DOOSAN

950106-00980E-2
February 2015

EXCAVATOR

Shop Manual

DX300LC-5

Serial Number 1001 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.)

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

DIM.	Boom	6.255 m (20' 6")			
	Arm	**3.1 m (10' 17") STD**	**2.5 m (8' 2")**	**2.85 (9' 4")**	**3.75 m (12' 3")**
	Bucket Type (PCSA)	**1.27 m^3 (1.66 yd^3)**	**1.51 m^3 (1.98 yd^3)**	**1.27 m^3 (1.66 yd^3)**	**1.03 m^3 (1.35 yd^3)**
A	Max. Digging Reach	10,860 mm (35' 7")	11,280 mm (36' 12")	10,555 mm (34' 8")	11,415 mm (37' 5")
B	Max. Digging Reach (Ground)	10,670 mm (34' 12")	10,075 mm (33' 1")	10,355 mm (34' 0")	11,235 mm (36' 10")
C	Max. Digging Depth	7,010 mm (22' 12")	6,510 mm (21' 4")	6,720 mm (22' 1")	7,605 mm (24' 11")
D	Max. Loading Height	8,895 mm (29' 2")	8,415 mm (27' 7")	8,575 mm (28' 2")	9,255 mm (30' 4")
E	Min. Loading Height	2,750 mm (9' 0")	3,370 mm (11' 1")	3,960 mm (13' 0")	3,010 mm (9' 11")
F	Max. Digging Height	12,085 mm (39' 8")	11,615 mm (38' 1")	11,760 mm (38' 7")	12,450 mm (40' 10")
G	Max. Bucket Pin Height	10,495 mm (34' 5")	7,970 mm (26' 2")	10,170 mm (33' 4")	10,855 mm (35' 7")
H	Max. Vertical Wall Depth	6,650 mm (21' 10")	5,915 mm (19' 5")	6,720 mm (22' 1")	7,135 mm (23' 5")
I	Max. Radius Vertical	6,330 mm (20' 9")	6,360 mm (20' 10")	6,730 mm (22' 1")	6,580 mm (21' 7")
J	Max. Depth to 2,500 mm Line	6,905 mm (22' 8")	6,295 mm (20' 8")	6,615 mm (21' 8")	7,515 mm (24' 8")
K	Min. Radius 2,500 mm Line	1,800 mm (5' 11")	1,825 mm (5' 12")	1,865 mm (6' 1")	1,820 mm (5' 12")
L	Min. Digging Reach	1,200 mm (3' 11")	1,320 mm (4' 4")	2,140 mm (7' 0")	-1,950 mm (-7' 7")
M	Min. Swing Radius	2,900 mm (9' 6")	3,065 mm (10' 1")	3,205 mm (10' 6")	3,105 mm (10' 2")
d	Bucket Angle	175°	176°	176°	174°

Swing Speed

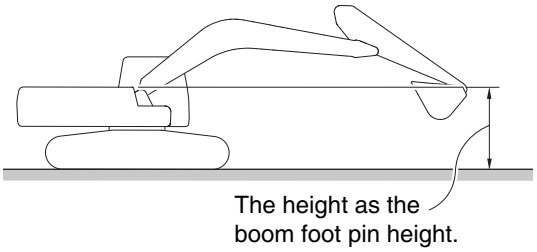
Summary

Measure the time required to swing three complete turns.

Preparation

1. Check the lubrication of the swing gear and swing bearing.
2. Place the machine on flat, solid ground with ample space lor swinging. Do not conduct this test on slopes.
3. With the bucket empty, position the front attachment as follows.
   With the arm cylinder fully retracted, and the bucket cylinder fully extended, raise the boom so bucket pin height is flush with the boom foot pin height.

   NOTE: *In case of no place to be measured, measure with the boom raised and the arm rolled-in.*
4. Maintain the hydraulic oil temperature at 50 ±5 °C (122 ±41 °F).



EX1301770

Figure 12

CAUTION

AVOID INJURY

Prevent personal injury. Always make sure that area is clear and that co-workers are out of the swing area before starting the measurement.

Measurement

1. Measurement conditions are as below.

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

2. Operate swing control lever fully.
3. Measure the time required to swing 3 turns in one direction. (Record the stopwatch measurement to the second decimal place.)
4. Operate swing control lever fully in the opposite direction and measure the time required for 3 turns.
5. Perform the measurement three times and calculate the average values.

Evaluation

Refer to “Operational Performance Standard Table” on page -22.

Be careful when installing sealing members, to avoid cutting or scratching. Curling under of any seal lip will seriously impair its efficiency. Apply a thin coat of Loctite #120 to outer diameter of metal casing and on oil seals to assure an oil tight install into retainer. Use extreme care not to get Loctite on lips of oil seals. If this happens, that portion of the seal will become brittle and allow leakage.

When replacing lip type seals, make sure spring loaded side is towards oil to be sealed.

5. If available, use magna-flux or similar process for checking for cracks that are not visible. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks or scores. Replace all gears showing cracks or spots where case-hardening has worn through. Small nicks may be removed with suitable hone. Inspect shafts and quills to make certain they have not been sprung, bent, or no twisted splines, and that shafts are true.

   NOTE: *Spline wear is not considered detrimental except where it affects tightness of splined parts.*

   Inspect thrust washers for distortion, scores, burs, and wear. Replace thrust washer if defective or worn.

6. Inspect bores and bearing surfaces of cast parts and machined surfaces for scratches, wear, grooves and dirt. Remove any scratches and burrs with crocus cloth. Remove foreign material. Replace any parts that are deeply grooved or scratched which would affect their operation.

Bearing Inspection

The conditions of the bearing are vital to the smooth and efficient operation of the machinery. When any component containing bearings is disassembled, always carefully examine the condition of the bearings and all of its components for wear and damage.

Once the bearing is removed, clean all parts thoroughly using a suitable cleaning solution. If the bearing is excessively dirty, soak the bearing assembly in a light solution and move the bearing around until all lubricants and/or foreign materials are dissolved and the parts are thoroughly clean.

When drying bearings, moisture free compressed air can be used. Be careful not to direct the air in a direction which will force the bearing to dry spin while not being properly lubricated.

After the bearings have been cleaned and dried, carefully inspect all bearing rollers, cages and cups for wear, chipping or nicks. If the bearing cannot be removed and is to be inspected in place, check for roughness of rotation, scoring, pitting, cracked or chipped races. If any of these defects are found replace the whole bearing assembly. NEVER replace the bearing alone without replacing the mating cup or the cone at the same time.

TYPE 8 PHOSPHATE COATED HARDWARE

This chart provides tightening torque for general purpose applications using original equipment standard hardware as listed in the Parts Manual for the machine involved. **DO NOT SUBSTITUTE**. In most cases, original equipment standard hardware is defined as Type 8, coarse thread bolts, nuts and thru hardened flat washers (Rockwell "C" 38 - 45), all phosphate coated and assembled without supplemental lubrication (as received) condition.

The torques shown below also apply to the following:

1. Phosphate coated bolts used in tapped holes in steel or gray iron.
2. Phosphate coated bolts used with phosphate coated prevailing torque nuts (nuts with distorted threads or plastic inserts).
3. Phosphate coated bolts used with copper plated weld nuts.

Markings on bolt heads or nuts indicate material grade ONLY and are NOT to be used to determine required torque.

Nominal Thread Diameter	Standard Torque ±10%	
	Kilogram.meter (kg.m)	Foot pounds (ft lb)
1/4"	1.1	8
5/16"	2.2	16
3/8"	3.9	28
7/16"	6.2	45
1/2"	9.7	70
9/16"	13.8	100
5/8"	19.4	140
3/4"	33.2	240
7/8"	53.9	390
1"	80.2	580
1 - 1/8"	113.4	820
1 - 1/4"	160.4	1160
1 - 3/8"	210.2	1520
1 - 1/2"	279.4	2020
1 - 3/4"	347.1	2510
2"	522.8	3780

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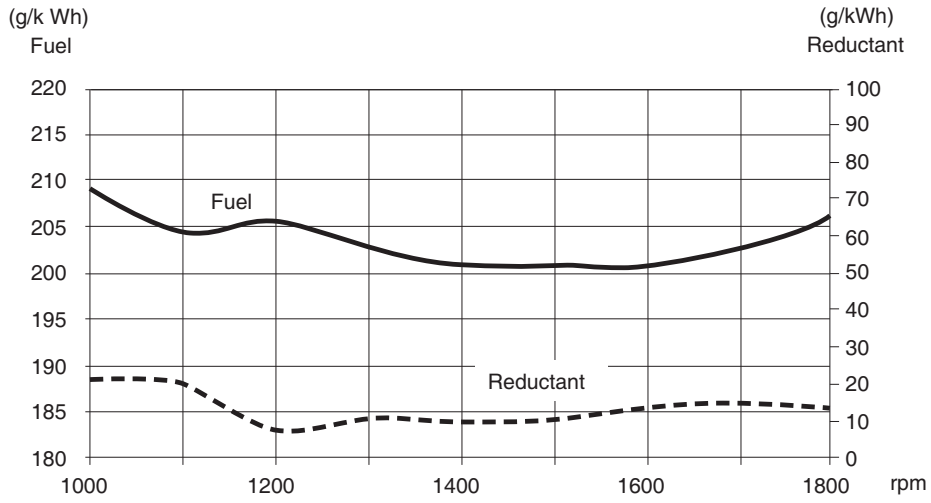


Spec. Fuel and Reductant Consumption

(g/kWh / 1.36 = g/hph)

EX1400008

Figure 9

Performance Condition	SAE J 1995
Emission	EU Stage IV and US Tier 4F
Power Output (Rated)	202 kW (270 HP) @ 1,800 rpm
Max. Torque	1,275 Nm @ 1,300 rpm
Fuel Consumption (Rated)	206 g/kWh

NOTE: *Barometric Pressure: 760 mm (30") Mercury*

Temperature: 20°C (68°F)

W/O Cooling Fan: Driven by hydraulic fan motor

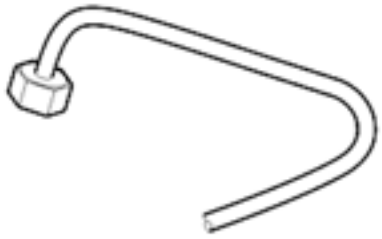
Alternator: Not Installed

Exhaust System: Complete, attached

Air Cleaner, Installed

Pressure Pipe

- Nut (M20): 38 Nm
- Nut (M16): 38 Nm
- Nut (M18 x 1.5): 35 ±5 Nm



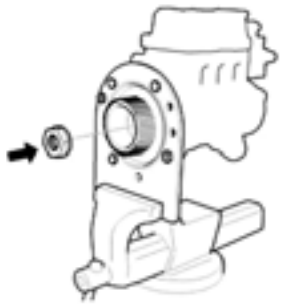
EX1301851

Accumulator

- End connection: 27 Nm + 90°
- Safety valve: 27 Nm + 90°
- Pressure sensor: 47 Nm

High-pressure Pump

- Pump gear: 300 Nm

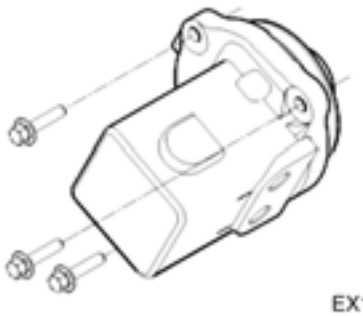


EX1301852

- High-pressure pump, cylinder head bolt: 68 Nm

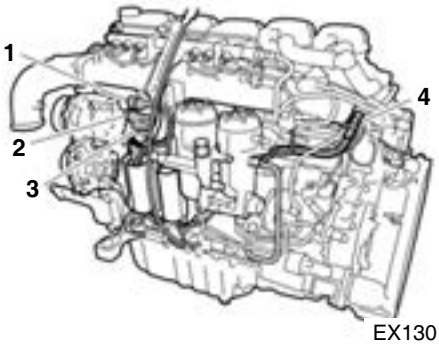
EX1301853

- Screw for feed pump: 25 Nm



EX1301854

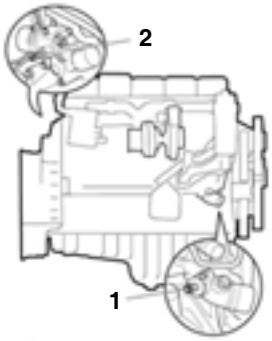
4. Connect connectors C4001 (1) and C4002 (3) and connector C4022 (4) to SCR.



EX1301907

Figure 26

5. Install the coolant connections for SCR, to engine (1) and from engine (2).



EX1301906

Figure27

6. Connect the fuel pipes to the high-pressure pump and hand pump.
7. Install the inlet pipe between the turbocharger and the air filter.
8. Install the connections for coolant and the charge air pipes between the engine and charge air cooler. Install the expansion tank bleed pipe.
9. Fill with coolant.
10. Install the cable harness to the starter motor and the ground connection to the negative terminal.
11. Start checking tool and check whether there are any fault codes. Rectify the fault codes.
12. Clear inactive fault codes.
13. Test run the engine to check that no leakage occurs. Top up with coolant if necessary.

8. When the sealing surface of the valve seat insert has been machined, reduce the cutting pressure by turning 2 - 3 revolutions without any feed. Continue turning clockwise while turning the screw counter clockwise until cutter is free.

   Disconnect the solenoid by briefly pressing switch position 2.

9. Continue with the next valve seat insert as described in the steps above.

Height Check of Valve Seat Insert

1. Make sure that cylinder head is clean.

   NOTE: *Use the same exhaust valve for the measurement below to avoid measurement errors.*

2. Install the exhaust valve in the first valve guide. Measure the height of the exhaust valve.

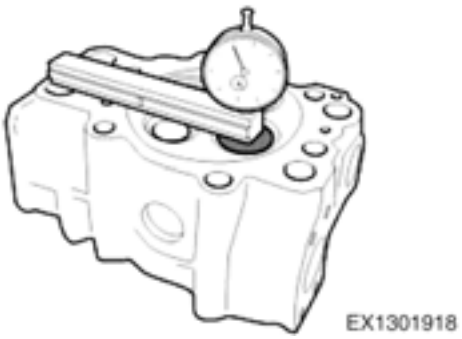


Figure 66

3. Install the same exhaust valve in the second valve guide. Measure the height of the exhaust valve.

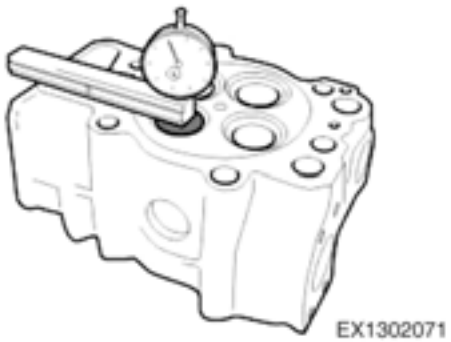


Figure 67

4. The height tolerance between exhaust valves is ±0.05 mm. If the difference is greater, machine the valve seat insert which is highest until height tolerance is obtained.

   Also check that distance between the valve disk and the bottom of the cylinder head is not less than 0.71 mm as shown in the illustration.

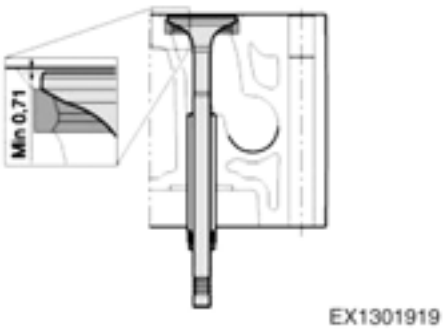


Figure 68

3. Place the cutting head in the fixture. Center the cutting head by turning it clockwise until it rests against the pin and the cutter stops against the loose stop lug.

4. If this value is correct, install the cutting head on the tool and tighten the hexagon socket screw. If the value needs to be adjusted, proceed as follows:

   - Cylinder liner diameter 139 mm

     Check that cutter is set so the micrometer indicates 14.03 mm.

   - Cylinder liner diameter 140 mm

     Check that cutter is set so the micrometer indicates 14.53 mm.

5. Hold the cutter against the lug and undo the hexagon socket screw securing the cutter. The cutter is spring loaded.

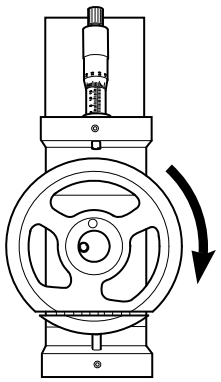


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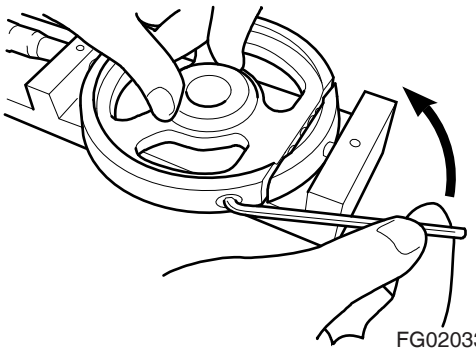
Figure 110

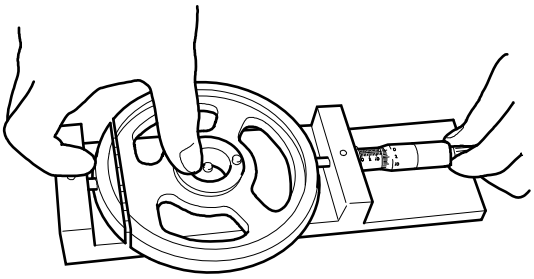


FG020338

Figure 111

6. Hold the cutting head with your hand and adjust the micrometer.

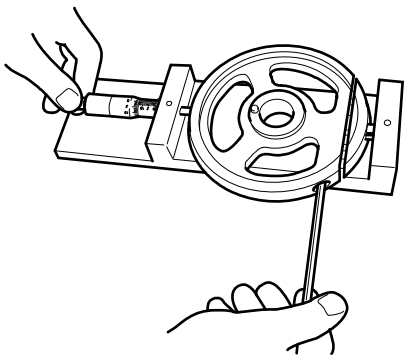
   - 14.03 mm gives the cutting head a diameter of 139.03 mm.
   - 14.53 mm gives the cutting head a diameter of 140.03 mm.



FG020339

Figure 112

7. Lightly tighten the hexagon socket screw securing the cutter.



FG020340

Figure 113

Replacing the front Crankshaft Seal

1. Remove cooling package and fan then release the belt drive and loosen the pulley (pulley on engines with geared-up fan) as described in the relevant work description °×Cooling System°± on page 4-1-275.
2. Remove crankshaft seal with a screwdriver, take care not to damage any sealing surfaces. Alternatively a self-tapping screw can be screwed into the crankshaft seal so the crankshaft seal can be pulled out with a slide hammer.
3. Wipe around all surfaces.
4. Install the new crankshaft seal onto tool 99 149.

   NOTE: *The crankshaft seal must be installed dry and on no account must it be lubricated. Do not touch the sealing lip with your fingers.*

   NOTE: *Note the installing direction of the seal.*
5. Press the new seal into position with tool 99 149. The seal is correctly installed when the tool is pressed home against the front cover.
6. Install the pulley (pulley on engines with geared-up fan), fan and cooling package as described in the relevant work description °×Cylinder°± on page 4-1-56.

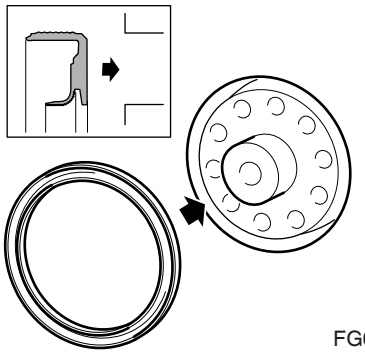
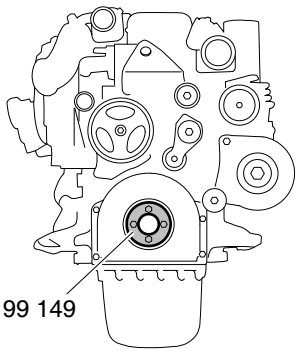

FG020380

Figure 159



FG020381

Figure 160

Oil Mist Separator

Overview

Intake and outlet on the oil mist separator

Reference Number	Description
1	Crankcase Gases from the Engine
2	Cleaned Crankcase Gases
3	Oil Separated from the Crankcase Gases
4	Inlet for Oil which Drives the Oil Mist Separator
5	Outlet for Oil which Drives the Oil Mist Separator

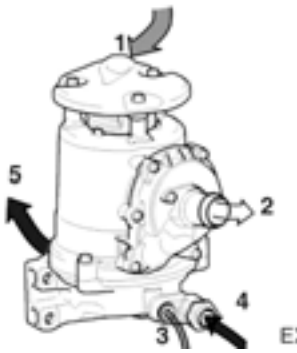


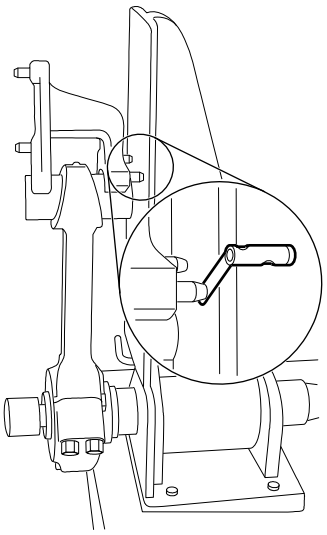
Figure 161

Function

The oil mist separator is driven by oil from the lubrication system. The oil flows into the oil mist separator and is sprayed

Check whether the connecting rod is twisted with the indicator studs horizontal.

