WENBM00350

Shop Manual

BACKHOE LOADER **WB97S-8E0**

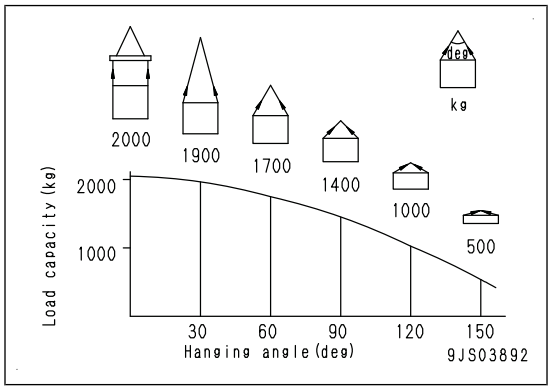
SERIAL NUMBERS WB97S-8E0 F45003 and up

KOMATSU

- When slinging a heavy load (25 kg or heavier), the hanging angle of the rope must be narrower than that of the hook.

REMARK

When slinging a load with 2 or more ropes, the force subjected to each rope increases with the hanging angle. The figure below shows the variation of allowable load in kN {kg} when slinging is made with 2 ropes, each of which is allowed to sling up to 9.8 kN {1000 kgf} vertically, at various hanging angles. When the 2 ropes sling a load vertically, they can sling up to 2000 kg of total weight. This weight is reduced to 1000 kg when the 2 ropes make a hanging angle of 120 °. If the 2 ropes sling a 2000 kg load at a hanging angle of 150 °, each rope is subjected to a force as large as 39.2 kN {4000kgf} .



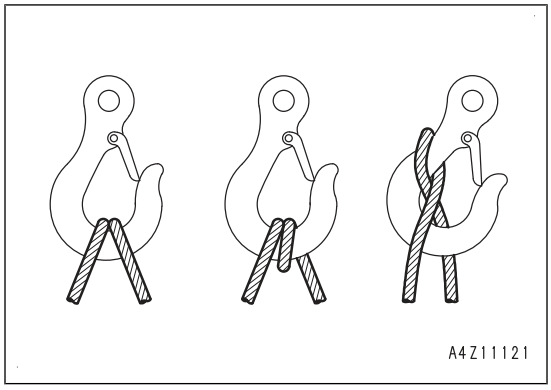
- When installing wire ropes to an angular load, apply pads to protect the wire ropes. If the load is slippery, apply proper material to prevent the wire rope from slipping.
- Use the specified eye bolts and fix wire ropes, chains, etc. to them with shackles, etc.
- Apply wire ropes to the middle part of the hook.

⚠ Do not use hooks if it does not have a latch system.

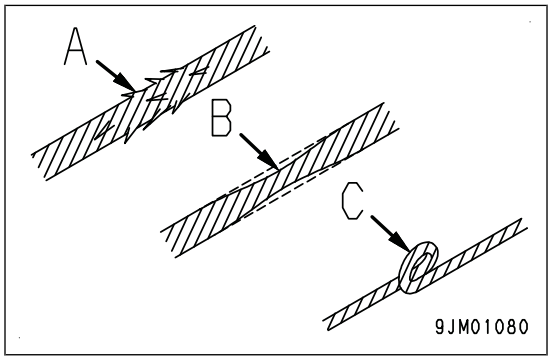
⚠ Slinging near the tip of the hook may cause the rope to slip off the hook during hoisting.

REMARK

The strength of the hook is maximum at its central part.



- Never use a wire rope which has breaks in strands (A), reduced diameter (B), or kinks (C). There is a danger that the rope may break during the towing operation.



Precautions for slinging up

- Wind in the crane slowly until wire ropes are stretched. When settling the wire ropes with the hand, do not grasp them but press them from above. If you grasp them, your fingers may be caught.
- After the wire ropes are stretched, stop the crane and check the condition of the slung load, wire ropes, and pads.
- If the load is unstable or the wire rope or chains are twisted, lower the load and lift it up again.
- Do not lift up the load at an angle.

Precautions for slinging down

- When slinging down a load, stop it temporarily at 30 cm above the floor, and then lower it slowly.
- Check that the load is stable, and then remove the sling.
- Remove kinks and dirt from the wire ropes and chains used for the sling work, and put them in the specified place.

Precautions for using mobile crane

REMARK

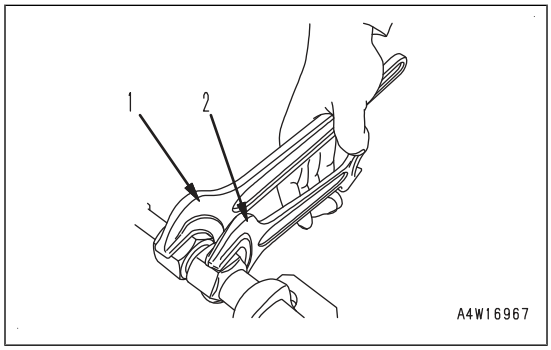
Read Operation and Maintenance Manual of the crane carefully in advance and operate the crane safely.

PRECAUTIONS FOR DISCONNECTION AND CONNECTION OF PIPINGS

When performing “testing and adjusting” of the machine, “removal and installation” and “disassembly and assembly” of the components, observe the following precautions.

Precautions for removal and disassembling work

- If the cooling water contains coolant, dispose of it correctly as chemicals. Do not drain it to the sewage rashly.
- After disconnecting the hoses or tubes, plug them to prevent dust from entering.
- When draining oil, prepare a container with sufficient capacity.
- Check the matchmarks which indicate the installing position, and put matchmarks on the places where they seem necessary before removal of the components to prevent any mistake when assembling.
- To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors. Do not pull the wires.
- Attach the tags to wires and hoses so that installation is done to the correct installing positions.
- Check the thickness and number of shims when storing shims.
- When hoisting the components, prepare the slings with sufficient strength.
- When using forcing screws to remove any component, tighten the forcing screws uniformly and alternately.
- Before removing any component, clean the surrounding area and cover the component to prevent any foreign material from entering after removal.
- To disconnect the face seal type hose from the cylinder tube, loosen the joint by gripping the two wrenches together, one is the wrench (1) on the hose side, and another is the wrench (2) on the cylinder tube reaction force point as shown in the following figure. Use the grip strength only.Check after disconnecting the hose that the joint portion of the cylinder and the cylinder tube is tightened to the specified torque. Re-tighten it if the tightening torque is insufficient.



NOTICE

Cylinder tube is rotated due to the load applied to the reaction force point of the cylinder tube, and it is a cause of weakening of the tightening torque. It may lead to oil leakage.

- After disconnecting the piping or removing a pipe joint, install the following plugs.

NOTICE

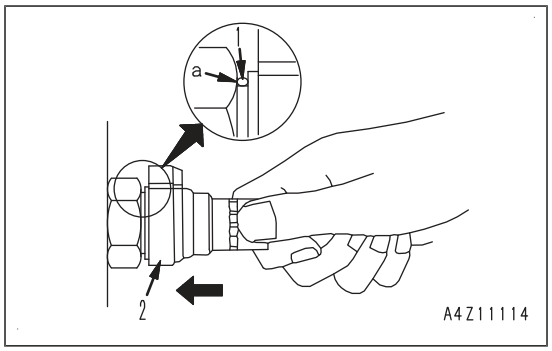
When disassembling the machine, check the part number by referring to the Parts Book and use the appropriate parts according to the usage conditions.

REMARK

The part numbers of O-ring shown in the table indicate the temporary part number when disassembling and transporting the machine.

Connection

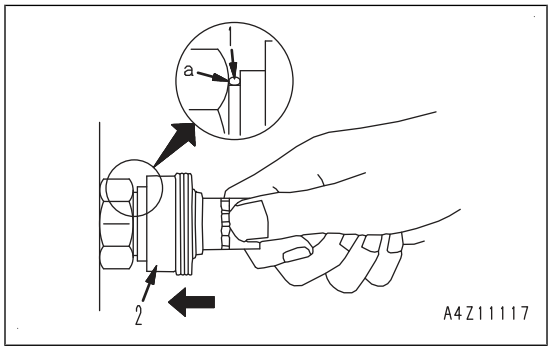
Hold the tightening adapter part, and push body (2) straight until sliding prevention ring (1) contacts contact surface (a) of the hexagonal part at the male end.



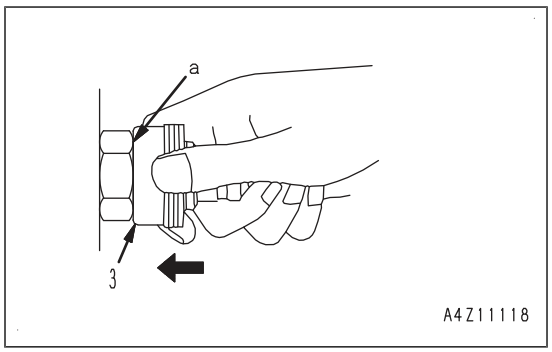
METHOD FOR DISCONNECTING AND CONNECTING TYPE 3 PUSH-PULL TYPE COUPLER

Disconnection

1. Hold the tightening adapter part and push body (2) straight until sliding prevention ring (1) contacts contact surface (a) of the hexagonal part at the male end.



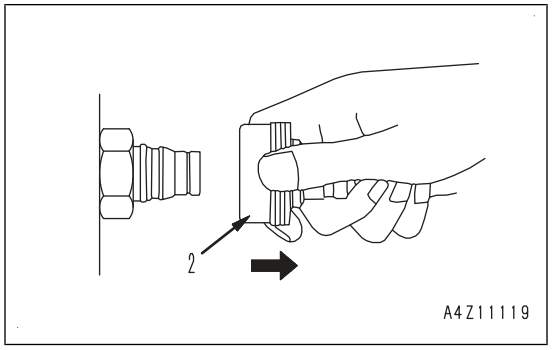
2. While keeping the condition of step 1, push cover (3) straight until it contacts contact surface (a) of the hexagonal portion on the male side.



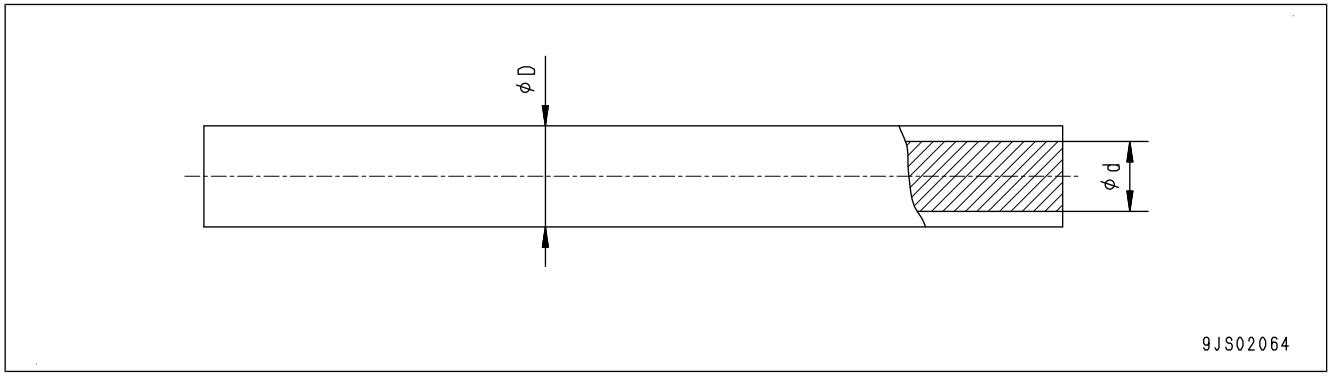
3. While keeping the conditions of steps 1 and 2, pull out whole body (2) to disconnect it.

   REMARK

   Provide an container to receive a quantity of hydraulic oil which may flow out.



Dimensions



(Table 2)

Nominal No.			0.5f	(0.5)	0.75f	(0.85)	1.25f	(1.25)	2f	2	3f	3	5
Conductor		Number of strands	20	7	30	11	50	16	37	26	58	41	65
		Diameter of strand	0.18	0.32	0.18	0.32	0.18	0.32	0.26	0.32	0.26	0.32	0.32
		Cross-sectional area (mm^2)	0.51	0.56	0.76	0.88	1.27	1.29	1.96	2.09	3.08	3.30	5.23
		d (approx.)	1.0		1.2		1.5		1.9	1.9	2.3	2.4	3.0
Coating D	AVS	Standard	2.0		2.2		2.5		2.9	2.9	3.5	3.6	-
	AV	Standard	-		-		-		-	-	-	-	4.6
	AEX	Standard	2.0		2.2		2.7		3.0	3.1	-	3.8	4.6

Nominal No.			8	15	20	30	40	50	60	85	100
Conductor		Number of strands	50	84	41	70	85	108	127	169	217
		Diameter of strand	0.45	0.45	0.80	0.80	0.80	0.80	0.80	0.80	0.80
		Cross-sectional area (mm^2)	7.95	13.36	20.61	35.19	42.73	54.29	63.84	84.96	109.1
		d (approx.)	3.7	4.8	6.0	8.0	8.6	9.8	10.4	12.0	13.6
Coating D	AVS	Standard	-	-	-	-	-	-	-	-	-
	AV	Standard	5.5	7.0	8.2	10.8	11.4	13.0	13.6	16.0	17.6
	AEX	Standard	5.3	7.0	8.2	10.8	11.4	13.0	13.6	16.0	17.6

Nominal No.		0.5f	0.5	0.75f	0.85	1.25f	1.25
Conductor	Number of strands	-	7	-	11	-	16
	Diameter of strand	-	round compression	-	round compression		round compression
	Cross-sectional area (mm^2)	-	0.56	-	0.88	-	1.29
	d (approx.)	-	0.9	-	1.1	-	1.4

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.847	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

kg to lb

1 kg = 2.2046 lb

	0	1	2	3	4	5	6	7	8	9
0	0	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

ℓ to U.S.Gal

1 ℓ = 0.2642 U.S.Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.264	0.528	0.793	1.057	1.321	1.585	1.849	2.113	2.378
10	2.642	2.906	3.170	3.434	3.698	3.963	4.227	4.491	4.755	5.019
20	5.283	5.548	5.812	6.076	6.340	6.604	6.869	7.133	7.397	7.661
30	7.925	8.189	8.454	8.718	8.982	9.246	9.510	9.774	10.039	10.303
40	10.567	10.831	11.095	11.359	11.624	11.888	12.152	12.416	12.680	12.944
50	13.209	13.473	13.737	14.001	14.265	14.529	14.795	15.058	15.322	15.586
60	15.850	16.115	16.379	16.643	16.907	17.171	17.435	17.700	17.964	18.228
70	18.492	18.756	19.020	19.285	19.549	19.813	20.077	20.341	20.605	20.870
80	21.134	21.398	21.662	21.926	22.190	22.455	22.719	22.983	23.247	23.511
90	23.775	24.040	24.304	24.568	24.832	25.096	25.361	25.625	25.889	26.153

ℓ to U.K.Gal

1 ℓ = 0.21997 U.K.Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.950	4.179
20	4.399	4.619	4.839	5.059	5.279	5.499	5.719	5.939	6.159	6.379

Unit: kg

Item	WB97S-8
Control valve (11-spool)	47.5
Backhoe telescopic arm	472
Outriggers	39x2
Boom cylinder	87.5
Arm cylinder	67
Bucket cylinder	52.5
Outrigger cylinder	27.5x2
Swing cylinder	34x2

- The Inducement strategy progresses in 3 levels from Warning, Low-Level Inducement, and Severe Inducement.
- Up to the start of Severe Inducement the start of each warning step is triggered by the amount of DEF in the DEF tank.
- The Inducement strategy status can be checked on “Aftertreatment system” screen of the user menu.
- The table shows warning indications and engine power derations by each Inducement strategy status.

Status		DEF level (*1) (DEF level gauge)	Machine monitor				Engine deration (*3)
			Message of Aftertreatment system	DEF level caution lamp (Action level)	Tone of audible alert	Activated failure code (*2)	
1	Warning	< 10%	1: DEF low level warning appears.	Red  APP14419	No sound	#T0215	No deration
2	Low-Level Inducement (Inducement 1)	< 5%	2: Engine power is under deration.	Red  APP14419 Red  APP14414	Intermittently	#T0419	65% Torque reduction 60% engine speed ramped in within 40 minutes
3	Severe Inducement (Inducement 2)	0% (No suction of DEF possible)	3: Engine is running at low idle	Red  APP14419 Red  APP14413	Continuously	#T0441	Torque: 100% Machine idle 50% Engine commanded to Low idle within 30 Minutes

*1: It is shown the value of Monitoring ID 19110: “DEF Level”.

*2: These failure codes are displayed on “Current Abnormality” in the operator mode, or “Abnormality Record” in the service mode.

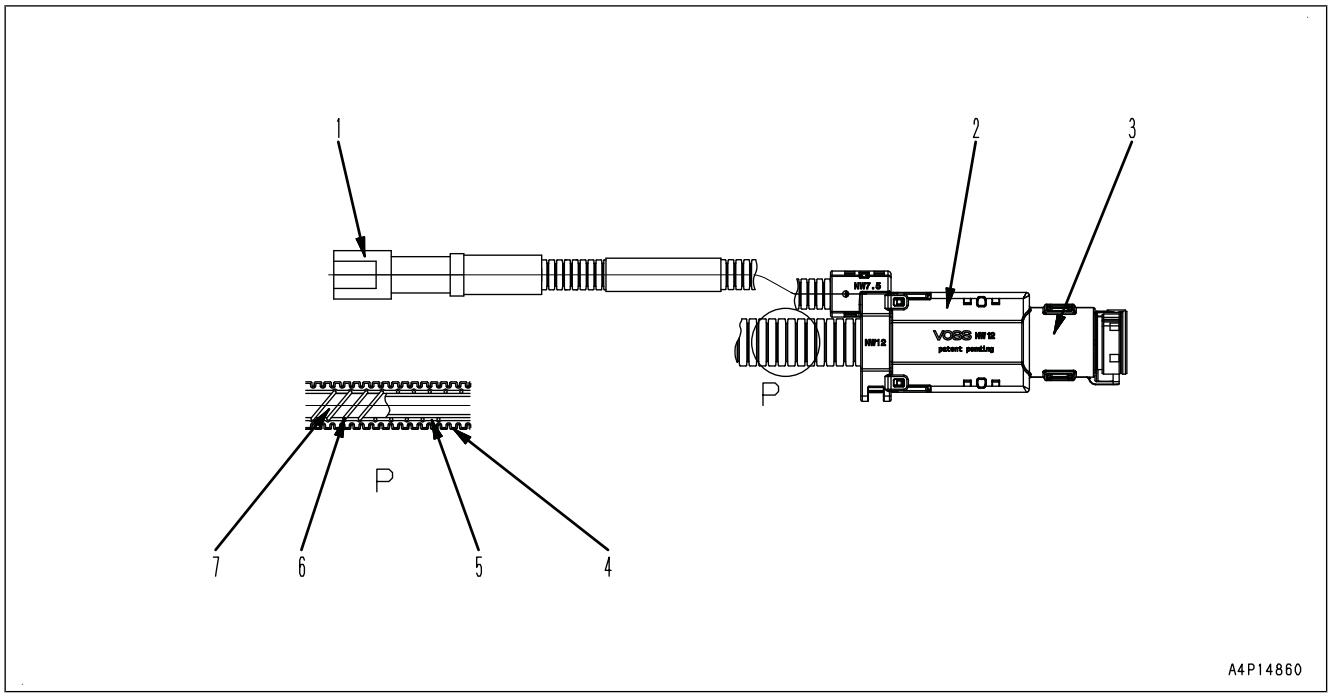
*3: These percentages show a torque reduction ratio from the full torque curve, and a speed reduction ratio from the rated speed.

INDUCEMENT STRATEGY WHEN ABNORMALITY IS FOUND IN THE DEF QUALITY OR IN THE UREA SCR SYSTEM DEVICES

- DEF system caution lamp lights up on machine monitor, and an action level is displayed when an abnormality occurs in quality in DEF or in urea SCR system. In addition to the caution by the DEF system caution lamp, alarm sounds as time passes after the abnormality occurred. Then, inducement strategy starts so that the engine output is lowered.
- The Inducement strategy status and the categories of abnormalities can be checked on the “Aftertreatment System” screen of the machine monitor.
- The table shows warning indications and engine power derations by each Inducement strategy status.

DEF HOSE

STRUCTURE OF DEF HOSE



1: Connector
2: Housing
3: Coupling
4: Corrugated tube
5: Insulation tape
6: Heating wire
7: Nylon tube

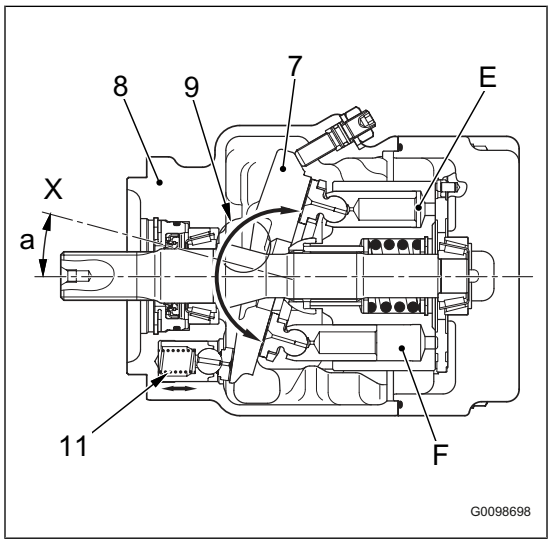
- It is used as DEF piping between DEF tank and DEF pump or between DEF pump and DEF injector.
- The shape of the engaging portion between DEF tank and DEF pump or DEF injector pin is based on 3/8 inches or 5/16 inches of SAE J2044. It can be disconnected or connected with one touch.
- There are 2 types of hose end shape such as straight shape and 90 deg. elbow shape.
- There are 2 types of nylon tubes of its outside diameter 5 mm and 8 mm. Choose the suitable one according to the model and the part to use.

FUNCTION OF DEF HOSE

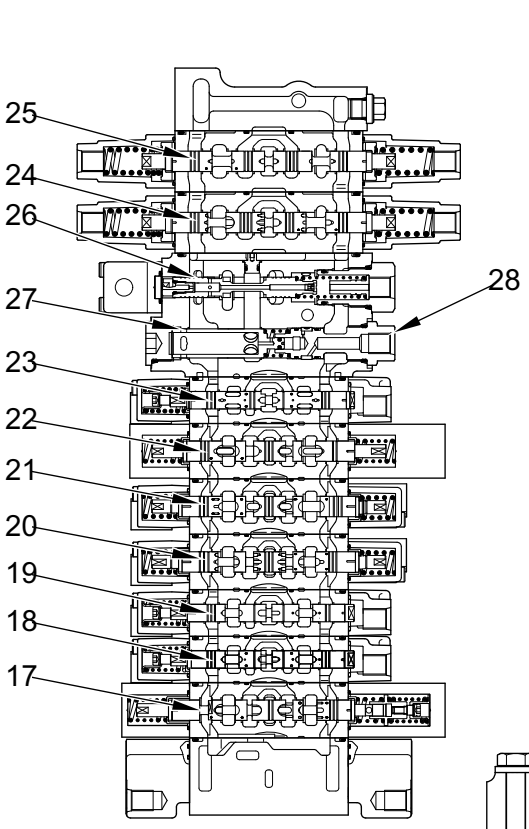
- In the cold weather, the specified current flows in the heating wire immediately after the engine is started. It heats nylon tube and thaws DEF which has frozen in the nylon tube while machine is stopped.
- It also keeps temperature to prevent DEF from freezing again while machine is operated.

Control of discharge amount

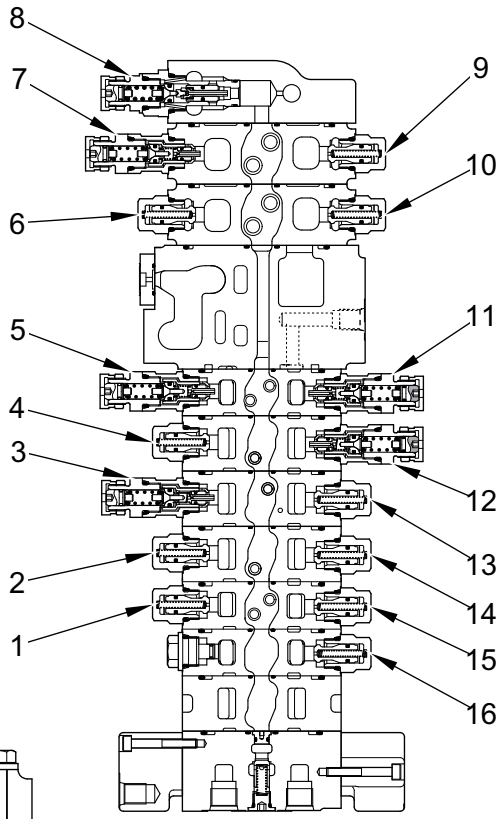
- If swash plate angle is increased, the difference between volumes (E) and (F) is increased, and so discharge (Q) is increased. Swash plate angle a is changed with servo piston (11).
- Servo piston (11) reciprocates straight according to the signal pressure of the servo valve. This straight motion is transmitted to swash plate (7). Then, swash plate (7) supported on ball (9) slides around ball (9).



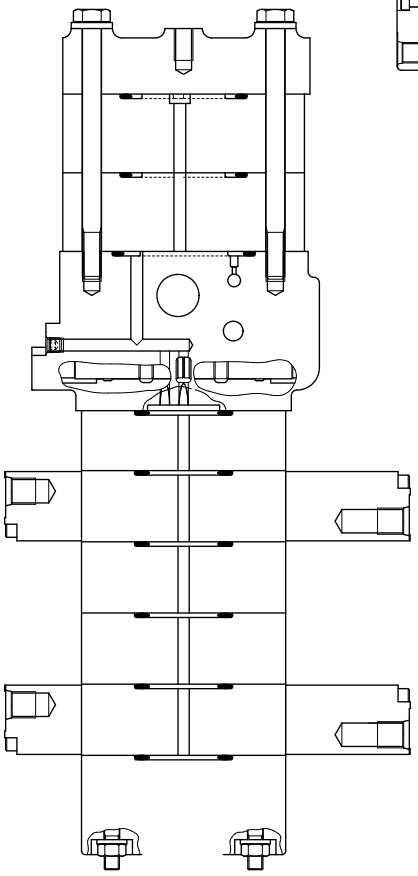
Sectional view (1 / 4)



B - B



A - A



AE - AE

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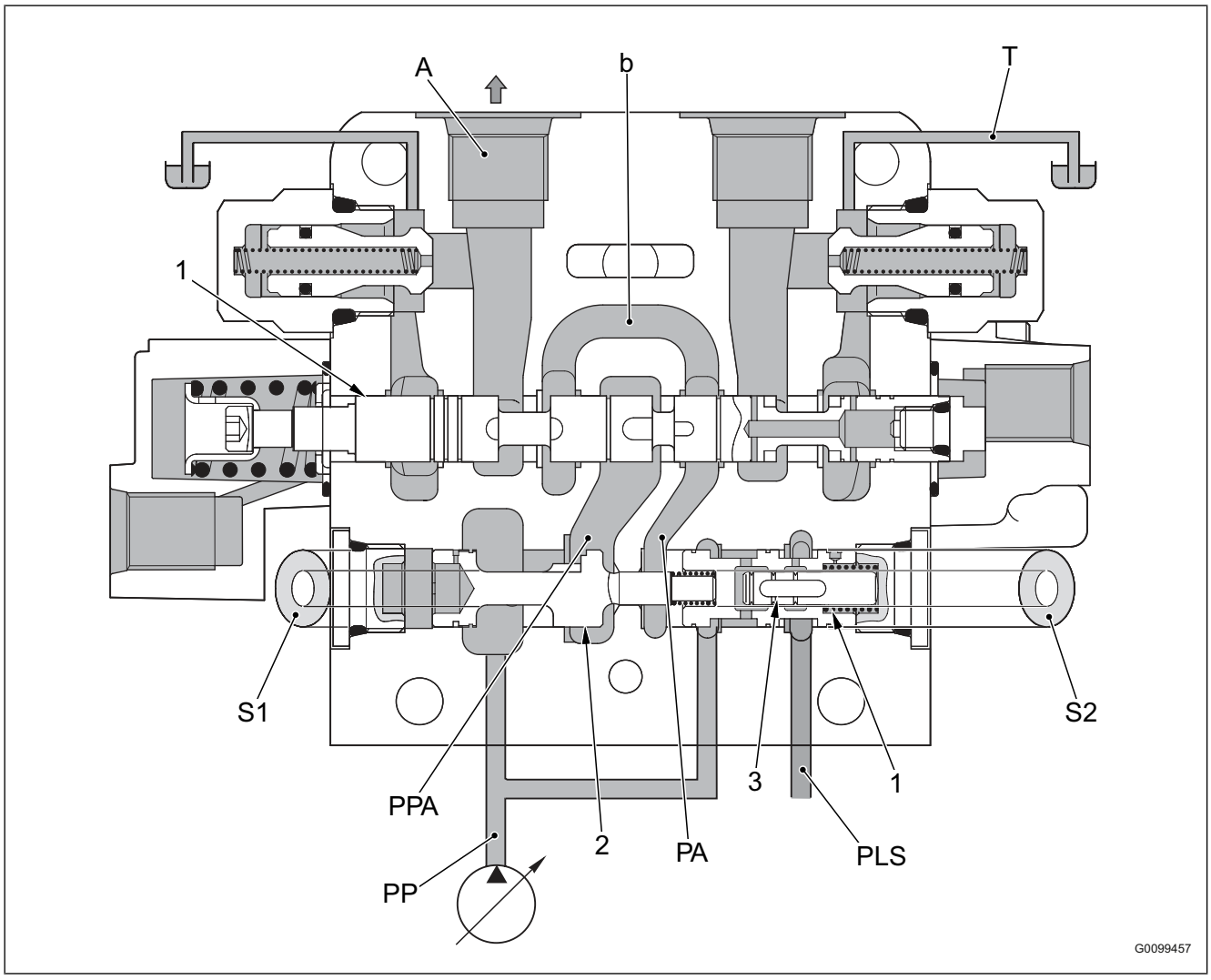
SURFACE AREA RATIO OF PRESSURE COMPENSATION VALVE OF CONTROL VALVE

FUNCTION OF SURFACE AREA RATIO OF PRESSURE COMPENSATION VALVE OF CONTROL VALVE



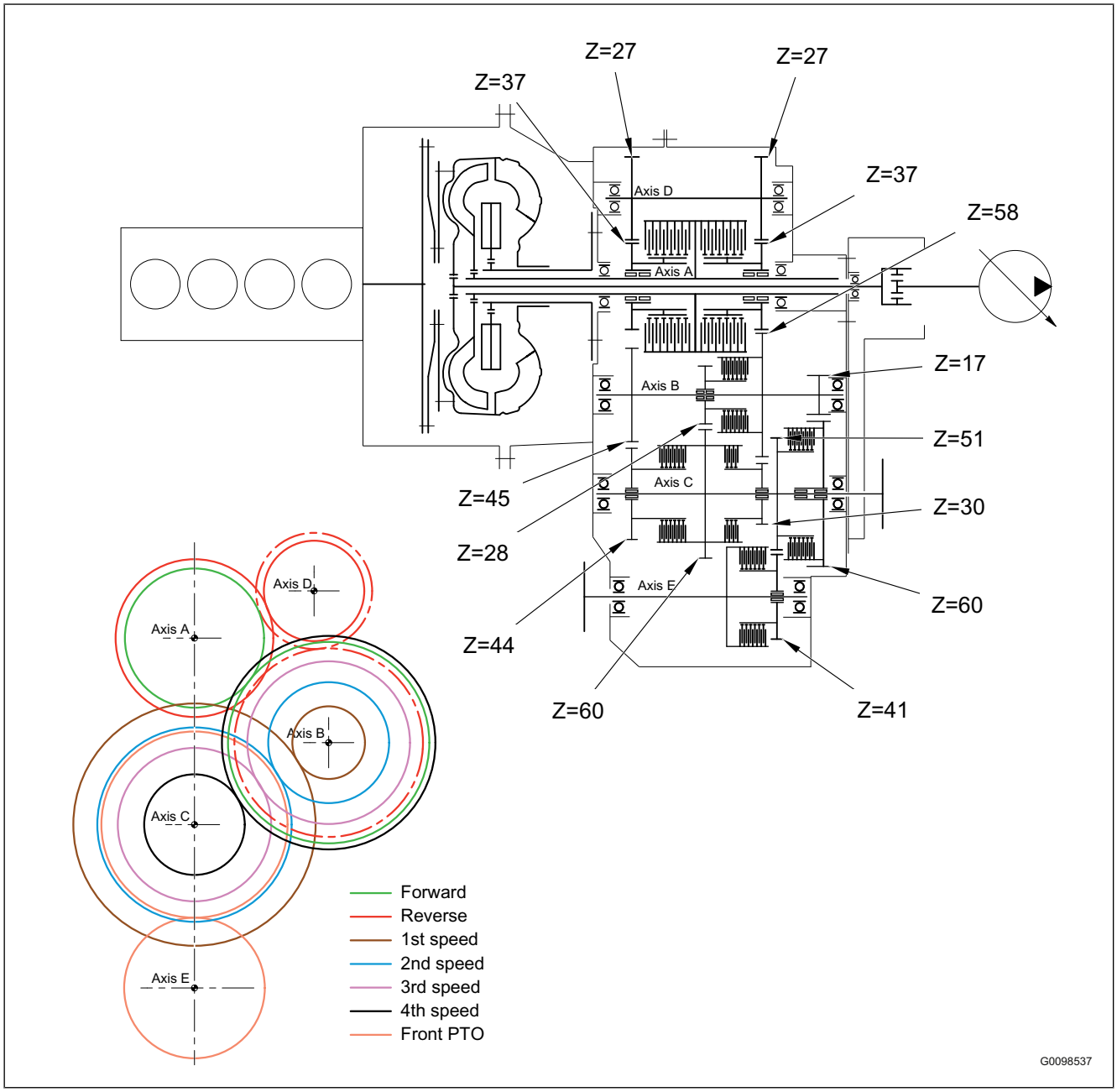
Function

- The pressure compensation valve determines the compensation characteristics by carrying out fine adjustment of the area ratio (S2/S1) between (left) area S1 of flow control valve (2) and (right) area S2 of reducing valve (1) to match the characteristics of each actuator.
  S1: Area of flow control valve (2) - area of piston (3).
  S2: Area of reducing valve (1) - area of piston (3).

Area ratio (S1:S2) and compensation characteristics

- When ratio is 1.00:
  PP - PPB = PLS - PA (= A)] and oil flow is divided in proportion to area of opening of spool.
- When ratio is more than 1.00
  PP - PPB > PLS - PA (= A) and oil flow is divided in a proportion less than area of opening of spool.
- When ratio is less than 1.00
  PP - PPB < PLS - PA (= A) and oil flow is divided in a proportion more than area of opening of spool.

