KOBELCO

SHOP MANUAL

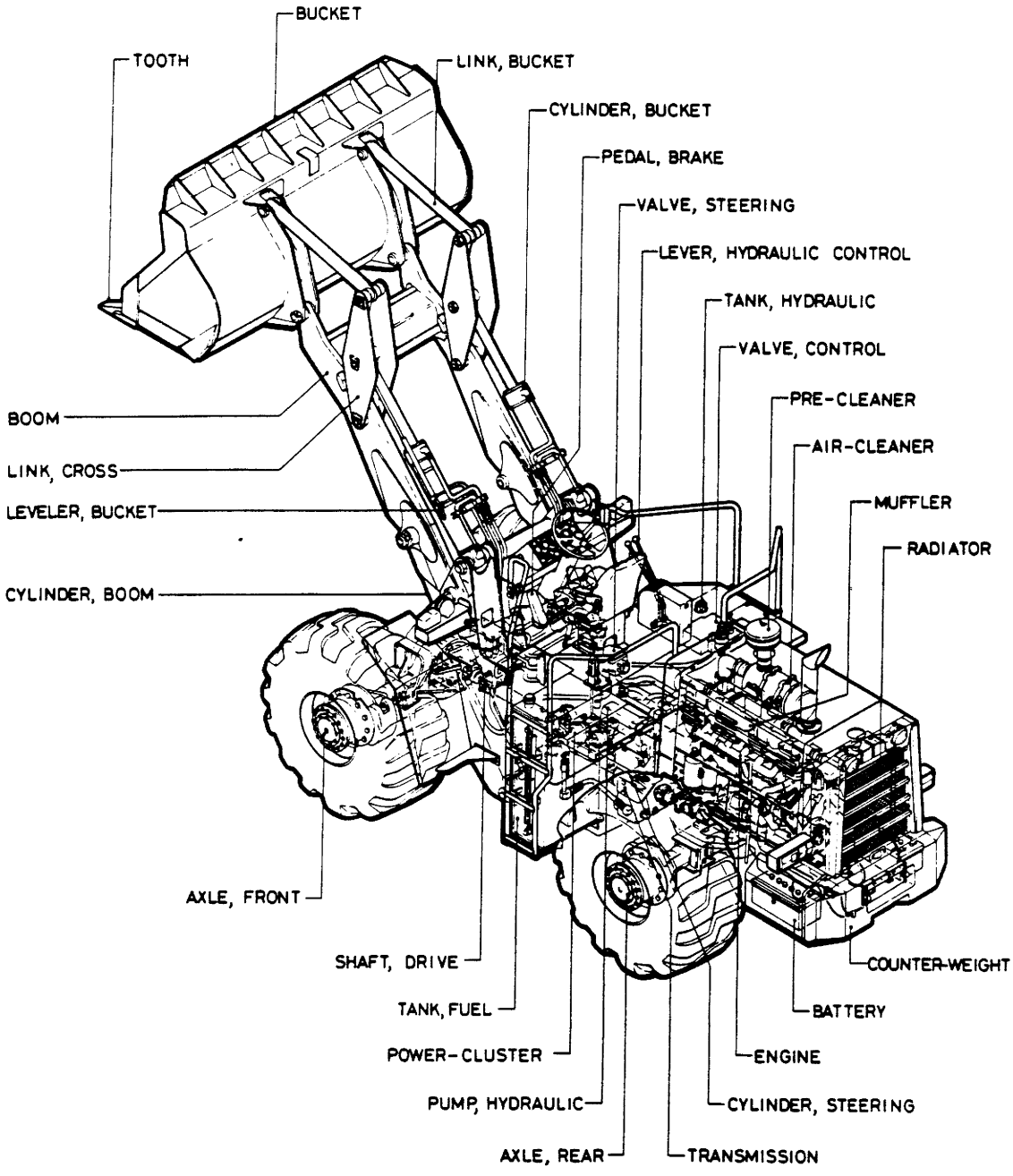
WHEEL LOADER

LK600

Applicable: LK600 RM-1004~

S5RE0001E-02 07/03

1. Names of Components



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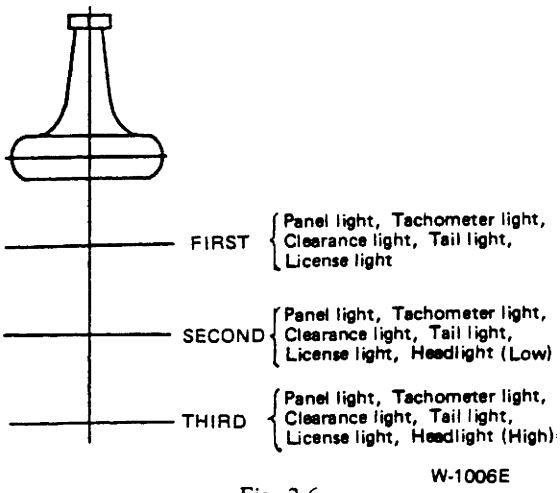


Fig. 3-6

(16) Turn Signal

Refer to (6) Flasher Switch.

(18) Tachometer and Hour Meter

This indicates number of engine revolutions per minute. Also provided is an hour meter to indicate the total operating hours of the wheel loader. (This hour meter advances when the engine is running even if the machine is not in motion.)

(19) Ammeter

The ammeter indicates the charging condition of the generator. When the battery charge is low, this meter indicates a high charging condition. When the battery is fully charged, the ammeter indicates a value nearly zero, except for a short time after the starter is used.

(20) Torque Converter Oil Thermometer

The torque converter oil thermometer indicates the temperature of oil which goes to the oil cooler at the converter outlet. The green on this thermometer refers to the normal operating region of 50~120°C.

(21) Engine Water Thermometer

The engine water thermometer indicates the temperature of engine cooling water. Its normal operating region is 67~102°C.*2

(22) Brake Air Pressure Gauge

The brake air pressure gauge indicates the brake air pressure in the air reservoir. The normal operating region is 5.0~8.0kg/cm². The pressure gauge is supplemented with an alarm lamp and a buzzer that operate when the pressure becomes too low.

(23) Transmission Oil Pressure Gauge

The transmission oil pressure gauge indicates the pressure of transmission oil when the transmission clutch is engaged. The green zone on the gauge indicates the normal operating region of 8.0~14.0 kg/cm²; the red zone is the critical region of 0~6.0 and 14.0~20.0kg/cm²; the yellow zone is the alarm region of 6.0~8.0kg/cm²;. Incidentally, this pressure gauge indicates normal if it is within the yellow zone when the engine is low idle.

(24) Engine Oil Pressure Gauge

The engine oil pressure gauge indicates the pressure of engine lubricating oil inside the engine. The normal operating region is 1.4~5.0kg/cm².*3

(25) Engine Oil Pressure and Oil Filter Alarm Lamp

When the pressure of lubricating oil inside the engine drops abnormally or when the filter becomes dirty, the engine oil pressure alarm lamp is lit as a warning of the critical condition of the engine lubricating oil.

(26) Low Air Pressure Alarm Lamp

The low air pressure alarm lamp and electric (operating) buzzer (not shown) are supplemented to the air pressure gauge. These devices operate when the ignition switch on the instrument panel is turned "ON," and the air pressure drops below 4.7kg/cm².

(27) Low Brake Fluid Alarm Lamp

The brake oil alarm lamp lights up when brake oil inside the brake oil reservoir drops below a certain level and indicates the need for more brake oil.

(28) Work Light Signal

The work light signal is lit when the work light is on.

(29) Panel Light

3.2.2 OTHER INSTRUMENTS

(1) Air Cleaner Indicator

When the filter element of the air cleaner becomes dirty, the air cleaner indicator signal becomes red.

*2: 72~85°C

*3: 3.2~4.6kg/cm²

4.1 LOG FORK

(1) Control Levers

Three control levers are provided at the right side of the operator's seat, and they perform the following functions:

1) Clamp Lever

This lever is used for picking up raw logs.

The clamps open when the lever is pushed away from the operator, and close when pulled toward the operator.

2) Fork Lever

This lever is used for rolling back the log fork and for the dumping operation. It works in the same manner as an orindary bucket control lever.

3) Boom Lever

The function of this lever is the same as that of an ordinary boom lever with a bucket attached.

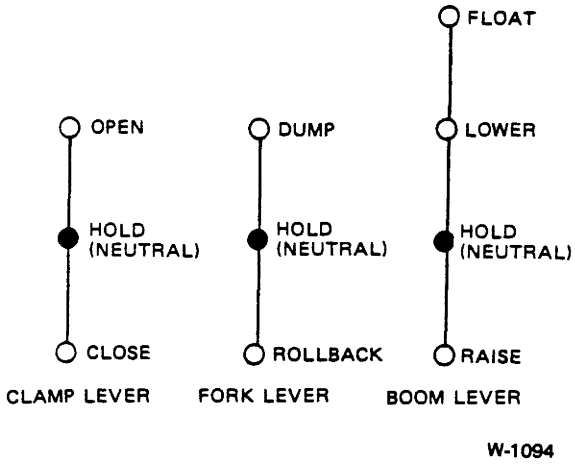


Fig. 4-1. Control Levers

(2) Safeguards for Use

1) Movable Capacity

The maximum movable load is 6,000kg. Strictly observe this maximum limit, because there is a possibility that the loader may be overturned if a load exceeding the above limit is applied. The load must be reduced on sloping or uneven surfaces.

2) Check for Stability

The wheel loader is least stable when the boom and the fork are set parallel to the ground (the state of maximum reach) with the steering wheel turned to the end position. Accordingly, even when stability is attained while the boom is held at its higher or lower position, there is a possibility that the loader may be overturned if the boom is brought to the maximum reach position where it becomes parallel to the ground.

To avoid accidents, strictly observe the aforementioned maximum loads.

Should the equipment become unstable, lower the boom immediately.

3) Traveling (Carrying) and Steering

Before starting to travel or steer while carrying a load, be sure to raise the fork toward you and bring the loader to the correct traveling position (the boom hinge pin held at a height of about 500mm or less above the ground). Never try to raise the boom while steering.

4) Loading and Unloading

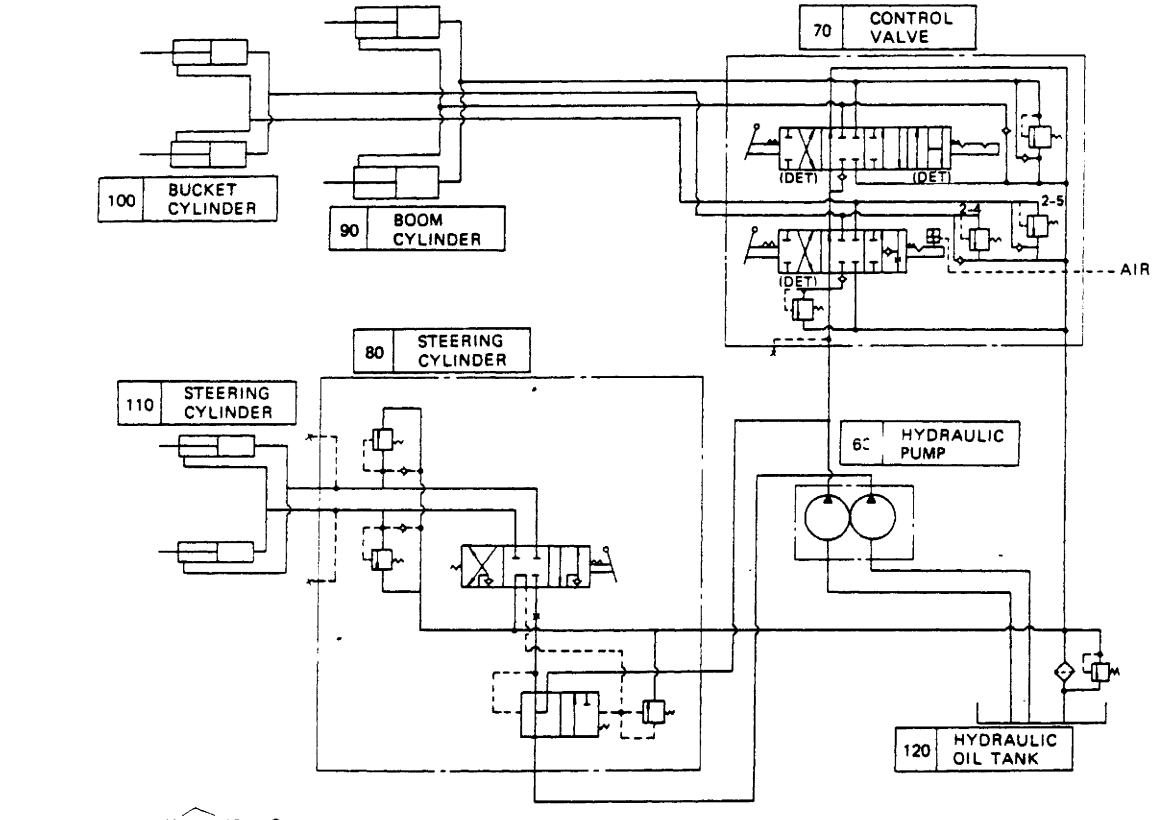
The load should be applied evenly on the fork. Unevenly applied loads may overturn the loader and damage the fork, or result in other accidents. Before raising or lowering the boom, the loader must without fail be brought to the upright position.

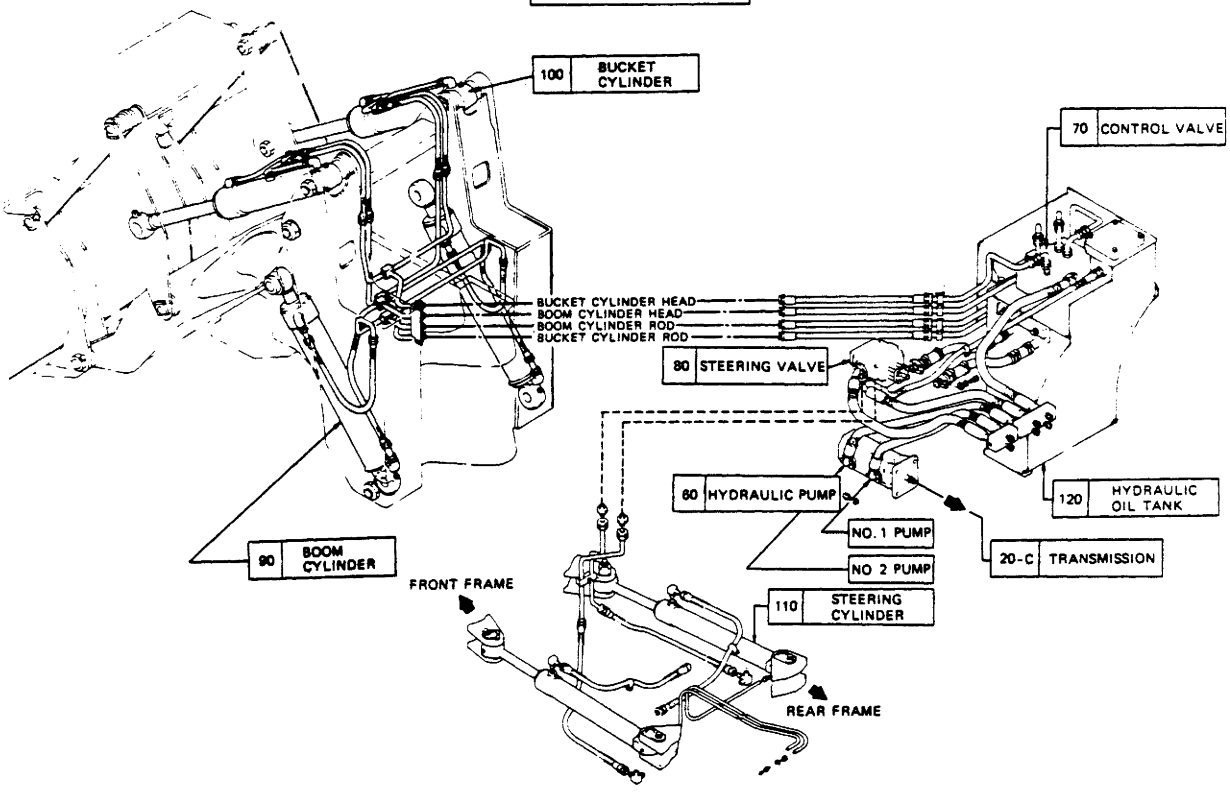
1.3 Transmission

Transmission Type	1 piece torque converter/transmission
Rated Power Max. Input Torque Max. Revolutions Max. Horsepower	 40kg·m 2600rpm 150PS
Gear Change	Forward 2 stages, Backward 1 stage, Single lever-speed selection system
Weight (dry)	Approx. 430kg
Direction of Rotation (as seen from the input side) Input Side Output Side	 Clockwise Forward, clockwise; Backward, anticlockwise
Torque Converter Type	 4 elements, one stage, 2-phase, First reactor reversion type
Stall Torque Ratio	5.40 : 1
Transmission Type Gear Ratios	 Countershaft type with power shift Forward low speed 2.150 : 1 Forward high speed 0.575 : 1 Reverse 1.648 : 1
Clutch Type Material	 Multiple plate type (wet) Paper
Engine Driving PTO No. of PTO Gear Ratio	 1 1 : 1
Direction of Rotation (as seen from the front)	Anticlockwise
Max. Driving Horsepower	110PS at 2000~2600rpm
Parking Brake Type Drum Diameter Shoe Width	 Internally expanding type 216mm 50mm
Hydraulic System Hydraulic Oil Pump	 Type : Built-in external gear Flow Rate: 80ℓ/min at 2000rpm
Control Valve Selector Valve Clutch Cut-off Valve Regulator Valve	 Manual type Brake air pressure-functioned type Modulation type
Oil Filter (separate) Type Size	 Full-flow with bypass valve Nominal 20μ
Oil Cooler (separate) Type Flow Rate Clutch Oil Pressure Torque Converter Inlet Pressure	 Flat tube type 48ℓ/min at 2000rpm 7~12kg/cm² 1~6kg/cm²
Hydraulic Oil	API classification CD10W or ATF oil
Oil Quantity	Approx. 28ℓ
Converter Outlet Max. Temperature	120°C

4. HYDRAULIC SYSTEM

4.1 Hydraulic System





(6) Engine Revolutions

Low Speed (Low Idle)	700rpm±50
High Speed (High Idle)	2250rpm±50

8.3.2 Adjusting Main Pressure

If the power to raise the boom or roll back the bucket is decreased, measure oil pressure. First check the following items:

(1) With the hydraulic oil temperature kept in the operating range and the engine at high idle, measure the time taken for the bucket to be raised from the ground to its highest level.

Compare the measurement with the value specified above. If it is larger than is specified, check the following:

1) Is the oil level in the hydraulic oil tank normal?
Referring to the section for the procedure of checking hydraulic oil, adjust the level.
2) Is the hydraulic oil as specified?
Refer to the Operator's Manual.
3) Are the suction line, filter element, and strainer clean?

Clean, adjust, and replace as required.

4) Does the engine idle at high speeds as specified?

Adjust according to the section for equipment specifications.

5) If there is a great difference in bucket raising time between when the bucket has a normal load of 3,950kg in it and when it carries no load, possible reasons include:

Internal leakage inside the hydraulic cylinder	→	Service the cylinder
Reduced efficieincy of the hydraulic pump	→	Service the pump
Low relief valve pressure setting	→	Refer to the sections below

(2) Adjusting Main Relief Valve

With the engine stopped, clean the outside of the control valve gauge port.

1) Attach an approved pressure gauge to the control valve.
2) Start the engine, maintain the oil temperature in the operating range, and place the bucket on the ground.
3) When the engine revolutions are increased to the specified value, place the bucket lever in the ROLL-BACK position, take the reading of the pressure gauge and return the lever to the NEUTRAL position.

Record the gauge reading.

4) To increase pressure, back off the lock nut on the relief valve and turn the adjustment screw clockwise.
5) To reduce pressure, turn the adjustment screw counterclockwise.
6) When changing pressure, turn the adjustment screw in degrees, increasing or decreasing in increments of approx. 5kg/cm^2. When the adjustment screw is being turned, maintain the condition mentioned in item 3) above.
7) After the pressure is set at the specified value of 210kg/cm^2, tighten the lock nut securely.
8) After the lock nut is tightened, relieve the valve again and check that the specified pressure is present.
9) Stop the engine and remove the pressure gauge, and wipe off any oil from the valve and body.

This completes the adjustment of the main relief valve pressure.

8.3.3 Internal Leakage Test

Raise the hydraulic oil temperature to the operating one (approx. 50°C), measure in the following way.

During the measurement, the work attachments such as boom and bucket may suddenly fall. Therefore, stay clear of them.

