Doosan Infracore

DX140W / DX160W

Serial Number 5001 thru 5115

Shop Manual

K1024899E-1

SUMMARY OF SAFETY PRECAUTIONS FOR LIFTING IN DIGGING MODE

DANGER!

Unsafe use of the excavator while making rated lifts could cause serious, potentially fatal injuries or extensive damage to the machine or nearby property. Do not let anyone operate the machine unless they've been properly trained and understand the information in the Operation and Maintenance Manual.

To lift safely while in Digging Mode, the following items must be evaluated by the operator and the work site crew.

- Condition of ground support.
- Excavator configuration and attachments.
- Weight, lifting height and lifting radius.
- Safe rigging of the load.
- Proper handling of the suspended load.

Tag lines on opposite sides of the load can be very helpful in keeping a suspended load secure, if they are anchored safely to control points on the ground.

WARNING!

NEVER wrap a tag line around your hands or body.

NEVER rely on tag lines or make rated lifts when wind gusts are more than 48.3 km/h (30 MPH). Be prepared for any wind gust when working with loads that have a large surface area.

Always engage the "Digging Mode" control on the Instrument Panel before using the excavator for lifting work.

WARNING!

If you need more information or have any questions or concerns about safe operating procedures or working the excavator correctly in a particular application or in the specific conditions of your individual operating environment, please consult your local *DOOSAN* representative.

Minimum levels of insurance coverage, work permits or certification, physical barriers around the work site or restricted hours of operation may be mandated by governing authorities. There may also be regulations, guidelines, standards or restrictions on equipment that may have to be followed for local requirements. There may also be regulations related to performing certain kinds of work. If there is any question about whether your machine and work site complies with the applicable standards and regulations contact your local authorities and agencies.

Avoid entering soft ground. It will be difficult for the machine to escape.

Avoid operating your machine too close to the edge of cliffs, overhangs, and deep ditches. The ground may be weak in such areas. If the ground collapses, the machine could fall or tip over resulting in serious injury or death.

Remember that soil after heavy rain, blasting or after earthquakes, is weakened.

Newly laid earth and the soil near ditches is typically loose. It can collapse under the weight of vibration of your machine and cause your machine to tip over.

Install the head guard (FOPS) if working in areas where there is a danger of falling rocks.

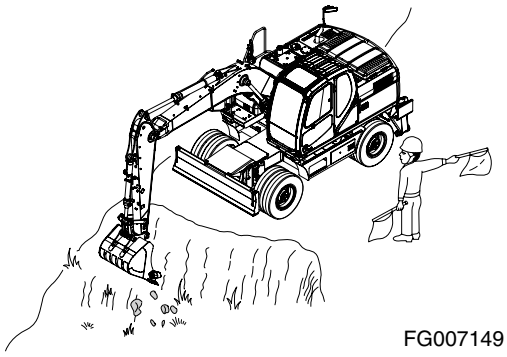
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Figure 15

Checks Before Starting Engine

Every day before starting the engine for the first time, carry out the following checks. If these checks are not carried out properly, there is a danger of serious injury.

Remove all wood chips, leaves, grass, paper and other flammable materials accumulated in the engine compartment and around the battery. They could cause a fire. Remove any dirt from the window glass, mirrors, handrails, and steps.

Do not leave tools or spare parts laying around in the operator's cabin. The vibration of the machine when traveling or during operations may cause them to fall and damage or break the control levers or switches. They may also get caught in the gap of the control levers and cause the work equipment to malfunction or move dangerously. This may lead to unexpected accidents.

Check the coolant level, fuel level, and hydraulic tank oil level, and check for clogged air cleaner and damage to the electrical wiring.

Adjust the operator's seat to a position where it is easy to operate the machine, and check the seat belt and mounts for damage and wear.

Check the operation of the gauges and the angle of the mirrors, and check that the safety lever is in "LOCKED" position.

If any abnormalities are found in the above checks, carry out repairs immediately.

Proper Tools

Use only tools suited to the task. Using damaged, low quality, faulty, or makeshift tools could cause personal injury. There is danger that pieces from, chisels with crushed heads, or hammers, may get into your eyes and cause blindness.

HDO1037L

Figure 31

Use of Lighting

When checking fuel, oil, battery electrolyte, or window washing fluid, always use lighting with antiexplosion specifications. If such lighting equipment is not used, there is a danger of an explosion.

If work is carried out in dark places without using lighting, it may lead to injury, so always use proper lighting.

Even if the place is dark, never use a lighter or flame instead of lighting. There is danger of fire. There is also danger that the battery gas may catch fire and cause an explosion.

HDO1040L

Figure 32

Fire Prevention and Explosion Prevention

All fuels, most lubricants and some coolant mixtures are flammable. Leaking fuel or fuel that is spilled onto hot surfaces or onto electrical components can cause a fire.

Store all fuels and all lubricants in properly marked containers and away from all unauthorized persons.

Store oily rags and other flammable material in a protective container.

Do not smoke while you refuel the machine or while you are in a refueling area.

Do not smoke in battery charging areas or in areas the contain flammable material.

Clean all electrical connections and tighten all electrical connections. Check the electrical wires daily for wires that are loose of frayed. Tighten all lose electrical wires before you operate the machine. Repair all frayed electrical wires before you operate the machine.

Remove all flammable materials before they accumulate on the machine.

Do not weld on pipes or on tubes that contain flammable fluids. Do not flame cut on pipes or on tubes that contain flammable

HDO1015I

Figure 33

SHIPPING AND TRANSPORTATION

Obey State and Local Over-the-Road Regulations

Check state and local restrictions regarding weight, width and length of a load before making any other preparation for transport.

The hauling vehicle, trailer and load must all be in compliance with local regulations governing the intended shipping route.

Partial disassembly or teardown of the excavator may be necessary to meet travel restrictions or particular conditions at the work site. See the Shop Manual for information on partial disassembly.

Refer to the Transportation and Shipping section of this Operation and Maintenance Manual for information on loading, unloading and towing.

LIFTING WITH SLING

⚠ WARNING!

Improper lifting can allow load to shift and cause injury or damage.

1. Refer to Specification section of Operation and Maintenance Manual for information on weight and dimensions.
2. Use properly rated cables and slings for lifting.
3. Position machine for a level lift.
4. Lifting cables should have a long enough length to prevent contact with the machine. Spreader bars may be required.

If spreader bars are used, be sure that cables are properly secured to them and that the angle of the cables is factored into the lift strength.

Reference Number	Description
1	Counterweight
2	Muffler
3	Engine Cover
4	Engine
5	Hydraulic Oil Tank
6	Fuel Tank
7	Control Valves
8	Radiator and Oil Cooler
9	Swing Motor
10	Air Cleaner
11	Swing Joint
12	Swing Bearing
13	Cabin
14	Seat
15	Boom
16	Boom Cylinders
17	Arm Cylinder
18	Arm
19	Bucket Cylinder
20	Guide Link
21	Push Link

Reference Number	Description
22	Wheel Chocks
23	Bucket Tooth
24	Side Cutter
25	Bucket
26	Ram Cylinders
27	Front Axle
29	Swing Lock
30	Step
31	Travel Motor
32	Driveshaft
33	Transmission
34	Return Filter
35	Rear Axle
36	Strainer
38	Dozer Blade
39	Dozer Blade Cylinders
40	Pump
41	Outrigger
42	Outrigger Cylinders
43	Steering Column

APPROXIMATE WEIGHT OF WORKLOAD MATERIALS

IMPORTANT

Weights are approximations of estimated average volume and mass. Exposure to rain, snow or groundwater; settling or compaction because of overhead weight, chemical or industrial processing or changes because of thermal or chemical transformations could all increase the value of weights listed in the table.

Material	Low Weight or Density 1,100 kg•m3 (1,850 lb/yd^3), or Less	Medium Weight or Density 1,600 kg•m3 (2,700 lb/yd^3), or Less	High Weight or Density 2,000 kg•m3 (3,370 lb/yd^3), or Less
Charcoal	401 kg•m3 (695 lb/yd^3)	----------	----------
Coke, blast furnace size	433 kg•m3 (729 lb/yd^3)	----------	----------
Coke, foundry size	449 kg•m3 (756 lb/yd^3)	----------	----------
Coal, bituminous slack, piled	801 kg•m3 (1,350 lb/yd^3)	----------	----------
Coal, bituminous r. of m., piled	881 kg•m3 (1,485 lb/yd^3)	----------	----------
Coal, anthracite	897 kg•m3 (1,512 lb/yd^3)	----------	----------
Clay, DRY, in broken lumps	1,009 kg•m3 (1,701 lb/yd^3)	----------	----------
Clay, DAMP, natural bed	----------	1,746 kg•m3 (2,943 lb/yd^3)	----------
Cement, Portland, DRY granular	----------	1,506 kg•m3 (2,583 lb/yd^3)	----------
Cement, Portland, DRY clinkers	----------	1,362 kg•m3 (2,295 lb/yd^3)	----------
Dolomite, crushed	----------	1,522 kg•m3 (2,565 lb/yd^3)	----------
Earth, loamy, DRY, loose	----------	1,202 kg•m3 (2,025 lb/yd^3)	----------
Earth, DRY, packed	----------	1,522 kg•m3 (2,565 lb/yd^3)	----------

General Maintenance Procedures

Edition 1

CLEANING AND INSPECTION

General Guidelines

All parts must be clean to permit an effective inspection. During assembly, it is very important that no dirt or foreign material enters unit being assembled. Even minute particles can cause malfunction of close fitting parts such as thrust bearing, matched parts, etc.

⚠ WARNING!

Care should be exercised to avoid inhalation of vapors, exposure to skin and creating fire hazards when using solvent type cleaners.

1. Clean all metal parts thoroughly using a suitable cleaning fluid. It is recommended that parts be immersed in cleaning fluid and moved up and down slowly until all oils, lubricants, and/or foreign materials are dissolved and parts are thoroughly clean.
2. For bearings that can be removed, soak them in a suitable cleaning fluid for a minute or two, then remove bearings from cleaning fluid and strike flat against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. To dry bearings, use moisture-free compressed air. Be careful to direct airstream across bearing to avoid spinning bearings that are not lubricated. DO NOT SPIN BEARINGS WHEN DRYING; bearings may be rotated slowly by hand to facilitate drying process.
3. Carefully inspect all bearing rollers, cages and cups for wear, chipping or nicks to determine condition. Do not replace a bearing cone or cup individually without replacing mating cup or cone at the same time. After inspection, dip bearings in lightweight oil and wrap in clean lintless cloth or paper to protect them until installation.

   For those bearings that are to be inspected in place; inspect bearings for roughness of rotation, scoring, pitting, cracked or chipped races. If any of these defects are found, replace bearings. Also, inspect defective bearing housing and/or shaft for grooved, galled or burred conditions that indicate bearing has been turning in its housing or on its shaft.
4. It is more economical to replace oil seals, O-rings, sealing rings, gaskets and retaining rings when unit is disassembled than waiting for premature failures; refer to latest Micro Fiche and/or Parts Book for replacement items. Be extremely careful when installing sealing members, to avoid cutting or scratching. Curling under of

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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.

Tightening Torque Specifications (Metric)

(For coated threads, prelubricated assemblies.)

SAFETY PRECAUTIONS

CAUTION!

Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section.

Always use tools and equipment that are in good working order.

Use lifting and hoisting equipment capable of safely handling the load.

Remember, that ultimately safety is your own responsibility.

APPLICABLE MODELS

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

MODEL	SERIAL NUMBER RANGE
DX140W	5001 and Up
DX160W	5001 and Up

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Fuel Tank

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22. Install eyebolts of 12 mm in holes (1 and 2, Figure 13). Use a proper lifting equipment and sling eyebolts.

23. Remove 4 bolts and washers (4, Figure 13) retaining tank (3) at the frame. Lift the tank 25 mm above and check if it is well balanced. Check also any connection of electrical wire or hose to the tank. After check, remove the tank assembly.

    NOTE: *The level gauge at the side of the tank is likely to be damaged. Take caution against obstacles and strong wind.*

24. Remove shims (5, Figure 13).

    NOTE: *Mark the position and depth of lead used at connection bolts for the tank to be reused.*

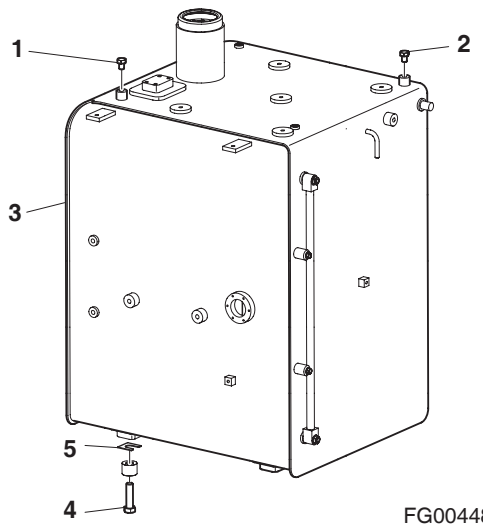

Figure 13

GENERAL DESCRIPTION

Theory of Operation

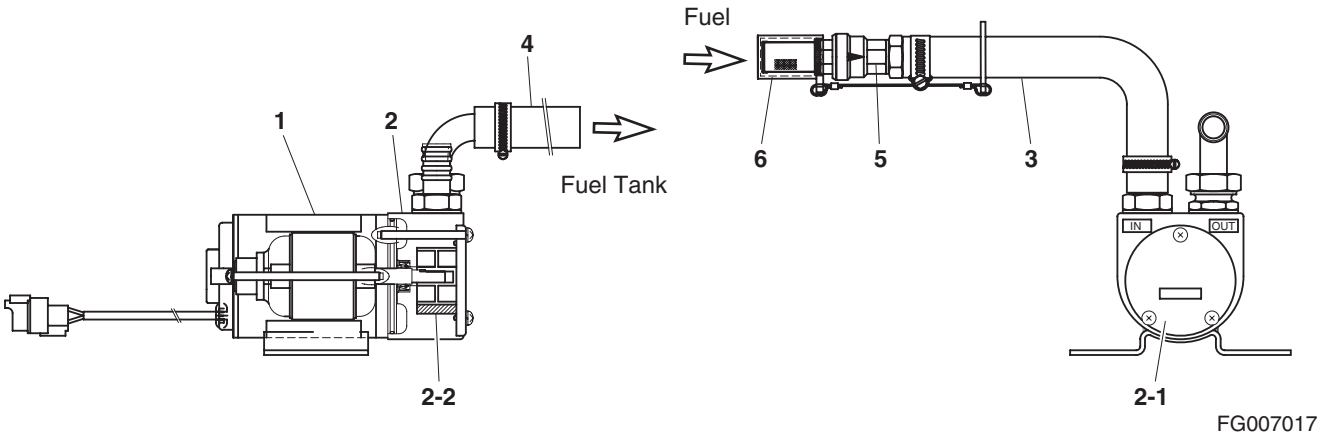

Figure 1

Reference Number	Description
1	Motor
2	Pump
2-1	Pump Cover
2-2	Rotor and Vane

Reference Number	Description
3	Inlet Hose
4	Outlet Hose
5	Check Valve
6	Strainer Cap

The fuel pump consists of a motor, pump, switch, and hose assembly.

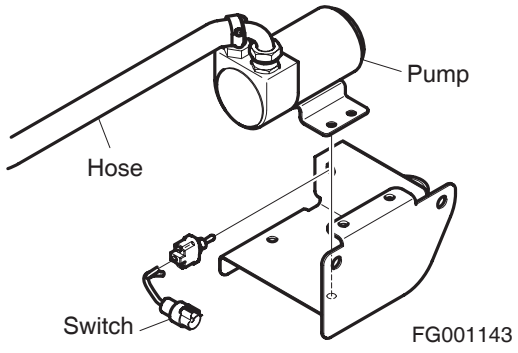

Figure 2

Swing Bearing Basic Operation

The swing bearing, which connects the upper structure with the lower structure, consists of a inner ring, outer ring and ball bearings. During swing movement, power from the swing motor is transferred to the pinion by planetary gears connected to gears on the inner ring, which is fixed in the undercarriage. Ball bearings turn the outer ring.

Reference Number	Description
1	Outer Ring
2	Inner Ring
3	Tapered Pin
4	Plug
5	Ball
6	Retainer
7	Seal A

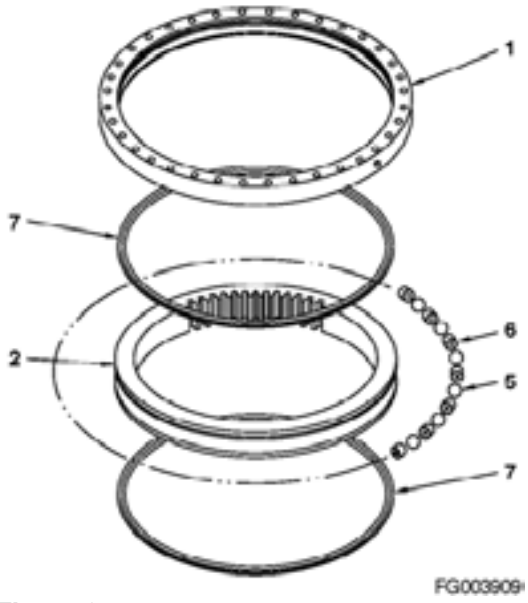

Figure 2

Rebuilding Swing Bearing

1. Remove tip of tapered pin (3, Figure 3) using grinder and tap lightly to remove debris.

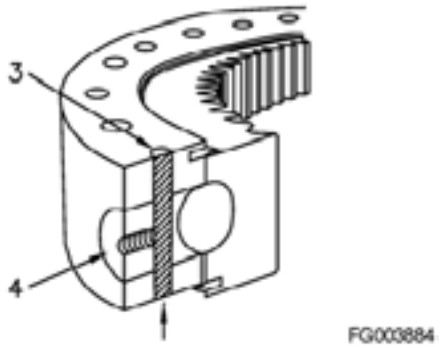

Figure 3

2. Remove plug (4, Figure 4) using a M10 x 1.25 bolt.

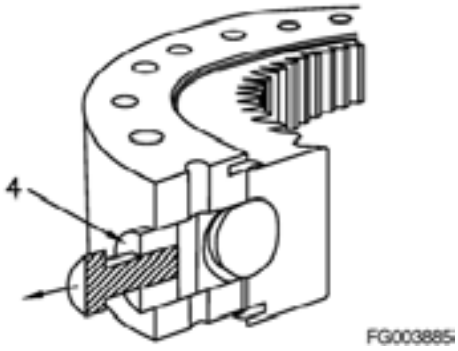

Figure 4

Reference Number	Description
1	Casing
2	Driveshaft
3	Ring Gear
4	Planetary Gear
5	Sun Gear 2
6	Planetary Gear
7	Sun Gear 1
8	Carrier 2
9	Carrier 1
10	Pin Assembly
11	Pin Assembly
12	Adjustment Washer
13	Adjustment Washer
14	Level Bar
15	Level Gauge Piping

Reference Number	Description
16	Pin
17	Roller Bearing
18	Roller Bearing
19	Socket Bolt
20	Oil Seal
21	Plug
22	Plug
23	Spring Pin
24	Retainer Ring
25	Retainer Ring
26	Ring
27	Spring Pin
28	Support Plate
29	Screw Bolt

ASSEMBLY OF THE MAIN

1. Washing of casing and other parts

   Wash casing and other parts with steam to remove remaining foreign substance after casting and machining.

