2.3 SPECIFICATIONS AND PERFORMANCE

SPEED AND GRADEABILITY

Model		E40.2SR				E50.2SR			
Applicable Machines		PH05-03501~				PJ04-03001~			
Shoe Type		Rubber shoe		Iron shoe (OPT)		Rubber shoe		Iron shoe (OPT)	
Slewing Speed	min^{-1} {rpm}	8.8 {8.8}				8.8 {8.8}			
Travel Speed	km/h (mph)	Low (1st)	High (2nd)	Low (1st)	High (2nd)	Low (1st)	High (2nd)	Low (1st)	High (2nd)
		2.8	4.6	2.8	4.6	2.8	4.6	2.8	4.6
Gradeability	% (degree)	58(30)							

ENGINE

Model (YANMAR)		4TNV88-XYB
Type		Water-cooled, 4-cycle type Swirl chamber type diesel engine
Number of cylinders-Bore × Stroke		4 - ø88 mm × 90 mm (3.46 in × 3.54 in)
Total Displacement	L	2.189 (134 cu•in)
Output Rating	kW/min^{-1} {PS/rpm}	30.4 / 2400 {41.3 / 2400}
Maximum Torque	N•m/min^{-1} (lbf•ft/rpm)	98.4 / 1440 (72.6 / 1440)
Starting Motor	V × kW	12 × 2.3
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	11-spool multiple control valve
Cylinder (Boom, Arm, 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)	505 / 325 (19.9/12.8)	495 / 375 (19.5 / 14.8)

WEIGHT

Machine Weight	kg (lb)	Rubber shoe	Iron shoe	Rubber shoe	Iron shoe
		4200 (9260)	4300 (9480)	4630 (10200)	4730 (10400)
Upper slewing body	kg (lb)	1930 (4260)	←	2280 (5030)	←
Travel system	kg (lb)	1670 (3680)	1770 (3900)	1720 (3790)	1820 (4010)
Attachment (Boom+STD Arm+STD Bucket)	kg (lb)	505 (1110)		535 (1180)	
Oil & Water	kg (lb)	95 (209)		←	

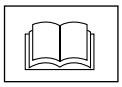
Note: This figure is calculated with standard bucket.

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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



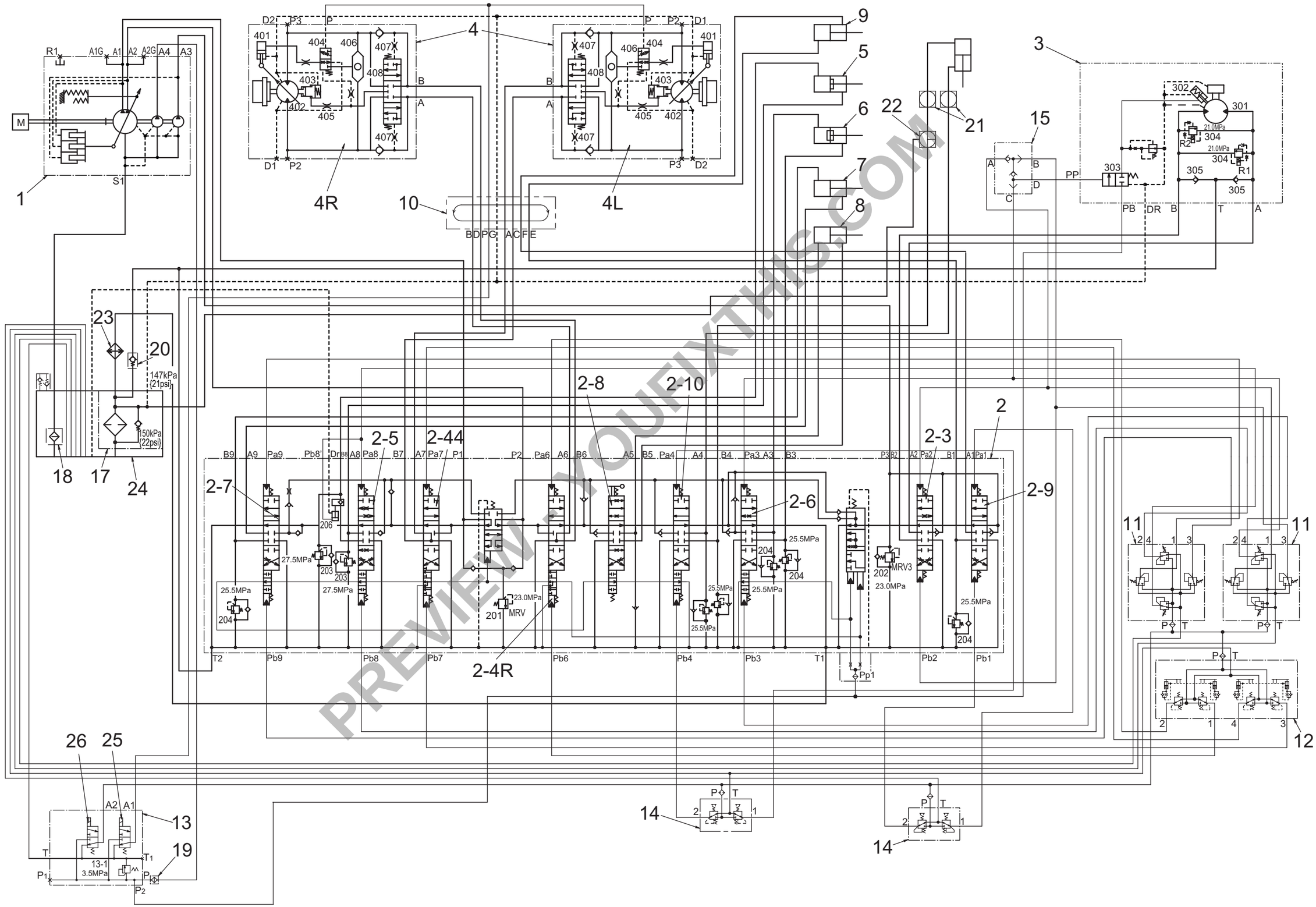
(1) Removing hydraulic equipment
1) Before disconnecting pipes, release the hydraulic pressure of the system, or open the return side cover and take out the filter.
2) Carefully drain oil of the removed pipes into a containers without spilling on the floor.
3) Apply plugs or caps on the pipe ends to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

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71.1.1 STANDARD SPECIFICATION

