
TO THE READER

This manual has been printed for a skilful engineer to supply the necessary technical information to carry out service operations on this machine.

Carefully read this manual to obtain correct information regarding repair procedures.

For any question or remark, or in case of any error in the contents of this manual, please contact:

CNH ITALIA S.p.A.
Via Plava, 80
10135 TORINO - Italy

REFERENCE

Beyond this Service Manual, also refer to the documents listed below:

- Operator's Manual
- Parts Catalogue

COMPLETE SERVICE MANUAL

The Service Manual consists of one volume:

- E35B SR - E39B SR - Service Manual "Hydraulic Mini Excavators"

The Service Manual for "Hydraulic Mini Excavators" contains the necessary technical information to carry out maintenance and repair operations on the machine, the necessary tools to carry out maintenance operations, the information on service standards, the procedures for removal, installation, disassembly and reassembly.

The Service Manual relevant to the excavator models **E35B SR - E39B SR** consists in the following volume, which is identified through the relevant print no. as reported below:

VOLUME	MACHINE TYPE	PRINT NUMBER
Service Manual for "Hydraulic Mini Excavators"	E35B SR E39B SR	84553640A

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: www.heydownloads.com by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

1.1 GENERAL PRECAUTIONS FOR REPAIRS

1.1.1 PREPARATION BEFORE DISASSEMBLING



- (1) Understanding operating procedure
Read OPERATION AND MAINTENANCE MANUAL carefully to understand the operating procedure.
- (2) Cleaning machines
Remove soil, mud, and dust from the machine before carrying it into the service shop to prevent loss of work efficiency, damage of parts, and difficulty in rust prevention and dust protection while reassembling.
- (3) Inspecting machines
Identify the parts to be disassembled before starting work, determine the disassembling procedure by yourself considering the workshop situations etc., and request procurement of necessary parts in advance.
- (4) Recording
Record the following items for communication and prevention of recurring malfunction.
 - 1) Inspection date and place.
 - 2) Model name, applicable machine number, and hourmeter read.
 - 3) Trouble condition, place and cause.
 - 4) Visible oil leakage, water leakage and damage.
 - 5) Clogging of filters, oil level, oil quality, oil contamination and loosening of connections.
 - 6) Result of consideration if any problem exists based on the operation rate per month calculated from hourmeter indication after the last inspection date.
- (5) Arrangement and cleaning in service shop
 - 1) Tools required for repair work.
 - 2) Prepare space to place the disassembled parts.
 - 3) Prepare oil containers for draining oil etc.

1.1.2 SAFETY IN DISASSEMBLING AND ASSEMBLING



- (1) Wear appropriate clothes with long sleeves, safety shoes, safety helmet and protective glasses.

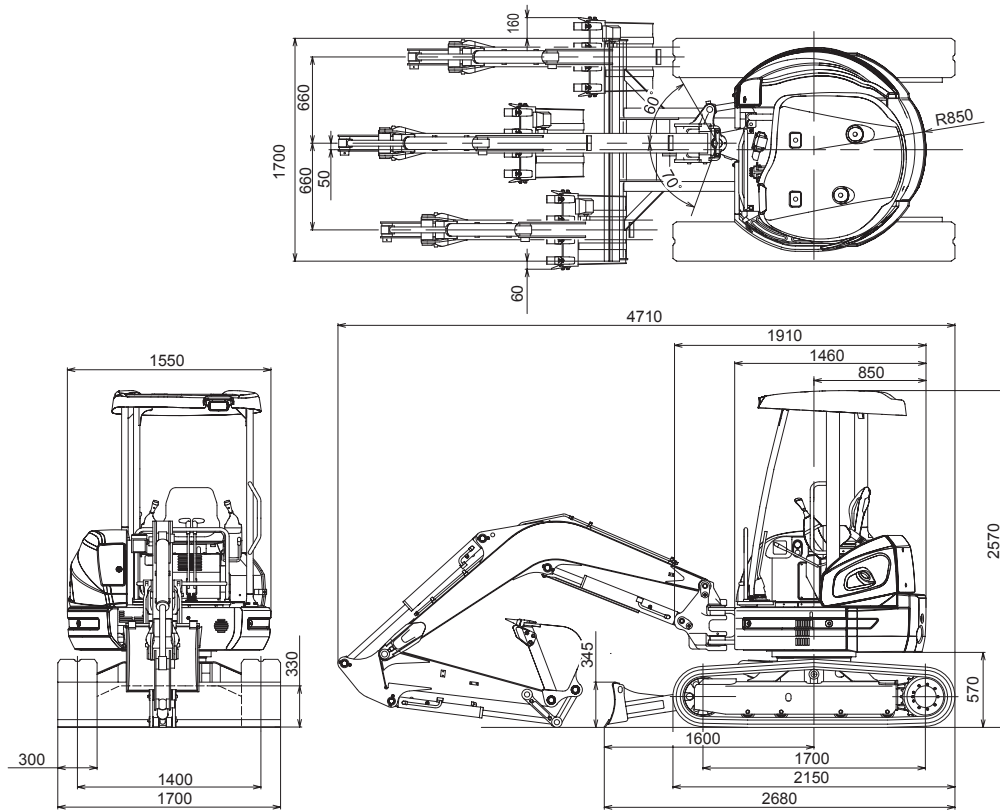
- (2) Suspend warning tag "DO NOT OPERATE" from the doorknob or the operating lever, and have a preliminary meeting before starting work.
- (3) Stop the engine before starting inspection and maintenance to prevent the operator being caught in machine.
- (4) Identify the location of a first-aid kit and a fire extinguisher, and also where to make contact in a state of emergency.
- (5) Choose a hard, level and safe place, and place the attachment on the ground securely.
- (6) Use a lifter such as a crane to remove heavy parts (20 kg or more) from the machine.
- (7) Use proper tools, and replace or repair defective tools.
- (8) Support the machine and attachment with supports or blocks if the work is performed in the lifted condition.

1.1.3 DISASSEMBLING AND ASSEMBLING HYDRAULIC EQUIPMENT

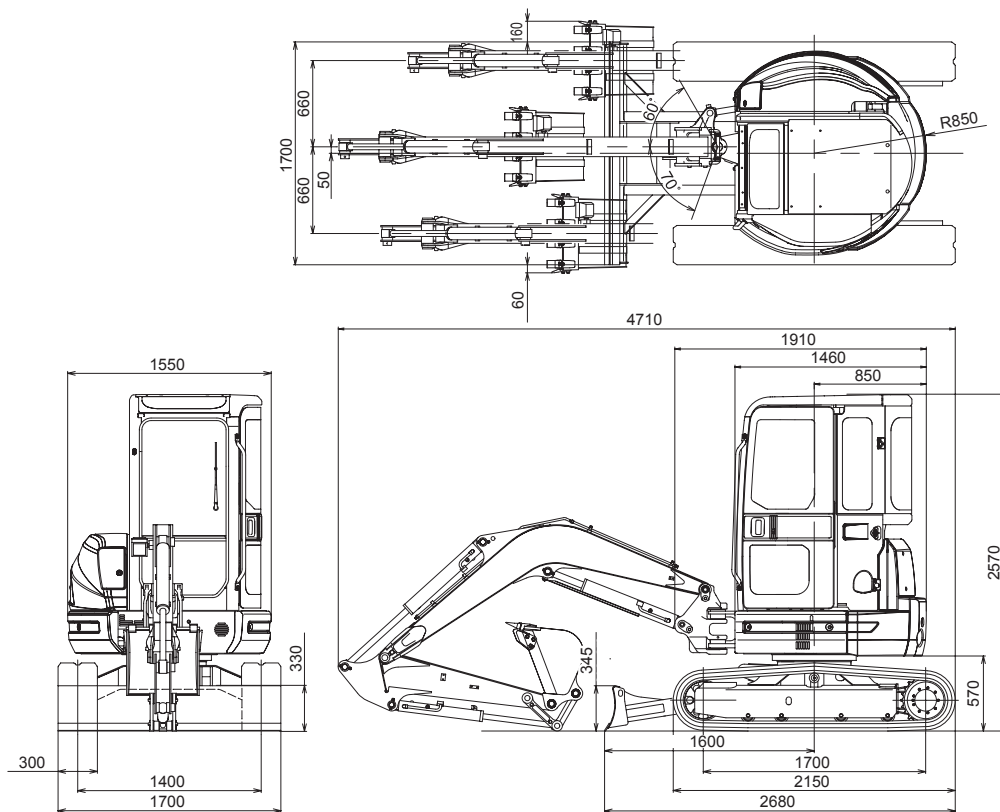


- (1) Removing hydraulic equipment
 - 1) Before disconnecting pipes, release the hydraulic pressure of the system, or open the return side cover and take out the filter.
 - 2) Carefully drain oil of the removed pipes into a containers without spilling on the floor.
 - 3) Apply plugs or caps on the pipe ends to avoid oil spillage and dust intrusion.
 - 4) Clean off the external surface of the equipment before disassembling, and drain hydraulic and gear oil before placing it on the workbench.
- (2) Disassembling hydraulic equipment
 - 1) Do not disassemble, reassemble or modify the hydraulic equipment without the permission of the manufacturer, who is not responsible for the performance and function of the product after modification.
 - 2) When disassembling and reassembling for unavoidable reason, refer the work to qualified personnel who have the specific knowledge or completed the parts service training.
 - 3) Provide matching marks to facilitate reassembling work.
 - 4) Before starting the work, read the manual of disassembling procedure, if it is provided, and decide whether the work can be performed by yourself.

(3) E39B SR (CANOPY)



(4) E39B SR (CAB)



2.9 LUBRICANT, FUEL AND COOLANT SPECIFICATIONS

The following table indicates the proper oils, lubricants and fuel to be used with various climates and service conditions.

Components	Technical name	Quantity	Operating range (ambient temperature °C)				Specifications
			-20°	-10°	0°	10° 20° 30° 40°	
Hydraulic oil tank	Selenia IDRAULICAR AP31	Tank: 38 l System: 54.5 l	ISO VG 32				QKF 583/HD
	Selenia IDRAULICAR AP46		ISO VG 46 *				
	Selenia IDRAULICAR AP51		ISO VG 68				
	Ambra HI-TECH 46		ISO VG 46				
Engine oil pan	Ambra Supergold	H level: 6.7 l L level: 2.8 l	15 W 40 *				API CH4 ACEA E5 QFK 583/HD
			10 W 30				
Fuel tank		38 l					EN590
Cooler	Ambra Agriflu - OT	1.6 l Total q.ty 4.6 l	50% LLC (long life coolant)*				NH 900 C ASTM D 3306 Type 1
Travel motor	Ambra HYPOIDE 90	0.7 l X 2	SAE 80 W-90				API GL5 NH 520 A
Upper rollers		45 cc X 2					
Idel wheels		80 cc X 2					
Attachment and dozer pin	Ambra GRS PLUS	20 - places					NLGI 2 QFK 586/GR
Swing cylinder pin		1 - place					
Slewing bearing		2 - place					
Idler adjuster		When required					
Operating lever and pedal							
Rotation gear	MG 2	1 - place					NLGI 2 QFK 586/GR
Air conditioner	R134A	700 g					
Compressor	Sanden SP-10	120 cc					

(*) The systems are filled with the products indicated with the asterisk.

NOTE:

USE OF BIO-DEGRADABLE OILS

When you use bio-degradable oil, please refer to following:

- there are two types of bio-degradable oil available: vegetable-based and synthetic-based. We recommend using synthetic oils, because vegetable ones have a maximum operating temperature of 80 °C. For this reason, the degradation of vegetable-based oil occurs more rapidly, and they have a reduced service life;
- do not mix Bio-oil with original factory-filled mineral oil; in case it is necessary to use Bio-oil, flush the hydraulic system that was filled with bio-oil three times;
- if you use Bio-oil, the performance of the rotation brake and that of the parking/travel brake will be reduced, because of the lower friction factor of Bio-oil compared to that of mineral oil;

USE OF COOLANT

- There are two types of coolant depending on the corrosion inhibitors base: ORGANIC-base and INORGANIC-base.
- Mini excavators is ORGANIC-base type factory filled.
- Both type can be used, BUT THEY CANNOT BE MIXED. Flush the cooling system before change coolant type.

3.2.2 DIPPER MAINTENANCE STANDARDS

(1) Clearance of pin and bushing

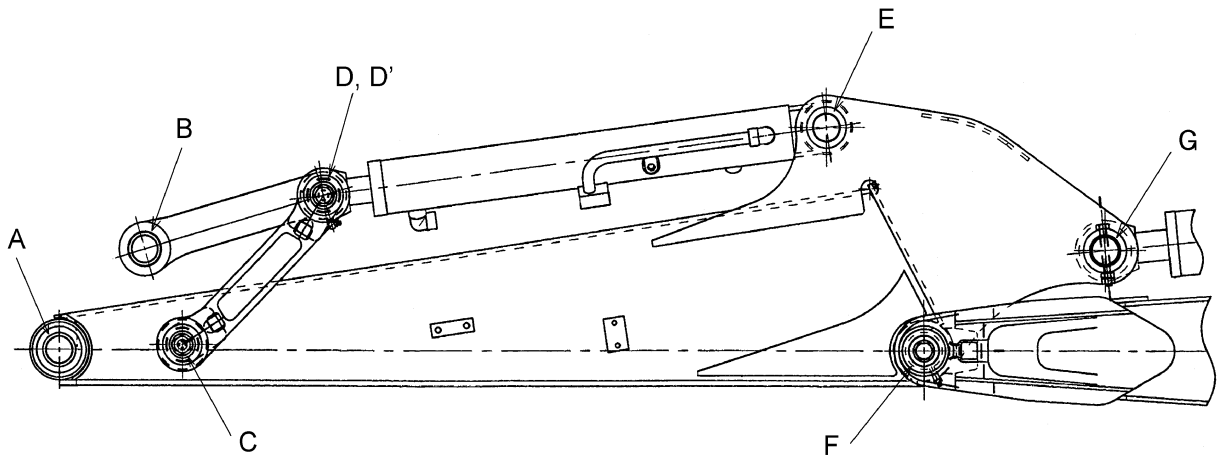


Fig. 3-5 Clearance of pin and bushing on dipper section

Table 3-5

• E35B SR

Unit: mm

Location	Piece	Standard dimensions			Tolerance			Remedy
		Pin diameter	Tolerance on pin diameter	Tolerance on bushing bore diameter	Standard value	Standard value for repair	Serviceability limit	
A	Dipper point (Connected part of bucket)	ø40	-0.02 -0.05	+0.11 +0.06	0.08±0.16	0.7	1.0	Replace bushing or pin
B	Bucket connecting rod (Bucket side)			+0.11 +0.05				
C	Bucket link (Connected part of dipper)			+0.08 +0.03	0.05±0.13			
D	Bucket connecting rod (Idler link side)			+0.09 +0.03				
D'	Bucket cylinder (Rod side)			+0.25 +0.05	0.07±0.30			
E	Bucket cylinder (Bottom side)			+0.13 +0.07				
F	Dipper foot (Connection with boom)	ø45		+0.10 +0.05	0.07±0.15			
G	Arm cylinder (Rod side)			+0.13 +0.07		0.09±0.18		

3.5 SWINGING

3.5.1 SWING BRACKET DIMENSIONAL DRAWINGS

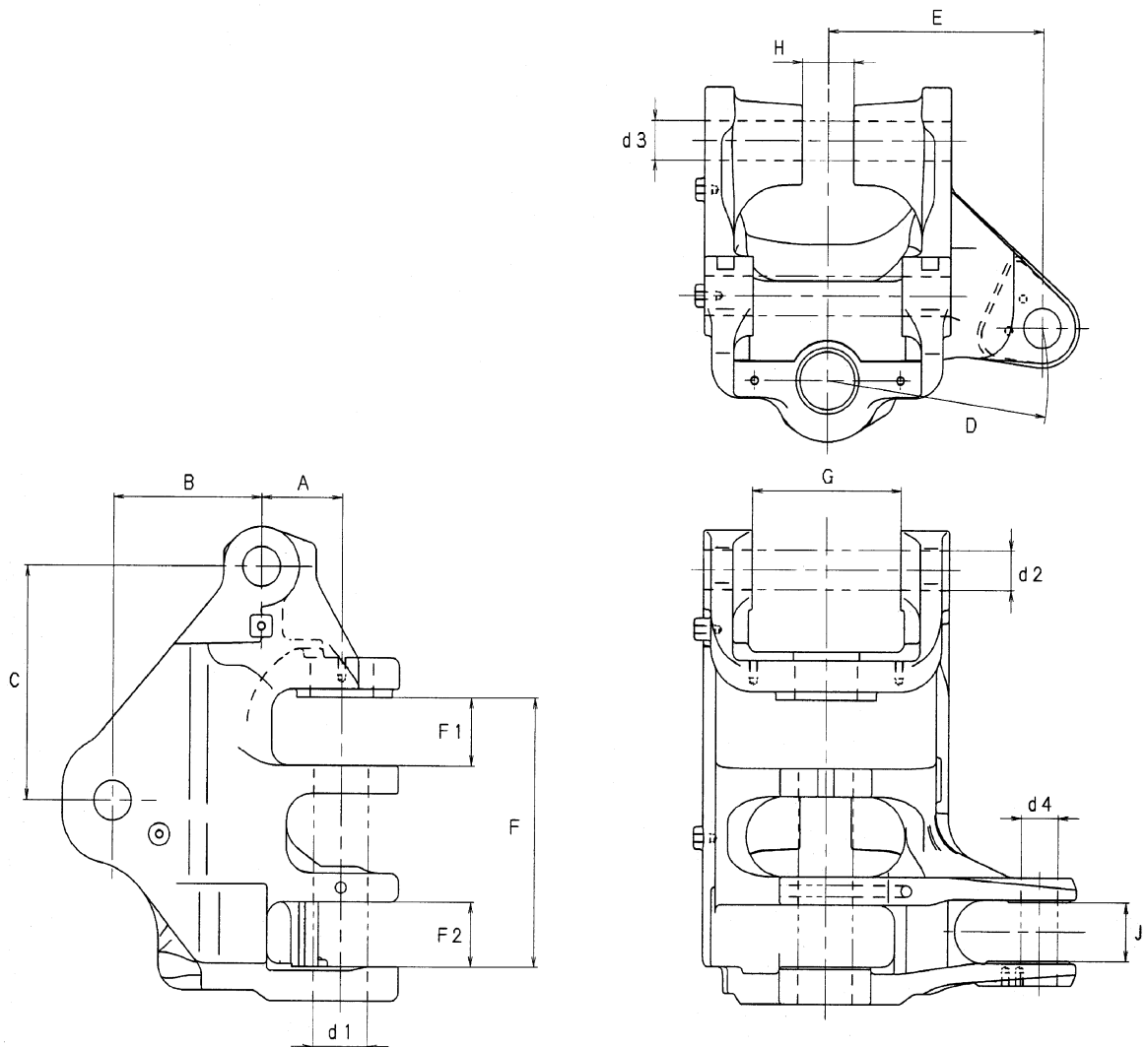






Fig. 3-12 Swing bracket dimensional drawings

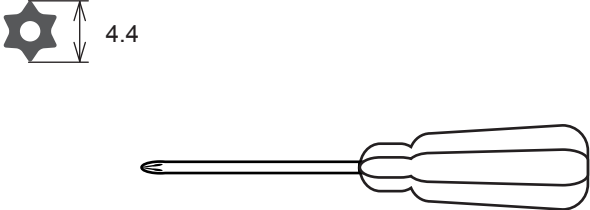
Table 3-15

		Unit: mm
No.	NAME	SIZE
A	Distance between swing centre pin and boom foot pin	96
B	Distance between boom foot pin and boom cylinder pin	176.8
C	- ditto -	266.9
D	Distance between swing centre pin and swing cylinder pin	R264
E	- ditto -	257
F	Inside width of swing centre	306
F1	- ditto -	78
F2	- ditto -	73.5
G	Inside width of boom foot	178
H	Inside width for installing boom cylinder	61
J	Inside width for installing swing cylinder	67
d1	Pin diameter of swing center	ø65
d2	Pin diameter of boom foot pin	ø45
d3	Pin diameter of boom cylinder	ø45
d4	Pin diameter of swing cylinder	ø45

11.5 SPECIAL SPANNERS FOR TUBES

Applicable tube diameter mm	Item no.	HEX mm	Dimensions of a special spanner mm
15		27	
18		32	
22		36	
28		41	

11.6 SPECIAL TOOLS

No.	Name	Tools no.	Shape	Use
1	Torx driver (with tamper proof) T25 (for M5)	—		For instrument right cover

11.7 APPLICATION OF SCREW LOCKING AND SEALING COMPOUNDS

Service	Loctite	Features
Screw locking compound	#242	Low strength
	#262	Middle strength
	#271	High strength
Sealing compound	#515	Sealing

13.3 MEASURING ENGINE SPEED

13.3.1 MEASURING ENGINE SPEED

(1) Measuring instruments

- 1) The speedometer (1) (measures the engine speed through the application of a sampling tool (2) to one of the injection pipes).
- 2) Surface thermometer (measuring the surface temperature getting contact of the probe with the surface of hydraulic oil tank and radiator)

(2) Engine warming up operation

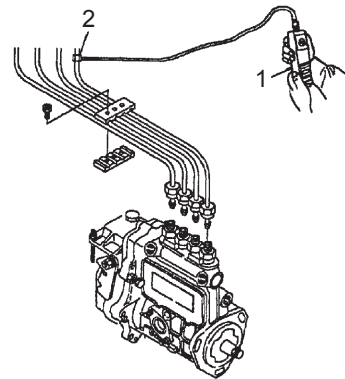
Start the engine and take the coolant temperature within the range of 60 to 90 °C.

Check the coolant temperature with the coolant thermometer on the control panel. The white colour zone shows approximately 67 to 105 °C of temperature range.

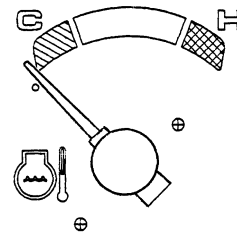
Therefore, when the indicator is located at around centre of the white zone, it is suitable for the engine operation.

(3) Engine speed measurement

- 1) Apply the pick up of speedometer to one of convenient injection pipes.
(See Fig. 13-1)
- 2) Measure the engine speed at idling with no load, and compare it to the figure in the STANDARD VALUE TABLE.



**Fig. 13-1 Engine speed measurement
(The above figure shows concept)**



WATER TEMPERATURE

13.7 MEASURING ATTACHMENT OPERATING PERFORMANCES

•TEST PROCEDURES

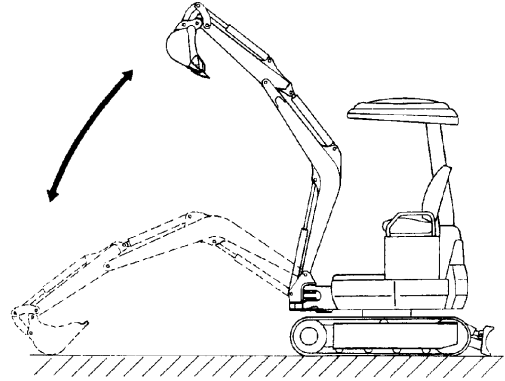
Measure 3-time each.

Apply average data of the above for judgement.

13.7.1 Cylinder speed

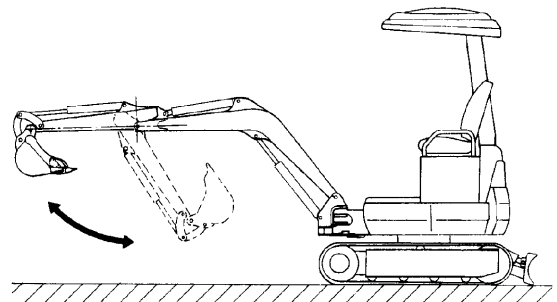
(1) Boom cylinder speed

- Engine: high idling
- Hydraulic oil temperature: $50 \div 60$ °C
- Measurement position: completely retract the arm cylinder, fully extend the bucket cylinder and place the dozer blade on the ground.
- Then measure the time required for the bucket to reach its highest point (lowest point) from its lowest point (highest point) placing on the ground. (Do not include the cushioning time).



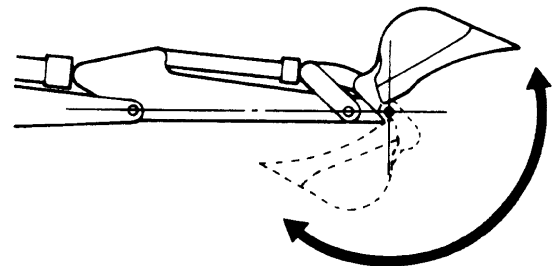
(2) Arm cylinder speed

- Engine: high idling
- Hydraulic oil temperature: $50 \div 60$ °C
- Measurement position: completely retract the arm cylinder, fully extend the bucket cylinder, position the arm horizontally and place the dozer blade on the ground.
- Then measure the time required for the arm cylinder to completely retract (extend) from a fully extended state (retracted state).



(3) Bucket cylinder speed

- Engine: high idling
- Hydraulic oil temperature: $50 \div 60$ °C
- Measurement position: completely retract the arm cylinder, position the arm horizontally and place the dozer blade on the ground.
- Then measure the time required for the bucket cylinder to completely retract (extend) from a fully extended state (retracted state).



