HYDRAULIC EXCAVATOR

SHOP MANUAL

model SK115SR-1ES
SK135SR(LC)-1ES
SK135SR L-1ES

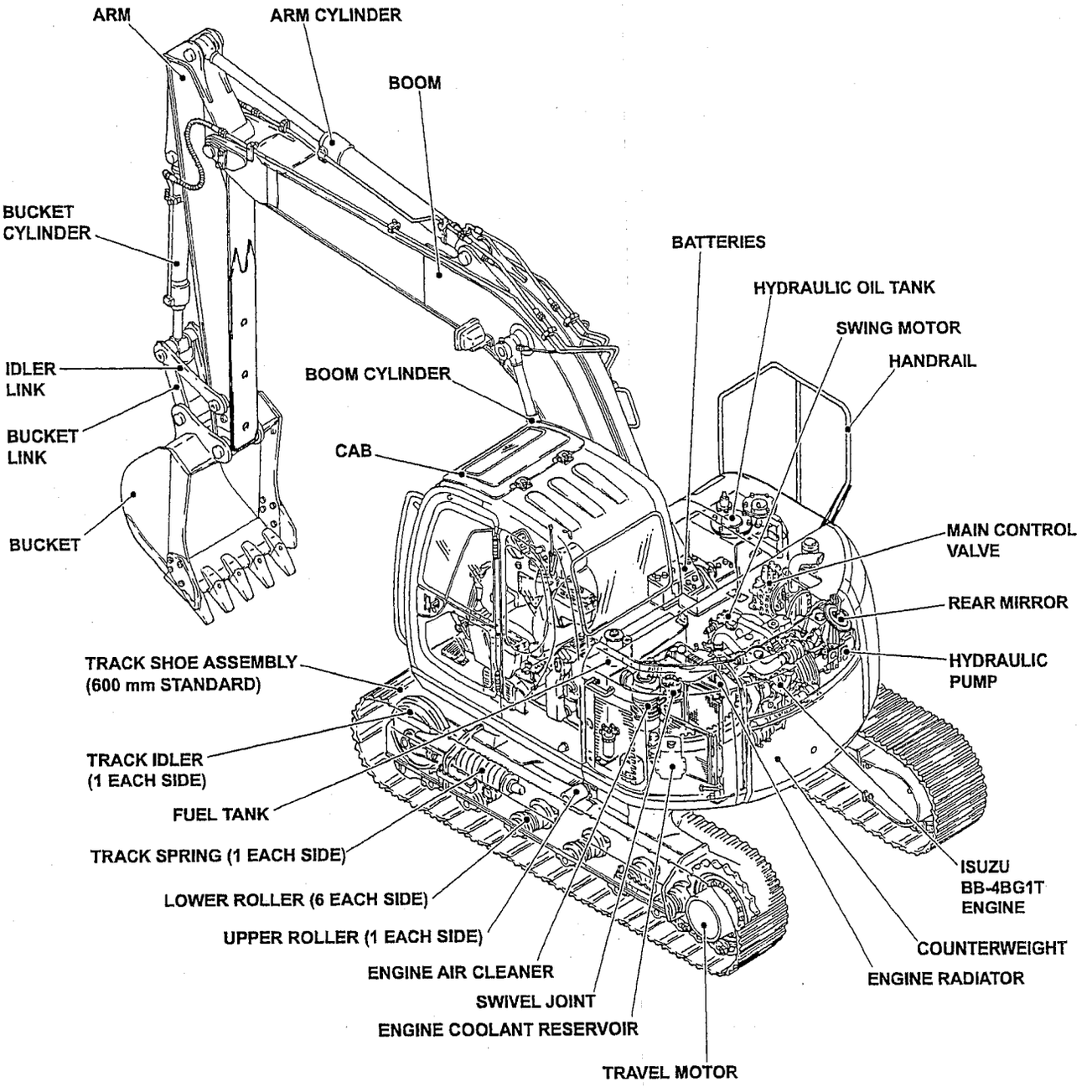
INDEX

1	SPECIFICATION SECTION
2	MAINTENANCE SECTION
3	SYSTEM SECTION
4	DISASSEMBLY SECTION
5	TROUBLESHOOTING
6	ENGINE SECTION
7	INSTALLATION PROCEDURES FOR OPTIONAL ATTACHMENT

KOBELCO

Book code No. S5YY0007E

1. NAME OF COMPONENTS



4. PLUG

(1) Plug for hydraulic pipe joint

1) Cap nut

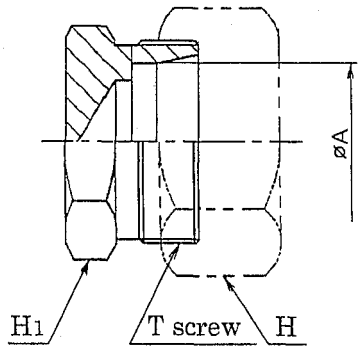


Table 4-1

Applicable pipe O. D : A	Cap nut parts No.	T screw	Opposing flat	
			H1	H
6	ZF83H06000	M12×1.5	14	14
8	ZF83H08000	M14×1.5	17	17
10	ZF83H10000	M16×1.5	17	19
12	ZF83H12000	M18×1.5	19	22
15	ZF83H15000	M22×1.5	24	27
18	ZF83H18000	M26×1.5	27	32
22	ZF83H22000	M30×1.5	32	36
28	ZF83H28000	M36×1.5	38	41

2) Plug

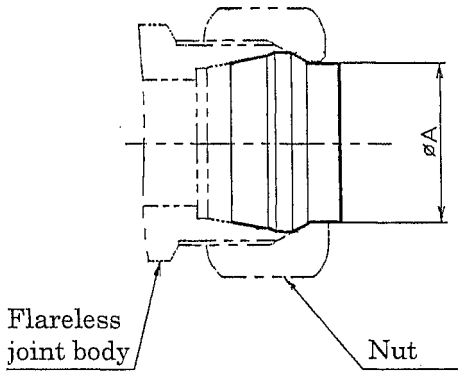


Table 4-2

Applicable pipe O. D : A	Plug parts No.
6	ZF83P06000
8	ZF83P08000
10	ZF83P10000
12	ZF83P12000
15	ZF83P15000
18	ZF83P18000
22	ZF83P22000
28	ZF83P28000

