

71.1.1 STANDARD SPECIFICATION

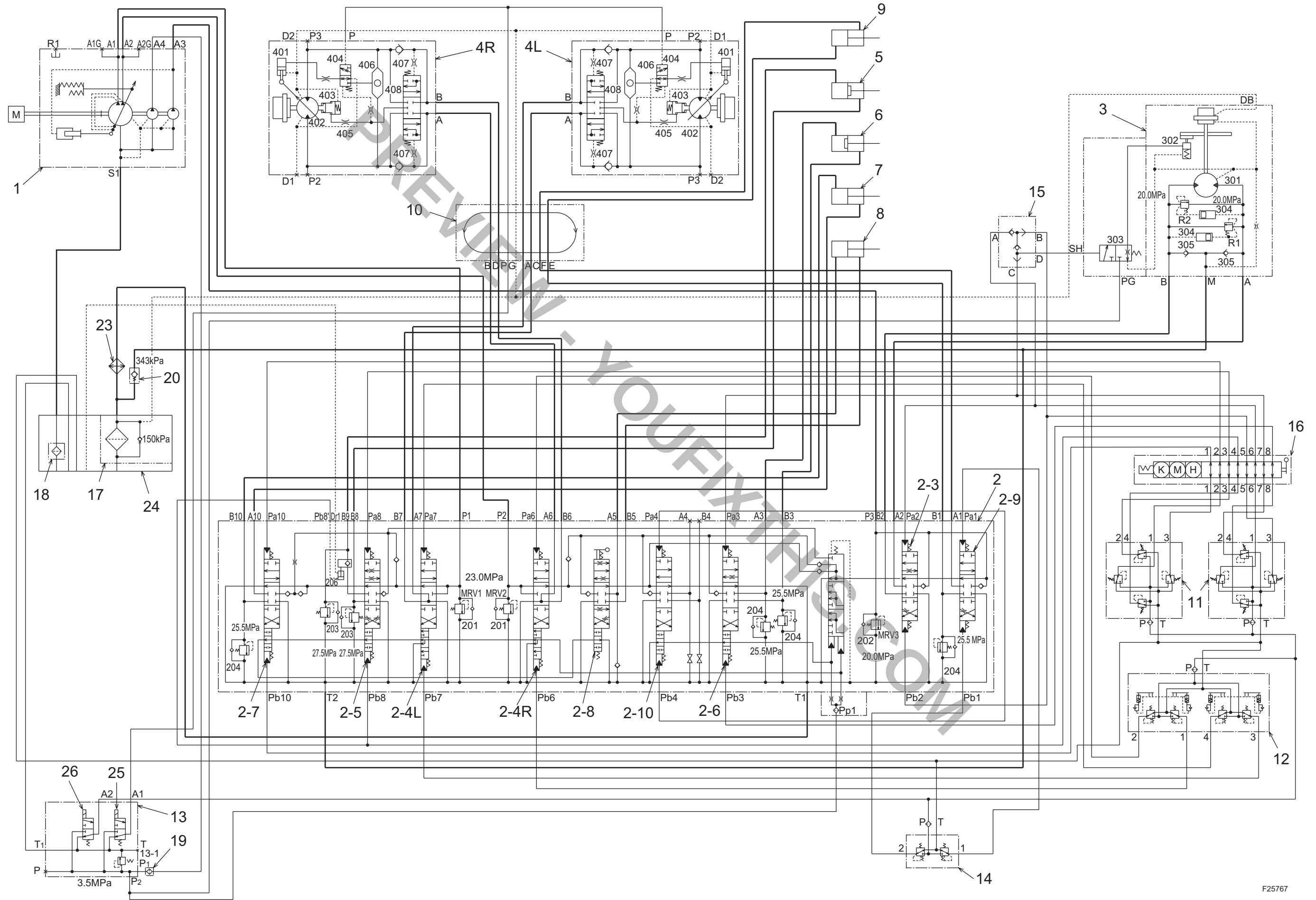


Fig. 71-1

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23.1 HOW TO READ CIRCUIT DIAGRAM AND HARNESS CONNECTION

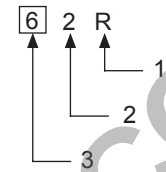
23.1.1 ELECTRIC CIRCUIT DIAGRAM

NOTE: For the electric circuit diagram, refer to Fig. 71–13 of Supporting Data that is provided at the end of this shop manual.

(1) In the diagram, the number, size and color of wires are shown on the wiring line.

The size of the wire is to be 0.75 sq (square mm = mm²) unless otherwise specified.

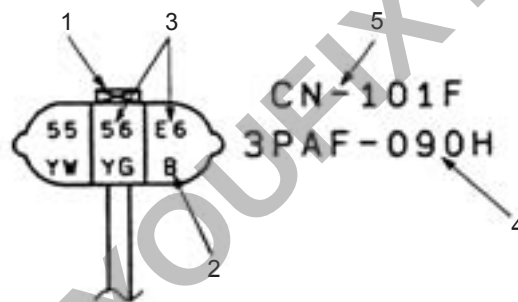
Symbol	Color	Symbol	Color
B	BLACK	O	ORANGE
G	GREEN	Br	BROWN
L	BLUE	Lg	LIGHT GREEN
R	RED	Gr	GRAY
W	WHITE	Sb	SKY BLUE
Y	YELLOW	V	VIOLET
P	PINK		



1. Wire color red
2. Wire size 2 sq (mm²)
3. Wire N. 6

23.1.2 HARNESS CONNECTION

(1) Indication for Connector

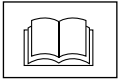


- 1) The figure for the connector pin arrangement is shown by putting the lock (1) (nail) to upper portion, and looking from the fitting face.
- 2) The numbers in the connector show the wire No. (3), and alphabetical letters show the wire color (2).
- 3) On the side face of connector, the connector name (4) and serial number of the connector No. (5) are indicated.
- 4) At the place indicated as "DOUBLE SPLICE", Two wires are connected to one place.
- (2) The connector is to be connected with engaging the male (M) and female (F) connectors of the same number.
Example: CN-101M and CN-101F
Where: M means for Male, and F for Female.
- (3) + — mark means the connector with diode. The direction for diode is shown by the arrow.
- (4) The AVSS wires are to be used for the size between 0.75 sq and 2 sq. AVS wires between 3 sq and 5 sq and others are AV wires, unless otherwise specified.
- (5) The wire size is 0.75 sq, unless otherwise specified.
- (6) The treatment for the harness end is to be as follows:
 - 1) — : After roughly applying harness taping, wires are installed in a corrugated tube.
 - 2) — : Harness taping by two plies.
 - 3) — : No harness treatment for connection.
- (7) The length for the above (6)-3) is to be 30 ± 10 mm. (1.2 ± 0.4 in), and the length includes in the total length of wire shown in the diagram.

1. OUTLINE

1.1 GENERAL PRECAUTIONS FOR REPAIRS

1.1.1 PREPARATION BEFORE DISASSEMBLING



- (1) Understanding operating procedure
Read OPERATION & 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 hour meter 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 hour meter 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 [45 lbs] 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



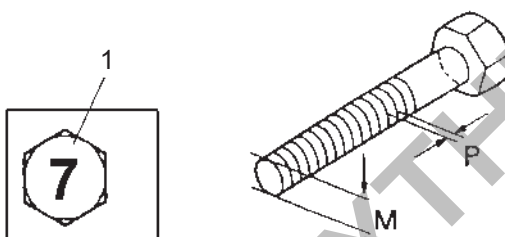
- (1) Removing hydraulic equipment
 - 1) Before disconnecting pipes, release the hydraulic pressure of the system, or open the return side cover and take out the filter.
 - 2) Carefully drain oil of the removed pipes into a containers without spilling on the floor.
 - 3) Apply plugs or caps on the pipe 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.

11.1 TORQUE SPECIFICATIONS FOR CAPSCREWS & NUTS

The following Torque Specifications are provided for use when actual torque value of a fastener is not known. Check the capscrews and nuts for their looseness and dropping off before the start of daily work and at the periodical maintenance. Retighten the loosened ones, and install new ones for the dropped off. For the new machine, the check and retightening of them must be carried out at first 50 hours operation. For the replacement of them, make sure to use the same size of genuine parts.

Refer to the table below for the tightening and retightening of capscrews.

- The table below is not applicable for the capscrews to fix the cover, etc., made of plastic. For the tightening torque for such capscrews, consult with an authorized Distributor. Over-tightening may cause damages on the parts to be fixed.
- In case that the tightening torque is specified in the manual, use such torque values regardless to the table below.
- Numerical indication on the capscREW head shows the classification for strength (e.g., 7 = 7 T). No indication is provided for smaller size of capscrews, M 5 or less.



