SHOP MANUAL

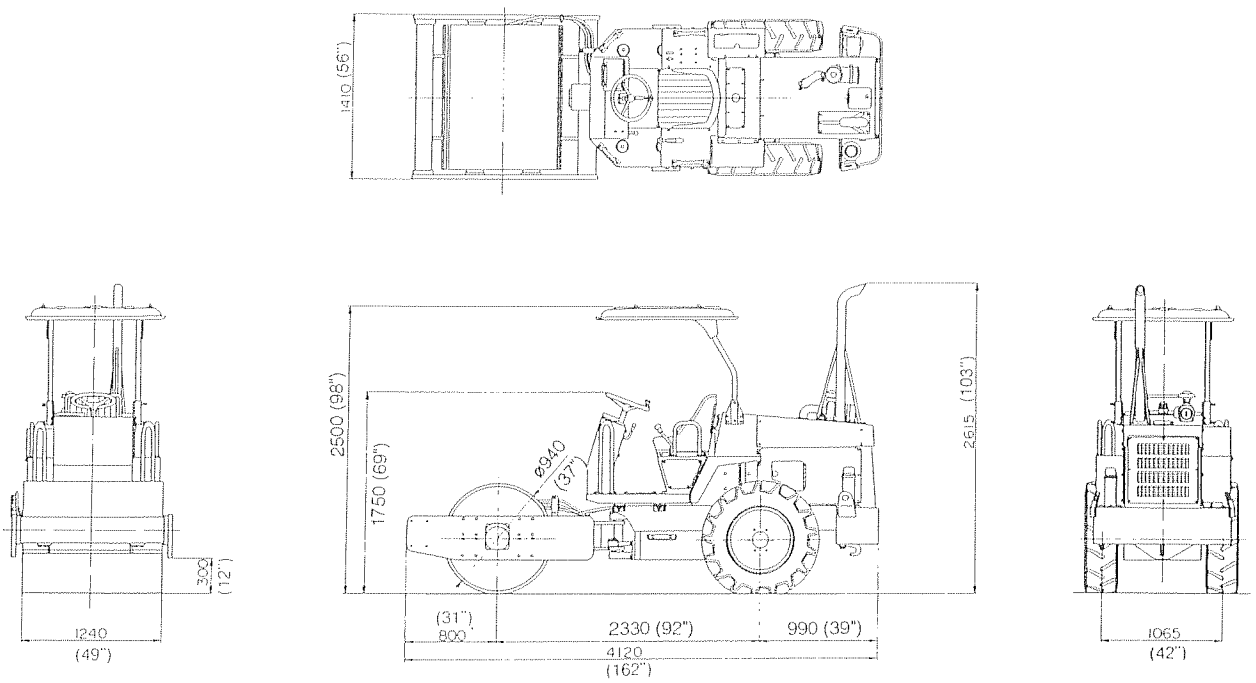
MODEL SV200 SERIES
VIBRATING ROLLER

SAKAI®

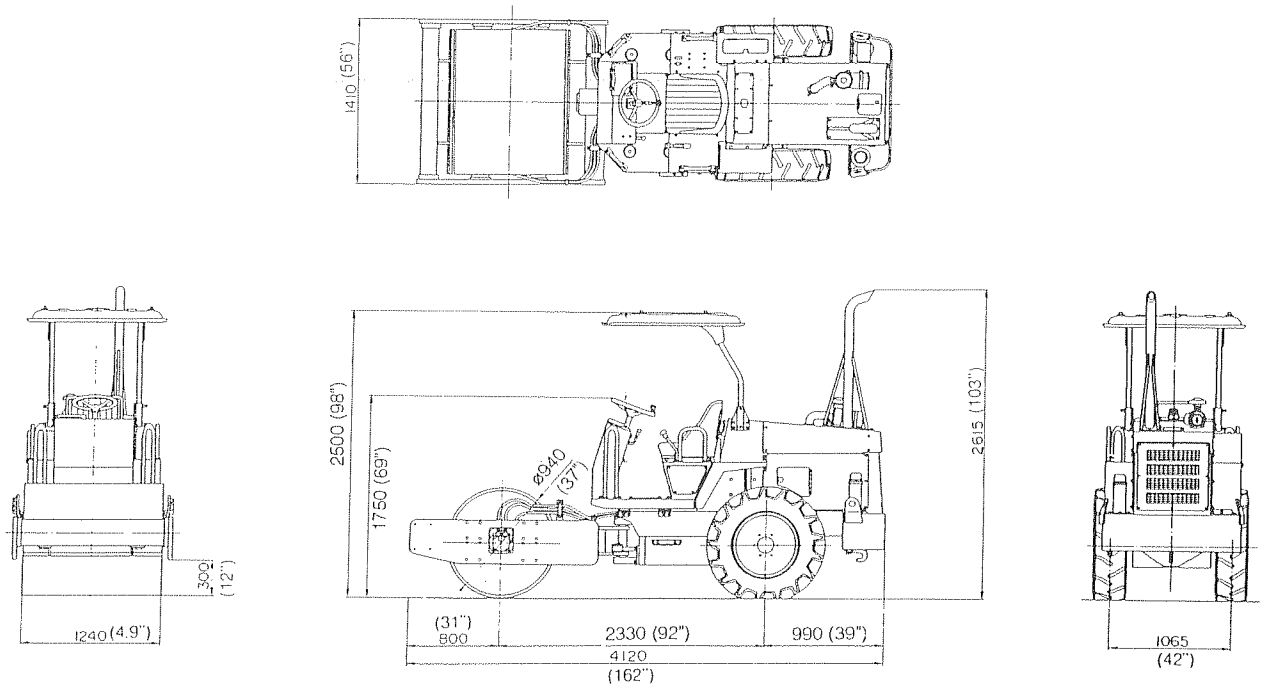
CONTENTS

DIMENSIONS

Model SV200



Model SV200D



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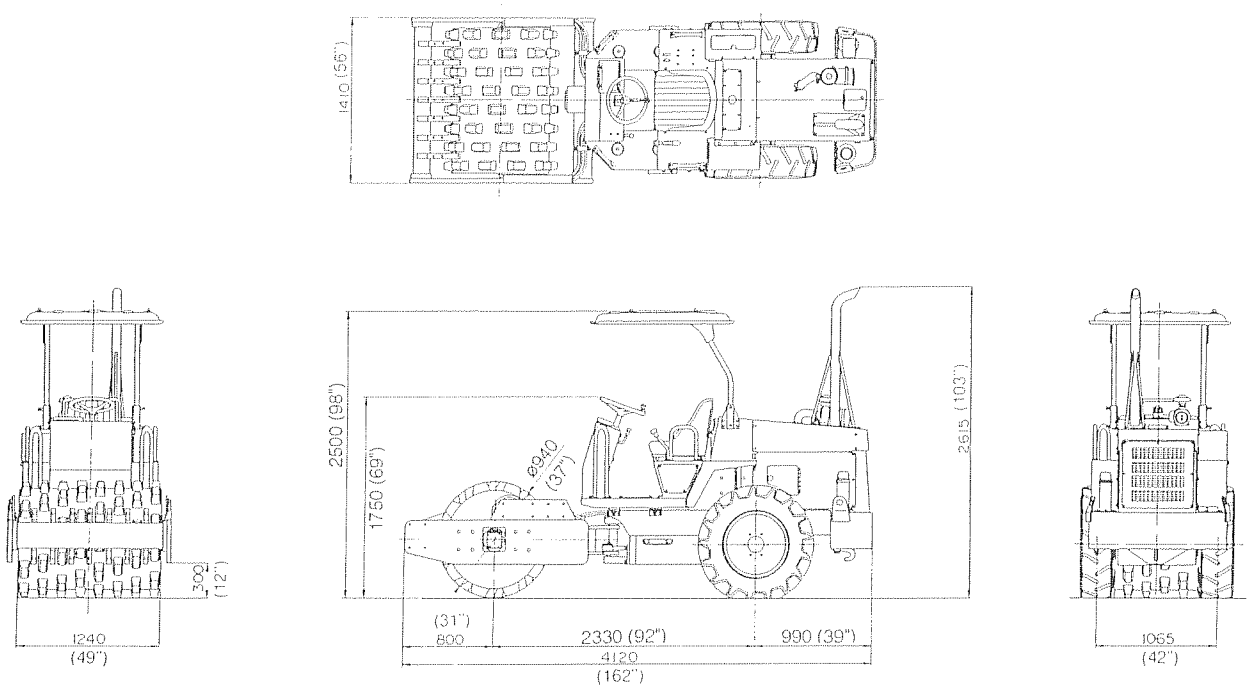
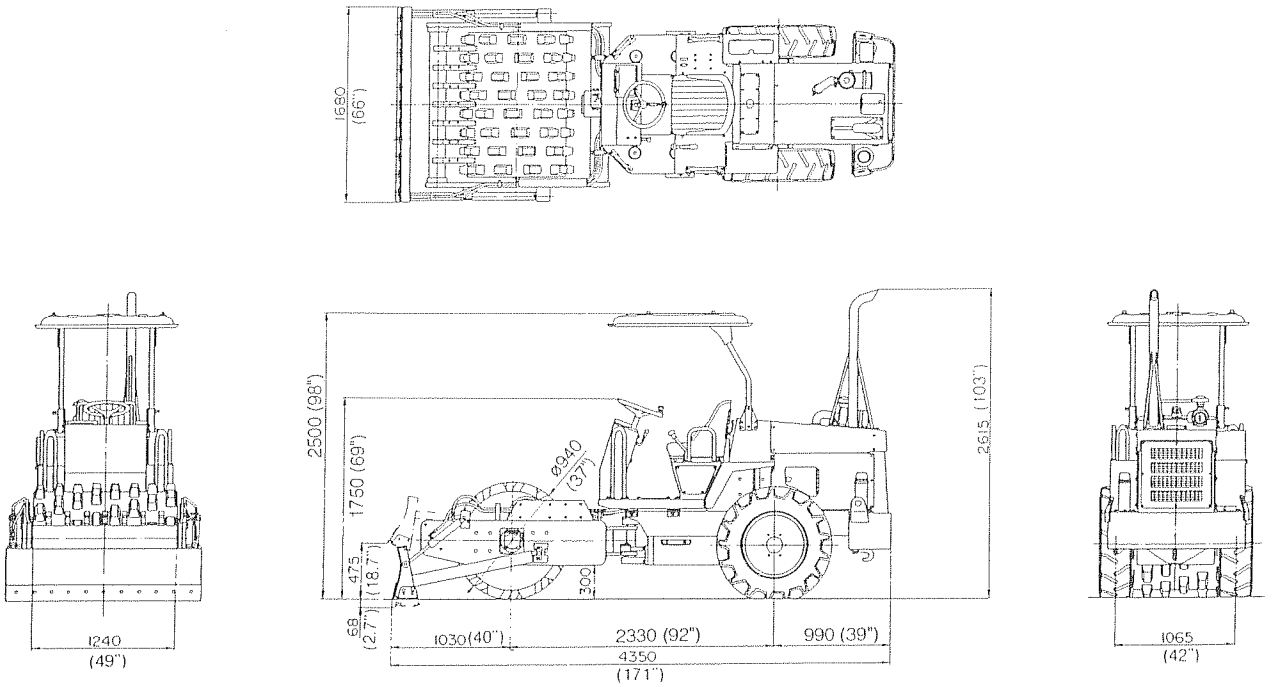


Model SV200TB



SPECIFICATIONS

Model	SV200	SV200D	SV200T	SV200TB
Weight				
Gross	4,050 kg (8,930 lbs)	4,050 kg (8,930 lbs)	4,250 kg (9,370 lbs)	4,450 kg (9,810 lbs)
Dimensions				
Overall length	4,120 mm (162")	4,120 mm (162")	4,120 mm (162")	4,350 mm (171")
Overall width	1,410 mm (56")	1,410 mm (56")	1,410mm (56")	1,680 mm (66")
Overall height	2,615 mm (103")	2,615 mm (103")	2,615 mm (103")	2,615 mm (103")
Wheelbase	2,330 mm (92")	2,330 mm (92")	2,330 mm (92")	2,330 mm (92")
Performance				
Travel speed (Forward & Reverse)	0 ~ 12 km/h (0 ~ 7.5 mile/h)	0 ~ 8.1 km/h (0 ~ 5 mile/h)	0 ~ 7.1 km/h (0 ~ 4.4 mile/h)	0 ~ 7.1 km/h (0 ~ 4.4 mile/h)
Vibrating power				
Frequency	1,800 vpm	1,800 vpm	1,800 vpm	1,800 vpm
Centrifugal force	5,200 kg (11,460 lbs)	5,200 kg (11,460 lbs)	6,500 kg (14,330 lbs)	6,500 kg (14,300 lbs)
Rolling width	1,240 mm (49")	1,240 mm (49")	1,240 mm (49")	1,240 mm (49")
Engine				
Model	ISUZU "4JB1" Diesel engine			
Displacement	2,771 cc (169 cu.in)			
Rated output	62 PS (61 HP)/2,500 rpm			

ENGINE

Specifications

Item			Specification	Limit for use	Remarks
Model			4JB1		ISUZU
Type			4-cycle, water-cooled, overhead valve, in-line direct injection		
Displacement		cc (cu.in)	2,771 (169)		
Cylinder Number – bore x stroke		mm (in)	4 x 93 x 102 (4 x 3.66 x 4.02)		
Rated output		PS (HP)/rpm	62 (61)/2,500		
Max. torque		kgf-m (lbs-ft)	17.5 (127)		
Min. revolution under no load		rpm	650 – 1,350		
Firing sequence			1-3-4-2		
Firing injection timing		deg.	17		Before upper dead point
Injection starting pressure		kgf/cm² (psi)	185 (2,640)		
Fuel consumption		g/PSh (lbs/PSh)	175 (0.386)		
Valve clearance	Intake	mm (in)	0.4 (0.016)		With cold engine
	Exhaust	mm (in)	0.4 (0.016)		
Compression		kgf/cm² (psi)	31 (441)		At 200 rpm
Temperature at which thermostat valve begins to pen		deg. centigrade	82		
Valve lift (full open)		mm (in)	8 (0.31)		At 90°C
Starter		V-kW	12-2.2		
Alternator		V-A	12-35		
Fan belt deflection		mm (in)	8 ~ 12 (0.31 ~ 0.47)		At a push of 10 kg (22 lbs)

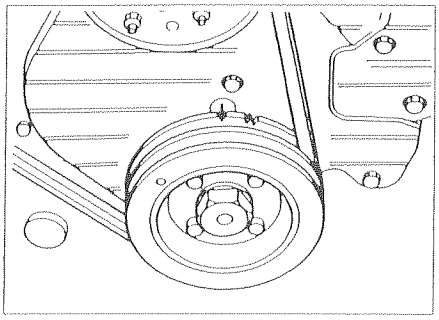
Tightening torque of major bolts

Unit: kg-m (ft-lb)

Item		Tightening torque		Remarks
Cylinder head bolt		1st step	2nd step	
	New	4 (28)	8.7 (63)	Apply a coat of engine oil
	Reused	8.5 (61)	10.5 (76)	Apply a coat of engine oil
Crankshaft front bolt		19.0 (136)		Apply a coat of molybdenum disulfide grease
Flywheel mounting bolt		12.0 (86)		
Crankshaft bearing cap bolt		17.0 (122)		Apply a coat of engine oil
Connecting rod cap bolt		8.5 (61)		Apply a coat of engine oil
Cam gear bolt		11.0 (79)		Apply a coat of engine oil
Rocker arm shaft bracket		5.5 (39)		

Valve Clearance Adjustment

Valve clearance must be adjusted every 1200 operation hours, or whenever valve rocker runs noisy abnormally, or engine malfunctions with fuel system working properly.



Adjustment Procedures

Turn crankshaft in engine rotative direction to bring piston in either No. 1 or No. 4 cylinder into Top Dead Center (TDC) on compression stroke by aligning TDC line on crankshaft pulley with pointer.

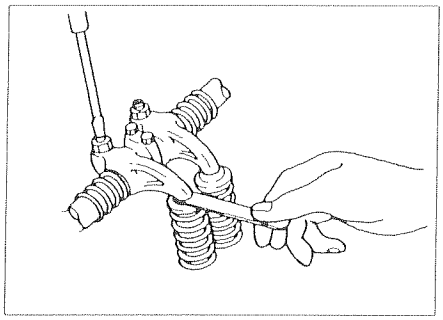
Hand-feel looseness of intake and exhaust valve push rods on No. 1 cylinder. When both push rods have a play, it indicates that piston in No. 1 cylinder is at TDC on compression stroke.

When push rods have no play and those ones on No. 4 have a play, it indicates that piston in No. 4 cylinder is at TDC on compression stroke.

Standard valve clearance; (cold)

Intake and exhaust valve	0.40 mm (0.016 in)

	Front							Rear
Cylinder No.	1		2		3		4	
Valve arrangement	I	E	I	E	I	E	I	E
Piston in No. 1 cylinder is at TDC on compression stroke	○	○	○			○		
Piston in No. 4 cylinder is at TDC on compression stroke				◎	◎		◎	◎

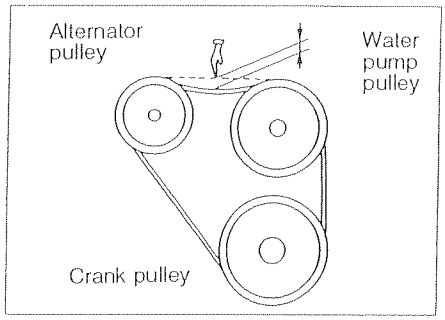


Fan Belt

Check fan belt for tension and any abnormalities.

Correctly adjusted belt will sag 8 to 12 mm (0.31 to 0.47 in) with a thumb push (about 10 kg) at midway between water pump pulley and alternator pulley.

A too tight belt will result an alternator failure. Contrary, a loose belt will cause a belt slippage leading to belt damage, also causing a noisy operation.



Tightening torque of bolt

With spring washer Unit in kgf-m (ft.lb)

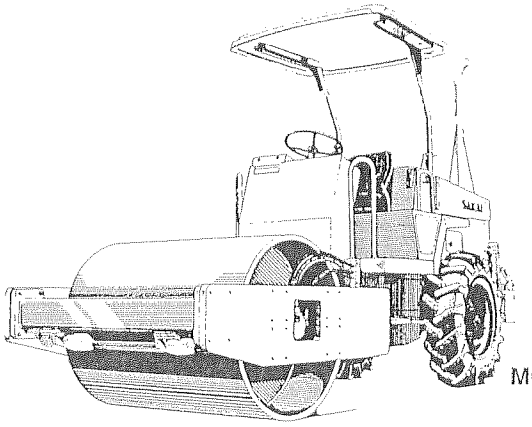
Classification		4T		7T		9T		11T	
Tensile strength		30 kgf/mm²		55 kgf/mm²		70 kgf/mm²		99 kgf/mm²	
		min.	max.	min.	max.	min.	max.	min.	max.
	M 8 x 1.0	1.0 (7.2)	1.2 (8.7)	1.8 (13.0)	2.3 (16.6)	2.5 (18.1)	3.0 (21.7)	3.4 (24.6)	4.2 (30.4)
	M10 x 1.25	2.1 (15.2)	2.6 (18.8)	3.8 (27.5)	4.6 (33.3)	4.7 (34)	5.8 (42)	6.8 (49.2)	8.2 (59.3)
	M12 x 1.25	3.7 (26.8)	4.5 (32.5)	6.8 (49.2)	8.2 (59.3)	8.6 (62.2)	10.6 (76.6)	12.2 (88.2)	15.0 (108)
	M14 x 1.5	5.8 (42)	7.1 (51.4)	10.6 (76.6)	13.0 (94)	13.5 (97.6)	16.6 (120)	19.1 (138)	23.4 (169)
	M16 x 1.5	8.8 (63.6)	10.7 (77.4)	16.1 (116)	19.6 (142)	20.5 (148)	25.0 (181)	28.9 (209)	25.3 (183)
	M18 x 1.5	12.7 (91.9)	15.6 (113)	23.4 (169)	28.5 (206)	29.7 (214)	36.2 (262)	41.9 (303)	51.2 (370)
	M20 x 1.5	17.7 (128)	21.7 (157)	32.5 (235)	39.7 (287)	41.4 (299)	50.5 (365)	58.5 (423)	71.4 (516)
	M22 x 1.5	23.7 (171)	29.0 (210)	43.4 (314)	53.0 (383)	55.2 (399)	67.5 (488)	78.2 (565)	95.5 (691)
	M24 x 2.0	30.0 (217)	36.7 (265)	54.9 (397)	67.1 (485)	69.9 (506)	85.4 (618)	99.0 (716)	121 (878)
	M27 x 2.0	43.9 (318)	53.7 (388)	80.6 (583)	98.5 (712)	103 (742)	125 (906)	145 (1050)	177 (1280)
	M30 x 2.0	61.3 (443)	74.9 (542)	112 (813)	137 (994)	143 (1030)	175 (1260)	202 (1460)	247 (1790)
	M 5 x 0.8	0.21 (1.5)	0.26 (1.9)	0.4 (2.9)	0.6 (4.3)	0.6 (4.3)	0.7 (5.1)	0.8 (5.8)	1.0 (7.2)
	M 6 x 1.0	0.4 (2.9)	0.6 (4.3)	0.7 (5.0)	0.9 (6.5)	1.0 (7.2)	1.1 (.80)	1.4 (10.1)	1.7 (12.3)
	M 8 x 1.25	1.0 (7.2)	1.2 (8.7)	1.8 (13.0)	2.2 (15.9)	2.2 (15.9)	2.7 (19.5)	3.2 (23.1)	3.8 (27.5)
	M12 x 1.5	1.9 (13.7)	2.4 (17.3)	3.5 (25.3)	4.3 (31)	4.6 (33)	5.5 (40)	6.4 (46)	7.8 (56)
	M12 x 1.75	3.4 (24.6)	4.2 (30.4)	6.2 (44.8)	7.6 (55.0)	7.8 (56.4)	9.6 (69.4)	11.2 (81.0)	13.5 (97.6)
	M14 x 2.0	5.4 (39.0)	6.5 (47.0)	9.8 (70.9)	12.0 (86.8)	12.5 (90.4)	15.2 (110)	17.9 (129)	21.9 (158)
	M16 x 2.0	8.2 (59.3)	9.9 (71.6)	14.9 (108)	18.2 (132)	19.0 (137)	23.2 (168)	26.9 (195)	32.8 (237)
	M18 x 2.5	11.2 (81.0)	13.8 (99.8)	20.6 (149)	25.2 (182)	26.2 (190)	31.9 (231)	37.0 (268)	45.1 (326)
	M20 x 2.5	15.8 (114)	19.4 (140)	29.0 (210)	35.4 (256)	37.0 (268)	45.1 (326)	52.2 (378)	63.9 (462)
	M22 x 2.5	21.4 (155)	26.2 (190)	39.3 (284)	48.0 (347)	50.0 (362)	61.0 (441)	70.6 (511)	86.3 (624)
	M24 x 3.0	27.3 (197)	33.3 (241)	34.0 (246)	61.0 (441)	63.7 (461)	77.8 (563)	90.0 (651)	110 (796)
	M27 x 3.0	40.5 (293)	49.4 (357)	74.2 (537)	90.6 (655)	94.5 (684)	115 (835)	134 (963)	163 (1180)
	M30 x 3.5	54.9 (397)	67.0 (485)	100 (728)	123 (890)	228 (1650)	156 (1130)	181 (1310)	221 (1598)

Tightening torque of bolt

Without spring washer Unit in kgf-m (ft.lb)

Classification		4T		7T		9T		11T	
Tensile strength		30 kgf/mm²		55 kgf/mm²		70 kgf/mm²		99 kgf/mm²	
		min.	max.	min.	max.	min.	max.	min.	max.
	M 8 x 1.0	1.2 (8.7)	1.6 (11.6)	2.2 (16.0)	2.7 (19.5)	2.9 (21.0)	3.5 (25.3)	4.0 (28.9)	5.0 (36.2)
	M10 x 1.25	2.5 (18.1)	3.0 (21.7)	4.5 (32.5)	5.4 (39.1)	5.6 (40.5)	6.9 49.9)	8.0 (67.9)	9.8 (70.9)
	M12 x 1.25	4.3 (31.1)	5.3 (38.3)	8.0 (57.9)	9.8 (70.9)	10.2 (73.8)	12.4 (89.7)	14.4 (104)	17.6 (127)
	M14 x 1.5	6.9 (49.9)	8.4 (60.8)	12.5 (90.4)	15.2 (110)	15.9 (115)	19.4 (140)	22.5 (163)	27.4 (198)
	M16 x 1.5	10.3 (74.5)	12.6 (91.1)	18.9 (137)	23.0 (166)	24.1 (174)	29.4 (213)	34.0 (246)	41.5 (300)
	M18 x 1.5	15.0 (108)	18.3 (132)	27.4 (198)	33.5 (242)	35.0 (253)	42.7 (309)	49.4 (357)	60.3 (436)
	M20 x 1.5	20.8 (150)	25.4 (184)	38.2 (276)	46.7 (338)	48.6 (352)	49.4 (357)	68.8 (498)	84.1 (608)
	M22 x 1.5	27.8 (201)	34,1 (247)	51.0 (369)	62.4 (451)	65.0 (470)	79.4 (574)	91.8 (664)	112 (812)
	M24 x 2.0	35.3 (255)	43.1 (312)	64.6 (467)	79.0 (571)	82.2 (595)	100 (723)	116 (841)	142 (1030)
	M27 x 2.0	51.7 (374)	63.2 (457)	94.7 (685)	116 (838)	120 (872)	147 (1070)	170 (1230)	208 (1510)
	M30 x 2.0	72.1 (521)	88.1 (637)	132 (956)	162 (1170)	168 (1220)	206 (1490)	238 (1720)	290 (2100)
	M 5 x 0.8	0.29 (2.1)	0.35 (2.5)	0.5 (3.6)	0.6 (4.3)	0.6 (4.3)	0.8 (5.8)	1.0 (7.2)	1.1 (7.9)
	M 6 x 1.0	0.5 (3.6)	0.6 (4.3)	0.9 (6.5)	1.0 (7.2)	1.1 (8.0)	1.4 (10.1)	1.6 (11.6)	1.9 (13.7)
	M 8 x 1.25	1.1 (8.0)	1.4 (10.1)	2.1 (15.1)	2.6 (18.8)	2.6 (18.8)	3.3 (23.9)	3.8 (27.5)	4.6 (33.3)
	M10 x 1.5	2.3 (16.6)	2.8 (20.2)	4.2 (30.4)	5.1 (26.9)	5.4 (39.1)	6.5 (47.0)	7.6 (55.0)	9.3 (67.3)
	M12 x 1.75	4.0 (28.9)	4.9 (35.4)	7.3 (52.8)	8.9 (64.3)	9.2 (66.5)	11.3 (81.7)	13.0 (94)	15.9 (115)
	M14 x 2.0	6.2 (44.8)	7.7 (55.7)	11.5 (83.2)	14.1 (102)	14.6 (106)	17.8 (129)	20.6 (149)	25.3 (183)
	M16 x 2.0	9.6 (69.4)	11.7 (84.6)	17.6 (127)	21.4 (155)	22.4 (162)	27.4 (198)	31.6 (229)	38.7 (280)
	M18 x 2.5	13.2 (95.5)	16.1 (116)	14.2 (103)	29.6 (214)	30.7 (222)	37.6 (272)	43.5 (315)	53.1 (384)
	M20 x 2.5	18.6 (135)	22.8 (165)	34.2 (247)	41.7 (302)	43.5 (315)	53.1 (384)	61.5 (445)	75.1 (543)
	M22 x 2.5	25.2 (182)	30.8 (222)	46.2 (334)	56.4 (408)	58.7 (424)	71.8 (519)	83.1 (600)	101 (730)
	M24 x 3.0	32.1 (232)	39.3 (284)	58.8 (425)	71.9 (520)	74.9 (542)	91.5 (662)	106 (766)	129 (936)
	M27 x 3.0	47.6 (344)	58.2 (421)	87.3 (631)	107 (771)	111 (804)	136 (982)	157 (1140)	192 (1390)
	M30 x 3.5	64.5 (467)	71.7 (519)	198 (1430)	145 (1050)	150 (1090)	184 (1330)	213 (1540)	260 (1880)

IDENTIFICATION NUMBERS

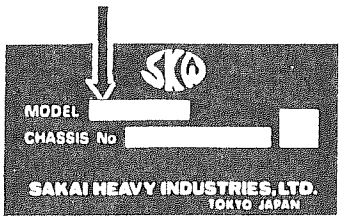


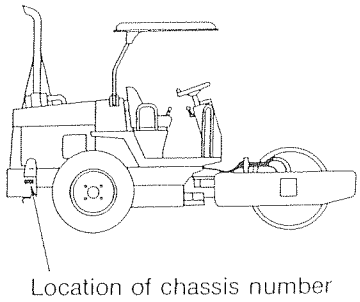
MODEL SV200D

Always safe operation!
Be sure to conduct periodic inspection and maintenance services!

