E20.2SR - E22.2SR - E27.2SR

WORKSHOP MANUAL
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EVOLVING TECHNOLOGY

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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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2.3 SPECIFICATIONS AND PERFORMANCE

SPEED AND GRADEABILITY

Model		E20.2SR / E22.2SR				E27.2SR			
Applicable machines		PM07-07001~				PV10-27001~			
Shoe Type		Rubber shoe		Iron shoe (OPT)		Rubber shoe		Iron shoe (OPT)	
Slewing Speed	min^{-1} {rpm}	8.7 {8.7}				8.7 {8.7}			
Travel Speed	km/h (mph)	Low (1st)	High (2nd)	Low (1st)	High (2nd)	Low (1st)	High (2nd)	Low (1st)	High (2nd)
		2.3	4.1	2.3	4.1	2.3	4.1	2.3	4.1
Gradeability	% (degree)	58 (30)							

ENGINE

Model (YANMAR)		3TNV82A-SYB
Type		Water-cooled, 4-cycle type Swirl chamber type diesel engine
Number of cylinders-Bore × Stroke		3 - ø82 mm × 84 mm (3.23 in × 3.31 in)
Total Displacement	L	1.330 (81.2 cu•in)
Output Rating	kW/min^{-1} {PS/rpm}	15.9 / 2200 {21.6/2200}
Intermediate Torque (Net)	N•m/min^{-1} (lbf•ft/rpm)	79.0 ~ 86.0 / 1320 ± 100 (58.3 ~ 63.4 / 1320 ± 100)
Starting Motor	V × kW	12 × 1.7
Generator	V × A	12 × 40

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	55°	
	Left	70°	
Stroke of Dozer (above/below)	mm (in)	425 / 290 (16.7/11.4)	445 / 335 (17.5/13.2)

WEIGHT

Machine Weight	kg (lb)	Rubber shoe	Iron shoe	Rubber shoe	Iron shoe
		2100 (4630)	2240 (4940)	2490 (5490)	2620 (5780)
Upper slewing body	kg (lb)	1090 (2400)	←	1310 (2890)	←
Travel system	kg (lb)	720 (1590)	850 (1870)	830 (1830)	960 (2120)
Attachment (Boom+STD Dipper+STD Bucket)	kg (lb)	240 (530)		300 (660)	
Oil & Water	kg (lb)	50 (110)		←	

Note: This figure is calculated with standard bucket.

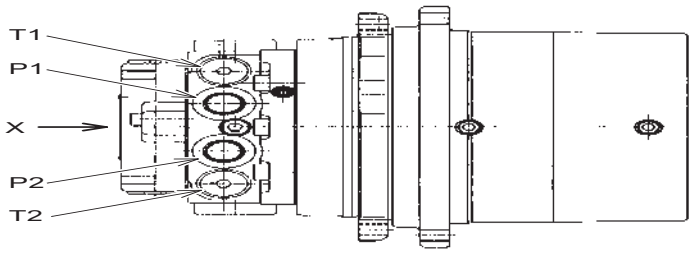
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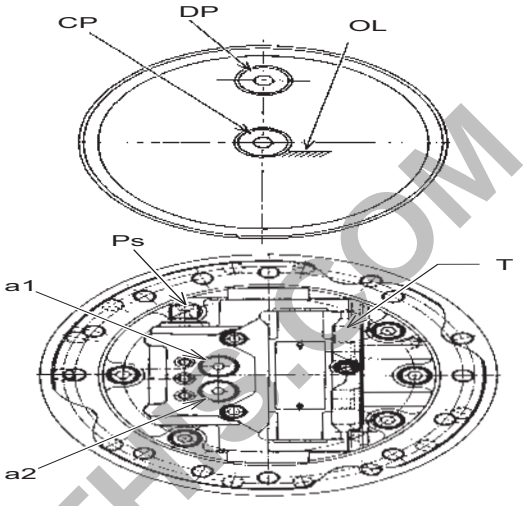
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24.1.6 TRAVEL MOTOR

24.1.6.1 SPECIFICATIONS

1. General View





E. Fill / drain port
F. Level line
G. Check port
T. Fill to this level with hydraulic oil

No.	NAME	SIZE
P1, P2	Hydraulic oil fill / drain port	PF1/2
T1, T2	Drain port	PF1/4
P	1st / 2nd speed select port	PF1/4
a1, a2	Pressure gauge port	PF1/8

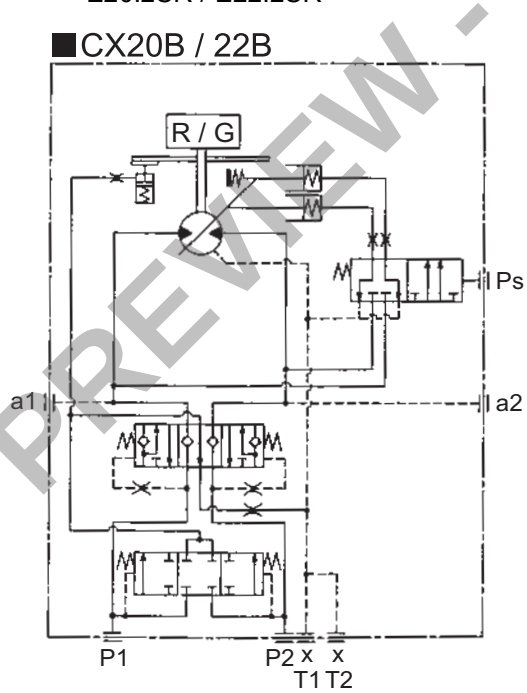
The relation between rotating direction of reduction unit and oil inlet and outlet port (View from X side)

Rotating direction	Oil inlet port	Oil outlet port
Clockwise	P2	P1
Counterclockwise	P1	P2

