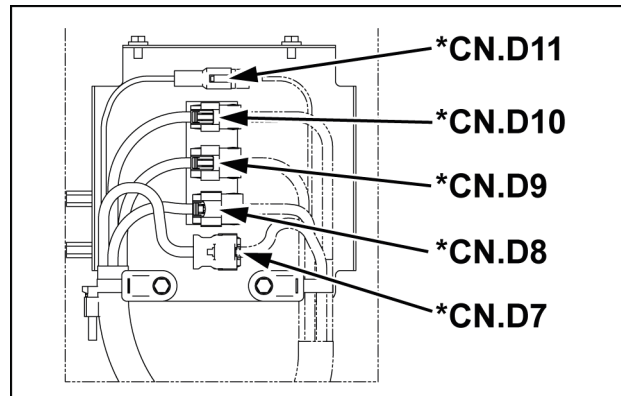
SMIL15CEX3909AA 6

Pin	From	Wire	Description	Color-Size	Frame
1	SP-112C-P-X	115		W-0.85	<b>SHEET 27 - Main cab-relays</b>
2	CN.A45-M-P-8	824B		LY-0.85	<b>SHEET 22 - Main cab-monitor display</b>
3	SP-112C-P-X	114		W-0.85	<b>SHEET 27 - Main cab-relays</b>
5	SP-890-P-X	890A		LR-0.85	

**CONNECTOR CN.D10 - (Male)**



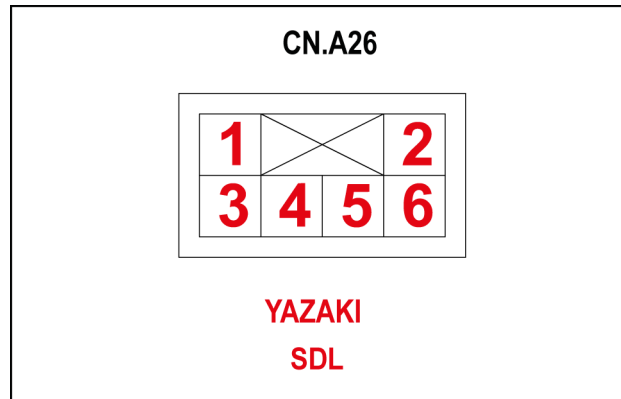
SMIL15CEX4031AA 48



SMIL15CEX4021AA 49

Pin	From	Wire	Description	Color-Size	Frame
1	CN.D1-02-P-83	342		YG-0.75	<b>SHEET 07 - Engine controller</b>
2	SP-395	394		RG-0.75	
3	SP-396	396		RW-0.75	
5	CN.D1-02-P-84	340		R-0.75	

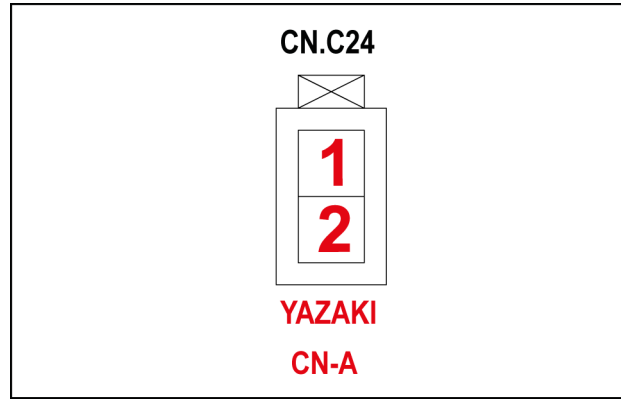
**CONNECTOR CN.A26 (Female)**



SMIL15CEX4242AA 19

Pin	From	Wire	Description	Color-Size	Frame
1	CN.52-F-P-A	631D		BG	<b>SHEET 25 - Main cab-CAN circuit</b>
2	CN.52-F-P-B	166A		RL	
3	CN.52-F-P-C	040T		P	
4	CN.52-F-P-D	041U		PG	
5	CN.52-F-P-E	081A		PL	

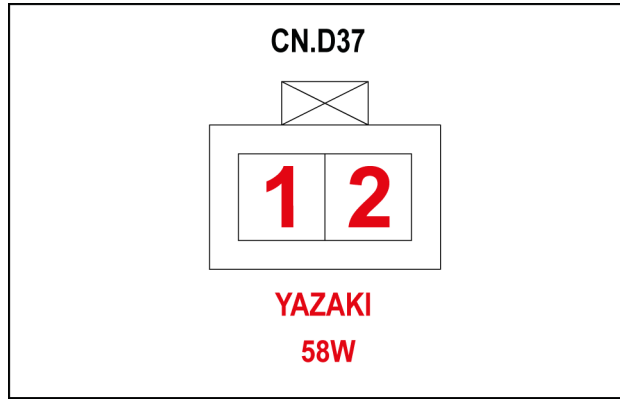
**CONNECTOR CN.C24 - SPEAKER RIGHT (Male)**



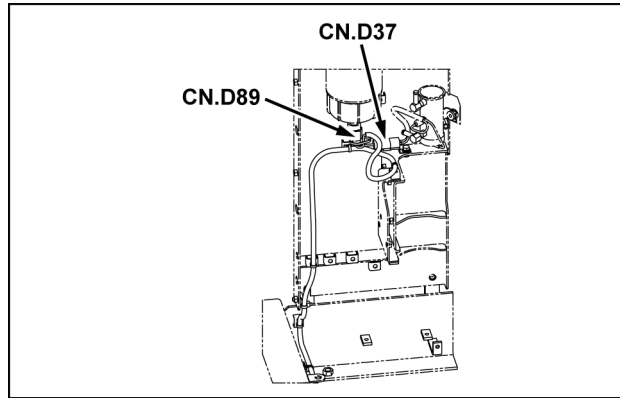
SMIL15CEX3879AA 44

Pin	From	Wire	Description	Color-Size	Frame
1	CN.C10-F-P-3	982		BY-0.85	<b>SHEET 24 - Main cab-lamp and speaker</b>
2	CN.C10-F-P-1	984		YB-0.85	