(2 / 2)


Z=27
Z=27
Z=37
Z=37
Z=58
Axis D
Axis A
Z=17
Axis B
Z=51
Z=45
Axis C
Z=30
Z=28
Axis E
Z=60
Z=44
Z=60
Z=41
Axis D
Axis A
Axis B
Axis C
Axis E
Forward
Reverse
1st speed
2nd speed
3rd speed
4th speed
Front PTO
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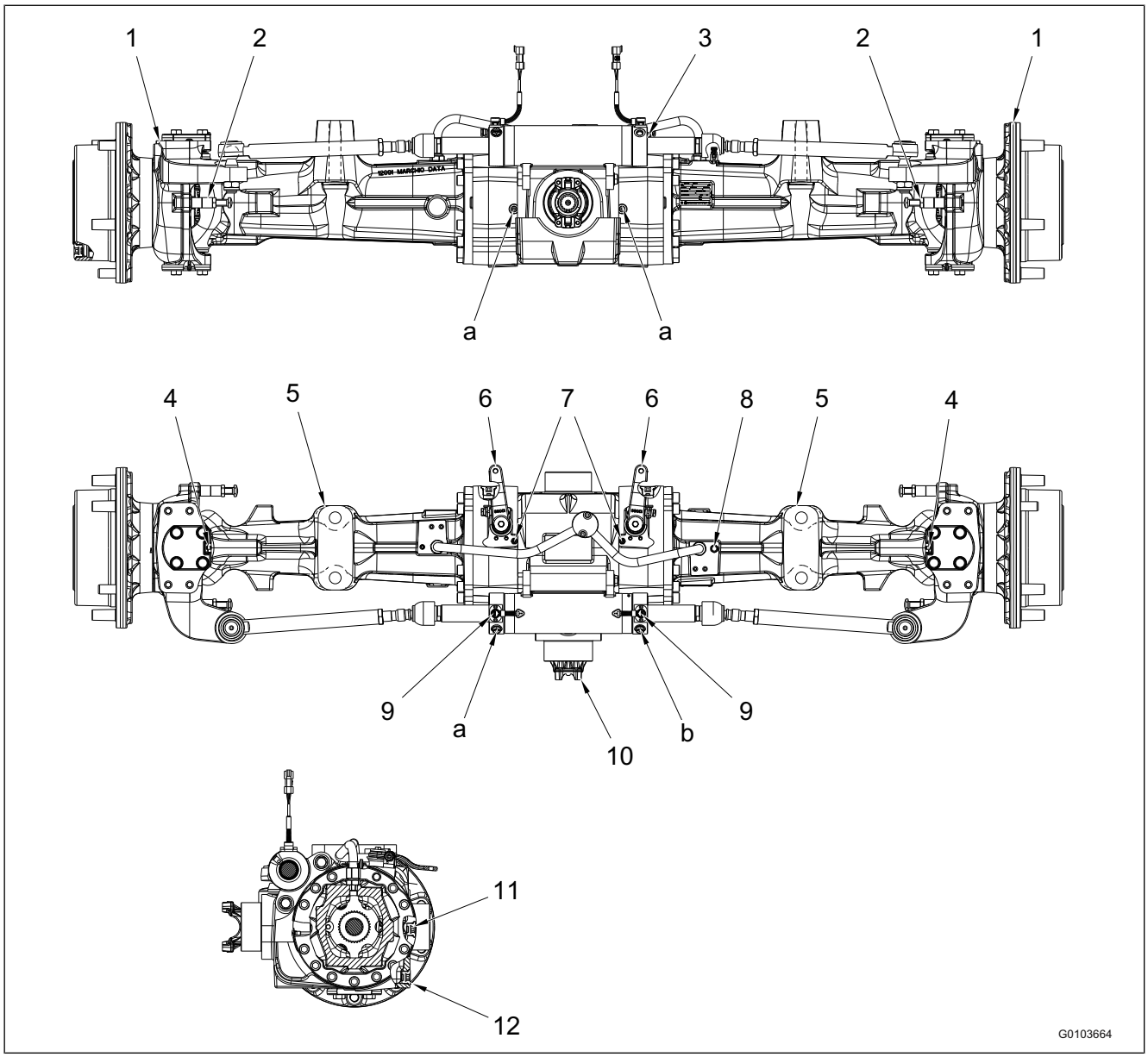
AXLE

STRUCTURE OF REAR AXLE

General view

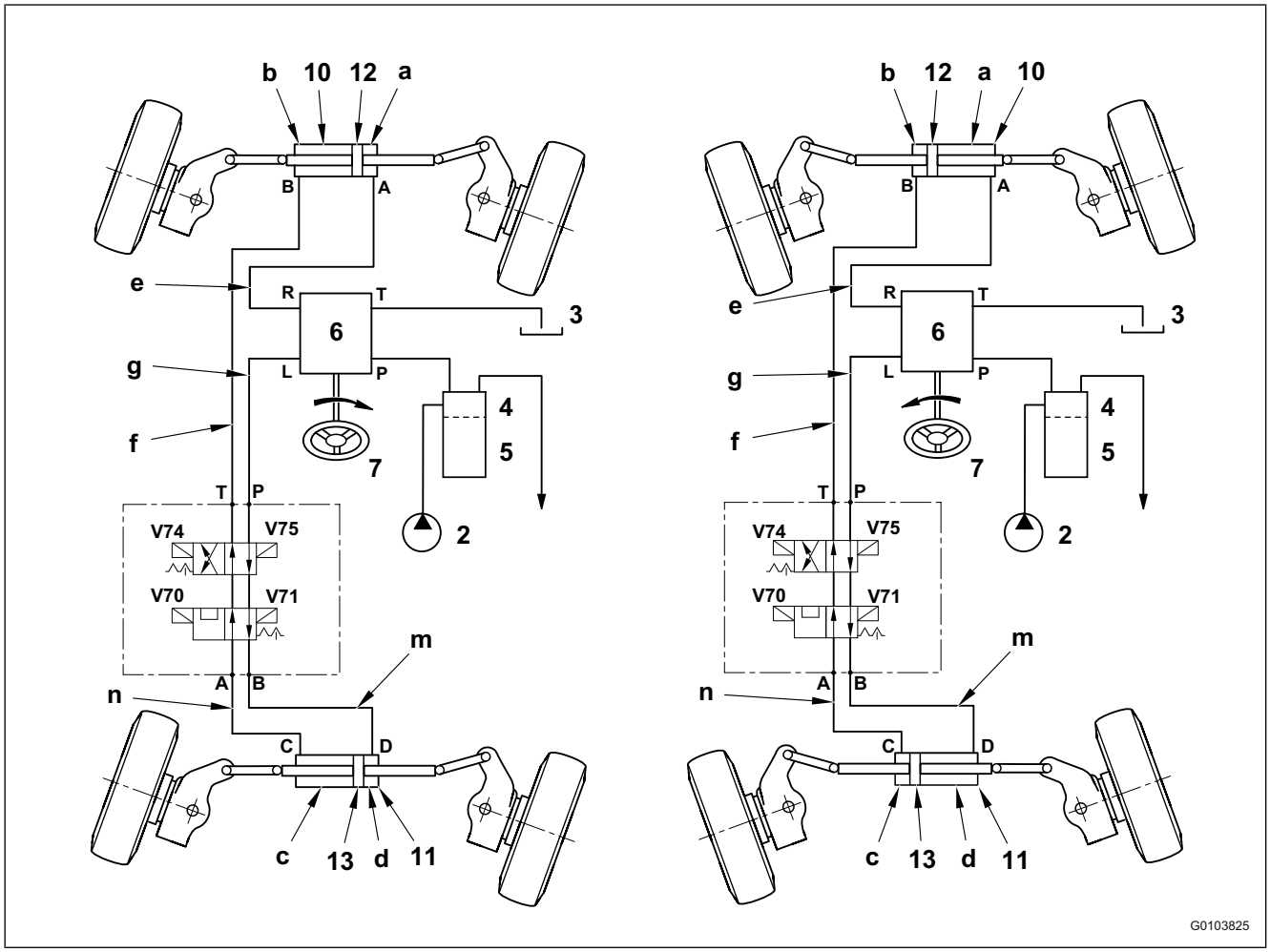


a: Working brake port
b: From steering mode solenoid valve
c: From steering mode solenoid valve
1: Final reduction
2: Steering angle adjusting screw
3: Steering cylinder
4: Grease fitting
5: Axle body
6: Parking brake lever
7: Working brake air bleeder
8: Breather
9: Wheel alignment optical sensor
10: Input flange
11: Oil filling plug
12: Oil drain plug

Specification

Axle oil quantity: 10.5 ℓ

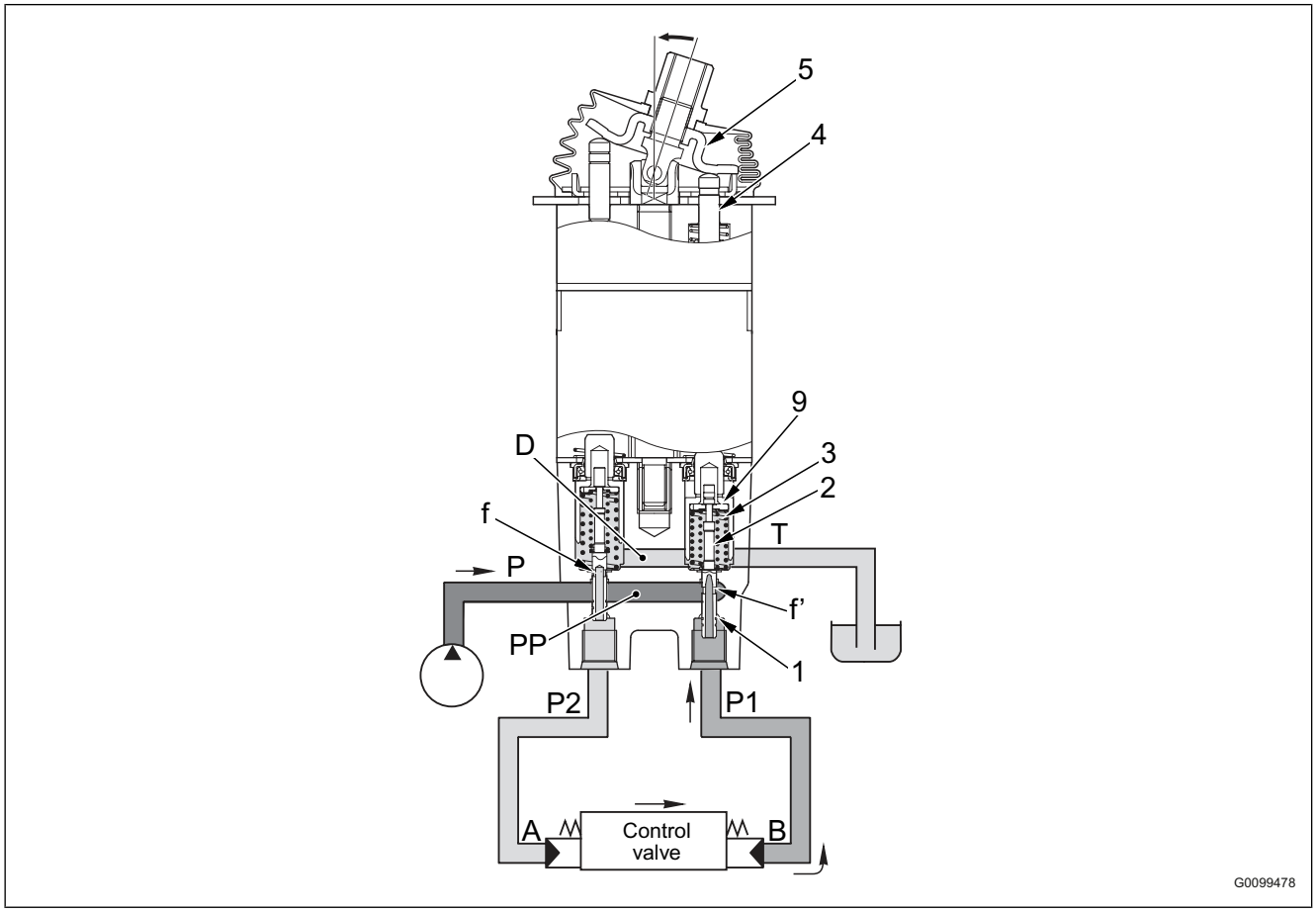
Operation when steer with 4 wheels steering in the same direction (crab steering)



- Steering to the right
  Turning the steering wheel (7) clockwise causes rotation of the steering metering group (6) and prepares the control valve (port R) to send oil through line (e) directly into chamber (a) of cylinder (10).
  The pressurized oil moves the piston (12) of cylinder (10) which steers the wheels while simultaneously impelling the oil in chamber (b) (at the same pressure as chamber (a)), through lines (f) to solenoid valve group and thence through line n, into chamber c of cylinder (11).
  The oil in chamber (d) of cylinder (11) is impelled through lines (m) and (g) to the control valve of the steering group (port L) from which it passes (port T) to drain into the tank (3).
- Steering to the left
  Turning the steering wheel (7) counterclockwise causes rotation of the steering metering group (6) and prepares the control valve (port L) to send oil (through line (g)) to solenoid valve group and thence through line m into chamber d of cylinder (11).
  The pressurized oil moves the piston (13) of the cylinder (11) which steers the wheels while simultaneously impelling the oil in chamber (c) (at the same pressure as chamber (d)), through lines (n) and (f) into chamber (b) of cylinder (10).
  The oil in chamber (a) of cylinder (10) is impelled through line (e) to the control valve of the steering group (6) (port R), from which it passes (port T) to drain into the tank (3).

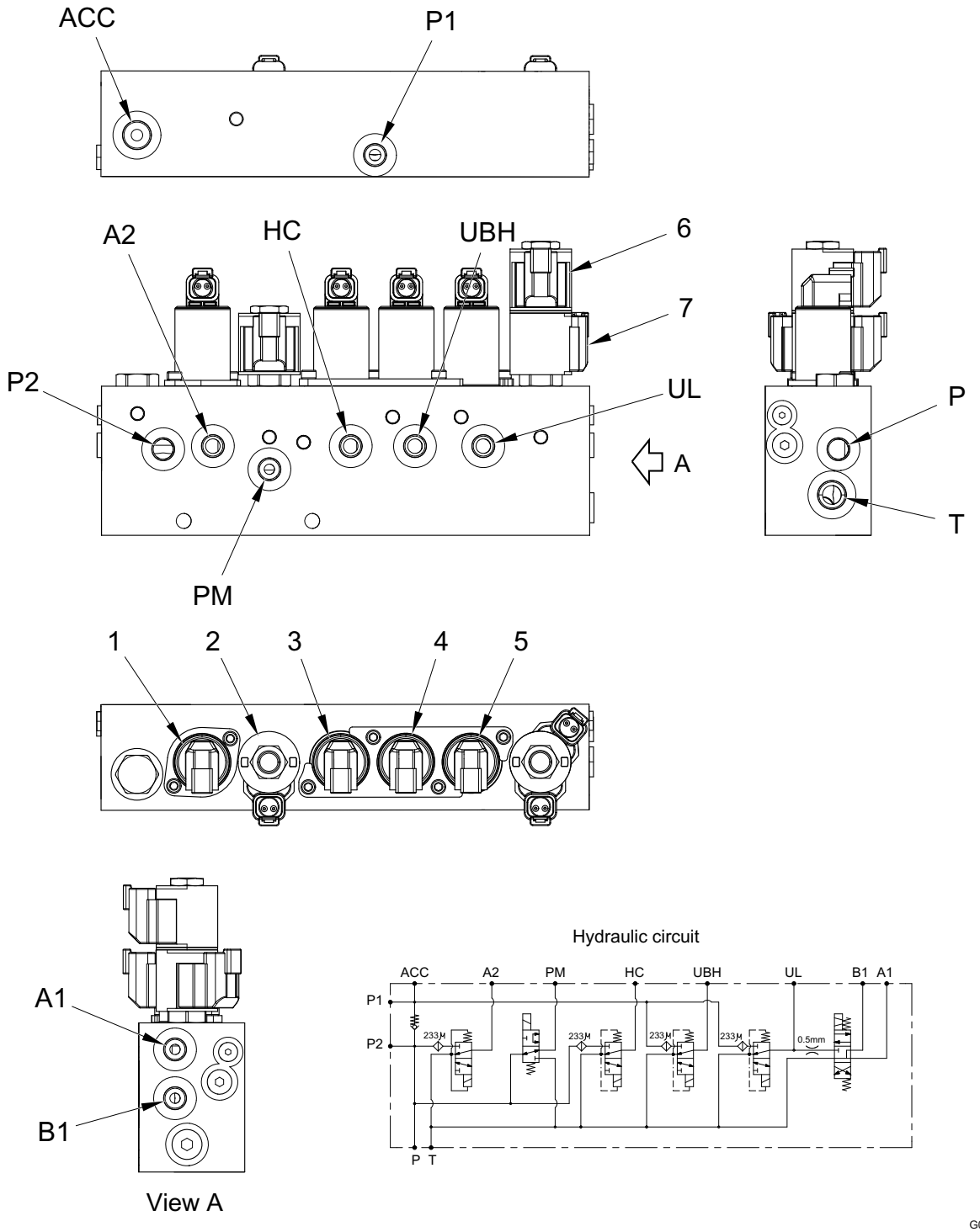
In fine control (when control lever is returned)

1. When disc (5) begins to return, spool (1) is pushed up by the force of centering spring (3) and the pressure in port (P1).
2. Fine control hole (f) is connected to drain chamber (D), and the pressurized oil in port (P1) is released.
3. When the pressure in port (P1) decreases too much, spool (1) is pushed down by metering spring (2).
4. Fine control hole (f) is disconnected from drain chamber (D) and connected to pump pressure chamber (PP) almost at the same time.
5. The pump pressure is supplied until the pressure in port (P1) recovers to the pressure corresponding to the lever position.
6. When the spool of control valve returns, the pressurized oil in drain chamber (D) flows in through fine control hole (f') in the valve on the side that is not operated. The oil passes through port (P2) and flows into chamber (B) to replenish the port with pressurized oil.



SOLENOID VALVES

SOLENOID VALVE GROUP STRUCTURE

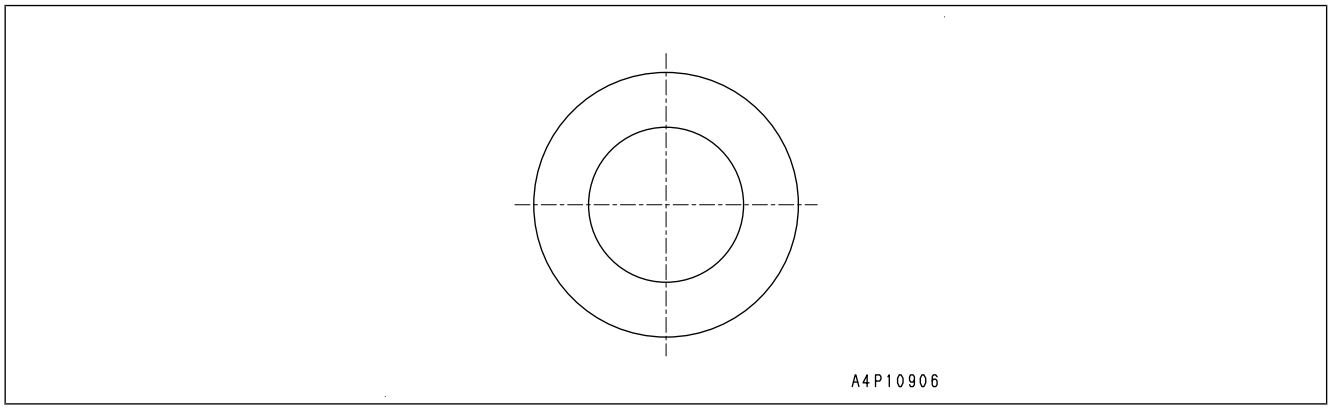


1: Boom unlock solenoid valve (F03)
2: Power mode solenoid valve (F08)
3: Backhoe hammer solenoid valve (F05)
4: Backhoe PPC solenoid valve (F02)
5: PPC solenoid valve (F01)
6: Loader bucket 4 in 1 solenoid valve (OPEN) (F10)
7: Loader bucket 4 in 1 solenoid valve (CLOSE) (F11)

FUNCTION OF WORK EQUIPMENT CLEARANCE ADJUSTMENT SHIM

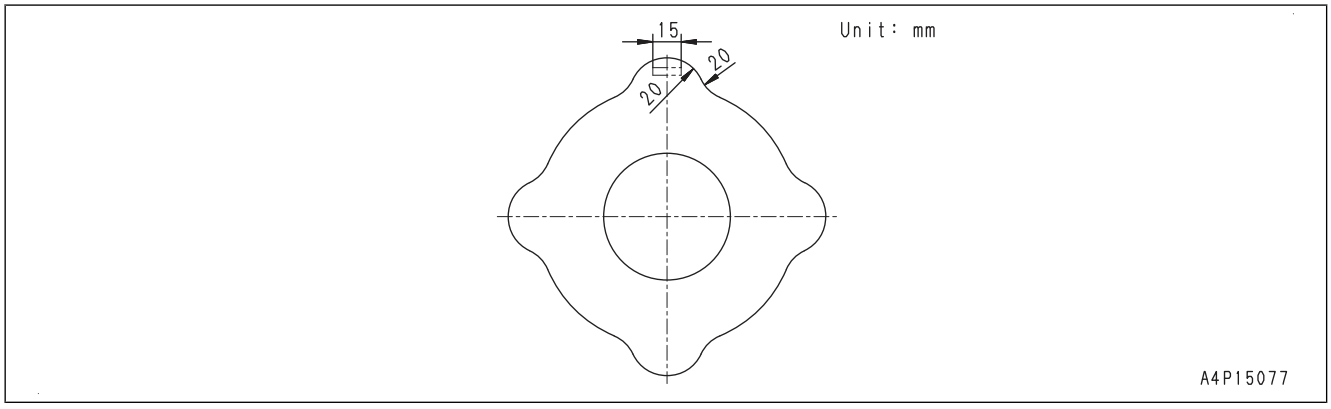
There are 2 types of the work equipment clearance adjustment shims. The steel shim and plastic shim. The following is the explanation of the function of each type of clearance adjustment shim.

Steel shim



The purpose of the steel shim is to reduce the clearance in the right and left direction. There may be some cases that shim is unnecessary to be inserted on one side if it is inserted in either on right or left side depending on the width of the clearance.

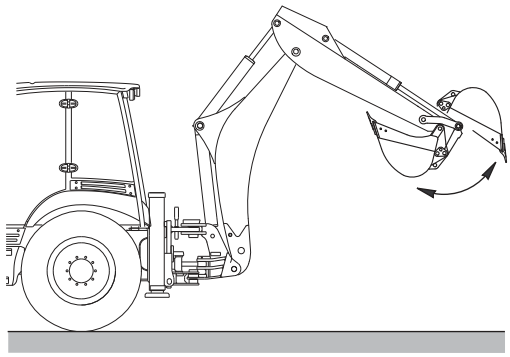
Plastic shim



The purpose of the plastic shim is to reduce the clearance in the right and left direction of the work equipment, and to prevent a creak and scuffing caused by rubbing of the end faces of steel parts of a joint.

Item	Test condition		Unit	Standard value for new machine	Repair limit
Boom relief pressure (with safety valve and standard arm)	• Hydraulic oil temperature: 45 to 55 °C • Engine speed: 1800 rpm • Working mode: P (Power Mode) • Hydraulic pump outlet pressure with measurement circuits relieved	Raise	MPa {kgf/cm^2}	8.3 to 8.9 {84.6 to 90.8}	8.3 to 8.9 {84.6 to 90.8}
		Lower		23.5 to 26.5 {249.8 to 270.2}	23.5 to 26.5 {249.8 to 270.2}
Boom relief pressure (with safety valve and telescopic arm)	• Hydraulic oil temperature: 45 to 55 °C • Engine speed: 1800 rpm • Working mode: P (Power Mode) • Hydraulic pump outlet pressure with measurement circuits relieved	Raise	MPa {kgf/cm^2}	12.6 to 13.2 {128.5 to 134.6}	12.6 to 13.2 {128.5 to 134.6}
		Lower		23.5 to 26.5 {249.8 to 270.2}	23.5 to 26.5 {249.8 to 270.2}
Side digging boom relief pressure	• Hydraulic oil temperature: 45 to 55 °C • Engine speed: 1800 rpm • Working mode: P (Power Mode) • Hydraulic pump outlet pressure with measurement circuits relieved		MPa {kgf/cm^2}	23.5 to 26.5 {249.8 to 270.2}	23.5 to 26.5 {249.8 to 270.2}
Arm relief pressure	• Hydraulic oil temperature: 45 to 55 °C • Engine speed: 1800 rpm • Working mode: P (Power Mode) • Hydraulic pump outlet pressure with measurement circuits relieved		MPa {kgf/cm^2}	23.5 to 26.5 {249.8 to 270.2}	23.5 to 26.5 {249.8 to 270.2}
Telescopic arm relief pressure	• Hydraulic oil temperature: 45 to 55 °C • Engine speed: 1800 rpm • Working mode: P (Power Mode) • Hydraulic pump outlet pressure with measurement circuits relieved		MPa {kgf/cm^2}	23.5 to 26.5 {249.8 to 270.2}	23.5 to 26.5 {249.8 to 270.2}
Bucket relief pressure	• Hydraulic oil temperature: 45 to 55 °C • Engine speed: 1800 rpm • Working mode: P (Power Mode) • Hydraulic pump outlet pressure with measurement circuits relieved		MPa {kgf/cm^2}	23.5 to 26.5 {249.8 to 270.2}	23.5 to 26.5 {249.8 to 270.2}
Boom swinf relief pressure	• Hydraulic oil temperature: 45 to 55 °C • Engine speed: 1800 rpm • Working mode: P (Power Mode) • Hydraulic pump outlet pressure with measurement circuits relieved		MPa {kgf/cm^2}	23.5 to 26.5 {249.8 to 270.2}	23.5 to 26.5 {249.8 to 270.2}

Fig. 13



G0102996

Fig. 14

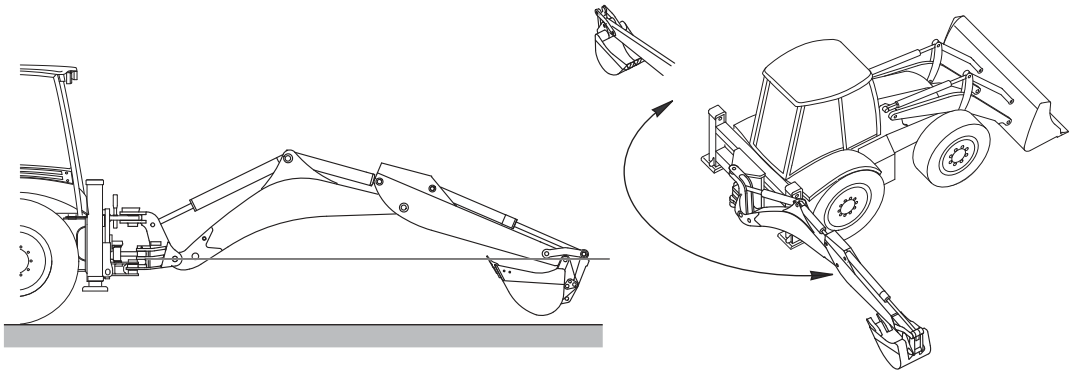


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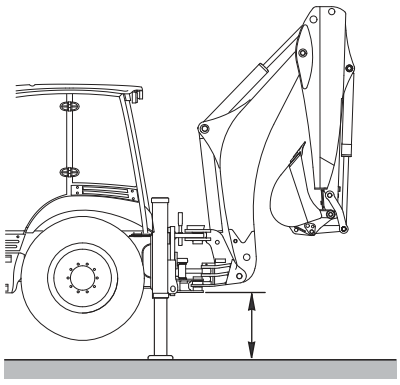
Fig. 15



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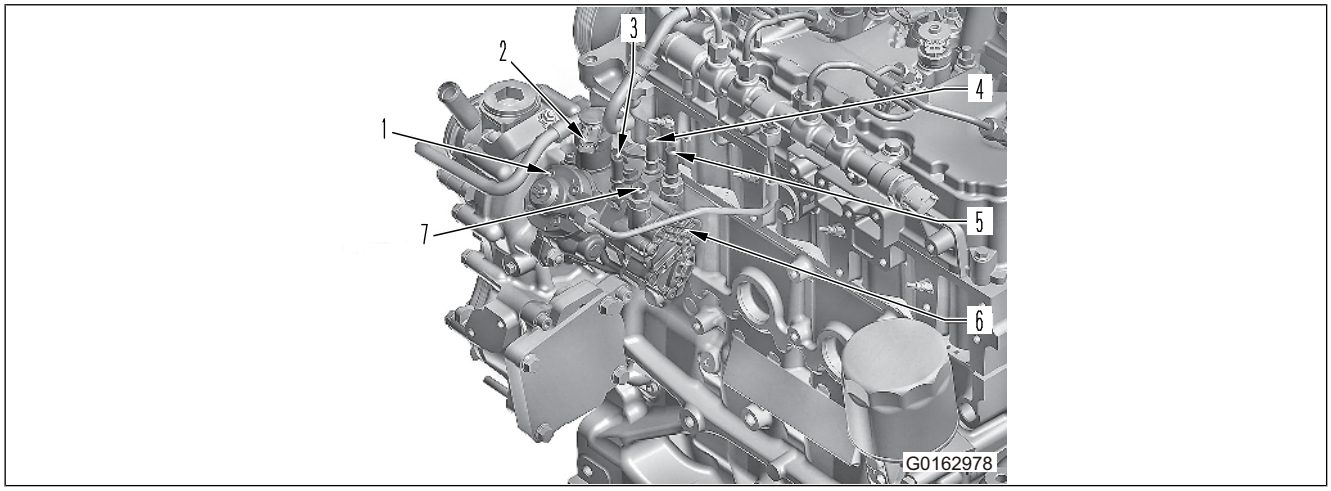
TEST CHECK EXTERNAL FUEL LEAKAGE ENGINE AREA

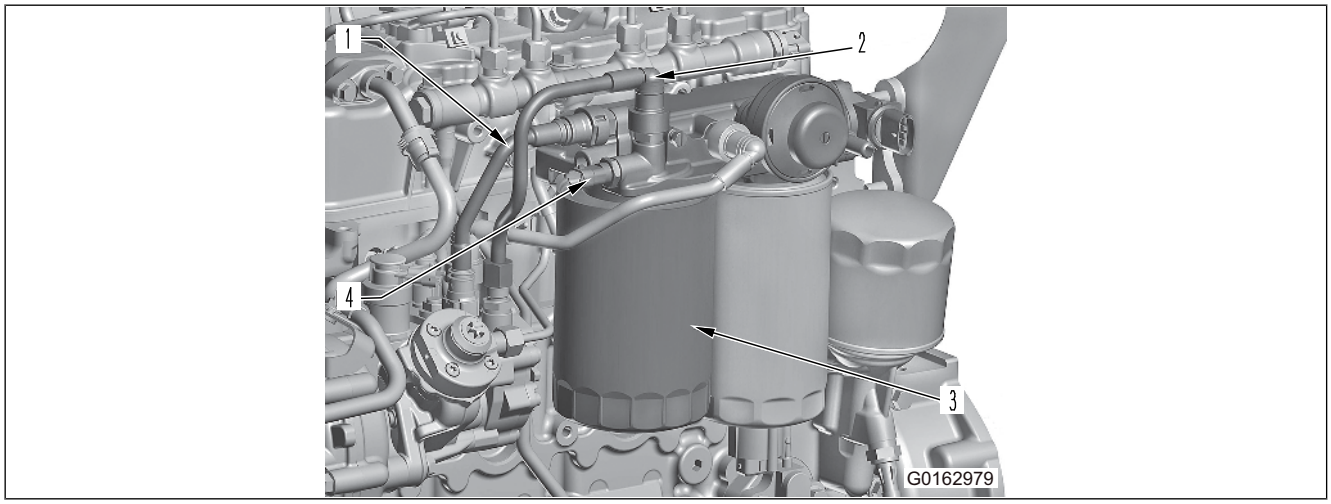
- Run the engine till it reaches normal operating temperature.

Location of the manin components of the fuel pump

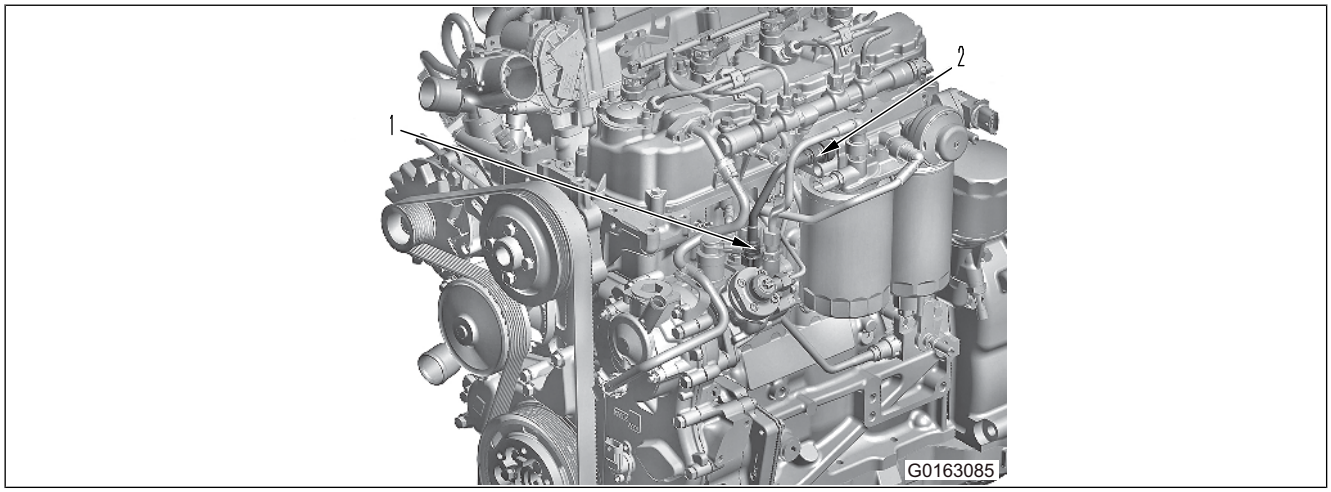


(1) High-pressure pump
(2) Pressure regulator valve (fuel metering unit)
(3) High pressure pump from main filter
(4) Return to reservoir
(5) Low pressure pump intake from pre-filter
(6) Gear low pressure pump
(7) Delivery from low pressure pump to main filter

Location of the main filter components



(1) Outlet from main filter outlet to high pressure pump
(2) Main filter inlet from low pressure pump
(3) Main fuel filter
(4) Fuel temperature sensor



(1) High-pressure pump intake

(2) Main filter outlet to high pressure pump

Offboard tools

- Low pressure vacuum gauge
- Adaptors
- Hose

1. Start or crank engine and let run for several minutes (please wait at least 30 s while engine cranking sessions)
2. Observe pressure built up in several engine conditions and note values
3. See table below for a list of expected results

REMARK

For the hydraulic measurement of the FUEL system under cranking condition, crank the engine no longer than 10 s ~ 12 s each time is recommended. The starter may be damaged if works continuously for a long time.