22.3.3 TRAVEL OPERATING CIRCUIT**(Refer to fig. 71-3)**

Pilot oil hydraulic system with operating lever

**22.3.3.1 2nd speed operating circuit
(Independent-forward travel)****(1) Pilot circuit****1) Shifting signal for 2nd speed travel.**

When the "Rabbit and Turtle" mark (at the power cut-off, it automatically takes back for 1st speed) on the knob of travel right lever is pushed down, it actuates the 1st and 2nd speed travel shifting valve of solenoid valve (13). The pressurized oil signal for 2nd speed is generated by the solenoid valve (13) and led to the travel motor (4) through the swivel joint (10), and shifts the 2nd speed shifting valve (404).

2) Changing travel valve spool

The pilot secondary pressure is generated from pilot valve (12) by the operation for travel forward. The pressurized oil is led to the Pb7 and Pb6 ports on control valve (2) to shift the travel valve spool.

(2) Main circuit**1) Circuit up to travel motor (4)**

The delivered oil from A1 and A2 ports on variable pump enters into the P1 and P2 ports of control valve (2), and led to the B7 and B6 ports through the travel valve. Then it is led to the A and B ports on left and right travel motors respectively through the swivel joint (10).

2) Travel motor

a. The pressurized oil supplied to the travel motor shifts the spool of the counterbalance valve (brake valve) (408), releases the parking brake (403), opens the hydraulic circuit having closed by the check valve (407) and rotates the travel motor. It actuates the speed shifting valve (404) when the 2nd speed signal is sent. The high-pressure oil pumped through the shuttle valve (406) passes through the speed change valve (404), actuates the speed shifting piston (401) so that the engine rotates at high speed but with a low torque.

b. When the motor reaches near to a self-running condition (over-running) at going down a slope and so on, the oil pressure of supply side gets down to lower pressure, and the counter balance valve [brake valve] (408) spool moves to the neutral position with the spring force.

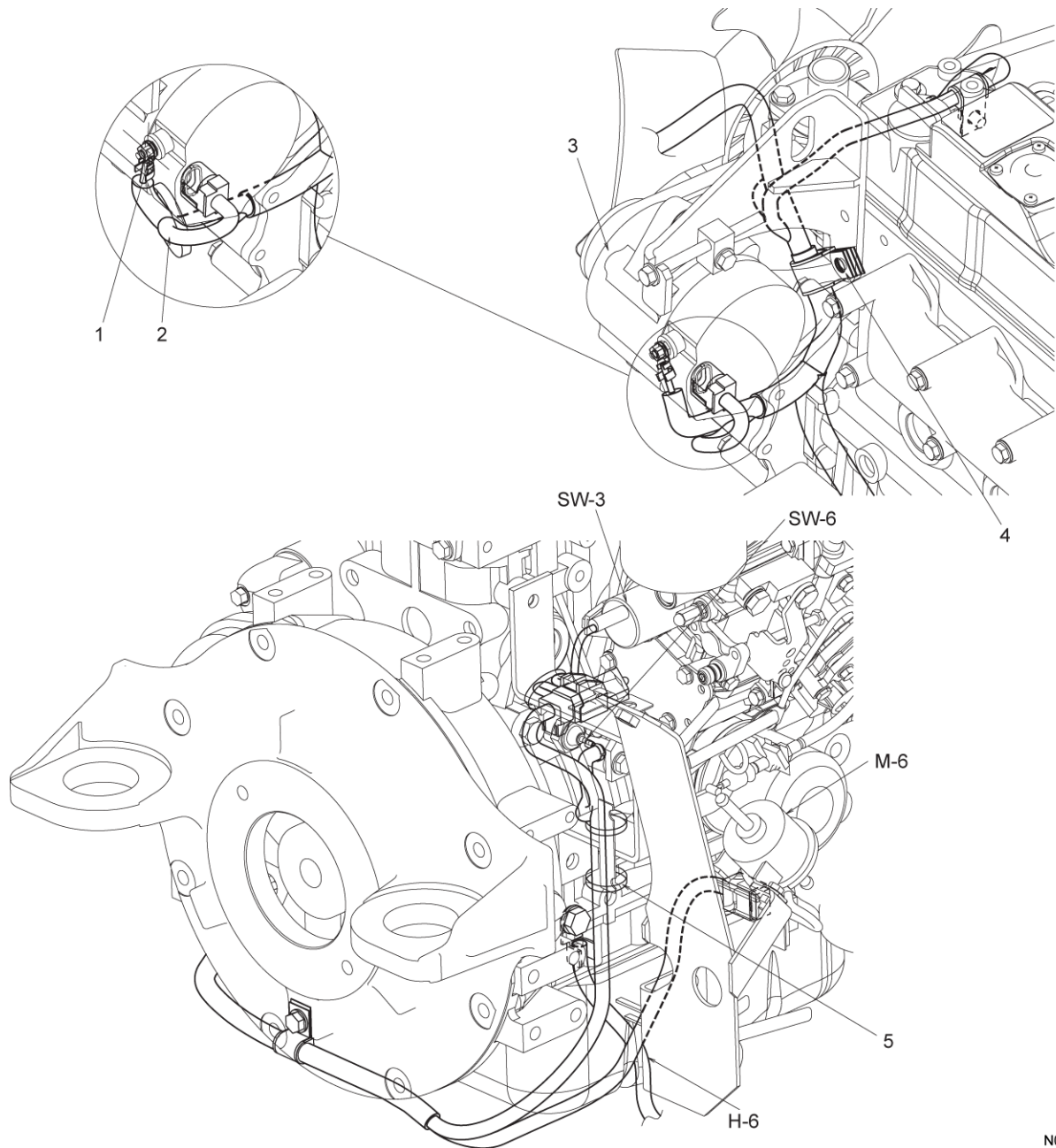
As the results, the passage in return oil side is throttled, and the motor speed is suppressed by a back-pressure, then the motor is controlled to the speed corresponding to the supplied oil volume of the pump.

c. The counterbalance valve spool is so designed that it is gradually shifted by a throttle effect to stop or start the motor absorbing shock at the start and stop of the machine.

d. When load increases during high speed travel, the speed automatically shifts to the 1st speed, resulting in low speed and high torque.

Group	Code	Part Name
Switch	SW-1	(KEY) STARTER SWITCH
	SW-2	WORKING LIGHTS SWITCH
	SW-3	2nd SPEED SELECTOR SWITCH
	SW-4	WIPER WASHER SWITCH
	SW-5	ENGINE COOLANT TEMPERATURE SWITCH
	SW-6	ENGINE OIL PRESSURE SWITCH
	SW-7	HORN SWITCH
	SW-9	LEVER LOCK SWITCH
	SW-10	HEATER SWITCH (OPT)
	SW-11	DECELERATION SWITCH
	SW-15	HIGH AND LOW PRESSURE SWITCH
	SW-16	CONDENSER SPEED SHIFT SWITCH
	SW-39	OVERLOAD PRESSURE SWITCH
	SW-40	OVERLOAD SWITCH

NOTE: the part number may be changed owing to modification, use them only for reference.



N00062

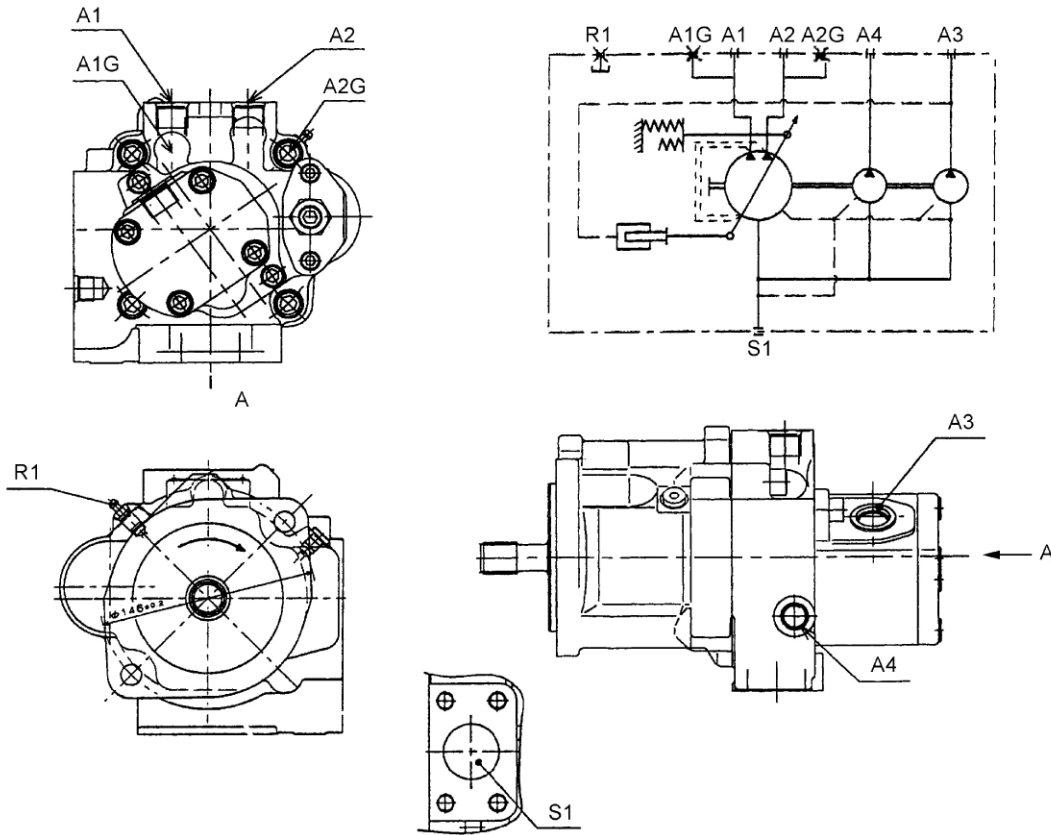
Fig. 23-2 Engine (2/2)

- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Fix perpendicularly. Tightening torque $5.9 \div 9.8$ Nm 2. Harness must pass below alternator 3. Alternator | <ul style="list-style-type: none"> 4. Fix the clip with a bolt of alternator bracket. Fix with tapping part 5. Fix with tapping part |
|--|--|

24.1 HYDRAULIC COMPONENTS

24.1.1 HYDRAULIC PUMP

24.1.1.1 TECHNICAL SPECIFICATIONS



N00065

Ports:

No.	Name	Dimensions
S1	Suction port	SAE 11/2
A1, A2	Delivery port	PF 1/2
A1G, A2G	Pressure port	PF 1/8
A3	Delivery port	PF 1/2
A4	Pilot delivery port	PF 3/8
R1	Air bleed port (with breather valve)	M10 x 1.0

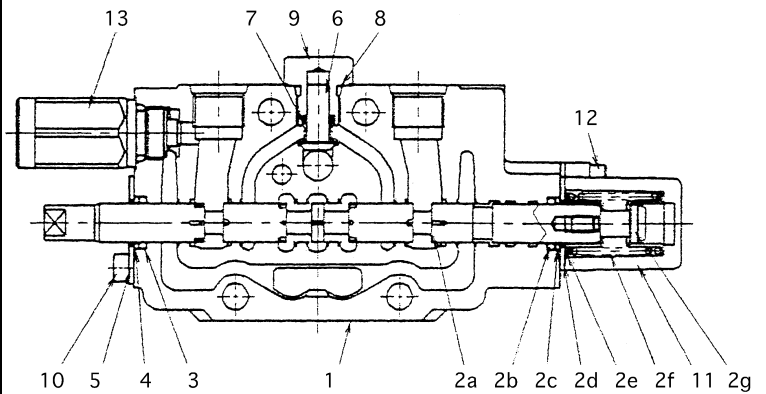
Fig. 24-1 General view of hydraulic pump

Model		AP2D18LV3RS7		
Pump		Piston pump P1 + P2	Gear pump P3	Trochoid pump P4
Working pressure	MPa	23.0	20.0	3.5
Displacement	cc/rev	16.0 x 2	8.6	5.1
Delivery flow	l/min	38.4 x 2	20.6	12.2
Control system		Total power shift control by tilting angle (power shift)		
Rating speed	rpm	2400		
Weight	kg	27.5		

* For respective operation section, only typical example is described.

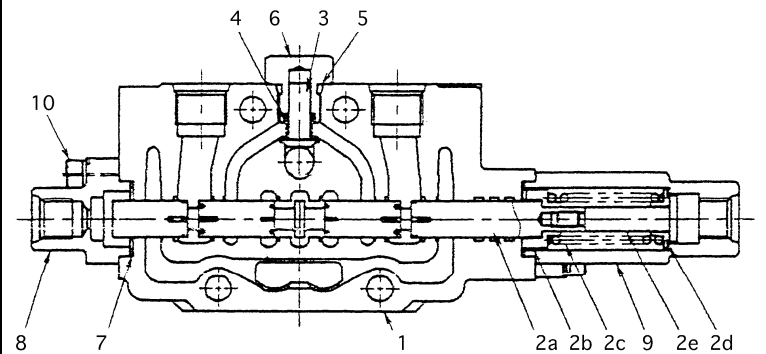
- Manual swing operation (No. 6)

No.	Name	Q.TY
1	Body	1
2a	Spool	1
2b	O-ring	1
2c	Dust wiper	1
2d	Oil seat retainer	1
2e	Spring seat	2
2f	Spring	1
2g	Spool end	1
3	O-ring	1
4	Dust wiper	1
5	Oil seat retainer	1
6	Lock check valve	1
7	Spring (for check valve)	1
8	O-ring	2
9	Plug (for check valve)	1
10	Screw M5x10	2
11	Cover	1
12	Screw M5x18	2
13	Anticavitation valve	1



- Pilot operation: slew (no. 2)

No.	Name	Q.TY
1	Body	1
2a	Spool	1
2b	Spring seat	1
2c	Spring	1
2d	Spring seat	1
2e	Spool end	1
3	Load check valve	1
4	Spring (for check valve)	1
5	O-ring	1
6	Plug (for check valve)	1
7	O-ring	2
8	Pilot cover	1
9	Pilot cover	1
10	Screw M5x10	4



• Release

When the pilot pressure is applied to the pilot port (Pb8') for releasing lock valve, the piston (A) is moved to the right side opening the needle valve through piston (B).

At that time, the return oil from boom cylinder passes through the throttle on lock valve, then lock valve chamber
 • → pilot piston chamber → drilled hole in turn, and flows into the tank path through the throttle hole (drilled hole) on boom spool pushing up the steel ball.

The opening of the needle valve results in the pressure drop in the lock valve chamber. The return oil from the boom cylinder opens the lock valve, and flows into the tank passage through the notch (groove) of the boom spool and the throttle (drilled hole).

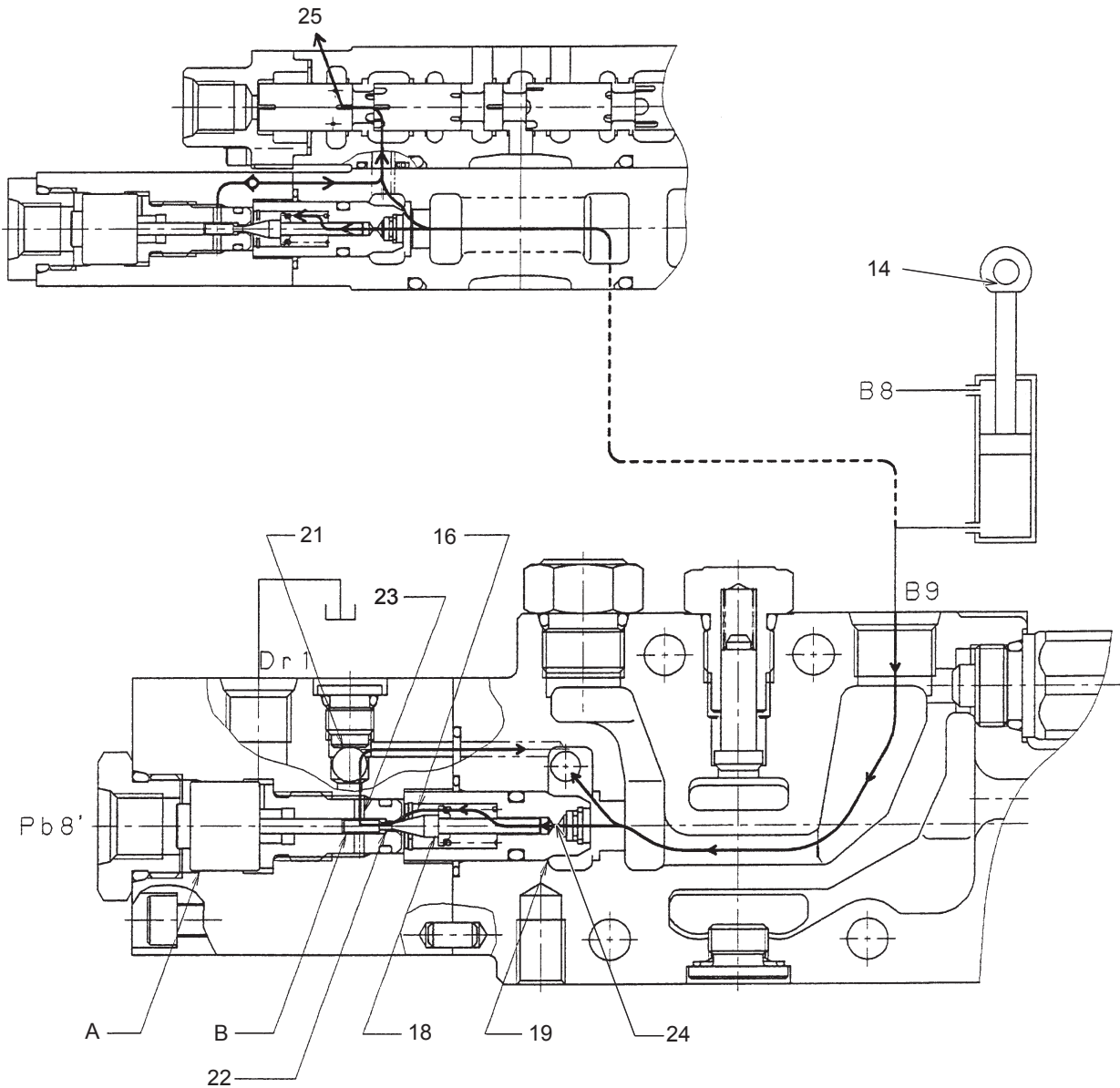
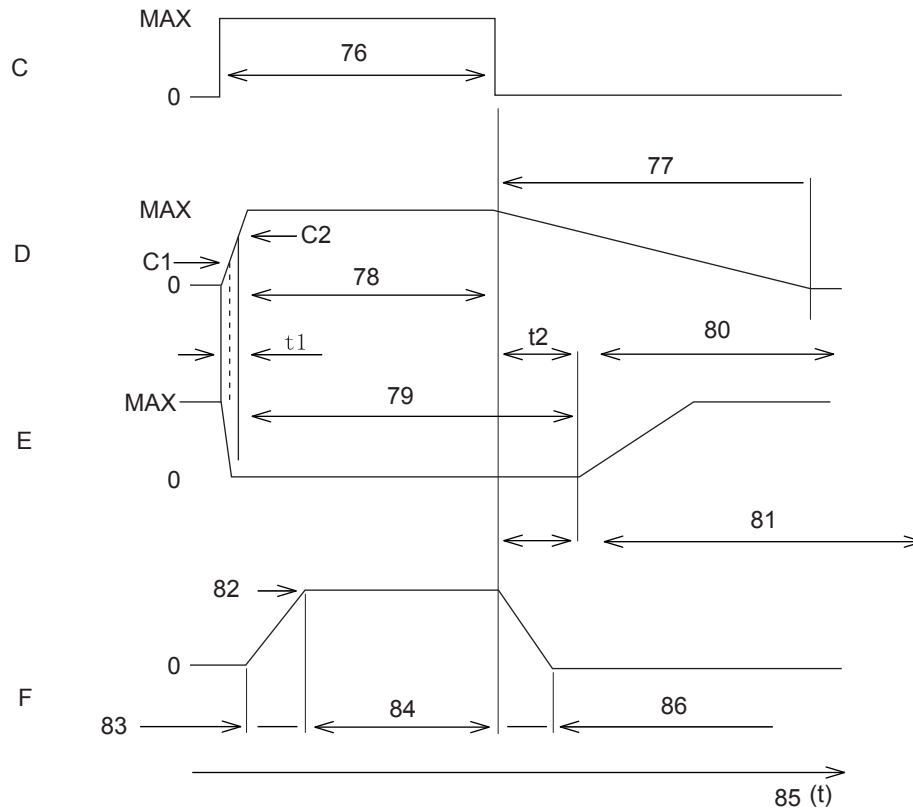


Fig. 24-18 Function of lock valve (release)

- | | |
|------------------------|--------------------------|
| 14. Boom cylinder | 22. Pilot piston chamber |
| 16. Lock valve chamber | 23. Drilled hole |
| 18. Needle valve | 24. Orifice |
| 19. Lock valve | 25. To tank |
| 21. Steel ball | |

Diagram

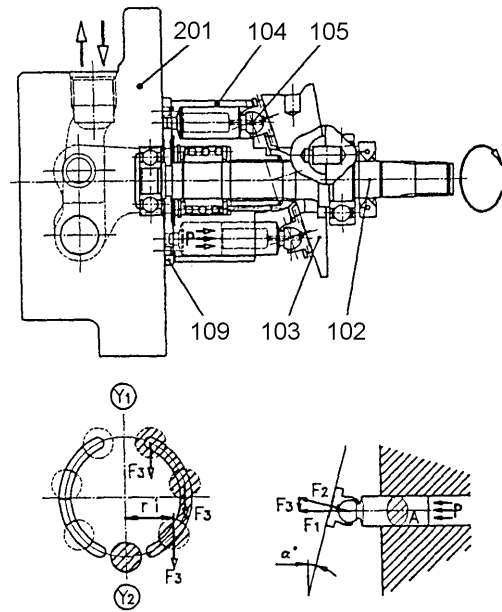


- | | |
|---|---|
| 76. In this interval, main control valve is switched. | 83. Acceleration |
| 77. Time zone the flow is controlled by orifice. | 84. Uniform speed area |
| 78. In this interval, (PG) supply pressure is acting on. | 85. Time (t) |
| 79. Releasing parking brake | 86. Deceleration area |
| 80. Timer set time | Hydraulic pressure dynamic brake |
| 81. In this interval, the parking brake does not activate and does not drag | C. Shuttle valve switching outer signal pressure SH |
| 82. Set slewing speed | D. Pressure of parking brake cylinder chamber |
| | E. Parking brake torque |
| | F. Upperstructure slewing speed |

2. Operation

1) Hydraulic motor

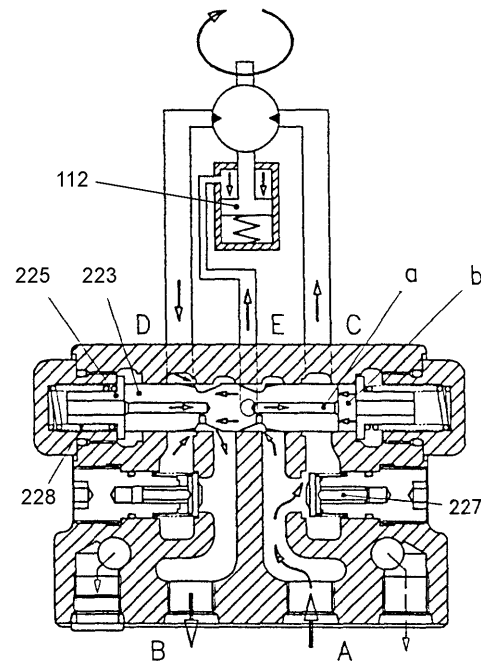
Hydraulic oil fed by pump enters rear flange (201) of travel motor, and is led from timing plate (109) to cylinder block (104) through brake valve mechanism. This pressure oil is led to only the one side of $Y_1 - Y_2$ tied between top dead point and bottom dead point of piston (105) stroke. And the pressure led to one side of cylinder block pushes 4 or 5 pistons (105), generating the power $\{F (N) = 100 \times P (MPa) (psi) \times A (cm^2)\}$. This power enters on swash plate (103), but swash plate is fixed having an angle (α) against axis of drive shaft (102), and divided into component of force (F_2, F_3). And the radial component of force (F_3) generated various torque ($T = F_3 \times r_i$) against line $Y_1 - Y_2$. The total torque [$T = \sum (F_3 \times r_i)$] is connected to turning effort, and rotates cylinder block (104) through piston (105). This cylinder block (104) is connected with drive shaft (102) with spline, and rotates drive shaft to transmit torque.



2) Brake valve

a. Operation (Brake released)

The pressure oil is led to through port (A), opens valve (227), and led to port (C) on the section side of hydraulic motor to rotate hydraulic motor. At the same time, the pressure oil enters chamber (b) through passage (a) from the small hole of spool (223), and exerts on the end of spool to generate the force. Then the force of spring (228) slides the spool placed on the neutral position leftward. The sliding of spool forms the space (passage) between spool and rear flange with spool groove. This passage is connected to port (D) and port (B) of the return circuit of the hydraulic motor, and the return oil returns to tank side, enabling hydraulic motor to rotate. Then, the sliding of spool (223) leads pressure oil to port (P). The pressure oil led to port (P) moves piston (112) of parking brake, and releases parking braking force. (For details, refer to item "Parking brake"). If pressurized oil is supplied from port (B) the movements of spool (223) and valve (227) are reversed so that the hydraulic motor is rotated reversely.