   - Washing fluid: PK6540 (alkali)
   - Concentration : 3-5%
   - Temperature: 60 - 70°C

2. Assembly of shaft and bearing

   A. Fix the washed casing on the turnover machine and rotate the turnover machine that the press fitting side of the shaft looks upward.

Figure 34

Figure 35

   B. Place the driveshaft assembly where bearing (#22314) is assembled on the case assembly, put a press jig on it, and use press to insert it.

CAUTION!

Make sure that bearing is not tilted for correct press fitting before using press.

Figure 36

E. Assemble the carrier #1 assembly in the same way as for the carrier #2.

Figure 73

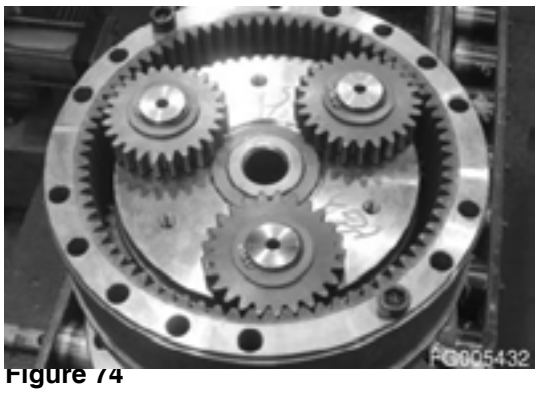

Figure 74

F. Assemble the sun gear #1.

Figure 75

Figure 76

Assembly and Disassembly of Chocking Valve

1. Assemble the main poppet, the pilot poppet, the spring and the spring seat in order. Insert the sub-assembly to the block and fasten the hexa-head plug.

   Hexa-head (41 mm) plug fastening torque : 7.0 kg•m

Figure 3

2. Insert each of the two plungers to each of the holes of the block.

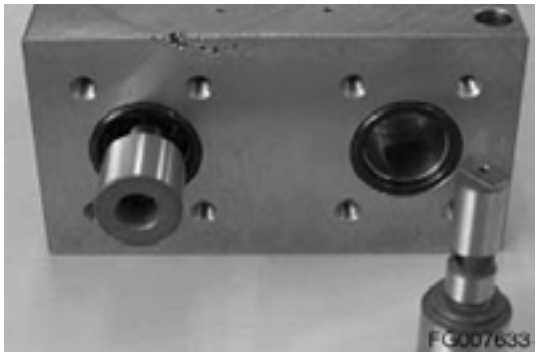

Figure 4

3. Mount the O-rings to the block and fasten the plate with bolts.

   A. O-ring: 1B-P24

   B. Wrench bolt (5 mm) fastening torque : 1.2 kg•m

Figure 5

NOTE: *Follow the reverse procedure for disassembly.*

2. Assemble the spool ass'y to the body.

   A. Insert the assembly to the hole of the C port direction.

   B. Insert the spool ass'y to the spool hole of the body precisely and be careful not to allow intrusion of foreign material. Do not apply excessive force for assembly.

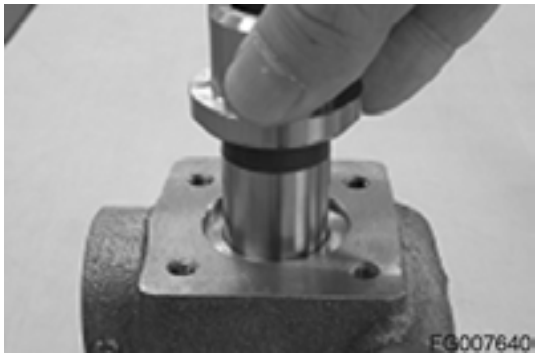

Figure 5

3. Assemble the return spring #1 and #2 to the body, insert the O-ring into the cover #1 and fasten the cover to the body with bolts.

   A. Fastening O-RING: 1B-P41

   B. Bolt Fastening Torque : 0.8 kg•m - 1.2 kg•m

Figure 6

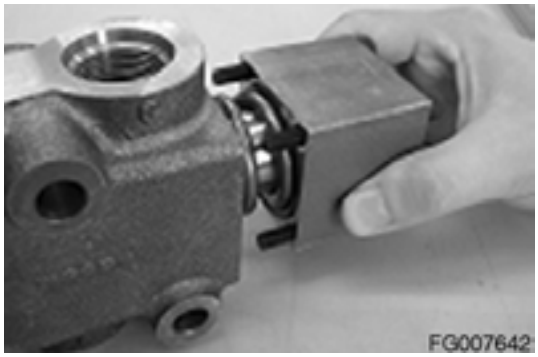

Figure 7

4. Insert the O-ring into the cover #2 for the opposite side and fasten the cover #2 to the body with bolts.

   A. Bolt Fastening Torque : 0.8 kg•m - 1.2 kg•m

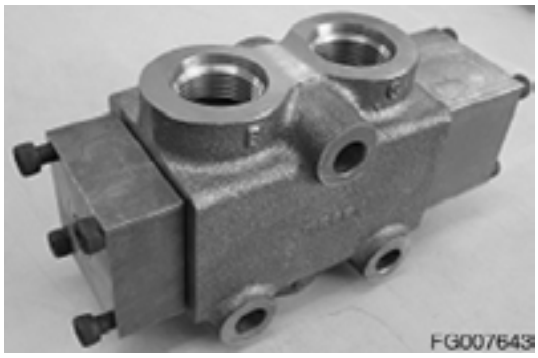

Figure 8

NOTE: *Follow the reverse procedure for disassembly.*

OPERATIONAL PRINCIPLE

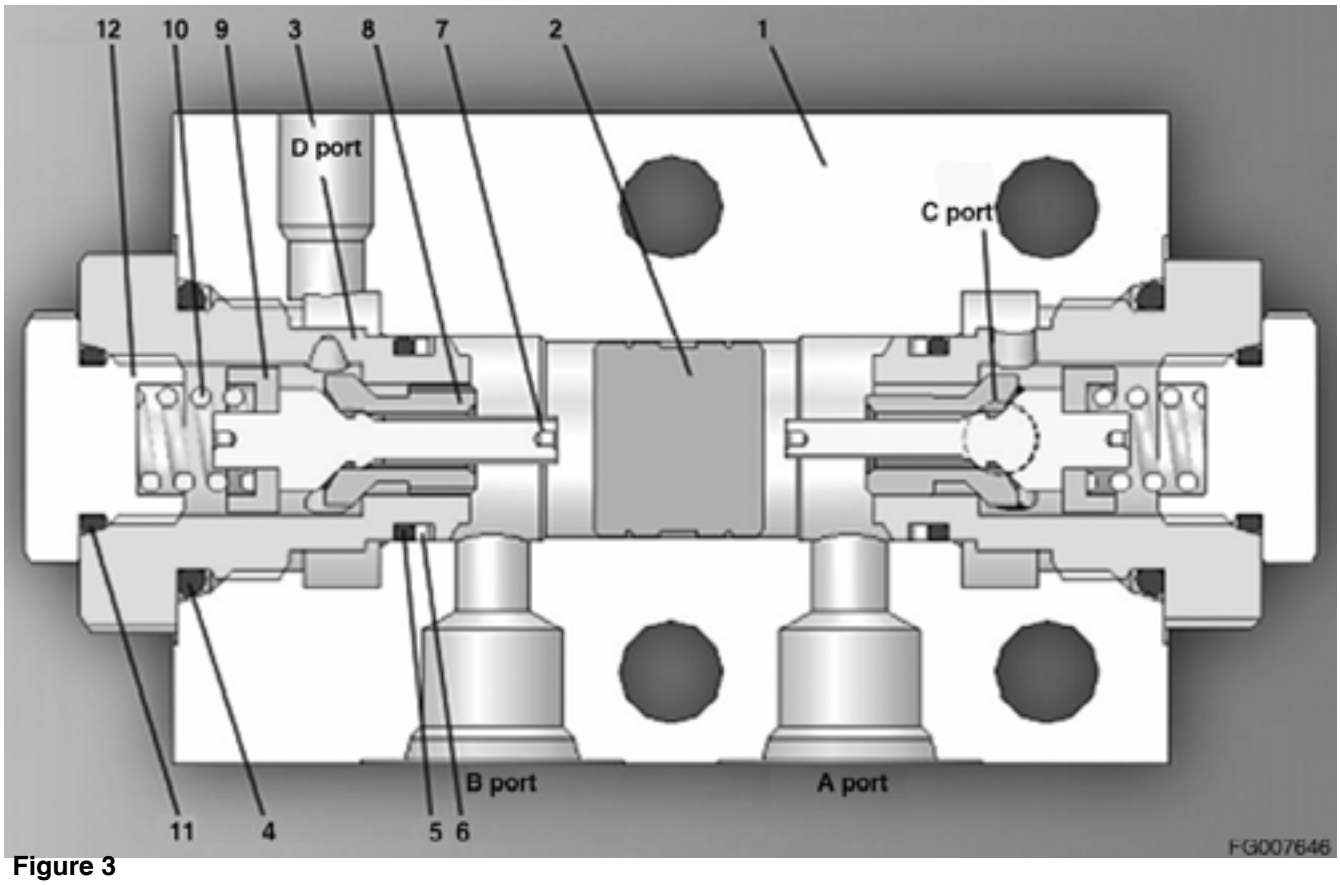

Figure 3

A → C, D → B

The pressured oil, flowed in through the A port, is to be flowed out to the C port through oil passage of the side of the nipple (3) while pressing the poppet (7) and the sleeve (8) simultaneously. The pressure of the hydraulic oil, flowed in through the A port, pushes the plunger (2) of the center to the left side, and if the pressure is greater than the spring (10) force, the poppet is to be pushed back to make a gap between the sleeve (8) and the plunger (2) and it discharges the hydraulic oil, flowed in from the D port, to the B port.

B → D, C → A

The same principle of 3.1 is to be applied to case of the hydraulic oil, flowed in through the port B.

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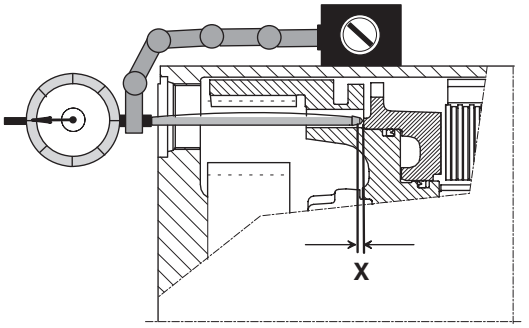

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Figure 12

Lining Wear Measurement of Multidisk Brake

With unapplied brake, piston is in contact with ring gear by compression spring return. see Figure 11

- get dial indicator (3) into touch with piston (6) through oil filler /oil drain hole (1) and gauge hole (2).
- Apply pressure on brake and determine piston stroke (X. see Figure 12) using dial indicator
- Take limit value of piston stroke (at max. wear) from the chart below

Axle type	Lined disks	Piston stroke with new disks	Limit value of piston stroke (X) at max. wear
MT-E 3050	8 pcs.	1.2 ... 1.8 mm	7.0 mm
MT-E 3060	6 pcs.	0.7 ... 1.3 mm	6.0 mm
MT-E 3070	7 pcs.	0.7 ... 1.3 mm	6.5 mm
MS-E 3050	8 pcs.	1.2 ... 1.8 mm	7.0 mm
MS-E 3060	6 pcs.	1.2 ... 1.8 mm	6.0 mm
MS-E 3070	7 pcs.	1.2 ... 1.8 mm	6.5 mm

Make lining wear measurement on both outputs!

Then provide oil drain/fill plug with new O-ring and install it.

Tightening torque (M36x1.5) .....M_A = 50 Nm

2. Loosen threaded connection and remove upper bearing pin.

WARNING!

Remove lower bearing pin - using lifting device / see Figure 51 - not before securing the knuckle housing.

Figure 50

3. Secure knuckle housing using lifting device and dismantle lower bearing pin.

CAUTION!

Pay attention to releasing shim.

Figure 51

4. Remove bearing inner ring (7), O-ring (5), sealing cap (6) and brake connection screw neck (8) from bearing pin (1).

Figure 52

5. Separate knuckle housing with double u-joint shaft from axle housing.

WARNING!

Pay attention to seal ring in the axle housing - risk of damage

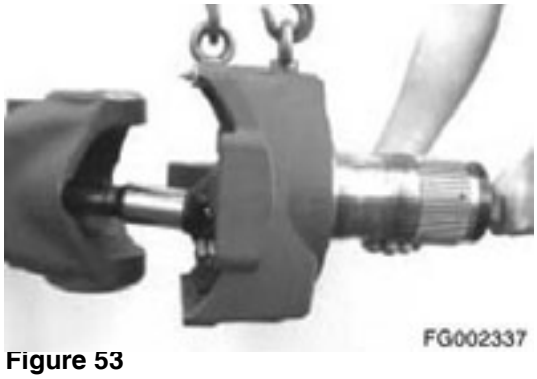


Figure 53

2. Insert the preas sembled drive pinion, mount the heated bearing inner ring until contact is obtained.

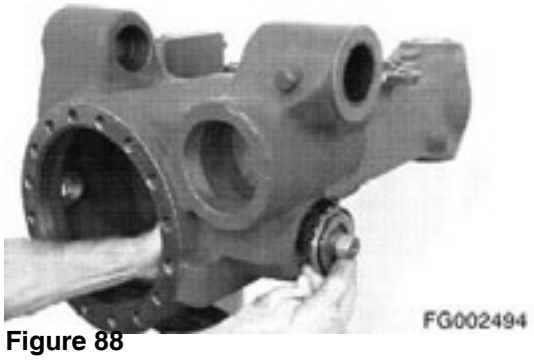


Figure 88

3. Mount flange, fix with washer and hex. nut.

   Tightening torque (M27x1.5) ..... M_A = 600 Nm

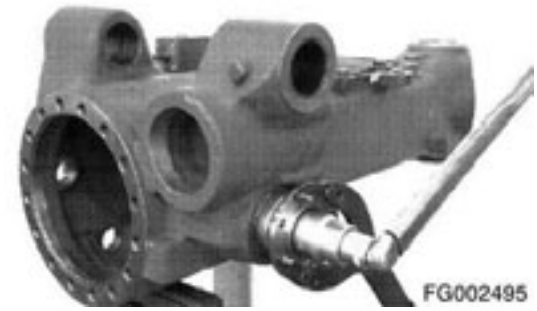


Figure 89

4. Check rolling moment of pinion bearing.

   Bearing rolling moment (without seal ring) 1.0 - 2.0 Nm

   Try to achieve upper value.

CAUTION!

If the rolling moment differs from the required value, correct it with a suitable spacer ring (See Figure 21 on page -17).

Figure 90

CAUTION!

Reassemble seal ring - as shown in page -45-74 (after completed differential assembly and positive contact pattern check).

Preassemble Axle Housim

1. Legend on Figure 124 - Figure 128

Reference Number	Description
1	Axle Housing
2	Bushing (Observe Installation Position)
3	Seal Ring (Observe Installation Position)
4	Bearing Outer Rings (Pivot Bearing)
X	Oil Chamber Side

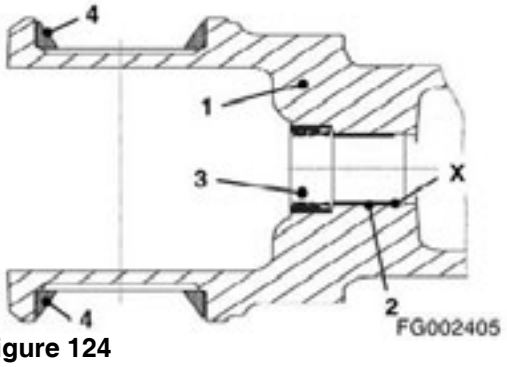


Figure 124

Bushing - lubrication groove outlet installed in 6 o'clock position (referred to the axle mounted in the vehicle).