1. Classification

11.1.1 Metric Coarse Thread Standard Tightening Torque Values. Make Certain to tighten all Capscrews & Nuts to proper torque values.

Torque value Unit: N•m (lbf•ft)

Classification		4.8T		7T		10.9T	
Nominal size		No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M6	P=1	4.4±0.5 (3.2±0.4)	3.7±0.4 (2.7±0.3)	9.6±1.0 (7.1±0.7)	8.1±0.8 (6.0±0.6)	17.4±1.8 (12.8±1.3)	14.7±1.5 (10.8±1.1)
M8	P=1.25	10.7±1.1 (7.9±0.8)	9.0±0.9 (6.6±0.7)	23.5±2.0 (17.3±1.5)	19.6±2.0 (14.5±1.5)	42.2±3.9 (31.1±2.9)	35.3±3.9 (26.0±2.9)
M10	P=1.5	21.6±2.0 (15.9±1.4)	17.9±1.8 (13.2±1.3)	46.1±4.9 (34.0±3.6)	39.2±3.9 (28.9±2.9)	83.4±8.8 (61.5±6.5)	70.6±6.9 (52.1±5.1)
M12	P=1.75	36.3±3.9 (26.8±2.9)	31.4±2.9 (23.2±2.1)	79.4±7.8 (58.6±5.8)	66.7±6.9 (49.2±5.1)	143±15 (105±11)	121±12 (89.2±8.9)
M14	P=2	57.9±5.9 (42.7±4.4)	49.0±4.9 (36.1±3.6)	126±13 (92.9±9.6)	106±10 (78.2±7.4)	226±20 (167±15)	191±19 (141±14)
M16	P=2	88.3±8.8 (65.1±6.5)	74.5±6.9 (55.0±5.1)	191±20 (141±15)	161±16 (119±12)	343±39 (253±29)	284±29 (209±21)
M18	P=2.5	122±12 (90.0±8.9)	103±10 (75.8±7.2)	265±29 (195±21)	226±20 (167±15)	481±49 (355±36)	402±39 (297±29)
M20	P=2.5	172±17 (127±13)	144±14 (106±10)	373±39 (275±29)	314±29 (232±21)	667±69 (492±51)	559±59 (412±44)
M22	P=2.5	226±20 (167±15)	192±20 (142±15)	500±49 (369±36)	422±39 (311±29)	902±88 (665±65)	755±78 (557±58)
M24	P=3	294±29 (217±21)	235±29 (173±21)	637±69 (470±51)	520±49 (383±36)	1160±118 (856±87)	941±98 (694±72)
M27	P=3	431±39 (318±29)	353±39 (260±29)	941±98 (694±72)	765±78 (564±58)	1700±167 (1250±123)	1370±137 (1010±101)

42.2 TROUBLE DIAGNOSIS: HYDRAULIC

Classification	Reference No.	Phenomenon	Causes			Pump			Valve					Actuator		
			Main pump	Trochoid pump	Gear pump	Travel & ATT main R/V	Main gear pump R/V	Each overload R/V	Travel straight valve	Travel spool	Attachment spool	Check valve	Shuttle valve	Slewing motor unit	Travel motor unit	Hydraulic cylinder
Attachment	1	(1) Attachment operational failure (excluding swing operation)	○							○	○					
		(2) Travel speed is slow.	○								○					○
		(3) Attachment operating power is low.				○		○								○
		(4) Malfunction of attachment							○	○						○
Travel operation	2	(1) Travel operational failure	○							○					○	
		(2) Travel speed is slow.	○							○					○	
		(3) Travel operating power is low.				○									○	
		(4) It deviates in travel independent operation.	○						○	○					○	
Slewing operation	3	(1) Slewing operational failure									○			○		
		(2) Slewing speed is slow.			○											
		(3) Slewing operating power is low.					○	○						○		
		(4) Malfunction of slewing operation									○		○	○		
Pump	4	(1) Engine speed is reduced due to pump load.	○													
		(2) Malfunction of pump	○	○	○											

Abbreviation

E/G: Engine

SOL: Solenoid

SW: Switch

ATT: Attachment

C/V: Control valve

R/V: Relief valve

V: Valve

2. SPECIFICATIONS

2.3 SPECIFICATIONS AND PERFORMANCE

SPEED AND GRADEABILITY

Model	E30.2SR				E35.2SR				
Applicable Machines	PW11-30001~				PX12-11001~				
Shoe Type	Rubber shoe		Iron shoe (OPT)		Rubber shoe		Iron shoe (OPT)		
Slewing Speed	min ⁻¹ {rpm}		8.9 {8.9}		8.9 {8.9}				
Travel Speed	km/h (mph)	Low (1st)	High (2nd)	Low (1st)	High (2nd)	Low (1st)	High (2nd)	Low (1st)	High (2nd)
		2.5	4.5	2.5	4.5	2.5	4.5	2.5	4.5
Gradeability	% (degree)		58 (30)						

ENGINE

Model (YANMAR)	3TNV88-PYB			
Type	Water-cooled, 4-cycle type Swirl chamber type diesel engine			
Number of cylinders-Bore × Stroke	3 - ø88 mm × 90 mm (3.46 in × 3.54 in)			
Total Displacement	L	1.642 (100.2 cu·in)		
Output Rating	kW/min ⁻¹ {PS/rpm}	21.2 / 2400 {29 / 2400}		
Maximum Torque	N·m/min ⁻¹ (lbf·ft/rpm)	98.4 / 1440 (72.6 / 1440)		
Starting Motor	V × kW	12 × 1.7		
Generator	V × A	12 × 55		

HYDRAULIC COMPONENTS

Hydraulic Pump	Variable displacement axial piston + gear pump			
Hydraulic Motor	Axial piston			
Hydraulic Motor w/Reducer (Travel)	2-Axial piston, 2-Speed motor			
Control Valve	10-spool multiple control valve			
Cylinder (Boom, Dipper, Swing, Bucket, Dozer)	Double action cylinder			
Return Filter	Safety valve containing/Filter Type (30μ)			

SIDE DIGGING & DOZER

Type	Boom swing by hydraulic cylinder		
Boom Swing Angle	Right	60°	
	Left	70°	
Stroke of Dozer (above/below)	mm (in)	560 / 410 (22.0/16.1)	540 / 440 (21.3 / 17.3)

WEIGHT

Machine Weight	kg (lb)	Rubber shoe	Iron shoe	Rubber shoe	Iron shoe
		3,000 (6620)	3,110 (6860)	3,580 (7900)	3,700 (8160)
Upper slewing body	kg (lb)	1,650 (3640)	←	1,900 (4190)	←
Travel system	kg (lb)	1,050 (2320)	1,160 (2560)	1,140 (2520)	1,260 (2780)
Attachment (Boom+STD Dipper+STD Bucket)	kg (lb)	370 (815)		460 (1020)	
Oil & Water	kg (lb)	80 (175)		←	

Note: This figure is calculated with standard bucket.

51. ENGINE

51.2 INSPECTION AND ADJUSTMENT

51.2.1 PERIODIC MAINTENANCE SCHEDULE

The engine periodic inspection timing is hard to determine as it varies with the application, load status, qualities of the fuel and lubricating oils used and handling status. General rules are described here.

○: User-maintenance ☼: Parts replacement ●: Shop-inspection

Classification	Item	Daily	Maintenance period				
			Every 50 hours	Every 250 hours or 3 months	Every 500 hours or 6 months	Every 1000 hours or one year	Every 2000 hours or two years
Whole	Visual check around engine	○					
Fuel oil system	Fuel tank level check and fuel supply	○					
	Fuel tank draining		○				
	Water separator (Option) draining		○				
	Bleeding the fuel system		○				
	Water separator cleaning				○		
	Fuel filter element replacement				☼		
Lubricating oil system	Lube oil level check and replenishment	○					
	Lube oil replacement			☼			
	Lube oil filter replacement		☼ 1st time	☼ 2nd time and thereafter			
Cooling water system	Coolant water level check and replenishment	○					
	Radiator fin cleaning			○			
	V-belt tension check		○ 1st time	○ 2nd time and thereafter			
	Coolant water replacement					☼	
	Coolant/water path flushing and maintenance						●
Rubber hoses	Fuel pipe and coolant water pipe inspection and maintenance	○					●
Governor	Inspection and adjustment of governor lever and accelerator	○		○			
Air intake system	Air cleaner cleaning and element replacement			○	☼		
	Diaphragm assy inspection					● (2 years)	
	Turbocharger blower cleaning*					●*	
Electrical system	Warning lamp & instruments function check	○					
	Battery electrolyte level check and battery re-charging		○				
Cylinder head	Intake/exhaust valve head clearance adjustment					●	
	Intake/exhaust valve seat lapping						●
Fuel injection pump and nozzle	Fuel injection nozzle pressure inspection					●*	
	Fuel injection timing adjustment						
	Fuel injection pump inspection and adjustment						●*

*EPA allows to maintain the emission related parts every 1,500 or 3,000 hours.

