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April 2012

EXCAVATOR
**Shop
Manual**

DX140LC-3

Serial Number 1001 and Up

Serial Number 50001 and Up (Europe Only)

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Track Excavator Maintenance Safety

Edition 3

Correction of Machine Problems

If any machine problems are found during operation and maintenance (noise, vibration, smell, incorrect gauges, smoke, oil leakage, etc.), or if any abnormal warning alerts are displayed on display monitor, stop the machine and take the necessary corrective actions. Do not operate machine until problem has been corrected.

Crushing and Cutting

Keep objects away from moving fan blades. Fan blades can throw and cut objects.

Do not use a wire rope that is kinked or frayed, or a wire rope with any loss of diameter. Wear leather gloves when handling a wire rope.

When striking a loose retainer pin, it can fly out and can cause a serious injury. Make sure that area is clear of personnel when striking a retainer pin. To avoid injury to your eyes, wear safety goggles when striking a retainer pin.

Do not put your hand, arm or any other part of your body between movable parts. If going between movable parts is necessary, always position and secure work equipment so it cannot move. Properly support equipment before performing any work or maintenance under raised equipment.

If control levers are operated, clearance between machine and work equipment will change and this may lead to serious damage or can result in death or serious injury. Stay clear of areas that may have a sudden change in clearance with machine movement or equipment movement. Stay clear of all rotating and moving parts. Unless instructed, never attempt adjustments while machine is moving or while engine is running.

Do not depend on hydraulic cylinders to support raised equipment. Equipment can fall if a control is moved, or if a hydraulic line breaks or is loosened or disconnected.

If it is necessary to remove guards to perform maintenance, always install guards after maintenance is completed.



HDO1010L

Figure 5

- When driving up or down ramps, the center of gravity of machine will change suddenly causing the tracks to drop down to the ramps or trailer. This will occur at the joint between the ramps and trailer. Travel slowly over this point.
- For machines equipped with a cabin, always lock door after loading machine to prevent door from suddenly opening during transportation.

Transporting Machine

When transporting machine on a trailer or truck, do the following:

- The weight, transportation height, and overall length of machine may change depending on work equipment attached to it. Always check the machine dimensions and work equipment's dimensions before transporting.
- When passing over bridges or structures on private land, check that structure is strong enough to support weight of machine. Before traveling on public roads, check with appropriate authorities and follow their instructions.

Never turn starter switch to "O" (OFF) position when traveling. This can lead to a loss of steering control.

Do not operate attachments while traveling.

Do not change selected travel mode (FAST/SLOW) while traveling.

Never travel over obstacles or excessive slopes that will cause machine to tilt severely. Avoid any slope or obstacle that can cause machine to tilt 10° or more to right or left, or 30° or more from front to rear.

Do not operate steering controls suddenly. Work equipment can hit ground and this can damage machine or structures in area.

When traveling on rough ground, travel at low speed, and avoid sudden changes in direction.

Always operate within permissible water depth. Permissible water depth is up to centerline of upper track roller(s).

When passing over bridges or structures on private land, check that structure is strong enough to support weight of machine. Before traveling on public roads, check with appropriate authorities and follow their instructions.

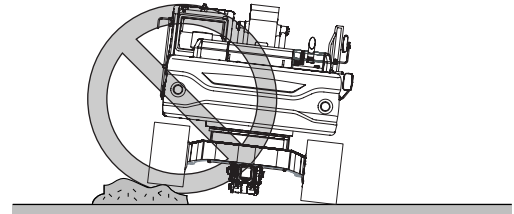
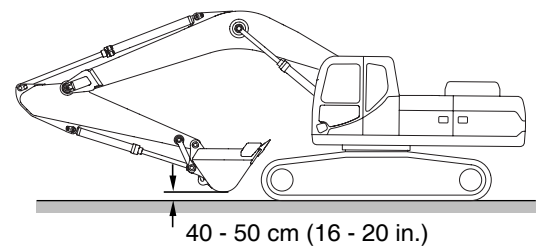
Never exceed maximum permitted load for bridges.

Always operate machine with idler wheels to front under cabin and drive sprockets to rear.

Know permitted ground pressure. Ground pressure of the machine may change depending on attachment and load.

Keep height and length of attachment in mind.

Travel Position



FG018461

Figure 27

- When performing maintenance of engine and you are exposed to engine noise for long periods of time, wear hearing protection while working.
- If noise from the machine is too loud, it can cause temporary or permanent hearing problems.
- Do not smoke when you service an air conditioner or if refrigerant gas is present.
- Inhaling fumes either from a flame or gas from a cigarette that has contacted air conditioner refrigerant can cause death or serious injury.
- Never put maintenance fluids into glass containers. Drain all liquids into a suitable containers.
- Unless instructed otherwise, perform maintenance with equipment in servicing position. Refer to this manual for procedure for placing equipment in servicing position.

Accumulator

The pilot control system is equipped with an accumulator. For a short period of time after engine has been stopped, accumulator will store a pressure charge that allow hydraulic controls to be activated. Activation of any controls will allow selected functions to operate under force of gravity.

When performing maintenance on pilot control system, release hydraulic pressure in system as described in Operation and Maintenance Manual.

The accumulator is charged with high-pressure nitrogen gas. If it is improperly handled it can explode causing death or serious injury. Always observe the following precautions:

- Do not drill or punch holes in accumulator or expose it to any flames, fire or external heat source.
- Do not weld on accumulator.
- When performing disassembly or maintenance of accumulator, or when disposing of accumulator, charged nitrogen gas must be properly released. Contact your DOOSAN distributor for assistance.
- Wear safety goggles and leather gloves when working on an accumulator. Hydraulic oil under pressure can penetrate skin and result in death or serious injury. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

Compressed Air

- When cleaning filters, radiator or other components with compressed air, there is a hazard of flying particles that can result in serious injury.
- Always wear safety goggles, dust mask, leather gloves, and other protective devices.



FG018458

Figure 45

8. An extra outer air filter must be kept in operator's cabin to replace element that could become iced and cause restricted airflow to engine.
9. Clean off all mud, snow and ice to prevent freezing. Cover machine with a tarp if possible, keep ends of tarp from freezing to ground.

Operation in Extreme Heat

Continuous operation of machine in high temperatures can cause machine to overheat. Monitor engine and hydraulic system temperatures and stop machine to let it cool, when necessary.

1. Make frequent inspections and services of fan and radiator. Check coolant level in radiator. Check grilles and radiator fins for accumulation of dirt, debris and insects which could block cooling passages.
 - Formation of scale and rust in cooling system occurs more rapidly in extremely high temperatures. Change antifreeze each year to keep corrosion inhibitor at full strength.
 - If necessary, flush cooling system periodically to keep passages clear. Avoid use of water with a high alkali content which increases scale and rust formation.
2. Check level of battery electrolyte daily. Keep electrolyte above plates to prevent damage to batteries. Use a slightly weaker electrolyte solution in hot climates. Batteries self-discharge at a higher rate if left standing for long periods at high temperatures. If machine is to stand for several days, remove batteries and store in a cool place.

IMPORTANT

Do not store acid type storage batteries near stacks of tires. Acid fumes can damage rubber.

3. Service fuel system as directed in Operation and Maintenance Manual and Operation and Maintenance Manual, of this manual. Check for water content before filling fuel tank. High temperatures and cooling off cause condensation in storage drums.
4. Lubricate as specified in Operation and Maintenance Manual, in this manual or Lubrication Decal on machine.
5. Do not park machine in sun for long periods of time. If possible, park machine under cover to protect it from sun, dirt and dust.
 - A. Cover machine if no suitable shelter is available. Protect engine compartment and hydraulics from dirt and debris.

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DIM.	Boom	4.6 m (15' 1")		
	Arm	3.0 m (9' 10")	2.1 m (6' 11")	2.5 m (8' 2")
	Bucket Type (PCSA)	0.39 m ³ (0.51 yd ³)	0.51 m ³ (0.67 yd ³)	0.45 m ³ (0.59 yd ³)
A	Max. Digging Reach	8,665 mm (28' 5")	7,815 mm (25' 8")	8,285 mm (27' 2")
B	Max. Digging Reach (Ground)	8,530 mm (28' 0")	7,660 mm (25' 2")	8,140 mm (26' 8")
C	Max. Digging Depth	6,135 mm (20' 2")	5,235 mm (17' 2")	5,635 mm (18' 6")
D	Max. Loading Height	6,440 mm (21' 2")	5,865 mm (19' 3")	6,315 mm (20' 9")
E	Min Swing Radius	2,625 mm (8' 7")	2,285 mm (7' 6")	2,380 mm (7' 10")
F	Max. Digging Height	8,745 mm (28' 8")	8,150 mm (26' 9")	8,660 mm (28' 5")
G	Max. Bucket Pin Height	7,655 mm (25' 1")	7,080 mm (23' 3")	7,535 mm (24' 9")
H	Max. Vertical Wall Depth	4,685 mm (15' 4")	3,710 mm (12' 2")	4,495 mm (14' 9")
I	Max. Radius Vertical	5,970 mm (19' 7")	5,745 mm (18' 10")	5,605 mm (18' 5")
J	Max. Depth to 2.5 m Line	5,890 mm (19' 4")	4,910 mm (16' 1")	5,395 mm (17' 8")
K	Min. Radius 2.5 m Line	1,825 mm (6' 0")	1,805 mm (5' 11")	1,915 mm (6' 3")
L	Min. Digging Reach	-225 mm (0' -9")	955 mm (3' 2")	325 mm (1' 1")

EXCAVATOR PERFORMANCE MEASUREMENTS

Evaluation of equipment performance under certain operating conditions can be made by running the excavator through a series of different tests, and recording results with a stopwatch and tape measure.

Compare results of performance tests against the specifications and operating conditions that follow, which are for equipment in new or renewed condition.

Test Conditions

1. All tests must be performed on a flat, level, firm supporting ground surface.
2. All recommended, applicable maintenance and adjustment service must be completed before testing.
3. Hydraulic fluid and engine oil must be of appropriate viscosity for ambient weather. Warm up hydraulic oil to standard operating temperature, between 45° - 55°C (112° - 135°F).
4. Run all tests with the engine speed control set to maximum rpm.
5. Repeat tests with control settings at both Standard Mode (standard work mode) and Power Mode (high-speed mode). Travel speed tests should also be repeated at both high and low speed.

Travel Speed and Travel Motor Balance (Steering Deviation) Tests

Speed Test

Prepare the excavator for travel speed tests by extending all hydraulic cylinders - boom, arm and bucket - to the fully extended position, shown in Figure 7.

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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.

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NOTE: *The formula assumes there is no added deflection or "give" in the joint between the extension and torque wrench. Readings may also be inaccurate:*

- If the extension itself absorbs some of the tightening force and starts to bend or bow out.
- If an extension has to be fabricated that is not perfectly straight (for example, an extension made to go around an obstruction, to allow access to a difficult to tighten fastener), the materials and methods used must be solid enough to transmit full tightening torque.

Other Uses for Torque Wrench Extension Tools

Torque wrench extensions are sometimes made up for reasons other than increasing leverage on a fastener.

For example, a torque wrench and extension can be used to measure adjustment "tightness" of a linkage or assembly. Specially fabricated extensions can be used to make very precise checks of the force required to engage or disengage a clutch mechanism, release a spring-applied brake assembly, or "take up" free play in most any movable linkage.

Once the value of the adjustment force is established, repeated checks at regular intervals can help to monitor and maintain peak operating efficiency. These types of adjustment checks are especially useful if physical measurements of linkage travel are difficult to make or will not provide the needed degree of precision and accuracy.

To allow the assembly or mechanism to accept a torque wrench, welding a nut or other adapter on the end of a linkage shaft or other leverage point will allow turning the shaft or assembly manually.

SAFETY INSTRUCTIONS



WARNING

AVOID DEATH OR SERIOUS INJURY

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

APPLICABLE MODELS

The contents of this section apply to the following models and serial number ranges.

MODEL	SERIAL NUMBER RANGE
DX140LC-3	1001 and Up, 50001 and Up
DX180LC-3	1001 and Up, 50001 and Up
DX225LC-3	1001 and Up, 50001 and Up
DX255LC-3	1001 and Up, 50001 and Up
DX300LC-3	1001 and Up, 50001 and Up
DX340LC-3	1001 and Up, 10001 and Up
DX350LC-3	1001 and Up, 10001 and Up
DX380LC-3	10001 and Up
DX420LC-3	10001 and Up
DX490LC-3	10001 and Up
DX530LC-3	10001 and Up

Counterweight

Edition 1

Fuel Tank

Edition 1

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

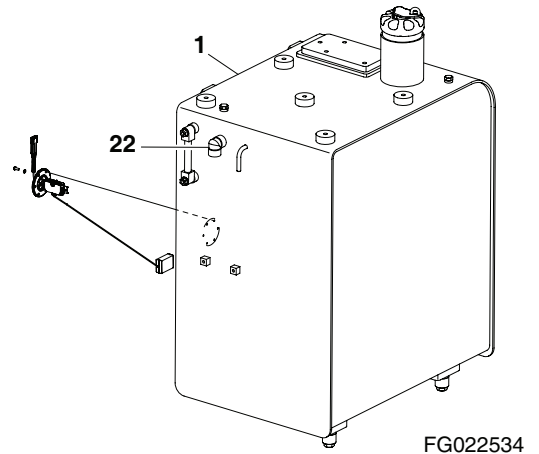


Figure 11

20. Tag and disconnect wires leading to fuel sensor (14) and fuel float switch (17, Figure 12) on side of fuel tank (1).

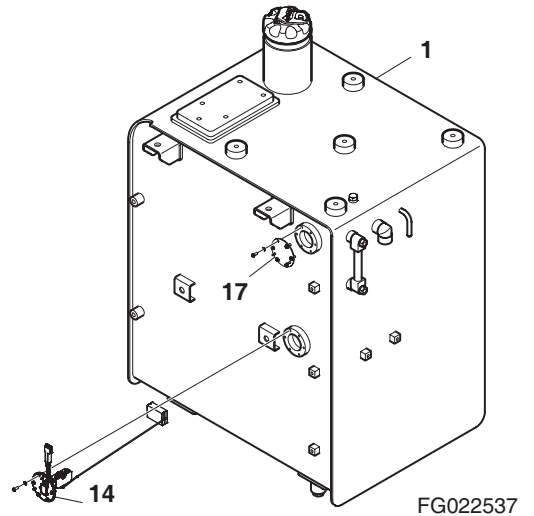


Figure 12

21. Install two 12 mm eyebolts in threaded holes (38 and 39, Figure 13). Using a suitable lifting device, sling eyebolts.
22. Remove six bolts (7) and spacers (13, Figure 13) holding tank (1) to frame. Lift tank 25 mm (1") and make sure it is balanced. Make sure there are no other electrical wires or hoses connected to tank. Completely remove tank after inspection.

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

23. Remove shims (9, Figure 13).

NOTE: *If tank is to be reused note position and amount of shims used for each mounting bolt location.*

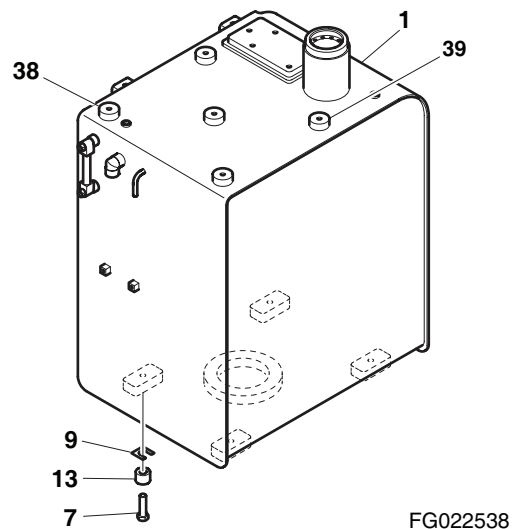


Figure 13

SAFETY INSTRUCTIONS



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DX350LC-3	1001 and Up, 10001 and Up
DX380LC-3	10001 and Up
DX420LC-3	10001 and Up
DX490LC-3	10001 and Up
DX530LC-3	10001 and Up

SAFETY INSTRUCTIONS



WARNING

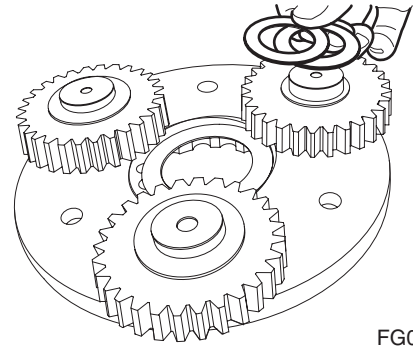
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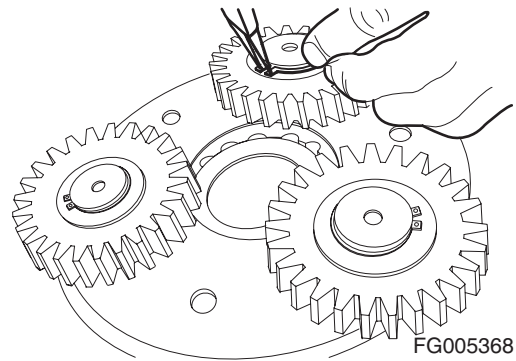
MODEL	SERIAL NUMBER RANGE
DX140LC-3	1001 and Up, 50001 and Up



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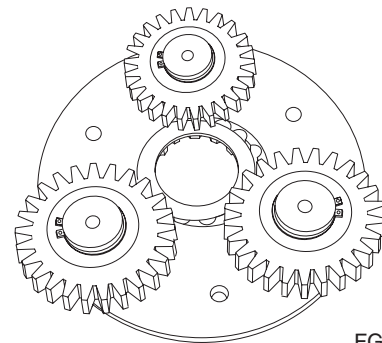
Figure 19

- G. Install a retaining ring ($\varnothing 30$, C type, and for shaft) on each and check if gear rotates smooth.