2. Hydraulic circuit

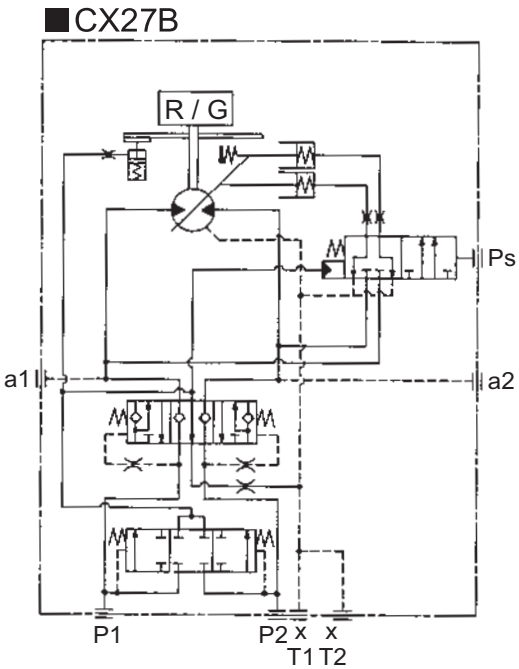
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■CX20B / 22B



E27.2SR

■CX27B



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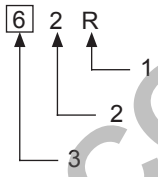
23.1 HOW TO READ CIRCUIT DIAGRAM AND HARNESS CONNECTION

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 = mm^2) unless otherwise specified.

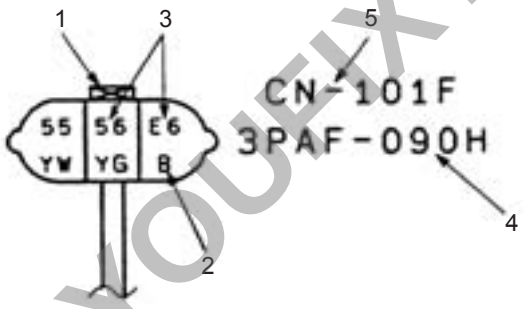
Symbol	Color	Symbol	Color
B	BLACK	O	ORANGE
G	GREEN	Br	BROWN
L	BLUE	Lg	LIGHT GREEN
R	RED	Gr	GRAY
W	WHITE	Sb	SKY BLUE
Y	YELLOW	V	VIOLET
P	PINK		



1. Wire color red
2. Wire size 2 sq (mm^2)
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:

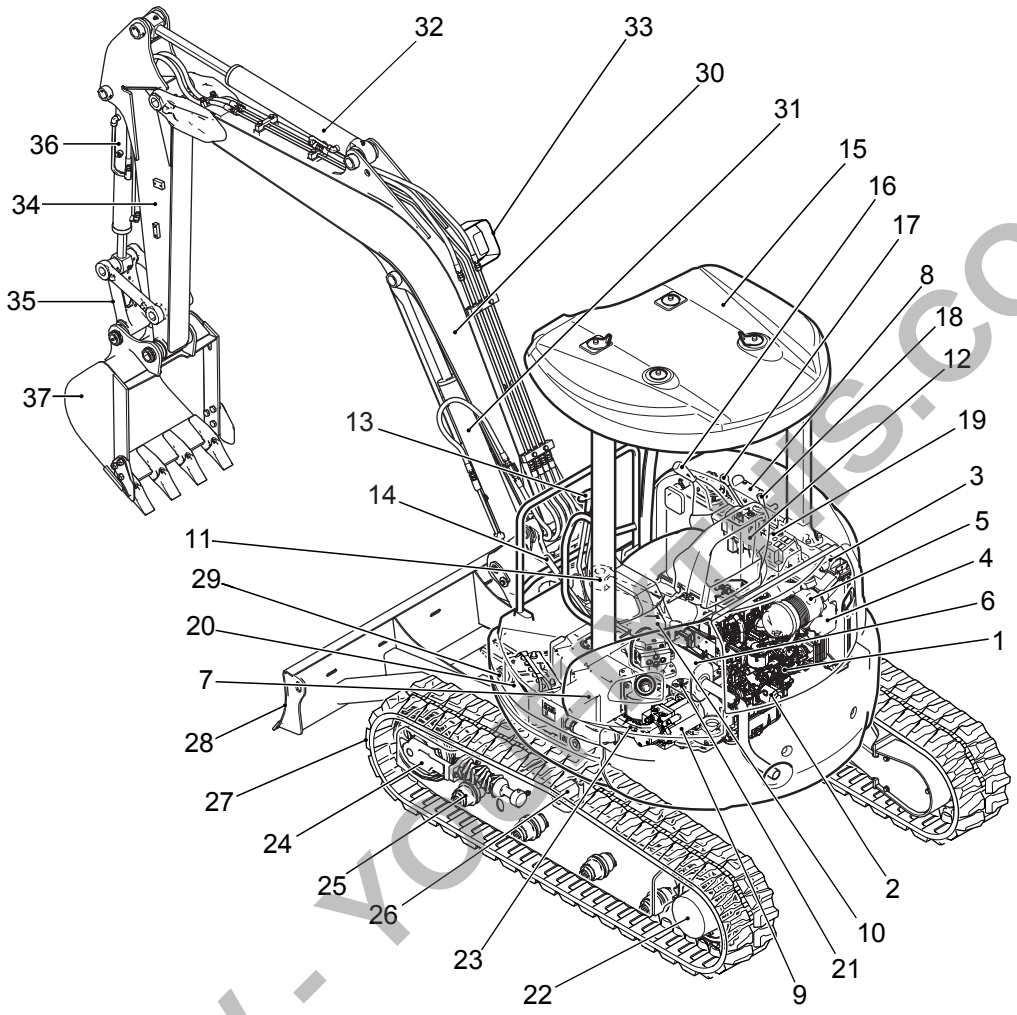
1) ═══ : After roughly applying harness taping, wires are installed in a corrugated tube.
2) ——— : Harness taping by two plies.
3) ——— : No harness treatment for connection.