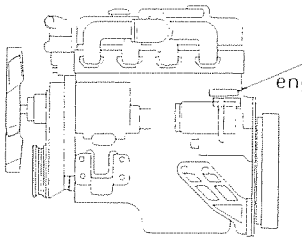
FOR ORDERING PARTS OR MAKING INQUIRIES

Quote the following:
(1) Model (2) Chassis number (3) Engine number





Location of chassis number



Location of engine number

⚠ Chassis number

Model SV200	⇨	VSV3-00000
Model SV200D	⇨	VSV3D-00000
Model SV200T	⇨	VSV3T-00000
Model SV200TB	⇨	VSV3T-00000

Chassis number

SERVICING PRECAUTIONS

Observe the following precautions to conduct proper maintenance.

Preliminary steps

(1) Wash vehicle beforehand in shop.
(2) Inspect each unit for proper function before disassembly and make sure of a faulty part and its cause. Refer to disassembling chart to remove units in proper order. Any unit should not be removed unless it needs repair or replacement.

Removal and disassembly

(1) Removed pipes, hoses and hydraulic devices must be sealed with tape at their openings to keep out dust.
(2) Make a matching mark on electric wires when they are disconnected.
(3) Inspect for presence of water and sediment in oil reservoirs. Do not reuse drained oil.
(4) Clean unit before proceeding to disassembly.

Assembly and installation

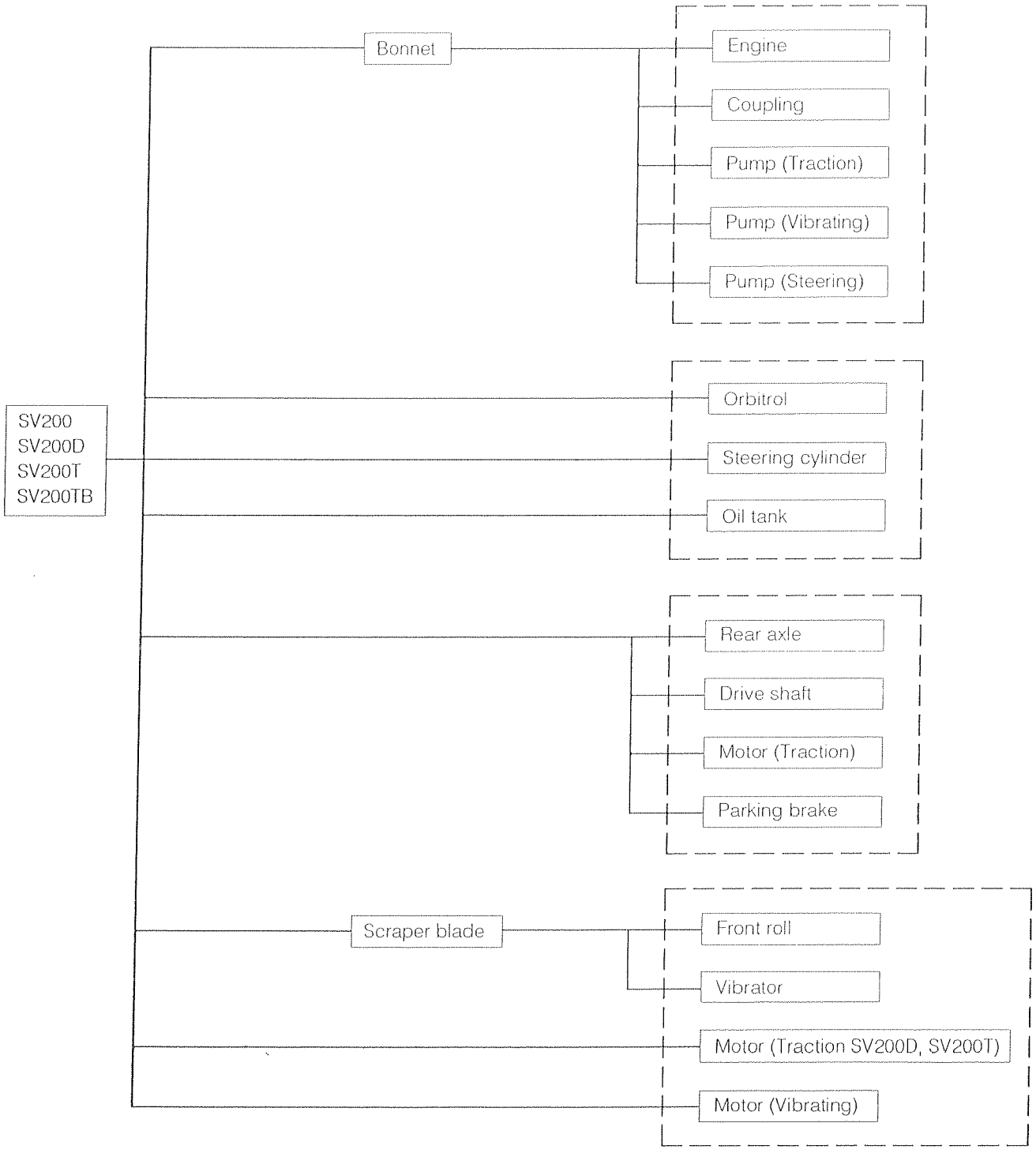
(1) Clean parts before assembly or installation.
(2) Apply grease or oil to the following parts when they are assembled.
    1. Mating surfaces of press-fitted parts.
    2. Oil seal lip and sealing surface.
    3. Bearing and fitting surface of bearing.
(3) Use liquid packing LG-1 (sealing compound) at the following:
    1. Bolts which are screwed in through holes of the oil-containing case.
    2. Bolts that secure cover to oil-containing case.
    3. Mating surface of cover and oil-containing case.
    4. Oil seal periphery.
(4) Make sure that bent end of lock plate is seated properly on a flat of nut or cap screw.
(5) Tighten bolts following torque values unless otherwise specified.

DISASSEMBLING CHART

Disassembling chart shows procedures for removal of main units mounted on the SV500 Series Vibrating Rollers.

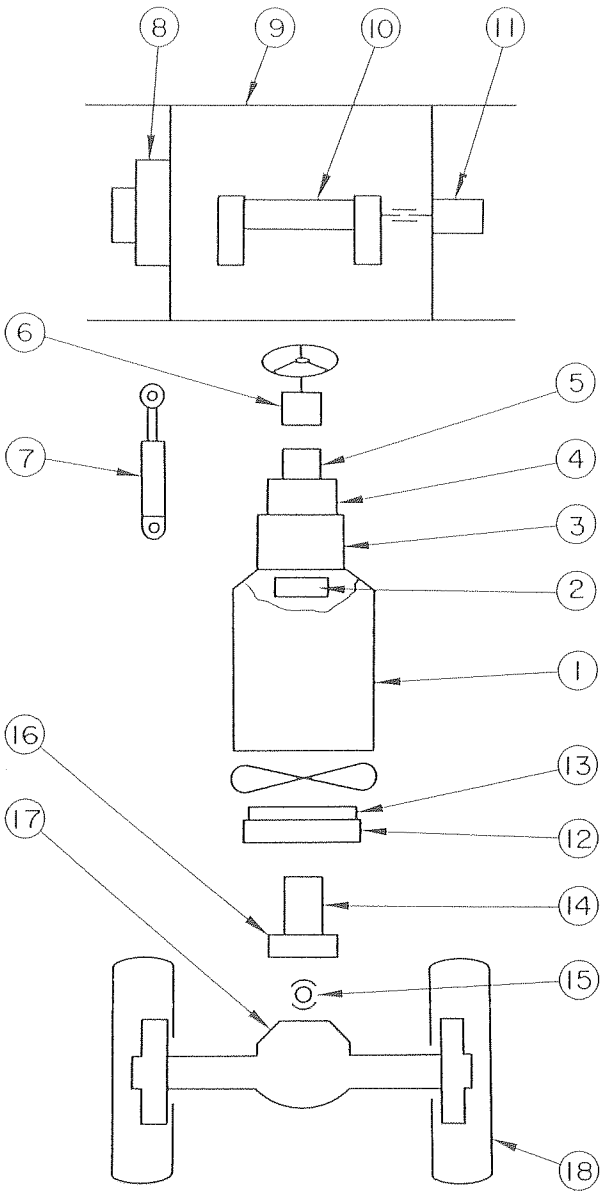
(1) Remove main units from the Machines in order as below:

(2) Units enclosed by dotted lines can be removed in a body.



LOCATION OF KEY UNITS

Drive train

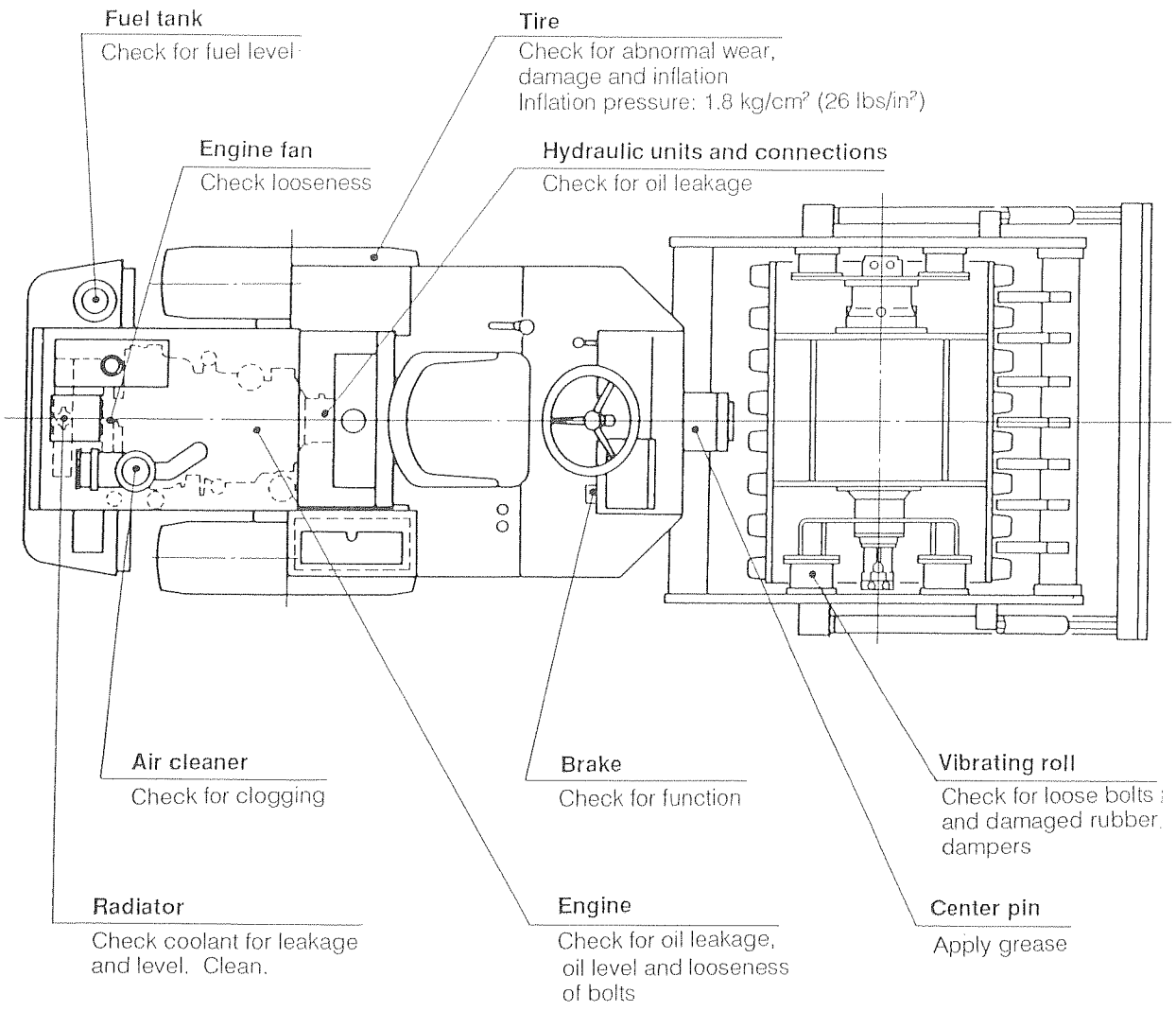


1. Engine
2. Coupling
3. Traction pump
4. Vibrator pump
5. Steering pump
   (Combined use for controls)
6. Steering control valve
   (Orbitrol)
7. Steering cylinder
8. Front roll drive motor
9. Front roll
10. Vibrator shaft
11. Vibrator drive motor
12. Radiator
13. Oil cooler
14. Rear wheel drive motor
15. Drive shaft
16. Brake
17. Differential
    (No-spin differential)
18. Tires

Power from engine (1) is conveyed through coupling (2) to hydraulic pumps (3), (4) and (5) that drive respective motors.

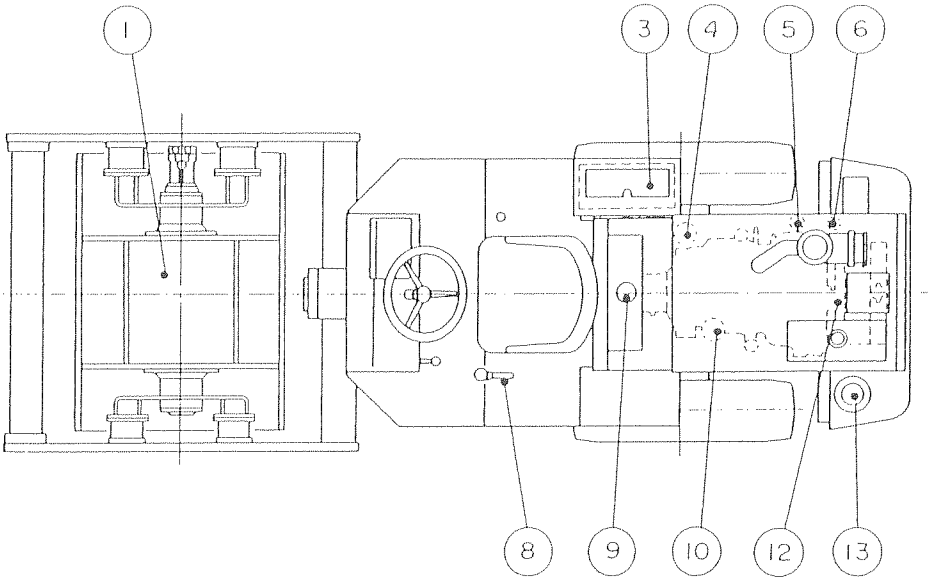
Walk-Around Checks

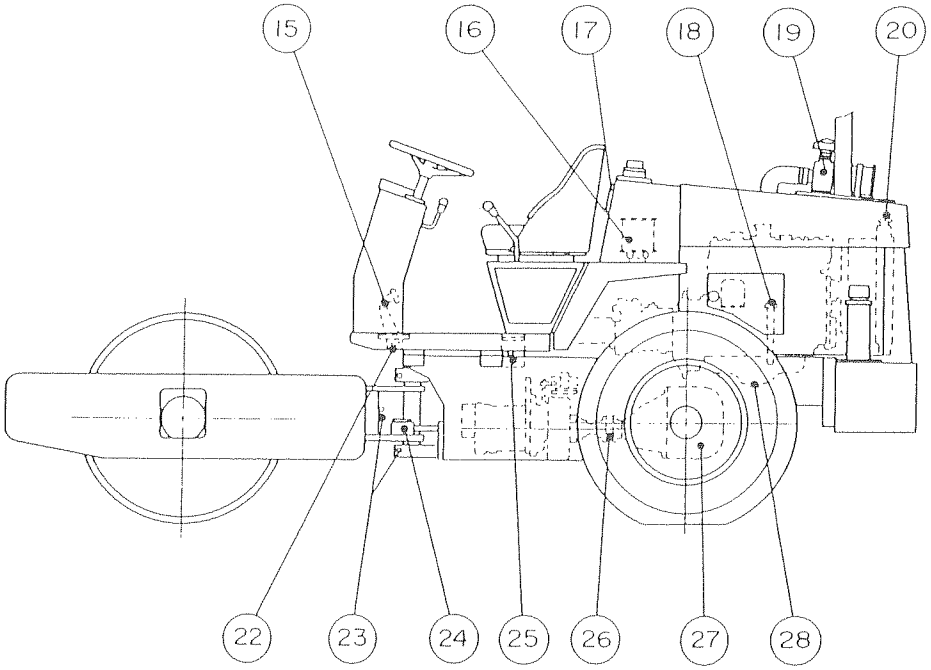
For safety and maximum service life of the Machine, a through walk-inspection should be made before starting.



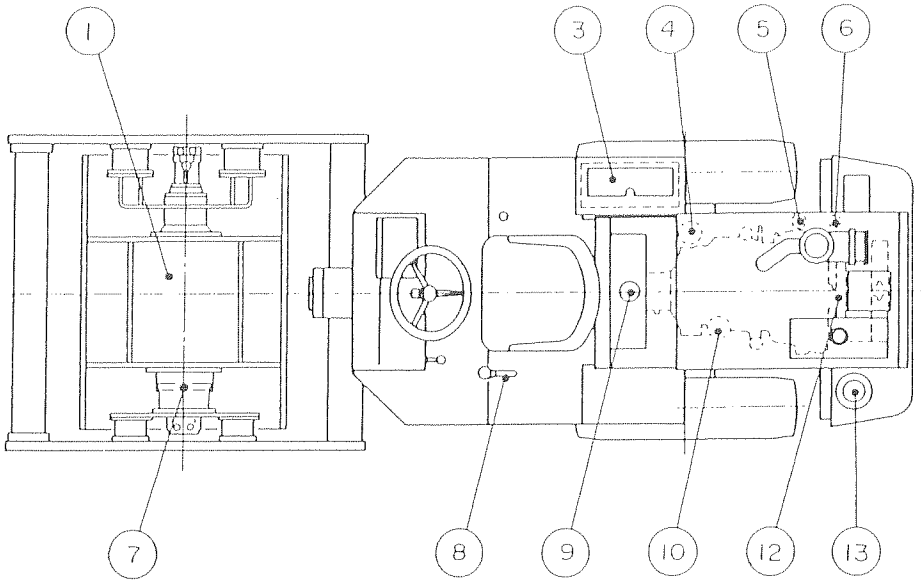
Portions to be Checked and Serviced at Regular Intervals

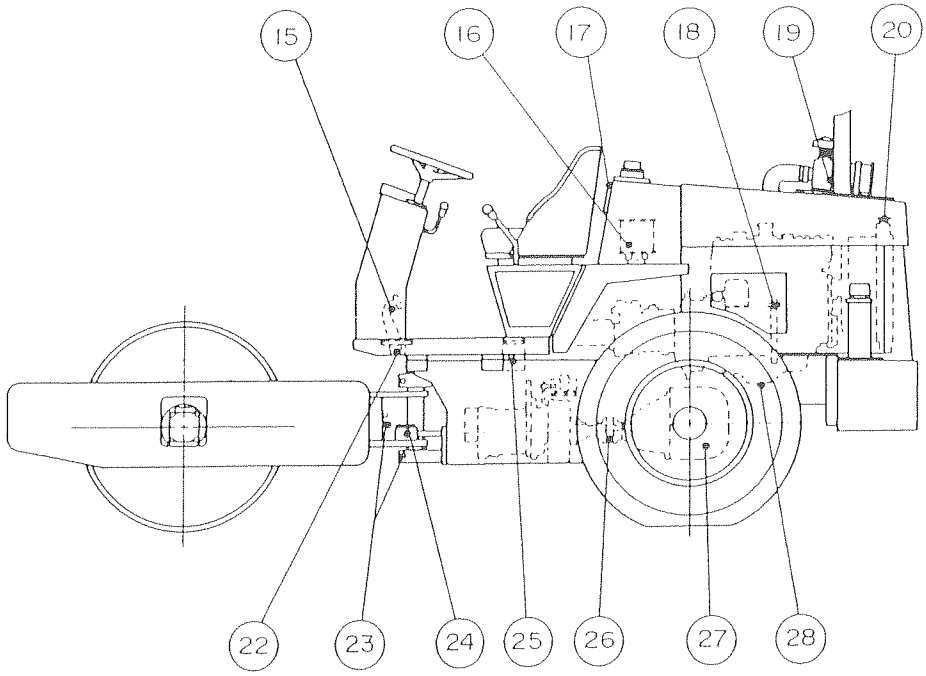
Model
SV200



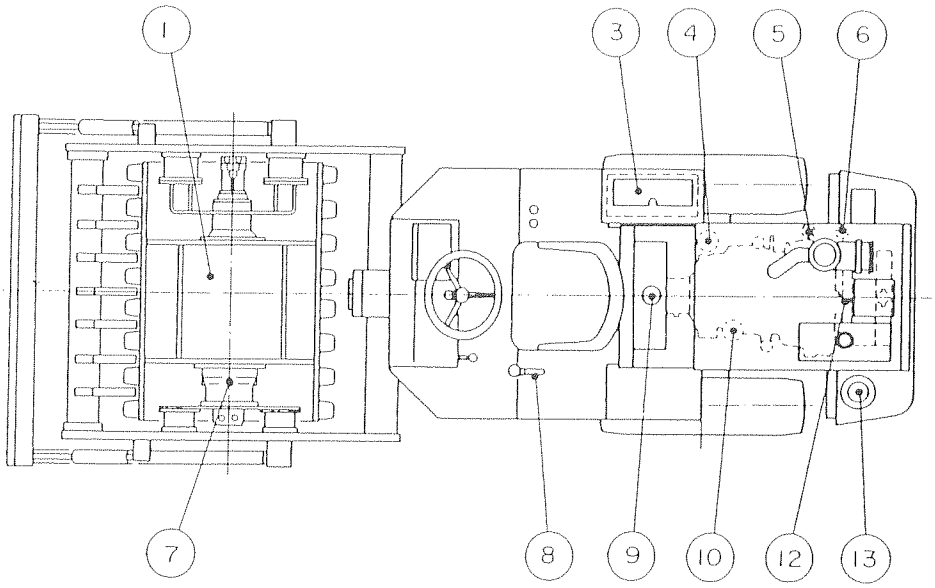


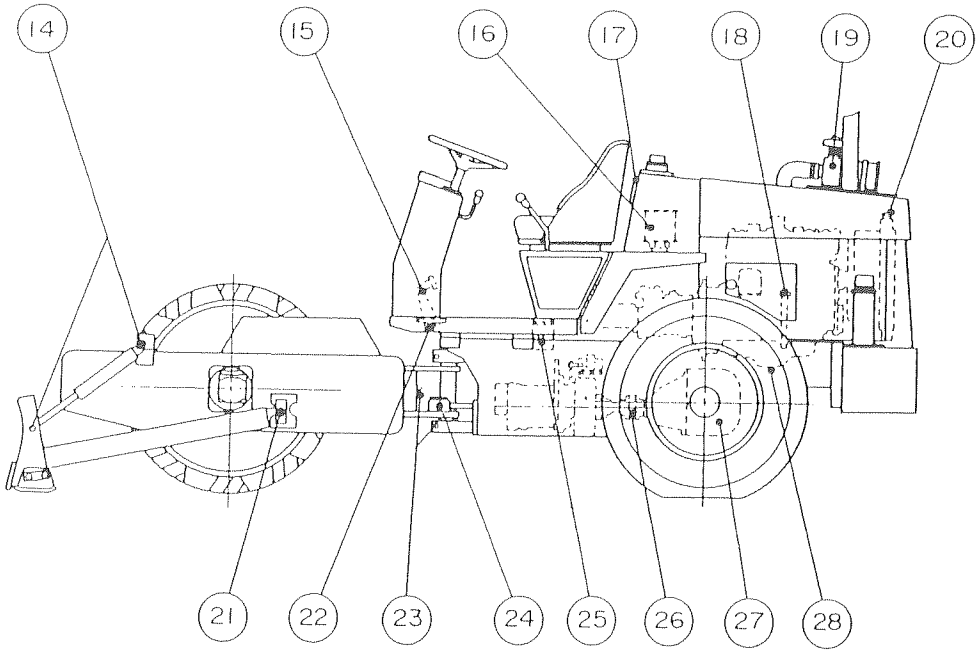
Model
SV200D
SV200T





Model
SV200TB





Servicing chart

Interval	Ref. No.	Item	Service	Lubricant	Q'ty
Every 10 service hours or daily	18	Engine oil pan	Check oil level, add as necessary	Engine oil	
	20	Radiator	Check coolant, add as necessary	Coolant	1
	23	Center pin and tilt pin bearings	Apply grease	Grease	4
Every 50 service hours	3	Battery	Check fluid level	Battery fluid	1
	6	Fuel sedimenter	Check and drain water and dirt		1
	12	Fan belt	Check and drain water as necessary		1
	** 14	Cylinder head pin and anchor pin	Apply grease	Grease	4
	15	Brake	Check function and adjust		1
	17	Hydraulic oil tank	Check oil level		1
	** 21	Push rod anchor pin	Apply grease	Grease	2
	22	Brake shaft bearings	Apply grease	Grease	2
	24	Cylinder head pin and anchor pin	Apply grease	Grease	4
	25	Brake links	Apply grease	Grease	4
	26	Drive shaft bearings	Apply grease	Grease	4
Every 250 service hours	1	Vibrator	Check oil level		1
	10	Engine oil filter	Replace filter cartridge		1
	28	Engine oil pan	Change oil	Engine oil	1
Every 500 service hours	4	Suction filter	Replace element		1
	5	Fuel filter	Replace element		1
	8	Control links	Check loose bolts, nuts and adjust rod		1
Every 1000 service hours	1	Vibrator	Change oil	Gear oil	1
	* 7	Gear case; wheel motor	Change oil	Gear oil	1
	9	Hydraulic oil tank	Change oil	Hydraulic oil	1
	16	Hydraulic oil Suction filter	Clean filter element		1
	27	Differential gear case	Change oil	Gear oil	1
When required	13	Fuel tank	Drain water and dirt	Diesel fuel	1
	19	Air cleaner	Clean element		