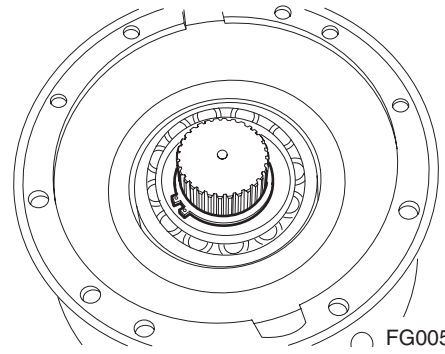
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Figure 20



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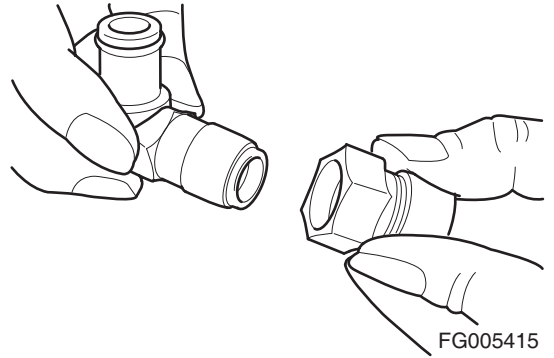
Figure 21



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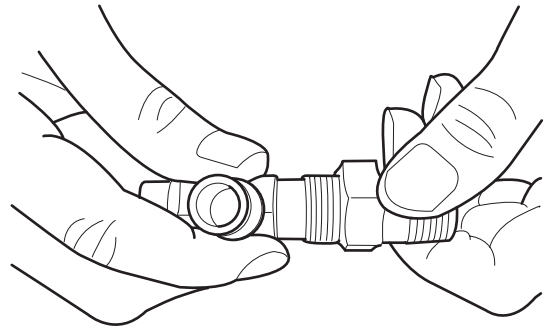
Figure 56

H. Install drain valve on PT3/8 tap of the side of the case.



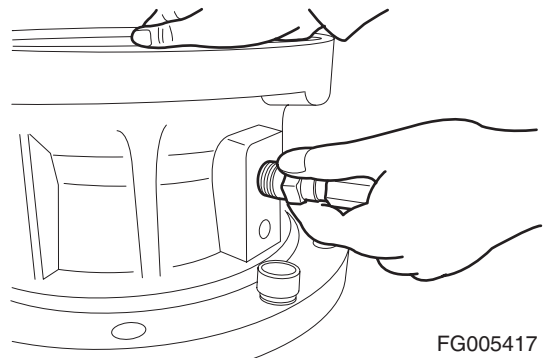
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Figure 57



FG005416

Figure 58



FG005417

Figure 59

- C. Place the motor carefully on the reduction gear while arranging its direction as shown in figures (with caution not to have flange of the motor contact the applied fluid gasket). Assemble it by slowly turning it right and left so that spool line of the shaft engages with the threads of the sun gear #1.

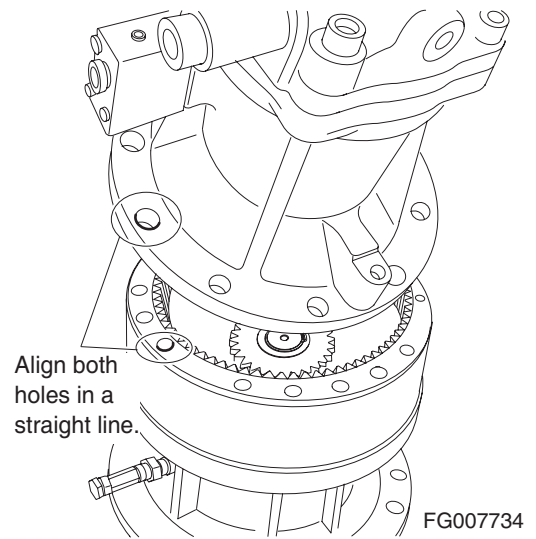


Figure 88

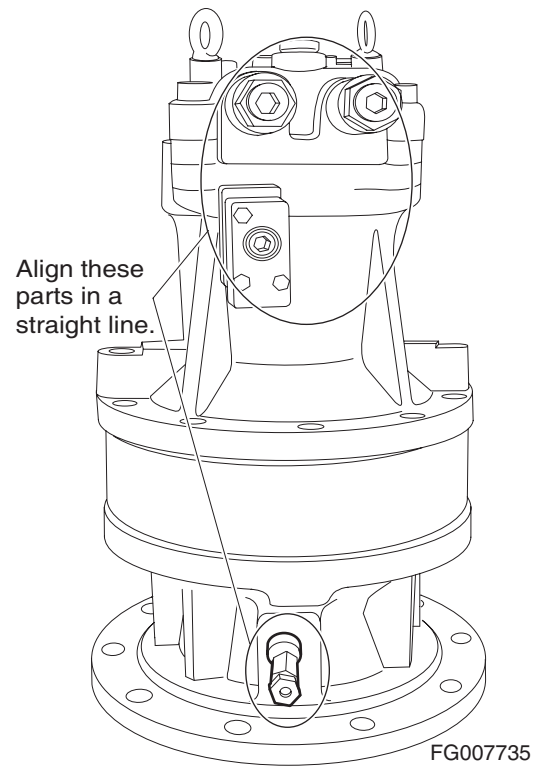


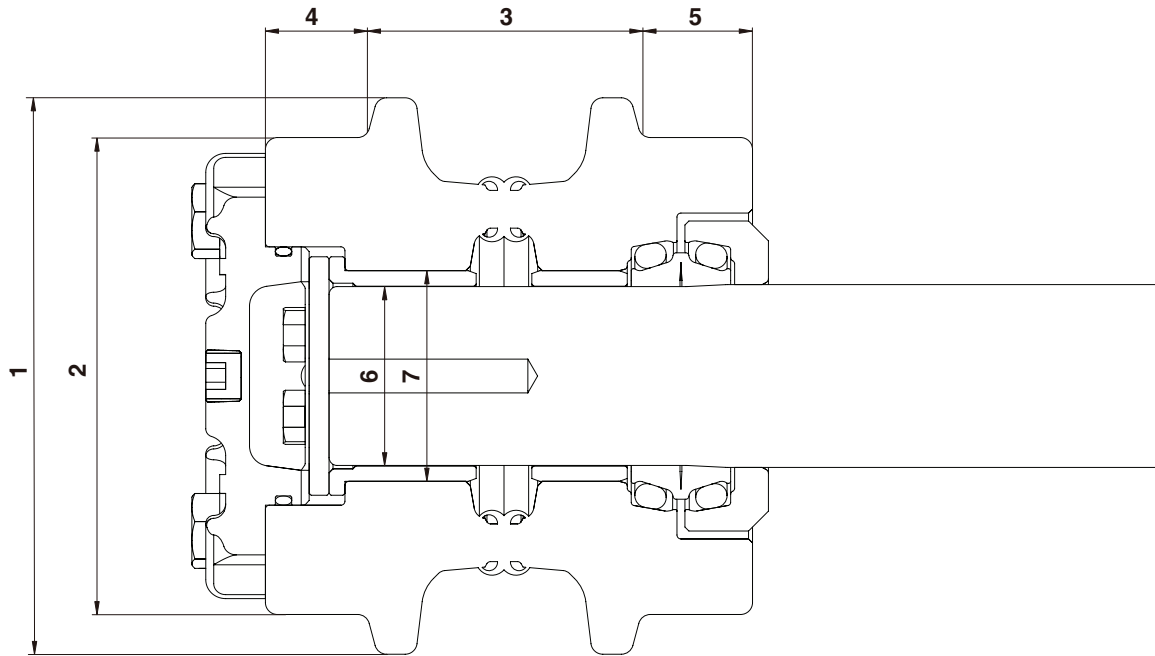
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Upper Roller



FG022542

Figure 6

No.	Check Item	Standard Dimension		Recommended Limit for Maintenance			Limit for Use (Repair - P or Replace - R)
1	Outside Diameter of Flange	140 mm (5.512")					
2	Outside Diameter of Tread	120 mm (4.724")		112 mm (4.409")			
3	Width of Tread	69 mm (2.716")					
4	Width of Flange	25.5 mm (1.004")		29 mm (1.142")			
5	Width of Flange	28 mm (1.102")		31.5 mm (1.240")			
6	Clearance between shaft and bushing	Standard Dimension (Shaft)	Tolerance	Standard Dimension (Bushing)	Tolerance	Standard Clearance	Repair Limit
		45 mm (1.772")	-0.05 -0.08	45.2 mm (1.779")	+0.05 +0	0.25 - 0.33	
7	Interference between roller and bushing	Standard Dimension (Roller)	Tolerance	Standard Dimension (Bushing)	Tolerance	Standard Interference	Repair Limit
		53 mm (2.087")	+0.03 -0.02	53 mm (2.087")	+0.1 +0.05	0.02 - 0.12	

4. Remove O-rings (7, Figure 30) from the axle.
5. Separate floating seals (6, Figure 30) from the collar and roller (1).
6. Remove collar (2, Figure 30) and O-rings (7) from the axle, using press.

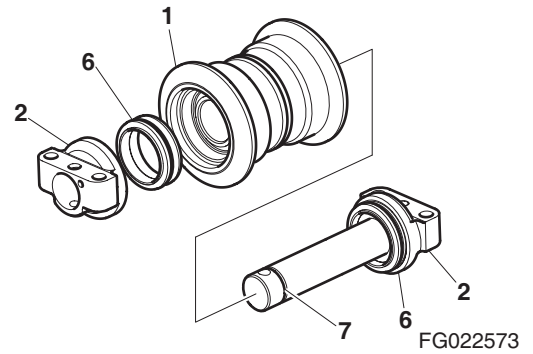


Figure 30

Lower Roller Reassembly

1. Degrease, clean and dry all parts before reassembly. Insert bushing (4, Figure 31) into roller.

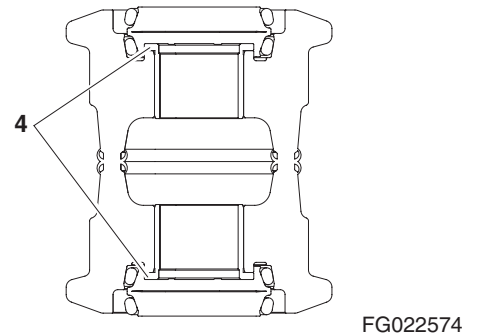


Figure 31

2. Apply grease to the O-rings (7, Figure 32) and insert into axle.
3. Align collar (2, Figure 32) and axle (3) pinholes and pin (5) the collar.

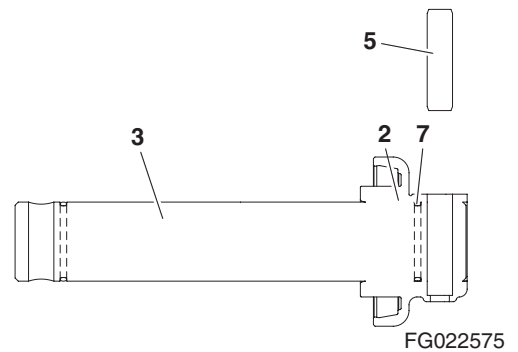


Figure 32

4. Insert floating seals (6, Figure 33) into the roller (1) and collar (2).

NOTE: Apply clean gear oil (ISO VG 220EP) to the joint side of the floating seal. Apply grease to the floating seal O-ring.

5. Slide the axle inside the roller.

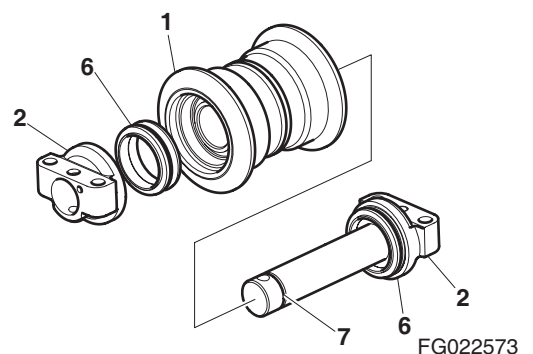


Figure 33

Engine Coolant Heater (Option)

Edition 2

Changing the Combustion Air Fan

Removal

1. Remove heater.
2. Disconnect the electrical connections.
3. Remove screws (2, Figure 3).
4. Pull the combustion air fan (1, Figure 3) off the burner head (4, Figure 3) and remove with the shaped sealing ring (3, Figure 3).

NOTE: *Remove control unit if necessary from the Thermo 90 S/Thermo 90 ST heater with flange mounted control unit.*

5. Complete the work on stripped-down components.

Installation

NOTE: *Insert the shaped seal (3, Figure 3) correctly and grease it (e.g. with Vaseline). Take care not to squash it.*

1. Install the new shaped sealing ring (3, Figure 3) onto the combustion air fan (1, Figure 3). Bring the fan into the assembly position and secure it with screws (2, Figure 3).
2. Tighten the screws (2, Figure 3) to 3 Nm \pm 10%.

NOTE: *Install the control unit if necessary on the Thermo 90 S/Thermo 90 ST heater with flange mounted control unit.*

3. Connect the electrical connections.
4. Install the heater.

Table of Contents

Drive Coupling (Main Pump)

Safety Instructions	5
Applicable Models	5
Drive Coupling	6
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Installation Procedure.....	10

Hydraulic System Troubleshooting, Testing and Adjustment

Edition 1

Bucket Operating Circuit

The bucket operating circuit includes the left main pump, the left half of the control valve and the bucket cylinder. 370 kg/cm² (5,265 psi) overload relief valves at BKT and BKTD 1 ports of the control valve protect the circuit and its components from being damaged.

Bucket Crowd Circuit

When the bucket control lever is placed in the crowd position, the bucket control valve spool on the left side of the control valve opens and oil from left main pump flows to the bucket cylinder.

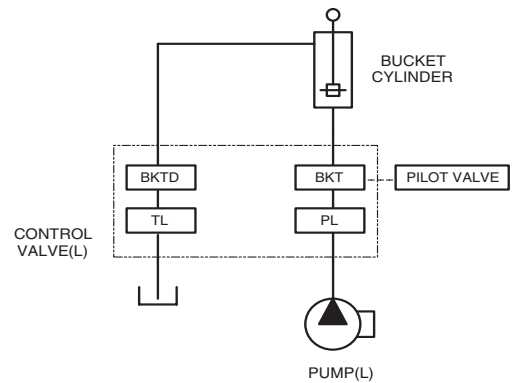


Figure 6

Bucket Dump Circuit

When the bucket control lever is put in the dump mode, the bucket control valve spool in the left half of the control valve opens to supply oil from the left main pump to the cylinder.

Swing Operating Circuit

The swing operating circuit consists of the right main pump in the pump assembly, the right half of the control valve and the swing motor. To keep the upper works from coasting when the swing control is in neutral, an electrical sensor in the control circuit activates a valve to automatically engage a mechanical brake.

