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2.3 SPECIFICATIONS AND PERFORMANCE

SPEED AND GRADEABILITY

Shoe Type		Rubber crawler belt		Iron crawler belt	
Slewing Speed	min^{-1}	8.6			
		Low (1st)	High (2nd)	Low (1st)	High (2nd)

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23. ELECTRICAL SYSTEM

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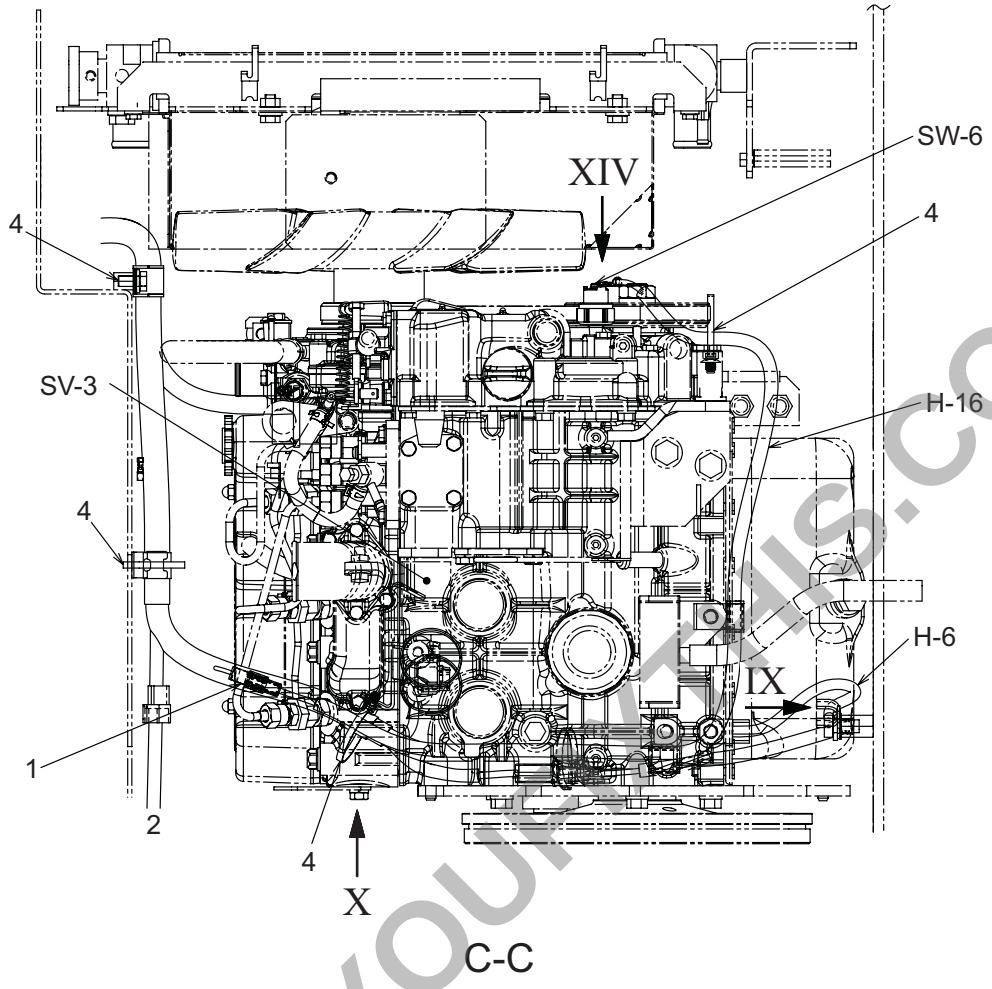


Fig. 23-9 Upper Frame Portion (9/16)

H-6 Engine earth cable
H-16 Pressure switch extension harness
SV-3 Engine stop solenoid
SW-6 Engine oil pressure switch

1. Connect to main harness
2. To left console box
4. Clip

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Part	Code	Name
	SW-1	KEY SWITCH
	SW-2	WORKING LIGHT SW. (CAB)
	SW-3	2-SPEED SELECT SW.
	SW-4	WIPER WASHER SW. (CAB)
	SW-5	E/G COOLANT TEMP. SW.

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42. TROUBLESHOOTING (HYDRAULIC SYSTEM)

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11.1 TORQUE SPECIFICATIONS FOR CAPSCREWS AND 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.

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INDEX **CX17B**

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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 AND 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) Clearance in thrust direction on boom and cylinder installation section