Engine condition	Pressure value (rel.) bar		Remark
	Minimum	Maximum	
Low idle speed	3.0	6.2	at 850 rpm
High idle	3.0	6.2	at 1500 rpm

4. Check if the pressures measured are in the range explained in the table above.

REMARK

The pressure difference between at the main filter inlet and outlet should be less than 2.0 bar. Otherwise replace main filter

- If the expected results are NOT OK (Gear pump pressure too low, below minimum values):
  - Check tightness of tubes, connectors. Any small defect in tightness will lead to a reduced suction pressure. Air will be sucked into the system and the diesel flow will be reduced (check that there are no air bubbles in the backflow from the pump)
  - Main filter blocked or damaged
  - Pre-filter blocked or damaged
  - Tubes/connectors are damaged
  - Overflow-valve in high pressure pump sticking in open position (check the high pressure pump back- flow rate)
  - Rare but possible: defective gear pump (exclude the possibility of other fuel delivery component problems before making this conclusion)

REMARK

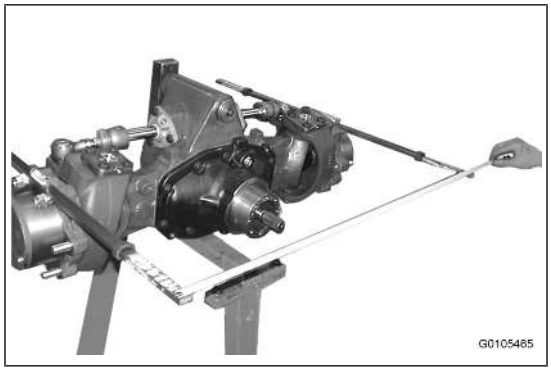
For the hydraulic measurement of the FUEL system under cranking condition, crank the engine no longer than 10 s ~ 12 s each time is recommended. The starter may be damaged if works continuously for a long time.

Engine condition	Pressure value (rel.) bar	Remark
Low idle speed	<0.0 bar	At 900 rpm
High idle	< 0.0 bar	At 1500 rpm

4. Check if the pressures measured are in the range explained in the table above.
   - If the expected results are NOT OK (Suction pressure too low, above maximum values) the possible root cause are:
     - Check tightness of tubes, connectors. Any small defect in tightness will lead to a reduced suction pressure. Air will be sucked into the system and the diesel flow will be reduced. (Check that there are no air bubbles in the backflow from the pump)
     - Less diesel in tank
     - Pre-filter blocked or damaged
     - Rare but possible: defective gear pump (exclude the possibility of other hydraulic component be- fore mak- ing this conclusion)
     - If present: electrical lift pump defect
   - If the expected results are NOT OK (Suction pressure too high, below minimum values), possible root cause are:
     - Pre-filter blocked or damaged
     - Tubes, connectors squeezed/damaged/wrong diameter
     - Tank system dirty
     - Tank ventilation blocked/dirty (open tank cap, and listen to sucking sound)

The system works properly.

2. Measure the distance in mm M between the bars ends with a tapeline.



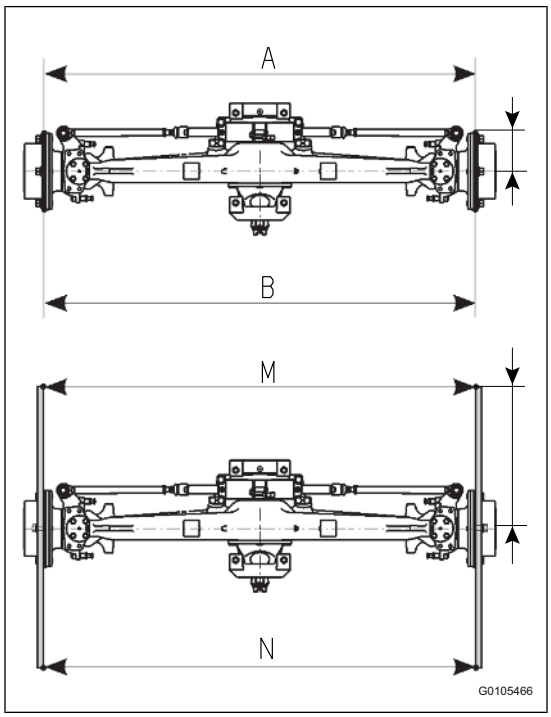
REMARK

Keep the minimum value, swinging the measurement point.

3. Check that the difference of the measurements between the wheel hubs diameters ends is within the requested tolerance range. The nominal toe-in value (A) is referred to the external diameter of the wheel hubs flange, therefore the measured value (M) at the bars ends must be related to the ratio between length of the bar and flange diameter

Nominal toe-in: A=B to A=B–2

Measured toe-in: M= N–2.63

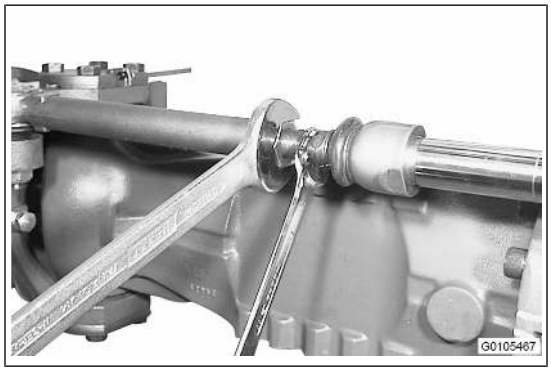


Toe-in at wheel hub outside diameter (mm)	-2.00 to 0
Toe-in at a distance of 200 mm from center of wheel hub revolution (mm)	-2.11 to 0
Toe-in at a distance of 250 mm from center of wheel hub revolution (mm)	-2.63 to 0
Toe-in at a distance of 500 mm from center of wheel hub revolution (mm)	-5.26 to 0
Toe-in factor to be multiplied by distance from center of wheel hub revolution (mm)	-2 * distance *0.00526

REMARK

If the toe-in measurement is made with a manual procedure an approximation of the ±20% can be applied, thus the toe-in at wheel hub of - 2.50 mm to 0 mm might be considered inside the range a range +0.5 to -3.0 mm

4. If toe-in is incorrect, operate with two wrenches on the guide rods (1) screwing in and out the two joint tie rods (3) equally till the toe-in is within the requested tolerance. After adjusting, screw in the lock nuts (2) of the guide rods (1) to the requested tightening torque.



Lock nuts: 250 Nm

BRAKE SYSTEM

TEST BRAKE SYSTEM PRESSURE

Tools to test steering circuit oil pressure

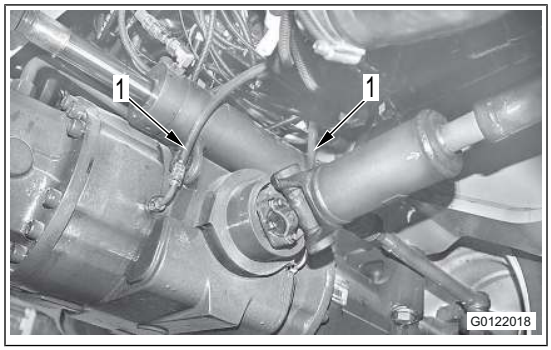
Symbol		Part No.	Part name	Q'ty	Remarks
P	1	799-101-5002	Hydraulic tester	1	-
		790-261-1204	Digital hydraulic tester	1	-
	2	799-401-3100	Adapter	1	Size: 02
	3	799-101-5220	Nipple	1	M10x1.25 mm
		07002-11023	O-ring	1	-

⚠ **Place the machine on a level ground, fully raise the front work equipment and secure them with the safety lock, so that it is stable, and then stop the engine.**

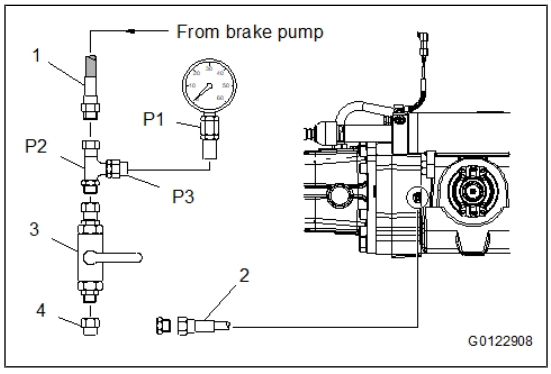
Check this item under the following conditions.

- Engine coolant temperature: 75 to 94 °C
- Hydraulic oil temperature: 45 to 55 °C
- Rear axle oil temperature: 75 to 85 °C

1. Disconnect hose (1) of the brake line to be tested and plug the service brake port on the axle with plug (2).



2. Install on hose (1) the following components:
   a) the adapter P2 and the nipple P3
   b) an hydraulic tester P1 (6 MPa {60 kgf/cm^2})
   c) a cock (3)
   d) a plug (4) (to be installed after bleeding air from the circuit)
   - Brake hose and pipe thread: 1/2” - 20 UNF



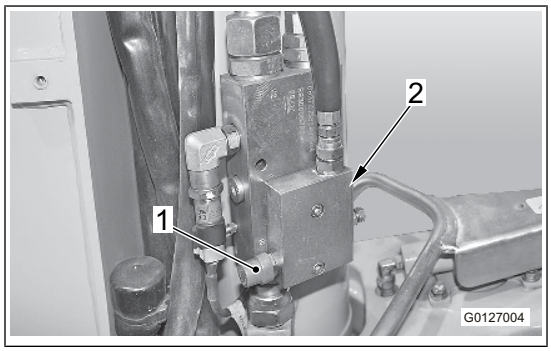
3. Bleed air from the circuit before proceeding with the test. For detail see “BLEED AIR FROM THE BRAKE CIRCUIT (30-71)”.
4. Disconnect the pedal connecting pin and press the corresponding brake pedal (left pedal for the left side brake unit, right pedal for the right side brake unit) until reaching 4.1 ± 0.5 MPa {41.8 ± 5.1 kgf/cm^2} while pressing the pedal with a force of 294 ± 29.4N {30 ± 3 kgf}.

   REMARK

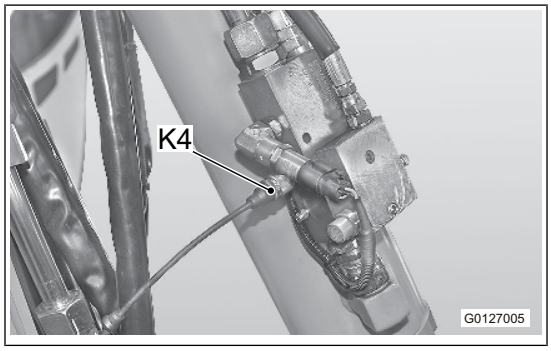
   The pressure of 4.1 ± 0.5 MPa {41.8 ± 5.1 kgf/cm^2} have to be reached when the force of 294 ± 29.4N {30 ± 3 kgf} is applied. If this situation does not occur, as example if the pressure is not reached or the pressure is reached with a higher force, there is a problem in the brake system. Check the brake system for leakages or brake pump problem.
5. Hold the brake pedal in that position without moving it for the next 2 minutes.

TEST BACKHOE BOOM OVERLOAD SWITCH

1. Remove oil pressure measurement plug (1) on backhoe boom safety valve (2).



2. Install nipple K4 and connect oil pressure gauge of hydraulic tester K1.
   - Use the oil pressure gauge of 40 MPa {400 kgf/cm^2}.
3. Start the engine and set the working mode to power P mode.
4. Run the engine at 1800 rpm using fuel control dial.
5. Operate the backhoe boom rise lever until stroke end and increment the pressure to test the boom overload alarm switch.



   - The backhoe boom overload pressure is the pressure set to avoid the raising of object which can cause damage to the equipment or the overtilting of the machine.
   - If the pressure is not within the right value, the overload alarm switch might be defective or there might be an electrical problem in wiring harness.
6. After finishing test, remove the testing tools and return the removed parts.

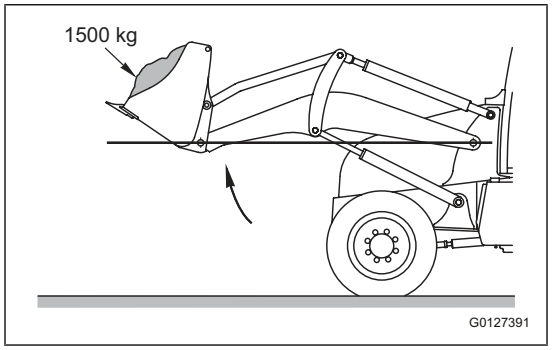
TEST THE PARTS WHICH CAUSE HYDRAULIC DRIFT OF WORK EQUIPMENT

a If the work equipment (cylinder) drifts hydraulically, perform check to see if the problem is in the cylin-der seal or control valve according to the following procedure.

- When the machine is set to the hydraulic drift measuring posture (holding pressure is applied to the bottom side), oil leaks from the bottom side to the head side. The volume on the head side is smaller than that on the bottom side by the volume of the rod. As a result, the inner pressure in the head side is increased by the oil flows from the bottom side.
- As the inner pressure on the head side increases, the inner pressure on the bottom side (it is different in response to the leakage amount) also increases. As a result, the pressure at each side are balanced with each other, and the lowering speed decreases. At this time, when the lever is operated to the direction that the oil in the head side of the cylinder to be tested is drained to the tank circuit, oil in the head side flows to the drain circuit (the bottom side is blocked by the check valve). As a result, the pressure at the head side is not balanced with the one at the bottom side, and the lowering speed increases.

TEST PARTS CAUSING HYDRAULIC DRIFT OF LOADER ARM CYLINDER

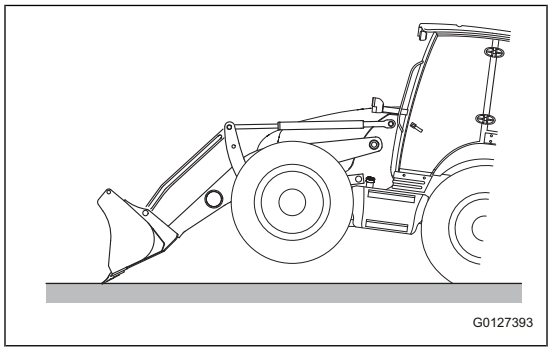
1. Move the loader bucket in the posture described in the picture and stop the engine.
2. Turn ON the starting switch without starting the engine, and enable the work equipment using the “Work Equipment Lock Switch”.
3. If the loader arm cylinders are equipped with safety valve (lifting capability of the machine), disable the function using the “Lifter Mode selection switch”.
4. Move the loader arm control lever to “RAISE” side for judgment.



   - When the lowering speed is increased at this time, the cylinder packing is defective.
   - If the lowering speed does not change at this time, the control valve is defective.

TEST PARTS CAUSING HYDRAULIC DRIFT OF LOADER BUCKET CYLINDER

1. Move the loader bucket in the posture described in the picture and stop the engine.
2. Turn ON the starting switch without starting the engine, and enable the work equipment using the “Work Equipment Lock Switch”.
3. If the loader arm cylinders are equipped with safety valve (lifting capability of the machine), disable the function using the “Lifter Mode selection switch”.
4. Release the parking brake.
5. Move the loader bucket control lever to “DUMP” side for judgment.



   ⚠ When the control lever is moved the machine might move backward.

   - When the lowering speed is increased at this time, the cylinder packing is defective.
   - If the lowering speed does not change at this time, the control valve is defective.

6. After the “Usage Limitation New Password Input” screen is displayed, use a switch on the switch panel to input and validate a new password. •
   - NEXT switch (6): Switch to the next numeric input box.
   - UP switch (7): Increase the Number in the selected box.
   - DOWN switch (8): Decrease the number in the selected box.
   - RETURN switch (9): Clears an input numeric/ Return the screen to the standard screen.
   - ENTER switch (10): Validates the inputted password.

REMARK

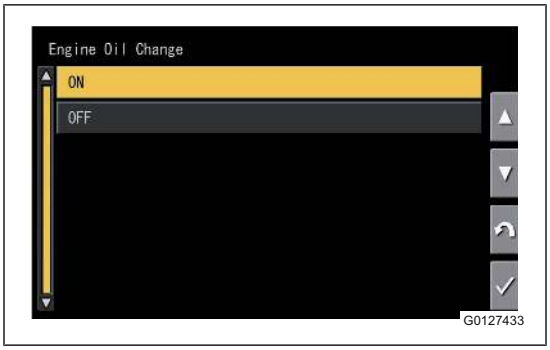
- Default password: 000000.
- When the input password is correct, the screen changes to the next screen.
- When the input password is incorrect, the screen displays message to request inputting the password again.
- Set a new password of 4 to 6 digits (If it has only 3 or less digits or has 7 or more digits, it is not accepted).

7. After “Usage Limitation New Password Input” screen is displayed again, use a switch on the switch panel to input and validate a new password.
   - NEXT switch (6): Switch to the next numeric input box.
   - UP switch (7): Increase the Number in the selected box.
   - DOWN switch (8): Decrease the number in the selected box.
   - RETURN switch (9): Clears an input numeric/Return the screen to the standard screen.
   - ENTER switch (10): Validates the inputted password.

REMARK

- If the input password is different from the one input before, the message to request inputting again is displayed.
- If the standard screen is displayed after the screen to notify completion of setting is displayed, the password is changed successfully.

7. When the oil change interval screen is displayed, use a switch o the switch panel to select "ON" or "OFF".
   - “ON”: Function of the particular maintenance item becomes enabled on operator mode.
   - “OFF”: Function of the particular maintenance item becomes ineffective in operator mode.
   - UP switch (7): Moves the selected item up by one item.
   - DOWN switch (8): Moves the selected item down by one item.

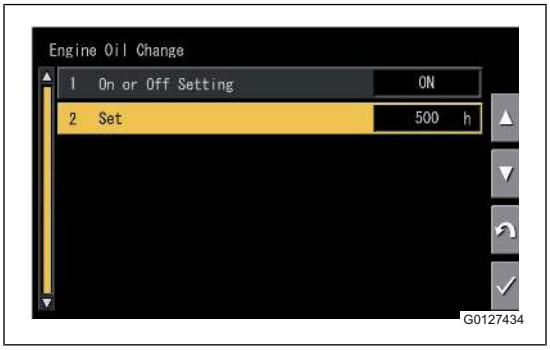


   - RETURN switch (9): Cancels the selection and returns the display to the individual setting screen.
   - ENTER switch (10): Enters the selected item and switches the display to the individual setting screen.

REMARK

The image will be displayed when “Engine Oil Change” is selected.

8. When the screen of selected maintenance item is displayed, select “Set” and change the setting with switches on the switch panel.
   - UP switch (7): Moves the selected item up by one item.
   - DOWN switch (8): Moves the selected item down by one item.
   - RETURN switch (9): Chancels the selection and returns the display to the “Maintenance Mode Setting” screen.



   - ENTER switch (10): Enters the selected item and switches the display to the individual screen.

REMARK

The image will be displayed when “Engine Oil Change Interval” is selected.

9. When “Set” screen is displayed, change a set value with the switches on the switch panel.
   - “Default”: Maintenance set time set on the machine monitor.
   - “Set”: Maintenance notice time that can be freely set. Maintenance reminder function works according to this set time in operator mode (the time can be increased or decreased in multiples of 25 hours).
   - UP switch (7): Increases the set value.
   - DOWN switch (8): Decreases the set value.

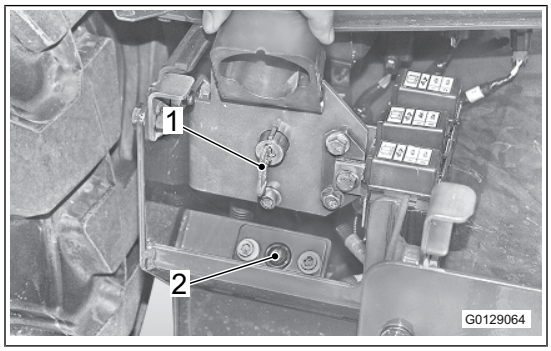
   - RETURN switch (9): Chancels the setting and returns the display to the individual screen.
   - ENTER switch (10): Enters the setting and switches the display to the individual screen.

BATTERY DISCONNECT SWITCH

The battery disconnect switch is installed inside the rear left cover of the machine.

1. When the battery disconnect switch is turned to OFF (O) position, be sure to remove switch key (1).

   ⚠ A hazard can result if an unauthorized person turns switch key (1) to ON position carelessly.



2. The operating condition of each controller can be checked with the system operating lamp (2) to prevent the abnormal end of the disconnection of the battery power supply circuit while the controllers are in operation.
   1) Before shutting off the battery power supply circuit, turn the starting switch to OFF position, and check that system operating lamp (2) goes off, then turn the battery disconnect switch to OFF (O) position.
   2) If the battery disconnect switch is turned to OFF (O) position (battery power supply circuit is OFF) while system operating lamp (2) is lit, data loss error of controller may occur. Never operate the battery disconnect switch while system operating lamp (2) is lit.
   3) System operating lamp (2) goes off in 2 minutes after the starting switch is turned to OFF position.
   4) System operating lamp (2) may sometimes light up while the starting switch is turned to OFF position because KOMTRAX terminal may maintain its communication under this condition.
   5) System operating lamp (2) may look slightly luminous in the dark after it is turned off. It is due to the minute leakage of current and not an abnormal phenomenon.
      - After the starting switch is turned to "OFF" position, KOMTRAX terminal repeats the start and stop to maintain the periodic communication.
      - The start and stop cycle (sleep cycle) of KOMTRAX terminal varies depending on the factors including the communication state and machine stop time. So the lamp can be lit as long as approximately 1 hour.
   6) When you want to cut off the battery circuit for maintenance but the system operating lamp (2) is kept lit, turn the starting switch to ON position once and then turn it to OFF (O) position. Lamp (2) goes out in max. 2 minutes. After system operating lamp (2) goes out, turn the battery disconnect switch immediately to OFF (O) position.

GENERAL TROUBLESHOOTING POINTS

⚠ If you remove the radiator cap while the engine is still hot, hot coolant may spout out and can scald you. Wait until the engine cools down.

⚠ Take extreme care not to touch a hot portion or not to be wound in a turning portion.

⚠ Before removing a plug or a cap of a portion where oil pressure, hydraulic pressure, or air pressure is applied, release the internal pressure first, then connect the measuring tool securely.

⚠ When disconnecting wiring, remove the key and turn the battery disconnect switch to OFF position.

⚠ Park the machine on a level place and check the frame lock bar, chocks, parking brake, etc.

⚠ When working in a group, make signs and allow only the persons concerned to approach the machine.

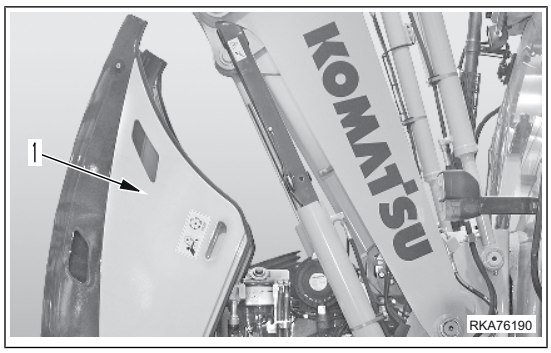
- Troubleshooting means to investigate the root cause of a failure, repair immediately, and prevent recurrence of the failure.
- One important thing when you perform troubleshooting is to understand the structure and operation.
- It is important to have an interview with the operator and set up an aim of failure cause for performing a troubleshooting effectively.
- If you disassembly the machine hastily when it has a failure, you may disassemble unrelated portions and may not be able to find the cause. As a result, the costs of the man-hours, parts, oil, or grease may increase, and you may lose the confidence of the users and operators. Accordingly, sufficient advance check and proper procedure are necessary for troubleshooting.

1. Ask users or operators the following questions.
   1) Have any other problems occurred apart from the problem that has been reported?
   2) Is there anything strange about the machine before the failure occurred?
   3) Did the failure occur suddenly, or were there problems with the machine condition before this?
   4) Under what conditions did the failure occur?
   5) Had any repairs been performed before the failure? When were these repairs performed?
   6) Has the same kind of failure occurred before?
2. Perform the following checks before troubleshooting.
   1) Check the machine for a symptom of abnormality.
   2) Perform the Check before starting items.
   3) Check the other check items.
   4) Check other maintenance matters which can be checked externally and are considered to be necessary.
3. Check the degree of the trouble by yourself and judge if it is a real failure or it is a problem of handling or operation.

   When reproducing the trouble phenomenon by operating the machine, do not perform check or measurement that can increase the failure.
4. Use the results of the investigation and inspection to narrow down the probable causes of the failure, then use the troubleshooting flow chart (matrix) to locate the failure exactly.

   The basic troubleshooting procedure is as follows.
   - Start from the simple points.
   - Start from the most likely points.
   - Investigate other related parts or information.
5. If the root cause is not corrected, a similar failure may occur again even if the apparent failure has been repaired. Always find out the cause of a failure first and remove the root cause of each failure.

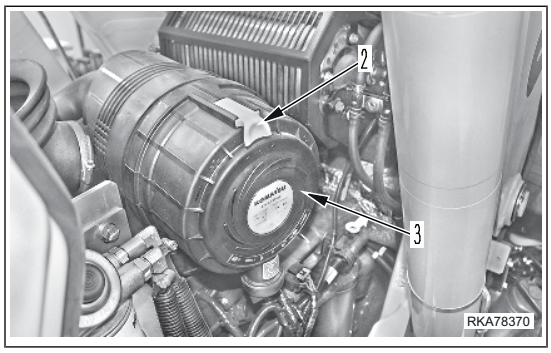
1. Open the engine hood (1).
2. Pull the yellow lock (2) of the air filter and unlock it.



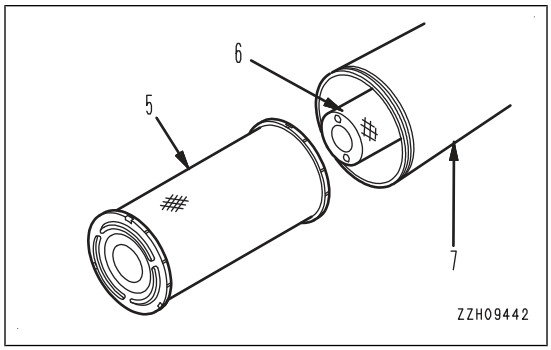
3. Loosen the cover (3) by turning it counterclockwise.
4. Hold the outer element (5) and lightly move it (up, down, right, and left), then pull out the element while you rotate it.

   NOTICE

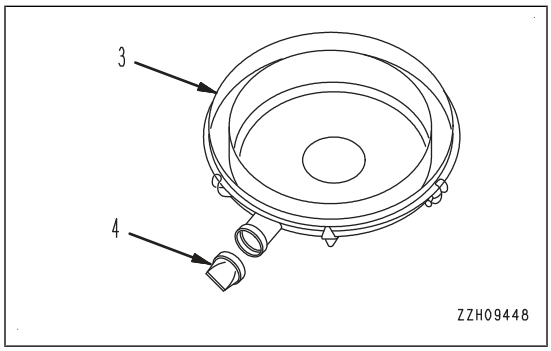
   Do not remove inner element (6). If it is removed, dirt will enter and can cause an engine trouble.



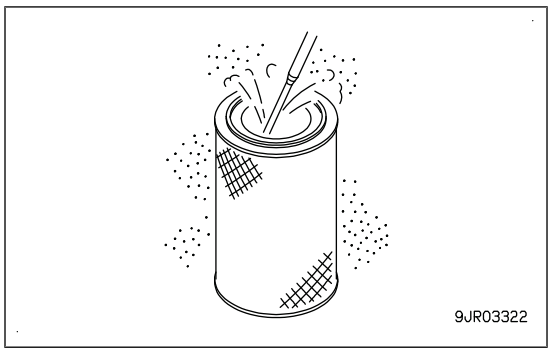
5. While pressing inner element (6) not to let it come off, clean the inside of air cleaner body (7) and the cover (3).

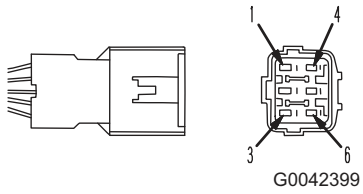
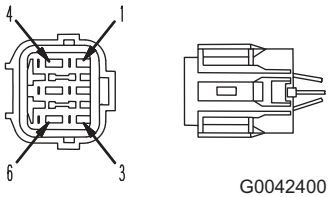
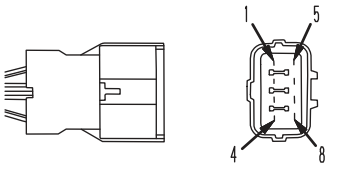
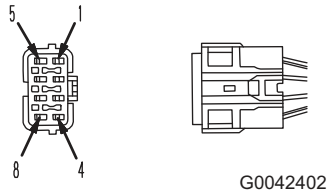
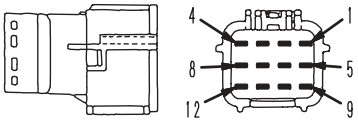
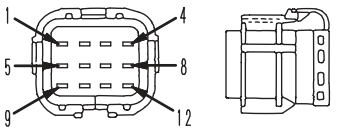
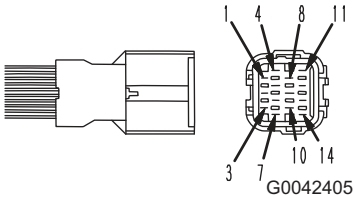
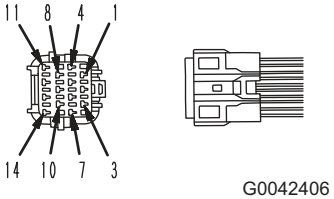
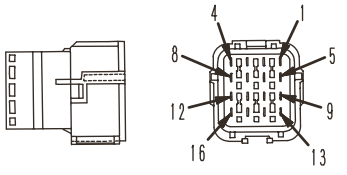
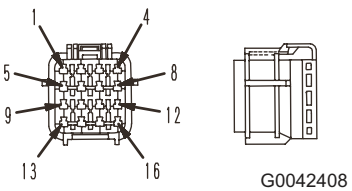


6. Wipe off the dust sticking to cover (3) and vacuator valve (4) with a dry cloth or blow it by using compressed air.
7. Check that the lip of vacuator valve (4) has no crack. When crack is found, replace it with a new one.

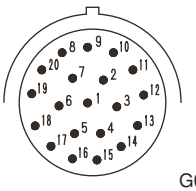
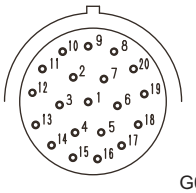
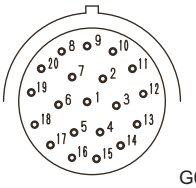
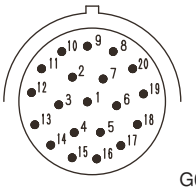
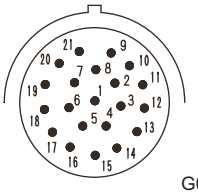
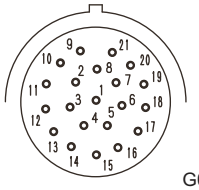
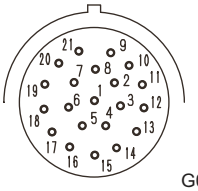
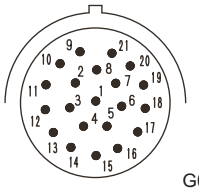


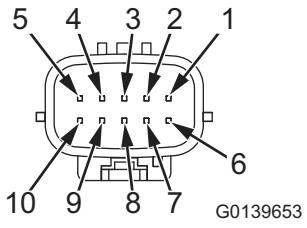
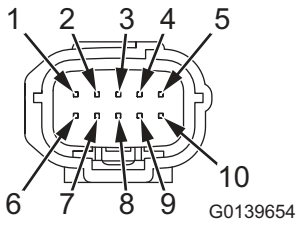
8. Blow dry compressed air (0.2 Mpa {2.1 kgf/cm^2} or lower) from the inside of outer element (3) along the pleats.
9. Blow along the pleats from the outer side, then blow again from the inside.