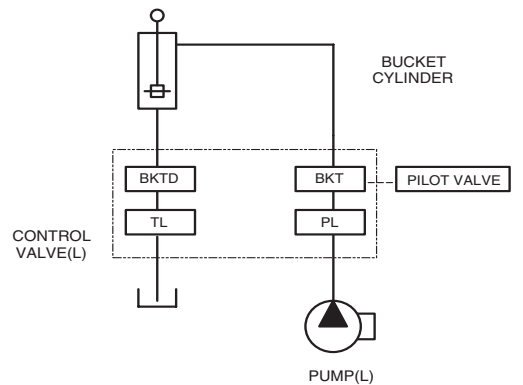
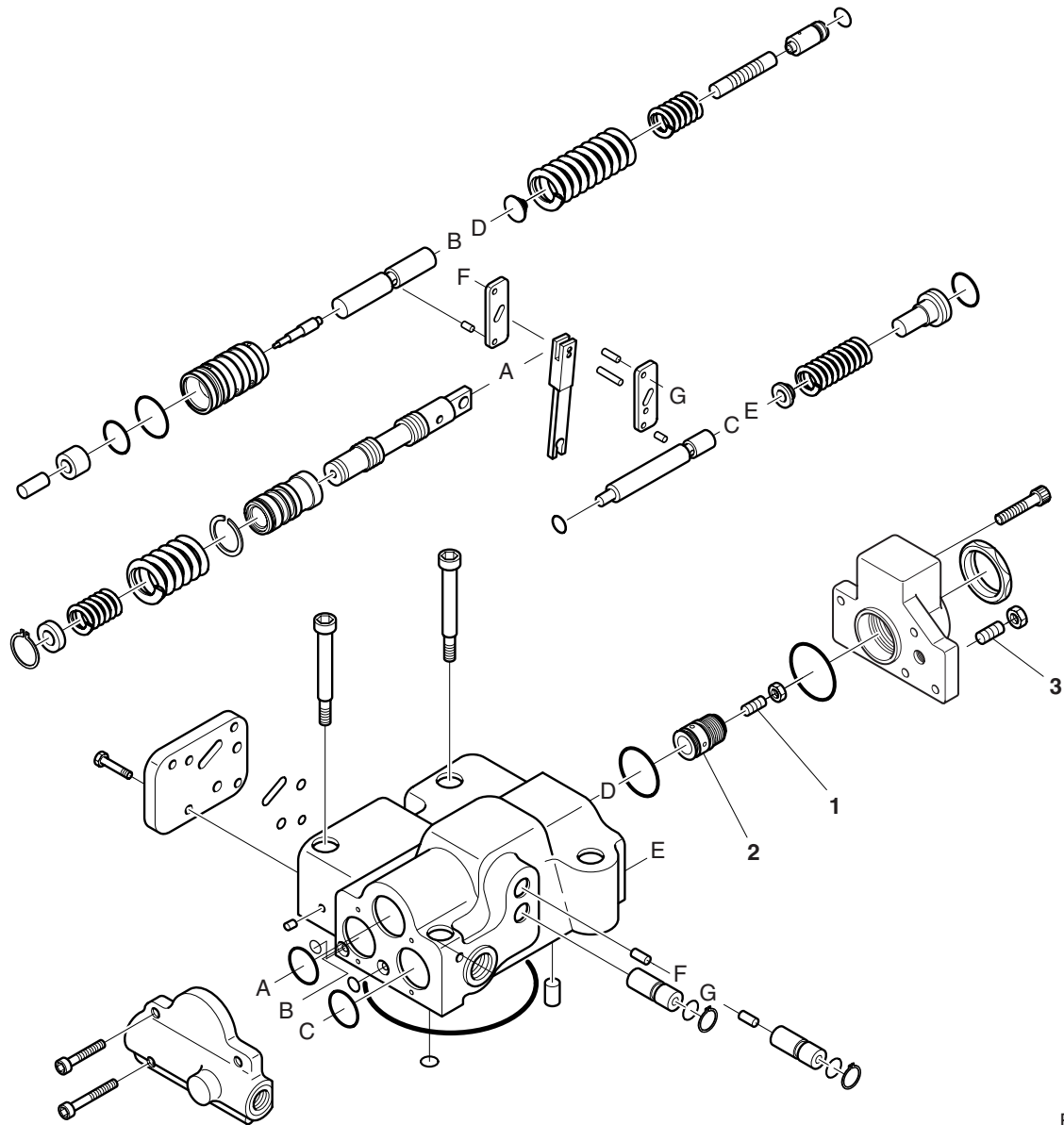


Figure 7

To check pump imbalance without a flow meter, travel the excavator forward on flat, level terrain. If the machine veers off despite neutral control input and even, balanced track adjustment, the pump which supplies output to the track frame toward which the excavator is veering is weak.



FG000654

Figure 12

Refer to the illustration of the pump regulator control valve (Figure 12) for the location of adjustment screws (1, 2 and 3). There are two different adjustments, with the Negacon, negative control, adjustment screw (3, directly below 1 and 2). Each one of the adjustment procedures could affect the setting of the others.

Check and record the arm dump speed performance test before and after input power adjustment, whether or not a flow meter is used.

NOTE: *Regulator adjustments affect total cumulative horsepower, since each regulator compensates for*

TROUBLESHOOTING – CONTROL VALVE

Check control valve problems only after other hydraulic circuit operational tests have been made. Refer to "Troubleshooting Baseline Recommendations" procedure. Pump flow, pilot pressure, Negacon pressure, main relief pressure, and port relief pressure should all be checked before starting to work on the control valve. Make sure the hydraulic system is refilled up to the required level and free of oil leaks or air in the system that could cause cavitation problems.

Problem	Possible Cause	Remedy
Main relief valve.	Particulate contamination.	Disassemble, clean main poppet.
	Broken or damaged spring.	Replace.
	Adjusting screw loose.	Readjust.
	Main poppet sticking.	Repair/replace.
	Clogged orifice in pilot passage to control valve.	Clean/replace.
Cylinder goes down in spool neutral.	Excessive clearance between casing and spool.	Replace spool or casing.
	Spool does not return to neutral/ sticking spool.	Check secondary pilot pressure.
	Spool does not return to neutral because of dirt or other contaminants.	Clean.
	Broken or damaged spring.	Replace.
	Main relief or port relief not operating properly.	See above.
	Impurities in pilot circuit.	Clean.
Cylinder drops before start at boom up operation.	Rod check valve damaged or clogged.	Clean/replace.
	Poppet sticking.	Clean/replace.
	Broken or damaged spring.	Replace.
Slow operation or response.	Excessive clearance between spool or casing.	Check pilot pressure and/or replace spool or casing.
	Sticking spool.	Clean/replace.
	Broken or damaged spring.	Replace.
	Main or port relief valve damaged.	Check pressure/replace.
Boom and arm cylinders do not perform normally in combined operation.	Priority valve faulty or spool sticking.	Check pilot pressure.
	Broken or deformed spring.	Replace.
	Excess clearance between right and left casing and valve spool.	Clean/replace.
	Clogged spool passage.	Clean/replace, replace filter.
Relief valve malfunctions:		
Pressure does not increase at all.	Main poppet or pilot poppet stuck open.	Clean/replace.

When hydraulic fluid is pushed out the lower valve opening by the pressure of the gas charge on the other side of the diaphragm - and there is no counterpressure from system oil - the valve button on the bottom of the diaphragm eventually seals off the lower oil passage. Just after the needle on the gauge reaches its highest point (when there is 0 bar (0 psi) resistance from hydraulic system pressure) pressure on the gauge will drop sharply to zero, as the accumulator is completely emptied of oil and the diaphragm button closes.

Record the highest gauge reading and compare to "P1" rated precharge pressure on the accumulator manufacturer's data label. Repeat this test at least once a year to verify proper functioning of the accumulator.

3. As hydraulic system pressure overcomes accumulator precharge pressure, the flexible diaphragm begins to retract upward.
4. When system oil is at highest working pressure and the accumulator fills to maximum reserve capacity, the flexible diaphragm is pushed up into the top of the upper chamber.

The highest working pressure is sometimes referred to as the "P3" pressure and can also be referenced on the manufacturer's data label on the exterior of the accumulator.

5. If system oil pressure begins to fall off or is momentarily checked or interrupted, the energy stored on the other side of the diaphragm, in the form of compressed gas, pushes oil back out of the lower chamber, maintaining oil pressure of the circuit.
6. With minimal system pressure, an equilibrium point may be reached in which accumulator precharge pressure and hydraulic system oil pressure achieve a rough balance. In this condition a minimal amount of oil is stored in the accumulator.

TROUBLESHOOTING, TESTING AND ADJUSTMENT

Inspection

The center joint must be checked for evidence of external oil leakage every 2,000 operating hours. Leaking or defective O-rings are an indication that dirt and other contaminants could be getting inside the assembly, which will promote accelerated, abnormal wear and can cause early failure of the assembly.

If internal seals or other sliding surface components are worn and there is internal fluid leakage, complete overhaul and repair or replacement of the center joint may be required.

Testing

To check pressure through the center joint, make up a test kit from the following equipment list:

- 700 bar (10,000 psi) pressure gauge.
- Adapters, connectors, piping and flange block off plates conforming to those used in high-pressure piping connections of the excavator.
- A high-pressure relief valve with a setting pressure 1.5 times maximum system pressure.
- A stop valve.
- A manually operated, in-line changeover valve.

Install the changeover valve upstream from one of the stem high-pressure ports. Connect the pressure gauge downstream from one of the body ports. Install the stop valve between the changeover valve and the stem of the center joint. Other components must be installed according to the layout in the block diagram. The test kit is used to pressurize the center swivel above normal working pressure and lock in the higher pressure (as the stop valve is closed manually) for a leak down test.

NOTE: *The same type of kit can also be made up for the drain port (return line) side of the center joint. Use appropriate piping, connectors, test gauges, etc., and follow the same block diagram general layout (Figure 2).*

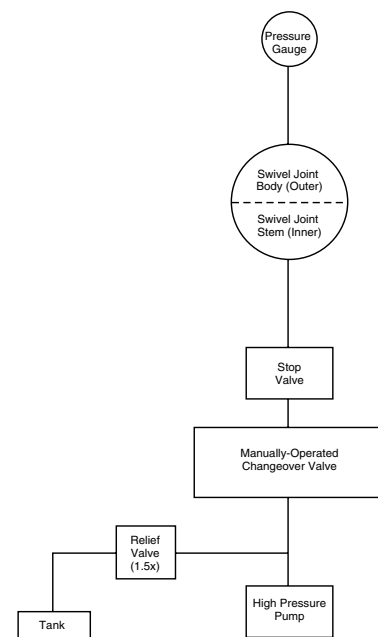


Figure 2

0370

SAFETY INSTRUCTIONS



WARNING

AVOID DEATH OR SERIOUS INJURY

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

APPLICABLE MODELS

The contents of this section apply to the following models and serial number ranges.

MODEL	SERIAL NUMBER RANGE
DX140LC-3	1001 and Up, 50001 and Up

Model	Cylinder	A	Model (Cylinder)
DX140LC-3/ DX140W-3	Boom	Hex 80	
	Arm	Hex 80	
	Bucket	Hex 70	
	Arti	Hex 90	
DX180LC-3/ DX190W-3	Boom	Hex 80	
	Arm	Hex 90	
	Bucket	Hex 80	
	Arti	Hex 100	
DX225LC-3	Boom	Hex 80	
	Arm	Hex 110	
	Bucket	Hex 80	
	Arti	Hex 110	
DX255LC-3	Boom	Hex 90	
	Arm	Hex 110	
	Bucket	Hex 90	
	Arti	Hex 110	
DX300LC-3	Boom	Hex 110	
	Arm	Hex 110	
	Bucket	Hex 100	
DX340LC-3/ DX350LC-3	Boom	Hex 110	
	Arm	Hex 130	
	Bucket	Hex 110	
DX380LC-3	Boom	Hex 110	
	Arm	Hex 130	
	Bucket	Hex 110	
DX420LC-3	Boom	Hex 130	
	Arm	Hex 130	
	Bucket	Hex 120	
DX490LC-3/ DX530LC-3	Boom	Hex 130	
	Arm	Hex 140	
	Bucket	Hex 130	

Slipper Seal Jig

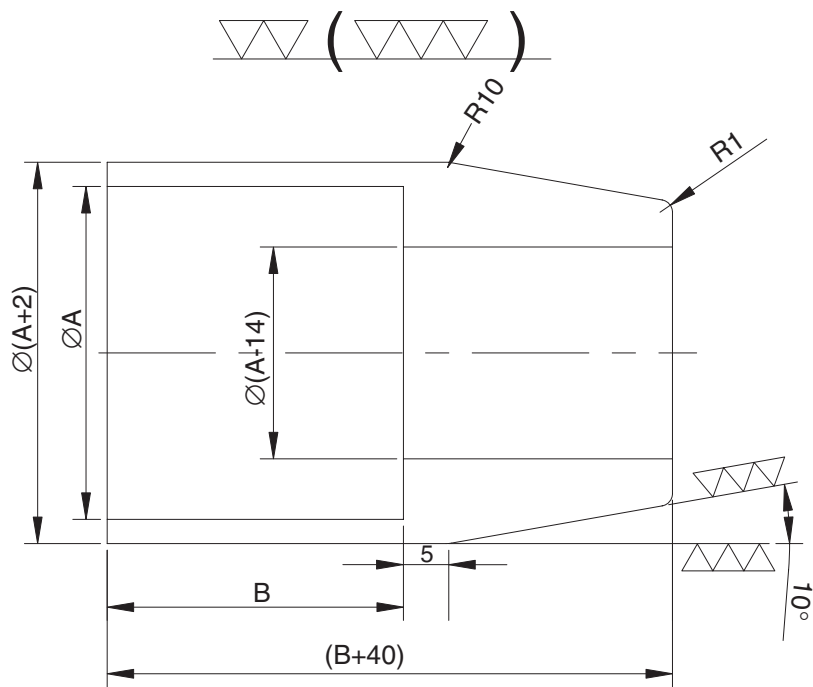


Figure 11

ARS4770L

15. During disassembly of cylinder head, be careful not to damage buffer seal (8) and U-packing (9).

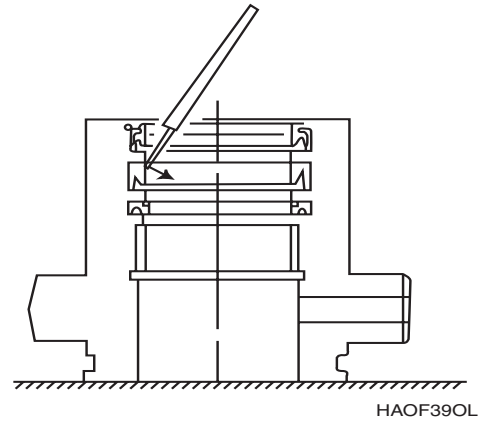


Figure 27

16. Disassemble retaining ring (12) and dust wiper (11). Separate retaining ring (7) and rod bushing (6).

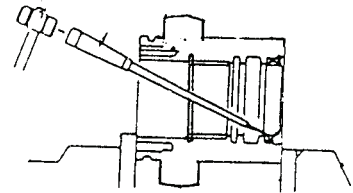
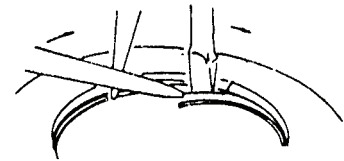
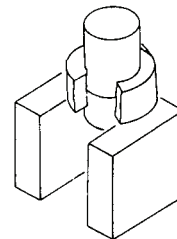


Figure 28

17. Force out pin bushing (2), (4) from body of cylinder.



0349

Figure 29

SAFETY INSTRUCTIONS



WARNING

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

APPLICABLE MODELS

The contents of this section apply to the following models and serial number ranges.

MODEL	SERIAL NUMBER RANGE
DX140LC-3	1001 and Up, 50001 and Up

Precaution in Use

Inspection

Before installation of a new motor, inspect the following items.

1. Inspect whether or not there is any damage during transit, or if any parts are lost or missing.
2. Inspect each tightened part to see if it is loose or not.
3. Check whether or not covers for flange surfaces and drain ports are perfect, and if the inside of the motor is dirty with intruded dust.

Rotation Direction

The relation between the oil flow and the revolutionary direction of the shaft is self-explanatory as shown in Figure 7 and table.

The revolutionary direction of a motor vary according to the slope surface of casing.

Pay attention to discriminate between geometry of casing and the direction of flange as the direction of tilting angle.

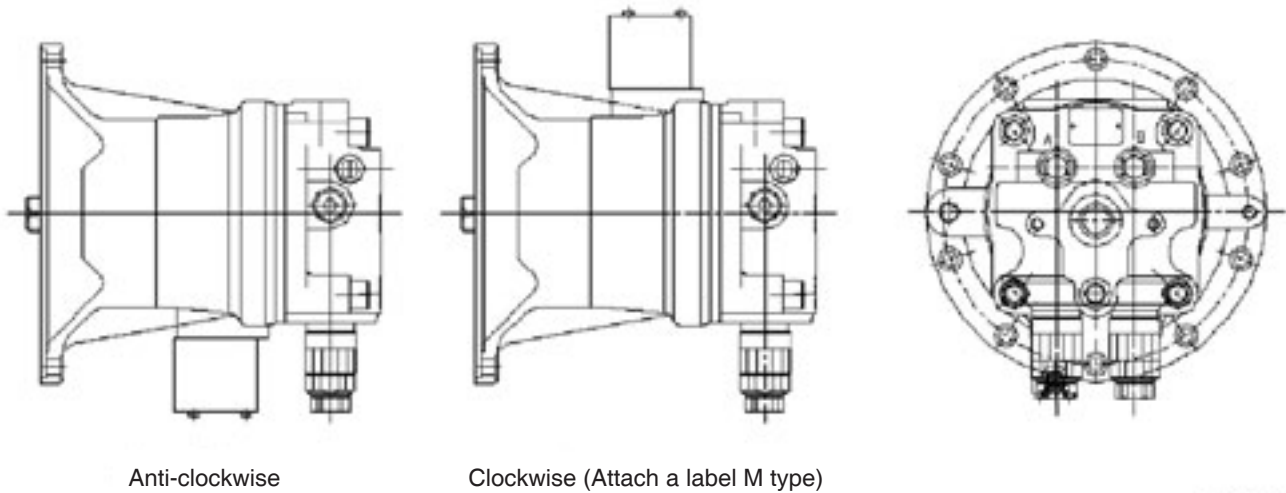


Figure 7 Brake Working Description

FG007425

Direction	Inlet Port	Outlet Port	Revolutionary Direction of Shaft Facing the Shaft Side
counterclockwise	A	B	Right-handed
Clockwise	B	A	Left-handed

Procedures for Disassembly

Please use the following procedures for the inspection and repair of the motor.