NOTE: *Checking for twisted connecting rod.*

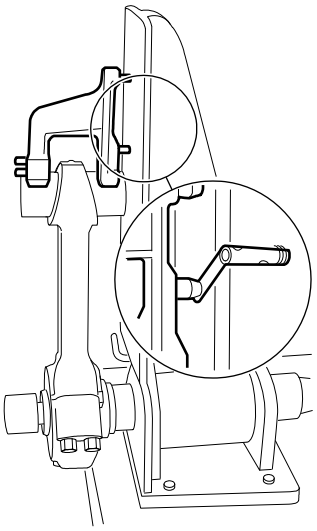


FG020401

Figure 191

Check whether the connecting rod is bent with the indicator studs vertical.

NOTE: *Checking for bent connecting rod.*



FG020402

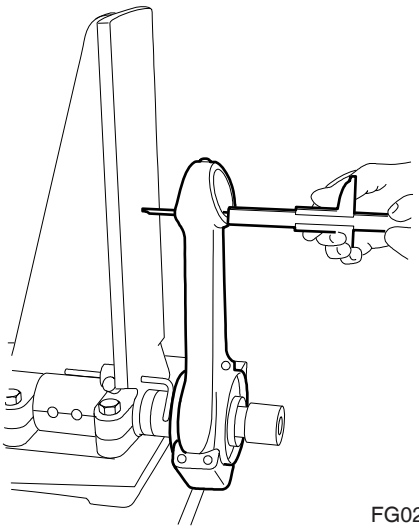
Figure 192

The distance between the indicator studs on the tool illustrated here is 75 mm. The distance between one of the indicator studs and the measuring surface must be max. 0.1 mm when measured using this tool. Check with a feeler gauge.

Check also whether the connecting rod is bent in an S-shape. This is done by measuring the distance between the outside of the connecting rod bushing and the level surface of the tool.

Turn the connecting rod around and measure the corresponding distance. The deviation must not be greater than 0.6 mm.

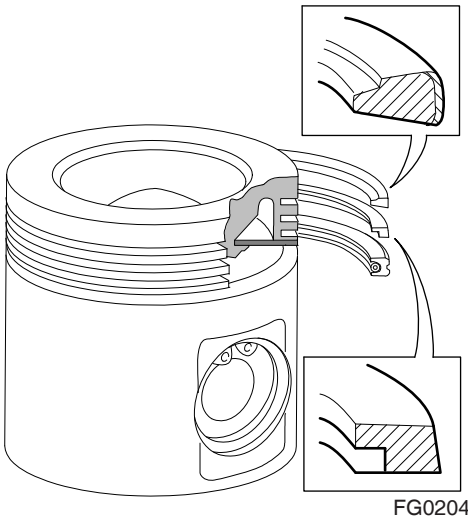
NOTE: *Checking whether the connecting rod is bent in an S-shape.*



FG020403

Figure 193

In order for the piston to run smoothly there must be a gap between the piston and the cylinder wall. The piston therefore has two compression rings which seal this gap and conduct the heat from the piston.



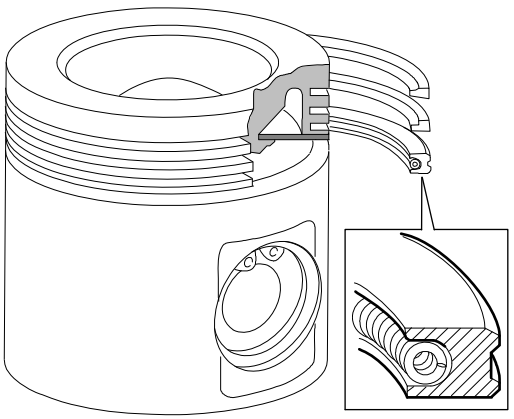
FG020428

Figure 231 Piston Compression Rings on Engines with Cylinder Block

The oil ring prevents lubrication oil from the crankcase getting into the combustion chamber.

Inside the oil scraper ring there is an expander which presses the ring against the cylinder wall. The expander is a coil spring.

The design of the piston and the piston rings is vital for the reliability, lubrication, oil consumption and fuel consumption of the engine.

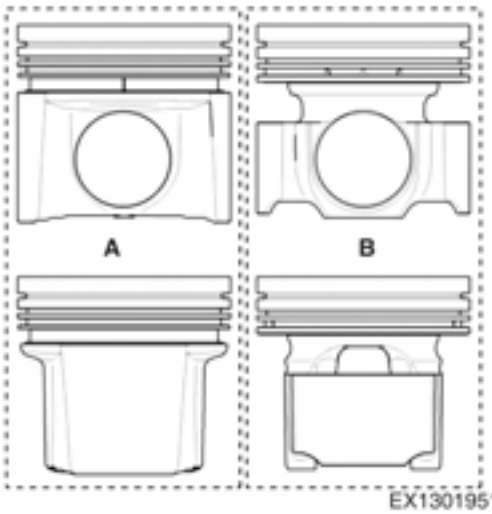


FG020429

Figure 232 Piston Oil Scraper Ring

IMPORTANT

Mixing different piston types is not permitted. Check the model and part number of the piston crown before installing.



EX1301951

Figure 233

Balance Shaft Unit

Description

The balance shaft unit counteracts vibrations which arise in the engine.

Location

The balancer shaft unit is mounted underneath the cylinder block.

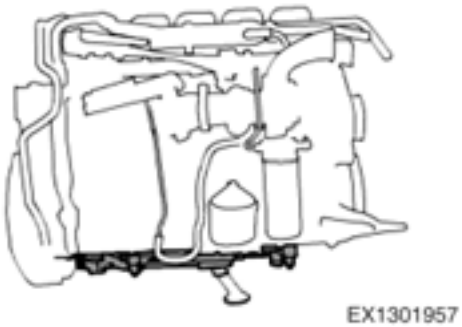
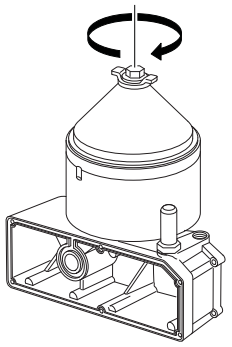


Figure 274

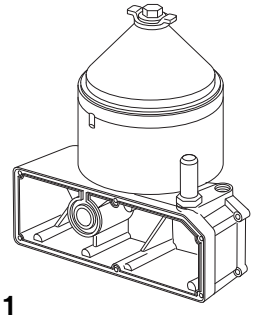
14. Reinstall the rotor cover. Ensure that the O-ring is not outside the cover.
15. Tighten the rotor nut by hand.
16. Check that shaft is not loose. Secure with thread-locking fluid 561 200 if it is loose. First clean thoroughly using a suitable solvent. Then tighten the rotor shaft using socket wrench 99 520.
17. Reinstall the rotor and rotate it by hand to make sure it rotates easily.



EX1301991

Figure 310

18. Install a new O-ring in the cover. Reinstall the cover and tighten the locknut.



EX1301992

Figure 311

Operational Testing of the Centrifugal Oil Cleaner

Operational testing need only be done if there is a suspicion that centrifugal oil cleaner is not working properly. For example, if there is an abnormally small amount of deposit in the centrifugal oil cleaner in relation to the distance driven.

The rotor rotates very fast and should continue to turn when the engine has stopped.

1. Run the engine until it reaches normal operating temperature.
2. Stop engine and listen for the rotor. Use your hand to feel if the filter housing is vibrating.

EX1301993

Figure 312

3. If the filter housing is not vibrating, dismantle and check the centrifugal oil cleaner.

Specification

Permitted thickness of deposits on the walls of the cover

Permitted thickness of deposits on the walls of the cover	28 mm

Example of Completed Driver's Log-book for Measuring Oil Consumption

Chassis Number	Chassis Type	Engine Serial Number	Dealer	Owner
No: 1 234 567		No:		

Date	Mileage (km) or Operating Time (hours)	Filled Fuel	Lubrication Oil Consumption*, Liters	Main Type of Driving Laden, Unladen
090703	37,905 km	250	1	
090705	38,477 km	250	2	
090711	39,125 km	300	etc.	
090714	39,845 km	275		
090720	40,256 km	etc.		
090722	etc.			
090723				
		Total: 3800	Total: 12	
* Enter the amount of lubricating oil used to top up.				

When changing oil, estimate how much oil has been consumed before the oil is drained or measure how much oil is drained from the engine.

Fuel consumed = 3800 liters

Oil consumed = 12 liters

Oil consumption in percent of fuel consumption: 12/ 3800 * 100% = 0.31

The consumption is slightly higher than recommended but is acceptable if most of the driving has been on fast main roads with low vehicle load.

Driver's Log-book for Measuring Oil Consumption

Chassis Number	Chassis Type	Engine Serial Number	Dealer	Owner
No:		No:		

Date	Mileage (km) or Operating Time (hours)	Lubrication Oil Consumption*, Liters	Filled	Main Type of Driving Laden, Unladen
			Liters	
			Liters	
			Liters	
			Liters	
			Liters	
			Liters	
			Liters	
* Enter the amount of oil used to top up.				

- Exhaust gas leakage between exhaust manifold and cylinder heads.
- Exhaust gas leakage in slip joints upstream of turbocharger.
- Exhaust gas leakage at turbocharger gasket.
- Exhaust gas leakage in joint between turbocharger turbine housing and bearing housing.
- Leakage at turbocharger turbine sealing rings during exhaust braking, which can result in high oil carryover levels.
- Worn engine components such as piston rings, cylinder liner, valve guides, valve stem seals or leaking valves, which can result in oily or sooty exhaust gases.
- Worn camshaft, which can result in insufficient valve lift on one or more cylinders.
- Depleted, diluted or unsuitable engine oil which can result in oily or sooty exhaust gases.
- Poorly performing injector (one or more) so fuel is inadequately atomized, which in turn can result in sooty exhaust gases.
- Incorrect diesel with a very high sulfur content or other contamination.
- Incorrect crankcase ventilation.
- Suction leakage in the fuel system, which can cause air bubbles which disrupt the fuel flow.
- Blocked fuel filter.
- Chip tuning.
- Bent connecting rods because of liquid slugging, caused by condensation in the charge air cooler.
- Leakage in the exhaust system, which can result in an incorrect back pressure.
- Silencer that has been dented, knocked or damaged in some other way, which can result in an incorrect mixture when reductant is injected.
- Incorrect reductant contaminated or diluted.
- Reductant residue in the silencer, which can result in malfunctions in the mixing chamber.
- Air compressor that is worn or defective in some other way, which can result in oily compressed air for reductant injection.

6. Check that O-rings in the cover are undamaged.
7. Reinstall the cover.
8. Reinstall the reductant doser.

NOTE: *Clean the surfaces of the evaporator and reductant doser and replace the graphite gasket before reinstalling the reductant doser.*

IMPORTANT

Tighten the screws in stages when installing and tightening the reductant doser. This is to ensure that reductant doser is correctly located and does not damage the graphite gasket.

Reference Number	Description
1	Housing
2	Bushing
3	Bushing
4	Pin
5	Bracket
6	Sleeve
7	Screw
8	Bolt
9	Screw
10	Tube
11	Electric Actuator
12	Bolt

Reference Number	Description
13	Shaft
14	Nut
15	Locknut
16	Link
17	Spring
18	Locknut
20	Pin
22	Gasket
23	Exhaust Brake Sensor
24	Turbo Clamp
25	Clamp

Location

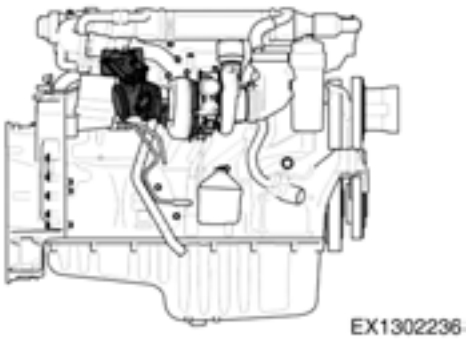


Figure 414

Function

Industrial engines use an electrically controlled damper for the exchange of gases. The exhaust brake bypass valve is positioned downstream of the turbocharger near the exhaust manifold.

By controlling the damper position, the exhaust gases are restricted thus creating a back pressure. Apart from enhancing the engine braking action, the back pressure created also warms up the engine more rapidly and keeps the exhaust gas aftertreatment system warm.

Removing Exhaust Brake

IMPORTANT

Risk of crush injuries. The actuator can be activated automatically when supplied with voltage. Caution!

1. Drain the coolant.

5. Clean the sealing surfaces and check that they are free from unevenness; grind carefully with an emery cloth if necessary.

Figure 439

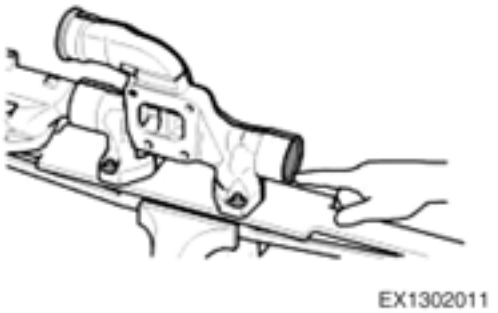


Figure 440

6. Install the new sealing ring on the assembly tool and then tap the sealing ring into place with a rubber/plastic mallet.

Figure 441

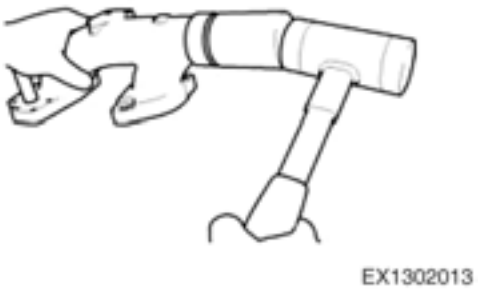


Figure 442

Controlling the flow

The engine control unit controls the flow of exhaust gases. The control unit regulates EGR content, i.e. the volume of exhaust gases that are returned to the engine. The level is measured in percent 10% EGR content means that 10% of the total flow into the engine is exhaust gas and 90% is air.

The mass flow sensor detects and informs the control unit of how much air passes into the engine. The control unit also receives information from the charge air pressure and temperature sensors and exhaust gas pressure sensor. The control unit uses information from the sensors to calculate the total volume of gas (air and exhaust gases) which enter the cylinders. By measuring the total volume of gases and subtracting from this the airflow from the mass flow sensor, the control unit calculates the EGR content.

To increase measurement accuracy and to avoid incorrect values, the control unit shuts the EGR valve for a preset time interval, to avoid any gases flowing back to the cylinders. The control unit compares the value from the mass flow sensor with the calculated gas volume entering the cylinders. These two values must be the same. If the values do not agree, the control unit calibrates the mass flow sensor. The system is set in motion when the engine is started and warmed up.

If a fault occurs in the system which results in the control unit not being able to control the components as expected, fault codes are generated and the control unit reduces the engine power until fault is rectified.

Cold engine

The EGR valve is closed until engine has been warmed up. No exhaust gases are then circulated.

Warm engine

Once the engine has been warmed up, the EGR valve is open and exhaust gases then circulate in the EGR system. Where the throttle is rapidly opened, the engine control unit reduces the EGR content. This is intended to compensate for the shortage of induction air that occurs before the turbocharger begins to charge.

Shut-off conditions

- The control unit shuts down the EGR system if:
- The charge air temperature falls below a specific value. There is then a risk of freezing in the intake manifold.
- The engine is at such a high altitude that the air pressure affects its performance.
- Coolant temperature is too high. At very high coolant temperature, the control unit closes the EGR valve to avoid loading the engine with additional heat from the EGR cooler.
- The white smoke limiter is active.
- There is a risk of the EGR system freezing if the ambient temperature is very low.

5. Drain the cooling system.
6. Fill the cooling system with clean, hot water and run the engine for about 20 - 30 minutes.
7. Drain the water from the cooling system.
8. Reinstall the thermostats.
9. Fill the cooling system with fresh coolant.

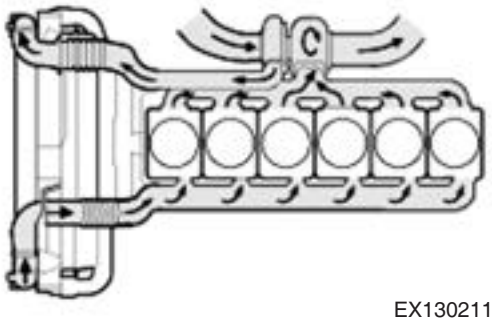
Charge Air Cooler

Function

Maximum engine output depends among other things on the amount of fuel that can be efficiently combusted in the engine.

Cold air has a higher density and contains more oxygen by volume than heated air. The temperature of the intake air increases when passing through the turbocharger. If the air then is cooled, the air density increases and more oxygen is supplied to the engine. This means that more fuel can be combusted.

If more fuel is combusted, this results in higher output, lower fuel consumption and lower emissions. The cooled air lowers the combustion temperature and the temperature of the parts affected by the combustion, resulting in lower thermal stress despite the increased engine output.



EX1302113

Figure 495

Intake system

The intake system consists of pipes that lead air from the turbocharger to the charge air cooler. The charge air is cooled by the air passing on the outside of the charge air cooler.

After being cooled down, the intake air is led to the intake manifold, which distributes the air to the cylinders.

NOTE: *Replacing coolant hoses if there is clear damage to the coolant hoses which were removed.*

WARNING

AVOID DEATH OR SERIOUS INJURY

For ethanol-powered engines: Read the regulations for ethanol in document 00:01-02 before starting work Follow the instructions in the section Procedures for all work in the workshop.

Comply with the rules on working with ethanol which have been established locally for the workshop.

Test pressurizing the charge air cooler

Water separation

The fuel system is sensitive to water. Water must therefore be separated from the fuel.

Water is separated from the fuel in the water separating suction filter and is collected in the bottom of the fuel filter housing.

A proportion of the fuel from the pressure filter is led back to the fuel tank, and on its way back the fuel passes a venturi. The water is extracted from the water separating suction filter using the venturi and travels with the return fuel.

The water is collected in the fuel tank and if necessary the fuel tank must be drained of water.

Reference Number	Description
1	Venturi
2	Fuel Tank
3	Water Separating Suction Filter
4	Fuel
5	Water
6	Draining

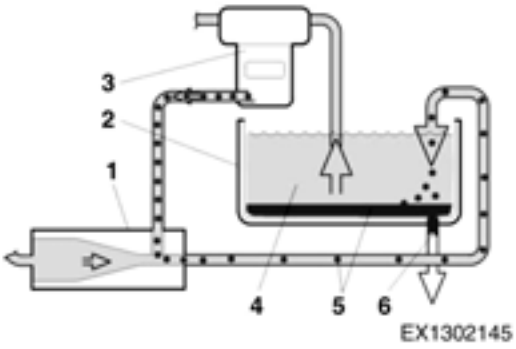


Figure 523

Measuring the Fuel Pressure

NOTE: *The test connection for measuring fuel pressure is located on the high-pressure pump (at the arrow to the left in the illustration) and the fuel manifold (at the arrow to the right in the illustration).*

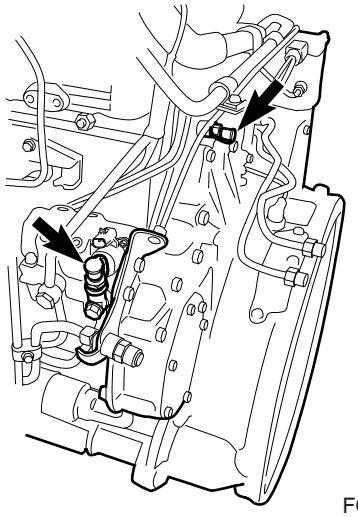


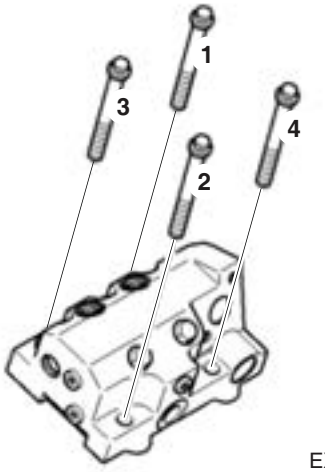
Figure 524

Measuring Supply Pressure

1. Connect pressure gauge 99 362 to the test connection on the high-pressure pump and open the test connection.
2. Crank with the starter motor for approximately 20 seconds. Read the pressure. The pressure must be more than 3 bar.
3. If the engine starts: Increase engine speed to 1,500 rpm. Read the pressure. The pressure must be between 9 and 14 bar.
4. Switch off the engine, remove pressure gauge and close the test connection.

Removing

1. Remove high-pressure pump.
2. Gradually slacken the screws on the cylinder head (8) in a diagonal sequence as illustrated. The tension in the springs can cause the cylinder head to stick if the screws are not slackened off in this way.
3. Remove cylinder head (6) with gasket (7).