2. Flush-mount bushing in the axle housing hole, considering the installation position (see detailed sketch).

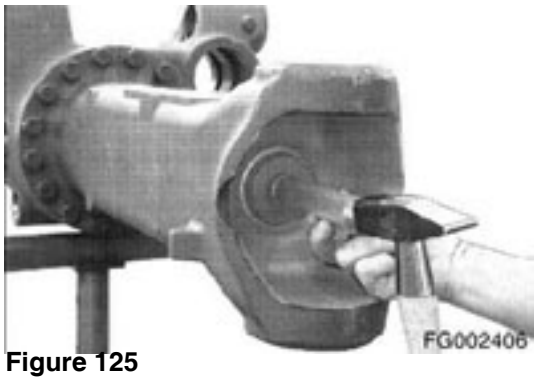


Figure 125

Detailed sketch - 90° offset:

Reference Number	Description
1	Axle Housing
2	Bushing
X	Oil Chamber Side Observe Installation Position of Bushing

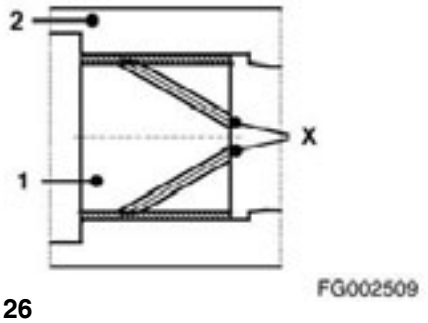


Figure 126

lubrication groove outlet in 6 o'clock position (referred to axle mounted in vehicle).

3. Flush-mount seal ring (item 3 - See Figure 124) into axle housing hole, with seal lip showing to oil chamber.

CAUTION!

Contact face (outer diameter) of seal ring:

- **Wet it with spirit (assembly aid) if rubber-coated**
- **Apply sealing agent (Loctite no. 574) if made of metal**

Apply grease on seal and dust lip of the seal ring.

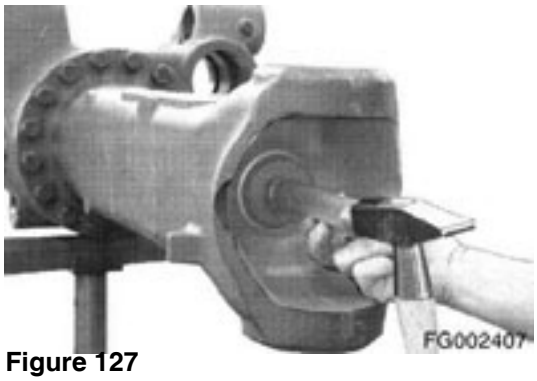


Figure 127

4. Oil sealing elements and locate in annular grooves (arrows) of the ring gear - as shown in the detailed sketch.

Figure 161

CAUTION!

Pay attention to installation position and arrangement of sealing elements.

Legend to Figure 161 and detailed sketch:

Reference Number	Description
1	Ring Gear
2	Support Ring
3	U-ring
4	U-ring
5	Support Ring

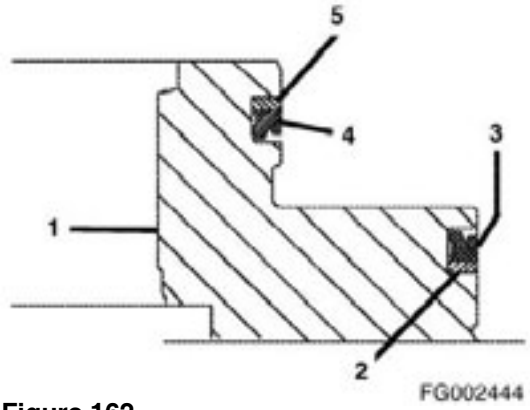


Figure 162

5. Just for "assembly of new parts" or if disassembled:

   Mount cylindrical pins into piston, considering installation dimension "X"

   MS-E 3050 = 18.00 mm

   MS-E 3060 = 16.00 mm

   MS-E 3070 = 16.00 mm

Figure 163

6. Install piston on preassembled ring gear.

Figure 164

7. Insert u-ring (6), rod wiper (7) and dual ring (8) in brake head (2).

   Observe installation position - in this connection refer to detailed sketch.

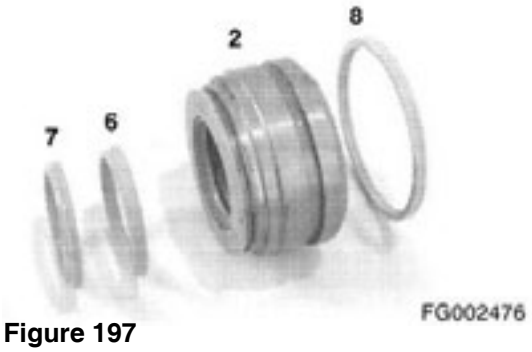


Figure 197

Detailed Sketch:

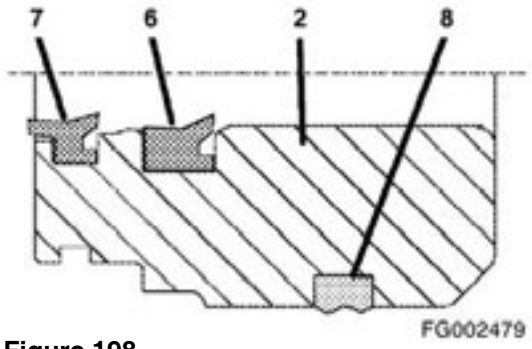


Figure 198

8. Install preassembled brake head.

CAUTION!

Slightly oil all sealing elements before inserting the brake head.

Figure 199

9. Push brake head into the steering cylinder (arrow) so the retaining ring (9) can be mounted.

Figure 200

DISASSEMBLY

1. Mount the axle to the assembly truck.

   (Illustration shows axle version MT-E 3060 with attached HL-transmission)

Figure 13

2. Loosen oil drain plug and drain oil from the axle - use suitable collecting basin.

Figure 14

⚠ WARNING!

To avoid injury when opening the oil drain and oil fill plug, because of a possible pressure build-up in the oil system of the planetary carrier

- bring drain hole to topmost position (12 o'clock) and carefully unscrew oil drain and oil fill plug.

Then bring drain hole to lowermost position (6 o'clock) and drain oil from outputs - use suitable collecting basin! Then bring drain hole to 6 o'clock position and drain the oil.

Figure 15

4. Oil sealing elements and locate in annular grooves (arrows) of ring gear as shown in the detailed sketch.

CAUTION!

Pay attention to installation position and arrangement of sealing elements.

Figure 54

Legend to Figure 54 and detail

Reference Number	Description
1	Ring Gear
2	Support Ring
3	U-ring
4	U-ring
5	Support Ring

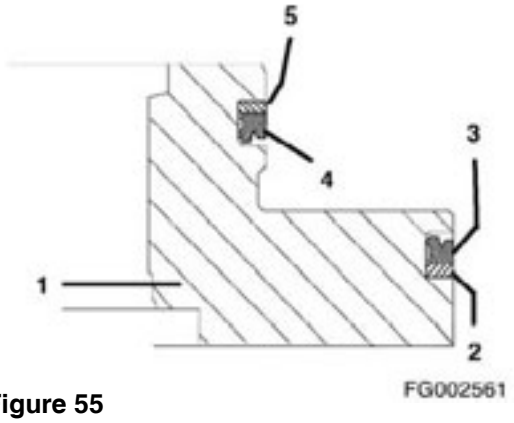


Figure 55

5. Just for. assembly of new parts. or if disassembled.

   Mount all cylindrical pins into piston considering installation dimension "X"

   MT-E 3050 = 18.00 mm

   MT-E 3060 = 16.00 mm

   MT-E 3070 = 16.00 mm

Figure 56

6. Install piston on preassembled ring gear.

Figure 57

3. Separate differential carrier halves and remove releasing single components.

Figure 93

4. Push crown wheel off from differential carrier half.

Figure 94

MEASURING POINTS AND CONNECTIONS OR INSTALLATION VIEW 2 HL 250/ 270/290 LAYOUT "AXLE ATTACHMENT"

(With electr, downshift interlock integranted in the vehicle)

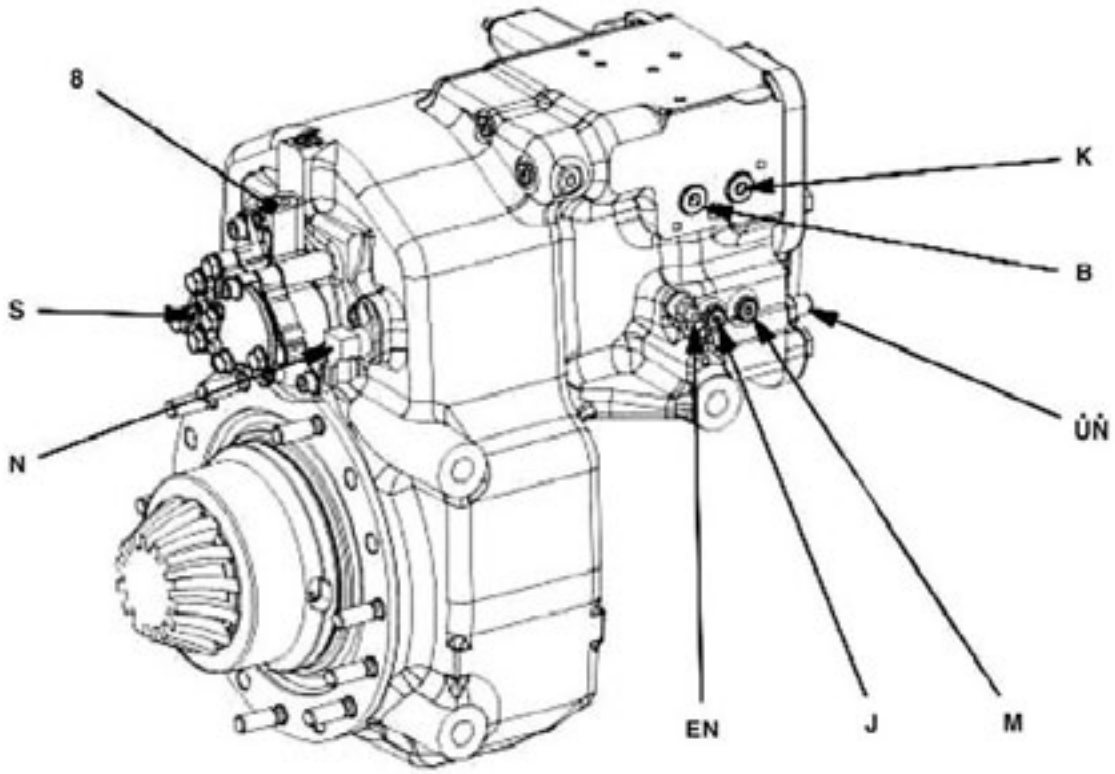


Figure 3

FG002635

Reference Number	Description
8	Lube Oil Pump
B	Brake (M16x1.5)
K	Clutch (M16x1.5)
J	Road Speed (Brake - M10x1)
M	Off-road Speed (Clutch - M10x1)

Reference Number	Description
N	Speed Transmitter (Output Speed)
S	Lubrication Pressure (M10x1)
EN	Bleeder Valve (Emergency Actuation Parking Brake)
UN	Pressure Relief Valve (Emergency Actuation Parking Brake)

⚠ WARNING!

Remove the pressure ring from the ring cautiously using lever action - risk of damaging the sealing surfaces.

Figure 29

8. Remove the gasket and O-rings from the pressure ring / ring.

Figure 30

9. Take the disk set of the brake with end shim (s) out of the housing.

⚠ CAUTION!

Illustration shows version / components of the 2 HL-290.

Figure 31

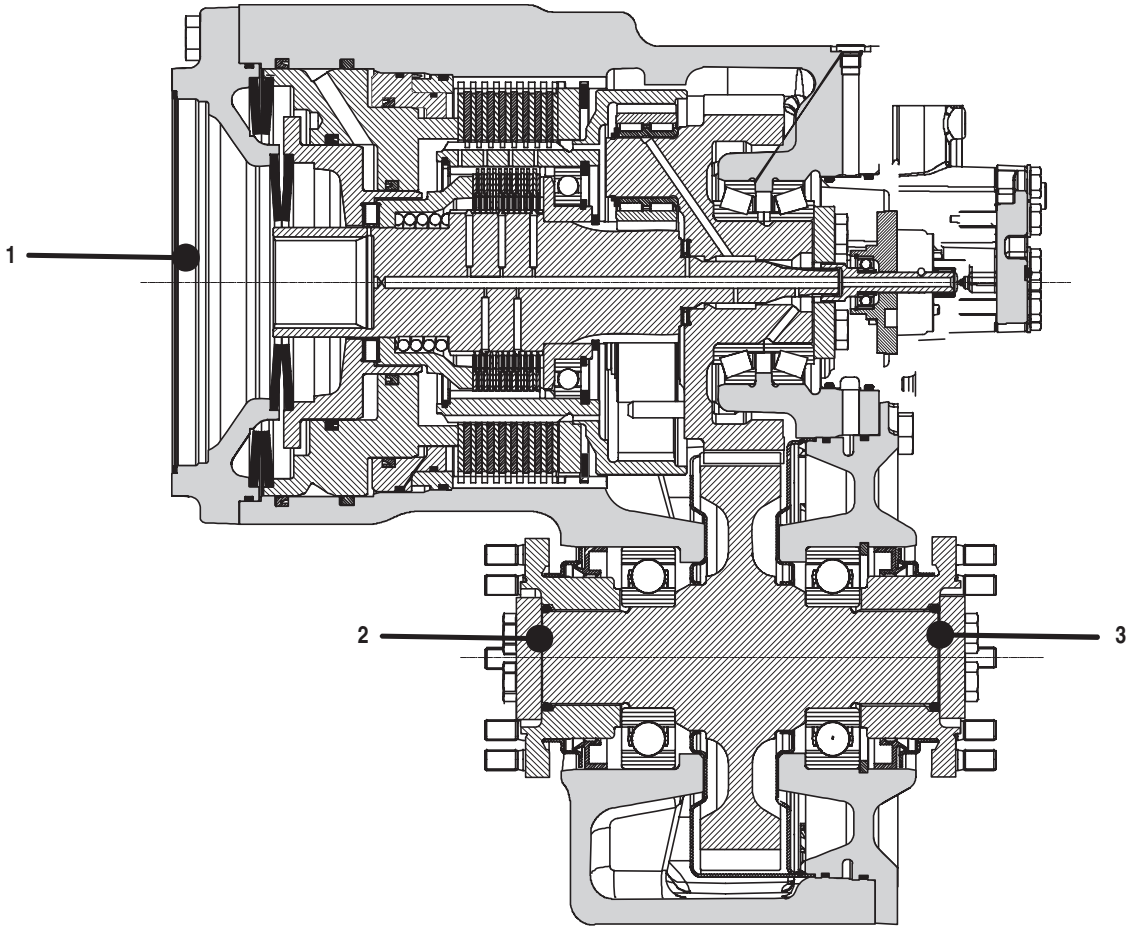
10. Unsnap the retaining ring.

Figure 32

Version - "Separate Installation"

(HL-Transmission installed separately from the axle)

In case of the transmission version "Separate Installation" it is possible, differently from the transmission version "Axle Attachment," to remove and to install the output - without the previous disassembly of brake/clutch and planet carrier.



FG007292

Figure 67

1. Legend to Figure 67

Reference Number	Description
1	Input
2	Output - Front Axle
3	Output - Rear Axle

Determine the Adjusting Ring for Rolling Moment/Pinion Bearing

1. Rotate the transmission by 180°.

   Mount the adjusting ring (s = optional).

CAUTION!

It is recommended to reinstall the adjusting ring (e.g. s = 1.35 mm) from the disassembly, if however the required rolling moment of 1.5 - 3.0 Nm (without shaft seal) is not obtained - see bearing rolling moment check Figure 104 - the bearing rolling moment is to be corrected with an adequate adjusting ring.

Figure 99

2. Mount the heated bearing inner ring and install it subsequently until contact.

Figure 100

3. Mount the flange.

Figure 101

4. Put on the washer and fasten the flange with hexagon screws.

CAUTION!

Rotate the pinion - when tightening - in both directions (aligning of rollers) several times.

Tightening torque (M 10/8.8) .....M_A = 46 Nm

Figure 102

7. Position the washer and fasten the output flange using hexagon screws.

CAUTION!

Install the second shaft seal/output flange (front axle output) analogously.

WARNING!

Before put the unit into operation the specifications and regulations respectively and the instructions of the operating and maintenance instructions and the specifications and instructions of the vehicle manufacturer have to be observed.

Figure 132

B. Insert the end shim (2).

Figure 166

C. Insert the disk set (outer/inner disks) - beginning with an outer disk - alternately.

CAUTION!

Position the outer disk (1 Pc.) s = variable 2.8 - 3.7 mm, in the disk set on the top (piston-side).

With outer disk s = variable, the disk clearance/ piston stroke will be adjusted - See Figure 180.

Figure 167

D. Clutch:

Insert the disk set (outer/inner disks) - beginning with an outer disk - alternately.

CAUTION!

Position the outer disk (1 Pc.) s = variable 1.2 - 1.6 mm, in the disk set on the top (piston side).

With outer disk s = variable, the disk clearance/ piston stroke will be adjusted - See Figure 179.