Numerals given in parentheses following the parts names indicate the parts number shown by the drawing in the instruction and maintenance manual.

1. Wind the wire rope at motor outside, lift up the motor, and clean the motor with cleaning oil.

After cleaning, dry with compressed air.

2. Draw the oil out of the casing (301).
3. Mount on a suitable table for the driven-axis (201) below.

Before disassembling make a match mark on motor casing (301) and valve casing (101).

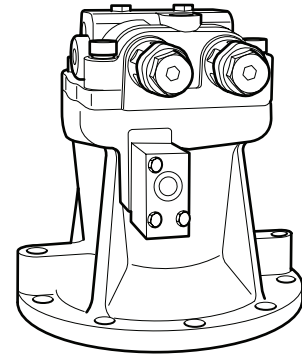


Figure 12

FG001856

4. Remove brake valve (400).

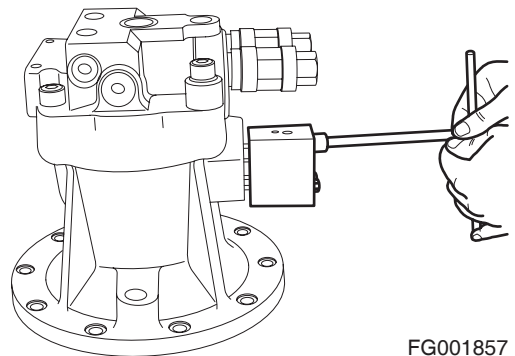


Figure 13

FG001857

5. Remove relief valve (107) from valve casing (101).

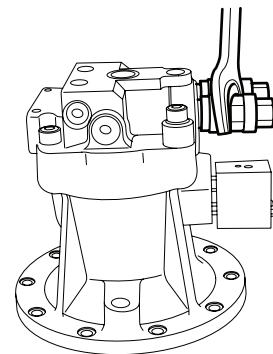


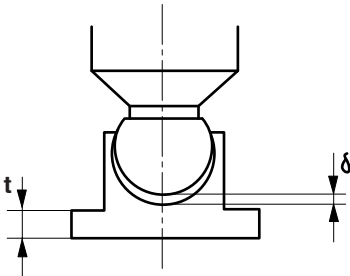
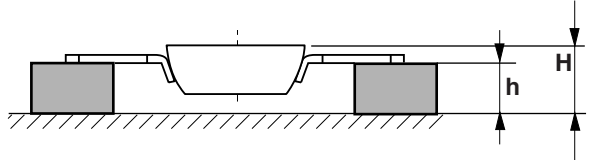
Figure 14

FG001858

Maintenance Standards

Standards for Replacement of Worn Parts

If the various parts of the motor have been worn out beyond the following standard values, please replace them. But this shall apply only to those cases when there is no remarkable outside damage.

Item	Standard Dimension (mm)	Recommended Value for Replacement (mm)	Remedy
Clearance between piston and cylinder bore	0.025 (0.036)	0.055 (0.066)	Replace piston or cylinder block.
Gap between piston and caulked part of shoe (δ)	0.05	0.2	Replace piston or shoe.
Thickness of shoe (t)	4.5 (6.5)	4.3 (6.2)	Replace piston or shoe.
Assembled height of retainer (H-h)	10.8 (13.0)	10.3 (12.5)	Replace spherical bushing and retainer as a pair.
Thickness of friction plate	3.5	3.1	Replace it.
 <p>Gap between piston and caulked part of shoe (δ). Thickness of shoe (t)</p>	 <p>Assembled height of retainer (H-h)</p>		

Standard for Correcting Sliding Surfaces

If the surface roughness of the sliding surface of a part exceeds the following standard, correct it or replace the part.

Table 4 Revise standard

Item	Surface Roughness	Roughness Requiring Correction
Shoe	0.8 - Z (Ra = 0.2) (Lapping)	3 - Z (Ra = 0.8)
Swash Plate	0.4 - Z (Ra = 0.1) (Lapping)	3 - Z (Ra = 0.8)
Cylinder Block	1.6 - Z (Ra = 0.4) (Lapping)	12.5 - Z (Ra = 3.2)
Valve Plate	0.8 - Z (Ra = 0.2) (Lapping)	6.3 - Z (Ra = 1.6)

NOTE: Lap each sliding surface to a standard roughness level or finer.

If the sliding surface of the cylinder block, valve plate, retaining plate.

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Reference Number	Description	Q'ty
1	Hub	1
2	Spindle	1
	Carrier Assembly (1)	1
3	Carrier (1)	1
5	Planetary Gear (1)	3
6	Carrier Pin (1)	3
11	Thrust Washer (1)	6
16	Parallel Pin (1)	3
27	Needle Roller Bearing	3
	Carrier Assembly (2)	1
7	Carrier (2)	1
9	Planetary Gear (2)	3
10	Carrier Pin (2)	3
12	Thrust Washer (2)	6
17	Parallel Pin (2)	3
28	Needle Roller Bearing	3
4	Sun Gear (1)	1
8	Sun Gear (2)	1
13	Thrust Plate	1
14	Cover	1
15	Coupling	1
22	Lock Washer	2
23	Shim	1
24	Angular Ball Bearing	2
	Floating Seal Kit	1
29	Floating Seal	2
30	Plug	3
31	O-ring	3
32	O-ring	1
33	O-ring	2
34	Parallel Pin	2
35	Hex. Socket Bolt	12
36	Retaining Ring for Hole	1
102	Shaft	1
103	Swash Plate	1
	Cylinder and Piston Kit	1
	Piston Kit	1
	Piston Assembly	9
105	Piston	1
106	Shoe	1
104	Cylinder Block	1
107	Retainer Plate	1
108	Thrust Ball	1

Reference Number	Description	Q'ty
109	Timing Plate	1
110	Washer	2
112	Piston	1
113	Spring	10
114	Spring	1
115	Friction Plate	3
116	Mating Plate	4
132	Oil Seal	1
135	O-ring	1
139	O-ring	1
145	Retaining Ring	1
149	Ball Bearing	1
150	Ball Bearing	1
151	Needle Roller	3
	Piston Assembly	1
161	Piston	1
162	Shoe	1
167	Pivot	2
171	Parallel Pin	2
185	Spring	1
	Relief Assembly	2
201	Valve Seat	1
202	Valve	1
203	Sleeve	1
204	Collar	1
205	Plug	1
206	Spring	1
207	O-ring	1
208	Back up Ring	2
209	O-ring	1
210	Back up Ring	2
211	O-ring	1
212	O-ring	1
213	Shim	1
	Rear Flange Assembly	1
	Rear Flange Kit	1
	Spool Assembly	1
323	Spool	1
326	Plug	2
327	Valve	2
330	Spring	2
331	O-ring	2
301	Rear Flange	1

B. High-speed

When the pilot pressure is supplied through the port (D), it defeats the spring (366) force and pressurized oil through the port (A) or (B) to push down the valve (363) to lower position, the pressurized oil at the port (C) is led to the chamber (P) through the valve (363), and the piston (161) pushes the swash plate (103) up to the plane X and maintain it at its position. At that time, the tilt angle of the swash plate becomes the minimum θ_2 resulting the minimum stroke volume and high-speed rotation of the hydraulic motor.

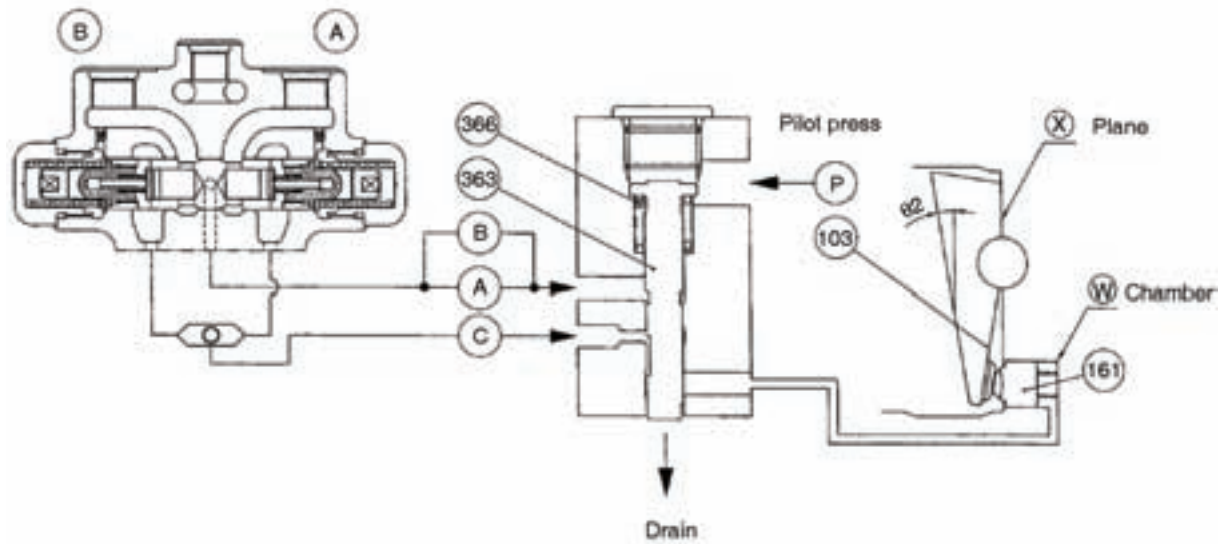


Figure 9

FG009766

Equipments

Application (Use or P/N)	Name	Type · Specification	Q'ty
Assembling and Disassembling	Workbench		1
Washing (product and parts)	Wash Tank	Washing·final washing	1
24, 104, 149	Press Workbench	24: press Cap. 9,800 (N) (1,000 (kgf)) min. 104: press cap. 1,960 (N) (200 (kgf)) min. 149: press cap. 1,960 (N) (200 (kgf)) min.	1
149	Heating Tank	Heating Cap: 100°C min Volume: 500 x 500 x 500 min	1
Drying after Washing	Compressed Air	0.29 - 0.49 (MPa) 3 - 5 kg/cm ²	1

Fabricated Tools

1. Workbench for travel motor
 - For easy and safe work of disassembling and assembling travel motor.

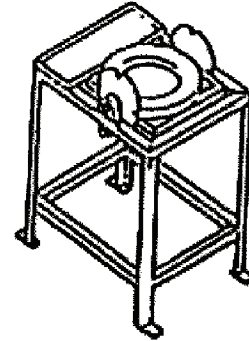


Figure 12

FG009804

2. Pressing tool (l)
 - Used for inserting spring (114), washer (110), or retaining ring (145) into the cylinder block (104).
 - Used for removing the spring (114) from cylinder block (104).

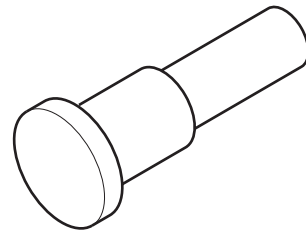


Figure 13

FG009805

10. Removing the hub

- A. Remove hex-groove bolt joining the hub and the turn-over table.
- B. Mount eyebolts (M10) on the hub and lift it up with crane.



WARNING

AVOID DEATH OR SERIOUS INJURY

To prevent injury from falling or dropping parts.

- Always use an adequate lifting device to lift the Hub. Do not Lift Hub at an angle. Lift Hub aligned with the Spindle shaft.
 - Lift Hub slowly and avoid using excessive force that could damage lifting device.
 - Use a press to remove Hub, if necessary.
-



Figure 33

11. Removing the floating seal

- A. Exert force with hand on the inner side of the floating seal (29) towards upside.

NOTE: *Wear gloves to prevent cutting hand by the edge of the floating seal.*

If solidified with soil inside, remove it with (-) screw drive or similar tools as leverage.



Figure 34

12. Removing the angular ball bearing

- A. Place a pin punch on the edge of the outer ring of the angular ball bearing (24) at 3 or 5 points which divide the ring in equal intervals. Hammer the punch to remove bearing small by small.

NOTE: *Do not hammer the inner ring of the angular ball bearing. if the inner ring is damaged, the bearing cannot be used. Therefore, do not knock the inner ring, unless the bearing is to be replaced.*

When the outer ring of the ball bearing (24) is out of the hub (1), the bearing falls down. Place a pan covered with rubber mat to receive the bearing.



Figure 35

- D. Remove 2-speed switching piston assembly and the spring (185) from the spindle (2).



Figure 68

23. Removing the deep grooved ball bearing

NOTE: Remove deep grooved ball bearing only for replacement.

- A. Place a press tool (II) on the press workbench, and insert the shaft (102) in it.
- B. Press the end of the shaft with the press to remove inner ring (149) of the deep grooved ball bearing from the shaft (102).

NOTE: Do not reuse the deep grooved ball bearing.

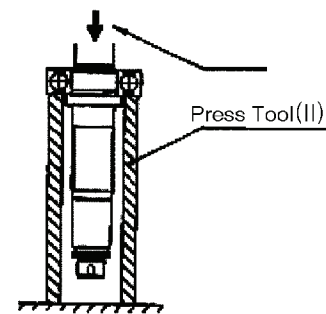


Figure 69

24. Removing the parts on the spindle

- A. Remove seal (23) from the spindle (2).



Figure 70

5. Assembling the motor parts in the spindle

- A. Insert the oil seal (132) into the spindle (2) using oil seal press-fitting tool and hammer

NOTE: When assembling the oil seal, apply lithium grease on the oil seal lip

Take care that assembling direction of the oil seal (132) is correct.

- B. Assemble the two parallel pins (171) into the pinholes of the spindle (2).
- C. Apply lithium grease on the semi-spherical surface of the two pivots (167) and press fit them into the parallel pins (171) which are inserted in the spindle (2).
- D. Apply grease on the spring (185) and assemble it with the piston assembly piston (161), shoe (162).
- E. Apply machine oil on the reciprocating surface of the piston assembly and mount it into the piston hole on the spindle (2).
- F. Insert the two parallel pins (34) into the pin groove on the fitting surface of the rear flange of the spindle (2).

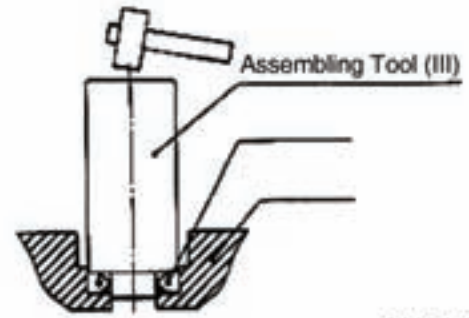


Figure 87

FG009925



Figure 88

FG009860

6. Assembling the shaft



CAUTION

Wear leather gloves during the assembly work, to prevent burns or other injuries to hands.

- A. Put the deep grooved ball bearing (149) into the heating tank, heat it for 10 minutes at $100 \pm 10^{\circ}\text{C}$, and insert it onto the shaft (102).
- B. Turn the travel motor by 90 degrees.
- C. Insert the shaft (102) into the spindle (2).

NOTE: Insert the shaft (102) slowly into the spindle (2) so lip of the oil seal (132) inserted into the spindle is not damaged.

Damaged lip will cause oil leak, resulting in the earlier failure of the travel motor.

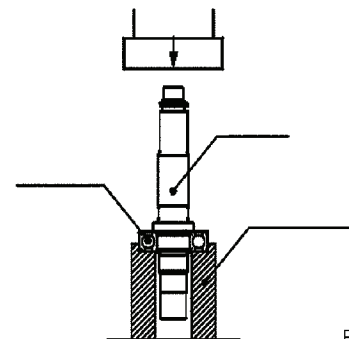


Figure 89

FG009878



Figure 90

FG009859

- B. Insert the sun gear (1, 4) into the coupling (15), aligning the splines.

NOTE: *If the sun gear (1, 4) cannot be inserted because the spline of the sun gear touches the teeth end of the planetary gear, as the gears are positioned such, slowly lift the carrier assembly (1) up until sun gear (2, 8) leaves the coupling, and then insert the sun gear (1, 4).*



Figure 125

- C. Assemble the thrust plate (13) with the carrier (1, 3).



Figure 126

21. Assembling the cover

- A. Apply loctite 515, which is a sealant, on the fitting surface with the cover (14) of the hub (1).

NOTE: *Apply the sealant without interval.*



Figure 127

- B. Mount eyebolts on the PF1/2 port, place the cover (14) on the hub (1), matching the bolt groove position.