3) Nut

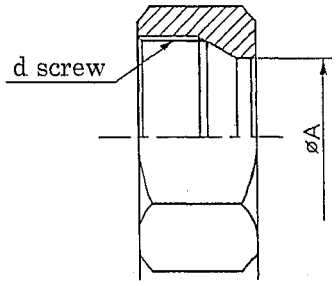
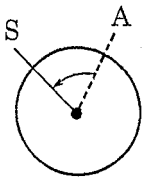
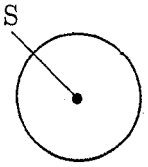
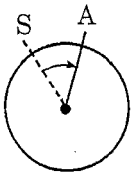
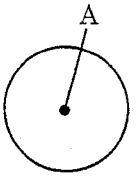
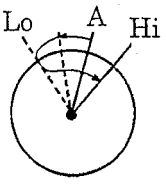
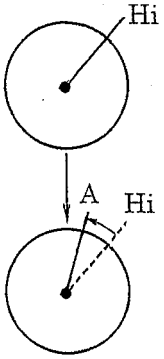


Table 4-3

Applicable pipe O. D : A	Nut parts No.	d screw	Opposing flat
6	ZF93N06000	M12×1.5	14
8	ZF93N08000	M14×1.5	17
10	ZF93N10000	M16×1.5	19
12	ZF93N12000	M18×1.5	22
15	ZF93N15000	M22×1.5	27
18	ZF93N18000	M26×1.5	32
22	ZF93N22000	M30×1.5	36
28	ZF93N28000	M36×1.5	41
32	ZF93N32000	M42×1.5	50
35	ZF93N35000	M45×1.5	55
38	ZF93N38000	M48×1.5	60

Table 18 (2/2)

Procedure	Multi display on gauge cluster	Movement of governor motor
③ Keep the buzzer stop switch pressed and when it is let free after 5 to 10 seconds, STEP 1 is displayed on the multi display. Then wait till the display changes to STEP 2.	STEP 1 CPU START ⇩ STEP 2	 Self-traveled to the engine stop position (S).
④ After confirming the STEP 2 display, move to the engine room and adjust the rod assy to its standard length 135mm(5.31in) so the clearance between the governor lever and the engine stop set bolt becomes 0.1mm (0.004in). Then if the governor motor is replaced, insert the rod assy after the STEP 2 indication.	STEP 2 CPU GAP (STOP)	 Stop at the position 〔Tools〕 ● Spanner 13mm×2pcs ● Spanner 6mm ● Thickness gauge
⑤ Press the buzzer stop switch once, and wait until the STEP 3 indication is provided.	STEP 3 CPU START E/G	 Automatically run to the engine available position(A).
⑥ When STEP 3 comes up, start the engine. On that occasion, the accel dial may be in any position.	STEP 3 CPU START E/G	 Stop at the A position
⑦ If the buzzer stop switch is pressed one time, STEP 4 comes up. The controller reads revolution from the A position of governor motor to LOW IDLE and then to HI IDLE. (The required time is approx 3 minutes.)	STEP 4 CPU MEMORY	 Move from A position to Lo idling position, and self-travels from Lo position to high idling (Hi) position.
⑧ Wait till the indication on the multi display changes to "FINISH" after reading is completed. When the indication on the display changes, the engine revolution returns automatically to an initial position of the accel dial. Note: If "FINISH" is not indicated, it means that the adjustment has failed. Then turn OFF the starter switch and readjust it.	FINISH CPU 2310 rpm.	