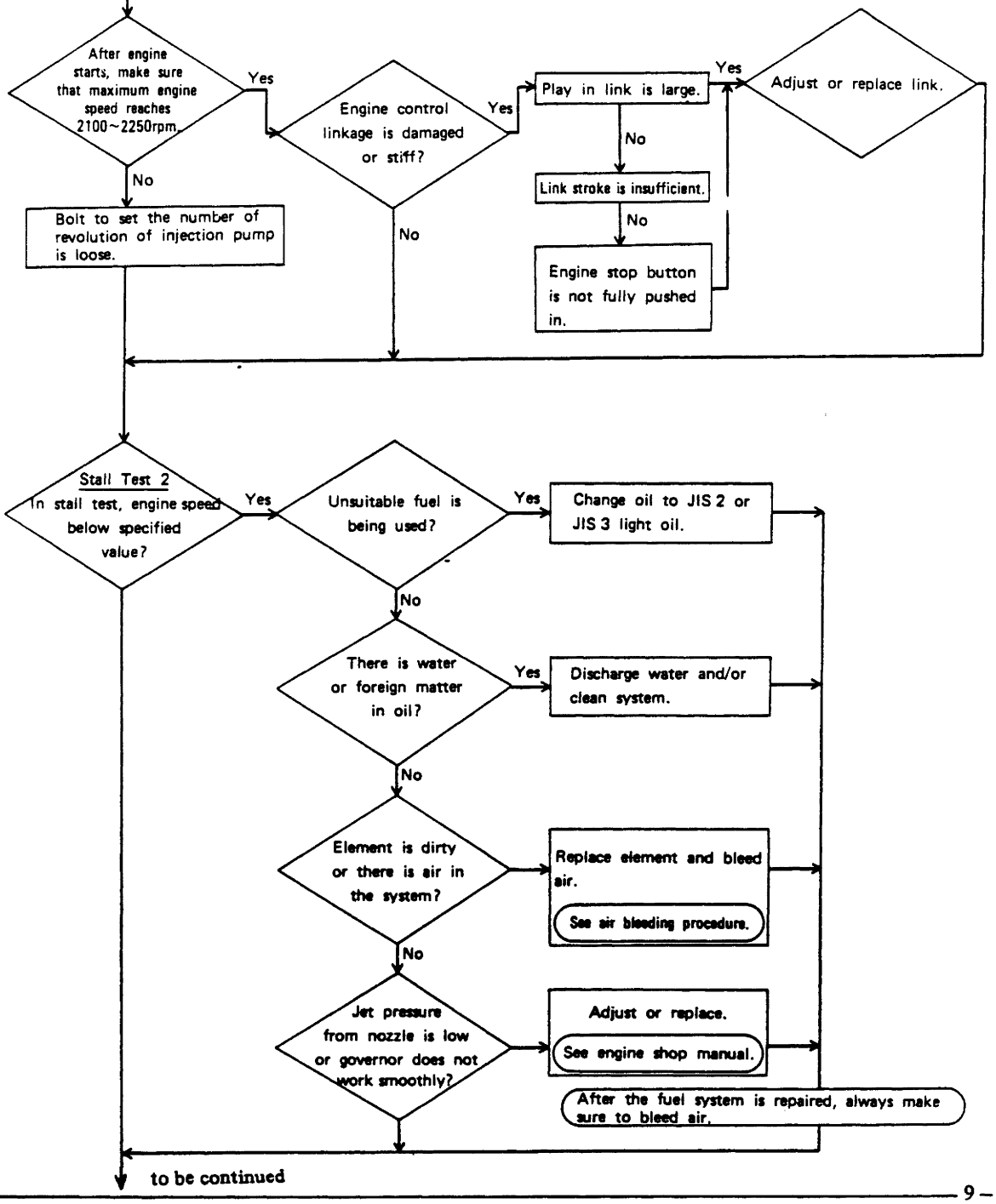
10.2 ENGINE OUTPUT DECREASES

Decreased engine output means decreased acceleration and tractive force. This can also be checked by the transmission stall test.

(1) Check the fuel system if there is too little exhaust smoke.

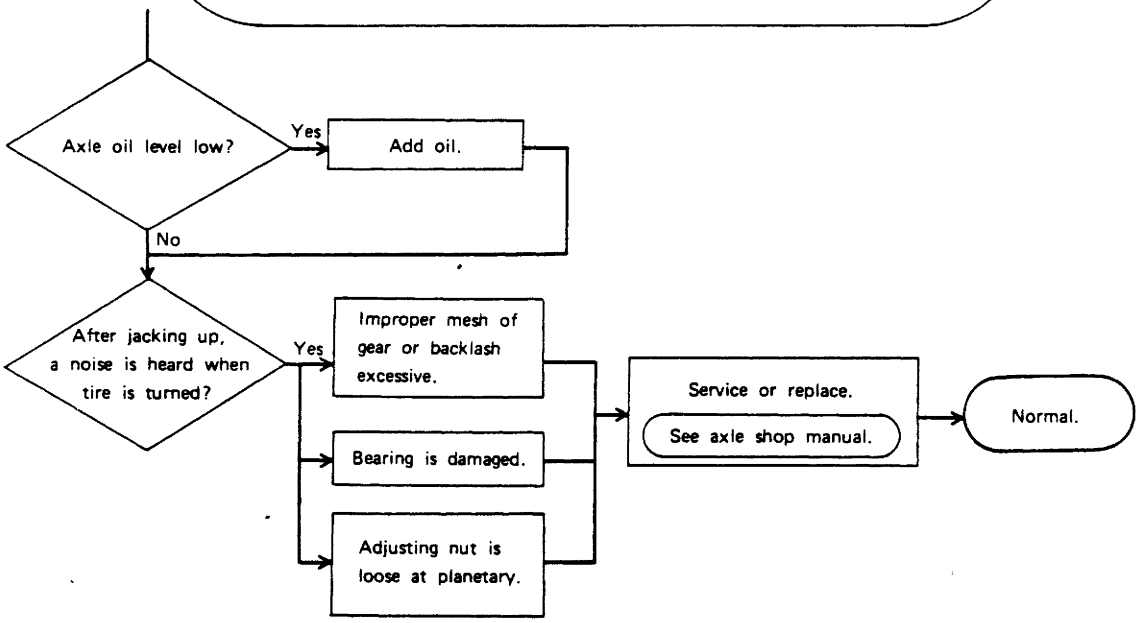
(2) Check the suction system if a large amount of exhaust gas is produced.

(3) Check the fuel system and valve mechanism if engine does not run smoothly.

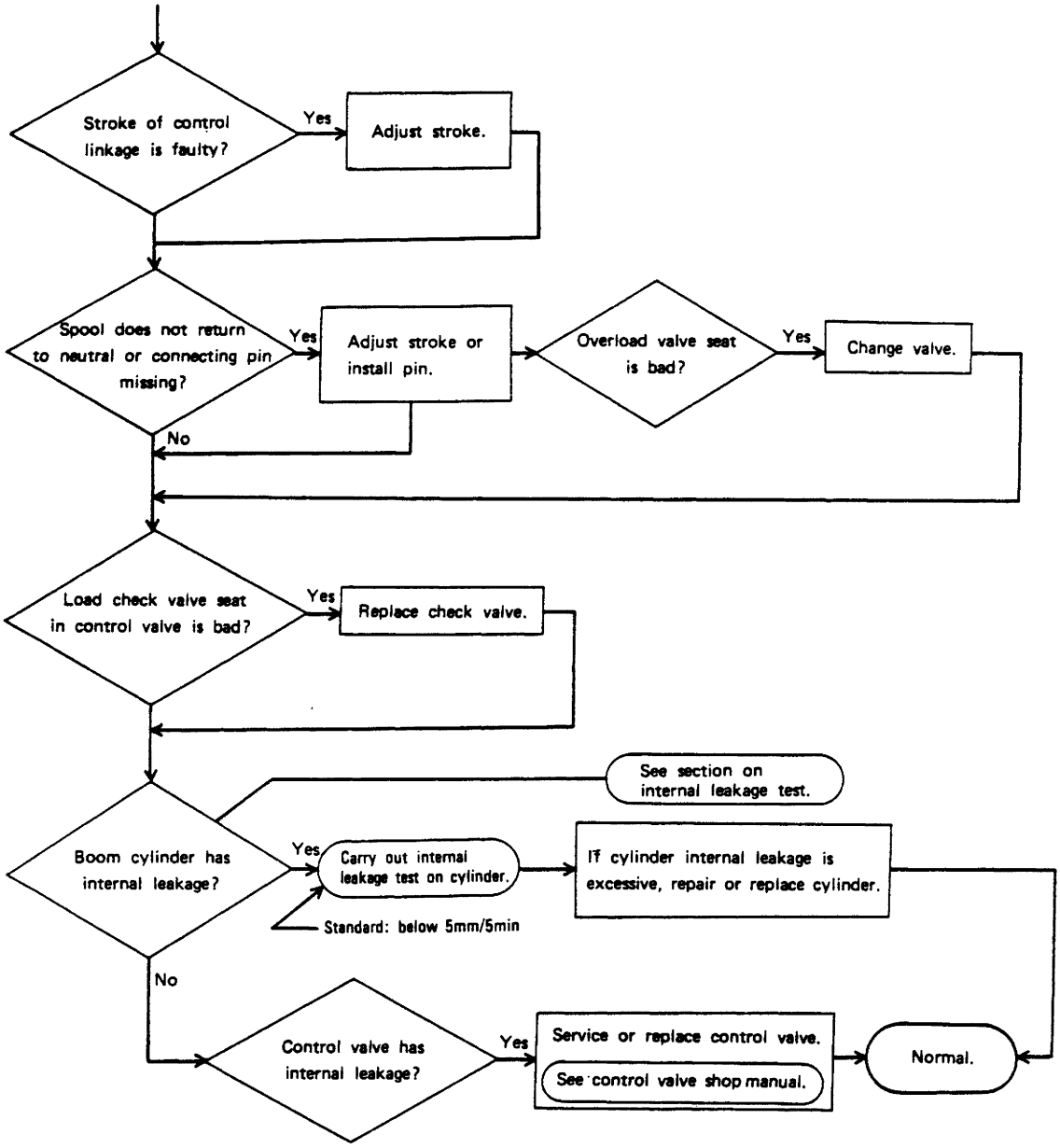


40.2 ABNORMAL NOISE FROM AXLE

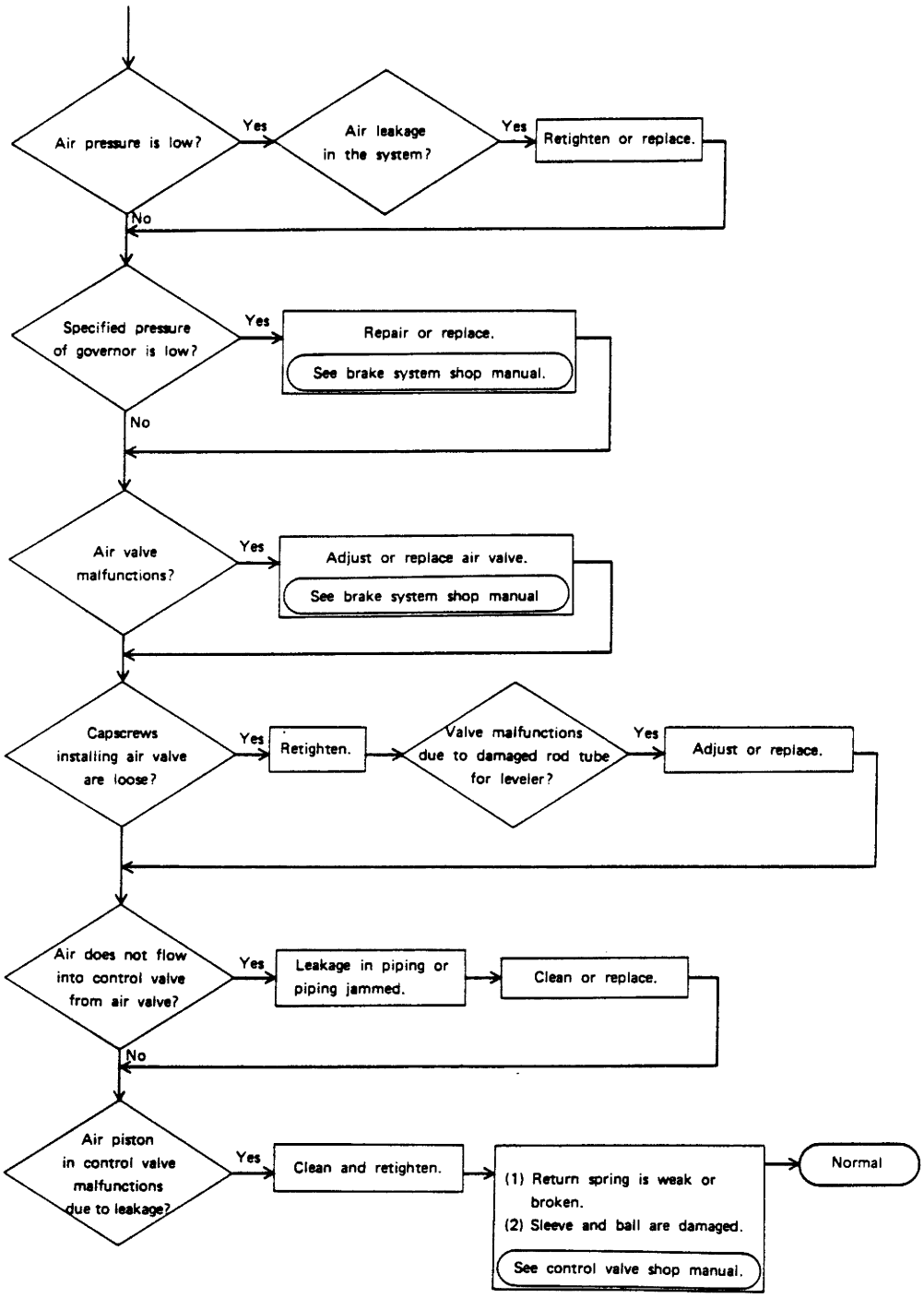
When noise is heard from the axle, it is usually an indication of burned gears, breakage, or damage in the bearing. Therefore, before operating the loader, either remove the axle shaft or operate after the planetary has been serviced.



70.7 BOOM CAN NOT BE HELD IN NEUTRAL POSITION



160.1 BUCKET LEVELER DOES NOT WORK



in →mm

(2) Fractional inch and mm

in	0	1	2	3	4	5	6	7	8	9
						mm				
0	0.000	25.400	50.800	76.200	101.600	127.000	152.400	177.800	203.200	228.600
1/64	0.397	25.797	51.197	76.597	101.997	127.397	152.797	178.197	203.597	228.997
1/32	0.794	26.194	51.594	76.994	102.394	127.794	153.194	178.594	203.994	229.394
1/16	1.588	26.988	52.388	77.788	103.188	128.588	153.988	179.388	204.788	230.188
3/32	2.381	27.781	53.181	78.581	103.981	129.381	154.781	180.181	205.581	230.981
1/8	3.175	28.575	53.975	79.375	104.775	130.175	155.575	180.975	206.375	231.775
5/32	3.969	29.369	54.769	80.169	105.569	130.969	156.369	181.769	207.169	232.569
3/16	4.763	30.163	55.563	80.963	106.363	131.763	157.163	182.563	207.963	233.363
7/32	5.556	30.956	56.356	81.756	107.156	132.556	157.956	183.356	208.756	234.156
1/4	6.350	31.750	57.150	82.550	107.950	133.350	158.750	184.150	209.550	234.950
9/32	7.144	32.544	57.944	83.344	108.744	134.144	159.544	184.944	210.344	235.744
5/16	7.938	33.338	58.738	84.138	109.538	134.938	160.338	185.738	211.138	236.538
11/32	8.731	34.131	59.531	84.931	110.331	135.731	161.131	186.531	211.931	237.331
3/8	9.525	34.925	60.325	85.725	111.125	136.525	161.925	187.325	212.725	238.125
13/32	10.319	35.719	61.119	86.519	111.919	137.319	162.719	188.119	213.519	238.919
7/16	11.113	36.513	61.913	87.313	112.713	138.113	163.513	188.913	214.313	239.713
15/32	11.906	37.306	62.706	88.106	113.506	138.906	164.306	189.706	215.106	240.506
1/2	12.700	38.100	63.500	88.900	114.300	139.700	165.100	190.500	215.900	241.300
17/32	13.494	38.894	64.294	89.694	115.094	140.494	165.894	191.294	216.694	242.094
9/16	14.288	39.688	65.088	90.488	115.888	141.288	166.688	192.088	217.488	242.888
19/32	15.081	40.481	65.881	91.281	116.681	142.081	167.481	192.881	218.281	243.681
5/8	15.875	41.275	66.675	92.075	117.475	142.875	168.275	193.675	219.075	244.475
21/32	16.669	42.069	67.469	92.869	118.269	143.669	169.069	194.469	219.869	245.269
11/16	17.463	42.863	68.263	93.663	119.063	144.463	169.863	195.263	220.663	246.063
23/32	18.256	43.656	69.056	94.456	119.856	145.256	170.656	196.056	221.456	246.856
3/4	19.050	44.450	69.850	95.250	120.650	146.050	171.450	196.850	222.250	247.650
25/32	19.844	45.244	70.644	96.044	121.444	146.844	172.244	197.644	223.044	248.444
13/16	20.638	46.038	71.438	96.838	122.238	147.638	173.038	198.438	223.838	249.238
27/32	21.431	46.831	72.231	97.631	123.031	148.431	173.831	199.231	224.631	250.031
7/8	22.225	47.625	73.025	98.425	123.825	149.225	174.625	200.025	225.425	250.825
29/32	23.019	48.419	73.819	99.219	124.619	150.019	175.419	200.819	226.219	251.619
15/16	23.813	49.213	74.613	100.013	125.413	150.813	176.213	201.613	227.013	252.413
31/32	24.606	50.006	75.406	100.806	126.206	151.606	177.006	202.406	227.806	253.206

S5RE0300E

WHEEL LOADER
SHOP MANUAL

LK600

HYDRAULIC SYSTEM

KOBE STEEL, LTD.

2. MAINTENANCE

2-1. General Notes

In handling the hydraulic system, observe the following general notes.

(1) Do not adjust the set pressure of the relief valves unless necessary. Every structure has limits to strength and durability, and the relief valves are provided to prevent damage to the wheel loader by limiting the pressure working on the hydraulic components.

(2) The hydraulic components are highly precise. Even small particles of dust or foreign substances entering the hydraulic circuit may cause wear and damage resulting in unstable operation or serious failure. Maintain clean hydraulic oil at all times. Check the filter on the return line and replace the element at regular intervals.

(3) Take a sample of hydraulic oil, approx. 200cc, from the hydraulic tank every 6 months and have the sample analysed and evaluated by a specialist to check if it can continue to be used. Sample after raising the hydraulic oil temperature to the normal operating level. Since operating conditions determine the rate at which hydraulic oil must be changed, maintain clean hydraulic oil at all times.

(4) If components or parts are damaged, or if metal particles or other foreign substances are present in the circuit, drain the hydraulic oil and flush the system. Replace the filter element and clean the tanl as well. Replace all the hydraulic oil.

(5) If there are any metal particles on the element when the filter is inspected, drain all the hydraulic oil and flush the circuit. Fill with fresh hydraulic oil. Since there is a possibility of damage to components or parts, if any metal particles are on the element, carefully inspect and repair or replace before flushing the circuit.

(6) To replenish or change hydraulic oil, only suitable oil. (Refer to the recommended lubricants and hydraulic oil table in the operator's manual.) Do not mix different types of hydraulic oil or oils from different manufacturers.

(7) To replace hydraulic oil, use a clean vessel and fill the tank using a clean funnel. Do not use cloth as lint may get into the oil.

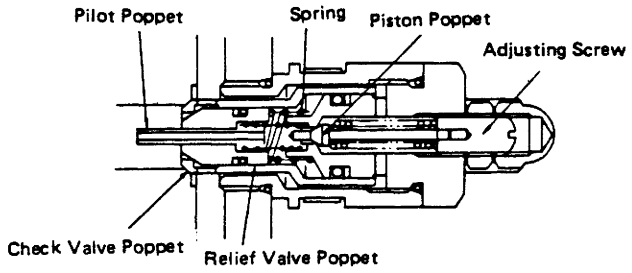
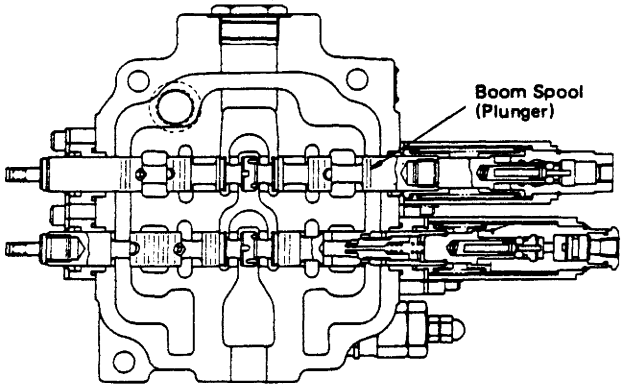
(8) When removing the hydraulic components, apply plugs or caps to hoses or tube lines and ports, and place mating marks on the parts to facilitate reassembly.