Figure 128

GENERAL DESCRIPTION

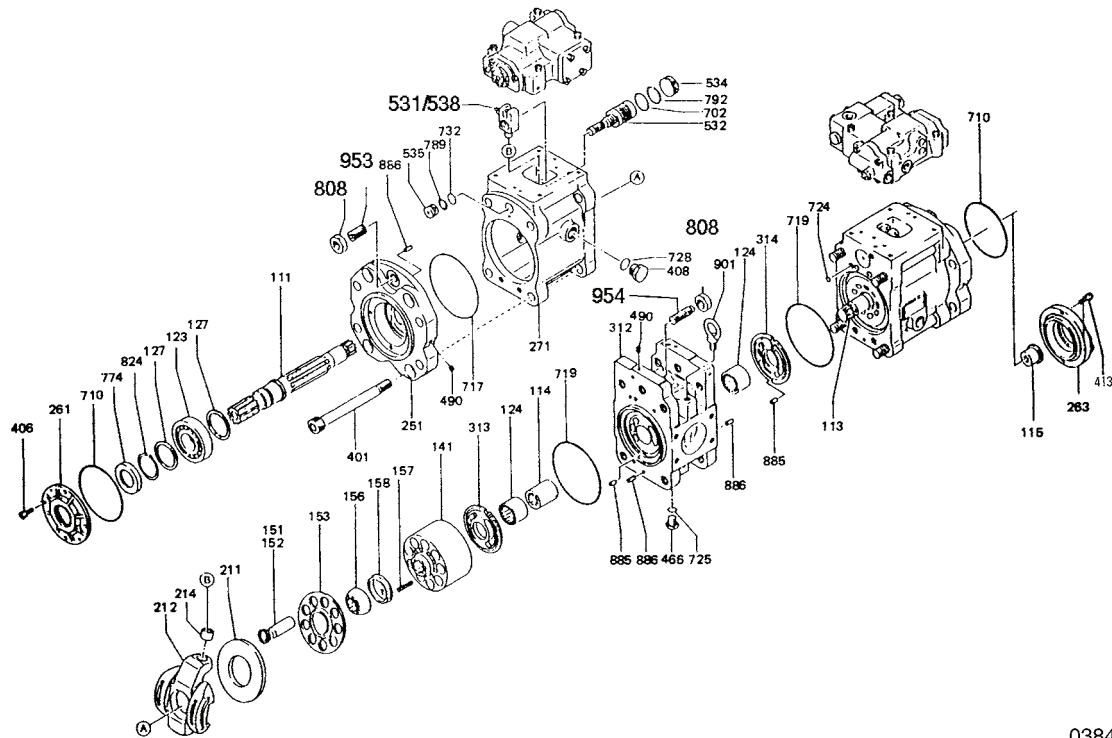


Figure 1

0384

The main pump assembly contains two variable displacement axial piston pumps connected in series, driven through a flexible coupling off the back of the engine. A regulator mounted on each pump controls the flow output of that pump. A gear type pilot pump is mounted on the second main pump (farther away from the engine) and supplies oil to the two regulators and the control valve.

The axial piston pumps in the main pump assembly are units that incorporate three main functional subassemblies:

- The rotary group includes a driveshaft, cylinder block, piston, shoe, push plate, and spherical bushing.
- The rotary group driveshaft is driven directly off the engine and turns at the same rate as engine rpm. The cylinder block and pistons revolve around the driveshaft, producing oil flow through the pump whenever the angle of the swash plate is tilted past the 0 degree (vertical) angle. Whenever the pump swash plate angle is at 0 degrees, piston stroke length is reduced to 0, and there is no output from the pump.
- The swash plate group includes the shoe plate, swash plate support, and servo pistons.

Reference Number	Description
4	Gear Pump
111	Shaft (F)
113	Shaft (R)
114	Spline Coupling
123	Roller Bearing
124	Needle Bearing
127	Bearing Spacer
141	Cylinder Block
151	Piston
152	Shoe
153	Push Plate
156	Spherical Bushing
157	Cylinder Spring
158	Spacer
211	Shoe Plate
212	Swash Plate
214	Tilting Bushing
251	Support Plate
261	Seal Cover (F)
263	Rear Cover
271	Pump Casing
312	Valve Block
313	Valve Plate (R)
314	Valve Plate (L)
401	Socket Bolt
406	Socket Bolt
413	Socket Bolt

Reference Number	Description
466	VP Plug
468	VP Plug
490	Expander
531	Tilting Pin
532	Servo Piston
534	Stopper (L)
535	Stopper (S)
548	Feedback Pin
702	O-ring
710	O-ring
717	O-ring
719	O-ring
724	O-ring
726	O-ring
728	O-ring
732	O-ring
774	Oil Seal
789	Backup Ring
792	Backup Ring
808	Nut
824	Retaining Ring
885	Pin
886	Spring Pin
901	Eyebolt
953	Set Screw
954	Adjusting Screw

3. Remove retaining ring (814), spring seat (653) and return spring (654) from feedback lever spool (652).
4. Remove pin (898) and Pf sleeve (631) from compensator piston bore.

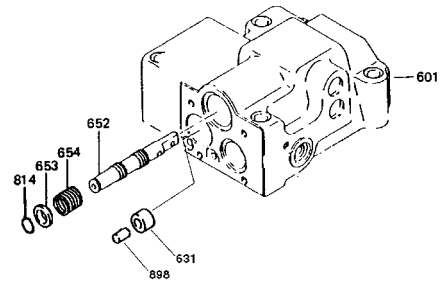


Figure 25

HAOF010S

5. Remove four Allen head bolts (438) and pilot piston lower cover (629) from regulator casing. Remove and inspect O-rings (756, 763). Remove inner spring (626), outer spring (625) and spring seat (624) from Pf piston bore.

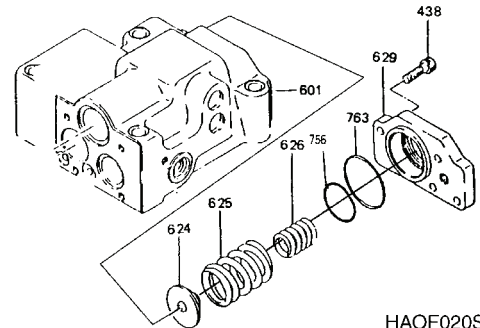


Figure 26

HAOF020S

6. Remove adjusting ring (645) from bore by threading a 4 mm x 50 mm bolt into center of adjusting ring and gently pulling it out. Remove and inspect O-ring (728). The shim (649), pilot spring (646) and spring seat (644) will become loose and slide out of the bore.

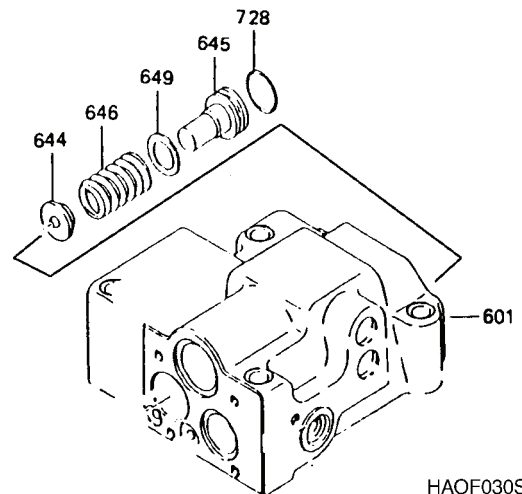


Figure 27

HAOF030S

- Subassemble driveshaft (111 or 113) with roller bearing (123), bearing spacer (127) and retaining ring (824). Install driveshaft into swash plate support (251).

IMPORTANT

Do not use excessive force, hammer blows or other tools to install the driveshaft. The subassembly can be assembled using your hands.

- Mount outer wheel of bearing on end of driveshaft with plastic hammer. Use brass rod as a drift to push outer wheel into final position. Install retaining ring (824).
- Grease O-ring (710) and oil seal (774) for protection; then install seal cover (261) and tighten mounting screws.
- Assemble pistons (151) and shoes (152) and cylinder parts push plate (153), round bushing (156) and spacer (158) in cylinder (141) and install assembly in pump casing. Mount valve plate (313 or 314) on valve block (312) and verify valve plate inlet and outlet port alignment.

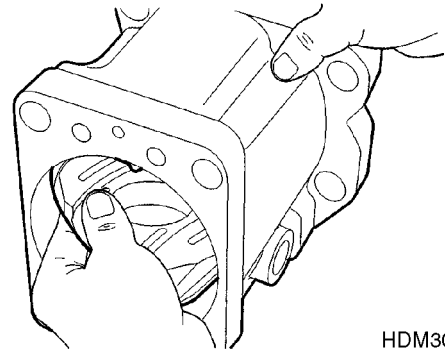


Figure 50

HDM3025P

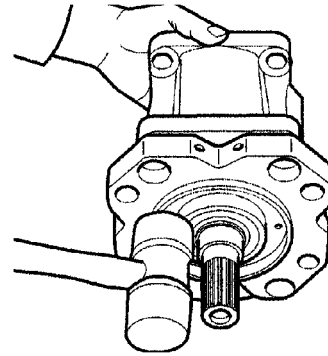


Figure 51

HDM3026P

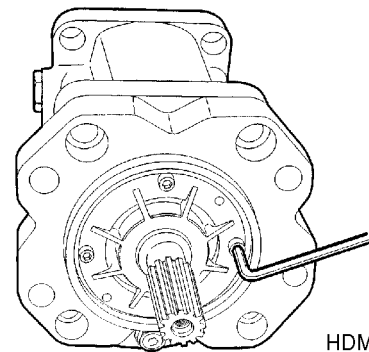


Figure 52

HDM3027P

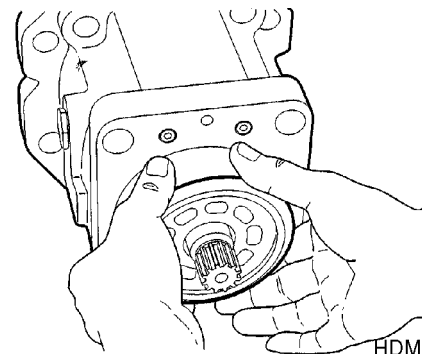


Figure 53

HDM3028P

3. Install retaining ring in groove.

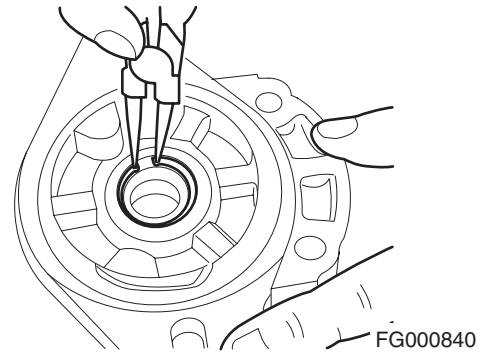


Figure 12

4. Install O-ring on both sides of rear section of body.

NOTE: Coat O-rings with grease to hold O-rings in body.

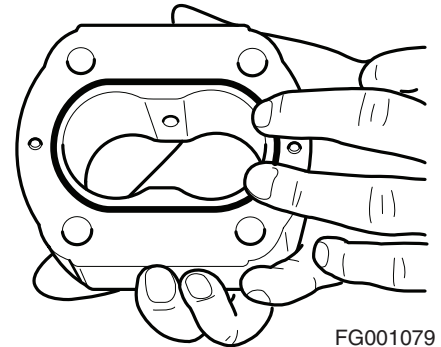


Figure 13

5. Install rear section body on rear cover.

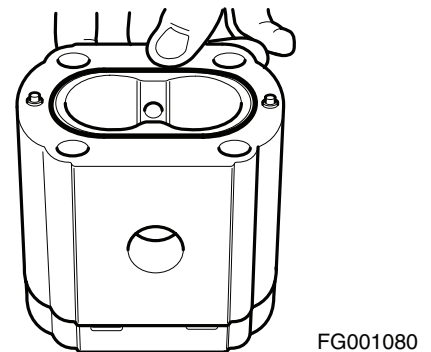


Figure 14

6. Install seals in pressure plate(s) groove. Then install backup ring in groove with seals. Coat seals with grease.

NOTE: The front and rear pressure plates and seals and backup rings are the same.

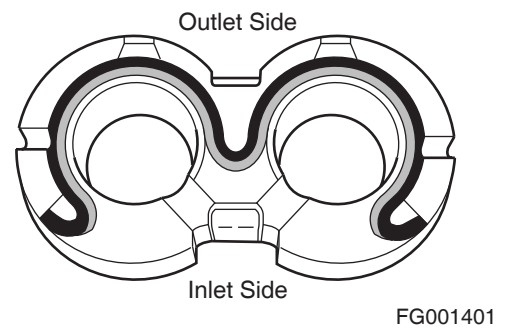


Figure 15

GENERAL DESCRIPTION

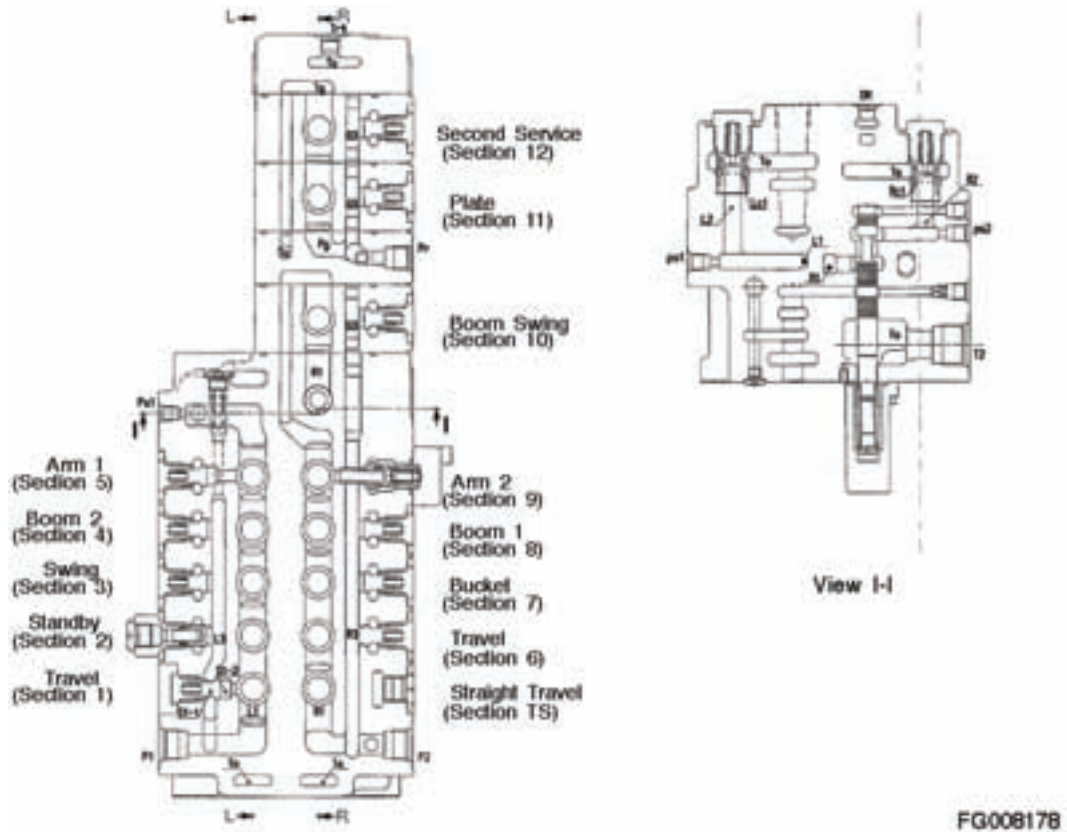


Figure 1

Neutral Cut Spool Movement (First Service convergence)

This valve is equipped with a neutral cut spool at the downstream end (upstream of the low-pressure relief valve) of the neutral path (R1). When port (pcc) is pressurized to move the neutral cut spool (R), the neutral path (R1) will be closed. Accordingly, the flow to the negacon relief valve (Rc1) is shut-off, changing the pressure of the ps2 signal.

In the meantime, the oil supplied through the P2 port joins into the path (S2-2) by (P4, Figure 2) with the external device check as media and by the empty part of the poppet (S2-1) of the first service.

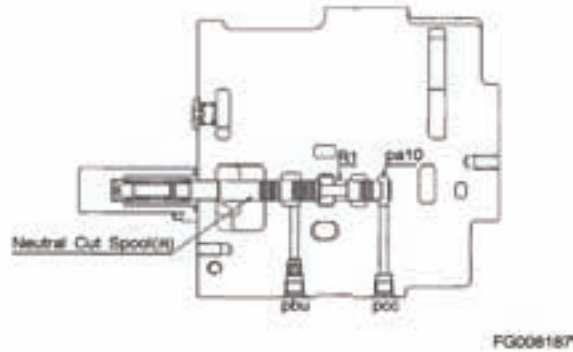


Figure 12

Add-on Spool Movement

As a representative example, the second service is illustrated.

When the spool is moved by pressure in the pilot port prb3 (pra3) of the second service (Section 12), the neutral path (pg) will be closed. The oil supplied through port Pr flows to port BR3 (AR3) by the parallel path (G3), load check valve (S12-1), path (S12-2), and spool head.