2. Arm cylinder

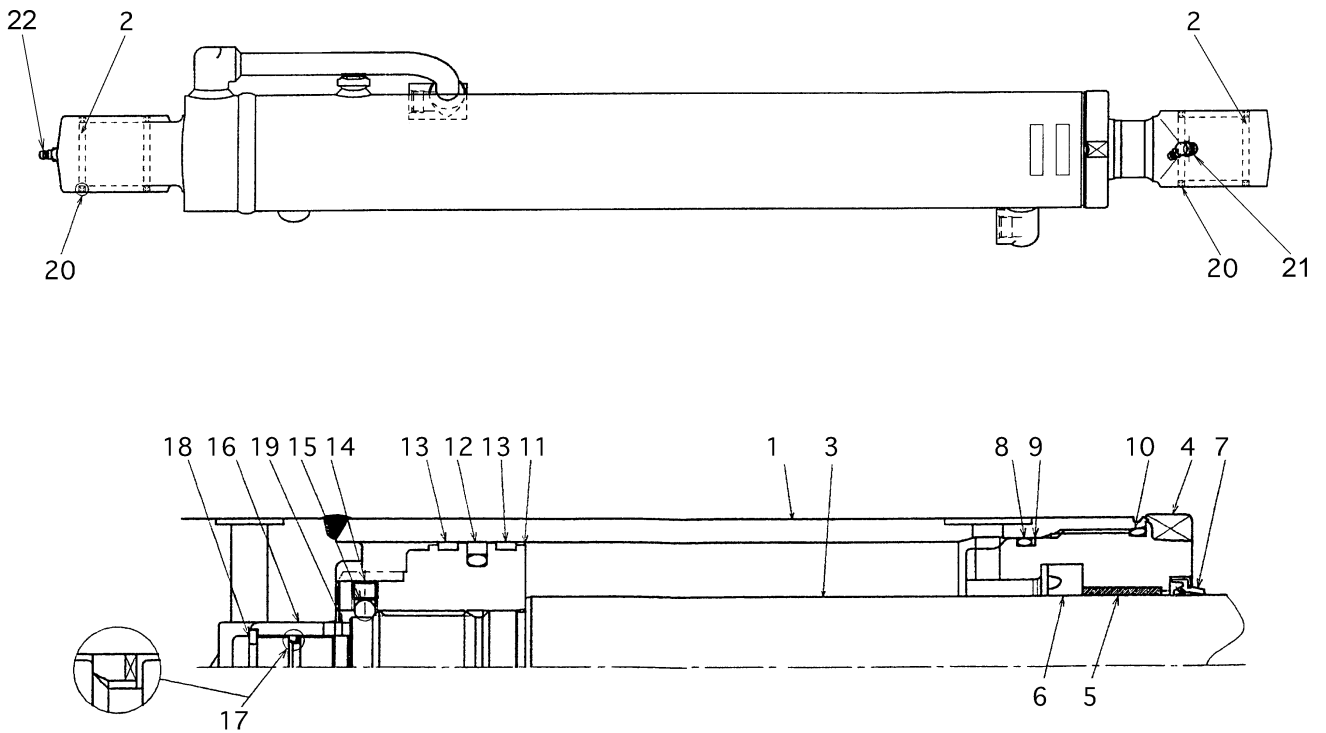
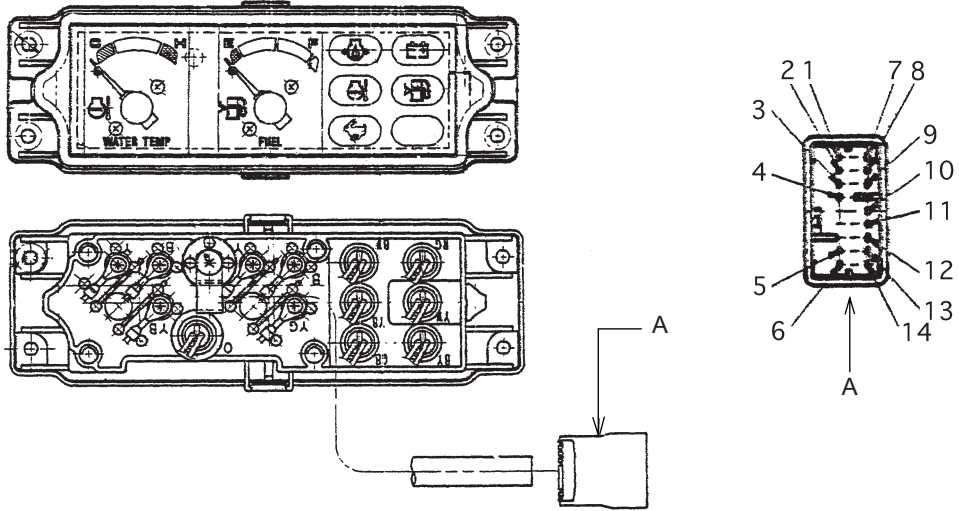
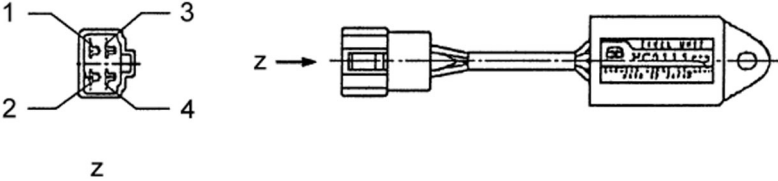
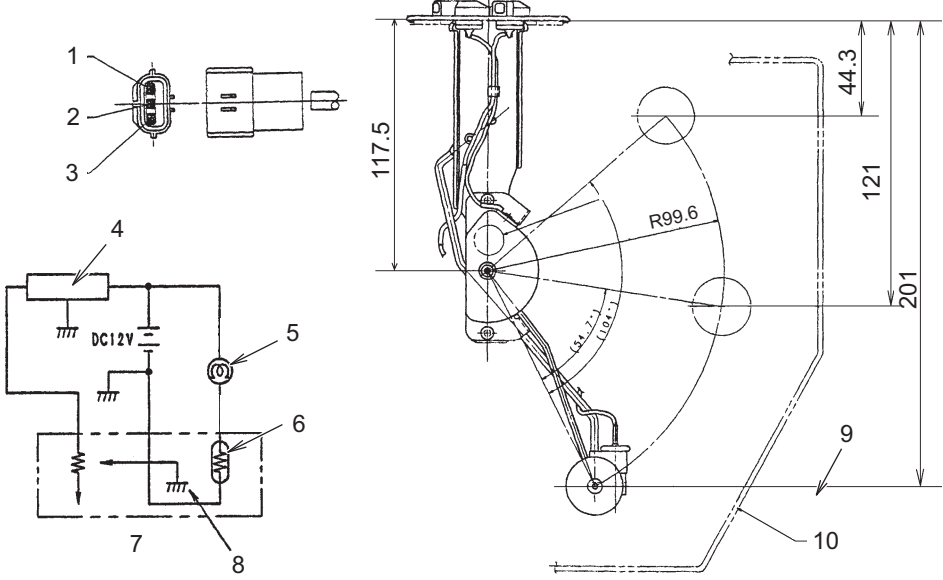


Fig. 24-33 Construction of arm cylinder

No.	NAME	Q.TY	No.	NAME	Q.TY	No.	NAME	Q.TY
1	CYLINDER LINER	1	9	BACK-UP RING	1	17	SEAL RING SHOCK ABSORBER	1
2	PIN BUSHING	2	10	O-RING	1	18	TRAVEL STOP	2
3	CYLINDER ROD	1	11	PISTON	1	19	SNAP RING	1
4	CYLINDER HEAD	1	12	SEAL RING	1	20	SEAL RING	4
5	BUSHING	1	13	SLIDE RING	2	21	GREASE NIPPLE	1
6	U-RING	1	14	ADJUSTING SCREW	1	22	GREASE NIPPLE	1
7	WIPER RING	1	15	BALL	1			
8	O-RING	1	16	BEARING	1			

Name	Specifications
E-6	
Gauge cluster	
	
Voltage of operation	12 V
No.	Connection
1	Illumination (+)
2	Engine oil pressure (-)
3	Charge (-)
4	Engine coolant temperature (-)
5	Lamp power source -1 (+) [engine coolant, fuel, travel 2 speed]
6	Fuel (-)
7	Travel 2 speed (-)
8	Lamp power source-2 (+) [engine oil pressure, charge, air cleaner clogging]
9	Air cleaner clogging (-)
10	F/T IGN (+)
11	Fuel unit
12	F/T illumination GND (-)
13	Temperature unit
14	Not used
A	Connector

Name	Specifications																																				
R-6																																					
Relay Timer	 <table border="1" data-bbox="639 479 1299 680"> <thead> <tr> <th>No.</th> <th>NAME</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Red (Acc)</td> </tr> <tr> <td>2</td> <td>Black (GND)</td> </tr> <tr> <td>3</td> <td>Red / White (Relay)</td> </tr> <tr> <td>4</td> <td>Yellow (Relay)</td> </tr> </tbody> </table> <table border="1" data-bbox="587 719 1351 842"> <tbody> <tr> <td>Rated voltage</td> <td>12 V</td> </tr> <tr> <td>Exciting current</td> <td>1 A</td> </tr> <tr> <td>Timer</td> <td>1sec</td> </tr> </tbody> </table>	No.	NAME	1	Red (Acc)	2	Black (GND)	3	Red / White (Relay)	4	Yellow (Relay)	Rated voltage	12 V	Exciting current	1 A	Timer	1sec																				
No.	NAME																																				
1	Red (Acc)																																				
2	Black (GND)																																				
3	Red / White (Relay)																																				
4	Yellow (Relay)																																				
Rated voltage	12 V																																				
Exciting current	1 A																																				
Timer	1sec																																				
SE-1																																					
Fuel meter																																					
	 <table border="1" data-bbox="480 1563 890 1603"> <tbody> <tr> <td>Rated voltage</td> <td>12 V</td> </tr> </tbody> </table> <table border="1" data-bbox="448 1644 922 1798"> <thead> <tr> <th>Float position</th> <th>Full</th> <th>1/2</th> <th>Empty</th> </tr> </thead> <tbody> <tr> <td>Resistance (Ω)</td> <td>10</td> <td>38</td> <td>90</td> </tr> <tr> <td>Allowable (Ω)</td> <td>0 -4</td> <td>-</td> <td>+10 0</td> </tr> </tbody> </table> <table border="1" data-bbox="948 1559 1481 2000"> <thead> <tr> <th>No.</th> <th>NAME</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Ground (black)</td> </tr> <tr> <td>2</td> <td>Unit (yellow)</td> </tr> <tr> <td>3</td> <td>Thermistor (red)</td> </tr> <tr> <td>4</td> <td>Gauge</td> </tr> <tr> <td>5</td> <td>Warning lamp</td> </tr> <tr> <td>6</td> <td>Thermistor</td> </tr> <tr> <td>7</td> <td>Fuel unit</td> </tr> <tr> <td>8</td> <td>Stay earth</td> </tr> <tr> <td>9</td> <td>Low fuel warning</td> </tr> <tr> <td>10</td> <td>Tank</td> </tr> </tbody> </table>	Rated voltage	12 V	Float position	Full	1/2	Empty	Resistance (Ω)	10	38	90	Allowable (Ω)	0 -4	-	+10 0	No.	NAME	1	Ground (black)	2	Unit (yellow)	3	Thermistor (red)	4	Gauge	5	Warning lamp	6	Thermistor	7	Fuel unit	8	Stay earth	9	Low fuel warning	10	Tank
Rated voltage	12 V																																				
Float position	Full	1/2	Empty																																		
Resistance (Ω)	10	38	90																																		
Allowable (Ω)	0 -4	-	+10 0																																		
No.	NAME																																				
1	Ground (black)																																				
2	Unit (yellow)																																				
3	Thermistor (red)																																				
4	Gauge																																				
5	Warning lamp																																				
6	Thermistor																																				
7	Fuel unit																																				
8	Stay earth																																				
9	Low fuel warning																																				
10	Tank																																				

31.1 GENERAL DISASSEMBLY AND ASSEMBLY

31.1.1 CONTENTS OF GENERAL DISASSEMBLY AND ASSEMBLY

This chapter consists in the following three sections:

- (1) EQUIPMENT..... No. index: 32
 Part I: removing and installing assembly
 Part II: disassembling and assembling components
 1) Hydraulic cylinder
- (2) UPPER SLEWING STRUCTURE..... No. index: 33
 Part I: removing and installing assembly
 Part II: disassembling and assembling components
 1) Hydraulic pump
 2) Control valve
 3) Pilot valve (ATT)
 4) Pilot valve (travel)
 5) Slewing motor
 6) Rotary control valve
- (3) TRAVEL SYSTEM No. index: 34
 Part I: removing and installing assembly
 Part II: disassembling and assembling components
 1) Travel motor

31.1.2 SPECIFICATION OF TIGHTENING TORQUE

Tightening torque is indicated as follows, for example:

$$T = 100 \text{ Nm}$$


Tolerance is $\pm 10\%$ unless otherwise specified.

•Refer Index no. 11 TOOLS for standard tightening torque.

32.1.4 BOOM

32.1.4.1 REMOVAL OF BOOM


- (1) Get down the boom from which the arm was removed, and support the boom end with a stable stand.
- (2) Disconnect all hoses from the bucket cylinder, arm cylinder and boom cylinder, and apply plugs to all the openings.

 : 22 mm

- (3) Disconnect the wiring for working light at the connector.
- (4) Removal of boom cylinder

- 1) Temporarily lift up the boom cylinder with a nylon sling to prevent the boom cylinder from falling down.

- 2) Removing the capscrew and nuts that are preventing the rod pin (C) from coming out, remove the pin (C).

 : 17 mm

- 3) Retract the rod, then put the cylinder on a stable stand.

- 4) Removing the capscrew that is preventing the head pin (B) from coming out, remove the pin (B).

- 5) Remove the boom cylinder.

Weight:

35 kg — E35B SR

35 kg — E39B SR

- (5) Removal of boom assembly

- 1) Temporarily lift up the boom assembly in order not to exert any load to the boom foot pin (A).

Weight of arm assembly: approximately

163 kg — E35B SR


184 kg — E39B SR

- 2) Removing the capscrew that is preventing the boom foot pin (A) from coming out, pull off the pin (A).

- 3) Applying a sling to the boom assembly, remove the boom assembly.

- (6) Removal of arm cylinder

- 1) Removing the capscrew and nuts that are preventing the head pin (D) from coming out, remove the pin (D).

 : 17 mm

- 2) Applying a nylon sling to the tube of arm cylinder, remove the arm cylinder.

Weight:

30 kg — E35B SR

34 kg — E39B SR

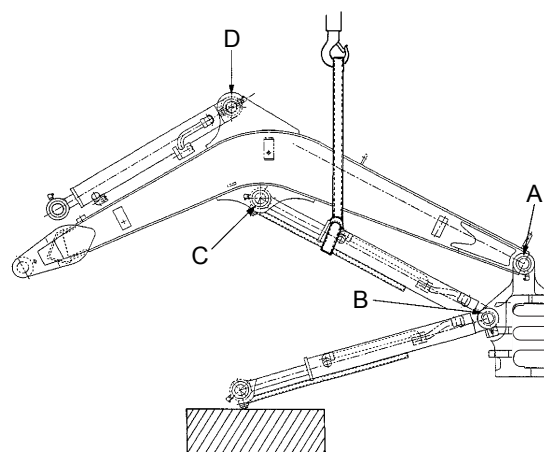


Fig. 32-11 Removal of boom assembly

Fig. 32-12 Sectional view of Installing pin

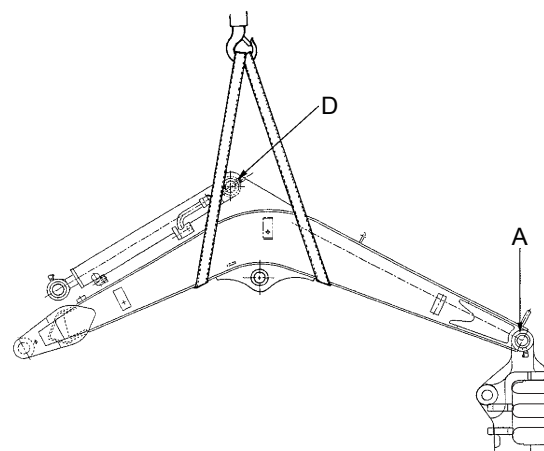


Fig. 32-13 Removal of boom assembly

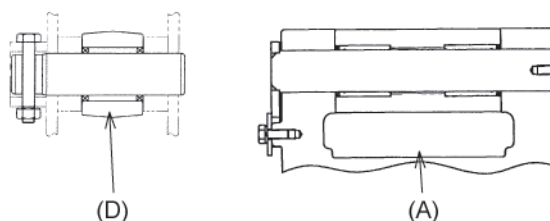


Fig. 32-14 Sectional view of Installing pin

Remove the U-ring (6)

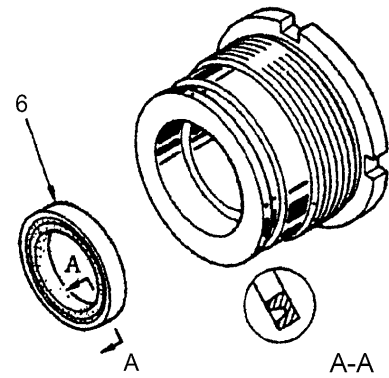


Fig. 32-31 Disassembling cylinder head

4) Remove the wiper ring (7).

- Alternately tap inside of the metal ring of wiper ring at several positions, as shown in the figure, to push it out step by step from the groove.

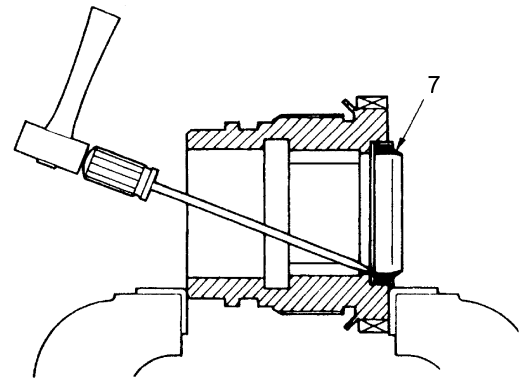


Fig. 32-32 Removing wiper ring

5) Remove the bushing (5) using a removal jig.

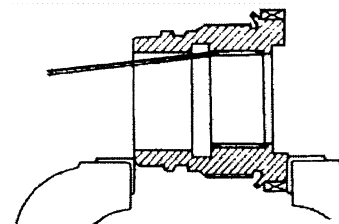


Fig. 32-33 Removing bushing

(5) Disassembly of clevis portion:

- Remove the seal ring (23) from the clevis portion of cylinder tube (1) and the cylinder rod (3).

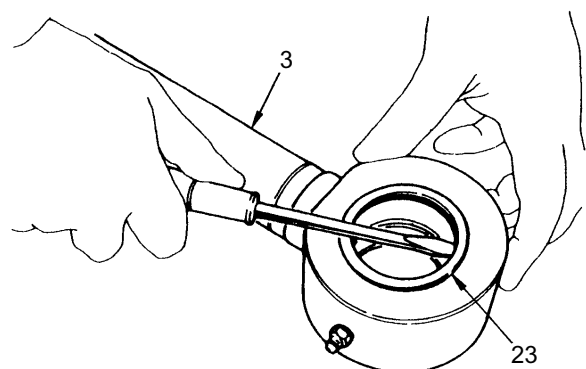
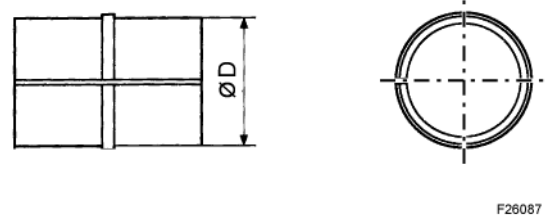


Fig. 32-34 Removing dust seal

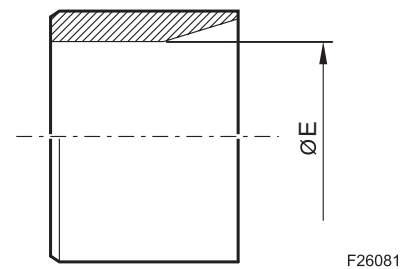
(4) Pushing Jig (D) for seal ring (18)

Applicable cylinder	
E35B SR	E39B SR
(Liner diameter; $\text{ØD} = 65 \text{ mm}$) Bucket	
(Liner diameter; $\text{ØD} = 75 \text{ mm}$) Arm	
(Liner diameter; $\text{ØD} = 80 \text{ mm}$) Boom Swing	
(Liner diameter; $\text{ØD} = 100 \text{ mm}$) Dozer	



(5) Reforming Jig (E) for seal ring (18)

Applicable cylinder	
E35B SR	E39B SR
(Liner diameter; $\text{ØE} = 65 \text{ mm}$) Bucket	
(Liner diameter; $\text{ØE} = 75 \text{ mm}$) Arm	
(Liner diameter; $\text{ØE} = 80 \text{ mm}$) Boom Swing	
(Liner diameter; $\text{ØE} = 100 \text{ mm}$) Dozer	



33.1.3.3 ASSEMBLING FLOOR PLATE

- (1) Assemble the floor plate in reverse order of the disassembly.

Sems-screws (6) M8:

: 13 mm

Tightening torque: 23.5 Nm


33.1.8 SOLENOID VALVE

33.1.8.1 PREPARATION FOR REMOVAL

- (1) Unlock and open the right upper cover (1).
- (2) Remove the right lower cover (4) [(See Section 33.1.2.1-(3)].

33.1.8.2 REMOVAL

- (1) Disconnecting hoses
 Disconnect all the hoses connected to the solenoid valve (B1). Then attach a plug and a tag recording the connecting port to each of their openings.
 - Item (B32) is a drain hose for the hydraulic oil tank. When disconnecting this hose, take care of oil leakage.
- (2) Disconnecting connector
 Disconnect two connectors connected to the main harness.
- (3) Removing solenoid valve
 Loosen two M8x20 capscrews (B5) to remove the solenoid valve (B1).

 : 13 mm

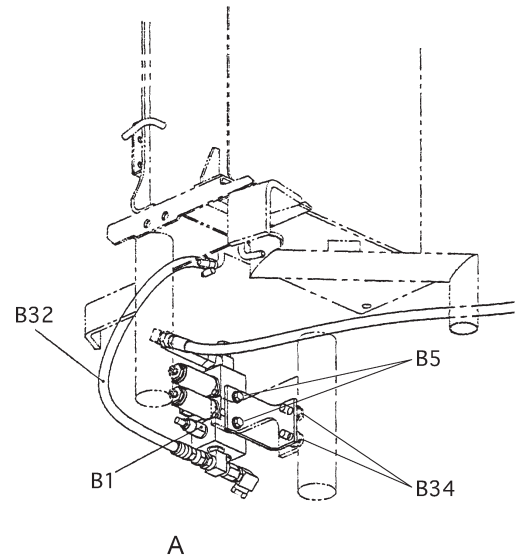
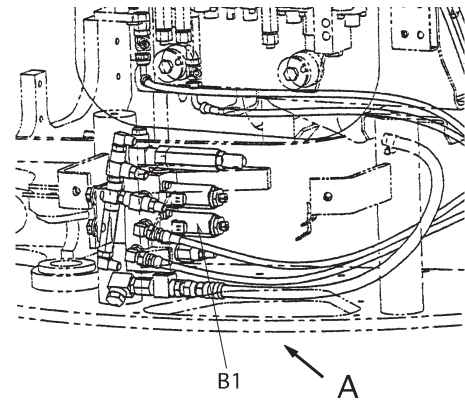


Fig. 33-29 Solenoid valve removal

33.1.8.3 INSTALLATION

- (1) Install the solenoid valve in reverse order of the removal. Tighten the fittings at the following torque:

Piece	Name	Tool (mm)	Torque (Nm)
B5	Screw M8	13	33.3
B34	Screw M10	17	65.7

Tightening torque (Nm)

Thread size (PF)	Spanner used (mm)	O-ring type fitting	30° flare type fitting
1/4	19	36.3	29.4
3/8	22	73.5	49

(6) PILOT VALVE REMOVAL FOR DOZER

1) Disconnecting hoses

Disconnect all the hoses connected to the Pilot valve (10). Then attach a plug and a tag recording the connecting port to each of their openings.

2) Removing pilot valve

Loosen two M8x20 capscrews (11) to remove the pilot valve.

