DOOSAN

950106-01005E-1
February 2015

EXCAVATOR

Shop Manual

DX490LC-5/DX530LC-5

Serial Number 10001 and Up

SAFETY INSTRUCTIONS

WARNING

AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or service. Untrained operators and failure to follow instructions can cause death or serious injury.

SAFETY MESSAGES

Replace with Safety Messages Section on pages III and IV in the Doosan Operation & Maintenance Manual.

OPERATION

Always make sure that the machine is properly maintained.

Before Engine Starting

Machine Condition

Every day before starting engine for first time, perform the following checks and repair machine before operating, as necessary. If these checks are not properly done death or serious injury could result.

- Check coolant, fuel, and hydraulic tank oil levels, and check for clogged air cleaner and damage to electrical wiring.
- Check operation of gauges, cameras (if equipped) and angle of mirrors, and check that safety lever is in LOCKED position.
- Check that work equipment and travel controls move freely, and work controls return to "NEUTRAL" when released.
- Check that attachment is properly attached and locked.

IMPORTANT

Only use Ultra Low Sulfur Diesel (ULSD) fuel and API CI-4/ ACEA E5, E7 or API CJ-4/ACEA E9 grade engine oil with this machine.

Make sure that the machine is equipped with a lighting system that is adequate for job conditions and lights are working properly.

Before moving machine, check position of undercarriage. The normal travel position is with idler wheels to front under cabin and drive sprockets to rear. When undercarriage is rotated in reversed position, directional or travel controls must be operated in opposite directions.

Before performing checks, move machine to an area where there are no obstructions, and operate slowly. Do not allow personnel near machine.

Know maximum operating dimensions of your machine.

Check After Long-term Parking

- All oil and fluid levels.
- Tension of all belts.
- Air pressure.
- Air cleaner.
- Batteries and electrical connections.
- Lubricate all greasing points.
- Wipe off grease from piston rods.
- Inspect for signs of nests (i.e. birds, rodents, etc.)
- Inspect safety labels (decals). Replace if damaged, worn, or missing.

Battery

Battery Hazard Prevention

Battery electrolyte contains diluted sulfuric acid and generates hydrogen gas. Hydrogen gas is highly explosive, and improper handling can cause death or serious injury, or fire. Do not allow electrolyte to contact skin or eyes. Always wear safety goggles and protective clothing when servicing batteries. Wash hands after touching batteries and connectors. Use of acid-resistant gloves is recommended. Always observe the following precautions.

- Do not smoke or bring any flame near battery.
- When working with batteries, Always wear safety goggles, protective clothing, and acid-resistant gloves.
- If you spill battery electrolyte on yourself or your clothes, immediately flush area with water.
- If battery electrolyte gets into your eyes, flush them immediately with large quantities of water and get immediate medical attention from a physician familiar with this injury.
- If you accidentally drink battery electrolyte, call a poison prevention center immediately and get immediate medical attention from a physician familiar with this injury.
- When cleaning top surface of battery, wipe it with a clean, damp cloth. Never use gasoline, thinner, or any other organic solvent or detergent.
- Tighten battery caps.
- If battery electrolyte is frozen, do not charge battery or start engine with power from another source. This could cause the battery to explode and start a fire.
- When charging battery or starting with power from another source, let battery electrolyte thaw and check that there is no leakage of battery electrolyte before starting operation.
- Always remove battery from machine before charging.
- Do not use or charge battery if battery electrolyte level is below LOW LEVEL line. This can cause an explosion. Periodically check battery electrolyte level and add distilled water to bring electrolyte level to FULL LEVEL line.
- Before maintaining or working with batteries, turn starter switch to "O" (OFF) position.

EX1400136

Figure 47

Specifications

Edition 1

mm (ft in)

DIM.	Boom	7.1 m (23' 4")				6.3 m (20' 8")	
	Arm	**3.35 m (11' 0")**	**2.9 m (9' 6")**	**3.98 m (13' 1")**	**3.35 m (11' 0") HD**	**2.4 m (7' 10")**	**2.9 m (9' 6")**
	Bucket Type (PCSA)	**2.14 m^3 (2.80 yd^3)**	**2.39 m^3 (3.13 yd^3)**	**1.83 m^3 (2.39 yd^3)**	**1.71 m^3 (2.24 yd^3) Rock**	**3.20 m^3 (4.71 yd^3)**	**2.85 m^3 (4.19 yd^3)**
A	Max. Digging Reach	12,125 (39' 9")	11,720 (38' 5")	12,670 (41' 7")	12,125 (39' 9")	10,305 (33' 10")	10,735 (35' 3")
B	Max. Digging Reach (Ground)	11,895 (39' 0")	11,485 (37' 8")	12,455 (40' 10")	11,895 (39' 0")	10,030 (32' 11")	10,475 (34' 4")
C	Max. Digging Depth	7,940 (26' 1")	7,490 (24' 7")	8,555 (28' 1")	7,940 (26' 1")	6,410 (21' 0")	6,905 (22' 8")
D	Max. Loading Height	7,715 (25' 4")	7,575 (24' 10")	7,875 (25' 10")	7,715 (25' 4")	6,500 (21' 4")	6,600 (21' 8")
E	Min. Loading Height	2,980 (9' 9")	3,430 (11' 3")	2,360 (7' 9")	2,980 (9' 9")	3,355 (11' 0")	2,830 (9' 3")
F	Max. Digging Height	10,900 (35' 9")	10,770 (35' 4")	11,055 (36' 3")	10,900 (35' 9")	9,345 (30' 8")	9,480 (31' 1")
G	Max. Bucket Pin Height	9,540 (31' 4")	9,400 (30' 10")	9,700 (31' 10")	9,540 (31' 4")	8,305 (27' 3")	8,405 (27' 7")
H	Max. Vertical Wall Depth	4,520 (14' 10")	4,195 (13' 9")	5,080 (16' 8")	4,520 (14' 10")	740 (2' 5")	1,305 (4' 3")
I	Max. Radius Vertical	9,970 (32' 9")	9,710 (31' 10")	10,235 (33' 7")	9,970 (32' 9")	9,845 (32' 4")	10,095 (33' 1")
J	Max. Depth to 8' Line	7,785 (25' 6")	7,315 (24' 0")	8,415 (27' 7")	7,785 (25' 6")	6,170 (20' 3")	6,685 (21' 11")
K	Min. Radius 8' Line	3,895 (12' 9")	3,885 (12' 9")	3,905 (12' 10")	3,895 (12' 9")	3,195 (10' 6")	3,175 (10' 5")
L	Min. Digging Reach	1,055 (3' 6")	2,195 (7' 2")	200 (8")	1,055 (3' 6")	2,165 (7' 1")	1,310 (4' 4")
M	Min. Swing Radius	5,210 (17' 1")	5,235 (17' 2")	5,185 (17' 0")	5,210 (17' 1")	4,740 (15' 7")	4,715 (15' 6")
d	Bucket Angle	189.1°	181.2°	180.9°	189.1°	184.5°	186.2°

Mistrack Check

Summary

1. Allow the machine to travel 20 m (65.6 ft). Measure the maximum tread deviation from the tread chord line drawn between the travel start and end points to check the performance equilibrium between both sides of the travel device systems (from the main pump to the travel motor).
2. If measured on a concrete surface, the tread deviation has a trend to decrease.

Preparation

1. Adjust the track sag of both tracks to be equal.
2. Provide a flat, solid test yard 20 m (65.6 ft) in length, with extra length of 3 - 5 m (9.8 - 16 ft) on both ends for machine acceleration and deceleration.

IMPORTANT

The bucket teeth will hit the boom if the bucket is rolled-in with the arm fully rolled-in.

As for this condition: arm fully rolled-in + bucket fully rolled-in, set the bucket at fully rolled-in and a perform arm roll-In operation.

3. Hold the bucket 0.3 - 0.5 m (12 - 20 in) above the ground the arm and bucket rolled-in.
4. Maintain the hydraulic oil temperature at 50 ±5 °C (122 ±41 °C).

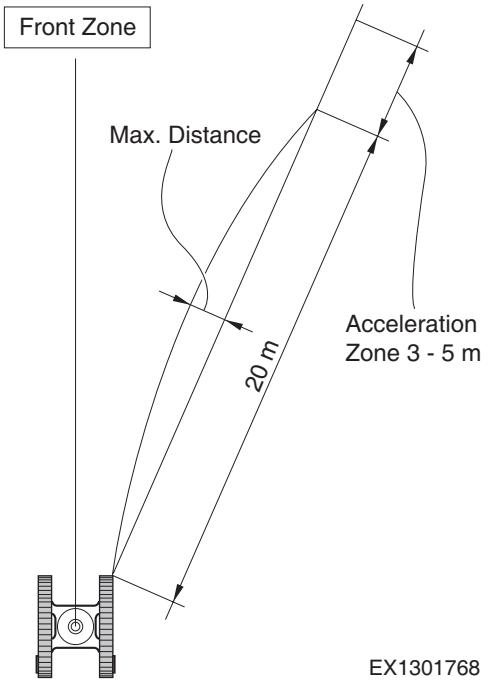


Figure 13

Measurement

1. Measure the amount of mistracking in both fast, and slow travel speeds.
2. Measurement conditions are as below.

Travel Mode Switch	Engine Control Dial	Power Mode Switch	Work Mode	Auto-idle Switch
Low Mode	High Idle	Power Plus Mode	Digging Mode	OFF
High Mode	High Idle	Power Plus Mode	Digging Mode	OFF

3. Start traveling the machine in the acceleration zone with the travel levers al full stroke.

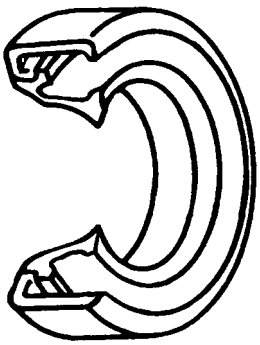
Oil Leakage Precautions

Oil that is visibly seeping from joints or seals should always serve as a "red flag" alarm.

Leaks must alert the machine operator and maintenance crew that air, water and dirt have an open, free passageway through which to enter the circuit. Corrosive salt air, freezing and thawing condensation cycles and working environments that are full of fine dust are especially hazardous. Clogging of valve spools or external piping (especially pilot circuit piping) can gradually diminish or suddenly put a stop to normal hydraulic function. You can prevent having to make these types of repairs by the following recommended assembly procedures:

1. Use new O-rings and oil seals whenever hydraulic assemblies are rebuilt.
2. Prepare joint surfaces before assembly by checking alignment and flatness. Clean and repair corrosion or any other damage.
3. Follow bolt torque recommendations and all other assembly requirements.

   NOTE: *Grease lip seals before assembly.*



0565A

Figure 1

TORQUE VALUES FOR STANDARD U.S. FASTENERS

Type	SAE Grade	Description	Bolt Head Marking
1	1 or 2	WILL HAVE NO MARKINGS IN THE CENTER OF THE HEAD. Low or Medium Carbon Steel Not Heat-treated.	
5	5	WILL HAVE THREE RADIAL LINES. Quenched and Tempered Medium Carbon Steel.	
8	8	WILL HAVE 6 RADIAL LINES. Quenched and Tempered Special Carbon or Alloy Steel.	

Recommended torque, in foot-pounds, for all Standard Application Nuts and Bolts, provided:

1. All thread surfaces are clean and lubricated with SAE-30 engine oil. (See Note.)
2. Joints are rigid, that is, no gaskets or compressible materials are used.
3. When reusing nuts or bolts, use minimum torque values.

NOTE: *Multiply the standard torque by:*

0.65 When finished jam nuts are used.

0.70 When Molykote, white lead or similar mixtures are used as lubricants.

0.75 When Parkerized bolts or nuts are used.

0.85 When cadmium plated bolts or nuts and zinc bolts w/waxed zinc nuts are used.

0.9 When hardened surfaces are used under the nut or bolt head.

NOTE: *When reusing bolts and nuts in service, use minimum torque values.*

ENGINE SPECIFICATION

Items		Specification
Engine	Type	4-Cycle Water Cooled, Waste Gate Turbocharge, Air to Air Intercooled Direct Injection
	Emission	US EPA Tier 4 Final (EU Stage IV)
	Model	DC 13
	Injection System	Extra High-pressure Fuel Injection System
	Rated Net Power	283 kW (380 HP) @ 1,800 rpm (SAE J1995)
Valve Clearance	Intake Valve	0.45 mm
	Exhaust valve	0.70 mm
Number of Cylinders and Configuration		6, Straight
Rotating Direction (from Flywheel)		Counterclockwise
Oil Pressure	Normal with the Engine at Operating Temperature, Operating Speed	3.1 ~ 6.1 kg/cm^2 (3 - 6 bar, 43.5 ~ 87 psi)
	Min. Permitted at Idling Speed	0.71 kg/cm^2 (0.7 bar, 10.2 psi)
Crankcase Pressure with Closed Crankcase Ventilation		-5.4 ~ 2.0 bar
Using Lubrication Oil		ACEA-E5 or E7 (for Fuel with Ultra Low Sulfur Content)
Oil Filter		Paper Filter
Interval Between Oil Changes		500 h
Working Principle		4 Stoke Engine
Cylinder Diameter		130 mm
Piston Stroke		160 mm
Displacement		12,700 cc
Compression Ratio		17.5:1
Number of Teeth on the Flywheel		158
Low Idle Speed		750 rpm
Max. Full Load Speed		1,850 rpm
Weight, without Coolant and Oil		1,075 kg
Cooling System	Volume, Excluding Radiator	17,000 cc
	Coolant Temperature	90 - 95°C
	Number of Thermostats	1
	Thermostat, Opening Temperature	80°C
Electrical System	Type	1-pin, 24V, DC
	Starter Motor (Standard Equipment)	1-pin, 24V, 6 kW
	Alternator (Standard Equipment)	1-pin, 28V, 100 A

Variable Geometry Turbocharger, Electric Motor

- To be tightened crosswise in two stages (Screw 12.9): 3 Nm, 11 Nm

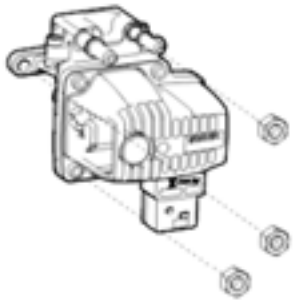
Silencer

- Exhaust pipe to and from silencer (V-clamp): 20 Nm

EX1301840

Reductant Doser

- Nut (M6): 10 Nm



EX1301847

Charge Air Cooler

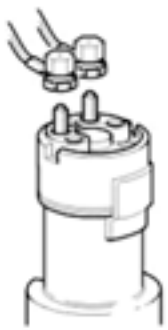
- Pipe connection (V-clamp): 8 Nm

EX1301840

Fuel System

Injectors

- Nut for cable connection: 2 Nm



EX1301848

Installing the Engine

1. Fasten the lifting chain 98 094 to the rear lifting eyes.

   NOTE: *The engine lifting eyes 99 637 are designed for lifting the engine only, not the engine with connected equipment (high-voltage current generator, gearbox, reverse gear, etc.) or frame. All three lifting eyes must be used.*

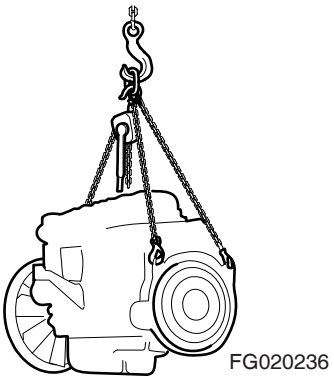


Figure 24

2. Fasten the ratchet lever hoist 587 308 to the front lifting eye.

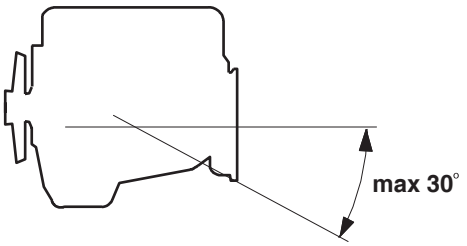


Figure 25

3. Lift the engine, position it on the engine insulators and screw it into place.
   - If removed, refit:
   - Unit gearbox.
   - Coolant level sensor.
   - Protective casing on cooling package and fan.
   - Pneumatic system.
   - Power take-off, see subgroup 01-55 Power take-off.
   - Hydraulic pump, see subgroup 13-15 Hydraulic pump.
   - AC compressor, see subgroup 18-75 AC compressor.

Installing a New Valve Seat Insert

1. Clean the cylinder head.
2. Tap/press in new valve seat inserts. Use drift 99 384 and shank 99 695. Cool the drift and valve seat insert to about -80°C with dry ice or liquid air. The tapping/pressing in must be done very rapidly.

WARNING

AVOID DEATH OR SERIOUS INJURY

Be careful when handling the cold parts and refrigerant mentioned above. Risk of frost injuries.

Oversize valve seat inserts can be installed if the valve seat insert position has been damaged. The position must then be machined with tool 587 277.

Figure 61

Machining the Valve Seat Insert Sealing Surface

1. Check that contact surface on the cylinder head is level and clean. Also check that magnetic stand on the valve seat cutter is clean. Clean the valve guides.
2. Adjust the cutting blade for a 30° valve seat position on the valve seat cutter and set the distance to approximately 17 mm as illustrated.

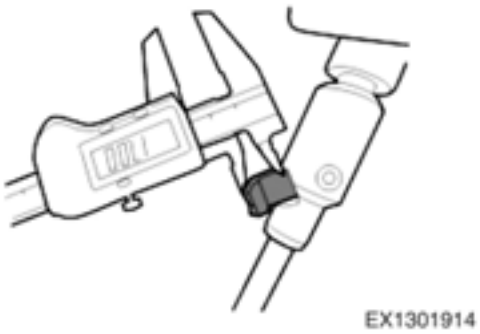


Figure 62

3. Lubricate the control spindle and insert it in the valve guide.

6. Machine the upper cylinder liner guide on the cylinder block with the tool.
7. Loosen the internal hexagon screws and remove tool.

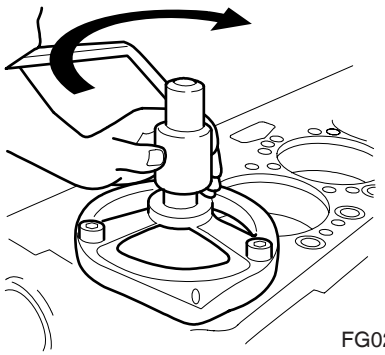

FG020331

Figure106

Cleaning and Checking

1. Clean the swarf collector with a vacuum and then remove it.
2. Remove burrs from the machined cylinder block edge with abrasive paper, size 400.
3. Clean the cylinder block.
4. Check that cylinder liner can be inserted in the cylinder block.
5. Clean the tool and return it to the box.

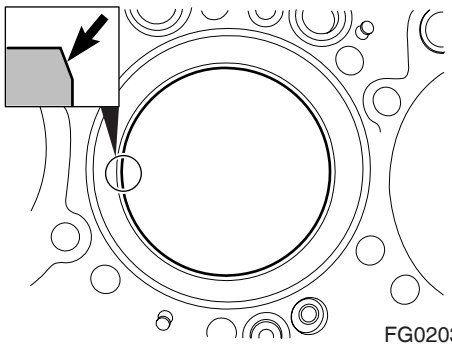

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Figure 107

Replacing the Rear Crankshaft Seal

1. Remove flywheel according to instructions.
2. Remove crankshaft seal using a screwdriver. Take care not to scratch the sealing surfaces on the crankshaft and the flywheel housing. Alternatively a self tapping screw can be screwed into the crankshaft seal so the crankshaft seal can be pulled out with a slide hammer.

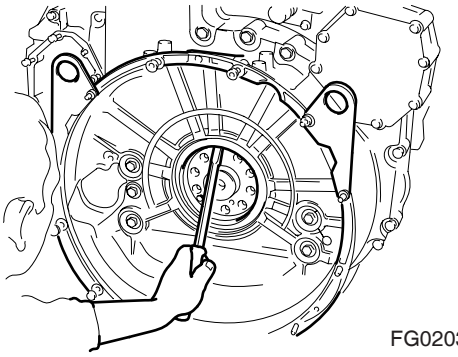

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Figure153

NOTE: *The crankshaft seal must be installed dry and must not be lubricated. The sleeve in the seal must be left in place. Do not touch the sealing lip with your fingers.*

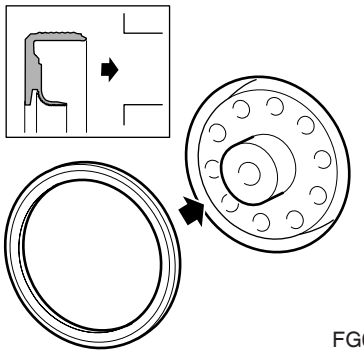

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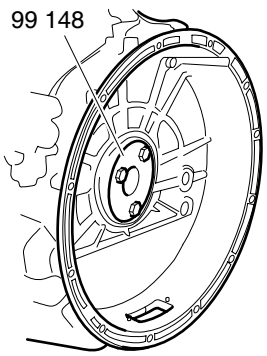
Figure 154

3. Install a new crankshaft seal using tool 99 148. Place the crankshaft seal on the tool and fasten the tool with the bolts.
4. Tighten the bolts alternately until tool stops against the cover. Then remove tool and the protection ring of the crankshaft seal.
5. Clean the flywheel sealing surface using degreasing agent and wipe it dry before assembly.
6. Install the flywheel according to instructions.



FG020376

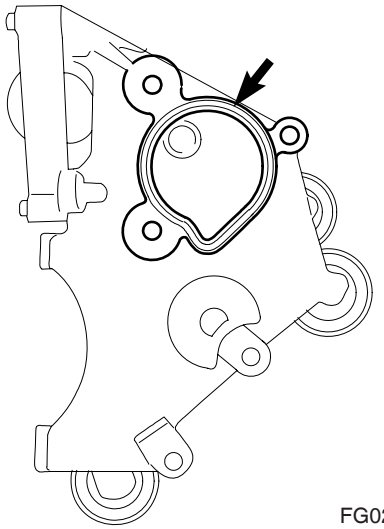
Figure 155

15. Apply sealant to the groove on the cover.

    The diameter of the bead must be approximately 4 mm.

IMPORTANT

Make sure that you apply the sealant evenly along the groove on the cover. Be particularly careful by the oilway which is visible under the camshaft. Excess sealant can block the channel.



FG020398

Figure 186

IMPORTANT

Assembly must be completed within 25 minutes of starting to apply the sealant.

16. Install the camshaft cover. Tighten the screws.
17. Install the idler roller, belt tensioner with the lock still in position, alternator and AC compressor.
18. Install the drive belt and fan as described in the instructions Replacing the drive belt.
19. Install the cooling package and filling the cooling system.
20. Install the gearbox.