Lubricant oil returns to the tank path (Ta) from AR3 (BR3) by the spool head.

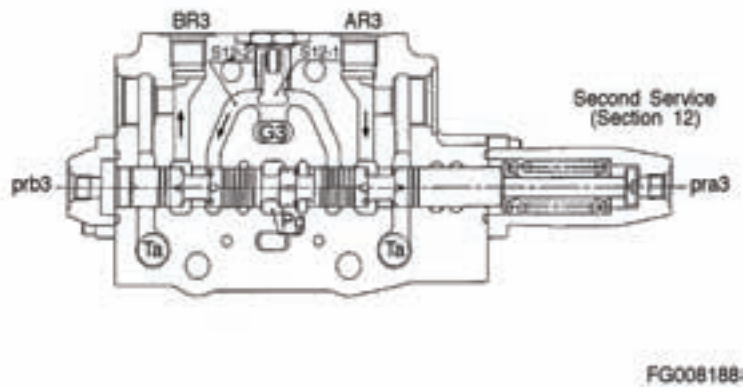


Figure 13

Disassembly of Other Plugs

1. Disassemble the plug assembly (width across flats: 19) of PP port, remove O-ring.
2. Disassemble the plug (width across flats: 19) in the preliminary section cap part, remove O-ring.
3. Disassemble the G1/8 plug (width across flats: 5, 3 in all) remove O-ring.
4. Disassemble the G3/8 plug (width across flats: 8, 4 in all), remove O-ring.
5. Disassemble the G1/2 plug (width across flats: 10, 2 in all), remove O-ring.
6. Disassemble the G3/4 plug (width across flats: 36, 2 in all), remove O-ring.
7. Disassemble the 7/8-14 UN plug (width across flats: 27), remove O-ring.

Disassembly of the Add-on Section

1. Remove hex nut (width across flats: 19) (width across flats: 22).
2. Remove outlet housing.
3. Remove valve housing for the spool section, remove O-ring on the contact surface.
4. Remove inlet housing, remove O-ring on the contact surface.
5. Remove O-ring on the main body contact surface.
6. Unscrew the tie rod and remove from the main body valve housing.

IMPORTANT

When removing the add-on section, be very careful not to dent or scratch the contact surfaces. Dents or scratches can cause an oil leak at the contacting surface, resulting in improper operation.

Keep dirt and debris away from valve components to prevent improper operation of the check valve, spool or spool actuator. If foreign material touches the spool sliding surface, the spool may get stuck, causing bad seating in the load check valve and resulting in the uncontrolled running of the actuator.

Assembling Other Plugs

1. Insert the plug assembly assembled with the O-ring.
 - Torque: 205 - 227 Nm
2. Insert the plug assembly assembled with the O-ring.
 - Torque: 73 - 79 Nm
3. Insert the plug assembly assembled with the O-ring.
 - Torque: 13.5 - 16.5 Nm
4. Insert the plug assembly assembled with the O-ring.
 - Torque: 103 - 113 Nm
5. Insert the plug assembly assembled with the O-ring.
 - Torque: 116 - 128 Nm
6. Insert the plug assembly assembled with the O-ring.
 - Torque: 49 - 59 Nm
7. Insert the plug assembly assembled with the O-ring.
 - Torque: 19 - 22 Nm

IMPORTANT

When assembled, check for any missing or loose parts. If loose, an oil leak can occur. All specified torque values are all in wet condition (applied with oil).

Adjusting Relief Valve

Main Relief Valve (common for body and add-on)

1. This part is designed for non-disassembly and is not subject to readjustment. If pressure is adjusted, we cannot guarantee its proper operation.
2. Install a precise pressure gauge at the circuit inlet.
3. Run the pump at the rated rpm.
4. Move the spool in the control valve, read the pressure gauge indication at the end of the cylinder stroke.

IMPORTANT

Move the spool of the actuator. The set pressure of the overload relief valve is higher than that of the main relief valve actuator spool.

5. Turn the adjuster clockwise until desired pressure is obtained.
17.8 MPa of pressure is increased by a turn of the adjuster.
6. When the desired pressure is reached, and press the adjuster so it does not rotate, then tighten the locknut.
 - Torque: 27 - 31 Nm
7. Raise the pressure again to check that specified pressure is obtained.

Overload Relief Valve

IMPORTANT

If the set pressure is higher than that of the main relief valve, it will be activated during the following adjustment. It is not possible to adjust the overload relief valve. Do not disassemble or adjust it. Replace with a complete new set of assembled relief valves.

1. This part is designed for non-disassembly and should not be adjusted. Replace by assembly. If the pressure has been adjusted, we cannot not guarantee its proper operation.
2. Move the control valve spool, and read the pressure gauge indication at the end of the cylinder stroke.

SAFETY INSTRUCTIONS



WARNING

AVOID DEATH OR SERIOUS INJURY

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

APPLICABLE MODELS

The contents of this section apply to the following models and serial number ranges.

MODEL	SERIAL NUMBER RANGE
DX140LC-3	1001 and Up, 50001 and Up
DX140W-3	1001 and Up, 50001 and Up
DX170W-3	1001 and Up
DX180LC-3	1001 and Up, 50001 and Up
DX190W-3	1001 and Up
DX225LC-3	1001 and Up, 50001 and Up
DX255LC-3	1001 and Up, 50001 and Up
DX300LC-3	1001 and Up, 50001 and Up

2. Install bushing (3) into case (1) using jig.

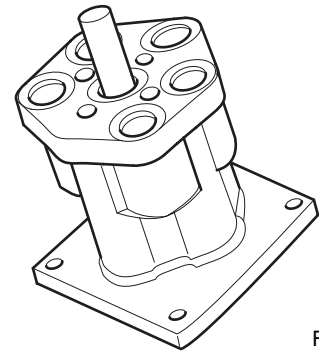


Figure 17

FG013506

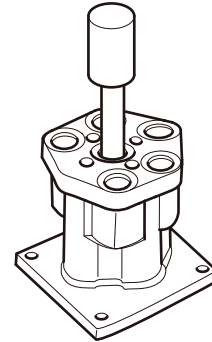


Figure 18

FG013508

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

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

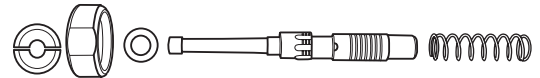


Figure 19

FG013509

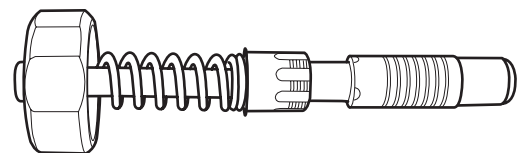


Figure 20

FG013503

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Travel Control Valve (with Damper)

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Installation	24
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REMOVAL

1. Park on firm and level ground.
2. Lower bucket (or work tool) to ground.
3. Stop engine.
4. Set safety lever in "RELEASED" position.
5. Turn starter switch to "I" (ON) position.

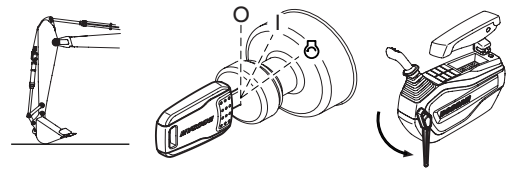


WARNING

AVOID DEATH OR SERIOUS INJURY

If engine must be running while performing maintenance, always use extreme caution. Always have one person in the cabin at all times. Never leave the cabin with engine running.

6. Fully stroke work levers (joysticks) in all directions to relieve any pressure from accumulators.
7. Set safety lever in "LOCK" position.
8. Turn key to "O" (OFF) position and remove from starter switch.
9. Hang a maintenance warning tag on controls.
10. Turn battery disconnect switch to "OFF" position.
11. Remove cabin under cover by loosening bolts.
12. Tag and disconnect hoses from pedal valve (1, Figure 6). Plug and cap hoses and ports to prevent contamination from entering hydraulic system or component.



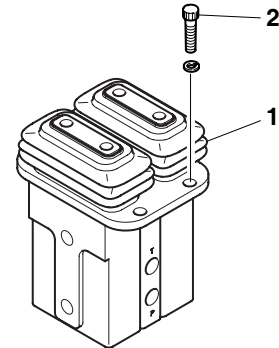
ON



OFF

FG018470

Figure 5



FG003016

Figure 6

14. Check cam balance.

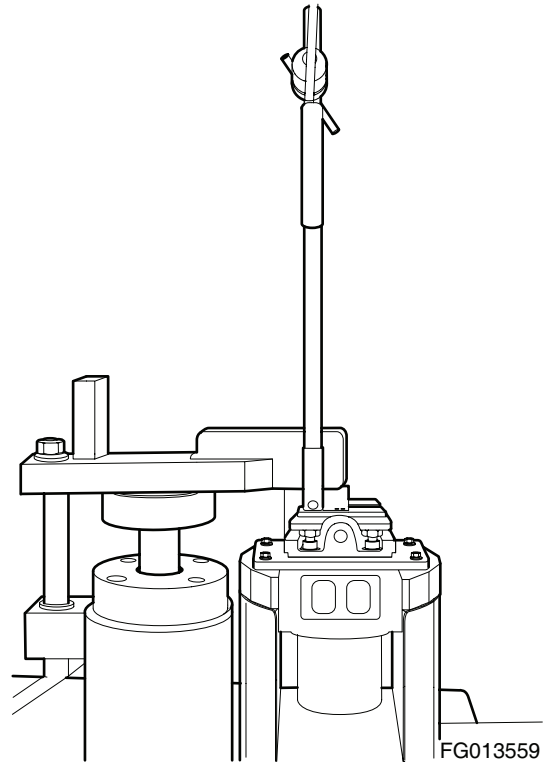


Figure 40

15. Install bellows.

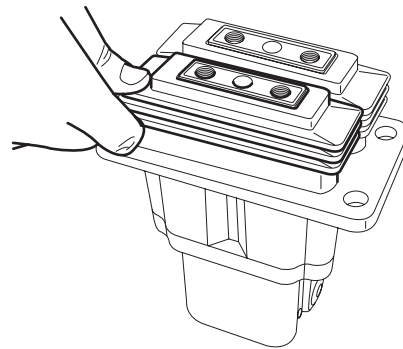


Figure 41

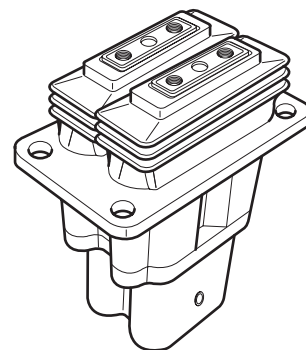


Figure 42

SAFETY INSTRUCTIONS



WARNING

AVOID DEATH OR SERIOUS INJURY

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

APPLICABLE MODELS

The contents of this section apply to the following models and serial number ranges.

MODEL	SERIAL NUMBER RANGE
DX140LC-3	1001 and Up, 50001 and Up
DX180LC-3	1001 and Up, 50001 and Up
DX225LC-3	1001 and Up, 50001 and Up
DX255LC-3	1001 and Up, 50001 and Up
DX300LC-3	1001 and Up, 50001 and Up
DX340LC-3	1001 and Up, 10001 and Up
DX350LC-3	1001 and Up, 10001 and Up
DX380LC-3	10001 and Up
DX420LC-3	10001 and Up
DX490LC-3	10001 and Up
DX530LC-3	10001 and Up

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Maintenance.....	8
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Assembly	10

Dozer Valve

Edition 2

ASSEMBLY METHOD

1. Assemble the plug (2) to the body (1).

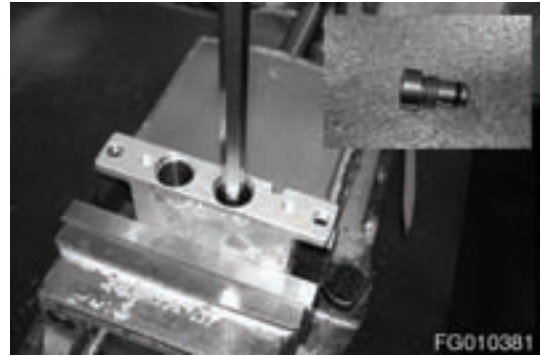


Figure 11

2. Assemble the spring (4) to the body (1).



Figure 12

3. Assemble the spool kit (I).
Assemble spring seat (I-5), spring (I-8), spring seat (I-5) stopper (I-9) to spool (I-6) in this order.



Figure 13

4. Assemble the spool kit (I) to the body (1).



Figure 14

DX140LC-3

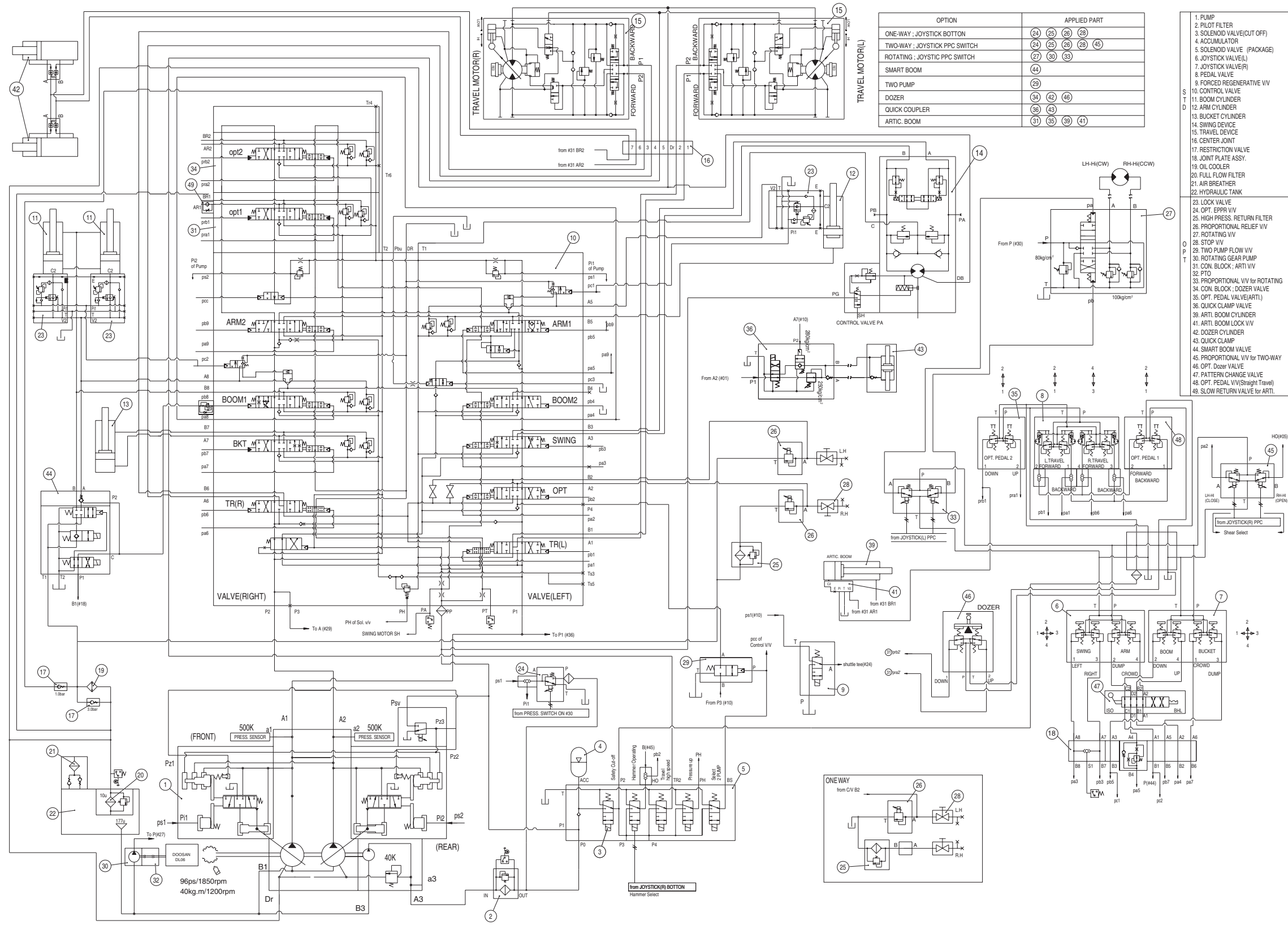


Figure 1

FG022736

SAFETY INSTRUCTIONS



WARNING

AVOID DEATH OR SERIOUS INJURY

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APPLICABLE MODELS

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MODEL	SERIAL NUMBER RANGE
DX140LC-3	1001 and Up, 50001 and Up
DX180LC-3	1001 and Up, 50001 and Up
DX225LC-3	1001 and Up, 50001 and Up
DX255LC-3	1001 and Up, 50001 and Up
DX300LC-3	1001 and Up, 50001 and Up