(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.

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2.1 COMPONENTS NAME



No.	NAME	No.	NAME	No.	NAME	No.	NAME
1	Engine	2	Oil filter	3	Radiator	4	Reservoir tank
5	Air cleaner	6	Muffler	7	Fuel tank	8	Hydraulic reservoir
9	Hydraulic pump	10	Slewing motor	11	Swing cylinder	12	Control valve
13	Travel lever	14	Safety lock lever	15	Canopy	16	Operating lever
17	Dozer operating lever	18	Throttle lever	19	Monitor panel (gauge cluster)		
20	Battery	21	Swivel joint	22	Travel motor	23	Slewing bearing
24	Idler assy	25	Lower roller	26	Upper roller	27	Rubber track
28	Dozer blade	29	Dozer cylinder	30	Boom	31	Boom cylinder
32	Dipper cylinder	33	Light	34	Dipper	35	Link
36	Bucket cylinder	37	Bucket				

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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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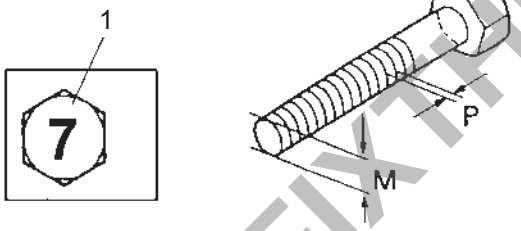
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11.1 TORQUE SPECIFICATIONS FOR CAPSCREWS & NUTS

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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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:
57 kg (126 lbs) — E20.2SR / E22.2SR
64 kg (141 lbs) — E27.2SR

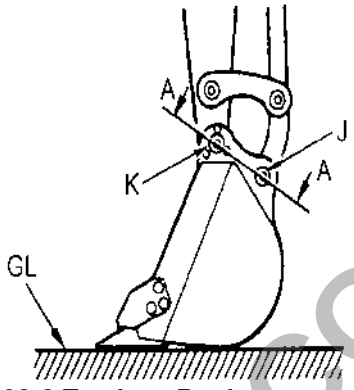


Fig. 32-2 To place Bucket on ground

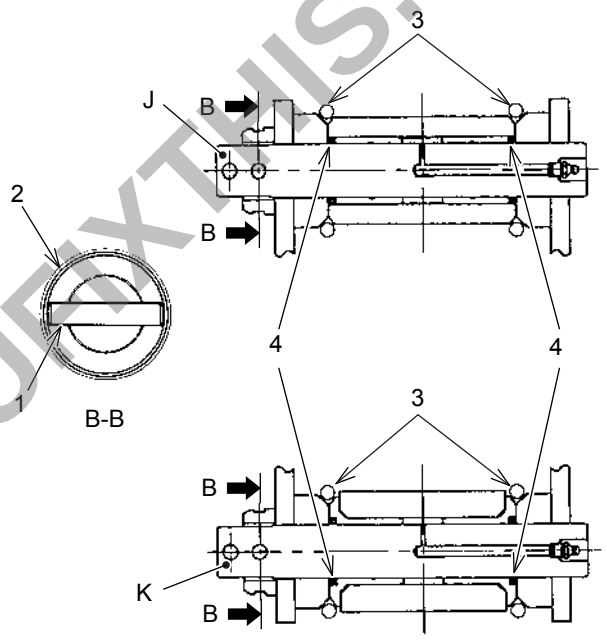


Fig. 32-3 Assembly of pin (A-A)

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

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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			✪ 2nd time and thereafter			
	Lube oil filter replacement		✪ 1st time				
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 recharging		❍				
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.

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3.1.2 BOOM MAINTENANCE STANDARDS