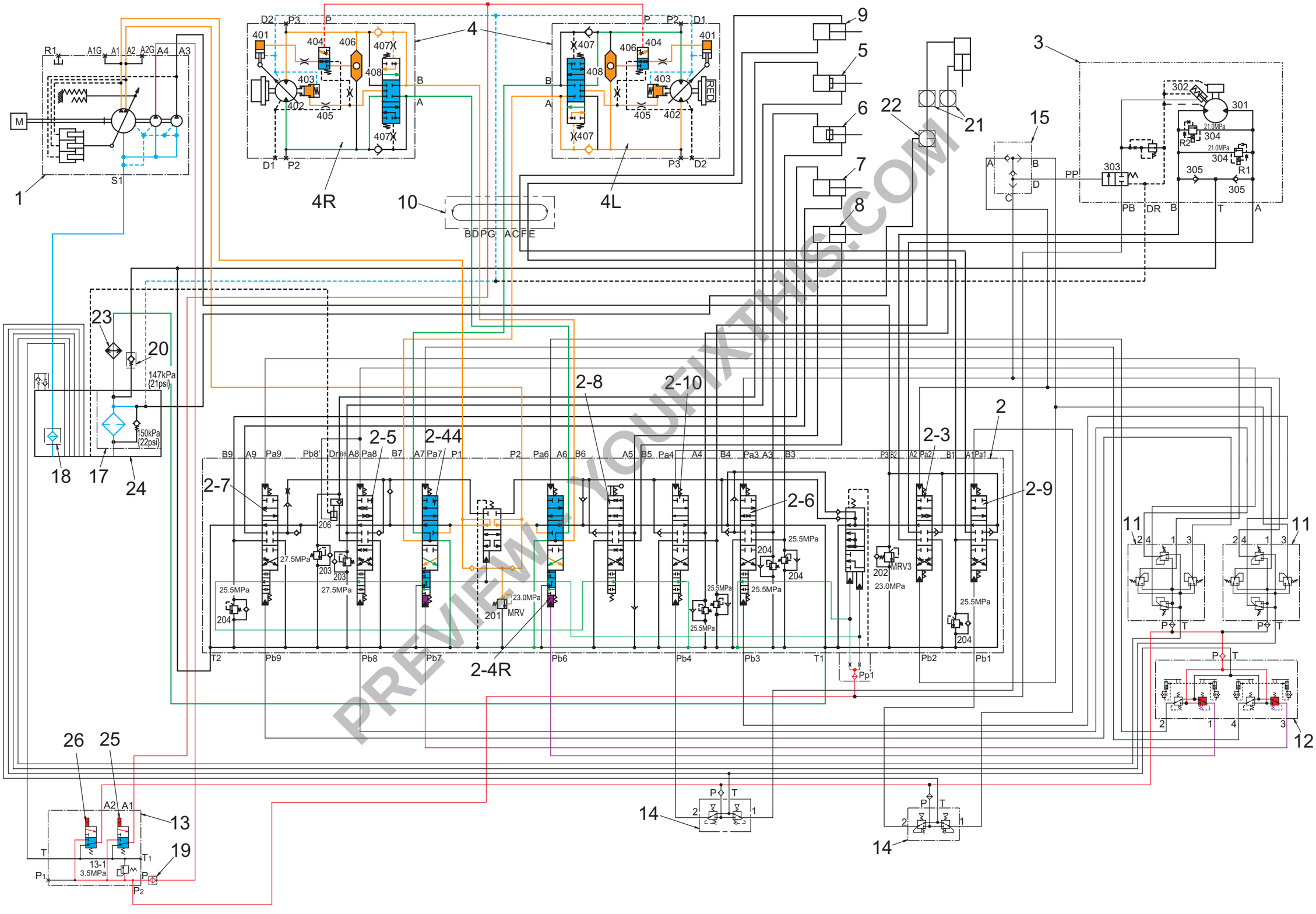


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Fig. 71-1

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(2) TRAVEL CIRCUIT: Travel forward operation at travel 2nd speed



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Fig. 71-3

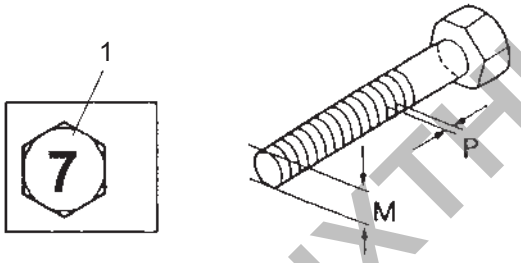
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11.1 TORQUE SPECIFICATIONS FOR CAPSCREWS & NUTS

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)

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42.2 TROUBLE DIAGNOSIS: HYDRAULIC

Classification	Reference No.		Causes / Phenomenon	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

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E40.2SR
E50.2SR

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GENERAL SAFETY INFORMATION

⚠WARNING

Do not operate or perform any maintenance on this machine until all instructions found in the OPERATION & MAINTENANCE MANUAL have been thoroughly read and understood.
Improper operation or maintenance of this machine may cause accidents and could result in serious injury or death.
Always keep the manual in storage.
If it is missing or damaged, place an order with an authorized our Distributor for a replacement.
If you have any questions, please consult an authorized our Distributor.

(1) Most accidents, which occur during operation, are due to neglect of precautionary measures and safety rules. Sufficient care should be taken to avoid these accidents. Erroneous operation, lubrication or maintenance services are very dangerous and may cause injury or death of personnel. Therefore all precautionary measures, NOTES, DANGERS, WARNINGS and CAUTIONS contained in the manual and on the machine should be read and understood by all personnel before starting any work with or on the machine.

(2) Operation, inspection, and maintenance should be carefully carried out, and safety must be given the first priority. Messages of safety are indicated with marks. The safety information contained in the manual is intended only to supplement safety codes, insurance requirements, local laws, rules and regulations.

(3) Messages of safety appear in the manual and on the machine: All messages of safety are identified by either word of "DANGER", "WARNING" and "CAUTION".

1) **DANGER-** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury and is represented as follows:

⚠DANGER

2) **WARNING-** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury and is represented as follows:

⚠WARNING

3) **CAUTION-** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against possible damage to the machine and its components and is represented as follows:

⚠CAUTION

(4) It is very difficult to forecast every danger that may occur during operation. However, safety can be ensured by fully understanding proper operating procedures for this machine according to methods recommended by Manufacturer.