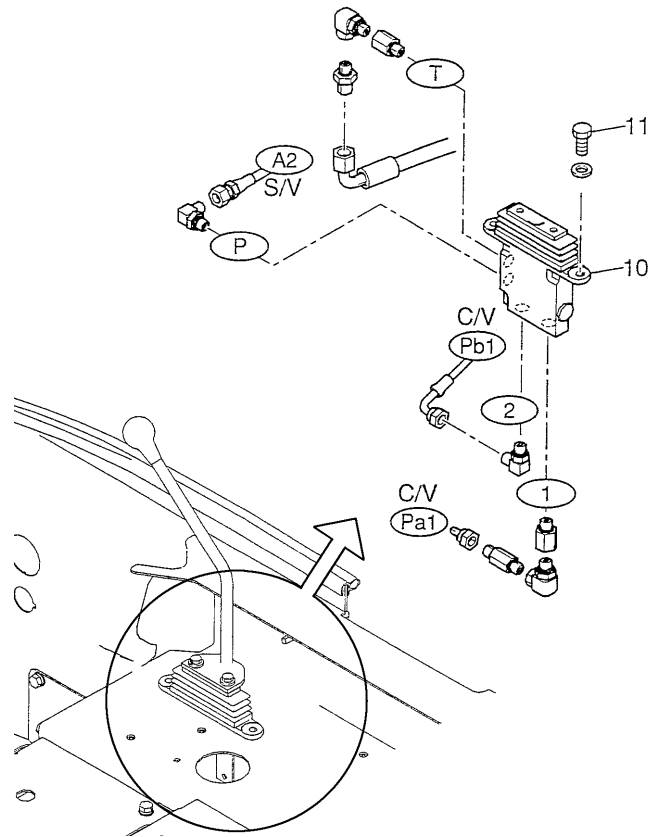



Fig. 33-45 Pilot valve removal for dozer

(7) Removing seat and front stand cover

Loosen four M8x20 sems-bolts (15) to remove the seat assembly (7) and the front stand cover (14) in one piece.

 : 13 mm

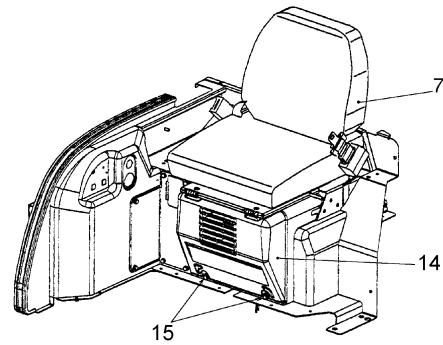



Fig. 33-46 Seat and cover removal

(8) Removing heat insulation cover

Loosen two M8x20 sems-bolts (24) to remove the cover (5).

 : 13 mm

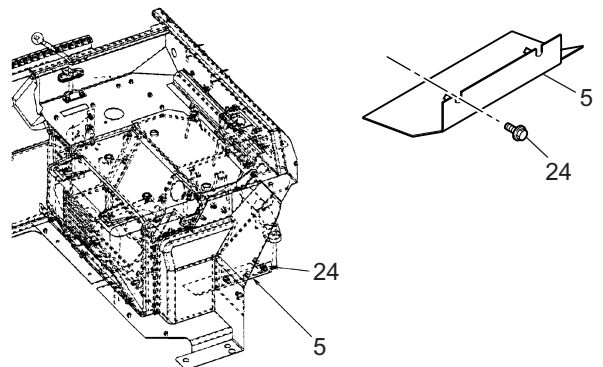


Fig. 33-47 Cover removal

33.1.18 CONTROL VALVE

33.1.18.1 PREPARATION FOR REMOVAL

Since the same method applies to the right-hand and the left-hand pilot valve, only the method for the right-hand is described.

- (1) Disconnect the negative side terminal of the battery.
- (2) Release the residual pressure in the circuit and the pressure in the hydraulic tank.
- (3) Remove the right and left control boxes and the control panel.
- (4) Loosen sems-bolts (10) to remove the cover assembly (18) and (19) (See Fig. 33-60).

: Torx driver

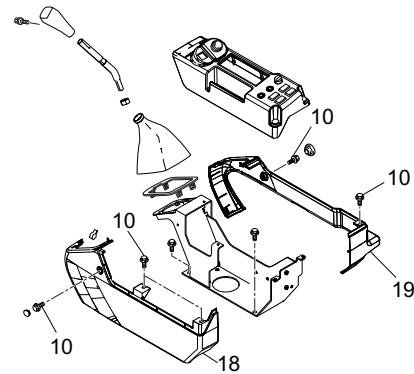



Fig. 33-60 Cover removal (Right control box)

33.1.18.2 REMOVAL

- (1) Disconnect each hose at the position marked with * and attach a plug and tag to facilitate installation.
 - (2) Shift the boot and remove four capscrews (A2).
- : 10 mm
- (3) Remove the pilot valve (A1).

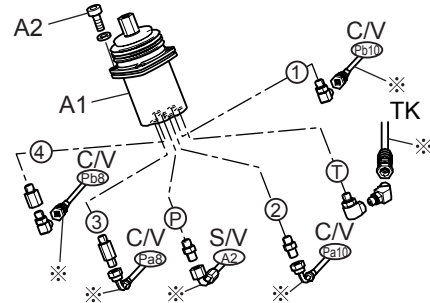


Fig. 33-61 Hose removal

TK. Tank

33.2.1.2 DISASSEMBLY AND ASSEMBLY

33.2.1.2.1 Tools and Jig

(1) Tools

Name	Q.ty	Size (Nominal)
Allen wrench	One each	4, 6, 8 and 10
Plastic hammer	1	Medium type
Snap ring pliers	1	For hole (snap ring 22)
Snap ring pliers	1	For shaft (snap ring 20)
Torque wrench	1	Possible to tighten to the specified torque
Grease	Little	
Adhesive agent	Little	Loctite type "high tack sealant #98"

(2) Jig

1. Working bench

Plate which is used to place the pump facing downward
 If the shaft end does not contact with work bench, the square timber is available instead of it.

2. Jig for removing and installing cover

Used to assemble and disassemble to preserve the shaft.

<Disassembly>

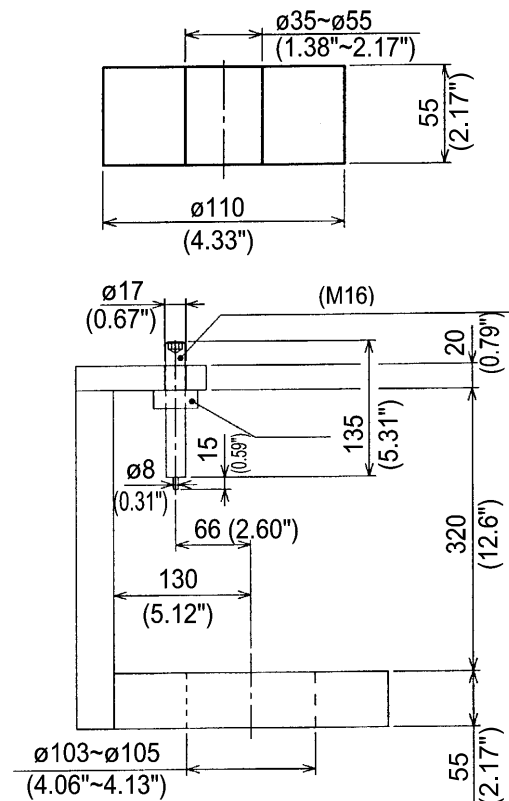
Prevent the cover from rising diagonally due to the control spring when removing 4 socket bolt (M12).

<Assembly>

Install the cover on the housing keeping it horizontal.
 The right figure shows the construction of jig. This is of the construction to push the cover applying the machined end of hexagon socket set screw (M16x150). (Note 1) to the adjusting screw

(Note 1)

When the socket bolt is used, machine 15 mm from the top end in $\varnothing 8$.



F26082

33.2.1.2.2 Cautions during assembling and disassembling

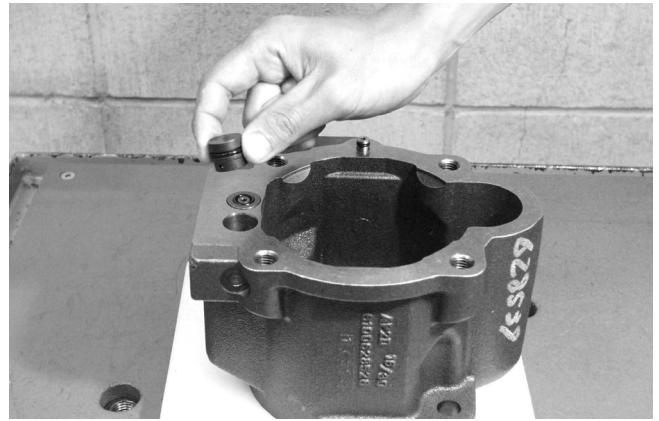
(1) Cautions for disassembling

- 1) Never attempt acting on the adjusting screw unless absolutely necessary.
- 2) Take the utmost care during disassembly not to knock or drop any part.

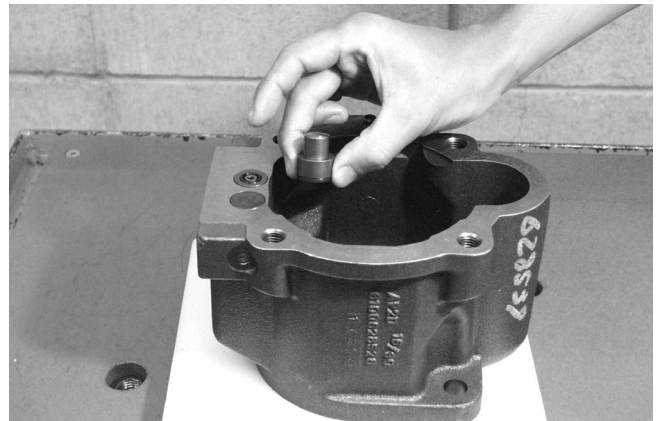
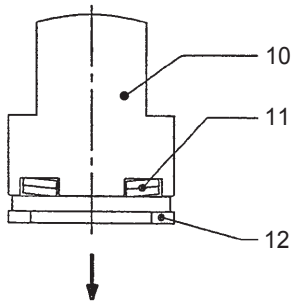
(2) Cautions for assembling

- 1) Wash each part thoroughly.
- 2) During assembling, take utmost care not to damage the part or allow foreign materials to enter.
- 3) As a rule, the O-ring and oil seal should not be reused.
- 4) In our assembly work, the torque wrench is used to control the torque. Be sure to use the torque wrench.

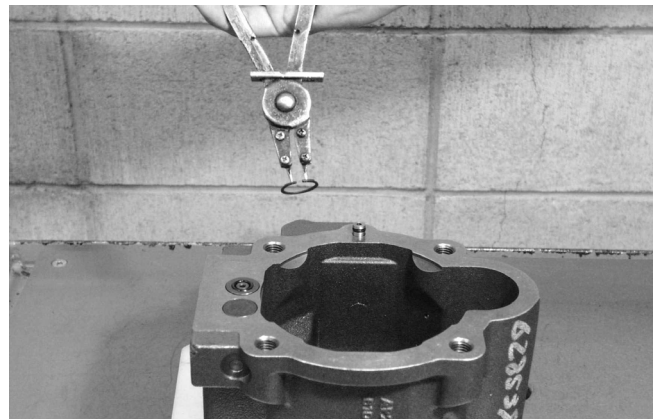
d) Install the piston of Pz shift side.



e) Installing minimum flow stopper
 Install the guide (10), disk spring (11), distance piece and shim (12) in the housing.
 • Be careful of direction of a disk spring.

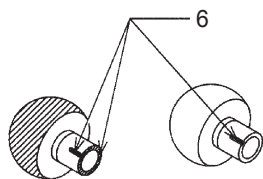


f) Place snap ring (22 for hole) in.
 Snap ring pliers (22 for shaft)



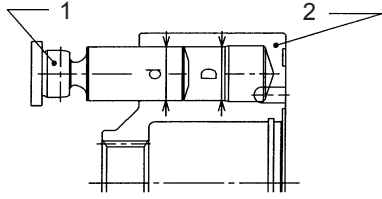
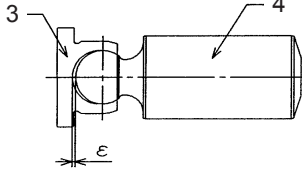
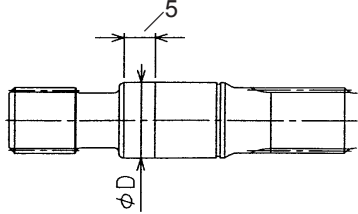
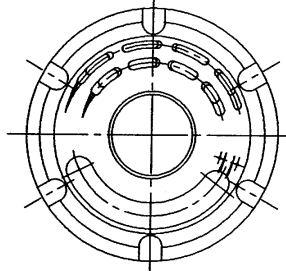
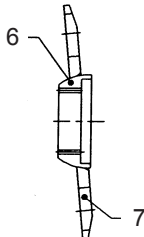
2) Installing swash plate

a) Place the guide in the housing.
 • Place in paying attention to the matchmark (6) put on at disassembling.



33.2.1.3 MAINTENANCE STANDARD

(1) Parts replacement standard

Piece	Replacement criterion	Remedy
Piston assembly (1) and cylinder block (2) 	<ul style="list-style-type: none"> Visual inspection To be free from flaw, galling and wear. (Especially the sliding section) Check clearance between the piston (1) outer diameter and inner diameter of the cylinder block (2). $D-d \leq 0.06 \text{ mm}$ 	<ul style="list-style-type: none"> Replace.
Piston shoe (3) and piston (4) 	<ul style="list-style-type: none"> Piston shoe (3) and piston (4) Check the play in the axial direction of the piston (4) and shoe shaft (3). $\epsilon \leq 0.2 \text{ mm}$ 	<ul style="list-style-type: none"> Replace.
Shaft 	<ul style="list-style-type: none"> Shaft Check the wear of the oil seal (5). Wear amount $\leq 0.025 \text{ mm}$ 5. Oil seal installing range 	<ul style="list-style-type: none"> Replace.
Control plate 	<ul style="list-style-type: none"> Check the sliding surface for flaw. 	<ul style="list-style-type: none"> Replace it when the flaw is severe.
Guide (6) and retainer (7) 	<ul style="list-style-type: none"> Check if it is free from galling and step wear. Check if it is free from galling and step wear. 	<ul style="list-style-type: none"> Replace it in a set if it is impossible to repair. After repairing with lapping, clean it to remove the lapping compound.

(7) Cautions for disassembling

▲ WARNING

The removed parts should be carried and stored carefully to prevent damage and contamination. And when the removed parts are applied, stored, or carried in the removed condition, fill up the holes after the removal of parts with cap, tape, etc. to protect it from entry of dust, dirt, etc.

(8) Disassembling anticavitation valve

▲ WARNING

Since the anticavitation valve is essential for the performance, replace it with the new assembly if necessary. Procedures for disassembling the valve to check for abnormality is shown below for reference. The figures in parentheses following the part names in the description are the item numbers in the cross-sectional drawing (Fig. 33-82). Firstly, hold the hexagonal section having width across flats of 22 mm with a vise lightly.

Loosen and remove the plug (3) with an Allen wrench of 8 mm.

Remove the spring (4). Then push in the anti-cavitation valve (1) from the seat side while taking care not to damage the seat section. Pull out the O-ring (6) and back-up ring (5) from the side from which the plug (3) was removed while taking care so that the rings are not damaged by the internal thread of the body (2).

(9) Relief valve (Code: RV)

Disassembly of overpressure relief valve (Code: ORV)

▲ WARNING

Since the overload relief valve is essential for the performance and safety and the resetting of the pressure is very difficult, replace it with the new assembly when an abnormality is detected. For reference, how to disassemble for checking the abnormality is shown below.

The figures in parentheses following the part names in the description are the item numbers in the cross-sectional drawing (Fig. 33-81). First, hold the body (5) with a vise at the hexagonal section of the opposing flat, 22.

Loosen and remove adjusting screw (7) with allen wrench of 4 mm. Take out spring (9), the poppet (6) and spring guide (16) with tweezers, etc.

Then, loosen and remove plug (4) with spanner of 19 mm, and the remaining parts can be taken out at the same time. And take out socket (1), piston (3), spring (10) and pressure regulating valve (2) in order.

33.2.3 ATTACHMENT CONTROL VALVE

33.2.3.1 COMPONENTS

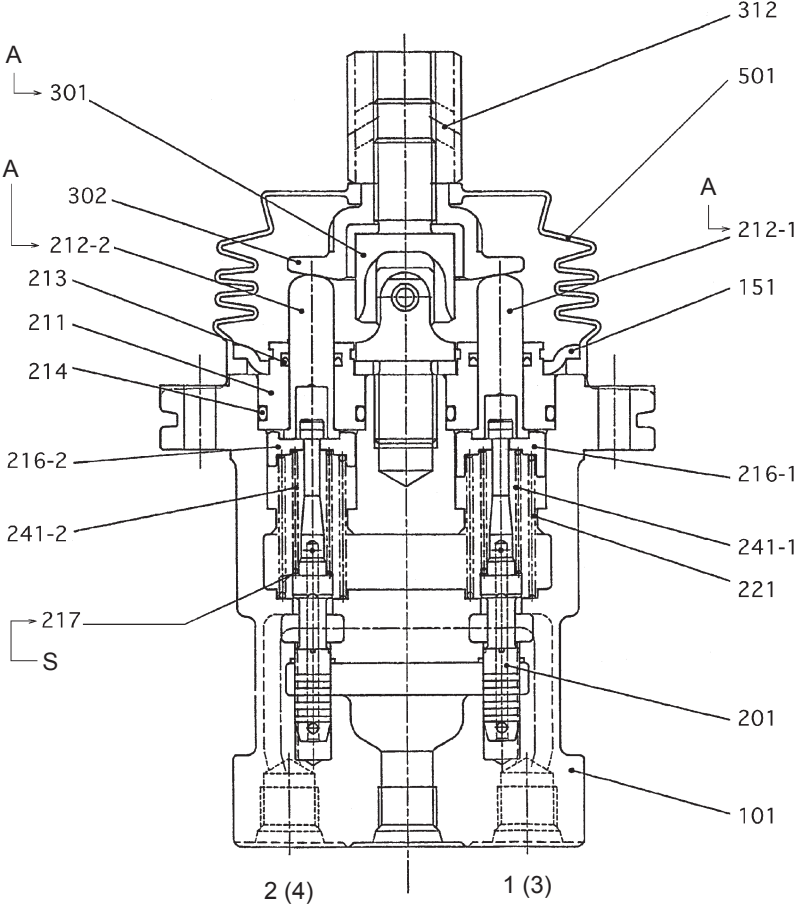


Fig. 33-91 Pilot valve (Attachment)

- A. Apply grease
- S. Shim for adjusting secondary pressure

No.	Thread size	Tightening torque table (Nm)
301	M14	47.1
302. 312	M14	68.6

No.	NAME	Q.TY	No.	NAME	Q.TY	No.	NAME	Q.TY
101	BODY	1	213	SEAL	4	241-1	SPRING	2
151	PLATE	1	214	O-RING	4	241-2	SPRING	2
201	SPOOL	4	216-1	SPRING SEAT	2	301	JOINT	1
211	PLUG	4	216-2	SPRING SEAT	2	302	DISK	1
212-1	PUSH ROD	2	217	WASHER	4	312	ADJUSTING NUT	1
212-2	PUSH ROD	2	221	SPRING	4	501	BELLOWS	1

33.2.4.2 DISASSEMBLY AND ASSEMBLY

- (1) Special jig for disassembly and assembly
Special jig 1 (for removal of bushing)

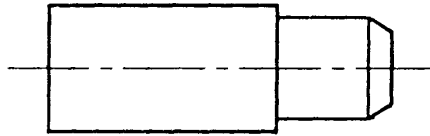


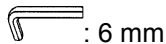
Fig. 33-114 Special jig 1

- (2) Precautions for disassembly and assembly

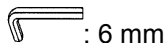
- 1) Disassemble and assemble the pilot valve, making sure dust, dirt etc. do not enter into it.
- 2) Handle parts carefully not to damage.
- 3) Write down the installing positions of respective part during disassembly, and assemble respective part to the position as they were before.

- (3) Disassembling

- 1) Stop respective port (P, T, 1, 2, 3 and 4) of the valve with plugs and clean the outer surface.
- 2) Fix the cleaned valve with vise.
- 3) Remove bellows (501) from cover (201).
- 4) Remove set screw (472).

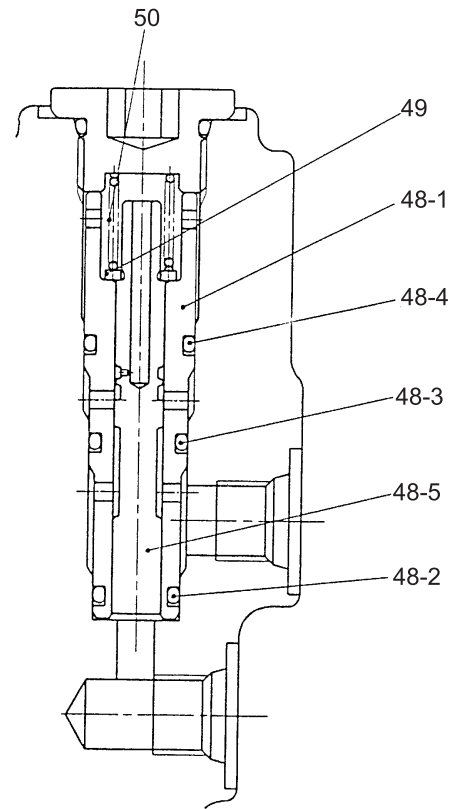


- 5) Contact pry bar ($\phi 7$ or less) to one end of cam shaft (413), and strike it lightly with a hammer.
- 6) Remove cam (420).
- 7) Remove socket bolt (271).



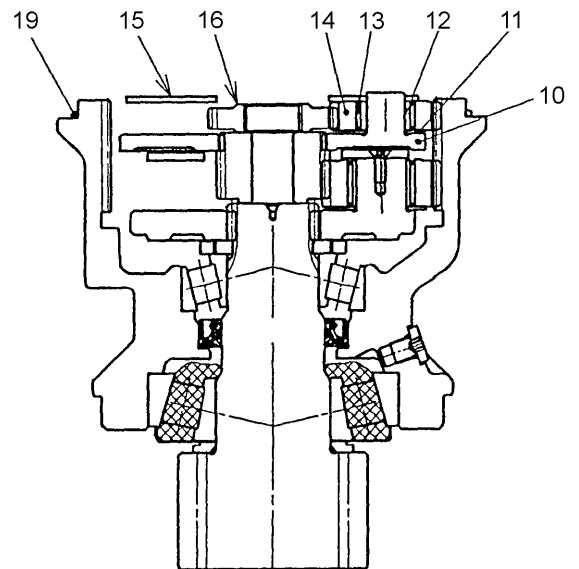
- 8) Remove cover (201).
- 9) Remove the casing upper assembly and fix the assembly with vise, again.
- 10) Pull out the push rod (214) from the plug (202).
- 11) Remove plug (202) with grease cup (203), packing (210) and O-ring (212).
- 12) Remove piston (224).
- 13) Remove damping spring (336) from the casing.
- 14) Place spring seat (218) in casing (102) with tweezers.
- 15) Take out steel ball (225) using magnet.
- 16) Fix the lower casing assembly with vise, and take out O-rings (211 and 213) from casing (101).
- 17) Remove reduction unit valve assembly and return spring (335) from casing (101).
- 18) Place cover (201) on the flat bench transverse, apply bushing (414) to special jig 1, strike it lightly with hammer, and pull the bushing out.
- 19) To disassemble the reduction unit valve, first push the valve seat (311) diagonally, so that the spring (324) generates secondary pressure, remove the valve from the spool (301) through the bigger opening.

- b) Remove spring (50), washer (49) and spool (48-5).
- c) Remove sleeve (48-1).



(3) Disassembling reduction unit

- 1) Remove O-ring (19), thrust plate (15), drive gear (16), planetary gear (14), needle bearing (13), inner race (12), thrust washer (11), holder (10).



CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

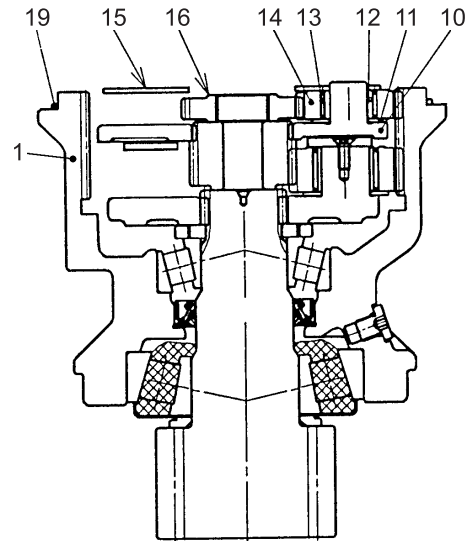
- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: www.heydownloads.com by clicking the link below



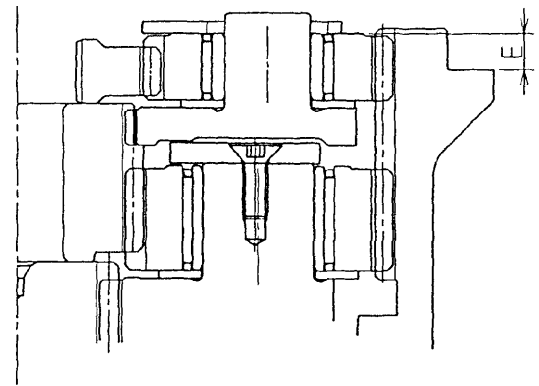
- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- 9) Install the thrust washer (11), the inner race (12), the needle bearing (13), the planetary gear (14), the thrust plate (15) and the drive gear (16) of the support (10).
- 10) Apply grease to the O-ring (19) and fit it in the housing (1).