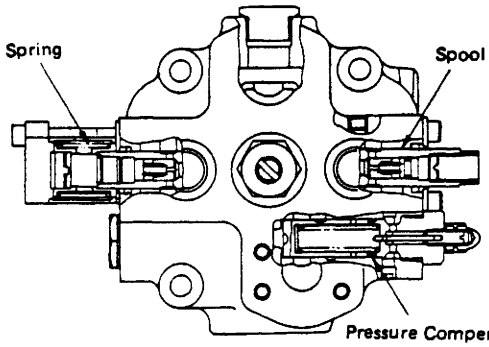
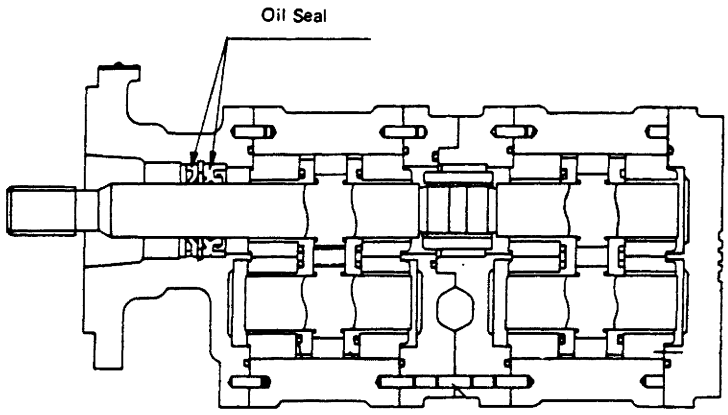
(9) Disassemble or reassemble the hydraulic components in a place free from dirt and dust. In disassembly, pay attention to the interchangeability of parts and clean the disassembled parts with clean mineral oil. Do not forget to clean internal oil paths. After they are dry, wipe the parts with clean, lint-free cloth.

(10) When the hydraulic components are overhauled, replace all the O-rings, back-up rings and oil seals. Before assembly, clean the parts and apply clean hydraulic oil to the parts. Apply grease or vaseline to the O-rings before installation.

(11) When the hydraulic components are removed, do not forget to refill with hydraulic oil after assembly to supplement oil lost in disassembly.

(12) Firmly tighten the joints. If the joints are loose, hydraulic oil may leak and the pumps may be damaged if air is taken in, due to lowered oil level by leakage. If the suction line joints are loose, air may be taken in resulting in abnormal noise and faulty operation.

Trouble	Check Point and Probable Cause	Remedy
	(3) Control valve • Overload valve unseated • Broken spring • Damaged overload valve • Leakage due to worn or damaged spool or body Overload relief valve  Control valve  	Repair or replace.

Trouble	Check Point and Probable Cause	Remedy
	(4) Steering valve • Damaged pressure compensation plunger • Damaged spool • Broken spring  	
(13) Decreased hydraulic oil level	(1) Hydraulic oil level (Level gauge) • Low oil level • Refer to (1)-(1) "Hydraulic oil level (Level Gauge)." If hydraulic level has dropped quickly, check transmission oil level. If transmission oil level has risen, refer to the following description of pump.	Add oil.
	(2) Pump • Damaged oil seal Hydraulic pump  	Repair or replace.
	(3) Transmission oil • Hydraulic oil in transmission oil	Replace.

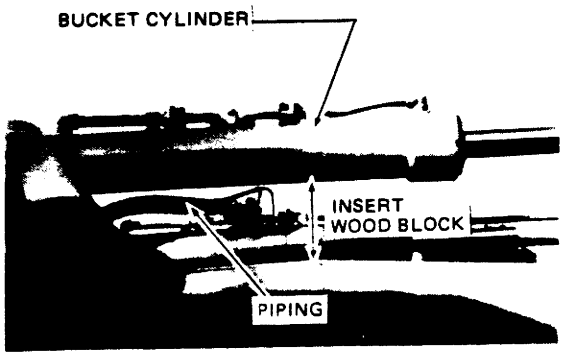


Fig. 1-5 Cylinder Rod Side Pin Removal

(5) After "slowly" retracting the bucket cylinder to full extent, remove the piping.

NOTE

After stopping the engine, operate the control lever to the stroke end several times to remove any pressure remaining in the system.

(6) Pull out pin (8) connecting the cross links (33 & 34) to the boom. Lift the links with a hoist and separate them from the boom.

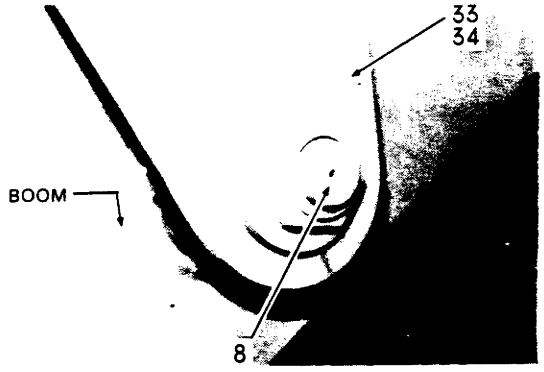


Fig. 1-6 Cross Link Removal

(7) Holding the bucket cylinder, withdraw pin (4) on the bottom. Shim (24) and washer (23) may be removed now but must be marked to identify for reinstalling and kept as a set.

* Boom weight: 900 kg
* Bucket weight: 980 kg

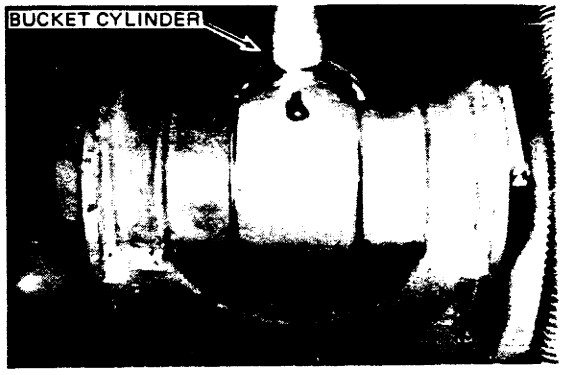


Fig. 1-7 Cylinder Removal

(8) Supporting the boom with a support bench, remove pin (10) on the rod side of the cylinder, and retain the cylinder.

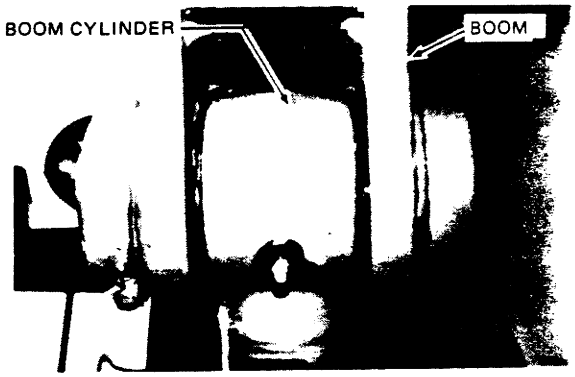


Fig. 1-8

(9) Remove boom foot pin (5) connected to the front frame. At this time retain the boom assembly with a hoist and pull it out.

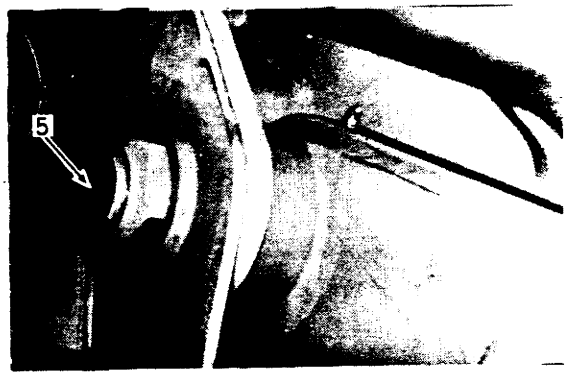


Fig. 1-9 Boom Foot Pin Removal

(10) Move the boom forward from the frame.

* Boom cylinder weight: 102 kg
* Bucket cylinder weight: 74 kg

2.3 INSPECTION

(1) Check the sliding surface (ball surface) for wear, seizure, scratches, etc. and replace if necessary.
(2) Replace all dust seals (3 & 15).
(3) Grind the pins (8 & 9) with oil stone if scored.
(4) Check the internal surface of the spacer (19) and bushing (14) for scars. Correct with grinder or buff if damaged.
(5) Usable limits of pins and bushings are as follows.

Numbers in Fig 2-1	Name	Standard dimensions	Usable limit			Remedy	Remarks
			Pin Dia.	Bore Dia.	Clearance		
8	Pin	470.0	69.5		1.0	Replace	Replace if scratched, worn, seized, etc.
18	Bushing			70.5			
9	Pin	475.0	74.3		1.2	Replace	
20	Bushing			76.0			
13	Nut	227~290 kg m	Tightening torque after lubrication.			Retighten	Use torque wrench.
21	Nut	12 kg·m					
4,24	Capscrew	20 kg·m					
3,15	Duse seal	When removed				Replace	

S5RE0400E

WHEEL LOADER
SHOP MANUAL

LK600

BRAKE SYSTEM

KOBE STEEL, LTD.

3-1. General

The parking brake is a drum type brake with an internal expansion mechanical system, and brakes the output shaft of the transmission.

The brake assembly is installed to the oil seal retainer of the transmission and the drum is secured to the yoke of the output shaft with bolts.

The control lever for the parking brake is provided to the left of the driver's seat. The brake is engaged by raising the lever and released by pushing the lever forward and down.

Parking brake specifications are as follows:

Diameter of drum	216mm
Width of shoe	50mm
Braking torque	250kg·m(1,808ft.lb.)

3-2. Brake Drum and Shoe

(Refer to Figs. 3-1 and 3-2.)

3-2-1. Removal

(1) Remove the universal joint for the drive shaft from the front side output shaft of the transmission.

(2) Remove the rod which is connected to the parking brake control lever assembly.

(3) Remove four bolts (1) and washers (2), and remove brake drum (3). This step, however, is not necessary when the yoke does not need to be separated from the drum.

(4) Remove nut (4) and washer (5) from the output shaft of the transmission.
At this point, the output shaft must be secured if the drive shaft for the rear output shaft has been removed to prevent it from rotating.

(5) Remove bolts (7) and washers (8), and remove the brake assembly from the oil seal retainer of the transmission.
At this time, the slinger will come off with the brake assembly.

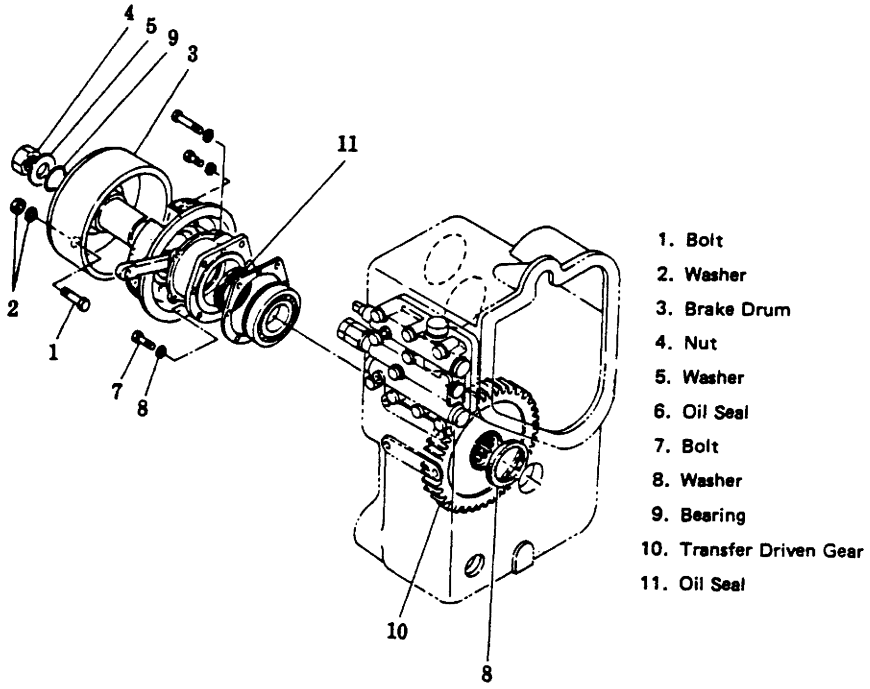


Fig. 3-1. Parking Brake

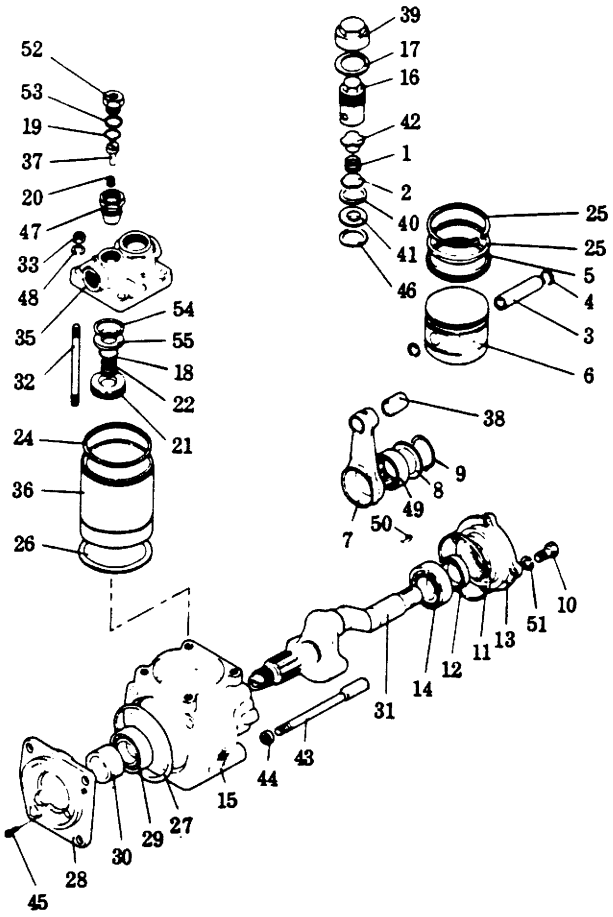
and air is supplied again.

Through repetition of this sequence, compressor loading is held within the established limit.

The cylinder head and cylinder liner are held in place by nuts on the four studs bolts protruding from the crankcase. The mounting hole for the oil connector is located on the side of the crankcase. Internal bearings are splash lubricated by engine oil. Excess oil passes from the front to the timing gear case.

The pistons are made of aluminum alloy, with two compression rings at the top and one oil ring at the bottom. The large end of the connecting rod is equipped with a needle bearing and the crankshaft is supported by two ball bearings. The front end of the crankshaft is splined (ten grooves). One of the grooves has a large cutaway which corresponds to the timing gear position.

The front end of the crankshaft also has a groove which serves to provide power for the meter driver.



29. Ball Bearing	38. Bushing	47. Valve Guide
30. Spacer	39. Valve Cap	48. Spring Washer
31. Crankshaft	40. Packing	49. Bearing
32. Stud Bolt	41. Valve Seat	50. Key
33. Nut	42. Spring Holder	51. Spring Washer
34. Connector Bolt	43. Bolt	52. Connector
35. Cylinder Head	44. Seal Washer	53. Packing
36. Cylinder	45. Screw	54. Suction Valve Packing
37. Unloader Valve	46. Valve Packing	55. Suction Valve Seat

Fig. 4-1(b)

(4) Secure crankcase (15) in a vise.

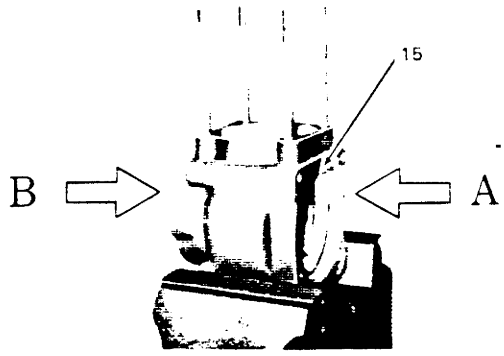


Fig. 4-42

(5) Install connecting rod (7) into crankcase (15) as shown in Fig. 4-43.

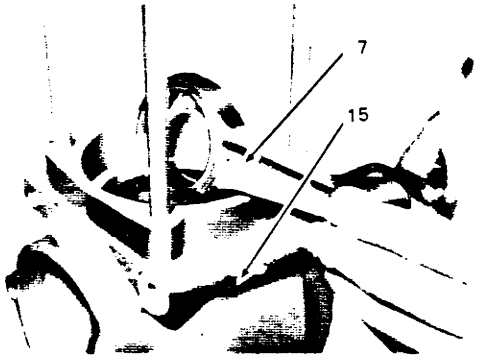


Fig. 4-43

(6) Install the crankshaft into the A end of the crankcase as shown in Fig. 4-42, passing it through the end of the connecting rod. Place the chamfered side of the ring (washer) toward the connecting rod.

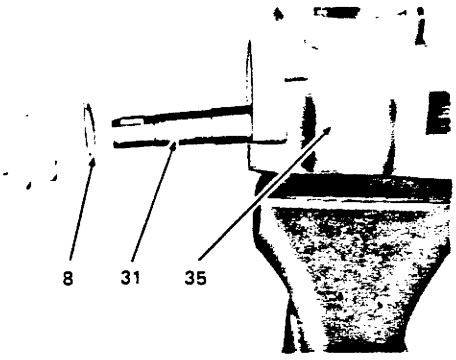


Fig. 4-44

(7) Install stop ring (9) to the crankshaft, and using the clip remover, position it accurately.

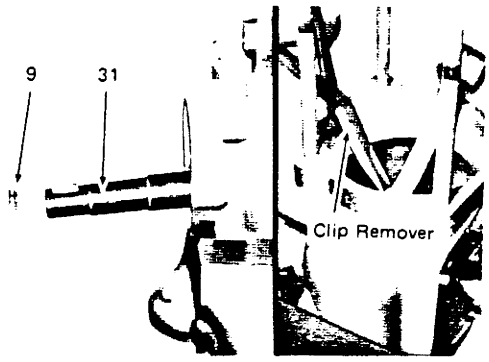


Fig. 4-45

NOTE

Make sure that the crankshaft and connecting rod are assembled as shown in Fig. 4-46.

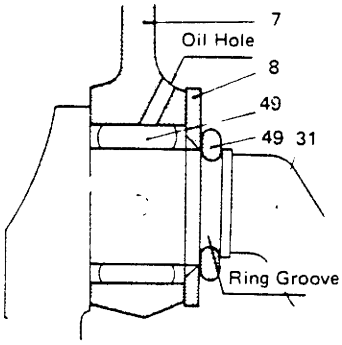


Fig. 4-46

(8) Installation of bearing holder (28)

Install O-ring (27) and bearing holder (28) with four screws (45).

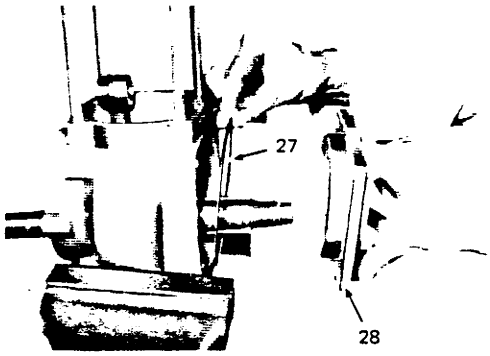


Fig. 4-47

7-1. General

The air reservoir is located under the radiator, and partitioned into the wet tank and dry tank. The wet tank is equipped with the safety valve, air check and drain cock, and the dry tank is equipped with the check valve and drain cock.

The wet tank separates the moisture in compressed air and oil mist from the air compressor so that clean air is fed to the brake valve and the power cluster to drive the equipment. At the same time, it serves to minimize problems in these devices.

In view of the above points, it is most important to follow the instructions in the operators manual regarding draining.

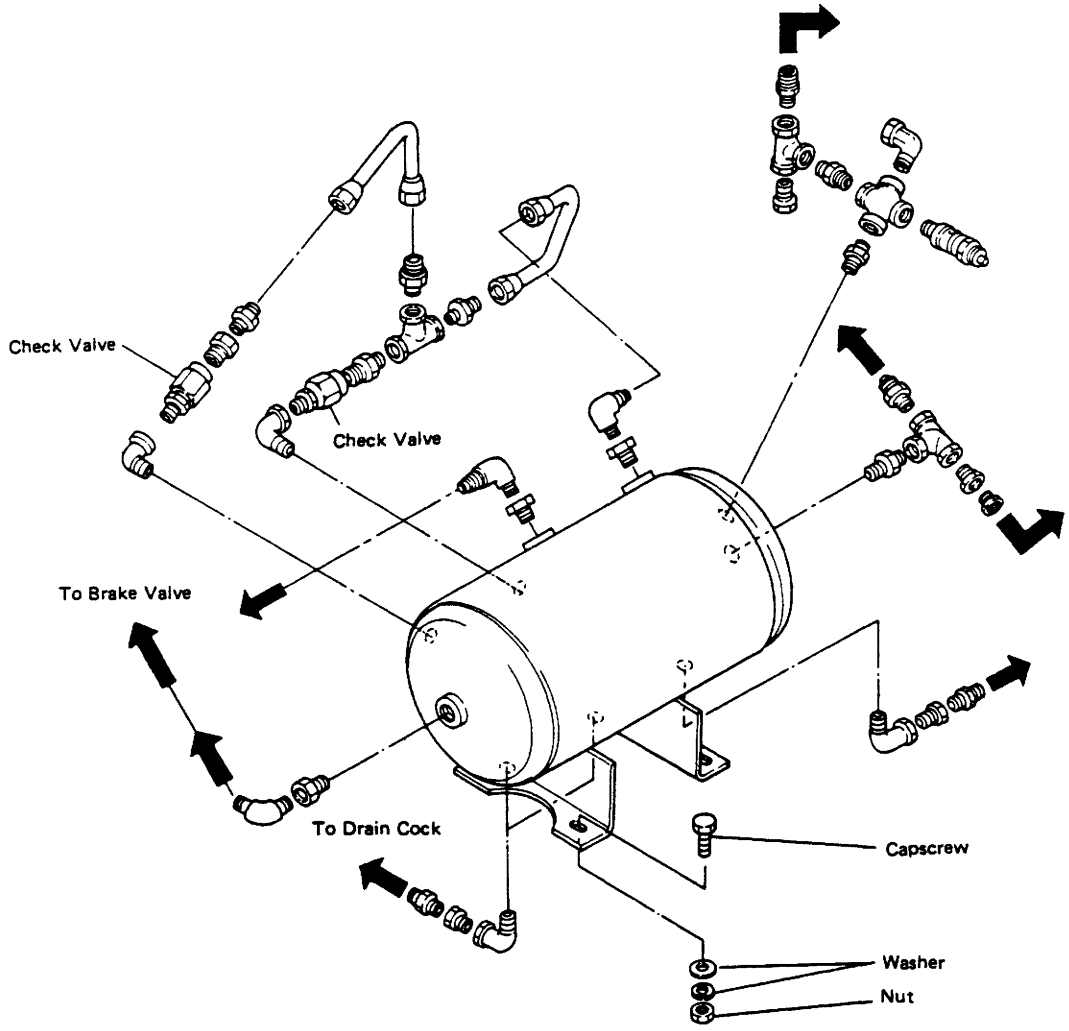


Fig. 7-1

10. TROUBLESHOOTING

Use this chart to determine effectively corrective action when problems occur.