INTRODUCTION

AVOID ACCIDENTS

Most accidents, whether they occur in industry, on the farm, at home or on the highway, are caused by the failure of some individuals to follow simple and fundamental safety rules or precautions. For this reason MOST ACCIDENTS CAN BE PREVENTED by recognising the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment there are conditions that cannot be completely safeguarded against without interfering with reasonable accessibility and efficient operation.

Carefully read indications, cautions and safety warning quoted in the "SAFETY RULES" section.

A careful operator is the best insurance against an accident.

The complete observance of one simple rule would prevent many thousand serious injuries each year.

That rule is:

Never attempt to clean, oil or adjust a machine while it is in motion.

ATTENTION

On machines having hydraulically, mechanically and/or cable controlled equipment (such as showels, loaders, dozers, scrapers etc.) be certain the equipment is lowered to the ground before servicing, adjusting and/or repairing.

If it is necessary to have the equipment partially or fully raised to gain access to certain items, be sure the equipment is suitably supported by means other than the hydraulic lift cylinders, cable and/or mechanical device used for controlling the equipment.

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3. ATTACHMENT DIMENSIONS

Table 3-4

Unit: mm (ft-in)

No.	Name	Dimensions	
		E30.2SR	E35.2SR
A	Dipper length	1180 (3'10.46")	1320 (4'3.97")
B	Distance between pins of boss and bracket	R304.5 (11.99")	R314 (1'0.36")
C	Distance between pins of boss and bracket	R1036 (3'4.79")	R1036 (3'4.79")
D	Distance between pins of boss and boss	R190 (7.48")	R190 (7.48")
E	Height between pins of boss and bracket	332 (1'1.07")	332 (1'1.07")
F	Height between pins of boss and bracket	180 (7.09")	149.5 (5.89")
G	Height between pins of boss and center	8 (0.31")	8 (0.31")
H	Boss width	140 (5.51")	140 (5.51")
J	Boss width	150 (5.91")	150 (5.91")
K	Bracket inner width	56 (2.20")	56 (2.20")
L	Bracket inner width	61 (2.40")	61 (2.40")
M	Idler link dimension	310 (1'0.20")	310 (1'0.20")
N	Bucket link dimension	285 (11.22")	285 (11.22")
D1	I.D. of boss	ø50 (1.97")	ø50 (1.97")
D2	I.D. of boss	ø50 (1.97")	ø50 (1.97")
D3	I.D. of boss	ø55 (2.17")	ø55 (2.17")
d1	Pin dia.	ø40 (1.57")	ø40 (1.57")
d2	Pin dia.	ø40 (1.57")	ø40 (1.57")
d3	Pin dia.	ø45 (1.77")	ø45 (1.77")
d4	Pin dia.	ø40 (1.57")	ø40 (1.57")
d5	Pin dia.	ø45 (1.77")	ø45 (1.77")

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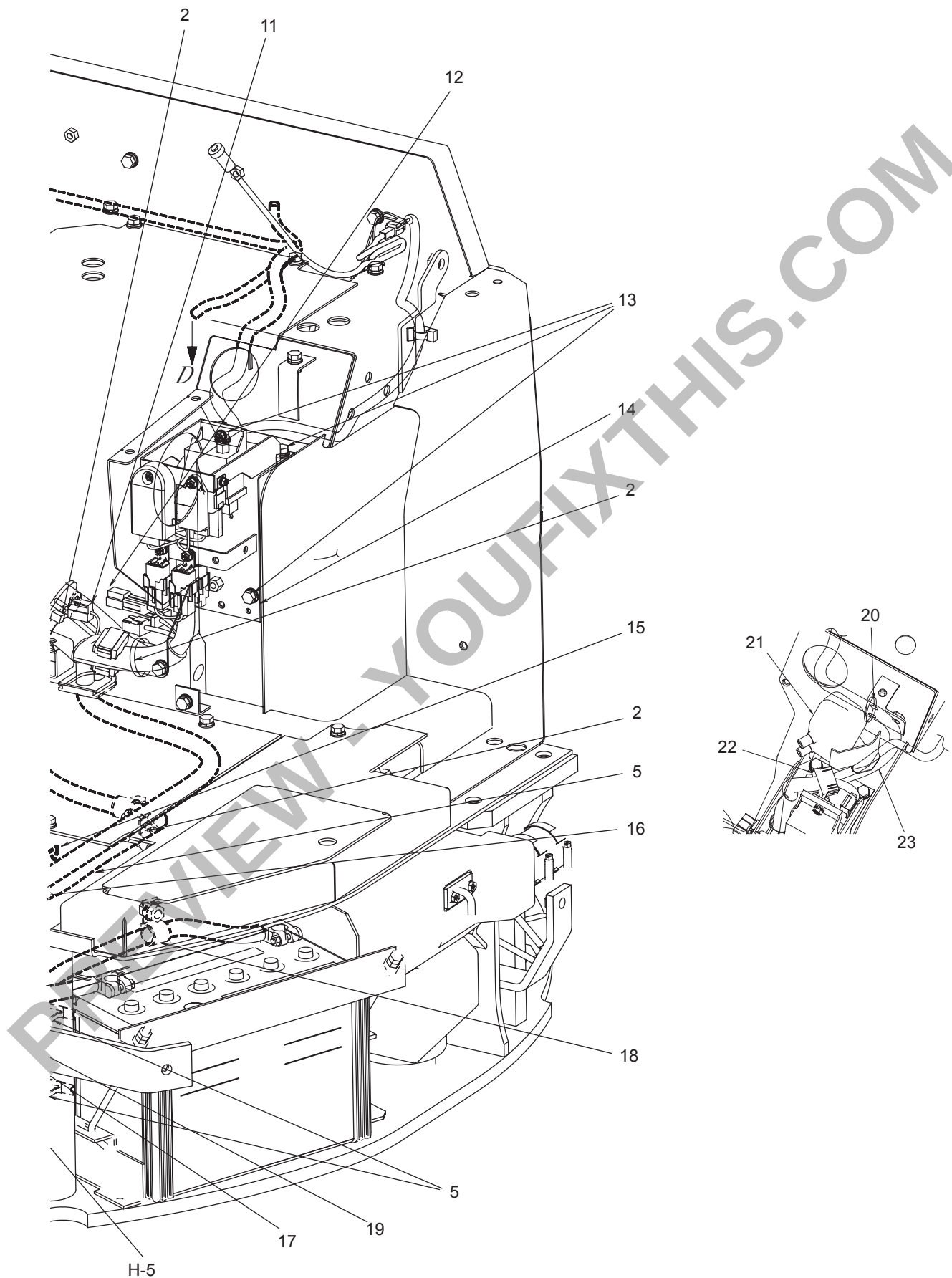


Fig. 23-2 Upper Frame Portion (2/6)

- Where the control section is inclined in the opposite direction from the full tilting

After tilting the cam clockwise fully, if it is rotated counterclockwise, the push rod on the port 2 side is pushed down and the piston moves down.

Then, the same as above, the oil in the damping piston chamber is discharged through restriction of piston, and the simultaneously generated pressure produces damping force.

On the other hand, the push rod on the port 1 side is moved up by the force of the return spring and damping spring.

Similarly oil is sucked from the tank into the damping piston chamber through three ball check valves.

And the oil in the piston chamber flows out through the passage leading from the casing top end to the tank port.

That is, either tilting operation from the neutral position to the full tilting position or the full tilting position to the neutral position is designed to produce the damping force.