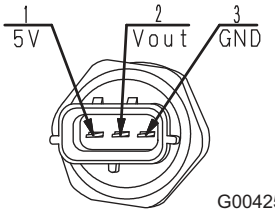
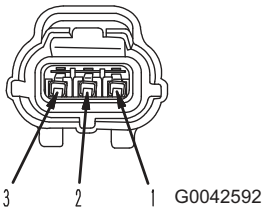
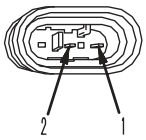
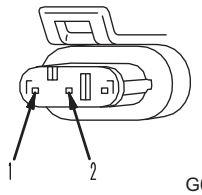


Total number of pins	SWP type connector		Special tool number for connection checks
	Male (concave engaging portion)	Female (convex engaging portion)	
6	 G0042399	 G0042400	799-601-7050 (T-branch)
	Part No.: 08055-10681	Part No.: 08055-10691	
8	 G0042401	 G0042402	799-601-7060 (T-branch)
	Part No.: 08055-10881	Part No.: 08055-10891	
12	 G0042403	 G0042404	799-601-7310 (T-branch)
	Part No.: 08055-11281	Part No.: 08055-11291	
14	 G0042405	 G0042406	799-601-7070 (T-branch)
	Part No.: 08055-11481	Part No.: 08055-11491	
16	 G0042407	 G0042408	799-601-7320 (T-branch)
	Part No.: 08055-11681	Part No.: 08055-11691	
-	Terminal part number: 79A-222-3510 • Wire size: 0.85 • Grommet: Black • Q'ty: 20	Terminal part number: 79A-222-3530 • Wire size: 0.85 • Grommet: Black • Q'ty: 20	-

[Pin No. also printed on connector (wire insertion side)]

Type (Shell size code)	HD30 series connector		Special tool number for connection checks
	Body (plug)	Body (receptacle)	
18-20 (3)	Pin (male terminal)	Socket (female terminal)	799-601-9230 (T-branch)
	 G0042501	 G0042502	
	Part No.: 08191-31201, 08191-31202	Part No.: 08191-34101, 08191-34102	
	Socket (female terminal)	Pin (male terminal)	799-601-9230 (T-branch)
	 G0042503	 G0042504	
	Part No.: 08191-32201, 08191-32202	Part No.: 08191-33101, 08191-33102	
18-21 (4)	Pin (male terminal)	Socket (female terminal)	799-601-9240 (T-branch)
	 G0042505	 G0042506	
	Part No.: 08191-41201, 08191-42202	Part No.: 08191-44101, 08191-44102	
	Socket (female terminal)	Pin (male terminal)	799-601-9240 (T-branch)
	 G0042507	 G0042508	
	Part No.: 08191-42201, 08191-42202	Part No.: 08191-43101, 08191-43102	

SUMITOMO connector			
Total number of pins	Radar		Special tool number for connection checks
	Body (plug)	Body (receptacle)	
10			3BB-56-63990 (T-branch)
	6188-0696	6189-1134	

AMP connector (for engine)			
Total number of pins	Common rail (fuel) pressure sensor (95, 125, 140 engines)		Special tool number for connection checks
	Sensor side (plug)	Harness side (receptacle)	
3			799-601-9420 (socket) (Kit: 799-601-4101) (Kit: 799-601-4201)
	-	-	
Total number of pins	Turbocharger speed sensor (107, 114 engines)		
	Valve side (plug)	Harness side (receptacle)	
3			799-601-4660 (socket) (Kit: 799-A65-4600)
	☆ Without pin 3	☆ Without pin 3	

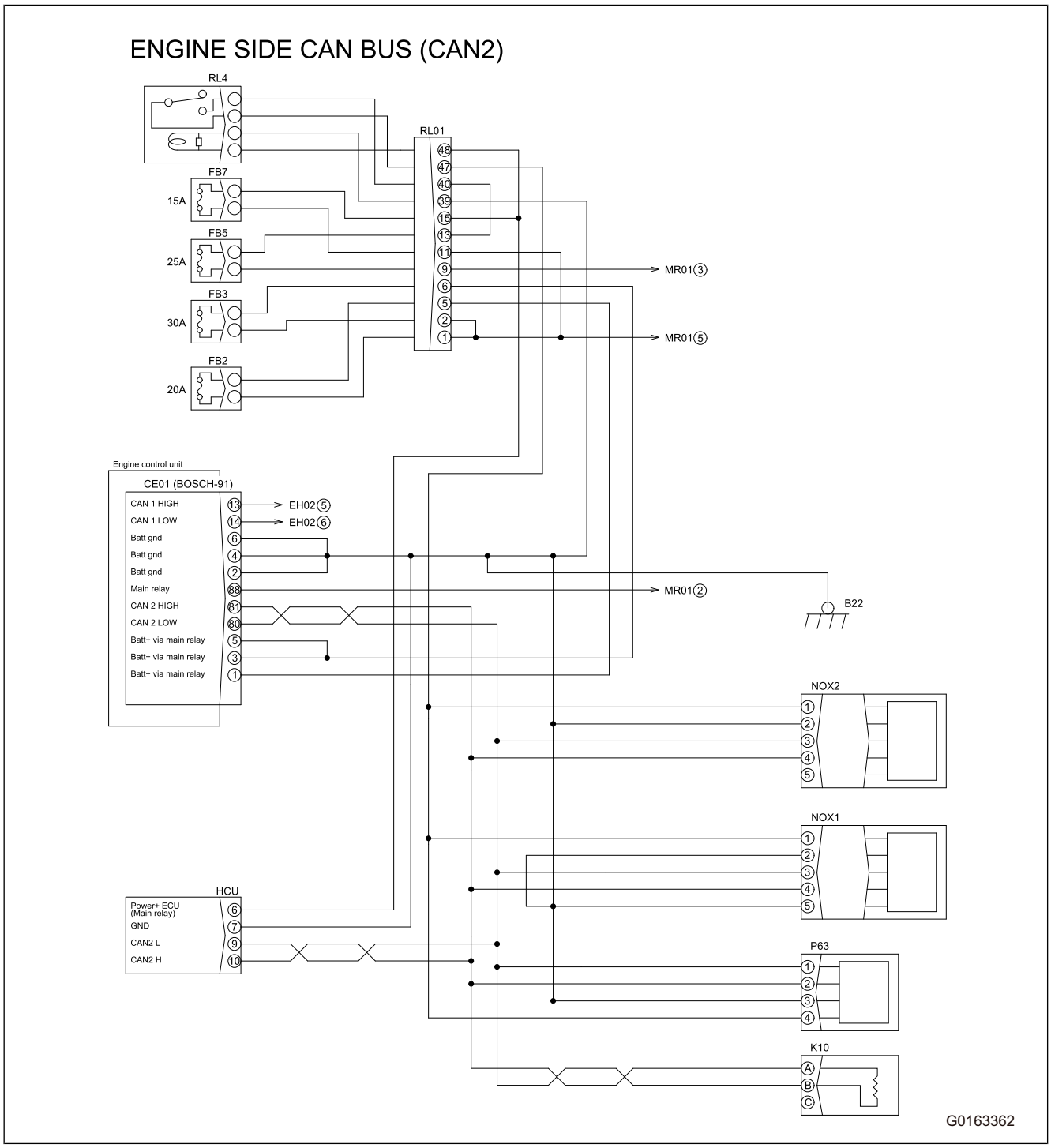
Part No.	Part name	Number of pins	Identification code	T-branch adapter kit														Non-kit part
				799-601-2500	799-601-2700	799-601-2800	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300	799-601-4101	799-601-4201	
799-601-2840	Extension cable (ECONO type)	12	ECONO 12P	●	●				●									
799-601-2850	Case			●														
799-601-4350	T-branch box (for DRC60, ECONO)	60														●		
799-601-4360	Case															●		
799-601-7010	Adapter for X (T-branch)	1							●		●							
799-601-7020	Adapter for X	2	X2P				●	●	●		●							
799-601-7030	Adapter for X	3	X3P				●	●	●		●							
799-601-7040	Adapter for X	4	X4P				●	●	●		●							
799-601-7050	Adapter for SWP	6	SW6P				●	●	●									
799-601-7060	Adapter for SWP	8	SW8P				●	●	●									
799-601-7310	Adapter for SWP	12	SW12P															●
799-601-7070	Adapter for SWP	14	SW14P						●		●							
799-601-7320	Adapter for SWP	16	SW16P															●
799-601-7080	Adapter for M (T-branch)	1							●		●							
799-601-7090	Adapter for M	2	M2P				●	●	●		●							
799-601-7110	Adapter for M	3	M3P				●	●	●		●							
799-601-7120	Adapter for M	4	M4P				●	●	●		●							
799-601-7130	Adapter for M	6	M6P				●	●	●		●							
799-601-7340	Adapter for M	8	M8P															●
799-601-7140	Adapter for S	8	S8P				●	●	●		●							
799-601-7150	Adapter for S (white)	10	S10P				●	●	●		●							
799-601-7160	Adapter for S (blue)	12	S12P				●	●	●									
799-601-7170	Adapter for S (blue)	16	S16P				●	●	●		●							
799-601-7330	Adapter for S (white)	16	S16PW								●							
799-601-7350	Adapter for S (white)	12	S12PW															●
799-601-7180	Adapter for AMP040	8	A8P						●									
799-601-7190	Adapter for AMP040	12	A12P						●		●							
799-601-7210	Adapter for AMP040	16	A16P				●	●	●		●							
799-601-7220	Adapter for AMP040	20	A20P				●	●	●		●							
799-601-7230	Short socket adapter for X	2					●	●	●		●							
799-601-7240	Case						●	●										
799-601-7270	Case								●									
799-601-7510	Adapter for 070	10	07-10							●								

Failure code	Failure (as displayed on screen)	Applicable component	Action level	Category of history
#V0078	Transmission Oil Overheat	MACHINE CU	L02	Mechanical
#V0079	Charge Voltage Low	MACHINE CU	L03	Mechanical
#V0080	Machine Controller Software Validation Process Error	MACHINE CU	L03	Electrical
#V0081	Machine Controller Internal Failure	MACHINE CU	L03	Electrical
#V0082	Air Cleaner Clogging	MACHINE CU	L01	Mechanical
#V0083	Brake Oil Level Abnormality	MACHINE CU	L03	Mechanical
#V0084	Fan Clutch Speed Target Not Reached	MACHINE CU	L03	Mechanical
#V0085	Idle Validation Process Error	MACHINE CU	L03	Electrical
＃V0086	Brake boost pressure Low	MACHINE CU	L03	Mechanical
＃V0087	Brake boost pressure sensor Ground Fault	MACHINE CU	L01	Electrical
＃V0088	Brake boost pressure sensor Hot Short Circuit	MACHINE CU	L01	Electrical
＃V0089	Brake boost pressure sensor Low Voltage Error	MACHINE CU	L01	Electrical
＃V0090	Brake boost pressure sensor High Voltage Error	MACHINE CU	L01	Electrical
＃V0091	Quick coupler lock line low pressure	MACHINE CU	L03	Mechanical
＃V0092	Rear Quick Coupler Power Output Ground Fault	MACHINE CU	L01	Electrical
＃V0093	Rear Quick Coupler Power Output Hot Short Circuit	MACHINE CU	L01	Electrical

MONITOR ECU FAILURE CODE TABLE

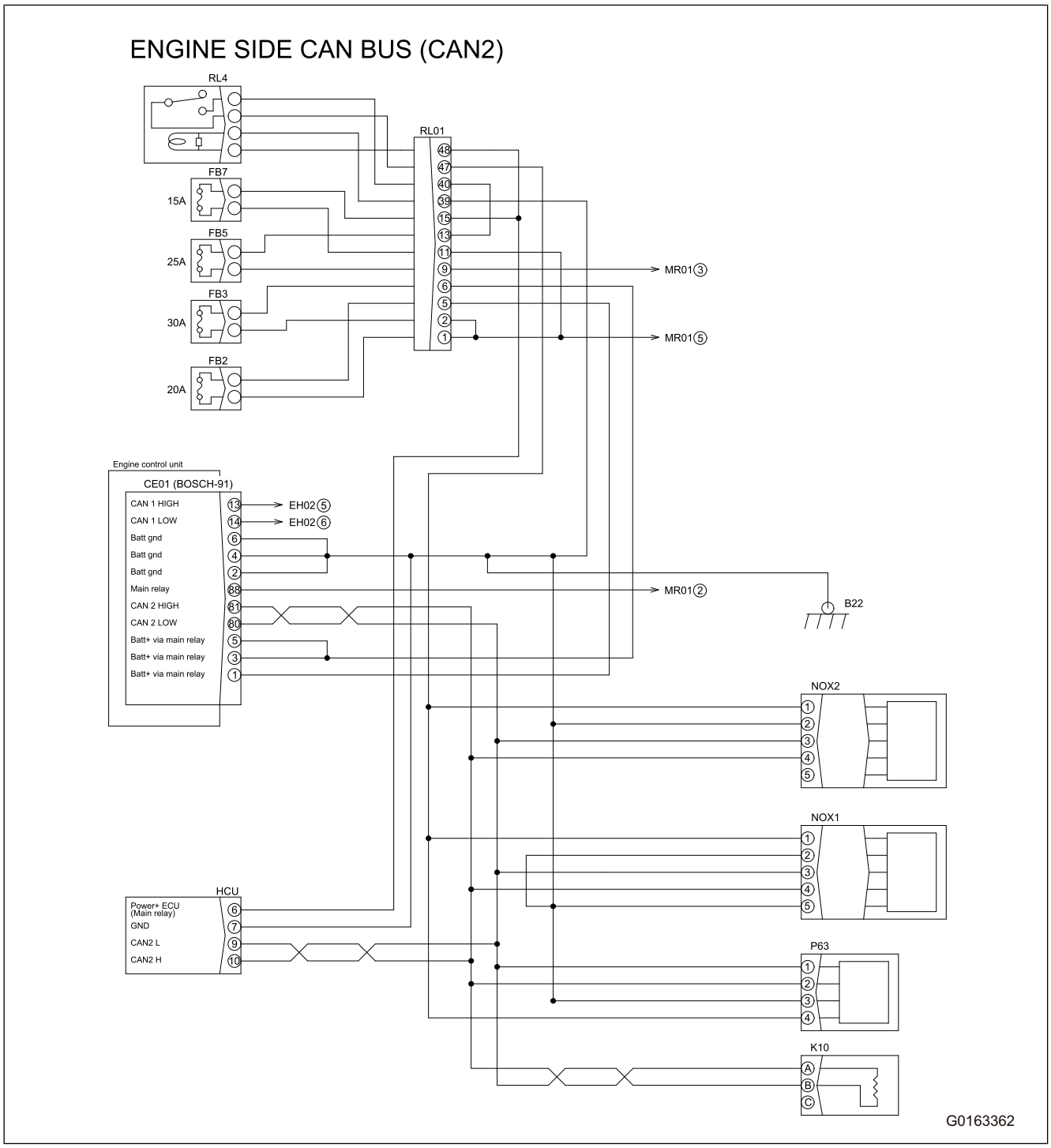
Failure code	Failure (as displayed on screen)	Applicable component	Action level	Category of history
#W8800	CAN Communication Error Machine Controller		L03	Electrical
#W8801	CAN Communication Error Engine Controller		L03	Electrical
＃W8802	CAN Communication Error TM Controller		L03	Electrical
＃W8803	Machine Model Setting Mismatch MON-TM		L03	L03
＃W8804	Machine Model Setting Mismatch MON-MACHINE		L03	Electrical
＃W8805	Timeout Engine Oil Counter Reset		L01	Electrical
＃W8806	CAN Communication Error KOMTRAX Controller		L01	Electrical

Circuit diagram



<table>
<tr><th>No.</th><th>Cause or Action</th><th>Procedure, measuring location, criteria and remarks</th></tr>
<tr><td>2</td><td>Check the integrityof the control of the NOx detection sensor upstream of SCR (NOX1).
Check for a short circuit to battery.</td><td>Disconnect the connector NOX1 at the NOx detection sensor upstream of SCR (NOX1).
Use a multimeter to check the continuity:
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>NOX1 (male) pin 2</td><td>NOX1 (male) pin 1</td><td>There should be no continuity</td></tr>
<tr><td>NOX1 (male) pin 3</td><td>NOX1 (male) pin 1</td><td>There should be no continuity</td></tr>
<tr><td>NOX1 (male) pin 4</td><td>NOX1 (male) pin 1</td><td>There should be no continuity</td></tr>
</table>
• If continuity is detected,repair or replace as required.
• If there is no continuity, go to step 3</td></tr>
<tr><td>3</td><td>Check the integrityof the control of the NOx detection sensor upstream of SCR (NOX1).
Check for a short circuit to ground.</td><td>Disconnect the connector NOX1 at the NOx detection sensor upstream of SCR (NOX1).
Use a multimeter to check the continuity:
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>NOX1 (male) pin 1</td><td>NOX1 (male) pin 2</td><td>There should be no continuity</td></tr>
<tr><td>NOX1 (male) pin 3</td><td>NOX1 (male) pin 2</td><td>There should be no continuity</td></tr>
<tr><td>NOX1 (male) pin 4</td><td>NOX1 (male) pin 2</td><td>There should be no continuity</td></tr>
</table>
• If continuity is detected,repair or replace as required.
• If there is no continuity, go to step 4</td></tr>
<tr><td>4</td><td>Check that the NOx detection sensor upstream of SCR (NOX1) is operating correctly.</td><td>• The module is working correctly, contact the Komatsu Distributor.
• The module is not working correctly,go to step 5</td></tr>
<tr><td>5</td><td>Replacethe NOx detection sensor upstream of SCR (NOX1).</td><td>Perform the Engine Restart Counter Reset/Unlock inducement configuration with the diagnostic tool before returning the machine to service.
Then carry out the SCR fault verification if necessary. Then check to see that this fault is resolved.
• If the fault is resolved, return the machine to service.
• If the fault has not been resolved, check the ENGINE ECU for the appropriate software and update if necessary.</td></tr>
<tr><td>6</td><td>Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires.
Check that the connectors are fully inserted.</td><td>Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display.
• If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.
• If no damage is detected, only normal readings will appear on the screen delete the fault code.</td></tr>
</table>

Circuit diagram



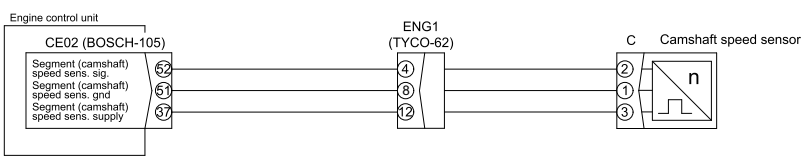
Failure Code [#T0069]

Action level	Failure code	DTMC	Failure	EGR Valve: Current limited
L03	#T0069	E70A-1F		
Detail of failure	The Engine ECU monitors the current sent to the actuator of the EGR actuator (EGR). If it exceeds a set limit for a time longer than the anti-bouncing time, a slow actuator condition is detected.			
Related information	The activation current of the EGR actuator (EGR) exceeds the current permitted to reach the required position: there could be an electrical problem inside the EGR valve actuator, a wiring problem ("short circuit") or a mechanical blockage in the valve.			

<table>
<tr><th>No.</th><th>Cause or Action</th><th>Procedure, measuring location, criteria and remarks</th></tr>
<tr><td>1</td><td>Check if the fault is present and active.</td><td>Use the diagnostic tool to check the status of this fault.
• If the fault is present and active, go to step 2.
• If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active, go to step 5.</td></tr>
<tr><td>2</td><td>Check for a short circuit to battery in the circuit of the EGR actuator (EGR).</td><td>Disconnect the EGR actuator (EGR) at the connector EGR.
Disconnect the engine wiring from the ENGINE ECU at connector CE02.
With the ignition switch set to OFF, use a multimeter to perform the following tests on the engine wiring: Then use the multimeter to perform the following tests on the engine wiring:
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>EGR (female) pin 2</td><td>Battery positive</td><td>There should be no continuity</td></tr>
<tr><td>EGR (female) pin 4</td><td>Battery positive</td><td>There should be no continuity</td></tr>
<tr><td>EGR (female) pin 5</td><td>Battery positive</td><td>There should be no continuity</td></tr>
</table>
• If there is continuity, there is a short circuit condition in the wiring. repair or replace as required.
• If there is no continuity, the wiring is operating correctly, leave the connectors disconnected and go to step 3.</td></tr>
<tr><td>3</td><td>Check for short circuit to ground in the circuit of the EGR actuator (EGR).</td><td>Disconnect the EGR actuator (EGR) at the connector EGR.
Disconnect the engine wiring from the ENGINE ECU at connector CE02.
With the ignition switch set to OFF, use a multimeter to perform the following tests on the engine wiring: Then use the multimeter to perform the following tests on the engine wiring:
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>EGR (female) pin 1</td><td>Ground</td><td>There should be no continuity</td></tr>
<tr><td>EGR (female) pin 2</td><td>Ground</td><td>There should be no continuity</td></tr>
<tr><td>EGR (female) pin 6</td><td>Ground</td><td>There should be no continuity</td></tr>
</table>
• If there is continuity, there is a short circuit condition in the wiring. repair or replace as required.
• If there is no continuity, the wiring is operating correctly, leave the connectors disconnected and go to step 4.</td></tr>
</table>

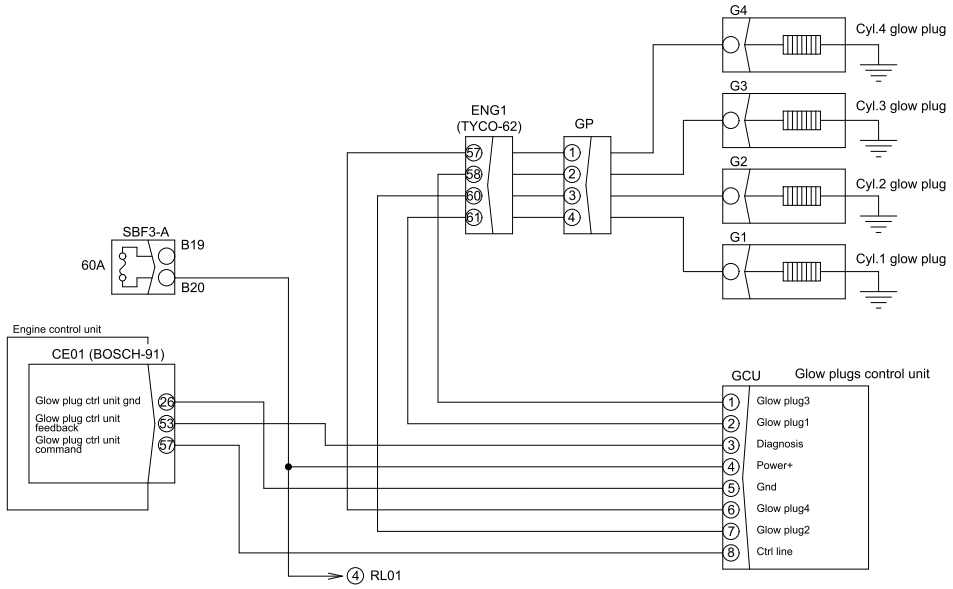
<table>
<tr><th>No.</th><th>Cause or Action</th><th>Procedure, measuring location, criteria and remarks</th></tr>
<tr><td>1</td><td>Verify thatthe fault is present and active.</td><td>Use the operator display or the diagnostic instrument to check the status of this fault.
• If the fault is present and active, go to step 2
• If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active, go to step 5.</td></tr>
<tr><td>2</td><td>Check the signal circuit of the camshaft sensor (C) for an interruption. Disconnect the engine wiring from the ENGINE ECU at connector CE02.</td><td>Disconnectthe engine wiring from the camshaft sensor (C), connector C.
With the ignition switch B05,B06 (OCCHIO #3) in the OFF position, use a multimeter to carry out the following continuity checks:
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>CE02 (female) pin 51</td><td>C pin 1</td><td>There should be continuity.</td></tr>
<tr><td>CE02 (female) pin 52</td><td>C pin 2</td><td>There should be continuity.</td></tr>
</table>
• If there is continuity during one or both checks,there is an open circuit in the signal circuit of the camshaft sensor (C). Locate and repair the broken conductor.
• If there is continuity in both checks, leave both connectors disconnected and go to step 3.</td></tr>
<tr><td>3</td><td>Check the integrity of the camshaft sensor (C).</td><td>Make sure that the sensor installed of the camshaft is the correct one and that it is correctly mounted, and that the sensor is not loose or moving.
Check the alignment of the camshaft timing gear plate (phonic wheel).
• In case of assembly or alignment problems, repair or replace as required.
• If no issues are found, go to step 4.</td></tr>
<tr><td>4</td><td>Replace thecamshaft sensor (C).</td><td>Use the operator display or the diagnostic instrument to check the status of this fault.
• If the fault has been resolved, return the machine to service.
• If the fault has not been resolved, check the ENGINE ECU for the appropriate software and update if necessary.</td></tr>
<tr><td>5</td><td>Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires.
Check that the connectors are fully inserted.</td><td>Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display.
• If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.
• If no damage is detected, only normal readings will appear on the screen delete the fault code.</td></tr>
</table>

Circuit diagram



G0163361

Circuit diagram



Failure Code [#T0110]

Action level	Failure code	DTMC	Failure	Glow plug: Power stage Overtemperature
L03	#T0110	A402-06		
Detail of failure	The ENGINE ECUdetects a high battery voltage, a high temperature inside the Engine ECU, a high load or a wiring problem or a problem with the glow plug control unit (GCU).			
Related information	The Engine ECU monitors the correct operation of the glow plug control unit (GCU). If there is a relay between the Engine ECU and the glow plug, the fault may be caused by the relay and not the glow plug. If there is no smart relay, an electrical fault in the glow plug cannot be detected. An overtemperature is reported.			

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Check if the fault is present and active.	Use thediagnostic tool to check the status of this fault. • If the fault is present and active, go to step 2. • If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active, go to step 4.

No.	Cause or Action	Procedure, measuring location, criteria and remarks
4	Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Check that the connectors are fully inserted.	Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display. • If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved. • If no damage is detected, only normal readings will appear on the screen delete the fault code.

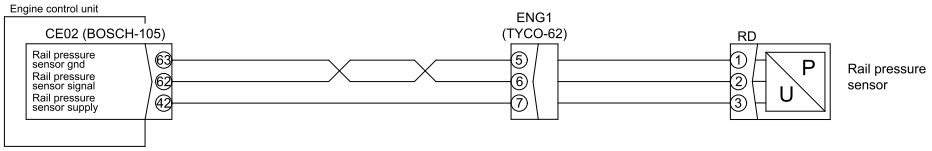
Failure Code [#T0128]

Action level	Failure code	DTMC	Failure	Injector cylinder 4: invalid programming of IMA code
L03	#T0128	8E02-1F		
Detail of failure	An invalid IMA code has been programmed for injector 4, or there is an incorrect initialization of the EEPROM of the control unit A-F02 or incorrect operation of the ENGINE ECU.			
Related information	The injectors are individually corrected (IMA code) to ensure the exact injection quantity of each injector from the lowestto the highest quantity. The correction is performed at the end of the production line (EOL) and after replacing the injectors with the tester. The data is stored in the EEPROM of the engine control unit A-F02 and the values stored in the EEPROM are protected with checksum parameters. At each key “on”, the correction data is read by the EEPROM and the values are checked to identify if they are plausible and the checksums are correct. Otherwise, the injector will not be corrected and the fault will be stored. Incorrect checksums of the injector adjustment codes may be reported, or the basic correction amount of at least 1 correction class is not within the acceptable range for this class, or the injector adjustment values might not be read at due to incorrect access to the EEPROM.			

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Verify fault is present and active.	Use the diagnostic instrument to check the status of this fault. • If the fault is present and active, go to step 2. • If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active, go to step 4.
2	Connectthe diagnostic tool to the Engine ECU.	Check the correct programming of the IMA code of injector 4. • If the IMA code of injector 4 has not been programmed or is not correct, programme the correct IMA code of injector 4. • If the programmed IMA code is correct, go to step 3.
3	Connectthe diagnostic tool to the Engine ECU and re-flash the control unit software with the latest version available.	Connect the diagnostic instrument to the Engine ECU, delete the error and check if the fault code returns active. • If code returns in an active status, replace the Engine ECU. • If code remains inactive, return the machine to service.

No.	Cause or Action	Procedure, measuring location, criteria and remarks
4	Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Check that the connectors are fully inserted.	Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display. • If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved. • If you do not find damage and the display indicates only normal readings, delete the fault code.

Circuit diagram



Failure Code [#T0201]

REMARK

Since this fault causes inducement, it is necessary to perform the Engine Restart Counter Reset/Unlock inducement configuration with the diagnostic tool before returning the machine to service.

Action level	Failure code	DTMC	Failure	Pressure relief valve reached maximum allowed open time
L03	#T0201			
Detail of failure	The ENGINE ECU has recorded a PRV opening for too long.			
Related information	The pressure relief valve (PRV), integrated in the fuel line, opens if excessive pressure is present in the rail. The Engine ECUdetects, counts and records the number and duration of PRV openings. If the ENGINE ECUdetermines that the PRV has remained open for too long, this fault occurs. 1. Faulty fuel injection system, causing the PRV to open for an extended period of time. 2. Faulty low pressure fuel lines, clogged fuel filter, faulty charge gear pump, faulty lift pump (if equipped). 3. Faulty fuel metering unit (X), internal failure or wiring. 4. Faulty PRV, mechanical failure. 5. Faul tin the rail pressure sensor (RD), implausible value. 6. Faulty ENGINE ECU, software.			

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Use the diagnostic tool to check if other faults relating to the fuel system, rail pressure or pressure relief valve are active.	• If other faults relating to the fuel system, rail pressure or pressure relief valve are active, diagnose them first and then return to this fault. • If other faults relating to the fuel system, rail pressure or pressure relief valve are not active, go to step 2.

No.	Cause or Action	Procedure, measuring location, criteria and remarks
2	Carry out the Diesel Exhaust Fluid (DEF) system test.	Use the diagnostic instrument to carry out the Urea Dosing System test. Perform the Engine Restart Counter Reset/Unlock inducement configuration with the diagnostic tool before returning the machine to service. Carry out the SCR fault verification. Then check to see that this fault is resolved. • If the fault is resolved, return the machine to service. • If the fault has not been resolved, check the ENGINE ECU for the appropriate software and update if necessary.

Failure Code [#T0220]

REMARK

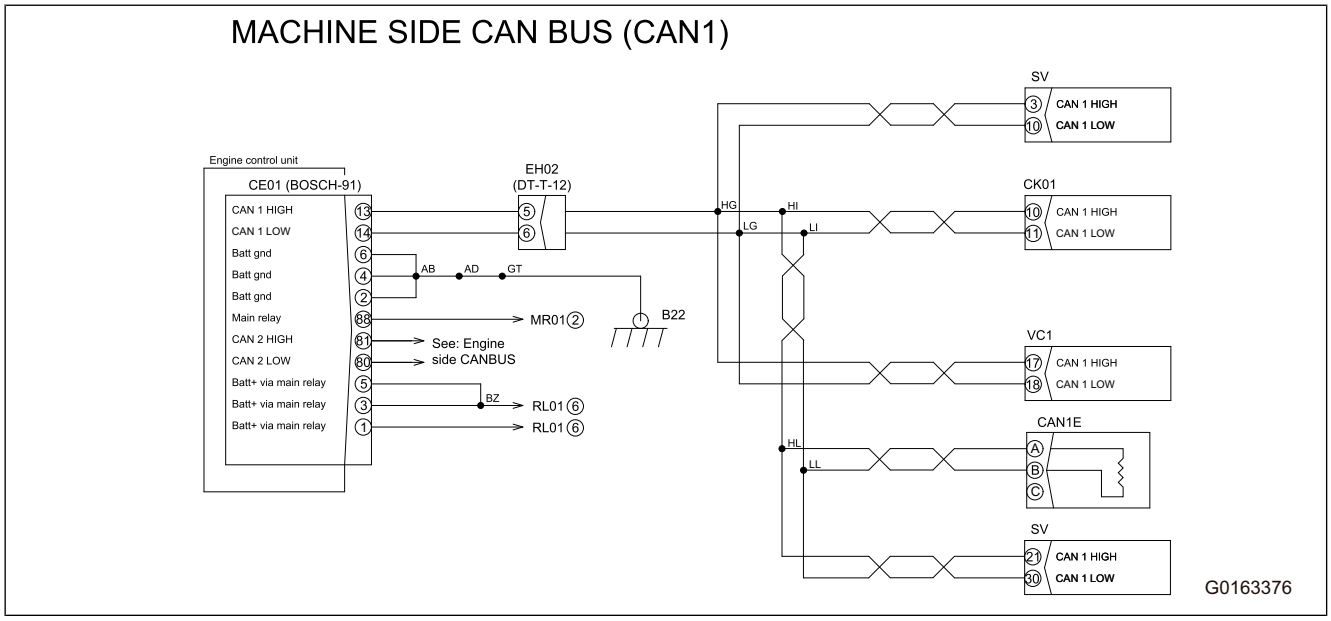
Since this fault causes inducement, it is necessary to perform the SCR Fault Repair Verification Test once the fault has been resolved.

REMARK

Since this fault causes inducement, it is necessary to perform the Engine Restart Counter Reset/Unlock inducement configuration with the diagnostic tool before returning the machine to service.

Action level	Failure code	DTMC	Failure	Pressure monitoring: Urea pressure too high
L03	#T0220	EE10-0F		
Detail of failure	The ENGINE ECU has determined the presence of an overpressure in the DEF system.			
Related information	The Engine ECU determines the conditions of the DEF of the selective catalytic reduction system (SCR). If the DEF metering system is in normal operating state (ready for metering), it is monitored to check the correct pressure; this check is mandatory to obtain a correct metering quantity. If the pressure of the DEF metering system is above the set threshold, it is not possible to ensure a correct metering quantity and this fault occurs. 1. Fault relatingto the DEF level, too low. 2. Faulty DEF back-flow line (tube), restricted or damaged. 3. Faulty DEF pump module (MB02), pump motor operation at maximum speed due to an electrical fault or a non- valid pressure signal. 4. Fault in the ENGINE ECU, software.			

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Check that the DEF tank is filled at the correct level and that the back-flow pipe is not restricted or damaged.	Check the tank level and the conditions of the back-flow pipe. • If the tank needs topping up or if the back-flow pipe cannot be subjected to maintenance, refill, repair or replace as needed. Then, reset the engine restart counter / unlock inducement configuration with the diagnostic tool. • If the tank level is correct and the back-flow pipe can be subjected to maintenance, go to step 2.
2	Checkthe correct operation of the DEF pump module (MB02).	• The module is working correctly, contact the Komatsu Distributor. The module is not working correctly, replace the DEF pump module (MB02) and go to step 3



Failure Code [#T0247]

REMARK

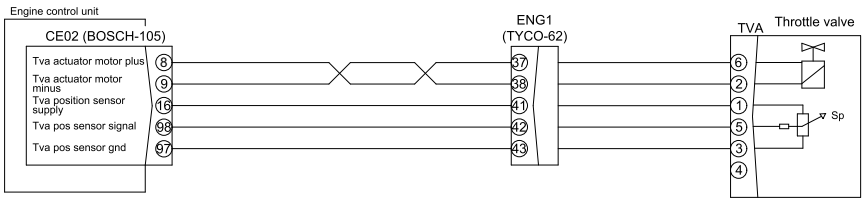
Since this fault causes inducement, it is necessary to perform the Engine Restart Counter Reset/Unlock inducement configuration with the diagnostic tool before returning the machine to service.

Action level	Failure code	DTMC	Failure	ECU internal: Error sensor supplies 1
L03	#T0247	B50D-0C		
Detail of failure	The ECU sensor supply 1 reference voltage is out of range.			
Related information	TheEngine ECU supplies six separate 5.0 V voltage supplies to the sensors. These voltages are monitored by the ECU hardware to make sure that they are within a set range. This range is defined by the hardware of the ECU and cannot be calibrated. If the power supply reference voltage of sensor 1 is not within the set range, this fault occurs. 1. Faulty differential pressure sensor on DPF (PDPF), internal failure. 2. Fault inthe intake air Intake air temperature sensor (TA01). 3. Faulty SCR pump module, internal fault or faulty wiring. 4. Faulty ENGINE ECU, software.			

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Verify fault is present and active.	Use the diagnostic tool to check the status of this fault. • If the fault is present and active, go to step 2 • If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active, go to step 10.

<table>
<tr><th>No.</th><th>Cause or Action</th><th>Procedure, measuring location, criteria and remarks</th></tr>
<tr><td>2</td><td>Check for a short circuit to ground in the wiring of the low side signal of the Starter control relay (RL2).</td><td>Disconnect the wiring harness from the ENGINE ECU at connector CE01.
With the ignition switch in the OFF position, use a multimeter to measure the voltage:<table><tr><th>From</th><th>To</th><th>Value</th></tr><tr><td>CE01 (female) pin 55</td><td>Ground</td><td>There should be no continuity</td></tr><tr><td>CE01 (female) pin 55</td><td>with all the other pins of the connector CE01</td><td>There should be no continuity</td></tr></table>• If there is no continuity, go to step 3
• If continuity is detected, locate and repair or replace the damaged conductors.</td></tr>
<tr><td>3</td><td>Check the correct operation of the Starter control relay (RL2).</td><td>• If the contactor is working correctly, contact the Komatsu Distributor.
• If the contactoris not working correctly, Go to step 4</td></tr>
<tr><td>4</td><td>Asthere is no method for field testing, replace the Starter control relay (RL2).</td><td>Check if the fault has been resolved.
• If this fault is resolved, return the machine to service.
• If fault has not been resolved, check the ENGINE ECU for the appropriate software and update if necessary.</td></tr>
<tr><td>5</td><td>Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires.
Check that the connectors are fully inserted.</td><td>Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display.
• If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.
• If no damage is detected, only normal readings will appear on the screen delete the fault code.</td></tr>
</table>

Circuit diagram



Failure Code [#T0284]

Action level	Failure code	DTMC	Failure	Throttle valve (TVA): plausibility error from overload on the power stage outputs
L03	#T0284	02F0-EF		
Detail of failure	The ENGINE ECU has detected a plausibility error due to a short circuit to ground or a short circuit to battery in the throttle valve solenoid valve (TVA)			
Related information	The Engine ECU internally monitors the operation of the control circuit of the pulse width modulated (PWM) bridge H, of the throttle valve solenoid valve (TVA), to detect electrical defects. If the ENGINE ECUdetects a plausibility error which could be due to a short circuit to ground or a short circuit to battery, this fault occurs. 1. Fault in wiring, short circuit to ground or short circuit to battery. 2. Fault in the throttle valve solenoid valve (TVA).			

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Verify fault is present and active.	Use the diagnostic instrument to check the status of this fault. • If the fault is present and active, go to step 2. • If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue to step 4.
2	Checkfor a short circuit to ground working on the wiring of the throttle valve solenoid valve (TVA).	With the wiring of the throttle valve solenoid valve (TVA), connector TVA, connected and in a Key-Off condition, use a multimeter to carry out the following continuity check:

From	To	Value
TVA pin 1	Ground	There should be no continuity
TVA pin 5	Ground	There should be no continuity
TVA pin 6	Ground	There should be no continuity

- If there is no continuity, continue with step 3.
- If there is continuity, a short circuit to ground is present. Locate and repair the shorted conductor.

No.	Cause or Action	Procedure, measuring location, criteria and remarks
3	Check the correct operation of the urea pipes heating contactor.	• If the unit is working correctly, contact the Komatsu Distributor. • If the unit is not working correctly, continue to step 4.
4	Replace the urea pipes heating contactor.	Then check to see that this fault is resolved. • If the fault is resolved, the machine can resume service. • If the fault has not been resolved, check the ENGINE ECU for the appropriate software and update if necessary.
5	Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Check that the connectors are fully inserted.	Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display. • If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved. • If no damage is detected, only normal readings will appear on the screen delete the fault code.