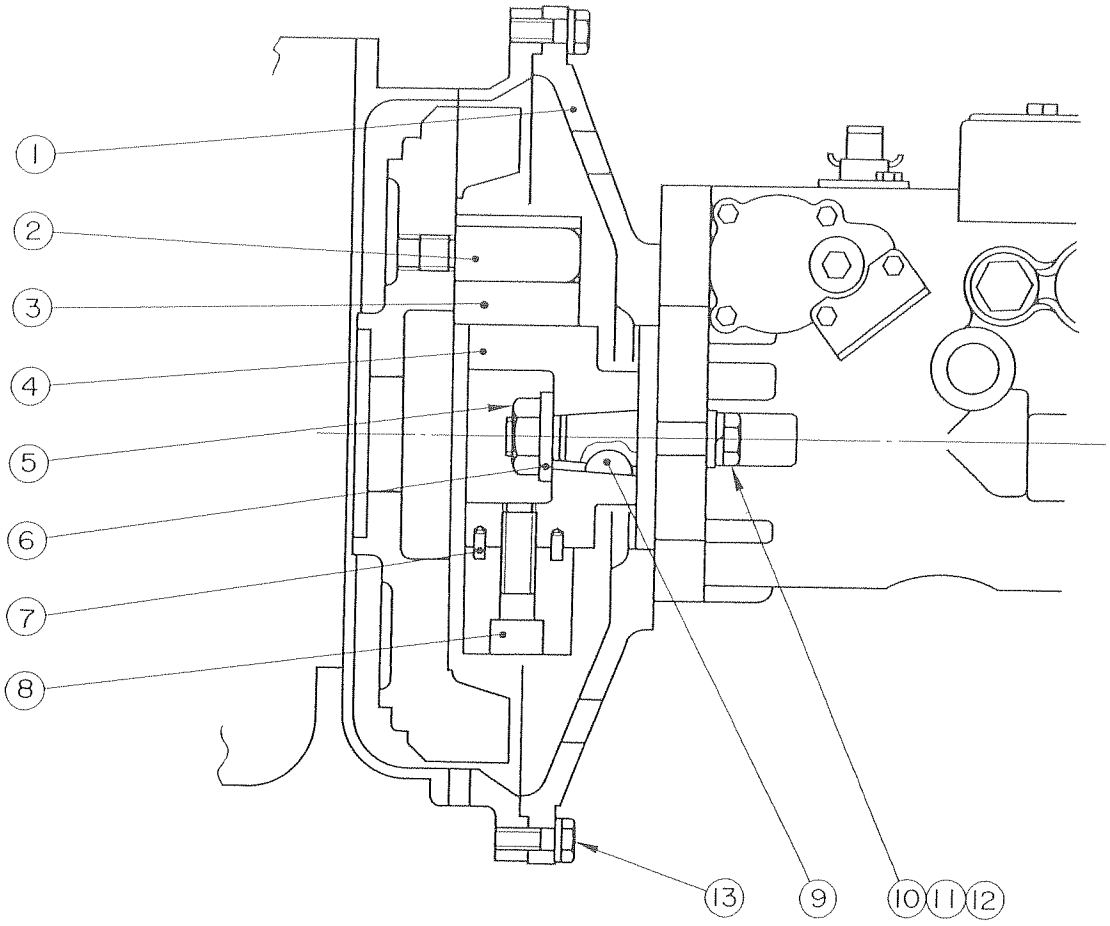
* For model SV200D, SV200T and SV200TB
** For model SV200TB only

MAINTENANCE INSTRUCTIONS

1. COUPLING

1.1 General

Power from engine is transmitted to pump through rubber coupling. Coupling is fixed to hub by Lock Tight sealant coated bolts. On hub are spring pins.



1. Cover
2. Bolt
3. Coupling
4. Hub
5. Nut
6. Washer
7. Spring pin
8. Bolt
9. Sunk key
10. Bolt
11. Spring washer
12. Washer
13. Bolt

Fig. 1

1.2 Trouble-shooting

Complaint	Cause	Remedy
Power not conveyed	Coupling damaged	Replace
	Coupling mounting bolts or spring pin broken	Replace bolts or spring pins
	Key damaged	Replace

1.3 Disassembly

(1) Raise pump assembly on a hoist. Remove mounting bolts (13) and pull off pump cover (1), hub (4) and coupling (3) as a unit from engine.

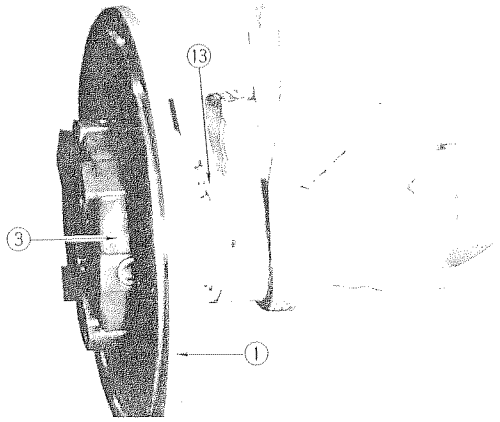


Fig. 2

(2) Remove bolts (8) and separate coupling (3) from hub (4).

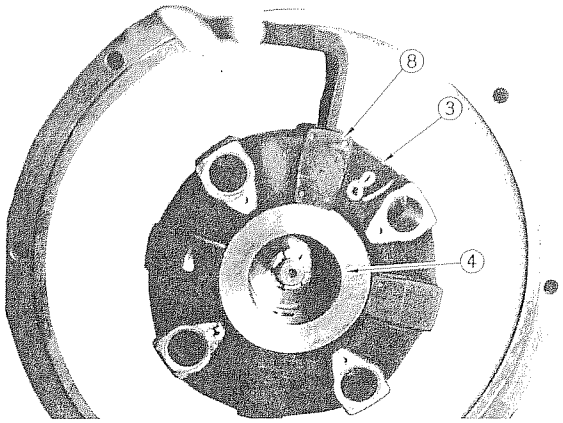


Fig. 3

(3) Remove nuts (5) to take off hub (4) from shaft. (use a puller)

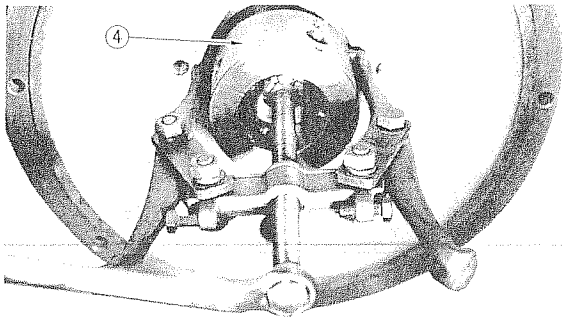


Fig. 4

(4) Remove bolts (10) and take cover (1) from pump.

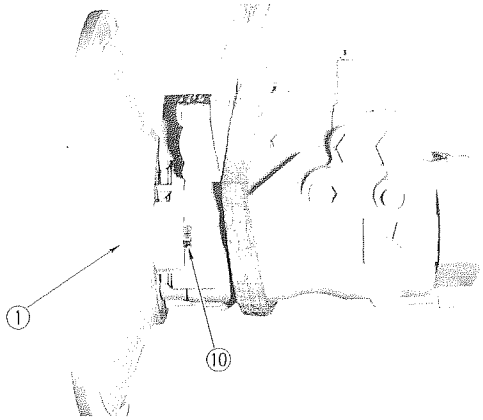


Fig. 5

(5) Take off stud bolts (2) from flywheel.

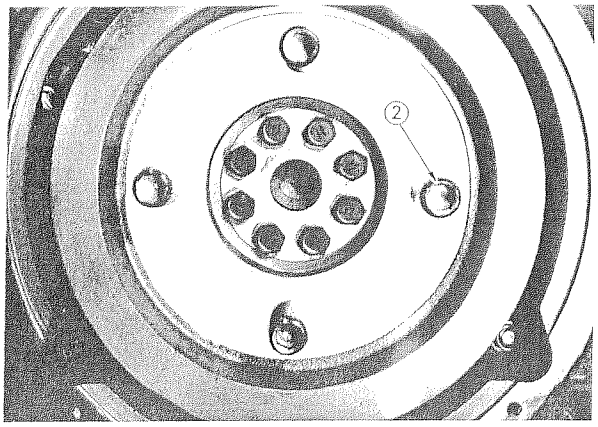


Fig. 6

1.4 Inspection

(1) Inspect rubber coupling and replace if found to be defective.
(2) Inspect hub fixing key and replace if abnormal such as stepped wear.

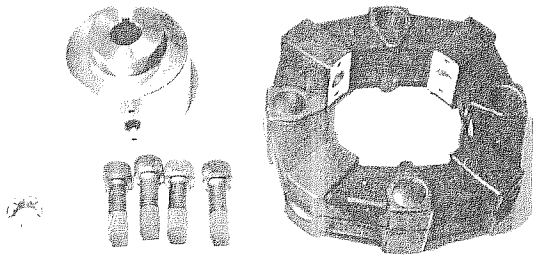


Fig. 7

1.5 Reassembly

Reverse disassembly procedure noting the following:
When reassembling, replace coupling mounting bolts with new ones.

Tightening torque

Unit: kgf-m (ft-lb)

Bolt (8)	25 (180)
Nut (5)	20 (145)
Bolt (13)	5 (36)
Bolt (10)	15 (108)
Stud bolt (2)	25 (180)

2. HYDRAULIC SYSTEM (TRACTION)

2.1 General Description

- **SV200**

  For propulsion line, the Model utilizes a closed circuit type hydrostatic transmission consisting of a variable displacement axial piston pump and fixed displacement axial piston motor.

- **SV200D, SV200T and SV200TB**

  For propulsion line, the Models also utilize a closed circuit consisting of a variable displacement axial piston pump and two fixed displacement motors. The motors are mounted on front roll and under rear frame. The motor on front roll has reductioner.

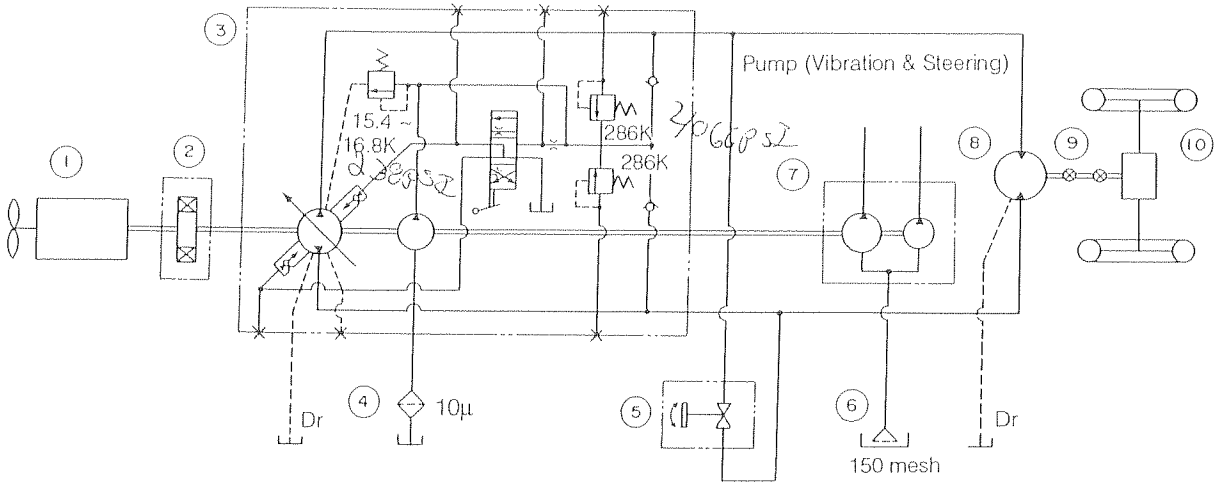


Fig. 8

SV200

1. Engine
2. Coupling
3. Pump
4. Filter
5. Valve
6. Filter
7. Pump
8. Motor
9. Drive shaft
10. Axle ass'y

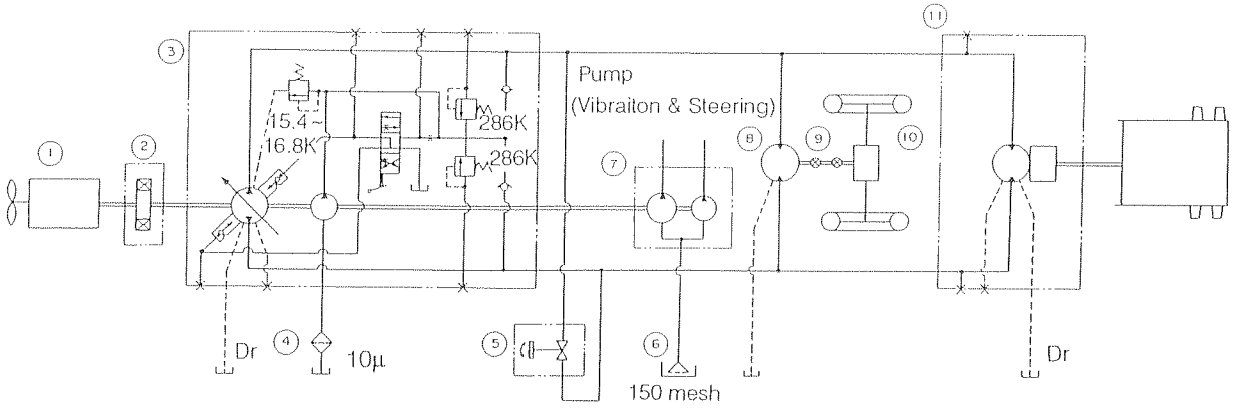


Fig. 9

SV200D, SV200T

1. Engine
2. Coupling
3. Pump
4. Filter
5. Valve
6. Filter
7. Pump
8. Motor
9. Drive shaft
10. Axle ass'y
11. Motor

2.2 Trouble-shooting

Complaint	Inspection (1)	Inspection (2)	Cause	Remedy
Engine does not start			Engine or its electric system at fault	See "Engine Manual"
			Broken pieces of coupling jammed in ring gear	See "Coupling"
		Excessive metal particles getting out from pump drain port	Pump seized	Repair or replace
Machine does not travel	Charge pressure is normal	Pressure in high pressure line does not rise	Outer link disconnected	Repair
			Control valve faulty	Replace
			Override valve faulty	Replace
			Transmission shift fork damaged	Replace
		Pressure in high pressure line rises normally	Rear axle or brake faulty	Repair or replace
		Pressure in high pressure line is low	Suction filter clogged	Replace element
			Suction line collapsed	Repair or replace
			Hydraulic fluid level too low	Add
			Charge relief valve defective	Replace
			Low pressure relief valve defective	Replace
			Pump or motor defective	Replace
Machine travels in one direction only	Charge pressure is normal	Pressure in high pressure line does not build up	High pressure relief valve remaining open	Replace
			Check valve inside the pump remaining open	Repair or replace
			Shuttle valve remaining open	Repair or replace
Pump is not placed in neutral with F-R lever in neutral			Outer link incorrectly adjusted	Adjust
			Control valve faulty	Replace
Unusual sound		Hydraulic fluid turned to white in color	Suction line is sucking air	Repair
			Water is mixed in fluid	Change fluid
		Cavitation	Filter clogged or line collapsed	Replace
		Metal particles coming out from drain port of pump or motor	Pump or motor damaged	Repair or replace

Complaint	Inspection (1)	Inspection (2)	Cause	Remedy
Hydraulic fluid too hot			Oil cooler fins clogged	Clean
			Oil cooler circuit restricted	Repair
			Shuttle valve malfunctioning	Repair
Air bubbles spouting out from hydraulic tank		Hydraulic fluid turned to white in color	Suction line is sucking air	Repair
			Water is mixed in fluid	Change fluid

2.3 Inspection

For trouble-shooting of hydraulic system, measure pressure as in the following. Repair or replace parts if found to be abnormal.

(1) High pressure line (Traction)
Gage port: Port (A) on top of traction pump
Port size: 9/16-18UNF-2B
Relief valve opening pressure:
286 kgf/cm² (4.080 psi)

(2) Charge pressure line (Traction)
Gage port: Port (B) on top of traction pump
Port size: 9/16-18UNF-2B
Relief valve opening pressure:
15.4 ~ 16.8 kgf/cm²
(220 ~ 240 psi)

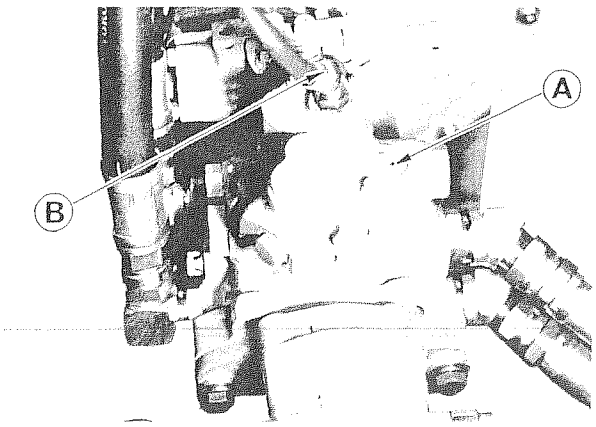


Fig. 10

3. HYDRAULIC SYSTEM (VIBRATOR)

3.1 General Description

Vibrator hydraulic system is of an open circuit consisting such major components as gear pump, directional control valves, fixed displacement piston motors.

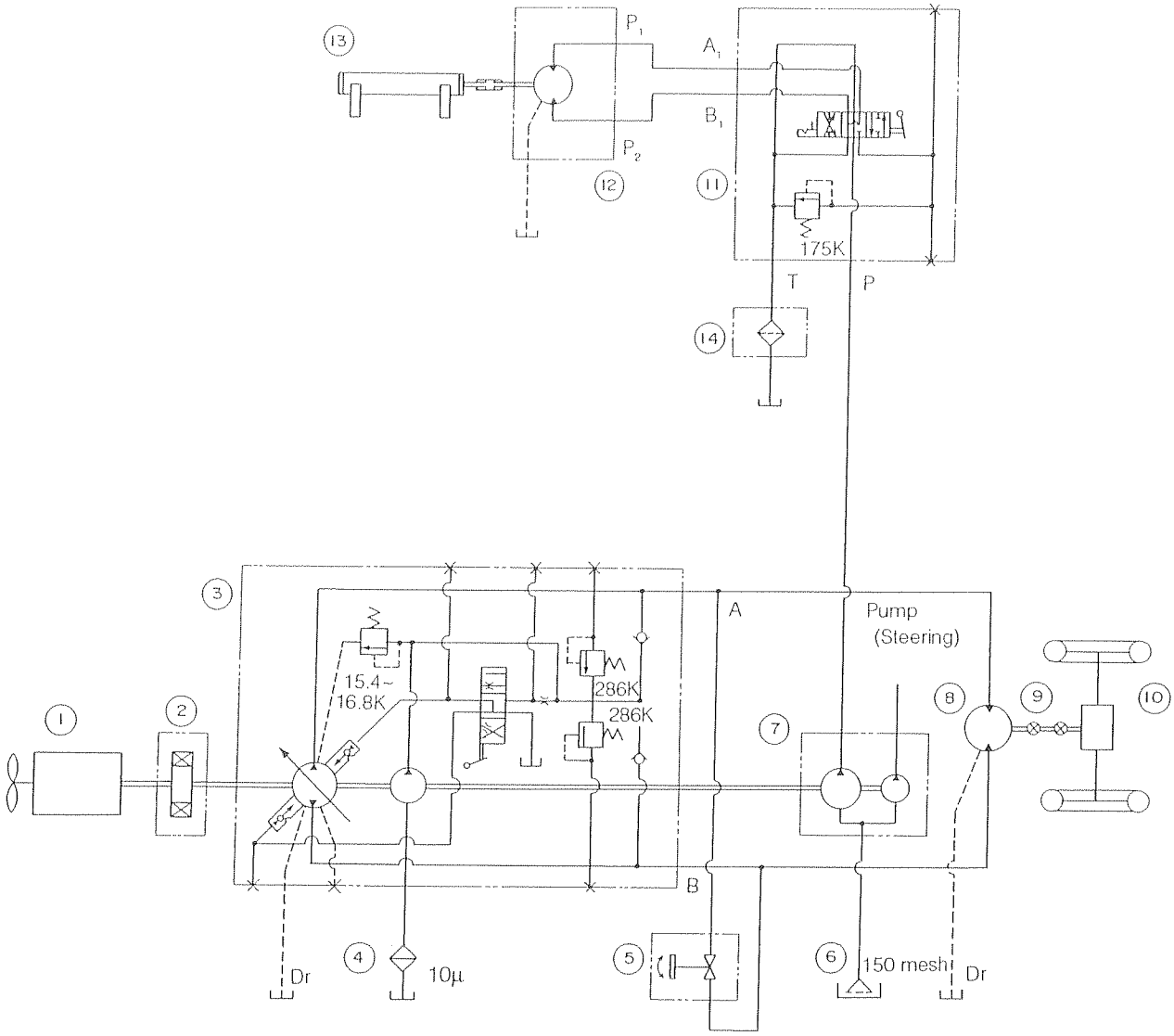


Fig. 11

1. Engine
2. Coupling
3. Pump
4. Filter
5. Valve
6. Filter
7. Pump, vibrator
8. Motor
9. Drive shaft
10. Axle ass'y
11. Valve ass'y
12. Motor, vibrator
13. Shaft, vibrator
14. Radiator

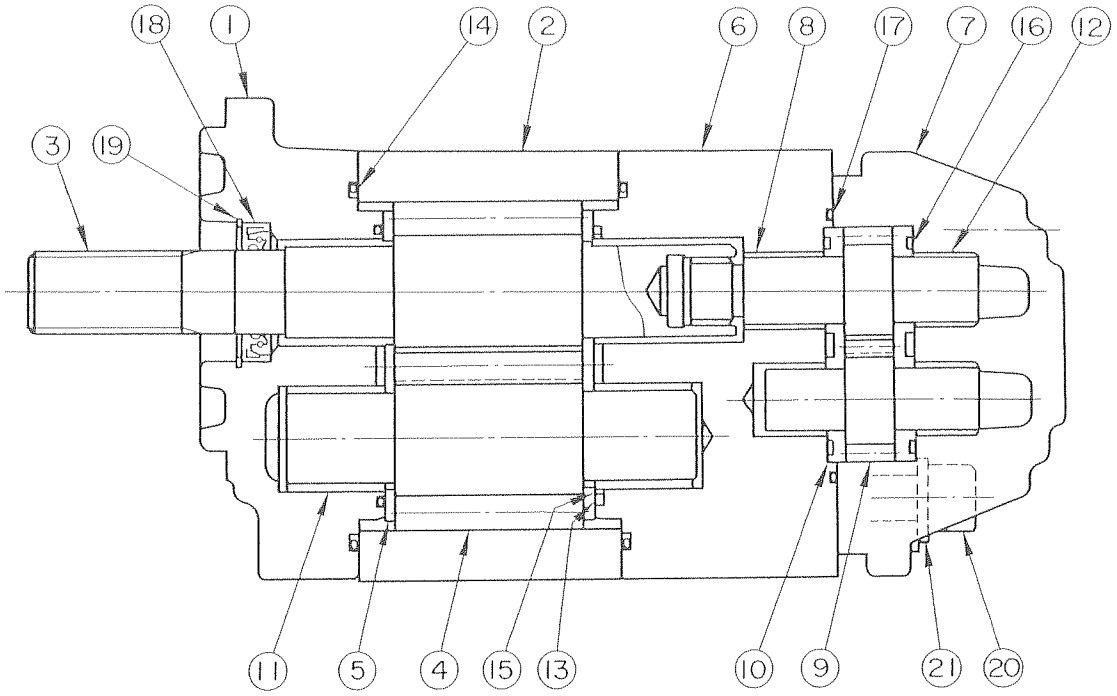


Fig. 12

1. Cover, front
2. Body
3. Gear, drive
4. Gear, drive
5. Side, plate
6. Adapter, plate
7. Body
8. Gear, drive
9. Gear, driven
10. Side plate
11. Bush
12. Bush
13. Gasket
14. Gasket
15. Back-up strip
16. Gasket
17. Gasket
18. Oil seal
19. C-retaining ring
20. Bolt
21. Washer

3.2 Trouble-shooting

Complaint	Inspection (1)	Inspection (2)	Cause	Remedy
Vibrator does not work			Vibrator pump coupling damaged.	Replace.
			Hydraulic pump (vibration) damaged.	Replace or overhaul.
			Hydraulic motor (vibration) damaged.	Replace.
			Relief valve is faulty.	Replace or overhaul.
			Valve faulty.	Replace or overhaul.
			Eccentric shaft bearings seized or damaged.	Replace (Refer to "Front roll")
Weak vibration force	Hydraulic motor r.p.m. does not rise.	Cavitation	Filter clogged or suction line damaged.	Clean or repair.
			Relief valve is faulty	Replace or overhaul.
			Pump or motor displacement efficiency lowered.	Overhaul.