(3) PTO gear case

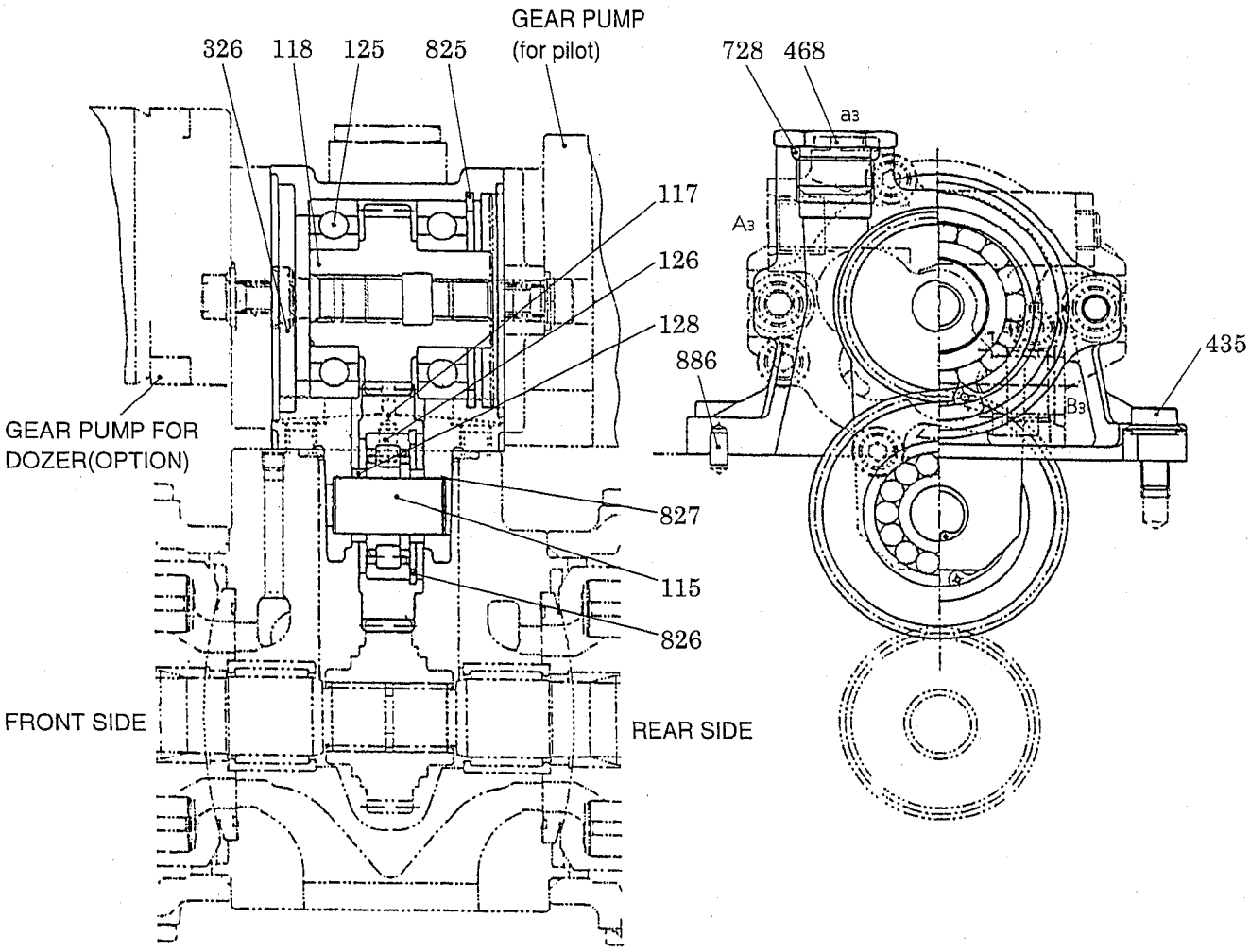


Fig.1-4 Construction of PTO gear case

Table 1-5

No.	NAME	Q'TY	No.	NAME	Q'TY
115	IDLE SHAFT	1	435	FLANGE SOCKET : M10×20	4
117	2nd GEAR	1	468	VP PLUG : PF3/4	1
118	3rd GEAR	1	728	O RING : 1B P24	1
125	BALL BEARING	2	825	SNAP RING	1
126	ROLLER BEARING	1	826	SNAP RING	1
128	BEARING SPACER	2	827	SNAP RING	1
326	GEAR CASE	1	886	PIN	2

3) Shuttle section

- If pressure is built up at port 1 or 3, the ball is pressed against the seat by the pressure. The pressure goes through from port 1 to port 5(or from port 3 to port 6).
  Only a little leakage occurs from port 2 or 4 as the ball is sealed metallically by the seat.
  If pressure occurs at port 2 or 4, the ball is pressed against the body by the pressure. The result is that the pressure connects with port 5 from port 2(with port 6 from port 4).
  Only a little leakage occurs at port 1 or 3 as the ball is sealed metallically against the body.

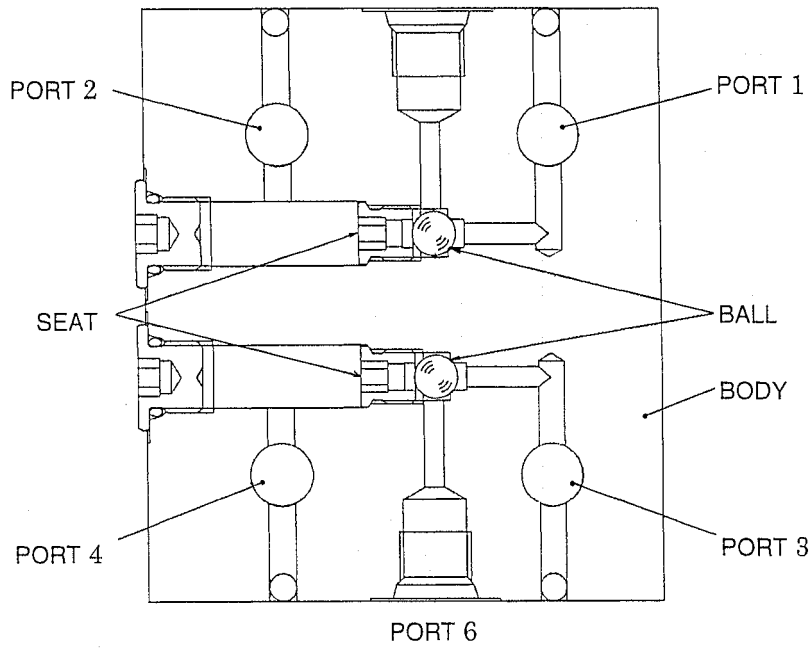


Fig. 3-5 Shuttle section

4) Auto 2—Speed Changeover Mechanism

a) At Low Speed

When no pilot pressure is supplied from port (D), spool (186) is pushed upward by the action of spring (189) and the hydraulic pressure from port (A) or (B) to shut off the pressure at port (C). As the result the oil chamber (P) is released into the motor casing via spool (186).

Consequently, swash plate (103) takes the maximum tilting angle of θ1 that maximizes the displacement of the pistons of the hydraulic motor to run it at low speed.

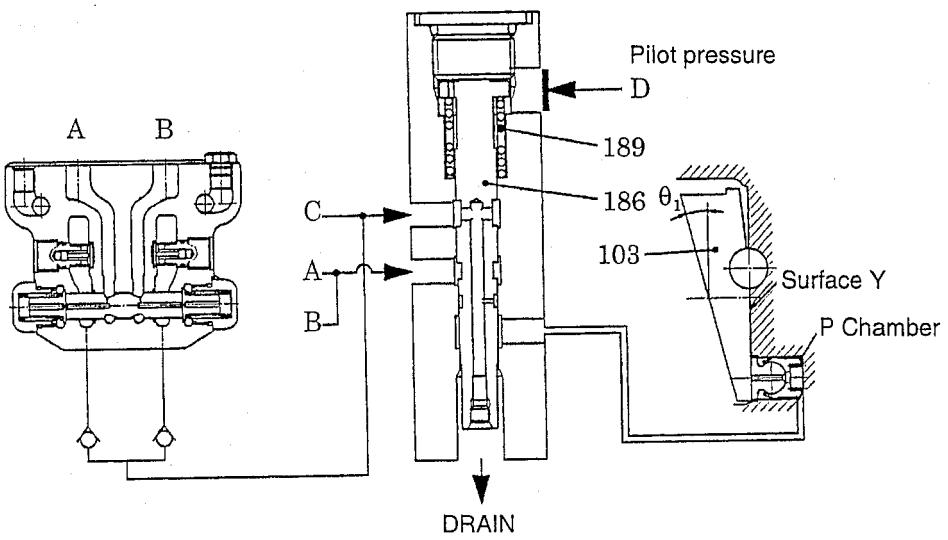


Fig. 13

b) At High Speed

When pilot pressure 〔50kgf/cm² (711 psi) or over〕 is supplied from port (D), it overcomes the action of spring (189) and the pressure through port (A) or (B) and presses spool (186) down. The pressure at port (C) enters chamber (P) via spool (186). Piston (161) then is pushed up till swash plate (103) hits surface X of spindle (2) and is held on that surface. On that occasion, swash plate (103) takes the minimum tilting angle θ2 that minimizes the displacement of the pistons of the hydraulic motor to run it at high speed.