Failure Code [#T0319]

Action level	Failure code	DTMC	Failure	Fault in the DEF heater module:short-circuit to battery
L03	#T0319	7EEC-E3		
Detail of failure	The ENGINE ECU has detected a short circuit to a high voltage source in the circuit of the resistors.			
Related information	The Engine ECU checks the correct operation of the urea pipes heating contactor which controls and monitors the resistors. If the ENGINE ECU detects a short to high voltage source in the circuit of the resistors, this fault occurs. 1. Fault in the wiring of the resistors in a short circuit to voltage source. 2. Fault in the urea pipes heating contactor, internal fault. 3. Faulty ENGINE ECU, software.			

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Check if the fault is present and active.	Use the diagnostic tool to check the status of this fault. • If the fault is present and active, continue to step 2. • If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue to step 5.
2	Check the vehicle wiring harness circuit wiring for a short to voltage condition.	Disconnect the vehicle wiring from the urea pipe heating contactor. With the ignition switch in the ON position, use a multimeter to check for voltage on the vehicle wiring side: • Ifthere is no voltage, continue to step 3. • If voltage is detected, Use the appropriate service manual, if necessary, to locate and repair the damagedconductors.
3	Check the correct operation of the urea pipes heating contactor.	• If the unit is working correctly, contact the Komatsu Distributor. • If the unit is not working correctly, continue to step 4.
4	Replace the urea pipes heating contactor.	Then check to see that this fault is resolved. • If the fault is resolved, the machine can resume service. • If the fault has not been resolved, check the ENGINE ECUfor the appropriate software and update if necessary.

No.	Cause or Action	Procedure, measuring location, criteria and remarks
2	Check the correct operation of the DEF tank quality - level - temperature sensor (P63).	• If the sensor is okay, contact the Komatsu Distributor. • If the sensor is not working correctly, go to step 3
3	Replace the DEF tank quality - level - temperature sensor (P63). Then check to see that this fault is resolved.	• If this fault is resolved, use the diagnostic tool to perform the Engine Restart Counter Reset/Unlock inducement configuration then return the machine to service. • If fault has not been resolved, check the ENGINE ECUfor the appropriate software and update if necessary.

<table>
<tr><th>No.</th><th>Cause or Action</th><th>Procedure, measuring location, criteria and remarks</th></tr>
<tr><td>2</td><td>Check the conditions of the coolant temperature sensor (F).</td><td>Disconnect the engine wiring from the coolant temperature sensor (F) at connector F. Use a multimeter to measure the resistance of the coolant temperature sensor (F):
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>Coolant temperature sensor F pin 1</td><td>Coolant temperature sensor F pin 2</td><td>There must be a measurable quantityof resistance according to the effective coolant temperature, between 100 – 50000 Ω.</td></tr>
</table>
REMARK

If there is a measurable amount of resistance, leave the connector disconnected and go to step 3.
If there is infinite resistance, the coolant temperature sensor (F) has failed internally. Replace sensor.
</td></tr>
<tr><td>3</td><td>Check the circuit of the coolant temperature sensor (F) for an interruption.</td><td>Disconnect the engine wiring from the ENGINE ECU at connector CE02.
With the ignition switch set to OFF, use a multimeter to carry out the following continuity check:
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>CE02 (female) pin 100</td><td>F pin 1</td><td>There should be continuity.</td></tr>
</table>

If continuity is detected, leave the connectors disconnected and go to step 4.
If there is no continuity, it means that there is an open circuit in the engine wiring between the connector F pin 1 of the coolant temperature sensor (F) and the connector CE02 (female) pin 100 of the ENGINE ECU. Locate and repair the conductor interruption.
</td></tr>
<tr><td>4</td><td>Check the signal circuit of the coolant temperature sensor (F) for a short circuit towards another circuit (high voltage source).</td><td>With the ignition switch in the OFF position, use a multimeter to carry out the following continuity checks:
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>CE02 (female) pin 100</td><td>All other pins in connector CE02</td><td>There should be no continuity.</td></tr>
</table>

If there is continuity, there is a short circuit towards another circuit (high voltage source) in the signal circuit of the coolant temperature sensor (F). Locate and repair the shorted conductors.
If no continuity is detected, leave the connectors disconnected and go to step 5.
</td></tr>
<tr><td>5</td><td>Check the signal circuit of the coolant temperature sensor (F) for a short circuit towards the power supply.</td><td>With the ignition switch set to “ON”, use a multimeter to perform the following voltage check:
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>CE02 (female) pin 100</td><td>Ground</td><td>There should be no voltage.</td></tr>
</table>

If there is voltage, there is a short circuit towards power supply in the signal circuit of the coolant temperature sensor (F). Locate and repair the shorted conductors.
In the absence of voltage, check the ENGINE ECU for the appropriate software and update if necessary.
</td></tr>
</table>

No.	Cause or Action	Procedure, measuring location, criteria and remarks
4	Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Check that the connectors are fully inserted.	Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display. • If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved. • If you do not find damage and the display indicates only normal readings, delete the fault code.

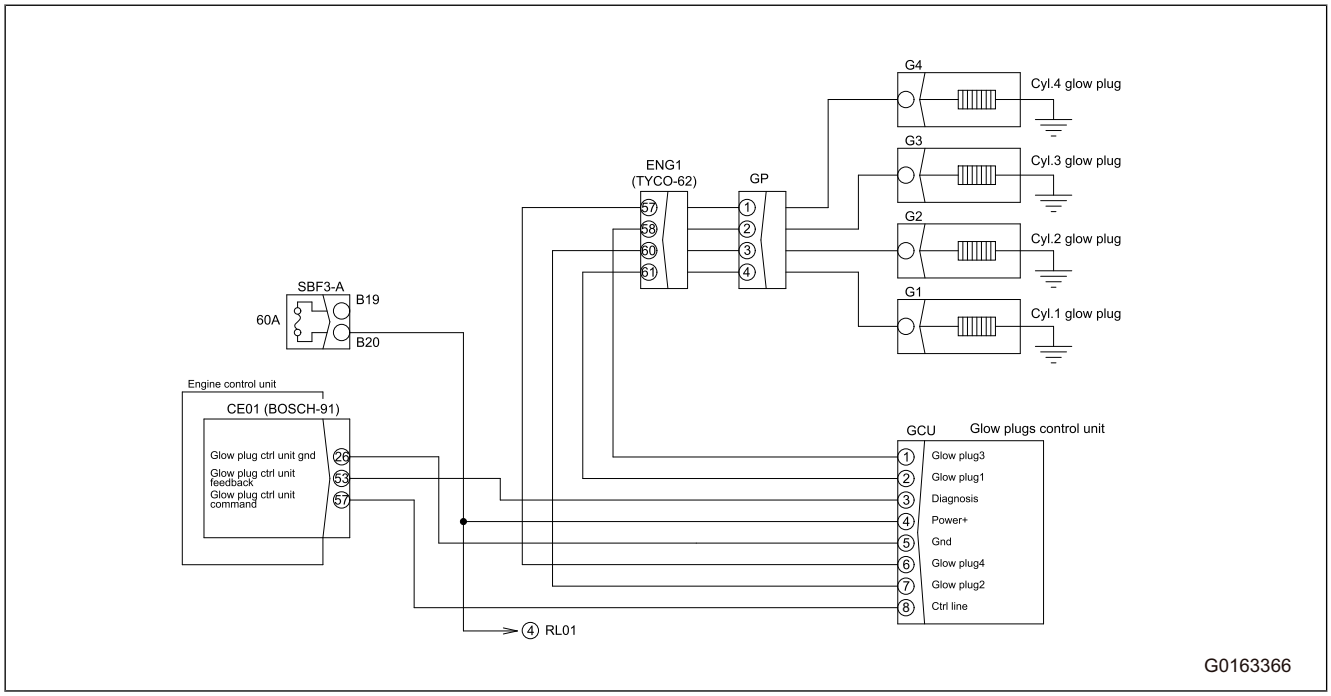
Failure Code [#T0412]

Action level	Failure code	DTMC	Failure	Engine oil pressure below the minimum value
L03	#T0412	6400-01		
Detail of failure	The ENGINE ECUdetects low engine oil pressure or the Low engine oil level alarm switch (V) is blocked.			
Related information	The Engine ECU monitors the engine oil pressure value for plausibility. When the engine is running, the pressure must be higher than a defined minimum value, detected by the Low engine oil level alarm switch (V). The oil pressure signal is acquired from the connected oil pressure sensor. There is no oil pressure signal or the digital oil pressure switch is not active.			

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Verify fault is present and active.	Use the diagnostic instrument to check the status of this fault. • If the fault is present and active, go to step 2. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active, go to step 4.
2	Check that the engine oil level is correct and top up if necessary.	Connect the diagnostic instrument to the Engine ECU, delete the error and check if the fault code returns active. • If code returns in an active status, go to step 3. • If code remains inactive, return the machine to service.
3	Checkthe correct operation of the Low engine oil level alarm switch (V).	Connect the diagnostic instrument to the Engine ECU, delete the error and check if the fault code returns active. • If code returns in an active status, replace the Low engine oil level alarm switch (V). • If code remainsinactive, return the machine to service.
4	Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Check that the connectors are fully inserted.	Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display. • If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved. If you do not find damage and the display indicates only normal readings, delete the fault code.

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Check the correct operation of the DEF pump module (MB02) and of the DEF metering module.	• If both of them operate correctly, go to step 2. • If at least one of the two is not operating correctly, replace the faulty component and go to step 2.
2	Carry out the Diesel Exhaust Fluid (DEF) system test.	Use the diagnostic instrument to carry out the Urea Dosing System test. Perform the Engine Restart Counter Reset/Unlock inducement configuration with the diagnostic tool before returning the machine to service. Carry out the SCR fault verification. Then check to see that this fault is resolved. • If the fault is resolved, return the machine to service. • If the fault has not been resolved, check the ENGINE ECU for the appropriate software and update if necessary.

Circuit diagram



Failure Code [#T0423]

REMARK

Since this fault causes inducement, it is necessary to perform the SCR Fault Repair Verification Test once the fault has been resolved.

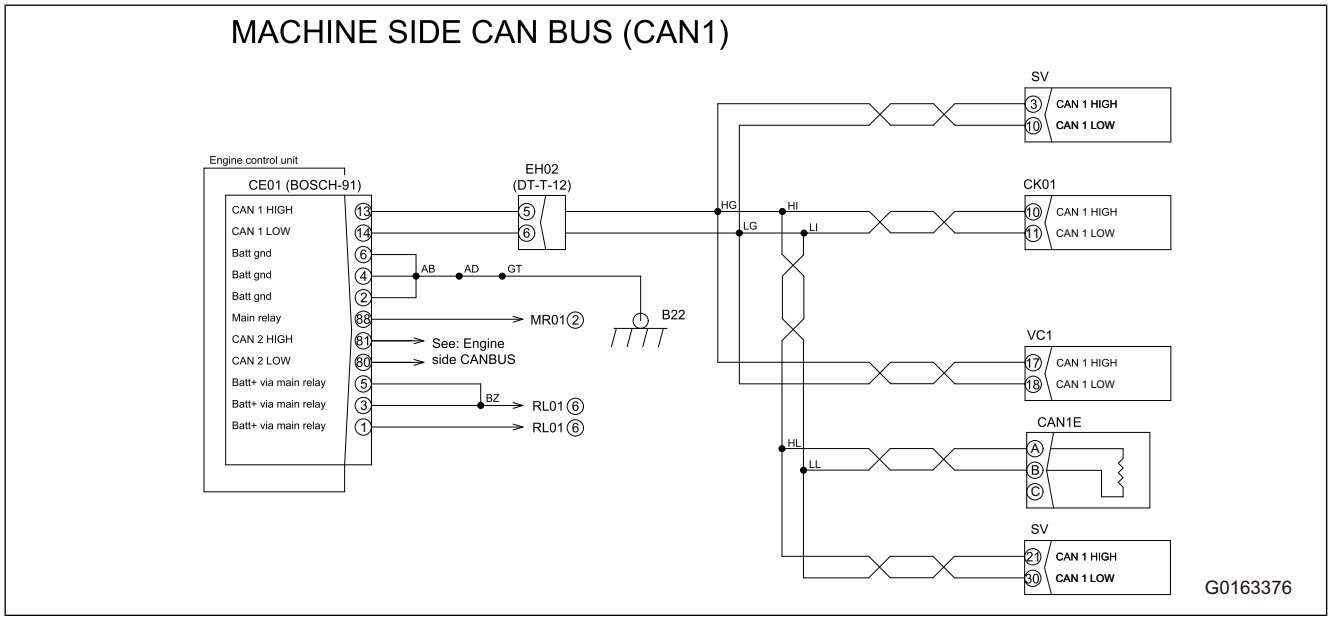
REMARK

Since this fault causes inducement, it is necessary to perform the Engine Restart Counter Reset/Unlock inducement configuration with the diagnostic tool before returning the machine to service.

Action level	Failure code	DTMC	Failure	DEF dosing valve stuck closed with low voltage levels
L03	#T0423	90EB-E7		
Detail of failure	The ENGINE ECU is not sensing full needle movement when the dosing module solenoid is mechanically blocked or frozen.			

Related information	The Engine ECU monitors the boost air temperature and pressure sensor (HP) checking for a short circuit towards a high voltage source or an open circuit. If the ENGINE ECU senses the presence of a short circuit towards a high voltage source or an open circuit in the temperature signal circuit of the boost air temperature and pressure sensor (HP), this fault occurs, If this fault occurs, the ambient temperature value is set by the ENGINE ECU at the last valid value detected or at a default replacement value, once the fault is validated. 1. Faulty temperature signal wire of the boost air temperature and pressure sensor (HP), short circuit towards a high voltage source or open circuit. 2. Fault in the boost air temperature and pressure sensor (HP), internal fault. 3. Faulty ENGINE ECU, software.

<table>
<tr><th>No.</th><th>Cause or Action</th><th>Procedure, measuring location, criteria and remarks</th></tr>
<tr><td>1</td><td>Verify fault is present and active.</td><td>Use the operator display or the diagnostic instrument to check the status of this fault.
• If the fault is present and active, go to step 2.
• If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active, go to step 6.</td></tr>
<tr><td>2</td><td>Check the temperature signal circuit of the boost air temperature and pressure sensor (HP) for an interruption.</td><td>Disconnect the engine wiring from the boost air temperature and pressure sensor (HP) at connector HP.
Disconnect the engine wiring from the ENGINE ECU at connector CE02.
With the ignition switch STARTER SWITCH S-F200 (--> DA DEFINIRE!!! <--) in the OFF position, use a multimeter to perform the following continuity check:
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>CE02 pin 38</td><td>HP pin 3</td><td>There should be continuity.</td></tr>
<tr><td>CE02 pin 61</td><td>HP pin 2</td><td>There should be continuity.</td></tr>
<tr><td>CE02 pin 95</td><td>HP pin 1</td><td>There should be continuity.</td></tr>
<tr><td>CE02 pin 96</td><td>HP pin 4</td><td>There should be continuity.</td></tr>
</table>
• If there is continuity, leave connectors HPand CE02 disconnected and go to step 3.
• If there is no continuity, this indicates an open circuit in the engine wiring between the connector CE02 and the connector HP, locate and repair the broken conductor.</td></tr>
<tr><td>3</td><td>Check the temperature signal circuit of the boost air temperature and pressure sensor (HP) for a short circuit towards another circuit.</td><td>With the ignition switch in the OFF position, use a multimeter to carry out the following continuity checks:
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>CE02 pin 96</td><td>All other pins in connector CE02</td><td>There should be no continuity.</td></tr>
<tr><td>CE02 pin 95</td><td>All other pins in connector CE02</td><td>There should be no continuity.</td></tr>
</table>
• If there is continuity, there is a short circuit towards another circuit in the temperature signal circuit of the boost air temperature and pressure sensor (HP). Locate and repair the shorted conductor.
• If there is no continuity, leave the connectors disconnected and go to step 4.</td></tr>
</table>



Failure Code [#T0442]

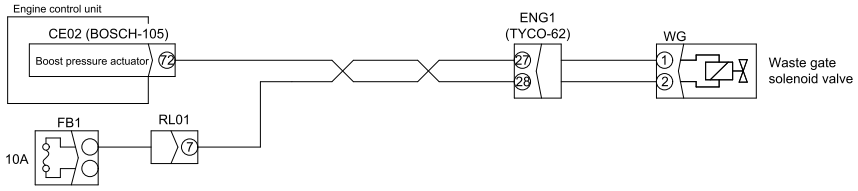
Action level	Failure code	DTMC	Failure	Open circuit in power stage of DEF dosing valve actuator
L03	#T0442	1215-1F		
Detail of failure	The ENGINE ECU has detected an interruption in the circuit of the metering valve of DEF.			
Related information	The Engine ECU monitors the circuit of the metering valve Diesel Exhaust Fluid (DEF). If the ENGINE ECU detects an interruption on the circuit of the metering valve of DEF, this fault occurs. 1. Internal fault of the metering valve of DEF. 2. Faulty wiring of the metering valve of DEF. 3. Fault in the ENGINE ECU, software.			

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Check if the fault is present and active.	Check if the fault is present and active. • If the fault is present and active, go to step 2. • If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active, go to step 5.
2	Check the DEF dosing module (MB03) for an internal fault.	Disconnect the wiring from the DEF dosing valve. Use a multimeter to check the resistance between the pins of the dosing valve. • If the resistance is within the 11 – 16 Ω, leave the connector disconnected and continue to Step 3. • If the resistance is within the 11 – 16 Ω, go to step 4.
3	Check the circuit of the DEF dosing module (MB03) for an interruption.	Disconnect the wiring from the ENGINE ECU. The key must be in the OFF position. Use a multimeter to check the continuity between the valve and the control unit. • If there is no continuity, there is an interruption in the circuit of the metering valve of DEF locate and repair the shorted conductor. • If continuity is detected, go to step 4.

<table>
<tr><th>No.</th><th>Cause or Action</th><th>Procedure, measuring location, criteria and remarks</th></tr>
<tr><td>2</td><td>Check the wiring of the DEF pump module (MB02).</td><td>With the key in the OFF position, use a multimeter to perform the following continuity check on the enginewiring harness side:
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>MB02 pin 2</td><td>CE02 pin 10</td><td>There should be continuity.</td></tr>
<tr><td>MB02 pin 3</td><td>RL3 pin 30
(RL1 pin 45)</td><td>There should be continuity.</td></tr>
<tr><td>MB02 pin 4</td><td>Ground</td><td>There should be continuity.</td></tr>
<tr><td>MB02 pin 5</td><td>CE02 pin 29</td><td>There should be continuity.</td></tr>
<tr><td>MB02 pin 6</td><td>CE02 pin 5</td><td>There should be continuity.</td></tr>
<tr><td>MB02 pin 8</td><td>CE01 pin 15</td><td>There should be continuity.</td></tr>
<tr><td>MB02 pin 9</td><td>CE01 pin 46</td><td>There should be continuity.</td></tr>
<tr><td>MB02 pin 10</td><td>CE01 pin 42</td><td>There should be continuity.</td></tr>
<tr><td>MB02 pin 11</td><td>HCU pin 1</td><td>There should be continuity.</td></tr>
<tr><td>MB02 pin 12</td><td>Ground</td><td>There should be continuity.</td></tr>
</table>
• If there is no continuity, if necessary, use the appropriate service manual to locate and repair the shorted conductor.
• If continuity is detected, go to step 3.</td></tr>
<tr><td>3</td><td>Check the correct operation of the DEF pump module (MB02).</td><td>• If the module is working correctly, go to step 4
• If the module is not working correctly, replace the DEF pump module (MB02), go to step 4</td></tr>
<tr><td>4</td><td>Carry out the Diesel Exhaust Fluid (DEF) system test.</td><td>Use the diagnostic instrument to carry out the Urea Dosing System test.
Perform the Engine Restart Counter Reset/Unlock inducement configuration with the diagnostic tool before returning the machine to service.
Carry out the SCR fault verification.
Then check to see that this fault is resolved.
• If the fault is resolved, return the machine to service.
• If the fault has not been resolved, check the ENGINE ECU for the appropriate software and update if necessary.</td></tr>
<tr><td>5</td><td>Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires.
Check that the connectors are fully inserted.</td><td>Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display.
• If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.
• If no damage is detected, only normal readings will appear on the screen delete the fault code.</td></tr>
</table>

No.	Cause or Action	Procedure, measuring location, criteria and remarks
5	Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Check that the connectors are fully inserted.	Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display. • If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved. • If no damage is detected, only normal readings will appear on the screen delete the fault code.

Circuit diagram



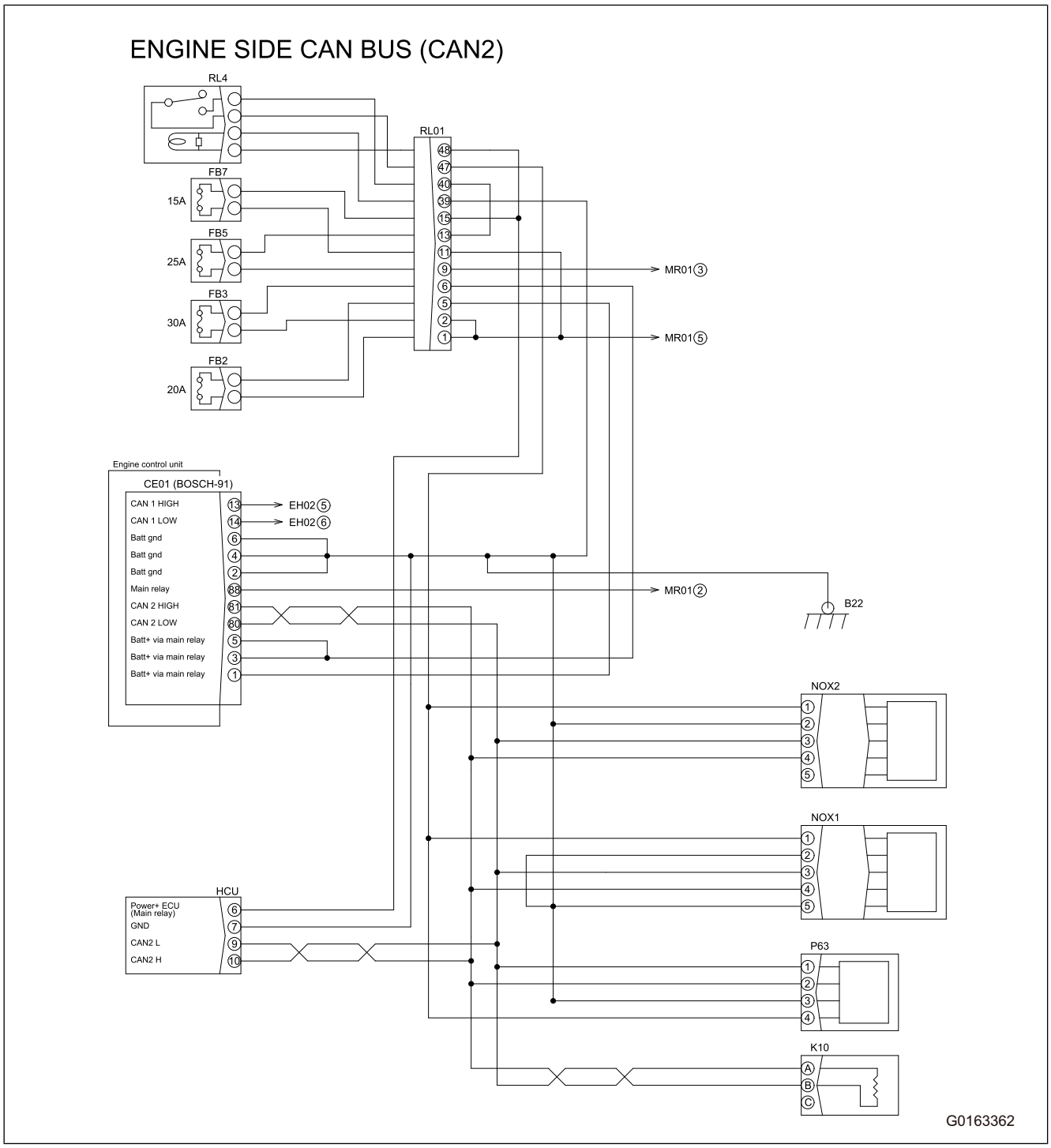
Failure Code [#T0461]

Action level	Failure code	DTMC	Failure	DEFheater module: voltage loss
L03	#T0461	0D20-0E		
Detail of failure	**REMARK** No action.			
Related information	The pressure line and supply module heaters are operated by the HCU (Heater Control Unit). The HCU is communicating with the ECU via CAN, providing the requested information for diagnostics, implementation status and request for the activation command from the ECU.			

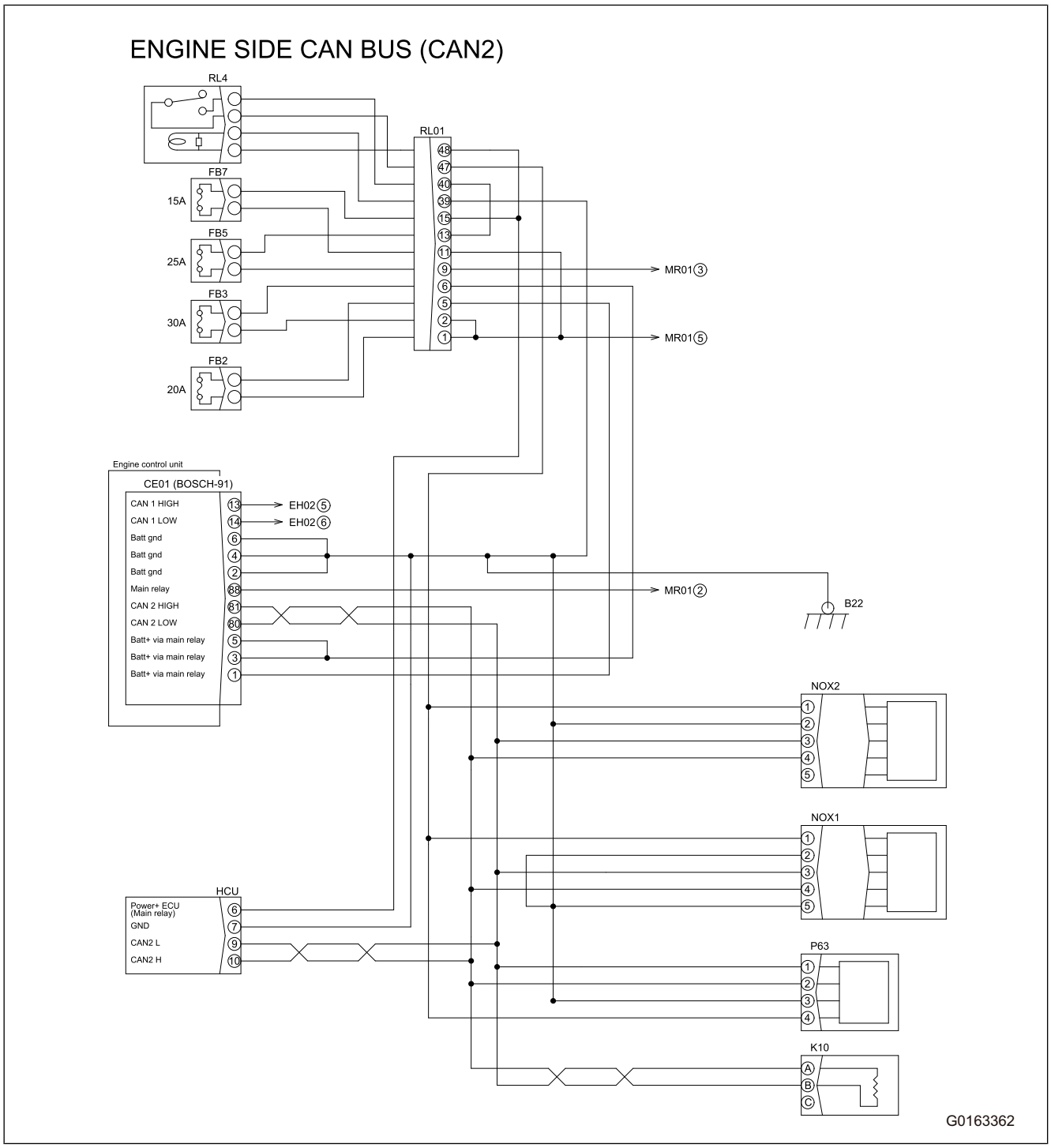
Failure Code [#T0462]

Action level	Failure code	DTMC	Failure	DEF heater module: error in non volatile memory
L03	#T0462	0D20-1F		
Detail of failure	Error in the non volatile memory of the DEF pipe heating control unit (HCU)			
Related information	The pressure line and supply module heaters are operated by the DEF pipe heating control unit (HCU). The DEF PIPE HEATING CONTROL UNIT (HCU) is communicating with the ENGINE ECU via CAN, providing the requested information for diagnostics, implementation status and request for the activation command from the ECU. A-F02 1. Fault in the vehicle system,associated CAN fault. 2. Fault in the power supply voltage or ground, missing. 3. Faulty CAN circuit wiring, open circuit, short circuit, short circuit to ground, or short circuit towards a high voltage source. 4. Faulty ENGINE ECU, software.			

Circuit diagram



Circuit diagram



<table>
<tr><th>No.</th><th>Cause or Action</th><th>Procedure, measuring location, criteria and remarks</th></tr>
<tr><td>2</td><td>Check for the presence of supply voltage fault.</td><td>Use the diagnostic instrument to determine the presence of a fault Upstream NOx Sensor - Sensor Supply Voltage is out of Range.
• If the fault is present, resolve it. Then determine if this fault is also resolved.
• If the fault is not present, go to step 3.</td></tr>
<tr><td>3</td><td>Determine the conditions of the CAN circuit of the NOx detection sensor upstream of SCR (NOX1).</td><td>Disconnect the engine wiring from the NOx detection sensor upstream of SCR (NOX1), connector NOX1.
Use a multimeter to measure the resistance on the CAN circuit on the engine wiring side:<table><tr><td>From</td><td>To</td><td>Value</td></tr><tr><td>NOX1 (male) pin 3</td><td>NOX1 (male) pin 4</td><td>There should be 60 Ω</td></tr></table>• If the measured resistance is correct, go to step 4.
• If the measured resistance is not correct, go to step 6.</td></tr>
<tr><td>4</td><td>Check that the NOx detection sensor upstream of SCR (NOX1) is operating correctly.</td><td>• If the sensor is okay, contact the Komatsu Distributor.
• If thesensor is not working correctly, go to step 5.</td></tr>
<tr><td>5</td><td>Replace the NOx detection sensor upstream of SCR (NOX1).</td><td>Then use the diagnostic instrument to perform the Replacement of NOx Upstream Sensor - Reset ECU Data configuration.
Then check to see that this fault is resolved.
• If the fault is resolved, use the diagnostic tool to perform the Engine Restart Counter Reset/Unlock inducement configuration then return the machine to service.
• If the fault has not been resolved, check the ENGINE ECU for the appropriate software and update if necessary.</td></tr>
<tr><td>6</td><td>Identify the problem of the CAN circuit of the NOx detection sensor upstream of SCR (NOX1).</td><td>Disconnect the CAN line connector CE01.
With the ignition switch set to OFF, use a multimeter to measure the resistance of the CAN connection on the engine wiring harness side:<table><tr><td>From</td><td>To</td><td>Value</td></tr><tr><td>CE01 (male) pin 80</td><td>CE01 (male) pin 81</td><td>The resistance should be 120 Ω.</td></tr></table>• If the measured resistance is correct, the problem found in the CAN circuit of the NOx detection sensor upstream of SCR (NOX1) is in the engine wiring. Locate and repair or replace the damaged conductors.
• If the measured resistance is not correct, go to step 7.</td></tr>
<tr><td>7</td><td>Identify the problem of the CAN circuit of the NOx detection sensor upstream of SCR (NOX1).</td><td>Disconnect the wiring from the CAN2 (Engine bus) terminal resistance (K10).
With the ignition switch set to OFF, use a multimeter to measure the resistance on the CAN2 (Engine bus) terminal resistance (K10):<table><tr><td>From</td><td>To</td><td>Value</td></tr><tr><td>K10H CAN line terminal</td><td>K10L CAN line terminal</td><td>There should be 120 Ω.</td></tr></table>• If the measured resistance is correct, the problem found in the CAN circuit of the NOx detection sensor upstream of SCR (NOX1) is in the CAN line wiring. Locate and repair or replace the damaged conductors.
• If the measured resistance is incorrect, the CAN2 (Engine bus) terminal resistance (K10) is faulty. Replace the CAN2 (Engine bus) terminal resistance (K10).</td></tr>
</table>

Related information	The Engine ECUcan connect and ensure communication between two distinct CAN (Controller Area Network) networks. The correct configuration and monitoring of the two networks configured with pairs of twisted wires is also a function of the ENGINE ECU. Node 1 of the CAN BUS is the main vehicle interface bus. The ENGINE ECUsupplies a CAN termination resistor for node 1 of the CAN BUS inside the ENGINE ECU. The ENGINE ECUreceives the CAN message TSC1VE containing the information regarding torque/speed requested by the vehicle control unit. If the ENGINE ECUdetects a timeout error for message TSC1VE and the fault condition occurs continuously, this error occurs. 1. Fault in the vehicle system,associated CAN faulty. 2. Fault in the power supply voltage or ground, missing. 3. Faulty CAN circuit wiring, open circuit, short circuit, short circuit to ground, or short circuit towards a high voltage source. 4. Faulty ENGINE ECU, software.

<table>
<tr><th>No.</th><th>Cause or Action</th><th>Procedure, measuring location, criteria and remarks</th></tr>
<tr><td>1</td><td>Verify that the fault code is presentand active.</td><td>Use the diagnostic tool to check the status of this fault.
• If the fault is present and active, go to step 2.
• If the fault is no longer present or is in an inactive state, the fault may be intermittent and not currently active, go to step 9.</td></tr>
<tr><td>2</td><td>Check forother vehicle CAN faults.</td><td>Use the diagnostic instrument to determine if CAN network faults exist related to the vehicle.
• If other vehicle CAN faults do exist,resolve the vehicle CAN faults, then check to see that this fault is also resolved.
• If other vehicle CAN faults do not exist, go to step 3.</td></tr>
<tr><td>3</td><td>Check the power supply voltage of the ENGINE ECU.</td><td>Disconnect the wiring harness from the ENGINE ECU at connector CE01.
With the ignition switch in the OFF position, use a multimeter to check the voltage:
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>CE01 (female) pin 1</td><td>Ground</td><td>It must be 12.0 V.</td></tr>
<tr><td>CE01 (female) pin 3</td><td>Ground</td><td>It must be 12.0 V.</td></tr>
<tr><td>CE01 (female) pin 5</td><td>Ground</td><td>It must be 12.0 V.</td></tr>
</table>
• If there is no voltage in one or more checks, Identify and restore power supply to ENGINE ECU.
• If voltage is present in all the checks, go to step 4.</td></tr>
</table>

No.	Cause or Action	Procedure, measuring location, criteria and remarks
9	Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Check that the connectors are fully inserted.	Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display. • If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved. • If no damage is detected, only normal readings will appear on the screen delete the fault code.