3.3 Inspection

Hydraulic Pressure Measurement

Measure pressure in high pressure line of vibrator circuit.

Gage port: Port (A) in selector valve or right side of machine.
Port size: PT1/4
Main relief set pressure:
175 kgf/cm² at 52 liter/min.
(2,500 psi at 52 liter/min.)

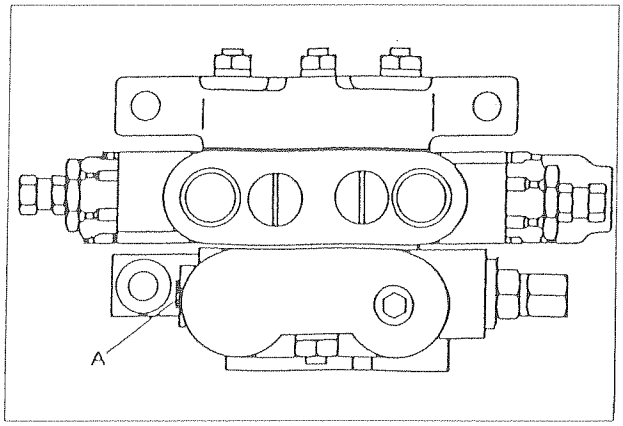


Fig. 13

4. VIBRATING ROLL

4.1 General

Front roll contains single vibrating shaft type vibrator in it.
Front roll assembly is so mounted, utilizing rubber isolators, on machine frame as to absorb vibration.

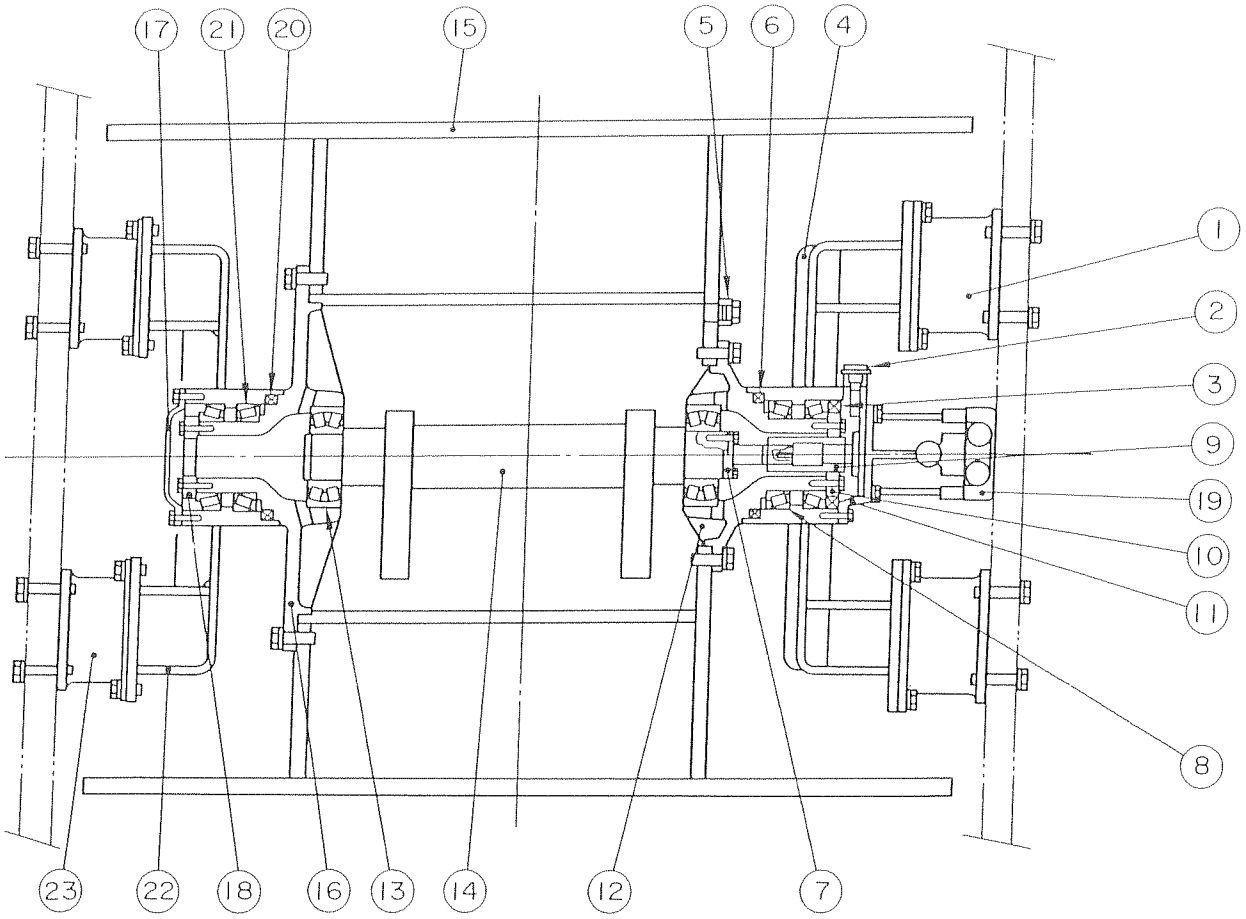
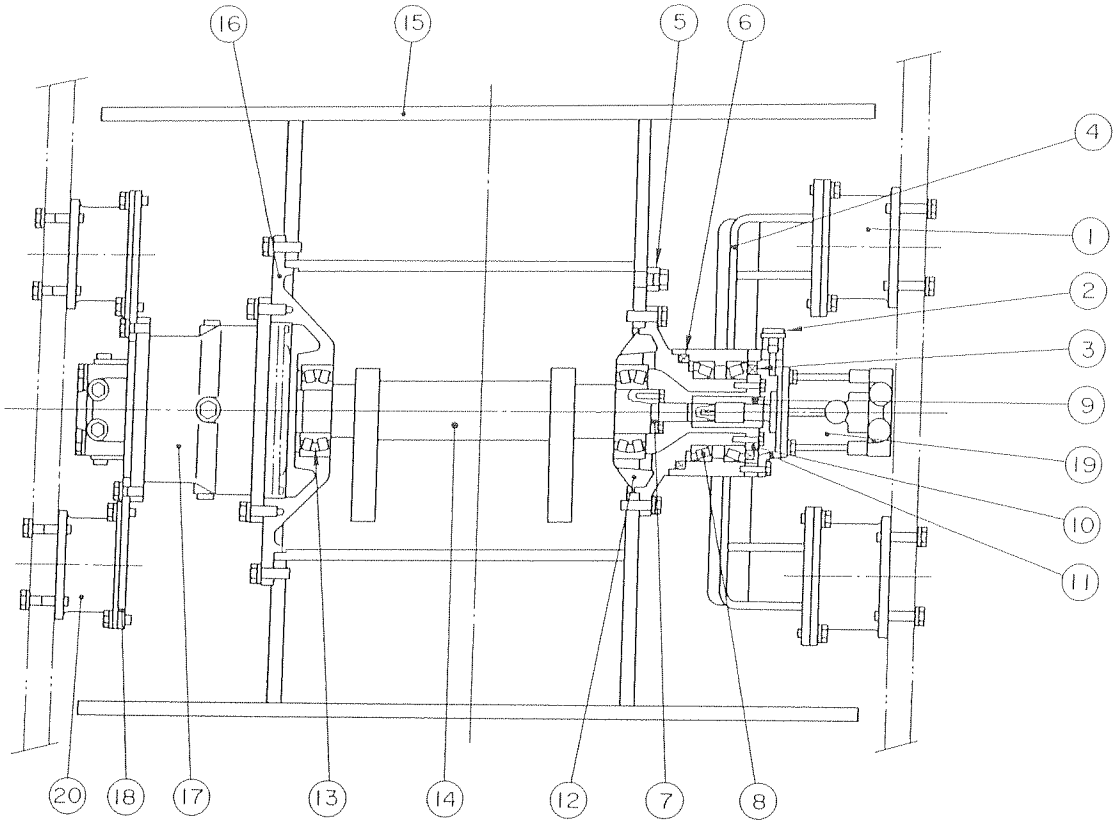


Fig. 14

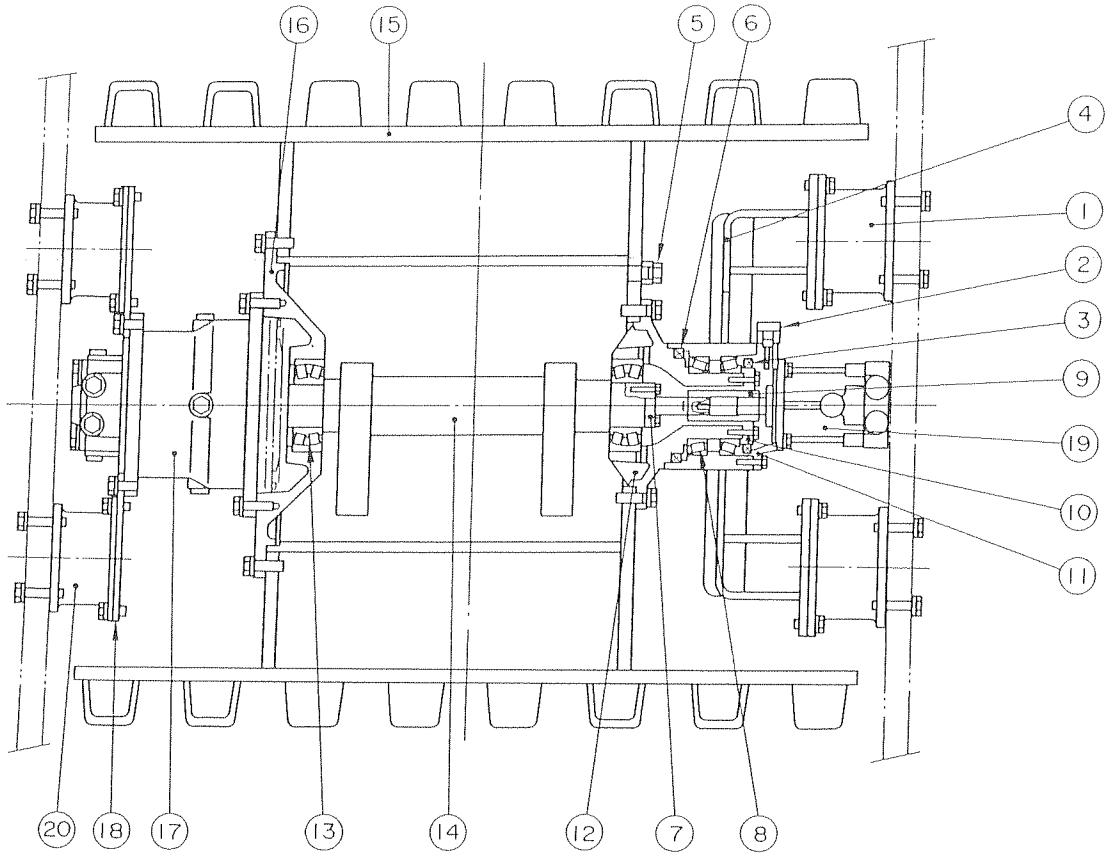
SV200

1. Rubber isolator
2. Breather
3. Oil seal
4. Axle
5. Plug
6. Oil seal
7. Shaft
8. Roller bearing
9. Sleeve
10. Cover
11. Flange
12. Axle shaft, V.B.
13. Roller bearing
14. Eccentric shaft
15. Roll
16. Axle shaft, V.B.
17. Cover
18. Cover
19. Motor, V.B.
20. Oil seal
21. Roller bearing
22. Axle
23. Rubber isolator



SV200D

Fig. 15



SV200T

Fig. 16

1. Rubber isolator
2. Breather
3. Oil seal
4. Axle
5. Plug
6. Oil seal
7. Shaft
8. Roller bearing
9. Sleeve
10. Cover
11. Flange
12. Axle shaft, V.B.
13. Roller bearing
14. Eccentric shaft
15. Roll
16. Holder
17. Motor, traction
18. Disc
19. Motor, V.B.
20. Rubber isolator

4.2 Trouble-shooting

Complaint	Cause	Remedy
Roll does not rotate.	1. Hydraulic motor (Front roll drive motor: SV200D, SV200T) defective 2. Bearings seized or damaged.	Repair or replace (Refer to shop manual "HYDRAULIC PUMP & MOTOR") Replace.
Vibrator does not work.	1. Hydraulic pump & motor (Vibration) defective. 2. Eccentric shaft bearings seized or damaged. 3. Shaft (7) and sleeve (9) broken or spline damaged.	Check and repair (Refer shop manual, "HYDRAULIC PUMP & MOTOR") Replace. Replace.
Abnormal sounds	1. Eccentric shaft bearings damaged. 2. Eccentric shaft mounting bolts loosened. 3. Rubber isolator extremely fatigued. 4. Reduction gear (mounted on motor) damaged. (SV200D, SV200T)	Replace. Check and replace. Replace. Repair or replace.
Roll heated.	1. Lubricant level to high.	Bring to proper level.

4.3 Roll Removal

(1) Hold frame on hoist.

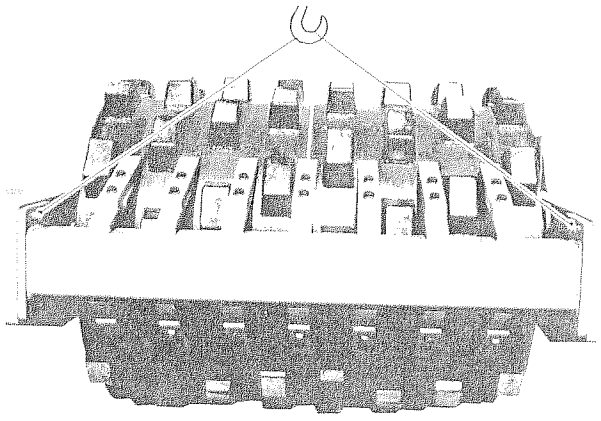


Fig. 17

(2) Remove bolts ① and remove upper blade as an assembly (SV200·SV200D). Remove bolts ② and cross member ③ (SV200T).

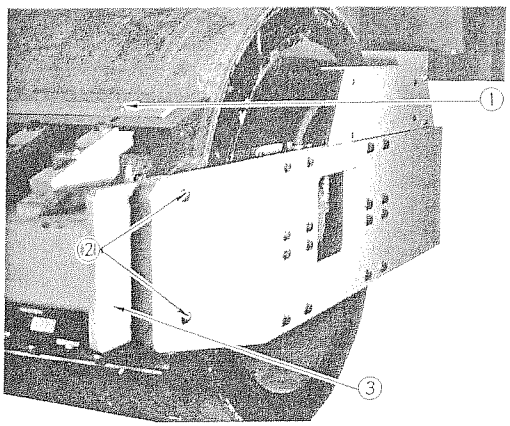


Fig. 18

(3) Remove bolts ① and dismount motor assembly ② together with hydraulic hose.

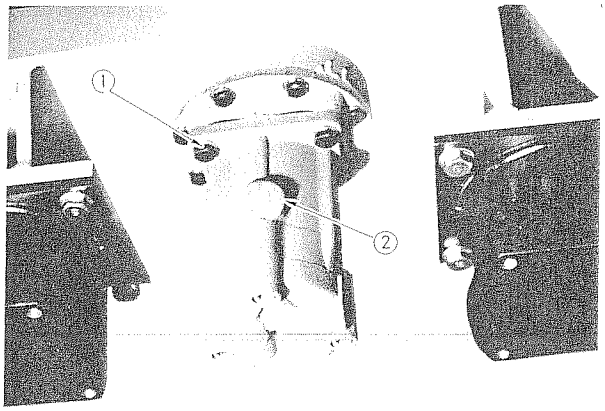


Fig. 19

(4) Remove sleeve ①.

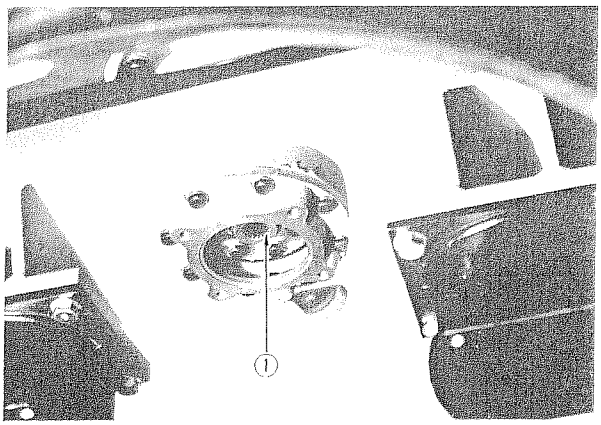


Fig. 20

(5) Remove hydraulic hose from left side of front frame. (SV200D, SV200T)

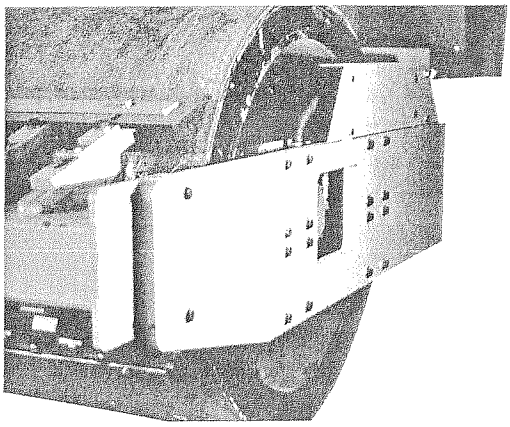


Fig. 21

(6) Remove bolts ① from frame.

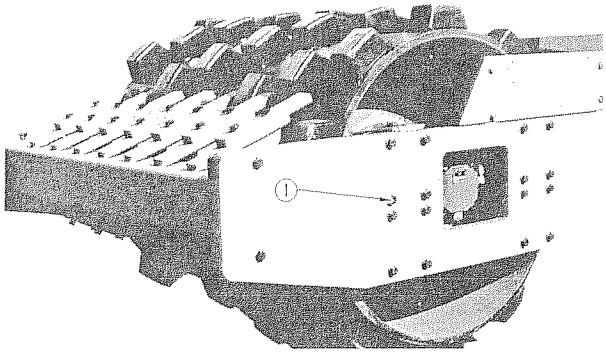


Fig. 22

(7) Rotate roll until plug ① comes to bottom, and drain oil.

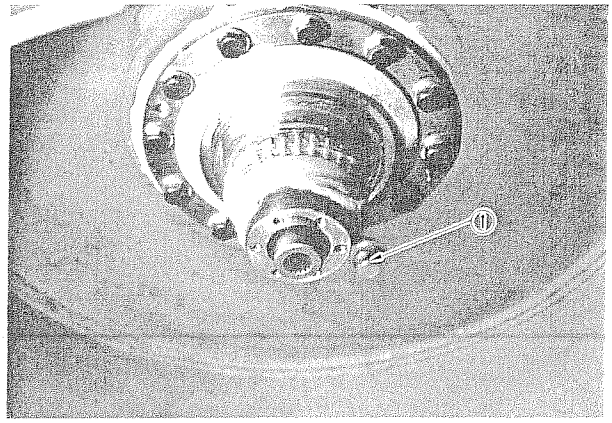


Fig. 23

4.4 Disassembly

Disassembly of right side of roll.
(Vibrating motor side)

(1) Erect roll with vibrating motor up.

CAUTION:
When erecting, place wooden blocks under roll to prevent shock mounts from making direct contact with ground.

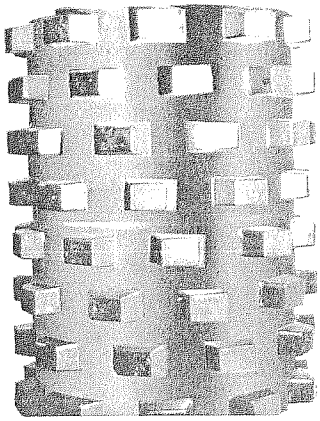


Fig. 24

(2) Remove bolts ① and cover ②.

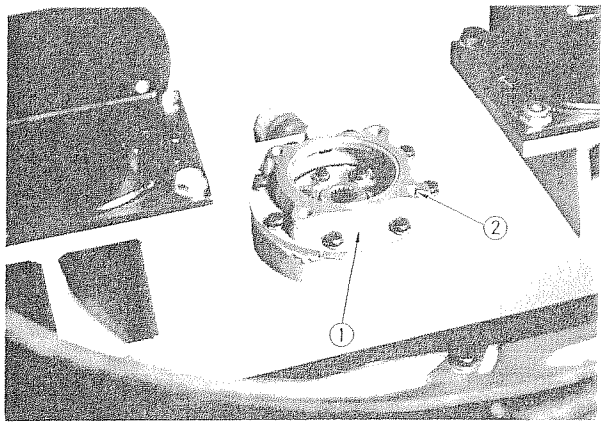


Fig. 25

(3) Remove bolts ①, cover ② and shims ③. Then, remove bolts ④ and holder ⑤.

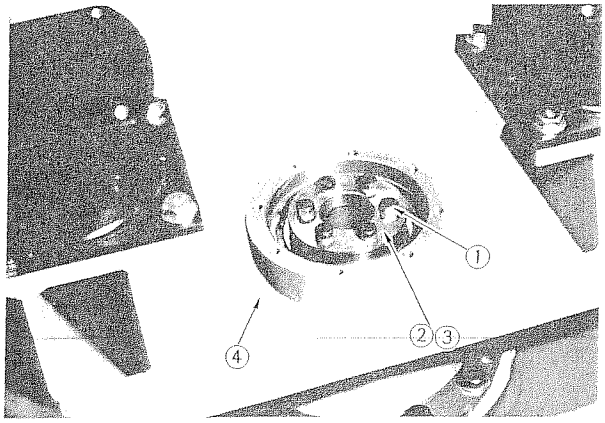


Fig. 26

(4) Remove bolts that secure axle shaft ①. Drive proper screws into the two plug holes to separate axle shaft.
When it has been completely separated from roll, lift it on hoist.
When lifting, make certain that vibrator shaft is left inside the roll.

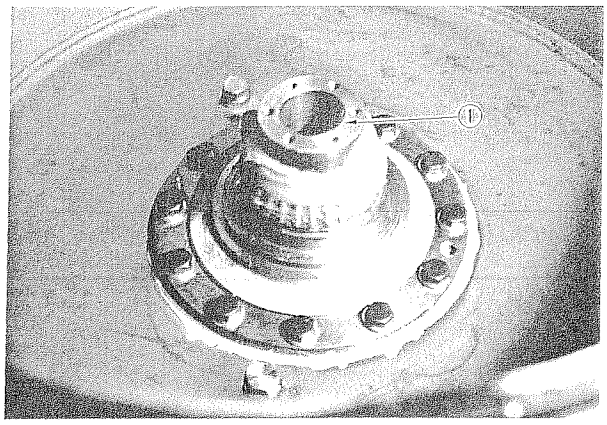


Fig. 27

(5) Remove bolts ① and shaft ②.