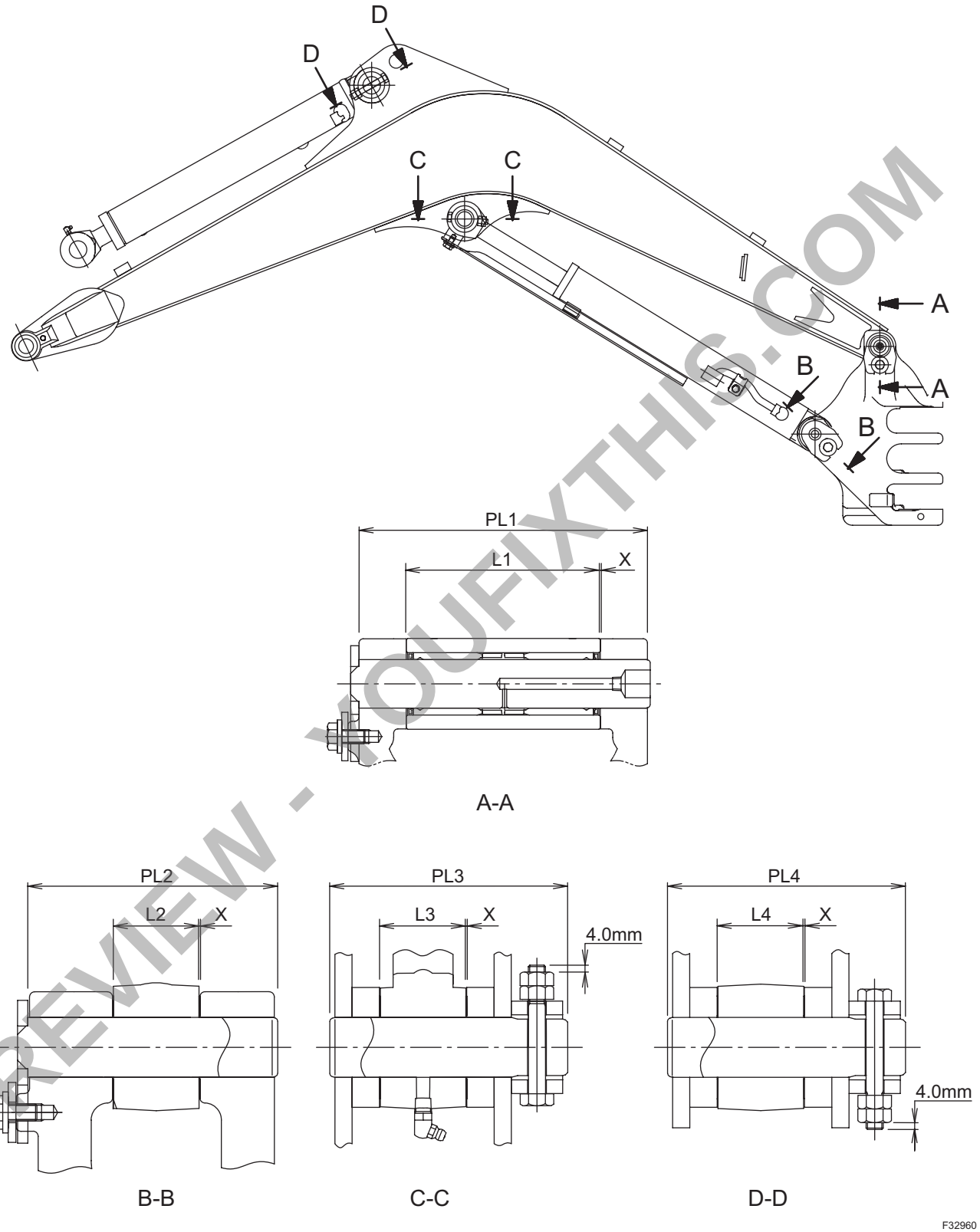


Fig. 3-3 Clearance in thrust direction on boom section

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GROUP No.		EQUIPMENT PORTION	WORK TO BE DONE	UNIT	REMARKS	UNIT: HOUR
04 Under carriage	33	Idler ASSY	O / H	One side		1.0
	34	Idler adjuster ASSY	- ditto -	One side		0.5
	40	**Sprocket portion**			Refer to 34.1.7	
	41	Sprocket	Replace	One side	After removing crawler shoe	0.5
	50	**Travel motor portion**			Refer to 3 34.1.8	
	51	Travel motor ASSY	Rem. / Inst.	One side	After removing crawler shoe	1.0
	52	• Motor cover	- ditto -	One side		0.1
	53	• Hydraulic connector, hose	- ditto -	One side	Include attaching hose's tag and plug	0.6
	54	• Motor fixing bolt	- ditto -	One side		0.3
	55	• Motor slinging	- ditto -	One side		0.1
	56	Travel motor	O / H	One side		3.0
	57	Travel reduction unit	- ditto -	One side		3.0
		Other necessary works	Feed	One side	Hyd. oil in motor	0.1
	60	**Slewing bearing portion**			Refer to 34.1.9	
	61	Slewing bearing ASSY	Rem. / Inst.	1 pc.	After removing upper frame	0.6
	62	• Slewing bearing fixing bolt	- ditto -	1 pc.		0.3
	63	• Slewing bearing	Cleaning	1 pc.	Decreasing / Replenishment	0.1
	64	• Slewing bearing slinging	Rem. / Inst.	1 pc.		0.2
	70	**Adjustable crawler frame width portion**			Refer to 34.1.10	
	71	Adjustable crawler frame width ASSY	Rem. / Inst.	1 pc.		2.5
	72	• Cylinder cover	- ditto -	1 pc.		0.1
	73	• Cylinder hydraulic hose	- ditto -	2 pc.		0.2
	74	• Bracket, pin	- ditto -	2 sets		0.2
	75	• Nuts for stopper bolt	- ditto -	2 sets	Include adjusting length	0.2
	76	• Crawler frame ASSY	- ditto -	1 pc.		1.5
	77	Cylinder	O / H	1 pc.		2.0
		Other necessary work	Preparation	1 set	Removal / Installation position (Secure working space)	0.5
			Rem. / Inst.	1 pc.	Under cover	0.1