(1) Clearance of pin and bushing on boom section

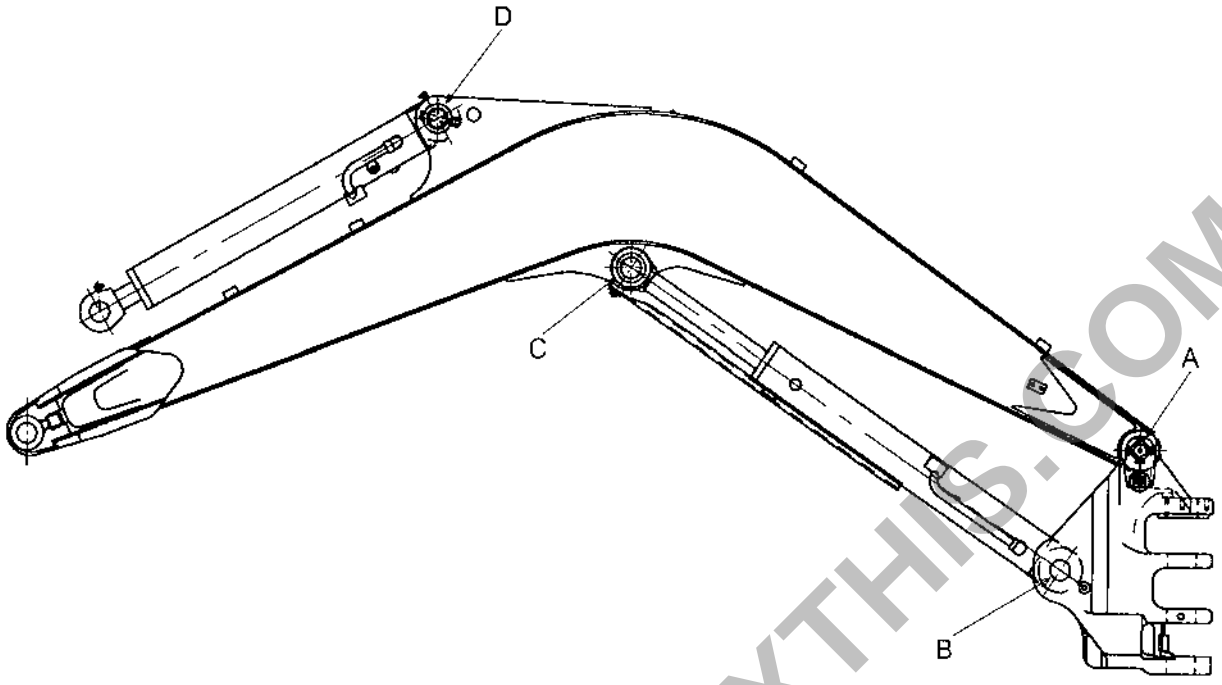


Fig. 3-2 Clearance of pin and bushing on boom section

Table 3-2

- E20.2SR / E22.2SR

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	Boom	ø40 (1.5748)	–0.02 –0.05 (-0.0008) (-0.0020)	+0.06 +0.01 (+0.0024) (+0.0004)	0.03~ 0.11 (0.0012~ 0.0043)	0.7 (0.028)	1.0 (0.039)	Replace bushing or pin
B	Boom cylinder (Head side)		–0.02 –0.08 (-0.0008) (-0.0031)	+0.18 +0.05 (+0.0071) (+0.0020)	0.07~ 0.26 (0.0028~ 0.0102)			
C	Boom cylinder (Rod side)		–0.02 –0.05 (-0.0008) (-0.0020)	+0.18 +0.05 (+0.0071) (+0.0020)	0.09~ 0.23 (0.0028~ 0.0091)			
D	Dipper cylinder (Head side)	ø35 (1.3780)						

(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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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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3.5.2 SWING PORTION MAINTENANCE STANDARDS

(1) Clearance of pin and bushing

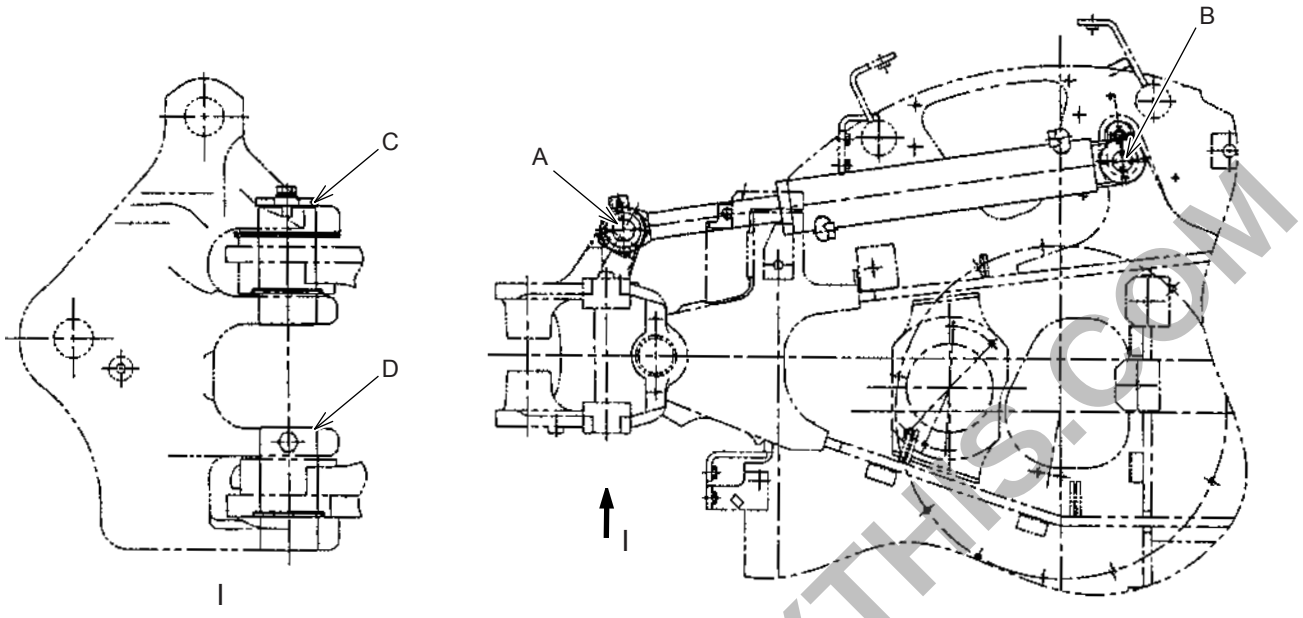


Fig. 3-13 Clearance of pin and bushing on swing portion

Table 3-20

Unit: mm (in)

Pos.	Item	Standard dimension			Clearance			Remedy
		Pin dia.	Tolerance on pin dia.	Tolerance on bushing bore dia.	Standard value	Standard value for repair	Serviceability limit	
A	Swing cylinder (Rod side)	ø35 (1.378)	–0.02 –0.05 (-0.0008) (-0.0020)	+0.10 0 (+0.0039) (0)	0.02~ 0.15 (0.0008~ 0.0059)	0.7 (0.028)	1.0 (0.039)	Replace bushing or pin
B	Swing cylinder (Head side)							
C	Swing center (Upper side)	ø60 (2.362)		+0.11 +0.03 (+0.0043) (+0.0012)	0.05~ 0.16 (0.0020~ 0.0063)			
D	Swing center (Lower side)							

(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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22.3.8 SWING OPERATING CIRCUIT

(Refer to Fig. 71-8)

Cable driving system with operating pedal

22.3.8.1 Swing (left) Operating Circuit

(1) Swing Operation

When depress the left side of swing pedal, the swing valve spool in control valve (2) is shifted by the cabling mechanism. Since the pilot oil pressure is not utilized for it is activated regardless to the safety lock lever.