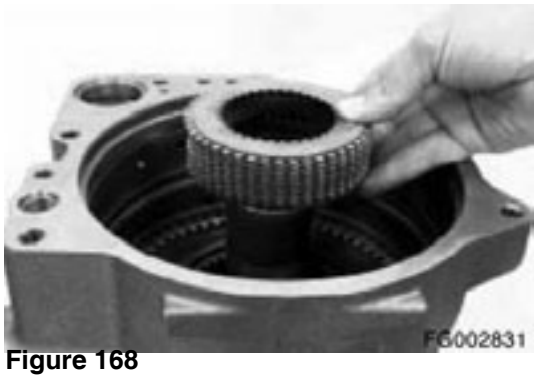


Figure 168

Adjust and check the Disk Clearance/Piston Stroke of Brake and Clutch

1. Mount the pressure piece (without compression spring).

Figure 169

Emergency Release (Parking Brake)

Legend to Figure 206:

Reference Number	Description
1	Input Housing
2	Housing
3	O-ring
4	Threaded Element (Orifice)
5	Ball
6	Compression Spring
7	O-ring
8	Bleeder
9	Position of lubrication nipple for the version "Transmission Installation Position Vertical" - Position of lubrication nipple for the version "Transmission Installation Position Horizontal" -See Figure 211

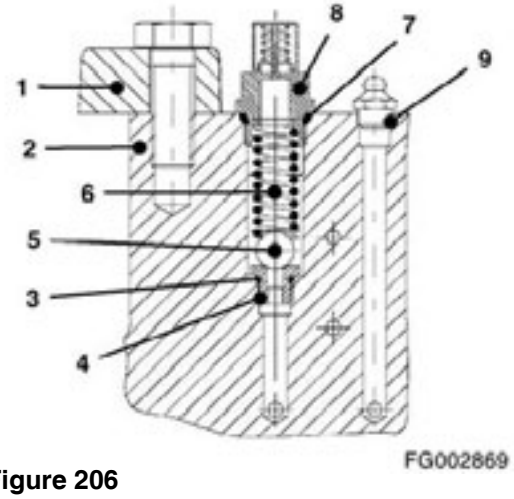


Figure 206

1. Install the threaded element (4) with O-ring (3).

   Tightening torque (M 10x1) .....M_A = 24 Nm

Figure 207

2. Insert the ball (5).

Figure 208

5. Loosen pump cover bolt connection.

Figure 237

⚠ CAUTION!

Keep pump to contact and rotate it by 180° - disassembly aid.

6. Then pull the pump in vertical position out of the housing - pay attention to possibly released balls/compression springs (See Figure 239 and 248).

Figure 238

7. Remove the outer (1) and internal rotor (2) and take the released ball [(3) driver] out of the control housing (4).

   Outer, internal rotor and control housing = rotor set

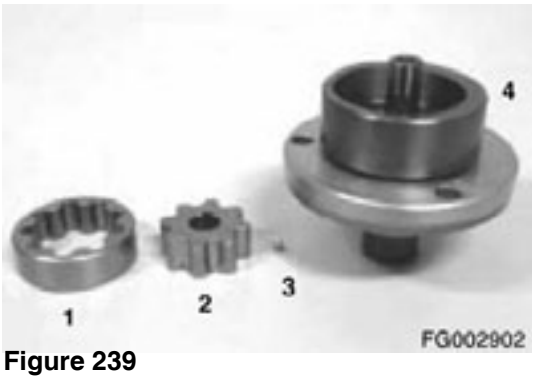


Figure 239

8. Remove the control housing and the released balls and compression springs (3 pcs. each).

Figure 240

6. Secure the check valves and the pressure limiting valve by two blows each with the center punch.

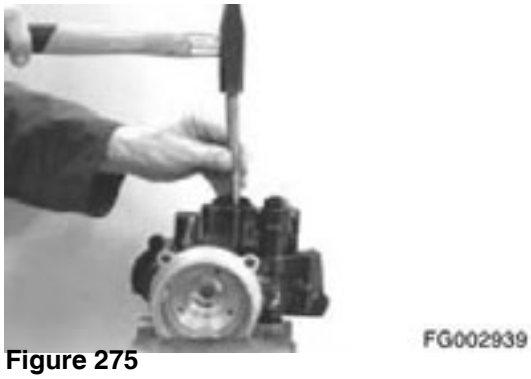


Figure 275

7. Check passage of the orifice / oil bore in the housing bottom.

CAUTION!

Insert the needle sleeve to installation dimension "X."

"X" = 0.2 - 0.7 mm below plane face/housing

CAUTION!

The exact installation position is ensured by use of the specified mounting tool.

CAUTION!

Insert the needle sleeve with marked face showing upwards.

Figure 276

8. Mount the ball bearing onto the shaft and fasten it with the retaining ring.

Figure 277

MEMO

Hydraulic System Troubleshooting, Testing and Adjustment

Edition 1

Arm Crowd Circuit

When the arm control lever is put in the crowd mode, the left side pilot valve generates secondary pressure that is transmitted to the right and left sides of the control valve simultaneously.

When secondary pilot pressure reaches 7 - 9 kg•cm^2 (100 - 128 psi), the arm control valve spool on the right and left sides of the control valve opens. Output flow from both halves of the pump assembly is directed to the arm cylinder.

When working in the arm crowd mode, under certain conditions, oil in the cylinder could suddenly be forced out by the weight of the arm and bucket itself. Insufficient oil flow to the cylinder could lead to cavitation in the cylinder and/or surging or irregular movement. This is prevented by a regeneration valve attached to the control valve which maintains the balance between oil flowing into the cylinder and oil flowing out.

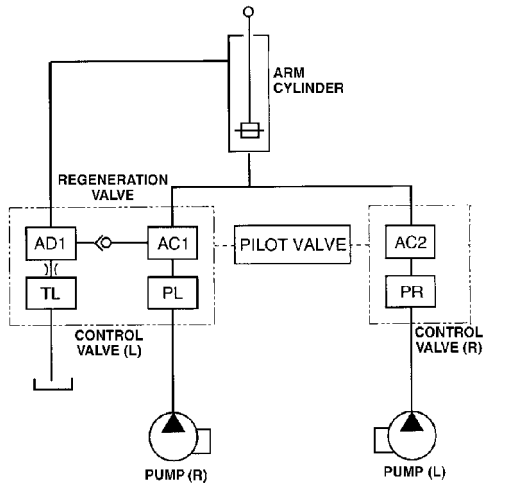


Figure 4

Arm Dump Circuit

When the arm control lever is put in "dump" mode, the left side pilot valve generates secondary pilot pressure that goes to both halves of the control valve simultaneously.

When pilot pressure reaches 7 - 9 kg•cm^2 (100 - 128 psi), the control spools open on both sides allowing oil from the right and left pumps to flow to the arm cylinder.

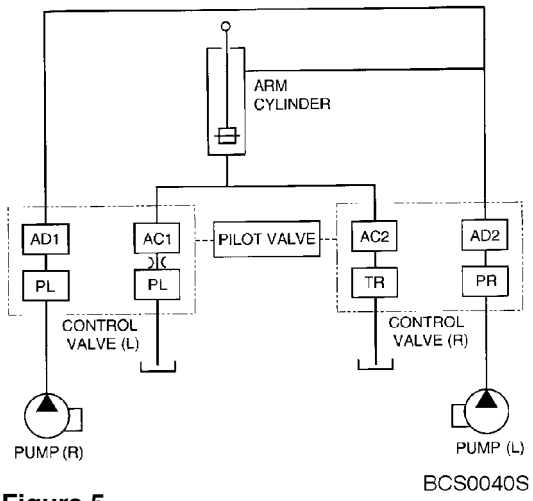


Figure 5

Bucket Operating Circuit

The bucket operating circuit includes the right and left main pumps, the right and left halves of the control valve and the bucket cylinder. 360 kg•cm^2 (5,112 psi) overload relief valves at BKC and BKD 1 ports of the control valve protect the circuit and its components from damage.

adjustment, the pump which supplies output to the track frame toward which the excavator is veering is weak.

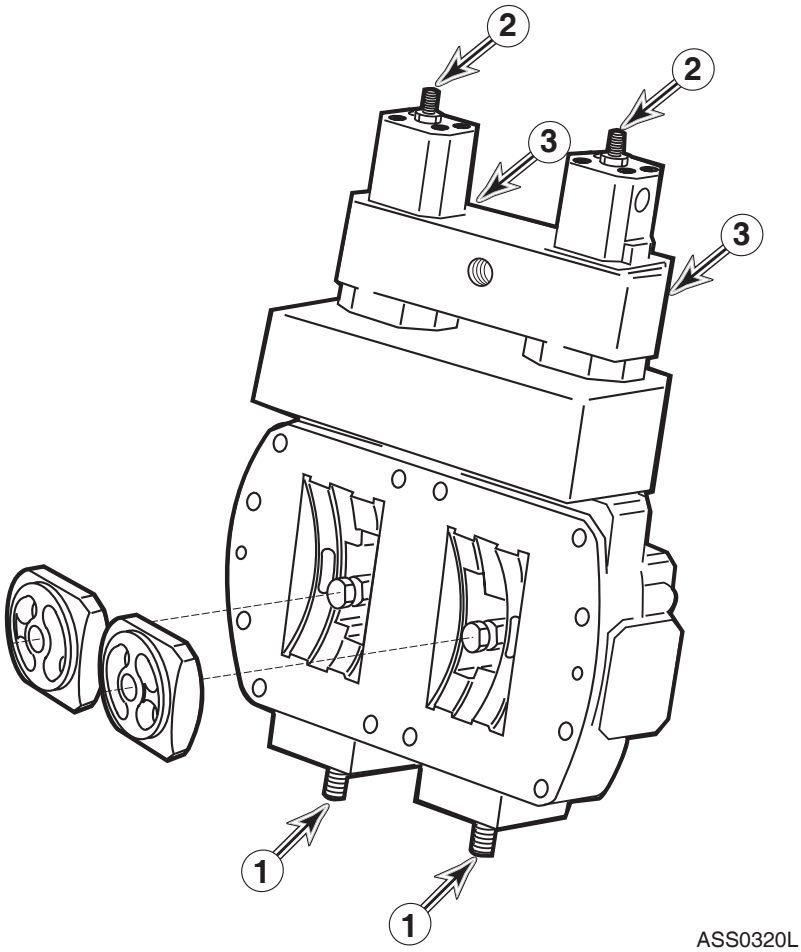


Figure 10

Refer to the illustration of the pump regulator control valve (Figure 10) for the location of adjustment screws (1, 2 and 3). There are two different adjustments, along 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 the output of the other. It is not necessary to adjust both regulators at the same time, but after checking or adjusting one of them, the remaining unit should also be checked.*

Problem	Possible Cause	Remedy
Pressure does not increase at all.	Main poppet or pilot poppet stuck open.	Clean/replace.
Irregular or uneven pressure.	Poppet seat damaged or pilot piston sticking to main poppet.	Clean/replace.
	Loose locknut and adjusting screw.	Readjust.
	Components worn out, past wear limits.	Replace.

TROUBLESHOOTING – TRAVEL CONTROL VALVE

Problem	Possible Cause	Remedy
Secondary pressure does not increase.	Low primary pressure.	Check primary pressure.
	Broken spring.	Replace spring.
	Spool sticking.	Clean, repair or replace.
	Excess spool to casing clearance.	Replace spool casing.
	Worn or loose universal joint (handle) subassembly.	Repair or replace U-joint subassembly.
Secondary pressure too high.	Dirt, other interference between valve parts.	Clean, repair or replace.
	Return line pressure too high.	Redirect return line.
Secondary pressure does not hold steady.	Dirt, other interference between valve parts, or worn spool sticking intermittently.	Clean, repair or replace.
	Interference or binding on spool return spring.	Clean, repair or replace.
	Interference, restriction or unsteady pressure in tank return line.	Repair or reroute tank return line.
	Air bubbles in piping (temporary) or air leak.	Vent air, or repair leak.
NOTE: *Look for evidence of leaking oil.*		

Specifications

Model	Serial Number	System	Charge Pressure	Volume
DX140W	S/N 5001 and Up	Pilot	15 kg•cm^2 (213 psi)	320 cc (19.53 in^3)
		Brake	30 kg•cm^2 (427 psi)	750 cc (45.77 in^3)
DX160W	S/N 5001 and Up	Pilot	15 kg•cm^2 (213 psi)	320 cc (19.53 in^3)
		Brake	30 kg•cm^2 (427 psi)	750 cc (45.77 in^3)

DISASSEMBLY

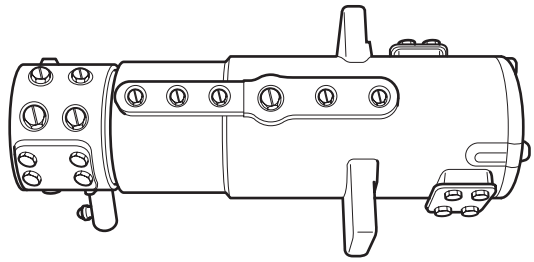
Refer to the assembly drawing of the swivel joint for component references (Figure 1).

IMPORTANT

Do not unbolt the center joint from the lower car body until an adequate number of piping block-off plates are available, for disconnected piping lines. Be sure that system pressure has been vented - including the hydraulic accumulator and tank reserve pressure - before disassembly is started.

1. Remove the Swivel Joint from the Vehicle

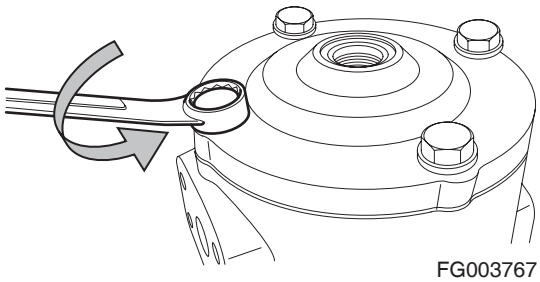
   Move the Swivel Joint removed from the vehicle to the work table using a crane.



FG003764

Figure 3

2. Remove Cover
   - Remove the bolts and washers using a wrench (wrench) or air impact.
   - Remove the cover.



FG003767

Figure 4

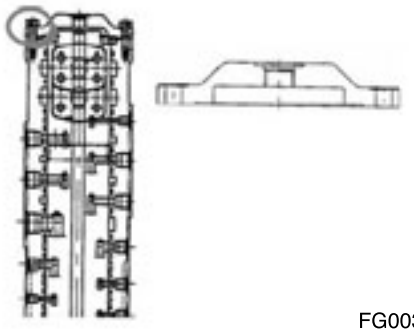


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Figure 5

GENERAL DESCRIPTION

Two essentially similar types of hydraulic cylinders are used on the excavator. The cylinder that is used to operate the excavator boom or bucket is equipped with a rod stopper, which acts as a cushion only when the cylinder rod is fully retracted (and the bucket is pulled close to the arm). This type of cylinder is shown in the lower drawing.

Arm cylinders have a cushion or stopper for operation in both directions. This type of cylinder is shown in the upper drawing.

Theory of Operation

1	**Piston**
2	**Oil Path A**
3	**Oil Path B**

Cylinder piston rods are extended or retracted by oil flow to the back side of the cylinder (shown as ("oil path A") or to the front of the cylinder ("oil path B").

The cylinder rod is extended as oil flow is pumped through the circuit to the back side of the piston. The force (F1) of the piston stroke can be expressed by the formula below, where P = circuit oil pressure and the inside diameter of the cylinder is expressed by D (Figure 1).

$$F_1 = P \times \frac{\pi D^2}{4}$$

(P: Pressure, π = 3.14, D: Cylinder Inside Diameter)

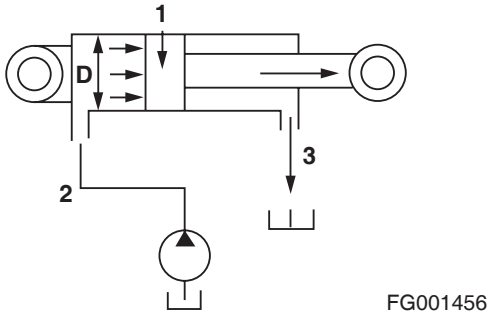


Figure 1

1	**Cylinder Inside Diameter - D**
2	**Oil Path A**
3	**Oil Path B**
4	**Rod Diameter - R**

When the cylinder rod is retracted, oil flow through the circuit from the pump to the front side of the cylinder generates a force (F2) that can be expressed by the formula in which the diameter of the piston rod is expressed by R, and the other two terms are the same as in the preceding expression.

$$F_2 = P \times \frac{\pi(D^2-R^2)}{4}$$

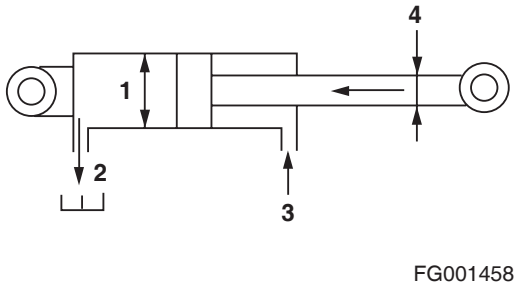
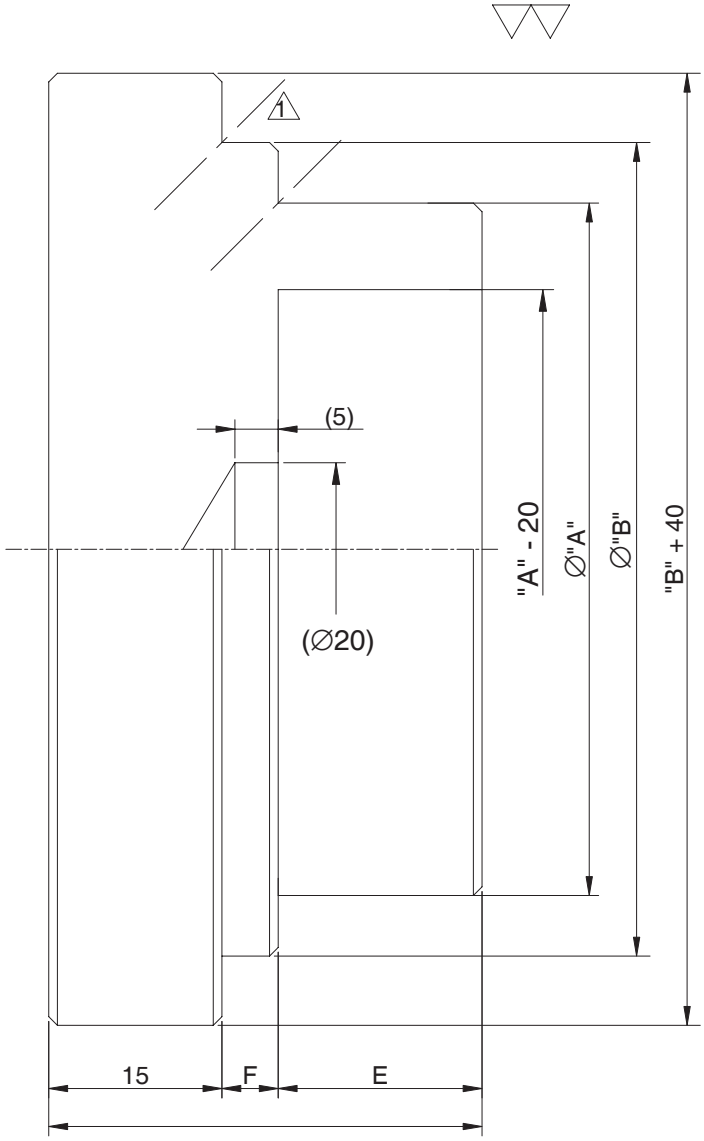


Figure 2

Steel Bushing Jig



ARS4750L

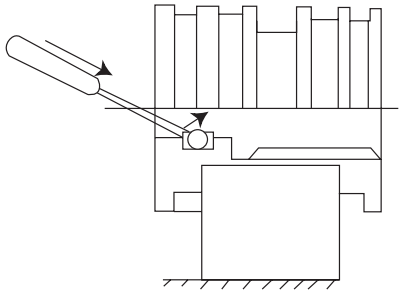
Figure 11

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

Undefined Chamfer C/R = 0.5 Max.