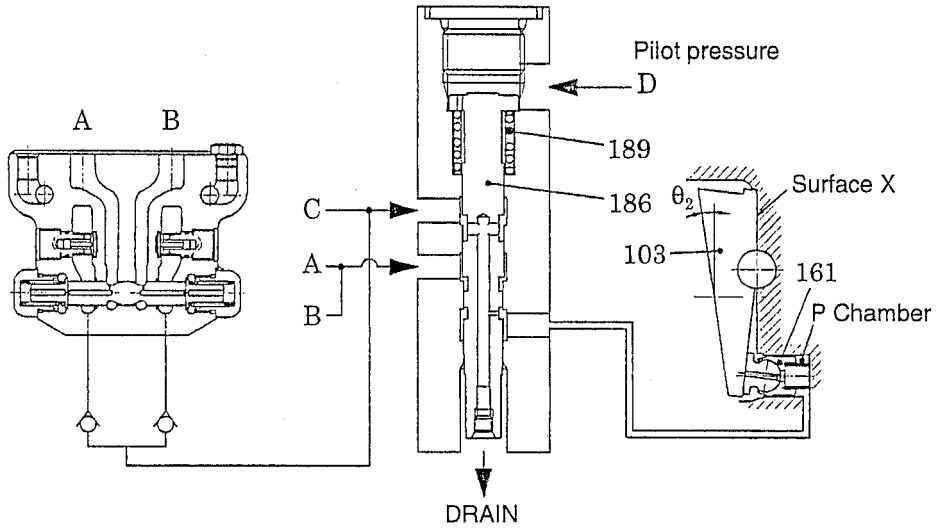


Fig. 14

(6) Replacing the evaporator and the expansion valve

1) Remove the evaporator assy from the bottom of the casing, together with the casing insulator and the expansion valve.

2) Remove the upper and lower casing insulators from the evaporator assy and draw out the evaporator sensor with the sensor holder.

3) Remove the socket head cap screws M5×40 (2 pcs.) from the evaporator. Then separate the expansion valve from the evaporator.
: 4mm

4) Attach O rings (NFO ring 5/8 and 1/2, one piece each) to a new evaporator. Then install the expansion valve to it.
: 4mm,
Tightening torque 0.7kgf·m (5.1 lbf·ft)

- When attaching O rings, use care so the O rings are not caught.

(7) Installing the evaporator sensor
Install the evaporation sensor as shown in Fig.21.

- When installing the casing, exercise care so the sensor cord is not caught by the casing.

(8) Replacing the motor actuator

1) Replacing the mode motor actuator
Remove the connector fixed to the motor actuator.
Remove the rod 120 linking the motor actuator with the mode cam, from the rod holder.
Remove three cross-recessed screws T4×14 (T1) fixing the motor actuator. Separate the motor actuator from the unit, together with the rod holder and the lever MAL1. Remove the rod holder and the lever MAL1 from the motor actuator and install them to a new motor actuator. Assembly is the reverse order of disassembly.

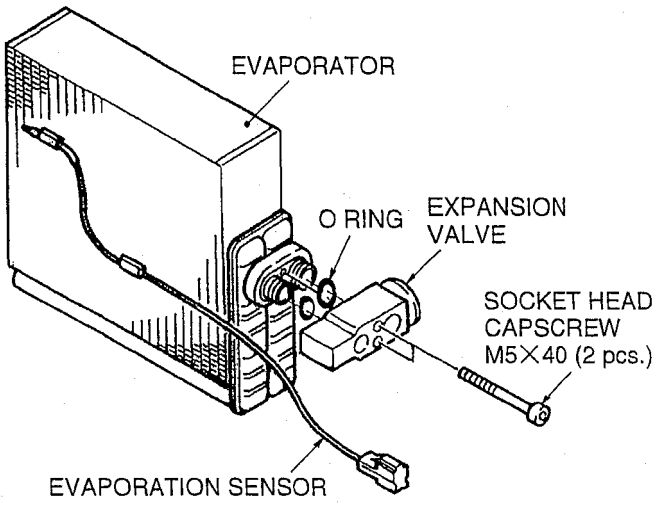


Fig. 20

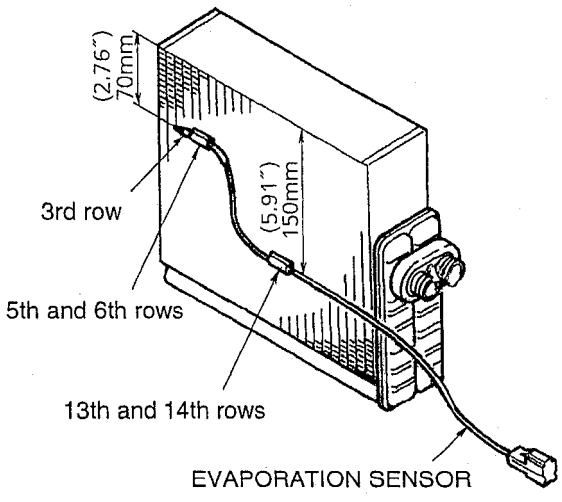


Fig. 21 Installing the evaporator sensor

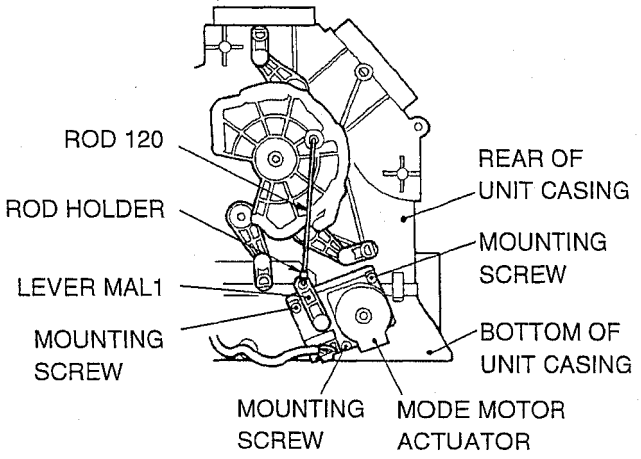


Fig. 22

17. PILOT VALVE (FOR ATT)

17.1 PREPARATION FOR REMOVING

The removing procedure for right and left is the same, so the preparation for left side is described here.