**CONNECTOR CN.D37 - FUEL PUMP (Male)**



SMIL15CEX3992AA 17

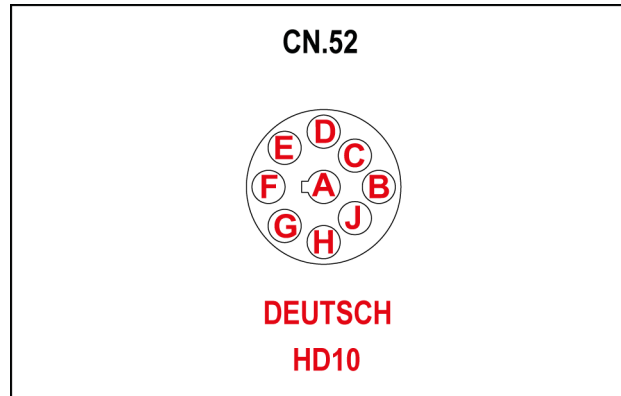


SMIL15CEX3991AA 18

Pin	From	Wire	Description	Color-Size	Frame
1	SP-119-P-X	118A		W-1.25	<b>SHEET 02 - Power distribution</b>
2	SP-753-P-X	753		G-1.25	<b>SHEET 10 - Fuel pump, horn &amp; lamps</b>

## Wire connectors - Component diagram 05

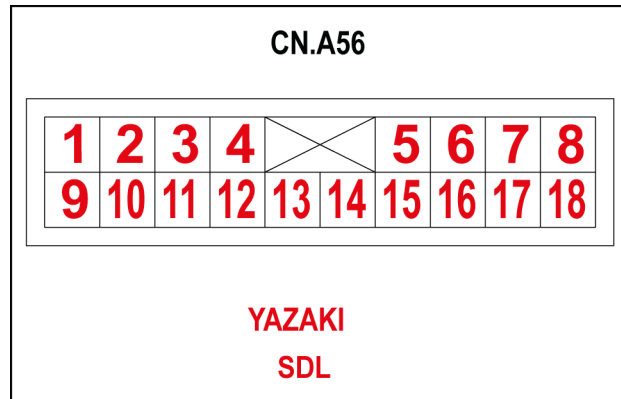
CONNECTOR CN.52 (Male)



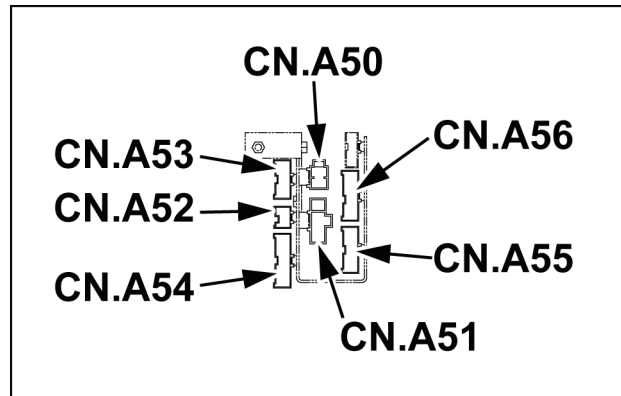
SMIL15CEX4175AA 1

Pin	From	Wire	Description	Color-Size	Frame
A	CN.A26-F-P-1	631D		BG	SHEET 25 - Main cab-CAN circuit
B	CN.A26-F-P-2	166A		RL	
C	CN.A26-F-P-3	040T		P	
D	CN.A26-F-P-4	041U		PG	
E	CN.A26-F-P-5	081A		PL	

**CONNECTOR CN.A56 (Male)**



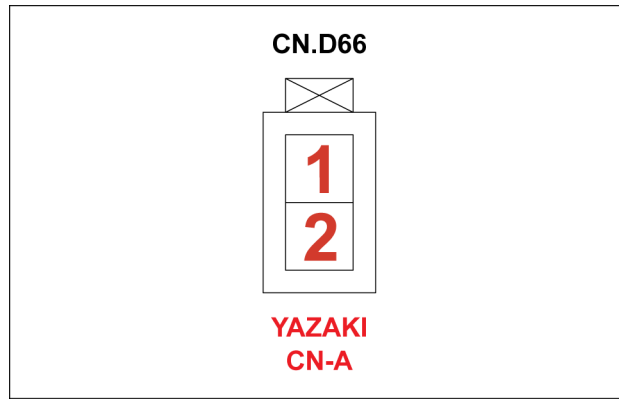
SMIL15CEX3946AA 41



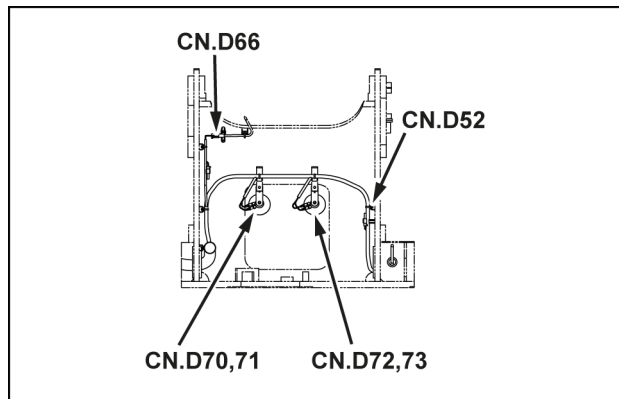
SMIL15CEX4244AA 42

Pin	From	Wire	Description	Color-Size	Frame	
1	CN.D39-P-1	900A		Y-0.75	<b>SHEET 12 - Engine-switches and proportional S/V</b>	
2	CN.D41-P-1	902A		O-0.85		
3	CN.D40-P-1	904A		L-0.75		
4	CN.D42-P-1	906A		G-0.85		
6	CN.D44-M-P-1	910A		VR-0.85		
9	CN.D39-P-2	901A		BY-0.75		
10	CN.D41-P-2	903A		BO-0.85		
11	CN.D40-P-2	905A		BL-0.75		
12	CN.D42-P-2	907A		GB-0.85		
13	CN.D43-P-2	818A		YL-0.85		
14	CN.D84-P-2	417A		LR-0.85		<b>SHEET 13 - Engine-sensors</b>
16	CN.D44-M-P-2	911A		VG-0.85		<b>SHEET 12 - Engine-switches and proportional S/V</b>