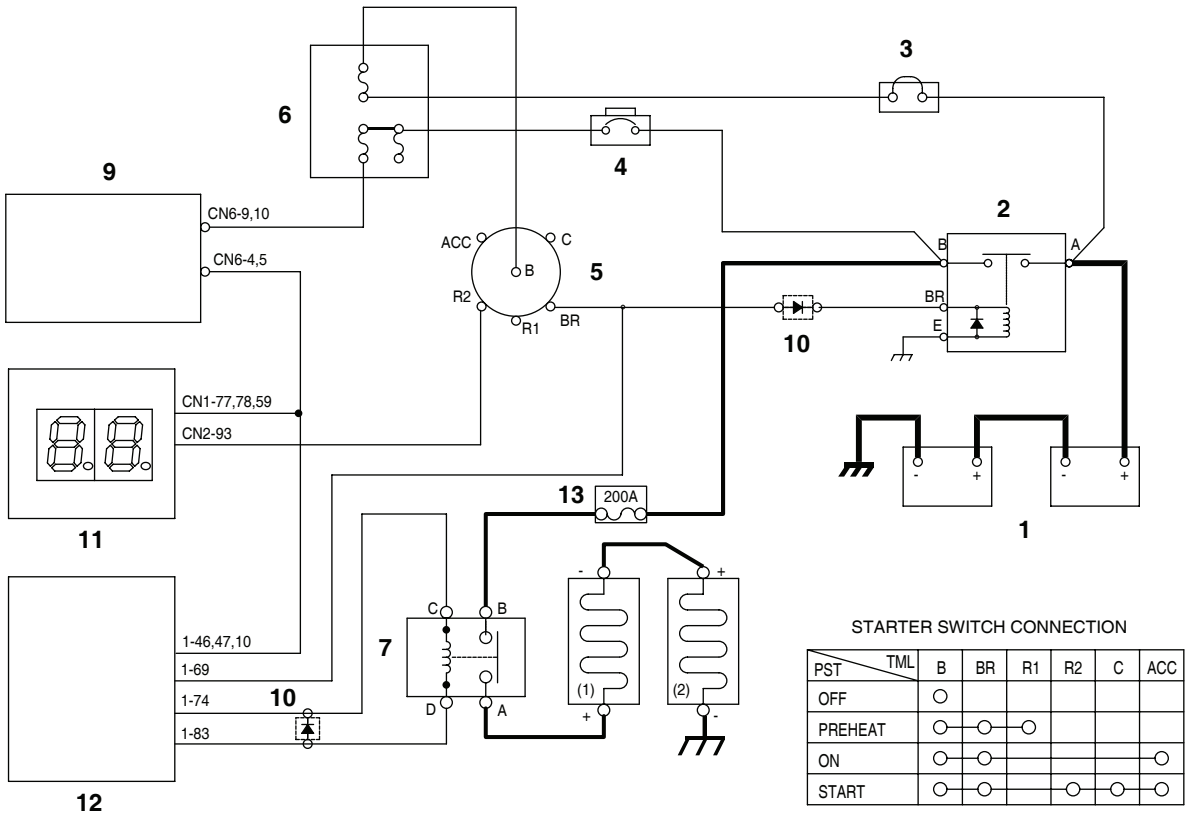
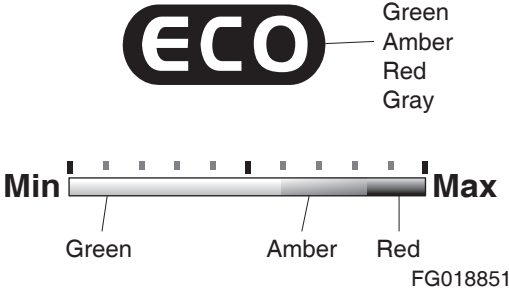


Figure 5 Engine Preheat Circuit

FG018842

Reference Number	Description
1	Battery
2	Battery Relay
3	Fusible Link
4	Circuit Breaker
5	Starter Switch
6	Fuse Box
7	Preheat Relay

Reference Number	Description
8	Air Heater
9	Preheat Indicator Light
10	Diode
11	EPOS Controller
12	Engine Controller
13	Preheat Relay Fuse

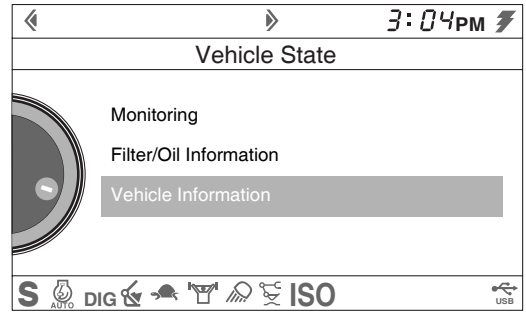
Function	Display	Sensor Specification	
		Input Terminal	Input Specification
Tachometer	<p style="text-align: center;">1750 RPM</p> <p style="text-align: right;">FG018850</p>	ECU-CAN Communication	<p>$N = 146 f / 60$</p> <p>$N = \text{Engine speed (rpm)}$</p> <p>$f = \text{Frequency of engine speed sensor (Hz)}$</p>
ECO Gauge	 <p style="text-align: right;">FG018851</p>	ECU-CAN Communication	<p>ECO symbol: The instant workload</p> <ul style="list-style-type: none"> - Green: Normal operation - Amber: Idling operation - Red: Heavy loading operation - Gray: ECO symbol off <p>ECO gauge: The average fuel efficiency for 1 minute</p> <ul style="list-style-type: none"> - Green: Fuel efficiency is good - Amber: Fuel efficiency is normal - Red: Fuel efficiency is not good

C. Vehicle Information

This is used to check the machine name, engine type and attachment options.

At the vehicle state, if the cursor is placed on the vehicle information, click the jog switch to access the vehicle information screen.

Click the ESC button to return to the previous screen.



FG018482

Figure 25

Vehicle Information	
Vehicle Name	
Engine	DOOSAN
Attachment Option	Not Available
Vehicle Number	000000

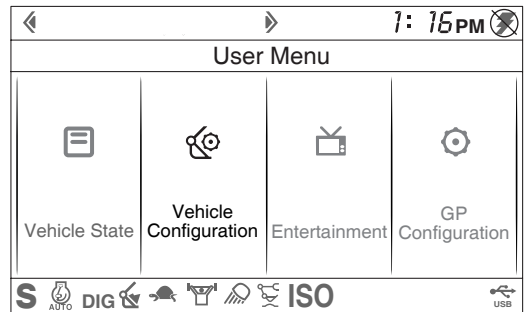
FG024557

Figure 26

2. Vehicle Configuration

This is used when selecting the functions such as attachment select, attachment setting, camera setting, and jog shuttle for dial.

Turn the jog switch and move the cursor to see an reversed display on the desired menu. Then, click the jog switch to select the menu.

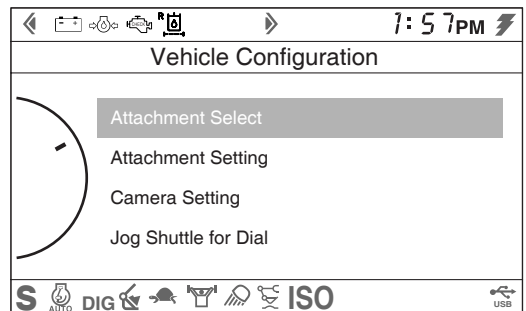


FG018488

Figure 27

Attachment Select ↔ Attachment Setting ↔ Camera Setting ↔ Jog Shuttle for Dial

Press the ESC button to return to the previous screen.



FG018489

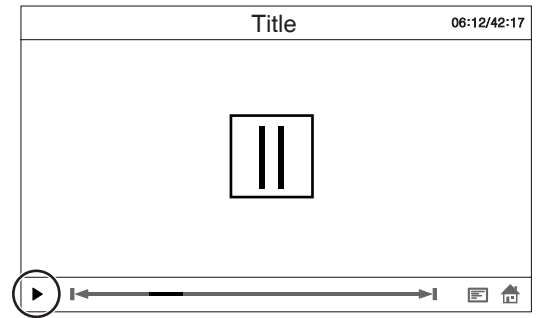
Figure 28

Play/Pause

Locate the cursor on the play/pause symbol and click on the jog switch to execute the video's play/pause functions.

With the play being on, click on the jog switch to display the pause symbol at the center of the screen, thus allowing the video to pause.

With the pause being on, click on the jog switch to cause the pause symbol at the center of the screen to disappear, resuming the video playing.

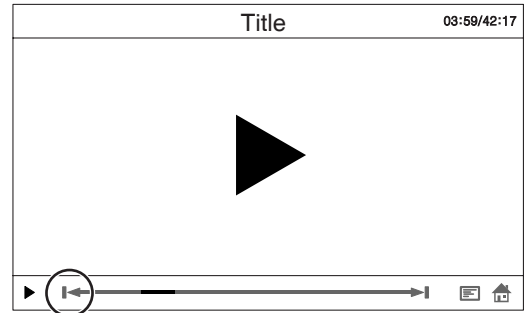


FG020117

Figure 58

Replay the Previous File

Locate the cursor at the replay the previous file symbol and click on the jog switch to replay the previous file.



FG020118

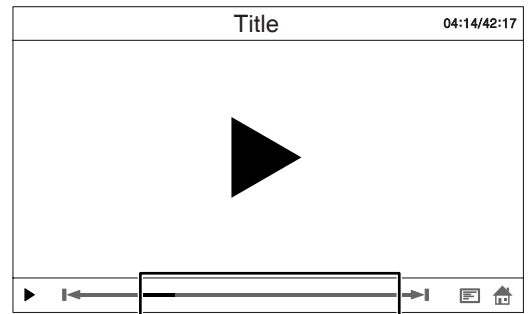
Figure 59

Locate the cursor at the video progress bar and click on the jog switch to convert into the fast forward/rewinding mode.

On the fast forward/rewinding mode, operate the jog switch clockwise/counterclockwise to conduct fast forward/rewinding.

Fast forward/rewinding can be conducted at an interval of 30 seconds per click during which the jog switch is turned.

On the fast forward/rewinding mode, press the ESC button to disable the fast forward/rewinding mode.

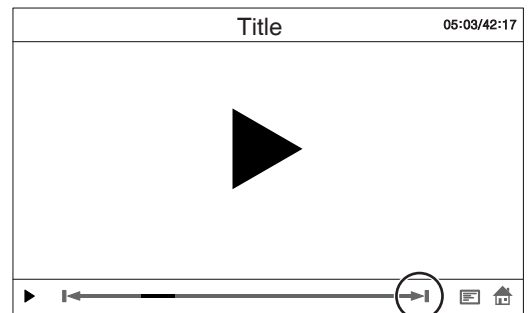


FG020119

Figure 60

Replay the Next File

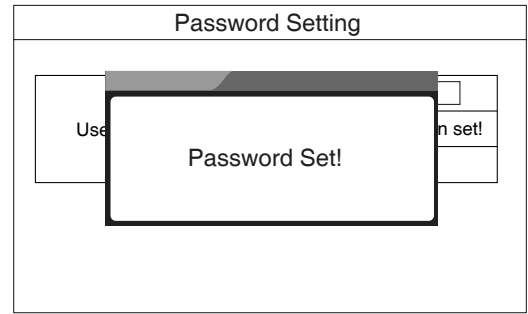
Locate the cursor at the replay the next file symbol and click on the jog switch to replay the next file.



FG020120

Figure 61

If the user password is changed successfully, the "Password Set!" popup message will appear.



FG020179

Figure 92

b) **Item Setting**

"Item Setting" enables the user to select the use of Engine Start-up, Attachment Setting, and Entertainment Use Setting.

The user can set the item only when the owner assign the right. (See "Owner Password Setting" on page -53.)

Engine Start-up

The password input function can be set for equipment start-up.

Attachment Setting

The password input function can be set for attachment setting.

Entertainment Use Setting

The password input function can be set for entertainment (video/MP3) use setting.

Item Setting	
Item	Use
Engine Startup	<input type="checkbox"/> <input checked="" type="checkbox"/>
Attachment Setting	<input checked="" type="checkbox"/>
Entertainment Use Setting	<input checked="" type="checkbox"/>

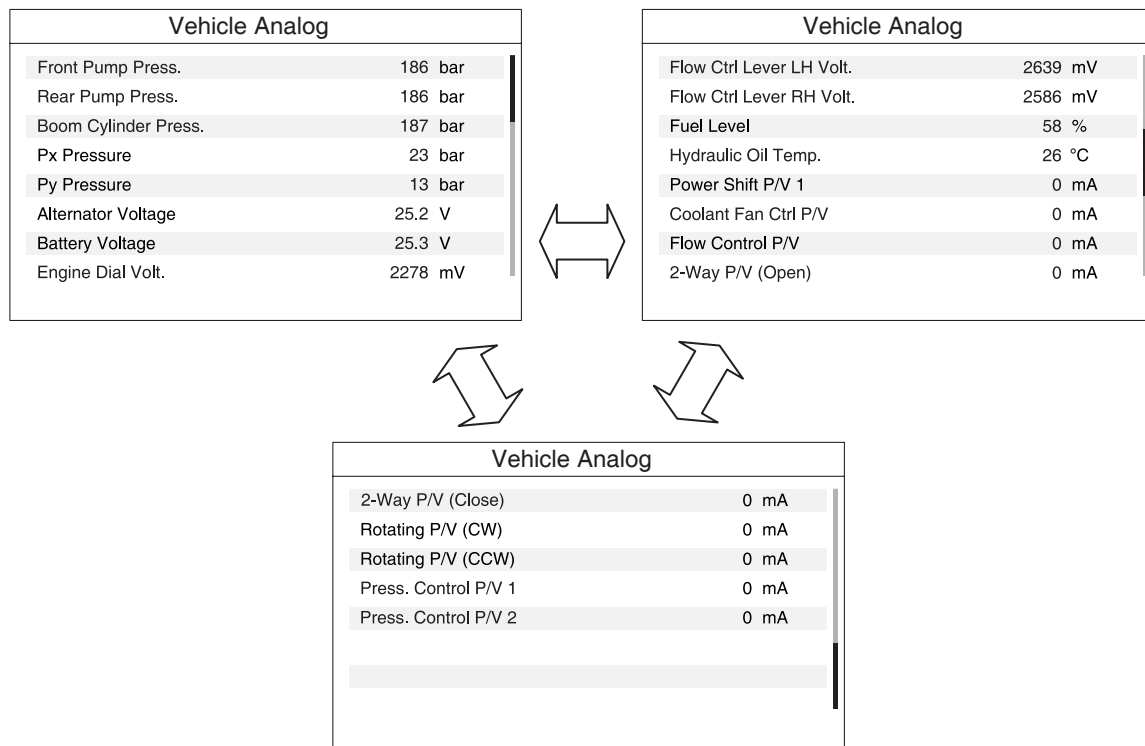
FG020180

Figure 93

Vehicle Analog Description

Analog Items	Display	Remark
1. Front Pump Pressure	bar	Front pump pressure
2. Rear Pump Pressure	bar	Rear pump pressure
3. Boom Cylinder Pressure	bar	Boom cylinder head pressure
4. Px Pressure	bar	Px pressure
5. Py Pressure	bar	Py pressure
6. Alternator Voltage	V	Indicating alternator voltage.
7. Battery Voltage	V	Indicating battery voltage.
8. Engine Dial Voltage	mV	Indicating dial voltage.
9. Flow Control Lever LH Voltage	mV	Indicating LH joystick thumb wheel switch voltage
10. Flow Control Lever RH Voltage	mV	Indicating RH joystick thumb wheel switch voltage
11. Fuel Level	%	Fuel residual quantity ratio of fuel tank
12. Hydraulic Oil Temperature	°C	Hydraulic oil temperature
13. Power Shift P/V 1	mA	Current in pump proportional valve.
14. Coolant Fan Control P/V	mA	Current in coolant fan control proportional valve.
15. Flow Control P/V	mA	Current in flow control proportional valve.
16. Two-way P/V (Open)	mA	Current in two-way (open) flow control proportional valve.
17. Two-way P/V (Close)	mA	Current in two-way (close) flow control proportional valve.
18. Rotating P/V (CW)	mA	Current in rotating (CW) flow control proportional valve.
19. Rotating P/V (CCW)	mA	Current in rotating (CCW) flow control proportional valve.
20. Pressure Control P/V 1	mA	Current in 1 way pressure proportional valve.
21. Pressure Control P/V 2	mA	Current in 2 way pressure proportional valve.