EX1302068

Figure 548

Installing

4. If a new cylinder head is to be installed: Remove protection plugs on the new cylinder head. Install new springs, a new gasket and new screws.
5. Clean the pump surface that faces against the cylinder head. Check that guide pins under the roller tappets are straight and that roller tappets are correctly positioned so they go down completely in their seats; see illustration.
6. Install the gasket (7) on the high-pressure pump (1).
7. Install the cylinder head (6).
8. Lubricate the cylinder head screws (8) and install them on the cylinder head.

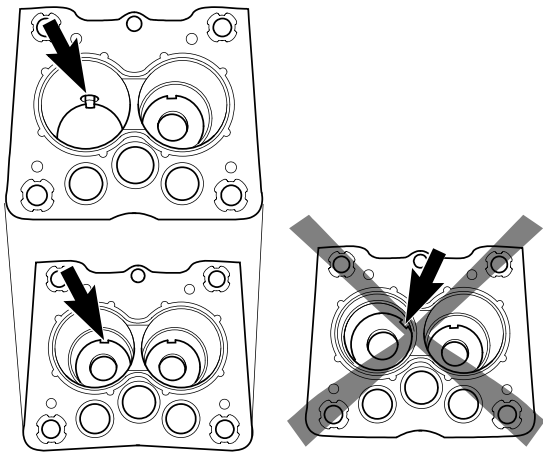
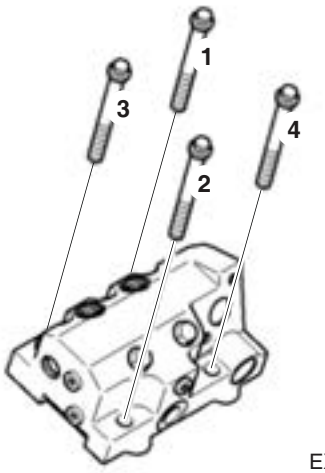


Figure 549

9. Gradually tighten the screws in a diagonal sequence as illustrated. The tension in the springs can make it difficult to screw on the cylinder head if the screws are not tightened in this way.
10. Install the seal and high-pressure pipe union (9) in the cylinder head.
11. Lubricate and install the two O-rings on the valve (14, 15). Then install the valve in the cylinder head using the two screws.
12. Install the high-pressure pump.

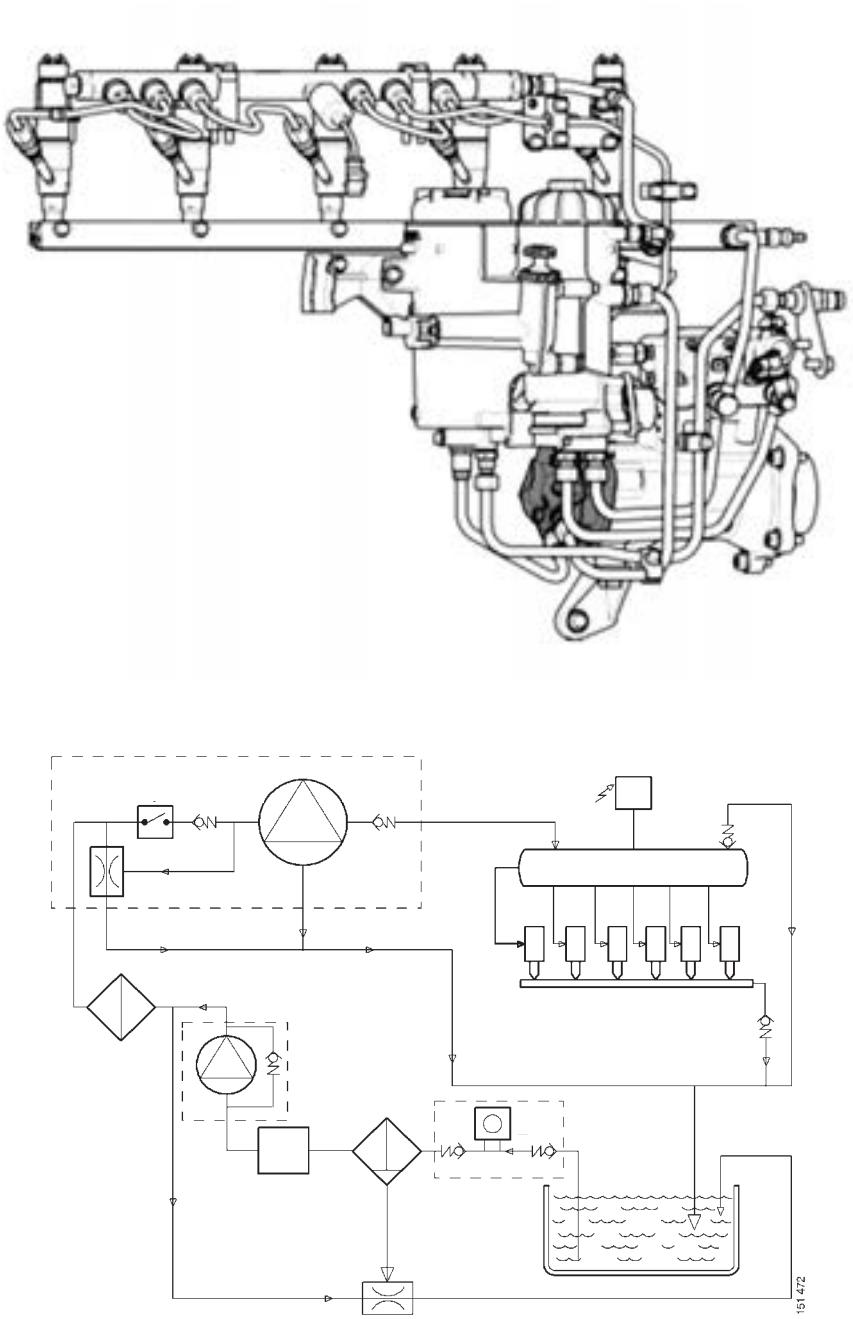


EX1302068

Figure 550

Check

High-pressure pump cylinder head.



EX1302185

Figure 575

Introduction

The EMS has been developed to control the Engine system. More components than before are controlled by the engine control unit and the control of some components has been extended.

- Rotational speed sensors (see also camshaft position sensor below in new EMS components)
- Coolant temperature sensor
- Charge air pressure sensor
- Charge air temperature sensor
- Oil pressure sensor
- Starter motor
- Fan
- Exhaust brake proportional valve
- Control of fuel injection
- Control of alternator/alternators
- Oil level sensor (improved oil level display, see below in new EMS components)
- Control of the EGR system and the variable geometry turbocharger
- Solenoid valve for the AC compressor
- New EMS components
- Camshaft position sensor (the number of rotational speed sensors is dependent on the combination of these and camshaft position sensors)
- Electric throttle
- Pressure upstream of the throttle
- Position sensor on pneumatic throttle
- New oil level sensor which provides an improved oil level display
- Rotational speed sensor and solenoid valve for the cooling fan

General

The engine management system controls the fuel system, EGR system, variable geometry turbocharger and several other components such as the alternator, starter motor, AC compressor and fan.

Electronic control of the fuel system provides increased control over injection, allowing combustion to be optimized. Optimum combustion results in turn in lower fuel consumption.

Electronic control of the fuel system is required to meet emission requirements.

Control Unit Pin	Task	Signal Type	Source/Destination
A19	Communication With the Engine Control Unit EMS	CAN Low	Engine Control Unit EMS (E44)
A20	Voltage Supply for the NOx Sensor	+24V	NOx Sensor Downstream of the Exhaust Gas Aftertreatment (T115)
A21	Grounding NOx Sensor 2	Ground	NOx Sensor Upstream of the Exhaust Gas Aftertreatment (T115)
A22	Communication With the Engine Control Unit EMS	CAN High	Engine Control Unit EMS (E44)
A23	Measuring NOx	CAN High	NOx Sensor Downstream of the Exhaust Gas Aftertreatment (T115)
A24	Measuring NOx	CAN Low	NOx Sensor Downstream of the Exhaust Gas Aftertreatment (T115)
A25			
A26			
A27			
A28	Logging of Data by CAN	CAN High	
A29	Measuring the Temperature, Level and Quality of Reductant in the Reductant Tank	CAN High	Sensor for Temperature, Level and Quality of Reductant (T4002) Deviations can occur
A30	Measuring The Temperature, Level and Quality Of Reductant In The Reductant Tank	CAN Low	Sensor for Temperature, Level and Quality of Reductant (T4002) Deviations can occur
A31	Logging of Data by CAN	CAN Low	
B1	Voltage Supply for Reductant Pump	+5V	Reductant Pump (V183)
B2	Regulation of Reductant Pump Speed	Output Signal, PWM Signal	Reductant Pump (V183)
B3	Injection of Reductant	Output Signal, PWM Signal	Reductant Injection Nozzle (V117)
B4	Signal Injection Nozzle for Reductant	Analogue Input Signal	Reductant Injection Nozzle (V117)
B5	Supply Injection Nozzle for Reductant	+5V	Reductant Injection Nozzle (V117)
B6	Injection of Reductant, Reductant Temperature	Input Signal	Reductant Injection Nozzle (V117)
B7	Injection of Reductant, Reductant Pressure	Input Signal	Reductant Injection Nozzle (V117)
B8	Injection of Reductant, Grounding	Grounding (0V)	Reductant Injection Nozzle (V117)
B9			
B10			
B11			
B12	Supply for the Reductant Pick-up Unit	+24V	Reductant Pick-up Unit
B13	Grounding of the Reductant Pick-up Unit	Ground	Reductant Pick-up Unit
B14			

Reference Number	Description
1	Not Used
2	L
3	15
4	Not Used
5	Not Used

On the alternator the charge regulator is constructed as a single unit with the carbon brushes.

The carbon brushes rest against the slip rings. The carbon brushes must be a certain length in order for the alternator to function.

If more power is required when the vehicle is stationary, the engine speed can be increased by adjusting the idle speed.

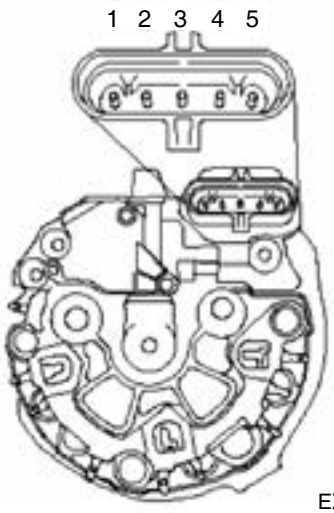


Figure 635

Removing Alternator

1. Cut the power using the battery master switch or by disconnecting the battery terminals.
2. If necessary clear the area. It may be necessary to remove mudguard, hatch, catwalk etc. to gain access.
3. Take the load off the belt transmission.

   Depending on the version, on engines with a 150 A alternator, the idler roller/belt tensioner must be removed before the screws securing the alternator are removed.

The illustration shows an 80 - 100A alternator.

4. Disconnect the positive cable 30 and the control cable.
5. Remove alternator.

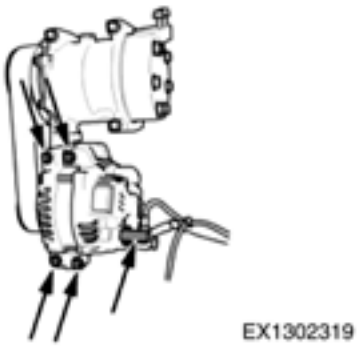


Figure 636

Connector C4000

Overview

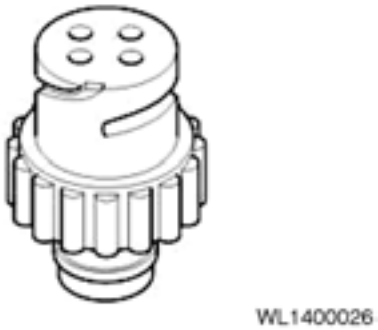


Figure 664

Connection

Pin	Signal
1	Voltage U15 to the Engine Control Unit
2	U3, Ground
3	CAN Signal High
4	CAN Signal Low

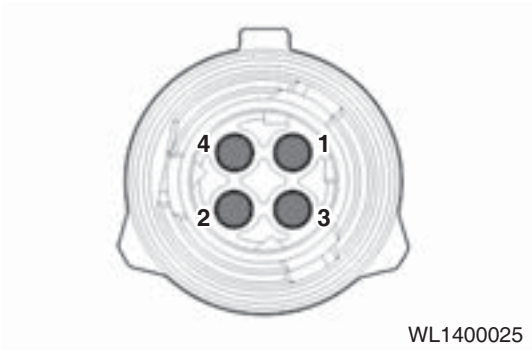


Figure 665

Location

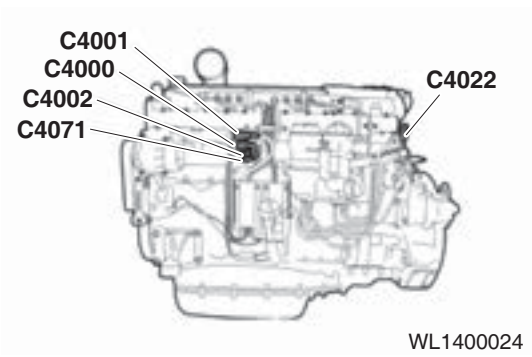


Figure 666

Engine Coolant Heater (Option)

Edition 1

Upper Structure

Left Glass

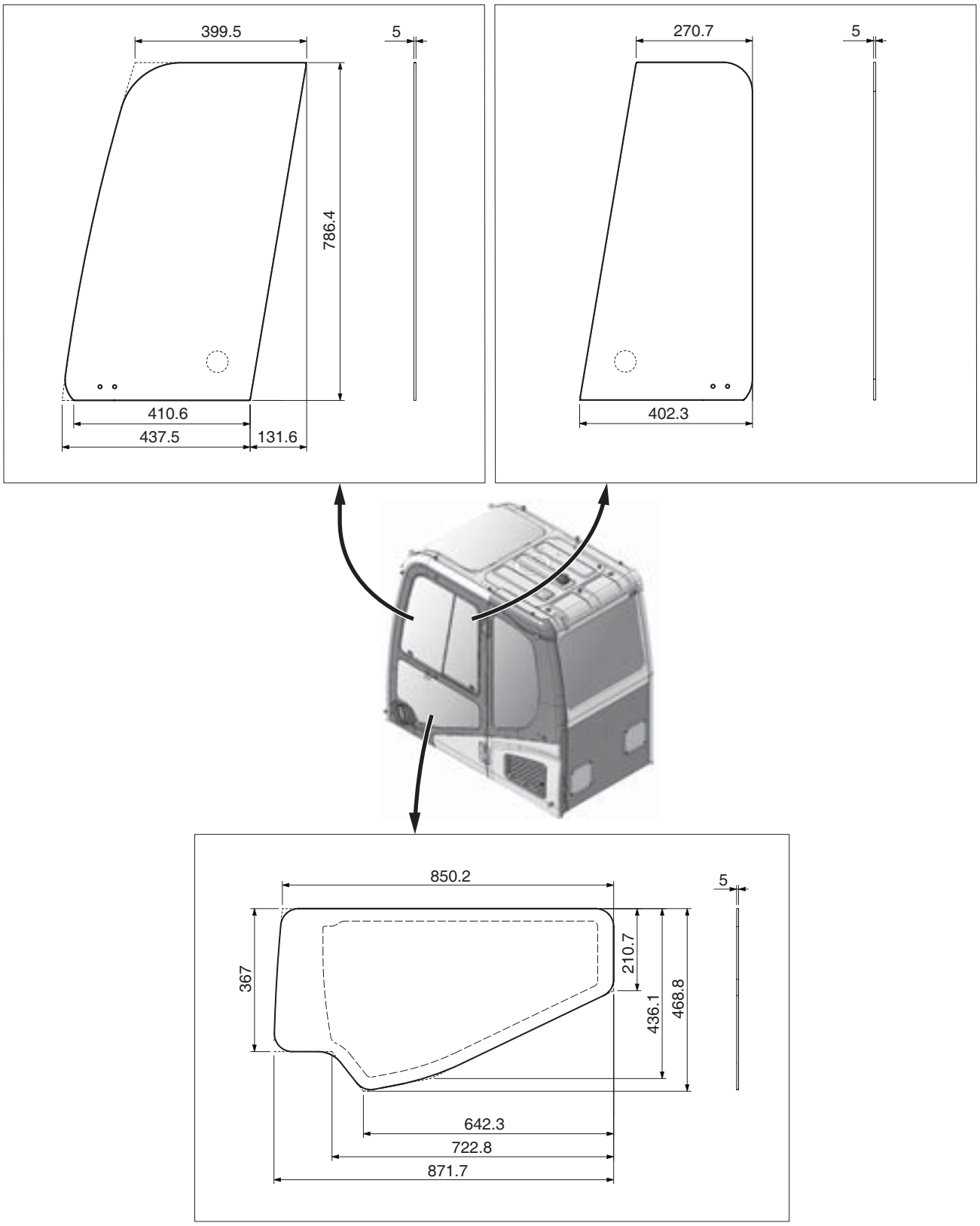


Figure 24

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

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.

12. Remove bolts and washers (1, Figure 9) (8 ea) with the guardrail (2) (1 ea).

    Remove bolts and washers (3, Figure 9) (4 ea) with cover of control valve (4).

    - Tool: 19 mm ()
    - Torque: 38.2 N.m (3.9 kg.m, 28.2 ft lb)
    - Control valve cover weight: 18 kg (39.7 lb)
    - Guardrail weight: 11 kg (24.3 lb)

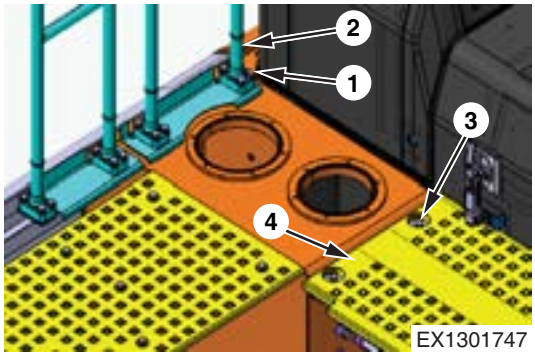


Figure 9

13. Install eyebolts (2 ea) on the oil tank.

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

    - Thread of hole: M10 x 1.5

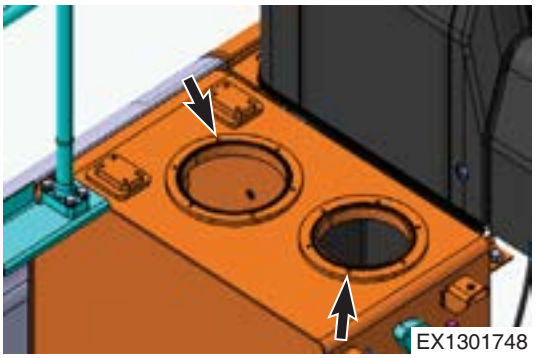


Figure 10

14. Open the right side door, remove bolts (2 ea). (Figure 11)

    - Tool: 19 mm ()
    - Torque: 107.8 N.m (11 kg.m, 79.5 ft lb)

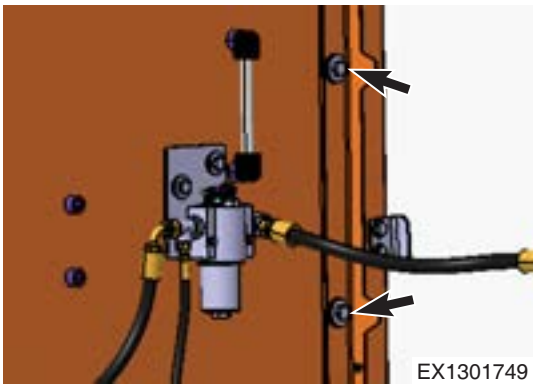


Figure 11

15. Remove bolts (1, Figure 12) (2 ea) with tank side cover (2).

    - Tool: 19 mm ()
    - Torque: 107.8 N.m (11 kg.m, 79.5 ft lb)
    - Tank cover weight: 20 kg (44.1 lb)

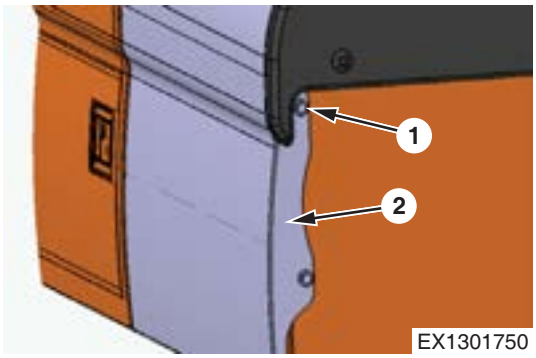
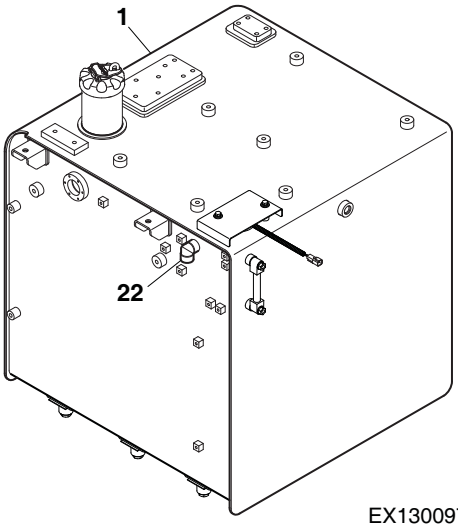


Figure 12

19. If equipped, remove components from fuel filler pump port (22, Figure 11) on side of fuel tank (1).

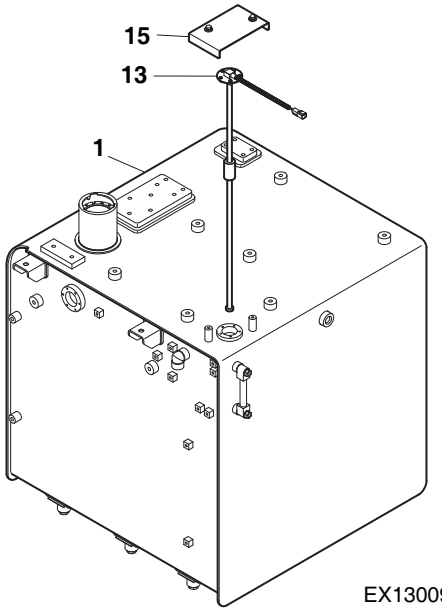


EX1300976

Figure 11

20. If equipped, remove cover (15, Figure 12) and fuel sensor.

    Remove cover (13) from fuel tank. Tag and disconnect wires leading to fuel sensor (13) on the fuel tank.