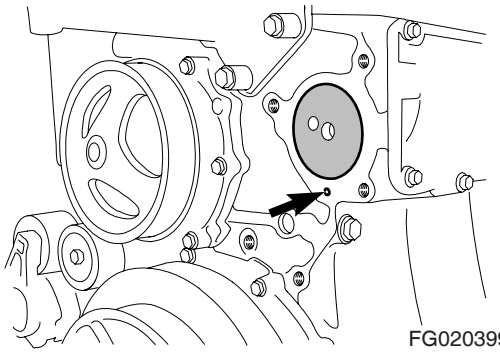


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Figure 187 Oilway under the camshaft.

Replacing the External Ring Gear on the Flywheel

Replace the flywheel external ring gear if the gear teeth have become so worn that starter pinion will not engage.

1. Grind a groove as deep as possible in the ring gear and crack it open with a chisel.

   Remove ring gear from the flywheel.

2. Clean the contact surfaces of the flywheel with a wire brush.

3. Heat the new ring gear evenly around its circumference to 100°C - 150°C.

4. Lay the heated external ring gear on the flywheel so the beveled side is facing the starter motor. Make sure the ring gear is securely against the flywheel. If necessary, knock down the ring gear with a plastic hammer.

5. The ring gear must not be cooled rapidly but be left to cool in the open air.

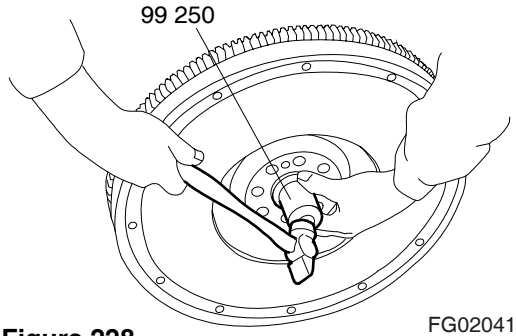
Replacing Support Bearing

1. Remove retaining rings on both sides of the support bearing.

2. Tap the support bearing out of the flywheel using drift 99 250.

3. Install the inner retaining ring and a new support bearing using drift 99 250.

4. Install the outer retaining ring.



FG020416

Figure 228

Checking the Flywheel

Check the friction surface of the flywheel for heat damage.

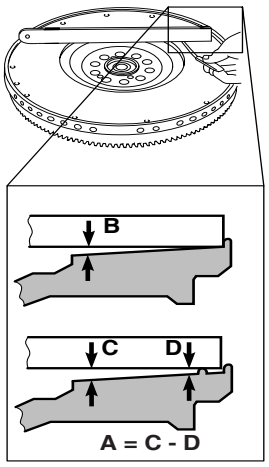
If the friction surface of the flywheel has deep thermal cracks or blueing that may sometimes be obvious as a movement of the material, the flywheel should not be re-used.

Heat, caused by incorrect use of the clutch, will often lead to the friction surface of the flywheel distorting and becoming concave.

The concavity is not detrimental if the same flywheel and disk are reinstalled. However, when replacing disks it is advisable to check how deep this concavity is.

If, by measuring as shown in the illustration, it is found that dimension B is greater than 0.6 mm, there is an increased risk of rapid disk wear in the future.

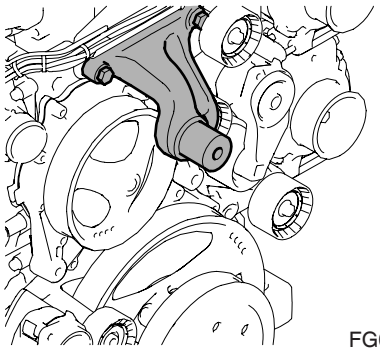
If the distortion or wear, dimension A, is greater than approximately 1 mm, the flywheel must be replaced.



FG020417

Figure 229

4. Install support drift 98 575 in the center as illustrated.
5. Pull off the driver.



FG020451

Figure 269

6. Press a new driver with bearing onto the shaft.
7. Screw on a 110 mm long M14 screw with washers through drift 99 452.
8. Tighten the screw so the driver is pressed onto the shaft.

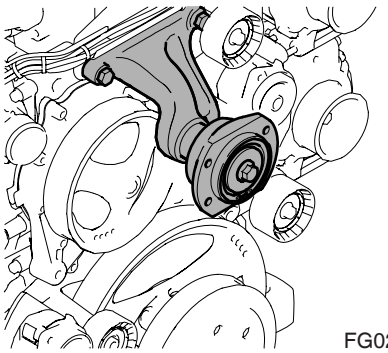


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Figure 270

9. Switch to a 75 mm long M14 screw and tighten the driver until it reaches the bottom of the shaft.

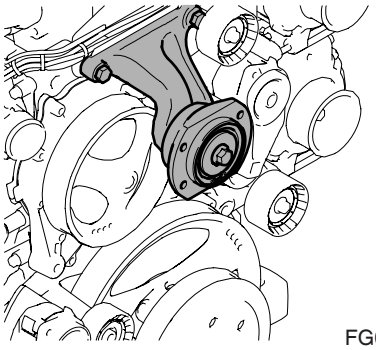

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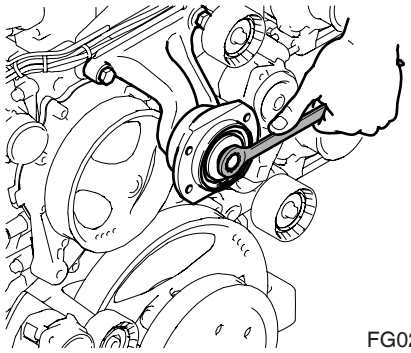
Figure 271

10. Tighten the driver.
11. Install the pulley and spacer on the driver.
12. Install the outer belt transmission poly-V-belt.
13. Install the fan on the spacer.

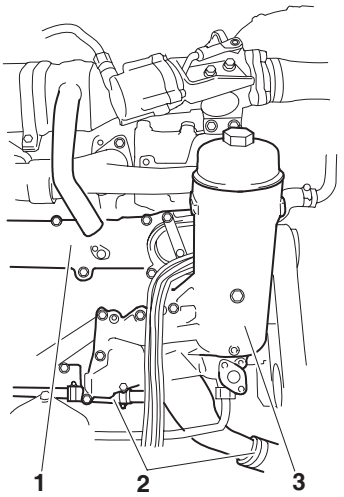


FG020454

Figure 272

Installing the Oil Cooler

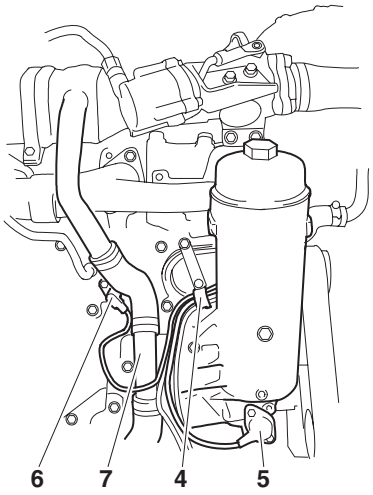
1. Clean the gasket faces on the cylinder block and oil cooler cover.
2. Install the oil cooler cover (1) with a new gasket.
3. Install the lower coolant hose (2).
4. Install the oil filter housing (3) with a new gasket and new oil filter.



WL1400048

Figure 314

5. Install the clamp of the turbocharger cable harness (4).
6. Install the oil pressure sensor (5) and the coolant temperature sensor (6).
7. Install the hose and coolant pipe (7) on the water-cooled EGR cooler.
8. Install the turbocharger.
9. Fill and bleed the cooling system.

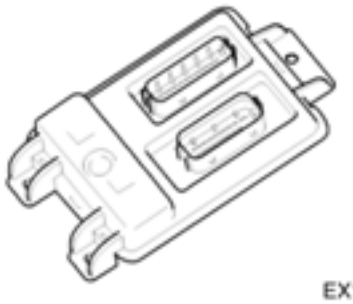


WL1400049

Figure 315

Control Unit EEC

The EEC control unit retrieves data from the system's sensors and components. EEC communicates with the engine control unit EMS. EMS decides on what measures are to be executed what quantity of reductant is to be metered to the exhaust gases, and notifies EEC. The EEC control unit is independently responsible for the functions which supply reductant to the exhaust gases. The EEC control unit is located on the reductant tank bracket underneath the reductant tank.

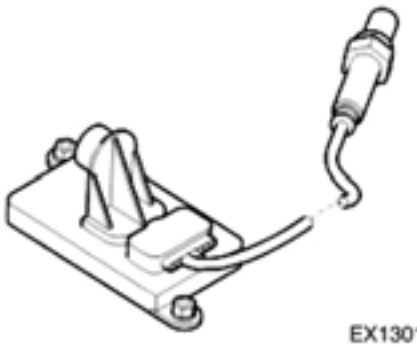


EX1302171

Figure 337

NOx Sensor (T115 and T131)

There are two NOx sensors in the system. They are used to measure the content of nitrogen oxide compounds in the exhaust gases before and after exhaust gas aftertreatment. The sensors report to EEC, which notifies EMS. The sensors are electrically heated by EEC. The NOx sensors are located on the exhaust outlet of the SCR catalytic converter (T115) and in the exhaust brake housing (T131).

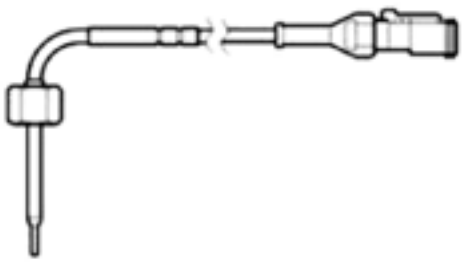


EX1301843

Figure 338

Temperature Sensor (T113)

There is a level and temperature sensor which measures the fluid level and fluid temperature. This sensor reports to EEC and is located in the reductant tank.



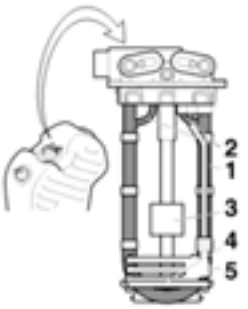
EX1302191

Figure 339

Sensor for Level, Temperature and Reductant Quality (T116)

Reference Number	Description
1	Pipe for Coolant
2	Pipe for Reductant
3	Level Sensor
4	Temperature Sensor
5	Reductant Quality Sensor

There is a connection for reductant and coolant on the top of the reductant tank. A unit with sensors is installed there which measures the fluid level, fluid temperature and quality of the reductant. The sensors report to EEC. The unit is available in two different lengths. 490 mm for the smaller reductant tank and 630 mm for the larger reductant tank.



EX1302172

Figure 340

T115, NOx Sensor

Description

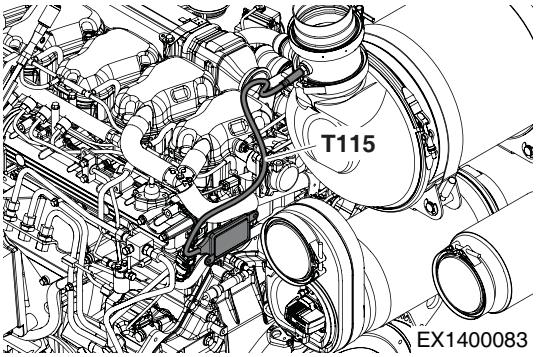
The NOx sensor measures the amount of nitrogen oxides in the exhaust gases and sends the information to the engine control unit.

Overview

EX1400082

Figure 356

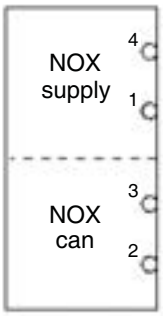
Location



EX1400083

Figure 357

Symbol



EX1302192

Figure 358

Safety Precautions for Work on the Reductant System

Even though the reductant is not toxic, the following must be taken into account when working on the reductant system.

- In case of eye contact, rinse immediately using an eye bath and then seek immediate medical attention.
- In case of contact with skin, rinse with water.
- Change immediately out of clothes which have spills on.
- If ammonia gas is inhaled, make sure that plenty of fresh air is provided immediately.

WARNING

AVOID DEATH OR SERIOUS INJURY

Use protective goggles and gloves if there is any risk of splashing or spraying of reductant or coolant.

WARNING

AVOID DEATH OR SERIOUS INJURY

When the engine is running, the exhaust system parts can reach such high temperatures there is a risk of personal injury. Make sure that exhaust system temperature has decreased to a suitable level before starting work.

WARNING

AVOID DEATH OR SERIOUS INJURY

The reductant system is heated by water from the engine cooling system. The cooling system runs at overpressure and when the engine is hot the coolant is hot. Do not open any hoses without first stopping the coolant flow in the hose.

Pos.		Comments
1	Clamp the hose using pliers to stop the coolant flow.	Warning! The hose contains coolant from the engine. Open the coolant fill cap first to relieve any pressure.
2	Detach the coolant hoses and the electrical connection.	
3	Replace the coolant valve.	

Replacing Exhaust Brake Actuator

Removing

1. Drain the cooling system.

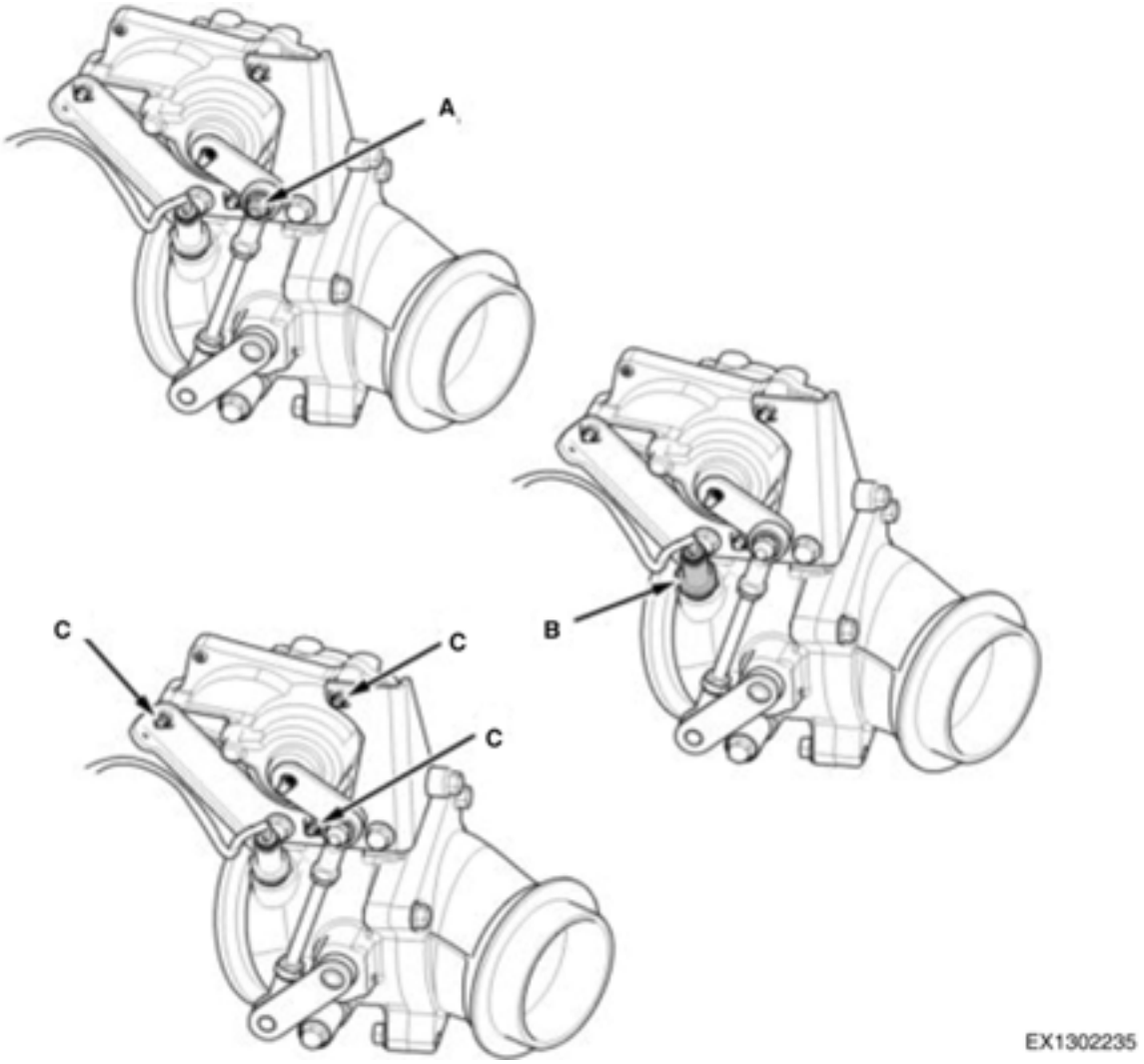


Figure 412

2. Remove 2 coolant hoses.
3. Remove right nipple to access the retaining screw.
4. Remove lock and nut from the link arm (A).
5. Remove link arm.
6. Remove actuator connection.
7. Remove connector from the NOx sensor (B).
8. Remove 3 screws from the actuator (C).
9. Remove actuator.

8. Remove screws towards the turbocharger.

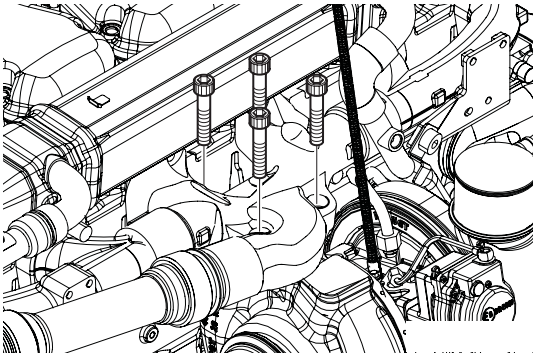


Figure 441

9. Remove screws towards the cylinder heads.
10. Remove exhaust manifold.

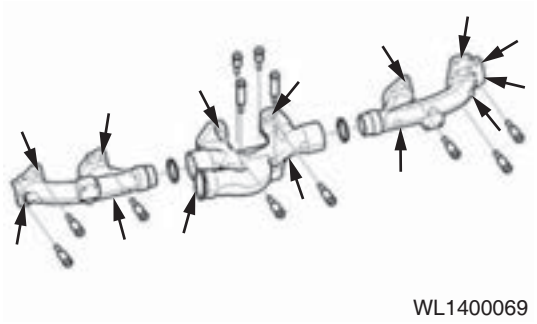


Figure 442

Installing Exhaust Manifold

NOTE: *Always use new gaskets.*

NOTE: *Cleanliness when installing the gasket is essential for the flange to be tight. Keep the surfaces around and on the flange clean and free from dirt.*

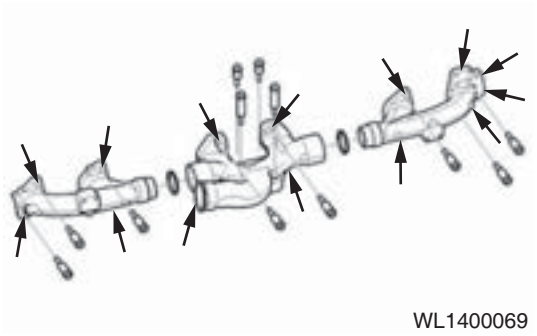


Figure 443

1. Install the exhaust manifold. Use new gaskets.

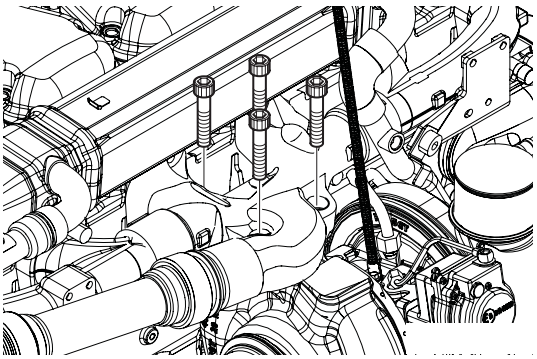


Figure 444

8. Close the valve (2) and read the air pressure in checking tool

   A pressure drop of 0.01 bar a second is acceptable. If the change is greater than 0.01 bar a second, there may be a leakage.

   If there is leakage, check:

   - That EGR valve closes and seals properly.
   - That no external air leaks can be heard between connections and hoses, charge air cooler or inlet pipe.
   - Use soapy water or leak detection spray to visually check for air leaks.

   Check the inlet side and charge air cooler

   - Remove EGR pipe which connects to the inlet pipe. Plug the connection and pressure test the system according to the method above.
   - If leakage is detected. Separate the pipes downstream of the charge air cooler.
   - If the pressure drop is more than 0.01 bar a second, even with the EGR system disconnected, continue troubleshooting to check for any other faults.

Check the EGR Valve

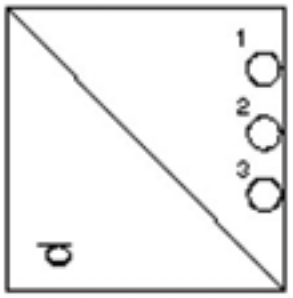
Disassemble the joint upstream of the EGR damper and plug the pipe. Pressure test the system according to the method above. If the system is sealed with the plugged pipe, the EGR valve is leaking and must be cleaned or replaced.

If the fault is rectified

Reinstall all components. Pressure test the system according to the method above. Use checking tool to delete fault codes which may have occurred while performing the work.

Charge Air Pressure Sensor

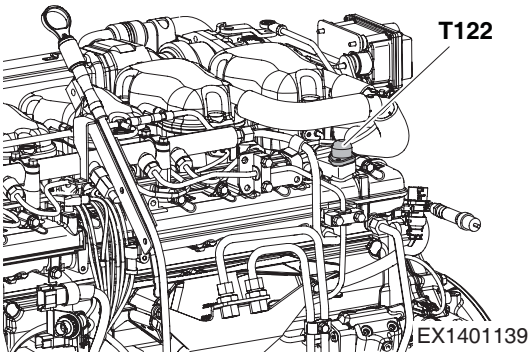
Symbol



EX1302118

Figure 492

Location



EX1401139

Figure 493

Description

The sensor informs the engine control unit of the current charge air pressure.

Overview

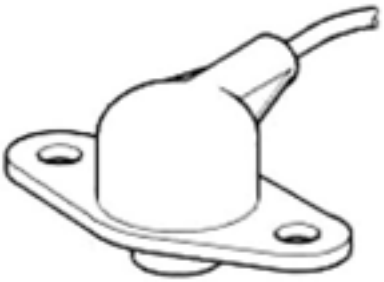


Figure 494

WARNING

AVOID DEATH OR SERIOUS INJURY

The fuel system has a very high fuel pressure of up to 3,000 bars (43,500 psi). The fuel system must be depressurized before any work is started.

Minimize the high-pressure in the fuel system.

The system should always be treated as pressurized, even when the engine is switched off.

Wear protective gloves and goggles.