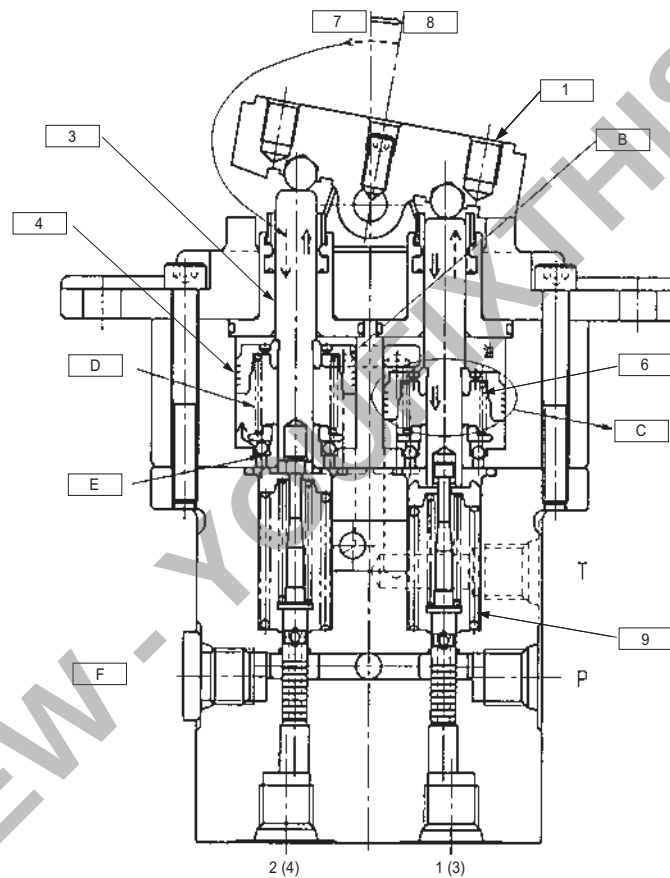


Fig. 24-11 Operation when the lever is stroked or operated in reverse

1. Cam
3. Push rod
4. Piston
6. Damping spring
7. Neutral position
8. Full stroke
9. Return spring
- B. The oil outside of the piston is ows through the passage leading to port T on the casing top end. (In operation in $\Rightarrow$ direction)
- C. The oil in the piston chamber is discharged through the restriction, and the simultaneously generated pressure produces the damping force. (In operation in $\Rightarrow$ direction)
- D. When tilting in reverse direction from the neutral position, the push rod is pushed up by the force of the damping spring. (In operation in $\Rightarrow$ direction)
- E. Oil in T lines is sucked in the damper chamber through three ball check valves. (In operation in $\Rightarrow$ direction)
- F. When shifting the lever in revease from $\Rightarrow$ direction to ($\Leftarrow$) condition, the piston on the left side immediately performs the roles of the damper piston. The damping force is produced on both sides constantly.

24.1.8 CYLINDER

24.1.8.1 SPECIFICATIONS

1. General View

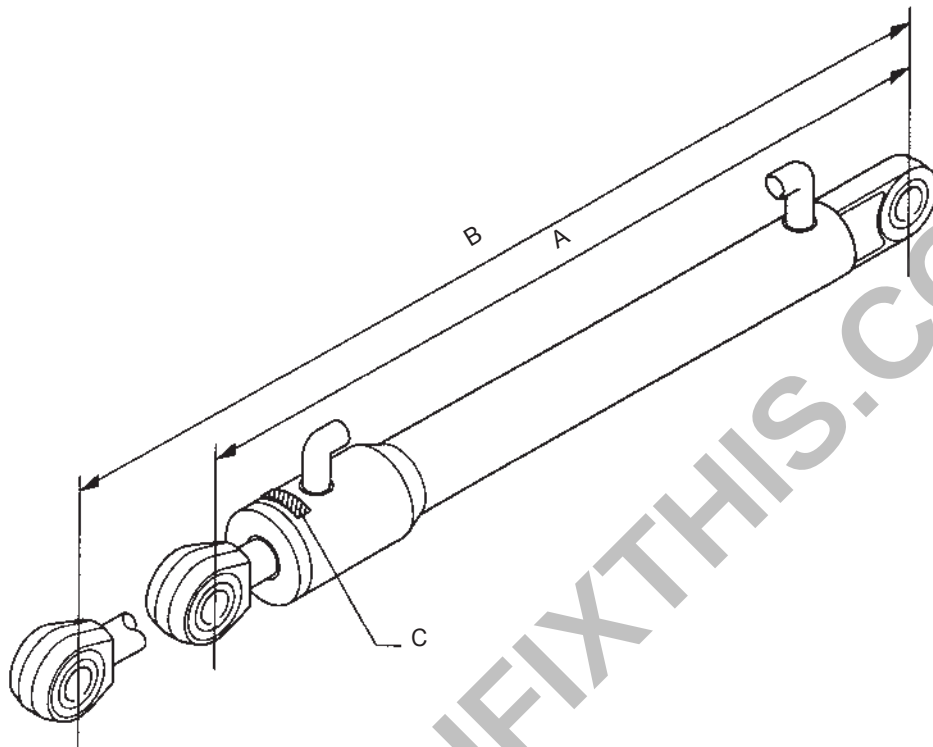


Fig. 24-31 General view of cylinder

A. Fully retracted length

C. Part No. and manufacturing No. stamp position

B. Fully extended length

E30.2SR					Unit: mm (ft-in)	
Cylinder	Cylinder Bore / Rod Dia.	Stroke	Center distance of mounting pins Full extend B / Full retract A	Cushion	Dry weight kg (lb)	
Boom (Canopy)	ø80 / ø45 (3.15" / 1.77")	585 (1'11")	1500 / 915 (4'11.1" / 3'0.0")	Rod side	35 (77)	
Boom (Cab)	ø80 / ø45 (3.15" / 1.77")	540 (1'9.3")	1455 / 915 (4'9.3" / 3'0.0")		35 (77)	
Arm	ø75 / ø45 (2.95" / 1.77")	541 (1'9.3")	1398 / 857 (4'7.0" / 2'9.7")	Head side	30 (66)	
Bucket	ø65 / ø40 (2.56" / 1.57")	497 (1'7.6")	1272 / 775 (4'2.1" / 2'6.5")	None	20 (44)	
Swing	ø80 / ø45 (3.15" / 1.77")	488 (1'7.2")	1286 / 798 (4'2.6" / 2'7.4")	None	37 (82)	
Dozer	ø100 / ø50 (3.94" / 1.97")	160 (6.3")	633 / 473 (2'09" / 1'6.6")	None	27 (60)	

E35.2SR					Unit: mm (ft-in)	
Cylinder	Cylinder Bore / Rod Dia.	Stroke	Center distance of mounting pins Full extend B / Full retract A	Cushion	Dry weight kg (lb)	
Boom (Canopy)	ø85 / ø45 (3.35" / 1.77")	578 (1'10.8")	1486 / 908 (4'10.5" / 2'11.7")	Rod side	35 (77)	
Boom (Cab)	ø85 / ø45 (3.35" / 1.77")	535 (1'9.1")	1443 / 908 (4'8.8" / 2'11.7")		35 (77)	
Arm	ø80 / ø45 (3.15" / 1.77")	560 (1'10")	1432 / 872 (4'8.4" / 2'10.3")	Head side	34 (75)	
Bucket	ø65 / ø40 (2.56" / 1.57")	497 (1'7.6")	1272 / 775 (4'2.1" / 2'6.5")	None	20 (44)	
Swing	ø80 / ø45 (3.15" / 1.77")	488 (1'7.2")	1286 / 798 (4'2.6" / 2'7.4")	None	37 (82)	
Dozer	ø100 / ø50 (3.94" / 1.97")	160 (6.3")	633 / 473 (2'09" / 1'6.6")	None	27 (60)	

32. ATTACHMENTS

32.1.2 BUCKET

32.1.2.1 REMOVAL OF BUCKET

- (1) Operate the operating lever and place the bucket on the ground, so the bucket and arm connecting pins are not loaded.
 - (2) Move the O-rings (3) toward the bucket bosses using a spatula.
 - (3) In order to remove pin (K) which links arm and bucket, remove the ring (2) and the pin (1) by means of straight driver, and draw out pin (K).
 - If the pin does not come off easily, the pin is loaded. Take off the load by manipulating the operating lever.
 - Take care so the dust seal between the arm and the bucket bosses is not damaged.
 - (4) Adjust the bucket by manipulating the operating lever so the pin (J) between the bucket link and the bucket is not loaded.
 - (5) Remove the ring (2) and pin (1) then pull out the pin (J).
 - (6) Remove bucket assembly.
- Weight:
- 81 kg (179 lbs) — E30.2SR
- 89 kg (196 lbs) — E35.2SR