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24.1 HYDRAULIC COMPONENTS

24.1.1 HYDRAULIC PUMP

24.1.1.1 SUMMARY

1. GENERAL VIEW

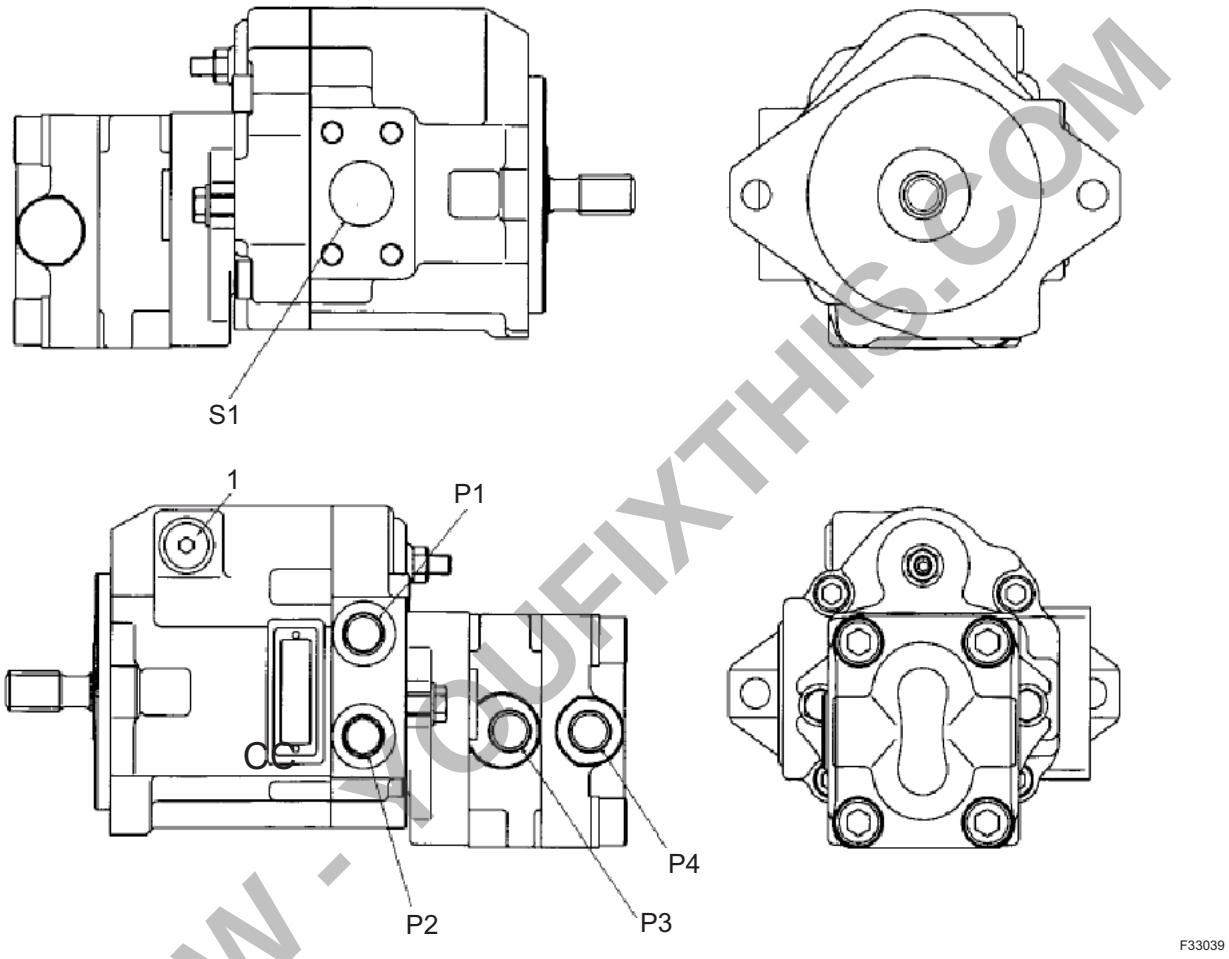


Fig. 24-1 General view of hydraulic pump

P1, P2, P3, P4 = Port 3/8 G
S1 = Suction port
1. Oil filling port

2. SPECIFICATIONS

Item	Model (Type)	PVD–00B–15P–5AG3–5055A			
		Piston pump section		Gear pump section	
		P1	P2	P3	P4
Displacement	cc/rev (cu•in/rev)	7.4 (0.45)	7.4 (0.45)	5.2 (0.32)	2.7 (0.16)
Working pressure	MPa (psi)	21.6 (3130)	21.6 (3130)	20.6 (2990)	3.5 (508)
Rated revolution	min^{-1}(rpm)	2200			
Delivery flow	L/min (gal/min)	16.28 (4.30)	16.28 (4.30)	11.44 (3.02)	5.94 (1.75)
Casing Capacity	L (gal)	0.3 (0.08)			
Weight	kg (lb)	14 (31)			

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24.1.6.3 OPERATION DESCRIPTION

The travel motor is constructed with; a stationary body consisting of a hydraulic motor and hydraulic valve; and a rotating body that is made up of a simple planetary gear reducer.

24.1.6.3.1 REDUCTION UNIT

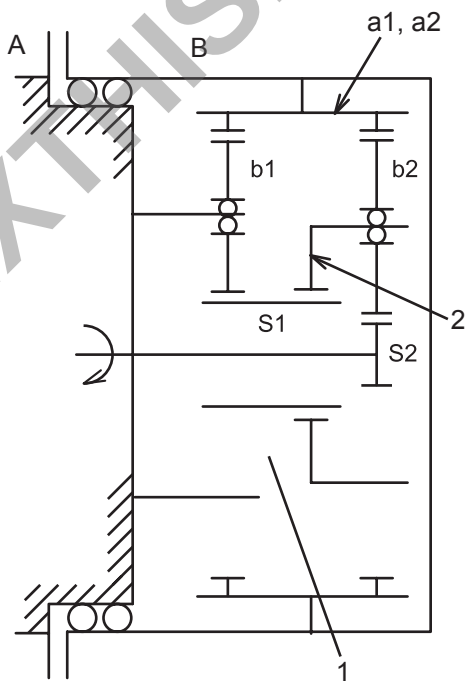
1. Function
   The reduction unit for the travel motor comprises two simple planetary gear (1) sets. It converts high-speed rotary motion from the travel motor into low-speed / high-torque motion, and rotates the body case.
2. Operation description
   Shaft S2 gear is splined on the output shaft of the travel motor and the reduction unit, and the rotation of gear S2 undergoes primary reduction through gears S2, b2 and a2. After primary reduction, rotation undergoes secondary reduction through gears S1 (splined to carrier 2) (2), b1 and a1. After secondary reduction, rotation is transmitted via the internal gears a1 and a2 to the reduction unit body, the sprocket installed with the body creates travel force.

   The reduction ratio for a two-stage simple planetary gear set can generally be expressed by

$$R = \frac{Zs1}{Zs1 + Za1} \cdot \frac{Zs2}{Zs2 + Za2}$$

   Where
   Zs1 and Zs2 = number of teeth on gears S1 and S2
   Za1 and Za2 = number of teeth on gears a1 and a2
   In the case of travel motor of PHV series, because the body case rotates, the gear ratio R' is

$$R' = \frac{1}{1-1/R}$$



F33076

Fig. 24-25 Reduction unit operation

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33.1.20 SWIVEL JOINT

33.1.20.1 REMOVAL PREPARATION

(1) Lift the machine by approx. 30 cm (1 foot) and insert support blocks at four places of the crawler shoes, namely, front, rear, right and left, to secure working space under the machine.

(2) Engage the slewing lock.

(3) Remove the cover (A2) of the floor plate (See Section 33.1.5.1).

(4) Remove the seat assembly and front cover of control stand lower.
(See Section 33.1.12.1)

(5) Loosen four M8x16 capscrews (A5) to remove the under cover (A10).

: 13 mm (0.51 in)

(6) Release the residual pressure in the circuit and the hydraulic tank.