EX1300977

Figure 12

Reference Number	Description
11	Piston Assembly
13	Cylinder Assembly (R)
14	Cylinder Assembly (L)
111	Drive Shaft (F)
113	Drive Shaft (R)
116	1st Gear
123	Roller Bearing
124	Needle Bearing
127	Bearing Spacer
153	Set Plate
156	Bush
157	Cylinder Spring
211	Shoe Plate
30	Swash Plate Assembly
212	Swash Plate
214	Tilting Bush
80	Proportional Reducing Valve
79	E.P.P.R Valve
79-1	O-ring
79-2	O-ring
79-3	O-ring
325	Valve Casing
407	Screw
251	Support
261	Seal Cover (F)
271	Liquid Gasket
312	Valve Block
326	Seal Cover (F)
401	Socket Bolt
406	Socket Bolt
414	Socket Bolt
466	Plug
467	Plug
468	Plug

Reference Number	Description
490	Plug
530	Tilting Pin Assembly
531	Tilting Pin
548	Feed Back Pin
532	Piston
534	Stopper (L)
535	Stopper (S)
41	Check Valve Assembly (1)
543	Stopper
42	Check Valve Assembly (2)
541	Seat
544	Stopper
545	Steel Ball
702	O-ring
710	O-ring
717	O-ring
724	O-ring
725	O-ring
726	O-ring
728	O-ring
732	O-ring
774	Oil Seal
789	Backup Ring
792	Backup Ring
806	Nut
808	Nut
824	Retaining Ring
885	Valve Plate Pin
886	Spring Pin
901	Eye Bolt
953	Screw
954	Screw
*	Pump Seal Kit

23. Remove bolts (10 ea) of pump without top bolts (2 ea).
    - Tool: 17 mm ( )
    - Torque: 63.7 N.m (6.5 kg.m, 47 ft lb)

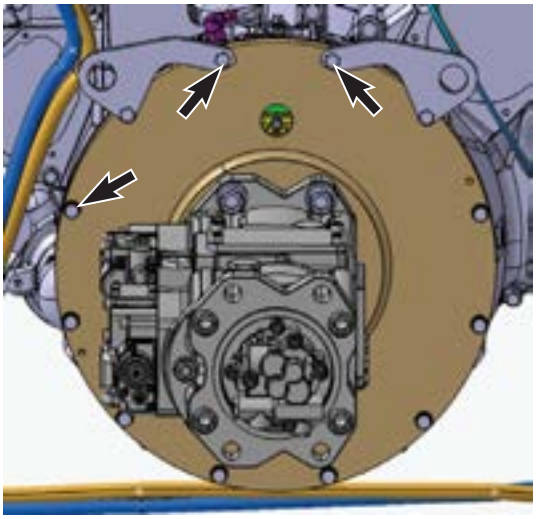


Figure 34 EX1301554

24. Attach a lifting device around pump. Raise the lifting device until the pump is supported prior to removing remaining bolts (2 ea).
    - Weight: about 136 kg (300 lb)

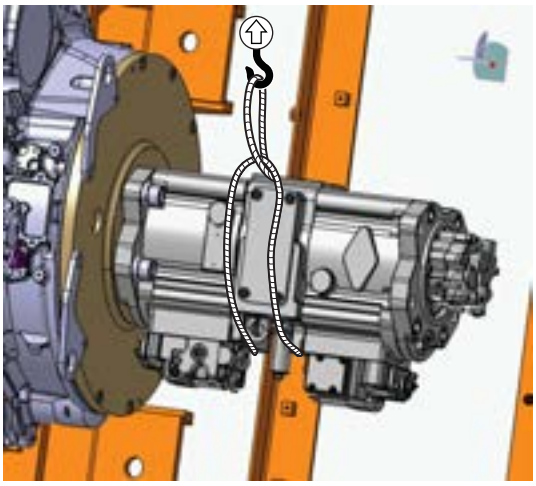


Figure 35 EX1301555

25. Remove remaining bolts (2 ea).
    - Tool: 17 mm ( )
    - Torque: 63.7 N.m (6.5 kg.m, 47 ft lb)

CAUTION

AVOID INJURY

Be careful don't drop the pump.

Figure 36 EX1301556

protruding pin (897) fixed to the feedback lever (611), the pin (897) moves to the right as lever 2 rotates. Since the opposing-flat section (D) of the feedback lever is attached with the pin (548) fixed by the tilting pin (531) that swings the swash plate, the feedback lever rotates around the fulcrum of point D, as the pin (897) moves. Since the feedback lever is connected with the spool (652) by the pin (874), the spool moves to the right.

The movement of the spool causes the delivery pressure P1 to connect to port C liter through the spool and to be admitted to the large-diameter section of the servo position. The delivery pressure P1 that is constantly admitted to the small-diameter section of the servo piston moves the servo piston to the right because of the area difference, resulting in decrease of the tilting angle.

When the servo piston moves to the right, point D also moves to the right. The spool is fitted with the return spring (654) and is tensioned to the left at all times, and so the pin (897) is pressed against the large-hole section (C) of lever2. Therefore, as point D moves, the feedback lever rotates around the fulcrum of point C, and the spool is shifted to the left. This causes the opening between the sleeve (651) and spool (652) to close slowly, and the servo piston comes to a complete stop when it closes completely.

12. Insert spring seat (644), pilot spring (646) and adjusting ring (Q) (645) into pilot hole.
13. Install spring seat (624), inner spring (626) and outer spring (625) into compensating hole.

IMPORTANT

When fitting spring seat, do not mistake direction of spring seat.

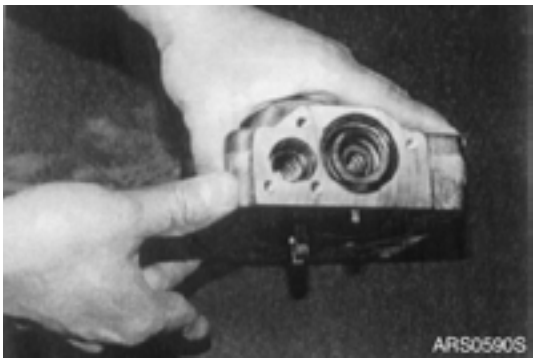


Figure 88

14. Install cover (C) (629) with adjusting screws (628 and 925), adjusting ring (C) (627), locknut (630), hex nut (801) and adjusting screw (924). Secure them with hex socket head screws (438).

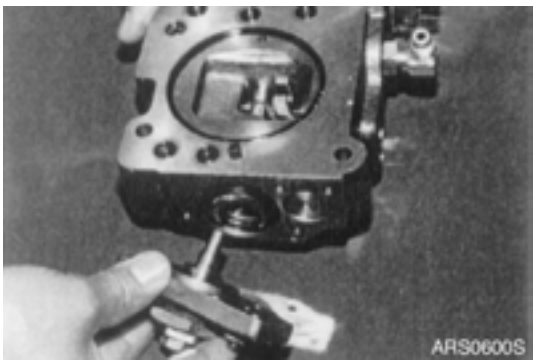
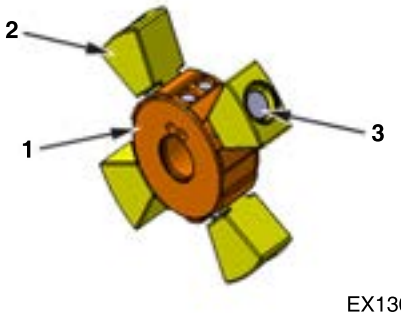


Figure 89

2. Assemble the insert (2, Figure 6) (4 ea) with socket bolts (3) (4 ea) to hub (attached by spring pin).
   - Torque: 431.2 ~ 480.5 Nm
     (44 ~ 49 kg.m, 318.3 ~ 354.4 ft lb)



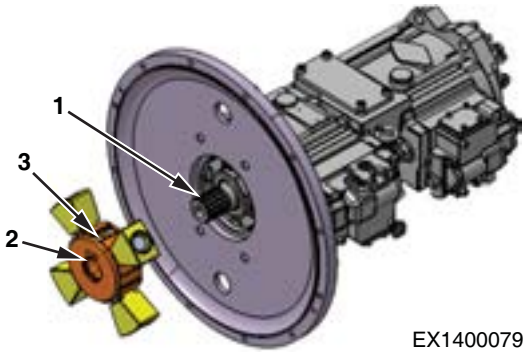
EX1301565

Figure 6

3. Slide hub into place on pump shaft (1, Figure 7) until retaining ring (2) in the hub touches the pump shaft (1) and secure it in position with clamping bolts (3).
   - Torque: 196.1 ~ 215.7 Nm
     (20 ~ 22 kg.m, 144.7 ~ 159.1 ft lb)

   NOTE: *Coat clamping* bolts *(3, Figure 7) with Loctite #262.*

   NOTE: *Refer to "Dimension" on page -5-6-9 of "H", "I".*



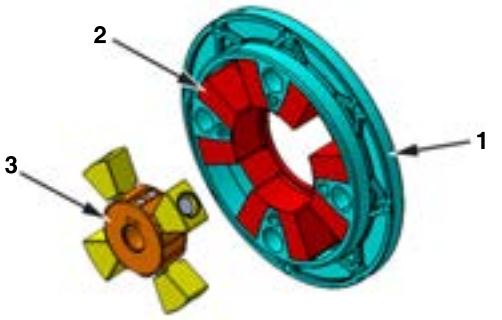
EX1400079

Figure 7

4. Install element (2, Figure 8) on the flange (1) on engine flywheel.
5. Install main pump and hub (3, Figure 8) by pushing it softly into element (2).

IMPORTANT

1. **Bolts are coated against loosening with a bonding compound. Do not use any additional bonding compounds, oils or cleaning solvents on them.**
2. **Element (2, Figure 8) is not resistant to bonding compounds, oil or grease. Be careful not to expose them to it.**
3. **Remove oil or dirt from flywheel cover and pump shaft before assembly.**
4. **Misalignment between pump and engine must be controlled to less than 0.5 mm (0.019 in).**



EX1301567

Figure 8

Reference Number	Description
1	Housing Valve
2	Arm Spool Assembly 2
3	Boom Spool Assembly 1
4	Bucket Spool Assembly
5	Travel Spool Assembly
6	T/S Spool Assembly
7	O-ring
8	Cap
12	Cap
13	Housing Valve
14	Arm Spool Assembly 1
15	Boom Spool Assembly 2

Reference Number	Description
16	Swing Spool Assembly
17	Option Spool Assembly
50	Plug
62	O-ring
63	Orifice Plug
65	O-ring
66	O-ring
70	Foot Relief Valve
72	Plug Assembly
74	Socket Bolt (M10 x 28L)
91	Plug
105	Plug Assembly

Arm Spool Shift

1. Neutral

   This valve also works with an antidrift valve that is installed on rod side of the arm cylinder.

   When in neutral, poppet (AD1) is closed by port (A5) pressure that is sent through passage (AD2), spool (AD3) and to spring chamber (AD4).

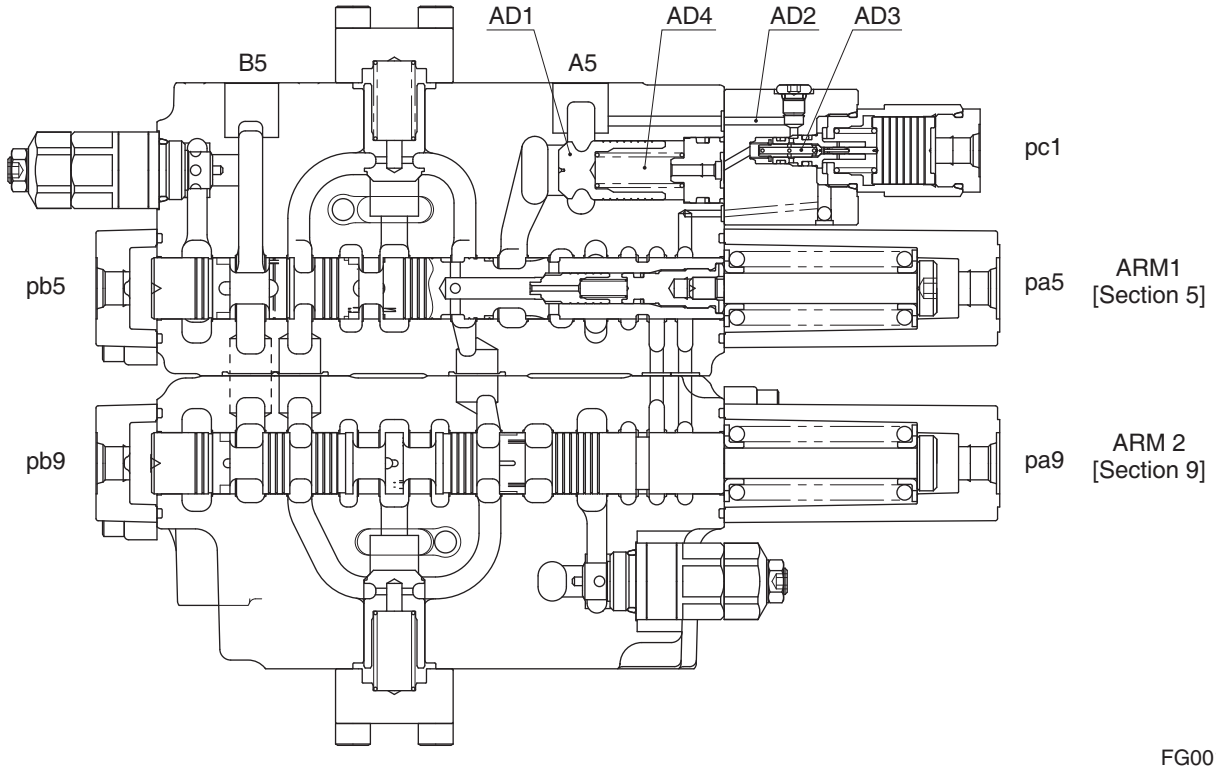


Figure 17

PRECAUTION

Lower the work equipment to the ground and stop engine.

Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping

Loosen the breather slowly to release the pressure inside the hydraulic tank.

Escaping fluid under pressure can penetrate the skin causing serious injury.

When pipes and hoses are disconnected, catch the oil with an oil pan.

Tools and Torques

Tool	Torque
Allen Wrench 4	1.5 kg.m
Allen Wrench 5	0.9 ~ 1.1 kg.m
Allen Wrench 6	1.6 kg.m
Allen Wrench 8	4 ~ 4.5 kg.m
Allen Wrench 14	17 ~ 18 kg.m
Wrench 17	7.3 kg.m
Wrench 22	4 ~ 4.5 kg.m
Wrench 27	11 kg.m
Wrench 32	11 kg.m
Wrench 30	6 ~ 7 kg.m
Wrench 36	22 kg.m
Wrench 38	15 ~ 16 kg.m
Bit Wrench 4	
Bit Wrench 4	
Loctite 271	

CAUTION

AVOID INJURY

Be careful, there is not a poppet and spring in travel straight valve section (Section H-H).

3. Remove socket head bolt (75, width across flats: 8 mm) and flange (52, two places).
4. Remove spacer (53) from valve housing. Remove O-ring (54) and backup ring (55) from spacer (53).
5. Remove spring (35) and poppet (34) from valve housing.
6. Remove plug (72, width across flats: 8 mm) (Section C-C).
7. Remove spring (33) and poppet (32) from valve housing.
8. Remove plug (72, width across flats: 8 mm) (Section L-L).
9. Remove spacer (57), spring (33) and poppet (32) from valve housing.
10. Remove plug (92, width across flats: 36 mm) (Section G-G).
11. Remove socket head bolt (73, four places, width across flats: 8 mm) and flange (43).
12. Remove spring (45), poppet (44) and O-ring (36) from valve housing.
13. Remove plug (46, width across flats: 27 mm) and O-ring (47).
14. Remove spring (48) and poppet (49) from valve housing.
15. Remove socket head bolt (101, four places, width across flats: 8 mm) from body (96, one places).
16. Remove body (96) from valve housing. Remove sleeve (99), piston (97), spring (98), poppet assembly (100), backup ring (103), and O-ring (104).
17. Remove O-ring (36).
18. Grip body (96) in vise. Remove plug (94), piston (95) and O-ring (102).

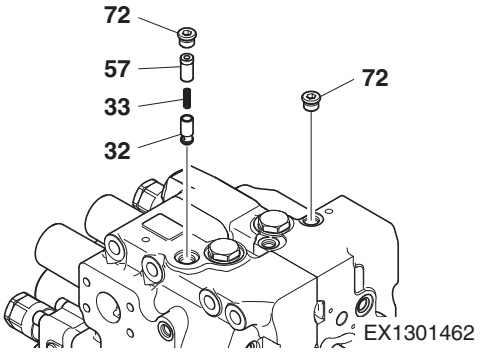


Figure 63

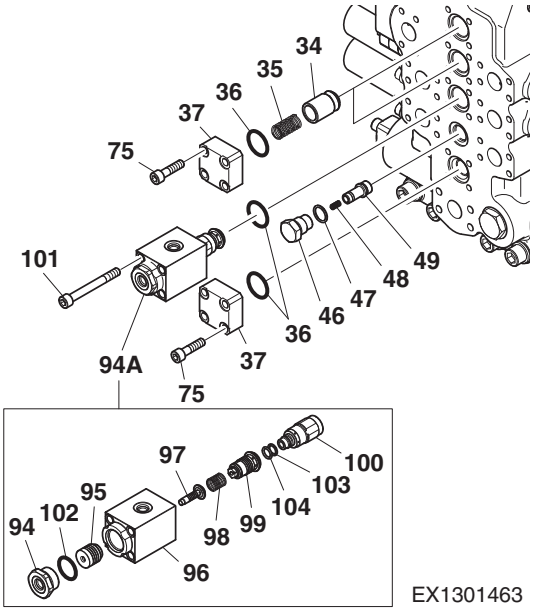


Figure 64

10. Insert poppet (32), spring (33), and spacer (57) in arm 2 para turn part (Section L-L). Install plug assembly (72) with O-ring. Tightening torque: 7.44 ~ 8.06 kg.m (54 ~ 58 ft lb). Allen Wrench 8.

Assembly of Antidrift Valve

1. Install O-rings (41 and 42) on surfaces of antidrift valve assembly of arm 1 section (Section D-D) and boom 1 section (Section E-E).
2. Insert poppet (38) and spring (39). Install spacer assembly (40) with O-ring and backup ring.

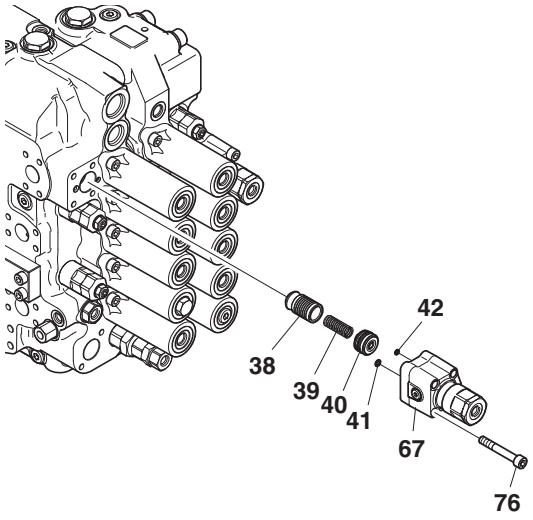
IMPORTANT

Be careful of installation position of O-ring and backup ring.

If they are reversed, the O-ring will be damaged and an oil leak can occur.

Check installing of O-ring (40-4) on spacer assembly and be careful of installation direction.

3. Install antidrift valve assembly (67, two places) and socket head bolt. Tightening torque: 3.98 ~ 4.49 kg.m (29 ~ 32 ft lb). Allen Wrench 8.