IMPORTANT

The fuel system is very sensitive to dirt. It is therefore very important that everything is as clean as possible when work is done on the fuel system.

When the fuel system has been opened, compressed air must not be used to blow clean components.

When cleaning, rags or paper which shed fibres must not be used. Use lint-free rags.

Clean tools before use.

Do not use worn chrome-plated tools as flakes of chrome may come off.

Cover connections of removed components with a lint-free rag and tape.

To remove an injector from the cylinder head, its connection must first be removed.

Reference Number	Description
1	High-pressure Pipe
2	Connection
3	Injector

1. Start by depressurizing the fuel system. Minimize the high-pressure in the fuel system.

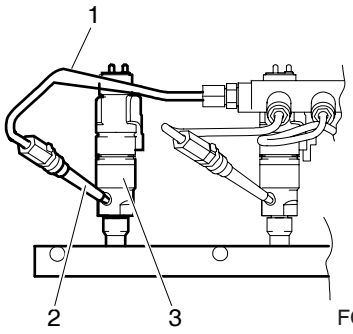


Figure 517

Injector

WARNING

AVOID DEATH OR SERIOUS INJURY

The fuel system has a very high fuel pressure of up to 3,000 bar.

The system should always be treated as pressurized, even when the engine is switched off.

Wear protective gloves and goggles.

IMPORTANT

The fuel system is very sensitive to dirt. It is therefore very important that everything is as clean as possible when work is done on the fuel system.

Compressed air must not be used to blow components clean if the fuel system is open.

When cleaning, cloths or paper which shed fibres must not be used. Use lint-free cloths.

Clean tools before use.

Do not use worn chrome-plated tools as flakes of chrome may come off.

Cover connections of removed components with a lint-free cloth and tape.

IMPORTANT

The holes in the injection nozzles are very small and must not be cleaned with any kind of cleaning tool because it will damage them.

Function

There is one injector for each cylinder. The injector is controlled electrically by the engine control unit.

The injector operates in two phases. One phase is when no power is supplied to the injector and it is closed. The other phase is when power is supplied to the injector and it is open.

The injector consists of a piston, injection nozzle needle, spring and an electromagnetically controlled fuel valve.

The fuel enters the injector by the connection. The injector is continuously pressurized to a maximum of 2,400 bar. When the

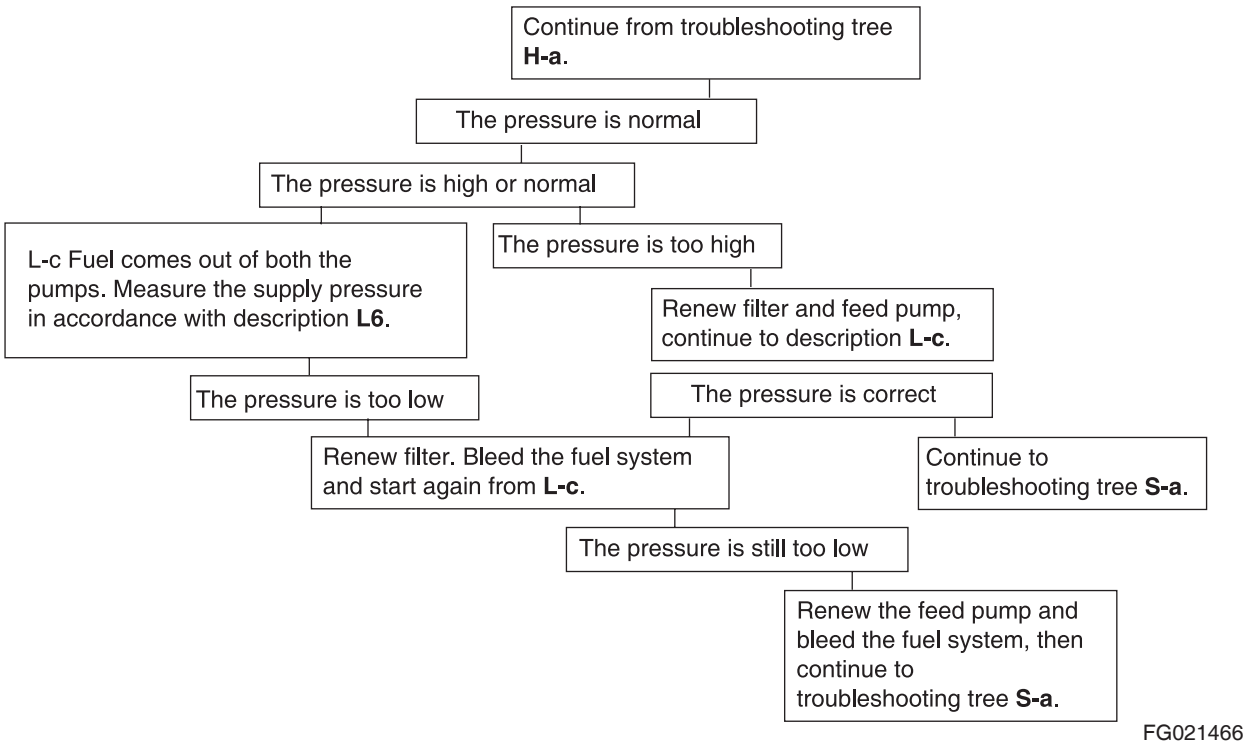

Continue from troubleshooting tree **H-a**.
The pressure is normal
The pressure is high or normal
L-c Fuel comes out of both the pumps. Measure the supply pressure in accordance with description **L6**.
The pressure is too high
Renew filter and feed pump, continue to description **L-c**.
The pressure is too low
The pressure is correct
Renew filter. Bleed the fuel system and start again from **L-c**.
Continue to troubleshooting tree **S-a**.
The pressure is still too low
Renew the feed pump and bleed the fuel system, then continue to troubleshooting tree **S-a**.
FG021466

Figure 569

Request for Exhaust Brake Control

The engine control unit may receive a request for exhaust brake from other systems.

The following priority applies to exhaust brake control:

1. Overspeed protection and internal control unit functions - EMS
2. Braking when changing gear - GMS
3. Braking - BMS
4. For the following, the request which is highest takes precedence:
    - Cruise control - EMS
    - Retarder braking - GMS
    - Braking - COO

A request for exhaust brake is rejected if there is fuel injection.

The request as described in point 4 above is rejected if the engine speed is below a certain level, the clutch is depressed, or if the torque converter is not locked.

The following can limit the exhaust brake, determined by the system which requests the most limitation:

- Retarder braking - GMS
- Braking when changing gear - GMS
- Braking - BMS

Request for Raised Engine Speed

When changing gear, the gearbox management system, GMS, requests a very high engine speed (2,700 rpm for a short period) to perform the gear change. The function can be interrupted as follows:

- Limiting the engine speed when starting.
- A specific engine speed because of the generation of fault codes.

Request for Stopping Engine

The coordinator and bodywork control unit can send a signal to the engine control unit to switch off the engine. The engine control unit then carries out a controlled shutdown. The engine then drops to a low idle until speed is 7 km/h, when the engine is switched off completely by shutting off the fuel supply.

Exhaust Gas Aftertreatment Systems SCR and DPF

The EEC control system carries out the control and diagnosis of the SCR.

Function

There are two rotation speed sensors in the engine control system, rotation speed sensor 1 and rotation speed sensor 2. The sensors are inductive. This means that they only produce signals when the engine is running. The signal strength varies significantly, depending on the gap between the sensors and the flywheel and on the engine speed. The engine management system estimates the signal strength at different engine speeds. If the signal strength becomes too low, a fault code is generated.

Rotation speed sensor 1 and rotation speed sensor 2 both read the position of the flywheel. This means that engine management system cannot determine which revolution the engine is at, i.e. determine which cylinder is at firing position. Every time the engine is stopped and the voltage cut off, the engine position is stored. Next time the voltage is turned on, the latest saved position is used so revolution the engine is at is known. When the engine has started, a system check is performed to verify stored position is correct.

The engine control unit receives signals from both rotation speed sensors. If the engine control unit receives the wrong signal or if the signal from any one of the rotation speed sensors is missing, the engine torque will be limited for reasons of safety. The engine will perform normally again as soon as the engine control unit receives a correct signal.

If the engine control unit receives the wrong signals or if the signals from both rotation speed sensors are missing, the engine will not start. If the engine is running, it will be shut down.

The engine speed sensors detect the holes in the flywheel when the flywheel rotates and send pulses to the control unit for each hole. In this way, the engine control unit can calculate where the engine is in the working cycle. The engine control unit detects and compares the engine speed at combustion in each cylinder. The engine control unit strives to maintain a constant acceleration from each cylinder by compensating the fuel quantity individually to each cylinder.

The interval between two of the holes is greater than the intervals between the remaining holes. When the engine control unit detects that sensor has gone past the larger interval, it knows that flywheel is in a particular position in relation to top dead center (TDC UP).

4. Hold the engine speed at 500 rpm and load the system by using the vehicle's current consumers according to the test report, column Check value. See below for examples of current consumers.

   Add the current you read at the batteries to the sum of the loads you are applying.

   Example: If you obtained a value of 10 A at the batteries, you only need to apply a load of 35 A to the alternator instead of 45 A. 10 A + 35 A = 45 A

5. Run the engine for a time while you are applying the load. Read the voltmeter again. It should still not show less than 27V.

   Examples of current consumers:

Cabin Fan at Maximum	Approximately 10 A
Main Beam	Approximately 6 A
Two Auxiliary Light	Approximately 6 A
Seat Warmer	Approximately 2.5 A/seat
Electrically Heated Mirrors	Approximately 2.5 A/mirror
Coolant-operated Cabin Heater	Approximately 6 A
Radio	Approximately 1.5 A

Connector C4003, C4004, C4005, C4006

Location

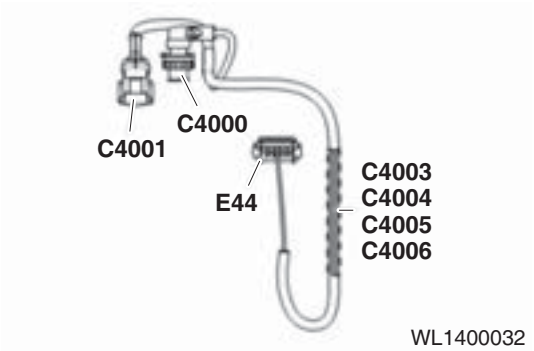


Figure 659

Connector C4007

Overview

Figure 660

Connection

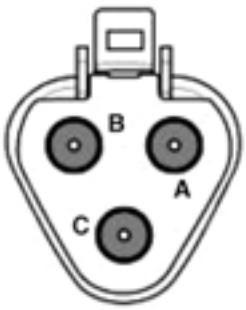


Figure 661

Location

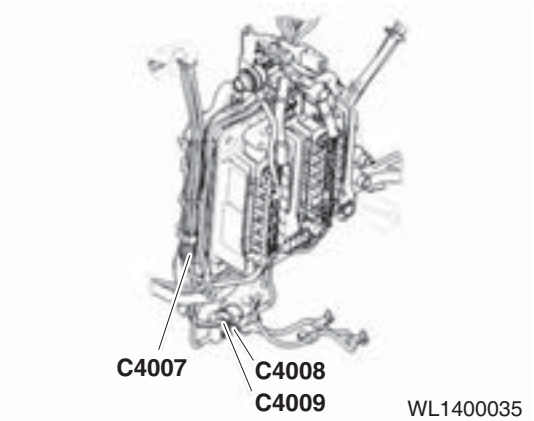


Figure 662

Table of Contents

Engine Coolant Heater (Option)

Cabin

Edition 1

Right Glass

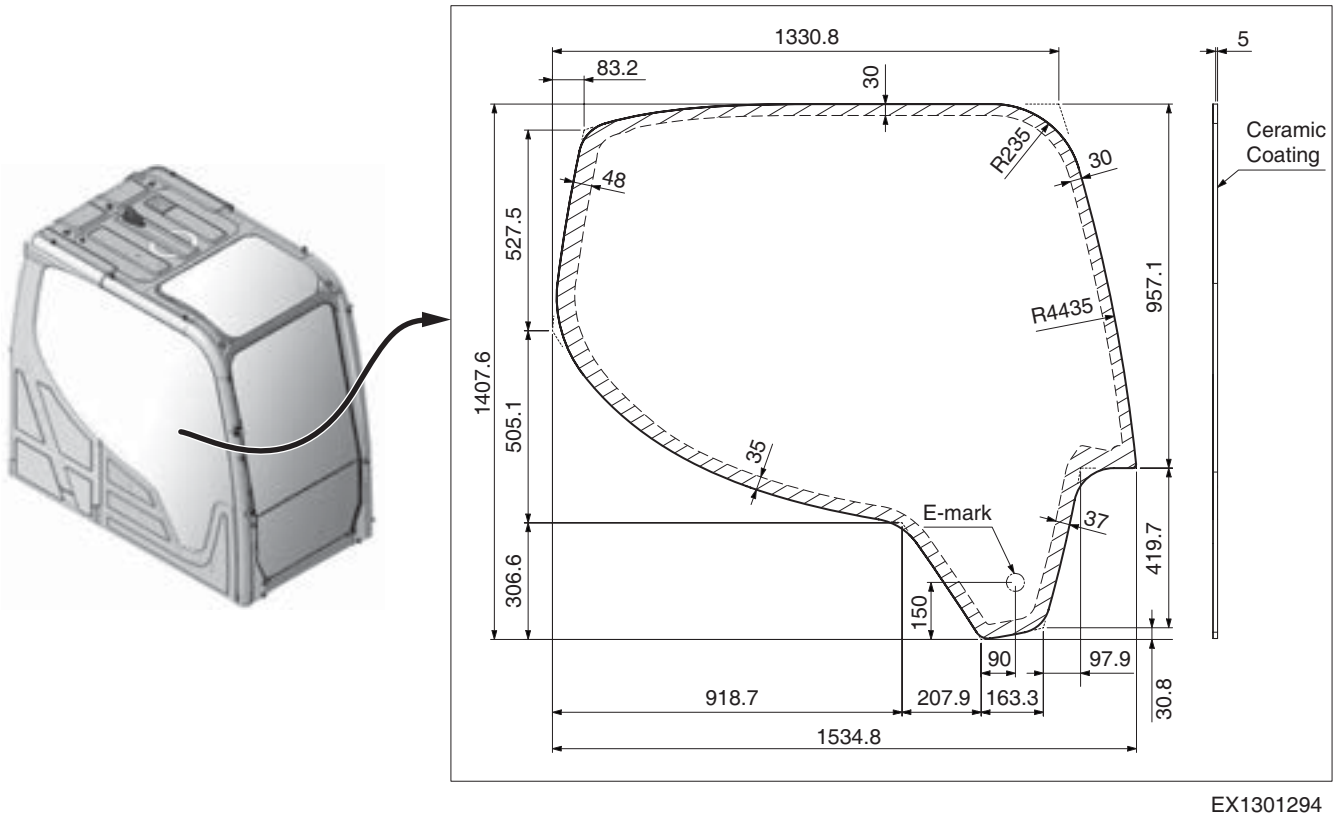


Figure 26

NOTE: *Unit: mm (1 mm = 0.039 in)*

Responsibility must be assigned to one person to be in charge of the lifting crew, and to verify that required safe lifting precautions have been taken before each part of this procedure has been started.

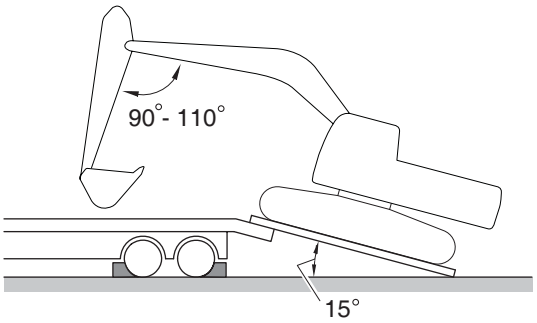
All members of the working crew should know and understand the signals that will be used between the lifting leader, the assist crane operator and the remainder of the work crew.

WARNING

AVOID DEATH OR SERIOUS INJURY

If the upper structure deck has been unbalanced by removal of weight from one end only, traveling with the excavator, swinging the turntable, movement over bumps or sloping and uneven surfaces could cause loss of control resulting in tipping or rollover.

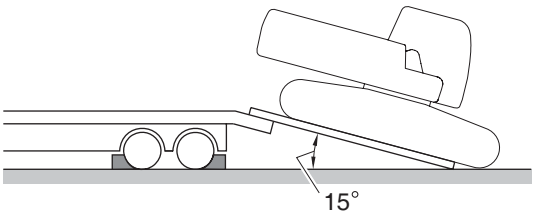
To maintain stability the counterweight must be removed only when the front attachment is taken off the machine.



EX1300746

Figure 2

When loading an excavator (either track or wheeled type) on a trailer for transport after the front attachment has been removed, always go backwards up the loading ramp with the counterweight uphill (Figure 3).



EX1300747

Figure 3

19. Install eyebolts (2 ea) on the oil tank. (Figure 15)

    And tie the rope to the bolts to lift oil tank.

    - Thread of hole: M10 x 1.5

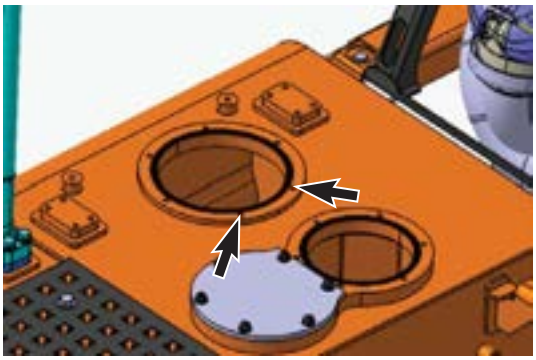


Figure 15 EX1400741

20. Remove bolts and washers (1, Figure 16) (6 ea) under cover (2) on bottom of main frame.

    - Tool: 19 mm ( )
    - Torque: 107.8 N.m (11 kg.m, 79.5 ft lb)
    - Under cover weight: 12 kg (26.5 lb)

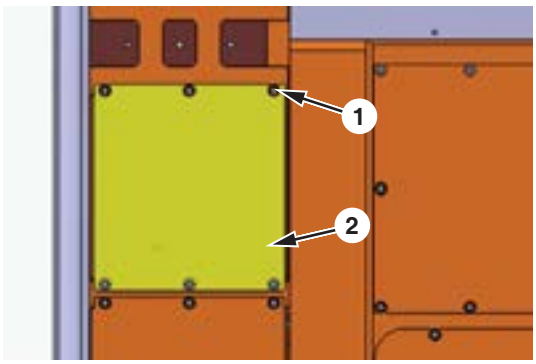


Figure 16 Bottom of Main Frame EX1400742

21. Remove oil tank mounting bolts and spacers (1, Figure 17) (6 ea) from the main frame.

    - Tool: 24 mm ( )
    - Torque: 264.6 N.m (27 kg.m, 195.2 ft lb)

22. Remove bolts (2, Figure 17) (6 ea) of suction pipe from the oil tank.

    - Tool: 17 mm ( )
    - Torque: 63.7 N.m (6.5 kg.m, 47 ft lb)

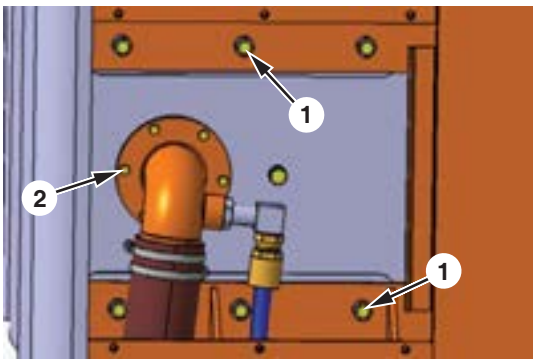


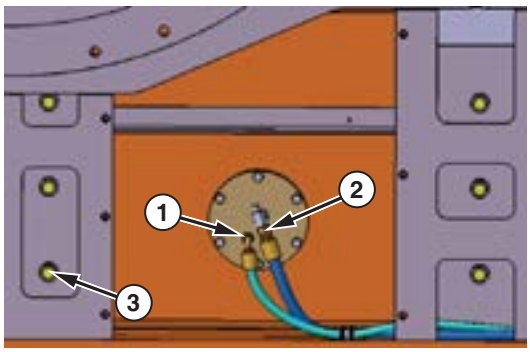
Figure 17 Bottom of Main Frame EX1400743

INSTALLATION

NOTE: *First, assemble the bolts and spacers (6 ea) of fuel tank mounting to main frame. (Figure 16)*

1. Install the fuel tank with bolts and spacers (3, Figure 16) (6 ea) to the main frame.
   - Tool: 24 mm ( )
   - Torque: 264.6 N.m (27 kg.m, 195.2 ft lb)

   NOTE: *The clear level gauge on the side of the tank is easily damaged. Be careful of obstacles and wind gusts.*



EX1401455

Figure 16 Bottom of Main Frame

2. Connect fuel supply line (2, Figure 16) and drain valve line (1) to fuel tank.
3. Perform installation in the reverse order to remove.
4. Make sure fuel tank drain valve (Figure 18) right side door is closed.
5. Fill fuel tank and check for signs of leaks. Correct any problems found.
6. Fuel tank capacity: 685 L (181 U.S. gal)