Failure Code [#T0539]

Action level	Failure code	DTMC	Failure	Upstream NOx sensor - Plausibility error
L03	#T0539	900C-0E		
Detail of failure	The ENGINE ECU has detected that one or more NOx sensors measure data not within the permitted range.			
Related information	The NOx detection sensor downstream of SCR (NOX2)and the NOx detection sensor upstream of SCR (NOX1) are used for the closed circuit check of the DEF dosing. An incorrect signal from the NOx sensordirectly influences the NOx emissionsand may cause non- reacted ammonia (NH3 slip). The fundamental principle of the plausibility monitoring by the Engine ECU is the integration and comparison of values measured by the NOx sensor with the values of NOx expected in three independent zones defined by the effective expected values of NOx.In each zone the values are integrated during an adjustable time interval. At the end of the integration time interval, the ratio between the integrated NOx values is saved. An error assessment is carried out at the end of the integration time interval in all three zones. If the ratios exceed the respective thresholds in all three zones, the fault detection counter is increased, otherwise it is decreased. If the ratio between the measured NOx values integrated and the calculated values integrated exceeds the calibration limit for all 3 zones defined, this fault occurs. 1. Fault in the NOx detection sensor downstream of SCR (NOX2), contaminated sensor or internal fault. 2. Fault in the NOx detection sensor upstream of SCR (NOX1), contaminated sensor or internal fault. 3. Faulty ENGINE ECU, software.			

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Check that the NOx detection sensor downstream of SCR (NOX2) is operating correctly.	• If the sensor is okay, contact the Komatsu Distributor. • If the sensor is not working correctly, continue with 2.
2	Replace the NOx detection sensor downstream of SCR (NOX2).	Then use the diagnostic instrument to perform the Replacement of NOx Downstream Sensor - Reset ECU Data configuration. Then check to see that this fault is resolved. • If the faulthas been resolved, return the machine to service. • If fault has not been resolved, Go to step 3.
3	Check that the NOx detection sensor upstream of SCR (NOX1) is operating correctly.	• If the sensor is okay, contact the Komatsu Distributor. • If the sensor is not working correctly, continue with step 4.

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Check the ENGINE ECU for the appropriate software and update if necessary.	• If the faulthas been resolved, return the machine to service. • If the fault has not been resolved, send a request to the Technical Help Desk.

Failure Code [#T0558]

Action level	Failure code	DTMC	Failure	Injector: voltage too low
L03	#T0558	ED05A-01		
Detail of failure	The supercharging voltage diagnostics threshold has not been reached			
Related information	The Engine ECU monitors the injectors for various electric problems.			

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Check if the fault is present and active.	Use thediagnostic tool to check the status of this fault. • If thefault is present and active, go to step 2. • If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active, go to step 3.
2	Check the correct operation of the ENGINE ECU.	Connect the diagnostic instrument to the Engine ECU, delete the error and check if the fault code returns active. • If code returns in an active status, replace the ENGINE ECU. • If code remains inactive, return the machine to service.
3	Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Check that the connectors are fully inserted.	Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display. • If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved. • If no damage is detected, only normal readings will appear on the screen delete the fault code.

Failure Code [#T0565]

Action level	Failure code	DTMC	Failure	Injector: short circuit on the low level check in injector 1 (in firing order)
L03	#T0565	8B02-04		
Detail of failure	During cylinder 1 injector (CYL1) evaluation, the pattern for a low side short circuit was detected.			
Related information	Hardware errors in the injectors and the respective supply stages of the Engine ECU are examined in the ENGINE ECU. The ENGINE ECU diagnostics procedure uses a detection scheme to identify the specific errors. When the specific combination of errors is detected, the associated fault occurs. 1. Faulty wiring of cylinder 1 injector (CYL1), low side circuit in short circuit towards a high voltage source (wiring damaged). Faulty ENGINE ECU, software.			

Detail of failure	
Related information	The Engine ECU internally performs extensive monitoring of the management module error (EMM) alarms, which are reported by the hardware of the safety management unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behaviour of the microcontroller in the event that it fails. The SMU centralises all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, the ENGINE ECU must be replaced.

Failure Code [#T0595]

Action level	Failure code	DTMC	Failure	ECU internal failure - Safety management unit alarm group 0 Failure 7 issued
L01	#T0595	9BF0-EB		
Detail of failure				
Related information	The Engine ECU internally performs extensive monitoring of the management module error (EMM) alarms, which are reported by the hardware of the safety management unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behaviour of the microcontroller in the event that it fails. The SMU centralises all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, the ENGINE ECU must be replaced.			

Failure Code [#T0596]

Action level	Failure code	DTMC	Failure	ECU internal failure - Safety management unit alarm group 0 Failure 8 issued
L01	#T0596	9CF0-FF		
Detail of failure				
Related information	The Engine ECU internally performs extensive monitoring of the management module error (EMM) alarms, which are reported by the hardware of the safety management unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behaviour of the microcontroller in the event that it fails. The SMU centralises all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, the ENGINE ECU must be replaced.			

Failure Code [#T0597]

Action level	Failure code	DTMC	Failure	ECU internal failure - Safety management unit alarm group 1 Failure 0 issued
L01	#T0597	9CF0-EB		

Detail of failure	
Related information	The Engine ECU internally performs extensive monitoring of the management module error (EMM) alarms, which are reported by the hardware of the safety management unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behaviour of the microcontroller in the event that it fails. The SMU centralises all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, the ENGINE ECU must be replaced.

Failure Code [#T0634]

Action level	Failure code	DTMC	Failure	ECU internal failure - Safety management unit alarm group 3 Failure 8 issued
L01	#T0634	AEF0-EB		
Detail of failure				
Related information	The Engine ECU internally performs extensive monitoring of the management module error (EMM) alarms, which are reported by the hardware of the safety management unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behaviour of the microcontroller in the event that it fails. The SMU centralises all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, the ENGINE ECU must be replaced.			

Failure Code [#T0635]

Action level	Failure code	DTMC	Failure	ECU internal failure - Safety management unit alarm group 3 Failure 9 issued
L01	#T0635	AFF0-FF		
Detail of failure				
Related information	The Engine ECU internally performs extensive monitoring of the management module error (EMM) alarms, which are reported by the hardware of the safety management unit (SMU). The SMU is a central component of the security architecture of the hardware structure to manage the behaviour of the microcontroller in the event that it fails. The SMU centralises all alarm signals related to security mechanisms based on software and hardware. The SMU also classifies all the alarms in different groups the status of which is stored in corresponding registers. This fault indicates that there is a fault inside the process. Since this fault is the result of an internal failure, the ENGINE ECU must be replaced.			

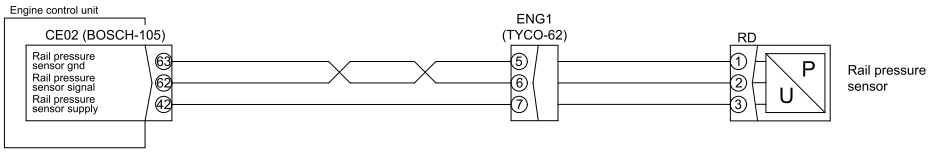
Failure Code [#T0636]

Action level	Failure code	DTMC	Failure	ECU internal failure - Safety management unit alarm group 4 Failure 1 issued
L01	#T0636	AFF0-EB		

Detail of failure	The ENGINE ECU has determined that the Differential pressure sensor on DPF (PDPF) signal level exceeds the limit.
Related information	If the exhaust gas return pressure reaches values which are too high due to a high level of soot, the system switches to an “alarm status” and the fault is activated. This can reduce engine power to protect the diesel particulate filter (DPF) from damage. The Engine ECU monitors operation of the exhaust until the battery voltage is above 10 V and the engine rpm is in standard conditions. A pressure drop on the filter greater than the exhaust flow, based on limits established by the ENGINE ECU, in continuous mode equal to a high level of soot which indicates an obstructed DPF means this fault occurs. Regeneration of the filter is not correctly completed or is not possible, we recommend managing the manual catalyst (MCM) to return the DPF to the correct condition. 1. Fault in the Differential pressure sensor on DPF (PDPF) signal, short circuit to high voltage source. 2. Fault in the Differential pressure sensor on DPF (PDPF), internal fault. 3. Faulty ENGINE ECU software.

<table>
<tr><th>No.</th><th>Cause or Action</th><th>Procedure, measuring location, criteria and remarks</th></tr>
<tr><td>1</td><td>Verify fault is present and active.</td><td>Use the operator display or the diagnostic tool to check the status of this fault.
• If the fault is present and active, go to step 2.
• If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active, go to step 4.</td></tr>
<tr><td>2</td><td>Check the Differential pressure sensor on DPF (PDPF) to check for a short circuit to ground or to another circuit.</td><td>Disconnect the Differential pressure sensor on DPF (PDPF) at connector PDPF.
Disconnect the engine wiring from the ENGINE ECU at connector CE01.
With the key switch in the OFF position, use a multimeter to perform the following continuity checks :
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>CE01 pin 15</td><td>Battery positive</td><td>There should be no continuity.</td></tr>
<tr><td>CE01 pin 15</td><td>All other pins in connector CE01_2</td><td>There should be no continuity.</td></tr>
</table>
• If there is continuity, there is a short circuit to battery in the Differential pressure sensor on DPF (PDPF).Locate and repair the shorted conductor.
• If no continuity is detected, go to step 3.</td></tr>
<tr><td>3</td><td>Replacethe Differential pressure sensor on DPF (PDPF).</td><td>Use the operator display or the diagnostic instrument to check that this fault has been resolved.
• If this faulthas been resolved, return the machine to service.
• If this fault has not been resolved. Check that the ECU software A-F02 is correct and update, if necessary.</td></tr>
<tr><td>4</td><td>Visually check the wiring and main connectors looking for any faults, bent or incorrectly positioned pins, corroded terminals, or broken wires.
Make sure that the connectors are fully mounted.</td><td>Bend the involved wiring to check for any intermittent faults or short circuits in the involved cables. Operate the machine and observe the display.
• If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.
• If there is no damage and the display indicates normal values, delete the fault code.</td></tr>
</table>

Circuit diagram

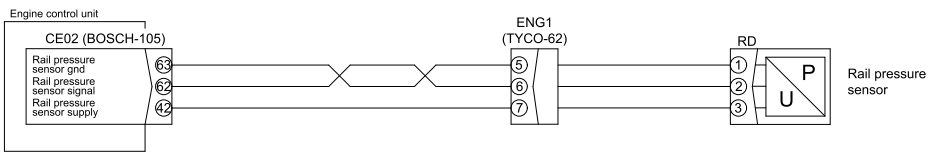


Failure Code [#T0678]

Action level	Failure code	DTMC	Failure	Pressure sensor on the rail: negative deviation
L01	#T0678	3DEF-E1		
Detail of failure	The ENGINE ECU detects a malfunction in the rail pressure sensor (RD).			
Related information	The Engine ECUcarries out monitoring of a positive deviation of the rail pressure regulator during the rapid warm-up phase. The error appears when the negative deviation of the rail pressure regulator is above the threshold on the basis of the operating point.			

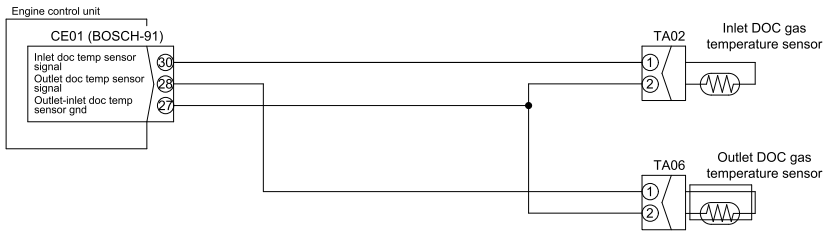
No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Verify fault is present and active.	Use the diagnostic instrument to check the status of this fault. • If the fault is present and active, go to step 2. • If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue to step 3.
2	Checkthe correct operation of the rail pressure sensor (RD).	• If the sensor is not working correctly, replace the rail pressure sensor (RD). • If the sensor is working correctly, return the machine to service.
3	Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Check that the connectors are fully inserted.	Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display. • If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved. • If you do not find damage and the display indicates only normal readings, delete the fault code.

Circuit diagram



<table>
<tr><th>No.</th><th>Cause or Action</th><th>Procedure, measuring location, criteria and remarks</th></tr>
<tr><td>4</td><td>Check the conditions of the exhaust temperature sensor upstream of the DOC (TA02).</td><td>Disconnect the exhaust wiring from the exhaust temperature sensor upstream of the DOC (TA02), connector TA02.
With the ignition switch set to OFF, use a multimeter to measure the resistance of the exhaust temperature sensor upstream of the DOC (TA02):
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>TA02 (male) pin 1</td><td>TA02 (male) pin 2</td><td>Thevalue must be between 169.7 – 738.2 Ω dependant upon the temperature at the exhaust -40 – 800 °C.</td></tr>
</table>
• If the measured resistance is not within specification, the exhaust temperature sensor upstream of the DOC (TA02) has failed internally.Replace the sensor.
If the measured resistance is within specification, go to step 5.</td></tr>
<tr><td>5</td><td>Replace the exhaust temperature sensor upstream of the DOC (TA02).</td><td>Use the operator display or the diagnostic instrument to check that this fault has been resolved.
• If this faulthas been resolved, return the machine to service.
• If this fault has not been resolved, check the ENGINE ECU for the appropriate software and update if necessary.</td></tr>
<tr><td>6</td><td>Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires.
Check that the connectors are fully inserted.</td><td>Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display.
• If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.
• If no damage is detected, only normal readings will appear on the screen delete the fault code.</td></tr>
</table>

Circuit diagram



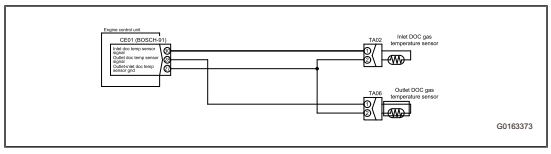
Failure Code [#T0697]

Action level	Failure code	DTMC	Failure	Urea Quality Sensor: low Urea concentration (estimate in terms of time)
L03	#T0697	BC0D-0C		
Detail of failure	The DEF tank quality - level - temperature sensor (P63) has reported to the ENGINE ECU that the DEF fluid concentration level is too low.			

<table>
<tr><th>No.</th><th>Cause or Action</th><th>Procedure, measuring location, criteria and remarks</th></tr>
<tr><td>3</td><td>Check the power supply circuit 3 for a short circuit towards a voltage source between the oil pressure and temperature sensor and the engine side control unit.
Set the ignition switch to ON.</td><td>Use a multimeter to check the voltage
• If the voltage is high, go to step 4
• If the voltage reading is correct, Go to step 5</td></tr>
<tr><td>4</td><td>Disconnect the wiring from the boost air temperature and pressure sensor (HP) at connector HP.</td><td>Use the diagnostic instrument to monitor the status of the alarm.
• If this fault is eliminated after disconnecting a connector, the sensor has an internal fault. Replace sensor.
• If the fault is not eliminated after the connectors have been disconnected, leave the connector disconnected and go to step 5.</td></tr>
<tr><td>5</td><td>Check the power supply-circuit 3 for a short circuit towards a voltage source.
Set the ignition switch to ON.</td><td>Use a multimeter to perform the following voltage check :<table><tr><th>From</th><th>To</th><th>Value</th></tr><tr><td>HP (male) pin 3</td><td>Ground</td><td>There should be between 4.5 – 5.5V
.</td></tr></table>• If the voltage is high, go to step 6
• If the voltage reading is correct, go to step 7</td></tr>
<tr><td>6</td><td>Check the power supply-circuit 3 for a short circuit towards a voltage source.
Set the ignition switch to ON.</td><td>Use a multimeter to perform the following voltagecheck :<table><tr><th>From</th><th>To</th><th>Value</th></tr><tr><td>CE02 pin 38</td><td>Ground</td><td>There should be between 4.5 – 5.5V
.</td></tr></table>• If the voltage is high, check the ENGINE ECU for the appropriate software and update if necessary.
• If the voltage value is correct, this indicates faulty wiring between the pressure and Boost air temperature and pressure sensor (HP) and the engine side control unit. Locate and repair the shorted conductor.</td></tr>
<tr><td>7</td><td>Disconnect the wiring from the rail pressure sensor (RD), connector RD.</td><td>Use the diagnostic instrument to monitor the status of the alarm 3511-3.
• If this fault is eliminated after disconnecting a connector, the sensor has an internal fault. Replace sensor.
• If the fault is not eliminated after the connectors have been disconnected, leave the connector disconnected and go to step 8.</td></tr>
<tr><td>8</td><td>Check the power supply-circuit 3 for a short circuit towards a voltage source. Set the ignition switch to ON.</td><td>Use a multimeter to perform the following voltage check :<table><tr><th>From</th><th>To</th><th>Value</th></tr><tr><td>RD (male) pin 3</td><td>Ground</td><td>There should be between 4.5 – 5.5V
.</td></tr></table>• If the voltage is high, go to step 9
• If the voltage reading is correct, check the ENGINE ECU for the appropriate software and update if necessary.</td></tr>
</table>

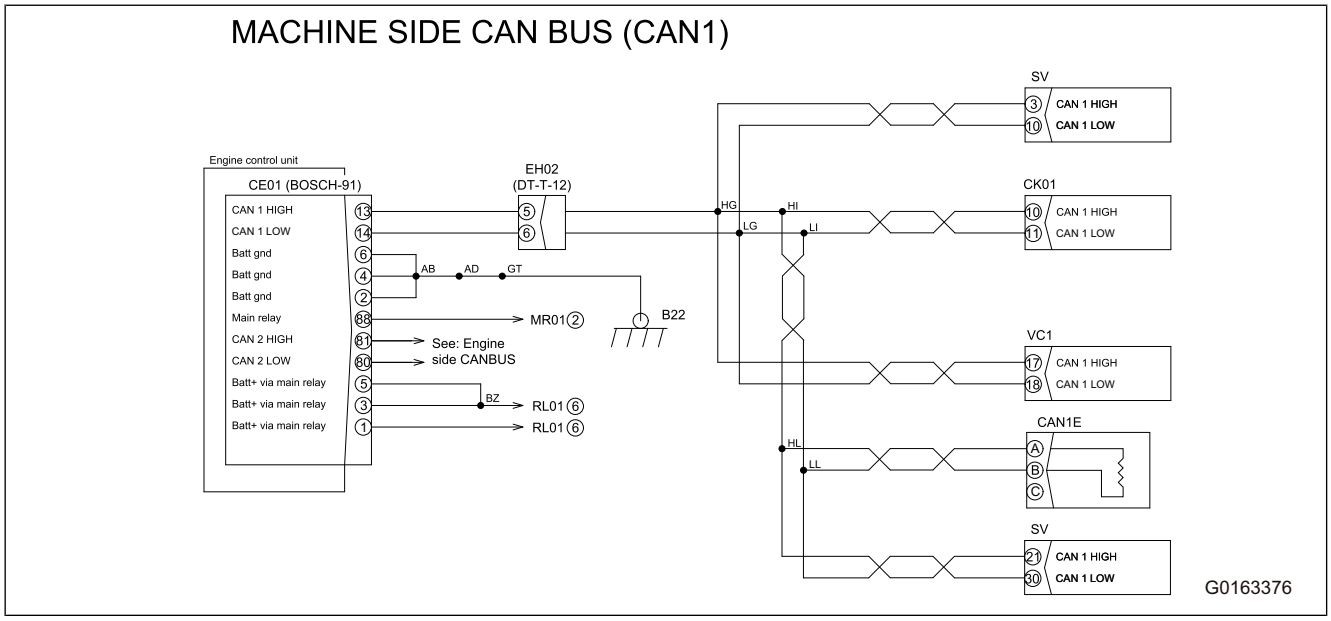
<table>
<tr><th>No.</th><th>Cause or Action</th><th>Procedure, measuring location, criteria and remarks</th></tr>
<tr><td>2</td><td>Check the temperature signal circuit of the exhaust exhaust temperature sensor downstream of the DOC (TA06).</td><td>Disconnect the engine wiring from the ECU control unit A-F02 at connector CE01.
With the key switch in the OFF position, use a multimeter to perform the following continuity checks:
<table>
<tr><th>From</th><th>To</th><th>Value</th></tr>
<tr><td>TA06 pin 1</td><td>CE01 (female) pin 29</td><td>There should be no continuity.</td></tr>
<tr><td>TA06 pin 2</td><td>CE01 (female) pin 27</td><td>There should be no continuity.</td></tr>
</table>
• If there is continuity, there is a short circuit towards another circuit of the temperature signal circuit of the exhaust temperature sensor downstream of the DOC (TA06), Locate and repair the shorted conductors.
• If no continuity is detected, leave the connector CE01 disconnected and go to step 3.</td></tr>
<tr><td>3</td><td>Check the correct operation f the exhaust temperature sensor downstream of the DOC (TA06).</td><td>• If the sensor is okay, go to step 5.
• If the sensor is not working correctly, go to step 4.</td></tr>
<tr><td>4</td><td>Replace the exhaust temperature sensor downstream of the DOC (TA06).</td><td>Use the operator display or the diagnostic instrument to check that this fault has been resolved.
• If this faulthas been resolved, return the machine to service.
• If this fault has not been resolved, check the ENGINE ECU for the appropriate software and update if necessary.</td></tr>
<tr><td>5</td><td>Visually inspect the relevant wiring harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires.
Check that the connectors are fully inserted.</td><td>Bend the relevant wiring to identify short circuits or intermittent interruptions in the wires. Operate the machine while monitoring the display.
• If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.
• If no damage is detected, only normal readings will appear on the screen delete the fault code.</td></tr>
</table>

Circuit diagram



Failure Code [#T0724]

<table>
<tr><td>Action level</td><td>Failure code</td><td>DTMC</td><td rowspan="2">Failure</td><td rowspan="2">The ENGINE ECU has detected a voltage higher than permitted in the temperature signal circuit of the exhaust temperature sensor downstream of the DOC (TA06).</td></tr>
<tr><td>L03</td><td>#T0724</td><td>9E12-03</td></tr>
<tr><td>Detail of failure</td><td colspan="4">The ENGINE ECU has detected a voltage higher than permitted in the temperature signal circuit of the exhaust temperature sensor downstream of the DOC (TA06).</td></tr>
</table>



Failure Code [#T0734]

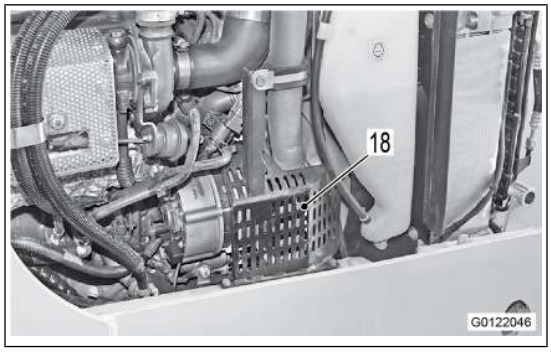
REMARK

Since this fault causes inducement, it is necessary to perform the Engine Restart Counter Reset/Unlock inducement configuration with the diagnostic tool before returning the machine to service.

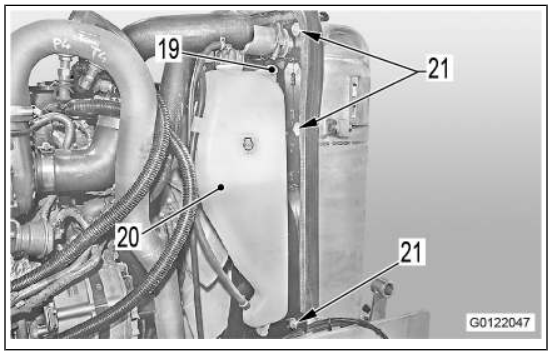
Action level	Failure code	DTMC	Failure	AdBlue tank temperature sensor: CAN message Error
L03	#T0734	D70B-13		
Detail of failure	The ENGINE ECU has detected an error message by the DEF tank quality - level - temperature sensor (P63).			
Related information	The Engine ECU monitors the correct operation of the quality and level/temperature sensor of the DEF tank quality - level - temperature sensor (P63) connected through CAN line. If the CAN message Com_tUTnkT reports an error, this fault occurs. 1. Fault in the DEF tank quality - level - temperature sensor (P63), internal damage. 2. Faulty ENGINE ECU, software.			

No.	Cause or Action	Procedure, measuring location, criteria and remarks
1	Check if the fault is present and active.	Use the operator display or the diagnostic tool to check the status of this fault. • If the fault is present and active, go to step 2. • If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active, go to step 5.
2	Check the part of the DEF tank quality - level - temperature sensor (P63)that monitors the detection area of the temperature to check it is not blocked.	• If no blockage is detected, go to step 3. • If a blockage is found,repair, clean or replace as required.
3	Check the correct operation, of the quality and level/temperature sensor of the DEF tank quality - level - temperature sensor (P63).	Then check the status of this fault again. • If the fault has been resolved, go to step 4. • If the fault has not been resolved, replace the sensor and go to step 4.

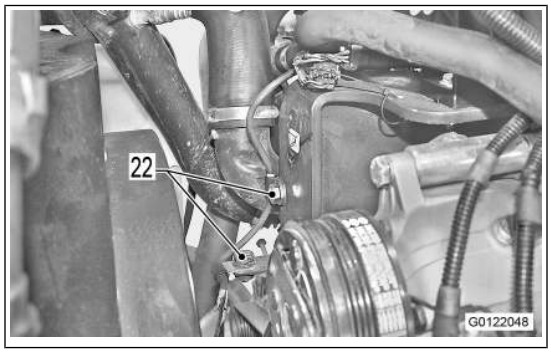
12. Remove protection (18).



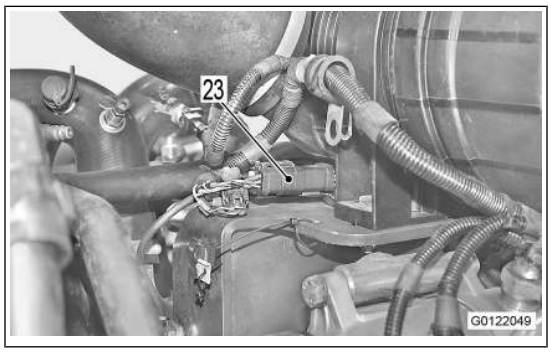
13. Remove bolts (19) and expansion tank (20).
14. Remove bolts (21).



15. Remove bolts (22) (3 pieces).



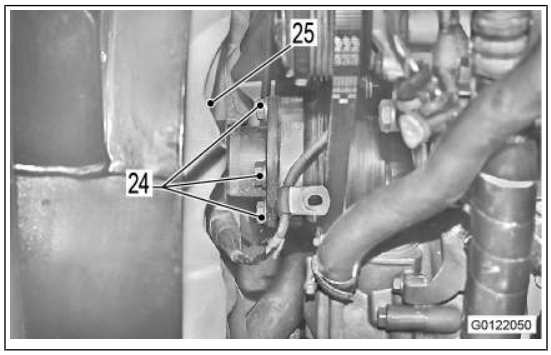
16. Disconnect connector FC01 (23) of fan clutch. [*3]



17. Remove bolts (24). Disconnect cooling fan (25) from engine and move it inside the conveyor (26). [*4]

REMARK

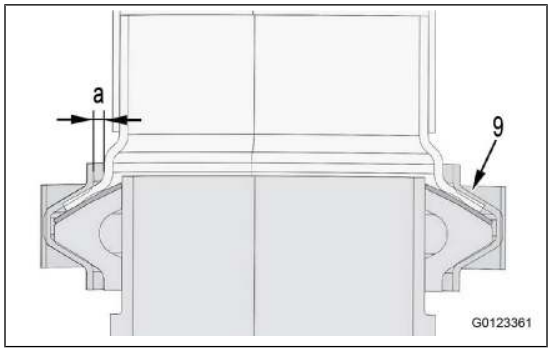
- Be careful not to damage the fin on the surfaces of the radiator assembly when handling the cooling fan.

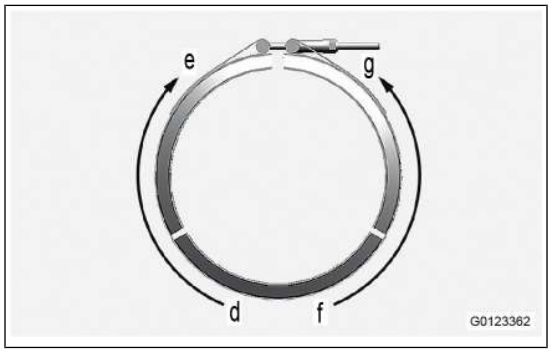


3) Tighten the clamps (9) to the specified torque.

Bolt (38): 52–71.5 Nm {5.3–7.29 kgfm}

[*2]

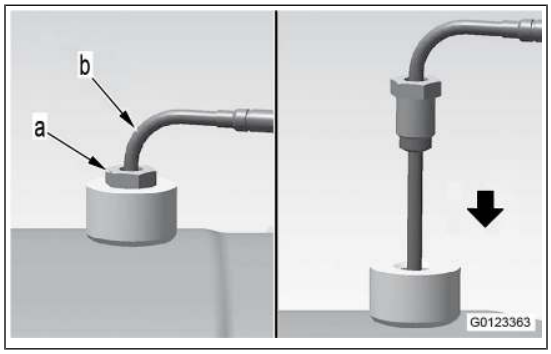




1. Hold the metal parts (b) by hands, and insert the sensors (8) vertically in the direction of the arrow, and tighten the nuts (a).

Threaded portion of sensor: Seizure prevention compound (LC-G)

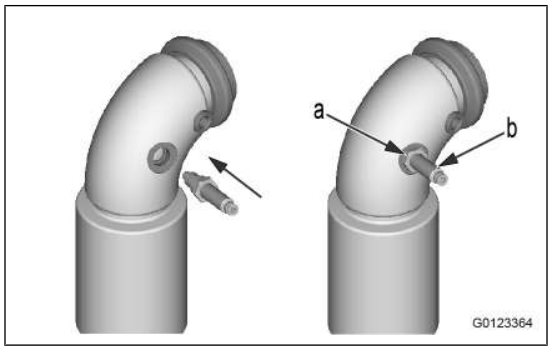
KDOC inlet temperature sensor (3): 40 to 50 Nm {4.1 to 5.1 kgfm}



2. Hold the metal parts (b) by hands, and insert the sensor (7) vertically in the direction of the arrow, and tighten the nuts (a).

Threaded portion of sensor: Seizure prevention compound (LC-G)

Turbocharger outlet NOx sensor (14): 40 to 60 Nm {4.1 to 6.1 kgfm}



REMOVE AND INSTALL DEF TANK SENSOR FLANGE ASSEMBLY

Tools to be used when removing and installing DEF tank sensor flange assembly

Symbol	Part No.	Part name	Necessity	Q'ty	New/Redesign	Sketch	Remarks
A	Commercially available	Vinyl gloves	●	1			Disconnecting and connecting DEF hose
B	Commercially available	Vinyl hose	●	1			Drain of DEF
	Commercially available	Fitting with valve		1			
C	Commercially available	Oil pan	●	2			Draining DEF and coolant
D	600-919-5030	Plug (for 3/8 inch hose diameter)	●	2			Disconnecting DEF hose
E	6540-71-2720	DEF pump cap kit	●	1			
F	Commercially available	Lifting tool (with hook)	●	1			Removing and installing DEF tank assembly

⚠ Place the machine on a level ground, lower the work equipment to the ground, and stop the engine.

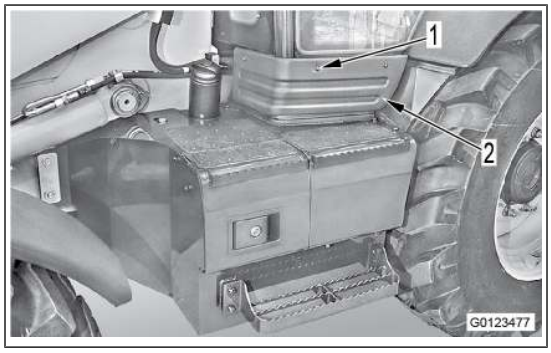
⚠ Turn the starting switch to OFF position to stop the engine.

⚠ Turn the battery disconnect switch to OFF position, and remove the key.

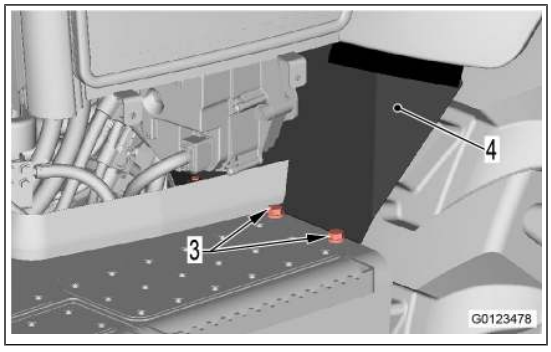
⚠ Before opening the water filler cap or draining coolant, check that the coolant temperature cools down to the temperature safe enough for anyone not to get burn.

REMOVE DEF TANK SENSOR FLANGE ASSEMBLY

1. Loosen screws (1) and remove L.H. cover (2).



2. Loosen bolts (3) and remove protection (4).



REMOVE AND INSTALL AIR CLEANER ASSEMBLY

⚠ **Place the machine on a level ground, fully raise the front work equipment and lock them in position with safety bar.**

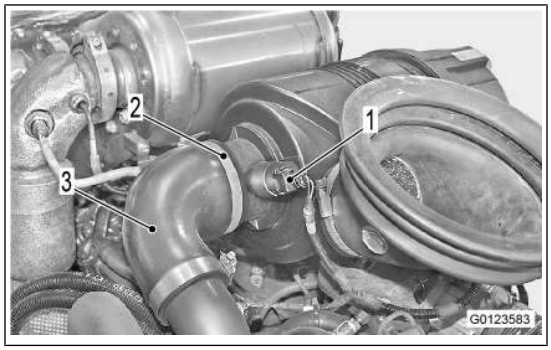
⚠ **Set the work equipment lock lever to LOCK position.**

⚠ **Turn the starting switch to OFF position to stop the engine.**

⚠ **Turn the battery disconnect switch to OFF position, and remove the key.**

REMOVE AIR CLEANER ASSEMBLY

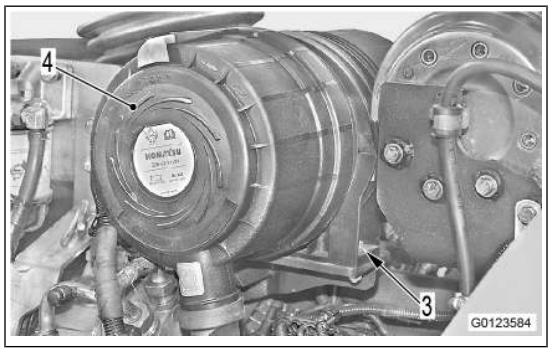
1. Disconnect connector AF01 (1) of air filter clogging sensor. [*1]
2. Loosen clamps (2) and remove hose (3).



3. Remove fastening bolts (3) and remove air filter assembly (4).

   REMARK

   - Cover the intake hose to prevent entering of dirty or foreign material.



INSTALL AIR CLEANER ASSEMBLY

Perform installation in the reverse order to removal.

[*1]

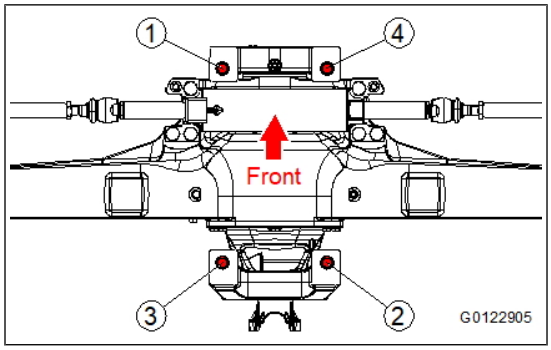
1. Connect the connector AF01 (1).