(1) Put attachment on ground, stop engine and release pressure in tank.

(2) Remove panel assy referring to Section 4. Instrument Panel.

(3) Remove one sems bolt (12) M5 from lower side of control box.
: cross recessed screw driver

(4) Remove cover on outer surface.

(5) Remove sems bolt (28) and rubber sheet (29) securing cover and control box on inner surface.
: cross recessed screw driver

(6) Remove cover on inner surface.
: cross recessed screw driver

(7) Remove harness connector for horn.

(8) Attach tag to hoses for identification.

17.2 REMOVAL

(1) Remove hoses from your side to far side in order.
: 19mm,22mm

(2) Shift boots.

(3) Remove four socket bolts (A1) M6.
: 5mm

(4) Remove pilot valve.

(5) Plug hose ends. Plug PF1/4

17.3 INSTALLATION

Install it in the reverse order of removal and tighten it to the below tightening torque.

: 5mm	T=1.5kgf·m	(11 lbf·ft)
: 19mm	T=3.0kgf·m	(22 lbf·ft)
: 22mm	T=5.0kgf·m	(36 lbf·ft)

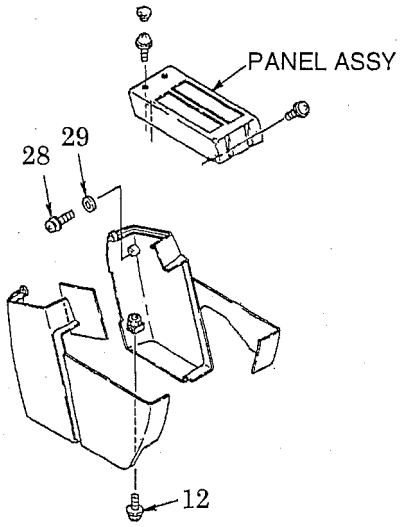


Fig. 17-1 Removing instrument panel

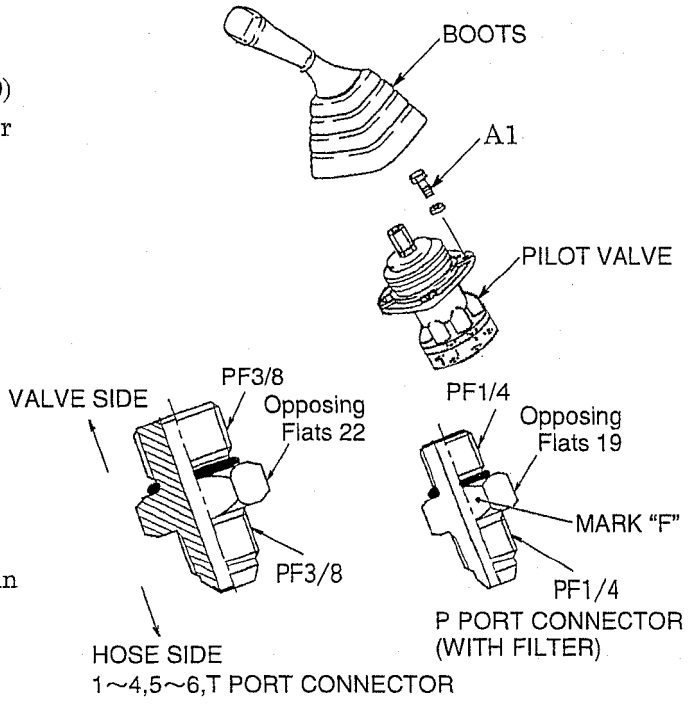


Fig. 17-2 Pilot valve connector

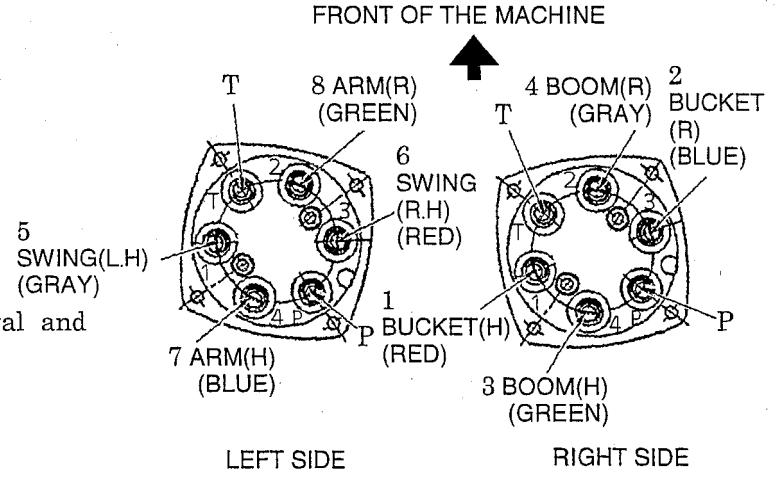


Fig. 17-3 Pilot valve port position (from upper side)

18) Insert outer race of roller bearing
Insert the outer race of roller bearing (444) into valve casing (303), knocking it lightly by means of a steel bar.

- Knock on the outer circumference of the outer race evenly around and fix it so it stops at the step of the valve casing.

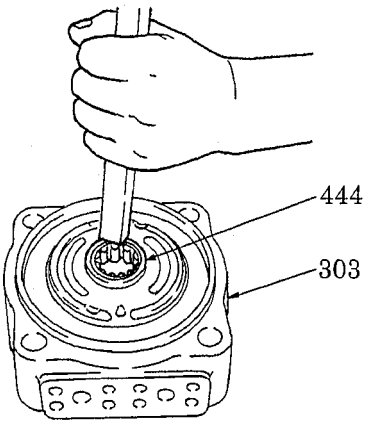


Fig. 5-35 Inserting outer race of roller bearing

19) Installing valve plate
Assemble valve plate (131) into valve casing (303) and then fit O ring (472) in place.