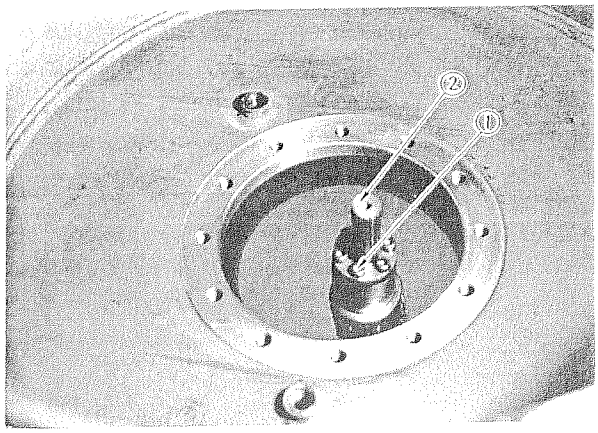


Fig. 28

(6) Hook wire to two eye bolts screwed into two holes provided nearer to eccentric weight, and pull off eccentric shaft straight.

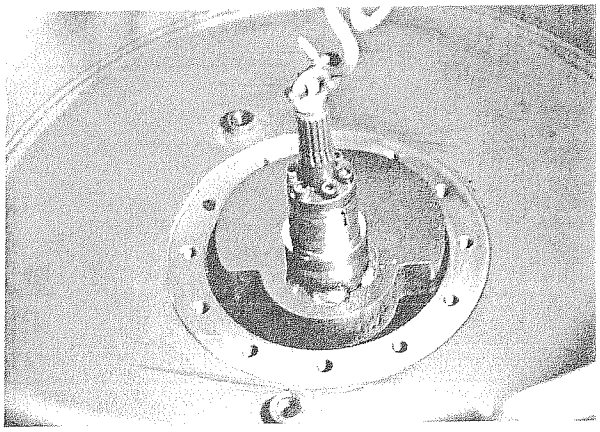


Fig. 29

Disassembly of left-side of roll (Opposite side of vibration motor) (SV200D SV200T)

(1) Erect roll with vibrating motor down. After removing bolts ①, remove plate ②. Remove bolts ③ and lift hydraulic motor (with reduction gear) ④. Then, remove bolts ⑤, drive proper screws into plug holes to separate holder ⑥.

CAUTION:
Do not remove holder ⑥ before dismounting eccentric shaft from roll.

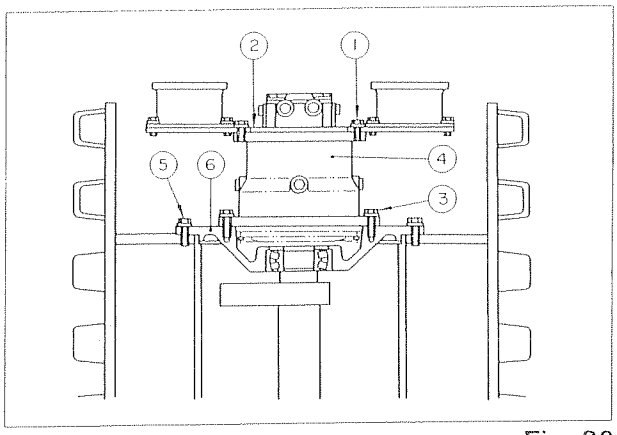


Fig. 30

Disassembly of left-side of roll (Opposite side of vibration motor) (SV200)

(1) Erect roll with vibrating motor down. Remove bolts ① and cover ②.

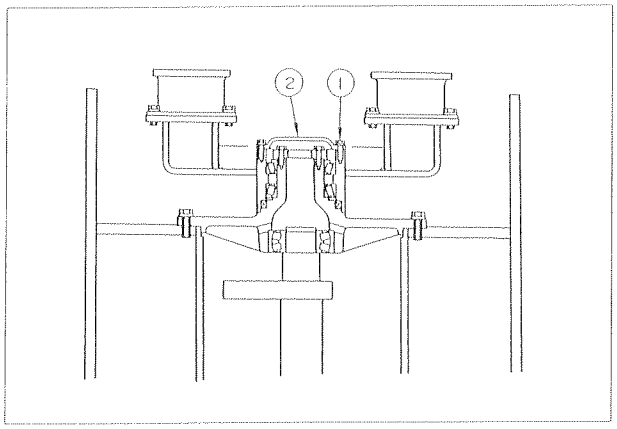


Fig. 31

(2) After removing bolts ①, remove cover ② and shims ③.

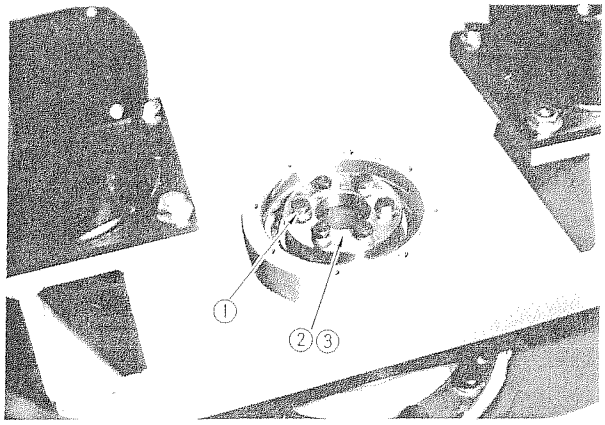


Fig. 32

(3) Lift holder ① straight and pull out from axle ②.

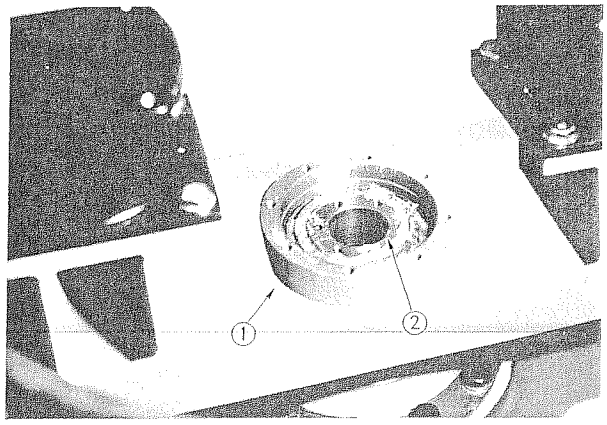


Fig. 33

(4) Remove mounting bolts, drive proper screws ② into plug holes to separate axle shaft ①. When completely separated, lift it on hoist.

CAUTION:
If required to dismount eccentric shaft, pull it out toward vibrator drive motor, and then remove axle shaft.

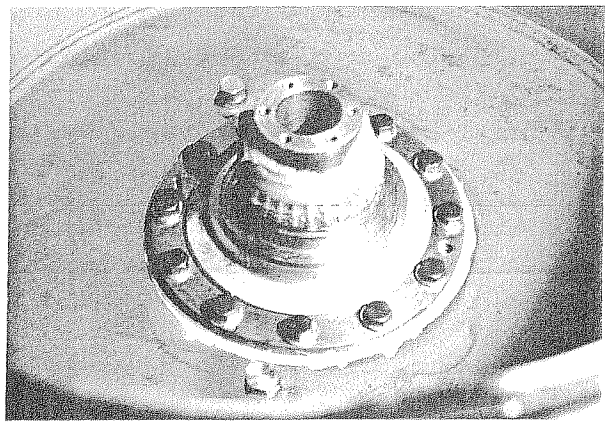


Fig. 34

4.5 Inspection

Inspect splines for wear, replace if measured values are beyond service limit.

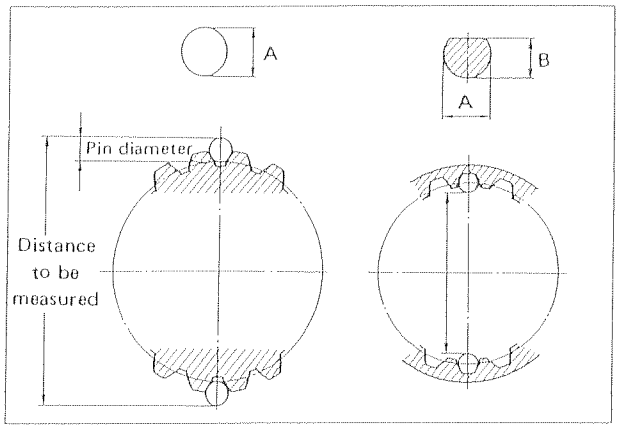


Fig. 35

Unit: mm (in)

Parts to be inspected	Standard value	Service limit	Pin diameter
Shaft (7)	31.412 ~ 31.475 (1.236 ~ 1.239)	31.2 (1.228)	3,048 (0.12)
Sleeve (9)	23.011 ~ 22.949 (0.906 ~ 0.903)	23.2 (0.913)	3,048 (0.12)
Motor (19)	31.412 ~ 31.475 (1.236 ~ 1.239)	31.2 (1.228)	2,743 (0.11)

4.6 Reassembly

Preload bearings by placing shims ④ when installing. To achieve this: Drive inner lace of bearing ⑤ into position until it does not go further. Then place shims ④ between axle shaft ③ and inner lace so as to provide a clearance of 0.1 mm between axle shaft ③ and cover ①. Apply lithium type grease on bearing.

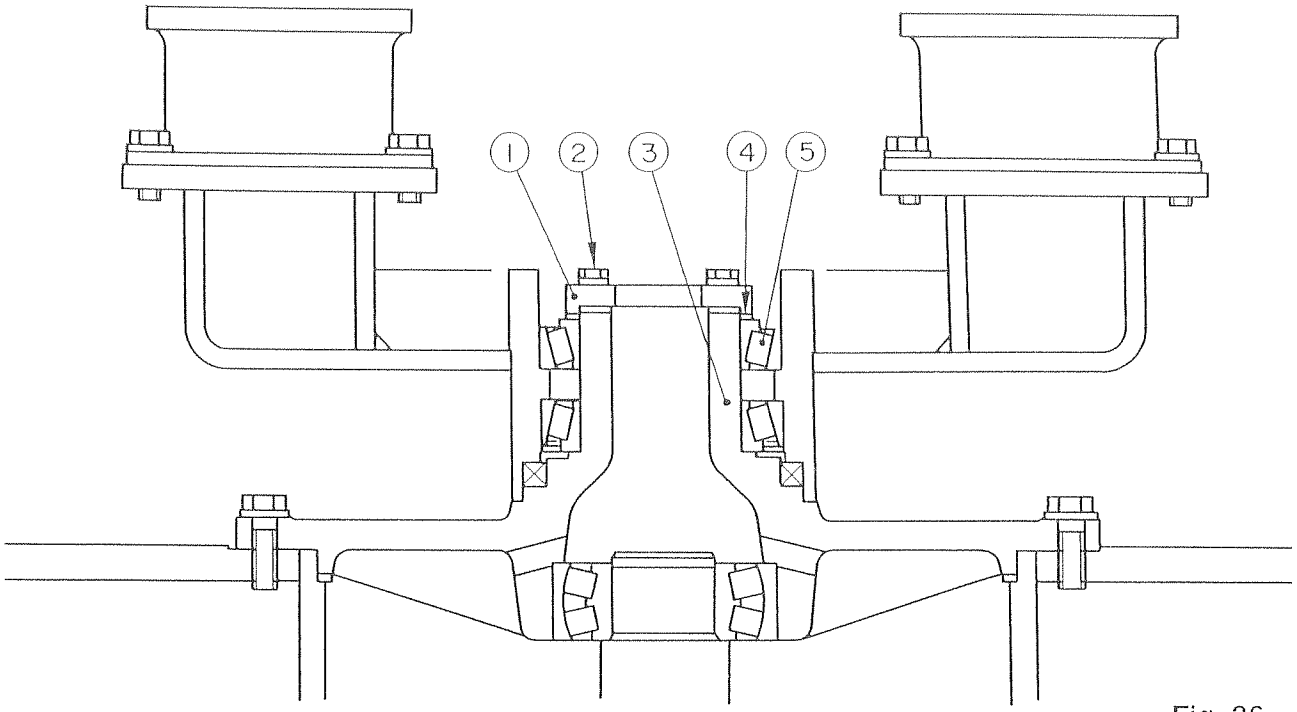


Fig. 36

Tightening torque of special bolts

Unit: kgf-m (ft-lb)

	Bolt size	Tightening torque
Rubber blocks – holder mounting bolt	M14 x 1.5	13 (93)
Axle shaft – cover mounting bolts	M14 x 2.0	15 (108)
Axle shaft – holder mounting bolts	M16 x 2.0	25 (180)
Frame – rubber blocks mounting bolts	M14 x 1.5	13 (93)

CAUTION: Replace bolts that were treated with a loose-proof material with new one.

When reassembly of vibrator is complete, refill vibrator case to specification.

Types of oil:
Gear oil SAE90 (API grade "GL-4")

Refill capacity:

liter (gal)

Model	Capacity
SV200	3.7 (1)
SV200D	3.7 (1)
SV200T	3.7 (1)

5. STEERING SYSTEM

5.1 General Description

Steering system is of a power-assisted, articulated type. Operation of steering wheel actuates control valve (Orbitrol) to admit hydraulic fluid under pressure from pump to steering cylinders, causing Machine to fold left or right at its center. Thus steering is performed. There is a relief valve as safety valve in steering circuit.

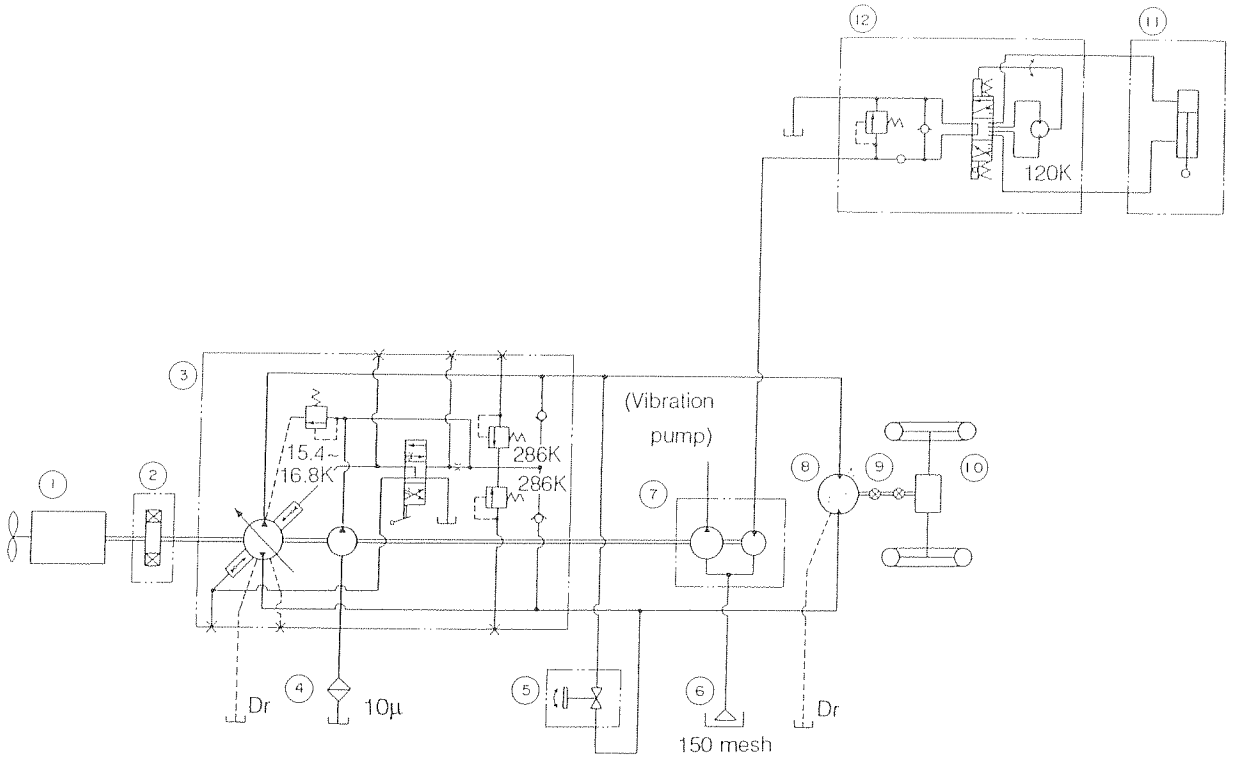


Fig. 37

1. Engine
2. Coupling
3. Pump, traction
4. Filter
5. Valve
6. Filter
7. Pump, vibrator and steering
8. Motor, traction
9. Drive shaft
10. Axle ass'y
11. Power cylinder
12. Orbitrol

5.2 Trouble-shooting

Complaint	Inspection (1)	Inspection (2)	Cause	Remedy
Steering not made	Steering wheel is unable to turn		Bushing and bearings of steering wheel shaft seized	Replace bushings or bearings
			Orbitrol defective	Repair or replace
	Steering wheel is able to turn	Main line pressure is below normal	Coupling damaged (Pump is not operating)	Replace coupling
			Relief valve built in Orbitrol defective	Clean or replace
			Orbitrol defective	Replace
			Pump defective	Replace pump
		Main line pressure is normal	Orbitrol defective	Replace Orbitrol
			Frame center pin seized	Repair or replace
Heavy steering			Bushings or bearings of steering wheel shaft defective	Replace bushings or bearings
		Main line pressure is below normal	Relief valve built in Orbitrol defective	Clean or replace valve
			Suction filter clogged or suction line is drawing air	Clean or repair
			Pump performance lowered	Replace
			Orbitrol defective	Replace
		Main line pressure is normal	Orbitrol defective	Replace
			Frame center pin seized	Repair or replace
			Hydraulic fluid viscosity improper	Change fluid with proper one
Machine makes turn slowly			Fluid leakage inside cylinder	Overhaul
			Pump performance lowered	Repair or replace
			Hydraulic fluid viscosity improper	Change fluid with proper one
Front wheels wobble			Suction line is drawing air	Repair
			Air inside Cylinder	Bleed
Strong reaction to steering wheel operation			Orbitrol incorrectly assembled	Correct

5.3 Gear Pump

Delivery: 9.08 cc (0.55 cu.in)/rev.
Rated pressure: 175 kgf/cm² (2,500 psi)
(Relief valve opening pressure in steering system: 120 kgf/cm² (1,700 psi)

5.4 Steering Cylinder

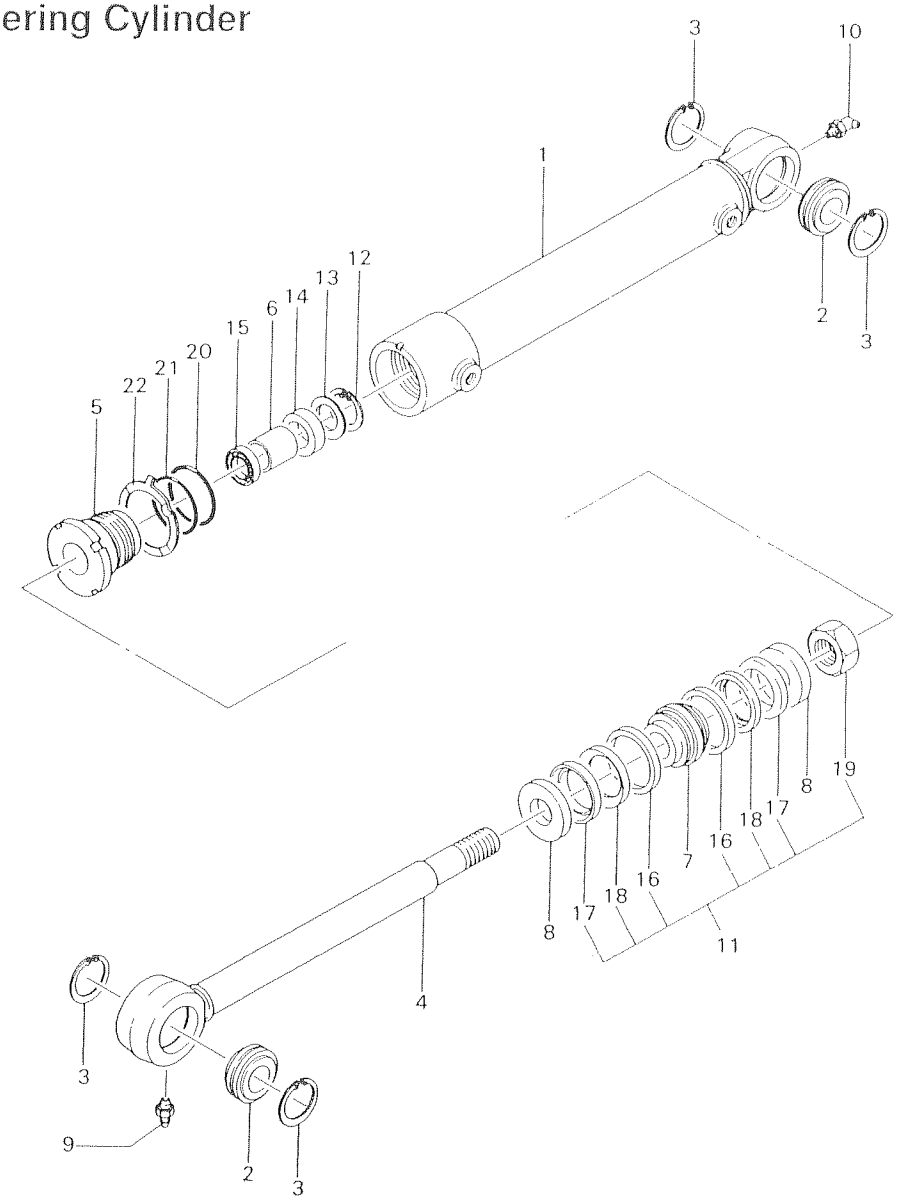


Fig. 38

1. Cylinder
2. Spherical bearing
3. C-retaining ring
4. Piston rod
5. Cylinder head
6. Bush
7. Piston
8. Holder
9. Grease fitting
10. Grease fitting
11. Piston assy
12. C-retaining ring
13. Packing header
14. Back-up ring
15. Dust seal
16. Piston ring
17. Back-up ring
18. Packing
19. Nut
20. O-ring
21. O-ring
22. Lock washer

5.4.1 Disassembly

(1) Mount cylinder in vise. Pull piston rod ④ part way about 150 mm (5.9 in).
(2) Flatten out lock washer ㉒, screw out and remove cylinder head ⑤ from cylinder and pull off piston rod assembly.

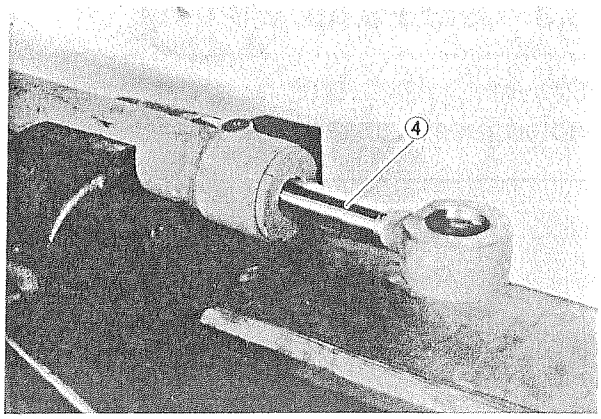


Fig. 39

(3) Remove nut ⑲ and remove piston assembly ⑪ and cylinder head assembly ⑤.

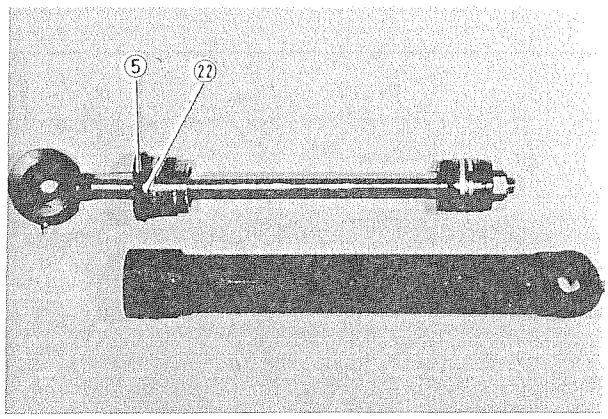


Fig. 40

(4) Disassemble piston assembly and cylinder head assembly into component parts.

5.4.2 Inspection

(1) Check piston rod surface and inner wall of cylinder for scores. Replace parts if found to be abnormal.
(2) When disassembled, replace seal kit.
(3) Inspect piston rod for bending. Replace it if bent beyond limit.

Unit: mm (in)

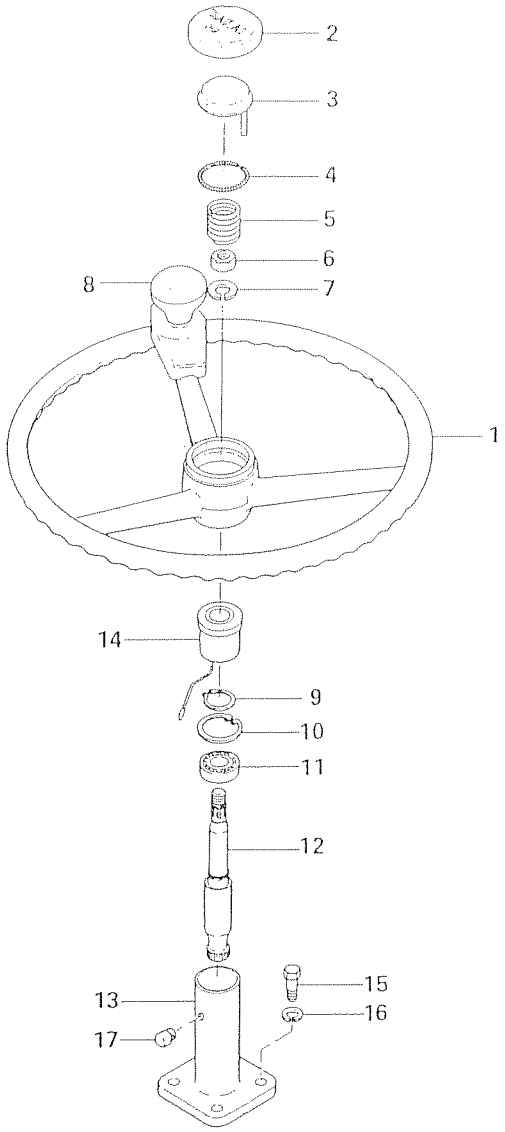
	Limit for use
Bending of piston rod	0.03 (0.001) and above

5.4.3 Reassembly

Reverse disassembling procedure using care not to damage seals.