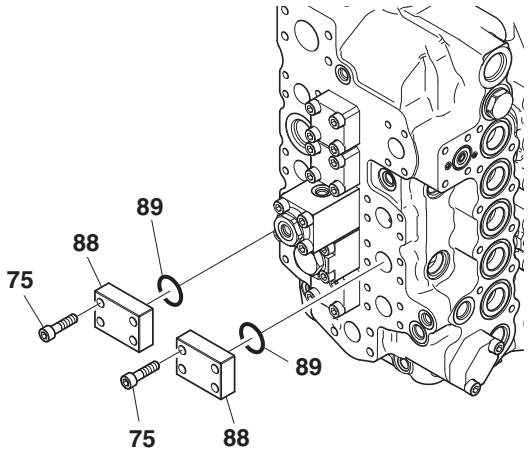


EX1301464

Figure 84

Assembly of Option Section Part

1. Install O-ring (89) on cap (88, two places) and fasten it in place with socket head bolt (75). Tightening torque: 5.91 ~ 6.53 kg.m (43 ~ 47 ft lb). Allen Wrench 8.



EX1301466

Figure 85

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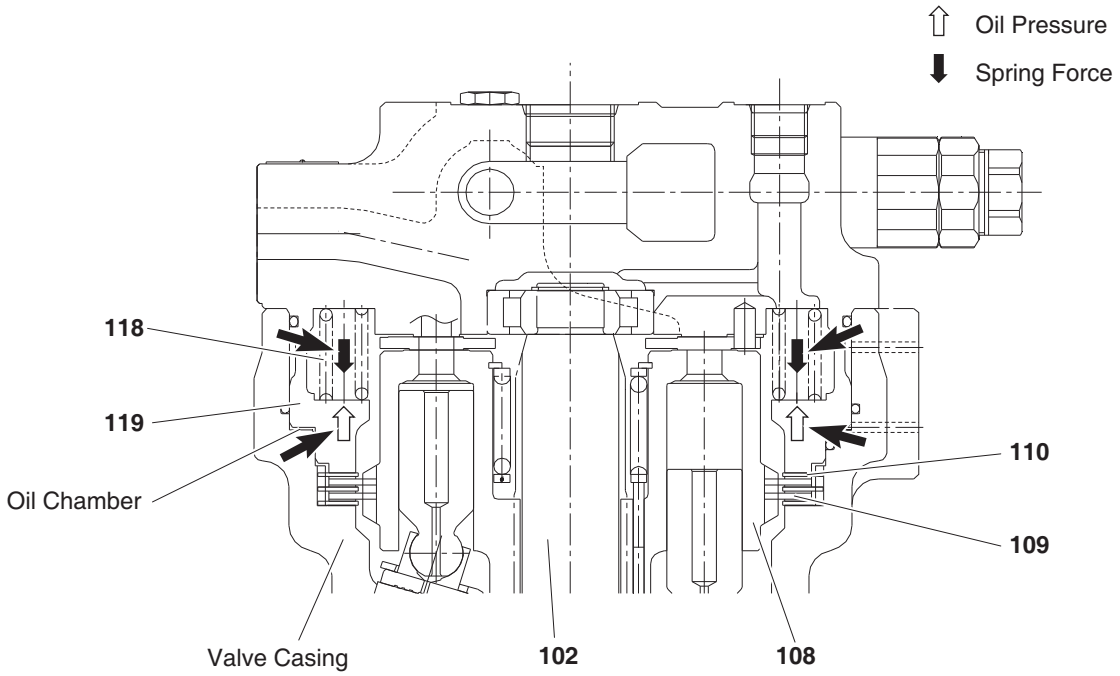
Swing Device

Brake Part

The cylinder block (108) is connected with the driveshaft (102) by spline joint, and rotation of the separation plate (110) in circumferential direction is restricted by the circular arc grooved on the casing (115). When the friction plate (109), engaged with the outer circumference of the cylinder with gears, is pressed to the casing (115) by the brake spring (118) with the separation plate (110) and brake piston (119) as the media. Friction force is generated between the friction plate and casing, separation plate and brake piston. This friction force restricts and brakes the driveshaft.

When brake release pressure is applied to the oil chamber formed between the brake piston and casing and this pressure overcomes the spring force, the brake piston moves and the friction plate is separated from the casing, and the brake is released.



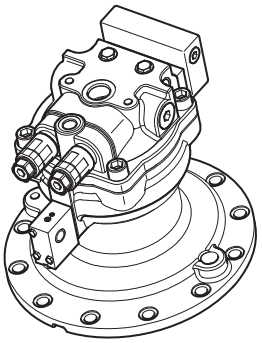
EX1301622

Figure 14 Operation Diagram of Brake

No.	Part Name
201	Casing
202	Pinion Shaft
203	Preload Plate
204	No.2 Carrier
205	No.2 Planetary Gear
206	Pin
207	Bushing
208	No.1 Carrier
209	No.1 Planetary Gear
210	No.1 Thrust Washer
211	No.2 Sun Gear
212	No.1 Sun Gear
213	Ring Gear
214	Cover
215	No.2 Thrust Washer
216	Thrust Plate

No.	Part Name
217	Thrust Washer
218	Oil Seal
219	Screw
220	Spherical Roller Bearing
221	Cylindrical Roller Bearing
222	Spring Pin
224	Hex Bolt
225	Needle Bearing
226	Inner Ring
227	Socket Bolt
228	PT Plug
230	Screw
231	PT Plug
232	Magnet
234	Pin

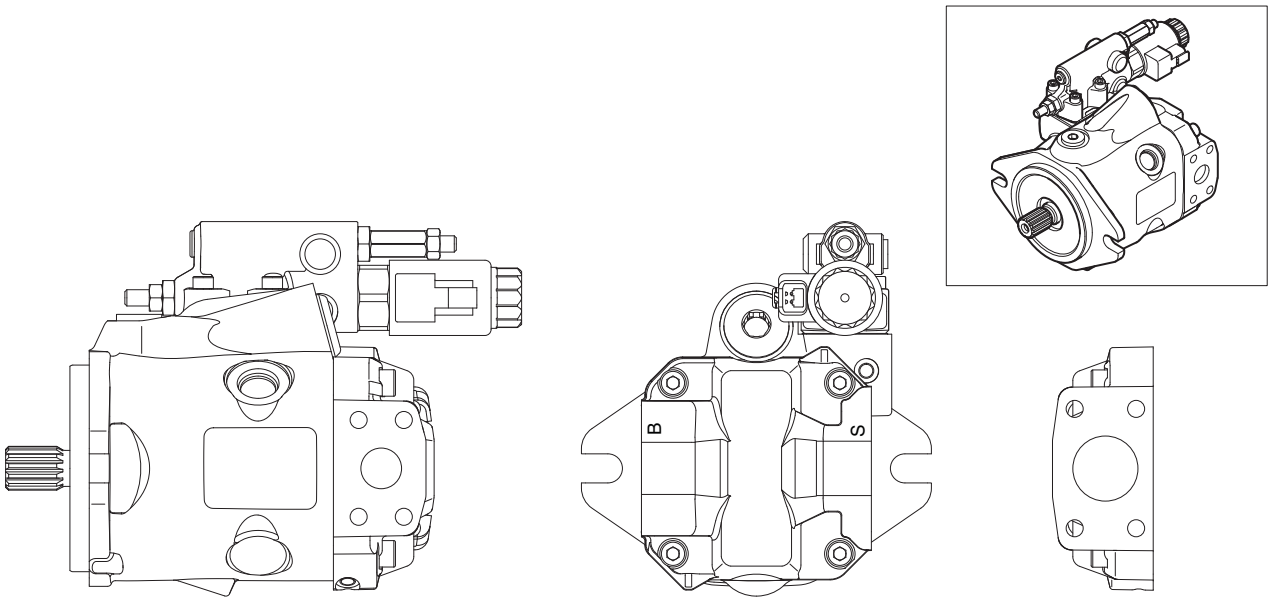
23. Wash the contact surface with the reduction gear with flushing oil and dry it with compressed air.



EX1401962

Figure 87

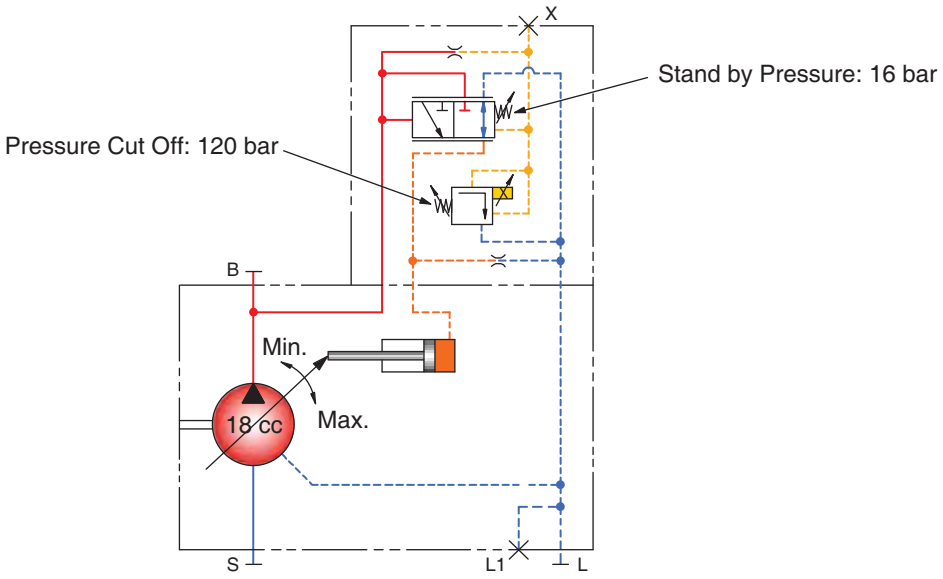
Overview



EX1301359

Figure 1

Port and Hydraulic Circuit

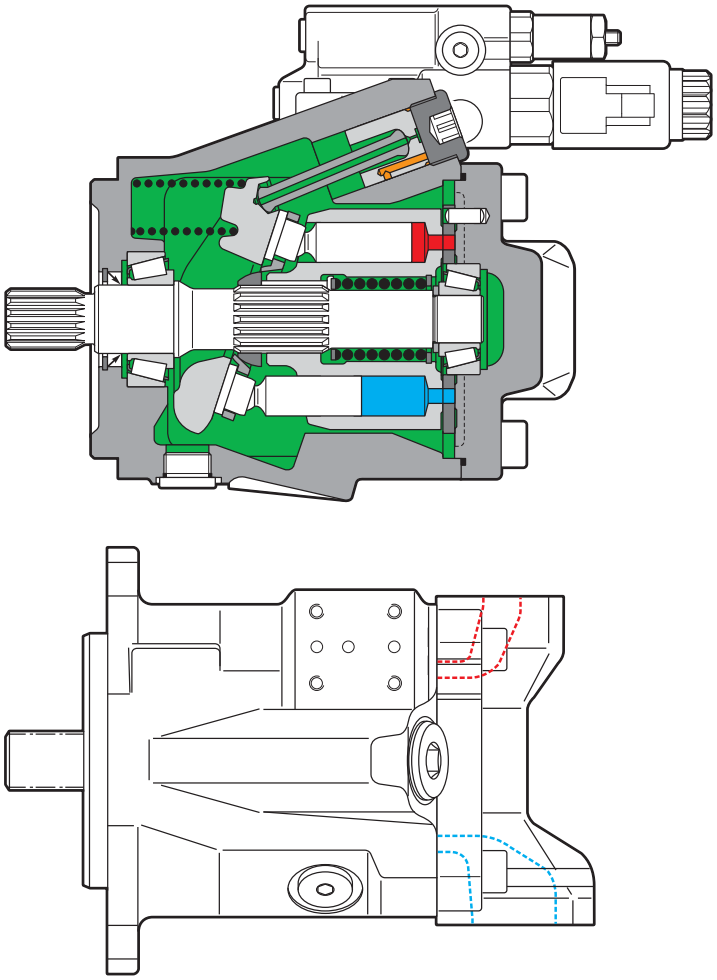


EX1401186

Figure 2

Port	Name	Size
B	Pressure	SAE 3/4
S	Suction	SAE 1 1/4
L	Case Drain	3/4-16UNF-2B

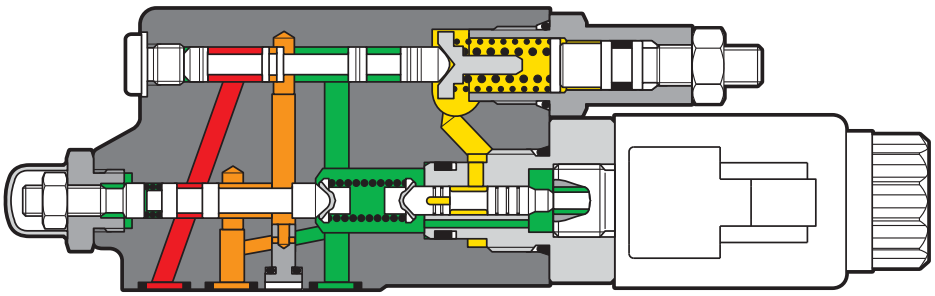
SECTION VIEW



EX1301987

Figure 33

EPPR Valve



EX1301988

Figure 34

Table of Contents

Fan Motor for Oil Cooler

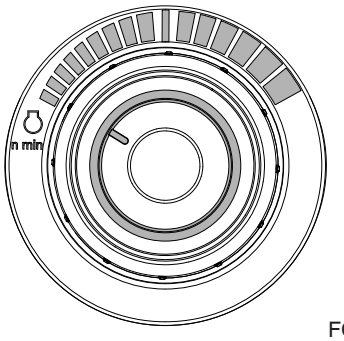
Gear Pump (Rotation)

Edition 1

Joystick Valve (Work Lever)

COMPLETING WORK

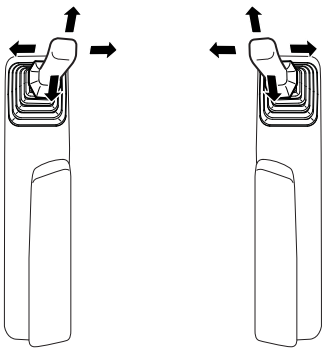
1. Start engine and set throttle at "LOW IDLE".
2. Move safety lever to "UNLOCK" position.



FG019382

Figure 26

3. Slowly cycle boom, arm, bucket cylinders and swing motor about five times without a load to vent air from pilot lines. Do this for five minutes.
4. Perform the machine performance test.



FG018384

Figure 27

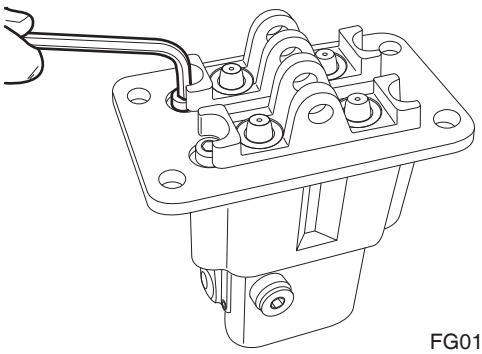
SAFETY INSTRUCTIONS

WARNING

AVOID DEATH OR SERIOUS INJURY

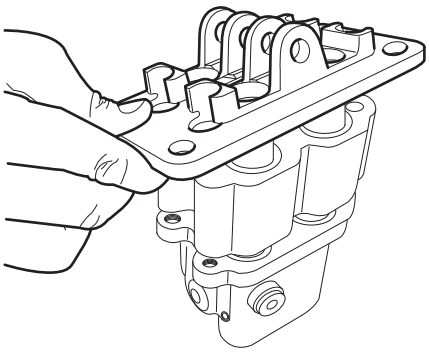
Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or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

5. Remove hex socket head bolt (25) and cover (24) from each body (1 and 2).



FG013539

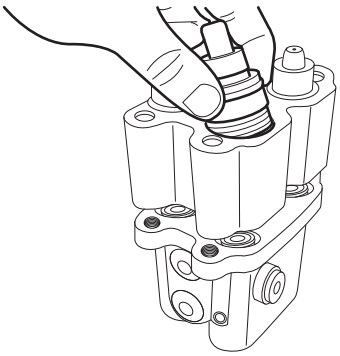
Figure 26



FG013540

Figure 27

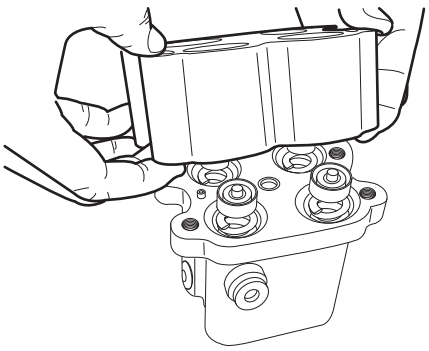
6. Remove push rod assembly from body (2).



FG013541

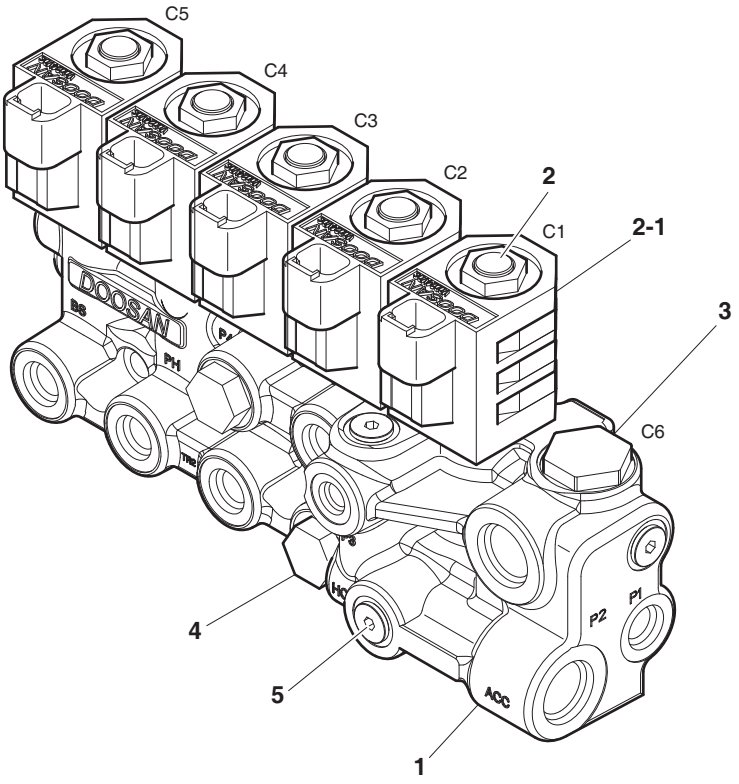
Figure 28

7. Remove body (2) from body (1).



FG013542

Figure 29



EX1301274

Figure 2

Reference Number	Description	Quantity	Remarks
1	Block Body	1	
2	Solenoid Valve	5	C1 - C5
2-1	Coil (Deutsch Type)	5	C1 - C5
3	Check Valve	1	C6
4	Plug	3	P3, P4, H0
5	Plug	6	

Reference Number	Function	Operations	Remarks
C1	Pilot Cut-off	Provides pressurized oil coming from the pilot pump for the pilot pressure supply solenoid valve to operate each work system.	
C2	Breaker Pressure Supply	Supplies pilot pressure for the pedal valve assembly and shuttle valve.	Optional
C3	High/Low Travel Speed	Sets low and high travel speed. Shifts speed between both depending on the state of the solenoid valve or a signal detected in the EPOS controller.	
C4	Main Pressure (Power Boost) Increase	Temporally increases the pressure setting of the main relief valve, to increase the excavation power.	
C5	Two-Pump Mode Selection	Supplies pilot pressure to two-pump valve that controls the two-pump function so it ready to work in the two-pump mode during breaker/shear mode.	Optional

SAFETY INSTRUCTIONS

WARNING

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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

The accumulator is a gas-charged storage device designed to hold a reserve quantity of hydraulic fluid under pressure. Accumulators are used in hydraulic circuits in much the same way that condensers (or capacitors) are used to collect, store and maintain electrical charge in a circuit.

In a hydraulic circuit, minor variations or lags in pump output that might otherwise cause unsteady or irregular operation are made up from the supply of pressurized oil in the accumulator.

Reference Number	Description
1	Screw Plug
2	Steel Pressure Vessel
3	Diaphragm
4	Fluid Valve

Accumulators are solidly constructed to resist the high operating pressures of the fluids they contain. There are only three main moving parts: a plug at the top allows precharging or expelling gas from the compressible, precharged upper chamber; a valve assembly at the bottom of the accumulator for passing hydraulic fluid in and out, and an elastic diaphragm to separate the two chambers. The flexible diaphragm changes shape to conform to the changing pressures and volumes of the two fluids in the upper and lower chambers.