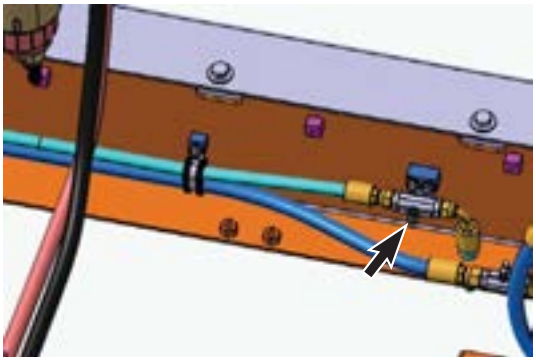

EX1400972

Figure 18

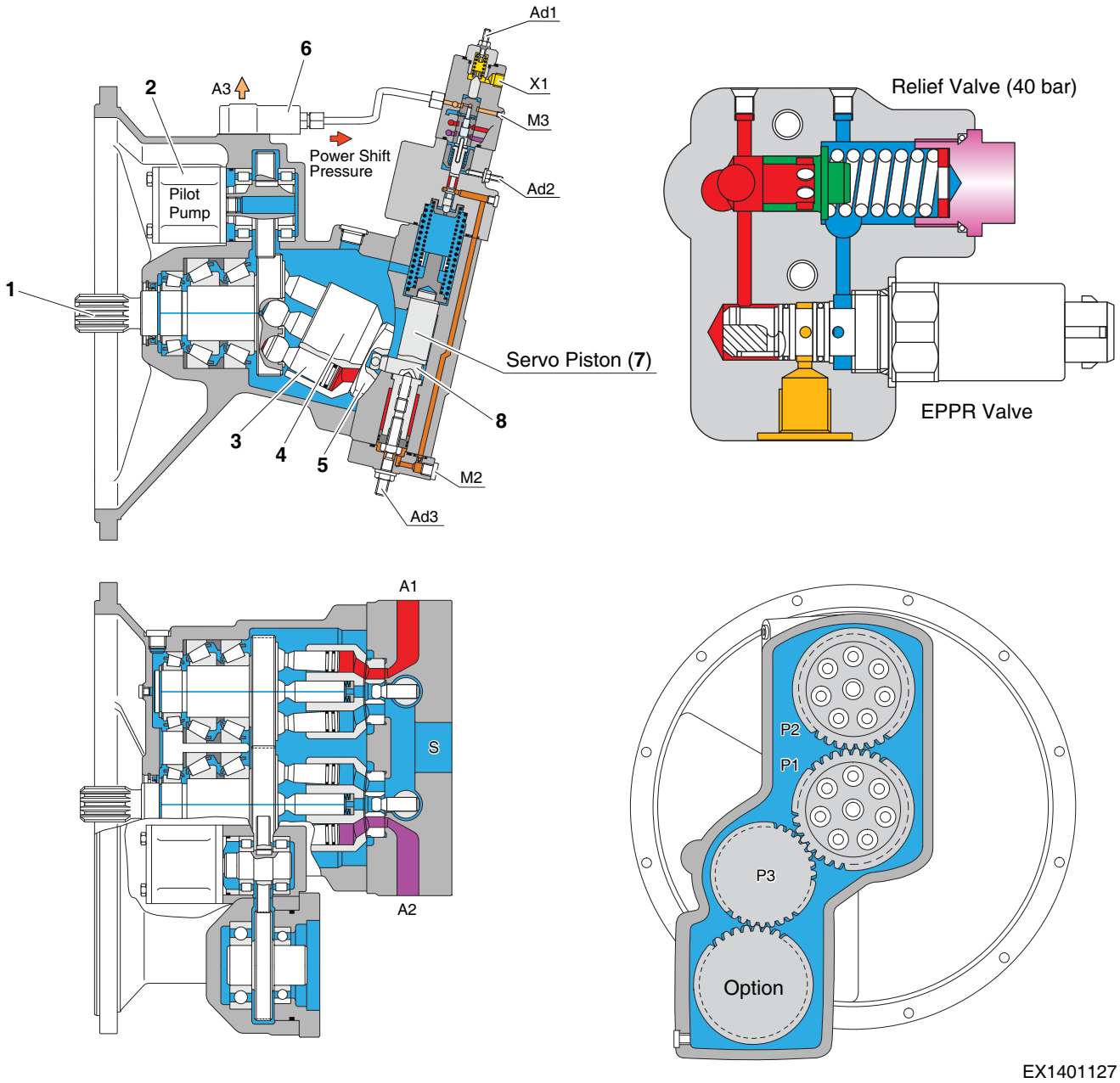


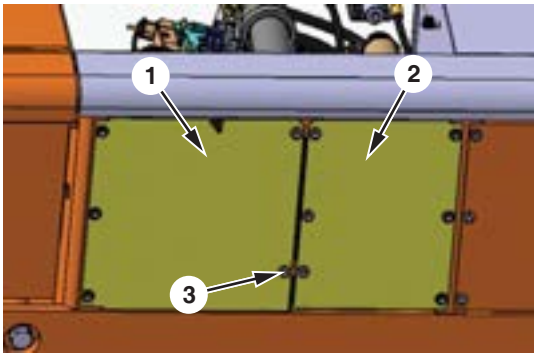
Figure 7

Reference Number	Description
1	Drive Shaft
2	Gear Pump (Pilot)
3	Piston
4	Cylinder
5	Control Lens
6	EPPR Valve

Reference Number	Description
7	Positioning Piston
8	Positioning Turnnion
S	Suction Port
A1, A2	High-pressure Delivery Port
A3	Pilot Port

11. Remove bolt (3, Figure 29) (11 ea) and remove under cover (1 and 2, Figure 29) under pump side.
    - Tool: 19 mm ( )
    - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
    - Cover weight

Reference Number	Weight	
	kg	lb
1	11	24.3
2	8	17.6



EX1400960

Figure 29

12. Remove bolt (6 ea) and remove engine cover of muffler side.
    - Tool: 19 mm ( )
    - Torque: 107.9 N.m (11 kg.m, 79.6 ft lb)
    - Weight: approximately 40 kg (88.2 lb)

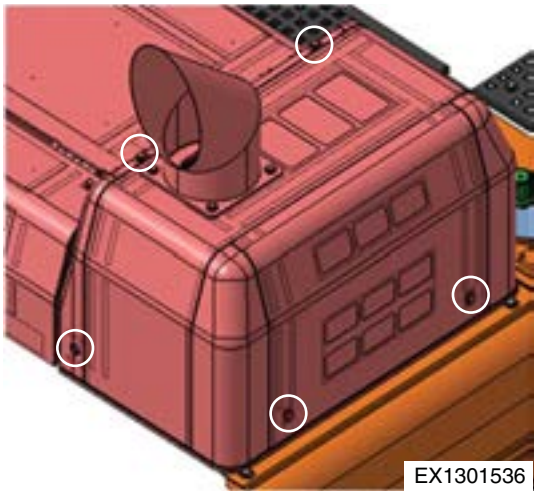

EX1301536

Figure 30

13. Disconnect the harness from SCR catalyst.
    - Tool: 24 mm ( )

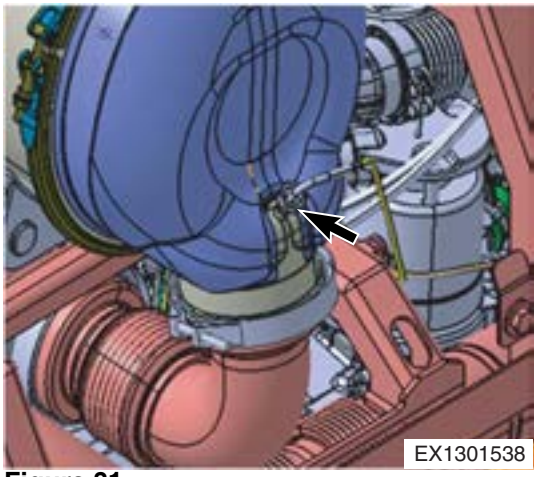
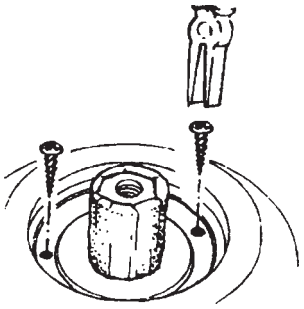

EX1301538

Figure 31

3. Screw sheet metal screw(s) into holes fitted with rubber.

   Pull out seal with pliers.



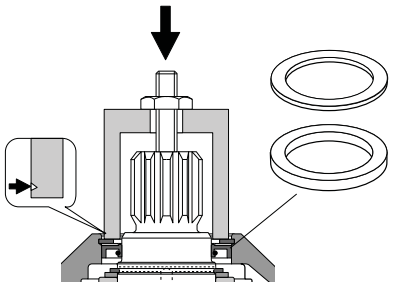
ASS0230L

Figure 73

4. Press in shaft seal ring and shim with bushing to stop.

IMPORTANT

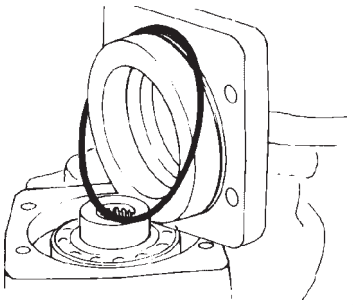
Take note of press-in depth. Install mark for press-in depth of safety ring.



ASS0240L

Figure 74

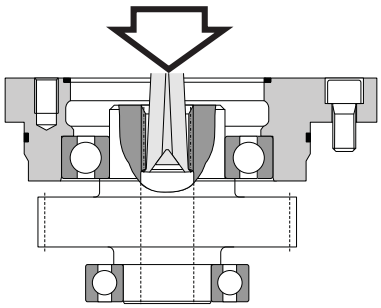
3. In the event of oil leakage, visually check O-ring, housing and groove.



ASS0590L

Figure 109

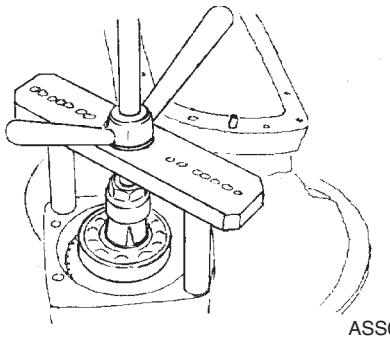
4. Install extractor device.



ASS0600L

Figure 110

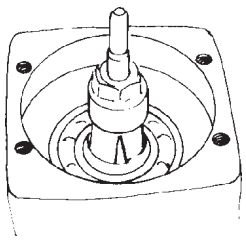
5. Pull out output pinion.



ASS0610L

Figure 111

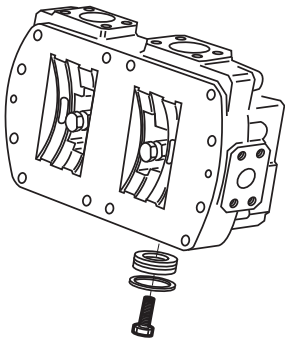
6. Install bearing extractor device.



ASS0620L

Figure 112

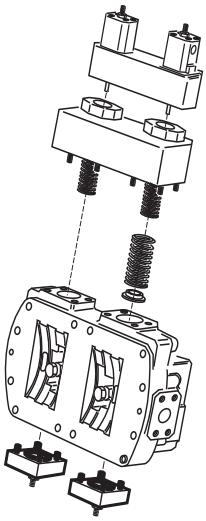
2. Push on piston ring by hand. Install adjustment piston. Take the tightening torques into account.



ASS1010L

Figure 147

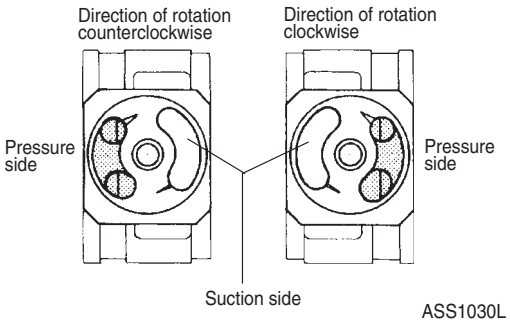
3. Install control housing.



ASS1020L

Figure 148

4. Install control lens in their correct position using grease to hold them in place.



ASS1030L

Figure 149

Reference Number	Description	Qty.	Torque
1	Flange	1	
2	Hub	1	
3	Element	1	
4	Clamping Screw	2	196.1 ~ 215.7 N.m (20 ~ 22 kg.m, 144.7 ~ 159.1 ft lb)
5	Spring Pin	8	
6	Insert	4	
7	Bolt	4	431.2 ~ 480.5 N.m (44 ~ 49 kg.m, 318.3 ~ 354.4 ft lb)
8	Socket Bolt	8	49 N.m (5 kg.m, 36.2 ft lb)
9	Retaining Ring	1	
10	Pump Shaft	1	
11	Flywheel	1	

Symbol	Dimension	Remarks
H	40 mm (1.57 in)	Distance between from Pump Shaft to Coupling Hub
I	49 mm (1.93 in)	Distance between from Pump Shaft to Coupling Flange

Tools

Name	Description
Allen Wrench	8 mm, 10 mm, 17 mm
Plastic Hammer	One Plastic Hammer
Pliers	One for Shaft and Hole Each

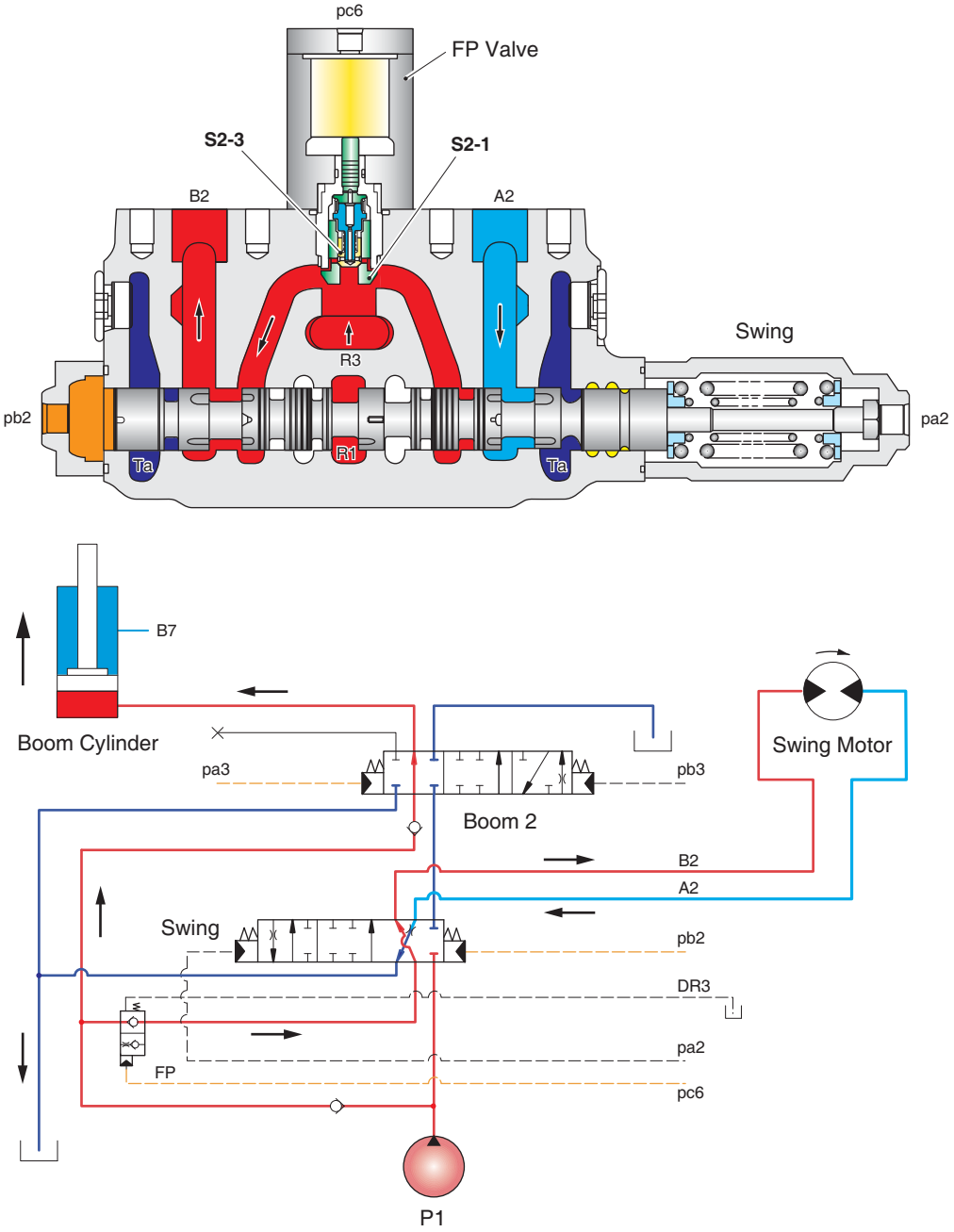
Reference Number	Description
1	Housing; Valve
2	Housing; Valve
3	Spool Kit (Arm-2)
4	Spool Assy, Bucket
5	Spool Assy, Boom 1
6	Spool Kit (Travel)
7	Spool Kit (Travel Straight)
8	Spool Assy, Arm 1
9	Spool Kit (Option)
10	Spool Kit (Boom-2)
11	Spool Assy, Swing
12	Cap
13	Cap
14	O-ring
20	Spool Kit; Arm Regeneration

Reference Number	Description
21	Seat; Spring
22	Spring
23	Plug
57	O-ring
76	O-ring
77	O-ring
78	O-ring
79	O-ring
84	Bolt; Socket M12 x 1.75 x 45
85	Bolt; Socket
89	Spool Assy
90	Cap
91	Plug Ass'y
*	Seal Kit; Control Valve

Swing Spool Shifting

When shifting swing spool by increasing pressure of swing pilot port (Pb2 (Pa2)), neutral port (R1) is closed. Oil supplied to port (P1) flows through, parallel passage (R3), load check valve (S2-1), and spool to port (B2 (A2)). Return oil flows through port (A2 (B2)), to spool, and returns to tank passage (Ta).

The FP valve is installed to the position of the swing load check valve to control the amount oil supplied to the swing line according to the operation mode.



EX1401055

Figure 17

REMOVAL

WARNING

AVOID DEATH OR SERIOUS INJURY

Contact with hydraulic fluid can harm your health. (e.g. eye injuries, skin damage or poisoning, if inhaled).

- **While performing removal and installation, wear safety gloves, safety glasses and suitable working clothes.**
- **If hydraulic fluid should come into contact with your eyes or penetrate your skin, consult a doctor immediately.**

WARNING

FIRE CAN CAUSE SERIOUS INJURY OR DEATH

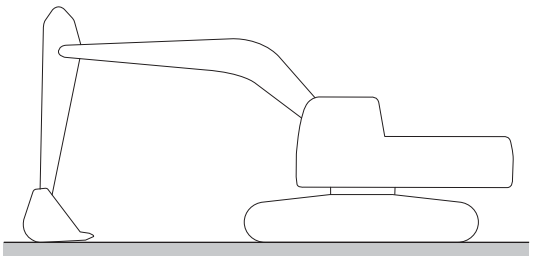
Hydraulic fluid is highly flammable.

- **Keep open flames and ignition sources away from the workplace.**

IMPORTANT

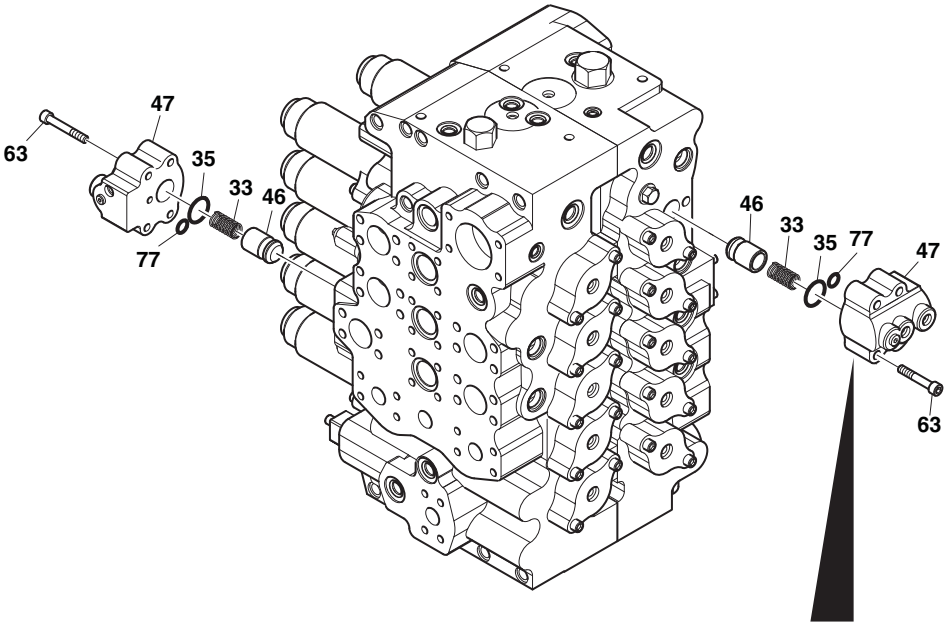
Fluid such as engine oil, hydraulic fluid, coolants, grease, etc. must be disposed of in an environmentally safe manner. Some regulations require that certain spills and leaks on the ground must be cleaned in a specific manner. See local, state and federal regulations for the correct disposal.

1. Park the machine on firm and level ground and lower the bucket as shown in Figure 41.
2. Stop engine.



EX1300684

Figure 41



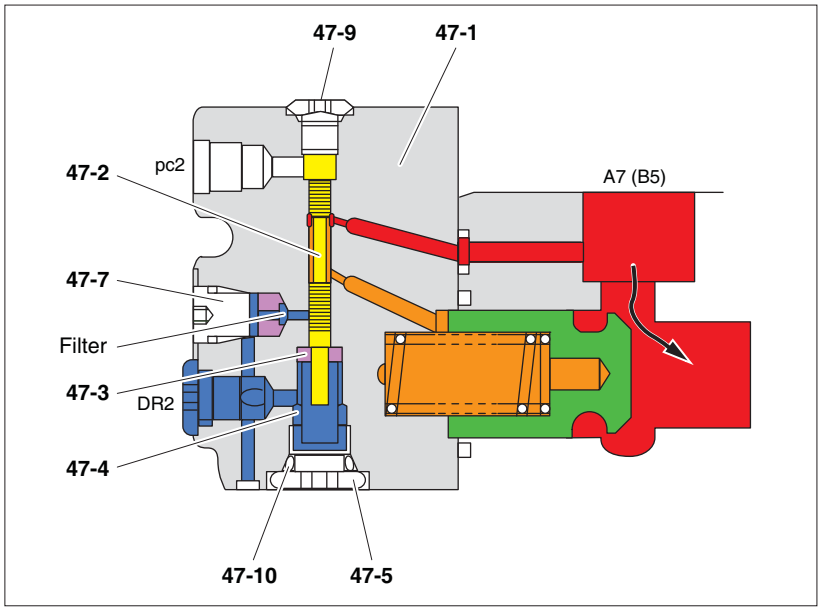


Figure 68

EX1401070

Reassembly of Relief Valve

1. Tighten eight overload relief valves (49).
   - Torque: 7.95 ~ 8.97 kg.m (58 ~ 65 ft lb).
2. Tighten main load relief valve (48).
   - Torque: 9.48 ~ 11.01 kg.m (69 ~ 80 ft lb).
3. Tighten foot relief valve (50).
   - Torque: 10.50 ~ 11.52 kg.m (76 ~ 83 ft lb).