**CONNECTOR CN.D66 (Male)**



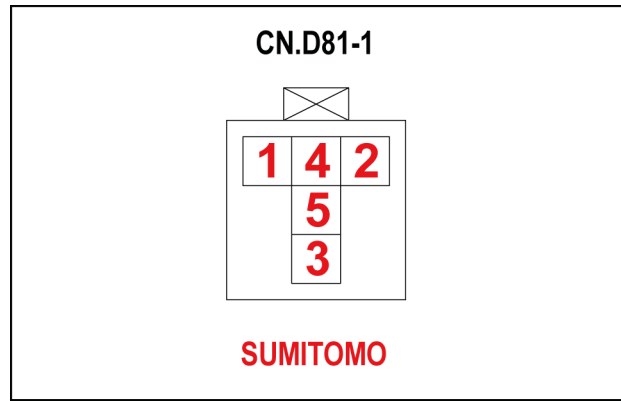
SMIL18CEX0757AA 22



SMIL15CEX3982AA 23

Pin	From	Wire	Description	Color-Size	Frame
1	SP-870-P-X	871		Y-1.25	SHEET 43 - Engine lamp
2	SP-700D-P-X	758		B-1.25	SHEET 10 - Fuel pump, horn & lamps

**CONNECTOR CN.D81-1 - RELAY PUMP (Male)**



SMIL15CEX4168AA 6

Pin	From	Wire	Description	Color-Size	Frame
1	SP-847-P-X	848		VR-0.85	<b>SHEET 14 - Engine-refuel pump</b>
2	SP-764-P-X	766		B-0.85	
3	SP-250-P-X	250C		GW-1.25	
5	CN.D81-3-P-2	896		LR-1.25	

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## Electrical systems - 55

### Engine control system - 015

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Electrical systems - Engine control system

<b>Pin No.</b>	<b>Terminal name</b>	<b>Connection</b>
118	OS-INJ4	Injector 4 control, No. 2 cylinder
119	OS-INJ1	Injector 1 control, No. 1 cylinder
120	OS-INJ2	Injector 2 control, No. 3 cylinder
121	OP-COM1	Injector power supply 1; No. 1 cylinder, No. 4 cylinder

1. Upper pressure sensor
2. Swing pressure sensor
3. Swing brake

---

## Engine starter - Prepare

### **⚠ WARNING**

**Battery gas can explode!**

**To prevent an explosion: 1. Always disconnect the negative (-) battery cable first. 2. Always connect the negative (-) battery cable last. 3. Do not short circuit the battery posts with metal objects. 4. Do not weld, grind, or smoke near a battery.**

**Failure to comply could result in death or serious injury.**

W0011A

### **⚠ WARNING**

**Avoid injury!**

**Shut off the engine, remove the key, and make sure all motion is stopped before servicing the machine.**

**Failure to comply could result in death or serious injury.**

W1128A

Items to prepare:

- Wrenches [ 8 mm, 13 mm, 14 mm, 17 mm, 19 mm]
- Rag
- Cleaning fluid

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## Glow plug system - Remove

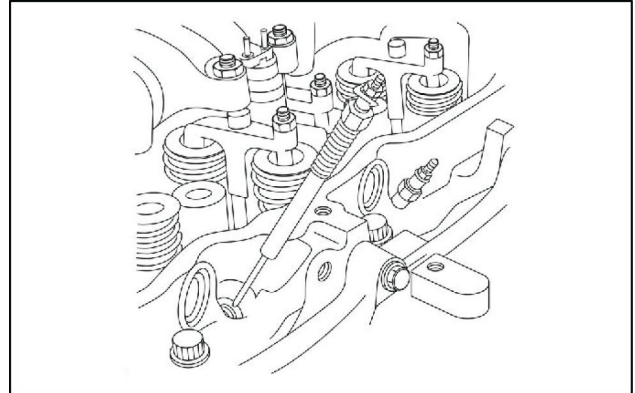
### Battery ground cable disconnect

1. Disengage the battery ground cable from the battery.

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

### Glow plug removal

1. Remove the glow plug connector from the glow plug.
2. Remove the glow plug from the cylinder head assembly.



SMIL13CEX0818AA 1

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## **Electronic modules - Install - Computer A**

1. To install, perform the reverse of the removal procedure.

## 1. Machine main unit

KEY-ON TIME	hour	Key ON time
ENGINE-RUN TIME	hour	Engine operation time
OPERATION TIME	hour	Operation time
UPPER OPERATION TIME	hour	Upper operation time
SWING OPERATION TIME	hour	Swing operation time
TRAVEL OPERATION TIME	hour	Travel operation time
INDEPENDENT TRAVEL TIME	hour	Independent travel operation time
Lo-SPEED TRAVEL TIME	hour	1 <sup>st</sup> speed travel operation time
Hi-SPEED TRAVEL TIME	hour	2 <sup>nd</sup> speed travel operation time

WORK HISTORY		1/7
KEY-ON TIME		hour
ENGINE-RUN TIME		hour
OPERATION TIME		hour
UPPER OPERATION TIME		hour
SWING OPERATION TIME		hour
TRAVEL OPERATION TIME		hour
INDEPENDENT TRAVEL TIME		hour
Lo-SPEED TRAVEL TIME		hour
Hi-SPEED TRAVEL TIME		hour

SMIL14CEX0468AA 20

## 2. Work mode

SP-MODE OPERATION TIME	hour	SP mode operation time
H-MODE OPERATION TIME	hour	H mode operation time
A-MODE OPERATION TIME	hour	A mode operation time
-	-	-
POWER-BOOST TIME	hour	Boosted pressure time
AUTO IDLE TIME	hour	Auto idle time
ONE-TOUCH-IDLE TIME	hour	One-touch idle time

WORK HISTORY		2/7
SP-MODE OPERATION TIME		hour
H-MODE OPERATION TIME		hour
A-MODE OPERATION TIME		hour
-	-	-
POWER-BOOST TIME		hour
Auto IDLE TIME		hour
One-Touch IDLE TIME		hour