(2) Main Circuit

1) Supply Circuit for Cylinder (8)
The delivered oil from A2 port on variable pump enters into P2 port on control valve (2), and comes out from A5 port through cylinder valve, and is supplied to the head side of cylinder (8) to activate the swing (left).

a. At activation of the swing valve spool for both left and right swing motions, a part of appropriate volume of oil is returned to the tank through the P2 bypass circuit due to the throttle effect on the spool.
Then supplying volume of oil to the cylinder is restricted to ensure the slow and stable swing motions for both leftward and rightward.

22.3.9 DOZER OPERATING CIRCUIT

(Refer to Fig. 71-9)

Pilot oil system with operating lever

22.3.9.1 Dozer Down Operating Circuit

(1) Dozer Operation

When the operating lever is pushed forward, the pilot secondary pressure is generated from the pilot valve (14) to shift the dozer valve spool through the Pb1 port of the control valve (2).

(2) Main Circuit

1) Supply Circuit for Cylinder (9)
The oil delivered from A3 port of the hydraulic pump (1) enters into P3 port on control valve (2), and is led to B1 port through dozer valve. The pressurized oil passed through swivel joint (10) is supplied to the head side of dozer cylinder (9) to activate dozer down motion.

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24.1.4.4 HYDRAULIC CIRCUIT

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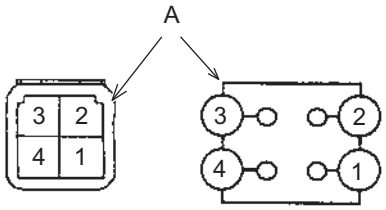
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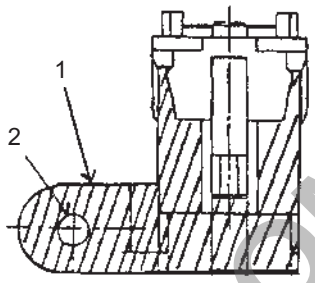
Code No. Parts Name Use	Specifications	Description

E-15

Fuse box
(For cooler)

Fuse (OPT)





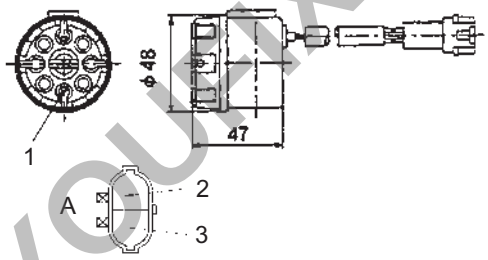
Fuse	20A blade X 2

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

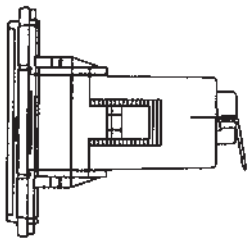
No.	NAME
1	Weep hole X 2
2	Power source (+) (Pink)
3	Power source (-) (Black)
A	Amp econo seal mark II water proof 2PM

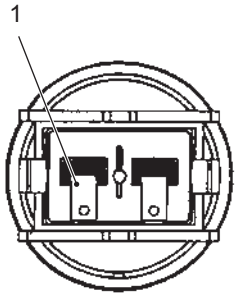
E-26

Hour meter

Service meter







Movement	Quartz
Rated voltage	10~80V CD

No.	NAME
1	Terminal parts Connector parts

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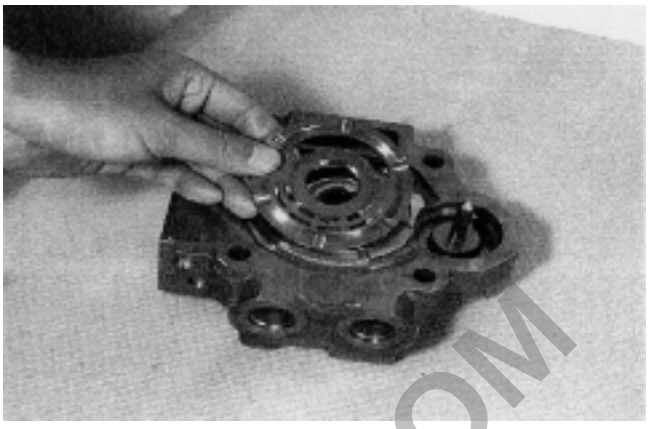
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33. UPPER SLEWING STRUCTURE

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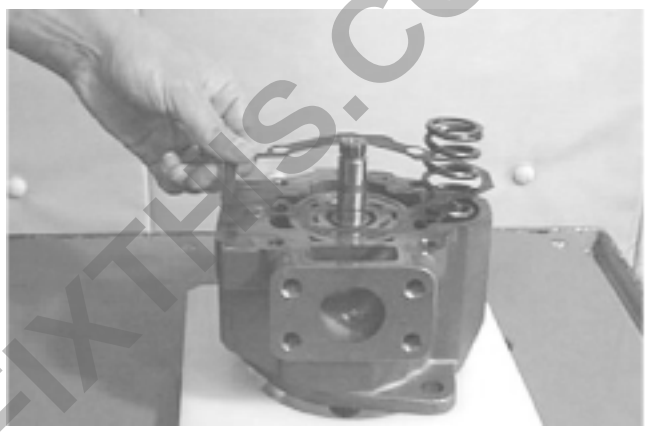
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b) Apply grease on the rear surface of the control plate to prevent it from dropping and place it in the cover aligning the hole for positioning pin.