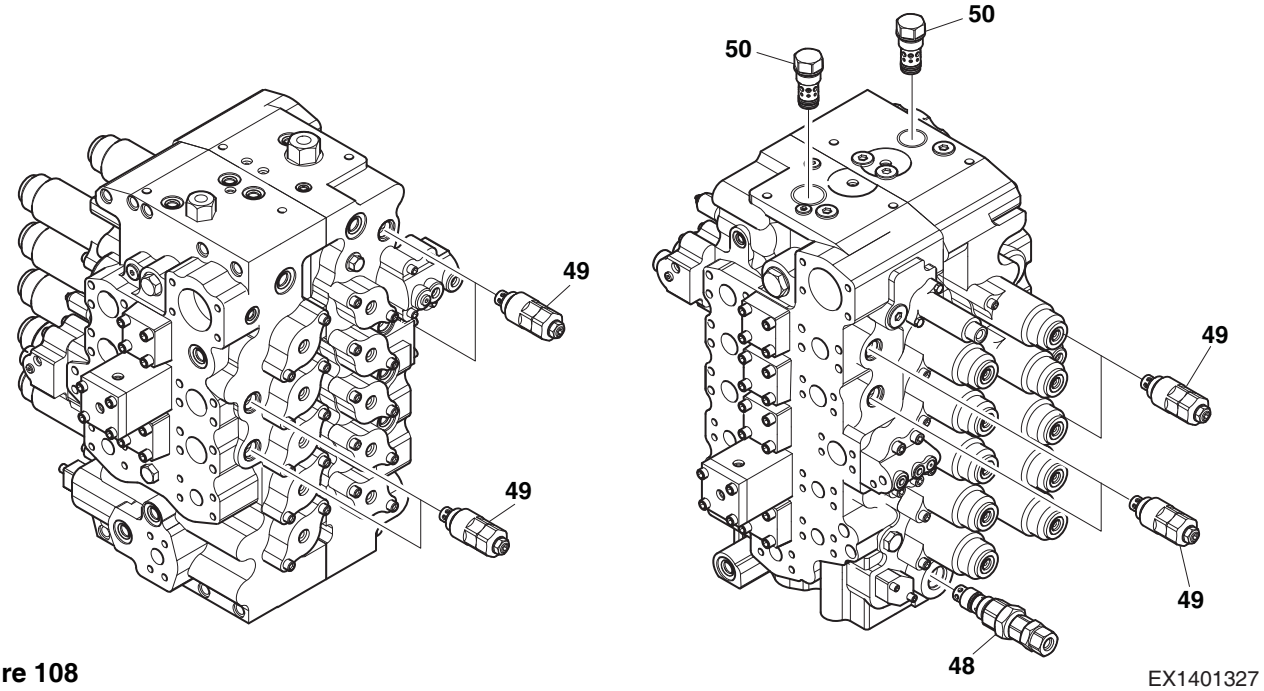


Figure 108

Reassembly of BC Valve (24)

1. Install spool (24) in valve hole it was removed from during disassembly.
2. Install spring seat (21) and spring (25).
3. Tighten plug (27) with O-ring (26).
   - Torque: 9.48 ~ 11.01 kg.m (69 ~ 80 ft lb).

IMPORTANT

Insert spool in hole perpendicularly. Make sure that spool is in correct position.

If it is not in correct position, improper operation can occur.

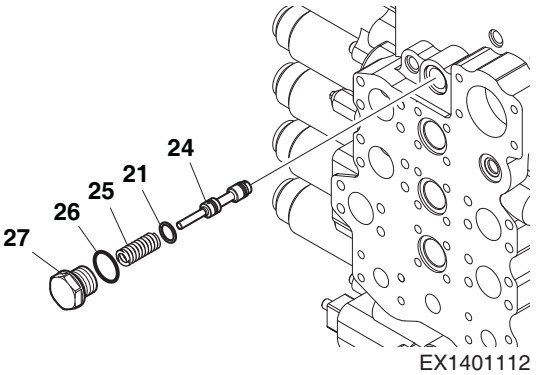


Figure 109

SAFETY INSTRUCTIONS

⚠ WARNING

AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicing machine. Read and understand the Operation and Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or service. Untrained operators and failure to follow instructions can cause death or serious injury.

GENERAL

Specification

Swing Motor

Type	Axial Piston
Displacement	132 cm^3 (0.005 ft^3)
Crossover Relief Valve Setting	300 kg/cm^2 (294 bar, 4,267 psi)
Max. Supply Flow	185 L/min (49 U.S. gal)
Motor Shaft Speed	1,401 rpm
Motor Shaft Torque	618 N.m (63 kg.m, 456 ft lb)
Accessory Valves	Swing Reactionless Valve
Weight	62 kg (137 lb)

Swing Reduction Gear

Drive Type	2 - Stage Planetary Gear
Reduction Ratio	21.6
Max. Output Speed	65 rpm
Max. Output Torque	13,337 N.m (1,360 kg.m, 9,837 ft lb)
Weight	195 kg (430 lb)

Pinion Gear

Type	Spur Gear
Gear P.C.D	D 180 mm
No. of Teeth	15
Module	12

Parking Brake

Spool Cracking	13 kg/cm^2 (12.7 bar)
Time Delay	5 ±3 sec

CAUTIONS FOR OPERATION

Inspection

Please check the followings before installing a new motor:

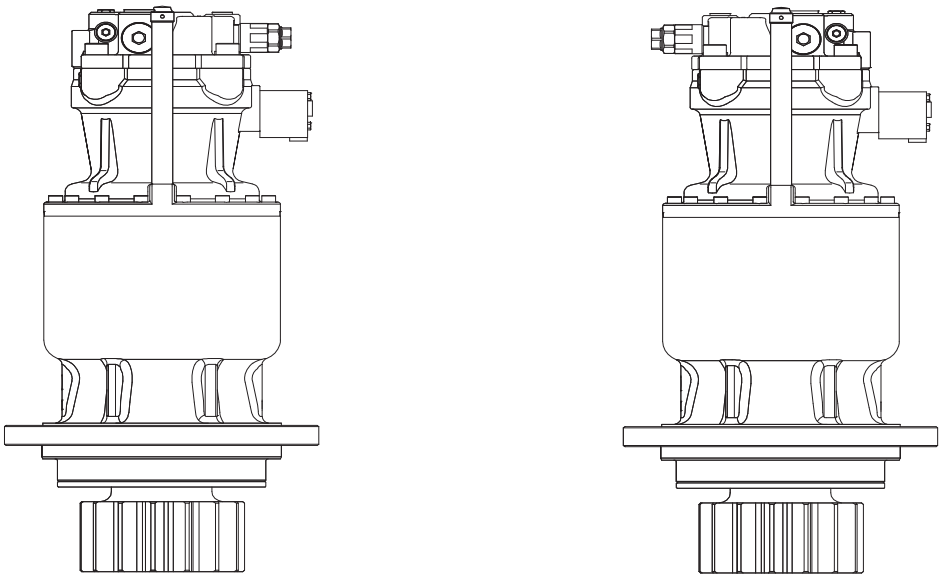
1. Check if there is any part damaged or missing (during transportation).
2. Check if there is any loose joint.
3. Check that flange surfaces and the drain port cover are properly assembled and there is no dust or other particle in the motor.

Direction of Rotation

The relationship between the directions of oil flow and shaft rotation is presented in Figure 17 and Table.

The direction of rotation differs by the direction of the slope of casing.

Be careful for the direction of swing which is differentiated by the shape of casing and direction of flange.



Normal Direction

Reverse Direction

EX1401275

Figure 17

Classification	Inlet	Outlet	Direction of the Rotation of the Shaft Seen at the End of the Shaft
Normal Direction	A	B	Right (Clockwise)
Reverse Direction	B	A	Left (Counterclockwise)

Reassemble Swing Motor

Assembly must be done in the reverse order of disassembly described above, taking into consideration the following points:

1) Parts damaged during disassembly must be repaired without fail and spare parts must be prepared in advance.
2) Every part must be cleaned well with cleaning oil and dried with compressed air before starting assembly.
3) Sliding parts and bearings must be applied clean active oil before their assembly.
4) Seal parts like O-rings and the oil seals must be replaced according to the standards.
5) Use a torque wrench to tighten or engage bolts and plugs according to reference “Tightening Torque of Bolts” on page-25.

1. Put the casing (301) on a proper place.

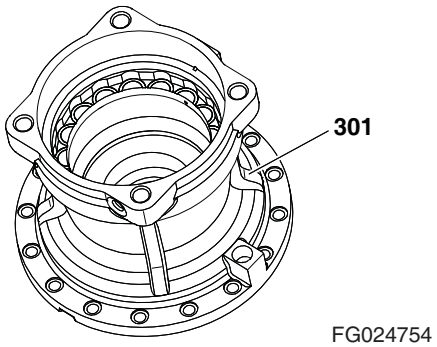


Figure 48

2. This procedure is necessary when the oil seal is separated from the casing.

   Use a tool to insert the oil seal (302) in the casing (301).

   NOTE: *Be careful to note the direction of oil seal and insert until fully seated in the casing.*

IMPORTANT

Do not reuse oil seal!

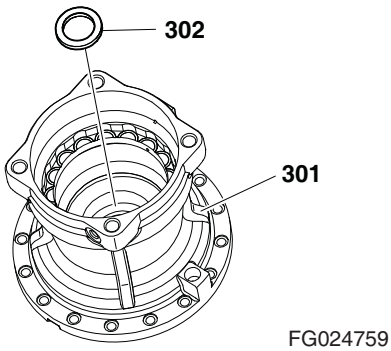


Figure 49

23. Apply Loctite to 16 socket bolts (314).

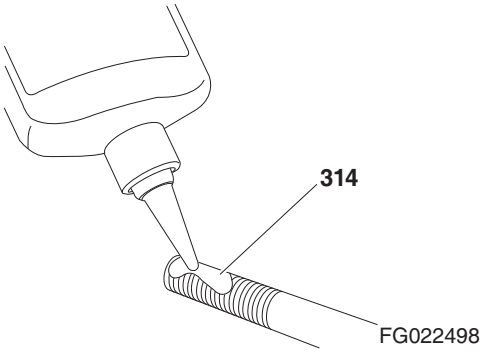


Figure 106

24. Insert bolt (314) into holes,and tighten with an impact wrench.

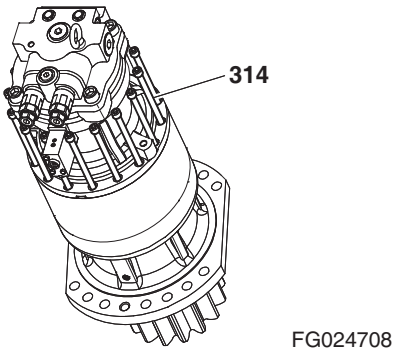


Figure 107

25. Engage the level gauge pipe sealed with teflon tape to the level gauge port of the port with a pipe wrench.

    Install air breather assembly to motor.

    After filling with oil, stick the level gauge into tank and check the oil level.

Assembly is done.

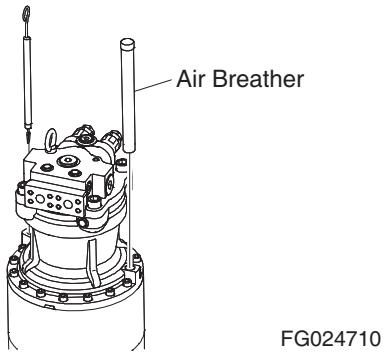


Figure 108

Control Section

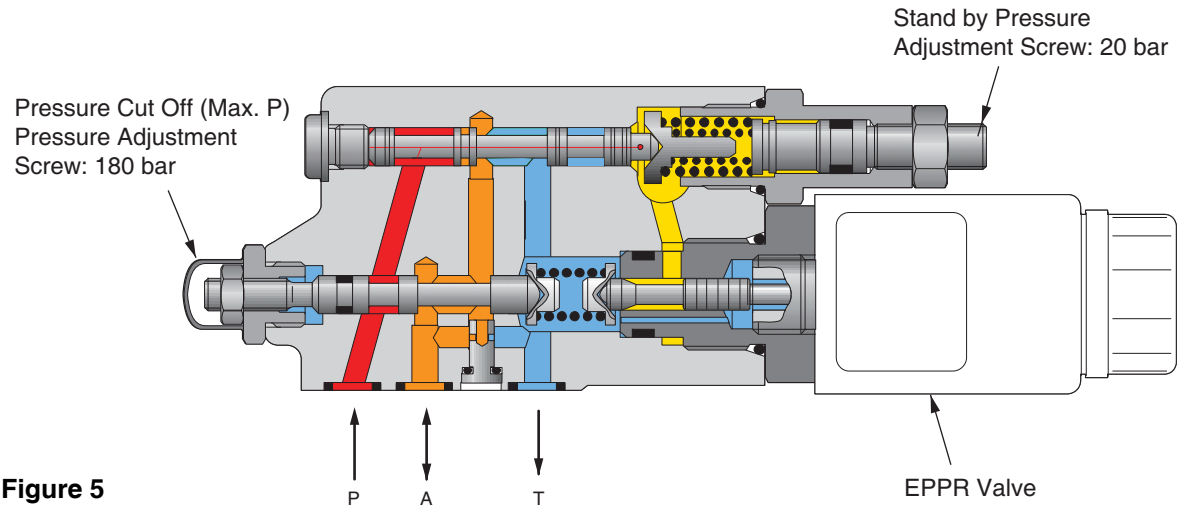
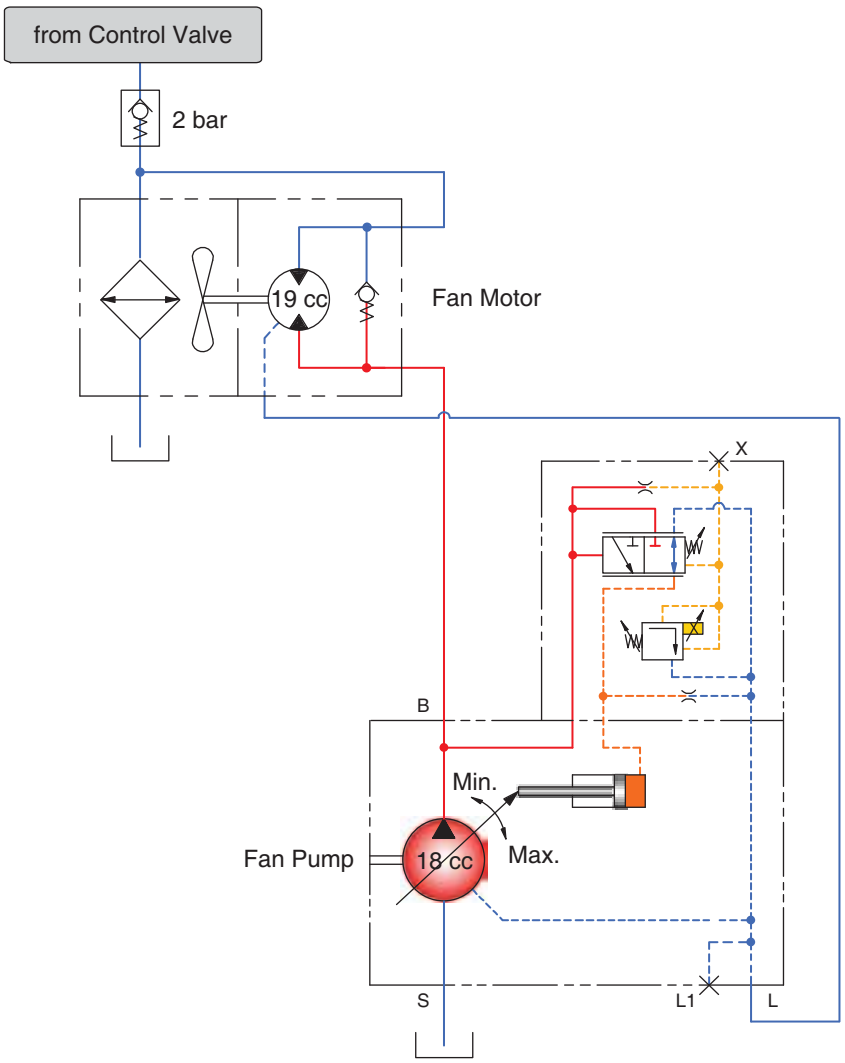


Figure 5

EX1401282

Circuit Diagram Related to Fan Drive



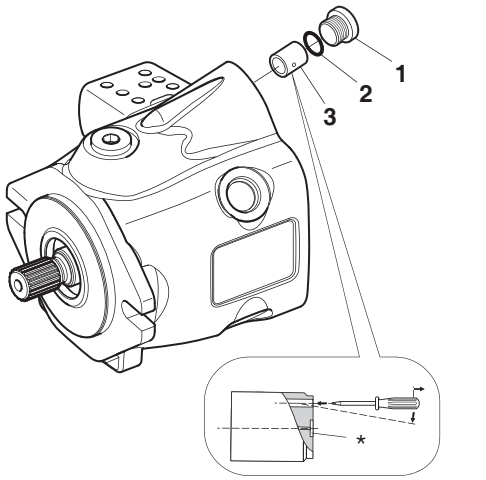
EX1301362

Figure 6

Disassembly of Control Device

1. Remove plug (1) from pump housing.

   Remove control piston (2) from pump housing (flat surface*) with tool.



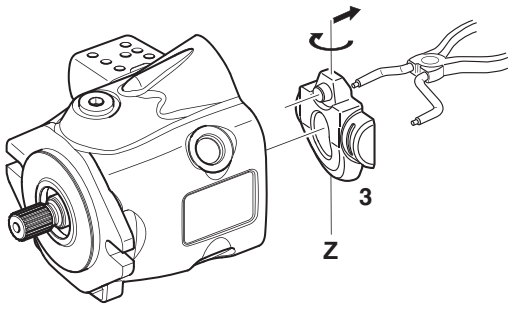
EX1301972

Figure 47

2. Remove swash plate from pump housing.

   NOTE: *Turn swash plate (3, Figure 48) inside housing slightly along Z-axis with tool.*

   Remove swash plate (3) from pump housing.

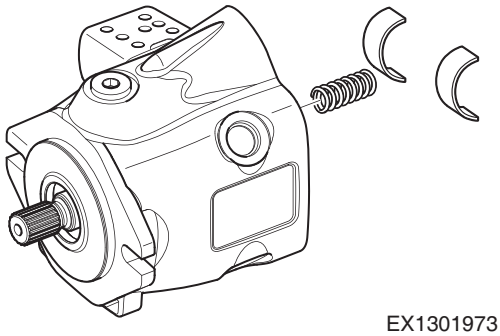


EX1301272

Figure 48

3. Remove bearing shells and bearing from pump housing.

   NOTE: *Note location of each bearing position in pump for installation.*



EX1301973

Figure 49

SAFETY INSTRUCTIONS

WARNING

AVOID DEATH OR SERIOUS INJURY

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or service. Untrained operators and failure to follow instructions can cause death or serious injury.

GENERAL

Specification

Direction of Rotation (Looking on the Driveshaft)		Reversible (R)
Displacement		19.09 cm^3/rev
Max. Continuous Pressure	P1	204 kg/cm^2 (200 bar, 2,900 psi)
Max. Intermittent Pressure	P2	224 kg/cm^2 (220 bar, 3,190 psi)
Max. Peak Pressure	P3	244 kg/cm^2 (240 bar, 3,480 psi)
Max. Drain Line Pressure on the Reversible Rotation Motors		5 kg/cm^2 (5 bar, 73 psi)
Speed	Min. P1	500 min^{-1}
	Max. P1	3,000 min^{-1}
Weight		4 kg (8.8 lb)

Gear Pump (Rotation)

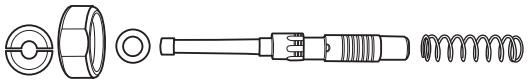
Edition 1

Reference Number	Description
1	Case
2	Plug
3	Bushing
4	Spool
5	Shim
6	Spring
7	Spring Seat
8	Stopper
9	Spring
10	Stopper
11	Spring
12	Push Rod
13	Spring
14	Spring Seat
15	Stopper
16	Plug
17	O-ring
18	Rod Seal
19	Plate

Reference Number	Description
20	Boot
21	Joint Assembly
22	Swash Plate
23	Nut
24	Nut
25	Joystick (LH)
	Joystick (RH)
25-1	Push Button Switch
25-2	Thumb Switch
26	Handle Bar
28	Bellows
29	Bushing
30	Washer
33	Spool Kit 1, 3
34	Spool Kit 2, 4
35	Plug Kit 1, 3
36	Plug Kit 2, 4
37	Handle Kit (RH)
38	Handle Kit (LH)

3. Take care when assembling spool kit assemblies (1 and 3, 2 and 4). (They must be assembled in same way).

   The assembly order is; spool (4), shim (5), spring (6), spring seat (7), and stopper (8).



FG013509

Figure 45

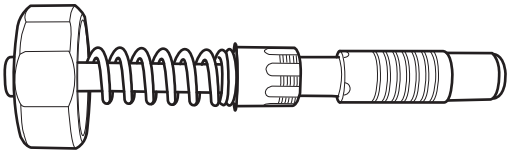


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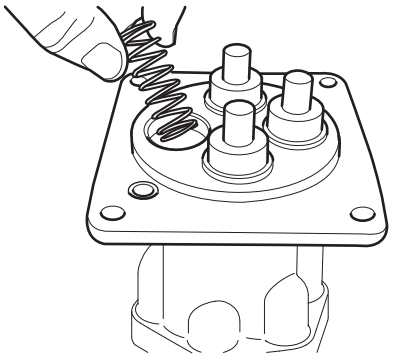
Figure 46

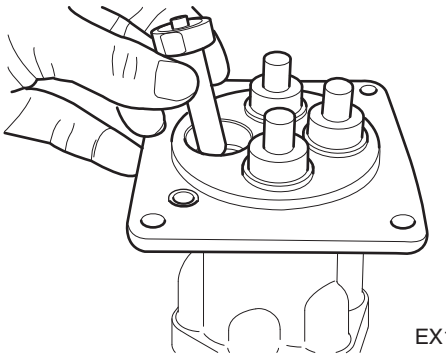
4. Install spring (9) into case (1).



FG013510

Figure 47

5. Install spool kit assembly into case (1). (The same way is used for four parts.)



EX1301732

Figure 48

2. Operation When Operating Lever In Neutral Condition
Climbing restoring force acting on push rod, raises piston in oil pressure prevention chamber and compresses upper oil pressure prevention chamber. This compression operation of upper oil pressure prevention chamber prevents the push rod from quickly rising by restoring spring, and the damping force is generated.