Submenu Selections



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Figure 123

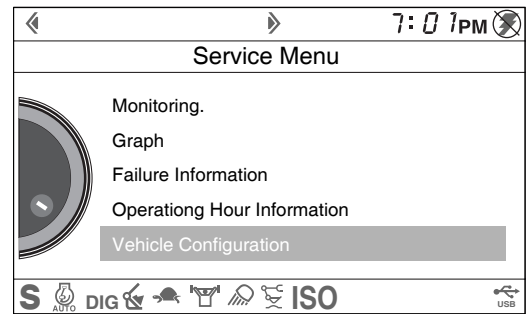
GP Display Code	GP Display Description	Measuring Point	Correct Value		Remarks
			Active	Passive	
V000252	Att (Option) Press. Sensor	CN4-6, CN4-12	V = 1 V		
V000253	Oil Temp. Sensor	CN1-15, CN1-33	-	R = 2.45 ±0.25 Ω (25°C (77°F)) R = 320 ±32 Ω (80°C (176°F))	
V000254	Accelerator Pedal Sensor	CN1-20, CN1-38		R = 2.5 ±0.3 kΩ	
V000255	Machine Speed Sensor	CN2-91, CN2-84	-	-	
V000256	Fuel Sensor	CN1-14, CN1-32		Empty: 5 ±0.2 kΩ Full: 320 ±32 Ω	
V000257	Alternator Potential	CN1-2	V = 2 ±1 V		It has to be measured in engine stop state.
V000258	Dial	CN1-16, CN1-34		R = 1.0 ±0.3 kΩ R = 4.0 ±1.5 kΩ	
V000259	Angle Sensor (A)	CN5-10, CN5-20	V = 0.5 V excess V = 4.5 V less than		
V000260	Angle Sensor (B)	CN5-9, CN5-19	V = 0.5 V excess V = 4.5 V less than	-	
V000261	WIF Sensor	CN1-21, CN1-39	V = 0.5 V excess V = 4.5 V less than		26.4 kΩ (25°C (77°F))
V000262	Accelerator Pedal Switch	CN2-82	-	-	
V000263	Thumb Wheel (RH)	CN1-11, CN1-30	V = 0.7 ±0.2 V V = 2.5 ±0.2 V neutral V = 4.3V ±0.2 V	R = 4.5 ±0.3 kΩ	
V000264	Thumb Wheel (LH)	CN1-12, CN1-31	V = 0.7 ±0.2 V V = 2.5 ±0.2 V neutral V = 4.3 ±0.2 V	R = 4.5 ±0.3 kΩ	

- NOTE:**
1. Active value: Starter switch has to be turned "ON"
Measuring points between component and wire harness have to be connected.
 2. Passive value: Starter switch has to be turned "OFF"
Measuring points between component and wire harness have to be disconnected.
 3. Measuring points are engine controller's points and passive value is each component's value.
 4. V_batt: Source power of equipment.

Vehicle Configuration

1. Vehicle Configuration

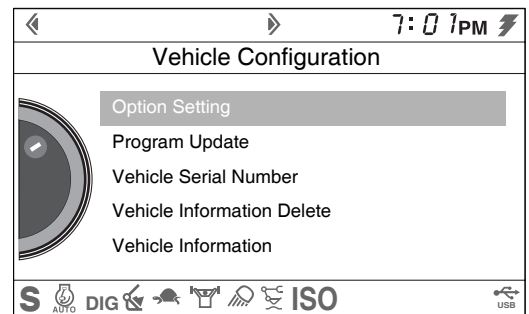
- A. Entering Submenus: When a cursor is located in "Vehicle Configuration" of special menu screen (Figure 142) press jog switch (1 on Figure 118) and "Vehicle Configuration" screen will be displayed (Figure 143).



FG018880

Figure 142

- B. Vehicle Configuration Screen (Figure 143).



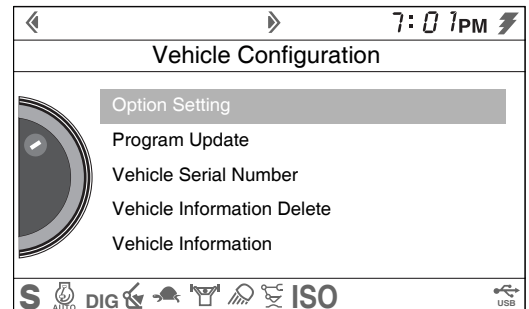
FG018881

Figure 143

- C. Exiting Submenus: If escape button (ESC, 4 on Figure 118) is pressed for more than 1 second, this information screen will be returned to previous screen.

Option Setting

1. Entering Submenus: When a cursor is located in "Option Setting" of special menu screen (Figure 144) press jog switch (1 on Figure 118) and "Option Setting screen" will be displayed (Figure 145)

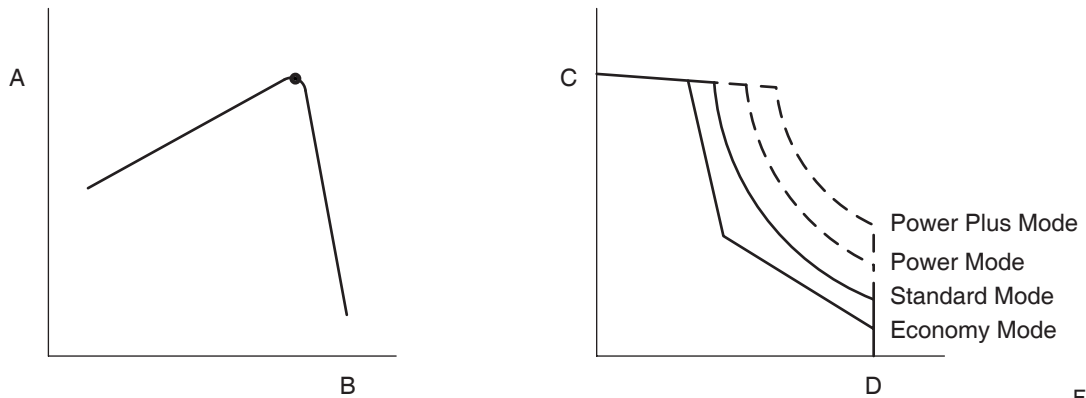


FG018881

Figure 144

2. Power Mode, Standard Mode, Economy Mode

Power Mode, Standard Mode or Economy Mode is selected on the work type. When the standard/economy mode is selected it will reduce noise and fuel consumption in comparison with Power Plus Mode. The EPOS controller compares the target engine speed with the actual engine speed and controls the signal to the EPPR valve which in turn varies the pump output quantity and it is the same method with power volume.



FG018902

Figure 160

Reference Number	Description
A	Engine Horsepower (hp)
B	Engine Speed (rpm)

Reference Number	Description
C	Pump Discharge Volume (lpm)
D	Pump Discharge Pressure (kg/cm ²)

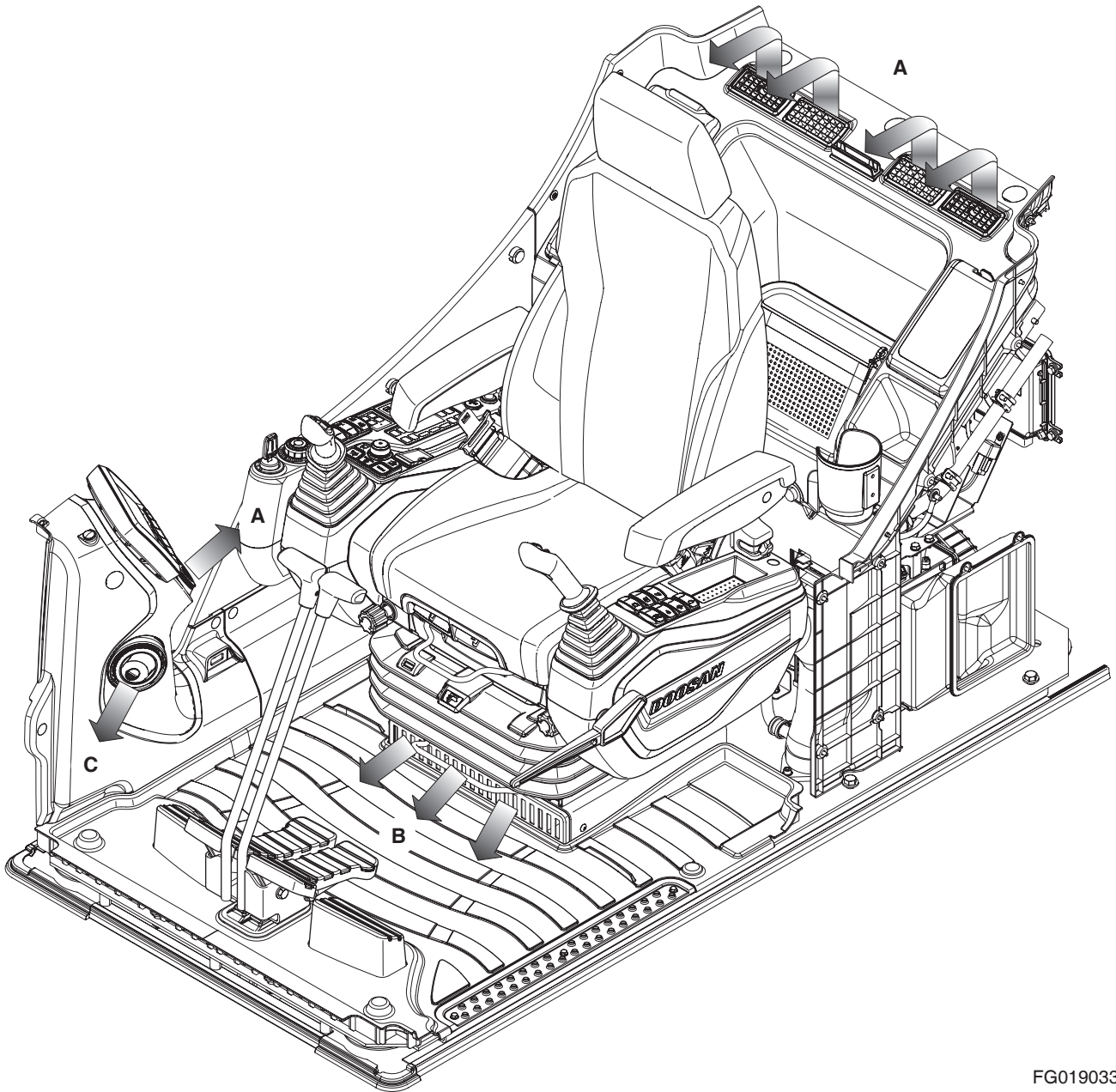
When the engine coolant temperature increases to over 107°C (225°F), the engine controller detects it from the sensor mounted in the coolant line and will send a signal to the EPOS controller. The EPOS controller sends a overheat signal to the instrument panel turning "ON" the warning light and buzzer simultaneously.

Also, the EPOS controller returns an overheat signal to the engine controller and changes power mode to standard mode. The engine speed is then set to a low speed by the engine controller.

When coolant temperature falls below 95°C (203°F), normal operation will resume.

AIR CONDITIONER SYSTEM

Outline



FG019033

Figure 172

Solid-type heater and air conditioner are installed in the cover behind the operator's seat.

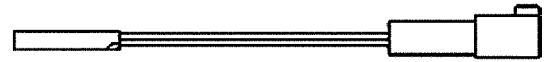
Temperature of the operator's cabin is adjusted automatically to the temperature set by operator.

(Please refer to the Operation and Maintenance Manual for detailed full automatic control.

Vent mode selects the direction of discharged air.

Coolant Temperature Gauge Sensor: It senses the temperature of coolant water in the heater core.

Temperature (°C)	Resistance (KΩ)
-10	55.8 ±1.7
0	32.9 ± 0.9
15	15.76 ±0.5
25	10.0 ±0.3
35	6.5 ±0.2

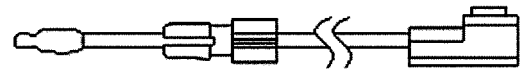


FG001060

Figure 186

Internal Air Temperature Sensor: Built in the internal air filter, it senses the internal temperature.

Temperature (°C)	Resistance (KΩ)
-15	218.2 ±7.5
0	97.83 ±0.9
15	47.12 ±0.7
25	30.0 ±0.36
35	19.60 ±0.3



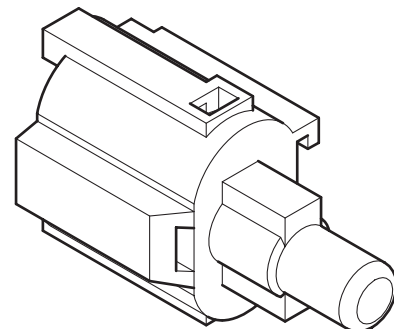
FG001061

Figure 187

Ambient Air Temperature Sensor

Built at the bottom of the cockpit, it senses the temperature of external air.

Temperature (°C)	Resistance (KΩ)
-10	163 ±4.9
0	96.9 ±2.9
10	59.4 ± 1.8
20	37.4 ±1.1
25	30 ±0.9
30	24.2 ±0.7



FG001064

Figure 188

TROUBLESHOOTING

Refrigerant Pressure Check

1. Open all doors and windows.
2. Install manifold gauge set.
3. Start engine and maintain engine speed at 1,800 - 2,000 rpm.

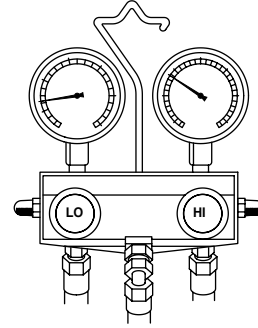


Figure 196

4. Check high / low-pressure of refrigerant.

1	High-pressure: 8.0 - 10.0 kg/cm² (114 - 142 psi) Low-pressure: Approximately 1.0 kg/cm² (14 psi)		
Possible Cause: Low Refrigerant Level			
Step	Inspection Item		Remedy
1	Check for traces of refrigerant oil.	Yes	Reassemble using correct tightening torque.
		No	Go to next step.
2	Using a leak detection device or soapy water check for refrigerant leakage at all major components and joints.	Yes	Repair leaking component.
		No	Recharge system to correct pressure.
2	High-pressure: Over 23 kg/cm² (327 psi) Low-pressure: Approximately 2.5 - 3.0 kg/cm² (36 - 43 psi)		
Possible Cause: Overcharge, Frost on condenser			
Step	Inspection Item		Remedy
1	Check for condenser pin damage or contamination.	Yes	Clean, repair or replace condenser.
		No	Refrigerant overcharge.
3	High-pressure: Approximately 20 - 25 kg/cm² (285 - 356 psi) Low-pressure: Approximately 2.5 - 3.5 kg/cm² (36 - 50 psi)		
Possible Cause: Air in system.			
<ol style="list-style-type: none"> 1. Recover any remaining refrigerant. 2. Vacuum out system. 3. Recharge system. 			
NOTE: <i>If the system has been exposed to the air for a long time, replace the receiver dryer.</i>			

Inspecting System For Leakage

After completing charging procedures, clean all joints and connections with a clean dry cloth. Using a refrigerant leak detecting device or soapy water, inspect system for leaks starting from the high-pressure side.

NOTE: *When the refrigerant circulation has been stopped the high-pressure will start to decrease and the low-pressure will start to increase until they are equalized. Starting the inspection from the high side will result in an accurate test.*

Reference Number	Description
1	Pressure
2	High-pressure
3	Low-pressure
4	Compressor Stop

Inspection Procedure

- High-pressure Side
Compressor outlet → condenser inlet → receiver dryer inlet
→ air conditioner unit inlet.
- Low-pressure side
Compressor inlet → air conditioner unit outlet.
- Compressor
Compressor shaft area, bolt hole area and magnetic clutch area.
- Receiver dryer
Pressure switch and plug area.
- Connection valve area
Inspect all valve areas.
Verify all valves are capped to prevent leaking.
Check for foreign material inside of valve cap.
- Interior of air-conditioning unit.
After stopping engine, insert detector probe into drain hose. (Leave inserted for 10 seconds minimum.)

NOTE: *When inspecting leakage from the air-conditioning unit, perform the inspection in a well ventilated area.*

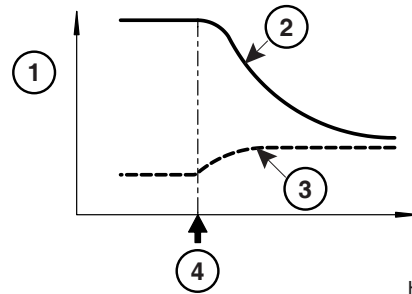


Figure 205

HDA6073L

Electrical Schematic

Edition 1

Boom and Arm

Edition 1

INSTALLATION

Arm Installation Procedure

Reattach the base of the arm cylinder to the mounting point on top of the boom.



WARNING

AVOID DEATH OR SERIOUS INJURY

Before assembling the front attachment, make sure that individual boom, arm and bucket sections are all compatible for work intended. Refer to the Safety Section, Lift Ratings, Working Range Diagrams and Weights of Materials sections in the Operation and Maintenance Manual. Consult your dealer or *DOOSAN* After Sales Service for more information if you have any questions.

Begin with the arm securely supported on blocking in front of the excavator. Pregrease the mounting pin for the rod end of the arm cylinder and push it through the ears on the end of the arm. Attach a sling around that mounting pin and lift the arm with an assist crane until it is in position for the boom-arm pin connection to be made.

Relieve hydraulic pressure from all points of the system before any hydraulic lines are opened, then carefully assemble hydraulic connections to the arm cylinder.

Remove sling from around the rod end arm cylinder pin, withdraw the pin and lift the body of the arm cylinder to repin the mounting connection.

Boom Installation Procedure

Before reassembling the attachment, make sure to inspect all bushings and pivot points of each section. To avoid damaging the seats, bushings should never be hammered or chiseled out of their seats.

Installation is otherwise a reversal of the removal procedures.

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