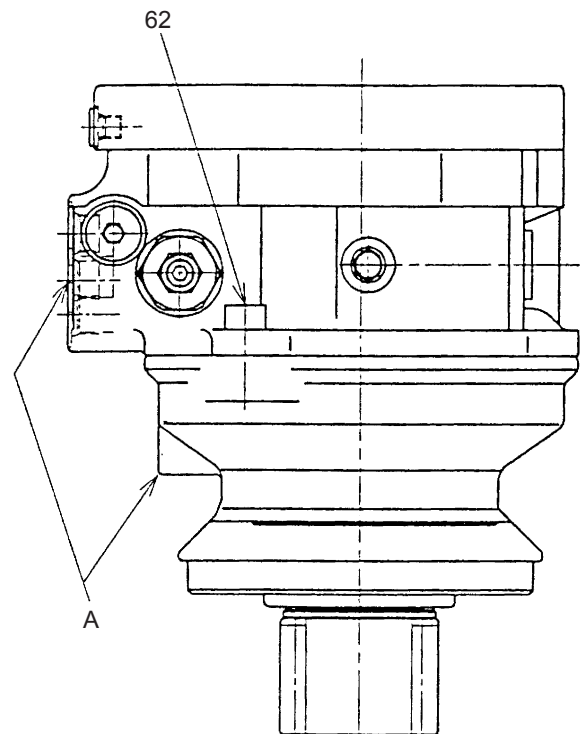
NOTE: selection for thrust plate (15)
 When any components of the reduction unit were changed, select and install thrust plate corresponding to the measured value "E" referring to the table below.



Dimension E (measured value)	less than 6.6	6.6 -7.2	more than 7.2
Plate (15) thickness: mm	3.2	2.8	2.3

- (3) Assembling motor assembly
 - 1) Install the reduction unit on the motor assembly, tighten socket bolt (62) temporarily, and tighten it to the specified torque.
 $T = 128 \pm 7 \text{ Nm}$

A. Align the protruded section with port.

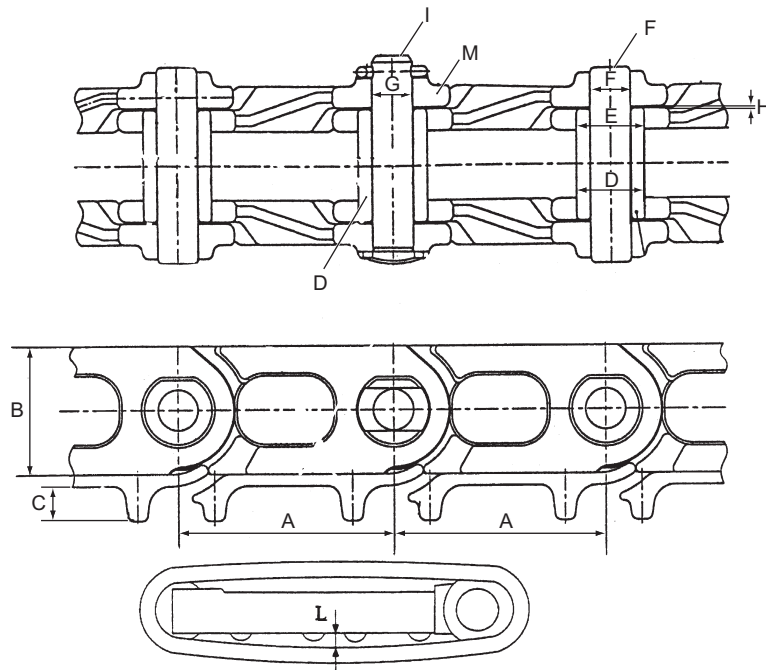


34. TRAVEL SYSTEM

TABLE OF CONTENTS

34.1 REMOVING AND INSTALLING	34-2
34.1.1 TRAVEL SYSTEM COMPONENTS	34-2
34.1.2 CRAWLER BELT	34-2
34.1.3 UPPER ROLLER	34-11
34.1.4 LOWER ROLLER	34-15
34.1.5 IDLE WHEEL	34-21
34.1.6 CRAWLER IDLER	34-25
34.1.7 SPROCKET	34-29
34.1.8 TRANSLATION MOTOR	34-30
34.1.9 SLEWING BEARING	34-32
34.2 DISASSEMBLY AND ASSEMBLY	34-35
34.2.1 TRANSLATION MOTOR	34-35

(2) Steel crawler (Track link)



- | | |
|---------------------------|---|
| A. Link pitch | G. \varnothing Master pin |
| B. Link height | I. Master pin |
| C. Height of crawler lug | L. Distance between the bottom of frame and top of rubber crawler |
| D. Bushing outer diameter | M. Master link |
| F. Track pin | |

- (5) Install the O-ring (8).
Install O-ring (8) to shaft groove.
- Coat grease to O-ring.
 - Always replace the O-ring with new one prior to reassembling.
- (6) Installing collar (2).
Insert the collar (2), into which the seal (7) is built in advance, into the shaft (4).
- Insert it until the stopper ring groove of the shaft (4) is in alignment with the end surface of the collar (2).
- (7) Installing stopper ring (6).
Fit the stopper ring (6) in the stopper ring groove of the shaft (4).

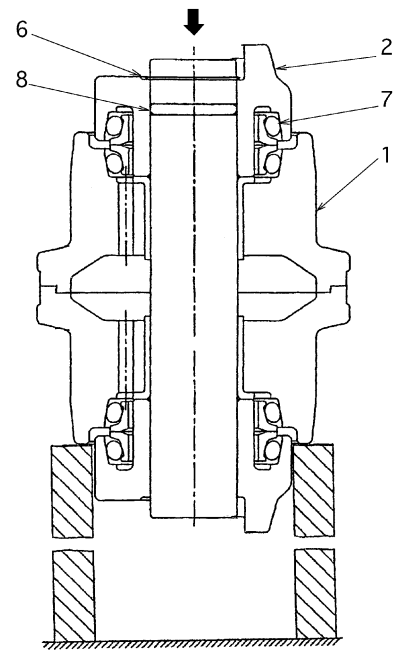


Fig. 34-41 Installing the collar (2)

- (8) Oil supply.
Supply 35 cc of HYPOIDE 90 class engine oil through the plug (9) hole.
- (9) Leakage test.
Perform leakage test at an air pressure of 2.0 kgf/cm² prior to tightening the plug (9).
- (10) Installing the plug (9).
Apply oil resistant sealing agent to the plug (9), and screw it in the plug hole in the end surface of the collar (2).

: 5 mm

Tightening torque: 9.8 Nm

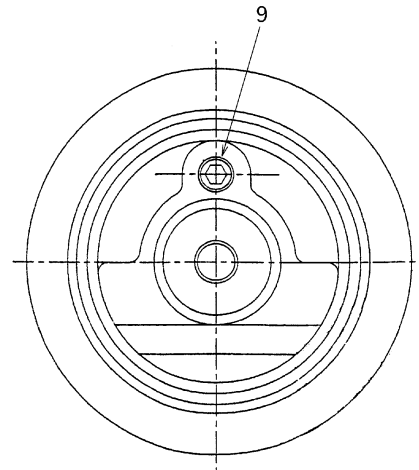


Fig. 34-42 Installing oil supply plug (9)

⚠ WARNING

After assembling the lower roller as a single unit, ensure that it shows no oil leakage and can be manually rotated.

34.1.7 SPROCKET

34.1.7.1 REMOVAL AND INSTALLATION PROCEDURES

34.1.7.1.1 Removing

- (1) Remove the crawler assembly.
- (2) Place wooden block (3) under the lower frame (1) so the sprocket (2) is off the ground.
- (3) Loosen capscrew (M12) for the mounting of the sprocket by means of an Allen wrench and remove the sprocket (2).



: 10 mm

Single weight of sprocket (2): 9 kg

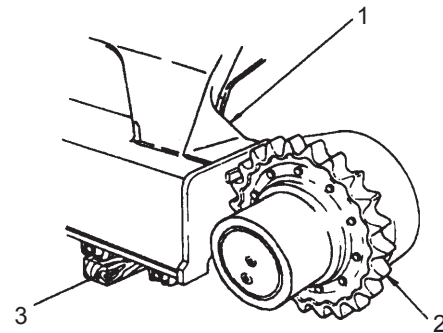


Fig. 34-63 Making sprocket free

34.1.7.1.2 Installing

- (1) Check the fixing parts of the travel motor (5) and the sprocket (2), eliminate burrs and dirt thoroughly, and install the sprocket (2).
- (2) Apply Loctite #262 to the threaded portion of cap-screw to mount the capscrews (4) and fasten them temporarily.
- (3) Remove the wooden block (3) under the lower frame (1) and tighten capscrews (4) to specified torque to fix sprocket (2) and travel motor (5).



: 10 mm

Tightening torque: 107 Nm

- (4) Install crawler.

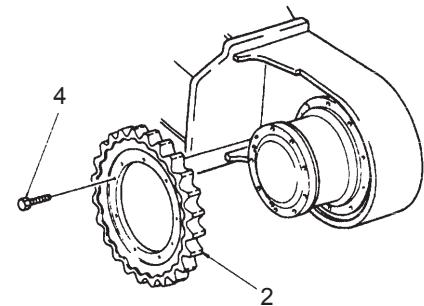


Fig. 34-64 Removing sprocket

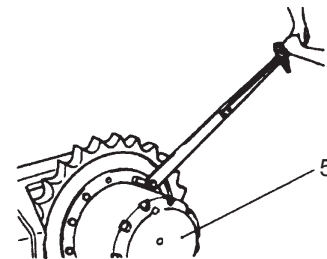


Fig. 34-65 Tightening capscrew

34.1.7.2 MAINTENANCE STANDARDS

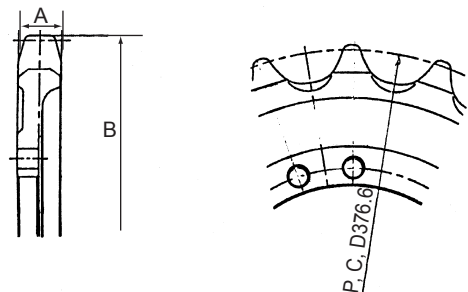
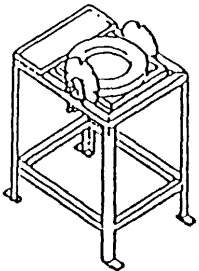
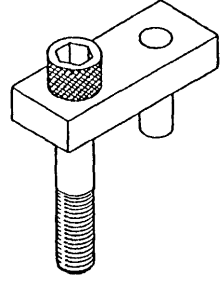
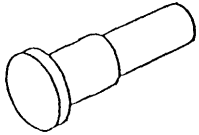
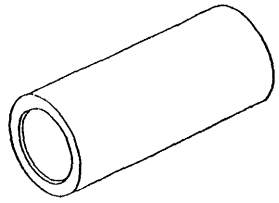
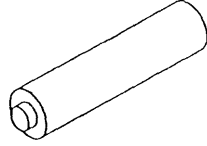
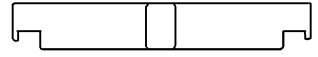
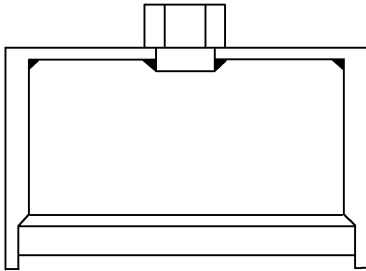
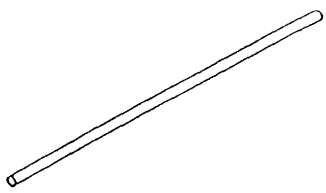


Fig. 34-66 Sprocket

Unit: mm

Code	REF.	STANDARD VALUE	REPAIRABLE LEVEL	SERVICE LIMIT	REMEDY
A	Width of sprocket teeth	24	21	20	Replace
B	Sprocket outer diameter	ø385.6	ø380	ø378	Welding repair or replacement

(3) Attachment

No.	NAME	No.	NAME
1	Working bench for travel motor (WB) No.  This is used to carry out the work for assembly and disassembly of travel motor easy and safe.	2	Fixing metal (FM) No.  This is used to connect the spindle (2) and hub (1).
3	Retainer metal (RM1) (RM) No.  This is used to insert spring (114), washer (110), snap ring (145) into cylinder block (104), and also used to remove spring (114) from cylinder block (104).	4	Retainer metal (RM2) No.  This is used to pull out bearing (149) from drive shaft (102).
5	Oil seal press fit tool (RM3) No.  For press fitting the oil seal (132) in the oil seal hole of the spindle (2).	6	Bearing press fit tool (BB) No.  For press fitting the ball bearing (24) in the hub (1).
7	Jig for adjusting the preload to the bearing (JB) No.  For installing the ring nut (22) to the spindle (2).	8	Steel rod (1) (SR) No.  This is used to remove the ring (45) from the hub (1).

- 7) Remove O-ring (237) from plug (226).
- Do not reuse the removed O-ring (237).

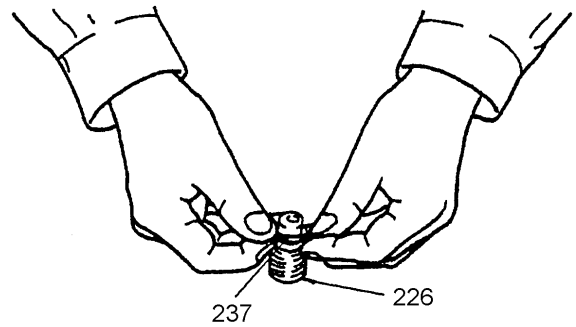


Fig. 34-109 Removing O-ring (237)

(11) Removing two-speed switching spool

- 1) Remove the plug (221) from the rear flange (201).
 - 2) Remove O-ring (273) from plug (221).
- Do not reuse the removed O-ring (273).

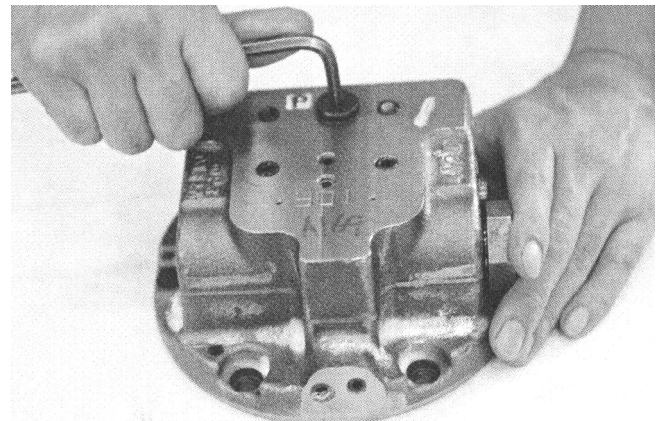


Fig. 34-110 Removing plug (221)

- 3) Remove the spool (263) and the spring (266) from the rear flange (201).

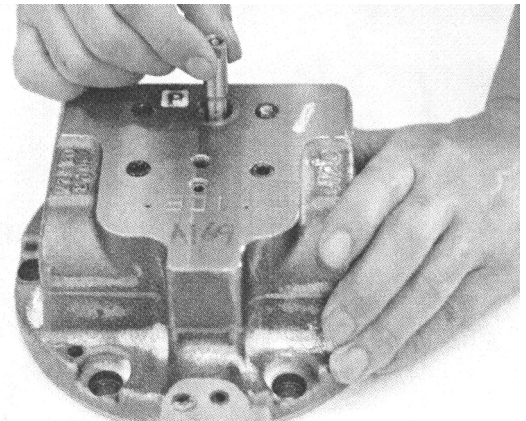


Fig. 34-111 Removing spool (263)

(1) Assembling hub section.

- 1) Place the hub (1) on the press workbench on a support (S).
- 2) Insert the main bearing (24) in the hub (1). Place the main bearing press fit jig (BB) on the outer race of the main bearing (24). Push down the jig by a press to press fit the bearing into the hub (1).
- 3) Turn over the hub (1).
- 4) Press fit the main bearing (24) into the hub (1) in the same way as the above item 2).

- Be careful not to mistake orientation of the main bearing (24) when press fitting.
- 5) Apply grease to the O-ring of the floating seal (31). Build the floating seal into the floating seal groove of the hub (1).

- Apply a small amount of grease to the entire surface of the O-ring after removing it from the floating seal.
- Place the FS inserting tool (FS1), the floating seal and the FS inserting tool (FS2) in this order, and press in until the FS inserting tool (FS2) contacts with the FS inserting tool (FS1). Remove the FS inserting tools and ensure that the end surface of the hub is in alignment with the face of the floating seal at an accuracy of 1 mm or less.

- 6) Attach two lifting eyes (LE) to the tapped holes of the hub (1) in diagonal position.

- 7) Attach a wire with hooks to the lifting eyes, lift the hub (1) by a crane and then install the hub (1) on the workbench.

- While aligning the tapped hole in the hub (1) with the fixing hole (F) in the workbench (WB), carefully insert the hub (1) into the fixing hole (F) in the workbench.

- 8) Attach the hub (1) to the workbench (WB) by tightening the screws diagonally.

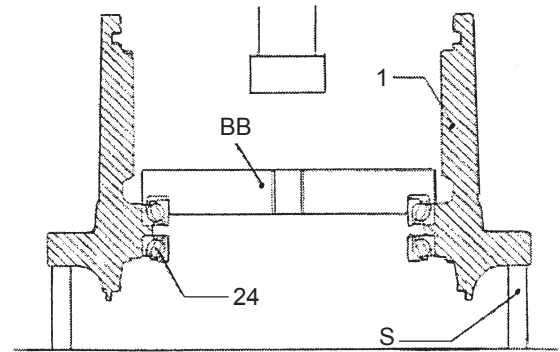


Fig. 34-141 Inserting bearing (24)

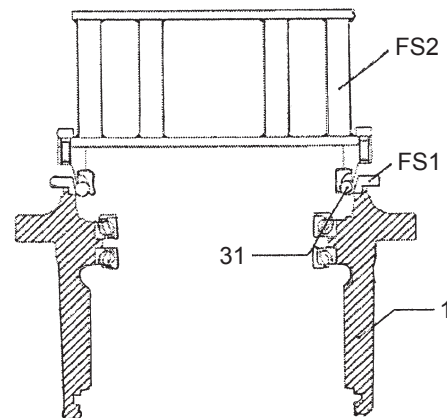


Fig. 34-142 Installing floating seal (31)

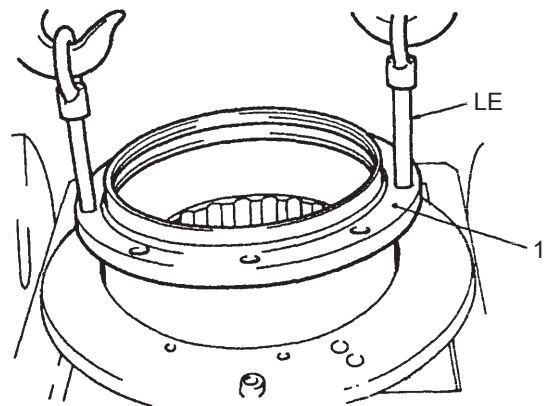


Fig. 34-143 Lifting hub (1)

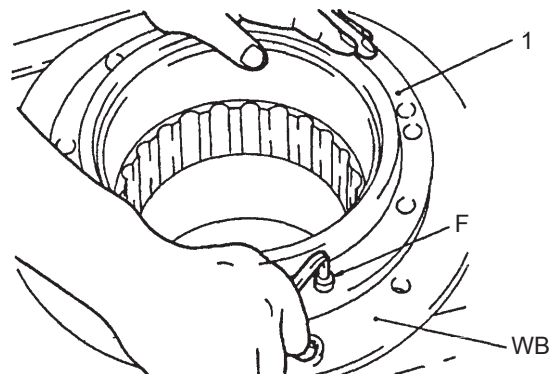


Fig. 34-144 Installing hub (1) to the workbench

⚠ WARNING

Fully tighten the nuts. Otherwise, the travel motor may fall down to cause injury when it is turned over.

- 6) Tighten four thrust washers 3 (12) into the column sections of the spindle (2) with four hexagon screws (40) at the specified torque.
Tightening torque: 29.4 ± 4.9 Nm

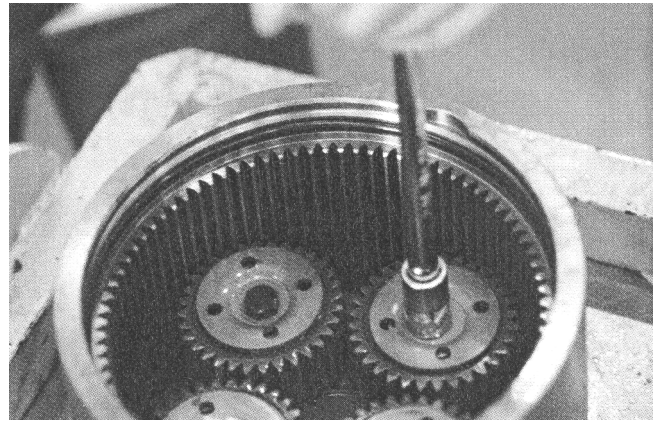


Fig. 34-179 Tightening hexagon head screw (40)

- (13) Installing the drive gear 2.

- 1) Install the coupling (14) to the shaft (102).
- 2) Make the drive gear 2 (6) mesh with the planetary gear 2 (7) to install.

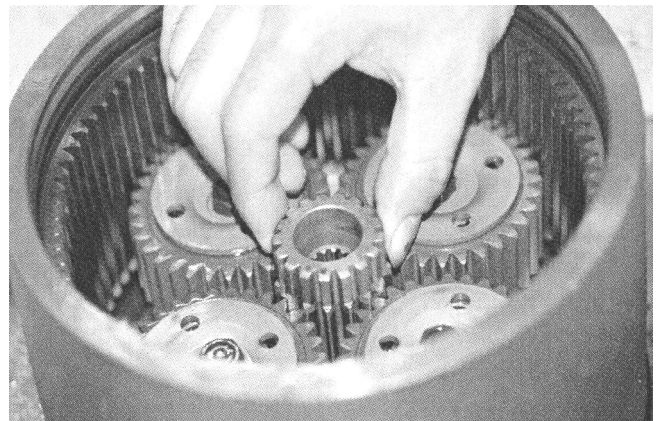


Fig. 34-180 Installing the drive gear (102)

- (14) Installing the planetary gear carrier assembly.

- 1) Install the planetary gear carrier assembly mounted in item (11) while making it mesh with the drive gear 2 (6) and the internal teeth of the hub (1).

- (15) Installing the drive gear 1.

- 1) Insert the drive gear 1 (4) into the coupling (14). Preassemble the steel balls (41) into the drive gear 1 (4).

- Apply grease to the steel balls (41) to prevent them from dropping before assembling them onto the drive gear 1 (4).

- 2) Install the drive gear 1 (4) while making it mesh with the teeth of the three planetary gears 1 (5).