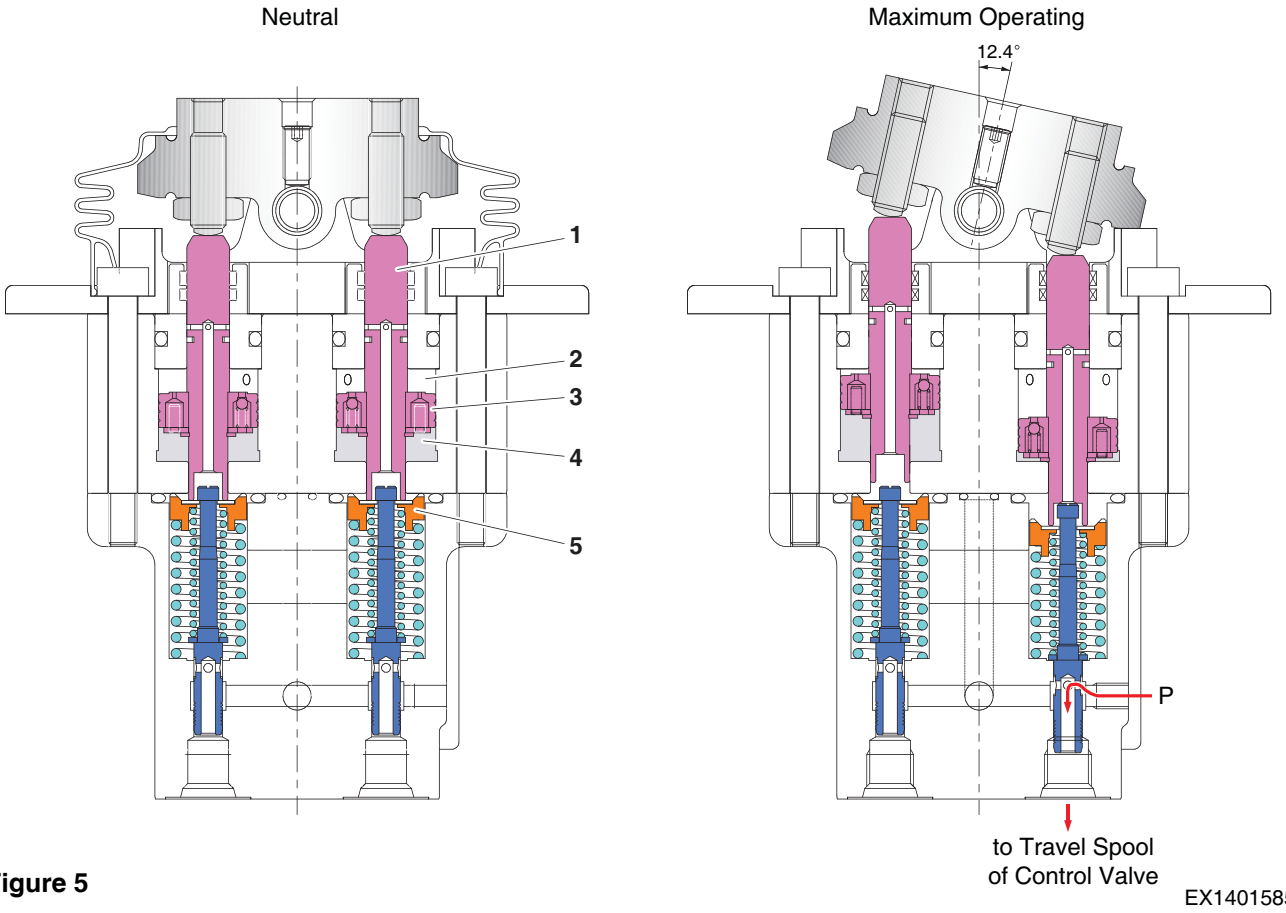


Figure 5

Reference Number	Description
1	Push Rod
2	Orifice
3	Piston

Reference Number	Description
4	Piston Chamber
5	Plug

Tools and Torques

Reference Number	Description	Size	Torque			Tool
			Nm	kg.m	ft lb	
25	Socket Bolt	M6	29.4	3	6	5 mm ( )
31	Nut	M10	43.1	4.4	32	17 mm ( )

14. Check cam balance.

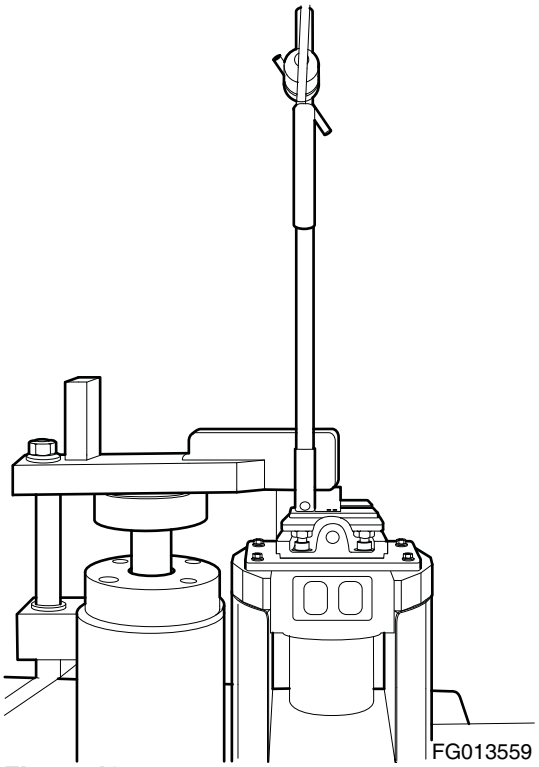


Figure 48

15. Install bellows.

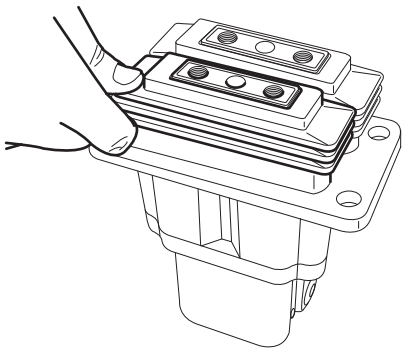


Figure 49

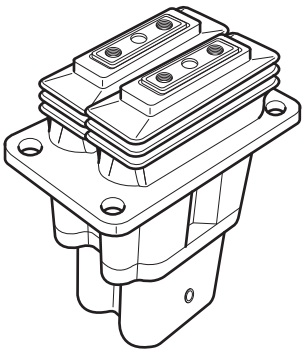


Figure 50

EPPR Valve

Swing Bearing

Edition 1

Parts List

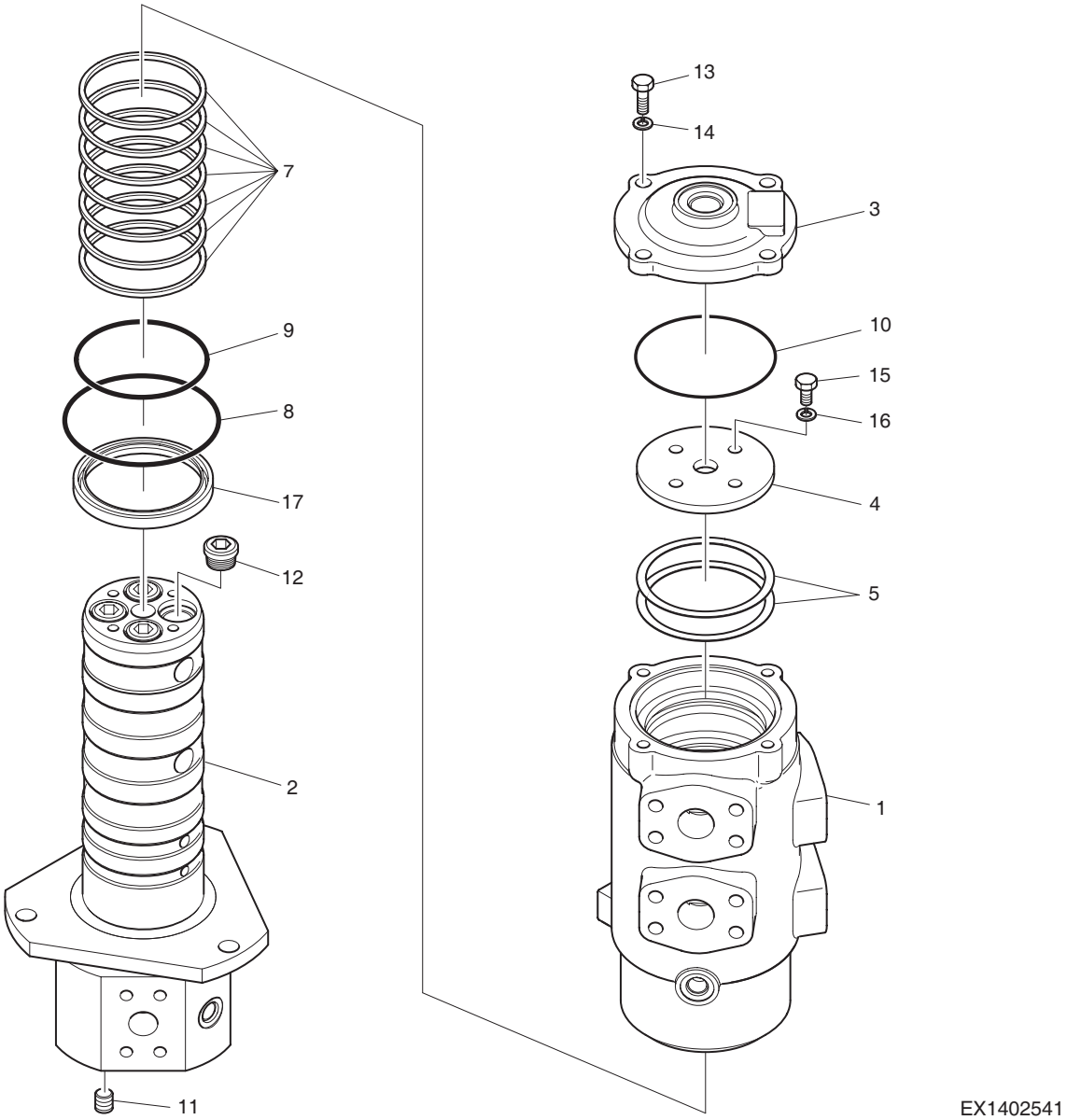


Figure 2

Reference Number	Description
1	Body
2	Spindle Assembly
3	Cover
4	Spacer
5	Shim
7	Seal
8	O-ring
9	O-ring
10	O-ring

Reference Number	Description
11	Plug
12	Plug
13	Bolt
14	Spring Washer
15	Bolt
16	Spring Washer
17	Dust Seal
*	Center Joint Seal Kit

Table of Contents

Travel Device

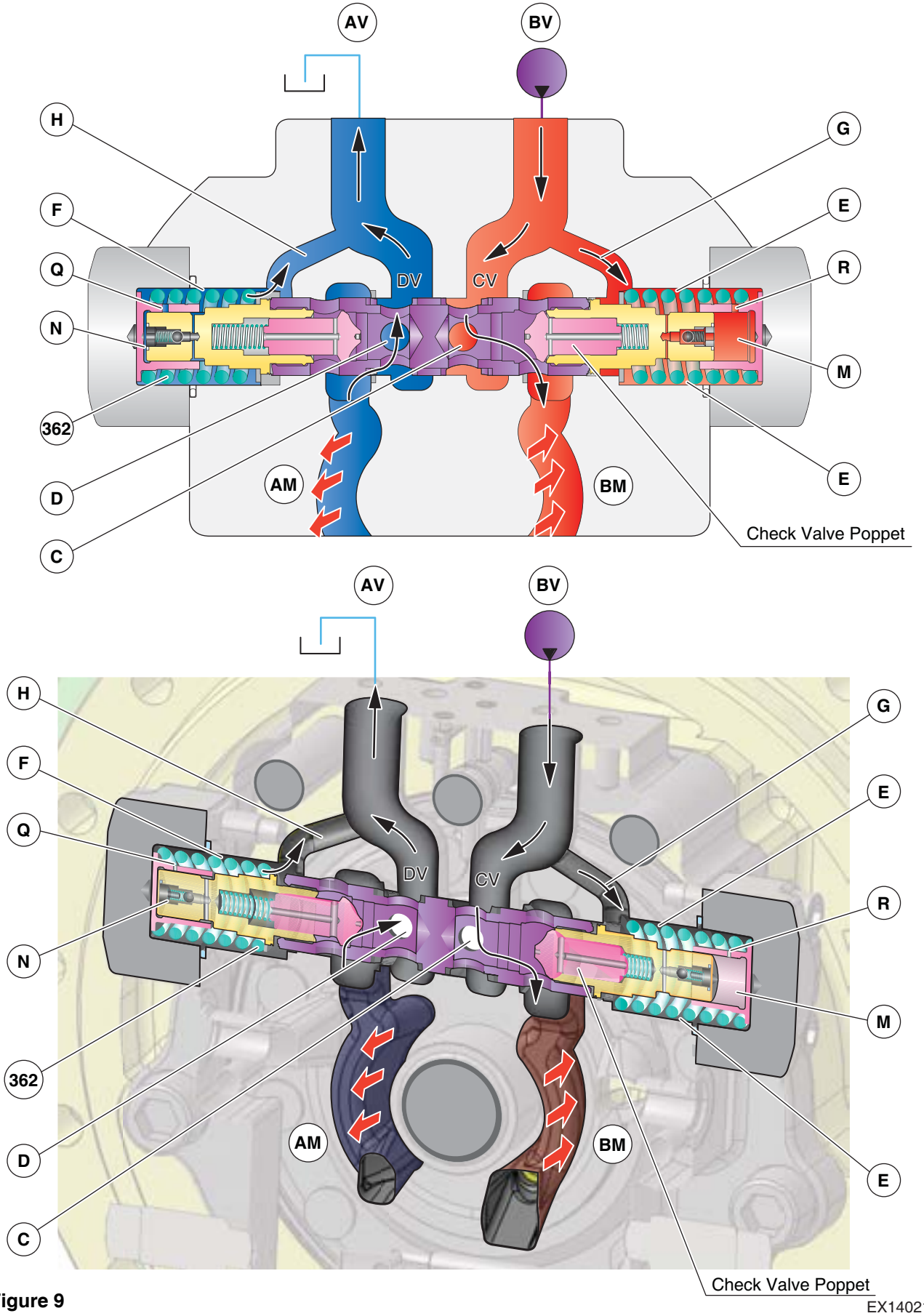
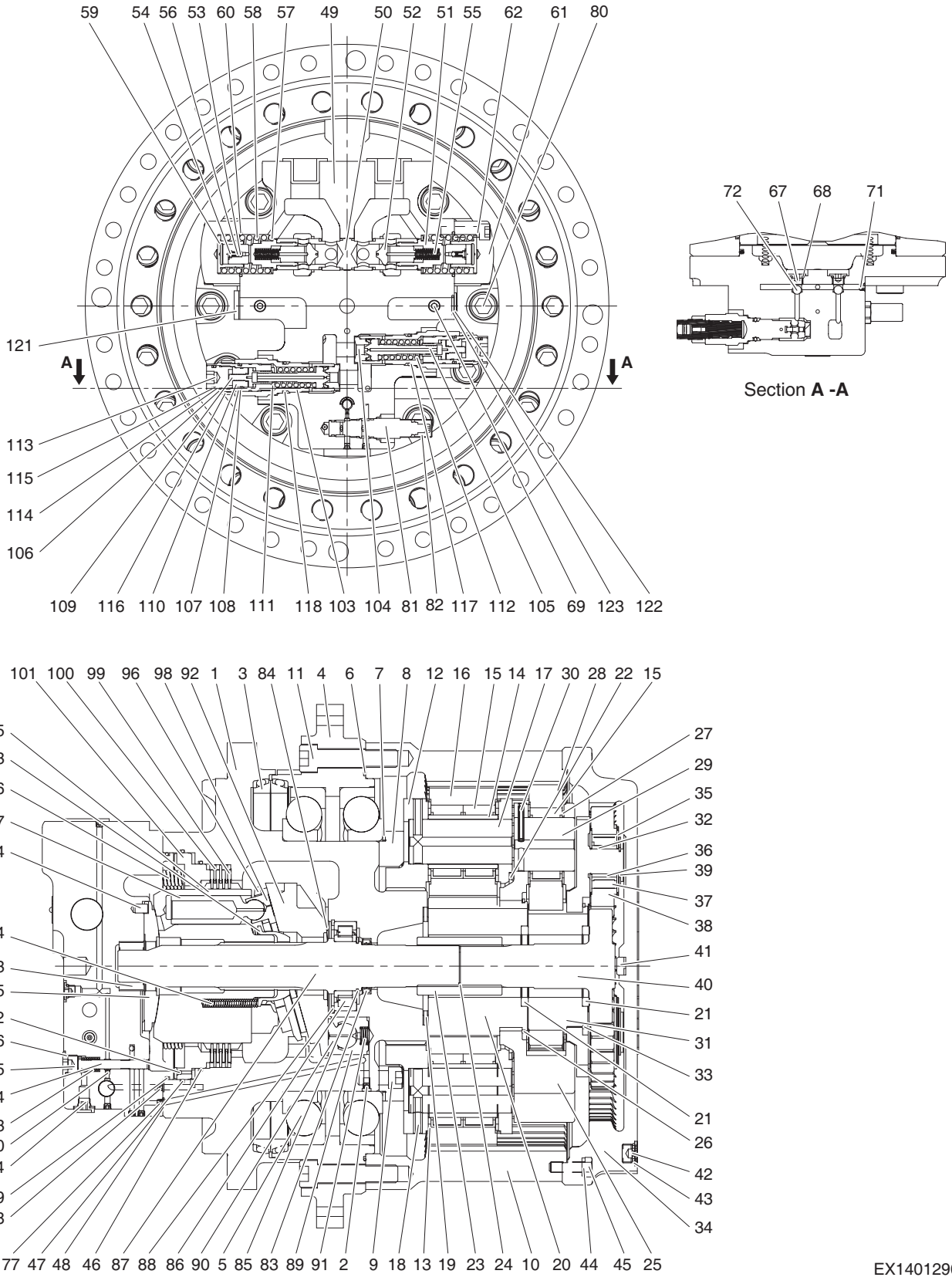


Figure 9

EX1402196

SECTION VIEW



EX1401290

Figure 35

9. Insert the spring pin (125) into the pinhole of the carrier No.2 (130).

   NOTE: *Align the centers of the carrier pin and planetary gear.*

Figure 80

10. Assemble No.3 planetary gear (121) with the needle bearing (122) and floating bushing (123), put thrust washers (126) on both sides and insert the assembly into the NO.3 carrier (120).

Figure 81

11. Insert shaft bearing No.3 (124).

Figure 82

12. Insert the spring pin (127) into the pinhole of the carrier No.3 (120).

    NOTE: *Align the centers of the carrier pin and planetary gear.*

Figure 83

PERFORMANCE TEST

Make sure to fill up the spindle with hydraulic oil before performance test. Conduct performance test as follows after completing the maintenance of travel motor.

1. With testing apparatus: If an internal part or parts have been replaced, conduct performance test according to the following conditions before commissioning.
   - Conditions for preparatory operation
     1) Unloaded operation at 20 rpm, left and right directions for one minute
     2) Operate left and right at 10 rpm with 196 bar (200 kg/cm^2) for one minute
     3) Unloaded operation at 25 rpm, left and right directions for one minute
   - Test Condition
     1) Hydraulic oil: wear resistant hydraulic oil ISO VG #46 or equivalent
     2) Lubricant: gear oil
     3) Temperature:

        Ambient temperature →room temperature

        Oil operating temperature →50 ± 5°C

        Reduction gear case temperature →40 - 80°C
     4) Oil drain pressure: 0.8 bar (0.8 kg/cm^2) or less

No.	Check Item	Standard Dimension				Recommended Limit for Maintenance		Limit for Use (Repair - P or Replace - R)
A	Link Pitch	215.9 mm (8.50")						
B	Bushing Outside Diameter	71.0 mm (2.80")				68.0 mm (2.68")		66.0 mm (R) (2.60")
C	Link Height	129 mm (5.08")				126 mm (4.96")		122 mm (P) (4.80")
D	Length at Tip	24 mm (0.94")						
E	Length at Tip	18 mm (0.71")						
F	Height	36 mm (1.42")				32 mm (1.26")		30 mm (1.18")
G	Interference between bushing and link	Standard Dimension	Tolerance Shaft	Standard Dimension	Tolerance Hole	Tolerance	Standard Interference	Repair Limit
		71.4 mm (2.81")	+0.05 0.0	71.0 mm (2.80")	+0.074 0.0	+0.45 0.326	0.326 - 0.45	
H	Interference between regular pin and link	Standard Dimension	Tolerance Shaft	Standard Dimension	Tolerance Hole	Tolerance	Standard Interference	Repair Limit
		47.0 mm (1.85")	+0.285 +0.135	46.8 mm (1.84")	0.062 0.0	+0.485 0.273	0.273 - 0.485	
I	Clearance between regular pin and bushing	Standard Dimension	Tolerance Shaft	Standard Dimension	Tolerance Hole	Tolerance	Standard Interference	Repair Limit
		47.0 mm (1.85")	+0.285 +0.135	47.9 mm (1.89")	+0.5 0.0	+1.265 0.615	0.615 - 1.265	
J	Interference between master pin and link	Standard Dimension	Tolerance Shaft	Standard Dimension	Tolerance Hole	Tolerance	Standard Interference	Repair Limit
		47.0 mm (1.85")	+0.11 +0.08	46.8 mm (1.84")	+0.062 0	+0.31 0.218	0.218 - 0.31	
K	Clearance between master pin and bushing	Standard Dimension	Tolerance Shaft	Standard Dimension	Tolerance Hole	Tolerance	Standard Interference	Repair Limit
		47.0 mm (1.85")	+0.11 +0.08	47.9 mm (1.89")	+0.5 0.0	+1.32 +0.79	0.79 - 1.32	

2. Apply grease to the O-rings (7, Figure 44) and insert into axle.
3. Align collar (2, Figure 45) and axle (3) pinholes and pin (5) the collar.

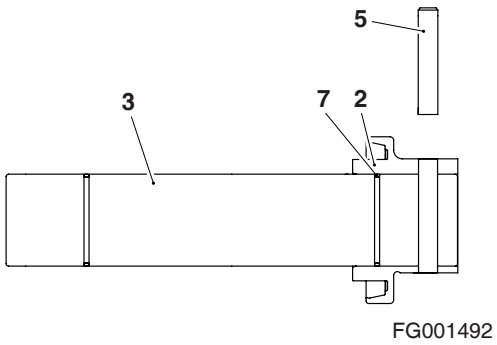


Figure 45

4. Insert floating seals (6, Figure 46) into the roller (1) and collar (2).

   NOTE: *Apply clean gear oil to the joint side of the floating seal. Apply grease to the floating seal O-ring.*

5. Slide the axle inside the roller.

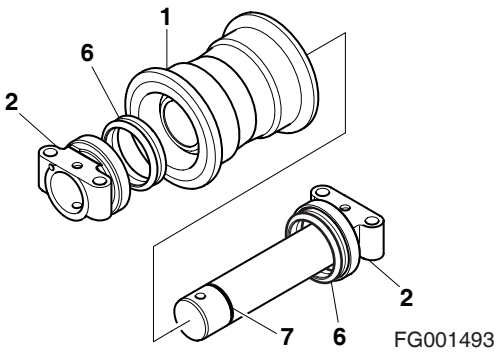


Figure 46

6. Install the collar (2, Figure 47), O-ring (7), and pin (5) on the remaining side.
7. Fill with clean gear oil (ISO VG 220 EP/VI 130) with approximately 485 cc (16.4 oz).
8. Install plug (8, Figure 47) on the collar.