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

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



HAOF37OL

Figure 26

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).

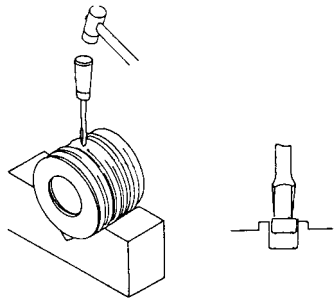


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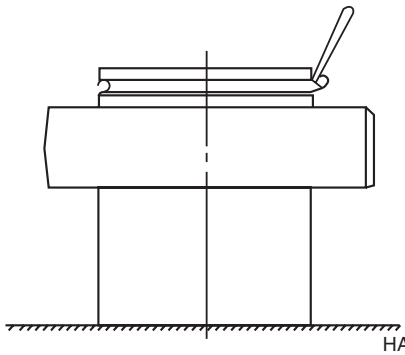
Figure 27

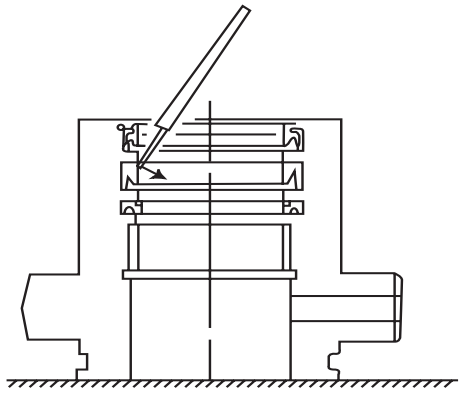
14. Remove O-ring (21) and backup ring (22) from cylinder head.



HAOF38OS

Figure 28

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



HAOF39OL

Figure 29

B. Boom-down (Pc > Pv) (Pi pilot signal: ON).

Pilot signal pressure enters signal port, spool A moves to the right and chamber (1) and drain (1) are connected allowing chamber (1) to drain. Since pressure Pc is greater than Pv, oil flows through the opened poppet B and flows back to the tank.

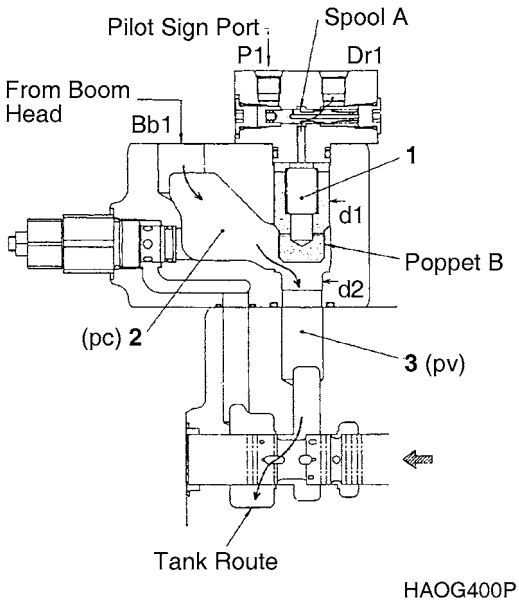


Figure 18

Specifications

Control Valve	Relief Valves (Main):	330 kg•cm^2 (4686 psi) – normal, travel 350 kg•cm^2 (4970 psi) – pressure up.
	Left Side Spools: (and spool diameter)	Travel: left 22 mm (0.866") diameter Swing: 22 mm (0.866") diameter Boom-2: 22 mm (0.866") diameter Arm-1: 22 mm (0.866") diameter
	Right Side Spools: (and spool diameter)	Travel: right 22 mm (0.866") diameter Option: open 22 mm (0.866") diameter Boom-1: 22 mm (0.866") diameter Bucket: 22 mm (0.866") diameter Arm-2: 22 mm (0.866") diameter
	Overload Relief Pressure:	360 kg•cm^2 (5112 psi)

Main Relief Valve

Reference Number	Description	Size
1	Adjusting screw	22 mm
2	Hexagonal nut	30 mm
3	Hexagonal nut	30 mm
4	Cap	30 mm
5	Pilot seat	
6	Lower sleeve	
7	Sleeve	27 mm

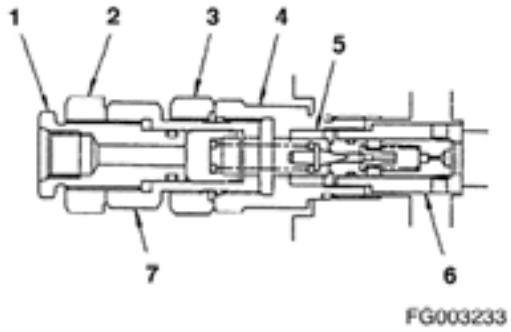


Figure 63

1. Hold adjusting screw (1) and loosen hexagonal nut (2).
2. Hold cap (4) and loosen hexagonal nut (3).
3. Loosen cap (4) and remove valve assembly by unscrewing cap (4).

Reference number	Description
6	Lower sleeve
8	Piston
9	Spring
10	Orifice

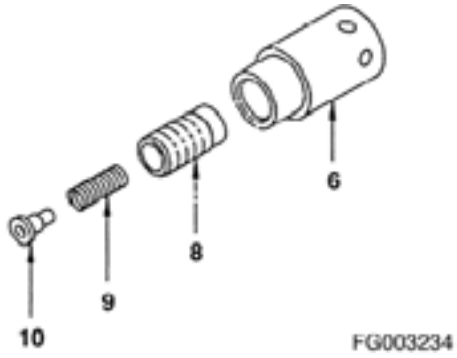


Figure 64

4. Remove lower sleeve (6) from cap (4) by gently pulling sleeve out of cap. Remove piston (8), spring (9) and orifice (10) from lower sleeve.

IMPORTANT

Further disassembly of pilot sheet from the cap is not recommended, as it is pressed in at the factory.

Foot Relief Valve

IMPORTANT

When disassembling Foot Relief Valve, tag and label each component so all parts can be reassembled in the proper order.

Reference Number	Description
1	Cap
2	Poppet
3	Cap
4	Shim
5	Spring

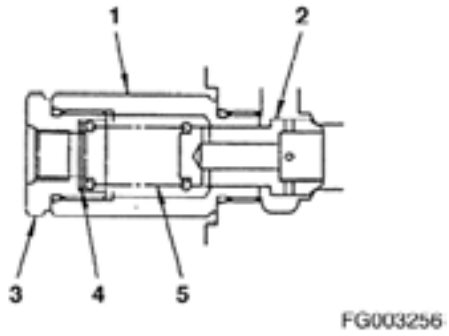


Figure 86

1. Loosen cap (1) and remove poppet (2).

Cap wrench size	30 mm
Tightening torque	6 kg•m (43 ft lb)

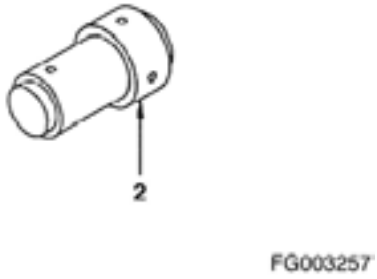


Figure 87

2. Loosen cap (3) and remove shim (4) and spring (5).

Cap wrench size	30 mm
Tightening torque	6 kg•m (43 ft lb)

IMPORTANT

Shim is necessary for correct pressure adjustment and must not be left out.

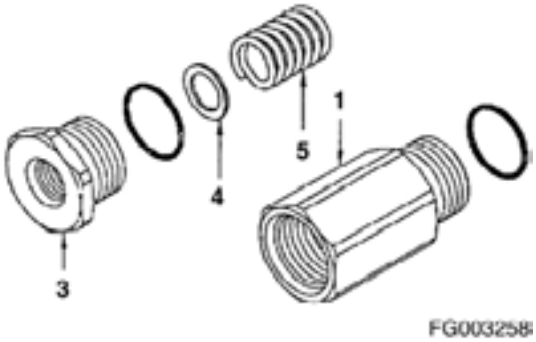


Figure 88

Swing Motor

Edition 1

1. Anticavitation Check Valve

   The motor can be rotated faster than supplied oil flow because there is no counterbalancing valve to prevent over speed ;

   to prevent cavitation of the motor, oil compensation insufficient flow is drawn through the anti-cavitation check valve.

2. Relief Valve: KRD22EK10C (See Figure 4 on page -13)

   We consider that port P is applied pressure by tank pressure.

   Port P, R are affected by tank pressure at first, as shown fig. 3-(1). The relief valve starts operating when the force that is determined by multiply the pressure area (A1) of plunger (301) by pressure P1 is equal to the sum spring (321) force (Fsp) and the force that is determined by multiply the pressure area (A2) by pressure Pg of room 'g' in the plunger (301).

   Here, Pg is the pressure of room 'g' applied pressure by passing oil through orifice m. If Pg arrives at the pressure which is determined by spring (321) pushing the piston (302), the piston move to left side. when piston (302) move left side, room 'h' operates as damping room because of orifice (n) which is designed at the side of adjustment plug (401) and piston (302). Because of this mechanism, the pressure of room 'g' increases smoothly while the piston (302) reaches end of adjustment plug (401). (Figure 4-(2))

$$P1 \times A1 = Fsp + Pg \times A2$$

$$P1 = \frac{Fsp + Pg \times A2}{A1}$$

   If the piston (302) reaches end of adjustment plug (401), it doesn't move left side anymore. So, the pressure of room 'g' is Ps and spring (321) force is Fsp. (Figure 4-(3)) Therefore, the pressure P changes as shown Figure 4-(4). The pressure (Ps) of last state is following equation.

$$P1 \times A1 = Fsp' + Pg \times A2$$

$$P1 = \frac{Fsp'}{A1 - A2}$$

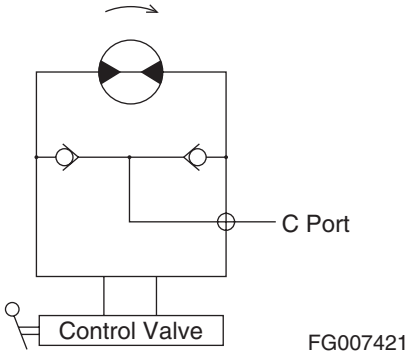


Figure 3

4. Brake torque is not sufficient.

Condition	Cause	Remedy
Brake torque is not sufficient	1. Friction plates are worn. 2. Brake piston is becoming stick. 3. Brake releasing pressure is not working. 4. Spline of friction plates are damaged.	1. Disassembly or inspection. When it is worn better than standard, replace it. 2. Disassembly or inspection 3. 1) Check for the circuit. 2) Check for the brake valve 4. Disassembly or inspection. 1) Replace for damaged parts.

5. Motor is much slip

Investigates the DRAIN quantity for motor.

Normal: app. 200cc/min (TSM140:500cc/min)

Condition	Cause	Remedy
Motor is much slip	1. Working defectiveness of relief valve is the same 1) an item. 2. Seat defectiveness of plunger.	1. It is the same 1) an item 2. Replace it.

6. Oil Leak

A. Oil leak from the oil seal

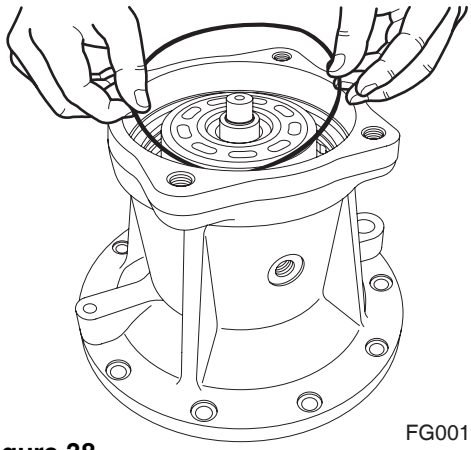
Condition	Cause	Remedy
Oil leak from the oil seal	1. The lip is dirty or damaged. 2. The shaft may be damaged or worn out. 3. The lib is damaged too high-pressure in the casing. 4. The shaft is rusty.	1. Replace the oil seal. 2. Replace the driving shaft or defective centering of the driving shaft. 3. It repairs the drain piping which is closed up. 4. Disassemble, repair, and replace the oil seal.

B. Oil leak from the blind and union

Condition	Cause	Remedy
Oil leak from the blind and union	1. O-ring is not in. 2. O-ring is broken. 3. Seal face is defective. 4. The bolt is loose or not tightened.	1. Insert O-ring. 2. Replace it. 3. Disassemble or repair. 4. Tighten adequately or replace it.

12. Mount O-ring (307, 308) to casing (301).

    (Coat the O-rings with grease. O-ring can be protected by grease.)

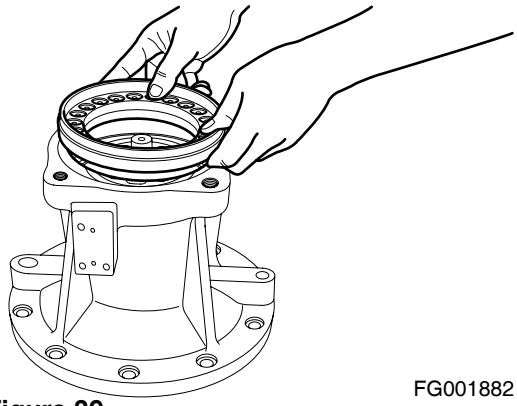


FG001881

Figure 38

13. Assemble brake piston (309) to casing (301).

    The piston is difficult to assemble because of the restriction of the O-ring; screw in two M8 bolts on the brake piston and tap them gently with plastic hammer.

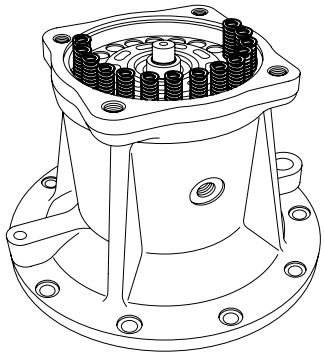


FG001882

Figure 39

14. Assemble brake springs (310) into brake piston (309).

    Confirm the springs are fitted to the brake piston completely.



FG001862

Figure 40

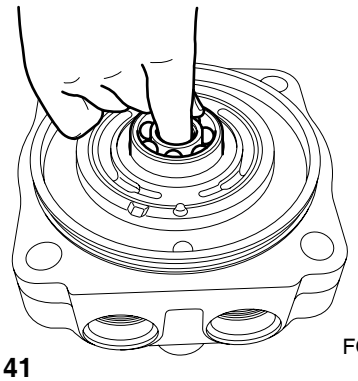
15. (It is necessary when ball bearing (108) was disassembled from the valve casing.)

    Assemble of ball bearing (108).

    Insert it to valve casing (101) while tapping it lightly.

    Tap evenly on the outer diameter of the outer race with a brass drift until it completely stops.

    Do not use a steel punch or bar on the bearing since it can chip or crack the race.



FG001884

Figure 41

GENERAL REPAIR GUIDELINES

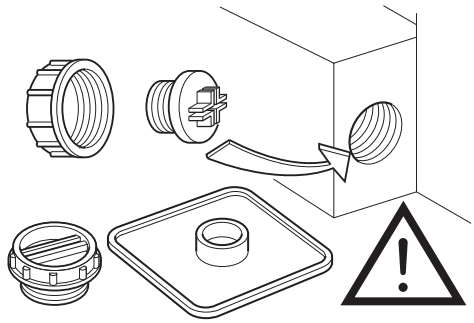
⚠ CAUTION!

Observe the following notices when carrying out repair work at hydraulic aggregates.

HB7M3002

Figure 2

1. Close all ports of the hydraulic aggregates.

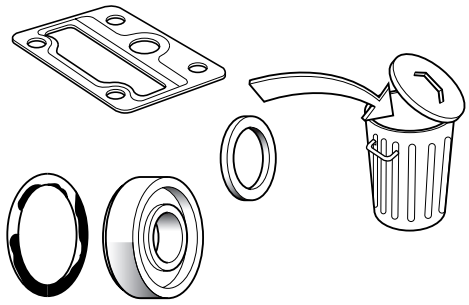


HB7M3003

Figure 3

2. Replace all seals.

   Use only original Hydromatik spare parts.