Problem	Cause	Remedy
Braking force is low.	① Brake is faulty. ② Brake pads are worn. ③ Air pressure is low. ④ Brake fluid is leaking. ⑤ Amount of brake fluid is low. ⑥ Brake valve is faulty. ⑦ Power cluster is faulty.	① Refer to the shop manual for the axle. ② Same as above. ③-1 Check for air leaks and repair. ③-2 Repair or replace the air compressor. ③-3 Replace the governor. ③-4 Replace the safety valve. ④ Replace the hose or tube, or retighten. ⑤ Add brake fluid. ⑥ Repair the brake valve, or replace if necessary. ⑦ Repair the power cluster, or replace if necessary.
Delayed braking effect	① Brake is faulty. ② Air pressure is low. ③ Brake valve is faulty. ④ Power cluster is faulty. ⑤ Hose of tube is blocked.	① Refer to the shop manual for the axle. ②-1 Stop air from leaking. ②-2 Repair the air compressor, or replace if necessary. ②-3 Replace the governor. ②-4 Replace the safety valve. ③ Repair the brake valve, or replace if necessary. ④ Repair the power cluster, or replace if necessary. ⑤ Clean the hose or tube, or replace if necessary.
Delay in brake disengaging	① Brake is faulty. ② Brake valve is faulty. ③ Hose or tube is blocked. ④ Air leak through the air system ⑤ Power cluster is faulty.	① Refer to the shop manual for the axle. ② Repair the brake valve, or replace if necessary. ③ Clean the hose or tube, or replace if necessary. ④ Replace the air system. ⑤ Repair the power cluster, or replace if necessary.
Brake does not work.	① Air pressure is extremely low. ② Tube or hose is blocked completely, or broken. ③ Brake valve is faulty. ④ Power cluster is faulty. ⑤ Amount of brake fluid is extremely low.	① Increase air pressure. ② Clean the tube or hose, or replace if necessary. ③ Repair the brake valve, or replace if necessary. ④ Repair the power cluster, or replace if necessary. ⑤ Add brake fluid.
Brake will not disengage.	① Brake is faulty. ② Brake valve is faulty. ③ Power cluster is faulty. ④ Tube or hose is blocked. ⑤ Brake pedal is stuck. ⑥ Pedal return spring is broken.	① Refer to the shop manual for the axle. ② Repair the brake valve, or replace if necessary. ③ Repair the power cluster, or replace if necessary. ④ Clean the tube or hose, or replace if necessary. ⑤ Repair the brake pedal. ⑥ Replace the spring.
Brake will not function.	① Brake is faulty. ② Brake pedal is stuck. ③ Brake valve is faulty. ④ Power cluster is faulty. ⑤ Brake system is blocked.	① Refer to the shop manual for the axle. ② Repair the brake pedal. ③ Repair the brake valve, or replace if necessary. ④ Repair the power cluster, or replace if necessary. ⑤ Repair and clean the brake system.
Brake does not engage smoothly.	① Brake is faulty. ② Brake valve is faulty. ③ Power cluster is faulty. ④ Amount of brake fluid is insufficient. ⑤ Air is mixed in with brake fluid.	① Refer to the shop manual for the axle. ② Repair the brake valve, or replace if necessary. ③ Repair the power cluster, or replace if necessary. ④ Add brake fluid. ⑤ Release the air mixed in with the brake fluid.

CONTENTS

Fig. 3-8

3-2 Disassembly and assembly of the inner parts of the pump

Before disassembling the pump, put proper mating marks on cover (6), body (1), covers (20) and (26) and cover (25), and arrange them in order and correct position to facilitate the assembly. Several identical parts are used inside the pump, and if any of them is interchanged in assembly, the performance of the pump may be reduced.

3-2-1 Disassembly

This multi-section pump consists of several units of single pumps of identical construction joined together and only the shapes of the parts used for connecting these pumps differ. Accordingly, once the socket screws which connect the pumps are removed as shown in Fig. 3-9, each of these pumps can be disassembled and assembled in the same manner as explained as a single-section pump, irrespective of the number of sections.

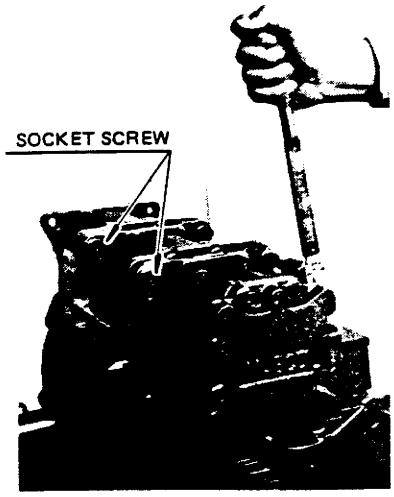


Fig. 3-9

Fig. 3-10 shows the state when the rear pump has been removed.

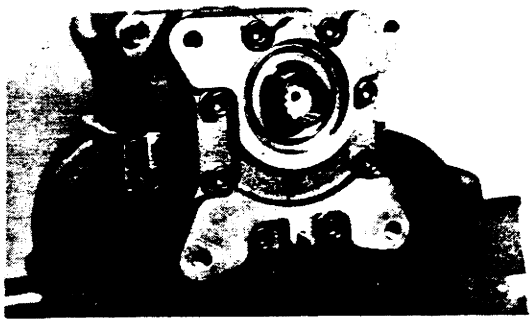


Fig. 3-10

Fix the pump assembly with the vise as shown in Fig. 3-11.

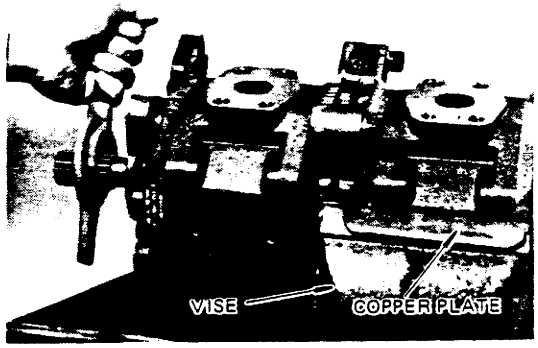


Fig. 3-11

CAUTION

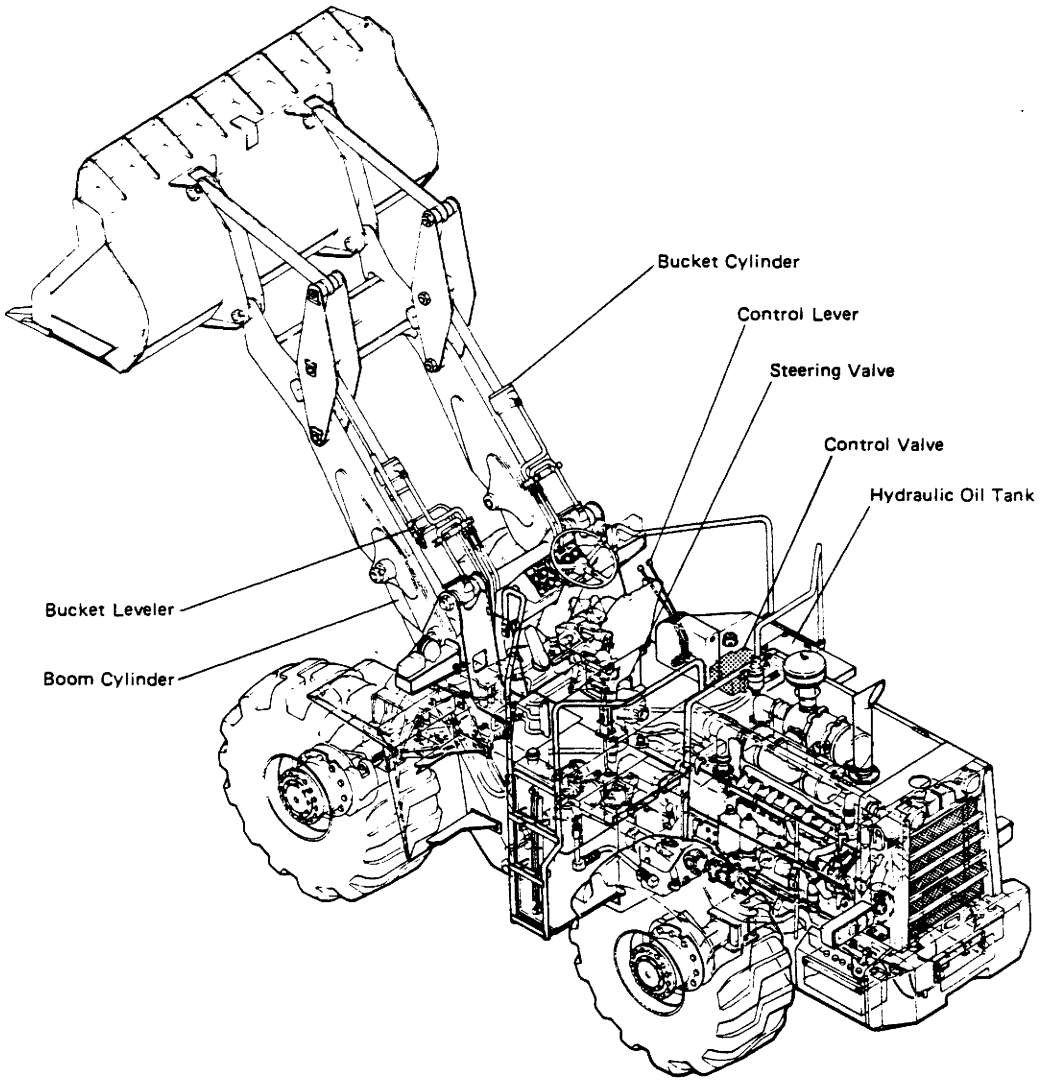
When securing the pump, use proper padding such as copper sheets or cloths so as not to clamp the pump directly in the vise, and use as small a force as possible to hold it.

(1) Loosen the socket screw, and remove it and the lock washer from rear cover (25).

PREFACE

This control valve manual is part of the shop manual for the KOBELCO Wheel Loader LK600. It provides service personnel with knowledge needed to maintain the equipment. Service personnel should carefully read through this manual to learn about maintenance of the control valve. Strict compliance with the instructions in the shop manual ensures trouble-free, long-term operation of the equipment.

When ordering replacement parts, be sure to refer to the applicable parts catalogs. Never use any of the drawings of photographs found in this manual for identification purposes when ordering parts.



LK600 Wheel Loader

3-2. Operating Position

(1) Figs. 3-2 and 3-3 show the operation of spool (1) for the bucket.

a) Fig. 3-2 shows the spool as it has been shifted in. When the bypass line has been closed, and the oil from the pump port pushes up the load check valve to flow into cylinder port "A."

In this instance, the poppet inside the spool is seated by the hydraulic pressure acting on the area difference between the diameter of the seat "C," ar d the outside diameter of the larger poppet "D." The return oil from the actuator returns to the tank port through cylinder port "B."

The spool is kept in the position as shown in Fig. 3-2 by the detent mechanism. When the detent is released manually or by pressurizing the kick-out pressure port, the spool is returned to the neutral position by the return spring.

b) Fig. 3-3 shows the spool when it has been shifted out. The oil from the pump port flows into cylinder port "B," and the return oil from cylinder port "A" opens the poppet inside the spool to flow into cylinder "B," and joins the oil from the pump port. The excess oil returns to the tank port through orifice "E."

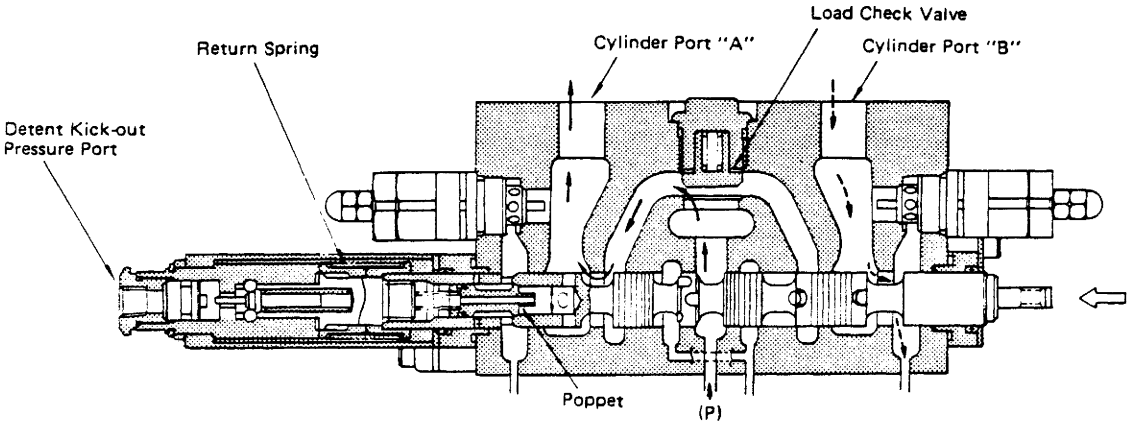


Fig. 3-2

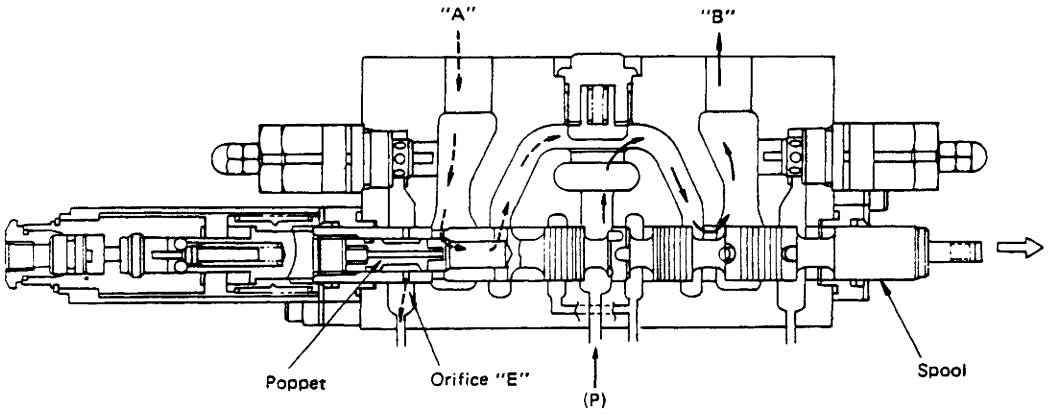


Fig. 3-3

——→ Indicates the pressure flow to the actuator.

- - - - → Indicates the return flow from the actuator.

⇨ Indicates the operating direction of the spool.

4-3. Cleaning

Clean all the disassembled parts thoroughly with cleaning oil and dry with compressed air, and place the individual parts on a sheet of clean paper for inspection.

4-4. Inspection

(1) Check all the surfaces of individual parts for flush, scratches and other damage. Remove all the flushes with an oil stone or by lapping. If the damage is serious enough to cause oil leakage, replace the part or valve assembly.

CAUTION

The body and spool are a selective fit with one another, and can not be interchanged.

(2) All the sliding parts should move easily.
(3) All the grooves and passages should be free of foreign matters.
(4) The springs and detent balls should be replaced if they are broken, worn, or deformed.
(5) All the O-rings and backup rings should be replaced.

4-5. Assembly

The following points should be observed when handling O-rings during assembly.

(1) The O-rings should be free of defects or damage caused during its manufacture or handling.
(2) The O-rings and O-ring mounting sections should be coated with grease or hydraulic oil for lubrication.
(3) The O-rings should not be stretched enough to cause a permanent deformation.
(4) Do not roll the O-rings during their insertion. (Twisted O-rings can not straighten out after mounting, and cause oil leakage.)

4-5-1. Plug assembly

(1) Install O-ring (23) onto plug (22) and install to valve housing (1) at 10.0~12.0kg·m.

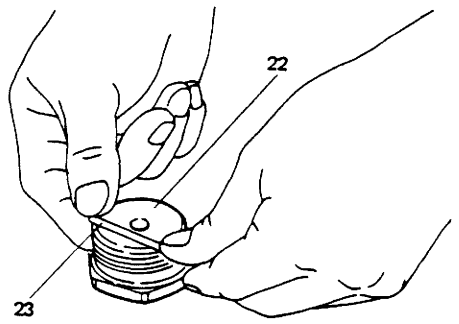


Fig. 4-12

(2) Install O-ring (21) onto plug (24), and install taper screw plug (25) onto plug (20). Wind a seal tape around the threaded portion of plug (25) in this step. (Tightening torque at 1.5~2.0kg·m)
Next, install O-ring (21) onto the plug and tighten into the valve housing. The tightening torque is 8~9kg·m.

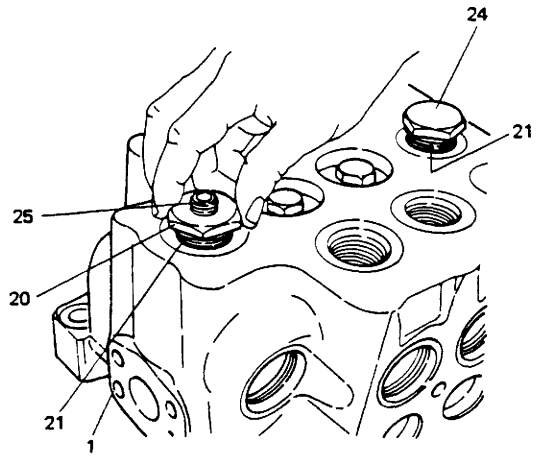


Fig. 4-13

4-5-2. Assembly of load check valve

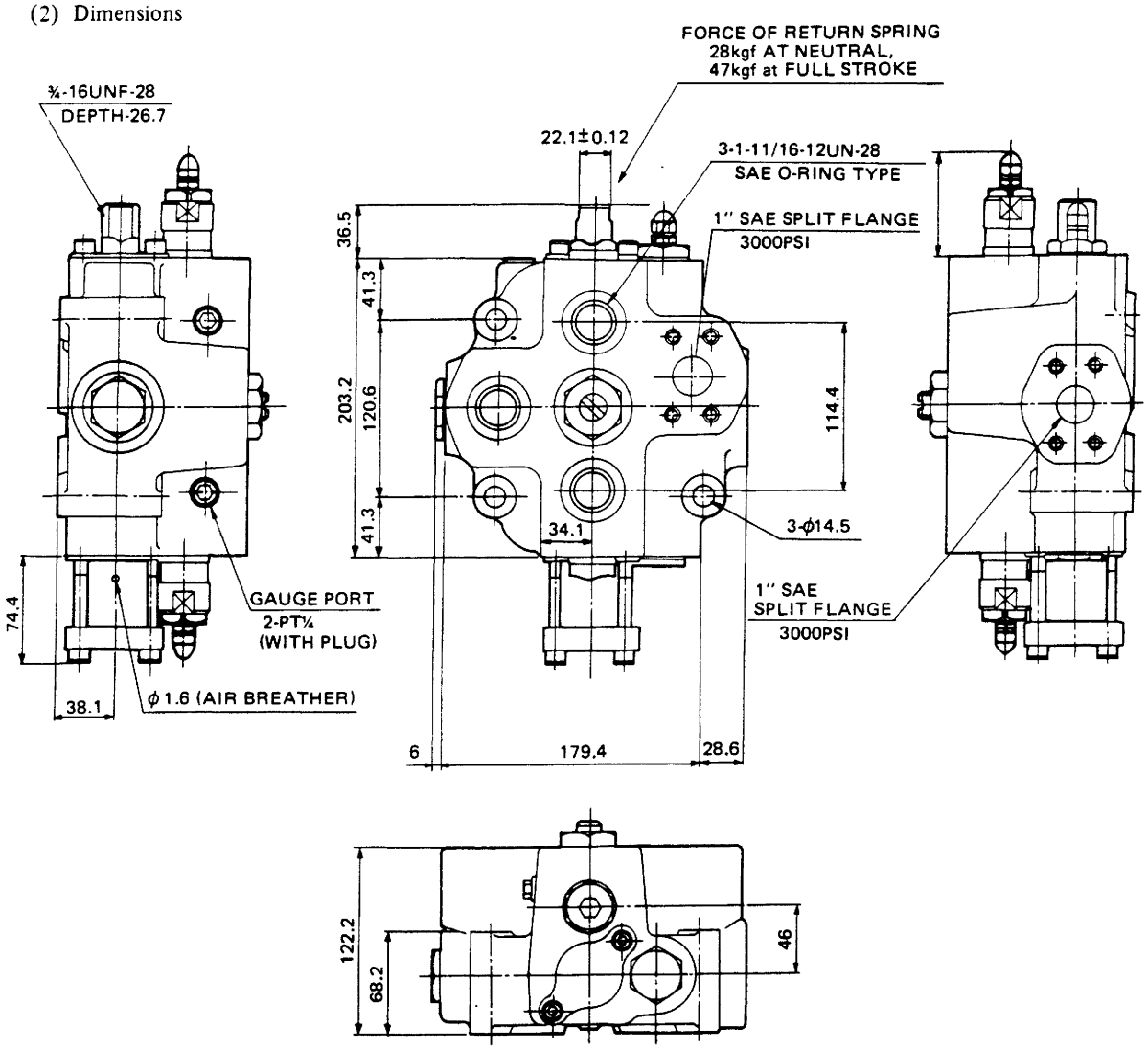
Install O-ring (14) and backup ring (15) onto plug (16).