NOTE: Tightening torque for nut ⑲ is 39 ~ 59 kgf-m (280 ~ 412 ft-lb).

5.5 Steering Wheel



1. Steering wheel
2. Horn cap
3. Contact plate
4. Lock spring
5. Spring
6. Nut
7. Spring washer
8. Handle knob
9. Snap ring
10. Snap ring
11. Bearing
12. Shaft
13. Column
14. Column bush
15. Bolt
16. Spring washer
17. Bushing

Fig. 41

5.5.1 Disassembly

(1) Take off horn cap and rubber cover by hand. Take out contact plate (3), lock spring (4) and spring (5).

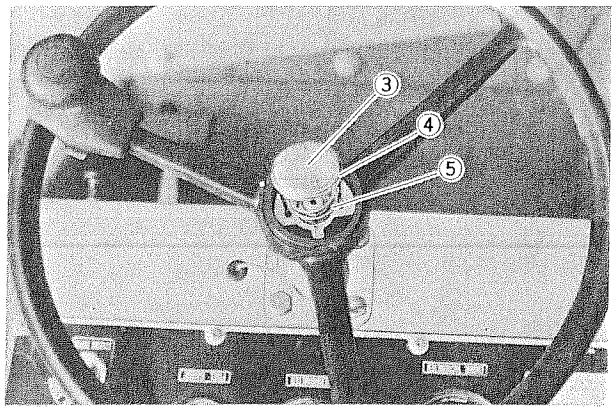


Fig. 42

(2) Remove nut ⑥ and spring washer ⑦. Separate steering wheel ①.

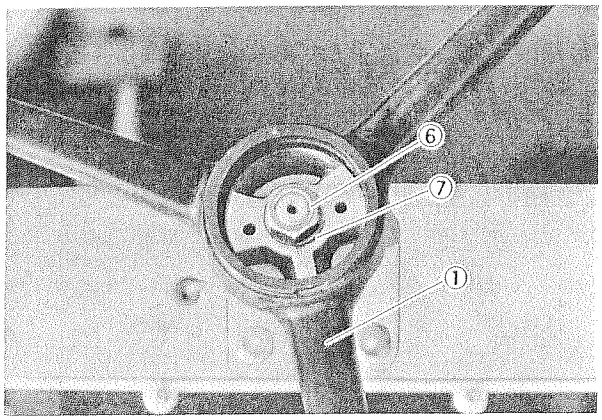


Fig. 43

(3) Remove bolts ⑮ and separate column ⑬ and control valve (Orbitrol).

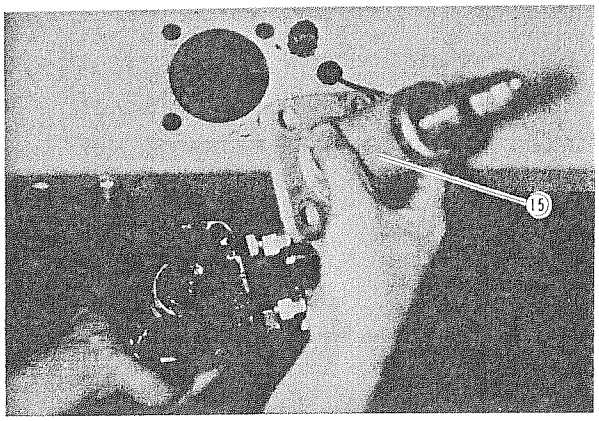


Fig. 44

(4) After removing column bush ⑭, take off snap ring ⑩.
Drive out shaft together with bearing toward steering wheel.

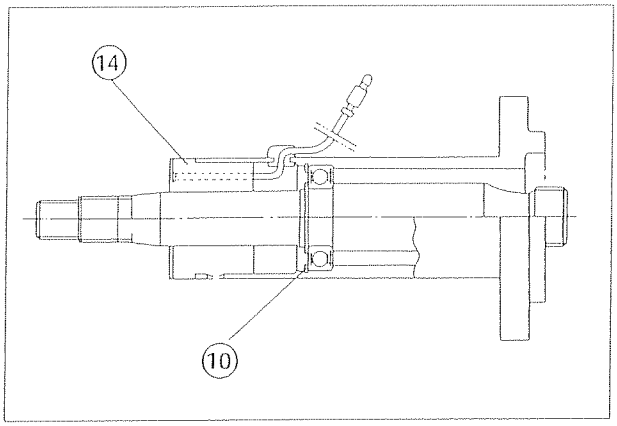


Fig. 45

5.5.2 Reassembly

Reverse disassembly procedure noting the following:
(1) Apply grease on contact surface between steering shaft and Orbitrol.

5.6 Orbitrol and Relief Valve

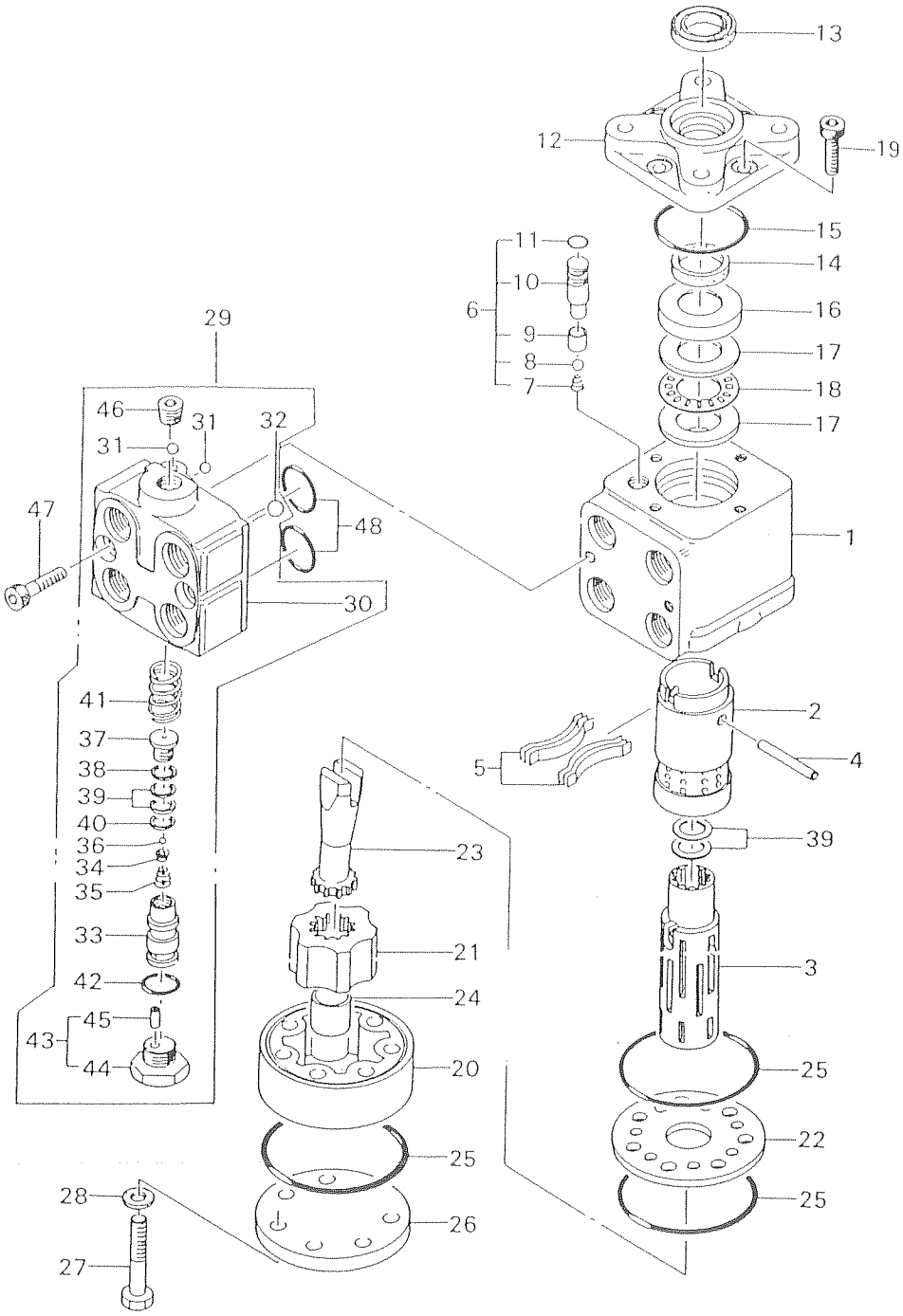


Fig. 46

1. Housing
2. Sleeve
3. Spool
4. Pin
5. Spring
6. Valve
7. Spring
8. Steel ball
9. Seal
10. Plug
11. O-ring
12. Plate
13. Dust seal
14. Packing
15. O-ring
16. Cover
17. Spacer
18. Needle bearing
19. Bolt
20. Casing
21. Rotor
22. Plate
23. Shaft
24. Spacer
25. O-ring
26. Cap
27. Bolt
28. Gasket
29. Valve
30. Housing
31. Steel ball
32. Steel ball
33. Valve
34. Retainer
35. Spring
36. Steel ball
37. Valve
38. Shim
39. Shim
40. Shim
41. Spring
42. O-ring
43. Plug
44. Plug
45. Pin
46. Plug
47. Bolt
48. O-ring

5.6.1 Disassembly

(1) Remove adapters ① ② ③ ④ and after Placing match mark on Orbitrol main body and relief valve assembly ㉙, remove bolts ㊼ with hex wrench and take off relief valve assembly.

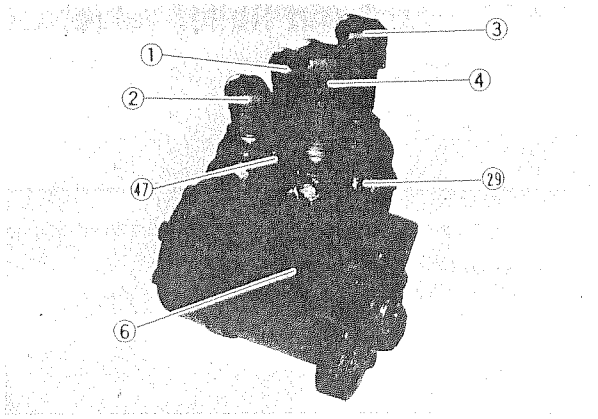


Fig. 47

(2) Remove retaining bolts and take off rear cover ㉖, casing ⑳, rotor ㉑, plate ㉒, and pull out drive shaft ㉓. Before disassembling, place match marks on outer surfaces of rear cover, casing, plate, and body.

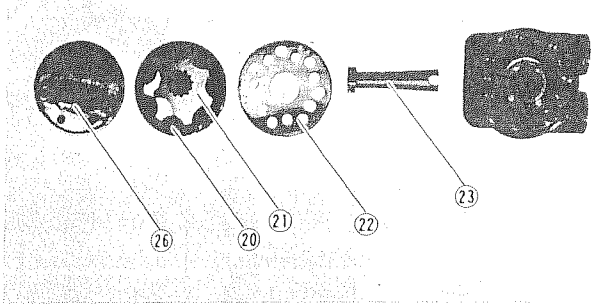


Fig. 48

(3) Remove bolts and take off plate ⑫.

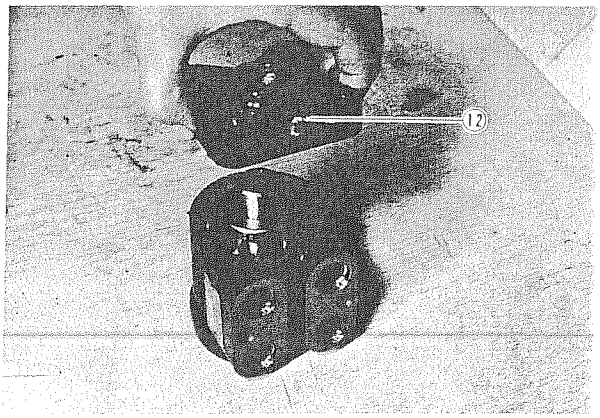


Fig. 49

(4) Pull out spacer ⑰, needle bearing ⑱, spool ③, and sleeve ② from body ①. After pulling out sleeve and spool together in one unit, remove pin ④ and separate spool ③ from sleeve ②.

CAUTION:
Note directions of sleeve and spool when separating. If reassembled erroneously with sleeve rotated 180 degrees from correct position, they will not operate properly.

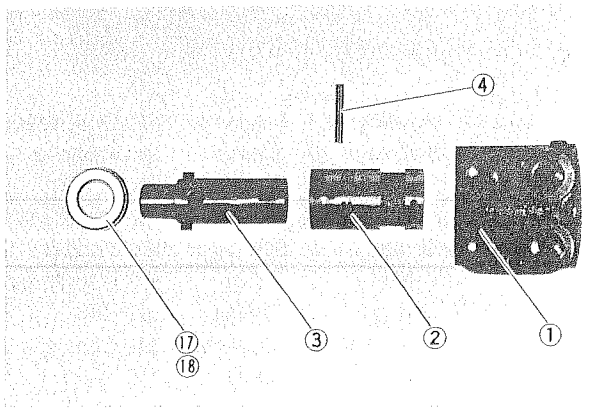


Fig. 50

(5) Remove plug (44), and pull out valve assembly and spring (41) from housing (30). Then remove vale (37) and pull out shims (38) (39) (40), ball (36), valve seat (34) and spring (35) in succession from valve (33).

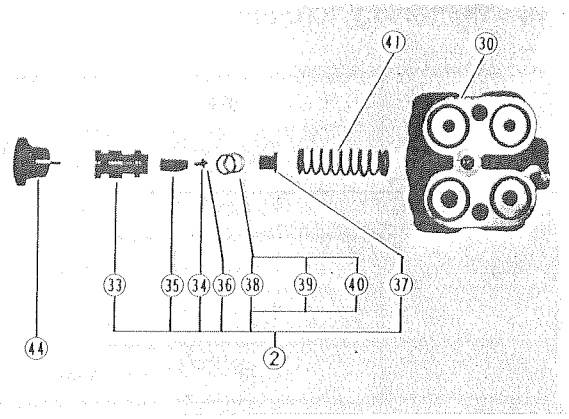


Fig. 51

5.6.2 Inspection

(1) Sleeve, spool, and housing sliding surfaces
Check sliding surfaces of Orbitrol sleeve, spool, and housing. If excessively marred or worn eccentric, replace Orbitrol assembly.

(2) Rotor and casing sliding surfaces
Check rotor and casing sliding surfaces, and if excessively marred or worn eccentric, replace Orbitrol assembly.

(3) Relief valve
Check relief valve spool sliding surfaces, and if excessively marred or worn eccentric, replace valve assembly.
Check ball and seat surface within valve spool, and if marred or badly bented, replace valve assembly.

5.6.3. Assembly

Assemble parts by performing disassembly in reverse order.
Exercise special care for the following:

(1) When assembling spool to sleeve, wash clean with hydraulic fluid and after oiling, lightly push it in while turning. At this time, make sure that spool and sleeve are properly positioned together. If incorrectly assembled, it can cause steering wheel to vibrate to left and right or cause other faulty operation.

(2) When assembling drive shaft (23) and rotor (21), valeys (A) of rotor (21), drive shaft slots (B) and (C), and port surface (D) should all be positioned parallel with each other.
Use extreme care to see that there is no error in installed positions as this can cause steering wheel to vibrate to left and right or cause other faulty operation. (Fig. 52).

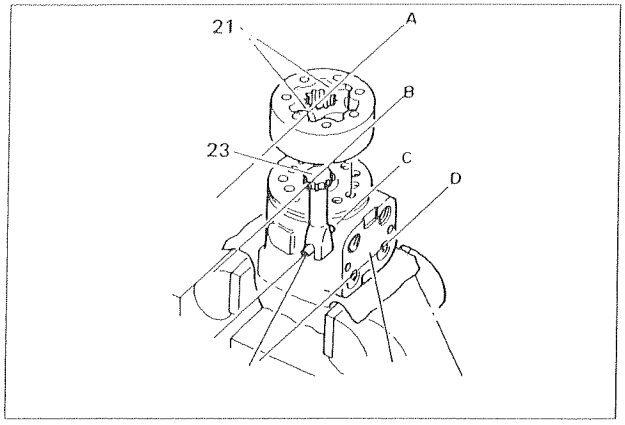


Fig. 52

(3) Tightening torque

Unit: kgf-cm (in-lb)

Item	Tightening torque
Plug ⑩	60 ~ 80 (52 ~ 70)
Plug ⑲	200 ~ 250 (174 ~ 217)
Plug ㊹	500 ~ 600 (434 ~ 520)
Bolt ㊼	300 ~ 350 (260 ~ 304)
Bolt ㉗	550 ~ 650 (477 ~ 565)

NOTE: Plugs and bolts in table above correspond to those in Fig. 46.

5.6.4 Adjustment

(1) High pressure relief valve adjustment
Adjust pressure by varying thickness of shims ㊳ ㊴ ㊵ between valve seat ㊲ and valve body ㉝.
Opening pressure of valve is 120 kgf/cm² (1,700 psi) (at 59 lit. (13 gal)/min)

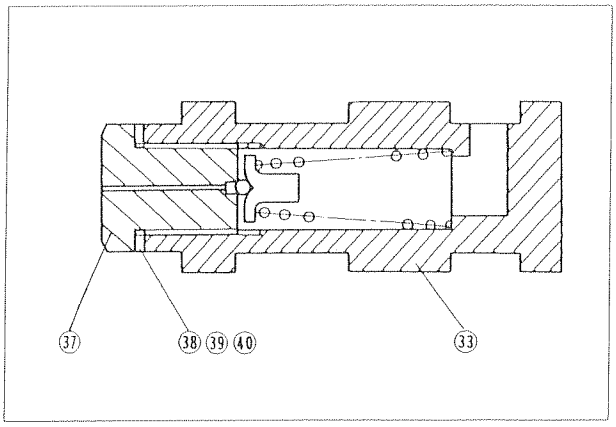


Fig. 53

6. BRAKE SYSTEM

6.1 General

Brake system is of 2-system with 3-operation.
"2-system" means two brakes; hydrostatic brake and internal expanding mechanical brake.
"3-operation" signifies operations of brakes utilizing forward-reverse lever, brake pedal and parking brake button.

(1) For service brake, operate forward-reverse lever to apply hydraulic brake.
(2) In an emergency, depress brake pedal. With brake pedal depressed, internal-expanding, mechanical brake applies. At the same time, forward-reverse lever is brought to neutral through a mechanical linkage. This also makes hydrostatic brake apply. Higher security is gained by this dual braking.
(3) Press parking brake button on instrument panel, and parking brake of an internal-expanding, mechanical type applies. This brake includes a hydraulic circuit that automatically brakes the Machine in case of an engine stall or abnormally low hydraulic pressure in forward-reverse control circuit.

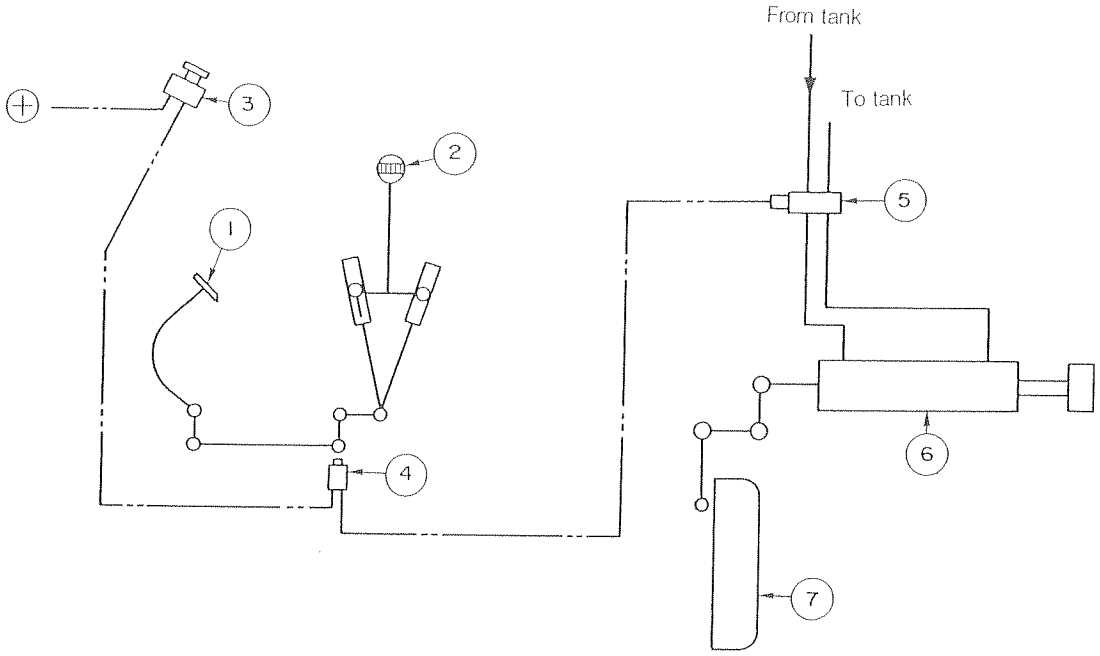


Fig. 54

Power input control and negative brake system

1. Brake pedal
2. F-R lever
3. Parking bake switch
4. Switch
5. Solenoid valve
6. Cylinder
7. Brake

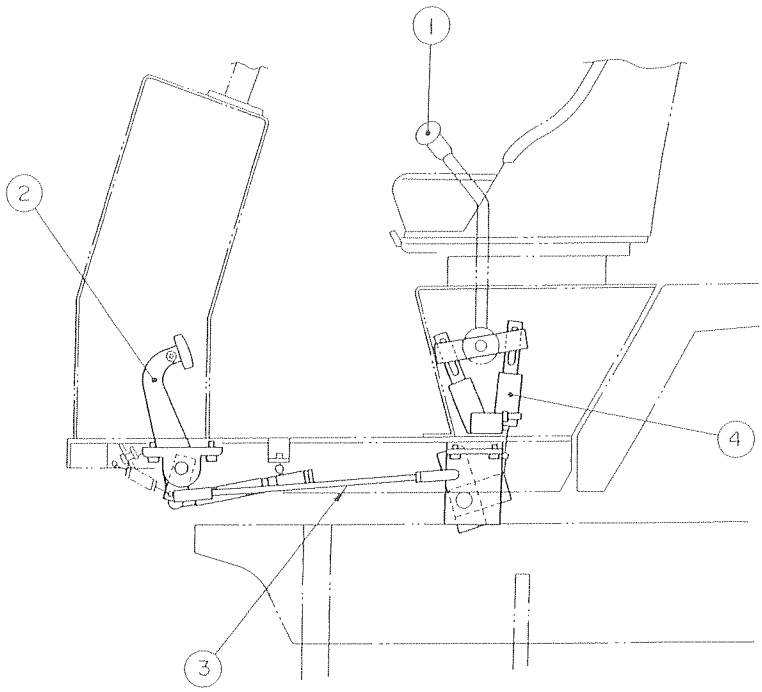


Fig. 55

1. F-R lever
2. Brake pedal
3. Rod
4. Bracket

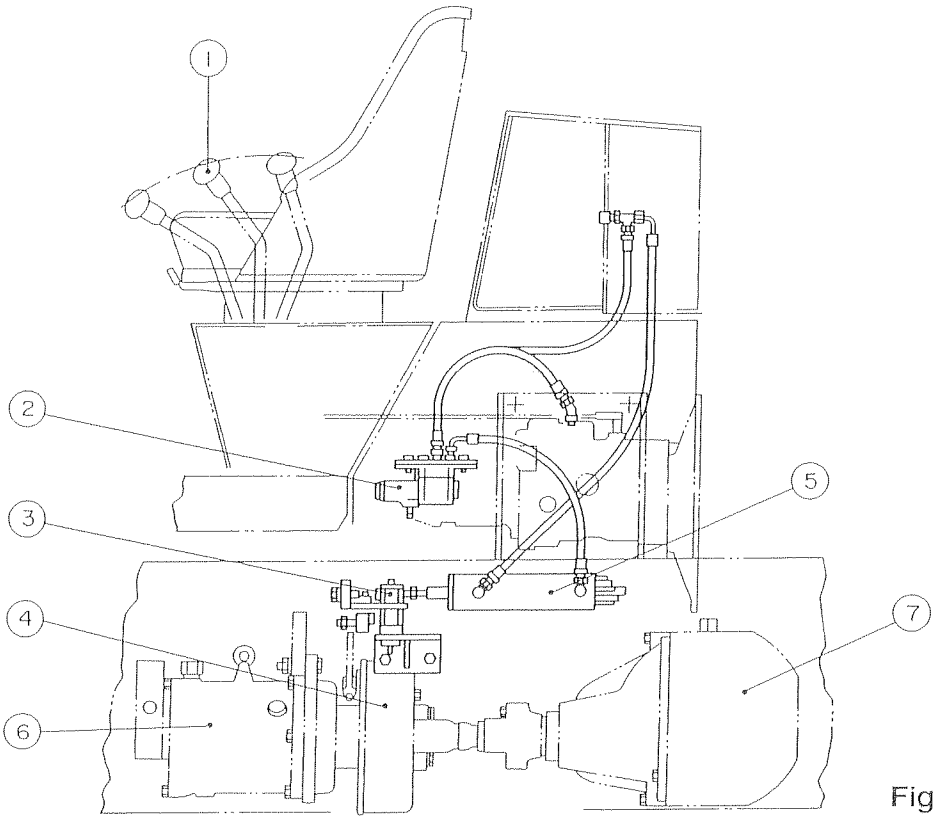


Fig. 56

1. F-R lever
2. Solenoid valve
3. Arm
4. Brake
5. Brake cylinder
6. Motor (traction)
7. Rear axle

6.2 Trouble-shooting

Complaint	Cause	Remedy
Brake does not apply	Linkage disconnected or incorrectly adjusted	Correct
	Linings worn or damaged	Replace linings
	Oil permeated into linings	Clean or replace linings
Brake dragging	Linkage sticking	Repair
	Lining sticking to drum	Repair

6.3 Disassembling

(1) Loosen two bolts (1) and pull off brake drum assembly (2).