(7) Take out the crawler frame width cylinder. (See Section 33.1.10.1 of TRAVEL SYSTEM)

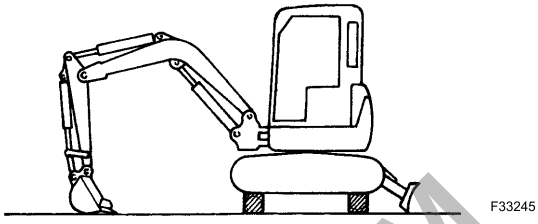


Fig. 33-60 Lifting machine

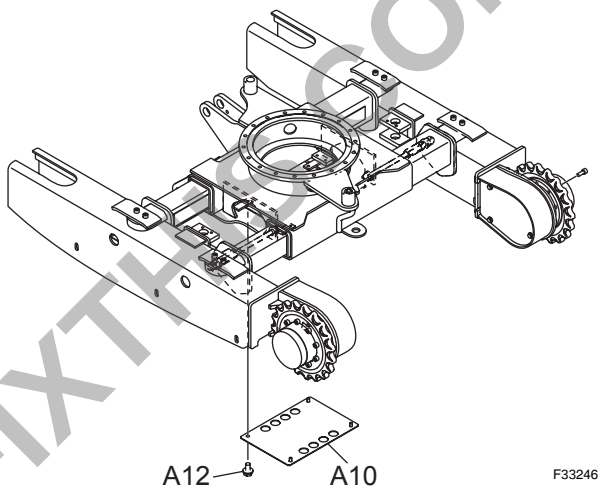


Fig. 33-61 Undercover removal

33.1.20.2 REMOVAL

(1) Disconnect all hoses connected to the swivel joint.

- Attach a plug and tag to each of the openings.

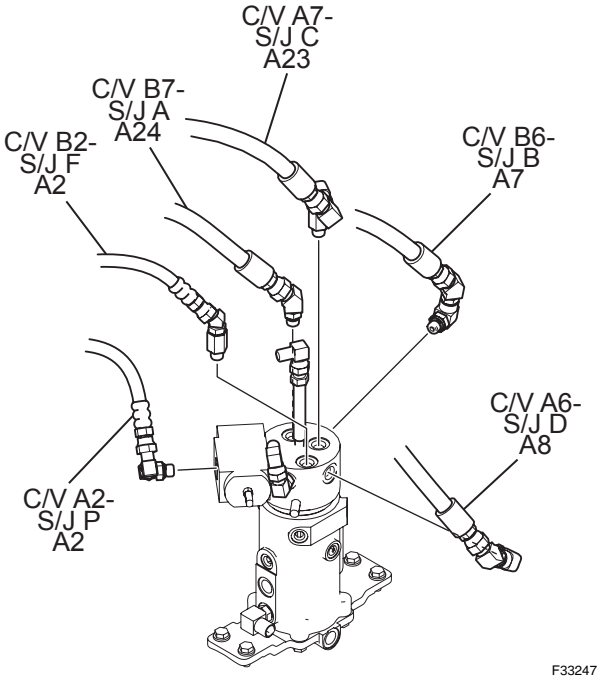


Fig. 33-62 Upper side hose disconnection

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33.2.3.3.2 Disassembly

(1) Remove the handle lever (1) assembly and boot (2) from the casing (101).

(2) Clean the pilot valve with white kerosene.

- Screw a blind plug in each port in advance.

(3) Hold the pilot valve with a vice by applying a copper or lead sheet.

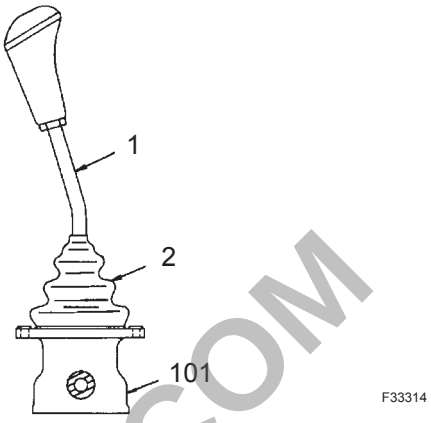


Fig. 33-91 Handle lever disassembly

(4) Apply wrenches to the adjusting nut (312) and the disk (302) across the flats to loosen and remove them.

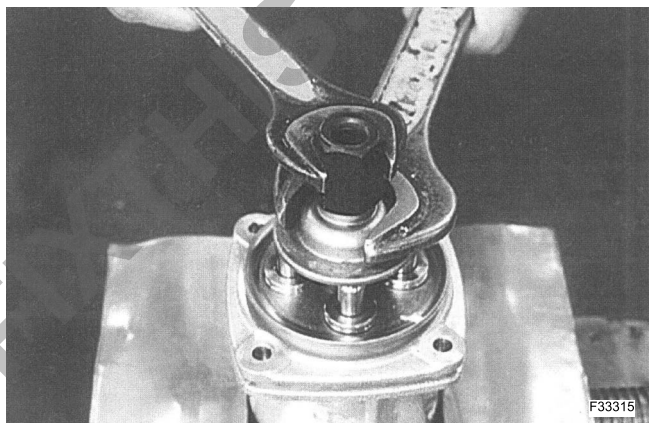


Fig. 33-92 Adjusting nut (312) removal

(5) Turn the joint (301) counterclockwise with a jig to loosen.

⚠ CAUTION

When pulling off the joint, be careful that the joint is no sooner loosened than the plate (151), plug (211) and push rod (212) may pop up if the return spring (221) is too strong.

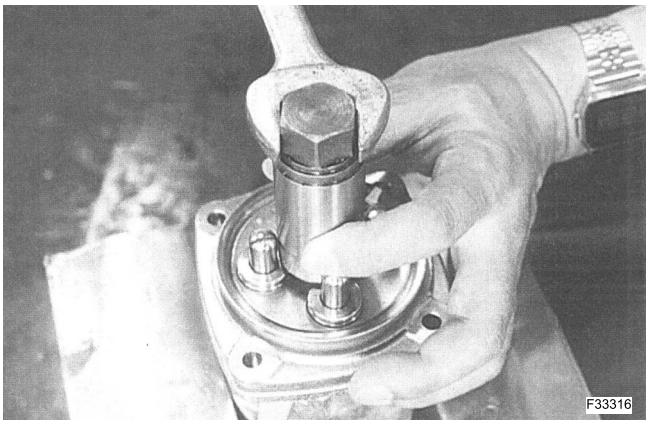


Fig. 33-93 Joint (301) removal

(6) Remove the plate (151).