2. SPECIFICATIONS

(1) Specifications

Max. pump flow rate	170 ℓ/min	* 45.5 ga/min
Controlled flow rate in cylinder port	57.4 ℓ/min	* 15.1 ga/min
Allowable back pressure	15 kg/cm^2	* 355 p.s.i.
Main relief pressure	150 kg/cm^2 (at 107 ℓ/min)	* 2133 p.s.i. (* 28.2 ga/min)
Port relief pressure	200 kg/cm^2 (at 19 ℓ/min)	* 2844 p.s.i. (* 5.0 ga/min)
Weight	25 kg	

(2) Dimensions



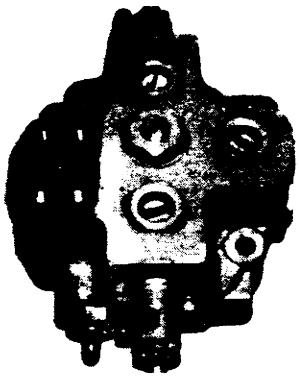


Fig. 3-33

Adjust the pressure of the main relief valve by the mechanical, as well as hydraulic testing device. Adjustment should proceed as follows:

Procedure for pressure adjustment

(1) First, loosen the adjusting screw, then operate with no-load.

(2) Raise the pressure slowly. (Turn the adjusting screw clockwise.)

(3) Set the pressure gauge to read 150kg/cm^2 [*1] when the system flow rate is 107l/min. [*2] and the oil temperature is 50°~55°C. [*3]

(4) Hold the adjusting screw not to turn with a screwdriver, then lock it with a lock nut.

(5) Raise the pressure again to 150kg/cm^2 and confirm that there is no oil leakage from any parts.

(6) Conduct a trial run after installing the cap.

*1 2133 p.s.i.

*2 28.2 ga/min

*3 122 ~ 131 F°

2. PRINCIPLE OF OPERATION

2-1. Neutral Position

In the neutral position, the pressure chamber "a" leads to the low-pressure passage through the plunger, as shown in Fig. 2-1.

The pressure compensation plunger thus strokes to the right, and the oil supplied from the hydraulic pump port (P) all flow to the carryover port, and to the operating circuit.

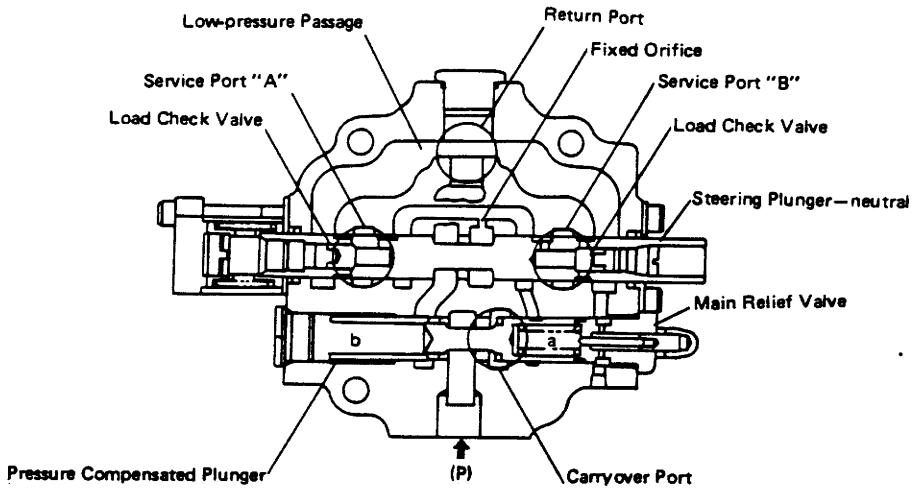


Fig. 2-1

2-2. Operating Condition

Fig. 2-2 shows the steering plunger when it has been pushed in from the neutral position and is steering. In this state, the oil from the pump port passes through the variable throttle in the middle of the steering plunger, pushes up the load check valve and flows into service port "B" (steering cylinder). During this process the load pressure from service port "B" is led to the pressure chamber "a" and the pressure in the upper flow in the variable throttle in the steering plunger to the pressure chamber "b," to keep the pressure difference between the front and back of the variable throttle constant. The stroke flow rate is thus kept constant, regardless of the load pressure in the service port and in the carryover port. The excess oil flows to the carryover port, and the fixed orifice keeps the flow rate constant at the stroke end of the plunger. The return oil from service port "A" flows through the load check valve to the low-pressure passage.

Fig. 2-3 shows the state where the plunger has been pulled out. The oil from the pump port flows into service port "A," and the return oil from service port "B" flows into the low-pressure passage.

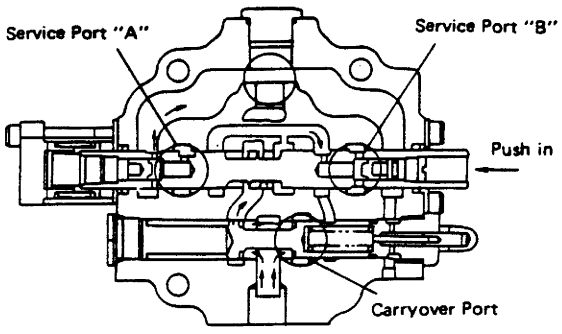


Fig. 2-2

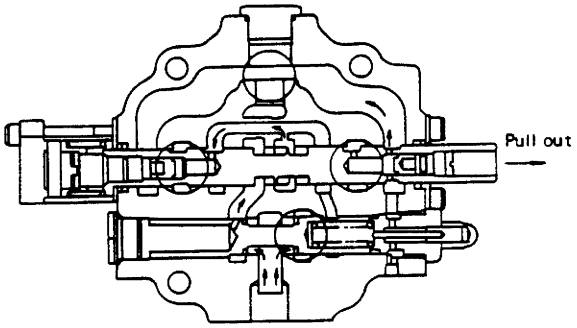


Fig. 2-3

2.2 TRANSMISSION

The transmission is essentially a combination of the torque converter and reduction gears. Engine torque from the engine is changed by the torque converter first and then by various gear reduction units, and transmitted through the transfer gear to the output (drive) shaft protruding from across the lower part of the transmission. At the front of the output shaft, the parking brake is attached.

Another P.T.O located at the upper left of the transmission receives engine torque through gears but not through the torque converter.

Hydraulic pressure required to operate the transmission is fed by the hydraulic system.

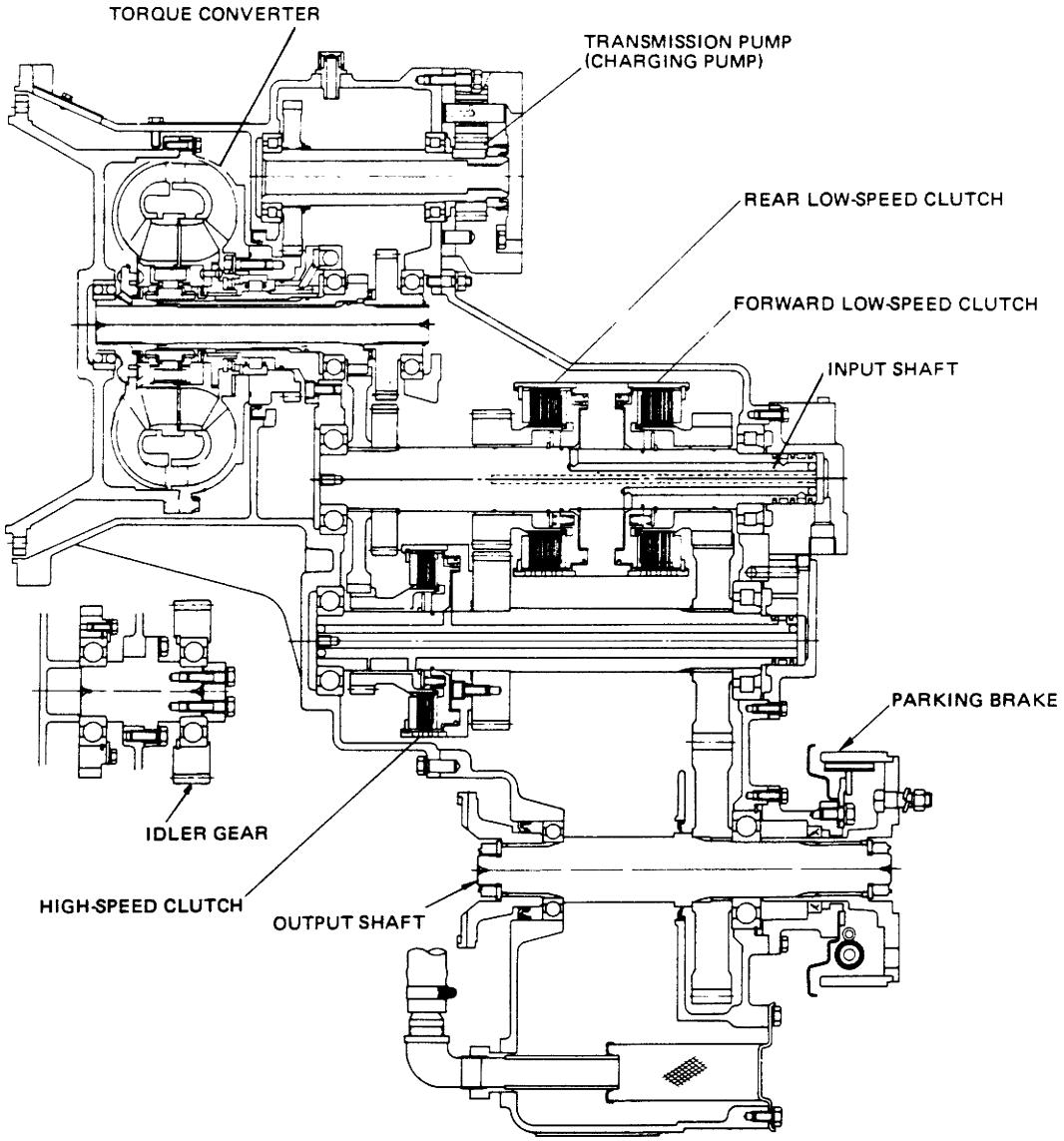


Fig. 2-4 Sectional View of the Transmission

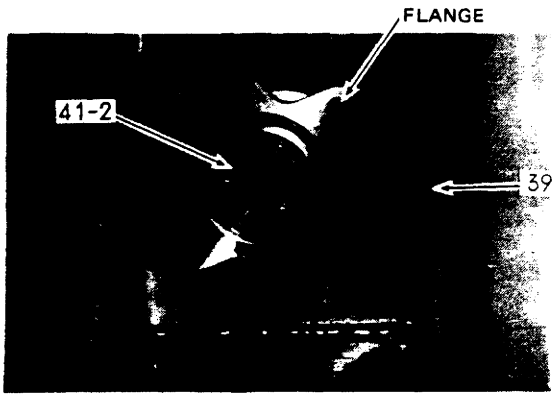


Fig. 3-24 Removing Flange/Cartridge

3.3.3 MAINTENANCE STANDARDS

No.	Name	Clearance
	Clearance at spline	Replace if 0.2 or more.
	Between spider and needle bearing	Replace if 0.5 or more.

3.3.4 REASSEMBLY

Reassemble by reversing the order of disassembly, paying attention to those items shown in Fig. 3-25. Adjust the shims (47) of cartridge (39) so that points "A", "B" and "C" are inclined 1.09° when the machine is horizontal.

Table 3-2 Tightening Torque

No.	Name	Tightening torque (kg·m)
35 25 54	Capscrew	15.8 ± 1.6
*1 *2	Capscrew	10.5 ± 1.0
43	Capscrew	34 ± 3

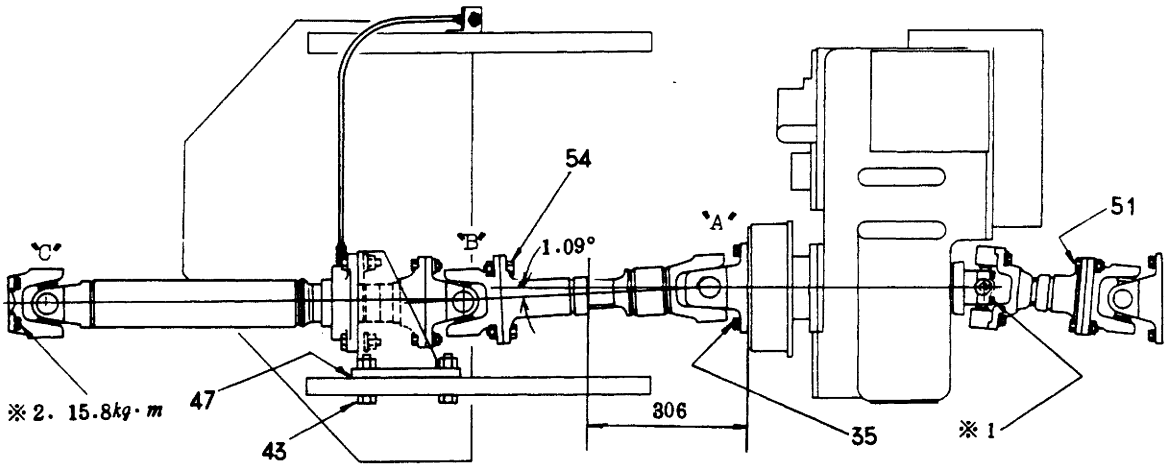


Fig. 3-25 Capscrew Tightening Torque

3.4 AXLE

3.4.1 REMOVAL

(1) Remove capscrew (51), nut (56), etc. connecting the drive shaft and differential.

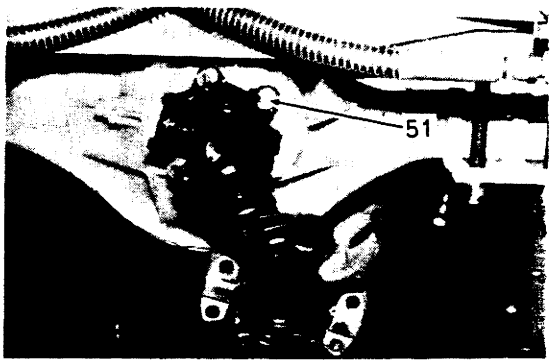


Fig. 3-26 Removing the Drive Shaft

Trouble	Part	Probable Cause	Remedy
3. Load will not hold. (This means Movement of Piston rod is more than 0.5mm in 10 minutes when static load equivalent to the value of the cylinder area multiplied by the maximum working pressure is applied to cylinder piston rod.)	1. Seal ring (11) or Slipper seal	1) Foreign material on the sliding surface of seal ring. 2) Flaws on of seal ring. 3) Other defect	o Remove foreign material and clean. o Replace seal ring. o Replace seal ring.
	2. Cylinder body (1)	1) Any scratching. 2) Large and deep flaws on Cylinder body sliding surface.	o Replace piston ring. o Replace wear ring.
	3. Piston ring (12) wear ring	1) Large flaws on sliding surface of piston ring 2) Damage or wear on wear ring	o Replace wear ring.
	4. O-ring (27)	1) Damaged O-ring	o Replace O-ring.

5-2-5 (c) DISASSEMBLY

(1) Removal of Wear Ring

Remove wear ring (A) from the slit by expanding it in the direction of the arrows (Fig. 5-24).

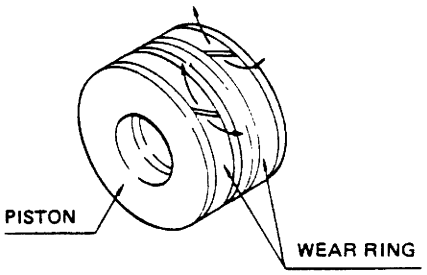


Fig. 5-24

(2) Removal of Slipper Seal (B) and O-ring (C)

Cut the slipper seal by tapping it lightly with a screw driver or a chisel. Be careful at this time not to strike it too hard or slip the screw driver or chisel which can damage the grooves.

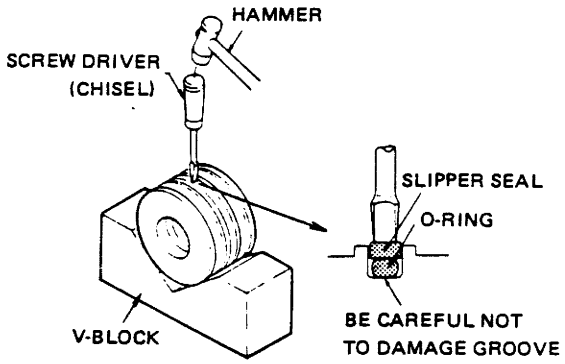


Fig. 5-25

(3) Remove O-ring (D) from the inner diameter side by using a spatula.

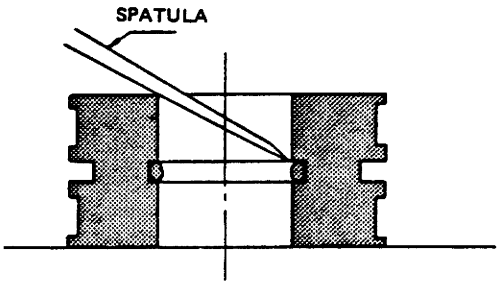
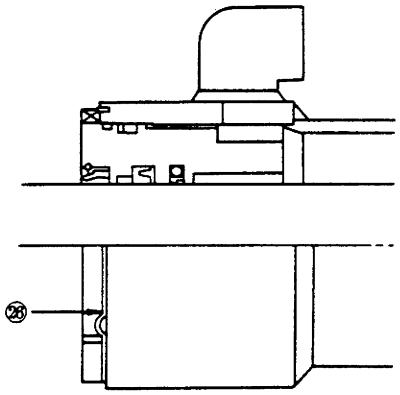


Fig. 5-26

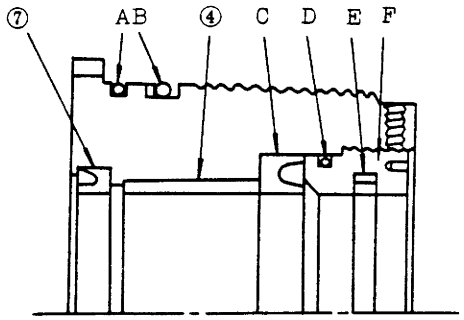
5-2-6 DISASSEMBLY OF CYLINDER HEAD

There are two kinds of cylinder head as shown in Fig. 5-27a.

Remove lock washer (26) on the outside of the cylinder head and each of seals, using a metal spatula.



a



b

Fig. 5-27

It is recommended to check the cylinder head construction with the parts catalog before proceeding. For example, the type shown in Fig. 5-27b requires a pin spanner (Example shown in Fig. 5-28) as a special tool.

(4) Install the back-up ring
The ring bias cut can be easily installed.

(5) Install seal ring assembly (11) and then keep it in position by putting the pipe corresponding to the inside diameter of each cylinder over the seal ring assembly.

(6) Install piston ring (12) on piston (10). Install piston ring (12) as shown in Fig. 8-8.

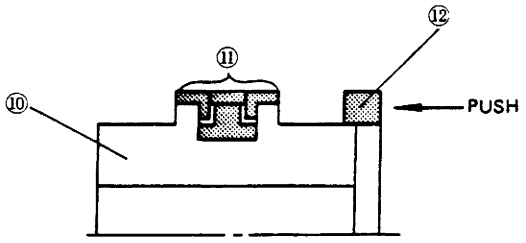


Fig. 8-8

(7) For Fig. 8-9, install piston ring (12) expanding using the spatula.
Be careful not to excessively expand the piston ring, otherwise it may be deformed.