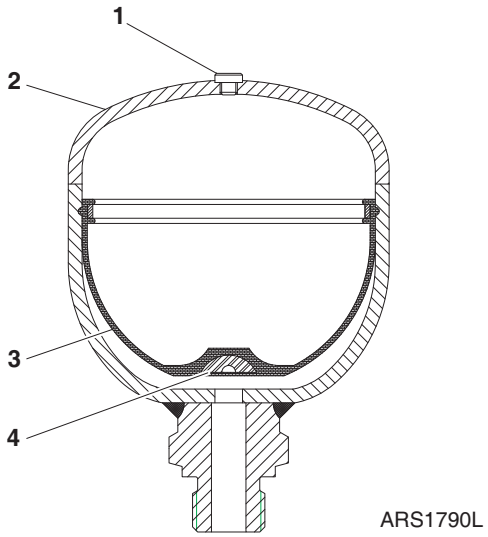


Figure 1

Center Joint

Edition 1

9. Remove the O-ring (10, Figure 21) (1 ea), dust seal (7) (1 ea), O-ring (6) (1 ea) and slipper seal (8) (7 ea) from the hub (1).
10. Remove foreign substance on pieces disassembled and wash them out.
11. Replace disassembled O-rings, dust seal and slipper seals with new ones, for they cannot be reused.
12. Clearance between the spindle and body of the center joint must be tight. Replace or repair either component if there is more than 0.1 mm (0.0039") of measurable wear.

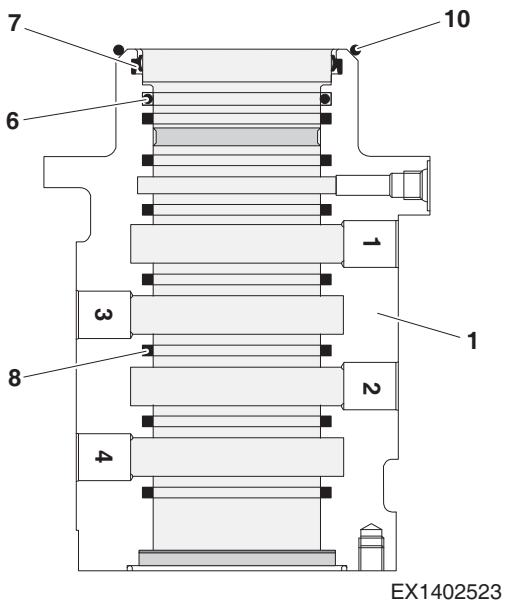


Figure 21

1. Hydraulic motor

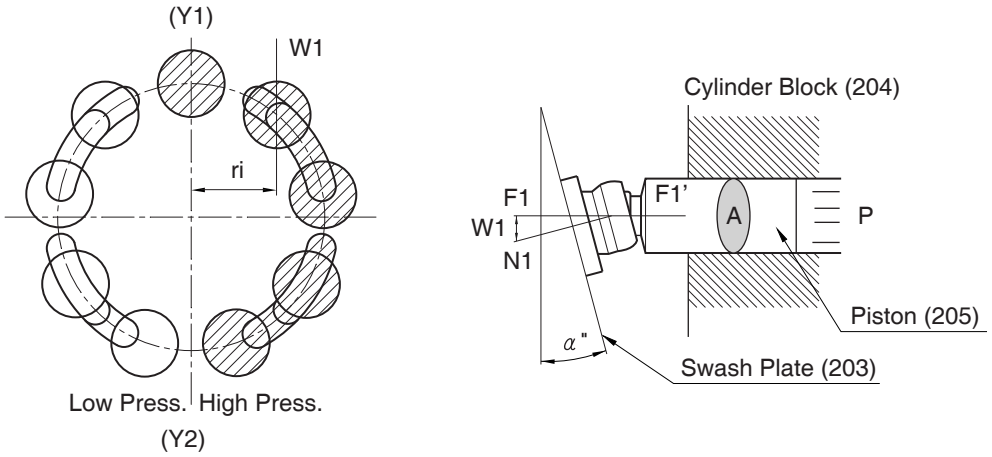


Figure 5

The high-pressure oil from the hydraulic pump flows through the rear flange (RF1) of the hydraulic motor, timing plate (209), and into the cylinder block (204). The high-pressure oil enters the cylinder through one side of the line Y1 - Y2 which connects the top-bottom dead points of the piston (205) stroke.

In the Figure 5 above, the high oil pressure is applied on the piston (205), pushing the swash plate (203) with force F1' (F1' = P x A, P: oil pressure, A: area), generating reaction F1. The reaction force F1 is divided into thrust component N1 and radial component W1 by the swash plate (203) having swivel angle of α. W1 is illustrated in the above figure, and generated torque T = W1 x r1 in relation to the line Y1 - Y2 which connects the top-bottom dead points of the piston (205).

This torque which is the resultant torque $\sum$(W1 x r1) x i of the torques generated by the pistons (4 or 5) on one side where high-pressure oil has passed, rotates the cylinder block (204) connected to the piston (205), and the cylinder block (204) transmits rotational torque to the driveshaft (202) connected by spline shaft.

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.

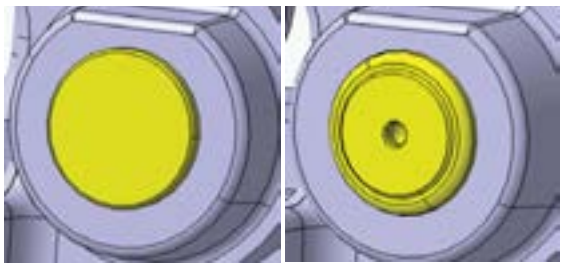
- **Keep open flames and ignition sources away from the workplace.**

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. Position machine on a smooth level surface with adequate space. Move machine until master pin is positioned at approximately 4 o'clock.

NOTE:



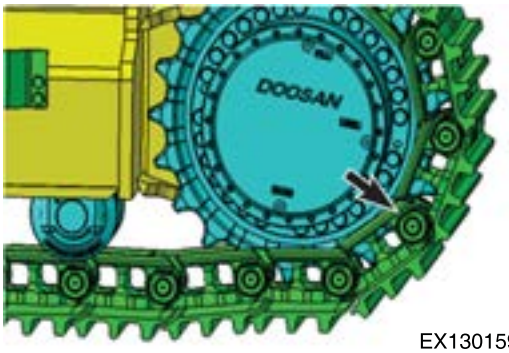
Regular Pin Master Pin

EX1400095

CAUTION

AVOID INJURY

Pressure of grease in adjuster cylinder is too high. Take precautions in opening valve against valve bounce or grease vent.



EX1301592

Figure 19

9. Disassemble the friction plat (215) (4 ea) and mating plate (216) (3 ea).

   NOTE: *While performing this job, keep the motor in horizontal position.*

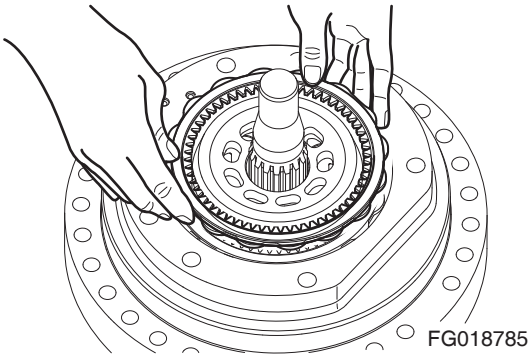


Figure 62

10. Disassemble the cylinder block kit.

    NOTE: *While performing this job, keep the motor in horizontal position.*

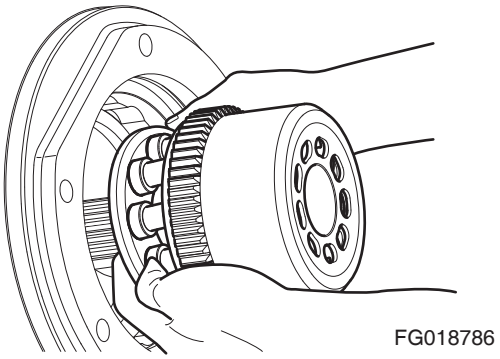


Figure 63

11. From the cylinder block (204), remove piston assembly assembled with the retainer plate (207).

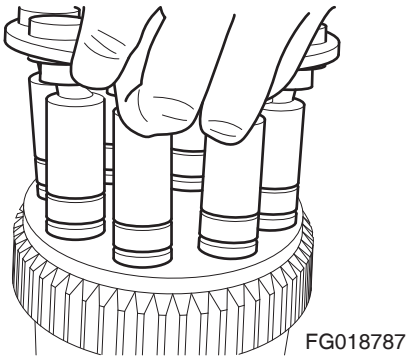


Figure 64

12. Disassemble the piston assembly from the retainer plate (207).

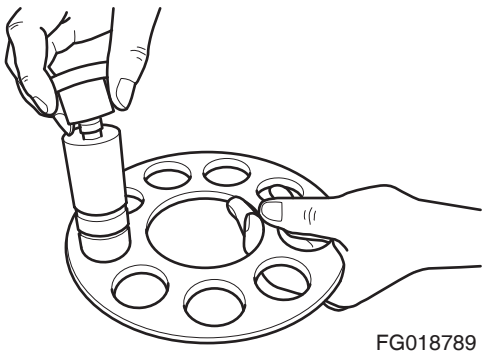


Figure 65

9. Assemble the spring pin (135) to the carrier No. 2 (130).

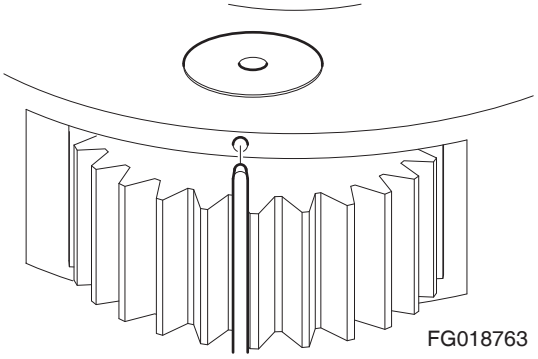


Figure 121

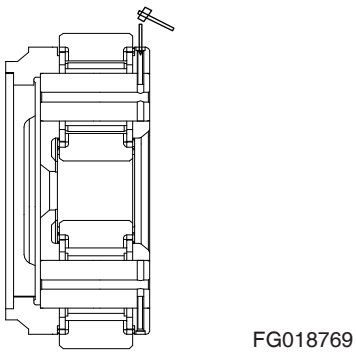


Figure 122

10. Assemble the carrier No. 2 assembly to the hub (102).

    NOTE: *Install M10 eyebolts and assemble it using a crane.*

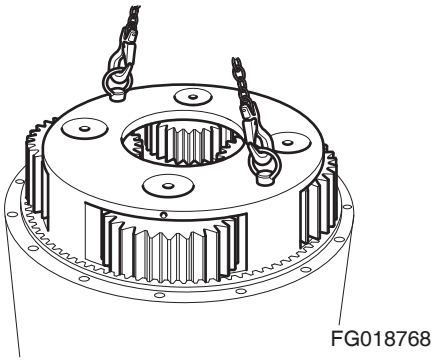


Figure 123

11. Assemble the sun gear (160).

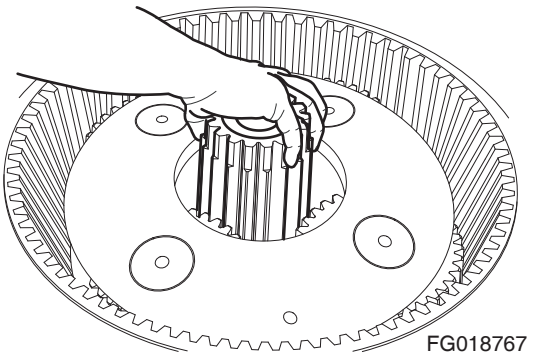


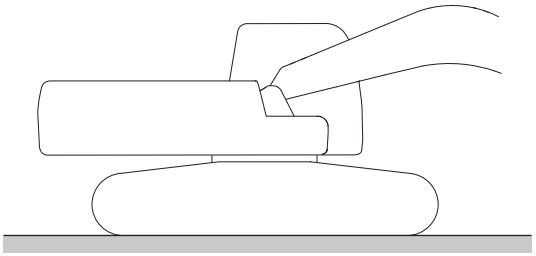
Figure 124

Reference Number	Description
1	Track Shoe Assembly
1-1	Track Link Assembly
1-1A	Track Link (RH)
1-1B	Track Link (LH)
1-1C	Track Pin
1-1D	Master Pin
1-1E	Regular Bushing
1-1F	Master Bushing

Reference Number	Description
1-1G	Dust Seal
1-1H	Spacer
1-2	Track Bolt
1-3	Nut
1-4	Track Shoe
2	Step
3	Spring Washer
4	Bolt

Track Removal

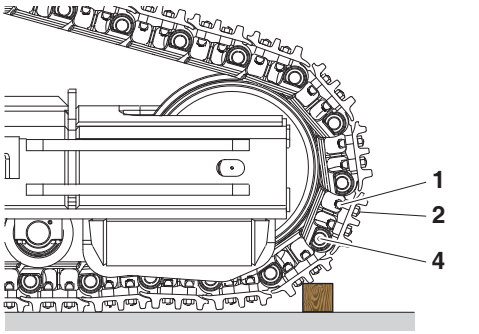
1. Position machine on a smooth level surface with adequate room for forward and reverse travel.



EX1301081

Figure 5

2. Move machine until master pin (4, Figure 6) is positioned at approximately 4 o'clock from top position on front idle roller.
3. Put a wooden block under track shoes, as shown.



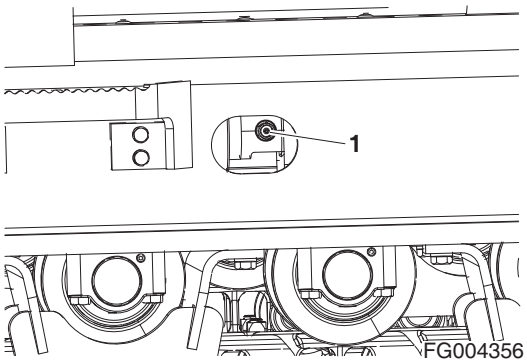
EX1401951

Figure 6

4. Loosen valve (1, Figure 7) for track adjuster to drain grease out. Use socket wrench 27 mm

   NOTE: *Loosen carefully, keeping face, hands, body away from the valve and nipple. Do not loosen valve Quickly.*

5. Remove four nuts and bolts (1 and 2, Figure 6) holding shoe to link. Remove enough shoes to make access to master pin.
6. Remove master pin from master link by hammer or press. Remove pin after detaching shoe.

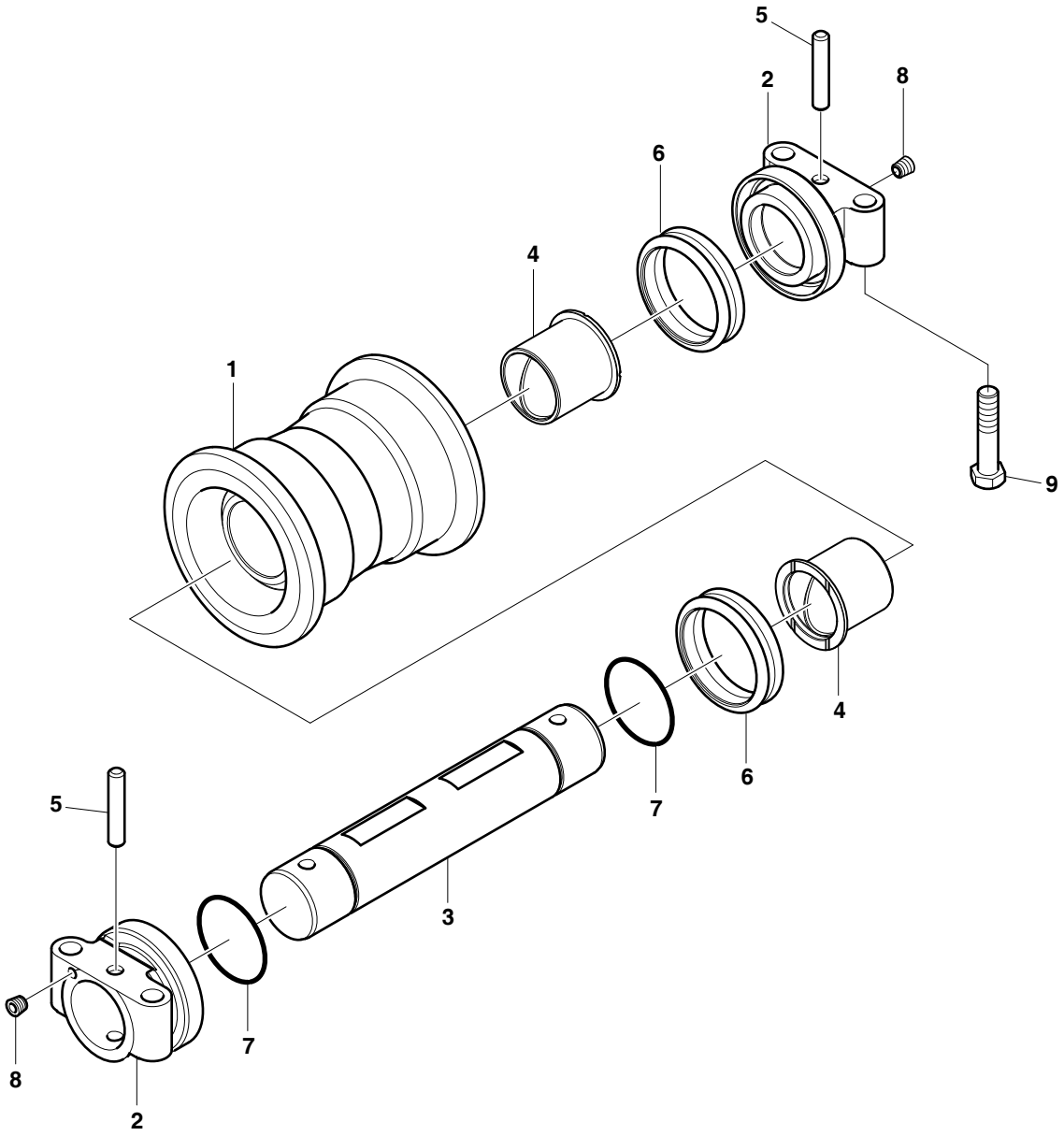


FG004356

Figure 7

LOWER ROLLER

Parts List



FG019395

Figure 37

Reference Number	Description
1	Roller
2	Collar
3	Shaft
4	Bushing
5	Pin

Reference Number	Description
6	Floating Seal
7	O-ring
8	Plug
9	Bolt

SAFETY INSTRUCTIONS

WARNING

AVOID DEATH OR SERIOUS INJURY

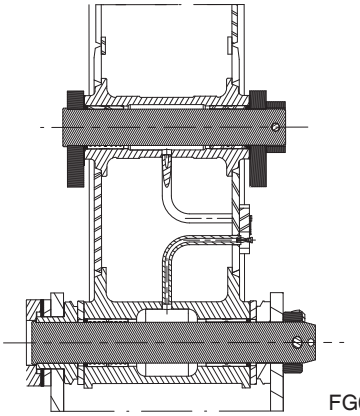
Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or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

BUCKET O-RING REPLACEMENT

WARNING

AVOID DEATH OR SERIOUS INJURY

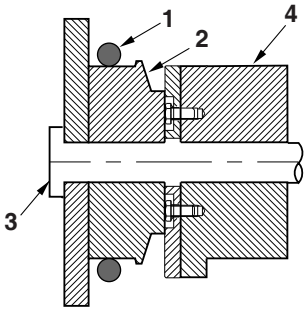
Prevent injury from flying metal objects. Always wear safety helmet, protective gloves and eye protection when changing pins.



FG018706

Figure 4

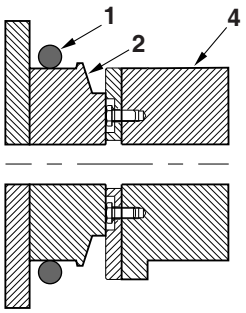
1. Inspect the bucket O-rings on a routine basis. If worn or damaged, replacement is necessary.
2. Roll the old O-ring (1, Figure 5) onto the boss (2) around the bucket pin (3). Remove bucket pin and move the arm or bucket link (4) out of the way.



FG019071

Figure 5

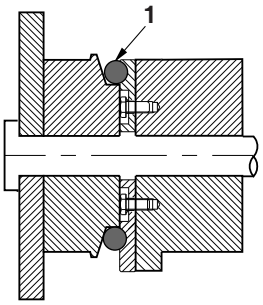
3. Remove old O-ring and temporarily install the new O-ring (1, Figure 6) onto the bucket boss (2). Make sure that O-ring groove on both the bucket link (4) and boss have been cleaned.
4. Realign the arm or link with the bucket pinhole and insert the bucket pin (3, Figure 5).