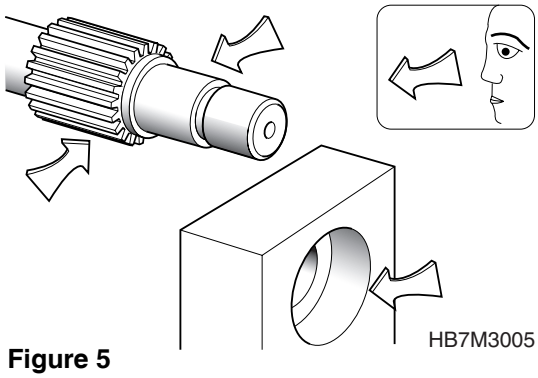
HB7M3004

Figure 4

3. Check all seal and sliding surfaces for wear.

⚠ CAUTION!

Rework of sealing area f. ex. with abrasive paper can damage surface.



HB7M3005

Figure 5

Diassembly of the Port Plate

1. Note dimension x.

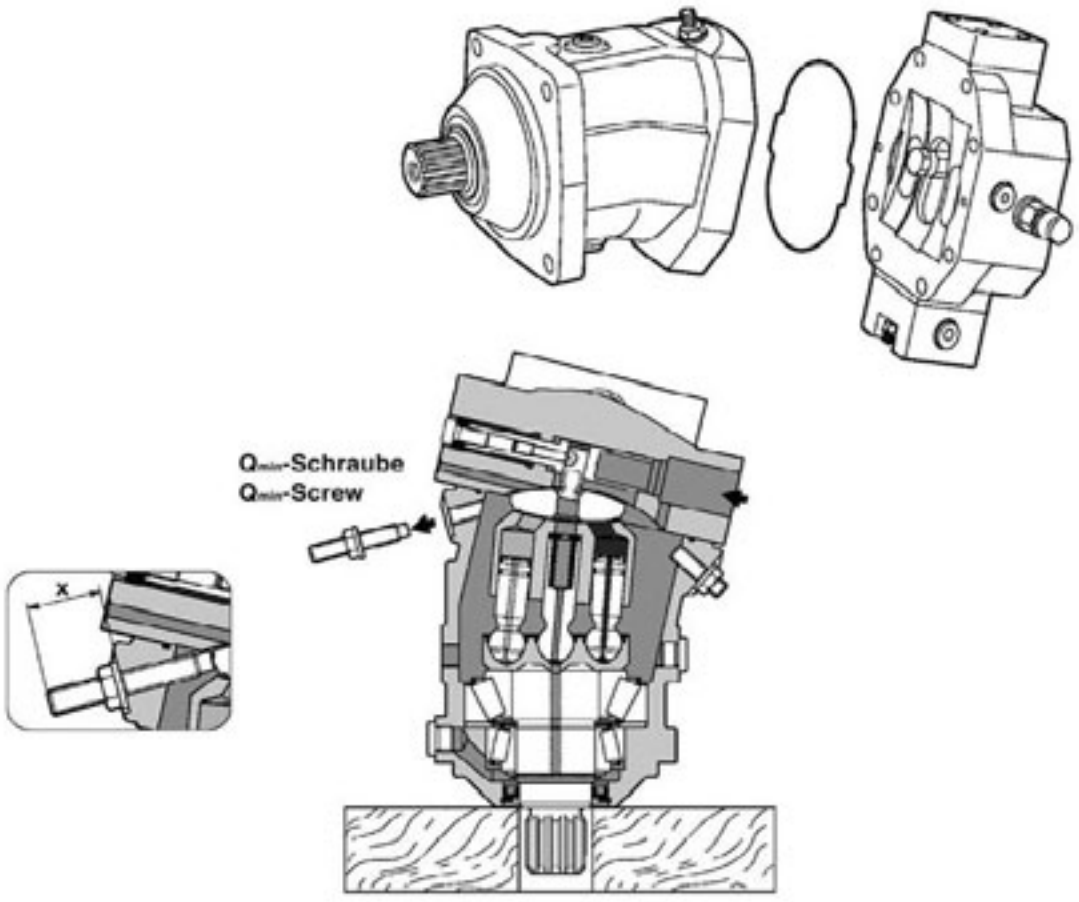
   Remove Qmin-screw.

   Swivel rotary group to zero position.

CAUTION!

For disassembly of the port plate, swivel always rotary group to zero position.

Piston rings to hang out of the cylinder boring.



FG002997

Figure 34

3. Place centering disk.

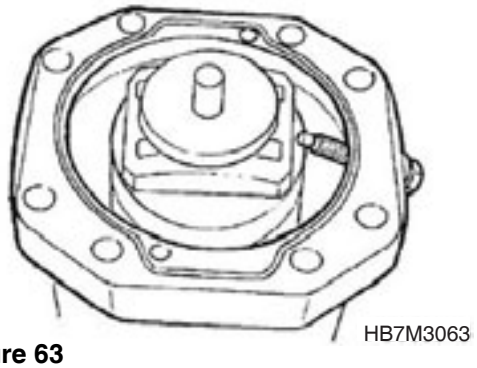


Figure 63

4. Mount measuring device.

Figure 64

5. Check dimension X.

Figure 65

9. Install plug (5) into body (1) (both sides) and torque to 70.75 ±0.95 kg•m (511 ±7 ft lb).

Figure 12

10. Install O-ring (25) into body (1) (both sides).

    NOTE: *It is recommended to replace O-ring with new.*

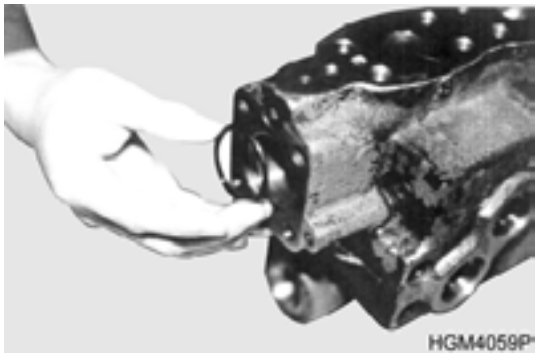


Figure 13

11. Install spool (2) into body (1).

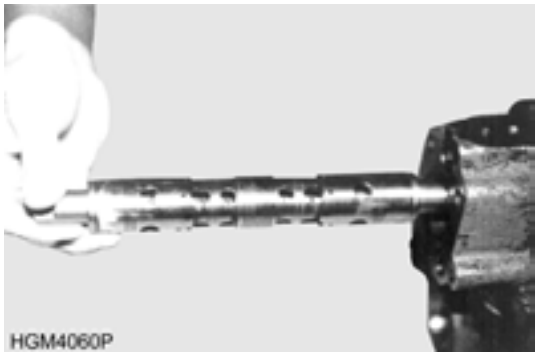


Figure 14

12. Install spring (19) into body (1), then install cover (6).

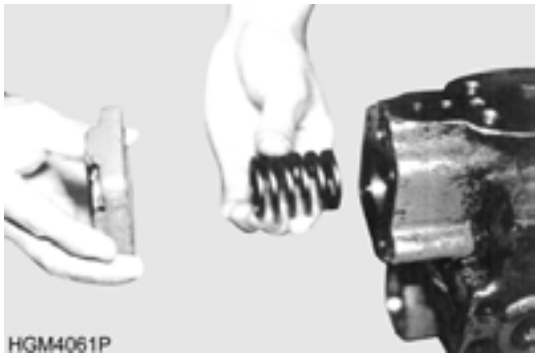


Figure 15

GENERAL REPAIR GUIDELINES

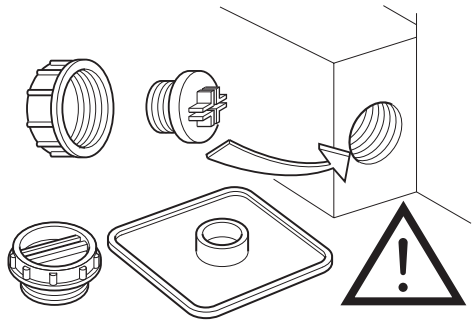
⚠ CAUTION!

Observe the following notices when carrying out repairs on hydraulic units!

HB7M3002

Figure 2

1. Close off all openings of the hydraulic unit.

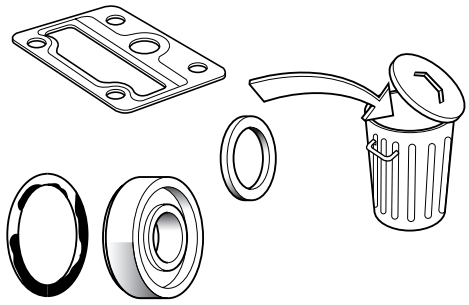


HB7M3003

Figure 3

2. Replace all the seals.

   Use only original HYDROMATIK spare parts.



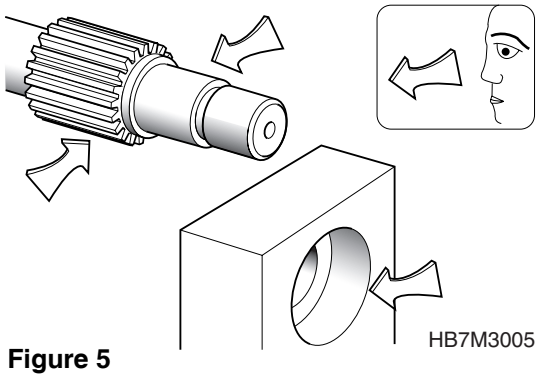
HB7M3004

Figure 4

3. Check all sealing and sliding surfaces for wear.

⚠ CAUTION!

Re-work of the sliding surfaces by using, for example with abrasive paper, can damage the surface.

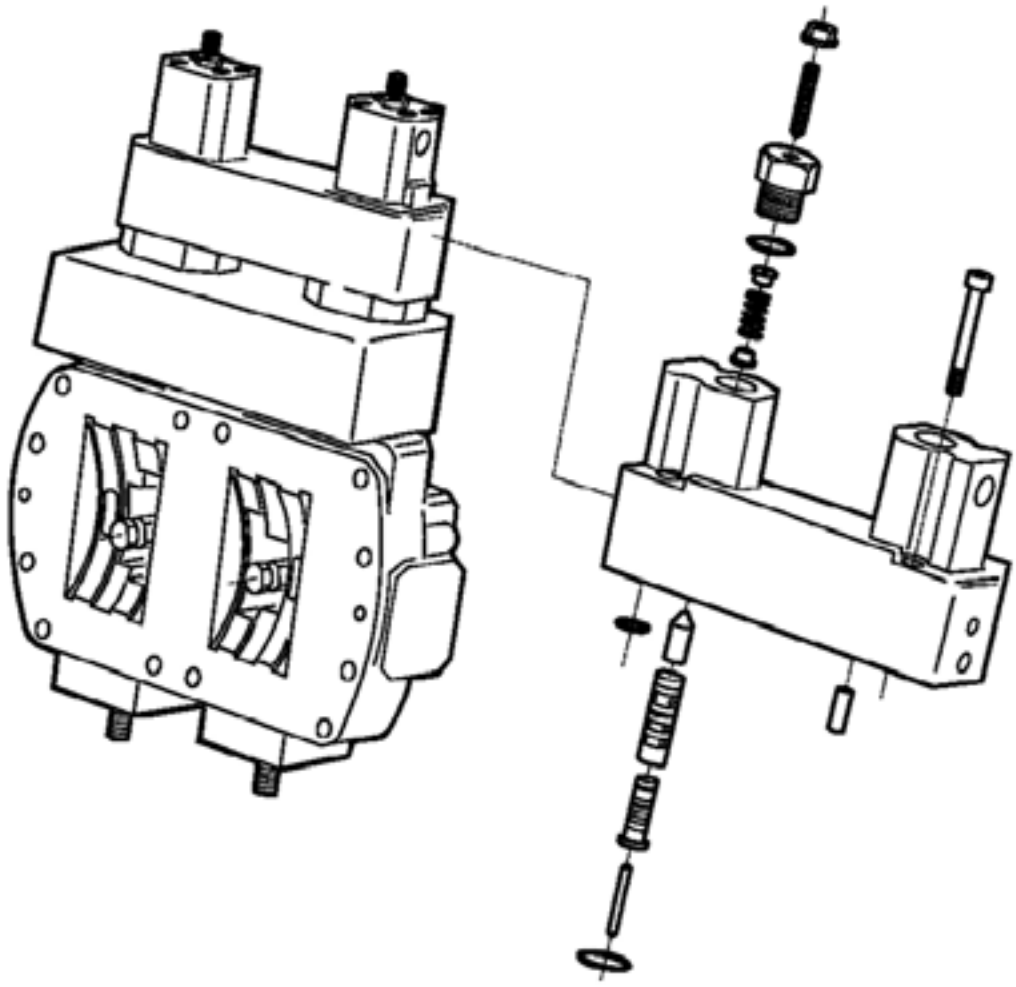


HB7M3005

Figure 5

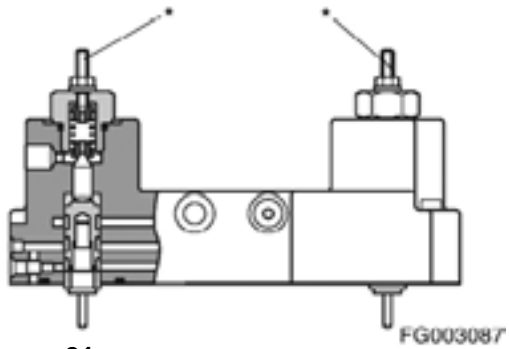
Control Module LR

1. Remove and disassemble control module LR.



FG003086

Figure 30



FG003087

Figure 31

6. Completely mount device and pull out bearing.

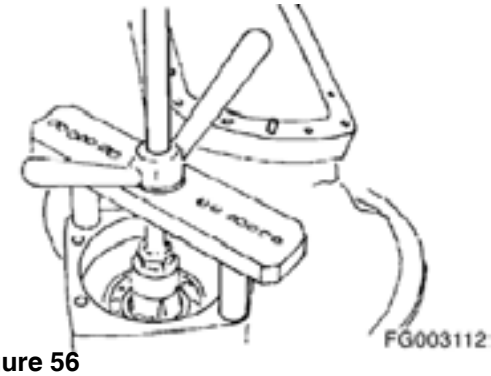


Figure 56

7. Pull out pinion bearing.

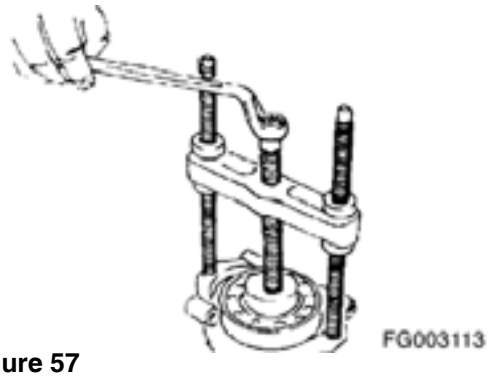


Figure 57

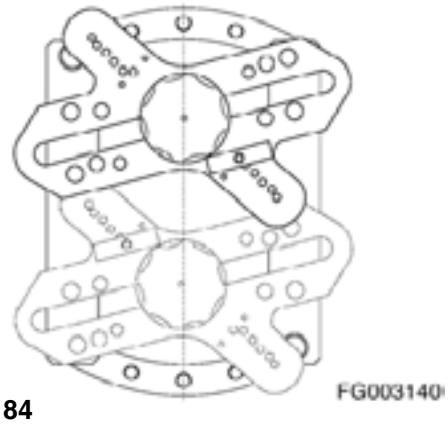


Figure 84

A. NG / size 80 - 107

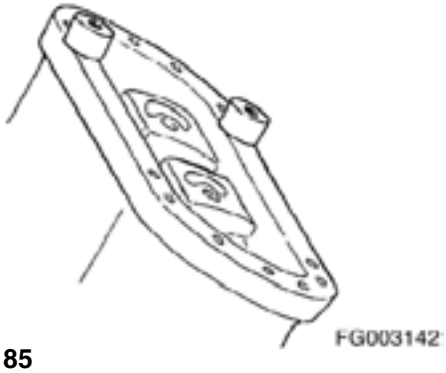


Figure 85

B. Only size 140 - 200

Fit the intermediate plates onto the housing.

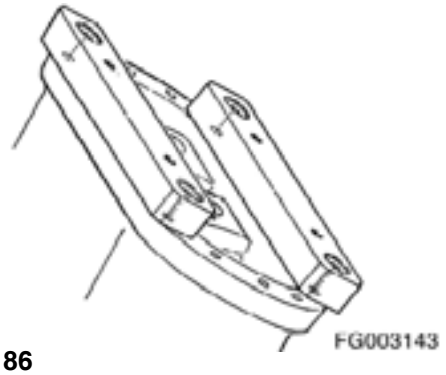


Figure 86

3. Zero Adjustment - measuring device

Turn using the hand wheel until the stop is reached.

- Set dial gauge to zero -

A. NG / size 80 - 107

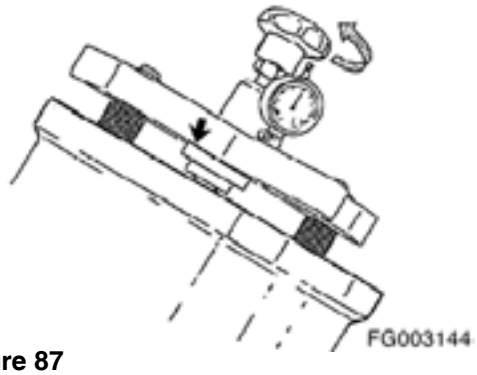


Figure 87

DOUBLE GEAR PUMP

Disassembly

1. Clean exterior of pump.

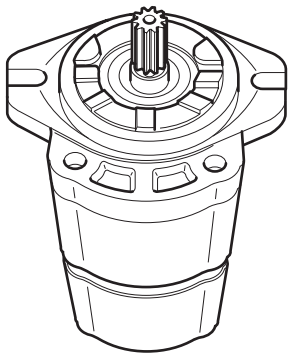


Figure 22

2. Remove clamp bolts.

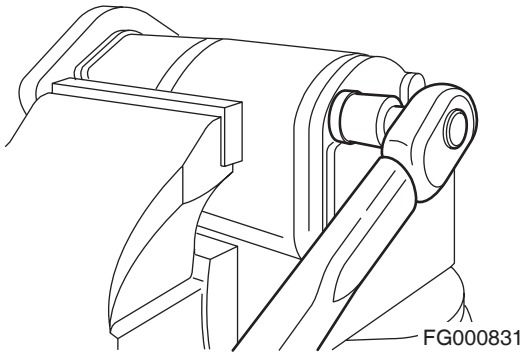


Figure 23

3. Cover sharp edges of driveshaft with adhesive tape, and coat shaft end extension with clean grease, to avoid any damage to lip of shaft seal when removing mounting flange.