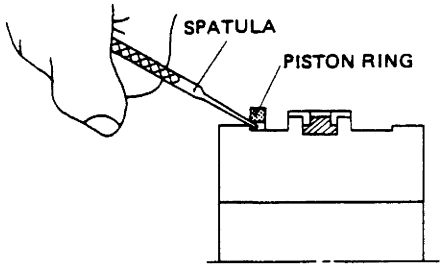
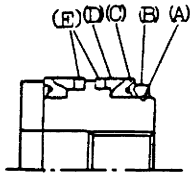


Fig. 8-9

8-3-2 ASSEMBLY OF TYPE (b)

(Refer to Section 8–10)

(8) Install piston ring (E), nylon heel (D), U-ring (C) to piston in this order. To install the piston ring, the same method is used was disassembly by using a snap ring spanner. Be careful not to expand the piston ring too much.



b Type

(9) Installing U-ring Holder (B) and Stopper (A)
First, apply a coat of vasoline or hydraulic oil to the U-ring holder and stopper and install this to the piston as shown in Fig. 8-10 and bend the edge of the stopper about 20mm to the inner side. Next, turn the U-ring holder with a spanner until the stopper is completely wound in and install the stopper fully into the groove from the U-ring holder notch.

(10) Install packing stopper (A)(C) and packing (B) by hand.

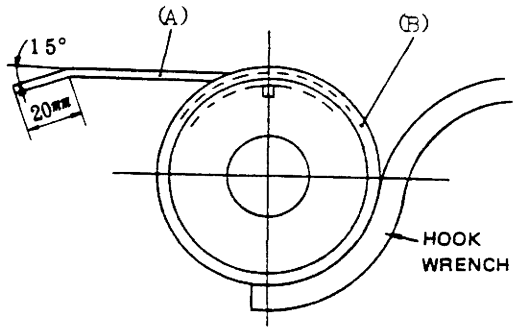


Fig. 8-10

If vasoline or hydraulic oil is coated to the piston and packing stopper, work can be performed more easily.

8-3-3 ASSEMBLY OF TYPE (c)

(Refer to Section 11–13)

(11) Coat O-ring (D) with vasoline or hydraulic oil and install this into the groove inside.

(12) Installation of O-ring (C) and Slipper Seal (B)
First install the O-ring, then next the slipper seal is installed but prepare a jig as the difference of the groove bottom girth and outer girth is large.

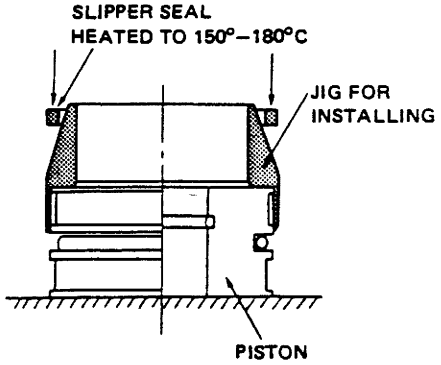


Fig. 8-11

Book code No. S595003 1E

KOBELCO

SHOP MANUAL LK SERIES

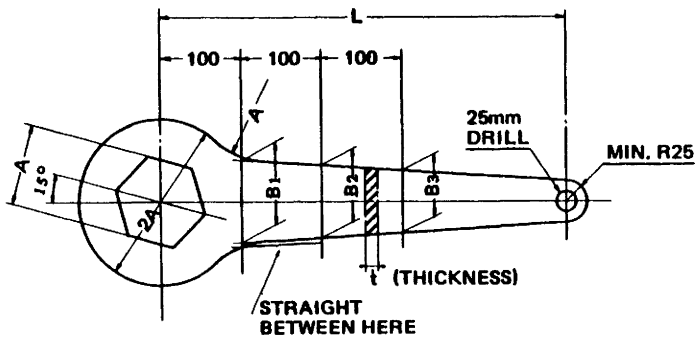
HYDRAULIC CYLINDER TOOL LISTS

TABLE OF CONTENTS

KOBE STEEL, LTD.

2.3 OFFSET WRENCH [SS]

– FOR HEXAGON HEAD NUT –



MATERIAL: STEEL PLATE

TOLERANCE OF "A"

DIMENSION	~50	51~80	81~120	121~
TOLERANCE	+0.2~+0.6	+0.3~+0.8	+0.3~+1.0	+0.4~+1.2

(mm)

TOOL NO.	A	L=300			L=500			
		B1	B2	t	B1	B2	B3	t
SS- 13	13	50	50	6	50	50	50	6
SS-14.3	14.3	〃	〃	〃	〃	〃	〃	〃
SS- 22	22	〃	〃	〃	〃	〃	〃	〃
SS- 27	27	〃	〃	〃	〃	〃	〃	〃
SS- 30	30	〃	〃	〃	〃	〃	〃	9
SS- 32	32	〃	〃	9	52	〃	〃	〃
SS- 36	36	57	〃	〃	63	55	〃	〃
SS- 41	41	58	〃	12	〃	〃	〃	12
SS- 46	46	70	55	〃	75	65	58	〃
SS- 50	50	80	57	〃	79	68	55	〃
SS- 55	55	〃	〃	〃	〃	〃	〃	〃
SS- 60	60	95	67	16	104	90	78	16
SS- 65	65	〃	〃	19	102	88	〃	19
SS- 70	70	〃	〃	25	104	96	78	25
SS- 75	75	100	70	28	108	90	77	28
SS- 80	80	110	78	〃	122	107	87	〃
SS- 90	90	〃	〃	〃	〃	〃	〃	〃
SS-100	100	〃	〃	16	〃	〃	〃	16
SS-115	115	〃	〃	〃	〃	〃	〃	〃
SS-120	120	165	116	28	180	156	127	28
SS-135	135	113	78	12	122	106	87	12
SS-145	145	〃	〃	〃	〃	〃	〃	〃
SS-165	165	〃	〃	〃	〃	〃	〃	〃

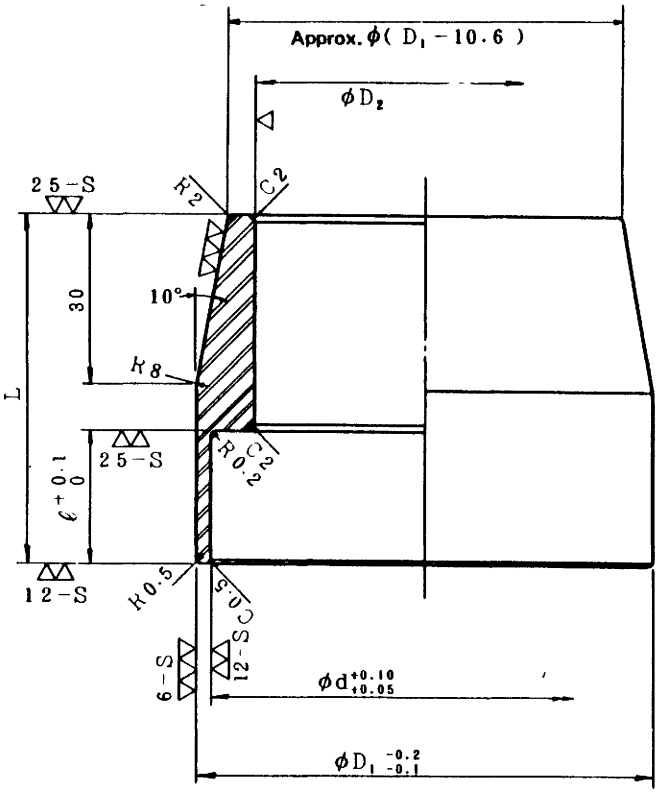
2.4 SINGLE OPEN END WRENCH [SS']

MATERIAL: CHROMIUM-VANADIUM STEEL PARKERIZED

(mm)

TOOL NO.	A	B	Length	Open End Thickness	Arm Width	Arm Thickness
SS'- 13	13	82	185	6.2	9	3.5
SS'- 14	14	84	140	6.7	10	4
SS'- 22	22	51	205	9.5	14	5
SS'- 27	27	61	245	11.5	17	5
SS'- 30	30	67	270	12.5	19	5.8
SS'- 32	32	72	285	13	19.5	6
SS'- 36	36	80	320	14	22	7
SS'- 41	41	90	360	16	24	8
SS'- 46	46	101	400	18	26	8.5
SS'- 50	50	109	430	19	29	9
SS'- 55	55	120	470	20	32	9.5
SS'- 60	60	129	510	21	34	10
SS'- 65	65	139	550	22	35	10.5
SS'- 70	70	143	580	24	36	11
SS'- 75	75	161	645	25	42	13
SS'- 80	80	161	645	25	42	13
SS'- 90	90	185	690	32	55	14
SS'-100	100	115	740	35	60	15
SS'-115	115	153	860	40	80	20
SS'-120	120	153	860	40	80	20

2.14 SPECIAL TOOL FOR INSERTING SLIPPER SEAL [C]

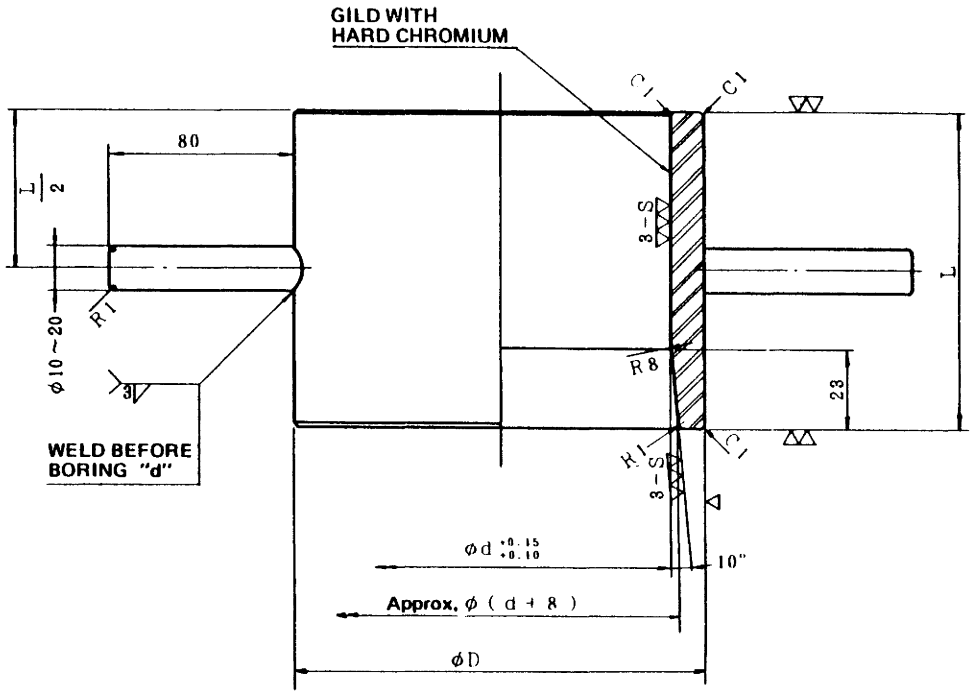


MATERIAL: STEEL

(mm)

TOOL NO.	D_1	d	D_2	ℓ	L
C − 1	101	99.5	80	20	55
C − 2	111	109.5	90	〃	〃
C − 3	121	119.5	100	30	65
C − 4	126	124.5	〃	22	57
C − 5	127.6	126.1	〃	30	65
C − 6	131	129.5	110	〃	〃
C − 7	161	159.5	140	31	66
C − 8	171	169.5	150	32	67
C − 9	191	189.5	170	31	66

2.15 SPECIAL TOOL FOR HOLDING SLIPPER SEAL [D]



MATERIAL: STEEL

(mm)

TOOL NO.	d	D	L
D − 1	100	115	35
D − 2	110	125	35
D − 3	120	135	40
D − 4	125	140	40
D − 5	126.5	145	45
D − 6	130	145	50
D − 7	160	175	55
D − 8	170	185	55
D − 9	190	210	55

S5RE0900E

WHEEL LOADER
SHOP MANUAL

LK600

TRANSMISSION

KOBE STEEL, LTD.

15

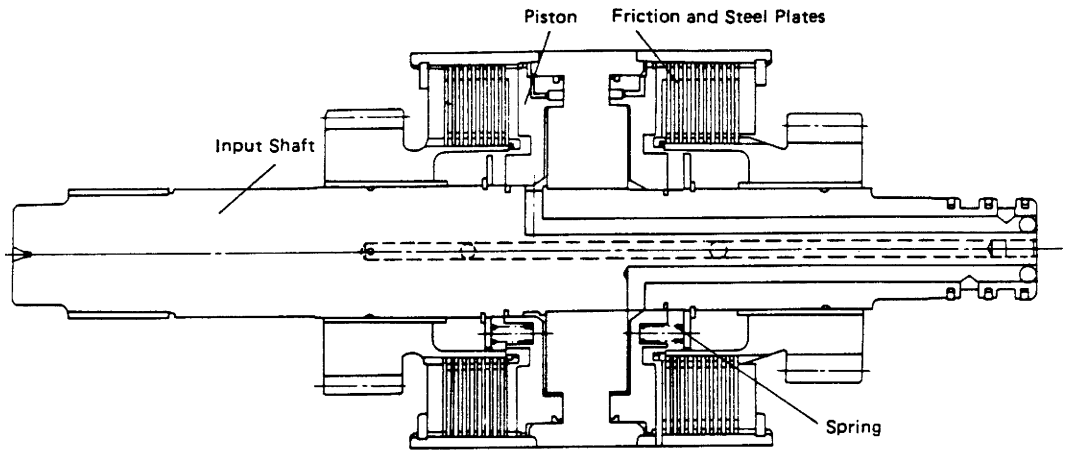


Fig. 2-5

2-4. Transfer Gear and Output Shaft

The power, whose speed has been adjusted by the speed change section, is transmitted to the output shaft through the transfer drive gear and driven gear. The output shaft has output flanges in the front and rear ends, and is also equipped with a parking brake on the rear end. (Refer to Fig. 2-6.)

2-5. Parking Brake (Refer to Fig. 2-6.)

The parking brake is of the internal expansion type. The shoe assembly is secured by bolts on the seal housing on the rear end of the transmission housing. The brake drum is secured by bolts to the rear output flange. The brake is operated manually, and is released by the spring.

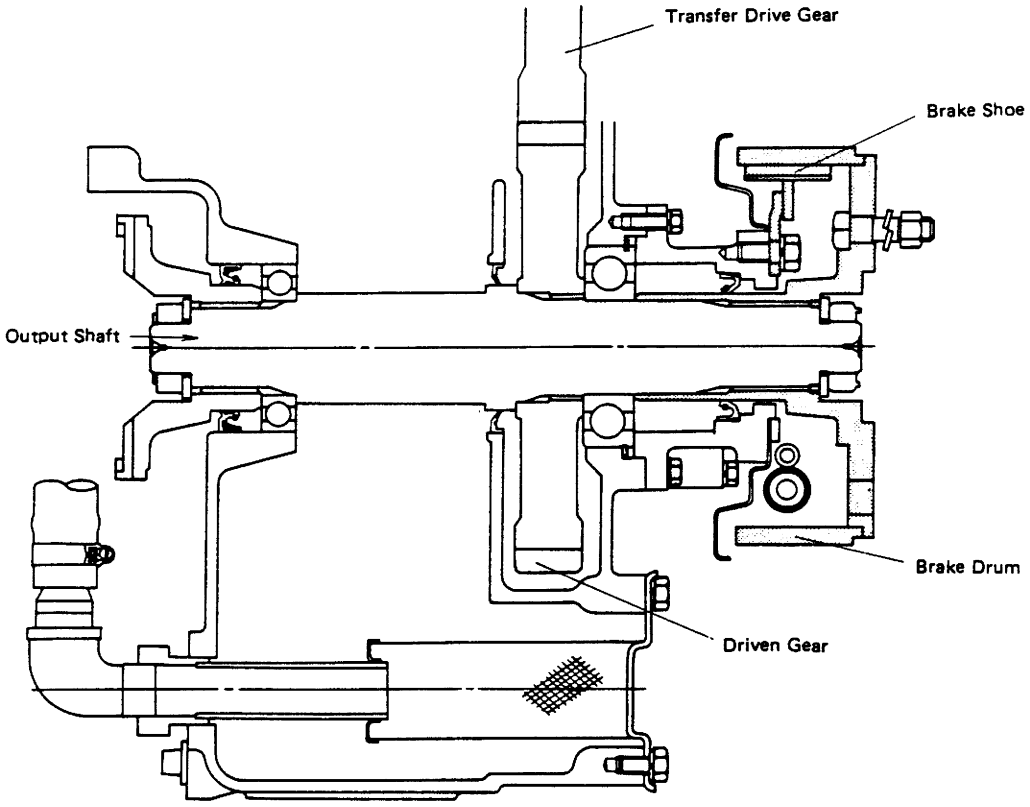


Fig. 2-6

3-1. General

The transmission must be handled correctly and periodically inspected in order to function at its optimal level. The frequency of the inspections varies according to the manner of use. The transmission must be inspected often, and its oil changed frequently when used under harsh conditions or in a dusty environment. If the oil is overheated (becomes discolored or has a bad smell) replace the oil immediately.

3-2. Handling

3-2-1. Hydraulic Oil

Torque converter oil not only acts as transmission oil for power through the torque converter section of the transmission, but also lubricates the gears, bearings, clutches and other parts, acts as the hydraulic oil to transmit hydraulic power for the hydraulic control components, acts as cooling oil and absorbs the heat generated in the clutches and torque converter to release the heat in the cooler.

In view of its multiple functions, be sure to use oil of the following specifications.

① API service classification, CD class SAE10W

② ATF oil, GM brand, meets Dexron standards

Approximately 28*l* of oil are required when filling with oil for the first time.

3-2-2. Starting

(1) Precautions when starting

a) Start with the transmission in neutral.

b) After starting run the motor for a few minutes and check that pressure gauge indicates the prescribed level when oil is distributed to all sections. The pressure gauge measures the main pressure; its correct level is 7~12kg/cm².

c) Check that there are no abnormalities, such as vibration, noise or oil leakage.

(2) Warming up

In order to get full transmission performance, warm up the motor until the oil temperature in the converter outlet reaches 50°C or more, after breaking the equipment in. The oil temperature can be quickly and effectively raised by warming up the engine with the torque converter in stall.

(3) Operation

Operate according to the operators manual on handling a machine installed with a transmission. Observe the following points on transmission:

a) Do not allow the oil temperature at the torque converter outlet to reach 120°C or more by operating harshly. If oil temperature rises beyond that point, quality of oil deteriorates rapidly, causing heat-damage to O-rings and oil seals. If this occurs, stop operation and run the engine under no load to lower the oil temperature.

b) Always make sure that the hydraulic pressure is within the range of 7~12kg/cm², and stop operation immediately for inspection and repair if any abnormality is noted.

c) Start in low speed, not in high speed. Shift up from low to high speed with the engine at full throttle when operating under load.

When shifting down from high speed to low speed, the engine must be at full throttle when operating under load. Do not shift down, however, when the revolutions of the transmission output shaft exceed the maximum revolutions for low speed.

3-3. Maintenance and Inspection

3-3-1. Inspection of Oil Level

The oil level in the transmission is checked by the oil level gauge dipstick on the right gear side of the transmission.

(1) Inspection of cold engine

a) Always check the oil level before starting the engine The engine can be safely started if the oil reaches the upper line on the dipstick. If the oil level does not reach that line, add oil so as to reach the upper line.

(6) Remove O-ring (15) and spacer (16).

(7) Remove needle thrust bearing (17) and thrust washer (18).

(8) Remove second reactor assembly (19) and shim, thrust washer, needle thrust bearing and thrust washer, in that order.

(9) Remove first reactor assembly (20).

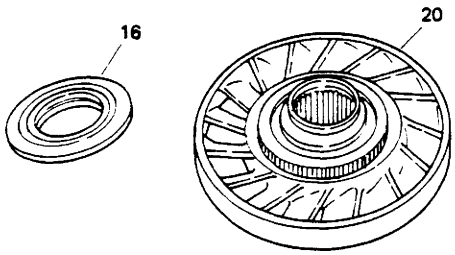


Fig. 5-4

(10) Remove thrust washer (21) and needle thrust bearing (22), in that order. Fig. 5-5 (A) shows

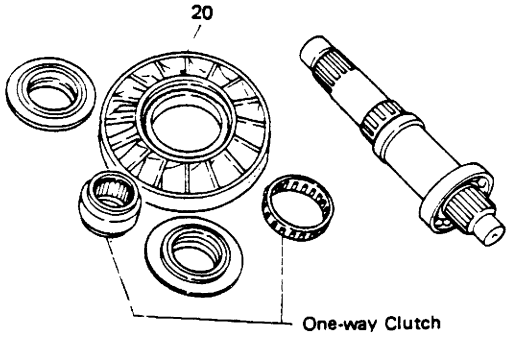


Fig. 5-5 (A)

(11) Remove the turbine assembly and bearing (24) from front cover (2).

Torque converter disassembly is now complete.

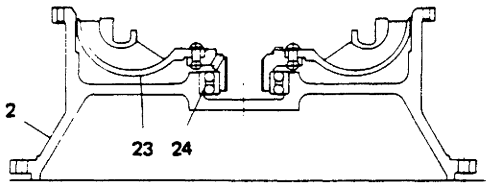


Fig. 5-5 (B)

5-3. Transmission Housing

5-3-1. Removal of Oil Screen and Suction Hose

(Refer to Fig. 5-6.)

(1) Loosen hose band (30) and remove rubber hose (29).

(2) Loosen and remove pipe (31), loosen and remove elbow (32).