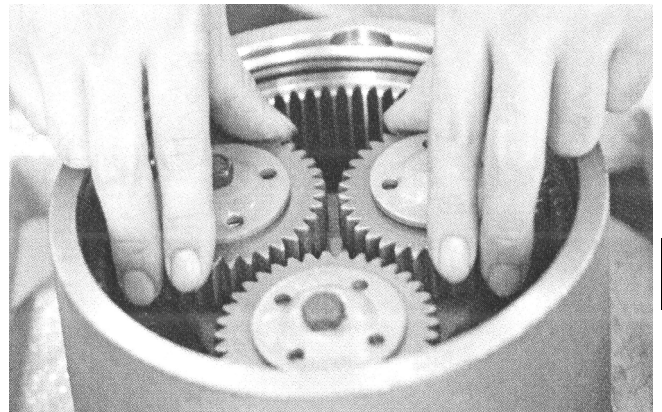


Fig. 34-181 Installing carrier assembly

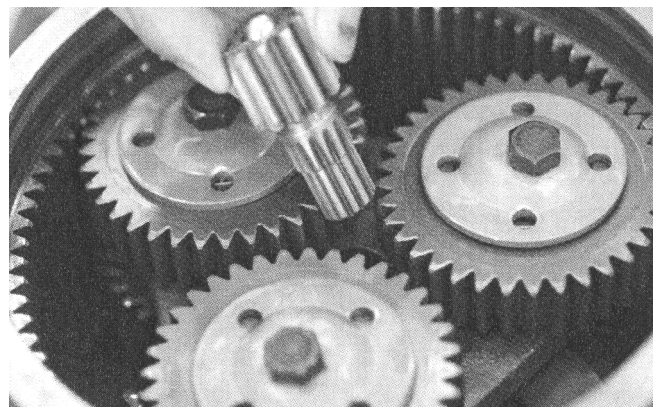
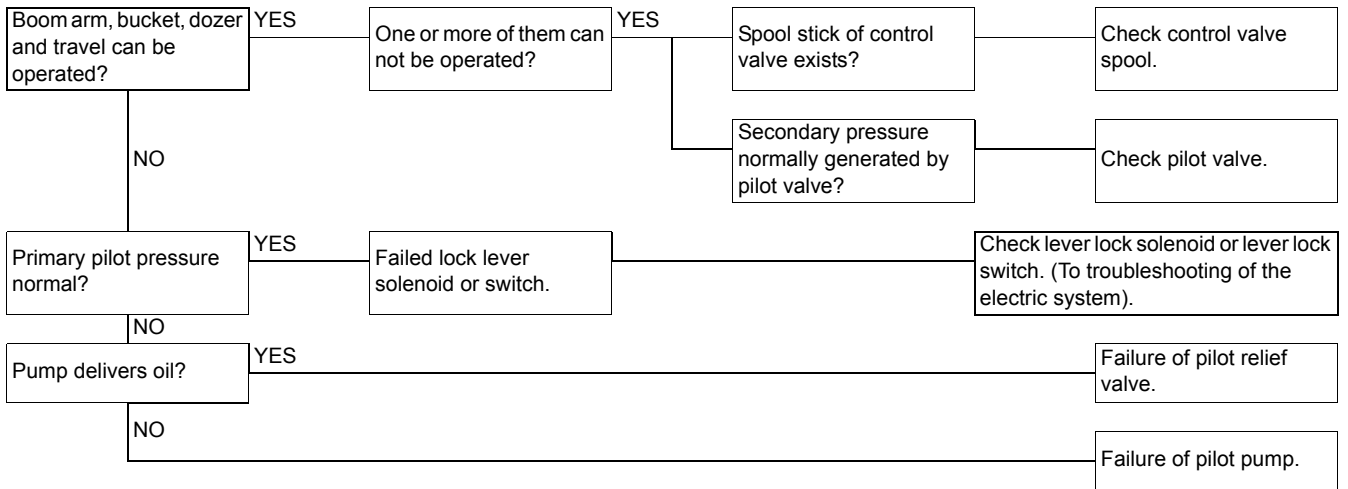


Fig. 34-182 Installing the drive gear 1 (4)

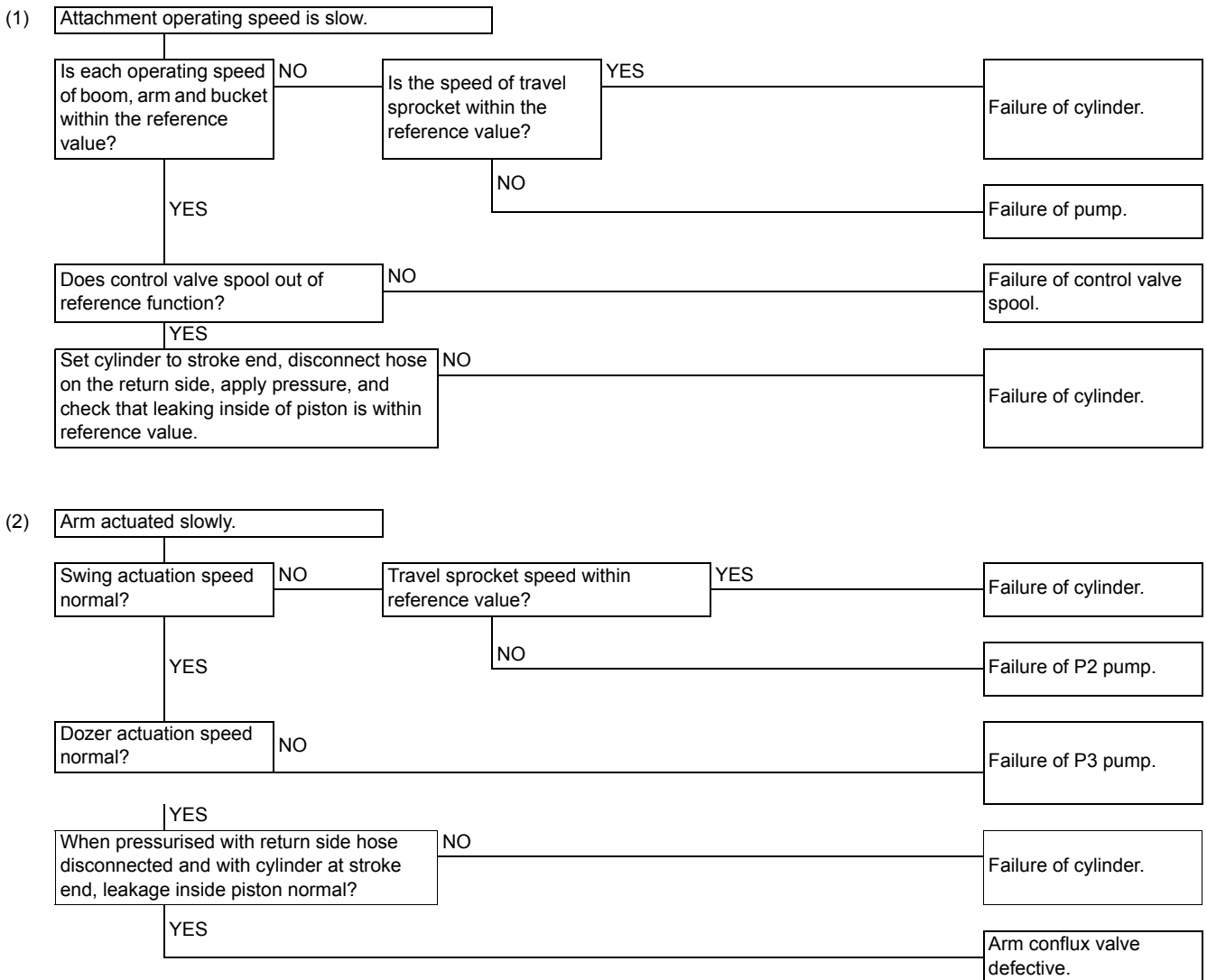
42.3 TROUBLESHOOTING

42.3.1 TOOL

42.3.1.1 Attachment operational failure (excluding swing operations)



42.3.1.2 Attachment speed is slow



43.1 TROUBLE DIAGNOSIS: ELECTRICAL SYSTEM

Classification	Reference No.	Causes	Electrical equipment		Sensors		Solenoid		Switch			Relay			Others									
			Gauge cluster	Generator	Working light	Deceleration motor	Horn	Coolant temp sensor	Fuel level sensor	Travel 1, 2 speed solenoid	Lever lock solenoid	For engine stop solenoid	Horn switch	Working light switch	Travel 1, 2 speed switch	Lever lock switch/limit switch	Deceleration switch	Engine stop solenoid relay	Charge indicator relay	Safety relay	Timer	Travel holding circuit control unit	Fuse, disconnect, short circuit, looseness	
General	1	(1) Engine does not start.		<input type="radio"/>						<input type="radio"/>						<input type="radio"/>		<input type="radio"/>	<input type="radio"/>			<input type="radio"/>		
		(2) Horn does not sound.					<input type="radio"/>				<input type="radio"/>												<input type="radio"/>	
		(3) Working light does not light up.			<input type="radio"/>							<input type="radio"/>											<input type="radio"/>	
		(4) Hourmeter does not actuate.	<input type="radio"/>	<input type="radio"/>														<input type="radio"/>					<input type="radio"/>	
		(5) Fuel gauge does not actuate.	<input type="radio"/>					<input type="radio"/>															<input type="radio"/>	
		(6) Water temperature meter does not actuate.	<input type="radio"/>					<input type="radio"/>															<input type="radio"/>	
Attachment operation	2	(1) All controls does not function. (Excluding swing operations)							<input type="radio"/>				<input type="radio"/>									<input type="radio"/>		
Travel operation	3	(1) Travel 1 and 2 speed can not be changed.						<input type="radio"/>				<input type="radio"/>										<input type="radio"/>	<input type="radio"/>	
Deceleration	4	(1) Deceleration switching can not be carried out.				<input type="radio"/>								<input type="radio"/>							<input type="radio"/>	<input type="radio"/>		

Abbreviations
 Decel: Deceleration
 SOL: Solenoid

44.1 TROUBLE DIAGNOSIS: ENGINE

Classification	Group no.	Cause	Serviceman																
			Inspection										Visual check						
			Filters					Fluid					Gas/fluid						
			No fuel or leakage	Air or water entered fuel system	Oil filter clogged	Air cleaner clogged	Primary fuel filter clogged	Fuel filter clogged	Fan belt slip	Breather hose clogged or depressed	Coolant level	Poor quality fuel or leakage	Improper specific gravity of battery electrolyte	Improper viscosity or level of engine oil, or leakage	Poor quality fuel or heavy oil used	Large amount of blow-by gas	Gas leakage through valve gasket	Excessive amount of engine oil	Improper battery electrolyte level
Trouble start	1	(1) Starter does not rotate.																	
		(2) Starter rotates but hard to start.	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>	
Rotation trouble	2	(1) Idling not smooth.		<input type="radio"/>			<input type="radio"/>	<input type="radio"/>						<input type="radio"/>					
		(2) Medium speed hunting.											<input type="radio"/>						
		(3) High speed not smooth.		<input type="radio"/>				<input type="radio"/>											
		Not reach maximum speed.						<input type="radio"/>											
Performance drop	3	(1) Engine output not enough.		<input type="radio"/>		<input type="radio"/>	<input type="radio"/>					<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>				
		Overheat.			<input type="radio"/>	<input type="radio"/>		<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
		(2) Knocking at high temperature.											<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
Other trouble	4	(1) Large amount of black exhaust gas.			<input type="radio"/>							<input type="radio"/>					<input type="radio"/>		
		White exhaust gas.		<input type="radio"/>											<input type="radio"/>	<input type="radio"/>			
		(2) Excessive oil consumption.								<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	
		(3) Excessive fuel consumption.			<input type="radio"/>							<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>				
		(4) Engine not stop when key turned OFF.																	
		(5) When key is turned OFF, power supply disconnected but engine not stop.																	

44.3 ELECTRICAL EQUIPMENT

44.3.1 ELECTRICAL EQUIPMENT LIST

Group	Code	Part Name
Diode	D-1	DIODE
	D-2	DIODE
	D-3	DIODE
	D-4	DIODE
	D-12	DIODE
	D-13	DIODE
	D-14	DIODE
	D-18	DIODE
Electrical system Fittings	E-1	FUSE BOX
	E-2	GENERATOR (ALTERNATOR)
	E-3	HORN
	E-4	FUSIBLE LINK (45A)
	E-6	GAUGE CLUSTER
	E-7	POWER SOCKET
	E-8	AIR HEATER
	E-10	RADIO (OPT)
	E-11	OVERLOAD BUZZER
	E-12	HEATER (OPT)
	E-13	BATTERY
	E-14	SEQUENCE BOX
	E-15	FUSE BOX FOR COOLER (OPT)
	E-16	RADIATOR
	E-17	ENGINE CONDENSER
	E-18	COMPRESSOR
	E-23	ANTENNA
	E-26	HOUR COUNTER
Lights	L-1	ROOM LAMP
	L-2	BOOM WORKING LIGHT
	L-5	CAB / CANOPY WORKING LIGHT
Engine	M-1	STARTER MOTOR
	M-2	WIPER MOTOR (CAB)
	M-3	WASHER MOTOR (CAB)
	M-4	DECELERATION MOTOR
	M-6	FUEL PUMP
Relay	R-1	BATTERY RELAY
	R-2	SAFETY RELAY
	R-3	DECELERATION RELAY
	R-6	TIMER UNIT
	R-7	ENGINE STOP RELAY
	R-8	CHARGE INDICATOR RELAY
	R-9	CAB / CANOPY WORKING LIGHT RELAY
	R-14	SLEW / SWING SELECT RELAY
Sensors	SE-1	FUEL SENSOR
	SE-2	ENGINE THERMO SENSOR
Solenoid	SV-1	LEVER LOCK SOLENOID
	SV-2	2-SPEED SELECT SOLENOID
	SV-3	ENGINE STOP SOLENOID
	SV-5	POWER SHIFTING SOLENOID (Radiator specifications)

(6) 4TNV84T

Engine name		Unit	4TNV84T							
Engine specification class		-	CL				VL			
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine							
Combustion chamber		-	Direct injection							
Number of cylinders		-	4							
Cylinder bore stroke		mm x mm	84 x 90							
Displacement		L	1.995							
Continuous rating	Rotation speed	rpm	1500	1800	-					
	Output	kW	19.1	24.3	-					
Rated output	Rotation speed	rpm	1500	1800	2000	2200	2400	2600	2800	3000
	Output	kW	21.3	26.9	27.9	30.5	33.5	35.7	38.6	41.2
Maximum no-load speed (± 25)		rpm	1600	1895	2180	2400	2590	2810	2995	3210
Order of ignition		-	1-3-4-2-1 (No.1 cylinder on flywheel side)							
Power take off		-	Flywheel							
Rotating direction		-	Counterclockwise (viewed from flywheel)							
Cooling system		-	Radiator							
Lubrication system		-	Forced lubrication with trochoid pump							
Starting system		-	Electrical system							
Appropriate fuel		-	ASTM fuel No. 2-D type TT							
Applicable lubricant		-	SUPER GOLD 15W-40				SUPER GOLD 10W-30			
Lubricant capacity (oil pan)*	Total	L	7.4							
	Effective	L	3.4							
Coolant volume (engine only)		L	2.7							
Engine Dimensions ** (with flywheel housing)	Overall length	mm	683				649			
	Overall width	mm	498.5							
	Overall height	mm	713							
Engine mass (dry) ** (with flywheel housing)		kg	183				170			
Fan (standard)		mm	370 mm O/D. 6 blades pusher type							
Crankshaft V pulley diameter and fan V-belt diameter (standard)		mm	120 x 90				110 x 110			

* Engine oil capacity may differ from the above depending on an engine installed on a machine unit.

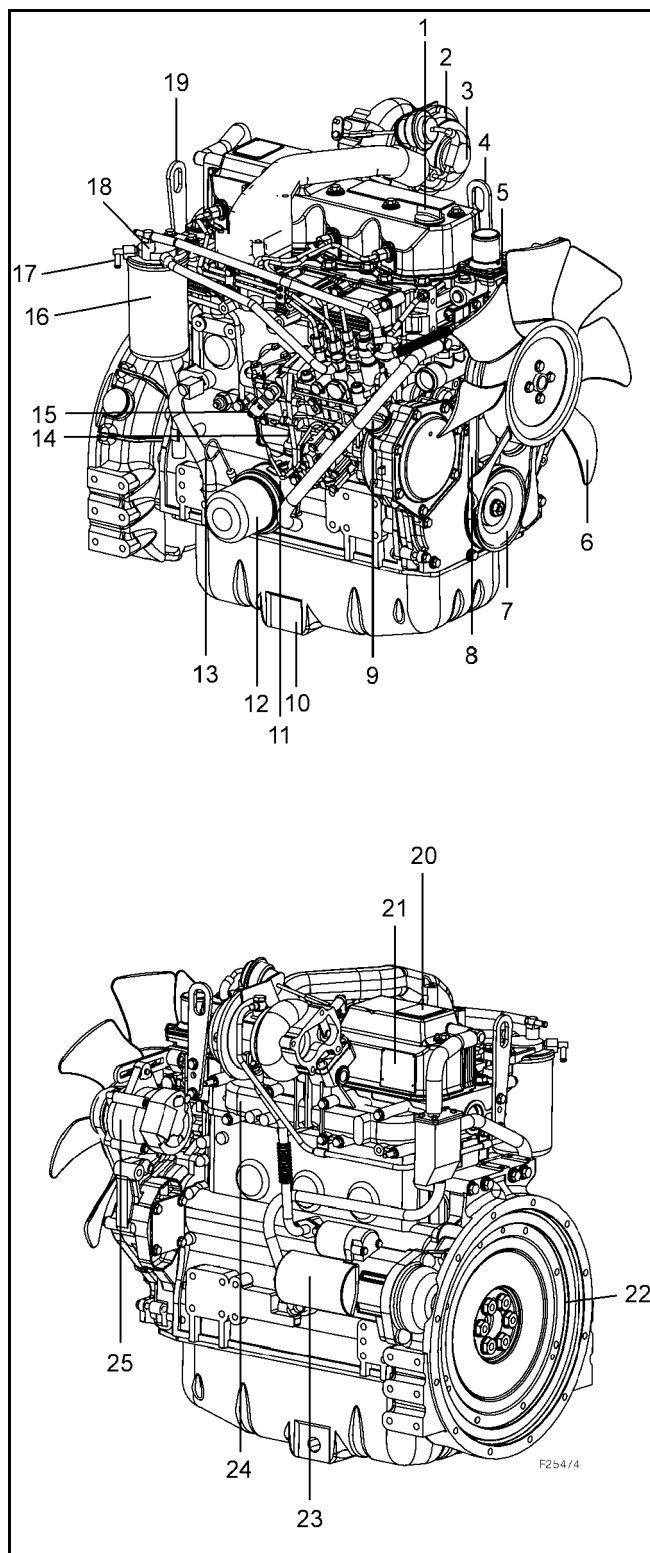
** Engine mass and dimensions without radiator.

51.1.4 ENGINE EXTERNAL VIEWS

1. Filler port (engine oil)
2. Turbocharger
3. Air intake port (from air cleaner, optional)
4. Lifting eye
5. Coolant pump
6. Fan
7. Crankshaft V-pulley
8. V-belt
9. Filler port (engine oil)
10. Drain plug (engine oil)
11. Engine oil cooler (4TNV98T, 4TNV106, 4TNV106T)
12. Engine oil filter
13. Dipstick (engine oil)
14. Fuel injection pump
15. Governor lever
16. Fuel filter
17. Fuel cock
18. Fuel filter mounting
19. Lifting eye
20. Engine name plate
21. Rocker arm cover
22. Flywheel
23. Starter motor
24. Exhaust manifold
25. Generator

NOTE: this illustration shows the 4TNV98T engine (with turbocharger).

The drain plug (engine oil) location depends on the engine installed on the machine unit to be on the fuel injection pump side (above illustration) or starter motor side.



3. Fuel system bleeding

Bleed the fuel system according to the following procedures. When there is air in the fuel system, the fuel injection pump (FI) will not be able to operate.

1. Check the fuel oil level in the fuel tank. Refuel if insufficient.
2. Open the cock (FC) of the water separator (W).
3. Loosen the air bleeding bolt (A) on the water separator by turning counterclockwise 2 ÷ 3 times using a screwdriver or a spanner.
4. When the fuel coming out is clear and not mixed with any bubble, tighten the air bleeding bolt (A).
5. Feed fuel with the fuel priming pump (FP) or electro-magnetic fuel feed pump.

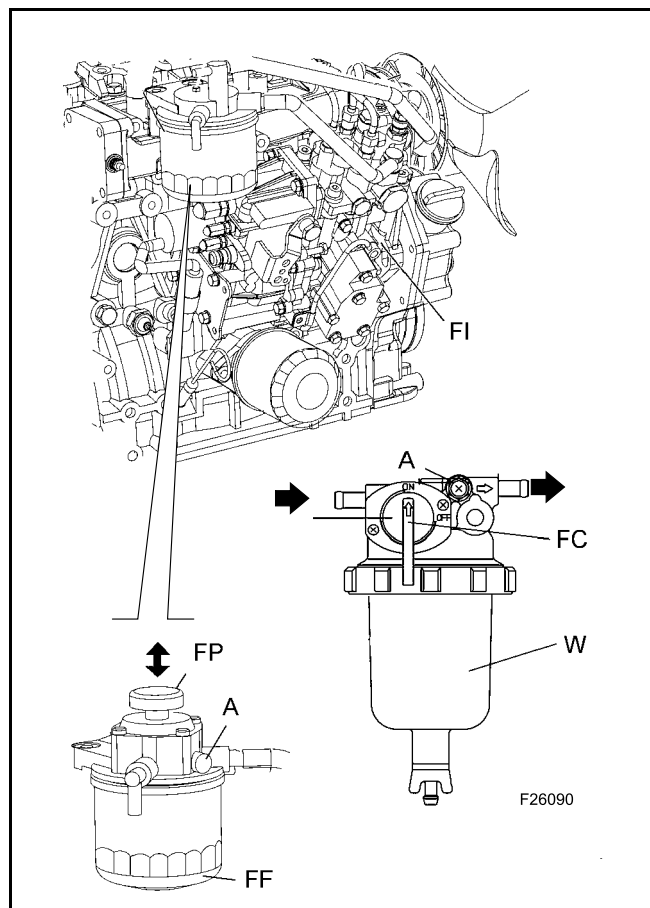
- In case the engine uses the electro-magnetic fuel feed pump.

Turn the starter switch to the ON position and hold it in the position for 10 ÷ 15 seconds to operate the fuel feed pump.

- In case the engine uses the electro-magnetic fuel feed pump (FP).

The priming pump is on the top of the fuel filter mounting. Move the priming pump up and down to feed fuel until feel your hand slightly heavy.

- Water separator (W)
(Installed on the pipe line)
- Fuel filter (FF)
(Mounting with fuel priming pump) (Option)



3. Turbocharger blower cleaning*

When the engine speed seems too low or the exhaust gas colour is strange, the blades of the turbocharger-blower may be dirty. Wash the turbine blower in such a case.

(a) General items

- As for washing, use washing liquid and clear water.
- Washing time is the time when about 10% of the boost pressure decreases more than that of usual operation state as a standard.
- Disassemble and clean the turbocharger periodically because the whole of the turbocharger cannot be cleaned with this method.

(b) Washing point

- A specified quantity of washing liquid/water is poured with a filler (e.g. oil sprayer) from the air inlet of the blower gradually (about ten seconds) at the normal load (3/4-4/4) of an engine. And, perform this work at no-load after load running of the engine, if it is difficult to pour the liquid into the blower at load running. Specified quantity of washing liquid/water.

Turbocharger model	RHB31, RHB51
Injection amount, one time	20 cc

▲ CAUTION

It causes an accident when large quantity of washing liquid is poured rapidly into a turbocharger.

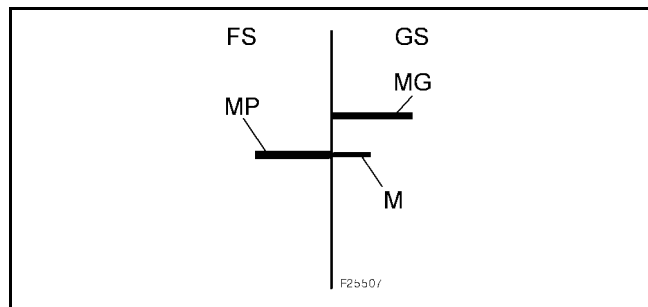
- Pour the same amount of clear water as washing liquid/water into the blower about 3-5 minutes later after the washing liquid/water injection and wash it.

▲ CAUTION

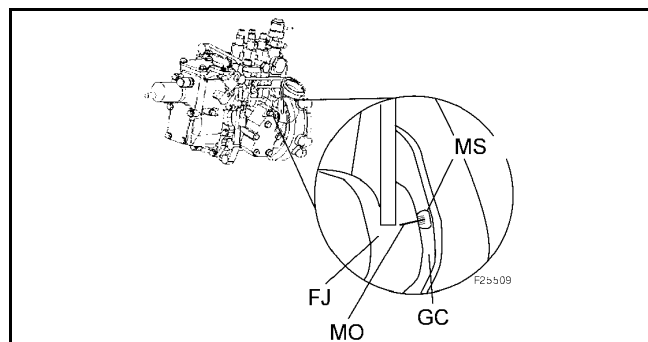
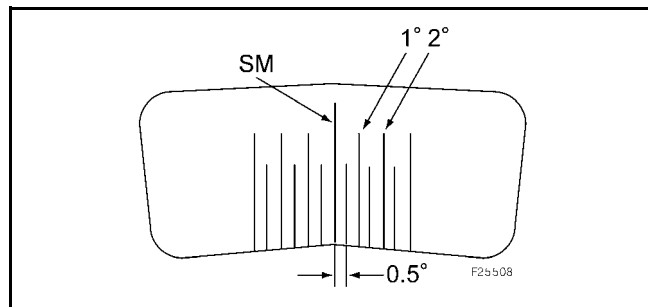
It causes an accident when large quantity of water is poured rapidly into a turbocharger.

- Repeat the washing after ten minutes when there is no change with the boost pressure or the exhaust gas temperature after washing. When there is no change at all even if it repeats 3-4 times, disassemble and maintain the turbocharger because of the cruel dirt of the blower or other causes.
- Operate the engine at load for at least 15 minutes after washing, and dry.

- Before removing a fuel pump (FJ) drive gear (GC), make identification marks (M) on the gearing part of the pump drive gear and the idle gear with paint and so on (MG).
- Make the mark-off line to the gear case precisely in accordance with the position of mark-off line of the fuel pump (MP).
- Before removing a fuel pump, put the standard mark of a sticker (MS) for fuel injection angle adjustment in accordance with the mark-off line of the fuel pump (MP) and paste it on the gear case.
- Remove a fuel pump, and read the fuel injection angle recorded in that fuel pump.
- Read the injection angle recorded on a reassembled fuel pump and calculate the difference from the injection angle of the disassembled fuel pump. (When re-installation does the same fuel pump, the angular difference is zero).
 Fuel injection angle difference (cam angle) = (the fuel injection angle of a reassembled fuel pump) - (the fuel injection angle of a disassembled previous fuel pump)



FS. Fuel pump side
GS. Gear case side



MO. Mark-off line

NOTE: tell the fuel pump number to Yanmar, and inquire the injection angle of the pump when it is hard to find out.

- Put the fuel pump (FJ) on the gear case (GC) temporarily and install the drive gear on the cam shaft with checking the identification marks (M), which were put on the fuel pump drive gear and the idle gear at the time of the disassembling.