(5) While operating the machine, be sure to perform work with great care, so as not to damage the machine, or allow accidents to occur.

(6) Continue studying the manual until all Safety, Operation and Maintenance procedures are completely understood by all persons working with the machine.

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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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3.2.2 ARM MAINTENANCE STANDARDS

(1) Clearance of pin and bushing

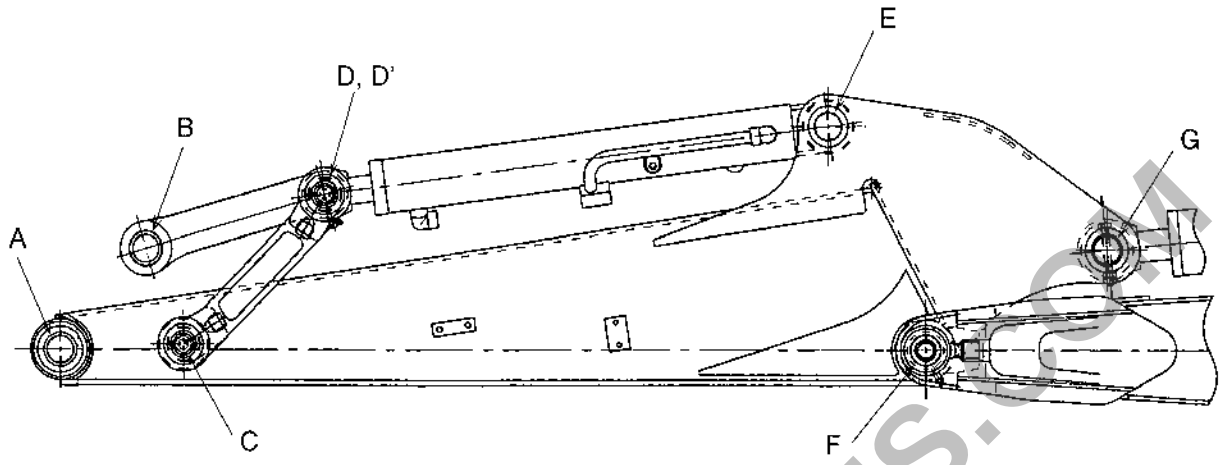


Fig. 3-5 Clearance of pin and bushing on arm section

Unit: mm (in)

Pos.	Item	Standard dimensions			Clearance			Remedy
		Pin dia.	Tolerance on pin dia.	Tolerance on bushing bore dia.	Standard value	Standard value for repair	Serviceability limit	
A	Arm point (Connected part of bucket)	ø45 (1.77)	–0.02 –0.05 (-0.0008) (-0.0020)	+0.064 +0.005 (+0.0025) (+0.0002)	0.025~ 0.114 (0.0010~ 0.0045)	0.7 (0.028)	1.0 (0.039)	Replace bushing or pin
B	Bucket link (Bucket side)							
C	Idler link (Connected part of arm)			+0.076 +0.035 (+0.0030) (+0.0014)	0.055~ 0.126 (0.0022~ 0.0050)			
D	Bucket link (Idler link side)			+0.073 +0.032 (+0.0029) (+0.0013)	0.052~ 0.123 (0.0020~ 0.0048)			
D'	Bucket cylinder (Rod side)			+0.25 +0.05 (+0.0098) (+0.0020)	0.07~ 0.30 (0.0028~ 0.0118)			
E	Bucket cylinder (Head side)							
F	Arm foot (Connected part of boom)	ø60 (2.36)		+0.061 0 (+0.0024) (0)	0.02~ 0.111 (0.0008~ 0.0044)			
G	Arm cylinder (Rod side)	ø45 (1.77)		+0.25 +0.05 (+0.0098) (+0.0020)	0.07~ 0.30 (0.0028~ 0.0118)			

(Note)

- The tolerance for bushing inside diameter means the dimension after fitting of it into place.
- The part number for pins may be changed owing to improvement, use them only for reference.

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13.3 MEASURING ENGINE SPEED

13.3.1 ENGINE SPEED MEASUREMENT

(1) Measuring Instruments

1) Diesel Speedometer (1) (Measuring engine speed by means of applying a pick-up (2) to one of 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 up the engine, and make the coolant temperature within the range of 60 to 90 °C (140 to 194 °F).

Check the coolant temperature with the coolant thermometer on the monitor panel. The white color zone shows approx. 67 to 105 °C (153 to 221 °F) of temperature range.

Therefore, when the indicator is located at around center 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. (Refer to Fig. 13-1)

2) Measure the engine speed at idling with no load, and compare it to the figure in the STANDARD VALUE TABLE.

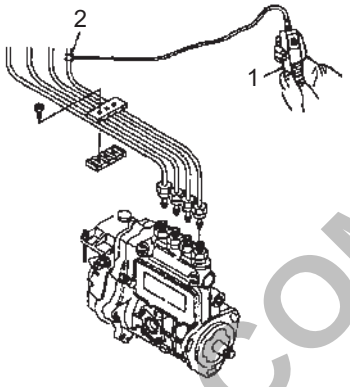
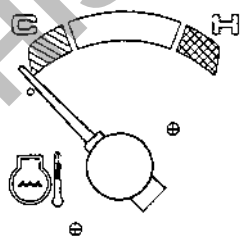


Fig. 13-1 Engine Speed measurement (The above figure shows concept)