(3) Loosen and remove socket (33), loosen capscrew (34) and remove screen (36) together with washer (35).

(4) Remove gasket (37).

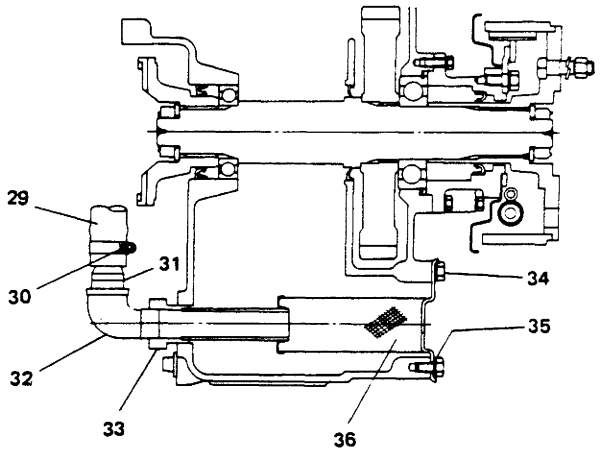


Fig. 5-6

5-3-2. Transmission Housing Assembly

(Refer to Fig. 5-A, structural diagram.)

(1) Remove gear pump assembly capscrews (38) and remove the gear pump assembly and washer (39).

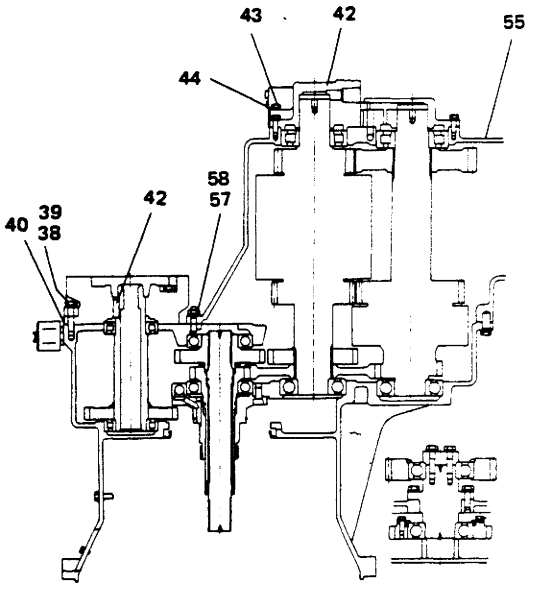


Fig. 5-7

5-7. Control Valve

(Refer to Fig. 5-F, structural diagram.)

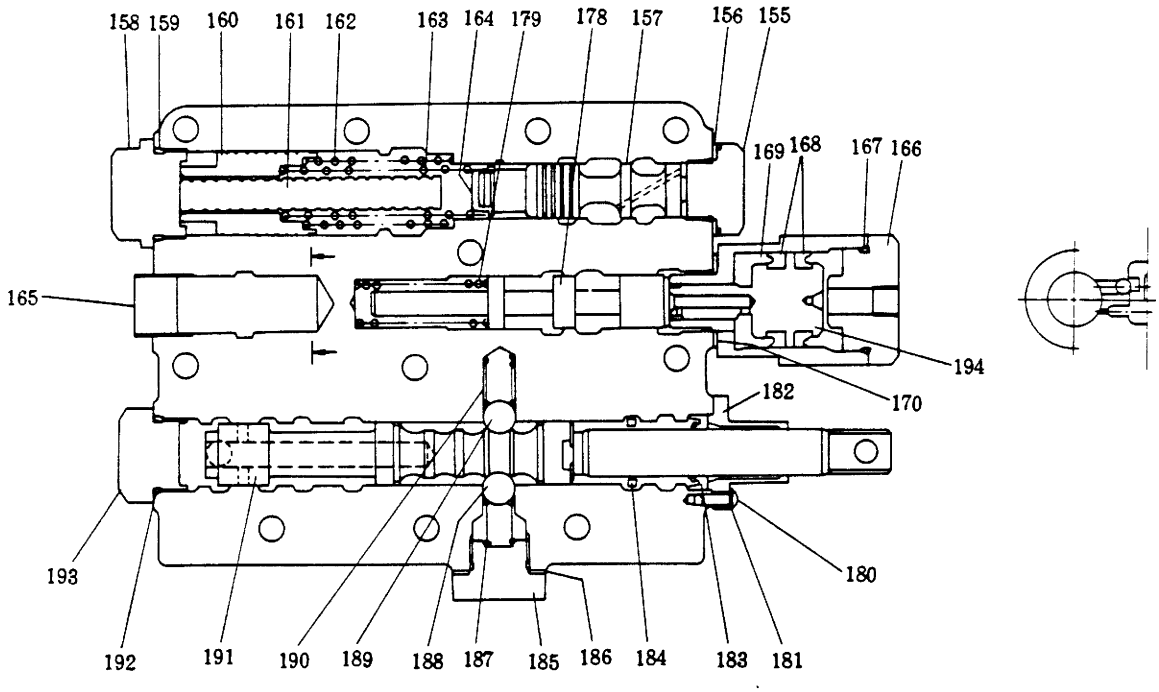


Fig. 5-F. Structural Diagram

155. Plug	163. Regulator Spring	178. Cutoff Valve	187. Spring
156. Seal Washer	164. Retair er	179. Spring	188. Ball
157. Regulator Valve	165. Plug	180. Screw	189. Ball
158. Plug	166. Plug	182. Seal Retainer	190. Spring
159. O-ring	167. O-ring	183. Oil Seal	191. Selector Valve
160. Trimmer Plug	168. Cup	184. Stopper	192. O-ring
161. Piston	169. Air Cylinder	185. Detent Plug	193. Plug
162. Trimmer Spring	170. Seal Washer	186. Seal Washer	194. Piston

7-3. Wear Limits

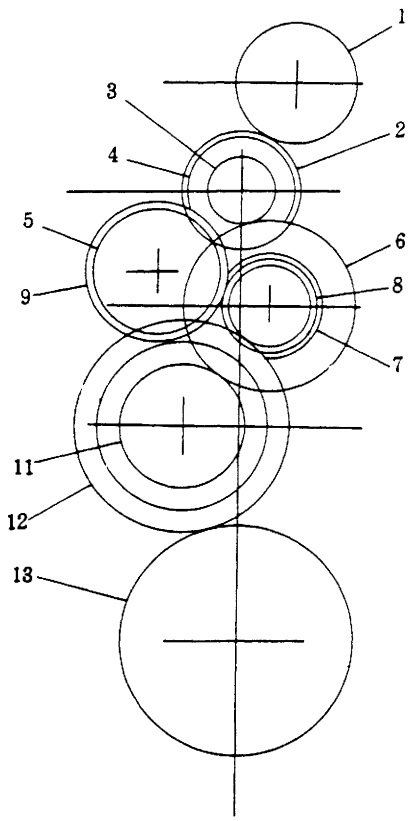
7-3-1. General

The amount of uniform wear on the gears and splines is small compared to the backlash, and does not pose any problems. If abnormal wear or damage such as pitching appear on the tooth surfaces, however, replace them.

The service life of the ball, roller or needle bearings determined more by the occurrence of flaking or damage by dirt than by durability. If any flaking occurs, or bearings no longer rotate smoothly, replace them.

The sliding parts of oil seals require even resistance. The slightest scratch on the sliding surface will cause an oil leak, and should be noted.

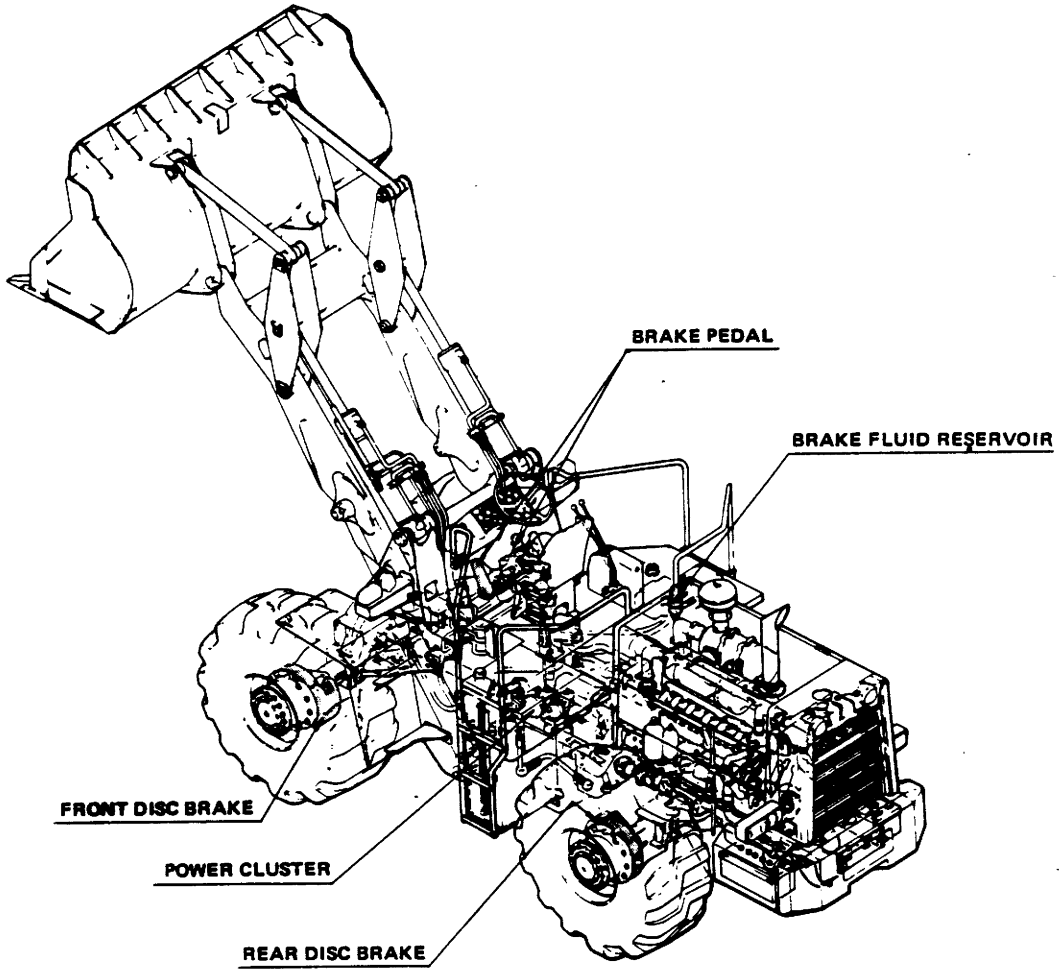
7-3-2. Overall Statistics on Transmission

Item	Maintenance Standards	Use Limit	Remarks
Backlash individual gears a b c d e f g h	0.2~0.3	0.5	

1. P.T.O. Driven Gear
2. P.T.O. Drive Gear
3. Reactor Drive Gear
4. Turbine Drive Gear
5. Idle Gear
6. Reactor Driven Gear
7. Turbine Driven Gear
8. Reverse Drive Gear
9. Idle Gear
10. Reverse Driven Gear
11. High Speed Driven Gear
12. Transfer Drive Gear
13. Transfer Driven Gear

PREFACE

This disc brake manual is part of shop manual for the KOBELCO Wheel Loader LK600. It provides service personnel with knowledge needed to maintain the equipment. Service personnel should carefully read through this manual to learn about maintenance of the brake system.
Strict compliance with the instructions in the shop manual ensures trouble-free, long-term operation of the equipment. When ordering replacement parts, be sure to refer to applicable parts catalogs. Never use any of the drawings or photographs found in this manual for identification purposes when ordering parts.
The following is a transparent view of LK600, showing the location of the disk brakes.



Then tighten to a torque of 4.4 ~ 5.0 kg.m.

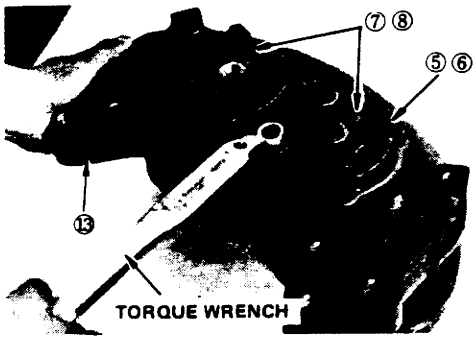


Fig. 3-16

(6) Grease torque pin (3) and the inside of torque pin holes evenly when installing torque pin (3) and bolt (2). (See Fig. 3-17.)

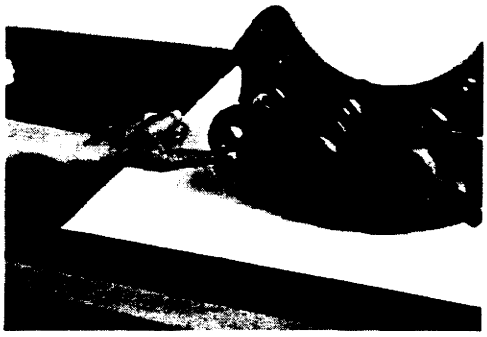


Fig. 3-17

Make sure that bolt (2) is properly installed in torque pin (3) groove.
This cam be checked by moving torque pin (3) in and out while tightening bolt (2).

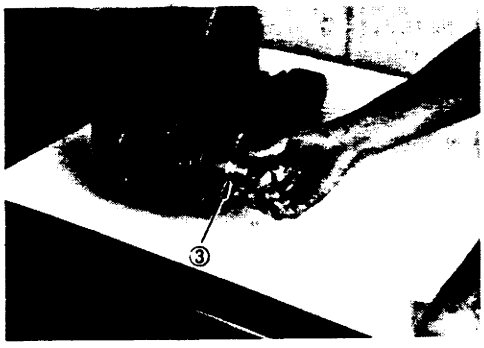


Fig. 3-18

(7) Install torque pin (3) away from the disc but the groove width. Tightening torque for bolt (2) should be 4.2 ~ 4.7 kg.m.

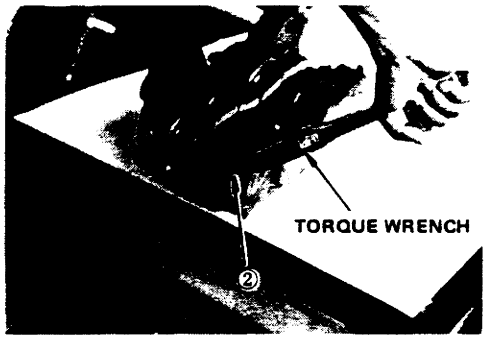


Fig. 3-19

NOTE

Replace of piston seal and cap seal.
It is recommended that piston seal (12) and cap seal (9) be replaced annually or every 1,000 hours for safety.

(8) Fig. 3-20 shows the completed assembly.
Place caps on each port so that no foreign material can enter.

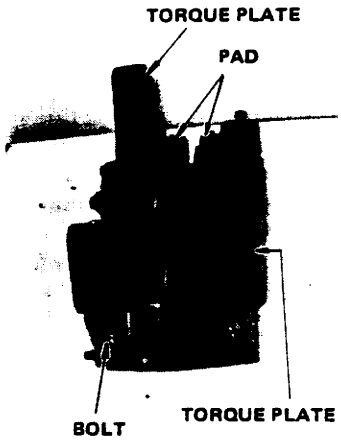


Fig. 3-20

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CAUTION

After connecting the brake lines, it is necessary to bleed air from the hydraulic brake system by supplying the brake fluid to the system. To bleed air, refer to the "Disk Brake" Manual.

(6) Connect the drive shaft to the differential.

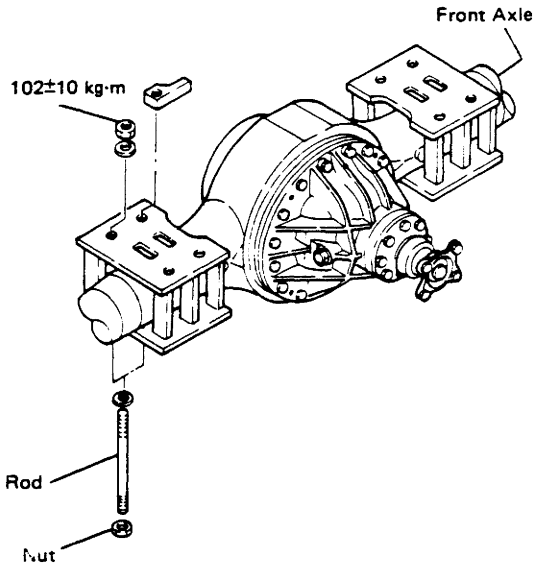


Fig. 2-4

(7) Check the axle breather for performance.

2-4 Removal of Rear Axle

WARNING

Apply the stoppers to the front wheels and lock the front and rear frames with the safety lock bars so that the loader can't move.

(1) Place jacks securely under the rear frame.

(2) Raise the rear frame with jacks until the tires are high enough to remove the axle.

(3) Securely support the rear frame with wood blocks.

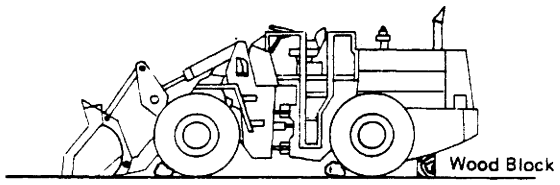


Fig. 2-5

(4) Stop the rear axle from rolling by inserting a wood board or steel plate between the rear frame and axle support.

(5) Remove the both rear tires. Disconnect and remove the hydraulic brake lines and the clamps from the axle.

(6) Remove the drive shaft from the axle differential.

(7) Support the underside of the rear axle housing with jacks, and remove the self-locking nuts and washers fixing the axle in place.

(8) Lowering the jacks, let the axle roll out from under the rear frame.

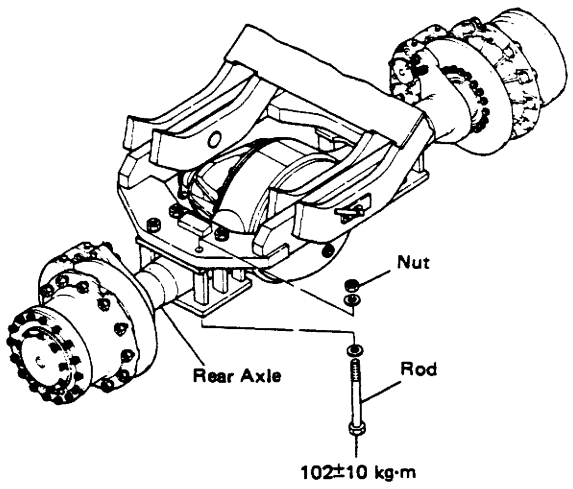


Fig. 2-6 Rear Axle

2-5 Installation of Rear Axle

(1) Clean and check the rear axle, and replace the axle housing shims and capscrews as required.

(2) Check the two bushings attaching the rear axle support to the frame and the pivot pins in the rear axle support.

4. CLEANING AND INSPECTION OF DIFFERENTIAL

4-1 Cleaning

(1) It is not recommended to clean the reassembled drive unit with use of steam after being removed from the housing. If used, moisture would find its way into passages through castings, and into the gaps in or between parts to corrode the important parts in the assembly and causing rust particles to mix in the lubricating oil and circulate in the oil line. Bearings, gears and other parts could become damaged earlier than their ordinary service life.

(2) Clean parts which have ground surfaces, such as gears, bearings, shafts and collars, with a solvent-type cleaner like petroleum solvate, emulsion cleaner, carbon tetrachloride, etc.

CAUTION

Do not clean these parts with gasoline or in a heating tank containing water and an alkaline liquid (sodium hydroxide, orthosilicate or phosphate).

(3) Clean other parts such as carrier castings and cast brackets in a heating tank containing a mildly alkaline liquid. Leave these parts in the tank until they get heated and completely cleaned. This will help the liquid evaporate from the parts after they are removed from the tank and make it easier to wash them with water. Clean them with water until no alkaline substance remains on them.

4-2 Inspection

(1) Inspection of gears

1) Final drive pinion gear and driven gear

2) Differential pinions and side gears

Check for tooth contact, heavy wear, damage and pitting, and replace abnormal ones.

CAUTION

As a general rule, replace the drive pinion and the driven gear as a set.

(2) Inspection of bearings

1) Differential case side bearings

2) Drive pinion bearings

3) Pilot bearings

Check races and rollers for peel, pitting, cracks, damage, heavy wear, creep and abnormal noise. If abnormal, replace them.

(3) Clearance between differential pinion gear and spider

Measure the inside diameter of differential pinion (23) and the outside diameter of spider (25). If the clearance is too large, replace the more worn item.

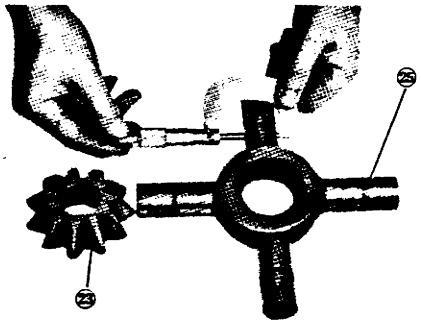


Fig. 4-1

Item	Standard value	Values requiring replacement
Clearance between pinion and spider	0.04 to 0.105mm	0.5mm or more

(4) Checking clearance between differential case and side gear

Measure the inside diameter of differential cases (17 and 18) and the outside diameter of side gear (24). If the clearance is too large, replace the more worn item.