- Coat the contact surface of the valve plate with a thin film of grease. (To prevent it from falling off.)

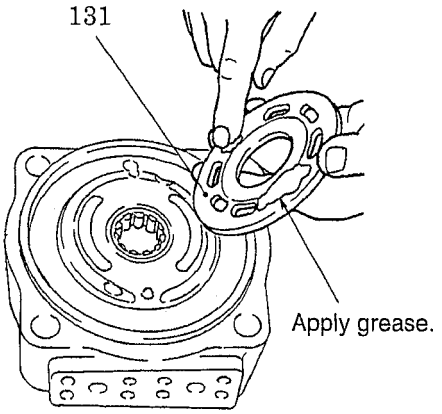


Fig. 5-36 Installing valve plate

20) Installing valve casing
Attach valve casing (303) to casing (301) and fasten it with socket bolt (401).
⌐ : 14mm, Tightening torque : 24kgf·m (170 lbf·ft)

- Beware of the direction of the valve casing.
- Be careful so the valve plate does not come off.
- Use care so the brake spring does not fall down.
- Fasten the socket bolts evenly all around.

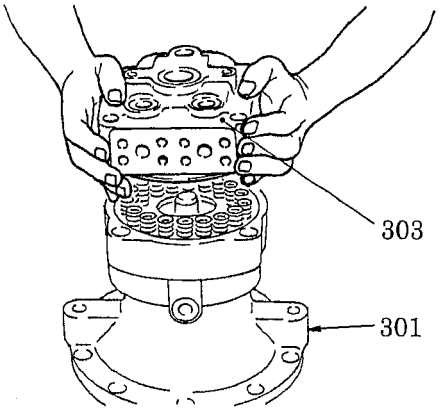


Fig. 5-37 Installing valve casing

21) Fitting plunger
Place plunger (351) and spring (355) into valve casing. Fasten RO plug (469) with O ring (488) into valve casing.
⌐ : 10mm, Tightening torque : 11kgf·m (80 lbf·ft)

- Make sure that the plunger moves smoothly.

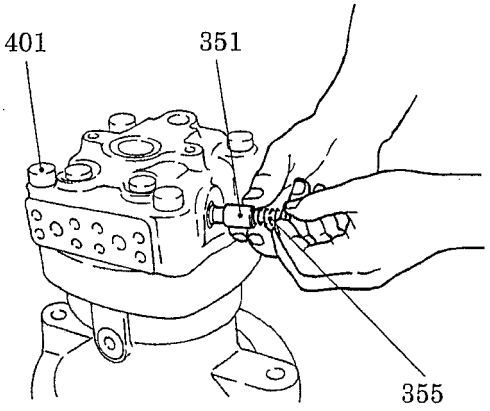


Fig. 5-38 Fitting plunger

2) Remove O ring (135),(139) from piston (112).

- Do not reuse removed O ring (135), (139).

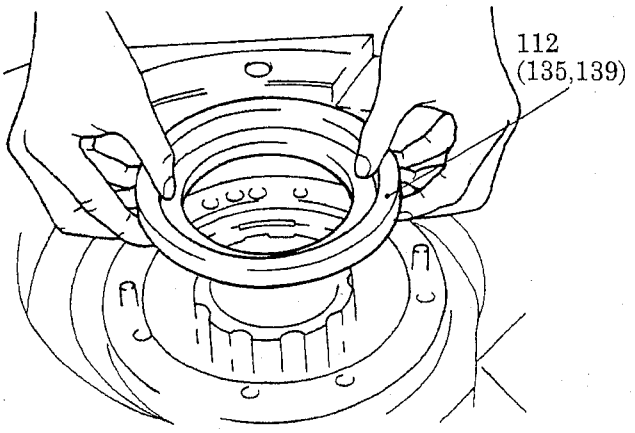


Fig. 1-37 Removing piston (112)

(12) Disassembling the hydraulic motor section

- When placing the travel motor on its side, oil spills ; place a container under the travel motor.

1) Lay down the travel motor through 90 degrees.
2) Drain out the oil of the travel motor.
3) Hold cylinder block (104) by hand, turn it both ways a few times alternately and separate shoe (106) from swash plate (103).
   - If cylinder block (104) is drawn out in that condition, shoe (106) stays with swash plate (103). Then parts (pistons, shoes, etc.) attached to cylinder block (104) come off from cylinder block (104) and fall into spindle (2). Care should be used about it.
4) Hold the cylinder block (104) and remove the shaft (102).
   - Also, friction plate (115) and separator plate (116) are also removed with cylinder block (104).
5) Remove friction plate (115) and separator plate (116), (117) attached on the removed cylinder block (104).
6) Remove piston assy[piston (105) and shoe (106)] and retainer plate (107) from cylinder block (104).
   - When removing the cylinder block, hold the retainer plate (107) by both hands and remove it with the piston assy.
   - Cylinder block (104) and piston assy [piston (105) and shoe (106)] are the minimum parts unit as cylinder & piston kits. When they have to be replaced, replace the cylinder & piston kit as a set. (Refer to the parts manal.)

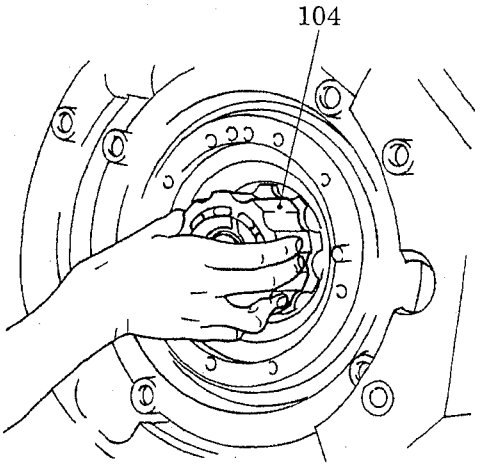


Fig. 1-38 Removing cylinder block (104)

(8) Fixings piston assembly [(161), (162)]

1) Fit piston assy [(161), (162)] and spring (191) to the piston hole of spindle (2).