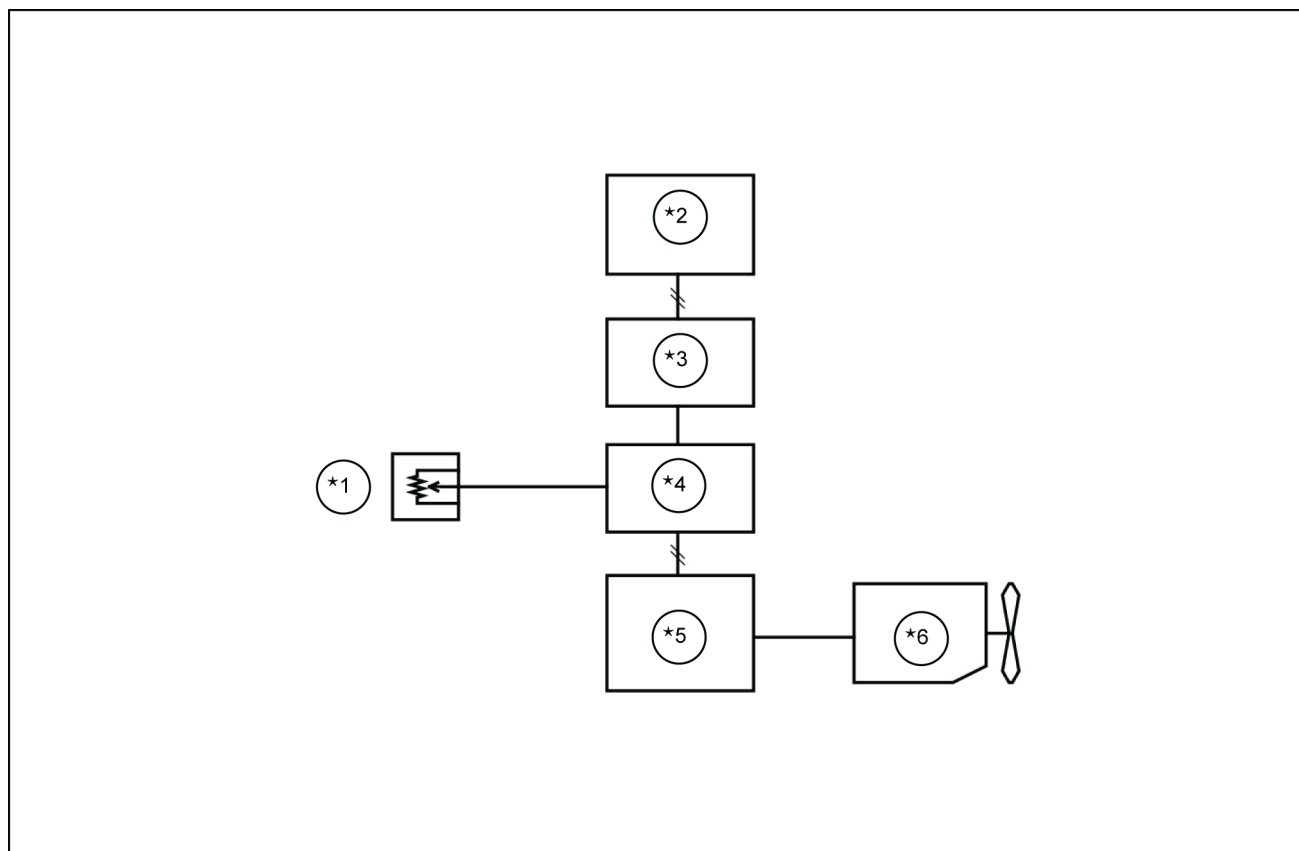
SMIL14CEX0469AA 21

## Instrument cluster - Static description - Throttle volume default setting

### Summary

Corrects the installation margin in the engine throttle switch.

### Configuration



LPIL12CX00468FC 1

- \*1. Engine throttle switch
- \*2. Monitor
- \*3. Computer B

- \*4. Computer A
- \*5. ECM
- \*6. ENG

### Operation explanation

1. Turn the key "ON" and select "Model Selection". (Refer to " **Instrument cluster - Static description - Model select (55.512)**")
2. Set all of the model selection items, set the engine throttle switch to H mode and confirm using the menu switch.
3. The system performs the initial adjustments to the engine throttle switch (\*1).
  - The adjustment results are stored even after the key is turned OFF.

### **Operation explanation**

- A. The operator operates the shovel.
- B. The system cancels the bucket control.

## Heating, Ventilation, and Air-Conditioning (HVAC) control system - Dynamic description

### Back-up function

Even when air-conditioner operation is stopped (switched OFF) with the vehicle main key power supply or operation panel ON/OFF switch, the set temperature and all the other setting states are stored in memory, so the next time air conditioner operation starts, it goes into the same state as before it was stopped.

When the vehicle main key power supply is cut off, the data is backed up by storing it in the internal EEPROM.

However, if the main key power supply is cut off within **0.5 s** of switch input, that switch input is not stored into memory.

Also, the data read out from EEPROM when the power is switched ON is judged to see if it is within the valid range. If data outside the valid range was written into memory, for example due to noise, then operation starts from the default setting values to avoid abnormal operation.

### Fahrenheit temperature display

To switch, hold down both the temperature setting UP and DOWN switches for **5 s**.

The display toggles between Celsius and Fahrenheit display each time the switches are both held down for **5 s**.

The Fahrenheit display is a 2-digit integer and below the decimal point is not used, so "F" is displayed.

However, in case of trouble, this display takes priority.

When this display is switched, the new status is backed up in memory, so even if the main key power supply is switched OFF, the display status is retained.

Internal calculations are all done in Celsius. Only the operation panel display is in Fahrenheit.

Therefore, the display may differ slightly from the exact Fahrenheit temperature.

### Air mix motor actuator control

#### 1. Summary explanation.

The provisional target degree of opening is determined from the target blow temperature and the current blow mode, various restrictions are applied, and the target degree of opening is calculated.

Then drive is output to move the motor actuator position to the target degree of opening. Below are the details.

#### 2. Heater unit hysteresis correction operation (motor actuator one-direction stop).

After the actuator moves to the target degree of opening, it returns to the specified position. However, if the target degree of opening is less than  $0^\circ$ , the actuator is treated as having reached the target degree of opening when it reaches  $0^\circ$ , then it moves to the specified position. (A stop in the fully-open direction is used as the reference.)

#### 3. Motor actuator operation priority order.

The operation priority for this motor actuator is No. 1.

This means that if the target degree of opening for this motor actuator changes and operation becomes necessary, even if some other motor actuator is operating, that other motor operation is paused, and this motor actuator operates.

#### 4. Motor actuator retry control.

Even when there are no changes to the target values after the target is attained, if the difference between the current value and the target value once every **5 min** is equal to or greater than the operation start angle, the motor actuator is operated.

### Blow mode motor actuator control

#### 1. Summary explanation.

The blow mode is switched by rotating the diffuser switching damper with the motor actuator. There are 2 types of control: auto and manual.

#### 2. Auto control.

# Contents

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## Electrical systems - 55

### Travel control system - 417

#### FUNCTIONAL DATA

Travel alarm	
Dynamic description .....	3

## Door link

When the room lamp switch is set to the DOOR position, the lamp lights when the door is open and goes out when the door is closed.