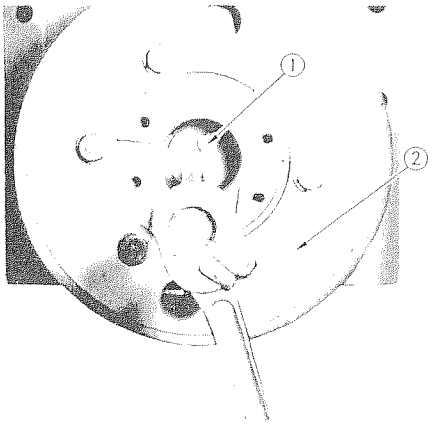


Fig. 57

(2) Remove and replace brake shoes (3)

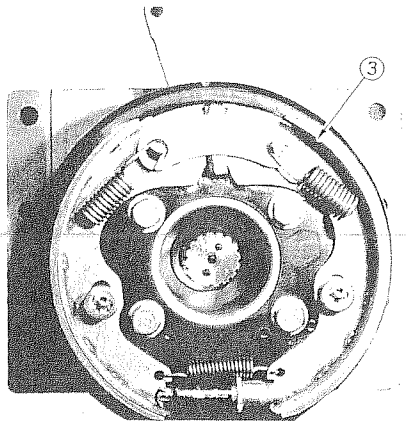


Fig. 58

6.4 Inspection

Inspect brake drum and linings for wear and damage.
Replace it if worn beyond limit or damaged.

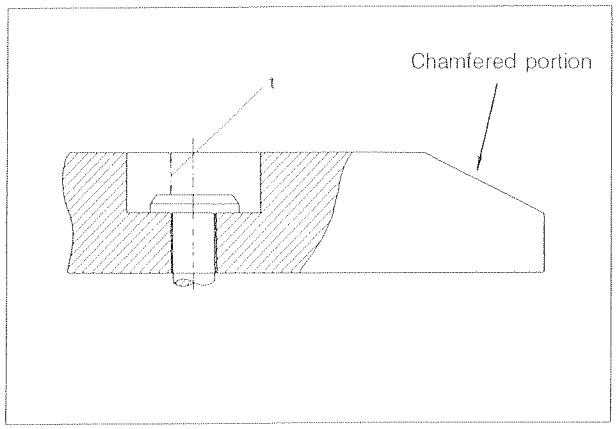


Fig. 59

Unit: mm (in)

	Standard value	Limit for use
Brake drum inner dia.	2.6 (01)	2.8 (0.11)
Rivet head depression (t)	3.5 (0.13)	0.3 (0.01)

6.5 Reassembly

Follow disassembly procedure in reverse order noting the following:
Keep brake drum and linings free from oil.

6.6 Adjustment

(1) When brake assembling is completed, adjust clearance between brake drum and linings by rotating adjuster.

NOTE:
Rotate adjuster to expand brake shoes until brake is dragged. After that, turn back adjuster by 11 notches.

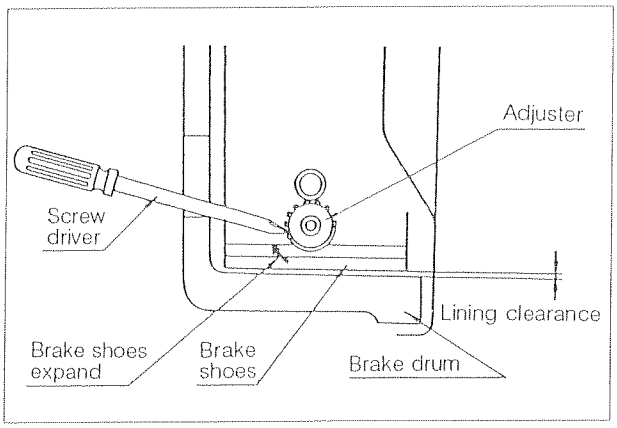


Fig. 60

(2) Adjustment of rod
Adjust rod (3) (Fig. 55) so that bake lever travels 2 to 3 notches of ratchet when brake is applied.
After that relax brake lever completely and adjust rod (3) (Fig. 55) so that height of brake pedal from floor board stands about 100 mm (3.9 in).

7. REAR AXLE

7.1 General

The SV200 is of rear wheel drive type in which one pump drives one motor.
The SV200D, SV200T, SV200TB are of all-wheel drive type with one pump driving two motors connected in parallel with each other. Front roll is directly driven by a motor with reduction gear built in it. Reduction gear is of 2-stage planetary gear type, delivering high power.
Rear wheels of all models are driven by low-speed, high-torque motor through drive shaft and differential (No-spin differential). Rear axle is fixed to frame.

Rear Axle

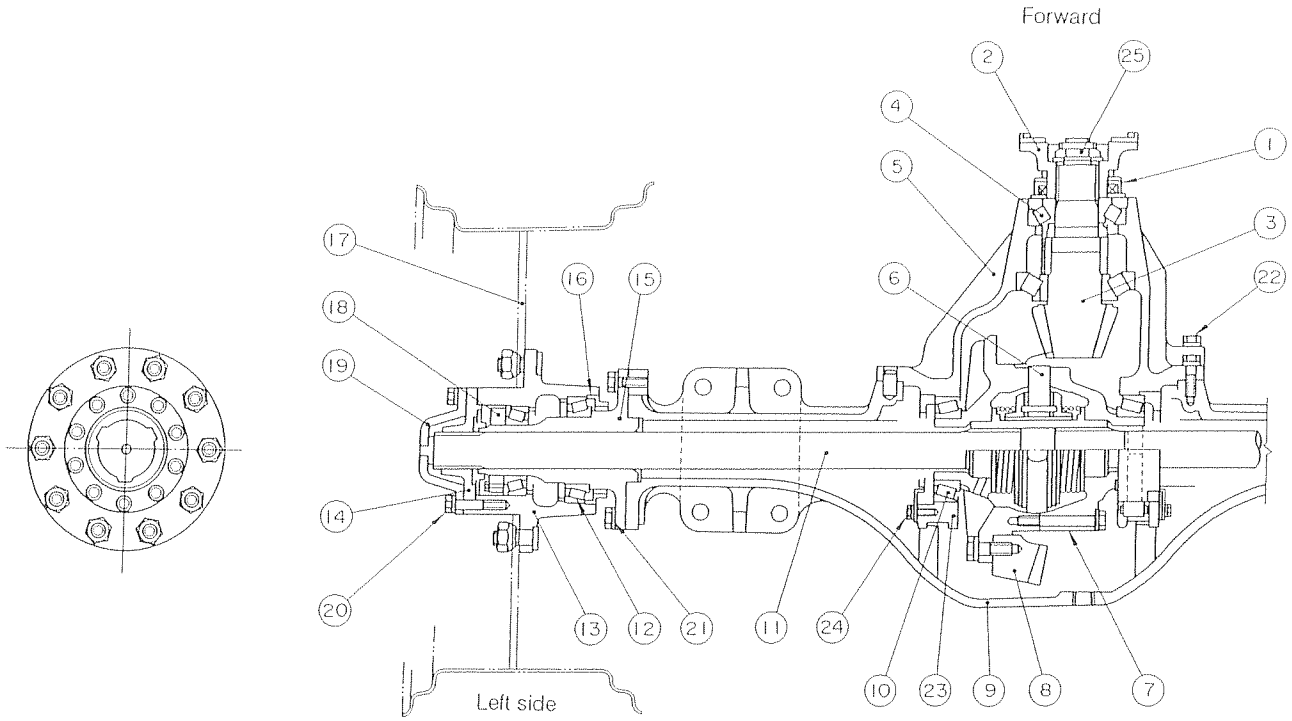


Fig. 61

1. Oil seal
2. Flange
3. Pinion gear
4. Roller bearing
5. Carrier
6. No-spin diff. ass'y
7. Diff. case
8. Gear
9. Housing
10. Roller bearing
11. Shaft
12. Roller bearing
13. Wheel hub
14. Cover
15. Spindle
16. Oil seal
17. Disc wheel
18. Bearing nut
19. Cover
20. Bolt
21. Bolt
22. Bolt
23. Cap
24. Lock washer
25. Nut

7.2 Trouble-shooting

Complaint	Cause	Remedy
Unusual vibration and noise	1. Drive shaft joint bearings damaged 2. Drive shaft bent or loose fixing bolts 3. Gears worn 4. Gears improperly meshing 5. Pinion gear bearings or differential bearings loosened or worn 6. Oil level low	Replace bearings Correct or replace, or retighten Replace Adjust Adjust preload or replace Add oil up to proper level
Unusual sound when starting or while operating	1. Gears broken 2. Spline play excessive 3. Joint kit worn or damaged 4. Mounting portions loosened 5. Foreign matter inside casing	Replace Replace splined parts Replace Retighten Remove
Oil leaks from casing	1. Oil seal damaged 2. Diff. carrier fixing bolts loosened 3. Cracks in casing 4. Air breather clogged	Replace Retighten Replace Clean or replace
Machine does not travel	1. Gear broken 2. Drive shaft or axle shaft broken	Replace Replace

7.3 Disassembly

Differential and Pinion Gear Ass'y

(1) Remove bolts (20) and cover (19). Pull off axle shaft (11) together with wheel hub cover (14).

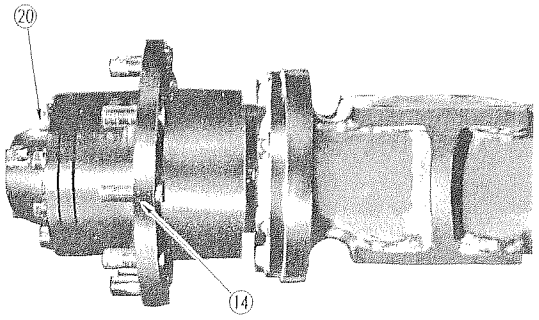


Fig. 62

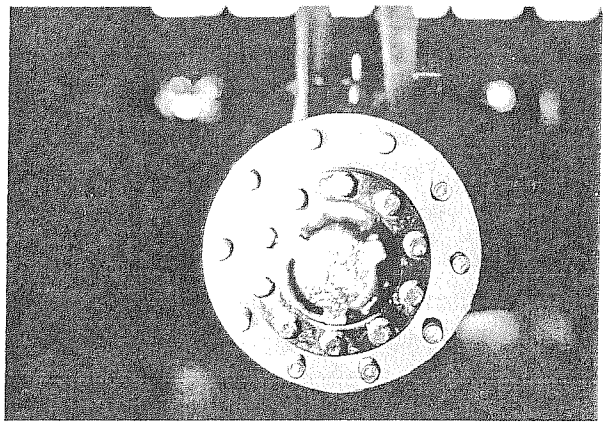


Fig. 63

(2) Remove diff. carrier securing bolts (22). Separate diff. carrier (5) from axle housing (9).

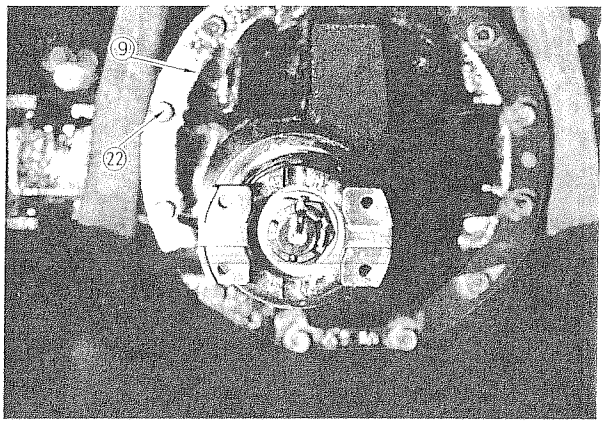


Fig. 64

(3) Scribe match mark on diff. carrier (5) and bearing cap (23).
(4) Remove lock washers (24) and remove retaining bolts. Separate diff. cases each other. Take out differential ass'y.
(5) Remove bolts that secure bevel gear to diff. case, and separate the gear.

Pinion Gear Ass'y

(1) Remove nut (25) and remove flange (2).
(2) Separate pinion gear (3) from diff. carrier (5) by means of a bench press or puller.

7.4 Inspection

Check disassembled parts for cracks, wear, damage, deformation and seizure. Correct or replace parts if found to be abnormal.

CAUTION:
When bevel gear or pinion gear needs replacement, replace both as a set.

7.5 Reassembly

Reverse disassembly procedure noting the following:

1. Drive Pinion Assembly

(1) Assemble drive pinion pilot bearing in advance and press it into pinion gear.
(2) To install bearings to pinion gear, check to be sure that they are facing in correct direction.
(3) Torque bolts and nuts to specification.

2. Differential Case Assembly

(1) Replace all bevel gear fixing bolts with new ones, and crimp after tightened to specification to prevent going loose.
(2) Make match mark on differential cases.
(3) Assemble bearings so that they are facing in correct direction. If disassembled bearings are used again, be sure to put them back where they were.

Tightening torque — Unit: kgf-m (ft-lb)

Fixing bolts or nuts for:	Tightening torque
Differential carrier	7 ~ 11 (50 ~ 79)
Bearing cage	9 ~ 13 (65 ~ 94)
Differential cases	9 ~ 13 (65 ~ 94)
Bevel gear	23 ~ 31 (166 ~ 244)
Bearing cap	28 ~ 36 (202 ~ 260)

7.6 Assembly

1. Pinion Gear Assembly

After installation of pinion gear assembly, adjust torque required to rotate bearing to 12 ~ 17 kgf-m (86 ~ 123 ft-lb) by means of shims. To determine torque, wind around bearing cage a rope with a pull scale at its end. If torque measured is in excess of specified value, add shims properly between cage and carrier. Reduce shims if hook scale reads below specification. After correct adjustment has been made, bend up plate that locks nut.

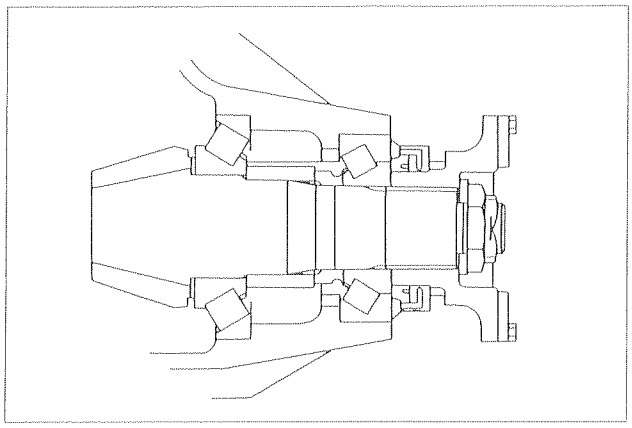


Fig. 65

2. Bevel Gear Contact and Backlash between Drive Pinion and Gear

(1) Temporalily assemble bevel pinion assembly to differential carrier using shims with a total thickness of 3.5 ~ 4.0 mm (0.138 ~ 0.158 in) and tighten fixing bolts. Then, assemble differential case assembly to carrier. Install bearing outer races, adjusting nuts and bearing caps to differential case assembly and temporarily tighten fixing bolts.
(2) Adjust tooth contact allowing a backlash of 0.2 ~ 0.3 mm (0.008 ~ 0.012 in) between drive pinion and bevel gear. To adjust drive pinion, use shims. To adjust bevel gear, screw in or out adjusting nut.

3. Preloading Differential Case Bearings

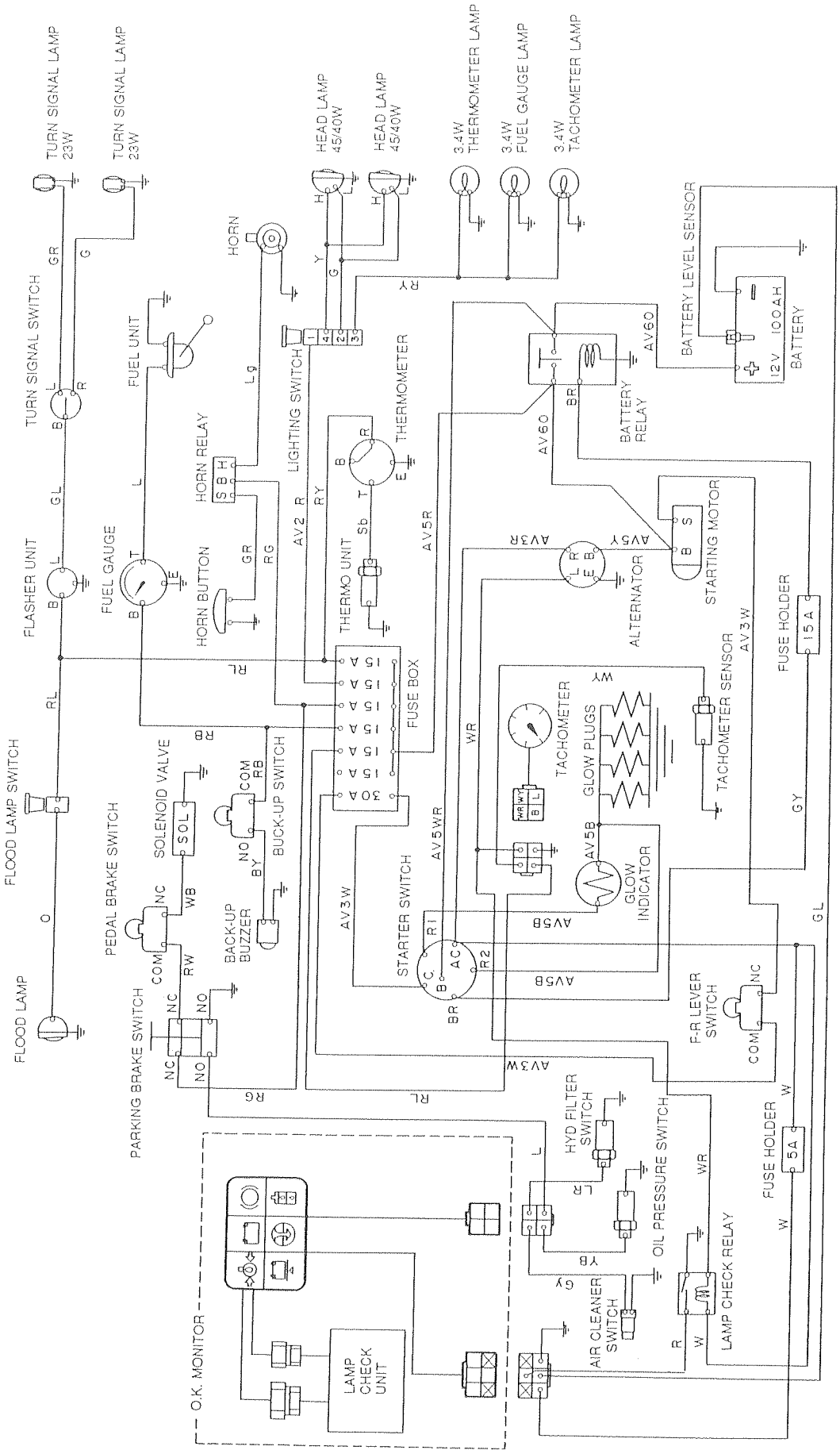
To preload differential case bearings, proceed as follows:
After correct backlash adjustment has been made, assemble component parts, recheck backlash between drive pinion and gear, screw in adjusting nuts until they come into contact with gearing. From this position, turn in nuts further 1 to 1.5 notches. Thus bearings will properly be preloaded.

4. Bevel Runout

Check bevel gear for runout at its back using a dial indicator. If measured value is in excess of 0.2 mm (0.008 in), disassemble gears and readjust them so that amount of backlash fall within 0.1 mm (0.004 in).

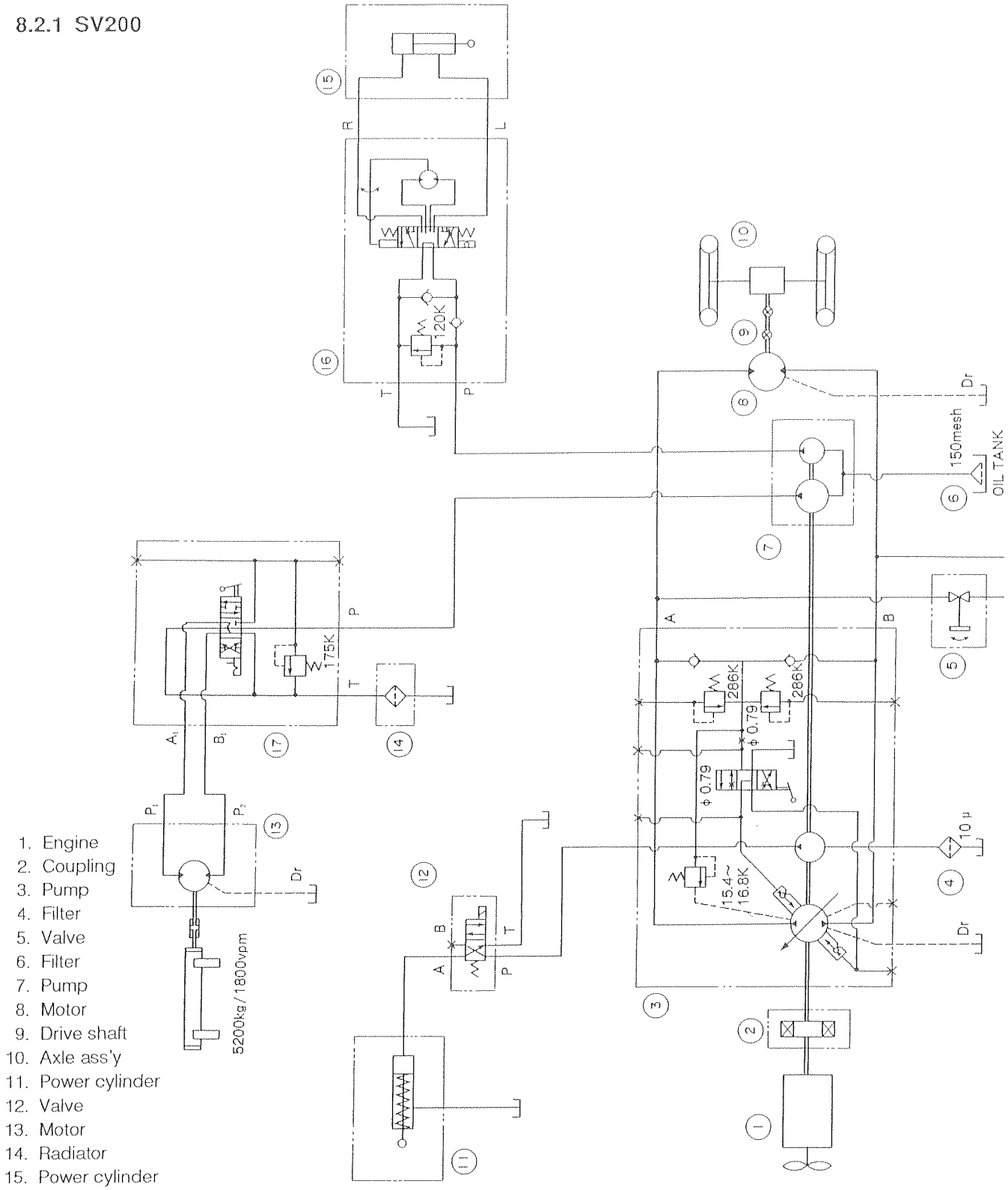
8. ELECTRIC WIRING DIAGRAM & HYDRAULIC CIRCUIT

8.1 Electric Wiring Diagram



8.2 Hydraulic Circuit

8.2.1 SV200



1. Engine
2. Coupling
3. Pump
4. Filter
5. Valve
6. Filter
7. Pump
8. Motor
9. Drive shaft
10. Axle ass'y
11. Power cylinder
12. Valve
13. Motor
14. Radiator
15. Power cylinder
16. Orbitrol
17. Valve ass'y

Fig. 66

1. Engine
2. Coupling
3. Pump
4. Filter
5. Valve
6. Filter
7. Pump
8. Motor
9. Drive shaft
10. Axle ass'y
11. Power cylinder
12. Valve
13. Motor
14. Radiator
15. Power cylinder
16. Orbitrol
17. Valve ass'y
18. Motor