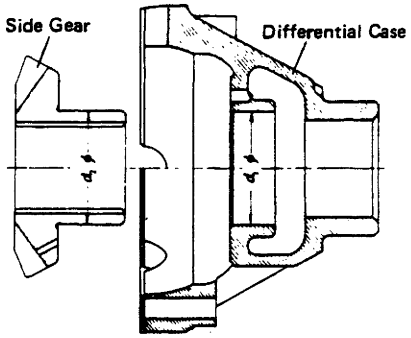


Fig. 4-2

6. INSTALLATION OF DIFFERENTIAL ASSEMBLY

(1) After putting the packing (59) on the face of differential carrier (1-2), install it to the axle case (housing).

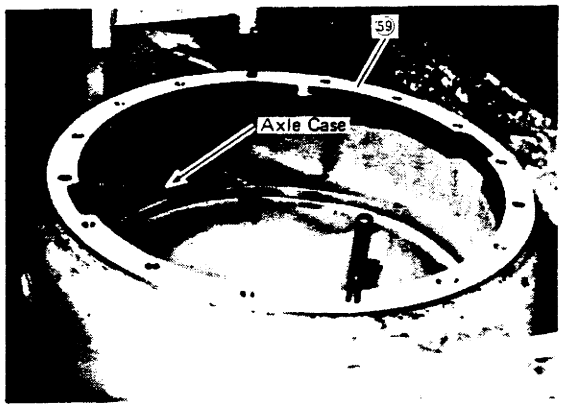


Fig. 6-1

(2) Apply liquid packing (equivalent to locktite No.515) to the differential carrier mounting capscrews (56) and tighten them on the axle case.

Torque value for differential carrier mounting capscrews	16 to 20 kg.m

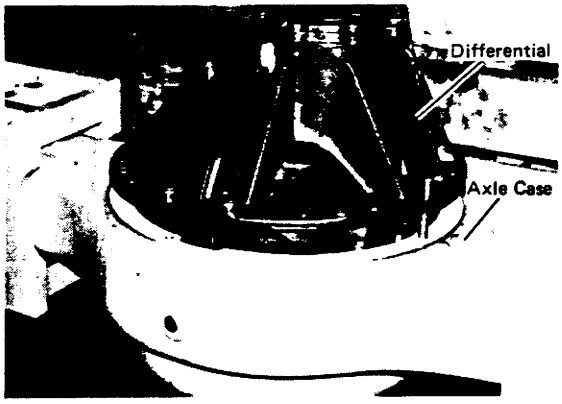


Fig. 6-2 Inserting Differential into Axle Case

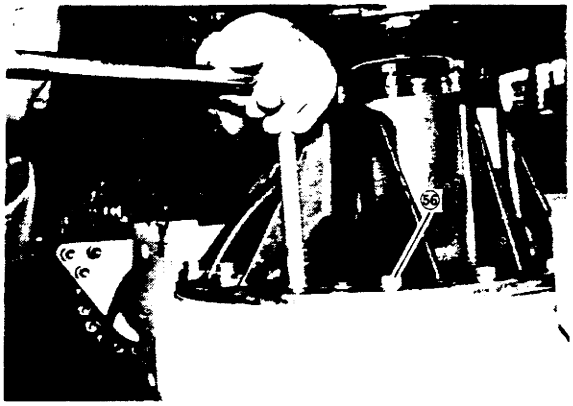


Fig. 6-3

(3) Proceed the following assembly in the reverse procedures of the disassembly.

(4) Fill the axle upto the level plug case with the specified gear oil through the filler plug hole. For the capacity, refer to maintenance paragraph 1-3.

9. ASSEMBLY AND INSTALLATION OF PLANETARY HUB

9-1 Installation of Sleeve

Fig. 9-1 shows the components of sleeve.

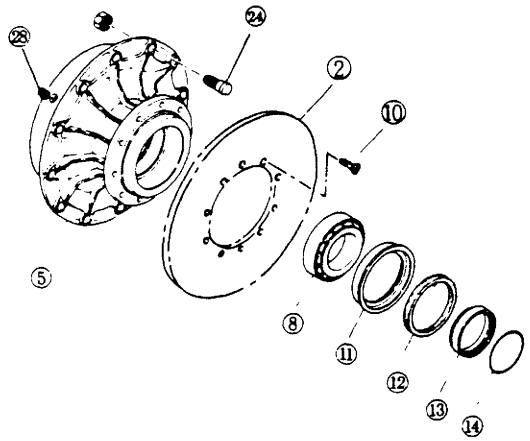


Fig. 9-1

(1) Apply grease to the groove of sleeve (13) and insert a new O-ring (14).

NOTE

If sleeve is unusually worn, replace it.

(2) Apply grease to the spindle outer surface and sleeve inner surface, and insert sleeve (13) onto the spindle paying attention to O-ring (14).

9-2 Installation of Wheel Hub and Disk Assembly

(1) Press a new oil seal (12) into seal retainer (11) correctly.

NOTE

Before insertion, apply non-hardening sealant to the circumference of the seal.

(2) Install inner bearing (8) on wheel hub (5), and press seal retainer (11) into the hub.

(3) If studs (24) have been replaced, press new ones into wheel hub (5).

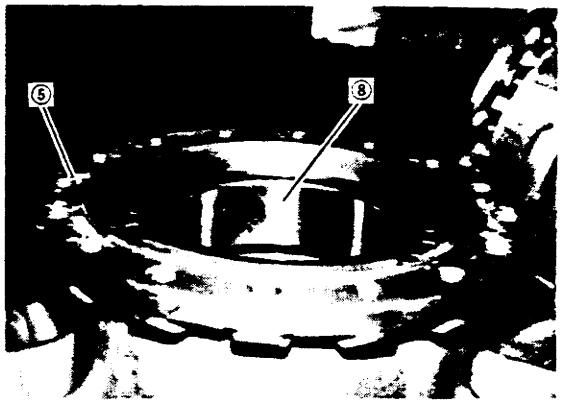


Fig. 9-2 After Bearing has been Inserted

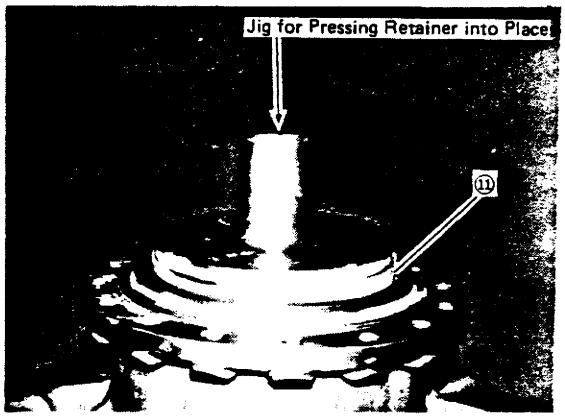
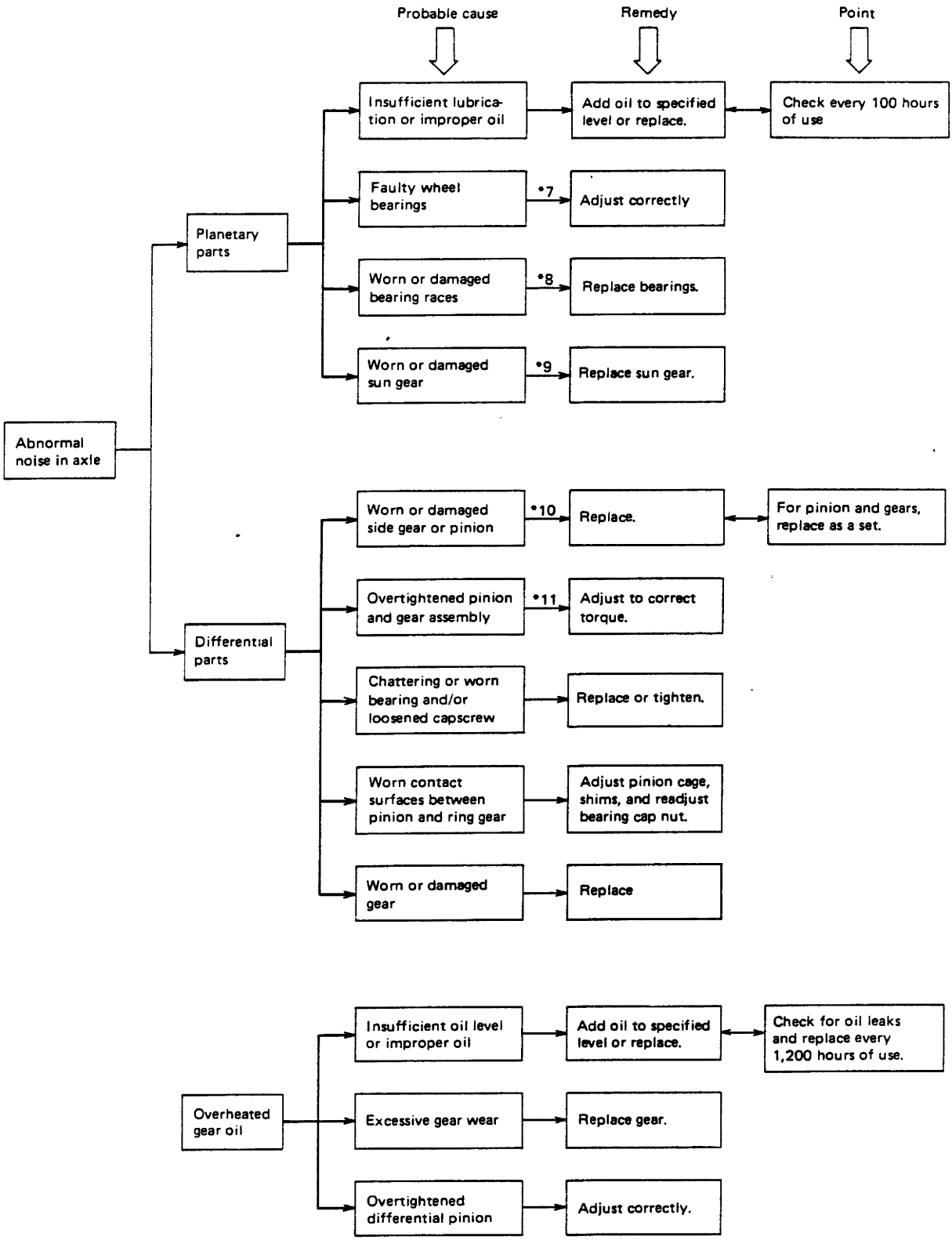


Fig. 9-3 Inserting Retainer

(4) If the outer bearing has been replaced, press cup into the wheel hub. If bearing (7) has been removed, press it into the hub.

(5) Install the disk on wheel hub (5), and tighten capscrews alternately on the disk to specified torque 25.5 to 31.6 kg.m. Numbers in Fig. 9-4 show an example of the order for tightening capscrews.

Explanation of " * No. " on next page.



For disk brake parts, refer to the disk brakes shop manual.

1.5 BALLAST VOLUME BY TIRE SIZE

Tables 1-1 and 1-2 indicate calcium chloride requirements.

Table 1-1 Standard Tires – When Filled to 75%

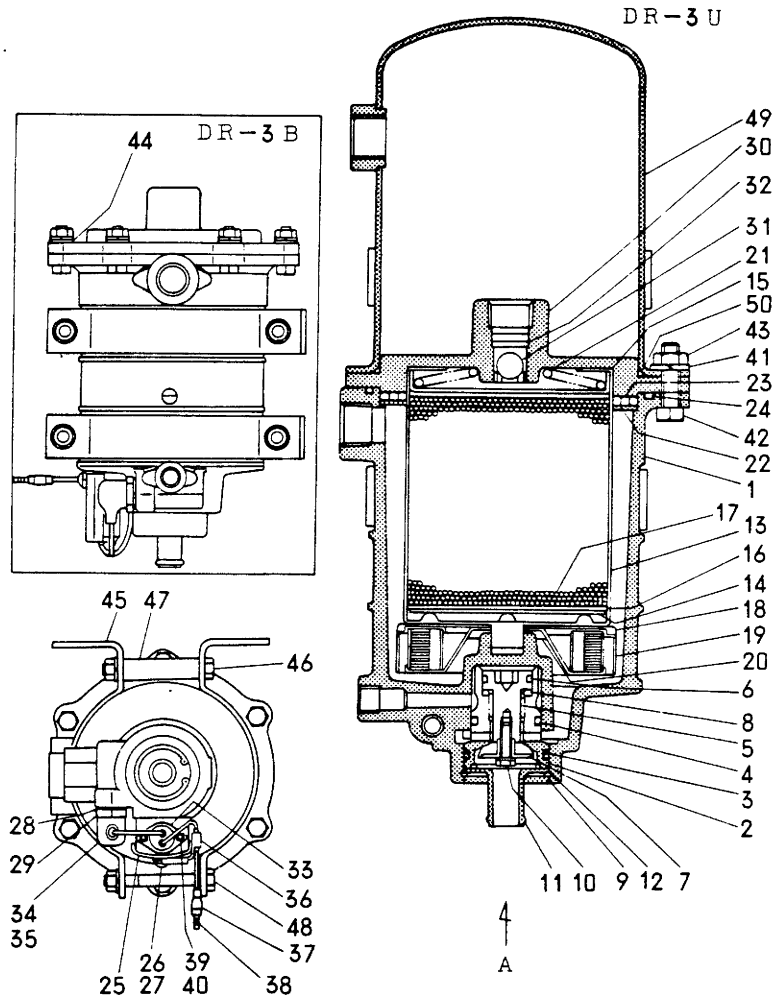
Tire Size	Liquid Volume (ℓ)	Aqueous Solution of Calcium Chloride (CaCl): 0.42kg of CaCl per liter of water Specific Gravity : 1.2 Freezing Point : -26°C			Aqueous Solution of Calcium Chloride (CaCl): 0.6kg of CaCl per liter of water Specific Gravity : 1.3 Freezing Point : -47°C		
		Water Volume (ℓ)	CaCl (kg)	Total Weight (kg)	Water Volume (ℓ)	CaCl (kg)	Total Weight (kg)
14.00–24/25	181	155	65	220	147	87	234
16.00–24/25	255	219	92	311	208	124	332
18.00–24/25	361	310	130	440	291	175	466
24.00–25	645	552	232	784	522	313	835

Table 1-2 Wide-base Tires – When Filled to 75%

15.5–25	175	178	64	242	–	–	–
16.9–24	204	151	63	214	140	85	225
17.5–25	227	195	82	277	181	110	291
20.5–25	339	291	122	413	272	164	436
23.5–25	446	382	161	543	361	217	578
29.5–29	847	726	305	1031	684	411	1095

1. CONSTRUCTION AND FUNCTION

1.1 COMPONENT LOCATION



VIEW FROM A

1. BODY
2. VALVE BODY
3. O-RING
4. O-RING
5. PISTON
6. O-RING
7. CAP
8. SPRING
9. WASHER
10. CAPSCREW
11. COVER
12. RING
13. CASE
14. PLATE (1)
15. PLATE (2)
16. FILTER
17. DESICCANT
18. GASKET
19. FILTER
20. RING
21. SPRING
22. GUIDE
23. SEAL RING
24. O-RING
25. PROTECTOR
26. WASHER
27. SCREW
28. GASKET
29. HEATER
30. COVER
31. CHECK VALVE
32. PLATE
33. THERMOSTAT
34. BOOT
35. TERMINAL
36. PLATE
37. COVER
38. TERMINAL
39. WASHER
40. SCREW
41. WASHER
42. CAPSCREW
43. NUT
44. WASHER (DR-3B)
45. BRACKET
46. CAPSCREW
47. SPACER
48. CAPSCREW
49. CHAMBER (DR-3U)
50. O-RING (DR-3U)

Fig. 1-1 Component Location

4. MAINTENANCE AND INSPECTION

4.1 QUARTERLY INSPECTION ITEMS

(1) Open the tank drain valve and check for moisture; confirm that the DR-3 functions normally.
(There may be some condensation when the temperature around the tank drops 16°C or more.)

(2) Check the discharge from the exhaust port of the DR-3 carefully; if an abnormal amount of oil is leaking out, check the compressor and take suitable measures.

(3) When a small amount of discharge comes out under normal use, disassemble the DR-3 main body to see if the desiccant has become contaminated by impure matter; if 1/5 or more is contaminated, replace with new. The desiccant loses its capacity to absorb water if soaked with oil, etc.

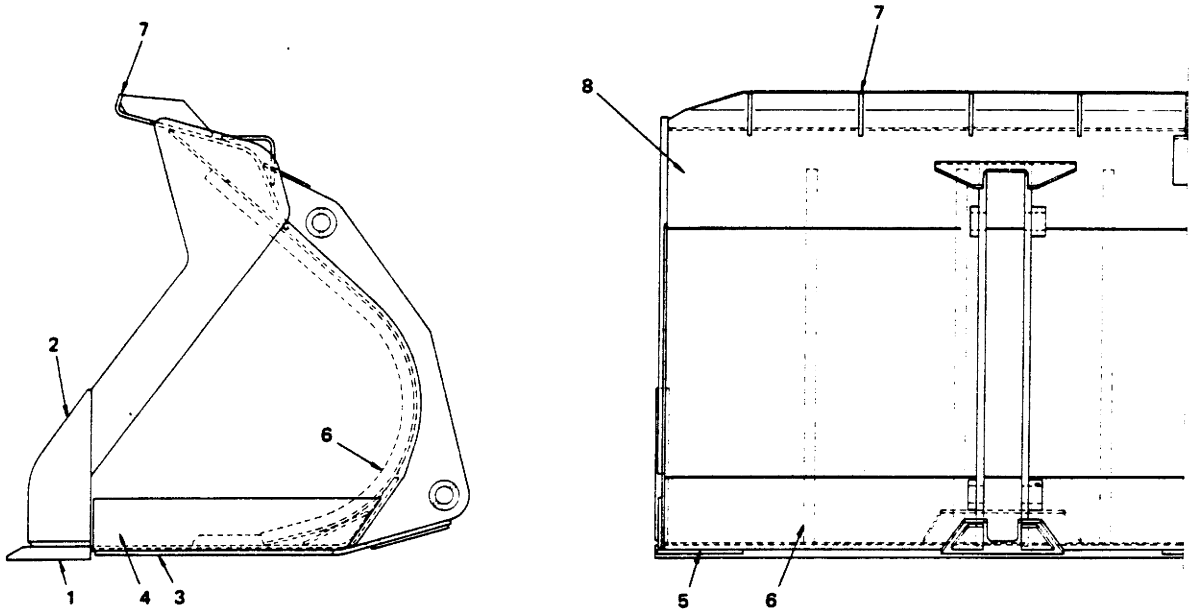
4.2 ANNUAL INSPECTION ITEMS

(1) Disassemble the DR-3 main body and replace the desiccant, oil filter, filter and all rubber parts.

(2) Check all piping and wiring for abnormality.

1. TERMINOLOGY OF BUCKET

Terms used in this manual are illustrated in Figure 1-1.



1. CUTTING EDGE
2. SIDE EDGE
3. BOTTOM PLATE
4. SIDE PLATE
5. WEAR PLATE (SKID)
6. RIB
7. SPILL GUARD
8. BUCKET MAIN BODY

Figure 1-1. Terminology of Bucket

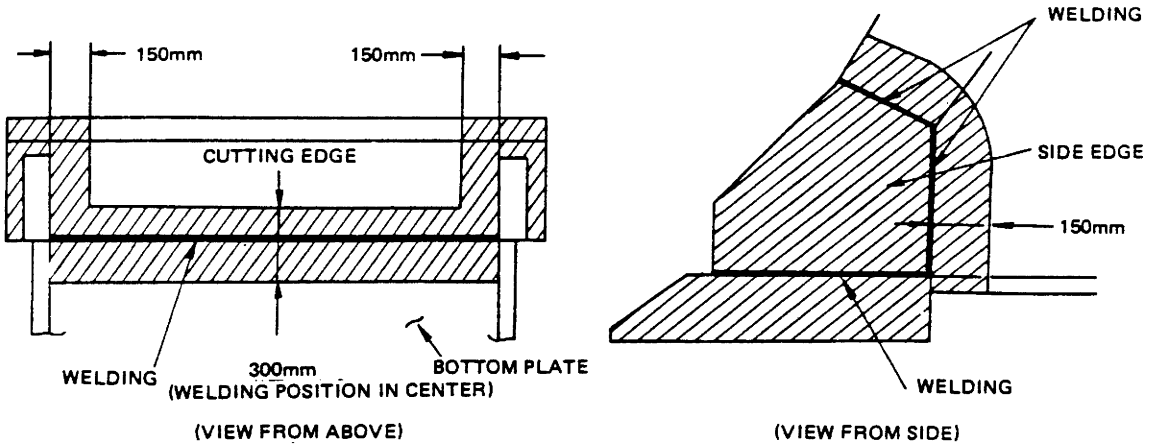


Figure 2-35. Preheat Area (LK1500)

CAUTION

After welding, inspect for defects. Concerning the inspection, refer to 6. Inspection.

6. INSPECTION

After removing the weld spatter at the end of work, inspect for cracks undercut and other defects.

Inspect visually, or with a magnaflux (this is most desirable), or color check.

If a defect is discovered, whether large or small, repair carefully in conformity with the instruction herein, because even a smallest defect may lead to a major trouble.