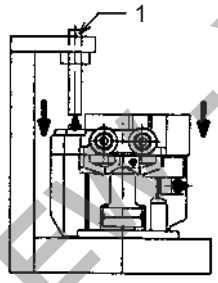


8) Installing cover

a) Fit the packing.



b) Tighten the hexagonal socket (1) set screw of the jig slowly keeping the cover horizontal and install the cover.

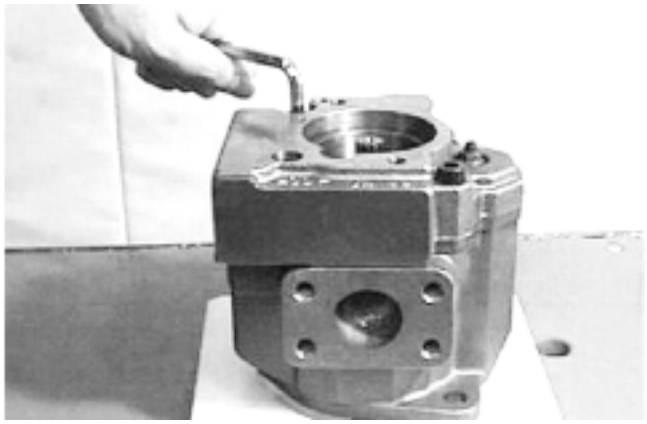




c) Fasten the cover with three M10×50 and one M10×40 capscrews.

: 8 mm

Tightening torque: 55~59 N•m (41~44 lbf•ft)



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(3) Valve

Part name	Maintenance standard
Piston (53-14) Casing (20)	1. Severe flaw of sliding section and roughness of sliding surface 2. Too large gap between piston and case hole Upper limit of diameter clearance: 0.04 mm (0.0016")
Spring (50) Spring (55)	1. Severe breakage and deformation
Plug (56, 53-6) Check valve (54) O-ring (53-8 to 53-11) (57) Back up ring (53-12, 53-13) O-ring (48-2 to 48-4) (51)	1. Flaw causing oil leakage, flaw causing insufficient sealing and permanent deformation.

(4) Others

Part name	Maintenance standard
Other plug and O-ring	1. Flaw causing oil leakage, flaw causing insufficient sealing and permanent deformation.

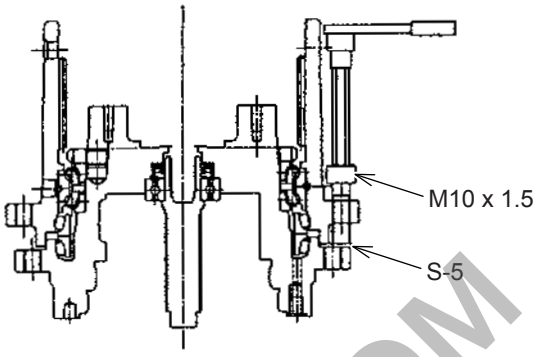
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8) Attach jig between flange holder (1) and housing (6), and tighten 3 bolts M10× 1.5 uniform from the housing side.

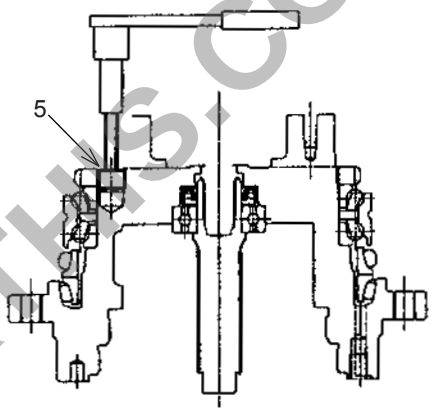
: 8 mm

Jig: S-5



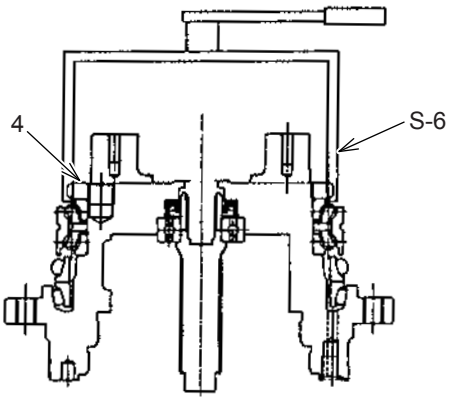
9) Remove plug (5).

: 6 mm



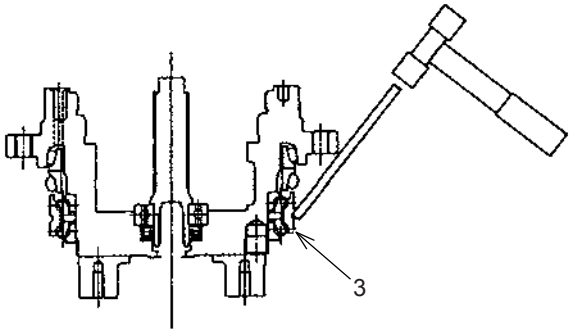
10) Remove ring nut (4).

Jig: S-6



11) Apply pry-bar to the groove for steel balls (7), and remove angular bearing (3) striking it by hammer.

