TIGHTENING TORQUE SPECIFICATIONS

Descriptions	Bolt Dia mm	Q'ty	Wrench Size mm	Torque		
				N·m	(kgf·m)	(lbf·ft)
Engine cushion rubber mounting nut	14	4	22	137	(14)	(101)
Engine cushion rubber mounting bolt, nut	16	2	24	235	(24)	(175)
Engine bracket mounting bolt	10	8	17	49	(5)	(36)
Hydraulic oil tank mounting bolt	16	4	24	206	(21)	(152)
Fuel tank mounting bolt	16	4	24	206	(21)	(152)
UNION fittings for hydraulic hoses and piping			19	29	(3)	(21.5)
			22	39	(4)	(29)
			27	93	(9.5)	(69)
			32	137	(14)	(101)
			36	175	(18)	(130)
			41	205	(21)	(152)
Pump mounting bolt	12	4	19	88	(9)	(65)
Control valve mounting bolt	14	3	22	175	(18)	(130)
Control valve bracket mounting bolt	14	4	22	137	(14)	(101)
Swing device mounting bolt	16	10	24	205	(21)	(52)
Battery mounting nut	10	4	17	20	(2)	(14.5)
Cab mounting nut	16	4	24	205	(21)	(152)
Swing bearing mounting bolt to upperstructure	16	4	24	265	(27)	(195)
Swing bearing mounting bolt to undercarriage	16	24	24	265	(27)	(195)
Center joint mounting bolt	10	3	17	49	(5)	(36)
Center joint stopper mounting bolt	12	2	19	88	(9)	(65)
Travel device mounting bolt	16	20	24	300	(31)	(225)
Travel motor cover mounting bolts	14	8	22	137	(14)	(101)
Sprocket mounting bolt	16	24	24	265	(27)	(195)
Upper roller mounting bolt	14	2	22	137	(14)	(101)
Lower roller mounting bolt	14	40	22	245	(25)	(180)
Track shoe mounting bolt	14	320	22	245	(25)	(180)
Access cover mounting bolt	6		10	9.8	(1)	(7.2)
	10		17	49	(5)	(36)
	12		19	88	(9)	(65)
Low pressure piping flex waster coupling	8	–	13	10.3to12.4	(1.05to1.26)	(7.95to9.11)
	5	–	8	2.9	(0.3)	(2.1)
	6	–	10	4.0	(0.45)	(3.3)
Counterweight mounting bolt	27	3	41	1370	(140)	(1010)

NOTE: (1) Apply lubricant (e.g. white zinc B dissolved into spindle oil) to bolts and nuts to reduce friction coefficient of them.

(2) Make sure bolt and nut threads are clean before installing.

(3) Apply Loctite to threads before installing and tightening swing bearing mounting bolts and lower roller mounting bolts.

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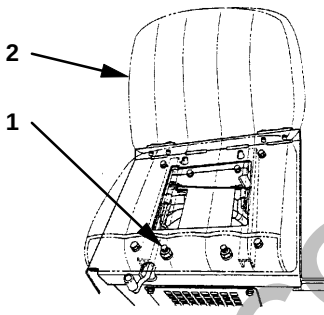
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REMOVE AND INSTALL CAB

Removal

1. Remove seat-mounting bolts (1) (2 used) to lift and remove seat (2).

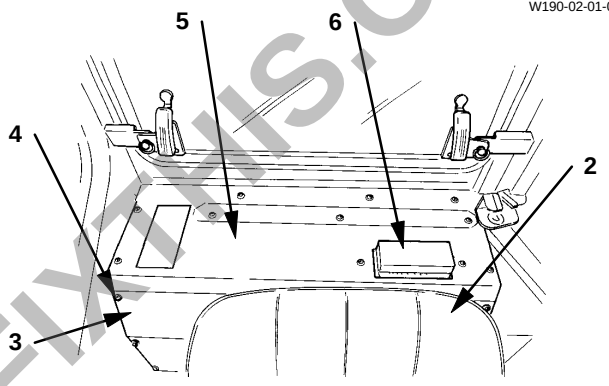
: 17 mm



W190-02-01-001

2. Loosen screws (4) (9 used) to remove cover (3) located behind seat (2).

IMPORTANT: The auto-MARCCINO control unit was installed at the lower back side of cover. Remove the auto-MARCCINO control unit connector (EX75UR-5).

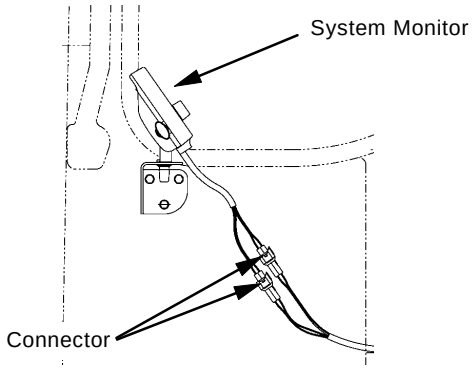


T196-01-02-004

3. Remove fuse box (6) from cover (5).

4. Disconnect the wire at the connector ends connected with the system monitor (EX75UR-5).

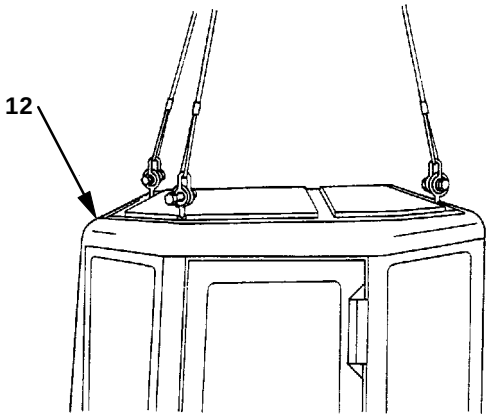
NOTE: The wiring are passing through the right in side of the cab. Pull the wire from the control monitor side until the connector comes out from the right inside of the cab. Then disconnect the connector.



W197-02-01-001

CAUTION: Cab weight: 218 kg (480 lb)