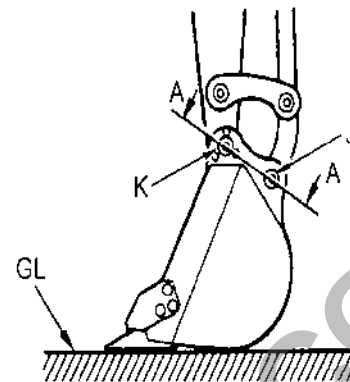


Fig. 32-2 To place Bucket on ground

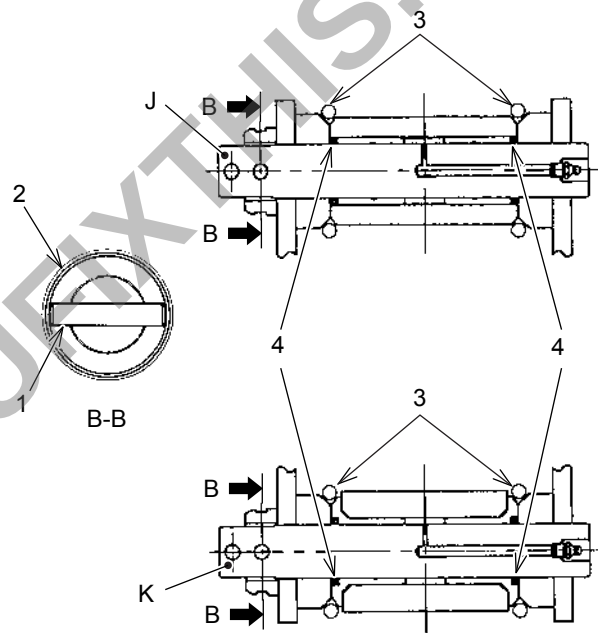


Fig. 32-3 Assembly of pin (A-A)

- 4. Dust seal
- J. Pin for bucket link
- K. Pin for arm

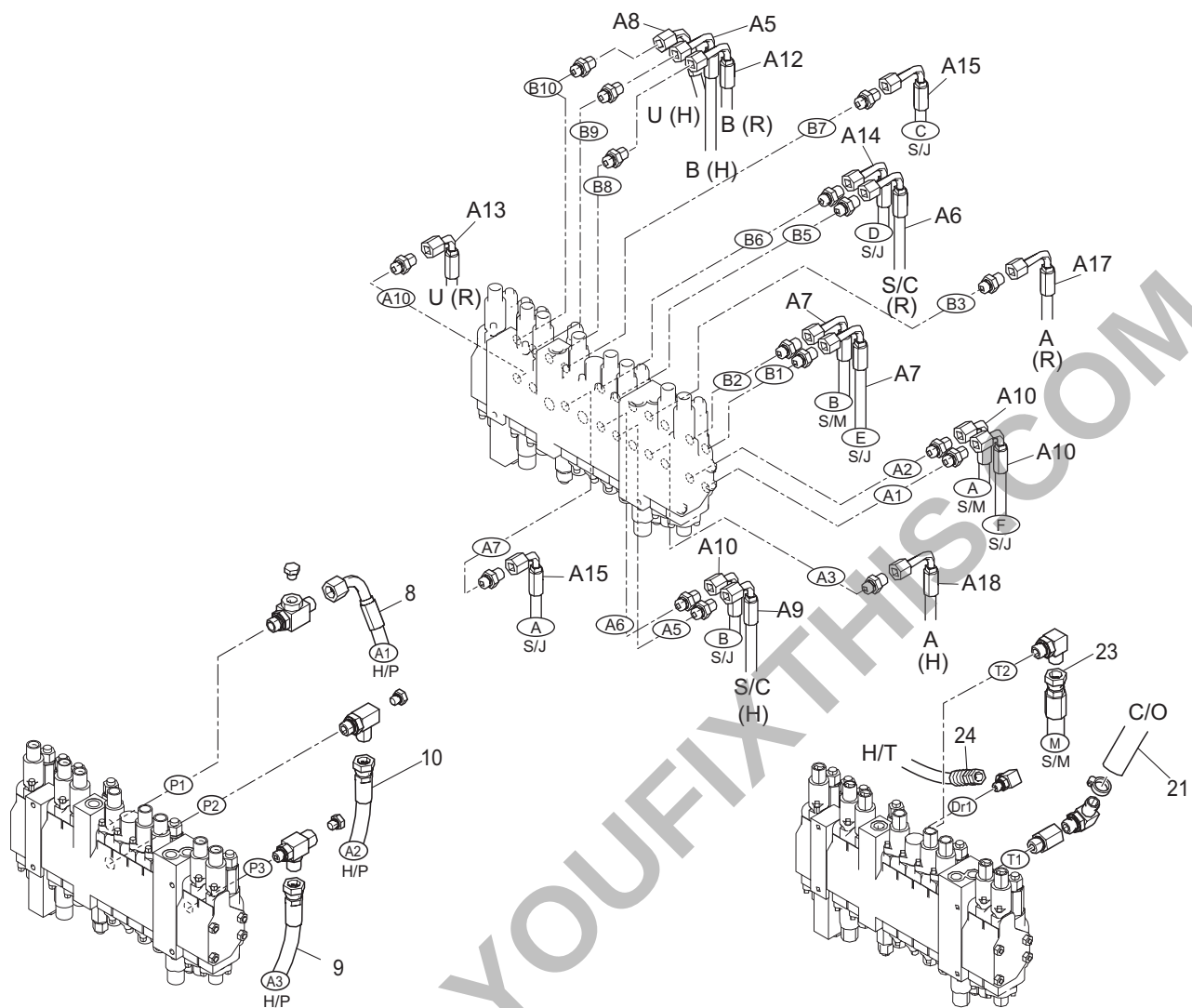


Fig. 33-24 Main hydraulic hose disconnection

C/O. Cooler oil (upper)

H/P. Hydraulic pump

H/T. Hydraulic Tank

S/C. Swing

S/J. Swivel joint

S/M. Slewing motor

A. Arm

B. Boom

U. Bucket

- e) Remove the drive gear, idle gear and side plate.



33.2.1.2.4 Assembly

Assemble the main pump in reverse order of the disassembly.

(1) Assembly of main pump

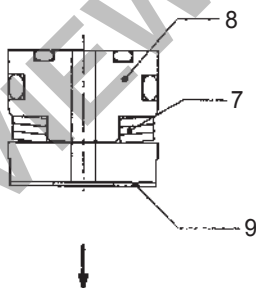
1) Assembling housing section

- a) Install the parallel pin and sleeve ($\varnothing 6$) of the P3 shift side into the housing.

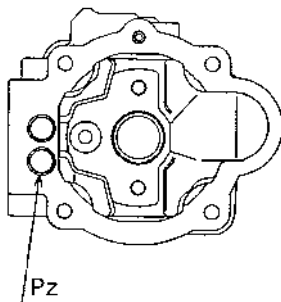


- b) Install the piston (8), coned disk spring (7), distance piece and shim (9) of P3 shift side into housing.

- Be careful to the orientation of the disk spring (7).



- c) Install the parallel pin and sleeve ($\varnothing 10$) of Pz shift side.



- Handle the assembled unit as an assembly.

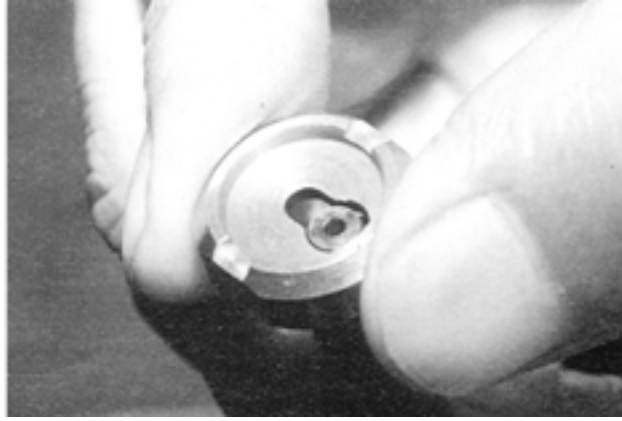


Fig. 33-115

20) Separate spool (301), spring (324) for secondary pressure setting, shim (217) and washer.

- Handle the assembled unit as an assembly. And there may be unit on which washer is not installed.

21) Remove grease cup (203) from plug (202).

22) Remove O-ring (212) from plug (202).

33.2.4.3 ASSEMBLY

(1) Clean all parts before assembly, and dry them by means of compressed air. Don't use rag.

- Repair the parts damaged when being disassembled, clean them, apply oil to the moving section, and install the same parts on the positions where they are before.
- Replace every O-ring and packing with new ones.

(2) Install washer (313), shim (217), spring (324) for resetting the secondary pressure, and spring seat on spool (301) in order.

(3) Pass spool (301) through the larger hole of spring seat (311), push the spring seat in, and install it making the spring for the secondary pressure deflect and shifting the spring seat laterally.

(4) Fix casing (101) with vise, and place spring (335) for return in casing (101).