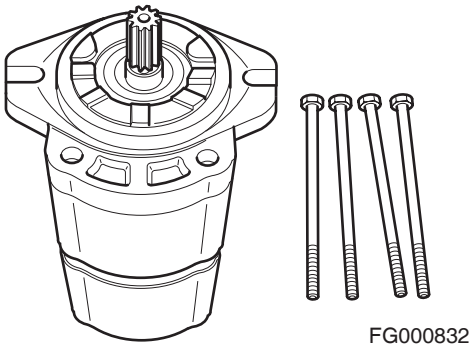


Figure 24

Table of Contents

Dozer Control Valve

Safety Precautions 5
Applicable Models 5
Structure 7
Parts List 8
Performance Curve 9
Hydraulics Symbol 9
Disassembly and Assembly Tools 9
Disassembly 10
Assembly 13

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

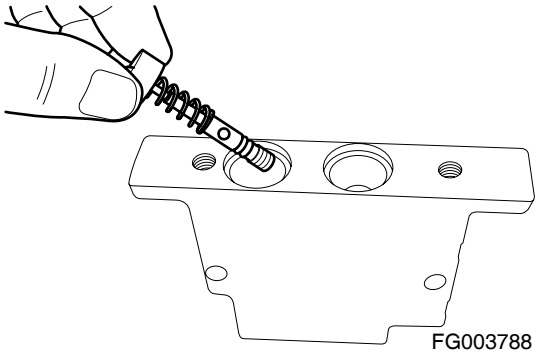


Figure 18

5. Assemble plug kit (II)

   Assemble rod seal (II-11), O-ring (II-12), push rod (II-13) and plug (II-10) in the order.

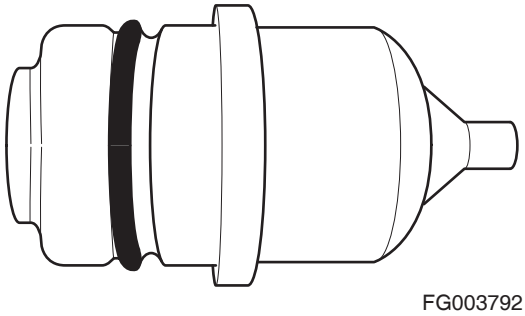


Figure 19

6. Assemble plug kit (II) in the body (1).

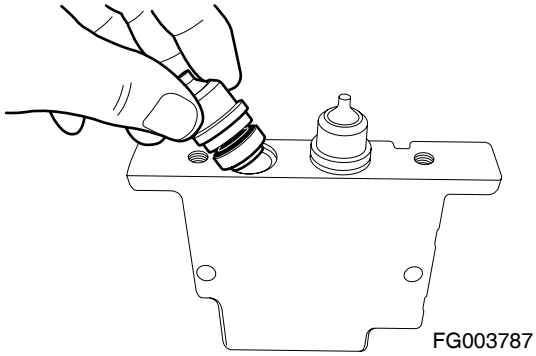
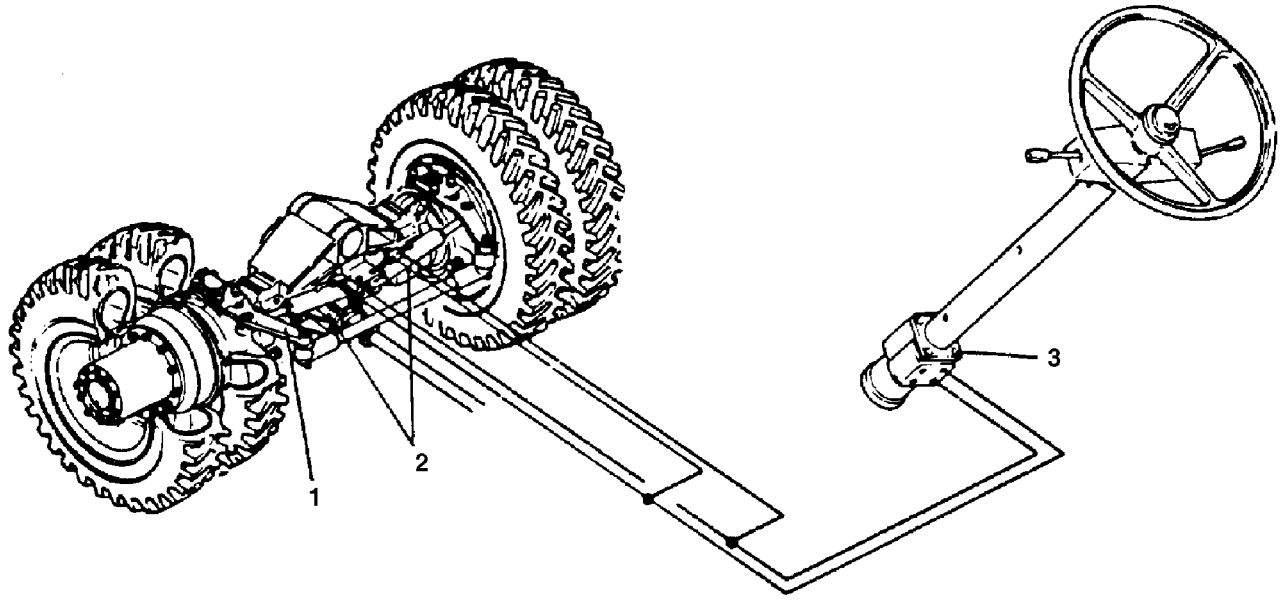


Figure 20

GENERAL DESCRIPTION

Turning the steering wheel causes hydraulic oil to be sent from the steering gear type pump to the steering valve which directs oil to the steering cylinders.



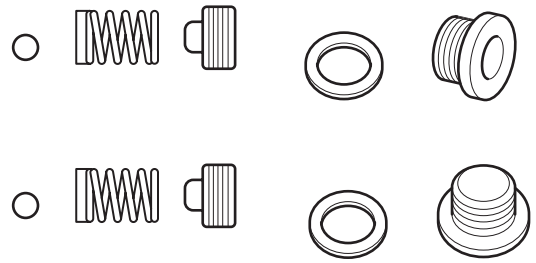
0820

Figure 1

Reference Number	Description
1	Knuckle Arm
2	Steering Cylinder

Reference Number	Description
3	Steering Valve

5. The shock valves are now dismantled.



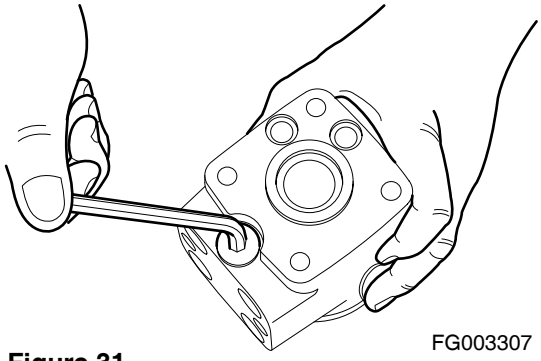
FG007473

Figure 30

Dismantling the Pressure Relief Valve for OSPC

1. Screw out the plug using and 8 mm hexagon socket wrench.

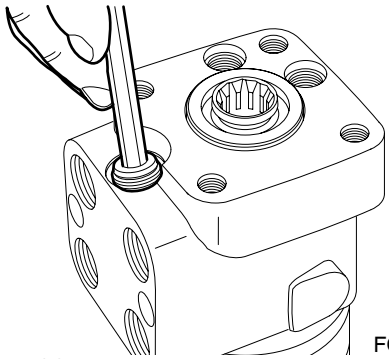
   Remove seal washers.



FG003307

Figure 31

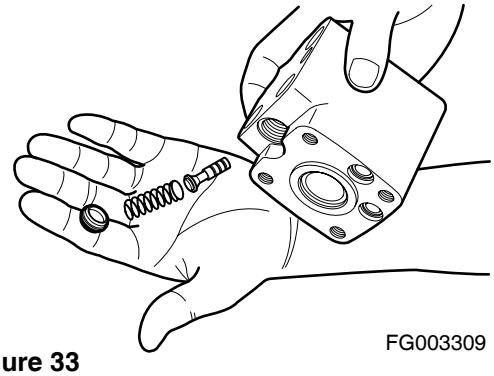
2. Unscrew the setting screw using an 8 mm hexagon socket wrench.



FG003308

Figure 32

3. Shake out spring and piston. The valve seat is bonded into the housing and cannot be removed.



FG003309

Figure 33

14. Place the cardan shaft as shown - so it is held in position by the mounting fork.

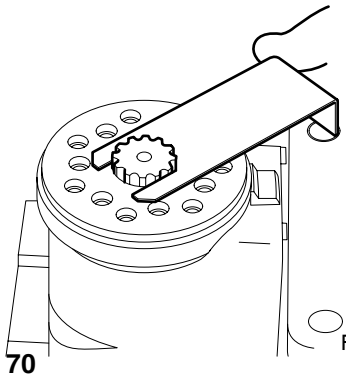


Figure 70

15. Grease the two O-rings with mineral oil approx. viscosity 50^{0} mm^2/s at 20°C and place them in the two grooves in the gear rim. Fit the gearwheel and rim on the cardan shaft.

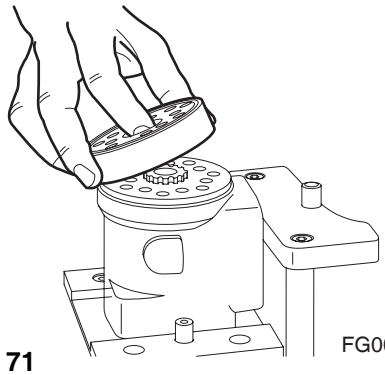


Figure 71

⚠ CAUTION!

Fit the gearwheel (rotor) and cardan shaft so a tooth base in the rotor is positioned in relation to the shaft slot as shown. Turn the gear rim so the seven trough holes match the holes in the housing.

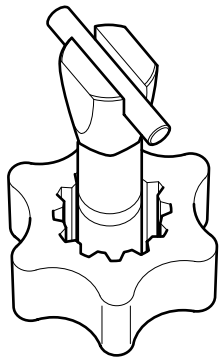


Figure 72

16. Fit the spacer, if any.

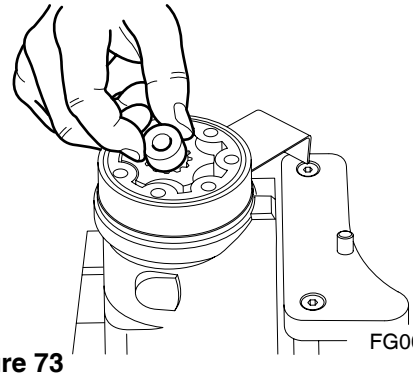


Figure 73

SAFETY PRECAUTIONS

CAUTION!

Follow all safety recommendations and safe shop practices outlined in the front of this manual or those contained within this section.

Always use tools and equipment that are in good working order.

Use lifting and hoisting equipment capable of safely handling the load.

Remember, that ultimately safety is your own responsibility.

APPLICABLE MODELS

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

MODEL	SERIAL NUMBER RANGE
DX140W	5001 and Up
DX160W	5001 and Up
DX210W	5001 and Up

DISASSEMBLY

1. Remove lead wire from bushing (29).

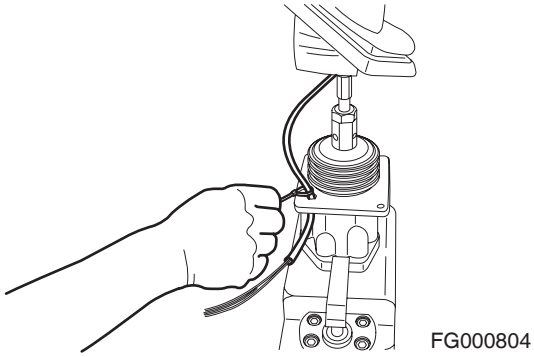


Figure 3

2. Remove lever assembly from case (1).

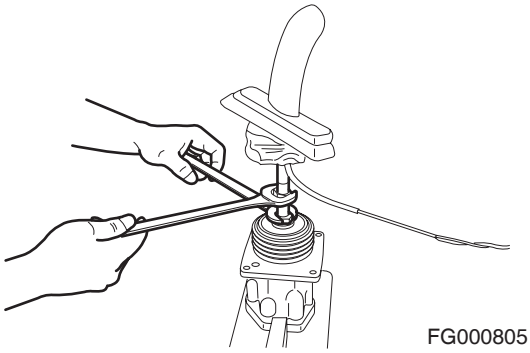


Figure 4

3. Remove hex nut (23) and swash plate (22) from case.

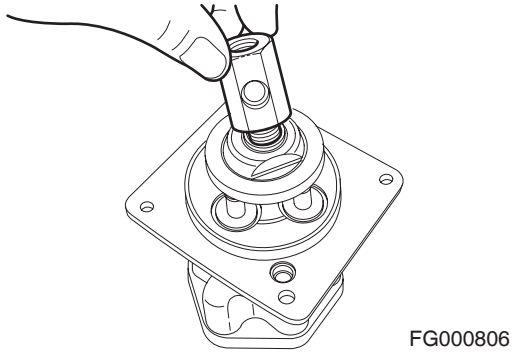


Figure 5

4. Remove joint assembly (21) from case.

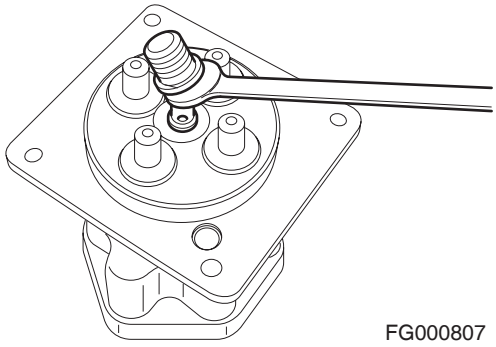
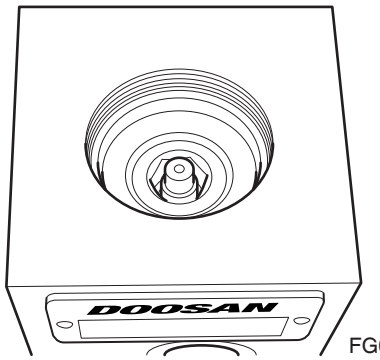


Figure 6

2. Assemble the spool, the spring, and the pin.



FG003695

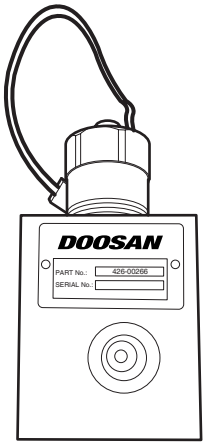
Figure 50

- The spring and the pin should not fall off and must remain in place durring installation.

FG003696

Figure 51

3. Assemble the solenoid correctly.



FG003697

Figure 52

Operation Principles

Brake valve is a reducing valve. Pressure to main pressure (P port) flows in the valve and reduced set pressure flows to the axle brake by way of the brake port (BR port) to stop the machine.

1. In Neutral Position

   A. P port spool (3) blocks main pressure to P1 port.

   B. T and BR ports are connected, which is the tank pressure.

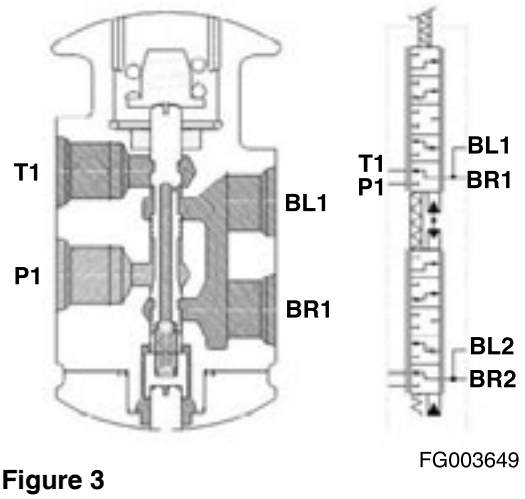


Figure 3

2. During Operation

   A. Operation of pedal causes action of main spring (13) and spool (3). The load of spring (13) generates pressure B port seating pressure.

   B. P and BR ports are connected and pressure is generated, which moves to orifice to act pilot pressure to the floor of spool (3).

   C. If pilot pressure is higher than pressure set to spring (13), spool (3) moves up and pressure decreases.

   D. If pilot pressure is lower than pressure set to spring (13), spool (3) moves down to close T port and pressure increases.