WATER TEMPERATURE

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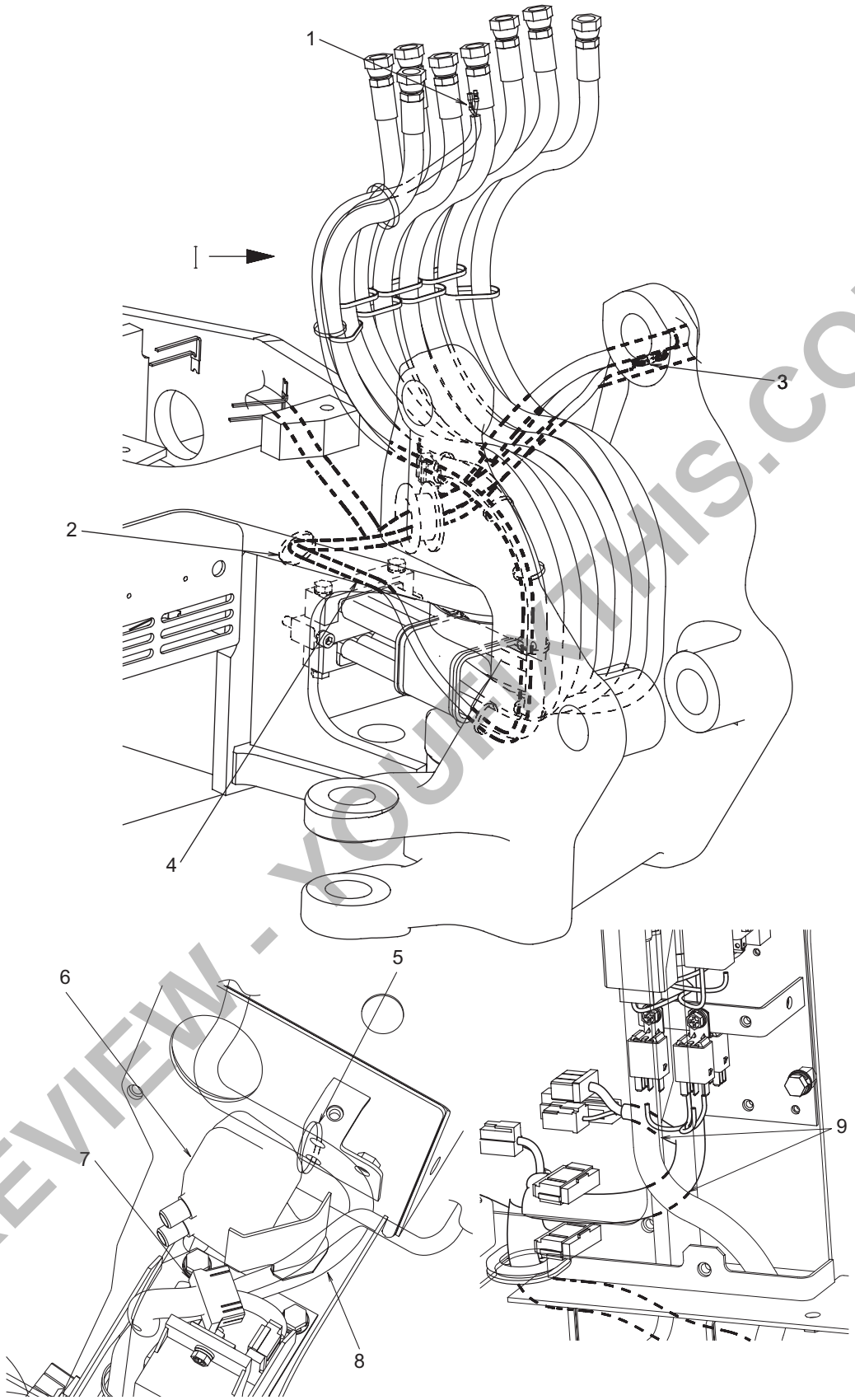


Fig. 23-7 Upper Frame Portion (7/8)

1. Connect with boom light harness
2. Clip
3. Inst·Main harness (Vender connection)
4. A white taping part is on a hose clamp.
5. It fixes so that harness may not swell to a breather tank side
6. Breather tank
7. Connect main harness to cab harness
8. Harness is fixed so that a plate may not be straddled
9. Let hose&tube of breather tank back pass

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24.1.4.5 EXPLANATION OF OPERATION

1. Neutral position

P1:

The oil delivered from the hydraulic pump flows from the P1 port of the control valve (hereafter called a C/V) into the left travel spool section through the passage of the supply section.

At the spool neutral position, the entered oil passes through the by-pass of the spool leading from the left travel to the boom because the spool does not cut off the by-pass and flows out to the tank circuit through the by-pass of the spool for the bucket and the by-pass leading to the tank.

P2:

The oil delivered from the hydraulic pump flows from the P2 port of C/V into the right travel spool section through the passage of the supply section.

At the spool neutral position, the entered oil passes through the by-pass of the spools for the right travel, boom swing and service, and flows out to the tank circuit through the by-pass circuit leading from the by-pass of the spool for service.

P3:

The delivery from the hydraulic pump flows from the (C/V) P3 port into the parallel circuit of swing and dozer operation.

Since the spool does not shut off the by-pass passage in the neutral spool condition, the oil having flown into the parallel passage flows out to the tank passage through the by-pass passages of the spools for the dozer and slewing and through the by-pass passage of the P3 supply section.

⚠ WARNING

As the flow from the pump is fed into each line (P1, P2, P3), the switching sections of respective line shown below are in operable condition. Therefore, don't operate them except when working.
P1 line: Left travel, Boom, Bucket
P2 line: Right travel, Boom Swing, Service and Arm
P3 line: Dozer, slewing [Service and Arm]

Pp1:

The delivery oil from the gear pump flows from the (C/V) Pp1 port into the pilot circuit through the orifice provided on P3 supply section. (Two systems for shifting independent travel and for shifting arm and service flow conflux)

In the neutral spool condition, the oil of the independent travel shifting side flows out to the tank passage through the passages provided to the right and left travel spool and the swing spool.

Therefore the pilot circuit pressure becomes equal to the tank pressure, the received pressure of the independent travel valve is equal to the tank pressure, and consequently the independent travel spool does not switch.

Moreover, the oil of the flow conflux shifting side flows out to the tank passage through the passage provided to the service spool. Since the pilot passage pressure equals to the tank pressure and the receiving pressure of the flow conflux piston equals to the tank pressure, the flow conflux spool is not shifted.

⚠ WARNING

When the engine is stopped (when each hydraulic pump is stopped), the actuator does not function even when being loaded by the self weight, because the pilot pressure does not act on the pilot control spool (except for the condition where the accumulator, etc. is attached and the pressure remains due to the pipe volume). On the spool of boom swing which directly actuates the spool, the port on the loaded side is led to the tank circuit with the operating direction making it unable to hold the load, consequently the actuator may be actuated causing danger. Therefore, even if the engine is stopped, when there are people around the machine or it may be in contact with implements, don't use the control lever.