1. Tighten bolts (8) and (9) with the order shown in picture, repeating position n° 1 at the end of the second step.

[*2]

Cardan shaft fixing: 30.4 to 41.8 Nm {3.1 to 4.3 kgfm}

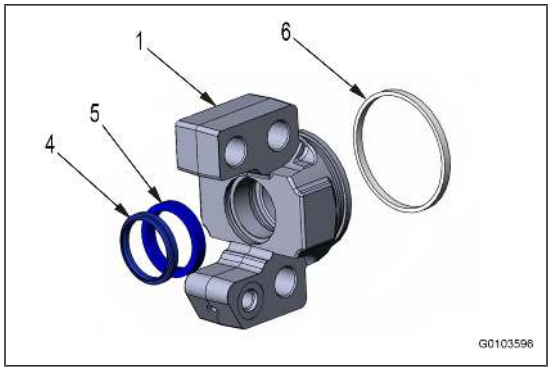
Cardan shaft fixing screws: Loctite 242



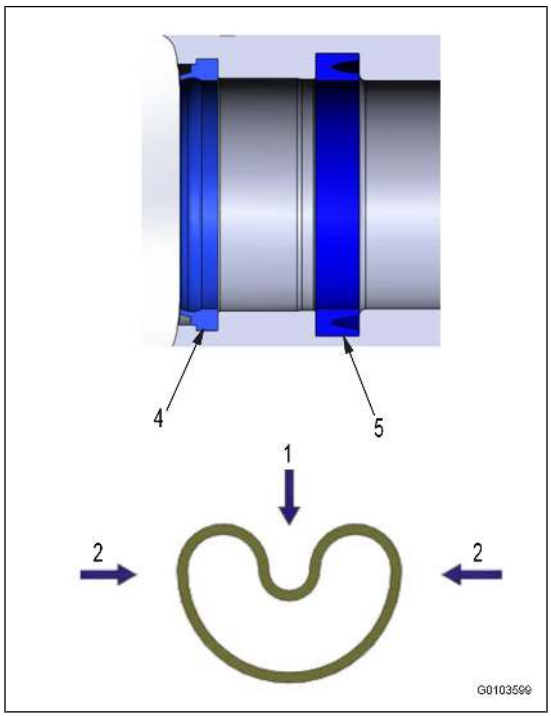
2. Remove from cylinder head (1) the dust seal ring (4), the seal ring (5) and seal (6). Repeat the procedure for the cylinder head (2).

REMARK

Before assembly, grease the seal ring seats.



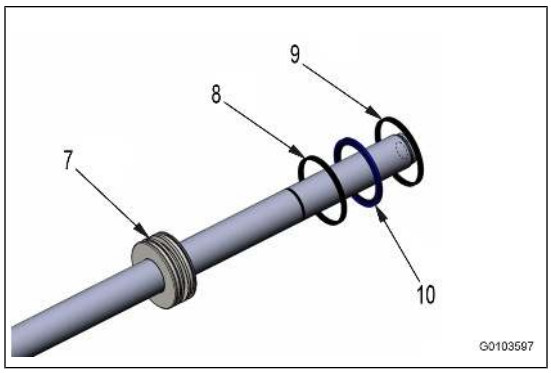
3. Correct orientation of the sela ring (5) and correct procedure to install it into the cylinder head (1).



4. Install onto piston (7) the guide rings (8) e (9) and the seal ring (10).

REMARK

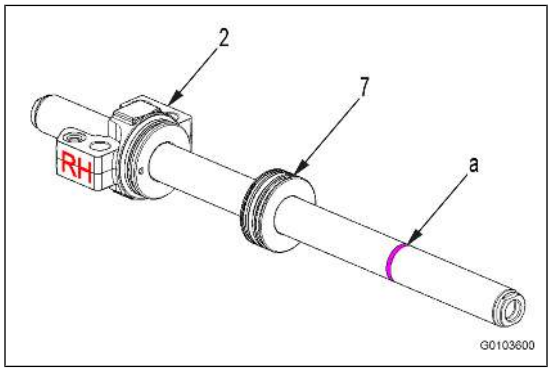
Before assembly, grease the seal ring seats.



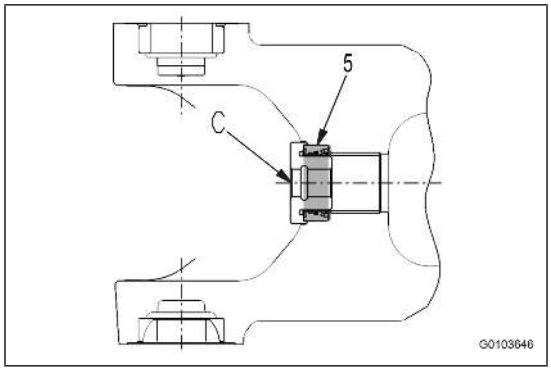
5. Assemble the R.H cylinder head (2) onto the piston (7) taking care to install it on the piston side without the notch a.

REMARK

Before assembly, grease the seal ring and the piston rod.



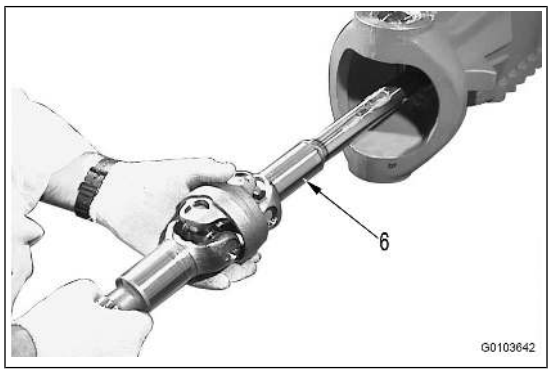
3. Assemble the seal ring (5) as in figure.



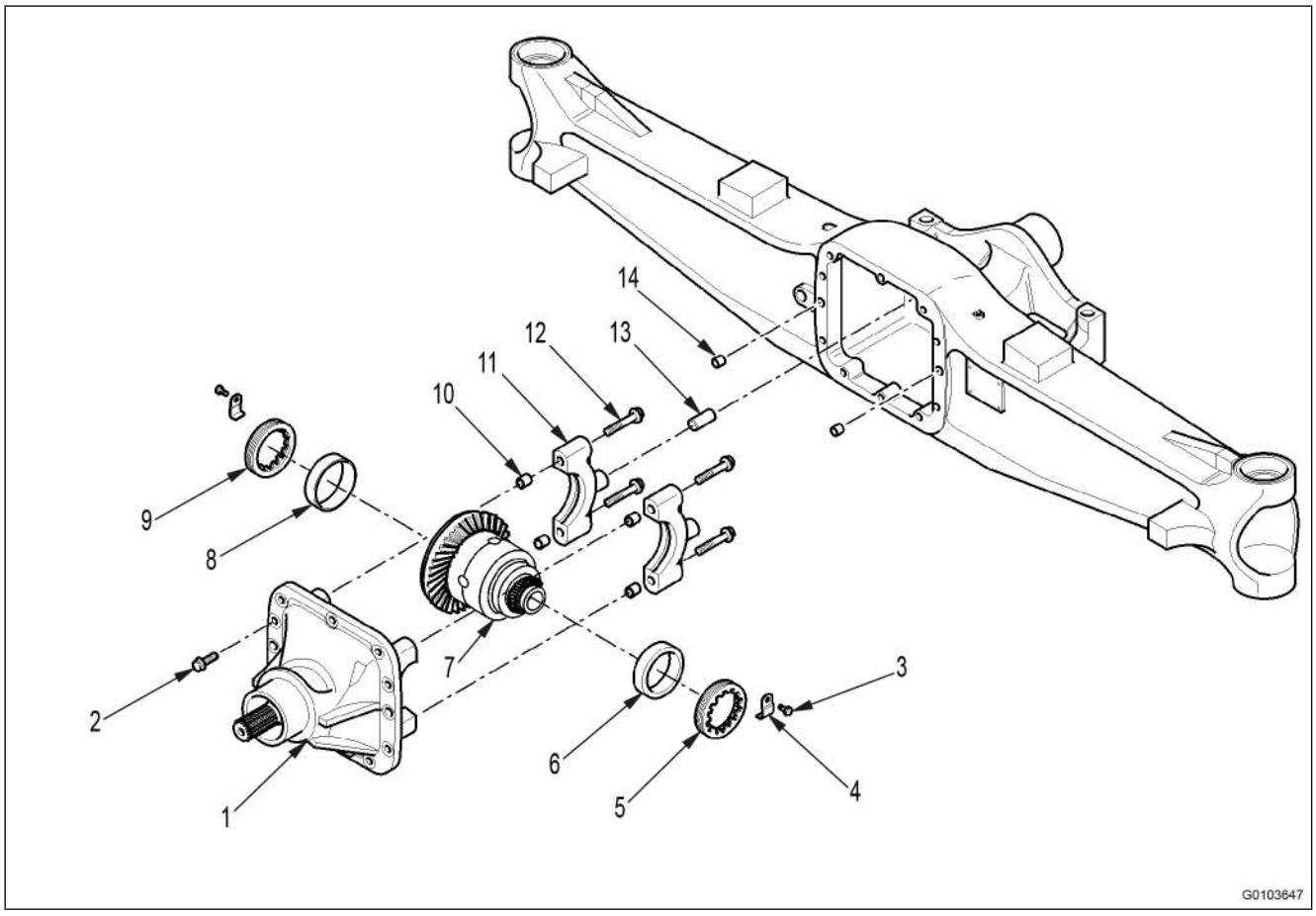
4. Insert the double U-Joint (6) inside the axle beam (1).

NOTICE

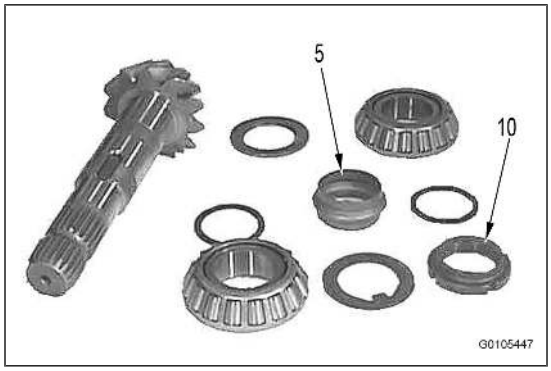
Be careful not to damage the seal ring (5).



DISASSEMBLE AND ASSEMBLE DIFFERENTIAL SUPPORT GROUP

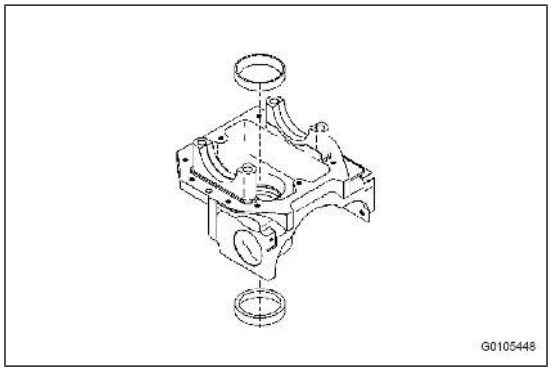


9. Check all pinion components for wear. The ring nut (10) and the collapsible spacer (5) must be replaced when reassembling the unit.

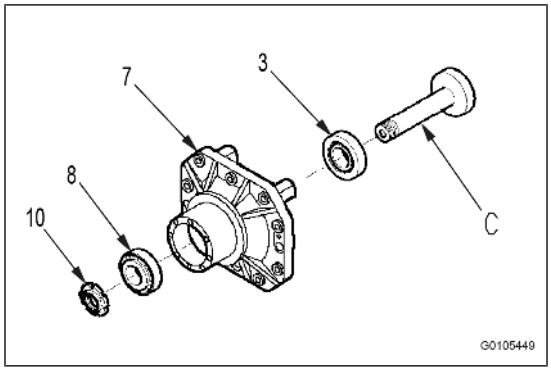


ASSEMBLE PINION GROUP

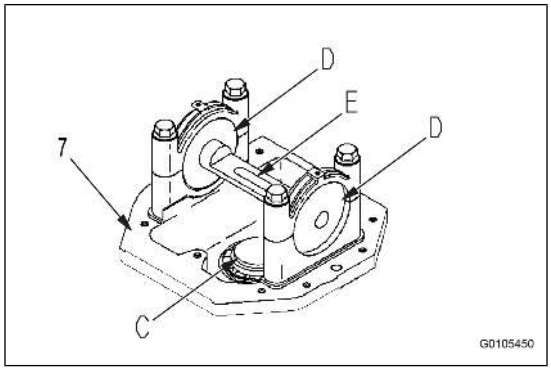
1. Fit the bearings cups (3) and (8) using the special tools (G).



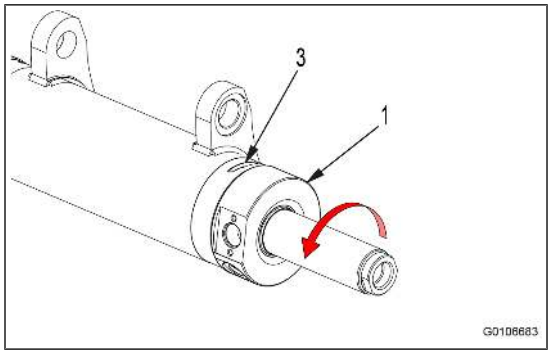
2. Insert the bearing cones (3) and (8) in their seats. Assemble the false pinion (C) and its ring nut (10). Tighten without exceeding the ring nut, till the backlash is eliminated.



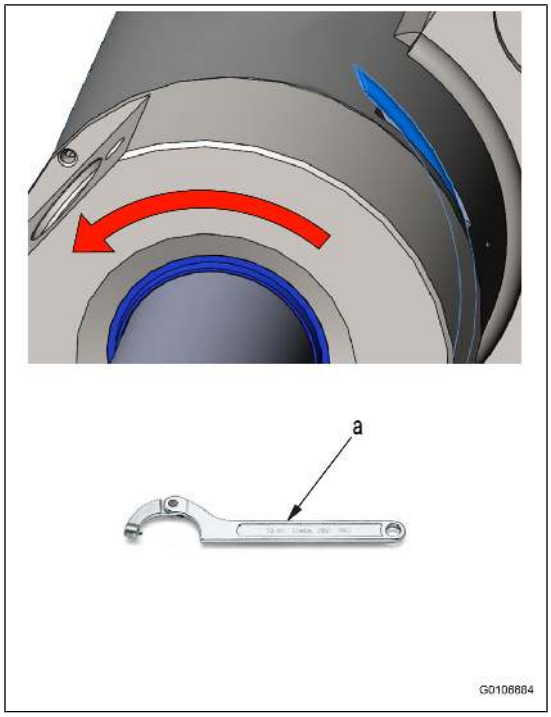
3. Assemble, as in the figure, the false differential box composed by rod (E) and discs (D).



3. Rotate the cylinder head (1) and simutanously let the wire (3) come out the cylinder. Repeat the procedure for the cylinder head (5).



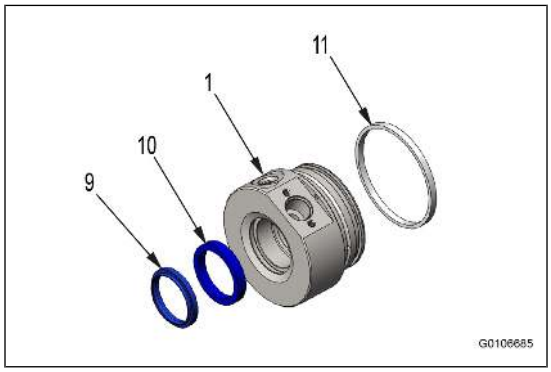
4. Correct procedure to remove the cylinder head (1). Use an adjustable hook wrench (a) with an 8 mm diameter round pin.



5. Remove from cylinder head (1) the dust seal ring (9), the seal ring (10) and seal (11). Repeat the procedure for the cylinder head (5).

REMARK

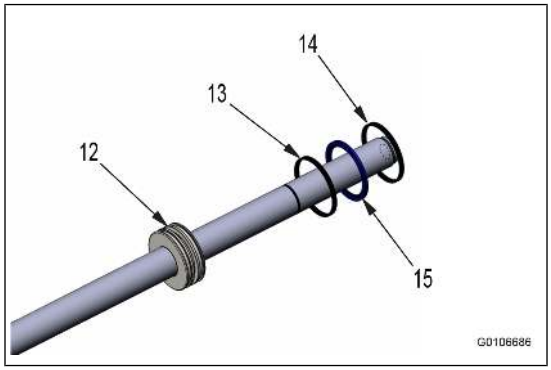
Destructive operation for the seals which must be replaced.



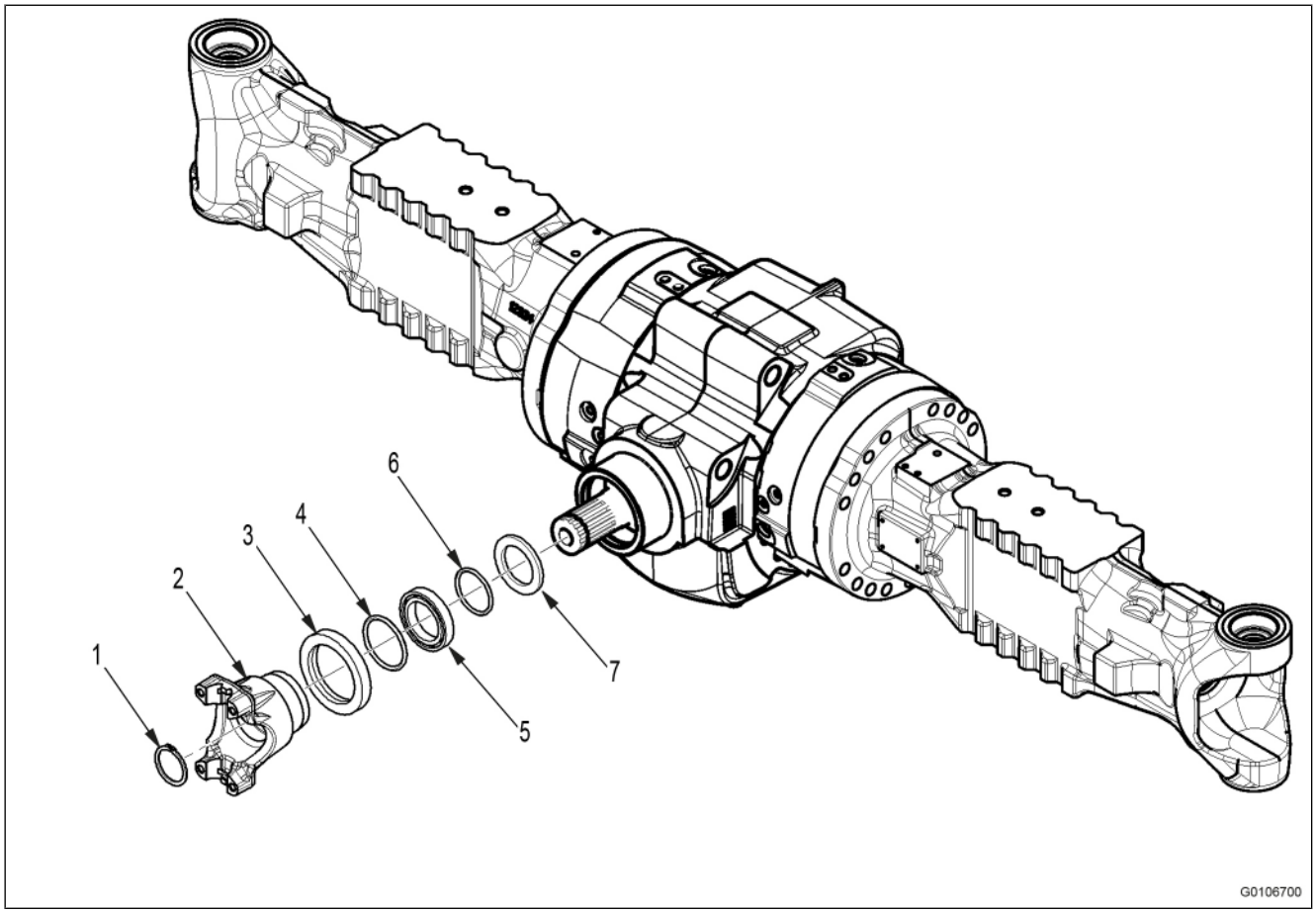
6. Remove from piston (12) the guide rings (13) e (14) and the seal ring (15).

REMARK

Destructive operation for the guide rings and seal which must be replaced.



DISASSEMBLE AND ASSEMBLE FLANGE GROUP

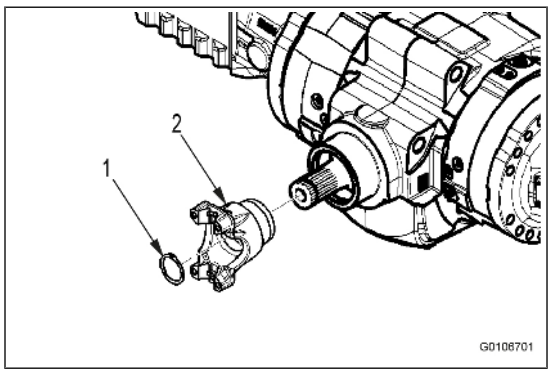


Tools to be used when you disassemble and assemble flange group

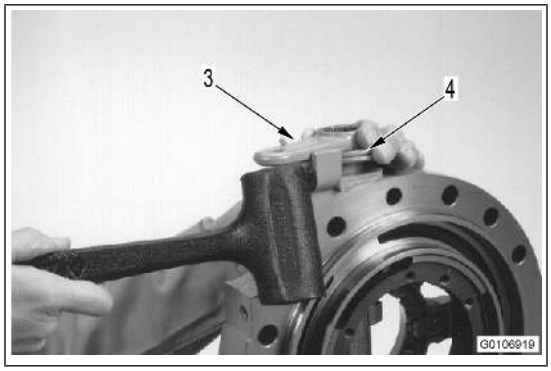
Symbol	Part No.	Part name	Necessity	Q'ty	New/Redesign	Sketch	Remarks
A	CA715543	Driver	●	1			For seal ring

DISASSEMBLE FLANGE GROUP

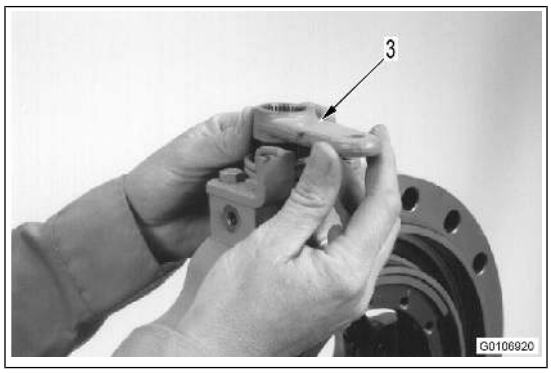
1. Remove the lock ring (1) and flange (2).



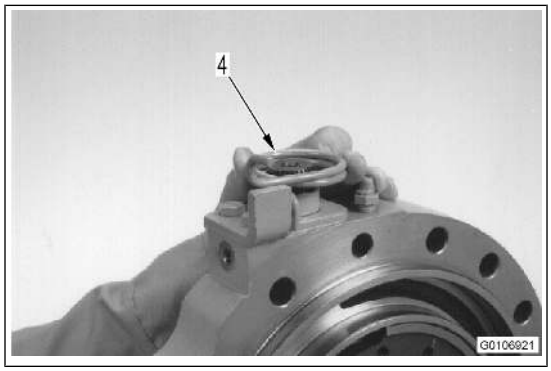
7. Loosen the lever (3) to release the tension on the spring (4).



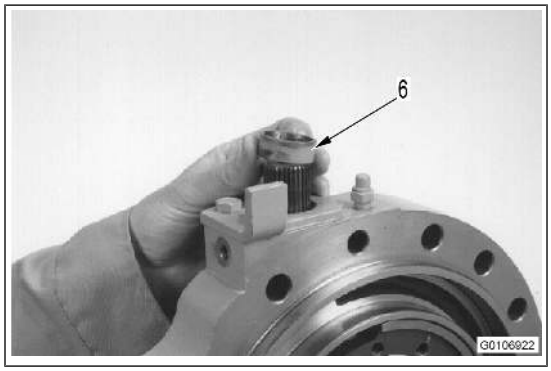
8. Remove the lever (3).



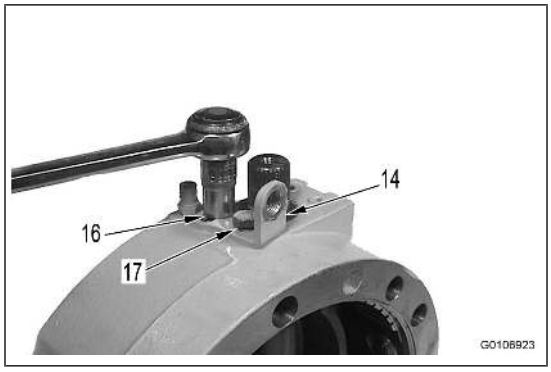
9. Remove the spring (4).



10. Remove the washer (5) and the spacer (6).

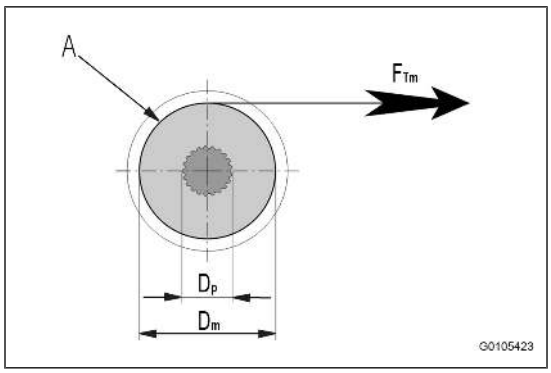


11. Remove the bracket (14) fastening screws (16) and (17).



18. Measure the diameter D_M (Diameter of measurement) of the special tool (A) and diameter of the pinion end D_P (diameter of pinion), then calculate the ratio R between the diameters: $R= D_M/D_P$.The measured value of total preloading F_{Tm} must be within the following range:

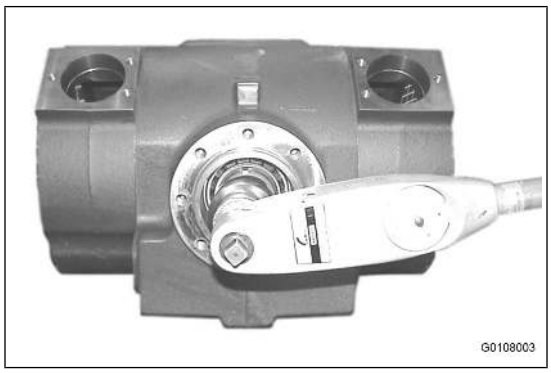
    $F_{Tmin}/R < F_{Tm} < F_{Tmax}/R$



19. Once the pinion-ring gear backlash has been established, instead proceeding with step [17] and [18] measure the total rolling torque (TT) of the bearings (pinion-crown bevel gear system) by using a torque meter and the special wrench (E).

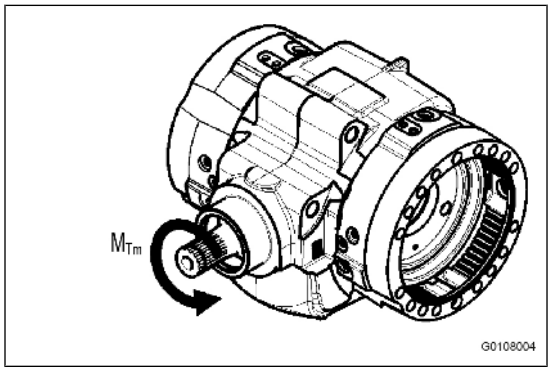
    NOTICE

    All the preloads must be measured without the seal installed.



20. The total rolling torque M_{Tm} must be within the range indicated in Product Data:

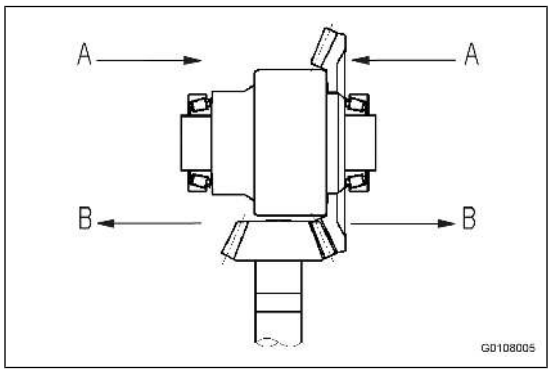
    $M_{Tmin} < M_{Tm} < M_{Tmax}$[N]



21. If the measurement is not within the requested range, check well the assembly of each component and operate on the adjuster ring nuts (8) of the differential support:

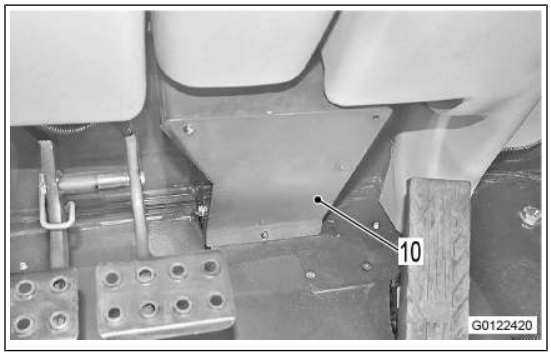
    A: if the total preload is less than the given range, screw in both adjuster ring nuts by the same measure, keeping the pinion-ring gear backlash value unchanged.

    (B): if the total preload is greater than the given range, unscrew both adjuster ring nuts by the same measure, keeping the pinion-ring gear backlash value unchanged.

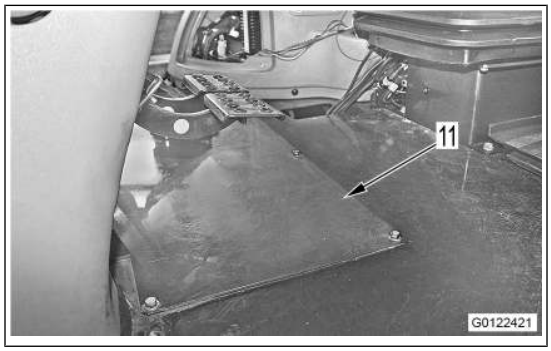


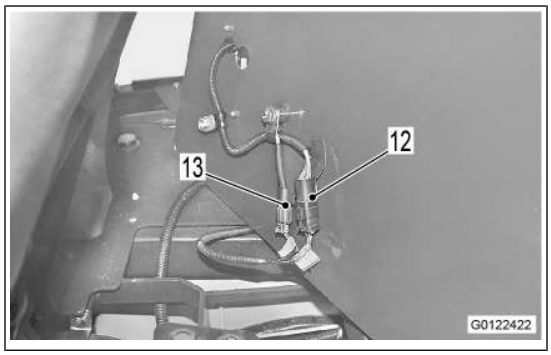
14. Remove front floor mat (9).

15. Remove protection (10).



16. Remove front floor cover (11) and disconnect connector PD1 (12) and K14 (13) of accelerator pedal.

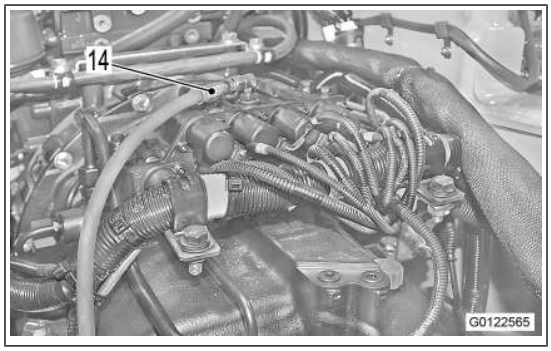




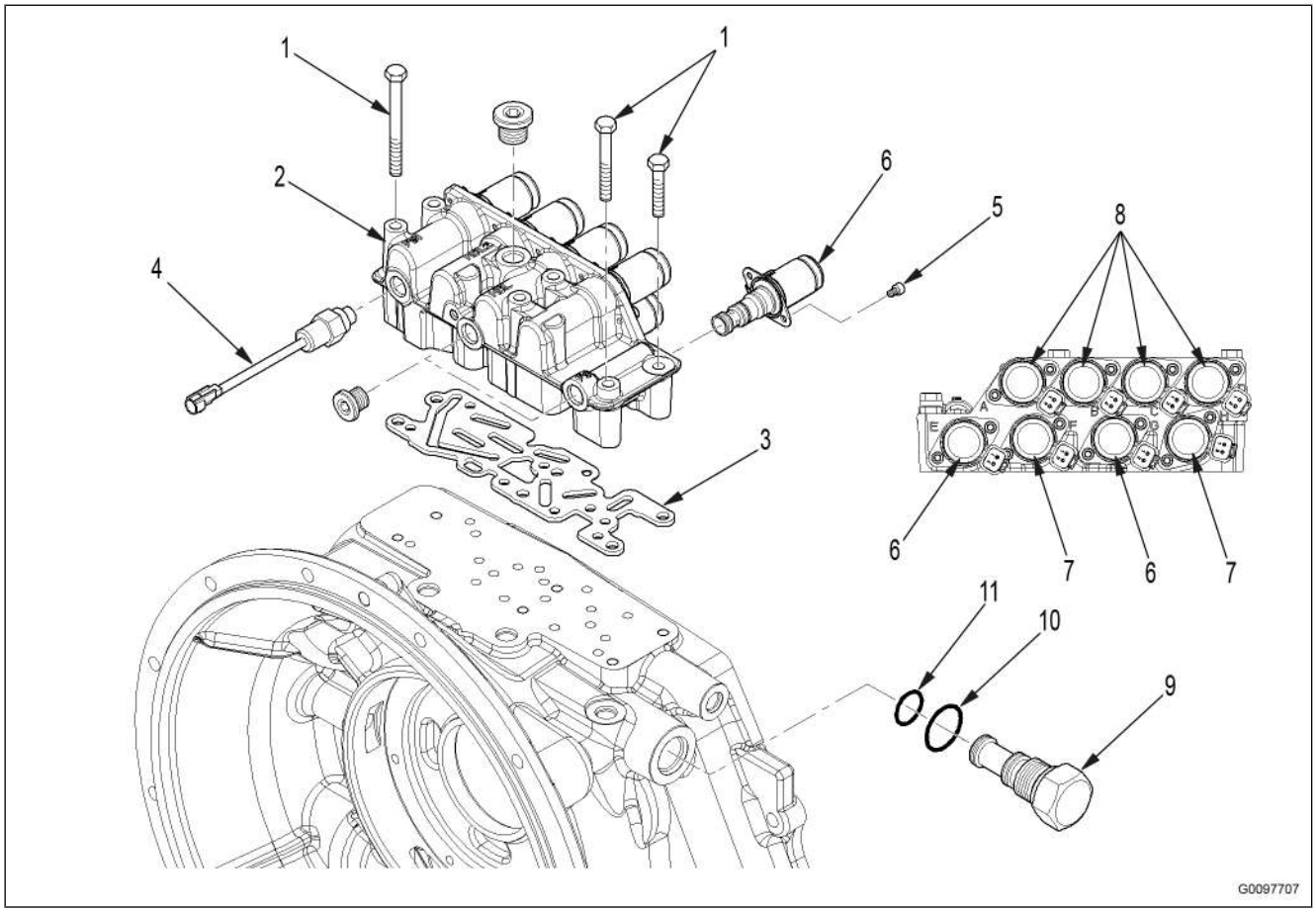
17. Disconnect hydraulic differential lock hose (14).

REMARK

- Plug all hoses to prevent entry of any impurities.