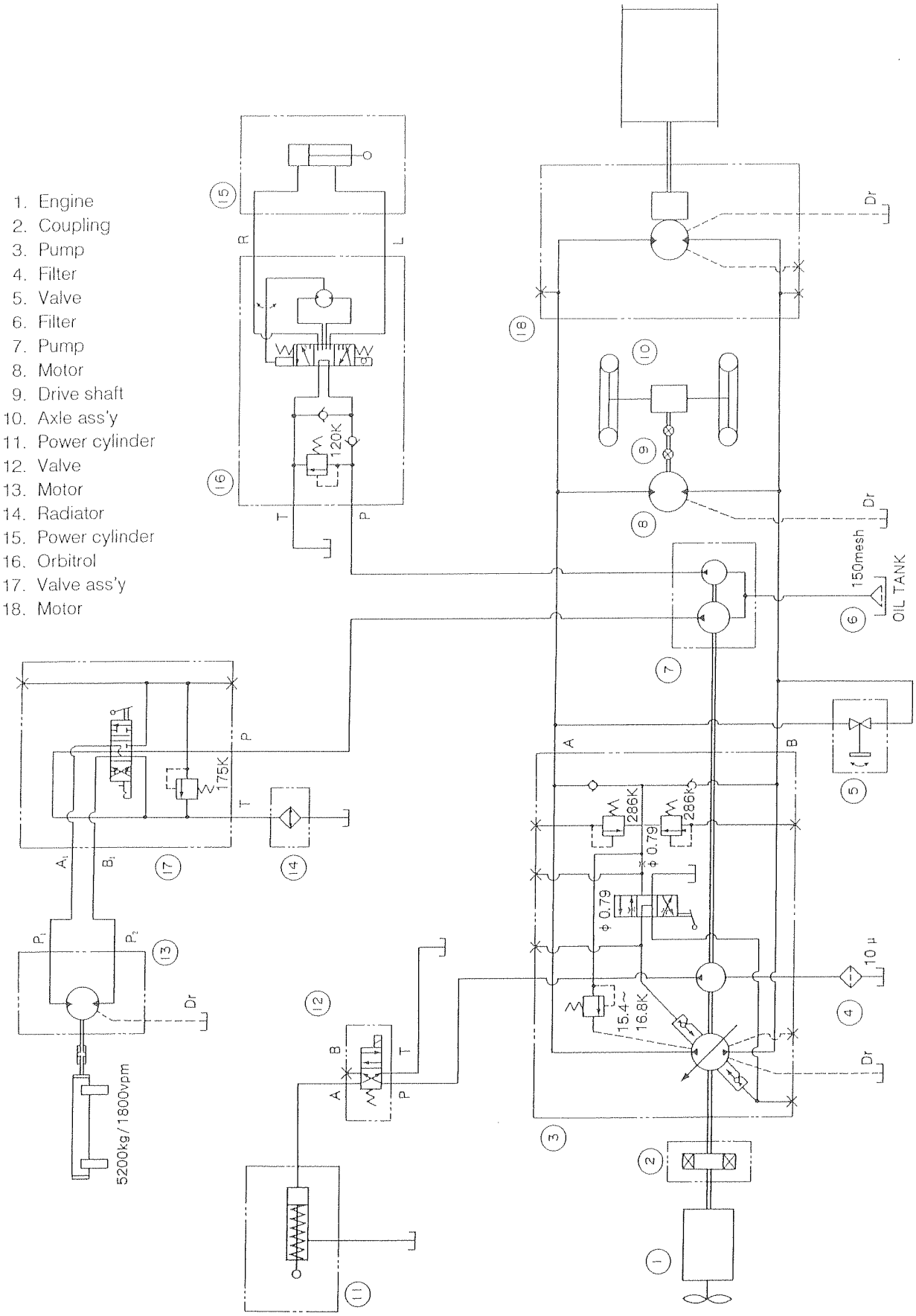


Fig. 67

1. Engine
2. Coupling
3. Pump
4. Filter
5. Valve
6. Filter
7. Pump
8. Motor
9. Drive shaft
10. Axle ass'y
11. Power cylinder
12. Valve
13. Motor
14. Radiator
15. Power cylinder
16. Orbitrol
17. Valve ass'y
18. Motor
19. Power cylinder
20. Power cylinder

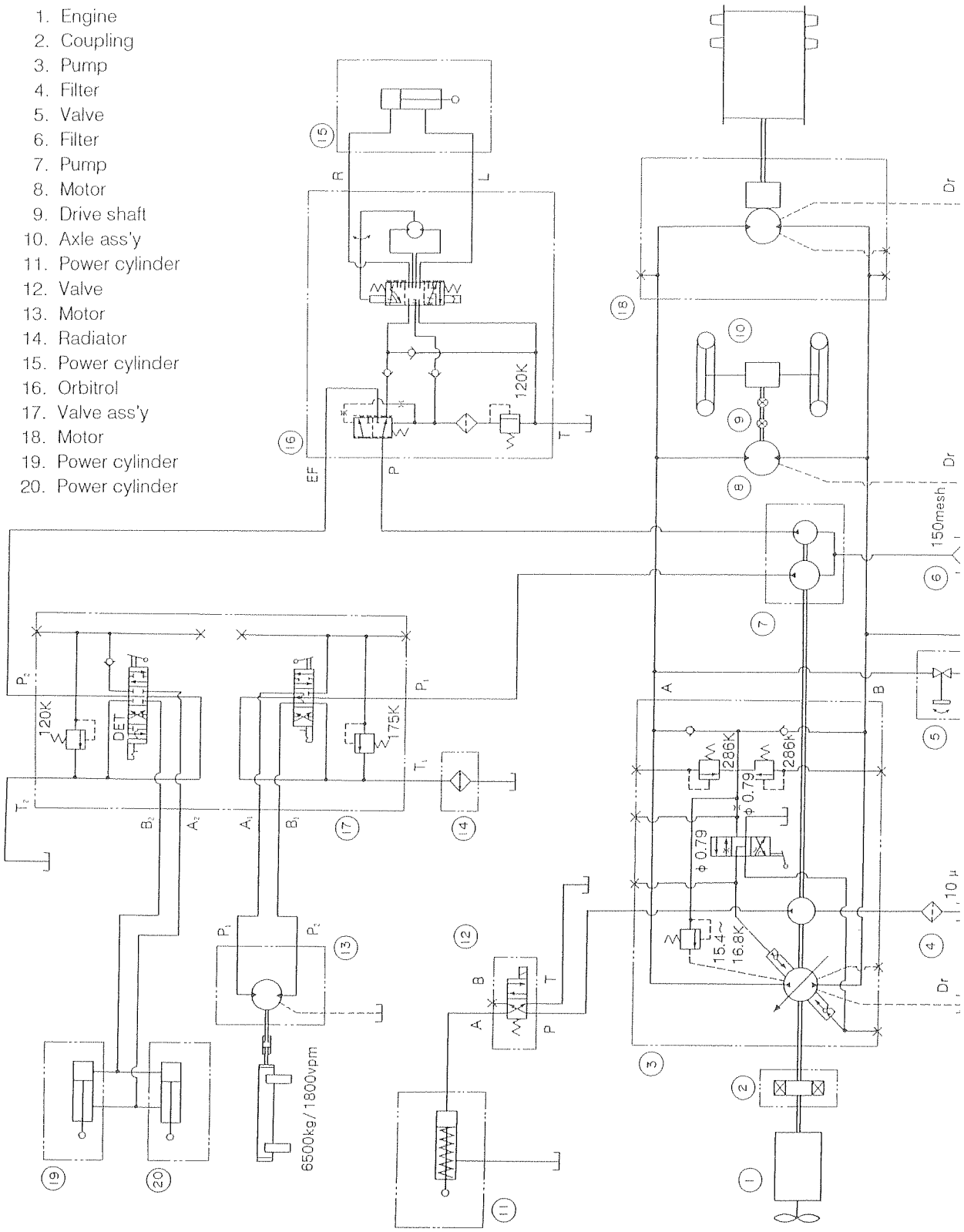


Fig. 68

9. LUBRICATION GUIDE

TO SUPPLY WATER AND LUBRICANTS

General Cautions

(1) Fill fluid reservoirs with filters installed.
(2) It is very important to use recommended lubricants only.
(3) Avoid mixed use with different brands.
(4) When changing fluids, drain completely and clean reservoir interior.

Refill Capacity

Fill compartment	Lubricant	Capacity liter (gal)
Fuel tank	Diesel fuel	100 (26.4)
Engine oil pan	Engine oil	4.5 (1.2)
Hydraulic tank	Hydraulic oil	37.5 (9.9)
Gear case: Wheel motor	Gear oil	1.7 (0.4)
Differential case	Gear oil	4 (1.1)
Vibrator	Gear oil	5 (1.3)
Radiator	Coolant	9 (2.4)

Rating

Lubricant	Service rating	Viscosity rating			Standard
		-15 ~ 30°C (5 ~ 86°F)	0 ~ 40°C (72 ~ 104 °F)	15 ~ 55°C (59 ~ 131°F)	
Engine oil	API grade "CD"	SAE10W-30	SAE30	SAE40	MIL-L-2104C
Gear oil	API grade "GL4"	SAE80W-90	SAE90	SAE140	MIL-L2105
Hydraulic oil	Wear resisting hydraulic oil	ISO VG32 over VI140	ISO VG46 over VI140	ISO VG68 over VI110	ISO-3448
Grease	Luthium type extreme-pressure grease NLGI-2				
Diesel fuel	ASTM-D975-2D				

STANDARD OF USABLE LIMIT FOR ANTIFRICTION-TYPE BEARINGS

Service limit for antifriction-type bearings

The service limits for antifriction-type bearings must be determined by inspecting the outer and inner races, rolling members (rollers, balls, needles), and retainers in respect to the conditions specified below.

1. External appearance
2. Rotating condition, noise
3. Radial clearance

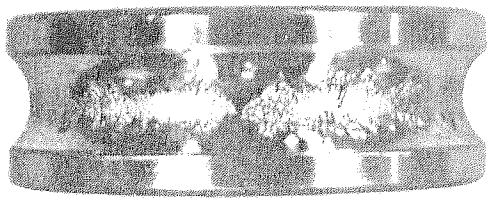


Fig. 1 Flaked race way

1. External appearance

a) Flaking

Flaking is surface exfoliation of the race way due to fatigue through repeated contact with loads, which is a sign of limitation to the service life of that particular bearing. Such bearings are no longer usable regardless of the extent of flaking. There occurs so-called "pitting" on the race way as an early stage of flaking. If it so happens, the bearing cannot be used.

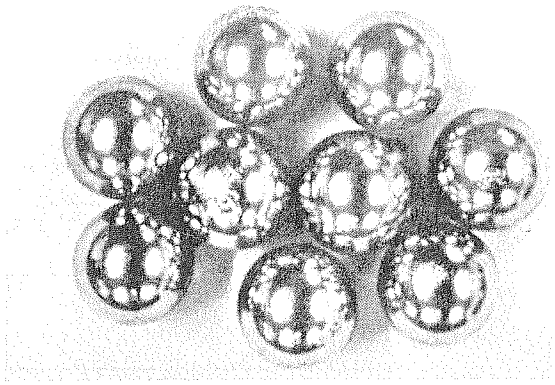


Fig. 2 Ball flaking

b) Discoloration and seizure

Discoloration results from oil staining, corrosion, and heat and is a sign of seizure. When the race way, rolling member, or retainer is violet-colored, the bearing has lost hardness and needs to be replaced. A brown stain resulting from oil buring should not always be critical to the bearing. It is serviceable when the stain can be removed with solvent or thinner.

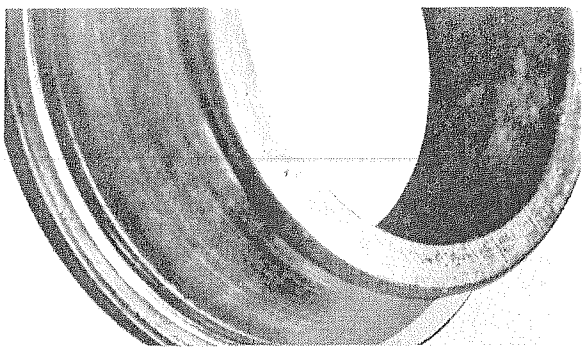


Fig. 3 Seizure

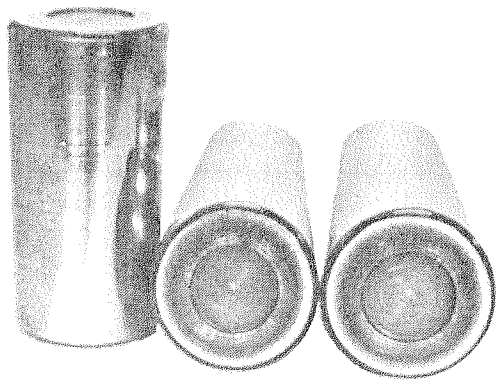


Fig. 4 Discoloration

c) Check and fracture

A hair line crack is sometimes invisible, but can easily be found by a dyeing crack-search method. Replace the bearing if hair-cracked even slightly. Fractures happen along the edge of the race way or roller-retaining rib and on the roller. The bearing will be allowed for use after careful polishing with fine tone, if its fracture is off such critical parts of the bearing and very slight.

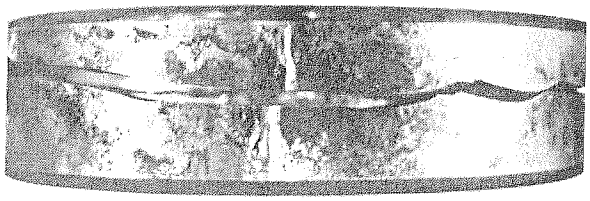


Fig. 5 Circular crack

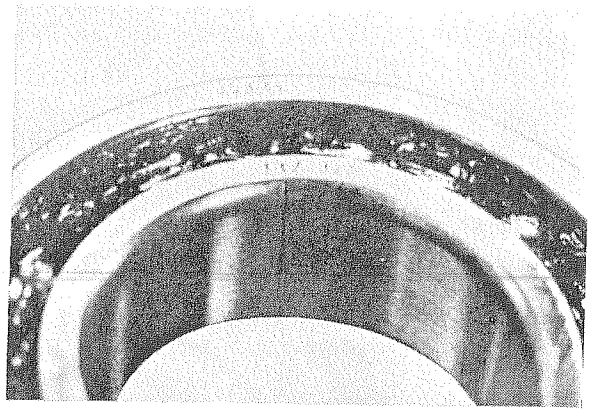


Fig. 6 Axial crack

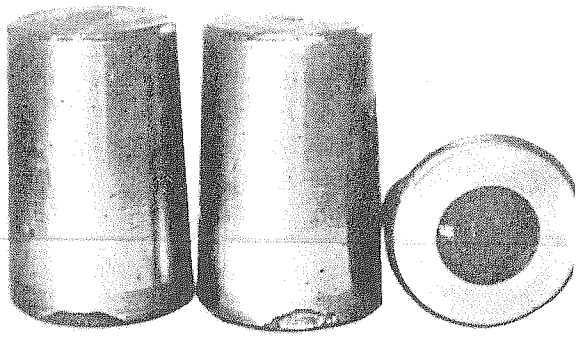


Fig. 7 Fracture

d) Retainers

Retainers can roughly be grouped into a pressed type and solid type by manufacturing process and into iron, gun metal and bakelite by material. The retainer, if broken or deformed, should be replaced regardless of the extent of damage.

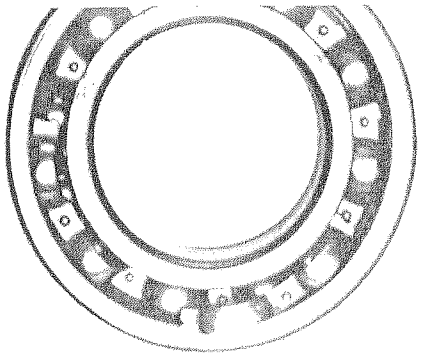


Fig. 8

e) Rust and corrosion

Moisture brings about a corrosive formation of ferrous oxide. Unlike wear, this corrosion is not related directly to the fatigue of the bearing material, therefore, a slight extent of corrosion does not make the bearing unusable, unless the race way and rolling members suffer corrosion. However, deep corrosion will possibly be a cause of early exfoliation or fracture, and hence the bearing should not be used if it is so corroded.

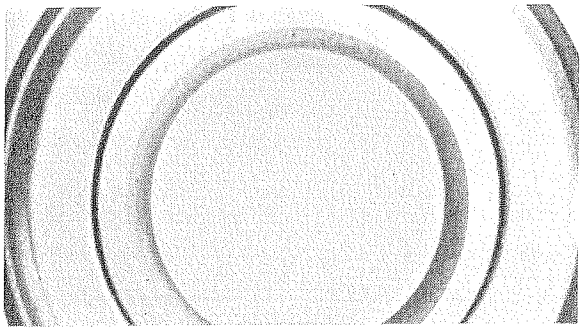
Corrosion or a rusty swelling, even if slightest, must be completely removed by oil stone. Handle bearings with care, because fingerprints left on them often result in a corrosive formation thereof.

Fig. 9 Corroded bearing

Fig. 10 Fingerprint rust

f) Wear

Wear on a bearing is caused by the slippage of its race way or the entering of abrasive particles from worn gears, and accordingly wear has nothing to do with the fatigue of the material. As long as the bearing is evenly worn and rotates smoothly, it may be used until the wear reaches the service limit of its radial clearance. A tapered roller bearing may be used by adjusting the clearance when the race way and roller surfaces are merely worn and it turns smoothly. When a bearing is unevenly worn or indented, or has loosened retainer rivets, the bearing should not be used any longer.



g) Electric erosion

The bearings used in this machine are designed to prevent an electric current from flowing, however, in those used on an electric motor, stray currents sometimes cause sparks to jump between the race ways and rolling members, thus developing a small melted point. A small electric erosion is permissible, but not a large one.

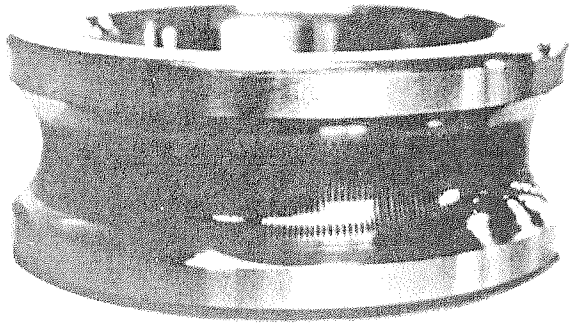


Fig. 12 Heavy electric erosion

h) Indentation by local pressing

Indentations by partial pressing are the result of plastic deformation caused by careless fitting, jamming obstacles, or impact load applied at installation. (ex. careless hammering).

An indented bearing should be replaced unless its indentation is very slight.

Careless handling at mounting or jamming obstacles admitted cause scratches on the contact face of the race and rolling members. A shallow or slight scratch may be permissible, but a score or scuff forming any plastic flow around it prohibits the use of the bearing. Bearings with localized scratches or scores should preferably be replaced.

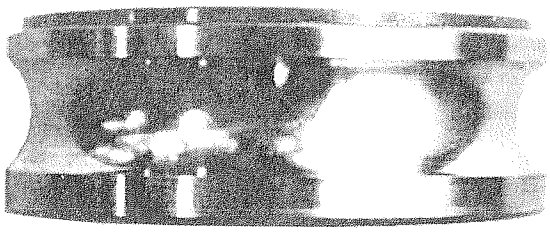


Fig. 13 Indentation caused by local pressing

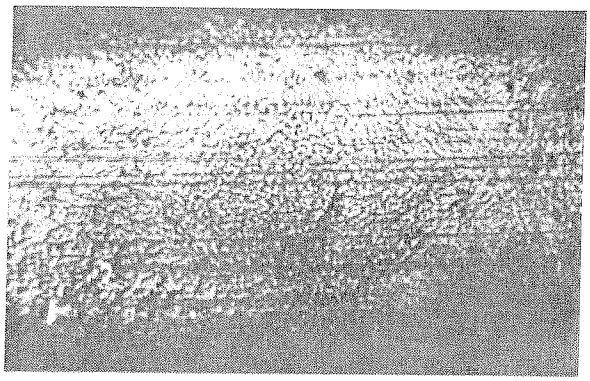


Fig.14 Enlarged view of indentation by local pressing

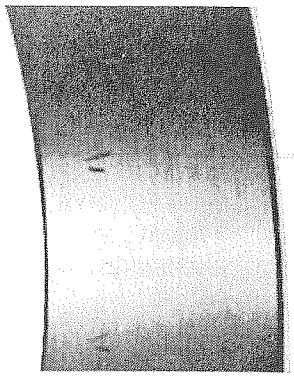


Fig. 15 Scratched outer race

i) Smearing

Smearing is a crowd of small abrasions which result from the slippage between the roller surfaces and race way due to improper lubrication. Smearing generally reduces the hardness of the bearing except tiny dots which may be permissible.

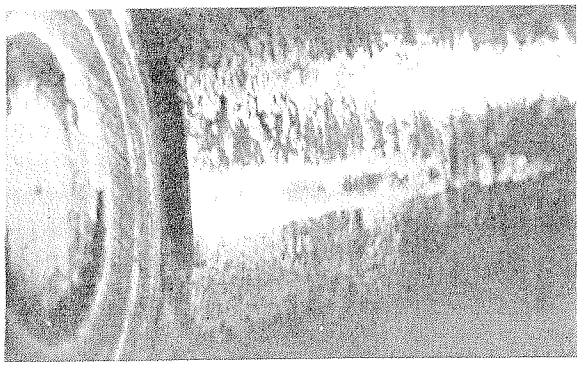


Fig. 16 Smeared roller

j) Creep

When a bearing is not fitted properly, its outer or inner race slips round on the fitted surface. This is called "Creep". A bearing being dragged must be replaced unless it is fitted in a position where the load is relatively small.

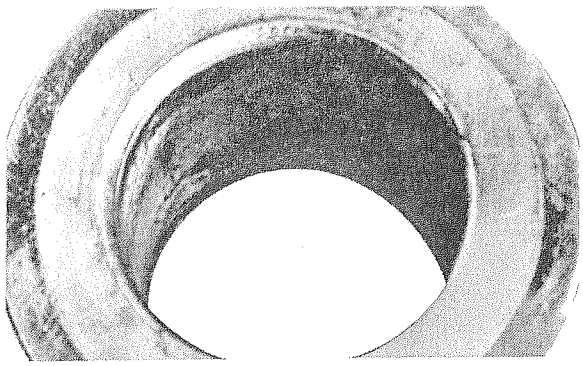


Fig. 17 Creep due to improper fitting

2. Checking for rotation and noise

To inspect a bearing for proper rotation, hold the inner race stationary, turn the outer race lightly, and change the position from vertical to horizontal and vice versa. If the bearing comes to a stop without noise or vibration, it proves to be in good condition, i.e., serviceable. Dust or grease must be completely removed from the bearing before this inspection. Foreign materials remaining inside the bearing cause irregular or noisy rotation. Further, excessively sticky oil or grease is a cause of misjudgement, as it acts as a damper to absorb vibration from the bearing being tested.

3. Clearance

What is meant by a clearance here is the clearance between the races and rolling members, that is, a radial clearance to be produced when one of the races is radially moved with the other one held stationary. When checking a radial clearance, hold one race stationary and measure the clearance with a dial gauge sensor by radially applying the load given below to the other free race. Check it at several points and take a mean value.

Bearing size Bore of inner race mm (in)		Measuring load kgf (lbs)
Over	To	
10 (0.4)	18 (0.7)	2.5 (5.5)
18 (0.7)	50 (2.0)	5 (11)
50 (2.0)	200 (7.9)	15 (33)

Clearance Limit

Unit: mm (in)

Normal size		Radial ball		Radial roller		Spherical roller		Needle roller		
Over	To	Max. gap	Limit	Max. gap	Limit	Max. gap	Limit	Max. gap	Limit	Measuring load kg (lbs)
24 (0.9)	30 (1.2)	0.025 (0.0010)	0.075 (0.0030)	0.045 (0.0018)	0.135 (0.0053)			0.065 (0.0026)	0.195 (0.0077)	5 (11)
30 (1.2)	40 (1.6)	0.025 (0.0010)	0.075 (0.0030)	0.050 (0.0020)	0.150 (0.0059)	0.040 (0.0016)	0.124 (0.0049)	0.070 (0.0028)	0.210 (0.0083)	5 (11)
40 (1.6)	50 (2.0)	0.028 (0.0011)	0.085 (0.0033)	0.055 (0.0022)	0.165 (0.0065)	0.045 (0.0018)	0.135 (0.0053)	0.080 (0.0031)	0.240 (0.0094)	5 (11)
50 (2.0)	65 (2.6)	0.036 (0.0014)	0.100 (0.0039)	0.070 (0.0028)	0.210 (0.0083)	0.055 (0.0022)	0.165 (0.0065)	0.090 (0.0035)	0.270 (0.0106)	15 (33)
65 (2.6)	80 (3.1)	0.038 (0.0015)	0.105 (0.0041)	0.080 (0.0031)	0.240 (0.0094)	0.070 (0.0028)	0.210 (0.0083)	0.100 (0.0039)	0.300 (0.0118)	15 (33)
80 (3.1)	100 (3.9)	0.044 (0.0017)	0.130 (0.0051)	0.085 (0.0033)	0.255 (0.0100)	0.085 (0.0033)	0.255 (0.0100)	0.105 (0.0041)	0.315 (0.0124)	15 (33)
100 (3.9)	120 (4.7)	0.049 (0.0019)	0.145 (0.0057)	0.090 (0.0035)	0.270 (0.0106)	0.105 (0.0041)	0.315 (0.0124)	0.210 (0.0047)	0.360 (0.0142)	15 (33)
120 (4.7)	140 (5.5)	0.056 (0.0022)	0.170 (0.0067)	0.105 (0.0041)	0.315 (0.0124)	0.120 (0.0047)	0.300 (0.0118)	0.130 (0.0051)	0.390 (0.0154)	15 (33)
140 (5.5)	160 (6.3)	0.061 (0.0024)	0.185 (0.0073)	0.115 (0.0045)	0.345 (0.0136)	0.140 (0.0055)	0.420 (0.0165)			15 (33)