## Auto lamp off

In 2, in order to prevent the battery from being run down, the room lamp goes out **30 s** after the door is opened.

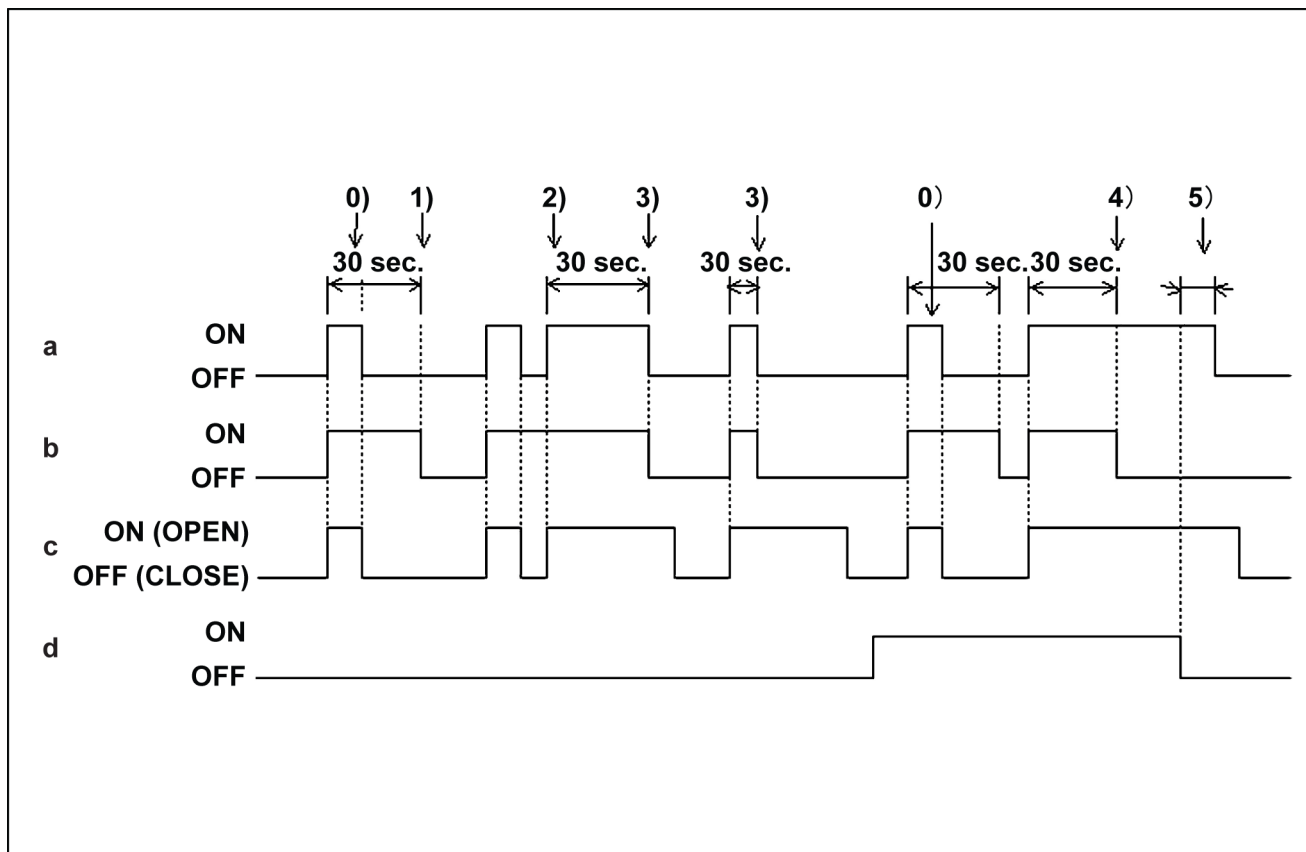
However, this function only works when the key switch is "OFF". If it is ACC or "ON", auto lamp off does not work. (Because even if the room lamp relay is "OFF", power is supplied from ACC.)

The only purpose of this auto lamp off function is to prevent the battery from being run down if the door is left open with the key "OFF".

## Time chart

The time chart shows how the function in 3 works.

The room lamp switch is set to DOOR.



SMIL14CEX0605FA 2

- |                    |                      |
|--------------------|----------------------|
| a. Room lamp       | c. Door limit switch |
| b. Room lamp relay | d. Key switch        |

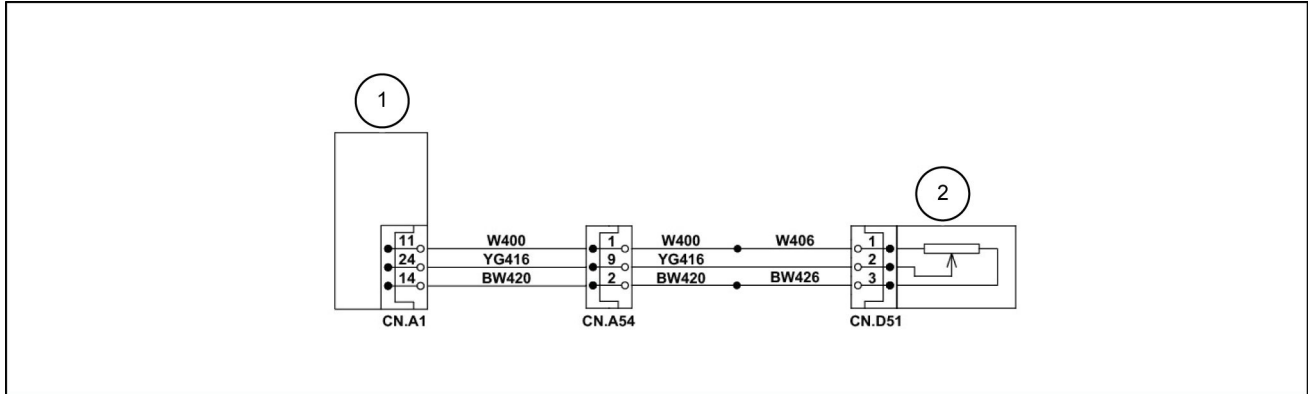
0. Door linked room lamp.
1. Even after the door is closed, the room lamp relay is "ON" for **30 s**.
2. **30 s** is counted from the last time the door was opened.
3. After **30 s**, the lamp goes off automatically.
4. Auto lamp off does not work if the key switch is "ON" or ACC.
5. When the key is switched "OFF", the lamp goes out. (after power-cut delay)