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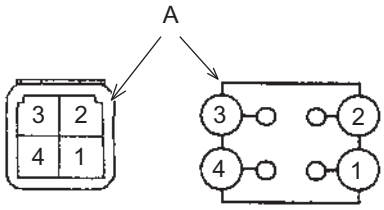
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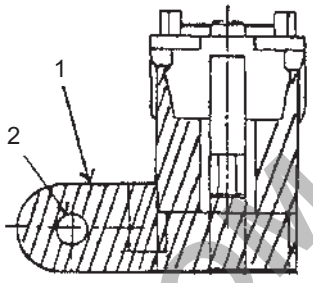
Code No. Parts Name Use	Specifications	Description

E-15

Fuse box
(For cooler)

Fuse (OPT)





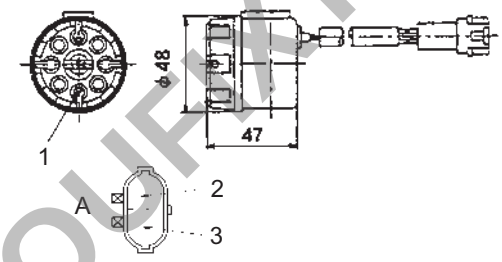
Fuse	20A blade X 2

No.	NAME
1	Bracket in the hatched area
2	Hole for M6
A	Arrangement of terminals and circuit diagram

E-20

Travel alarm
(Opt)

Warning sound



Rated voltage	DC12V·24V
(Usage range)	(9~36V)
Rated current	Max 50mA at rated voltage

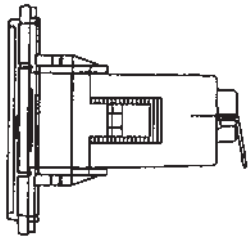
No.	NAME
1	Weep hole X 2
2	Power source (+) (Pink)
3	Power source (-) (Black)
A	Amp econo seal mark II water proof 2PM

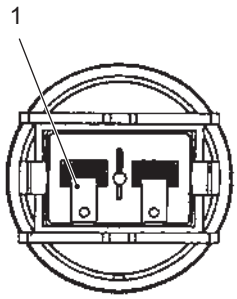
E-26

Hour meter

Service meter







Movement	Quartz
Rated voltage	10~80V CD

No.	NAME
1	Terminal parts Connector parts

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3) Installing seal ring

Install the back-up ring (16) and seal ring (15).

- Refer to article 32.2.1.3 CYLINDER CONSTRUCTION (EXAMPLE OF BOOM CYLINDER) and install the seal ring correctly.

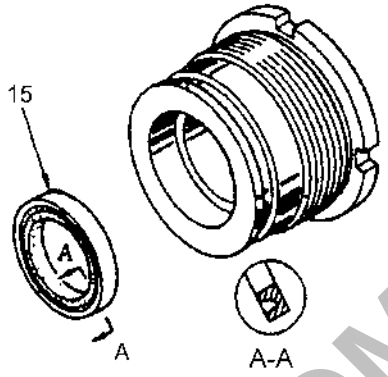


Fig. 32-37 Installing seal ring

4) Using the setting tool (C), install the dust seal (17).

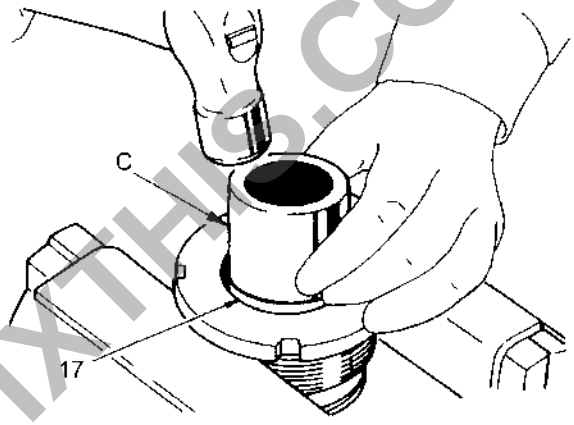


Fig. 32-38 Installing dust seal

(3) Assembly of piston portion:

1) Install the O-ring for the seal ring assembly (11). In this case, stretch the O ring as minimum as required to install.



2) Install wear ring (10) for piston from rod side. (2 places)

- Expand the split of wear ring as minimum as required.



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33.1.17 ENGINE

33.1.17.1 REMOVAL PREPARATION

(1) Remove the side cover and the bonnet (See Section 33.1.2).

(2) Remove the canopy (See Section 33.1.1).

(3) Remove the negative side terminal of the battery.

(4) Remove the counterweight (See Section 33.1.5).

(5) Remove the control stand (See Section 33.1.14).

(6) Remove the air cleaner (See Section 33.1.11).

(7) Remove the muffler (See Section 33.1.13).

(8) Remove the radiator (See Section 33.1.16).

(9) Remove the pump or disconnect the hose connected to the pump (See Section 33.1.6).

33.1.17.2 REMOVAL

(1) Disconnecting fuel hose
Disconnect each hose from the position marked with ★.

(2) Disconnecting cable connector
(for details, see ELECTRICAL SYSTEM)

1) Disconnect the terminal B of the starter motor (M-1) on the positive cable of the battery (See Section 33.1.15.2).

2) Disconnect the grounding cable of the engine.

(3) Removing engine

⚠ CAUTION

Prepare a worktable capable of enduring the weight of the engine and stably receiving the removed engine.

1) Loosen four M12×120 capscrews (12) fixing the engine on the rubber mount (6) and (7) to remove the engine.

: 19 mm

2) Lifting engine
Pass a wire rope through the two lifting eyes at the top of the engine and lift the engine.
Weight: Approx. 170 kg (370 lbs)

3) Place the engine stably on the worktable.

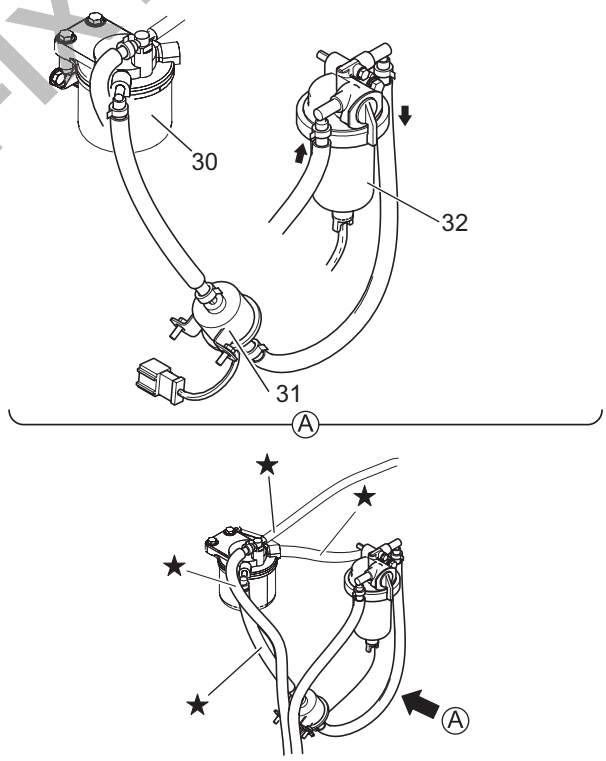


Fig. 33-58 Fuel hose removal

30. Fuel filter
31. Fuel feed pump
32. Water separator

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33.2.2.5 PRECAUTIONS WHEN ASSEMBLING

⚠ CAUTION

Precautions (Observe the following for safety.)