(5) Place the reduction unit subassembly described above par. 2) and 3) in casing (101).

- Install them on the positions as they were before.
- When placing the reduction unit subassembly in, pay attention to the spool lower end so as not to bring into contact with the corner of the casing (C).

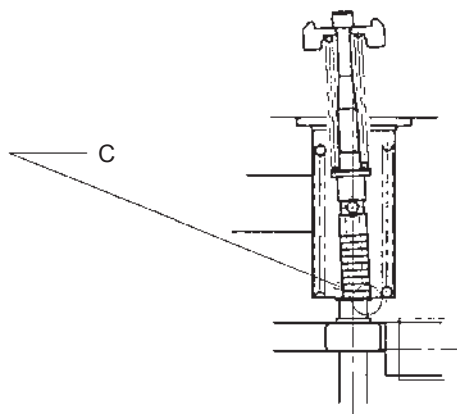


Fig. 33-116

(6) Place O-rings (211, 213) in casing (101).

(7) Fix upper casing (102) with vise and place the steel ball in it.

(8) Place spring seat (218) in casing (102) with tweezers.

(9) Place damping spring (336) in casing (102).

Unit: mm (in)

Symbol	ITEM	Reference value		Repairable level	Service limit	Remedy
A	Link pitch	101.6 (4.0)		105 (4.14)	107 (4.24)	Parts over the critical value in use should be replaced with link assembly.
B	Link height	60 (2.4)		57 (2.24)	56 (2.20)	
C	Height of shoe lug	16.5 (0.65)		10 (0.39)	8 (0.32)	
D	Bushing O.D.	$\varnothing 32.2^{+0}_{-0.04}$ ($\varnothing 1.27^{+0}_{-0.002}$)		$\varnothing 30$ ($\varnothing 1.18$)	$\varnothing 28$ ($\varnothing 1.10$)	
E	Interference of bushing and link	Basic dimension		Fit	Fit	Replace
		Shaft	$\varnothing 32.2^{+0}_{-0.04}$ ($\varnothing 1.27^{+0}_{-0.002}$)	Interference 0.11~0.20 (0.0043~0.0079)	Interference 0	
		Hole	$\varnothing 32^{+0.05}_{0}$ ($\varnothing 1.26^{+0.002}_{0}$)			
F	Interference of track pin and link	Shaft	$\varnothing 19.2^{+0.06}_{0}$ ($\varnothing 0.76^{+0.003}_{0}$)	Interference 0.15~0.26 (0.006~0.010)	Interference 0	
		Hole	$\varnothing 19^{+0.05}_{0}$ ($\varnothing 0.75^{+0.002}_{0}$)			
G	Fitting of master pin and link	Shaft	$\varnothing 18.93^{+0.05}_{0}$ ($\varnothing 0.745^{+0.002}_{0}$)	Clearance 0.02~0.12 (0.0008~0.0047)	—	
		Hole	$\varnothing 19^{+0.05}_{0}$ ($\varnothing 0.75^{+0.002}_{0}$)			
H	Clearance gap of link	0.9 (One side) (0.035)		4 (both side) (0.157)	6 (both side) (0.236)	Replace
—	Welding of link and shoe	To be free from weld crack, blow hole, etc.				Repair weld.
L	Slack of iron crawler	115~130 mm (4.5~5.1)		—		Adjust the tension.

34. TRAVEL SYSTEM

(14) Removing spring inside cylinder block

- 1) Place the cylinder block (104) on the press bench.
- Remove the spring, only when its replacement is necessary.
- When removing the spring, align the center of the retainer metal (RM1) with the washer center in order to prevent the cylinder block from being damaged by contact.
- Put a vinyl sheet (VS) over the cylinder block so as not to damage the surface of the cylinder block.

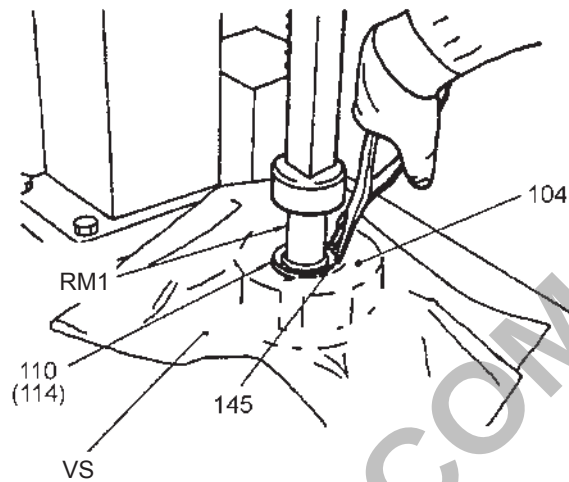


Fig. 34-120 Removing spring (114)

- 2) Place the retainer metal (1) against the washer (110), remove the snap ring (145) from the snap ring groove of the cylinder block (104) with a snap ring plier.

WARNING

Release pressing force slowly. Otherwise the spring may fly out to cause injury.

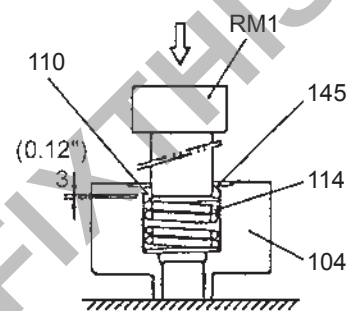


Fig. 34-121 Removing spring (114)

- 3) Remove the snap ring (145), washer (110), spring (114), and washer (110) out of the cylinder block.

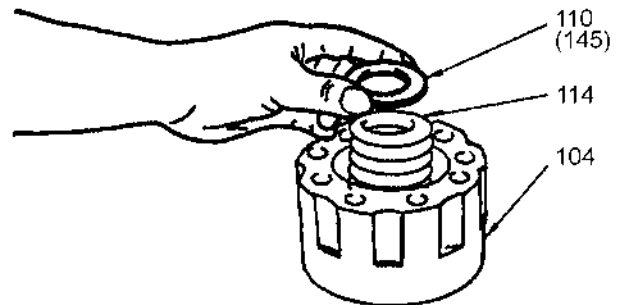


Fig. 34-122 Removing internals of cylinder block (104)

(15) Removing swash plate

- 1) Remove the swash plate (103) from the drive shaft (102).
- When removing the swash plate (103), ensure that pivot (167) is not adhered on the swash plate (103).

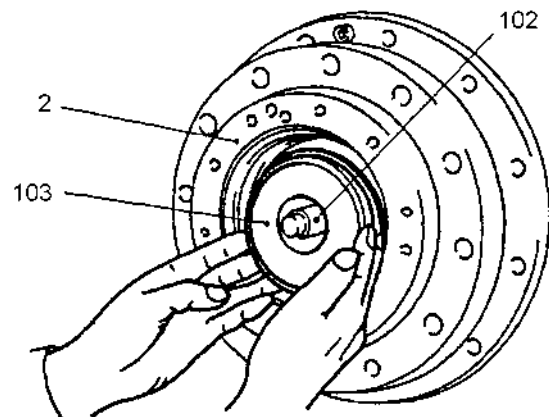


Fig. 34-123 Removing swash plate (103)