Tighten the installation nut of a pump drive gear.

Model	Tightening t	Lubricating oil application (thread portion, and seat surface)
3TNV82A~TNV88	78 ÷ 88	Not applied
4TNV94L/98/106(T)	113 ÷ 123	

Cause	Trouble symptom	Starting failure			Insufficient engine output		Strange exhaust gas colour		High knocking sound during combustion	Abnormal engine sound	Uneven combustion sound	Hunting		Corrective action	
		Engine does not start.	Engine starts but stops soon		Exhaust colour		During work					During idling	During work		
			Exhaust smoke		Normal	White	Black	White							Black
			None	Little											
Cooling Water System	Excessive cooling effect of radiator							○						Defective thermostat (kept closed) (See 51.2.2.7)	
	Insufficient cooling effect of radiator							○						Defective thermostat (kept opened) (See 51.2.2.7) or slipping fan belt (See 51.2.2.2-2)	
	Insufficient coolant water level							○						Water leak check in cooling water system (See 51.2.2.1-4)	
	Cracked water jacket													Repair or replace.	
	Slackened fan belt							○						Adjust the belt tension. (See 51.2.2.2-2)	
	Faulty thermostat							○	○					Check or replace. (See 51.2.2.7)	
Lubricating system	Improper properties of lubricating oil	○	○		○									Use proper lubricating oil. (See 51.1.3.2)	
	Leakage from lubricating oil piping system													Repair.	
	Insufficient delivery from trochoid pump													Check and repair. (See 51.5.5)	
	Clogged lubricating oil filter													Clean or replace.	
	Defective pressure regulating valve													Clean, adjust or replace.	
	Insufficient lubricating oil level	○												Add proper lubricating oil. (See 51.2.2.1-3)	
Fuel system	Too early timing of fuel injection pump							○	○	○				Check and adjust. (See 51.2.2.7-4)	
	Too late timing of fuel injection pump					○	○	○	○					Check and adjust. (See 51.2.2.7-4)	
	Improper properties of fuel oil				○	○	○	○	○		○			Use proper fuel oil. (See 51.1.3.1)	
	Water entrance in fuel system	○		○		○		○			○	○	○	Perform draining from the fuel filter. (See 51.2.2.3 and 51.2.2.5)	
	Fuel filter clogged	○	○		○									Clean or replace. (See 51.2.2.5)	
	Air entrance in fuel system	○	○		○									Bleed air (See 51.2.2.3)	
	Clogged or cracked fuel pipe	○	○		○									Clean or replace.	
	Insufficient fuel supply to fuel injection pump	○	○		○									Check the fuel tank cock, fuel filter, fuel pipe, and fuel feed pump.	
	Uneven injection volume of fuel injection pump					○	○	○	○		○	○	○	Check and adjust.	
	Excessive fuel injection volume								○					Check and adjust.	
	Poor spray pattern from fuel injection nozzle					○	○	○	○		○	○	○	Check and adjust. (See 51.2.2.6)	
	Priming failure	○												Foreign matter trapped in the valve inside the priming pump. (Disassemble and clean.)	
	Clogged strainer at feed pump inlet				○									Clean the strainer.	

51.4.1.3 Complete disassembly

Peripheral parts such as air cleaner, muffler and radiator differ in installation and types for each application. Therefore, description in this Chapter is started with the steps to be taken just after the peripheral parts have been removed.

Step	Removal Parts	Observations
1	<ol style="list-style-type: none"> 1. Thoroughly remove sand, dust, dirt and soil from the surface of the engine. 2. Drain coolant water and lubricating oil from the engine. 	
2	<ol style="list-style-type: none"> 1. Remove turbocharger and exhaust manifold. 2. Remove intake manifold and surge tank. 	
3	<ol style="list-style-type: none"> 1. Close the fuel cock valve of the fuel tank. 2. Remove high-pressure fuel pipe. 3. Remove fuel return pipe. 4. Loosen the tightening nut on fuel injection nozzle retainer and extract the retainer and fuel injection nozzle. *) Fuel injection nozzle for Indirect injection system is screwed type. 	<ol style="list-style-type: none"> 1. If nozzle seat is left on the cylinder head, remove the cylinder head before extracting nozzle seat. 2. To prevent dust from entering fuel injection nozzle, fuel injection pump and high-pressure fuel pipe, seal their respective threads with a tape or the like. 3. Whenever extracting fuel injection nozzle, replace nozzle protector with a new one.
4	<ol style="list-style-type: none"> 1. Remove rocker arm cover assembly. 	
5	<ol style="list-style-type: none"> 1. Remove valve rocker arm shaft assembly. 2. Remove the push rod. 	<ol style="list-style-type: none"> 1. Attach a tag with the reference No. of each cylinder to the push rod in order. 2. Remove valve cap from the intake/exhaust valve head. 3. Note that tappet of the indirect injection system can be removed at the same time when push rod is extracted. 4. Attach a tag to tappet for each cylinder No. to put the tappet in order.
6	<ol style="list-style-type: none"> 1. Remove the fan mounting screw, and then remove the fan. 2. Loosen the adjusting screw for the V-belt adjuster, and then remove the V-belt. 3. Remove alternator. 4. Remove the spacer for cooling fan and V-pulley. 	<ol style="list-style-type: none"> 1. Never turn down alternator vigorously toward the cylinder block. Otherwise, your finger may be nipped and alternator broken.
7	<ol style="list-style-type: none"> 1. Remove lubricating oil filter assembly. 2. Extract dipstick form the oil dip-stick hole. 	
8	<ol style="list-style-type: none"> 1. Disconnect fuel return pipes. 2. Remove the fuel filter. 	

2. Breather system (A reductor to intake air system of blow-by gas)

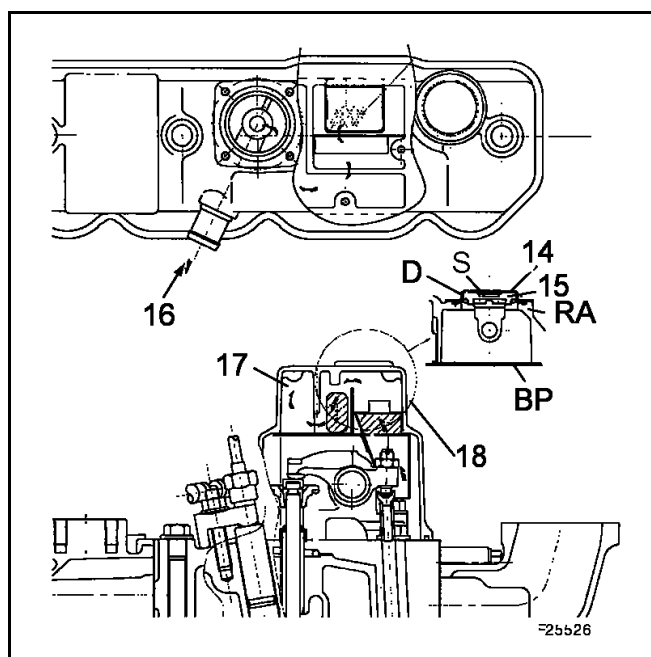
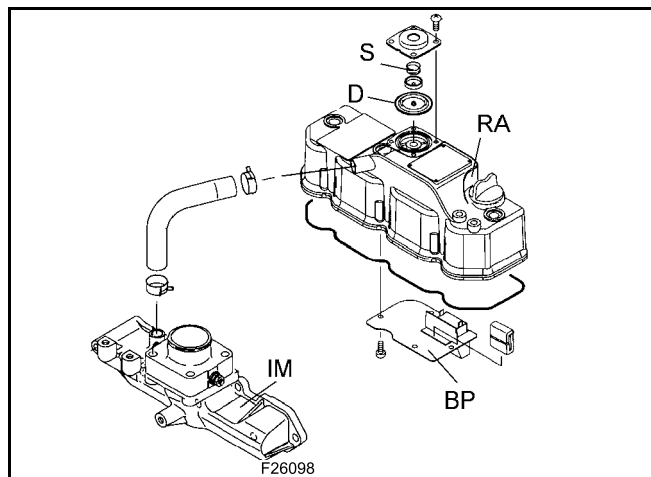
Emitting blow-by gas is harmful to natural environment. Therefore blow-by gas reductor is adopted to TNV series naturally- aspirated engines as breather system (Turbocharged engines emit blow-by gas).

The system of model 3/4TNV84 is shown as a representative of that breather system in the right figure. Some of the combustion gas (16) passes through the clearance between the cylinder and the piston, piston ring, and flows to the crankcase.

This is called blow-by gas (16). While it passes into the cylinder head and the rocker arm cover (RA), the blow-by gas mixes with splash oil and becomes sprayed-oil-mixed-with-blow-by-gas passing through the baffle plate (BP) inside a rocker arm cover (RA). And it passes through a diaphragm assy, and an intake manifold (IM), and is reduced in the combustion chamber. Pressure inside a crankcase is controlled by the function of the diaphragm assy, and suitable amount of blow-by gas is reduced in intake air system.

Disassembling

When a rocker arm cover (RA) is taken off, check whether oil or the like enter the diaphragm (D) space from a small hole on the side of a diaphragm cover or not without disassembling the diaphragm.



14. Cover

18. Diaphragm part

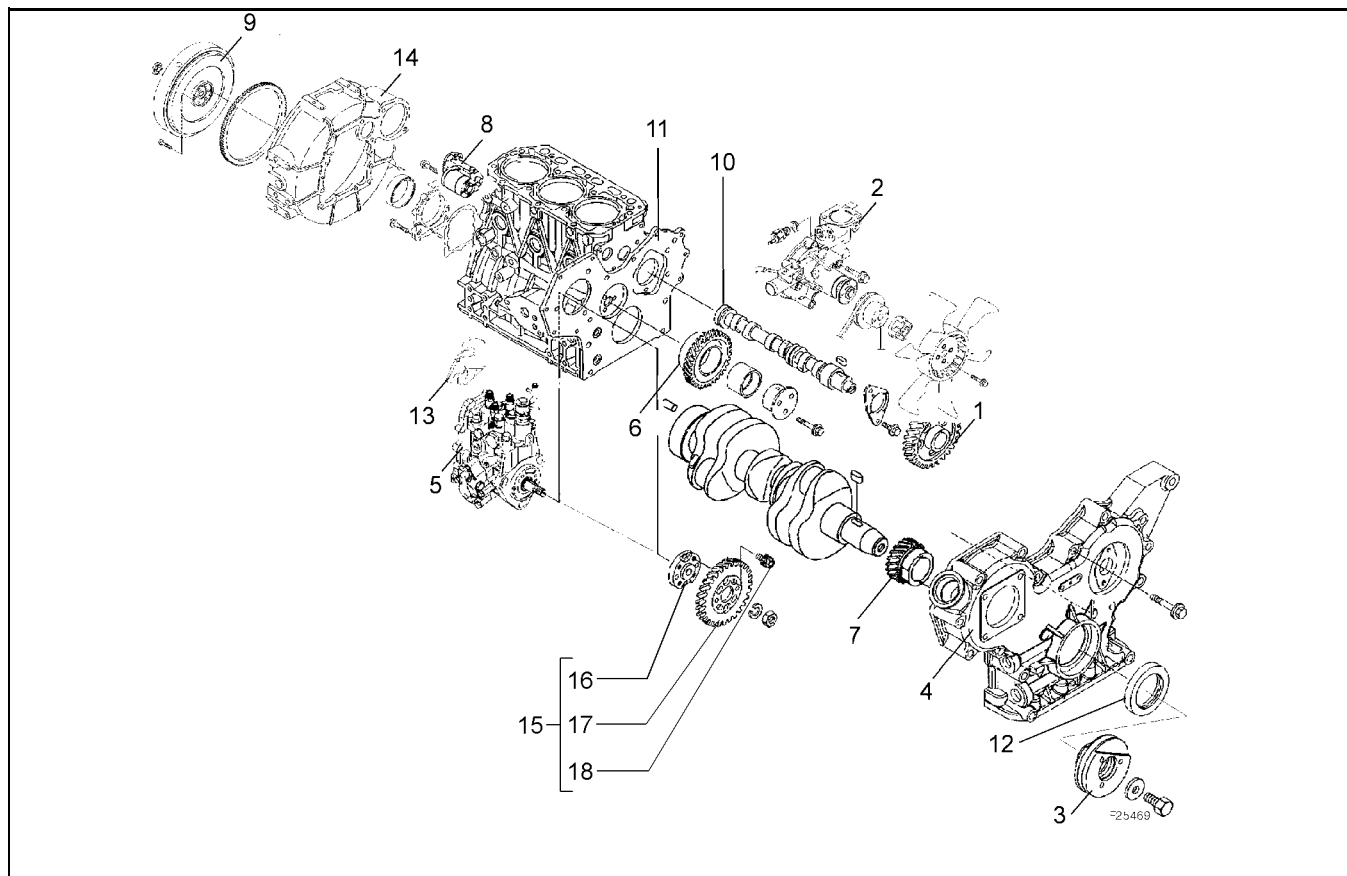
15. Center plate

17. Blow-by gas flow to diaphragm space

51.4.3 GEAR TRAIN AND CAMSHAFT

51.4.3.1 Components

NOTE: This figure shows the 3TNV84



- | | |
|--------------------------|--|
| 1. Camshaft driving gear | 9. Flywheel |
| 2. Coolant pump | 10. Cam shaft |
| 3. Crankshaft pulley | 11. Gear case flange |
| 4. Gear case | 12. Oil seal |
| 5. Fuel injection pump | 13. Fuel pump spacer |
| 6. Idler gear | 14. Flywheel housing |
| 7. Crankshaft gear | 15. Don't disassemble: pump flange 16, fuel pump drive gear 17, flange bolt 18 |
| 8. Starter motor | |

- Set the piston at the BDC position and remove the connecting rod cap. Then set the piston at the TDC (top dead centre) position, and push the connecting rod big end with a wooden bar or a hammer. Proceed carefully so as not to cause the cylinder block catch the rod big end. Set the rod caps and crankpin metals in their correct combinations.

Reassemble

- Apply oil especially carefully to the sliding contact surfaces of the pistons, rods and rings.
- Use the piston insertion tool (see 51.12.1-9) to insert each piston w/rod in the cylinder block and install the bearing metal cap.

Rod bolt tightening torque

Nm

Model	Standard (apply lube oil)
3TNV82A	37.2 ÷ 41.2
TNV84~88	44.1 ÷ 49.0
4TNV94L-98	53.9 ÷ 58.8
4TNV106(T)	78.5 ÷ 83.4

Point 3: mounting flange

Disassembly

Place the engine on a stable base with the cylinder block upper surface facing down, and remove the mounting flange carefully so as not to damage the combustion surface.

Reassemble

Apply sealant and install the mounting flange by matching the two dowel pins. After assembly, raise the engine with its mounting flange on the bottom side.

⚠ CAUTION

Unforeseen injury may arise due to falling or slipping when raising or reversing the engine. Proceed carefully so as not to lose balance.

NOTE:

If the oil clearance is excessive though the thicknesses of the journal and crankpin metals are normal or if partial uneven wear is observed, re-grind the crankshaft and use an oversized metals.

If rust or surface roughening exists on the rear side of the metals, coat it with blue or minimum. Then assemble the crankpin metal to the connecting rod, and tighten the rod screw to the specified torque to check the metal for contact. If the contact surface occupies 75% or more, the metal is normal. If the contact surface is smaller, the metal interference is insufficient.

Replace the metal with a new one.

- Thrust metal inspection
 - (a) Inspect any damage or wear.
 - (b) Measure side gap and thrust metal thickness

Side gap and thrust metal thickness

mm

Model	Side gap		Thrust metal thickness	
	Standard value	Limit value	Standard value	Limit value
TNV82A~88	0.14 ÷ 0.22	-	1.930 ÷ 1.980	1.850
4TNV94L-98	0.13 ÷ 0.23	-	1.930 ÷ 1.980	1.850
4TNV106(T)	0.13 ÷ 0.23	-	2.430 ÷ 2.480	2.35

If the side gap is exceeded, use an oversized thrust metal.

Oversized metal (0.25 mm)

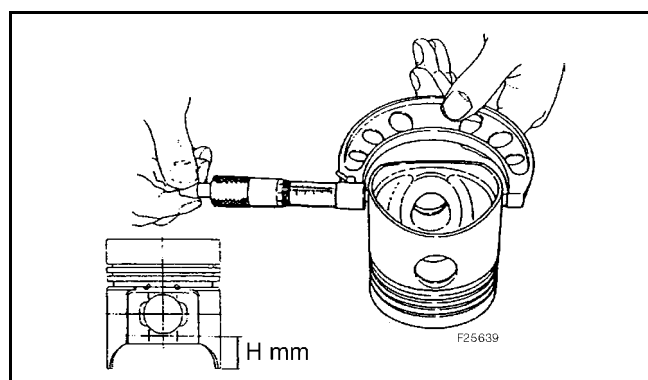
Model	Standard thickness mm
3TNV82A	2.15
TNV84~88	2.15
4TNV94L-98	2.055 ÷ 2.105
4TNV106(T)	2.555 ÷ 2.605

3. Piston

Especially clean the combustion surface, circumference, ring grooves and piston pin hubs, and check after removing any carbon deposit. Any burr at a ring groove or snap ring groove shall be removed. If crack is suspected, perform color check.

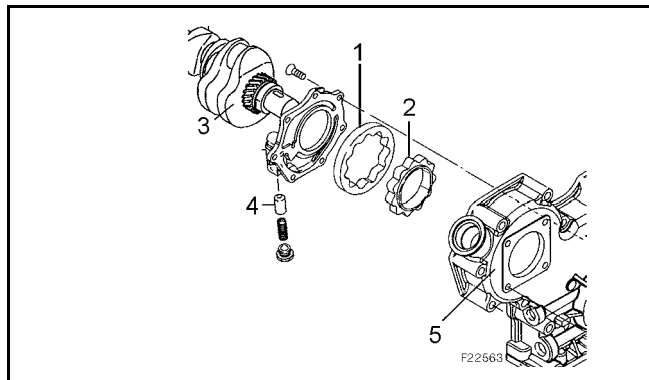
(a) Piston outside diameter measurement

Measure the long diameter at H mm from the bottom end of the piston of the oval hole in the vertical direction to the piston pin hole.

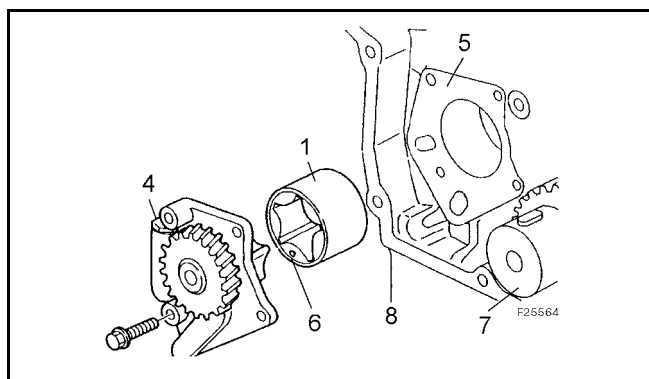


51.5.2 TROCHOID PUMP COMPONENTS

Trochoid pump (3TNV82A~TNV88)



Trochoid pump (4TNV94L/98/106)



- | | |
|------------------|---------------|
| 1. Outer rotor | 5. Gear case |
| 2. Inner rotor | 6. Punch |
| 3. Cover | 7. Crankshaft |
| 4. Control valve | 8. Mark |

51.5.3 DISASSEMBLY (REVERSE THE PROCEDURE BELOW FOR ASSEMBLY)

1. Loosen the belt, and remove the radiator pulley, fan and V-belt.
(See 51.4.2.2. 2).
2. Remove the crankshaft pulley. (See 51.4.3.2. 3).
3. Remove the gear case cover. (See 51.4.3.2. 4).
4. Remove the lubricating oil pump assy from the gear case for 4TNV94/98/106. (51.5.4 Point 1)
Remove the lube oil cover from gear case cover for 3TNV82A-88. (51.5.4 Point 1)
5. Remove the pressure regulating valve from the lubricating oil pump body. (51.5.4 Point 2)

51.7.2.5 Servicing points

Point 1

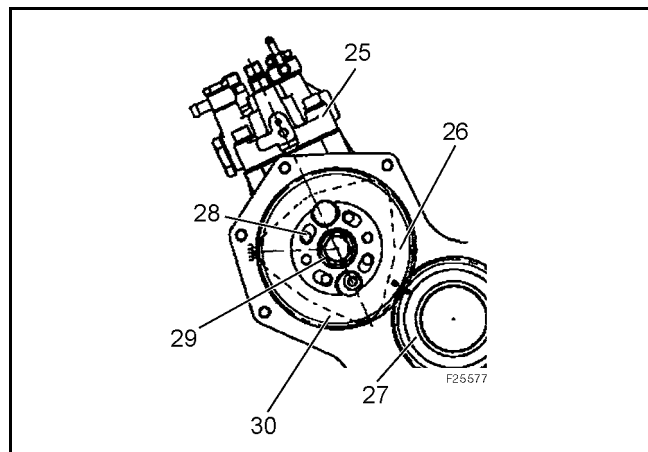
Disassembly

- Block an entrance with the tape so that trash may not enter the fuel injection pipe and the fuel injection pump (25).

Point 2

Disassembly

- After putting the I.D. marks (26) on the gearing part of the pump drive gear (30) and the idle gear (27) with paint and so on, remove the gear installation nut (29).



NOTE: do not remove the four flange screws (28).

Reassemble

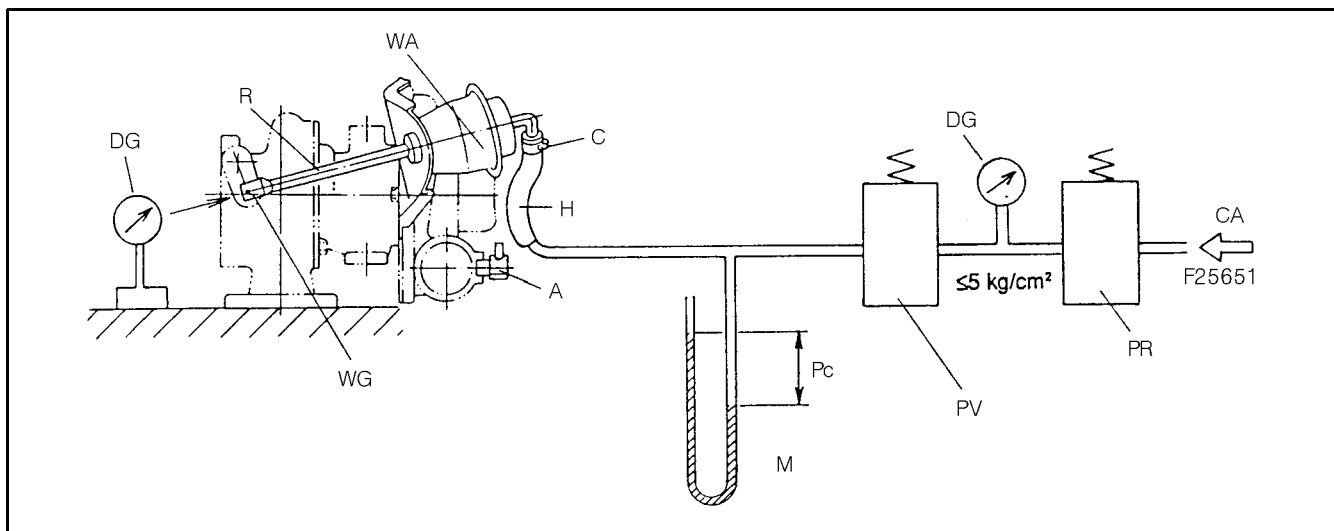
- Reassemble the pump driving gear while checking the I.D. marks (30) on the driving gear (26) and idle gear (27).

Tightening torque of the gear installation nut

Model	Nm	Lubricating oil application (threaded portion and seat surface)
TNV82A~88	78 ÷ 88	Not applied
4TNV94~106(T)	113 ÷ 123	

(b) Measuring instruments and devices

Dial gauge	Capable of measuring 0 to 10 mm (A flat head type is recommendable.)
Pressure gauge	Mercury column or electrical type (capable of measuring from 0 to 1500 mmHg)
Pressure regulating valve	Allowing gradual adjustment in a range between 0 and 2 kgf/cm ²
Pressure relief valve	Used for suppressing the air supply pressure at 5 kgf/cm ² or less.
Pressure gauge	Bourdon tube pressure gauge (from 0 to 10 kgf/cm ²)



A. Adapter
 C. Clip
 CA. Compressed air
 DG. Dial gauge
 M. Manometer
 N. Hose

PG. Pressure gauge
 PR. Pressure regulating valve
 PV. Pressure reducing valve
 WA. Waste gate actuator
 WG. Waste gate valve

(c) Check method

1. Set the manometer control pressure (P_c) applied to the waste gate actuator to 0 and set the dial gauge to the zero point.
2. Gradually open the pressure regulating valve and measure the P_c value when the actuator rod is operated by 2 mm.
3. For the hysteresis, let the rod move to 3 mm first. The gradually close the pressure regulating valve, measure the pressure when the rod is moved to 2 mm and obtain the difference from the pressure measured in b above.