(1) The unevenness of tightening torque and the contamination by dust during assembly may cause a failure. And observe the tightening torque specified in the description.

(2) When assembling, check up on the valve construction drawing, identify the number of part, and ensure that there is no installation error and omission of part, etc.

(3) After cleaning the parts required to use with cleaning solvent, immerse them in hydraulic oil as required and re-assemble them.

(4) Before applying Loctite, clean and decrease the surface sufficiently, and apply it to two threads. (Over application may cause a malfunction due to the squeezing out.)

33.2.2.6 PRECAUTIONS WHEN FITTING SEALS

⚠ CAUTION

Precautions (Observe the following for safety.)

(1) Replace seals with new ones when assembling.

(2) Ensure that seals are free from deformation and flaw coming about when handling them.

(3) Apply grease or hydraulic oil to the seals and seal fitting section to make the sliding smooth, unless otherwise specified.

(4) Do not stretch the seals too much. Otherwise they may be permanently deformed.

(5) Pay attention not to roll the O-ring when fitting. Because it is difficult for the twisted O-ring to be restored naturally after fitting, and it may cause oil leakage.

33.2.2.7 ASSEMBLY WORK

(1) Perform assembling work referring to the drawings in "Disassembly" Section.

(2) Assembling procedure

1) Assembling the main frame of the switching section (See Fig. 33-79.)
Put all sections of main frame in order as shown in Table 33-2 directing the actuator port downward.

SECTION (Block)	MARK AQ10
Dozer	SR
Slewing	AN
P3 inlet	ND
Arm	bB
Service	bC
B/Swing	bD
Travel RH	DG
P1, P2 inlet	FE
Travel LH	OC
Boom	QA
Bucket	AT
End cover	HD

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33.2.6.2 DISASSEMBLY AND ASSEMBLY

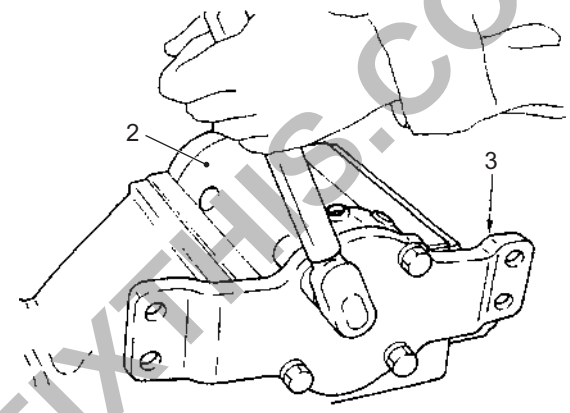
33.2.6.2.1 General precautions

- For disassembly and assembly, select the clean area and prepare clean containers to put the removed parts.
- Clean around the port and remove the paints of the joint with wire brush.
- Clean the removed parts with cleaning solvent, like light oil, etc.
- Replace seals with new ones every disassembly, and apply grease lightly.
- Check every part for severe wear and seizure, and remove burr, etc. with emery paper.
- Check that seal groove is free from foreign substances, dust, etc.

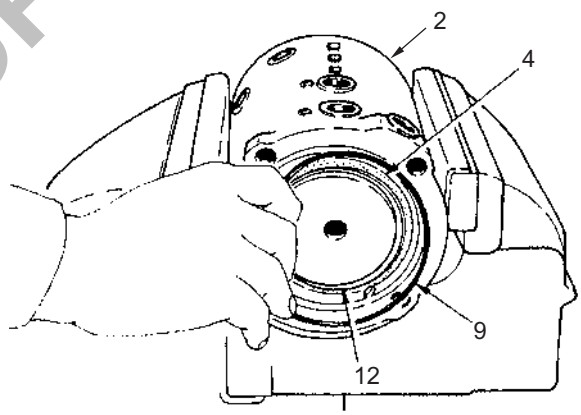
33.2.6.2.2 Disassembly

(1) Loosen bolt and remove flange (3).
Fix the body (2) with vise.

: 17 mm
or
: 17 mm

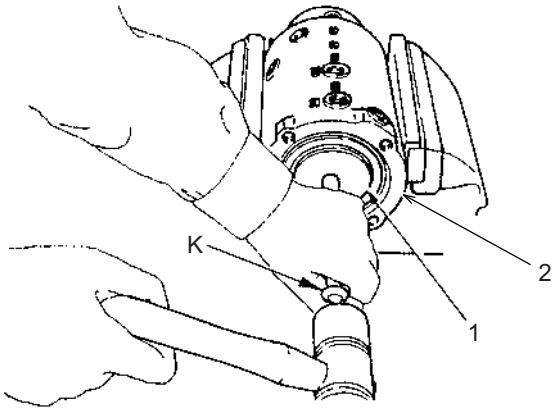


(2) Take out O-ring (9), snap ring (12) and spacer (4) from the body (2).



(3) Remove shaft (1) from the body (2).
- Apply the knock pin (K) to the end face of the shaft, and strike it with hammer.
- Choose the knock pin (K) made of copper, plastic, etc.

K. Knock pin



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34.1.9 SPROCKET

34.1.9.1 REMOVAL AND INSTALLATION PROCEDURES

34.1.9.1.1 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).

: 22 mm

Single weight of sprocket (2): 14 kg (31 lbs)

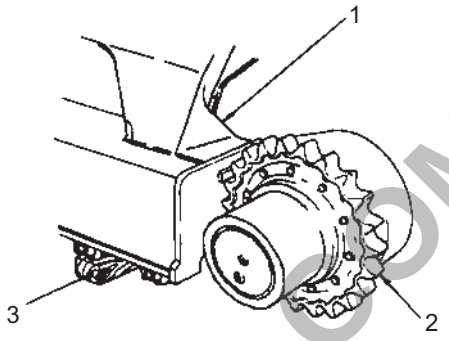


Fig. 34-74 Making sprocket free

34.1.9.1.2 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 capscrew to mount the capscrews (4) and fasten then 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).