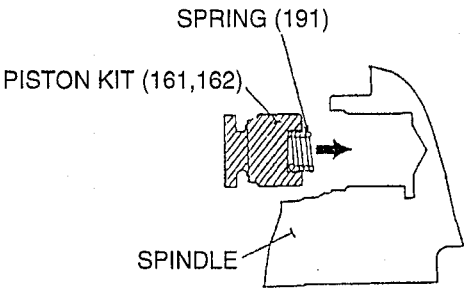


Fig. 55

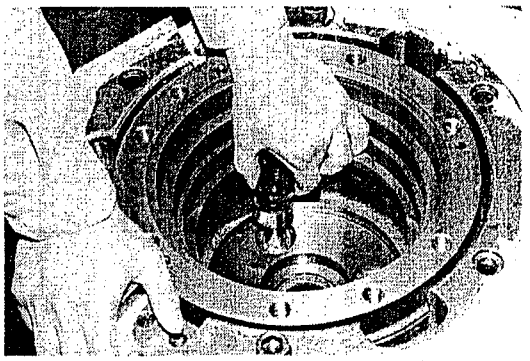


Fig. 56 Installing piston assembly (161), (162)

(9) Fixing steel balls (167)

1) Put two steel balls (167) into the steel ball holes in spindle (2).

(10) Assembling parts into cylinder block

1) Place washer (110), spring (114) and washer (110) into cylinder block (104) and fit snap ring (145) (for hole).

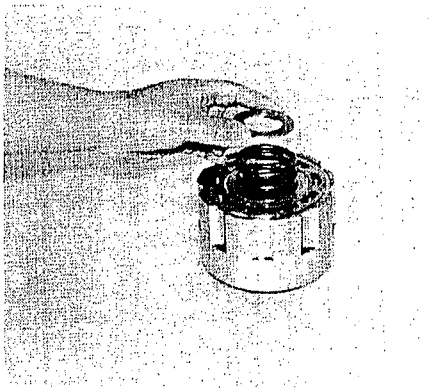


Fig. 57 Fitting cylinder block (104)

2) Place the above-mentioned cylinder block on the press bench. Put holding -down jig (Ⅰ) against washer (110), hold down spring (114) and fix snap ring (145).

⚠
- Cover the sliding surface of the cylinder block with a vinyl sheet for protection.
- Pressing force of spring (114) : more than 100kg.

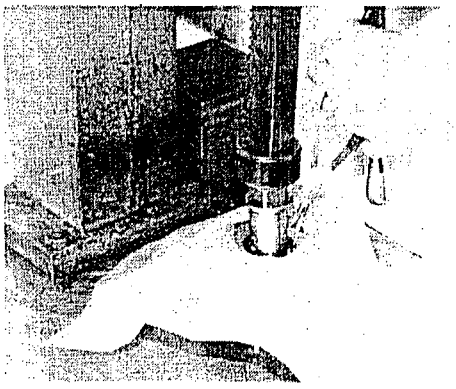
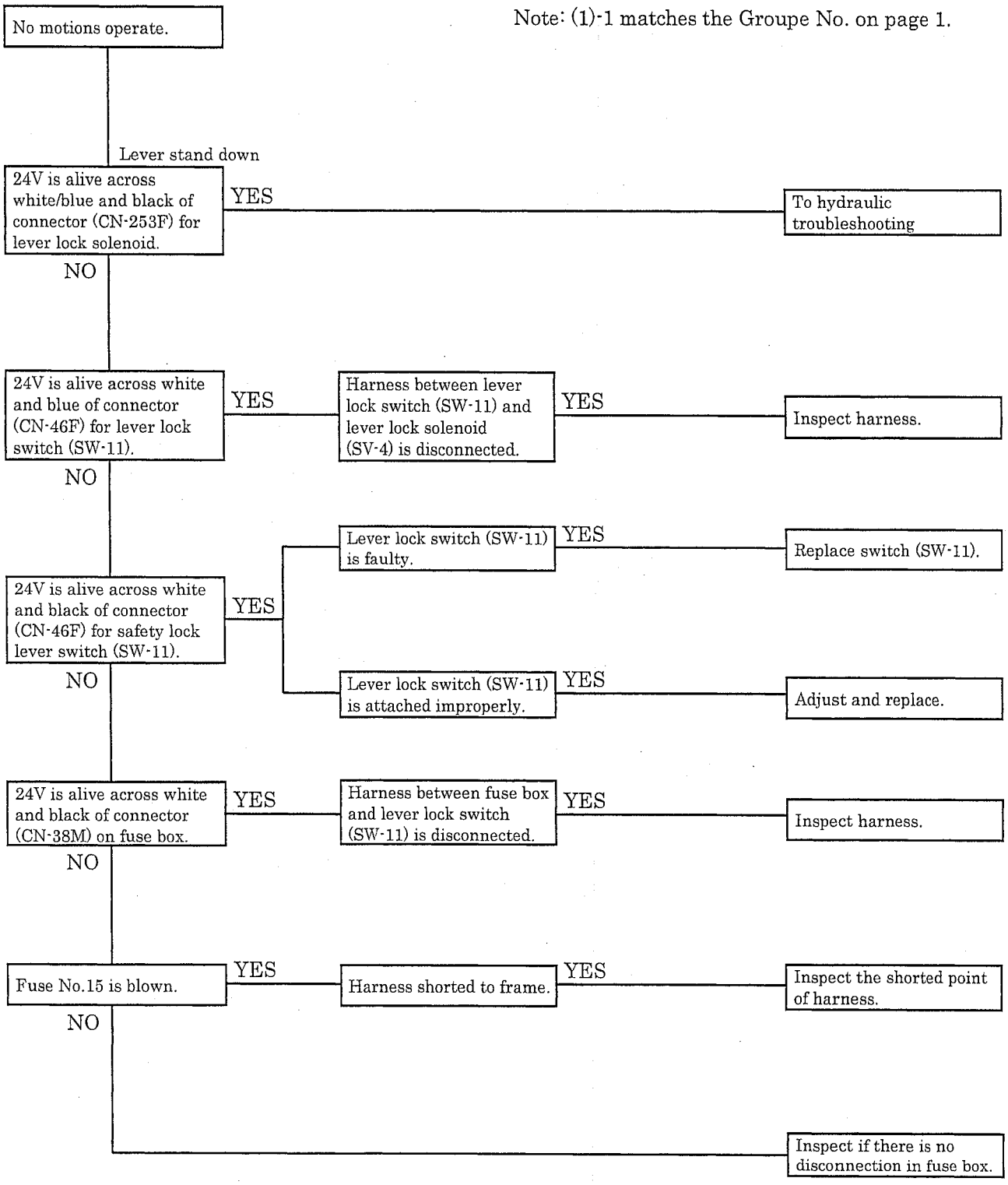