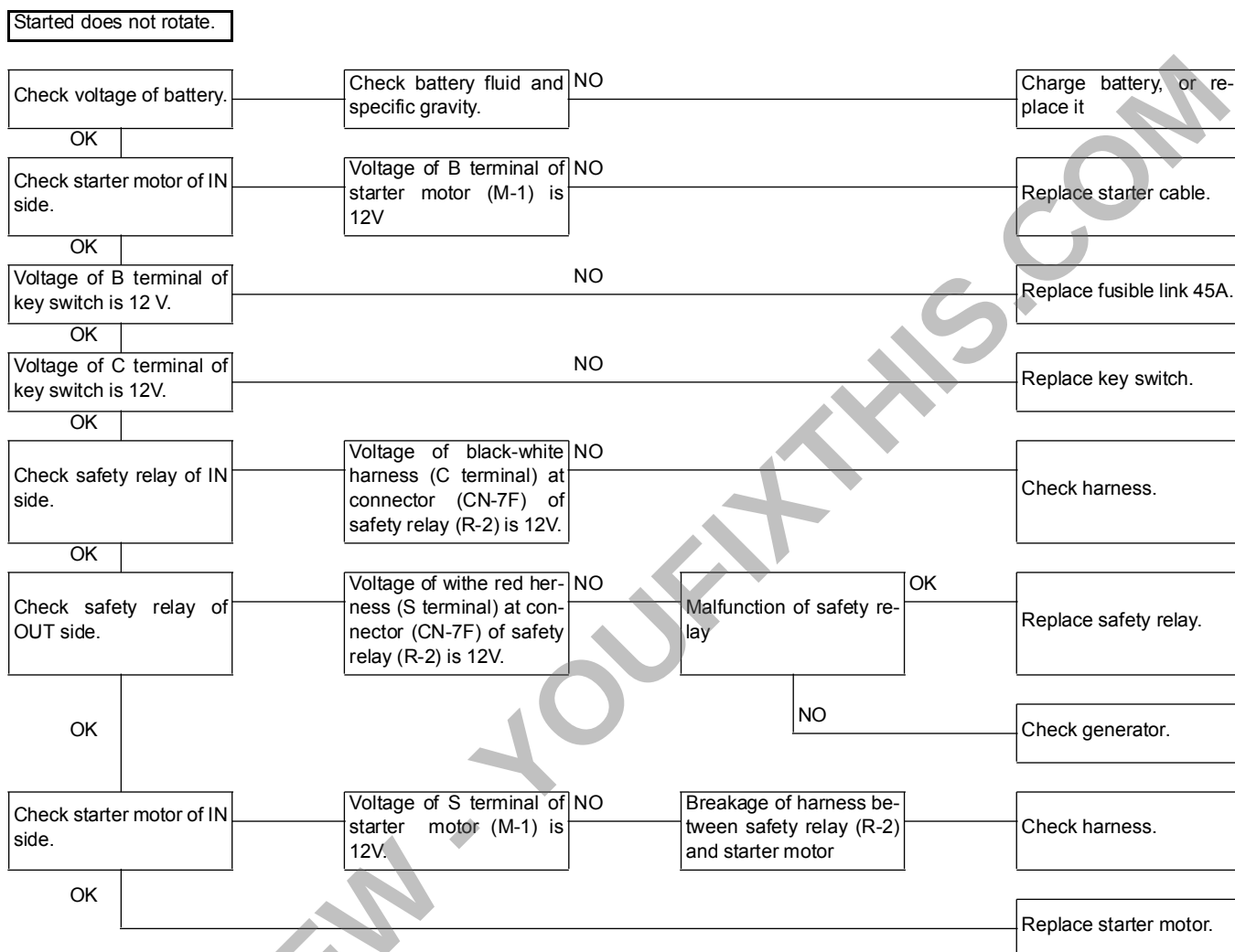
43. TROUBLESHOOTING (ELECTRICAL SYSTEM)

43.2 TROUBLESHOOTING

43.2.1 GENERAL

43.2.1.1 Engine does not start.

(1)



(9) 4TNV98

Engine name		Unit	4TNV98					
Engine specification class		-	CL			VM		
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine					
Combustion chamber		-	Direct injection					
Number of cylinders		-	4					
Cylinder bore x stroke		mm x mm	98 x 110					
Displacement		L	3.318					
Continuous rating	Revolving speed	Min ⁻¹	1500	1800	-			
	Output	kW (hp)	30.9 (42.0)	36.8 (50.0)	-			
Rated output	Revolving speed	Min ⁻¹	1500	1800	2000	2200	2400	2500
	Output	kW (hp)	34.6 (47.0)	41.2 (56.0)	41.9 (57.0)	45.6 (62.0)	49.3 (67.0)	51.1 (69.5)
Max. no-load speed (±25)		Min ⁻¹	1600	1895	2180	2400	2590	2700
Ignition order		-	1-3-4-2-1(No.1 cylinder on flywheel side)					
Power take off		-	Flywheel					
Direction of rotation		-	Counterclockwise (viewed from flywheel)					
Cooling system		-	Radiator					
Lubrication system		-	Forced lubrication with trochoid pump					
Starting system		-	Electric					
Applicable fuel		-	Diesel ASTM N. 2-D tipo TT					
Applicable lubricant		-	SUPER GOLD 10W-30		SUPER GOLD 15W-40			
Lubricant capacity (oil pan)*	Total	L	10.2					
	Effective	L	4.5					
Coolant water capacity (engine only)		L	4.2					
Engine Dimensions ** (with flywheel housing)	Overall length	mm	719					
	Overall width	mm	498					
	Overall height	mm	717					
Engine mass (dry) ** (with flywheel housing)		kg	248			235		
Cooling fan (std.)		mm	410 mm O/D, 6 blades pusher type					
Crankshaft V pulley diameter & Fun V pulley diameter (std.)		mm	130 x 130					

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

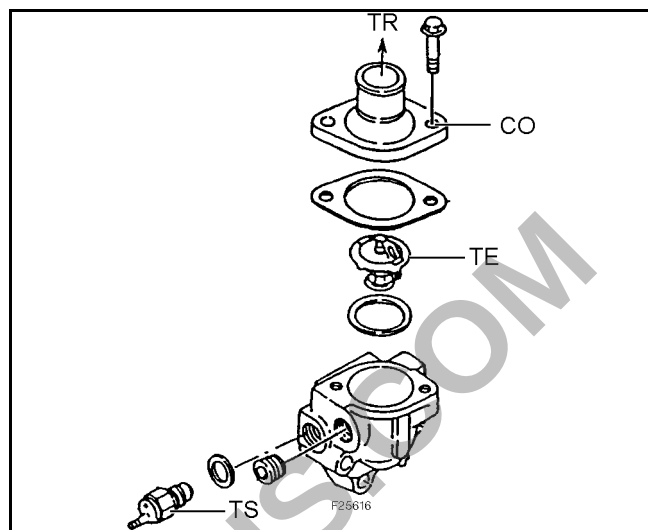
** Engine mass and dimensions without radiator.

51.2.7 THERMOSTAT INSPECTION

Place the thermostat in a container filled with water. Heat it while measuring the water temperature, and see that the thermostat is actuated at temperature of following table.

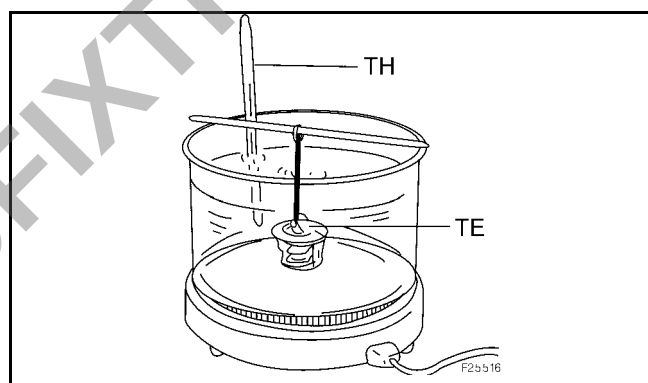
Model	Valve opening Temperature (°C)*	Full open lift (Temperature) (mm)
All models	69.5~72.5	8 or more (85 °C)

* Valve opening temperature is carved on the flange.



TR. To radiator
TE. Thermostat

CO. Cover
TS. Thermo switch



TH. Thermometer

TE. Thermostat

51.2.8 ADJUSTING OPERATION

Perform the adjusting operation of a engine as follows after the maintenance job:

1. Supply the fuel oil, lubricating oil and coolant water.

NOTE: Check the levels of the lubricating oil and coolant water again after test running (for about 5 minutes) and add as required.

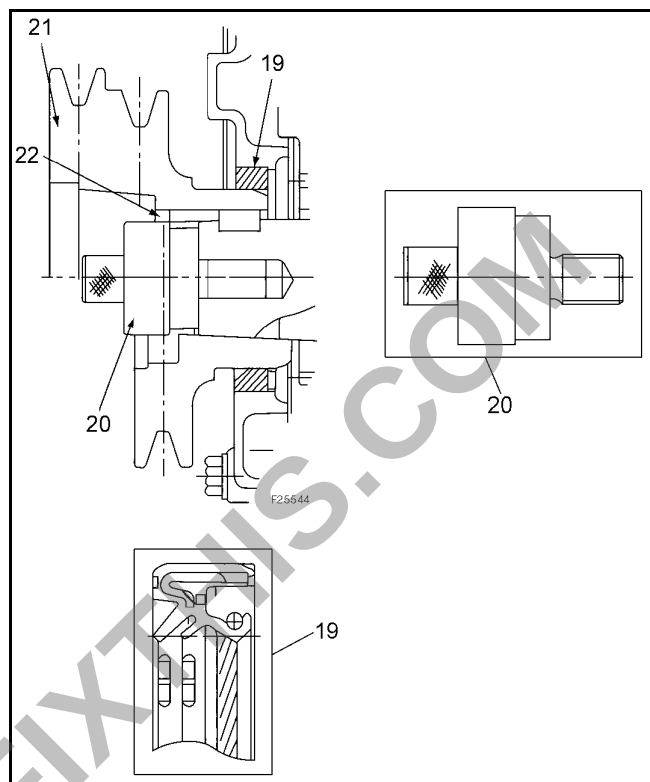
2. Start the engine, and carry out idling at a low revolution (700 to 900 rpm) for a few minutes.
3. Run in the engine for about five minutes at the rated revolution (no-load). Check any water, fuel or oil leak and existence of abnormal vibration or noise. Also check the oil pressure, coolant water temperature and exhaust gas color.
4. Adjust the no-load minimum and maximum revolutions according to the specifications.
5. Perform loaded operation as required.