: 22 mm, T=181 N•m (133 lbf•ft)

(4) Install crawler.

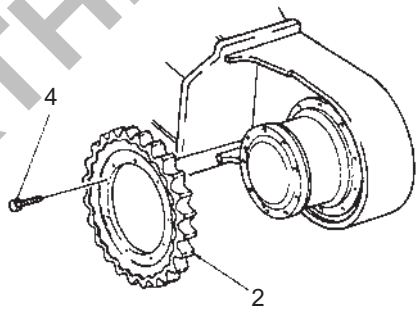


Fig. 34-75 Removing sprocket

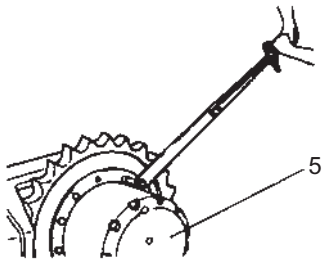


Fig. 34-76 Tightening capscrew

34.1.9.2 MAINTENANCE STANDARDS

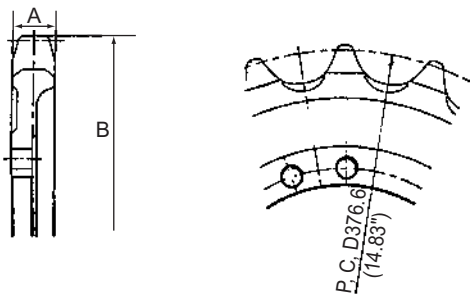


Fig. 34-77 Sprocket

Unit: mm (in)

Code	ITEM	STANDARD VALUE	REPAIRABLE LEVEL	SERVICE LIMIT	REMEDY
A	Width of sprocket teeth	32 (1.26)	29 (1.14)	27 (1.06)	Replace
B	O.D. of sprocket	ø435.8 (17.16)	ø429 (16.9)	ø427 (16.8)	Welded repair, or replace

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42. TROUBLESHOOTING (HYDRAULIC SYSTEM)

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42.3.3 SLEWING OPERATION 42-10
42.3.4 PUMP 42-11

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SAFETY PRECAUTIONS

(1) SERVICE AREA

⚠ WARNING



Sufficient Ventilation

Inhalation of exhaust fumes and dust particles may be hazardous to ones health. Running engines welding, sanding, painting, and polishing tasks should be only done in well ventilated areas.

⚠ CAUTION

Safe / Adequate Work Area

The service area should be clean, spacious, level and free from holes in the floor, to prevent “slip” or “trip and fall” type accidents.

⚠ CAUTION



Bright, Safely Illuminated Area

The work area should be well lit or illuminated in a safe manner. For work in enclosed or dark areas, a “drop cord” should be utilized. The drop cord must have a wire cage to prevent bulb breakage and possible ignition of flammable substances.

⚠ CAUTION



Safety Equipment

Fire extinguisher(s), first aid kit and eye wash / shower station should be close at hand (or easily accessible) in case of an emergency.

(2) WORK – WEAR (GARMENTS)

⚠ CAUTION



Safe Work Clothing

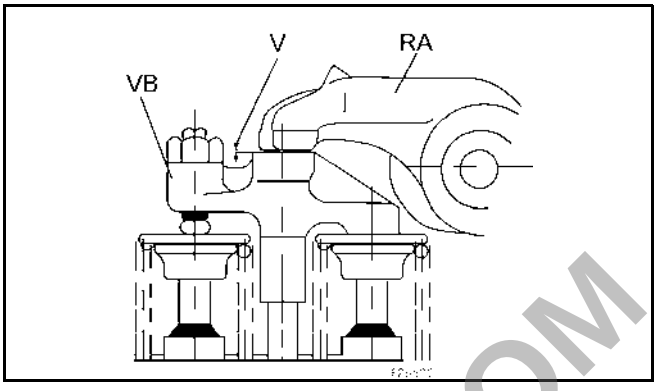
Appropriate safety wear (gloves, special shoes/boots, eye/ear protection, head gear, harness’, clothing, etc.) should be used/worn to match the task at hand. Avoid wearing jewelry, unbuttoned cuffs, ties or loose fitting clothes around moving machinery. A serious accident may occur if caught in moving/ rotating machinery.

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• Valve clearance measurement
In case of 2-valve cylinder head insert a thickness gauge between the rocker arm and valve cap, and record the measured valve clearance. In case of 4-valve head insert a thickness gauge between the rocker arm and the valve bridge, and record the measured valve clearance. (Use it as the data for estimating the wear state.)

• Adjusting other cylinders
In case of 4-cylinder engines, turn the crankshaft 180° and make adjustment for the No.3 cylinder. Then adjust the No.4 and No.2 cylinders in this order. The cylinder to be adjusted first does not have to be the No.1 cylinder. Select and adjust the cylinder where the piston is the nearest to the top dead center after turning, and make adjustment for other cylinders in the order of ignition by turning the crankshaft 180° each time. In case of 3-cylinder engines, turn the crankshaft 240° and make adjustment for the No.3 cylinder. Then adjust the No.2 cylinder in this order.



RA. Rocker arm
V. Valve clearance
VB. Valve bridge

The cylinder to be adjusted first does not have to be the No.1 cylinder. Select and adjust the cylinder where the piston is the nearest to the top dead center after turning, and make adjustment for other cylinders in the order of ignition by turning the crankshaft 240° each time.
The adjustment method of reducing the flywheel turning numbers (for reference):
For 3 cylinder engines
Set No.1 cylinder to the compression T.D.C.and adjust the clearance of the ● mark of the below table. Next, turn the flywheel once (the suction / exhaust valve of No.1 cylinder is in the position of the overlap T.D.C. at this time), and adjust the clearance of the ❍ mark.

Ignition order of 3 cylinder engines: 1→3 →2

Cylinder No.	1		2		3		
Valve	Suction	Exhaust	Suction	Exhaust	Suction	Exhaust	
No.1 compression T.D.C	●	●	●			●	The first time
No.1 overlap T.D.C				❍	❍		The second time

For 4 cylinder engines
Set No.1 cylinder to the compression T.D.C. and adjust the clearance of the ● mark of the bottom table.
Next, turn the flywheel once, and adjust the clearance of the ❍ mark.