Jig: Pry-bar



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Group	Code	Part Name
Relay	R-14	SLEW/SWING SELECT RELAY
	R-22	SW. SELECT RELAY
	R-23	SLEW/SWING PRESER VATION RELAY
	R-24	NIBBLER OPEN RELAY
	R-25	NIBBLER CLOSE RELAY
Sensor	SE-1	FUEL SENSOR
	SE-2	ENGINE THERMO SENSOR
Solenoid	SV-1	LEVER LOCK SOL.
	SV-2	2-SPEED SELECT SOL.
	SV-3	E/G STOP SOL.
	SV-5	POWER SHIFT SOL. (Cooler Spec)
	SV-9	NIBBLER OPEN SOL.
	SV-10	NIBBLER CLOSE SOL.
	SV-12	SLEW/SWING SELECT SOL.
Switch	SW-1	KEY SWITCH
	SW-2	WORKING LIGHT SW.
	SW-3	2-SPEED SELECT SW.
	SW-4	WIPER WASHER SW.
	SW-5	E/G COOLANT TEMP. SW.
	SW-6	E/G OIL PRESSURE SW.
	SW-7	HORN SW.
	SW-9	LEVER LOCK SW.
	SW-10	HEATER SW. (OPT)
	SW-11	DECELERATION SW.
	SW-15	HI,LOW PRESS SW.
	SW-16	CONDENSER SPEED SHIFT SW.
	SW-23	TRAVEL ALARM SELECT SW. (OPT)
	SW-24	TRAVEL RIGHT (FORWARD) PRESSURE SW. (OPT)
	SW-25	TRAVEL RIGHT (REVERSE) PRESSURE SW. (OPT)
	SW-26	TRAVEL LEFT (FORWARD) PRESSURE SW. (OPT)
	SW-27	TRAVEL LEFT (REVERSE) PRESSURE SW. (OPT)
	SW-28	SLEW/SWING SELECT SW.
	SW-30	SLEW/SWING LEVER PRESS. SW.(LEFT)
	SW-31	SLEW/SWING LEVER PRESS. SW.(RIGHT)
	SW-33	NIBBLER OPEN SW.
	SW-34	NIBBLER CLOSE SW.
Fuses	F-1	WIPER HEATER 30A
	F-2	RELAY SOLENOID 10A
	F-3	WORKING LIGHT 30A
	F-4	HORN ROOM LAMP30A
	F-5	ENGINE STOP SOLENOID 30A
	F-6	BATTERY RELAY GAUGE CLUSTER 10A

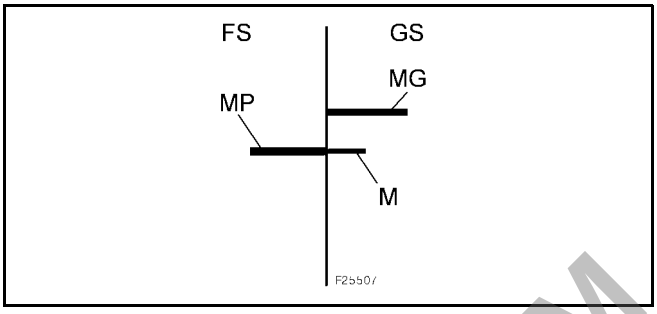
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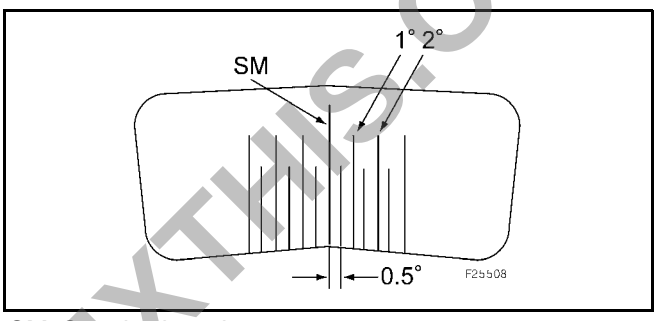
- Before removing a fuel pump drive gear, make ID marks on the gearing part of the pump drive gear and the idle gear with paint and so on.
- Make the mark-off line to the gear case precisely in accordance with the position of mark-off line o the fuel pump.
- Before removing a fuel pump, put the standard mark of a sticker for fuel injection angle adjustment in accordance with the mark-off line of the fuel pump 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)

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

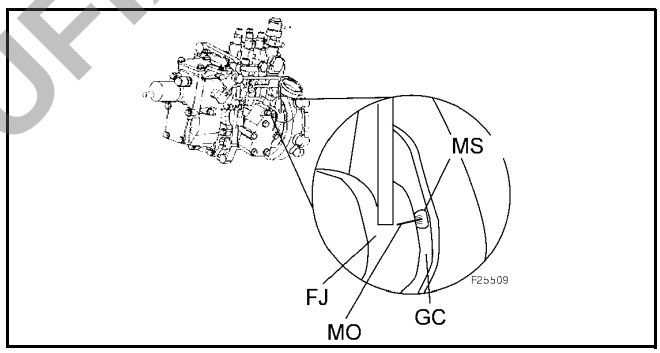
- Put the fuel pump on the gear case temporarily and install the drive gear on the camshaft with checking the ID marks, which were put on the fuel pump drive gear and the idle gear at the time of the disassembling.



FS. Fuel pump side
GS. Gear case side
M. Marking
MG. Mark-off line on gear case
MP. Mark-off line on fuel pump



SM. Standard mark



FJ. Fuel injection pump
GC. Gear case
MO. Mark-off line
MS. Mark sticker

Tighten the installation nut of a pump drive gear.

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

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Crankpin

mm

Model & Item		Standard	Limit
3TNV82A	Pin outside diameter	42.952~42.962	42.902
	Metal thickness	1.487~1.500	-
	Oil clearance	0.038~0.090	0.150
TNV84~88	Pin outside diameter	47.952~47.962	47.902
	Metal thickness	1.492~1.500	-
	Oil clearance	0.038~0.074	0.150
4TNV94L·98	Pin outside diameter	57.952~57.962	57.902
	Metal thickness	1.492~1.500	-
	Oil clearance	0.038~0.074	0.150
4TNV106(T)	Pin outside diameter	63.952~63.962	63.902
	Metal thickness	1.984~1.992	-
	Oil clearance	0.054~0.090	0.150

If the oil clearance exceeds the limit, use an undersized bearing.