## 7022 - Travel pressure sensor signal abnormality

### Control Module: MCM

#### Solution:

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



LPIL12CX00891EB 1

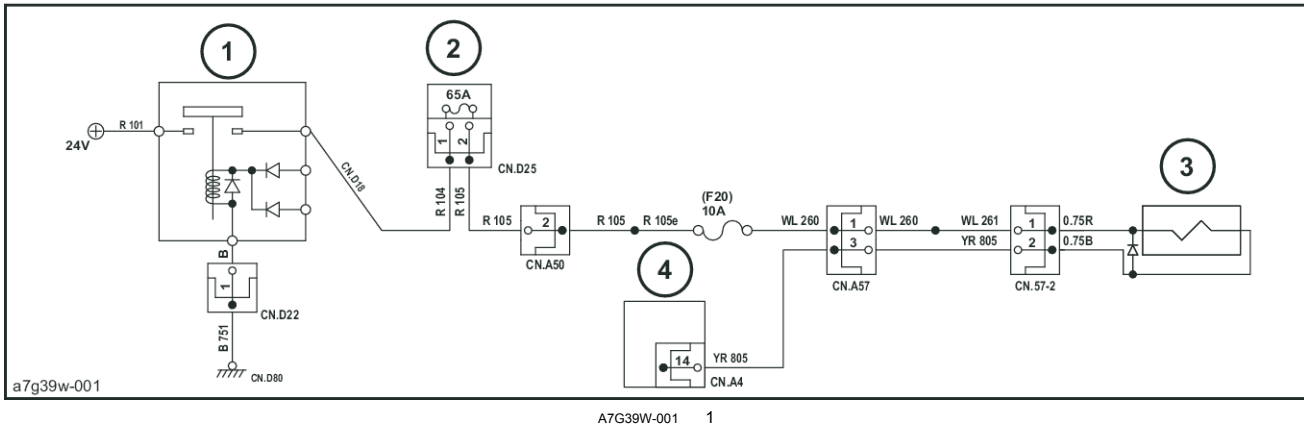
1. Computer A
2. Pilot travel pressure sensor  
Turn ON the key switch.  
Inspect the connection status of each connector. Make sure that all the connectors are secured.
  - A. If Diagnostic Trouble Code 7022 is displayed, proceed to Step 2.
2. Check the travel pressure sensor (2) voltage on the service support screen.
  - A. If the voltage is more than or equal to **4.75 V**, proceed to Step 3.
  - B. If the voltage is equal or lesser than **0.25 V**, proceed to Step 6.
3. Turn OFF the key switch and disconnect the travel pressure sensor connector **CN.D51**.  
Turn ON the key switch.  
Measure the voltage between the ground and terminal 1 of the travel pressure sensor connector **CN.D51** harness side.
  - A. If the voltage is not about **5 V**, find and replace the wire ID W400 or W406.
  - B. If the voltage is about **5 V**, proceed to Step 4
4. Measure the voltage between the ground and terminal 2 of the travel pressure sensor connector **CN.D51** harness side.
  - A. If the voltage is more than **4.75 V**, find and replace the wire ID YG416.
  - B. If the voltage is equal or lesser than **4.75 V**, proceed to Step 5.
5. Measure the voltage between the ground and terminal 3 of the travel pressure sensor connector **CN.D51** harness side.
  - A. If the voltage is more than **0.25 V**, find and replace the wire ID BW420 or BW426.
  - B. If the voltage is equal or lesser than **0.25 V**, replace computer A (1).
6. Turn OFF the key switch.  
Disconnect the travel pressure sensor connector **CN.D51**.

## 7246 - 2 pumps flow solenoid signal abnormality

### Control Module: MCM

#### Solution:

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



- |                           |                          |
|---------------------------|--------------------------|
| 1. Relay battery          | 3. 2 pumps flow solenoid |
| 2. Fusible link; fuse box | 4. Computer A            |

Turn ON the key switch.

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

Inspect the fusible link ( **65 A** ) fuse ( **2** ) and fuse box F20 ( **10 A** ) fuse to see if either is blown.

A. If diagnostic trouble code 7246 is displayed, proceed to Step **3**.

3. Turn OFF the key switch and disconnect the 2 pumps flow solenoid connector **CN.57-2**.

Measure the resistance between the terminals 1 and 2 of the 2 pumps flow solenoid connector **CN.57-2** solenoid side.

A. If the resistance is not within **34 – 47 Ω**, replace 2 pumps flow solenoid ( **3** ).

B. If the resistance is within **34 – 47 Ω**, proceed to Step **4**.

4. Turn ON the key switch.

Measure the voltage between the ground and terminal 2 of the 2 pumps flow solenoid connector **CN.57-2** harness side.

A. If the voltage is not **0 V**, find and replace the wire ID YR805.

B. If the voltage is **0 V**, proceed to Step **5**.

5. Turn OFF the key switch.

Inspect for continuity between the ground and terminal 1 of the 2 pumps flow solenoid connector **CN.57-2** harness side.

A. If there is no continuity, proceed to Step **6**.

B. If there is continuity, find and replace the wire ID WL260, WL261, R105e, R105, or R104.

6. Inspect for continuity between the ground and terminal 2 of the 2 pumps flow solenoid connector **CN.57-2** harness side.