Ignition order of 3 cylinder engines: 1→3 →4 →2

Cylinder No.	1		2		3		4		
Valve	Suction	Exhaust	Suction	Exhaust	Suction	Exhaust	Suction	Exhaust	
No.1 compression T.D.C	●	●	●			●			The first time
No.4 compression T.D.C				❍	❍		❍	❍	The second time

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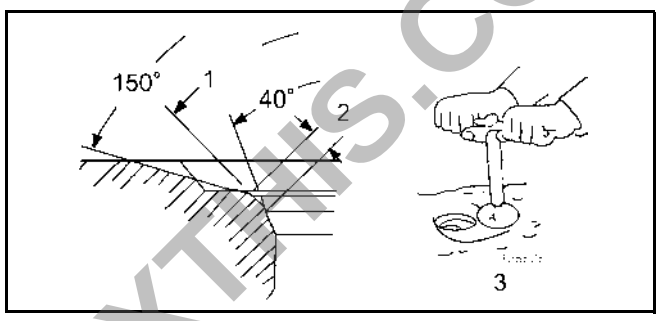
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51.4.2.6 Valve seat correction

NOTE: Always check the oil clearance between the valve and valve guide before correcting the valve seat. If it exceeds the limit, replace the valve or valve guide first to make the clearance satisfy the standard.
After correction, wash the valve and the cylinder head sufficiently with diesel oil to remove all grinding powder or compound.

1. If the seat surface is slightly roughened: perform (A) and (B) below.
   (A)**:** Lap the valve and seat with a mixture of valve compound and engine oil.
   (B)**:** Lap with engine oil only.
2. If the seat is heavily roughened but the width is almost normal, correct with a seat grinder or seat cutter first. Then perform lapping (A) and (B).

	Intake	Exhaust
Seat cutter angle	120	90



1. Seat angle
2. Seat width
3. Seat cutter

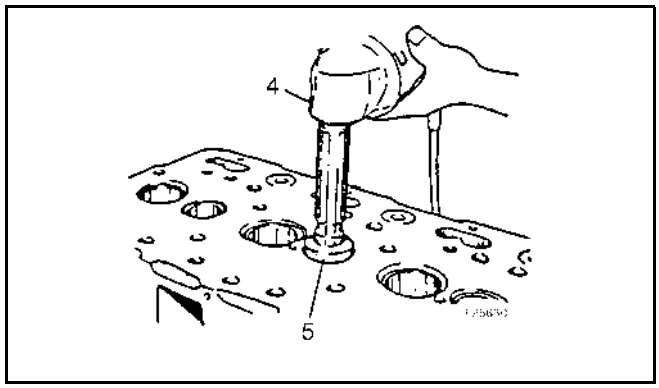
3. If the seat is heavily roughened and the width is much enlarged, grind the seat inner surface with a seat grinder whose center angle is 40°, then grind the seat outer surface with a grinder whose center angle is 150° to make the seat width match the standard. Then perform seat correction as described in 2), and then carry out lapping (A) and (B).

	θ1	θ2
Grinding wheel angle	40	150

51.4.2.7 Valve guide replacement

1. Use a valve guide extraction tool (51.12.1-1) and extract the valve guide from the cylinder head.
2. Put liquid nitrogen or ether (or alcohol) with dry ice added in a container and put the valve guide for replacement in it for cooling. Then insert it in with a valve guide inserting tool (Refer to No.2 of 51.4.1.2).

⚠ CAUTION
Do not touch the cooled valve guide with bare hands to avoid skin damage.



4. Grinder
5. Grindstone

3. Check the inside diameter and finish to the standard inside diameter as required with a reamer.

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51.8.1.3 Structural and functional outline

No.	Part name	No.	Part name
1	Turbine shaft	11	Turbine housing
2	Oil thrower	12	M6 hexagon bolt
3	Turbine side seal ring	13	Turbine side clamp
4	Seal plate	14	Lock washer
5	Journal bearing	15	Bearing housing
6	Thrust bearing	16	Retaining ring
7	Compressor housing	17	M3 countersunk flat head screw
8	M5 hexagon bolt	18	Compressor wheel
9	M5 spring washer	19	Shaft end nut
10	Compressor side clamp	20	Heat protector

1. Turbine

   The exhaust gas from the engine is accelerated at the nozzle portion in the turbine housing and blown onto the turbine impeller to rotate the turbine shaft. This is called the turbine. A seal ring and heat insulating plate are installed to prevent the bearing from adverse influence of the gas.

2. Compressor

   The compressor impeller installed on the turbine shaft rotates with the shaft to suck and compress air for feeding into the intake manifold.
   This is called the blower or compressor.

3. Bearings

   Thrust bearing

   As the turbine shaft is constantly applied with a thrust force, this bearing prevents the shaft from being moved by the thrust force.

   Radial bearing

   A floating bearing is adopted. Since the bearing moves with the turbine shaft as the oil films are formed both inside and outside the bearing, the bearing sliding speed is slower than the turbine shaft speed, resulting in higher dynamic stability.

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51.9.2.7 Assembly

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

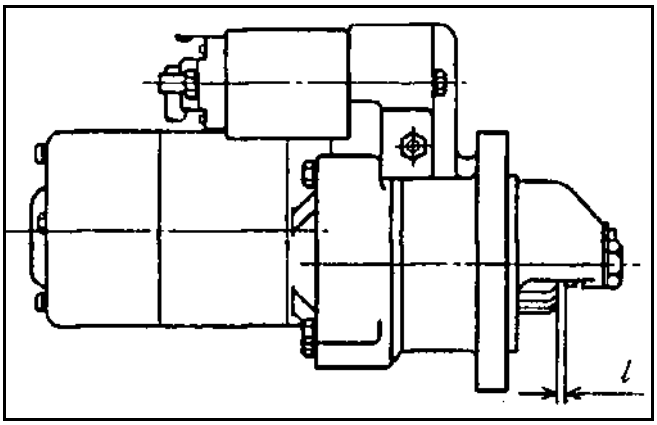
1. Apply grease as instructed below.

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 appropriate thrust is from 0.05 to 0.3 mm. If it is over 0.3 mm, and the appropriate thrust washer, but pay attention so that the thrust is not 0.

51.9.2.8 Adjustment

1. Pinion projection length L by magnetic switch



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