Undersized crankpin bearing (0.25 mm)

Model	Standard thickness (mm)
3TNV82A	1.612~1.625
TNV84~88	1.617~1.625
4TNV94L·98	1.617~1.625
4TNV106(T)	2.109~2.117

Pin machining dimension

Model	Pin machining dimension (mm)
3TNV82A	Ø 42.702~42.712
TNV84~88	Ø 47.702~47.712
4TNV94L·98	Ø 57.702~57.712
4TNV106(T)	Ø 63.702~63.712

Crank journal

mm

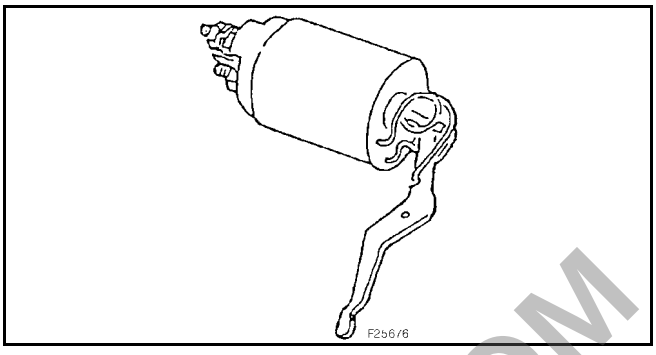
Model & Item		Standard	Limit
3TNV82A	Journal O.D.	46.952~46.962	46.902
	Metal thickness	1.987~2.000	-
	Oil clearance	0.038~0.080	0.150
TNV84~88 (Selective assembly)	Journal O.D.	53.952~53.962	53.902
	Metal thickness	1.995~1.990	-
	Oil clearance	0.038~0.068	0.150
4TNV94L·98 (Selective assembly)	Journal O.D.	64.952~64.962	64.902
	Metal thickness	1.995~2.010	-
	Oil clearance	0.038~0.068	0.150
4TNV106(T) (Selective assembly)	Journal O.D.	75.952~75.962	75.902
	Metal thickness	2.488~2.503	-
	Oil clearance	0.052~0.082	0.150

If the clearance limit is exceeded, use an undersized bearing.

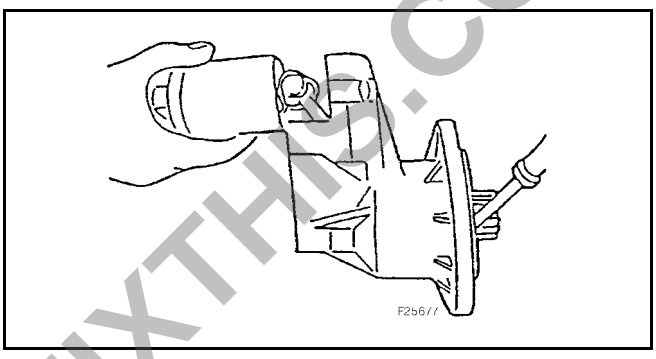
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2. Magnetic switch assembly
   • Install the shift lever on the magnetic switch with the torsion spring in-between.



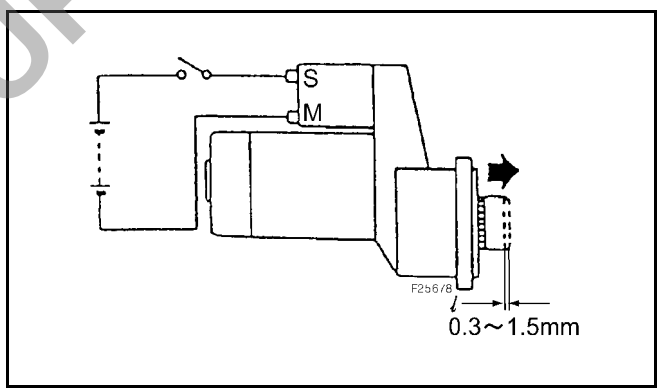
   • For installation on the gear case, install the magnetic switch with the shift lever on the gear case after pulling the pinion out. Fix the magnetic switch by tightening a built-in bolt M6.
   Do not forget to install the dust cover (adjusting shim).



3. Pinion projection length
   Connect the positive (+) lead from the battery to terminal S and negative (-) lead to terminal M. Turn the switch ON and measure the pinion moving distance L in the thrust direction.
   Perform this test within 10 seconds.

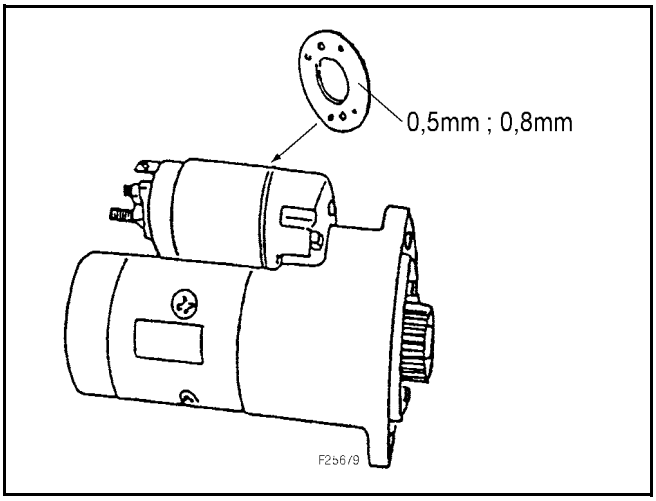
mm

	Standard
L	0.3~1.5



NOTE: Before measuring the dimension, pull the pinion out lightly in the direction of the arrow.

If the measured L dimension is outside the standard range, either insert or remove the dust cover (adjusting shim 0.5 mm, 0.8 mm) for adjustment.



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