FG019074

Figure 6

5. Roll the new O-ring (1, Figure 7) into the O-ring groove.



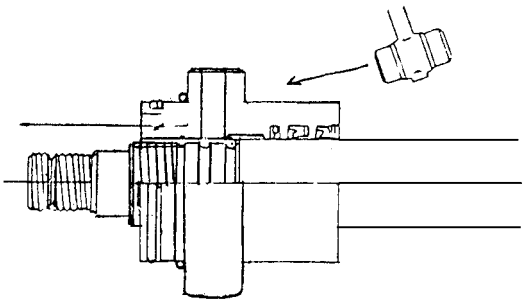
FG019075

Figure 7

Reference Number	Description
1	Tube Assembly
2	Carburizing Bushing
3	Cylinder Rod
4	Carburizing Bushing
5	Rod Cover
6	DU-bushing
7	Retaining Ring
8	Buffer Seal
9	U-packing
10	Backup Ring
11	Dust Wiper
12	Retaining Ring
13	O-ring
14	Backup Ring
15	O-ring
16	Cushion Ring
17	Piston
18	Slipper Seal
19	Wear Ring
20	Slyd Ring
21	O-ring
22	Backup Ring
23	Piston Nut
24	Set Screw
25	Steel Ball
26	Cushion Plunger

Reference Number	Description
27	Stop Ring
28	Hex Socket Bolt
29	Check Valve
30	Spring
31	Spring Support
32	O-ring
33	Plug
34	Pipe Band Assembly - H
35	Pipe Band
36	Spring Washer
37	Hex Bolt
38	Pipe Band Assembly - R
39	Pipe Band
40	Spring Washer
41	Hex Bolt
42	Pipe Assembly
43	O-ring
44	Spring Washer
45	Socket Bolt
46	U-bolt
47	Spring Washer
48	Nut
49	Pipe Clamp
50	Washer
51	Bolt

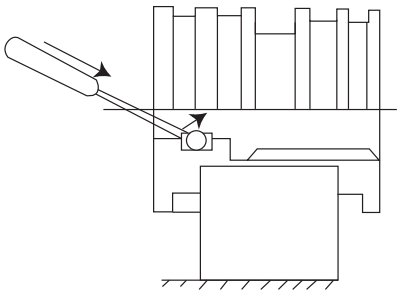
11. Use a plastic hammer to evenly pull off rod cover (5) from end of piston rod. Be careful not to damage rod bushing (6) and dust wiper, U-packing and other seals.



HAOF350S

Figure 28

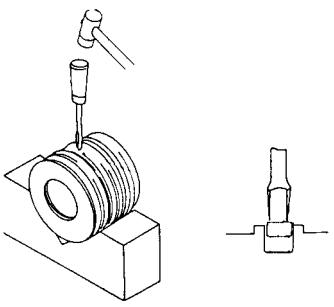
12. Use a dull, rounded tip tool to pry off O-ring (13) and backup ring (14).



HAOF37OL

Figure 29

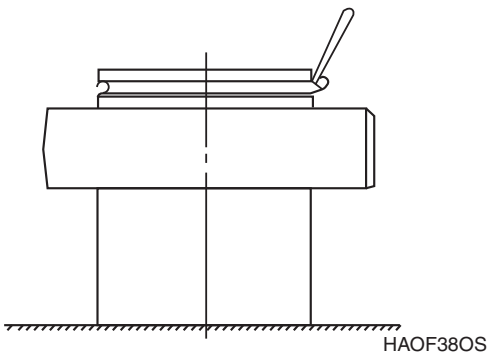
13. Find a screwdriver with an appropriate width tip to facilitate removal of slipper seal (18), wear ring (19) and slide ring (20) from piston (17).



0345

Figure 30

14. Remove O-ring (21) and backup ring (22) from cylinder head.



HAOF38OS

Figure 31

cleanliness and must be cleaned each time hydraulic fluid is drained and replaced. An oil cooler in the hydraulic system helps maintain the operating temperature of the system at approximately 50°C (122°F).

- The arm cylinder operating circuit includes anticavitation valves which protect the hydraulic system from vacuum that could result from external shocks or other unusual conditions. Boom, Arm, and Bucket cylinder circuit are also protected by overload relief valves. Whenever high-pressure is generated because of a shock or overload, excess pressure is dumped to the reservoir return circuit through the relief valve.

A selection valve in the travel circuit can be used to provide constant high torque/low speed travel, or variable speed/ variable torque output for travel. To prevent sliding during simultaneous travel and boom/arm/bucket operation, select the high torque/low speed travel position.

Oil from the hydraulic tank (22) fills accumulator (15) first after passing through pilot pump and filter (14) and is supplied to the solenoid package valve (16).

Oil that passed through safety cutoff valve of solenoid package valve (16) inside moves swing spool of main control valve (2) of swing device (3) the following the operation of joystick valve (11).

Once swing spool moves, pressure of oil supplied from pilot pump to main control valve's (2) PA port increases and the oil is supplied to swing device's (3) SH port causing brake release piston to move.

Then oil is supplied to swing device's (3) PG port connected to pilot pump and swing parking brake is released.

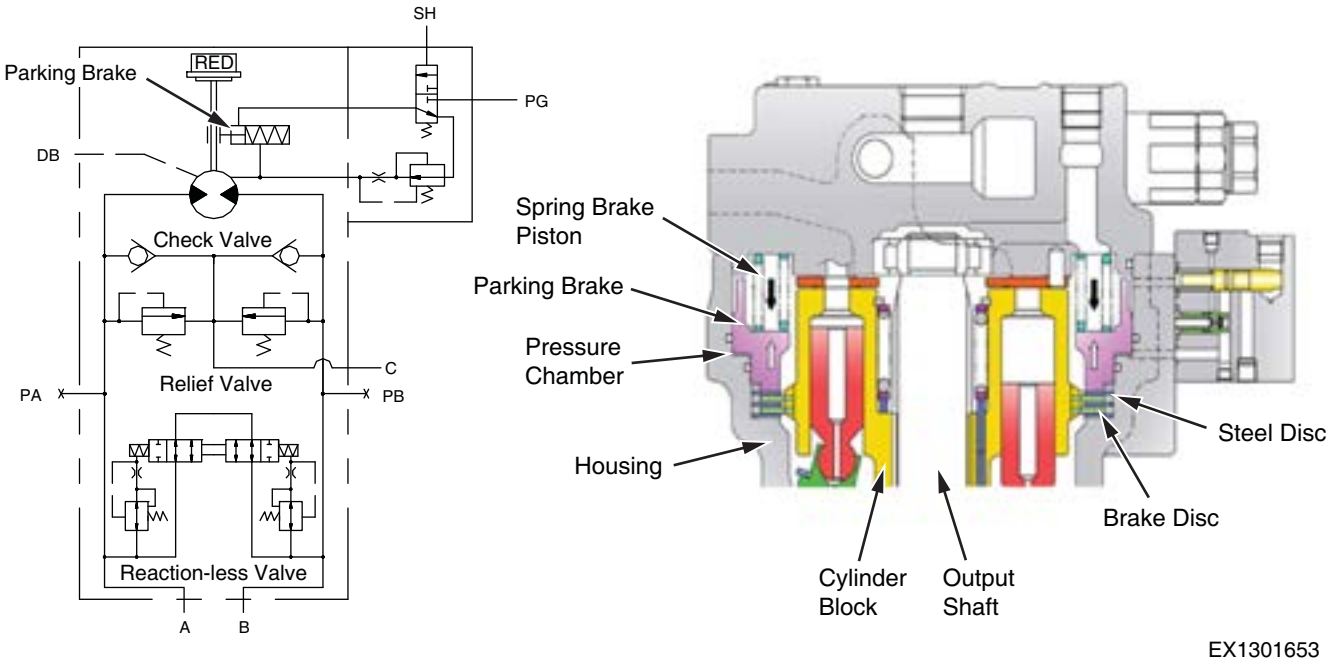


Figure 11

Oil supplied from hydraulic tank (22) passes through pilot pump connected to main pump (1) and filter (14) and is supplied to solenoid package valve (16) after accumulator (15) is first filled with the oil.

If pilot oil is supplied to arm 1 and arm 2 spool of main control valve (2) by the operation of joystick valve (11), then spool is moved and main pump (1) oil passage and arm cylinder (7) head oil passage open.

Oil passage supplied from main pump (1) is supplied to arm cylinder (7) head after passing through arm holding valve (J), causing the arm moving to take place.

Rapidly occurring arm crowd causes short supply of oil in the arm cylinder head, in which case the oil in arm cylinder rod is supplied to arm cylinder head so oil cavitation may be prevented.

If arm crowd action is stopped, oil in arm cylinder is obstructed by check of arm holding valve (J), and the moving of arm is blocked.

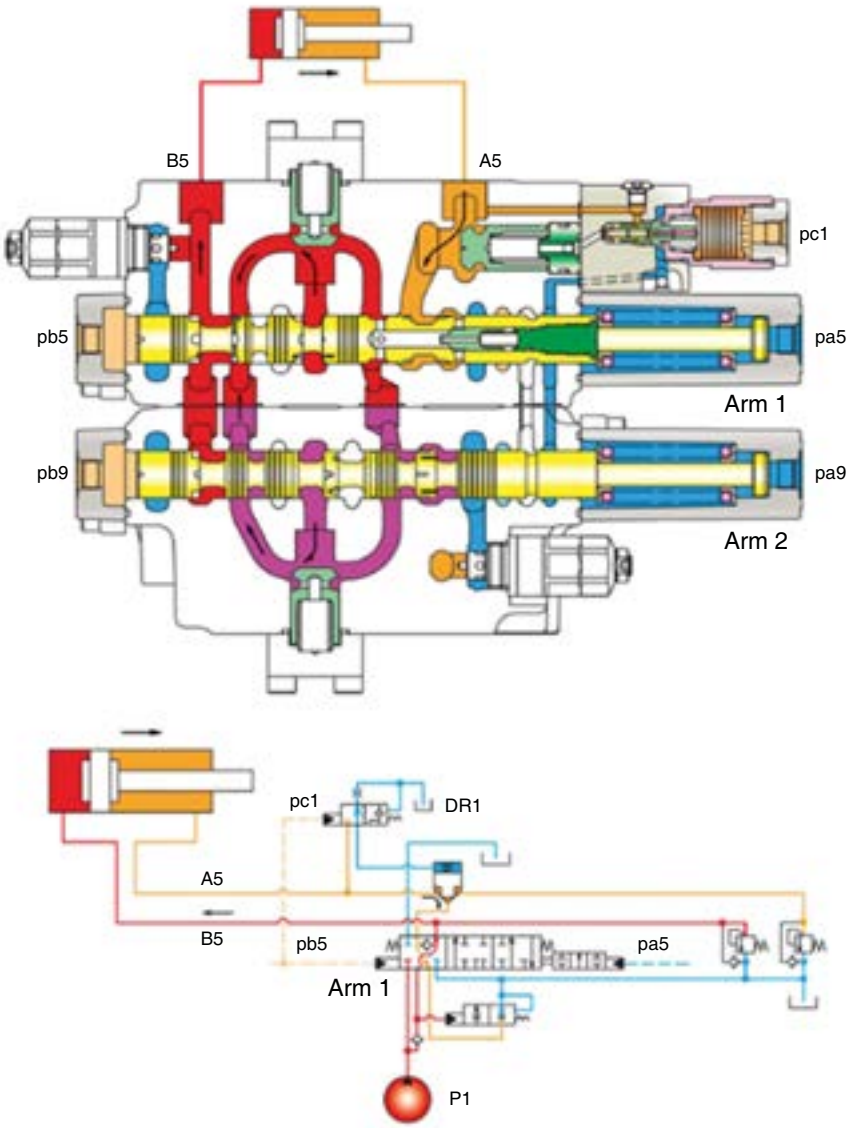


Figure 24

EX1301659

SAFETY INSTRUCTIONS

WARNING

AVOID DEATH OR SERIOUS INJURY

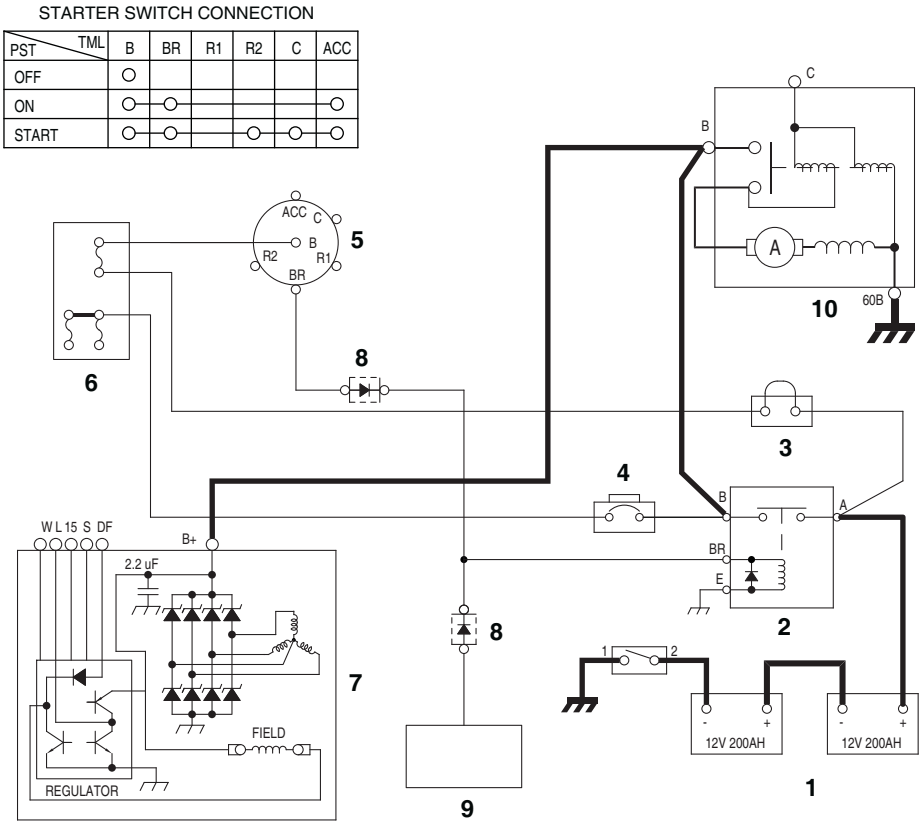
Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments repairs or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

Hydraulic System Troubleshooting

Edition 1

TROUBLESHOOTING – SWING GEARBOX

Problem	Possible Cause	Remedy
Swing motor fails to operate and:		
Three pressure tests at motor, brake or makeup valve show low reading (s).	Swing relief valve defective. Brake release valve defective. Motor makeup valve defective.	Adjust pressure to recommended range in affected valve. OR Disassemble and clean valve assembly. Replace all valve components that show damage.
All three pressure checks are OK but left travel also fails to run.	Exchange front and rear pump inlet and outlet hoses to test pump function.	If swing and left travel are restored but right travel stops working, replace or repair P1 pump.
All three pressure tests are OK, but machine fails to swing at all.	Brake assembly or motor friction plate failing to release.	Check for binding. Disassemble and repair.
	Pilot (control) pressure low or swing control valve stuck.	Disassemble/Repair pilot pressure swing spool (305) and/or swing control valve.
	Swing motor defective.	Test motor drain rate. Replace/Repair motor.
	Gear train defective.	Refer to "Swing Gear Troubleshooting" procedure.
Swing functions but only at reduced rpm.	Causes listed above could also produce dragging swing, OR hot or wrong oil OR worn-out parts.	Check above list; then replace oil, test motor drain rate and check for "03" reading (EPOS self-test).
Left travel speed is also reduced.	Low output at P1 pump or external pilot piping leaks/is clogged.	Clean and repair piping or repair or replace pump P1.
Swing control movement is reversed.	Inlet/outlet piping reversed.	Reset controls or reverse piping.
Machine swings but continues moving past stopping point.	Swing control valve spool not centered.	Replace return spring; clean/ repair valve piston and spool.
	Pilot pressure may be outside range.	Disassemble, clean or replace pilot relief valve or pilot valve.
	Swing relief valve may be faulty.	Repair/Replace swing relief valve.
Swing movement is in one direction only.	Check to see that pilot pressure is the same right and left.	If pilot pressure is unequal, clean or repair piping or repair/replace valve.
	Swing control valve spool may be stuck.	Repair/Replace the swing control valve.
	Swing relief valve may be faulty.	Repair/Replace the swing relief valve.
No rotation and:		
Pressure at swing motor inlet increases.	Swing brake not releasing.	Check brake engagement and disengagement; check release pressure.
	Internal damage to gearbox drivetrain.	Replace broken gears and drivetrain assemblies.
	Overload.	Reduce load weight.



EX1301079

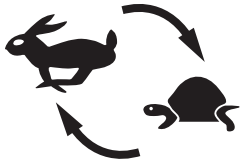
Figure 1 Electric Power Circuit Diagram

Reference Number	Description
1	Battery
2	Battery Relay
3	Fusible Link
4	Circuit Breaker
5	Starter Switch

Reference Number	Description
6	Fuse Box
7	Alternator
8	Diode
9	Engine Controller
10	Starter

Description	Symbol	Input Terminal	Operation	Remarks
Overload Warning	 FG000253	CN1-32 CN1-28	Warning buzzer also starts when boom pressure sensor output voltage is about 2.68 V while overload warning switch is "ON".	It flashes in case of 2.68 V and above and lights continuously in case of 2.77 V and above (and warning buzzer also starts).
Work Light	 HB4O2003	CN1-79	This symbol appears when work light turns "ON" (24 V applied).	

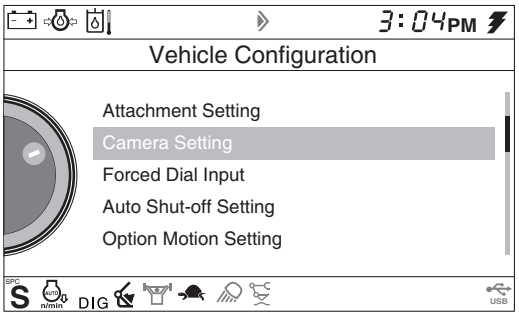
Indication of Multifunction Gauge

Description	Symbol	Input Terminal	Operation	Remarks
Low-speed Travel	 EX1301575		Basic run mode	
High-speed Travel	 EX1301577	CN1-80	This symbol appears when high-speed run mode switch is operated.	It only operates when the auto idle pressure is 10.5 bar or more during running and the high-speed run solenoid valve is operated.
Automatic Travel	 EX1301577	CN1-61 CN1-80	This symbol appears when the automatic run mode switch is operated.	When the auto idle pressure is 10.5 bar or more, dial voltage is less than 2.5 V and pump pressure is 153.7 bar during running, the high-speed run solenoid valve is operated.

C. Camera Setting

The camera setting screen is designed to set up various cameras "ON/OFF" and normal/mirror.

From the vehicle configuration, select camera setting to access the camera setting list screen.



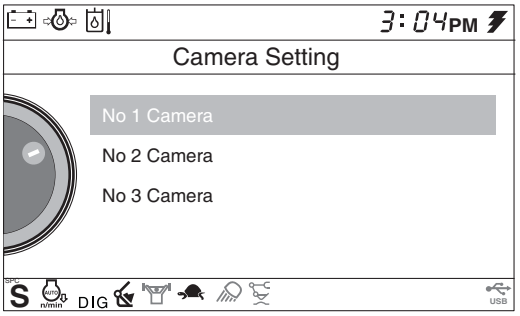
EX1301037

Figure 43

The camera setting list screen displays various camera states (ON/OFF, NORMAL/MIRROR).

Select a camera and click the jog switch to access the relevant camera setting screen.

Press the ESC button to return to the previous screen.

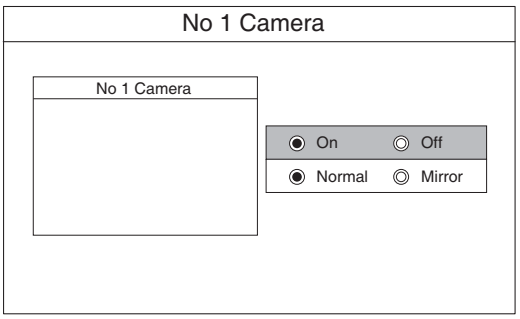


EX1301038

Figure 44

On the camera setting screen, set up the camera state (ON/OFF, NORMAL/MIRROR).

Also, see the actual image of the currently installed camera.



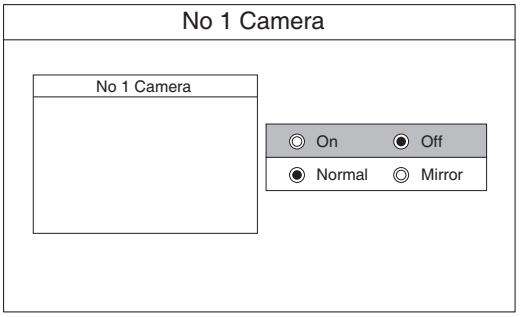
EX1301421

Figure 45

If a camera is not installed, the camera image section is shown as a blue screen.

If the cursor is placed on "ON/OFF", click on the jog switch to set up "ON" ↔ "OFF".

Turn the jog switch to locate the cursor at normal/ mirror. Then, click on the jog switch to set up normal ↔ mirror.



EX1301422

Figure 46

c) Entertainment use setting
Setting of password input for entertainment (video/MP3) use setting.

Engine start-up setting

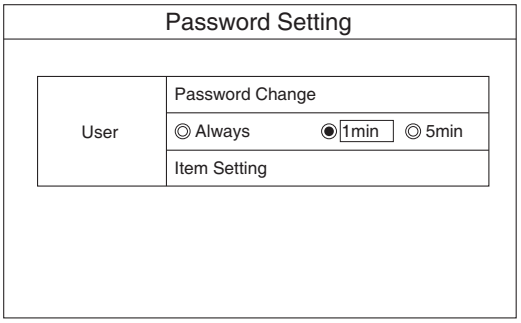
By selecting "Engine Start-up" among item settings the reentry time for password entry upon start-up of the equipment can be set.

a) Always
Password is entered with each start-up.

b) 1 min
If the system is started again within 1 minute from key-off after the password is input, the password is not requested again.

c) 5 min
If the system is started again within 5 minutes from key-off after the password is input, the password is not requested again.