A. If there is no continuity, find and repair or replace the open circuit on the wire ID YR805.

---

## **P0016 - Abnormally correlation between crankshaft position and camshaft position**

### **Control Module: ECM**

#### **Solution:**

1. Check the trouble code setting conditions before you proceed with the diagnostics code P0016.
  - Diagnostic trouble codes P0335, P0336, P0340, P0651 and P1655 are not detected.
  - Starter switch is ON.
  - The crankshaft position sensor signal pulse is detected.
  - The camshaft position sensor signal pulse is detected.
  - While the engine is running, the ECM detects that the crankshaft position sensor signal and camshaft position sensor signal are not synchronized.
2. Check and diagnose the below fault codes before you proceed with the diagnostics code P0016.
  - Diagnostic trouble code P0335
  - Diagnostic trouble code P0336
  - Diagnostic trouble code P0340
3. Inspect the crankshaft position sensor. (Refer to “ **Engine speed/RPM sensor - Inspect (55.015)**”)
  - A. If a problem is found, replace the crankshaft position sensor. (Refer to “ **Engine speed/RPM sensor - Remove (55.015)**” and “ **Engine speed/RPM sensor - Install (55.015)**”)
  - B. If there are no problems, proceed to Step 4.
4. Inspect the camshaft position sensor. (Refer to “ **Engine timing sensors - Inspect (55.015)**”)
  - A. If a problem is found, replace the camshaft position sensor. (Refer to “ **Engine timing sensors Camshaft sensor - Remove (55.015)**” and “ **Engine timing sensors Camshaft sensor - Install (55.015)**”)
  - B. If there are no problems, proceed to Step 5.
5. Inspect the flywheel.
  - Make sure that the flywheel is no damaged.
  - Make sure that the flywheel is installed correctly.
    - A. If a problem is found, repair the flywheel.
    - B. If there are no problems, proceed to Step 6.
6. Inspect the camshaft gear.
  - Make sure that the camshaft gear is no damaged.
  - Make sure that the camshaft gear is installed correctly.
    - A. If a problem is found, repair the camshaft gear.
7. Confirm resolution:
  1. Display RESET on the service support screen on the monitor and reset FAULT HISTORY. See "Service Support - RESET Screen List".
    - NOTE:** All the generated Diagnostic Trouble Codes will be cleared.
  2. Turn OFF the starter switch and keep it OFF for **1 min** or longer.
  3. Start the engine.

## P0219 - Engine overspeed condition

### Control Module: ECM

#### Solution:

1. Check the trouble code setting conditions before you proceed with the diagnostics code P0219.

- The ECM detects that the engine speed exceeded the specified speed for **5 s**.

2. Check and diagnose the below fault codes before you proceed with the diagnostics code P0219.

Diagnostic trouble code P0335

Diagnostic trouble code P0336

3. Turn OFF the starter switch and keep it OFF for **1 min** or longer.

Start the engine.

Check the engine speed indicated in MACHINE STATUS on the service support screen on the monitor.  
See "Service Support - MACHINE STATUS".

Increase the engine speed as necessary.

Check the engine speed indicated in MACHINE STATUS on the service support screen on the monitor.  
See "Service Support - MACHINE STATUS".

A. If it does not exceed the no-load maximum speed, proceed to Step **4**.

B. If it exceed the no-load maximum speed, proceed to Step **5**.

4. Check with operator if there was an operating mistake that was caused by an overrun.

A. If there has been an engine overrun in the past, be sure to inspect the engine.

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

5. Inspect the crankshaft position sensor. (Refer to "**Engine speed/RPM sensor - Inspect (55.015)**")

A. If there is an abnormality in the inspection result, replace the crankshaft position sensor. (Refer to "**Engine speed/RPM sensor - Remove (55.015)**" and "**Engine speed/RPM sensor - Install (55.015)**").

6. Confirm resolution:

1. Display RESET on the service support screen on the monitor and reset FAULTY HISTORY. See "Service Support - RESET Screen List".

**NOTE:** All the generated Diagnostic Trouble Codes will be cleared.

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

3. Start the engine and raise the engine speed between idle and no-load maximum speed while checking the engine speed indicated in MACHINE STATUS on the service support screen on the monitor. See "Service Support - MACHINE STATUS".

4. Check that the indicated speed does not exceed the no-load maximum speed.

5. Display FAULTY HISTORY on the service support screen on the monitor and check that no Diagnostic Trouble Code has been detected. See "Service Support - FAULTY HISTORY".

## **P060B - Internal control module A/D processing performance**

### **Control Module: ECM**

#### **Solution:**

1. Check the trouble code setting conditions before you proceed with the diagnostics code P060B.
  - The ECM detects an internal A/D converter abnormality.
2. Replace the ECM. (Refer to “ **Engine Control Unit (ECU) - Remove (55.015)**” and “ **Engine Control Unit (ECU) - Install (55.015)**”).  
Set the injector ID code and the engine serial number on the ECM.
3. Confirm resolution:
  1. Display RESET on the service support screen on the monitor and reset FAULTY HISTORY. See "Service Support - RESET Screen List".  
***NOTE:** All the generated Diagnostic Trouble Codes will be cleared.*
  2. Turn OFF the starter switch and keep it 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. Display FAULTY HISTORY on the service support screen on the monitor and check that no Diagnostic Trouble Code has been detected. See "Service Support - FAULTY HISTORY".  
Conditions for setting the Diagnostic Trouble Codes such as engine run time or coolant temperature, etc., vary depending on the Diagnostic Trouble Codes.

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## P20DE - Fuel filter clog error (first stage)

### Control Module: ECM

#### Solution:

1. Check the trouble code setting conditions before you proceed with the diagnostics code P20DE.

- Diagnostic trouble codes P0182, P0183, P20DF, P20E0 are not detected.
- Fuel temperature is **5.0 °C (41.0 °F)** or higher.
- At least **3 min** passed after engine start.
- When the fuel filter clog sensor pressure is below **-30.0 kPa (-4.4 psi)** for **60 s** or longer.

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

Diagnostic trouble code P20E0

**NOTE:** *This Diagnostic Trouble Code is set when the fuel filter is clogged.*

3. Replace the fuel filter. (Refer to "**Fuel filters - Remove (10.206)**" and "**Fuel filters - Install (10.206)**").

Turn ON the starter switch.

Display RESET on the service support screen on the monitor and reset FAULTY HISTORY. See "Service Support - RESET Screen List".

**NOTE:** *All the generated Diagnostic Trouble Codes will be cleared.*

Turn OFF the starter switch and keep it OFF for **1 min** or more.

Start the engine.

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.*

Check for Diagnostic Trouble Codes on the monitor screen. (Refer to "**Instrument cluster - Dynamic description - Diagnostic trouble code indicator (55.512)**")

Inspect for clogging, twisting, and bending in the fuel pipe between the fuel tank and the fuel filter.

A. If a problem is found, repair or replace the fuel pipe.

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

4. Turn OFF the starter switch.

Disconnect the harness connector from the fuel filter pressure sensor.

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 there are no problems, proceed to Step 5 .