   E. Operation angle of pedal changes load of spring (13) and thus the second pressure of BR port.

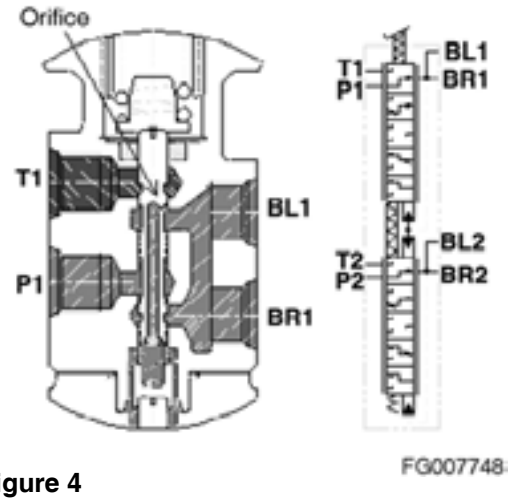


Figure 4

Refer to the Curve

P1, P2 ports: Supply pressure

T1, T2 ports: Tank port

BR1, BR2 ports: Brake supply port

BL1, BL2 ports: Brake pressure sensor location

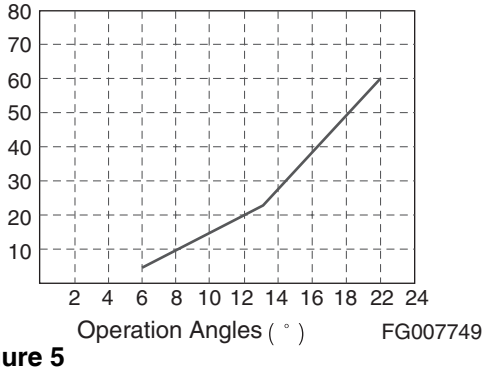


Figure 5

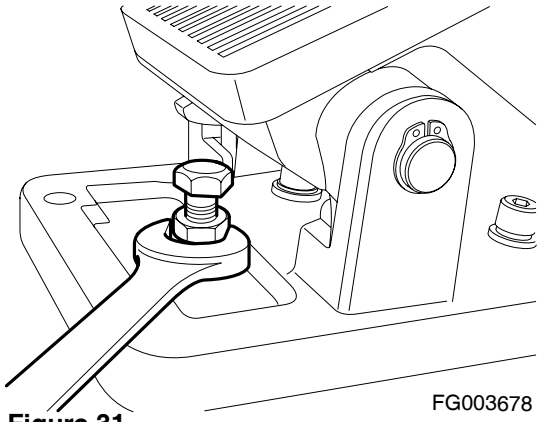
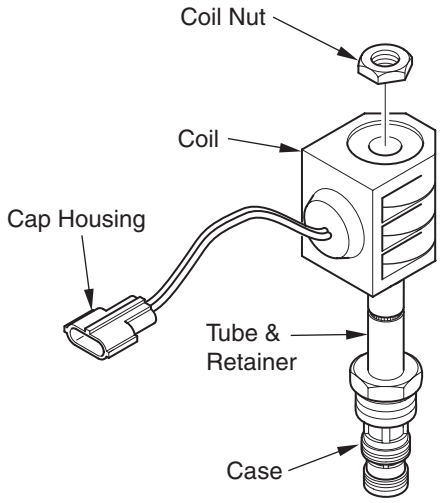


Figure 31

Solenoid Valve Diagram



FG007535

Figure 3

Troubleshooting Guide

Symptom	Checkpoints	Descriptions	Remedy
Solenoid valve will not function properly	1. Foreign materials, contaminants in valve	1. Disassemble valve and check if any foreign materials or contaminants such as sludge lodged between case and spool.	Remove foreign materials and clean the contaminated area.
	2. Damages in tube and retainer	2. Disassemble valve and check if the tube and retainer area is deformed (dented, contracted).	Replace valve.
	3. Breaking of wire, short-circuiting, thermal reactions in coil	A. Disassemble valve and check resistance of coil. Condition: 26.7Ω @ 20°C Breaking of wire: The resistance of coil is ∞ (infinite). Short circuiting: The resistance is low or excessive.	Replace coil.
		B. Disassemble valve and check if the molded area of coil is melted by thermal reactions.	
	4. Connection to terminal in connector	4. Check if the terminals of the cap housing (with a lead coil) and the housing (facing housing) are connected properly.	Replace faulty housing and terminal.

Exploded View and Tools

The assembly torque of each part in the Solenoid Valve Package is described in the table below.

Observe the specified torque values using the right tool.

Disassembly, Re-assembly of Solenoid Valve Package, and Necessary Tools

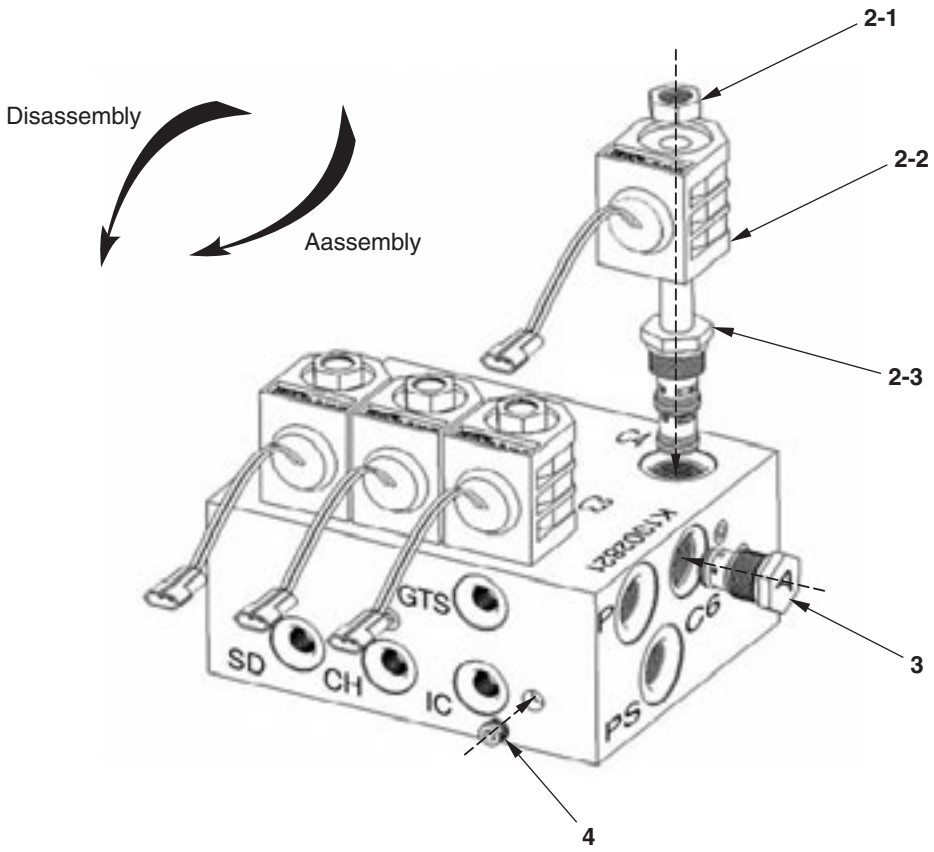


Figure 8 FG007550

No.	Part Name	Screw Spec	Assembly Torque (kg•cm)	Assembling Tools
2-1	Coil Locknut	UNF1/2-20"	60 ± 2	Torque wrench/ 19 mm hex. socket
2-3	Solenoid Valve	UNF7/8-14"	200 ± 25	Torque wrench/1" hex. socket
3	Check Valve	UNF7/8-14"	200 ± 25	Torque wrench/1" hex. socket
4	PT 1/8" Plug Bolt	PT 1/8-28"	280	Torque wrench/5 mm wrench socket

Electrical System

Edition 1

ENGINE STARTING CIRCUIT

Start Operation

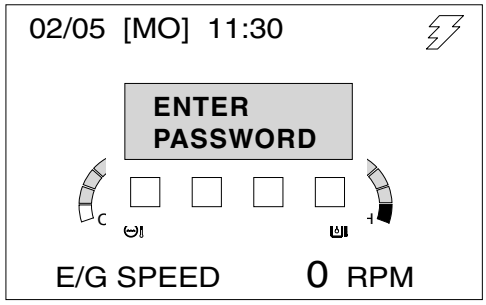
When the starter switch is turned to the "START" position, the "S" and "E" terminals of the starter controller (7) are connected. At this time the contacts in the starter relay (8) are closed by the current flow from the battery (1) → fusible link (3) → fuse box (6) → "B" terminal of starter switch (5) → "C" terminal of starter switch (5) → "30" terminal of starter relay (12) - "87a" terminal → "C" terminal of starter relay (8) - "D" terminal → "S" terminal of starter controller (7) - "E" terminal → ground.

When the contact point "B" and "PP" of starter relay (8) are connected, the pinion gear of the starter (9) is pushed forward and makes contact with the ring gear of the flywheel and the internal contacts of the starter are connected. The current flows from the battery (1) → "A" terminal of the battery relay (2) → "B" terminal of the battery relay (2, Figure 2) → "30" terminal of the starter (9). The starter motor is rotated and the engine is started.

If the instrument panel has the password function activated, input number should match the set number, otherwise the start circuit closes and the engine does not start.

NOTE: *If the security system is "LOCKED," a four-digit password will be required to start the engine. If the system is "UNLOCKED," no password will be required and this display screen will not appear.*

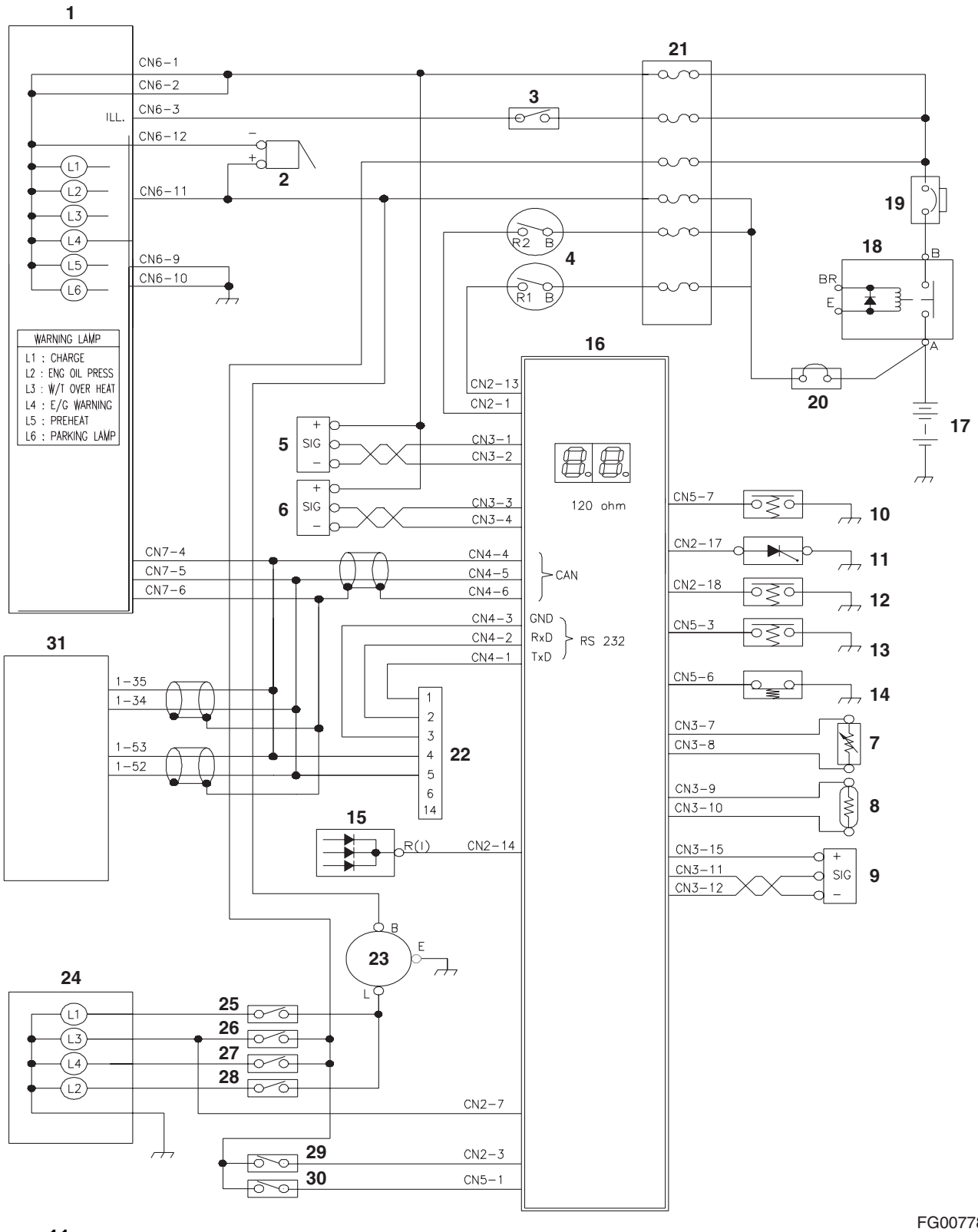
In the event the security system is locked, current flows from battery (1) → fusible link (3) → fuse box (6) → "B" terminal of starter switch (5) → "ACC" terminal of starter switch (5) → "86" terminal of starter relay (12) → "85" terminal of starter relay (12) → "CN1-15" terminal of e-EPOS (13) → ground. This current flow causes the coil in starter relay (12) to be activated, opening contacts at "87a" terminal. This prevents starter relay (8) from functioning.



FG001445

Figure 2

Monitoring System Schematic



FG007781

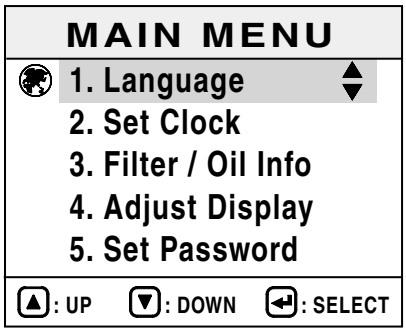
Figure 11

MAIN MENU

When the "ESC" button is pressed for more than 3 seconds, the main menu screen is displayed.

Main menu offers submenus (language setting, time setting, or filter/oil information, brightness adjustment, password) to the operator.

Refer to the "Operation and Maintenance Manual" for details.



FG000072

Figure 13

Language

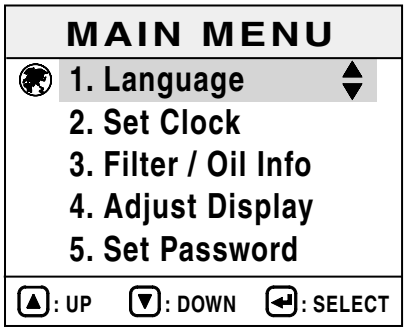
Put the cursor on Language in the main menu and put the Enter Button (↵, 3 on Figure 11) and the language select view appears.

The default language is Korean, but it will memorize and use the newly set language.

Use the Up Arrow Button (▲, 1 on Figure 11) or Down Arrow Button (▼, 2 on Figure 11) to move cursor to a language to be selected on the Language Select display and press the Enter Button (↵, 3 on Figure 11) and the selected language is indicated in the right bottom of the screen.

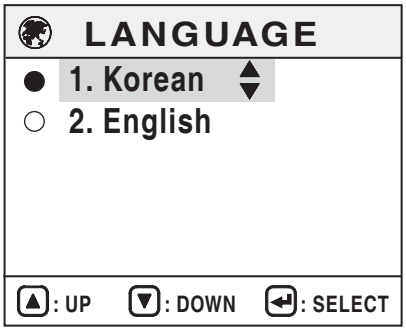
At this point pressing the Enter Button (↵, 3 on Figure 11) or the Escape Button (ESC, 4 on Figure 11) more than 1 second brings the main menu with changed language and then pressing the ESC button again shows the default view.

Without pressing a button more than 20 seconds, the default view appears.



FG000072

Figure 14

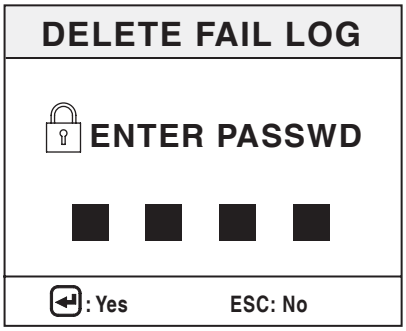


FG000783

Figure 15

Input your password with one of No. 1 - 8 switches.

When "NO" (ESC, 4 on Figure 24) button is pressed, the screen will recover to previous menu without deletion.

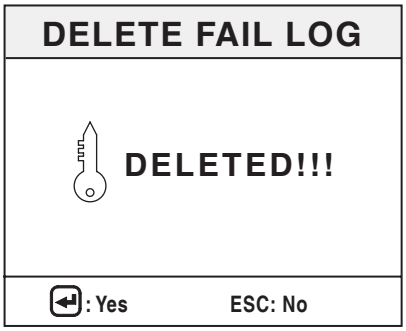


FG000568

Figure 37

Delete Completed screen will appear 3 seconds and the screen will move to Failure Info screen.

It has been shown 3 seconds upon deleting Fail Log.



FG000569

Figure 38

The screen shown on the left will appear 3 seconds in case of wrong password input and then Enter Password screen appears again.

It has been shown 3 seconds in case of password failure.

FG000570

Figure 39

Reference Number	Description
1	Instrument Panel
2	e-EPOS Controller
3	Engine Controller (ECU)
4	Main Pump
5	Aux Pump
6	Control Valve
7	Pressure Switch
8	Pump Pressure Sensor
9	Electromagnetic Proportional Pressure Reducing Valve
10	Electromagnetic Proportional Pressure Reducing Valve (Mode Control)
11	Solenoid Valve (Boost)
12	Solenoid Valve (Swing Priority)

Reference Number	Description
13	Solenoid Valve (High-speed)
14	Solenoid Valve (Breaker)
15	Travel Motor
16	Main Relief Valve
17	Engine Control Dial
18	Breaker/Boost/Shear Selector Switch
19	Work/Travel Selector Switch
20	Boost Switch (Right Work Lever)
21	Sensors
22	Aux Mode Switch
23	Aux Mode Resistance
24	Acceleration Pedal