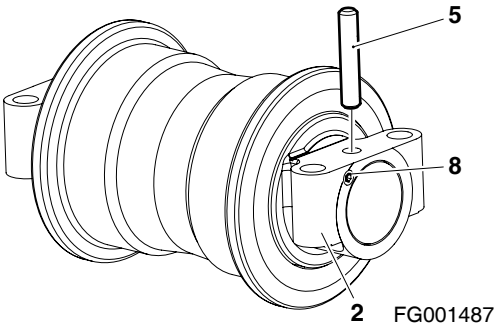


Figure 47

arm into the boom. Partially retract the boom cylinder so the boom is stretched out in front of the excavator, as low to the ground as possible, with the arm crowded under the boom.

The tip of the arm point must be lowered to secure blocking that will safely support the weight of the arm. Place the blocking directly in front of the excavator and make sure that it will not be unbalanced with an initial weight load that is all to one end, under the arm point.

Shut off the engine and release hydraulic system pressure - move any of the control levers with the engine off to release pressure built up in the accumulator. Manually vent residual hydraulic pressure in the tank by moving the lever near the cap, on top of the reservoir.

WARNING

AVOID DEATH OR SERIOUS INJURY

Secure the swing lock and tag and lock out controls in the operator's cabin to keep anyone from moving or inadvertently starting the engine. Restrict access to the work site while sections of the attachment are in the air, or while they are being supported by the assist crane. The safe lifting capacity of the assist crane or hoist that is used must exceed the weight of the heaviest section of the attachment, the boom (approximately 3,845 kg (8,477 lb), not including the weight of accessories or fixtures).

Before beginning the disassembly of attachment mounting pins, disconnect the arm cylinder hydraulic hose couplings and put a clean plug in the end of each one. Use any reasonable precautions necessary to avoid introducing dirt or other contaminants into the hydraulic system. Wipe down coupling points before disconnecting hydraulic lines and use evaporative type solvent spray cleaner. Tag and mark hoses for reassembly, if necessary.

Place a sling under the arm cylinder (the cylinder used to extend and retract the attachment arm, pinned to the top of the boom). Lift the sling so the weight load on the rod end of the arm cylinder (pinned to the ears on the inner end of the arm) is released. Prepare blocking under the arm that will securely support the weight of the arm and arm cylinder.

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Cylinders

Steel Bushing Jig

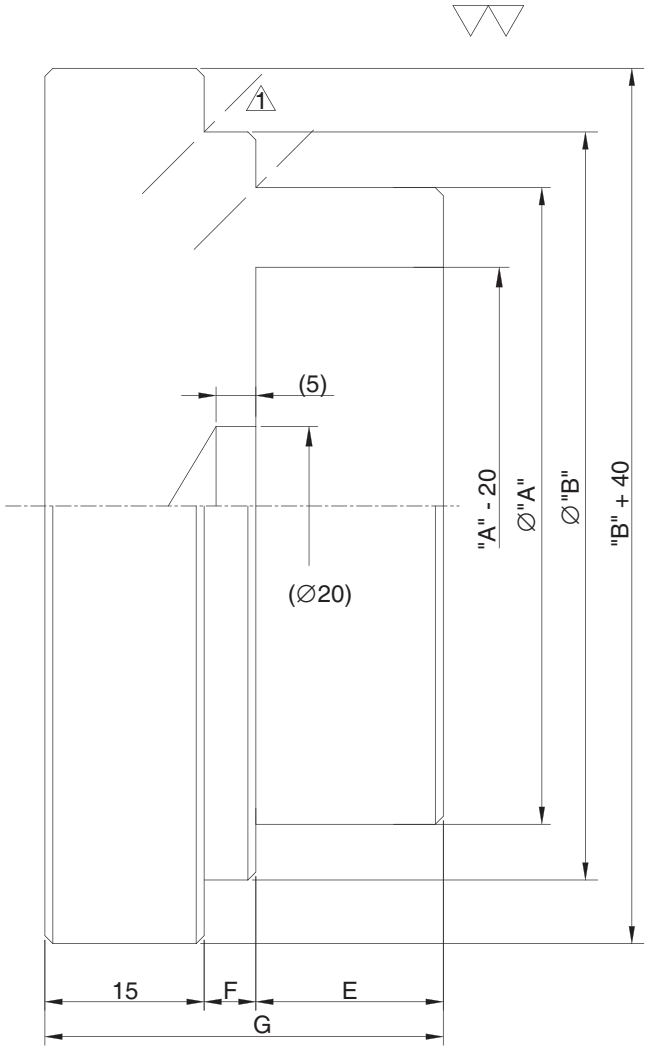


Figure 13

Material: SM45C which is done thermal refining <QT> HRC 22 - 28

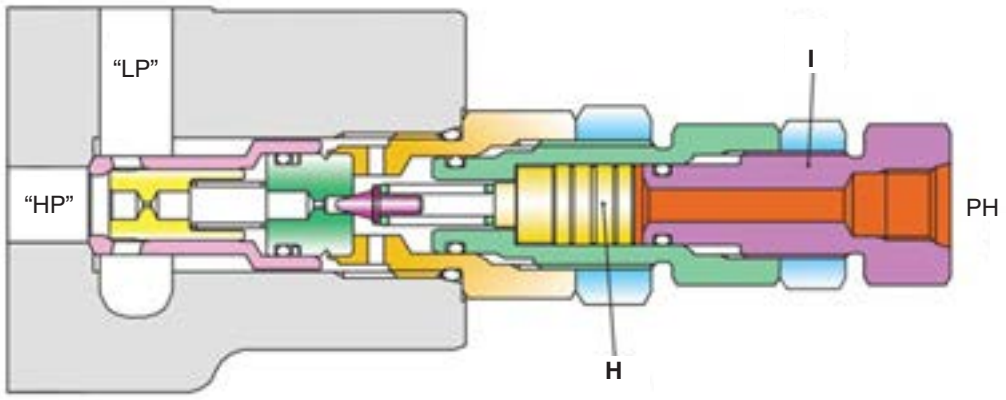
Undefined Chamfer C/R = 0.5 Max.

1 Place: Finally work to used DNMG Tip <Nose R0.4>

Cylinder	ø$A^{-0.05}_{-0.15}$	øB (±0.1)	E	$F^{+0.05}_{0}$	Remark
Boom	110.0 mm (4.33 in)	130.0 mm (5.12 in)	50.0 mm (1.97 in)	11 mm (0.43 in)	Head Side
	120.0 mm (4.72 in)	140.0 mm (5.51 in)	50.0 mm (1.97 in)	11 mm (0.43 in)	Rod Side
Arm	120.0 mm (4.72 in)	140.0 mm (5.51 in)	50.0 mm (1.97 in)	11 mm (0.43 in)	
Bucket	110.0 mm (4.33 in)	130.0 mm (5.12 in)	50.0 mm (1.97 in)	11 mm (0.43 in)	

Hydraulic System

If pressure is applied to the voltage step-up pilot port "PH", piston "H" moves to pilot poppet. As a result, spring force of pilot poppet will increase, causing setting pressure increase of "HP".
(from 336 to 357 kg/cm^2 (330 to 350 bar))



EX1301650

Figure 7

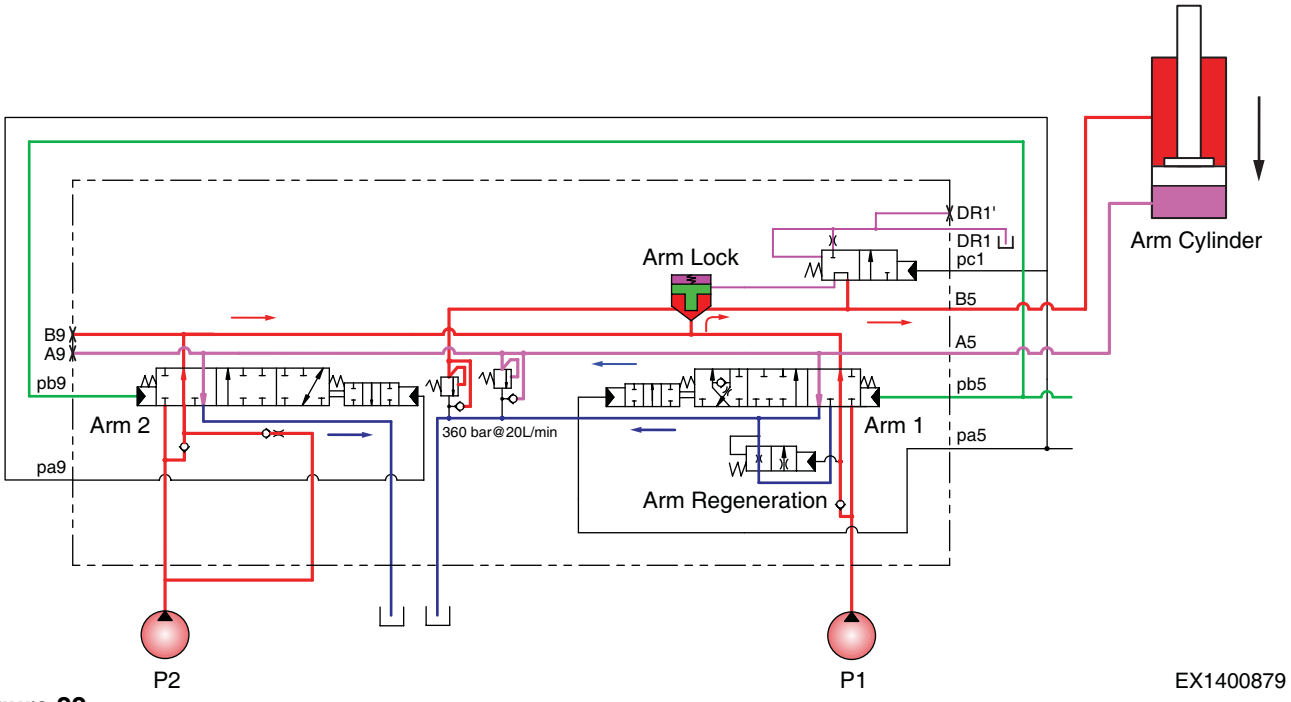

Arm Cylinder
DR1'
DR1
pc1
Arm Lock
B5
A5
B9
A9
pb9
pb5
Arm 2
Arm 1
360 bar@20L/min
pa5
pa9
Arm Regeneration
P2
P1
EX1400879

Figure 22

Table of Contents

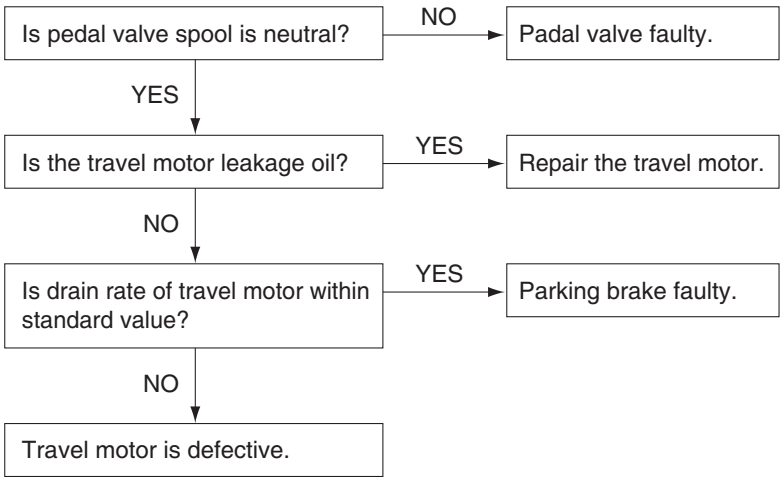
Hydraulic System Testing and Adjustment

has been restored but the brake still fails to release, the brake piston or friction plate may be frozen, requiring disassembly of the motor and parts repair/replacement.

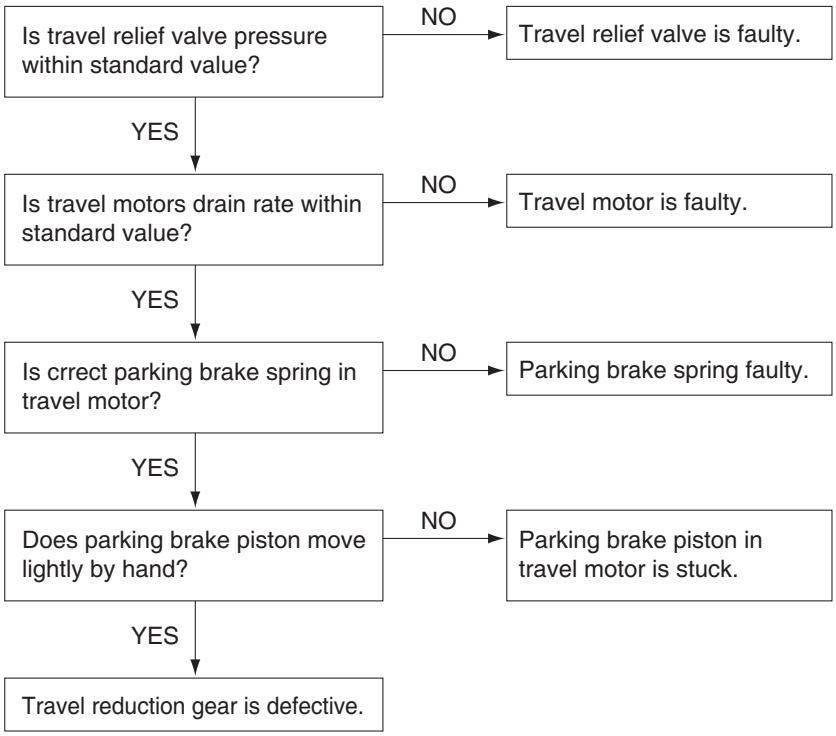
4. If pressure tested at the motor makeup valve drops below recommended minimum level, and consequent problems with cavitation, stalling and surging are observed, check the restriction valve. If pressure adjustment to the valve has been restored but if problems with cavitation continues, disassemble the upper swing motor housing and clean or replace assembly components as required.

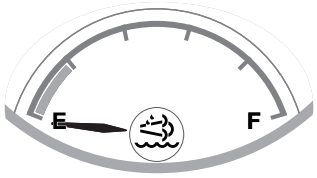
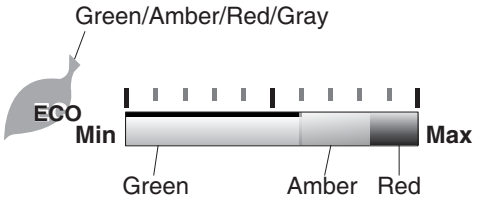
   NOTE: *If all tested pressures are at or above recommended levels, and there are no mechanical problems in the drivetrain or in the motor/brake assembly, the problem will require further hydraulic troubleshooting. It's also possible that a defective joystick, an intermittent short in an electrical control circuit or a problem in the EPOS circuit is causing diminished swing performance. Pull out the EPOS indicator panel from underneath the operator's seat and perform the self-diagnostic test. Refer to the Electrical section of this book for more information.*

Machine Does Not Stop on a Slope

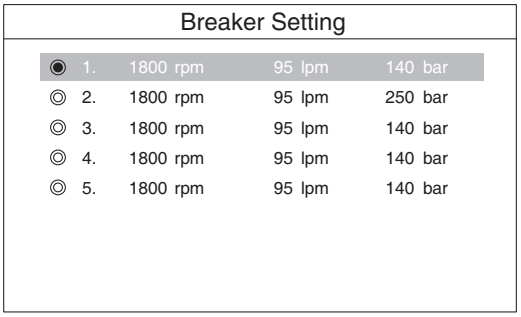


Travel Motor is Powerless (Travel Only)



Function	Display	Sensor Specification	
		Input Terminal	Input Specification
DEF (AdBlue) Level Gauge	 EX1300993	ECU-CAN Communication	5% → Min. 20% → Red Zone 100% → Max.
Tachometer	 EX1301378	ECU-CAN Communication	
ECO Gauge	 EX1300994	EPOS-CAN Communication	ECO symbol: The instant workload - Green: Normal operation - Amber: Idling operation - Red: Heavy loading operation - Gray: ECO symbol off ECO gauge: The average fuel efficiency for 1 minute - Green: Fuel efficiency is good - Amber: Fuel efficiency is normal - Red: Fuel efficiency is not good
Trip Meter	 EX1300995	EPOS-CAN Communication	Amount of fuel use (ℓ) Operating hours (hr) Average fuel efficiency (ℓ/hr) Daily average fuel efficiency (ℓ/hr)

If you access the breaker setting or two-way setting list screen, the initial screen locates the cursor at the top.

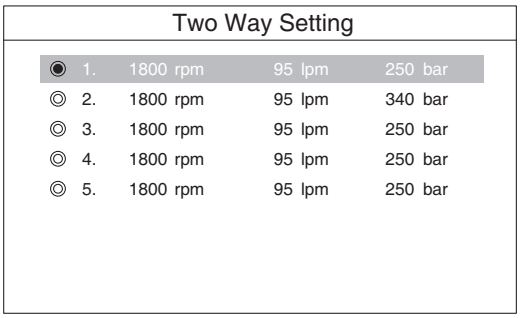


EX1301417

Figure 39

Operate the jog switch clockwise/counterclockwise to select breaker/two-way. Then, click on the jog switch on the list, operate the jog switch clockwise/ counterclockwise to move the cursor. Then, click on the jog switch to select the attachments to be set up and move to the attachment setting screen.

On the attachment setting list screen, when cursor is placed on the list, press the ESC button to locate the cursor at breaker/two-way at the top. When the cursor is placed at breaker/two-way at the top, press the ESC button to return to the previous screen.



EX1301418

Figure 40

How to Set Up Attachments

Attachment setting items include attachment use, max E/G limit, max pressure (ATT), max flow (ATT), min flow (ATT), and user setting max flow. Operate the jog switch clockwise/counterclockwise to locate the cursor. Then, click on the jog switch to set up relevant items.

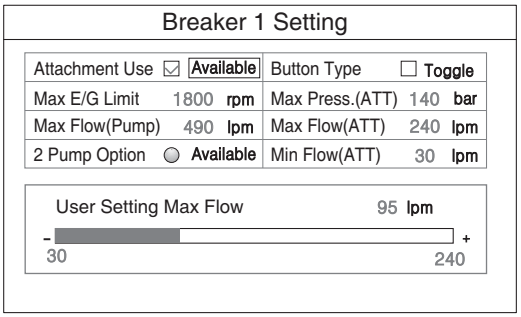
The cursor movement order goes like this:

1) Breaker Setting

   Attachment Use ↔ Toggle ↔ Max E/G Limit ↔ Max Pressure ↔ Max Flow ↔ Min Flow ↔ User Setting Max Flow

2) Two-way Setting

   Attachment Use ↔ Max E/G Limit ↔ Max Pressure ↔ Max Flow ↔ Min Flow ↔ User Setting Max Flow



EX1301419

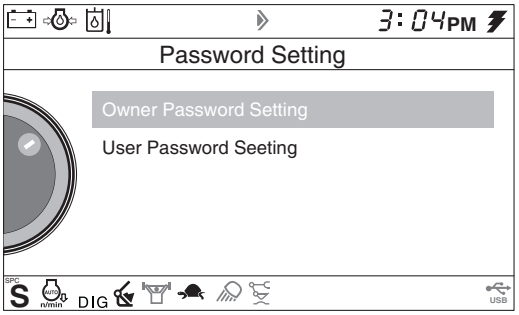
Figure 41

Owner Password Setting

1) Selection

An owner password can be set for managing functions of equipment and use privileges of the equipment for different users.

To set an owner password, place the cursor over Owner Password Setting in the settings screen and click the jog switch (or press "Enter" on the keypad).



EX1301055

Figure 85

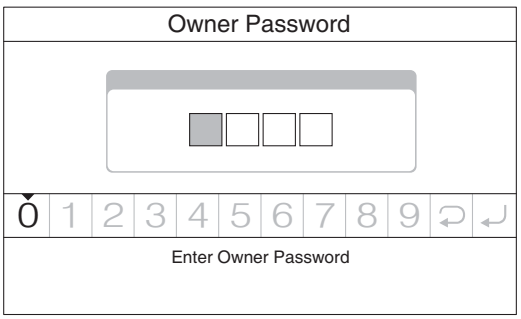
2) Password entry

When the password entry screen appears, use the jog switch (or the keypad) to enter the password and move to the settings screen.

The default password is "1111".

How to enter the password
Rotate the jog switch to select digits from 0 to 9 below, and click Enter on the jog switch to input the password.

If the password is input incorrectly, use the ⮌ button on the lower right to delete the input password.

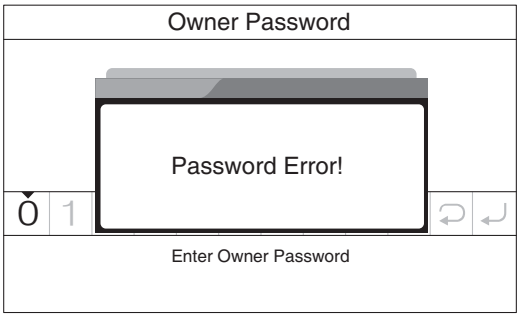


EX1301416

Figure 86

IMPORTANT

If the password is input incorrectly three times in a row, you will be redirected to the main screen and the system will not start for the next 10 minutes.

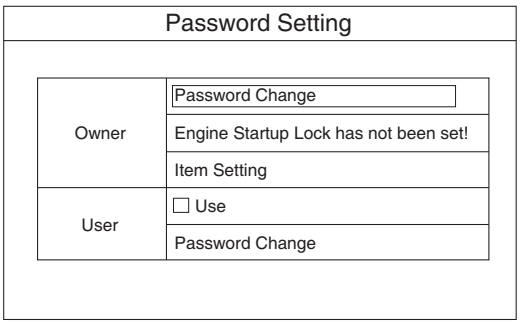


EX1301433

Figure 87

3) Structure

Owner password settings include password change, start-up restriction settings, function item settings, user password use settings, and user password change.