51.4.3.6 Oil seal replacement (Gear case side)

1. Replace the oil seal with a new one when the gear case is disassembled.
Extract the used oil seal.
2. Insert a new oil seal. Fit the position of the oil seal insertion to the end face of the gear case.
(Refer to the below figure.)
3. Apply grease to the oil seal tips. For the oil seal with double lips dust seal, further, slightly apply engine oil on the oil seal lip so as not to damage them, when installing the pulley.

NOTE: Pay attention not to drop any oil on the taper surface of the crankshaft. If dropped, clean by wiping off using detergent.

4. Carefully install the crankshaft pulley so as not to damage the oil seal lips. Especially for the engine installed the oil seal with double lips dust seal, be sure to use the crankshaft pulley-installing tool.



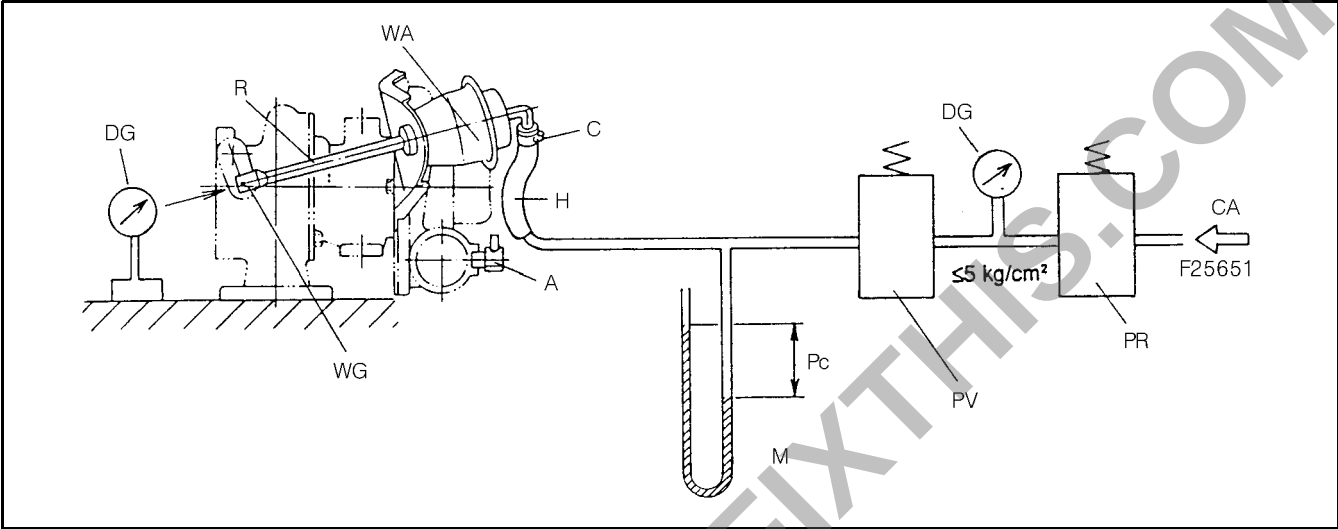
19. Oil seal with double lips dust seal
20. Crankshaft pulley installing tool
21. Crankshaft pulley
22. Guiding

51.4.3.7 Camshaft bushing replacement

Replace the bushing using the special service tool (Refer to No.7 of 51.4.1.2)

(b) Measuring instruments and devices

Dial gauge	Capable of measuring 0 to 10 mm (A flat head type is recommendable.)
Manometer	Mercury column or electrical type (capable of measuring 0 to 1500 mmHg)
Pressure regulating valve	Allowing gradual adjustment in a range between 0 and 2 kgf/cm ² (0.196 Mpa)
Pressure reducing valve	Used for suppressing the air supply pressure at 5 kgf/cm ² (0.49 Mpa) or less.
Pressure gauge	Bourdon tube pressure gauge (0 to 10 kgf/cm ² (0.98 Mpa))



- 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

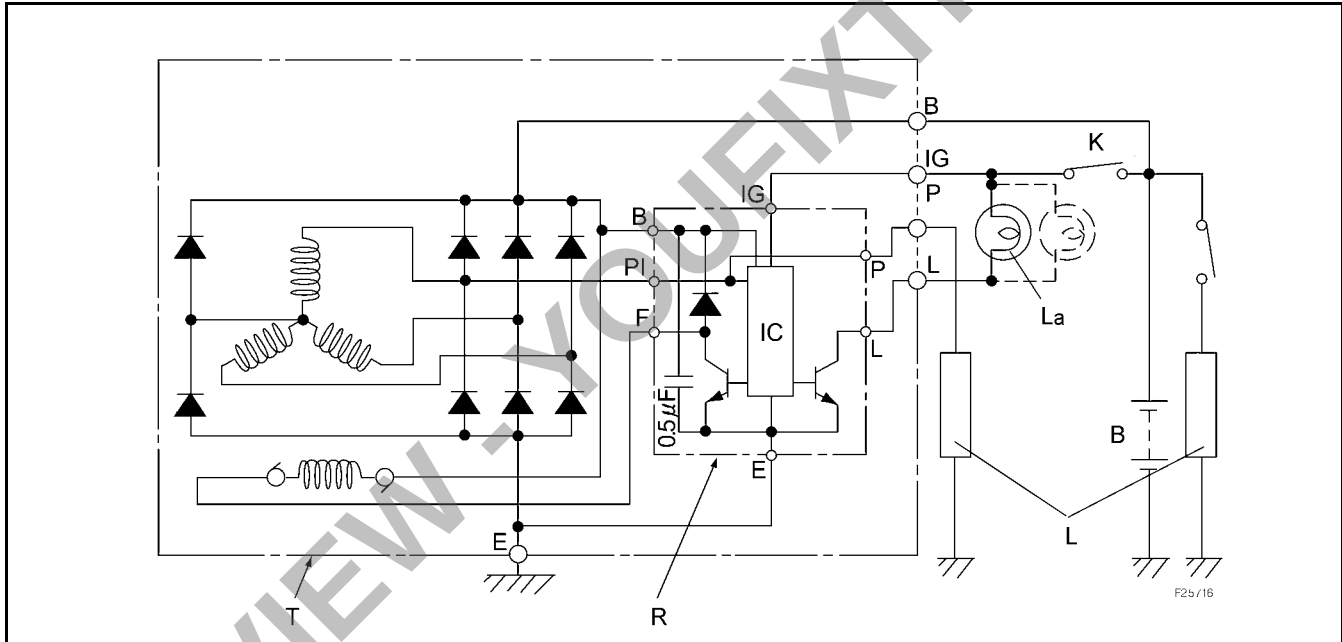
1. Set the manometer control pressure (Pc) applied to the waste gate actuator to 0 and set the dial gauge to the zero point.
2. Gradually open the pressure regulating valve and measure the Pc value when the actuator rod is operated by 2 mm.
3. For the hysteresis, let the rod move to 3 mm first. The gradually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

51. ENGINE

51.10.1.2 Specifications

Manufacturer's model (Hitachi)	-	ACFA68
Rating	-	Continuous
Battery voltage	V	12
Nominal output (13.5V heat)	A	40
Rated revolution	min ⁻¹	5.000
Operating revolution	min ⁻¹	1.350~18.000
Grounding characteristics	-	Minus side grounding
Direction of revolution (viewed from pulley)	-	Clockwise
Integrated regulator		IC regulator
Weight	kg	2.8
Pulley (outside diameter)	mm	69.2
Belt shape	-	Type A

51.10.1.3 Wiring diagram



- B. Battery

K. Key switch

L. Load
- La. Charge lamp (Max. 3.4 W)

R. IC regulator

T. Alternator assy

- Don't do miss-wiring and short-circuit of each terminal.
- Don't short-circuit between IG and L. (Connect it through the charge lamp.)
- Don't connect a load between L and E.
- Don't remove a battery terminal and a B terminal when rotating.
- Shut out a battery switch during the alternator stop.
- Tightening torque of each terminal: 1.7-2.3 Nm

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