DISASSEMBLE AND ASSEMBLE HYDRAULIC CONTROL VALVE

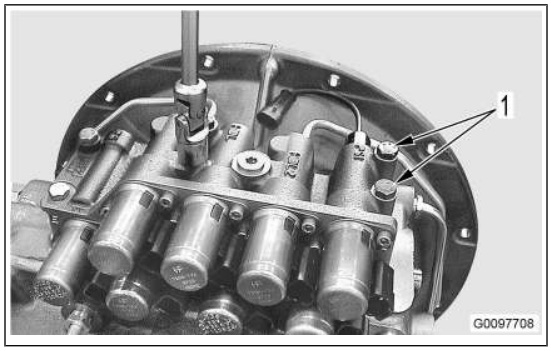


DISASSEMBLE HYDRAULIC CONTROL VALVE

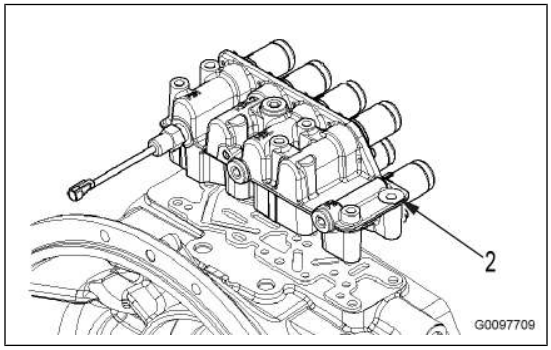
1. Drain oil from transmission hydraulic circuit.

   Transmission case: max. 20 ℓ

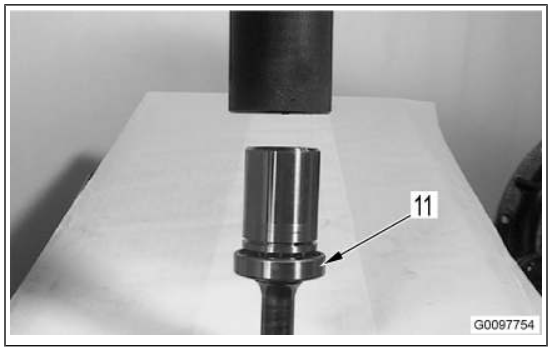
2. Disconnect all electrical connections. Untighten all the fittings of the delivery pipes connected with the control valve. Remove the bolts (1).



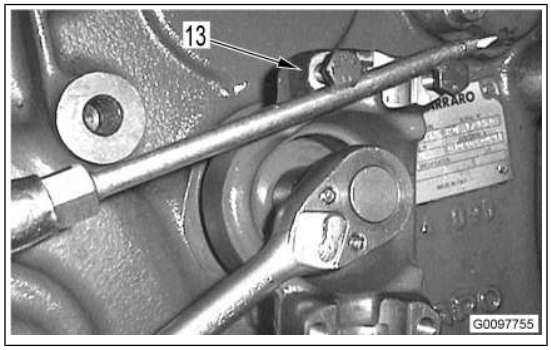
3. Lift control valve (2).



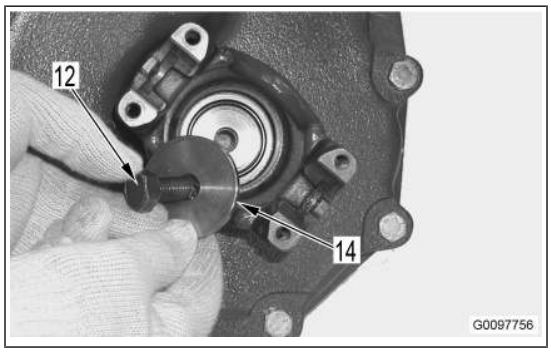
12. Extract bearing (11) using a suitable driver.



13. Unscrew flange (13) fastening bolt (12). Use a screwdriver and two screws to stop flange rotation.



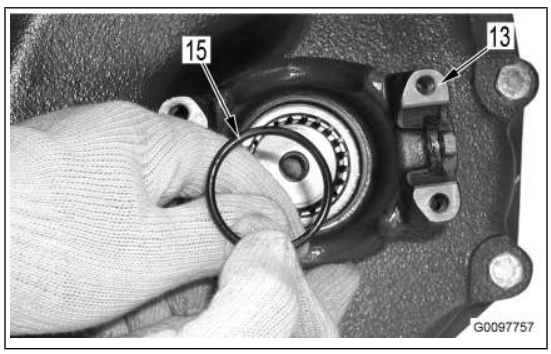
14. Remove the bolt (12) and washer (14).



15. Remove flange (13) and O-ring (15).

REMARK

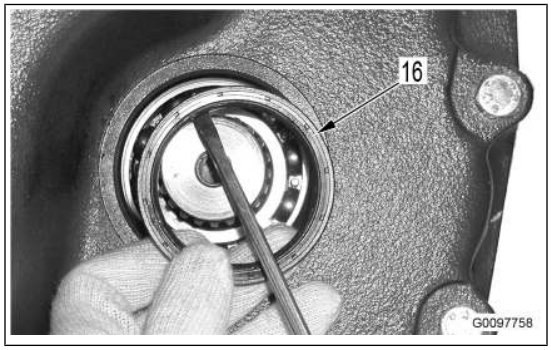
This is a destructive operation for the O-ring.



16. Remove seal ring (16).

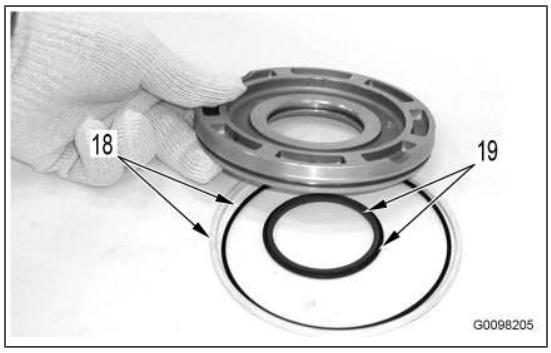
REMARK

This is a destructive operation for the seal ring.



ASSEMBLE SHAFT A

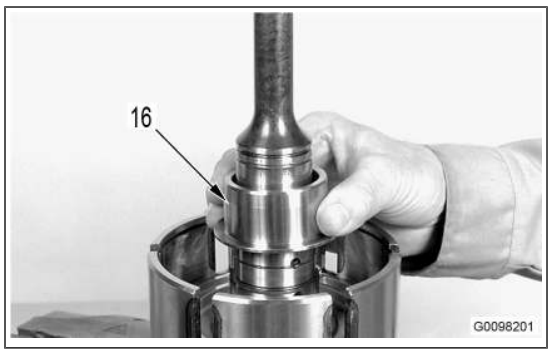
1. Assemble new teflon ring (18) and relevant inner O-rings, new teflon ring (19) and relevant inner O-rings respectively into the piston outer and inner seats.



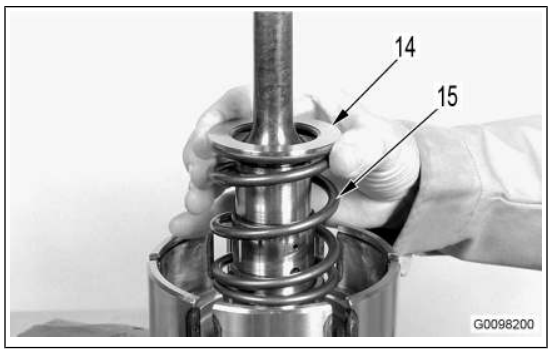
2. Apply a thin film of grease on the sealing rings just inserted.

3. Insert clutch piston (17) with special tool (a) (B) as protection of seal rings (19).

4. Assemble sleeve (16).

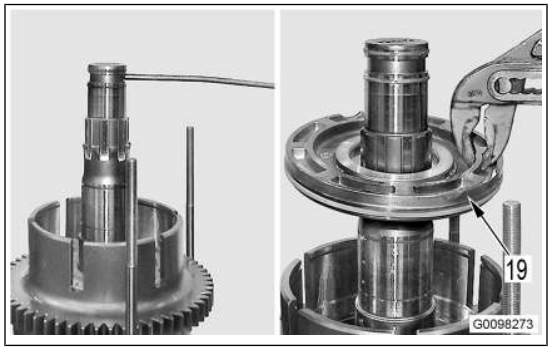


5. Assemble spring (15) and lock spring cover (14).

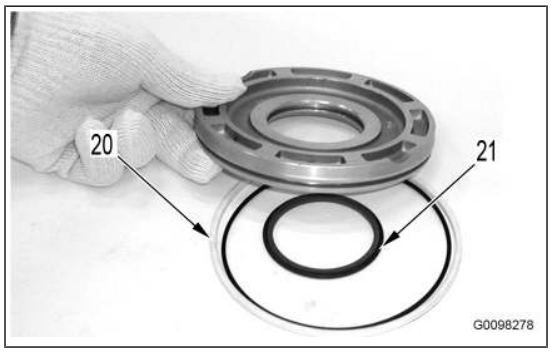


21. Remove sleeve (18).

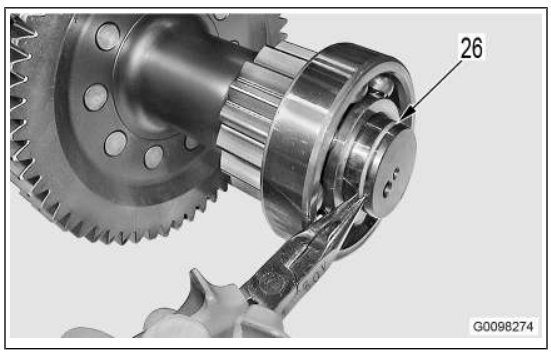
22. Remove clutch piston (19) by blowing in compressed air through the delivery hole.



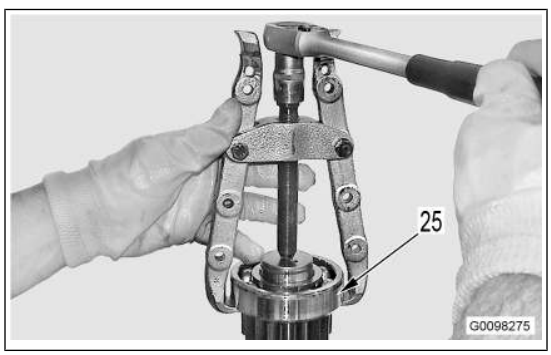
23. If to be replaced, remove teflon seal ring (20) and relevant inner O- ring from outer seat of piston and teflon seal rings (21) and relevant inner O-ring from inner of piston. To remove the rings it is necessary to cut them.



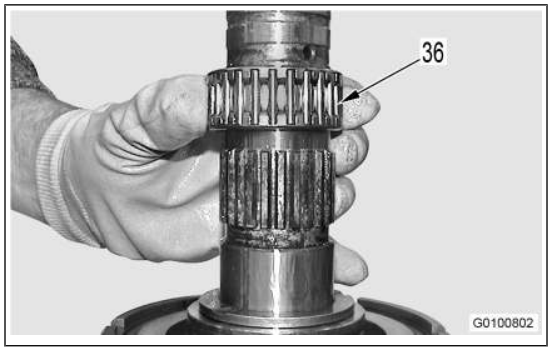
24. Remove the teflon seal ring (26).



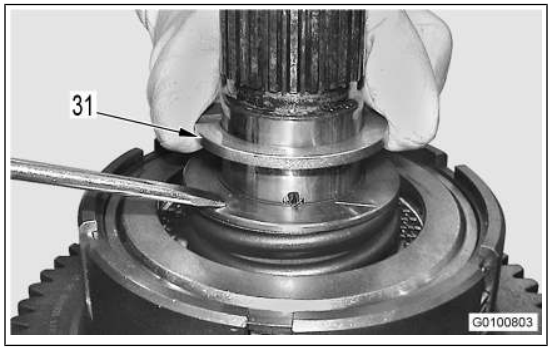
25. Remove bearing (25) by means of an extractor.
26. Check the sealing ring grooves (large and small) for wear and damage if necessary. Use new parts as required.
27. Check on the output shaft for wear and damage. Check oil passages in the output shaft to be sure that the passages are open and free of foreign material. Use new parts as required.
28. Check the ball bearings and the needle bearings for flat areas, pitting, and other damage. Use new parts as required.



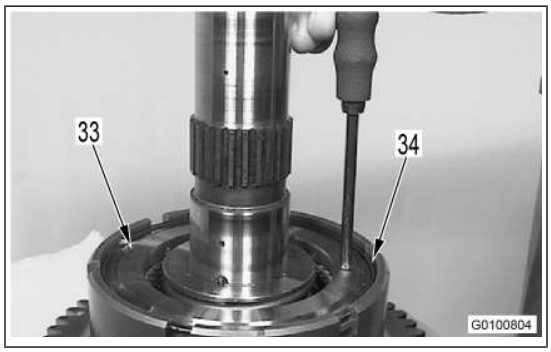
23. Remove roller retainer (36).



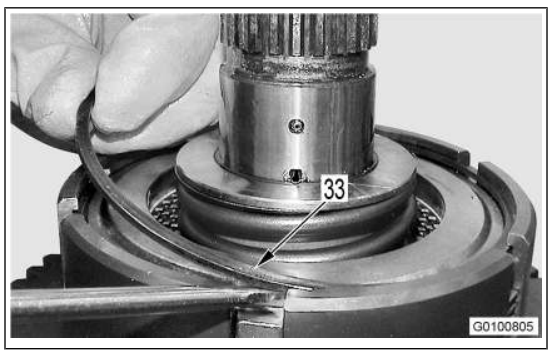
24. Remove the thrust washer (31).



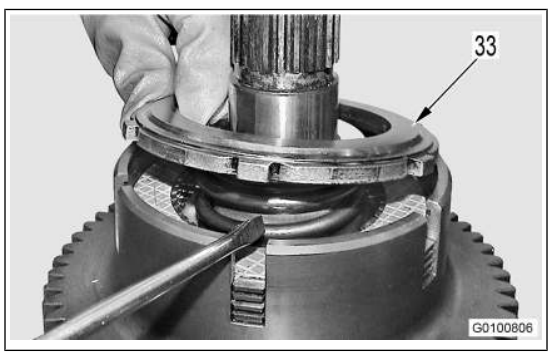
25. Push down the counterdisk (33) to set free the lock ring (34).



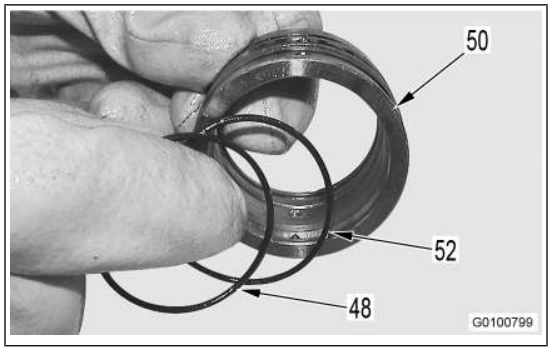
26. Remove the lock ring (34).



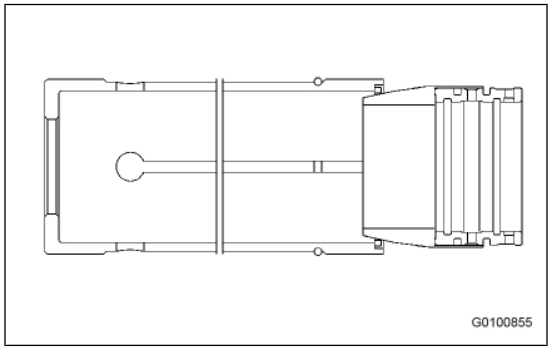
27. Remove the thrust plate (33) by means of two screwdrivers.



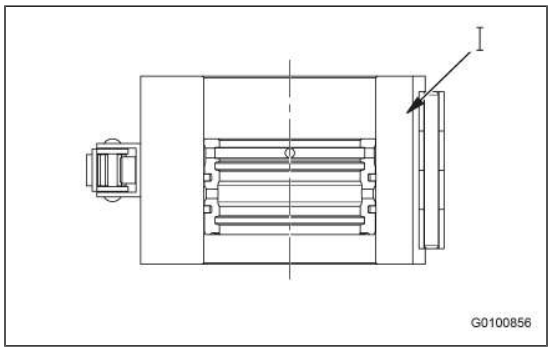
34. Assemble the new O-rings (48) and (52) to the bush (50).



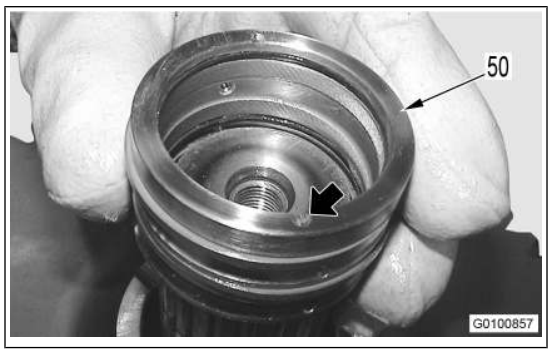
35. Assemble the new teflon seal rings (49) and (51) to the bush (50). For the introduction of the rings, re-peat the operations from sequence [29] to step [33] of “ASSEMBLE SHAFT A (50-229)”. Assembly using the following spacer rings: for the 1st teflon ring: no thickness for the 2nd teflon ring: length 10.50 mm with the expander (G), the pusher (H) and the seal compressor (I).



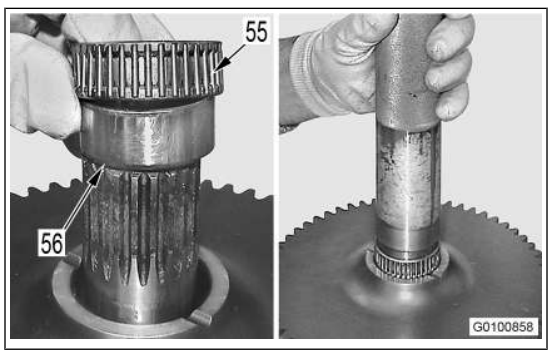
36. Special tool usage.



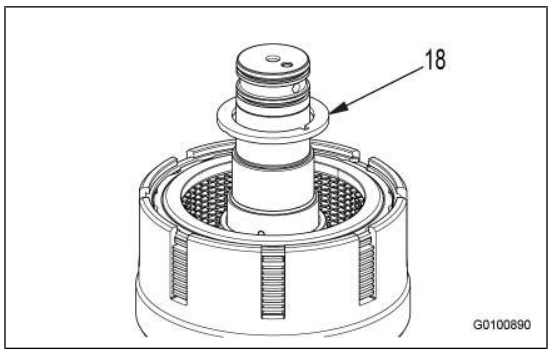
37. Assemble the bush (50) on main shaft (23) with special tool (G). The reference mark must be on the top surface



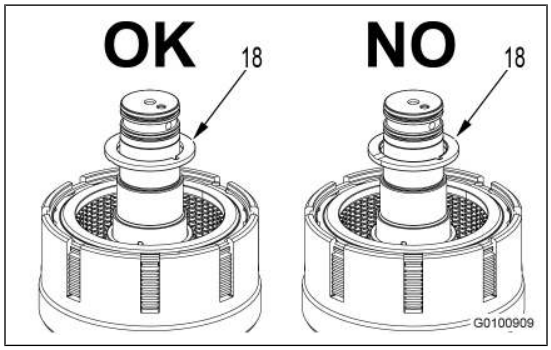
38. Assemble the bush (56). Using a suitable driver assemble needle bearing (55).



10. Install spacer (18).

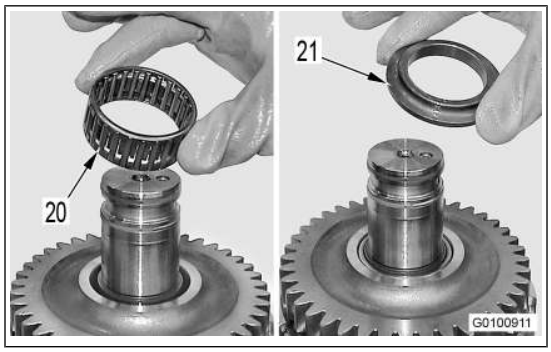


11. Correctly install spacer (18).

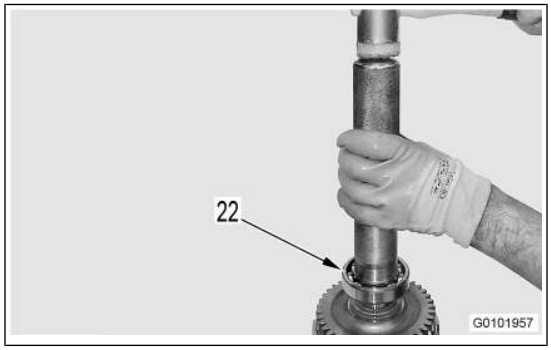


12. Assemble gear (19).

13. Assemble roller bearing (20) and spacer (21).



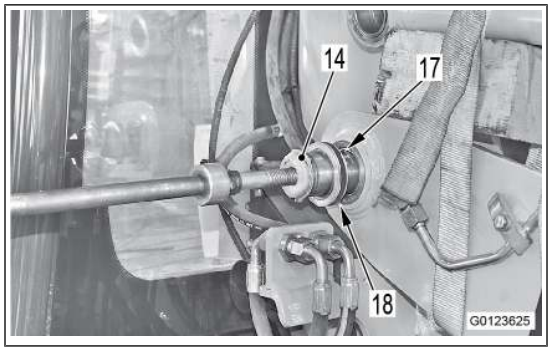
14. Using a suitable driver assemble bearing (22).



15. Remove bolts (2) locking the loader arm pins (14).
16. Extract pins (14) from both side.[*3]

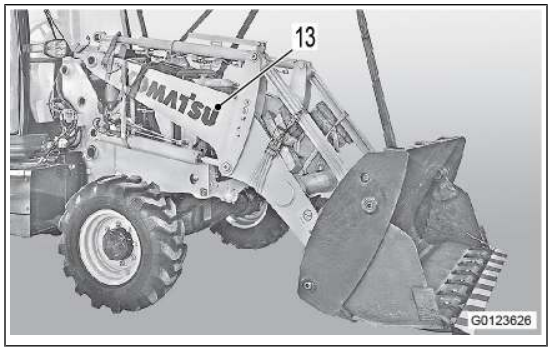
REMARK

- Notate the position of spacer (15) and the quantity of shims (16) between snap ring and arm.



17. Sling the front work equipment assembly (13).

Front work equipment assembly: 1050 kg



INSTALL LOADER WORK EQUIPMENT ASSEMBLY

To install, reverse the removal procedure.

[*1]

1. Adjust the position of the return to dig sensor.

[*2]

REMARK

- Use the procedure described below to install loader arm and bucket cylinders.

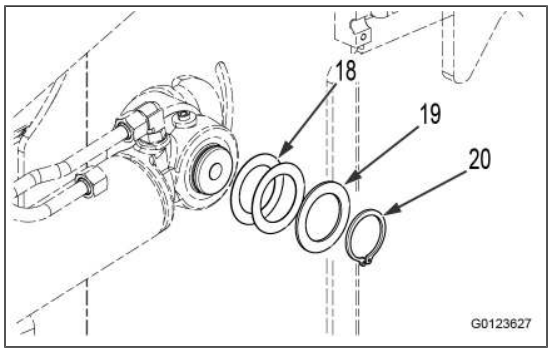
Sliding surface of mounting pin (When assembling): Hyper white grease (G2-T)

⚠ When aligning the pin holes, never insert your fingers in them.

1. Install pins (12) and lock them in position with bolts (2) and nuts (1).

Bolt (2): 96 to 132 Nm {9.8 to 13.5 kgfm}

2. Install shims (18), spacer (19) and snap ring (20).



- Adjust the shims so that clearance between snap ring and cylinders will be 1.0 mm or less. Shim thickness: t = 1.0 mm

Mounting pin (Greasing after assembly): Hyper white grease (G2-T)

[*3]

Inside bushings: Hyper white grease (G2-T)

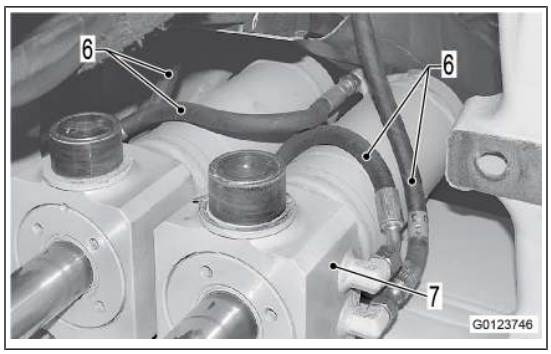
1. Position the loader work equipment (13) and align pin holes.

Sliding surface of mounting pin (When assembling): Hyper white grease (G2-T)

5. Disconnect hoses (6) from boom swing cylinders (7).

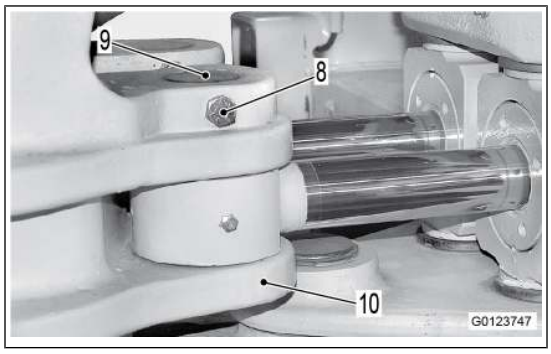
   REMARK

   - Plug all hoses to prevent entry of any impurities.



6. Loosen bolt (8) and remove pin (9). [*3]
7. Rotate the cylinder (7) to disengage the cylinder heads from the boom swing support (10) and sling the boom swing cylinder (7).

   Boom swing cylinder: 40 kg



INSTALL BACKHOE BOOM SWING CYLINDERS

Carry out installation in the reverse order to removal.

[*1]

⚠ **When aligning the positions between hole and pin, do not insert fingers in the holes to check the alignment.**

- Start the engine and using the boom swing control lever extend or retract the boom swing cylinders to center the pin hole.
- Install the pins (9) and lock them in position with bolt (8).

[*2]

Bolts (3): 900 to 1100 Nm {91.8 to 112.2 kgfm}

Bolts (3): Loctite 242

[*3]

NOTICE

DO NOT install pins (9) at this step

- Refilling with hydraulic oil.
- Bleed air from hydraulic circuit.
- Run the engine to circulate the oil through the system. Then, check the oil level again.

REMOVE AND INSTALL BACKHOE SLIDING BRACKET LOCKING PISTON

⚠ Place the machine on a level ground, lower the outrigger and fully extend backhoe work equipment.

⚠ Turn the battery disconnect switch to OFF position, and remove the key.

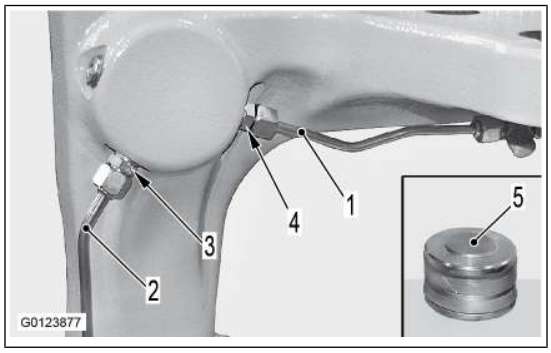
⚠ Loosen the hydraulic tank cap to release the pressure inside the hydraulic tank.

REMOVE BACKHOE SLIDING BRACKET LOCKING PISTON

1. Remove backhoe work equipment assembly (For details, see “REMOVE AND INSTALL BACKHOE SLIDING BRACKET (50-325)”).
2. Remove pipes (1) and (2).
3. Plug union (3) and inlet air compressed air through union (4) to remove upper piston (5). [*1]

   ⚠ Use low pressure air compressed (max 0.2 MPa {2 kgf/cm^2}.

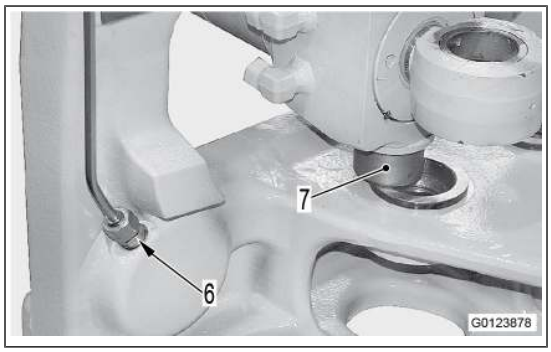
   ⚠ The the piston may be ejected suddenly and provide damage to things or persons. Always use a proper safety device to hold it.



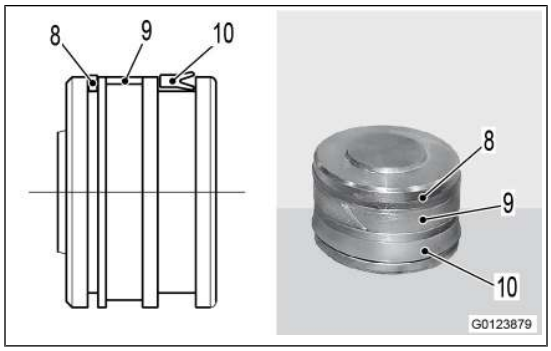
4. Inlet air compressed air through union (6) to remove lower piston (7). [*1]

   ⚠ Use low pressure air compressed (max 0.2 MPa {2 kgf/cm^2}.

   ⚠ The the piston may be ejected suddenly and provide damage to things or persons. Always use a proper safety device to hold it.



5. Remove from dust seal (8), guide ring (9) and packing (10). [*2]



INSTALL BACKHOE SLIDING BRACKET LOCKING PISTON

Carry out installation in the reverse order to removal.

[*1]

INSTALL ENGINE CONTROLLER ASSEMBLY

Perform installation in the reverse order to removal.

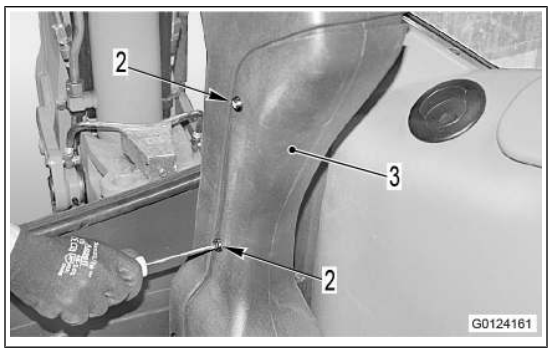
REMOVE AND INSTALL BACKHOE PPC VALVE SUPPORT RETURN GAS SPRING

REMOVE BACKHOE PPC VALVE SUPPORT RETURN GAS SPRING

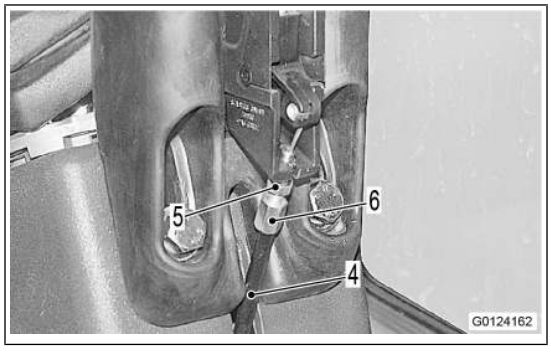
1. Lower the outriggers and the equipment to the ground; stop the engine.

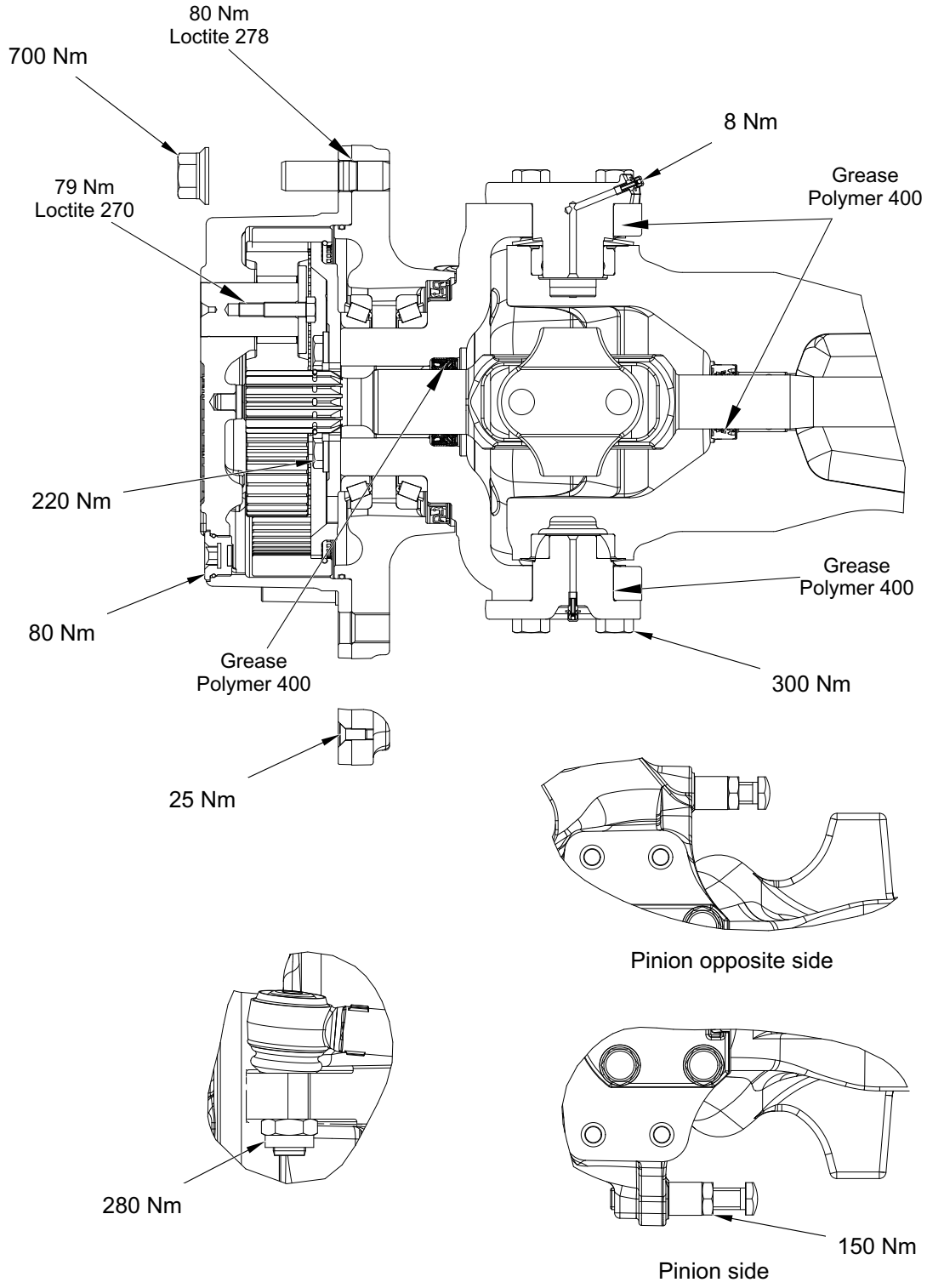
2. Remove the rear mat (1).

3. Loosen and remove the four screws (2) with their washer; remove the protection (3).



4. Remove the clamp retaining the cable (4).
5. Loosen the nut (5) and tighten fully the tensioner (6). [*1]




80 Nm
Loctite 278
700 Nm
8 Nm
79 Nm
Loctite 270
Grease
Polymer 400
220 Nm
Grease
Polymer 400
80 Nm
Grease
Polymer 400
300 Nm
25 Nm
Pinion opposite side
280 Nm
150 Nm
Pinion side
G0103814

MAINTENANCE STANDARD OF CONTROL VALVE

Since the valve are single add-on type, they can be added and removed one by one any time.