EX1301434

Figure 88

Submenu Selections

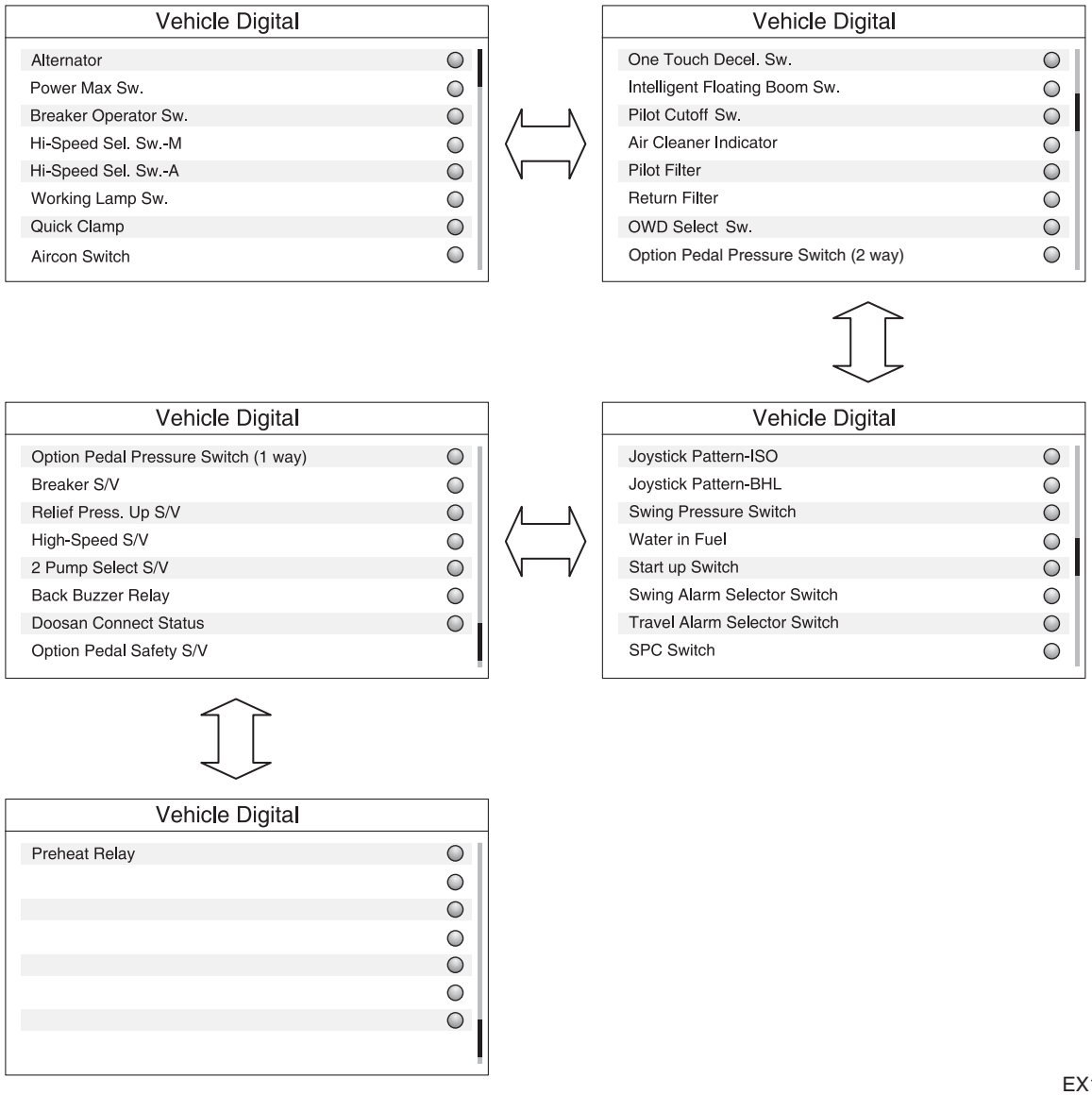


Figure 130

Failure Code at Engine Side

GP (Graphic Panel): Code displays on Panel Gauge
FMI (Failure Mode Identifier): Code displays on DMS
DTC (Diagnostic Trouble Code): Code displays on Diagnostic tool
HEX: Hexadecimal, DEC: Decimal number

GP Display Code	DTC Code		FMI	GP Display Description	Severity	Light Status	Remarks
	HEX	DEC					
E000046-01	46	2E	1	Low air pressure signal from APS (E56)	0	None	
E000046-19	46	2E	19	CAN message timeout from APS (E56)	0	None	
E000051-03	51	33	3	Throttle Position Sensor 1, short circuit to battery.	3	Yellow	
E000051-04	51	33	4	Throttle Position Sensor 1, Short Circuit to Ground	3	Yellow	
E000051-07	51	33	7	Adapted throttle position sensor voltage, at closed end position, is outside permitted range.	3	Yellow	
E000051-08	51	33	8	Adapted throttle position sensor voltage, at open end position, is outside permitted range.	0	None	
E000051-09	51	33	9	Throttle Position Sensor(s) Bad Performance, Correlation Error.	3	Yellow	
E000091-02	91	5B	2	Auxiliary accelerator pedal is used due to pedal faulty or other.	0	None	
E000091-09	91	5B	9	Acc pedal faulty or error via can.	0	None	
E000091-10	91	5B	10	Accelerator pedal not plausible, faulty	3	Yellow	
E000091-19	91	5B	19	Acc pedal value out of valid range (via CAN)	3	Yellow	
E000094-00	94	5E	0	Accumulator pressure is too high	3	Yellow	
E000098-02	98	62	2	Oil level sensor (L_OIL), faulty	0	None	
E000098-03	98	62	3	Oil level sensor (L_OIL), short circuit to +24V	0	None	
E000098-04	98	62	4	Oil level sensor (L_OIL), short circuit to ground or open load	0	None	
E000098-10	98	62	10	Oil level sensor stuck (T110)	0	None	
E000100-01	100	64	1	Oil press sensor, pressure too low	4	Red	
E000100-02	100	64	2	Oil press sensor (P_OIL), faulty	3	Yellow	
E000100-03	100	64	3	Oil press sensor (P_OIL), short circuit to +24V	3	Yellow	
E000100-04	100	64	4	Oil press sensor (P_OIL), short circuit to ground or open load	3	Yellow	
E000100-13	100	64	13	Oil pressure sensor (T5)	3	Yellow	
E000100-16	100	64	16	Oil press sensor, press above normal	3	Yellow	
E000100-17	100	64	17	Indicates low oil pressure, will optionally result in engine protective action	0	None	
E000100-18	100	64	18	Oil press sensor, press below normal	3	Yellow	
E000102-00	102	66	0	Boost pressure higher than reference	3	Yellow	
E000102-01	102	66	1	Boost pressure lower than reference	3	Yellow	
E000102-03	102	66	3	Boost press sensor (P_BOOST), short circuit to +24V	3	Yellow	
E000102-04	102	66	4	Boost press sensor (P_BOOST), short circuit to ground or open load	3	Yellow	
E000102-07	102	66	7	Turbocharger/Supercharger Boost Pressure Not Detected - Mechanical	3	Yellow	
E000102-08	102	66	8	Boost pressure (T122) not plausible	0	None	
E000102-09	102	66	9	Boost pressure (T122) not plausible	0	None	
E000102-10	102	66	10	Correlation error, MAP higher than Intercooler pressure	0	None	
E000102-15	102	66	15	Correlation error, MAP higher than EXP	0	None	
E000102-16	102	66	16	Boost pressure higher than reference at part load	3	Yellow	

Reference Number	Description
1	Instrument Panel
3	Engine Controller
4	EPOS Controller
17	Engine Control Dial
24	Battery
25	Battery Relay
26	Fuse

Reference Number	Description
27	Fusible Link
28	Starter Switch
32	Jog Switch Control Panel
33	Engine Emergency Stop Switch
34	Circuit Breaker
35	Solenoid Valve (Pressure Up)
36	Power Boost Switch

Internal and External Filters

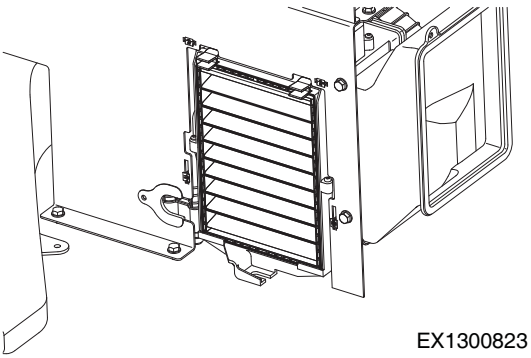
Internal and external air purification filters are installed for the operator's room.

Filters must be cleaned every 500 hours.

If machine operates in an excessively contaminated environment, filters must be cleaned more frequently and if necessary, replaced with new ones.

How to Check Internal Air Filter

1. Remove cover by pulling knob outward on top of the left and right of the filter which is inside the left rear part of the cabin.
2. Remove inner filter by pulling knob outward while pressing the upperpart and lower part of the filter handle.
3. Replace with new one.
4. Reassemble filter in reverse order.



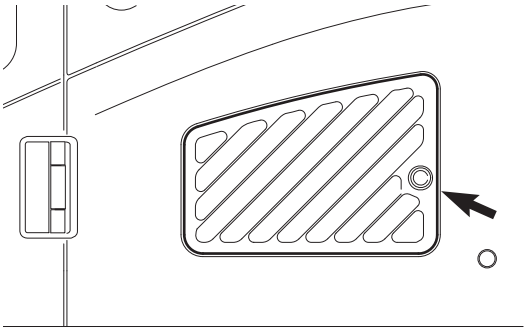
EX1300823

Figure 179

How to Check External Air Filter

NOTE: *All right and left call outs are based on the operator being seated in the operator's seat facing the front.*

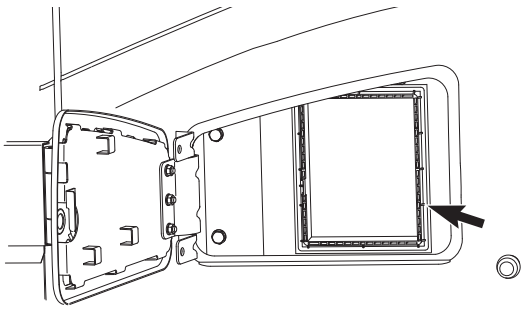
1. Open the cover by using the starter KEY in the left side of the cabin.



EX1300825

Figure 180

2. Remove filter (Figure 181) and replace with new one.
3. Reassemble in reverse order.



EX1403389

Figure 181

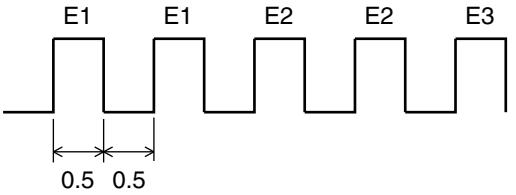
Error codes

Code	Description
E0	Normal
E1	Internal air temperature sensor short
E2	Internal air temperature sensor open
E3	Ambient air temperature sensor short
E4	Ambient air temperature sensor open
E5	Duct sensor short
E6	Duct sensor open
E7	Sun sensor short
E8	Sun sensor open
E9	Coolant temperature gauge sensor short
E10	Coolant temperature gauge sensor open
E11	D.P.S open
E12	Position error of airflow direction actuator
E13	Position error of temperature control actuator

NOTE: *The position error means that it fails to move to designated place in 40 seconds.*

Sun sensor displays E8 in case of no sunlight.

2 and more fails: Codes concerned blinks twice at a time.



FG001067

Figure 198

Ambient Temperature Display

Selection of both the SEL and MODE switch for more than 3 seconds indicates the ambient temperature in the set temperature display department.

- Range of temperature display: -40 - +60°C

NOTE: *Display of ambient temperature may be released in the same way for its entry way.*

It returns automatically to default mode 5 seconds after entering the ambient air temperature display mode.

Reference Number	Description
1	Battery
2	Battery Relay
3	Fuse Box
4	Light Switch
5	Cabin Light Switch
6	Headlight Relay (Work Light Indicate Light)
7	Work Light Relay
8	Front Cabin Light Relay

Reference Number	Description
9	Front Cabin Light / Rear Work Light Relay
10	Instrument Panel
11	EPOS Controller
12	Headlight (2 ea.)
13	Work Light (2 ea.)
14	Front Cabin Light (4 ea.)
15	Rear Cabin Light (2 ea.)
16	Rear Work Light (1 ea.)

NOTE: *The "*" mark are optional parts.*

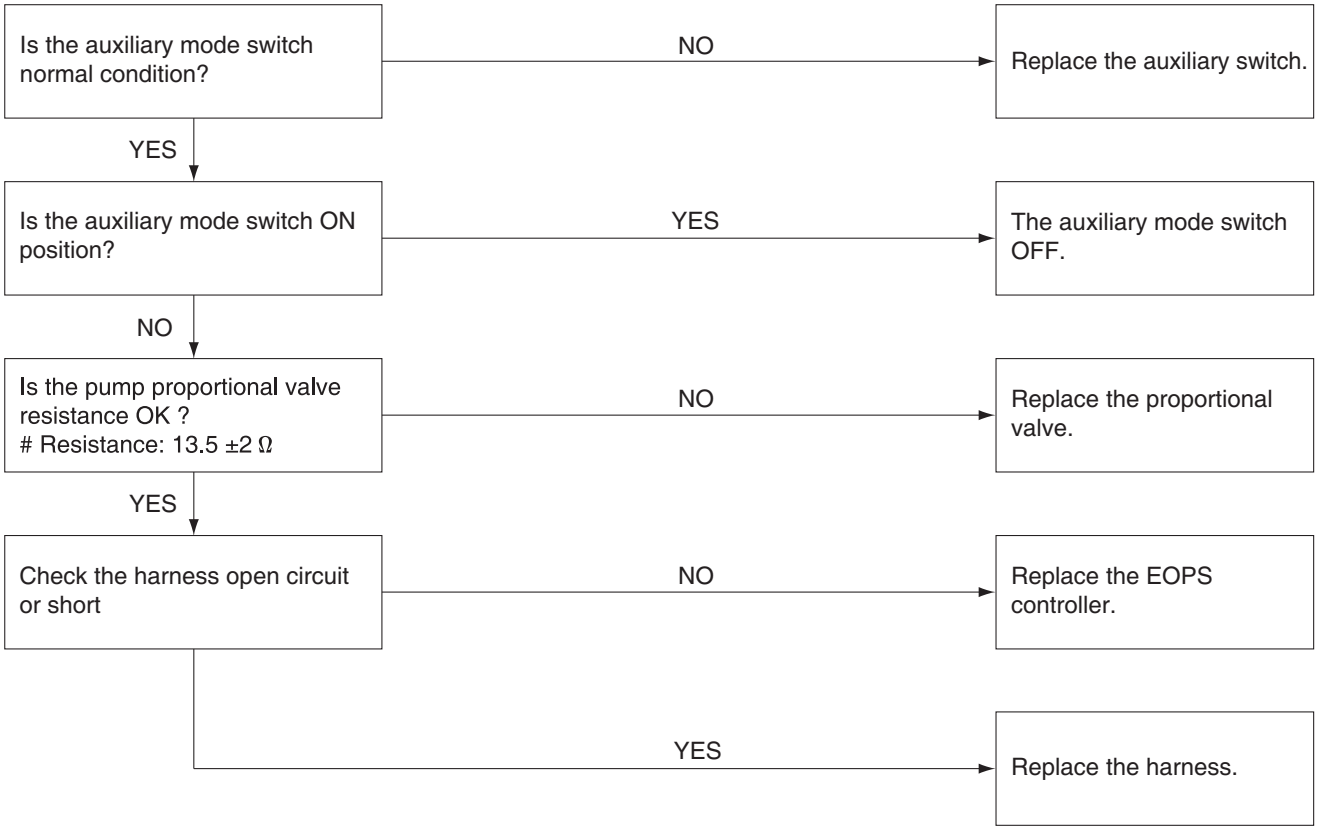
Kind of Light

The lighting system is consists of headlights, work lights, cabin lights (optional), relays and switches.

Operation

Switch	Position	Connected Terminal of switch	Activated Relay	Lit Light
Light Switch	1	"2-3" Terminal	-	Illumination Light of Switch
	2	"2-3" Terminal	-	Illumination Light of Switch
		"5-6" Terminal	Headlight Relay	Headlight (2 ea.)
			Work Relay	Work Light (2 ea.) Symbol Light of Work Light
Cabin Light Switch	1	"2-3" Terminal	Front Cabin Light Relay	Front Cabin Light (2 ea.) or Front Cabin Light (4 ea.)
	2	"2-3" Terminal	Front Cabin Light Relay	Front Cabin Light (2 ea.) or Front Cabin Light (4 ea.)
		"5-6" Terminal	Rear Cabin Light Relay/ Rear Work Light Relay	Rear Cabin Light (2 ea.) and Rear Work Light (1 ea.)

All Actuators Speed are Slow (EPPR Valve)



Reference Number	Description
1	Valve, EPPR
1-1	Valve; EPPR
2	Tee, Shuttle Valve
3	Bracket, EPPR Valve
4	Hose, Hydraulic
5	Hose
6	Hose Assembly, Hydraulic
7	Hose Assembly, Hydraulic
8	Hose Assembly, Hydraulic
9	Adapter

Reference Number	Description
10	Adapter, Filter
11	Tee
12	Bolt, Hex
13	Bolt, Hex M8 x 1.25 x 18
14	Washer, Spring
15	O-ring
16	O-ring
17	O-ring
18	O-ring
51	Valve, Solenoid; 4-sol

Caution for Installation

- When you install piping, make sure there is no foreign substance inside piping sub-parts such as hoses, pipes, valves and fittings.
- Prior to installing piping:

  A. Park on firm and level ground.

  B. Lower front attachment (bucket) to ground.

  C. Stop engine.

  D. Move safety lever to "RELEASED" (UNLOCKED) position.

  E. Turn starter switch to "I" (ON) position.

  F. Fully stroke work levers (joysticks) in all directions to relieve any pressure from accumulators.

  G. Move safety lever to "LOCK" position.

  H. Turn key to "O" (OFF) position and remove from starter switch.

  I. Attach a maintenance warning tag on controls.

CAUTION

AVOID INJURY

Release any pressure in the hydraulic oil tank before work.

Rotating

Edition 1

Reference Number	Description
1	Pipe Assembly, Hydraulic
2	Hose Assembly, Hydraulic
3	O-ring
4	Clamp; Pipe
5	Bolt
6	Washer; Spring
9	Bolt
10	Washer, Spring

Reference Number	Description
11	Valve; Switch (RH)
12	Valve; Switch (LH)
13	O-ring
14	Bolt; Socket
51	O-ring
52	Elbow
53	Cap
54	O-ring

After Installation Precautions

- After finishing installation of piping, connect 'P' and 'T' line directly to each other without connecting the attachments and do flushing process for a few minutes to clean hydraulic oil before connecting the hoses to the attachments.
- When connecting hydraulic hoses, making sure that 'Pressure' and 'Tank' lines are not reversed.
  When connecting the hoses, make it sure that no foreign substances get into the hoses.
  Dirt and sand can cause serious damage to the attachments.
- Arrange the connecting hoses so they are not twisted or excessively bent.

Air Bleeding

1. Start the engine and run at low idle.
2. Operate the joystick lever and actuate the hydraulic cylinder 4 ~ 5 times very slowly about 100 mm before the end of stroke.
3. Operate the rod of cylinder to the end of stroke to relieve the hydraulic piping.
   (The air breather of oil tank is actuated to bleed the air.)

COMPLETING WORK

- Control valve (rotating) pressure check (main relief): 81.6 kg/cm^2 (80 bar)
- Left joystick pilot pressure check: 31.6 kg/cm^2 (31 bar)

Reference Number	Description
1	Valve; Quick-fit
1-1	Valve, Solenoid
1-2	Valve, Reducing
1-3	Coil
2	Bracket, Quick Fit Valve
3	Hose Assembly, Hydraulic
4	Hose Assembly, Hydraulic
5	Hose Assembly, Hydraulic
6	Hose Assembly, Hydraulic
7	Hose Assembly, Hydraulic
8	Adapter

Reference Number	Description
9	Adapter
10	Adapter
11	Bolt; Set
12	Bolt
13	Washer, Spring
14	O-ring
15	O-ring
16	O-ring
17	O-ring
18	Harness, Joint

Electric Parts - Quick Coupler

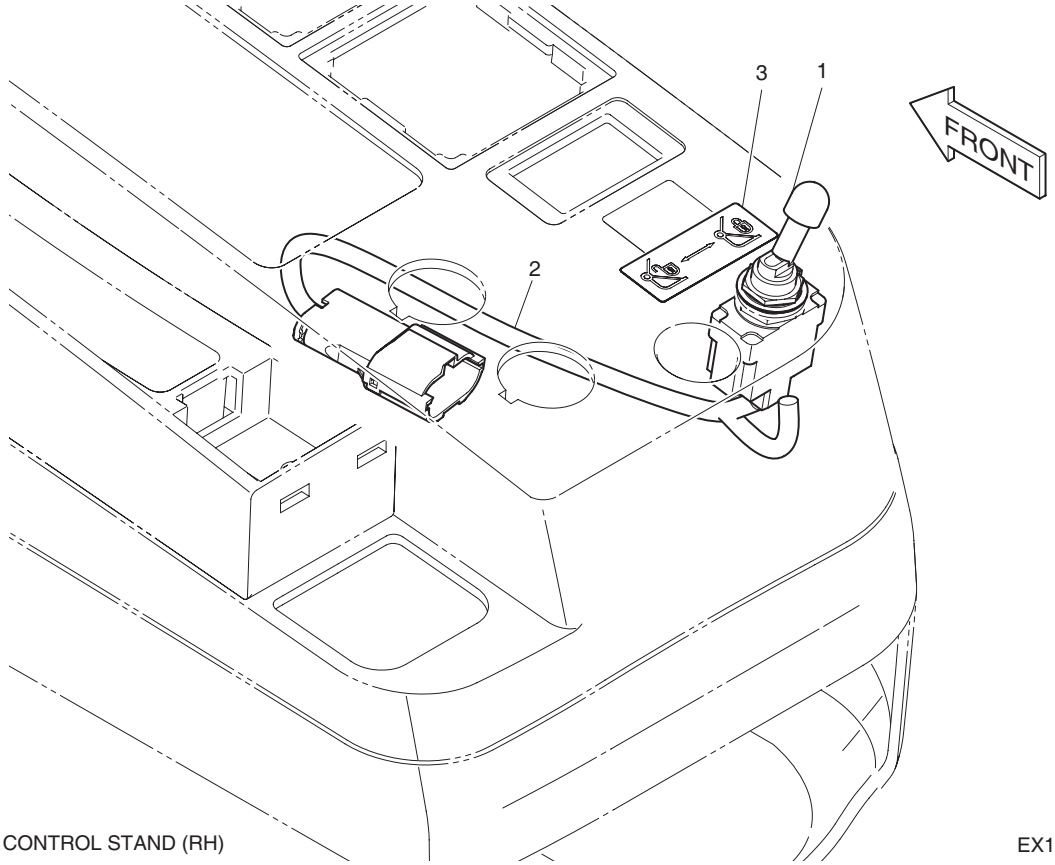


Figure 17

Reference Number	Description
1	Switch; Lockout Toggle
2	Harness; Joint

Reference Number	Description
3	Name Plate; Quick Clamp