5. Disconnect the harness connector **CN.D1-02** from the ECM.

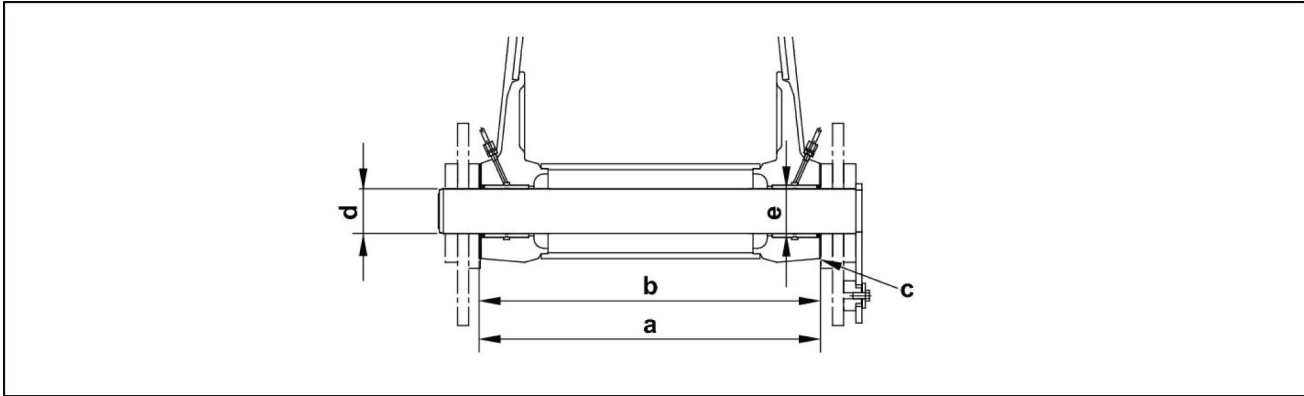
Inspect for a contact defect in the ECM harness connector **CN.D1-02**.

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

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

6. Inspect for high resistance in the circuits between the ECM and fuel filter pressure sensor.

## 1. Boom and swing frame installation section



SMIL13CEX1304EA 2

Part name	Code	Standard value	Usage limits	Judgment	Solution
Swing frame	a	685 mm (26.969 in)	693 mm (27.283 in)	Acceptable/ Unacceptable	-
Boom	b	681.5 mm (26.831 in)	679.5 mm (26.752 in)	Acceptable/ Unacceptable	Replacement
Clearance	c	0.5 – 2.5 mm (0.020 – 0.098 in)	Shim adjustment	Acceptable/ Unacceptable	Adjustment with shims
Pin	d	Ø90 mm (3.543 in)	Ø89 mm (3.504 in)	Acceptable/ Unacceptable	Replacement
Bushing (boom)	e	Ø90 mm (3.543 in)	Ø91.5 mm (3.602 in)	Acceptable/ Unacceptable	Replacement

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\*3. Adhesive application locations

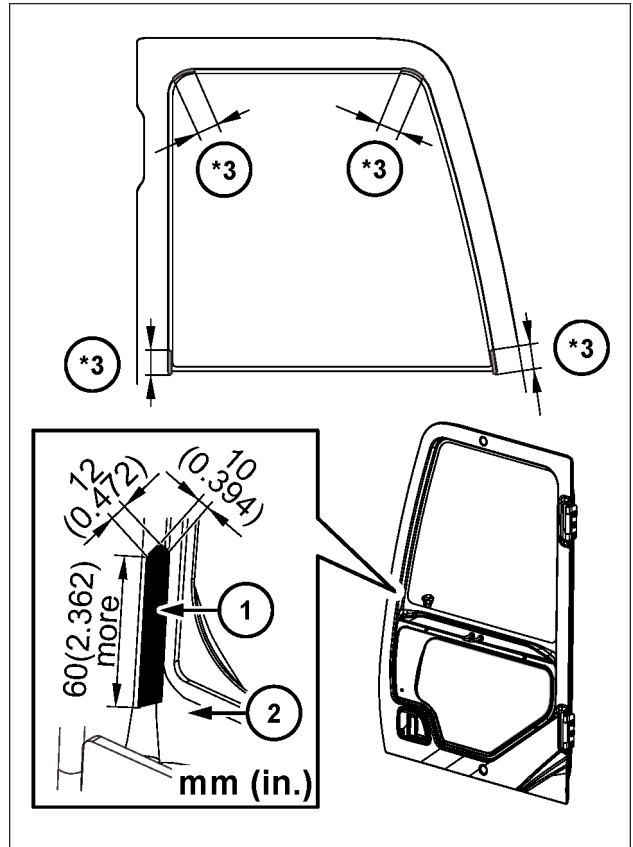
1. Adhesive
2. Door

3. Affix the spacers (3) and (4) at the locations shown in the figure.

3. Spacer (Small)
4. Spacer (Large)

4. Adhere the sash to the door.

**NOTICE:** Adhere the sash to the door in a period of **5 min** or less from starting to apply the adhesive. If not done so, drying of the surface, weakening of adhesion strength, or failure to adhere may occur.

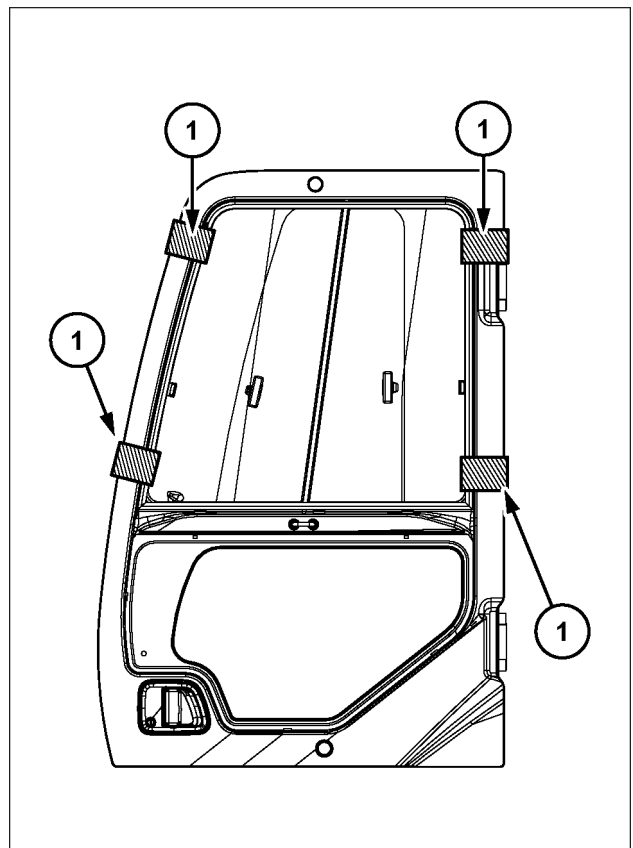


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5. After installing the sash, place the sash glass at the center and use the packing tape at 4 places to affix the sash frame to the door.

**NOTICE:** Keep the sash frame affixed for **60 min** or more.

1. Affixing location of the packing tape



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