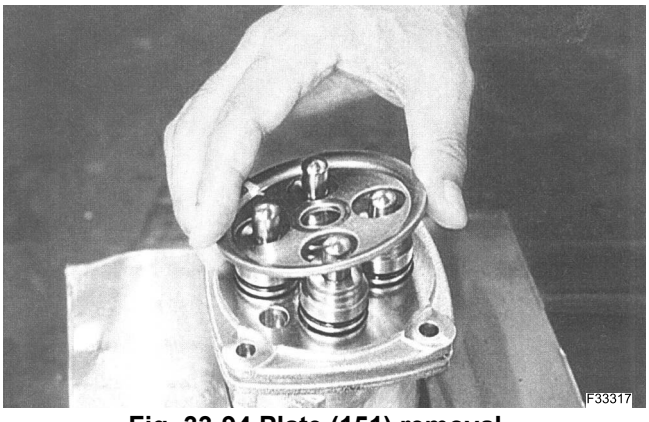


Fig. 33-94 Plate (151) removal

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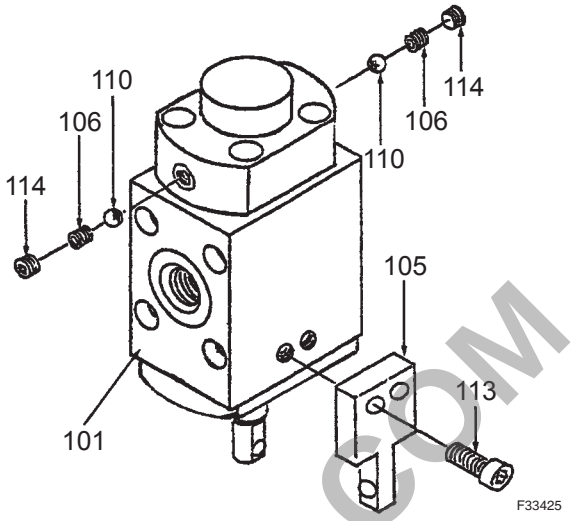
(7) Insert the steel ball (110) and spring (106) into the detent cover (104), and install it with the plug (114).

: 4 mm (0.15 in), T=9.8 N•m (7.2 lbf•ft)

- Confirm the effectiveness of the detent by means of moving the spool.

(8) Install the bracket (105) to the body (101) with the socket bolt (113).

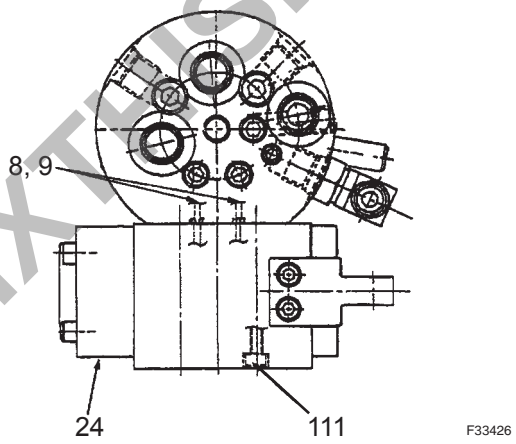
: 4 mm (0.15 in), T=6.9 N•m (5.1 lbf•ft)



(9) Attach the O-rings (8) and (9) to the side sealing face on the side of shaft (1).

(10) Install the selector valve assy (24) to the swivel joint with the socket bolt (111).

: 4 mm (0.15 in), T=6.9 N•m (5.1 lbf•ft)



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34.1.10 ADJUSTABLE CRAWLER FRAME WIDTH

34.1.10.1 REMOVAL AND INSTALLATION PROCEDURES

34.1.10.1.1 Removing

(1) Preparation for Removal

1) Lift up the machine by around 30 cm (1 ft) to secure the working space under the machine, and set a stable supporting stand at four positions, left and right of front and rear of crawler shoes.
2) Release air in the hydraulic oil tank.
3) Remove the under cover (A10).
Capscrew (A12): M10

: 17 mm (0.66 in)

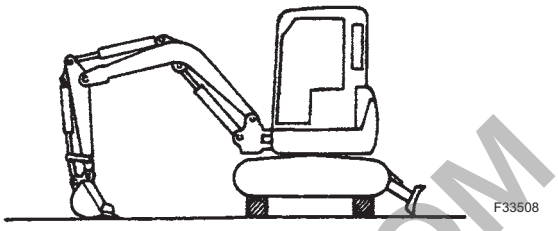


Fig. 34-74 Lift up the machine

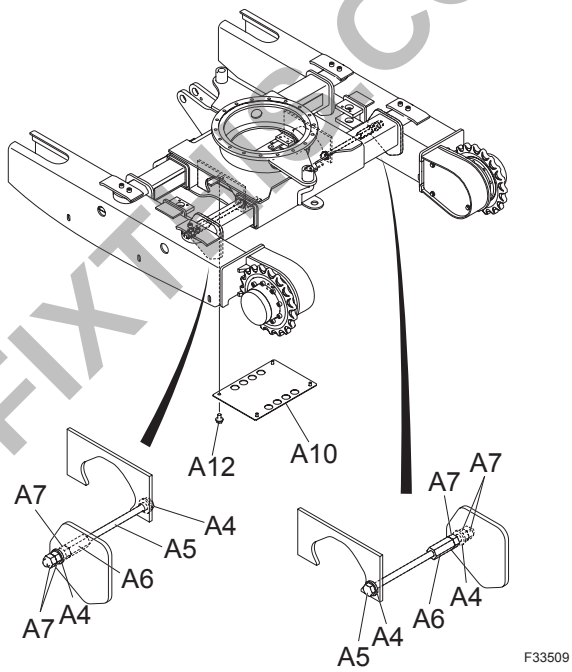


Fig. 34-75 Under cover (A10), Stopper bolt (A5)

(2) Disconnect the hydraulic hose connected to the adjusting cylinder (1), and apply a plug to openings.

: 19 mm (0.74 in)

(3) Remove the sems-bolts (5) that are fixing the cylinder and plate (4).