NOTE: *If the owner uses the engine start-up feature but does not permit the user to use it, the user cannot select whether to use the feature, but can select the password reentry time.*

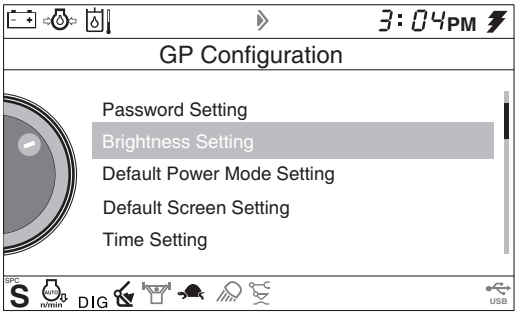


EX1301444

Figure 99

B. Brightness Setting

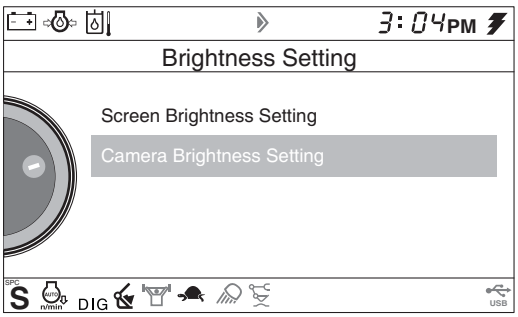
On the GP configuration screen, when cursor is placed on brightness setting, click on the jog switch to display the screen brightness setting and camera brightness setting screen.



EX1402179

Figure 100

If you want to change the screen brightness, select the screen brightness setting to display the brightness adjustment screen.



EX1301056

Figure 101

A. Current fault information

Current status of fault is displayed (Failure code, fault contents).

When several faults are produced, fault information can be checked using the jog switch (1, Figure 124).

No: Number of currently occurring failure

Code: Display of current failure code

VXXyyy-zz: Method of displaying machine related failure code

– V: Display of machine related failure code
– XX: Display of failed part
– yyy: Serial number of failed part
– zz: FMI (Failure Mode Identifier) number

Eyyyyyy-zz: Method of displaying engine related failure code

– E: Engine related failure code
– yyyyyy: Serial number of failed part
– zz: FMI (Failure Mode Identifier) number

* Method of displaying failed part of machine (VXX)

1) VCO: Communication related failure
2) VPV: EPPR valve related failure
3) VSV: Solenoid valve related failure
4) VRY: Relay related failure
5) VSP: Pressure sensor related failure
6) VSE: Sensor related failure except for pressure sensor
7) VS5: 5V sensor related failure
8) VAL: Other failures.

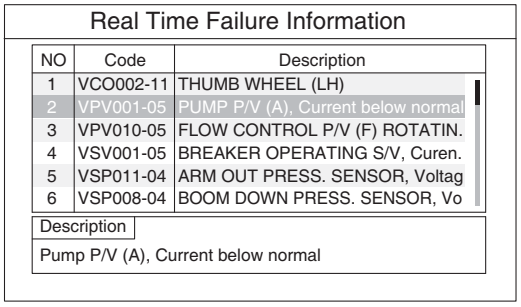
Example)

VPV001-05: EPPR valve (A) current is lower than normal current.

Description: Shows the description of the details of machine failure.

Refer to the failure information code for unique codes and FMI numbers.

This example shows one of two faults.



EX1301618

Figure 140

GP Display Code	DTC Code		FMI	GP Display Description	Severity	Light Status	Remarks
	HEX	DEC					
E000190-16	190	BE	16	Over speed protection, over speed	3	Yellow	
E000190-20	190	BE	20	Engine Overspeed, Value to high	0	None	
E000234-02	234	EA	2	The EMS and EEC control units are incompatible.	4	Red	
E000234-19	234	EA	19	Wrong CAN version transmitted by COO	3	Yellow	
E000532-14	532	214	14	Increased idle due to other fault.	0	None	
E000558-02	558	22E	2	Low idle switch error state from coordinator	0	None	
E000559-02	559	22F	2	Kickdown signal defect (via CAN)	0	None	
E000559-09	559	22F	9	Accelerator pedal kickdown CAN message, faulty	3	Yellow	
E000559-10	559	22F	10	Accelerator pedal/kick down switch, EMS and coordinator dont agree	3	Yellow	
E000597-02	597	255	2	Brake pedal signal defect (via CAN)	0	None	
E000598-02	598	256	2	Clutch pedal signal or clutch signal from Automatic Clutch defect (via CAN)	0	None	
E000598-07	598	256	7	Excessive Clutch slip	3	Yellow	
E000598-19	598	256	19	CAN-signal or engine shut-down command from OPC for automatic clutch failure, timeout	4	Red	
E000636-01	636	27C	1	Camshaft sensor (T135) fault or not connected	3	Yellow	
E000636-02	636	27C	2	Camshaft position sensor, intermittent fault	3	Yellow	
E000636-03	636	27C	3	Camshaft position sensor, short circuit to battery	3	Yellow	
E000636-04	636	27C	4	Camshaft position sensor, short circuit to ground	3	Yellow	
E000636-05	636	27C	5	Camshaft Position Sensor, Open Circuit.	3	Yellow	
E000636-07	636	27C	7	Engine speed detected by engine speed sensor, but no signal from camshaft position sensor	3	Yellow	
E000636-08	636	27C	8	Camshaft Pulse Pattern, Gap or Sync Error or other fault.	3	Yellow	
E000641-02	641	281	2	VGT internal temperature sensor stuck.	0	None	
E000641-04	641	281	4	VGT voltage supply open load	3	Yellow	
E000641-05	641	281	5	VGT internal temperature sensor open circuit	0	None	
E000641-07	641	281	7	VGT, motion limited or restricted	3	Yellow	
E000641-08	641	281	8	VGT, reference or position not found or ECU bootloader error on checksum calibration module 2.	3	Yellow	
E000641-09	641	281	9	VGT-temperature sensor (T121) value not plausible	3	Yellow	
E000641-10	641	281	10	VGT, motion error. Span too large	3	Yellow	
E000641-11	641	281	11	VGT, actuator faulty	3	Yellow	
E000641-12	641	281	12	VGT, internal fault	3	Yellow	
E000641-13	641	281	13	VGT actuator installation procedure was not completed	3	Yellow	
E000641-15	641	281	15	VGT temperature, high	3	Yellow	
E000641-16	641	281	16	VGT temperature too high	3	Yellow	
E000641-19	641	281	19	VGT, timeout on CAN	3	Yellow	
E000645-19	645	285	19	CAN message (TCO1) from tachograph timeout	3	Yellow	
E000651-01	651	28B	1	Two or more injectors with the same trim code, injector cyl. 1	3	Yellow	
E000651-02	651	28B	2	Injector trim code. Barcode or checksum error, injector cyl. 1	3	Yellow	
E000651-04	651	28B	4	Injector 1 cable short circuit to ground	3	Yellow	
E000651-05	651	28B	5	Injector cyl. 1 cable/injector open load	3	Yellow	
E000651-06	651	28B	6	Injector cyl. 1 cable/injector short circuit	3	Yellow	
E000651-07	651	28B	7	Injection error, physical cylinder 1	3	Yellow	
E000651-08	651	28B	8	Injector cyl. 1, over or under fueling	3	Yellow	

The Jog Switch Control Panel permits the selection of the appropriate engine power depending on the working condition. One of the four. Power Plus Mode, Power Mode, Standard Mode or Economy Mode setting can be selected. When the engine starter switch is turned "ON", the power mode is automatically defaulted to standard mode. The desired mode can be selected by pressing the jog switch on the jog switch control panel. When the power mode is selected, the indicator light will turn "ON" to display the selected mode.

The quantity of oil discharged by the pump and the engine speed are determined by the mode selected by the operator. The pump output in each mode is determined by the mode selection and is listed in the following table

Mode	Power Plus Mode	Power Mode	Standard Mode	Economy Mode
Output (%)	100%	Approximately 90%	Approximately 80%	Approximately 75%

1. Coolant Overheat Prevention System

The engine controller detects the engine coolant temperature with the temperature sensor in the coolant line. If the coolant is overheated, the engine controller send the overheat signal to the EPOS controller which conveys the signal to the instrument panel.

If the coolant is overheated, the pump output is reduced to prevent engine overheat.

When the coolant temperature reaches about 110 °C (230 °F), the pump output is reduced to 85 % into the Tropical mode. A pop-up screen appears on the instrument panel to inform the operator of the mode shift.

If the coolant temperature exceeds 113 °C (235.4 °F), the engine controller sends coolant overheat signal to the EPOS controller which conveys the signal to the instrument panel.

Receiving the engine overheat signal, the instrument panel turns on the warning light and triggers the buzzer for warning.

In addition, the EPOS controller sends a signal back to the engine controller and shifts the power mode to the standard mode.

The engine controller controls the engine speed to low speed range.

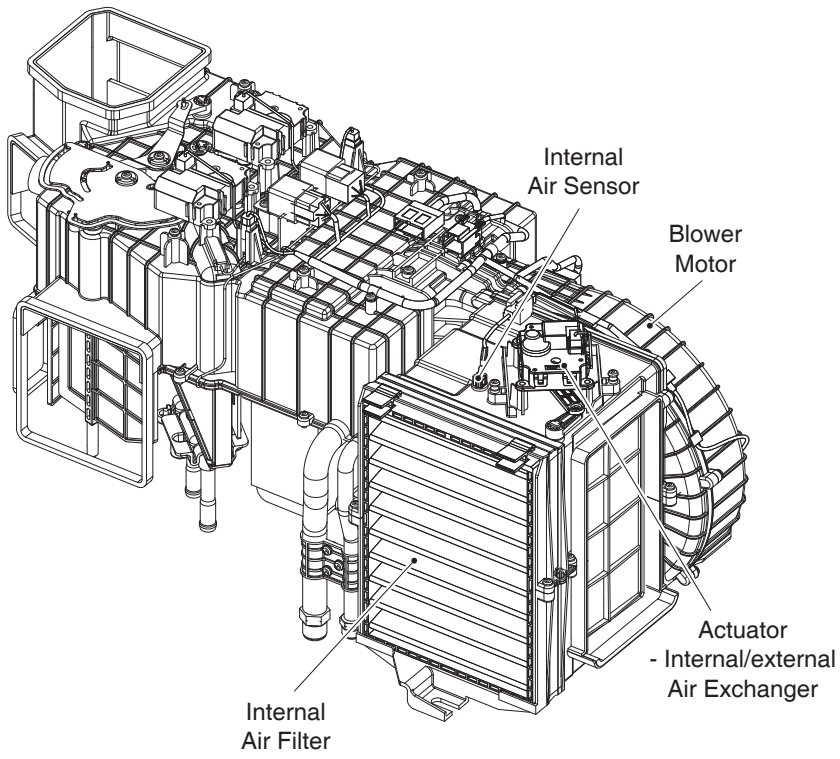
In summary, in case of engine coolant overheat, the system selects tropical mode, triggers warning buzzer, shifts to standard power mode, reduce engine speed, and reduces pump output.

When the coolant temperature is lowered to 104 °C (219.2 °F) or below, the system resumes normal operating condition.

Door Open by Vent Modes

Door	Mode				
	Vent	Bi-level	Foot	Def/foot	Def
Vent	100	60	0	0	0
Foot	0	40	100	80	60
Def	0	0	0	20	40

Main Components



FG016943

Figure 185

REFRIGERANT SYSTEM REPAIRS

WARNING

AVOID DEATH OR SERIOUS INJURY

Always wear safety goggles and gloves when handling refrigerant. If refrigerant comes in contact with the skin or eyes, immediately flush with clean, running water and consult a physician.

Select a clean and well ventilated area to work.

The refrigerant container is under high-pressure and must be stored below 40°C (104°F). Be careful not to drop the container from a high location.

The contents are under high-pressure and should not be used with compressed air or near an open flame.

Refrigerant Safe Handling Procedures

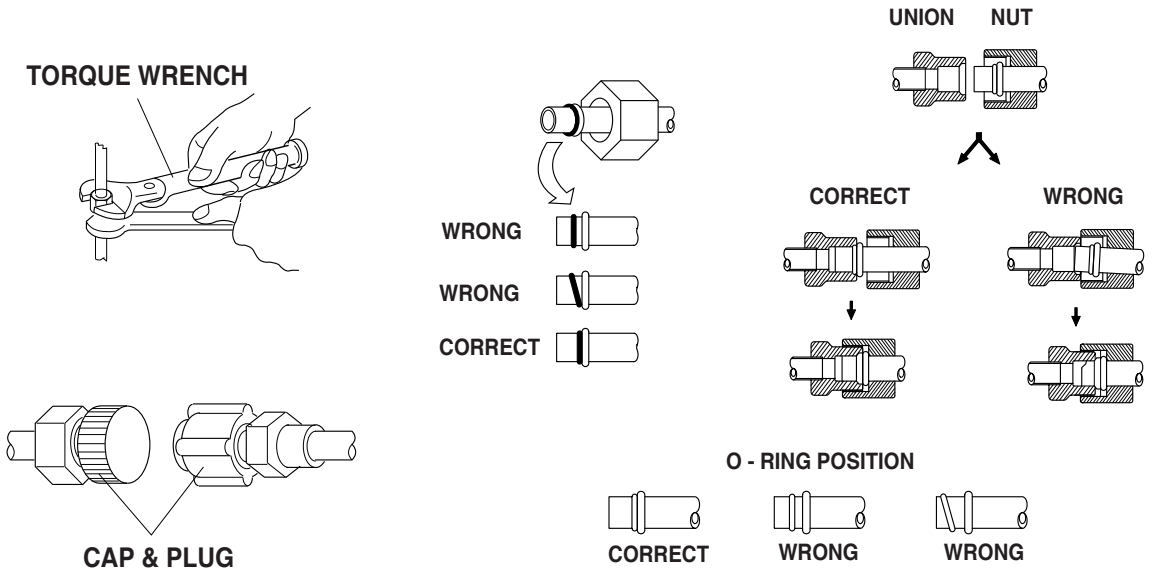


Figure 202

The following procedures must be observed for safe handling of refrigerant during vacuum and charging process.

1. Use an approved recovery/charging device which can safely perform vacuum and charge work simultaneously.

Electrical System Troubleshooting

Edition 1

One Way

Edition 1

Reference Number	Description
1	Pipe Assembly
2	Hose Assembly
3	Bolt
4	Spring Washer
5	Pipe Clamp
8	Split Flange
9	Socket Bolt
10	O-ring
11	Socket Bolt
12	Spring Washer
13	Socket Bolt
31	Stop Valve Assembly (LH)
31-1	Stop Valve (LH)
31-2	O-ring
31-3	Elbow
31-4	Cap

Reference Number	Description
31-5	O-ring
31-6	Plug
31-7	O-ring
31-8	Cap
31-9	O-ring
32	Stop Valve Assembly (RH)
32-1	Stop Valve (RH)
32-2	O-ring
32-3	Elbow
32-4	Cap
32-5	O-ring
32-6	Plug
32-7	O-ring
32-8	Cap
32-9	O-ring

After Installation Precautions

- After finishing installation of piping, connect 'P' and 'T' line directly to each other without connecting the breaker and do flushing process a few minutes to make hydraulic oil clean before connecting the hoses to the attachments.
- Connect hydraulic hoses as shown in Figure 9. Make it sure that 'Pressure' and 'Tank' lines are not reversed each other.
  When connecting the hoses, make it sure that no foreign substances get into the hoses.
  Dirt and sand can cause serious trouble to the attachments.
- Arrange the connecting hoses which are not to be twisted or excessively bent.

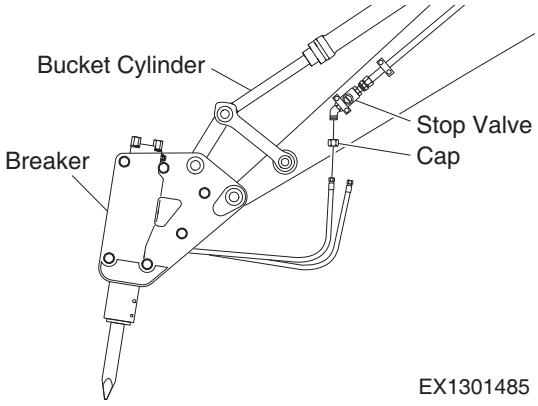


Figure 9

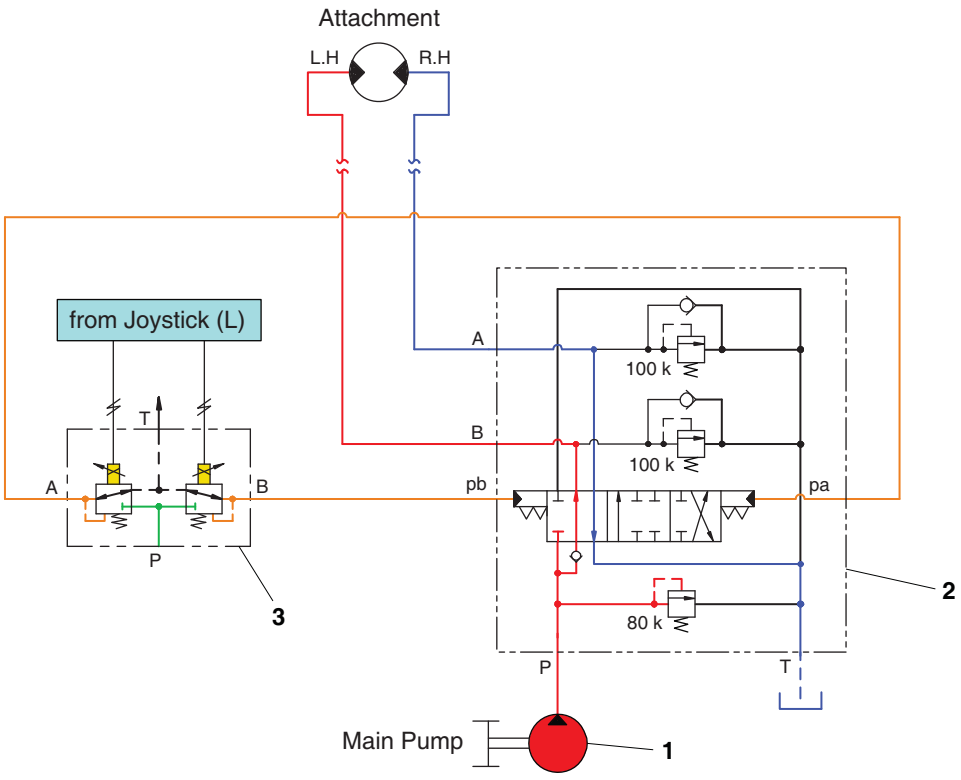
Air Bleeding

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.)

Reference Number	Description
1	EPPR Valve
1-1	E.P.P.R Valve
2	EPPR Valve Bracket
3	Hose
4	Hose Assembly
5	Hose Assembly
6	Hose
7	Hose Assembly
8	Adapter
9	Filter Adapter
10	Elbow

Reference Number	Description
11	Elbow
12	Tee
13	Shuttle Valve Tee
14	Set Bolt
15	O-ring
16	O-ring
17	O-ring
18	Spacer
19	Bolt
41	4-sol Solenoid Valve

Hydraulic Circuit



EX1301493

Figure 4

Reference Number	Description
1	Gear Pump (Rotating)
2	Control Valve (One Spool)

Reference Number	Description
3	EPPR Valve

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

General Description

Quick Couplers are attachments installed at the outer end of the work equipment of various types of construction and earth-moving machines. They facilitate the shorter time exchange of working tools, buckets and etc.

Figure 1

Theory of Operation

1. LOCK
   When the quick coupler switch on the right control stand is operated, a flow path will form according to the movement of the spool on the quick coupler solenoid valve, and pressure from the pump will be applied to the cylinder of the quick coupler, moving the quick coupler in a locking direction.
2. UNLOCK
   When the quick coupler switch of the right control stand is operated, a flow path will form because of the movement of the spool of the quick coupler solenoid valve, and pressure from the pump will be applied to the cylinder of the quick coupler, moving the quick coupler in an unlocking direction.

Quick coupler only operate over 280 bar pressure of bucket crowd.

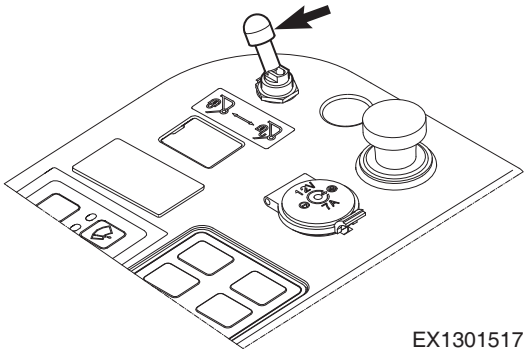


Figure 2

Table of Contents

Two Pump