Fig. 58 Fixing snap ring (45)

4. TROUBLESHOOTING

(1)-1

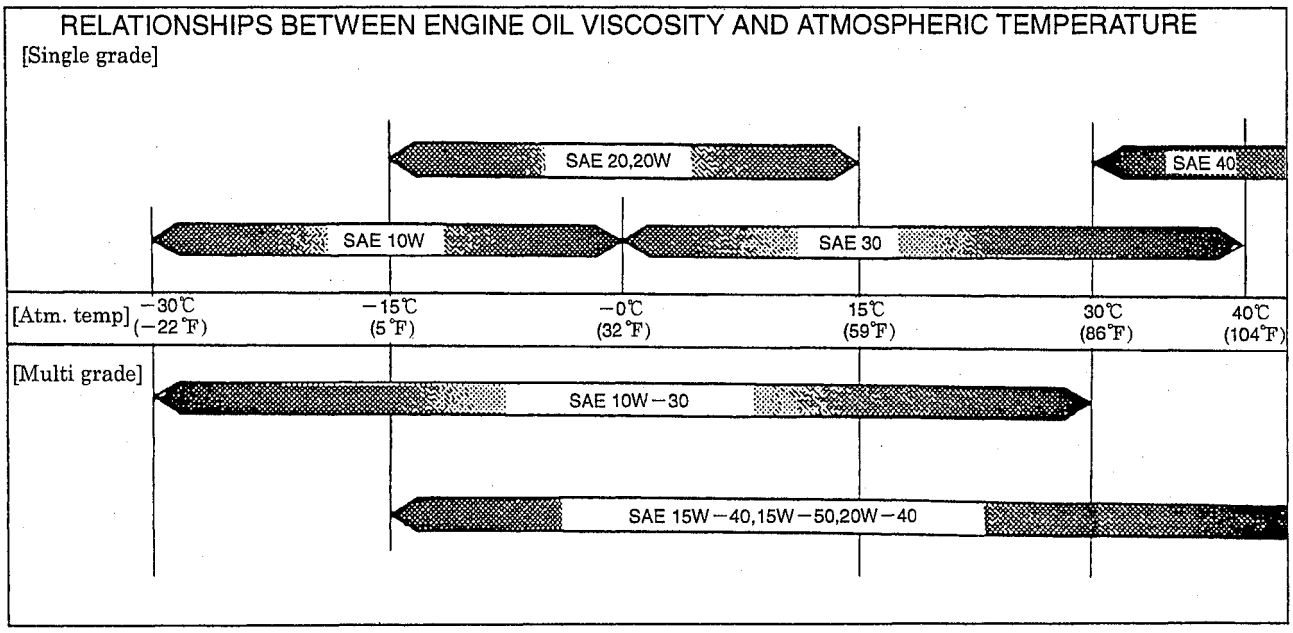
Note: (1)-1 matches the Groupe No. on page 1.



LUBRICANTS USED

TYPE OF ENGINE	LUBRICANT TO BE USED
Without turbo	API Grade CD
With turbo	Same as above

ENGINE OIL VISCOSITY CHART

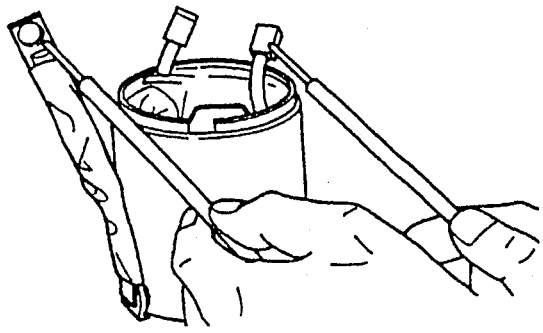


Use engine oils of different viscosity according to atmospheric temperature as the viscosity affects the atarting performance, operating performance, oil consumption, and abrasion and seizure of the moving parts.

6.3 FIELD COIL

(1) Check the field coil for continuity, using a circuit tester. The coil is disconnected if there is no continuity between the M terminal of the field coil and the lead on the brush side.

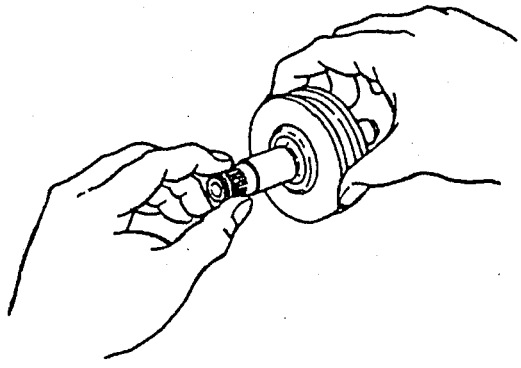
(2) Check for continuity between the field coil and the yoke. The field coil is satisfactory if there is no continuity between the field coil and the yoke.



6.4 OVERRUNNING CLUTCH

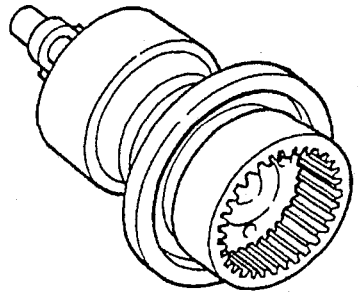
Turn the pinion by hand. The clutch is okay if it turns in one direction only. Inspect the pinion tooth surface and replace the pinion that is worn off or damaged.

⚠ If the overrunning clutch is all immersed in a cleaning fluid for cleaning purpose, the inside grease comes out and causes seizure.



6.5 REDUCTION GEAR

Inspect the reduction gear. It is satisfactory if it shows no excessive wear.



6.6 BEARING

Turn the outer race of the bearing by hand and check that it rotates smoothly.