: 13 mm (0.51 in)

(4) Remove the pins (3).

(5) Remove the crawler adjusting cylinder (1) together with cover (2).
Cylinder weight: 12 kg (26 lbs)

(6) Remove the nuts (A7) and washer (A4) for the stopper bolt (A5).

: 24 mm (0.94 in)

- In order not to change the stopper position, do not loosen the double nuts (A6) and (A7) of the opposite side.

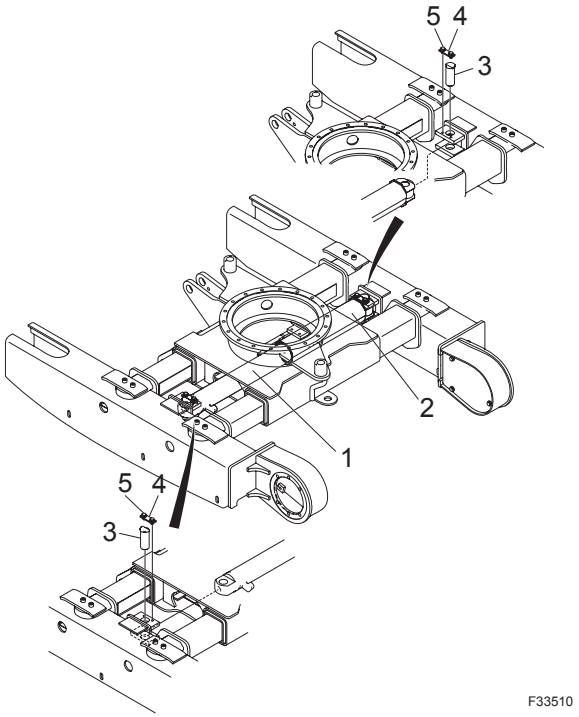
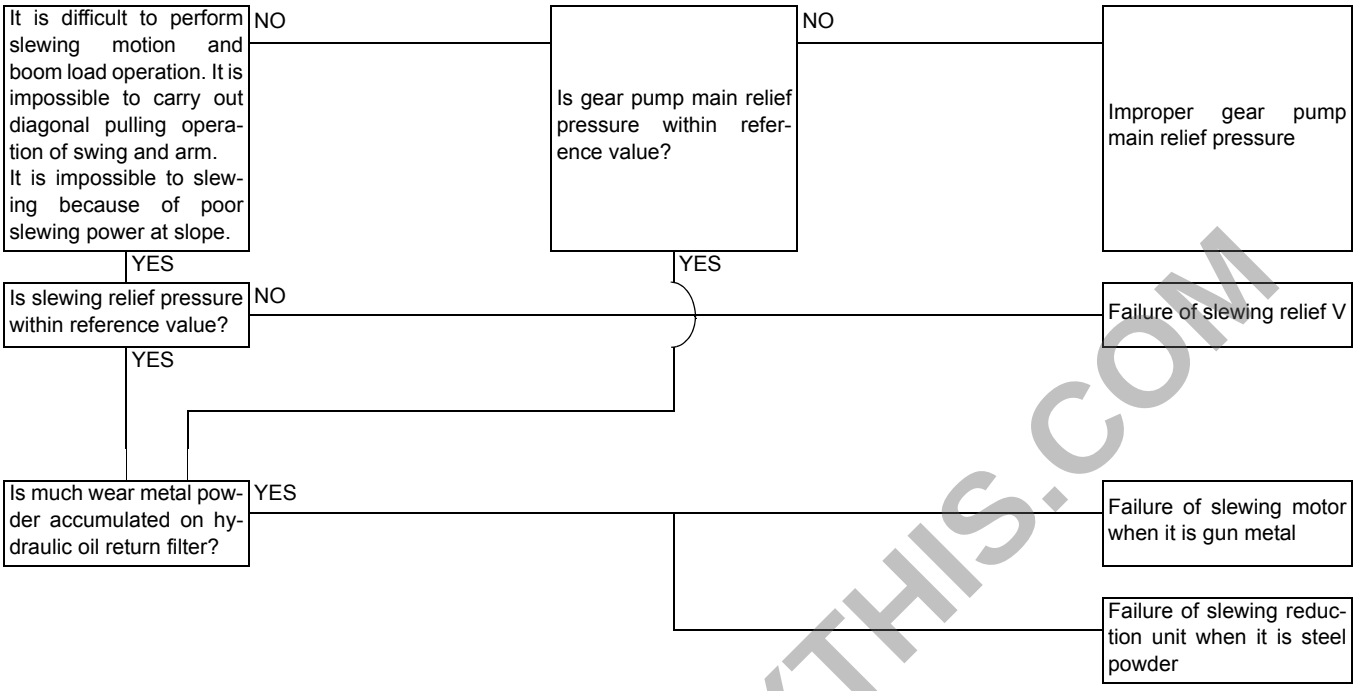


Fig. 34-76 Removing adjusting cylinder

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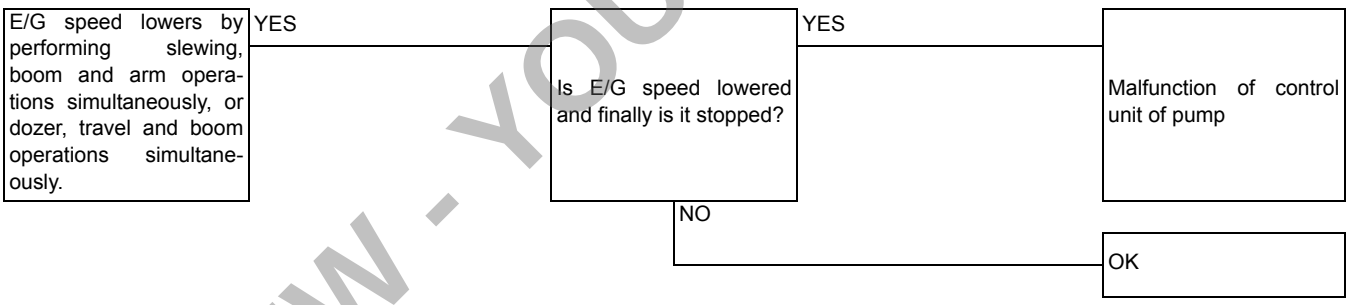
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42.3.3.3 Slewing power is low



42.3.4 Pump

42.3.4.1 Engine speed is reduced due to pump load



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1.8 TECHNICAL SPECIFICATIONS

Model				L3E
Main data	Type			In-line, water cooled, 4-cycle diesel engine
	Number of cylinders.			3
	Combustion type			Swirl chamber type
	Valve mechanism			Overhead valve type
	Cylinder bore x stroke			76 x 70 mm (2.99 x 2.76 in)
	Total displacement			0.952 l (0.251 U.S. gal)
	Compression ratio			23: 1
	Fuel			Diesel oil (JIS K2204 Special Number 1 - Special Number 3)
	Order of ignition			1-3-2
	Rotating direction			Counterclockwise as viewed from flywheel side
	Dry weight			71 kg (157 lb)
Main components	Piston ring	Number		Compression ring: 2 Oil rings (with expander): 1
	Valve timing (when warm)	Intake valve	Open	BTDC 18°
			Close	ABDC 46°
		Exhaust valve	Open	BBDC 46°
			Close	ATDC 18°
	Starting system			Electric starting
Fuel system	Fuel injection pump	Type		Bosch NC
		Manufacturer		DENSO CORPORATION
		Piston diameter		ø 5.5 mm (0.217 in)
		Cam lift		6 mm (0.24 in)
	Governor	Speed governing type		Centrifugal weight system
	Fuel injection nozzle	Type		Governor type
		Manufacturer		DENSO CORPORATION
		Spray angle		15°
		Valve opening pressure		13.73 MPa (140 kgf/cm²) (1992 psi)
	Fuel filter	Type		Paper filter element
	Fuel pump	Type		Solenoid fuel pump (compact type)
		Discharge rate		0.4 l/min or higher (at 12 V-1.5 A)

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BORING CYLINDER

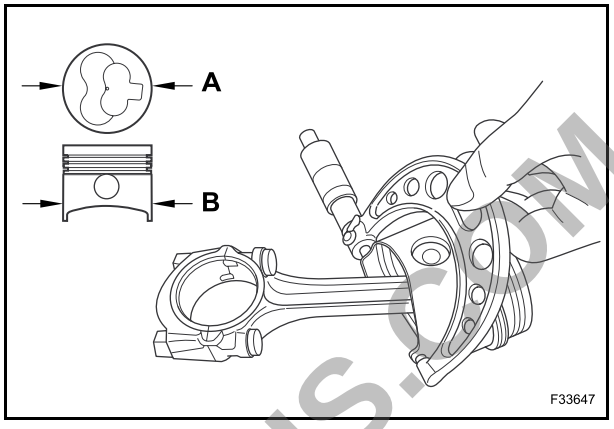
Cylinders shall be rebored according to the following procedure.

Measurement of piston outer diameter

Measure the piston's skirt portion diameter with a micrometer in the direction at right angles to the piston pin as shown in the illustration.

A. Measuring directions

B. Measuring positions



Item	Nominal	Standard
STANDARD	ø 76 mm (2.99 in)	75.906 to 75.926 mm (2.9884 to 2.9892 in)
0.25 OS	ø 76.25 mm (3.0020 in)	75.156 to 76.176 mm (2.9983 to 2.9990 in)
0.50 OS	ø 76.50 mm (3.0118 in)	76.406 to 76.426 mm (3.0081 to 3.0089 in)

Boring finish dimension

= (piston diameter) + (clearance) - (honing allowance [0.02 mm (0.0008 in.)])

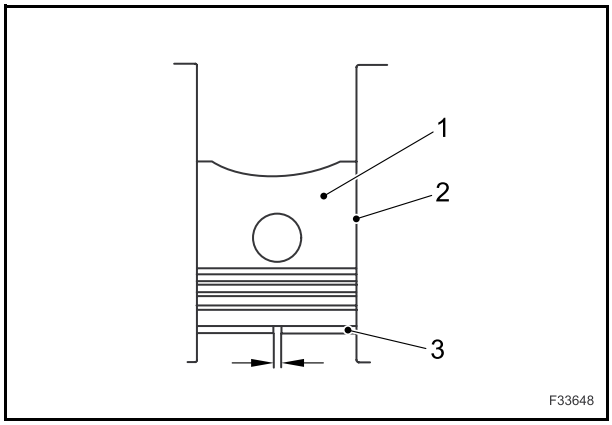
Item	Standard	Allowable limit	Remark
Clearance (clearance between piston and cylinder)	0.074 to 0.124 mm (0.0029 to 0.0049 in)	0.2 mm (0.008 in)	Repair to oversize or replace

MEASURING PISTON RING END GAP

⚠ CAUTION

When replacing rings without boring (honing), measure the end gap at the bottom of the cylinder (2) where the wear is minimum.
When replacing the ring (3), use the ring of the same size as the piston (1).

Insert the piston ring (3) into the cylinder bore and push it with the piston (1) to achieve squareness. Then measure the end gap with feeler gauges. Replace the piston ring (3) if the limit is exceeded.



Item		Standard	Allowable limit
End gap of ring	Ring	0.15 to 0.30 mm (0.0059 to 0.0118 in)	1.5 mm (0.059 in)
	Ring	0.15 to 0.30 mm (0.0059 to 0.0118 in)	
	Ring	0.15 to 0.35 mm (0.0059 to 0.0138 in)	

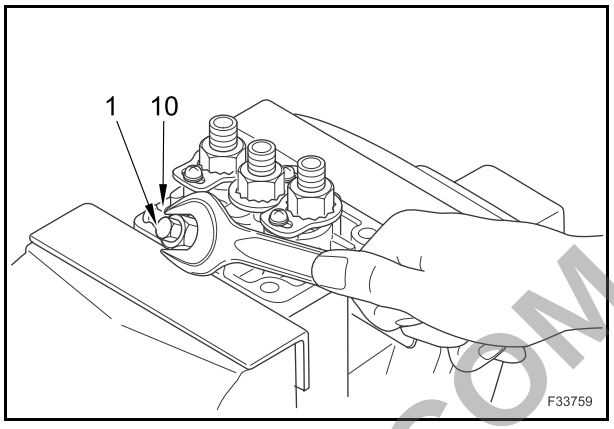
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INSTALLATION OF SWIVEL CONNECTOR

Install the swivel connector (1) in the pump housing (19).

Tighten the screws to the specified tightening torque of 9.8 ÷ 14.7 Nm (7.2 ÷ 10.84 lbf•ft).

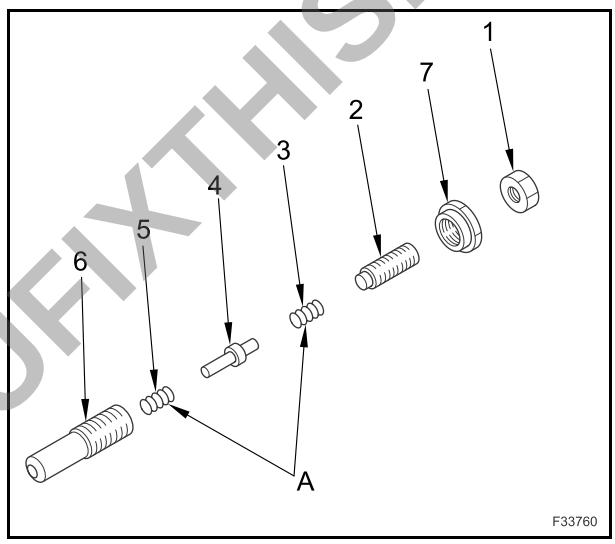


7.8 DISASSEMBLY, REASSEMBLY AND CHECK OF TORQUE SPRINGS

1. Nut
2. Adjusting screw
3. Torque spring
4. Spring stop
5. Torque spring
6. Torque spring body
7. Nut

Checks

A. Fatigue, cracks



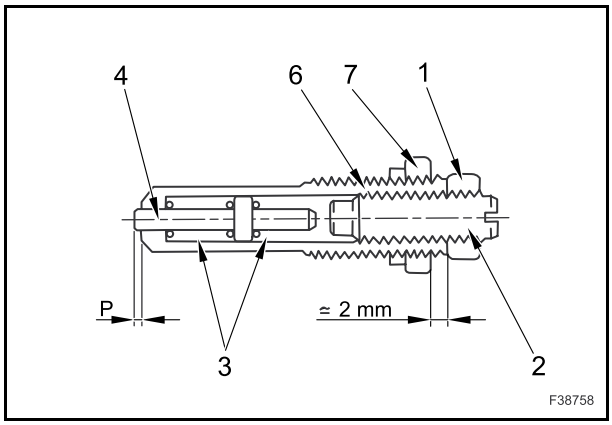
ASSEMBLY AND REASSEMBLY OF TORQUE SPRINGS

Screw in the adjusting screw (2) so that the end of the spring stopper (4) protrudes from the spring body (6) as much as protrusion (P).

P. From 0.2 to 0.3 mm (0.007 to 0.011 in).

Then tighten the nut (1) to the specified tightening torque of 7.5 ÷ 11.8 Nm (5.5 ÷ 8.7 lbf•ft) to secure the adjusting screw (2).

Press and hold the stopper (4) and make sure that it moves smoothly and is properly retracted to the end face of the spring body (6).



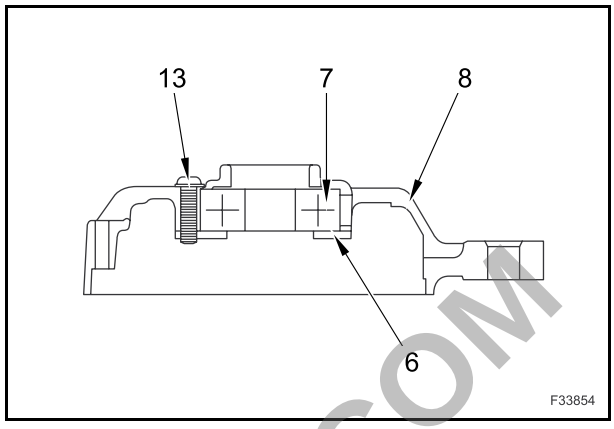
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REMOVE THE FRONT BEARING

Loosen and remove the screw (13).

Loosen and remove the bearing stopper (6) and the front bearing (7) from the front bracket (8).

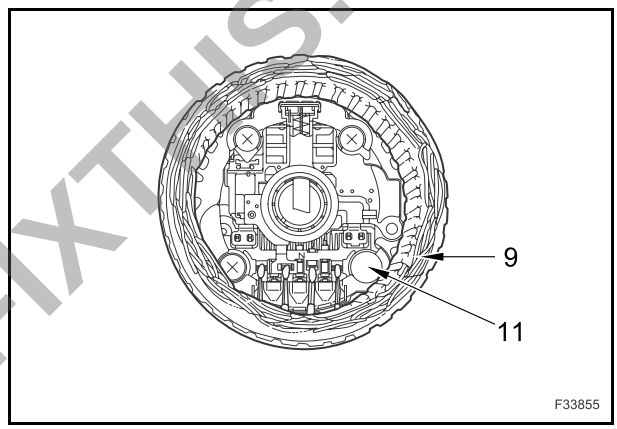


REMOVE THE STATOR

⚠ CAUTION

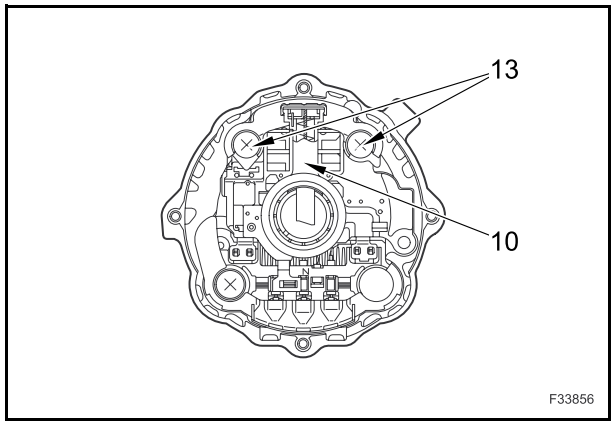
Unsoldering must be finished as quickly as possible. Extended heating will damage the diodes.

Cut off the joint of the stator and remove the stator (9) from the rectifier (11).



REMOVE THE REGULATOR ASSY

Loosen and remove the screws (13) and disassemble the regulator assy (10).



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