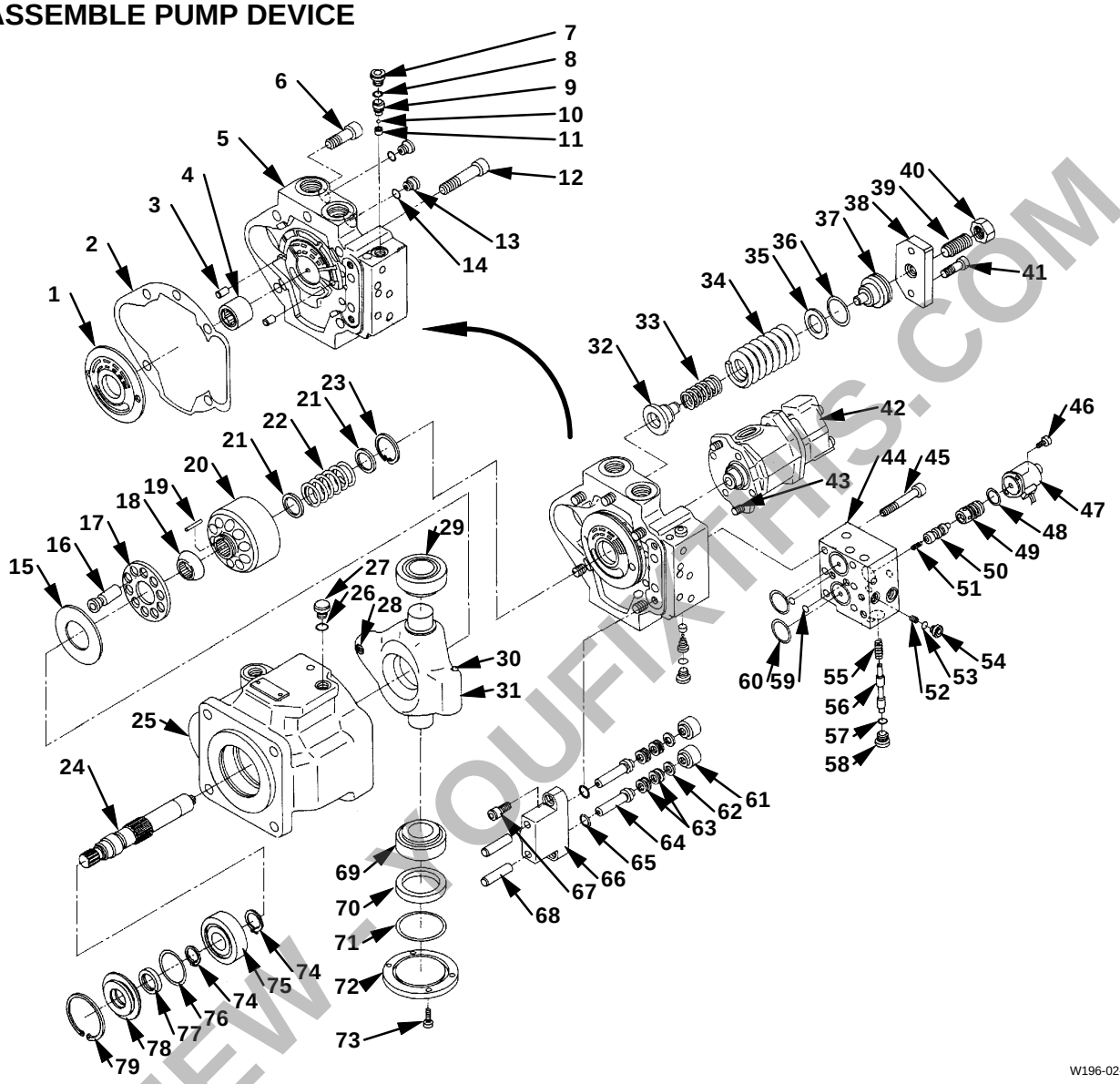
5. Attach straps to the sling bolts on the top of the cab and hold it with a crane.



W554-02-01-002

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DISASSEMBLE PUMP DEVICE



W196-02-04-002

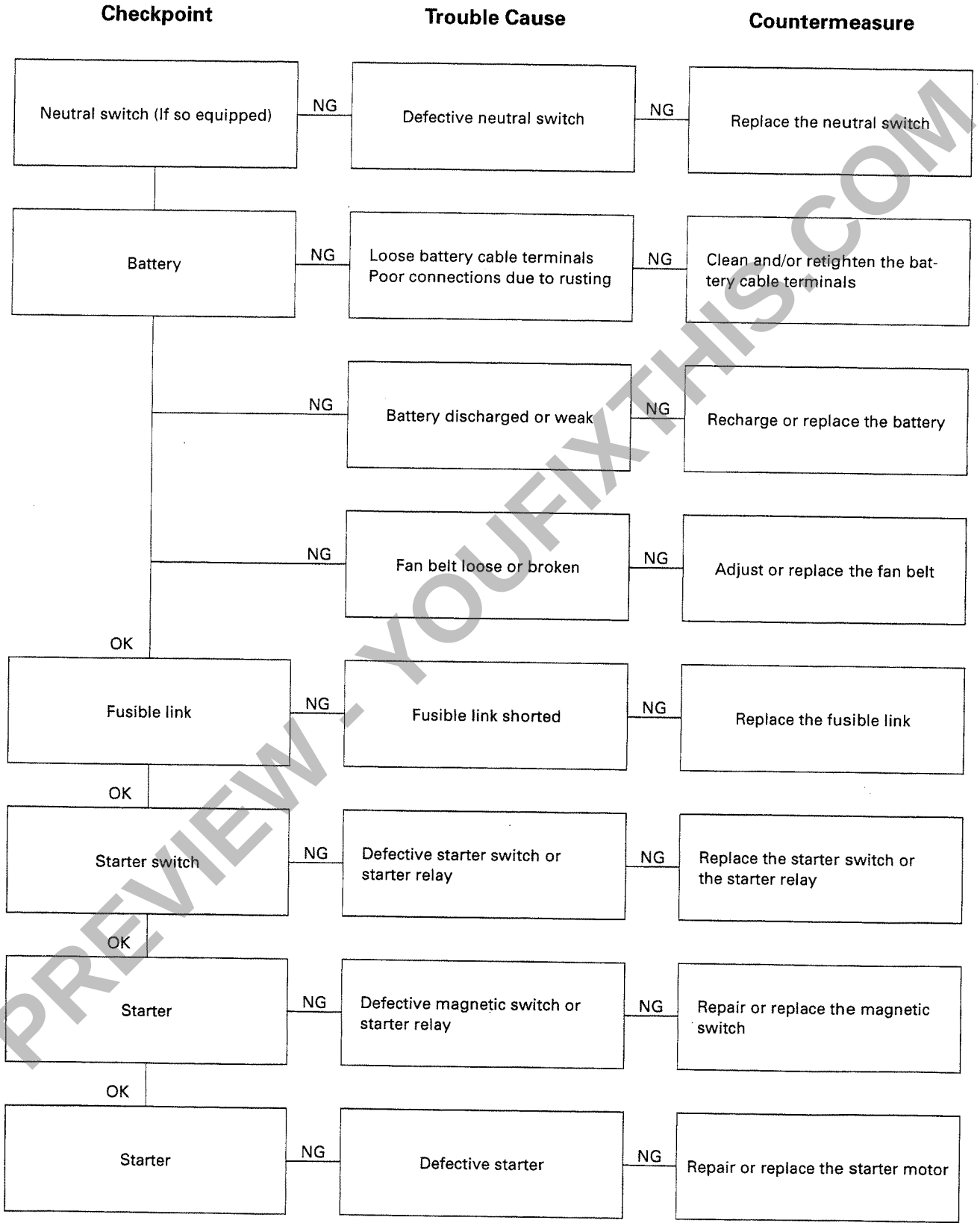
1 - Valve Plate
2 - Packing
3 - Knock Pin (2 Used)
4 - Needle Bearing
5 - Cover
6 - Socket Bolt (3 Used)
7 - Plug (2 Used)
8 - O-Ring (2 Used)
9 - Seat (2 Used)
10 - Steel Ball (2 Used)
11 - Guide (2 Used)
12 - Socket Bolt (2 Used)
13 - Plug (2 Used)
14 - O-Ring (2 Used)
15 - Plate
16 - Plunger (10 Used)
17 - Retainer
18 - Spherical Bushing
19 - Pin (3 Used)
20 - Cylinder Block
21 - Washer (2 Used)
22 - Spring
23 - Retaining Ring
24 - Shaft
25 - Housing
26 - O-Ring
27 - Plug
28 - Rod
29 - Bearing
30 - Pin
31 - Hanger
32 - Spring Seat
33 - Spring
34 - Spring
35 - Shim (3 Used)
36 - O-Ring
37 - Spring Seat
38 - Cover
39 - Adjusting Screw
40 - Lock Nut
41 - Socket Bolt (2 Used)
42 - Pilot Pump
43 - Socket Bolt (2 Used)
44 - Body
45 - Socket Bolt (6 Used)
46 - Socked Bolt (2 Used)
47 - Solenoid
48 - O-Ring
49 - Sleeve
50 - Spool
51 - Spring
52 - Orifice
53 - O-Ring
54 - Plug
55 - Spring
56 - Spool
57 - O-Ring
58 - Plug
59 - O-Ring (2 Used)
60 - O-Ring (2 Used)
61 - Piston (2 Used)
62 - Shim (2 Used)
63 - Disc Spring (8 Used)
64 - Piston (2 Used)
65 - O-Ring (2 Used)
66 - Cylinder
67 - Socket Bolt (2 Used)
68 - Pin (2 Used)
69 - Bearing
70 - Distant Piece
71 - O-Ring
72 - Cover
73 - Socket Bolt (4 Used)
74 - Retaining Ring (2 Used)
75 - Bearing
76 - O-Ring
77 - Oil Seal
78 - Cover
79 - Retaining Ring

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1. HARD STARTING

1. STARTER INOPERATIVE



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RECOGNIZE SAFETY INFORMATION

- This is the **SAFETY ALERT SYMBOL**.
  - When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.
  - Follow recommended precautions and safe operating practices.



001-E01A-0688

SA-688

UNDERSTAND SIGNAL WORDS

- On machine safety signs, signal words designating the degree or level of hazard - DANGER, WARNING, or CAUTION - are used with the safety alert symbol.
  - **DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
  - **WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
  - **CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
  - **DANGER or WARNING safety signs** are located near specific hazards. General precautions are listed on **CAUTION safety signs**.
  - Some safety signs don't use any of the designated signal words above after the safety alert symbol are occasionally used on this machine.
- **CAUTION** also calls attention to safety messages in this manual.
- To avoid confusing machine protection with personal safety messages, a signal word **IMPORTANT** indicates a situation which, if not avoided, could result in damage to the machine.
- ***NOTE*** indicates an additional explanation for an element of information.



SA-1223

002-E01C-1223

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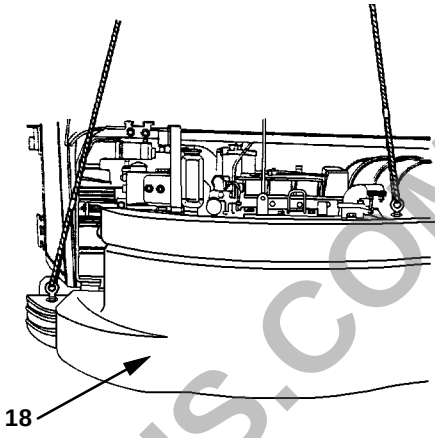
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CAUTION: Counterweight (18) weight: 1270 kg (2800 lb)

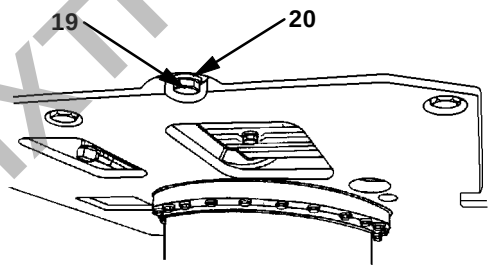
8. Install eye bolts (M27, Pitch 3.0) onto counterweight (18). Attach the wire ropes to the eye bolts. Hold the counterweight using a crane.



W190-02-02-012

9. Loosen and remove mounting bolts (19) (3 used) and washers (20) of counterweight (18). Using a crane, lift the counterweight slightly, then slide it backwards to remove it.

: 41 mm



W190-02-02-013

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Assemble Control Valve 2

1. Install O-ring (13) to each section.

2. Install check valve (14) and spring (15) to valve section (8)

3. Arrange the section in order as inlet section (34), valve sections (29), (20) and (8) and outlet section (16).

4. Pass bolts (35) (3 used) through each section. Then, tighten nuts (17) (6 used).

   : 19 mm
   : 59 to 64 N·m
   (6.0 to 6.5 kgf·m, 43 to 47 lbf·ft)

5. Attaching wooden pieces to both sides of spools (7), (19) and (24), secure each spool in a vise. Install spring seat (5), spring (6), spring seat (5) into spools (7), (19) and (24) in order respectively. Then install bolts (4) into spools (7), (19) and (24).

   : 5 mm
   : 9.8 to 12.8 N·m
   (1.0 to 1.3 kgf·m, 7.2 to 9.4 lbf·ft)

IMPORTANT: Insert the spools into the original location.

6. Insert each assembly of spools (7), (19) and (24) into each of valve section (8), (20) and (29) respectively.

7. Install O-rings (3) to cover (2) (3 used) and install cover (2) to each of the sections. Secure the covers with socket bolts (1) (9 used).

   : 5 mm
   : 9.8 to 12.8 N·m
   (1.0 to 1.3 kgf·m, 7.2 to 9.4 lbf·ft)

8. Install O-ring (3) to cover plates (18) (3 used). Install the cover plate to each of the sections. Secure the cover plates with socket bolts (1) (9 used).

   : 5 mm
   : 9.8 to 12.8 N·m
   (1.0 to 1.3 kgf·m, 7.2 to 9.4 lbf·ft)

9. Install check valves (23) and springs (22) into valve sections (20) and (29). Install O-rings (10) to plugs (9) (2 used). Then, install plugs into valve section (20) and (29).

   : 8 mm
   : 29 to 34 N·m
   (3.0 to 3.5 kgf·m, 21.5 to 25 lbf·ft)

10. Install O-rings (26) and (28) and backup rings (27) to overload relief valves (25) (2 used). Install the overload relief valves to valve section (29).

    : 19 mm
    : 34 to 39 N·m
    (3.5 to 4.0 kgf·m, 25 to 29 lbf·ft)

11. Install O-rings (38) and (36) and backup ring (37) to main relief valve (39). Then, install the main relief valve to inlet section (34).

    : 19 mm
    : 34 to 39 N·m
    (3.5 to 4.0 kgf·m, 25 to 29 lbf·ft)

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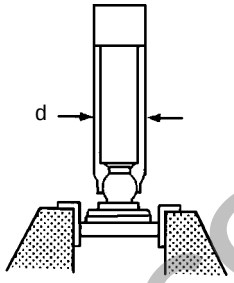
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MAINTENANCE STANDARD

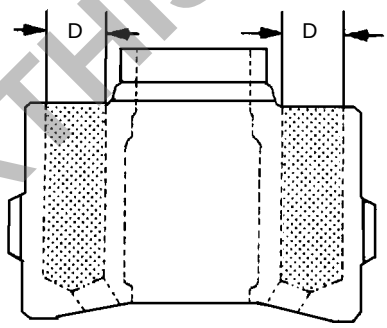
Swing Motor

1. Plunger and rotor bore clearance

   Standard clearance (D-d): 0.4 mm (0.0157 in) or less



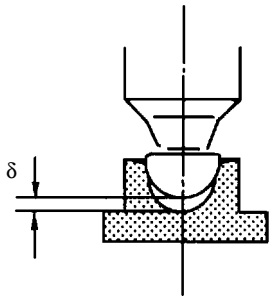
W107-02-06-138



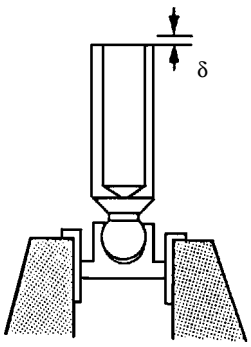
W107-02-06-139

2. Plunger and shoe end play

   Standard end play (δ): 0.4 mm (0.0157 in) or less



W107-02-06-140



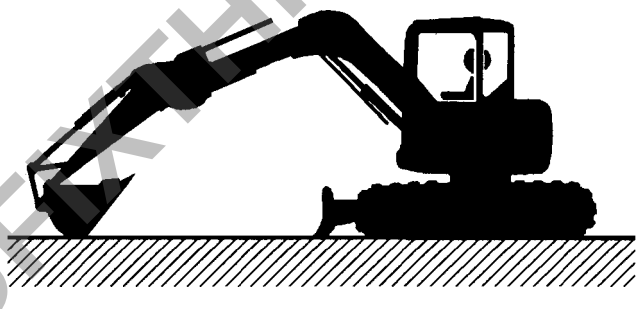
W107-02-06-141

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REMOVE AND INSTALL OFFSET PILOT VALVE

CAUTION: Escaping fluid under pressure can penetrate the skin, causing serious injury. Avoid this hazard by relieving pressure before disconnecting hydraulic lines.
Hydraulic oil may be hot after operation. Hot hydraulic oil may spout, possibly causing severe burns. Be sure to wait for oil to cool before starting any repair work.
The hydraulic oil tank cap may pop off by remaining pressure if removed quickly. Slowly loosen the cap to completely release any remaining pressure.



M197-07-001

Preparation

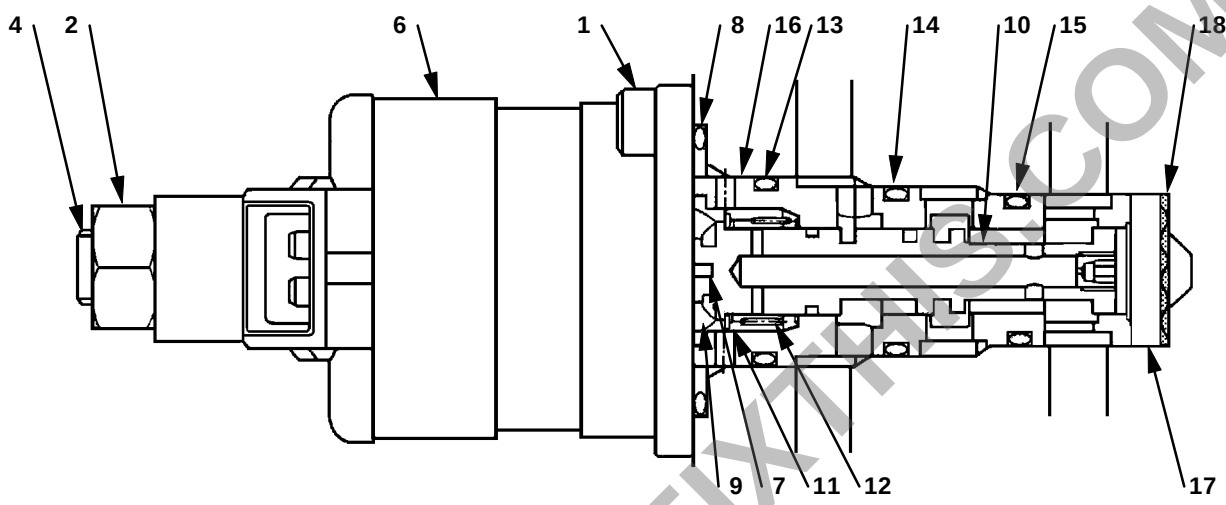
1. Park the machine on a solid level surface. Lower the bucket to the ground.

2. Stop the engine. Push the air release valve on the hydraulic oil tank to release any pressure remaining in the hydraulic tank.

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ASSEMBLE PROPORTIONAL SOLENOID VALVE



W157-02-11-001

1 - Socket Bolt
2 - Lock Nut
3 - O-Ring
4 - Adjusting Screw
5 - Spring
6 - Solenoid
7 - Spring
8 - O-Ring
9 - Diaphragm
10 - Spool
11 - Washer
12 - Spring
13 - O-Ring
14 - O-Ring
15 - O-Ring
16 - Sleeve
17 - Plate
18 - Washer

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REMOVE AND INSTALL TRAVEL DEVICE

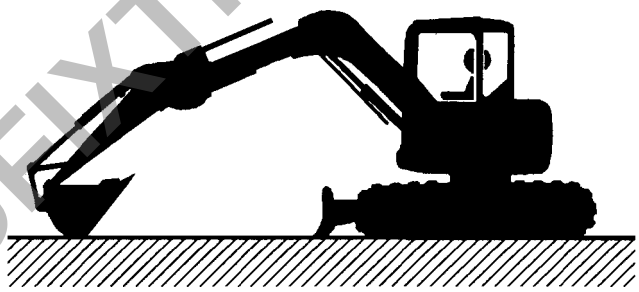
CAUTION: Escaping fluid under pressure can penetrate the skin, causing serious injury. Avoid this hazard by relieving pressure before disconnecting hydraulic lines.
Hydraulic oil may be hot after operation. Hot hydraulic oil may spout, possibly causing severe burns. Be sure to wait for oil to cool before starting any repair work.
The hydraulic oil tank cap may pop off by remaining pressure if removed quickly. Slowly loosen the cap to completely release any remaining pressure.

Preparation

1. Park the machine on a solid level surface. Lower the bucket to the ground.

2. Stop the engine. Push the air release valve on the hydraulic oil tank to release any pressure remaining in the hydraulic oil tank.

3. Remove the hydraulic oil tank cap. Connect a vacuum pump and operate it continuously to maintain negative pressure in the hydraulic oil tank. Run the vacuum pump continuously while working on the hydraulic system.



M197-07-001

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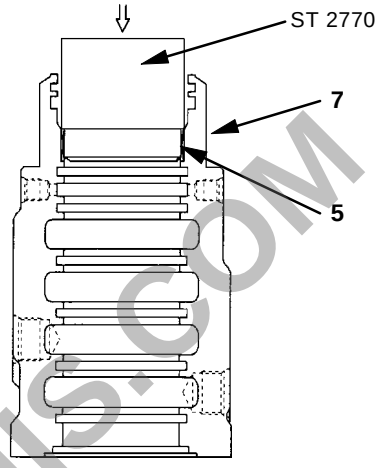
When replacing the body or spindle with new one, the following procedures shall be followed.

Replacing Body (7)

Press bushing (5) into body (7).

1. Clean body (7) and bushing (5).

2. Press bushing (5) into body (7), using pressing tool.
   Pressing force: 0.5 to 1.5 t
   Pressing Tool: ST 2770



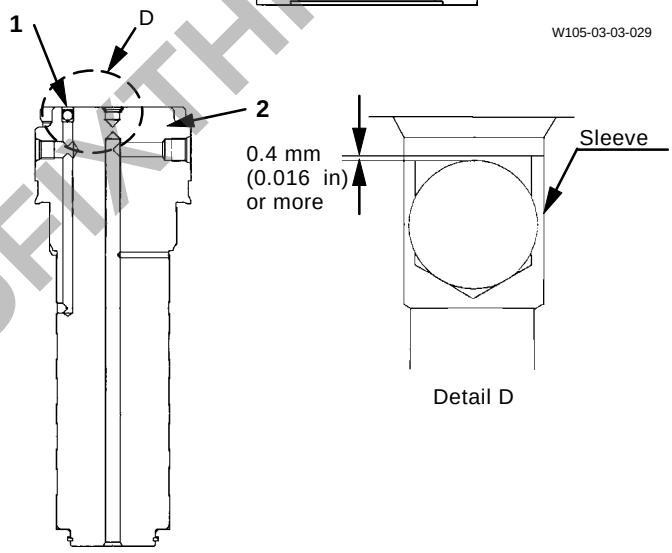
W105-03-03-029

Replacing Spindle (2).

1. Clean spindle (2).

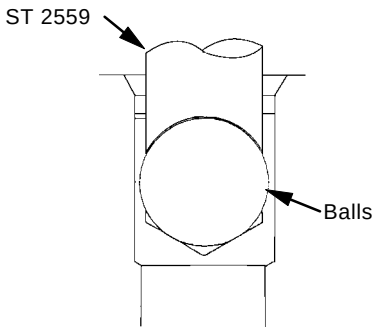
2. Insert plugs (1) into spindle (2) using special tool.

3. Insert the balls into the plug sleeves so that the top of each ball is 0.4 mm (0.016 in) lower than the respective sleeve edge or much lower as illustrated in detail D.
   Insert tool: ST 2559



W136-03-03-031

W135-03-03-001



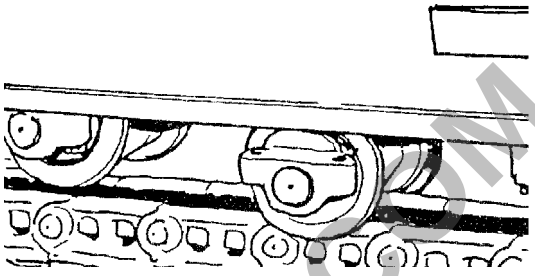
W157-03-03-004

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Installation

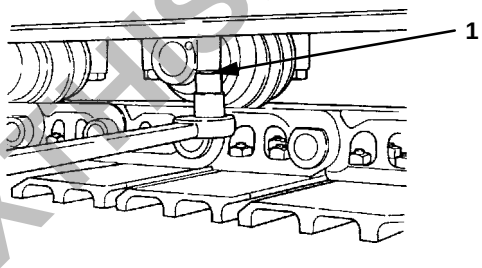
1. Place the lower roller on the track link so that the roller mounting bolt holes on the collar align with those on the track frame. Lower the track frame until the clearance between the track frame and the lower roller is very close.



W105-03-06-012

2. Secure the lower roller to the track frame with bolts (1).

: 22 mm
: 245 N·m (25 kgf·m, 180 lbf·ft)

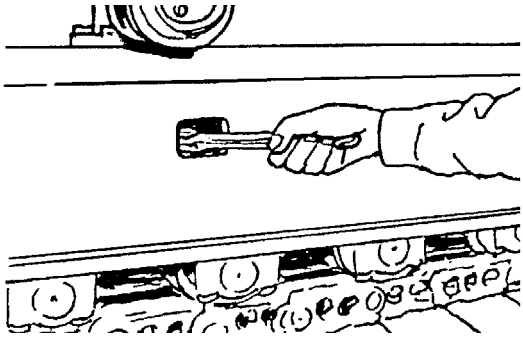


M102-07-063

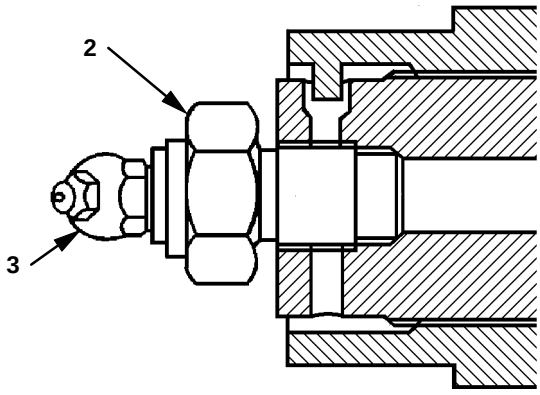
3. Tighten track adjuster valve (2). Supply grease via grease fitting (3) to adjust track tension.

Track sag specifications (A): 210 to 235 mm (8.3 to 9.3 in)

: 24 mm
: 147 N·m (15 kgf·m, 108 lbf·ft)



W105-03-06-001

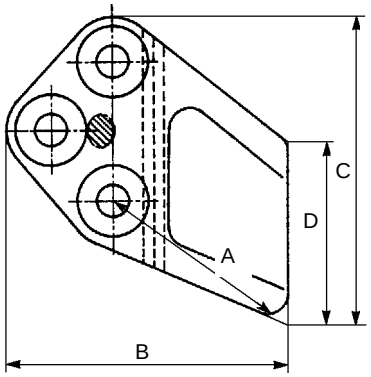


M104-07-119

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Side Cutter

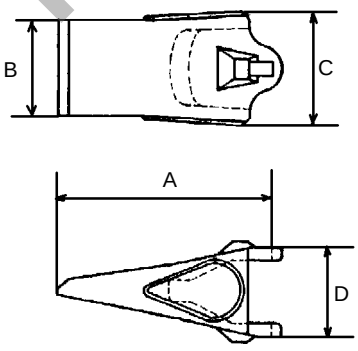


W505-04-01-001

Unit: mm (in)

	Standard	Allowable Limit	Remedy
A	225 (8.86)	145 (5.71)	Replace
B	250(9.84)	-	
C	295 (11.6)	-	
D	150(5.91)	-	

Point



W554-04-01-003

Unit: mm (in)

	Standard	Allowable Limit	Remedy
A	165 (6.50)	85 (3.3)	Replace
B	57 (2.2)	-	
C	60 (2.4)	-	
D	62 (2.4)	-	

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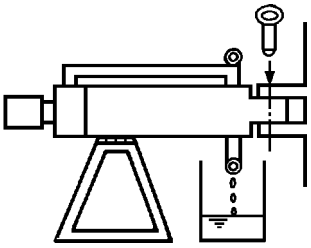
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Disassemble Offset Cylinder and Blade Cylinder

- Be sure to thoroughly read all precautions for disassembly / assembly work on page W1-1-1 before starting any repair work.
- The disassembly procedure below starts on the premise that the hydraulic lines and the line securing bands have been removed.

CAUTION: Offset cylinder weight: 55 kg (121 lb)
Blade Cylinder Weight: 64 kg (141 lb)

1. Lift and securely place the cylinder on a workbench using a crane. Drain hydraulic oil from the cylinder.



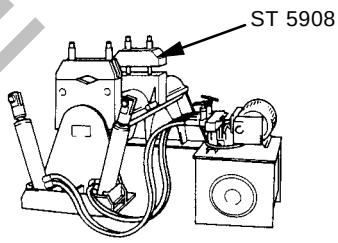
W102-04-02-027

2. Extend the detents to unlock cylinder head (6). Using R wrench (Offset cyl: ST 3219. Blade cyl: ST 3223), loosen cylinder head (6) 1 to 2 turns.

IMPORTANT: Be sure to pull piston rod (26) straight out to prevent the sliding surface from damaging.

3. Fully extend piston rod (26) to hold the rod end with a crane. Remove cylinder head (6) from cylinder tube (1) to remove piston rod (26).

4. Securely place piston rod (26) on special tool (ST 5908). Put a matching mark on piston rod (26) and nut (23).



W158-04-02-022

5. Remove set screw (24) to remove steel ball (25).

: 8 mm (Offset)
: 10 mm (Blade)

NOTE: Set screw (24) was crimped with a punch in 2 places after it was tightened. Before loosening set screw (24), cut away the crimped portions.

6. Loosen nut (23) using special tool (ST 5908) to remove shim (22).

Nut turning special tool: (Offset cyl.): 70 mm (ST 3261)
Nut turning special tool: (Blade cyl.): 85 mm (ST 3304)

7. Remove cylinder head (6) from piston rod (26).

IMPORTANT: When removing the seals, take care not to damage the mating parts.

8. Remove slide rings (17 and 21), seal ring (19), O-ring (20) from piston (18).

9. Remove wiper ring (2), backup ring (3), U-ring (4), buffer ring (5), snap ring (8), and bushing (7) from the inside of cylinder head (6).

Bushing special tool (Offset cyl.): 60 mm (ST 8012)
Bushing special tool (Blade cyl.): 70 mm (ST 8017)

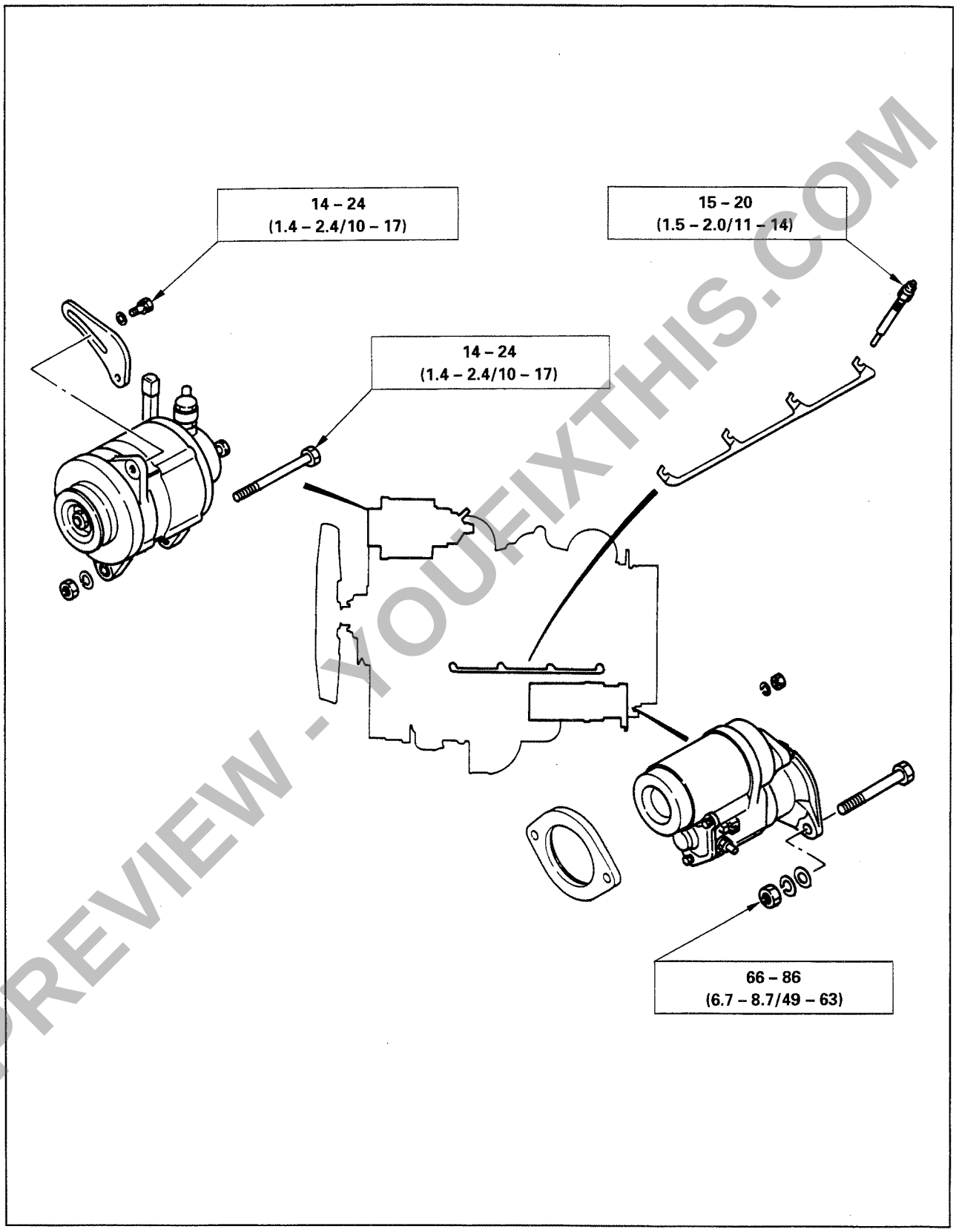
10. Remove O-rings (9 and 13), backup ring (10) from the outside of cylinder head (6).

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Engine Electrical

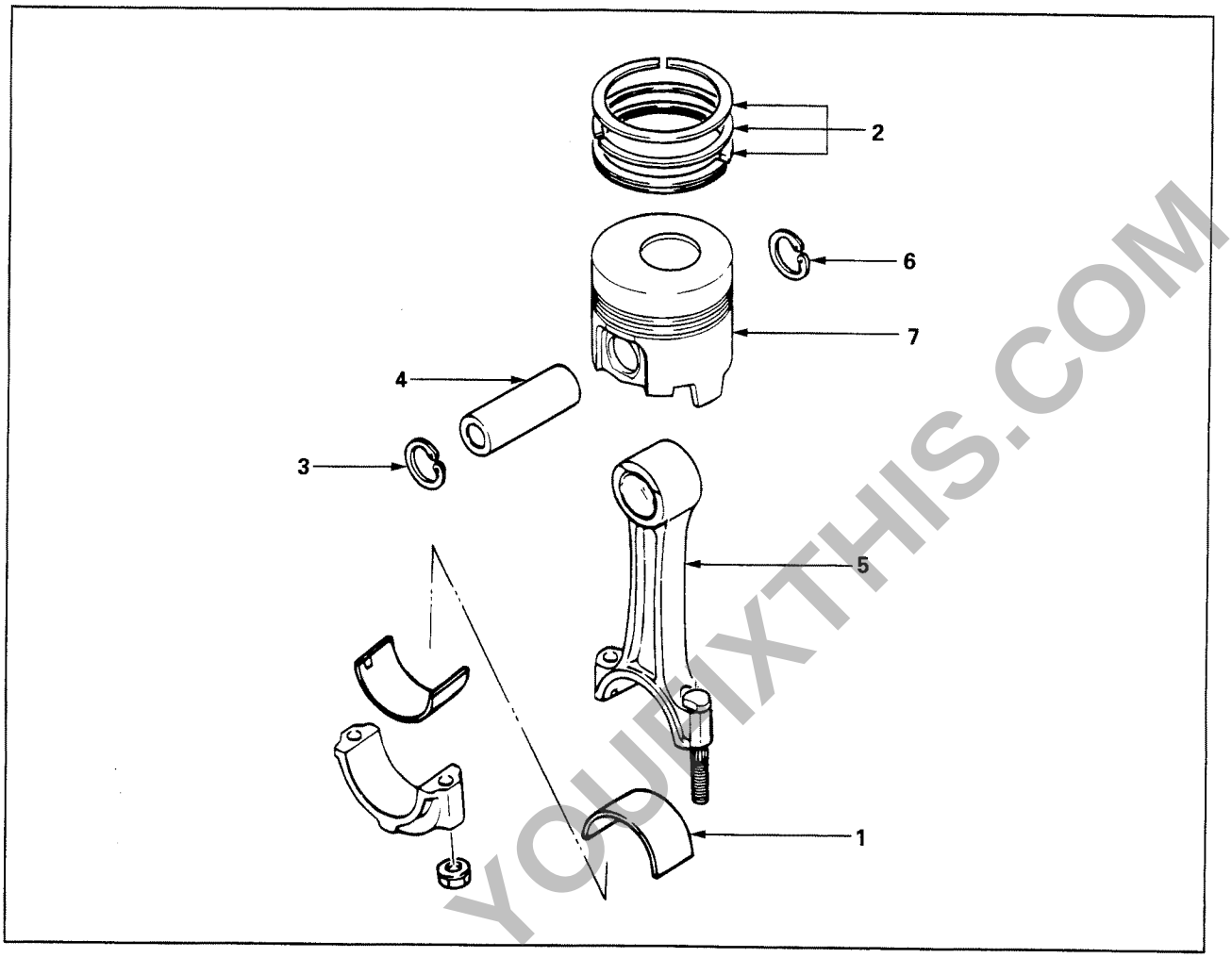
N·m (kgf·m/lb.ft)



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PISTON AND CONNECTING ROD

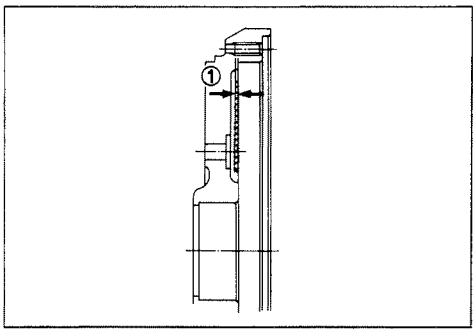


Disassembly Steps

▲ 1. Connecting rod bearing
▲ 2. Piston ring
▲ 3. Piston pin snap ring
▲ 4. Piston pin
5. Connecting rod
▲ 6. Piston pin snap ring
▲ 7. Piston

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FLYWHEEL AND RING GEAR

Flywheel

1. Inspect the flywheel friction surface for excessive wear and heat cracks.
2. Measure the flywheel friction surface wear amount (depth)

   The flywheel friction surface area actually making contact with the clutch driven plate (the shaded area in the illustration) will be smaller than the original machined surface area.

   There will be a ridge on the flywheel surface area. Be sure to measure the surface wear in the area inside the ridge.

   If the measured value is between the standard and the specified limit, the flywheel may be reground.

   If the measured value exceeds the specified limit, the flywheel must be replaced.

Flywheel Friction Surface Depth ① mm(in)

Limit
1.0 (0.04) or more

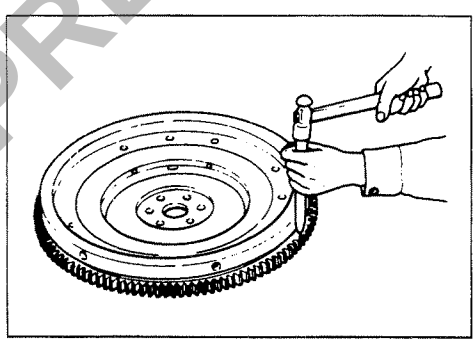
Note:

Because a ridge is produced at the flywheel friction surface as illustrated, do not measure the friction surface wear amount at the non-ridge area but be sure to measure it at the rear-friction surface which is shown in the illustration by shaded area.

Ring Gear

Inspect the ring gear.

If the ring gear teeth are broken or excessively worn, the ring gear must be replaced.



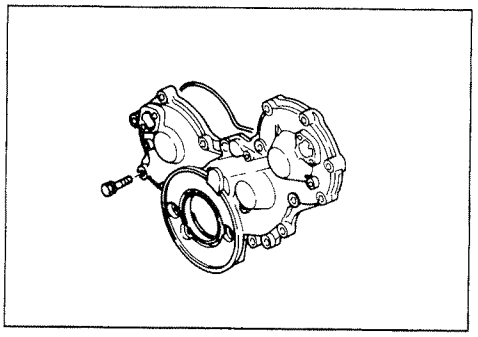
Ring Gear Replacement

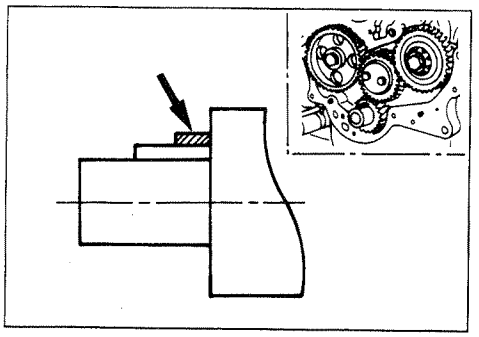
Ring Gear Removal

Strike around the edges of the ring gear with a hammer and diesel to remove it.

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5. Timing Case Cover

1) Before installing the timing gear case, apply a 3 mm x 5 mm (0.12 in x 0.20 in) strip of sealant to the portion of the feather key indicated by the arrow in the illustration.
2) Check that the timing case cover O-ring is firmly inserted into the gear case groove.
3) Tighten the timing case cover bolts to the specified torque.

Timing Case Cover Bolt Torque N·m(kgf·m/lb.ft)

M 8 x 1.25	14 – 24 (1.4 – 2.4/10 – 17)
M12 x 1.25	65 – 85 (6.7 – 8.7/48 – 63)

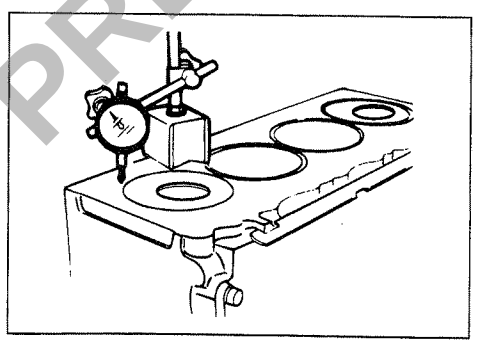
7. Crankshaft Damper Pulley with Dust Seal

1) Block the flywheel ring gear with a piece of wood to prevent it from turning.
2) Tighten the crankshaft damper pulley to the specified torque.

Crankshaft Damper Pulley Bolt Torque N·m(kgf·m/lb.ft)

197 – 240(20.1 – 24.5/145 – 177)

Take care not to damage the crankshaft damper pulley boss.



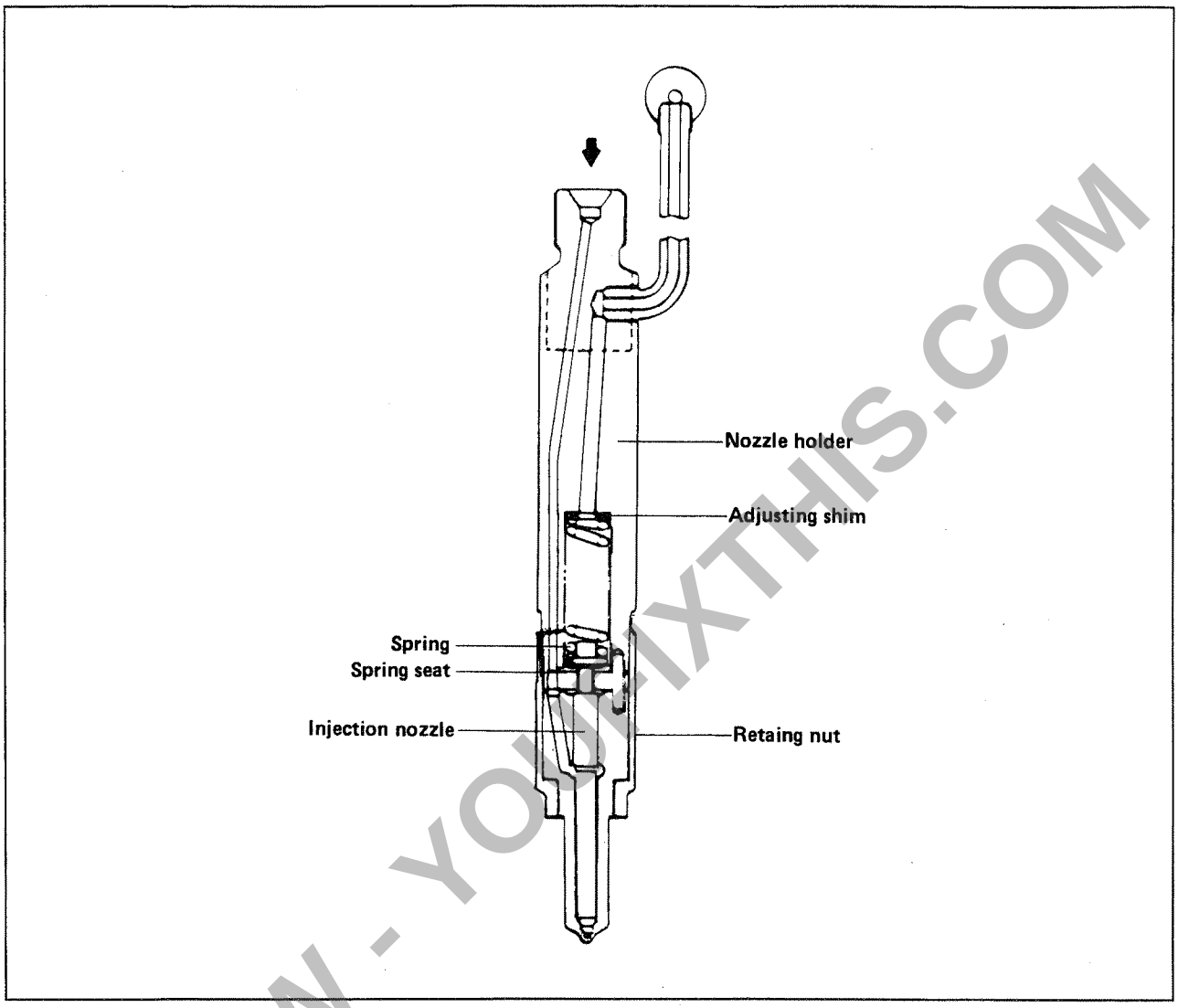
8. Cylinder Head Gasket

1. Carefully remove carbon deposits and gasket residue from the piston top face and the cylinder body upper surface.

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INJECTION NOZZLE



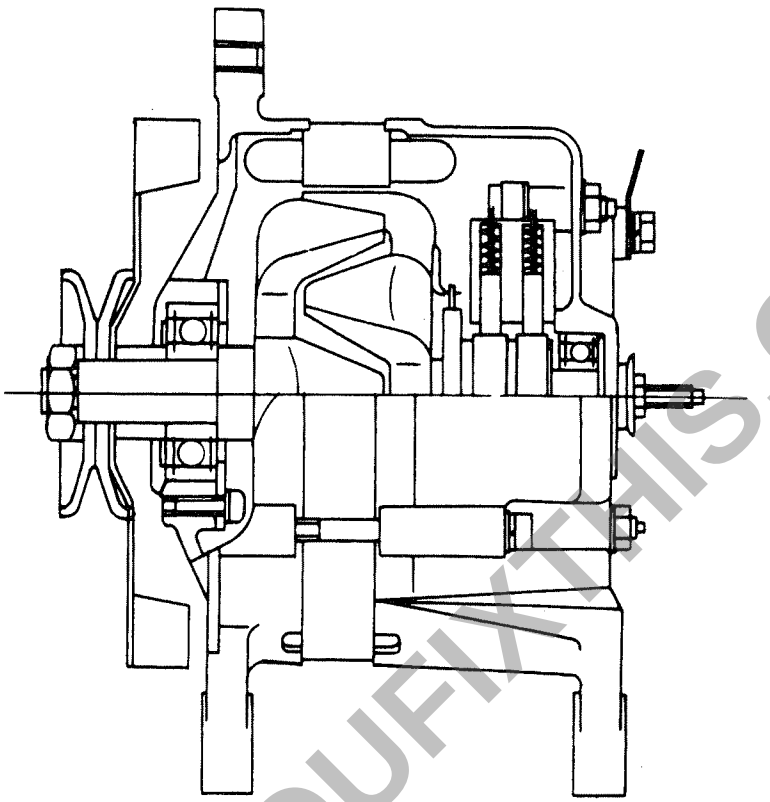
A hole (with 5 orifices) type injection nozzle is used. It consists of the nozzle body and the needle valve assembly.

The injection nozzle sprays pressurized fuel from the injection pump into the combustion chamber through the nozzle body injection orifice.

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GENERAL DESCRIPTION



Based on LR240

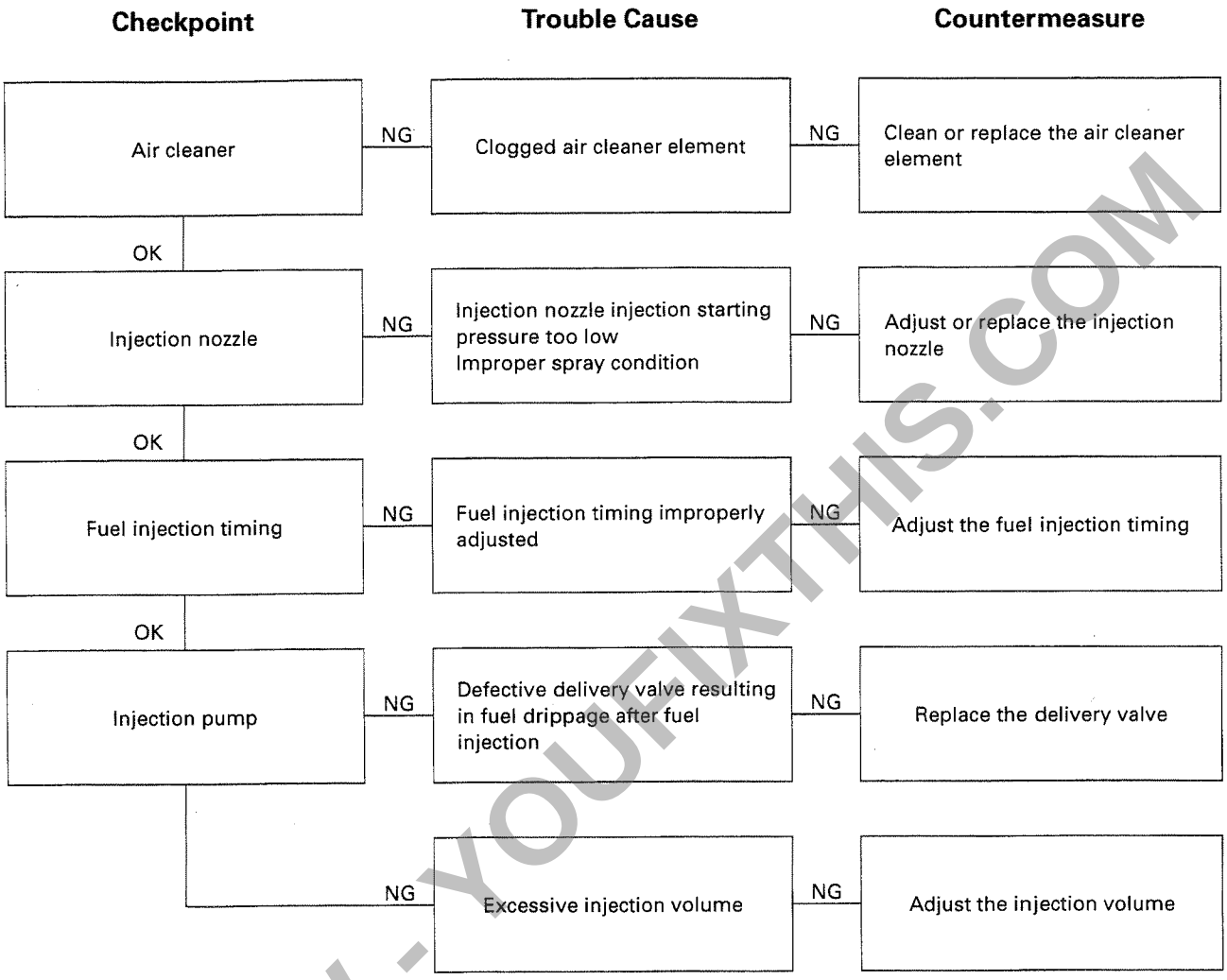
The alternator consists of the front cover, the rotor, the stator, the built-in IC regulator (some engines use a Tirrell alternator with separate regulator), and the rear cover.

This small size and light weight alternator provides excellent reliability. Its simple construction makes it very easy to service. The built-in IC regulator minimizes circuit wiring.

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8. DARK EXHAUST SMOKE



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