2. Turbine shaft installation

- Fit the seal ring onto turbine shaft 1.
- Install heat insulating plate 20 on the turbine side of bearing housing 15.
- Apply lubricating oil on the journal portion of the turbine shaft and insert the shaft from the turbine side of bearing housing 15.

NOTE: carefully operate so as not to damage the floating bearing by the turbine shaft. The seal ring joint shall be positioned on the lubricating oil inlet side after centering with the turbine shaft.

3. Thrust bearing installation

- Fit thrust bushing on turbine shaft 1.
- Apply lubricating oil on the bearing portion of thrust bearing 6 and install it in bearing housing 15.
- Apply Loctite on the threaded portion of M3 Torx T machine screw 17 for thrust bearing installation, and use Torx torque driver for installation by tightening to the specified torque.

Tightening torque: 1.3 ± 0.1 Nm

4. Seal plate installation

- Fit the seal ring on oil thrower 2.
- Insert oil thrower 2 into seal plate 4.

NOTE: the seal ring joint portion shall be positioned as illustrated at right.

- Apply liquid gasket on the seal plate mounting surface on the compressor side of bearing housing 15.

NOTE: see the illustration below for the applying position.

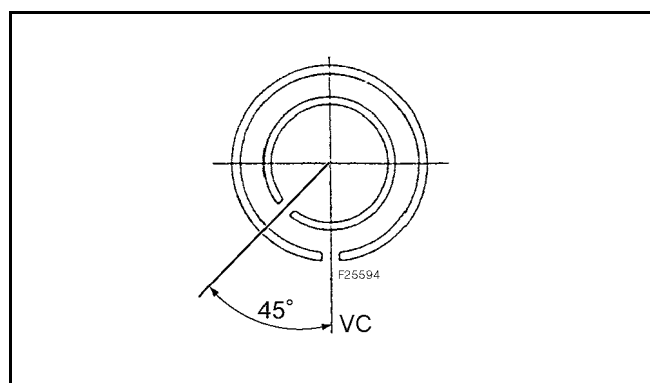
Applying thickness: $0.1 \div 0.2$ mm

- Install seal plate 4 on bearing housing 15.
- Apply Loctite on the threaded portion of M3 machine screw for seal plate mounting, and tighten it with a torque screwdriver.

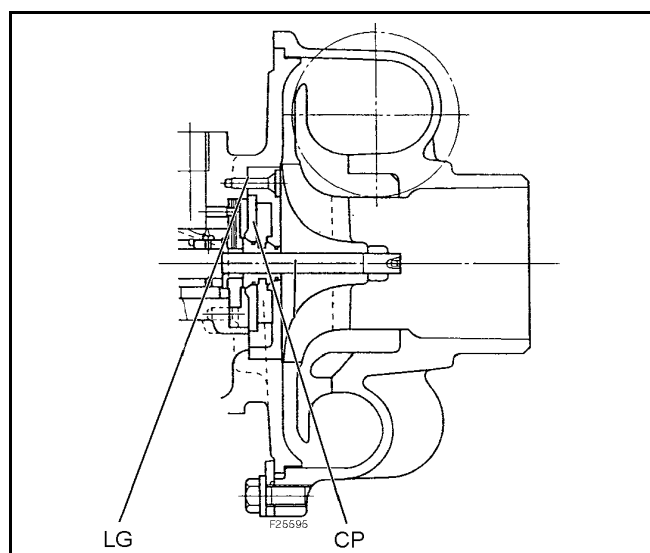
Tightening torque: 1.3 ± 0.1 Nm

CP. Carefully prevent the liquid gasket from leaking out to this area

LG. Liquid gasket applying position

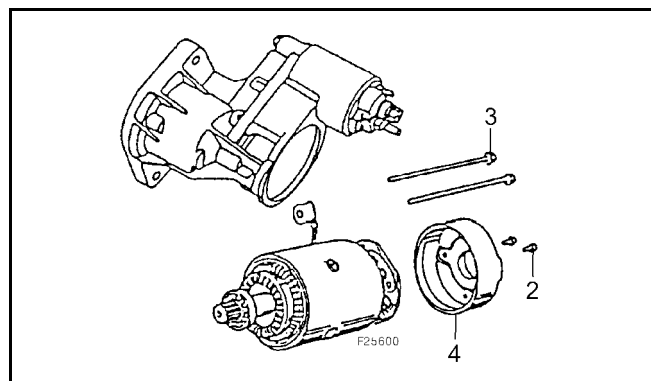


VC. View from the compressor



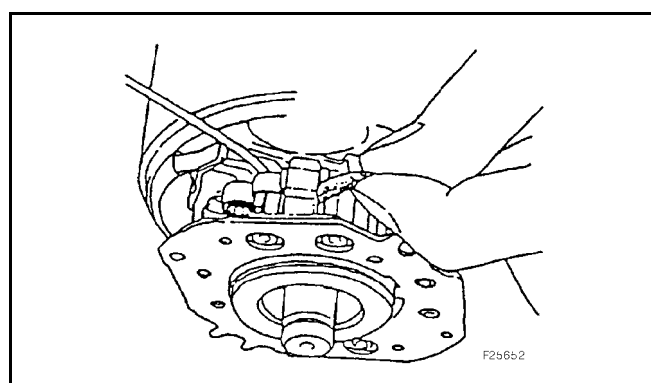
- Screw M4 (2)
- Through bolt M5 (2)
- Rear cover

Remove the M4 screw fastening the brush holder and remove through bolt M5 for rear cover removal.



- Brush holder

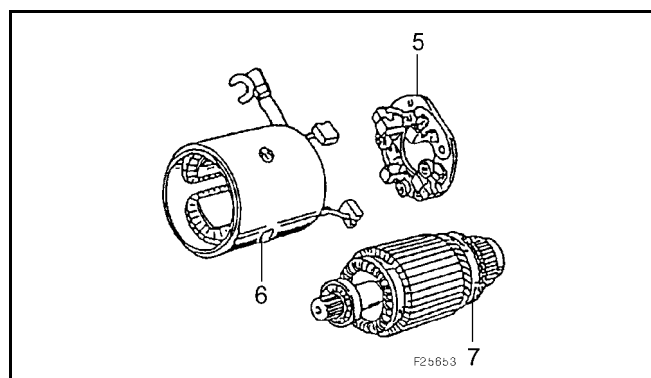
Pull the brush spring up with the brush spring puller. On the negative (-) side, bring the brush spring into contact with the side of the brush for lifting from the commutator surface. On the positive (+) side, extract the brush from the brush holder.



- Yoke assy.

- Rotor

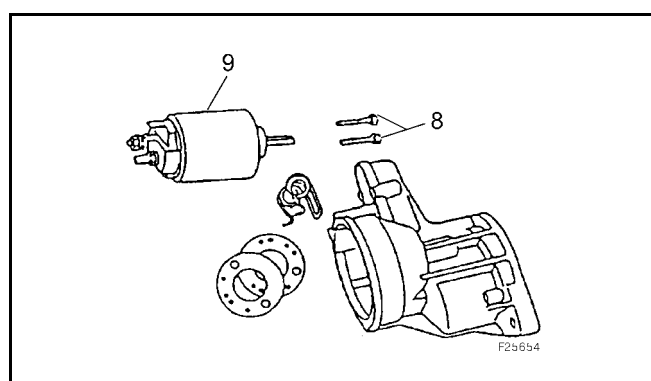
Remove the brush holder. The armature and yoke assy can now be removed.



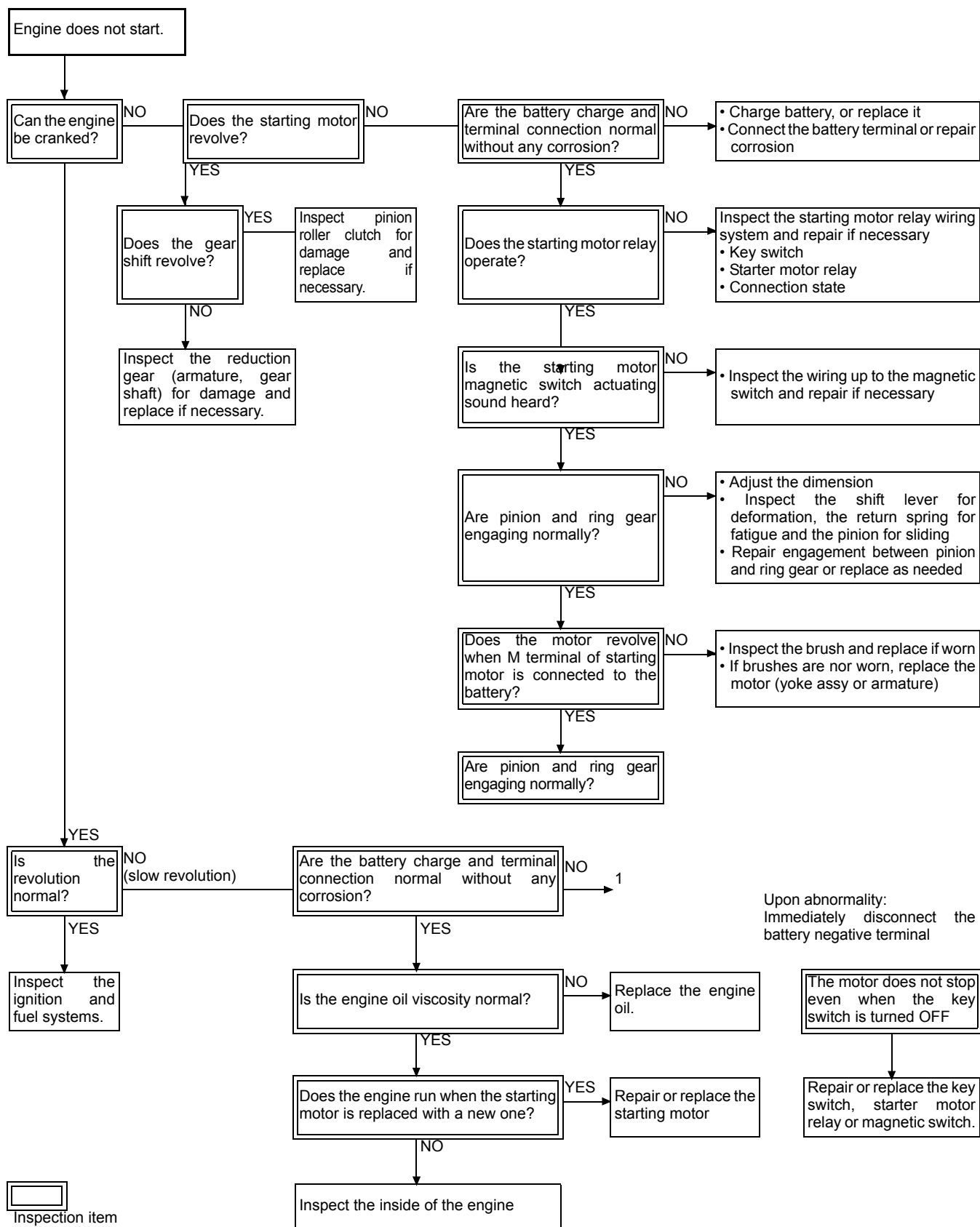
- Bolt M6 (2)

- Magnetic switch

Remove bolt M6 (10 mm) (0.39 in), and the magnetic switch can be removed.



51.9.2.3 Troubleshooting



Inspection item
 Causes and remedies

Upon abnormality: Immediately disconnect the battery negative terminal

51.9.2.7 Assembly

The assembly procedure is the reverse of the disassembly procedure, but pay attention to the following points:

1. Apply grease as instructed below.

Greasing point	Grease type
Sliding portions and head of plunger Pinion metal and metal portions of gear case Spline portions of pinion Sliding portions of shift lever Deceleration gear	MG2

2. Armature thrust

No adjustments are needed for the thrust.

3. Gear shaft thrust

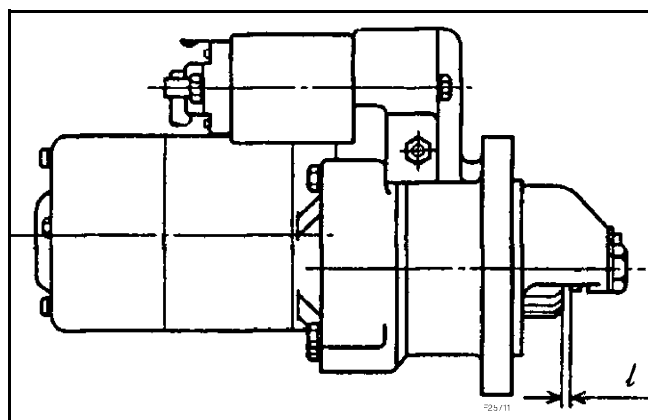
Some thrust washers of 1.0 and 0.25 mm thickness are provided between the center bracket and gear shaft supporting surface. Make sure to check them at reassembly.

If washers are deformed or worn, replace them with new ones.

The thrust washer is correct if its thickness is between 0.05 and 0.3 mm. If it exceeds 0.3 mm, make sure the thrust is not zero.

51.9.2.8 Adjustment

1. Pinion projection length L by magnetic switch



5. Regarding lamp control

Once the charge lamp goes out after the start of charging, it does not come on again even if the engine speed falls and charging is insufficient. The lamp will not light again if the charging circuit is normal.

The lamp only comes on during operation if the alternator itself is broken or the drive V-belt breaks. However, when an LED is used for the charge lamp, the LED will shine faintly even during normal operation. This is due to the control system for the alternator lamp and is not an abnormality.

6. Use of a non-specified V-belt

Use of a non-specified V-belt will cause inadequate charging and shorten the life of the belt. Use a belt of the specified type.

7. Direct high pressure washing is prohibited

Water will enter the brush if the alternator is washed directly at high pressure, causing inadequate charging. Warn users not to use direct, high-pressure washing.

8. Use of agricultural or other chemicals (direct contact or airborne)

Adhesion of agricultural and other chemicals, especially those with high sulphur content, to the IC regulator corrodes the conductor on the substrate, leading to over-charging (battery boiling) and charging malfunctions. Consult with Yanmar prior to use in such an environment. Use without prior consultation removes any breakdown from the warranty.

51.12.2.2 Gear Train and Camshaft

1. Cam shaft

Inspection item			Standard value	Limit value
Side gap			0.05 ÷ 0.20	0.30
Bending (1/2 the dial gauge reading)			0 ÷ 0.02	0.05
Cam height	3TNV82A-TNV88		38.600 ÷ 38.800	38.350
	4TNV94L·98		43.400 ÷ 43.600	43.150
	4TNV106(T)		50.900 ÷ 51.100	50.650
Shaft outside diameter / Metal inside diameter				
TNV82A~TNV88	Gear side	Bushing inside diameter	44.990 ÷ 45.055	45.130
		Camshaft outside diameter	44.925 ÷ 44.950	44.890
		Tolerance	0.040 ÷ 0.130	0.240
	Intermediate	Bushing inside diameter	45.000 ÷ 45.025	45.100
		Camshaft outside diameter	44.910 ÷ 44.935	44.875
		Tolerance	0.065 ÷ 0.115	0.225
	Flywheel side	Bushing inside diameter	45.000 ÷ 45.025	45.100
		Camshaft outside diameter	44.925 ÷ 44.950	44.890
		Tolerance	0.050 ÷ 0.100	0.210
4TNV94L/98(T)	Gear side	Bushing inside diameter	49.990 ÷ 50.055	50.130
		Camshaft outside diameter	49.925 ÷ 49.950	49.890
		Tolerance	0.040 ÷ 0.130	0.240
	Intermediate	Bushing inside diameter	50.000 ÷ 50.025	50.100
		Camshaft outside diameter	49.910 ÷ 49.935	49.875
		Tolerance	0.065 ÷ 0.115	0.225
	Flywheel side	Bushing inside diameter	50.000 ÷ 50.025	50.100
		Camshaft outside diameter	49.925 ÷ 49.950	49.890
		Tolerance	0.05 ÷ 0.100	0.210
4TNV106(T)	Gear side	Bushing inside diameter	57.980 ÷ 58.050	58.105
		Camshaft outside diameter	57.910 ÷ 57.940	57.875
		Tolerance	0.040 ÷ 0.140	0.250
	Intermediate	Bushing inside diameter	58.000 ÷ 58.030	58.105
		Camshaft outside diameter	57.895 ÷ 57.925	57.860
		Tolerance	0.075 ÷ 0.135	0.245
	Flywheel side	Bushing inside diameter	58.000 ÷ 58.030	58.105
		Camshaft outside diameter	57.910 ÷ 57.940	57.875
		Tolerance	0.050 ÷ 0.120	0.230

2. Idle gear shaft and bushing

Inspection item	Standard value	Limit value
Shaft outside diameter	45.950 ÷ 45.975	45.900
Bushing inside diameter	46.000 ÷ 46.025	46.075
Tolerance	0.025 ÷ 0.075	0.175

61. AIR CONDITIONING SYSTEM

INDEX

61.1 DESCRIPTION AND OPERATION - AIR CONDITIONING SYSTEM.....	61-1
61.1.1 AIR CONDITIONING SYSTEM COMPONENTS	61-1
61.1.2 OPERATING	61-2
61.2 AIR CONDITIONING SYSTEM POSITIONING SCHEME	61-3
61.3 AIR CONDITIONING REFRIGERANT CHECK AND FILLING	61-11
61.4 HYDRAULIC CIRCUIT	61-16
61.5 ELECTRICAL DIAGRAM	61-17
61.6 TROUBLESHOOTING	61-19

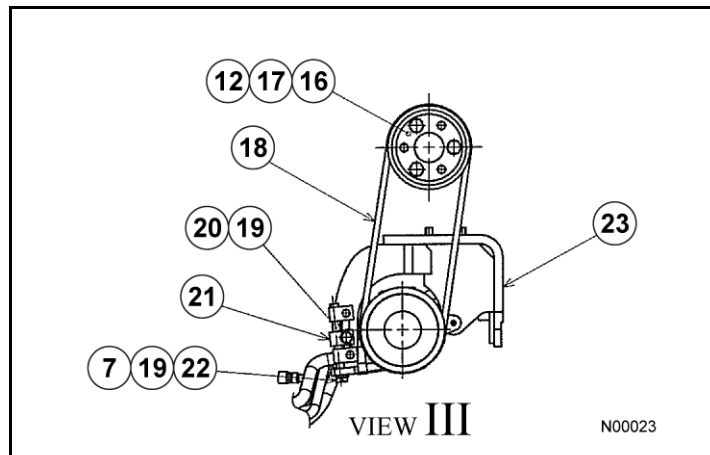


Fig. 61-1 (7/9)

- 7. Washer 8x17x1.6
- 12. Lock washer D=10
- 16. Pulley
- 17. Screw M10x30. Tightening torque 46.5 ± 4.6 Nm (3 places)
- 18. V-belt. Adjust belt tension applying a force of 19 N with max. 4 mm arrow.
- 19. Lock washer D=8
- 20. Screw M8x50. Tightening torque 23 ± 2.3 Nm
- 21. Plate
- 22. Screw M8x100. Tightening torque 23 ± 2.3 Nm
- 23. Bracket

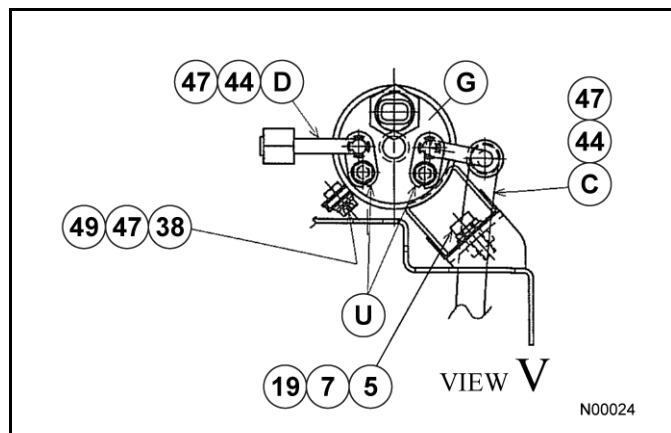


Fig. 61-1 (8/9)

- C. Flexible hose assy (tightening torque 13.7 ± 1 Nm)
- D. Tube assy
- G. Receiver/Dryer
- U. Tightening torque $7.8 \div 11.8$ Nm
- 5. Screw M8x20. Tightening torque 23 ± 2.3 Nm (2 places)
- 7. Washer 8x17x1.6
- 19. Lock washer D=8
- 38. Screw M6x20. Tightening torque 49 ± 1 Nm (2 places)
- 44. Screw M6x25
- 47. Washer 6x12x1.6
- 49. Lock washer D=6

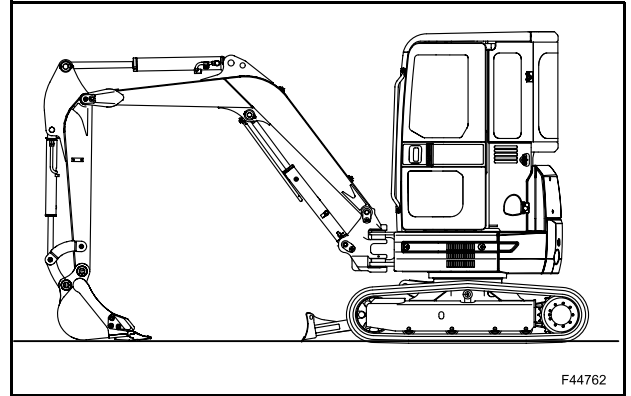
62. OBJECT HANDLING SYSTEM

INDEX

62.1 DESCRIPTION AND OPERATION - OBJECT HANDLING SYSTEM	61-1
62.1.1 BOOM CYLINDER HOLDING VALVE	62-3
62.1.2 DIGGING CYLINDER HOLDING VALVE	62-4
62.2 LIFTABLE LOADS TABLES	62-5
62.3 REMOVAL AND INSTALLATION OF OBJECT HANDLING SYSTEM	
COMPONENTS.....	62-7
62.3.1 SWITCH FOR ACTIVATION OF ANTI-TIPPING SENSOR.....	62-7
62.3.2 ACOUSTIC ALARM (BUZZER)	62-8
62.3.3 BOOM HOLDING VALVE AND PRESSURE SWITCH.....	62-9
62.3.4 DIGGING HOLDING VALVE.....	62-13
62.3.5 TIGHTENING TORQUE.....	62-17
62.4 HYDRAULIC CIRCUIT	62-18
62.5 ELECTRICAL DIAGRAM	62-20
62.6 TROUBLESHOOTING	62-21
62.6.1 MALFUNCTIONING OF BUZZER	62-21
62.6.2 MALFUNCTIONING OF OBJECT HANDLING SYSTEM	
HYDRAULIC CIRCUIT	62-22

62.3.3 BOOM HOLDING VALVE AND PRESSURE SWITCH

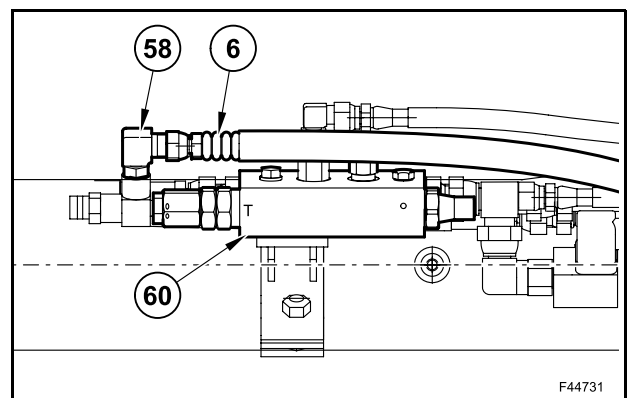
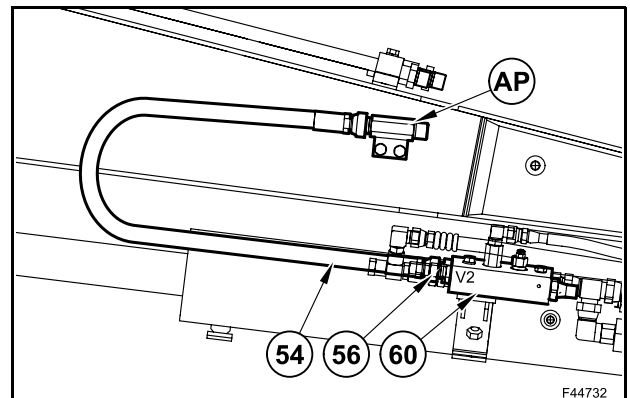
1. Move the machine to a level and firm ground, away from any soft ground, excavations or poorly shored cavity.
Lower the dozer to the ground.
Place the working attachment in front of the machine and extend the arms, so that they can be accessed.
Place the bucket on the ground.
Release hydraulic pressure and drain the hydraulic oil tank by following the instructions contained in the Operator's Manual.
Stop the engine and remove the starter switch key.
Check that all control levers are in neutral position and that the safety lever (red lever) and the safety lock lever are in locked position.



⚠ WARNING

During these operations, pay attention to further hydraulic oil leaks; protect the machine and, if necessary, carry out the appropriate cleaning operations.

2. Remove the 3/8" hose (54) connected to the fitting (AP) and to the 3/8"-1/2" straight fitting (56) available in port V2 of the valve (60).
3. Disconnect the 3/8" draining hose (6) coming from the machine to the 1/4"-3/8" 90°-fitting (58) installed on port T of the valve (60).



CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: www.heydownloads.com by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL