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TORQUE SPECIFICATIONS - DECIMAL HARDWARE

Use the torques in this chart when special torques are not given. These torques apply to fasteners with both UNC and UNF threads as received from suppliers, dry, or when lubricated with engine oil. Not applicable if special graphites, molydisulfide greases, or other extreme pressure lubricants are used.

Grade 5 Bolts, Nuts, and Studs



Size	Pound-Feet	Newton metres
1/4 in	9-11	12-15
5/16 in	17-21	23-28
3/8 in	35-42	48-57
7/16 in	54-64	73-87
1/2 in	80-96	109-130
9/16 in	110-132	149-179
5/8 in	150-180	203-244
3/4 in	270-324	366-439
7/8 in	400-480	542-651
1.0 in	580-696	787-944
1-1/8 in	800-880	1085-1193
1-1/4 in	1120-1240	1519-1681
1-3/8 in	1460-1680	1980-2278
1-1/2 in	1940-2200	2631-2983

Grade 8 Bolts, Nuts, and Studs



Size	Pound-Feet	Newton metres
1/4 in	12-15	16-20
5/16 in	24-29	33-39
3/8 in	45-54	61-73
7/16 in	70-84	95-114
1/2 in	110-132	149-179
9/16 in	160-192	217-260
5/8 in	220-264	298-358
3/4 in	380-456	515-618
7/8 in	600-720	814-976
1.0 in	900-1080	1220-1465
1-1/8 in	1280-1440	1736-1953
1-1/4 in	1820-2000	2468-2712
1-3/8 in	2380-2720	3227-3688
1-1/2 in	3160-3560	4285-4827

NOTE: *Use thick nuts with Grade 8 bolts.*

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CAPACITIES AND LUBRICANT SPECIFICATIONS

Fuel Tank
- Capacity ..... 132.1 U.S. gallons (500 litres)
- Type of fuel ..... See Diesel Fuel on page 6

Engine Oil Capacity
- Capacity with filter change ..... 7.7 U.S. gallons (29 litres)
- Type of Lubricant ..... Case IH Engine Oil, see Engine Lubrication on page 5

Engine Cooling System
- Capacity ..... 12.7 U.S. gallons (48 litres)
- Type of coolant ..... Use a mixture of 55% ethylene glycol and 45% water. If lowest ambient temperature will be below -34˚F (-36.6˚C) adjust the mixture.

Hydraulic Reservoir
- Tank Capacity ..... 55.5 U.S. gallons (210 litres)
- System Capacity ..... 118.9 U.S. gallons (450 litres)
- Type of fluid ..... See Hydraulic Oil Chart on page 4

Swing Gearbox
- Capacity ..... 5.5 U.S. gallons (21 litres)
- Type of lubricant ..... Case IH 135H EP Gear Lube

Swing Ring Gear
- Capacity ..... 68.3 pounds (31 kg)
- Type of lubricant ..... Case No. 2 Lithium Grease

Turntable Bearing
- Capacity ..... As required
- Type of lubricant ..... Case No. 2 Lithium Grease

Final Drives
- Capacity ..... 1.8 U.S. gallons (6.8 litres)
- Type of lubricant ..... Case IH 135H EP Gear Lube

Track Roller
- Capacity ..... 14.5 ounces (440 cc)
- Type of lubricant ..... Shell Rimula Oil No. 30 or equivalent to API Class CD, SAE 30

Carrier Roller
- Capacity ..... 6.6 ounces (200 cc)
- Type of lubricant ..... Shell Rimula Oil No. 30 or equivalent to API Class CD, SAE 30

Idler Wheel
- Capacity ..... 11.9 ounces (360 cc)
- Type of lubricant ..... Shell Rimula Oil No. 30 or equivalent to API Class CD, SAE 30

Track Adjustment Cylinder
- Capacity ..... As required
- Type of lubricant ..... Case No. 2 Lithium Grease

Grease Fitting
- Type of lubricant ..... Case No. 2 Lithium Grease

Batteries
- Capacity ..... As required
- Type of lubricant ..... Use drinking or distilled water

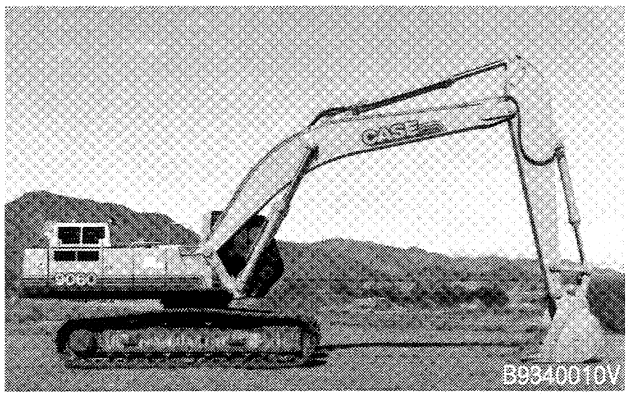
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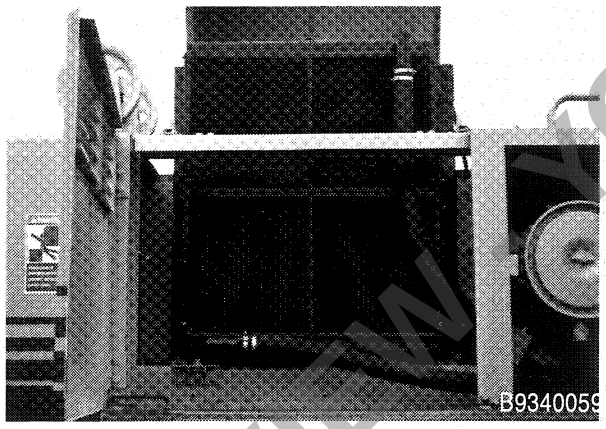
ENGINE

Removal

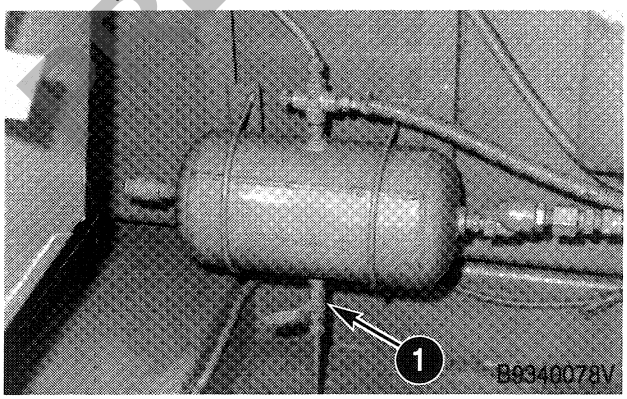
1. Park the machine on a hard level surface. Lower the tool to the floor and stop the engine.



2. Remove the access door over the engine. Open the access doors on each side of the engine compartment. Remove the access covers from under the engine and the radiator.

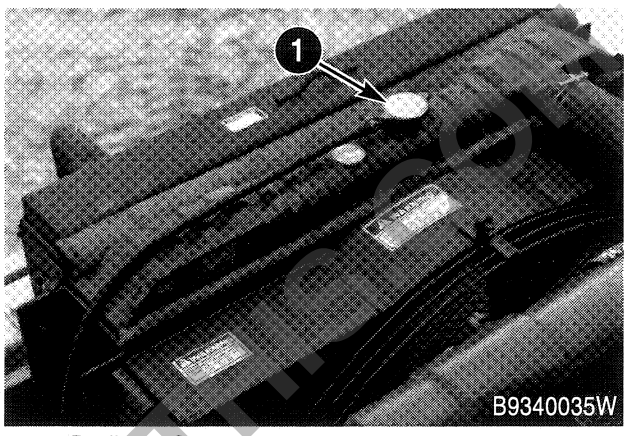


3. Open the drain valve for the air reservoir and release the air from the system. The drain valve is shown in the closed position.



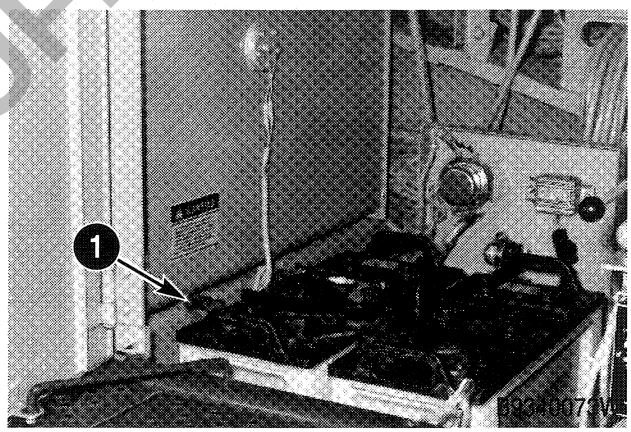
1. Drain Valve

4. Make sure that the engine is cool and remove the radiator cap. Open the drain valve and drain the cooling system. The cooling system holds 12.7 U.S. gallons (48 litres) of coolant.



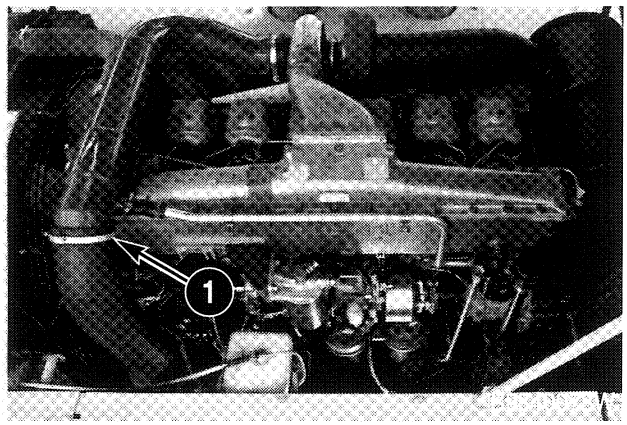
1. Radiator Cap

5. Open the access door for the batteries and disconnect the ground cable.



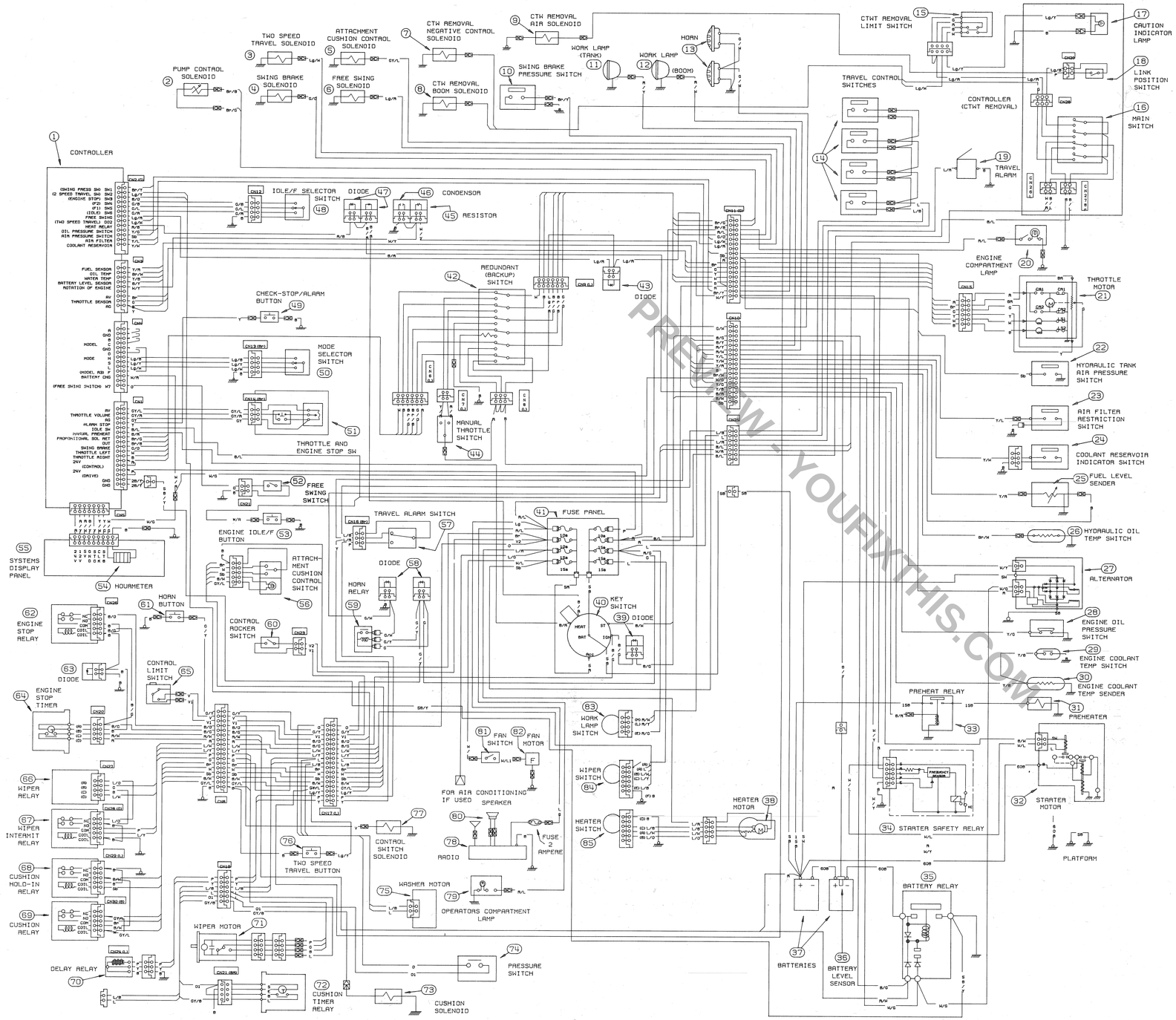
1. Ground Cable

6. Disconnect the hose for the air cleaner from the tube on the turbocharger (2).



1. Disconnect hose here.

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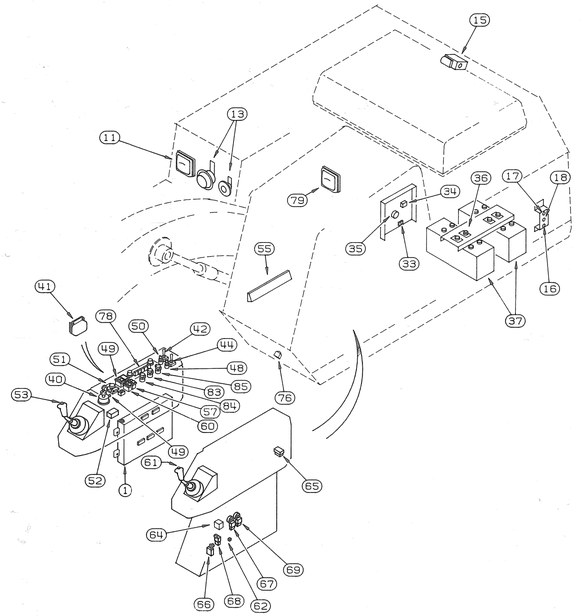
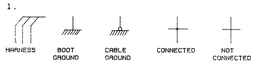


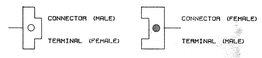
TABLE OF COLOR SYMBOLS			
SYMBOL	COLOR	SYMBOL	COLOR
B	BLACK	R	RED
W	WHITE	Y	YELLOW
Br	BROWN	Lg	LIGHT GREEN
P	PINK	Sb	SKY BLUE
V	VIOLET	L	BLUE
G	GREEN	GY	GRAY
O	ORANGE		

NOTES:

1.



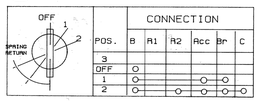
2.



3.

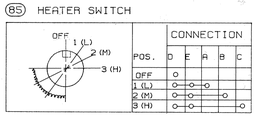


40 KEY SWITCH



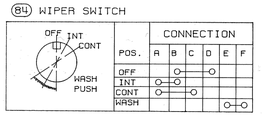
POS.	CONNECTION B	R1	R2	Acc	Br	C
3						
OFF	○					
1	○			○	○	○
2	○			○	○	○

85 HEATER SWITCH



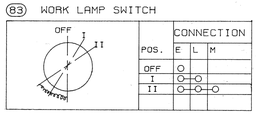
POS.	CONNECTION D	E	A	B	C
OFF	○				
1 (L)	○	○	○		
2 (M)	○	○		○	
3 (H)	○	○			○

84 WIPER SWITCH



POS.	CONNECTION A	B	C	D	E	F
OFF						
INT	○	○				
CONT	○		○			
WASH					○	○

83 WORK LAMP SWITCH



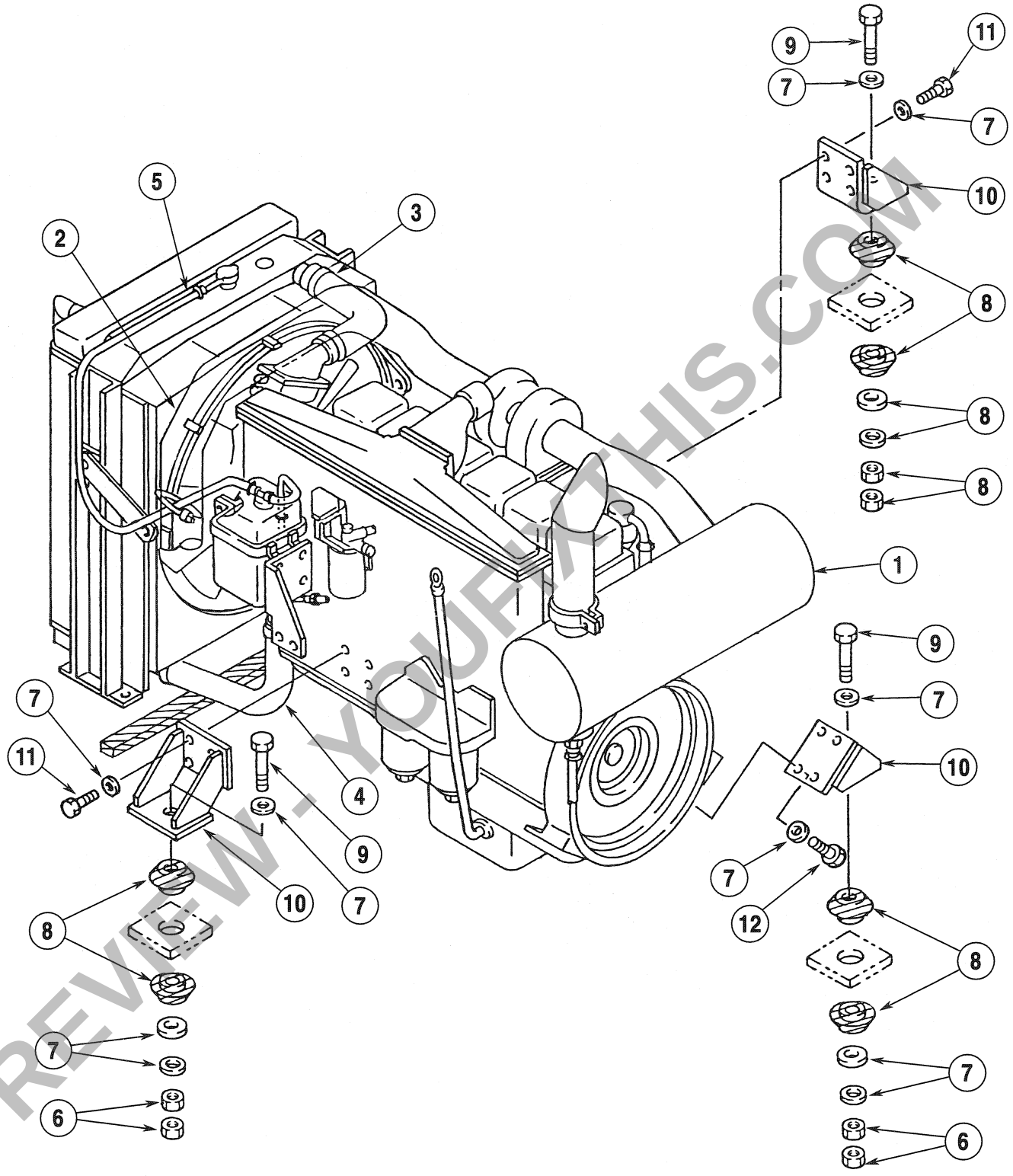
POS.	CONNECTION E	L	M
OFF	○		
I	○	○	
II	○	○	○

9060 HYDRAULIC AND ELECTRICAL SCHEMATIC

Additional copies of this hydraulic and electrical schematic can be ordered through Technical Publications Distribution System. The part number is 7-46810.

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1. *Muffler*
2. *Disconnect Hose for Air Cleaner Here.*
3. *Top Radiator Hose*
4. *Bottom Radiator Hose*
5. *Hose for the Coolant Reservoir*
6. *Self-Locking Nut*
7. *Washer*
8. *Insulator*
9. *Tighten to 213 to 249 pound-feet (289 to 337 Nm)*
10. *Engine Mounting Bracket*
11. *Tighten to 128 to 149 pound-feet (173 to 202 Nm)*
12. *Tighten to 197 to 230 pound-feet (267 to 312 Nm)*

NOTE: *Apply Loctite 262 on the threads of the bolts (9), and the cap screws (11 and 12).*

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6. TROUBLESHOOTING

Symptom	Probable cause	Remedy	Ref group
Engine will not start	Inadequate oil viscosity	Replace	Group 12
	Incorrect fuel in use		Group 13
	Low compression pressure • Incorrect valve clearance	Adjust	
	• Defective head gasket	Replace	
	• Worn valve and valve seat, carbon deposit		
	• Deteriorated valve spring		
	• Worn or damaged piston ring		
	• Worn or damaged piston ring groove		
	• Worn piston and cylinder liner	Change to oversize	
	Defective preheater • Defective starter switch	Correct or replace	Group 16
	• Defective heater relay		
	Incorrect injection timing	Adjust	Group 13
	Insufficient injection amount • Defective injection pump	Correct or replace	Group 13
	• Incorrect injection amount		
	Cooling system not functioning properly	Correct or replace	Group 14
Rough idle	Inadequate oil viscosity	Replace	Group 12
	Incorrect fuel in use		Group 13
	Defective cooling system	Correct or replace	Group 14
	Low compression pressure (See "Engine will not start".)		
	Incorrect injection timing	Adjust	Group 13
	Defective fuel system • Defective injection pump	Correct or replace	Group 13
	• Defective injection nozzle		
	• Air trapped in fuel system		
Abnormal exhaust gas color	Incorrect fuel in use	Replace	Group 13
	Cooling system not functioning properly	Correct or replace	Group 14
	Intake/exhaust system not functioning properly • Clogged air cleaner	Correct or replace	Group 15
	• Clogged muffler		
	• Oil leaks to intake/exhaust pipes		
	Low compression pressure (See "Engine will not start".)		
	Defective fuel system • Defective injection pump	Correct or replace	Group 13
	• Defective injection nozzle		
	Incorrect injection timing	Adjust	
	Excessive engine oil	Adjust	Group 12
	Binding of major moving parts	Correct or replace	

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Section

1001

STANDARD TORQUE SPECIFICATIONS FOR 9000 SERIES EXCAVATORS

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Bur 7-44790

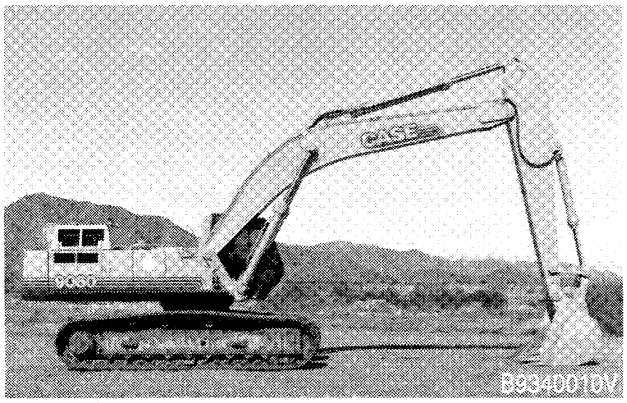
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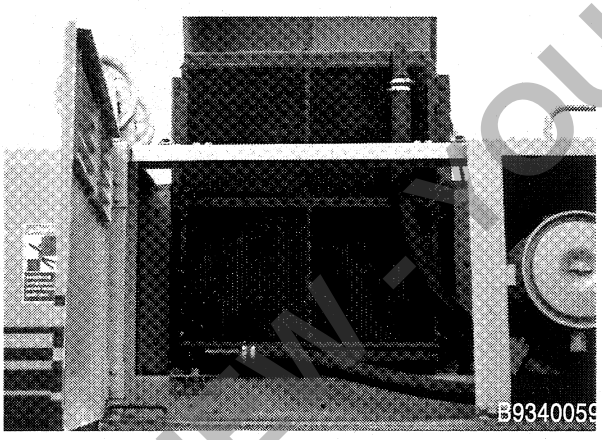
RADIATOR

Removal

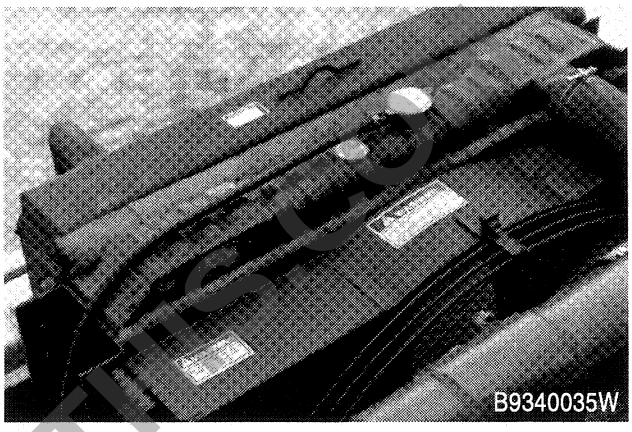
1. Park the machine on a hard level surface. Lower the tool to the floor and stop the engine.



2. Open the access doors over the engine and on the right side of the engine compartment. Remove the access cover from under the radiator.



3. Make sure that the engine is cool and remove the radiator cap. Open the drain valve and drain the cooling system. The cooling system holds 12.7 U.S. gallons (48 litres) of coolant.



4. Disconnect the top and bottom radiator hoses from the radiator.

5. Disconnect the hose for the coolant reservoir from the radiator.

6. Remove the fan guard and the fan shroud from the radiator.

7. Remove the cap screws and hardware that hold the fan and the spacer to the engine. Remove the fan and the spacer.

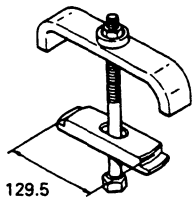
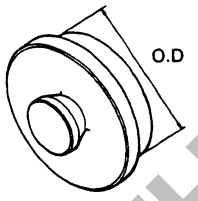
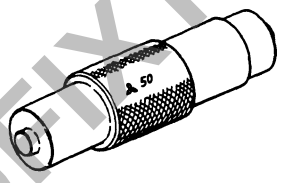
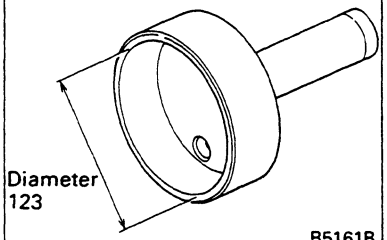
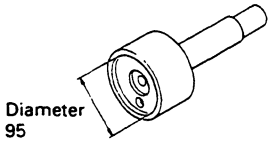
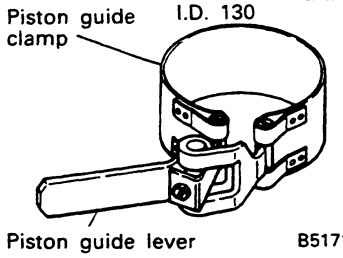
8. Connect acceptable lifting equipment to the radiator. The weight of the radiator is 441 pounds (200 kg)

9. Remove the hardware that holds the radiator to the frame.

10. Remove the radiator from the machine.

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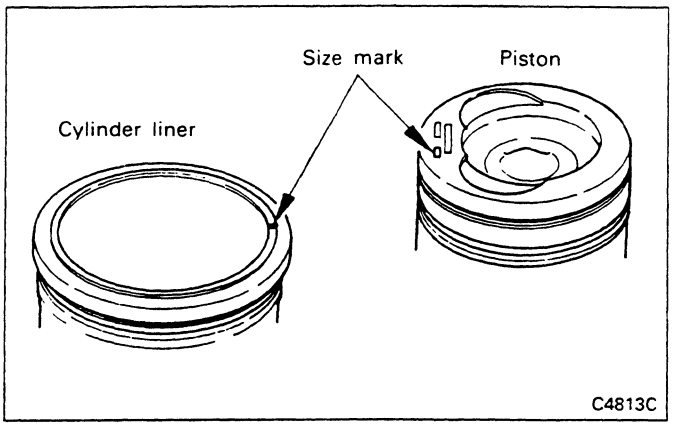
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Tool name		Part No.	Shape	Use
Cylinder liner extractor		MH061490	 B5131A	Removal of cylinder liner
Cylinder liner installer		MH061759	 B5141A	Press-fitting of cylinder liner
Connecting rod bushing puller		MH061238	 B5321A	Removal and installation of connecting rod bushing
Rear oil seal slinger installer		MH061652	 B5161B	Press-fitting of rear oil seal slinger
Front oil seal slinger installer		MH061817	 B0585A	Press-fitting of front oil seal slinger
Piston guide	Piston guide clamp	MH061666	 B5171B	Insertion of piston
	Piston guide lever	MH061658		

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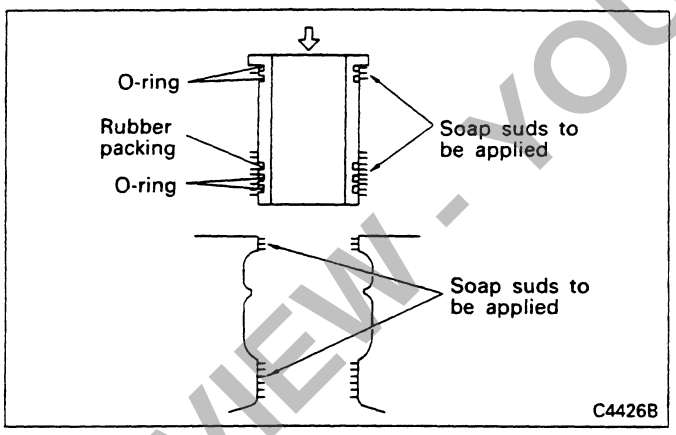
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(b) Installation

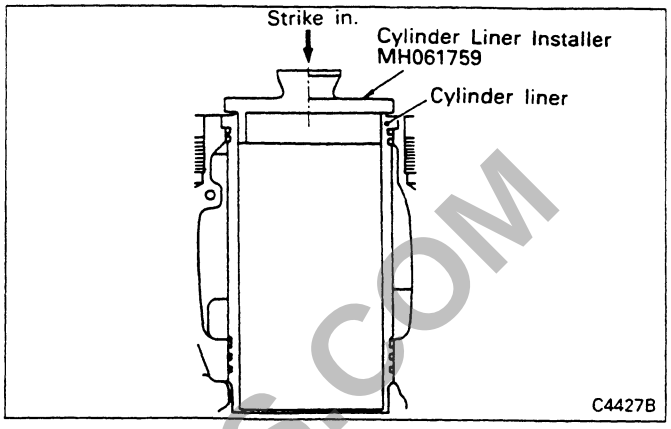


1) When replacing the cylinder liner, use a cylinder liner with the same size mark as that of the piston to be selected.

Size mark of piston	A	B	C
Size mark of cylinder liner	A	B	C



2) After a new rubber packing and O-ring have been installed to the cylinder liner, slowly insert the cylinder liner into the crankcase.



3) Securely seat the cylinder liner on the crankcase by lightly striking the flange portion, using Cylinder Liner Installer (special tool).

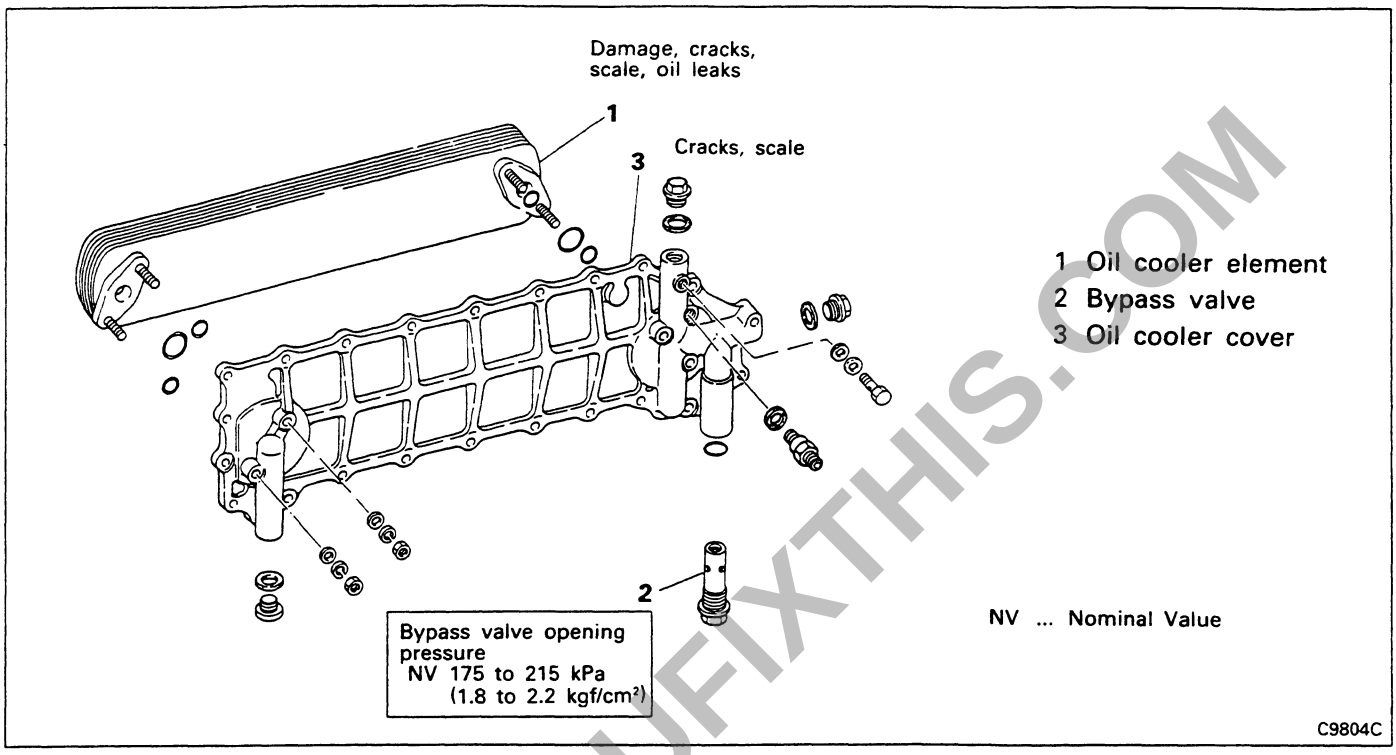
NOTE:

1. **Apply soap suds to the crankcase and cylinder liner fitting portions and make sure that the rubber packing and O-ring are not twisted when inserted.**
2. **After installation, conduct the leak test to verify air-tightness. Apply thrust force to cylinder liner flange.**

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4.2.3 Oil Cooler



(1) Cleaning

(a) Check for carbon or sludge deposited in the oil passage of the oil cooler element and bypass valve. If contamination is evident, wash in a cleaning oil.
(b) If there is much scale on the element and cover, wash with tap water (preferably hot water).

(2) Air Pressure Test

To check for oil leaks due to a broken or cracked element, air pressure test should be performed.
Apply 1470 kPa (15 kgf/cm²) air pressure to the element to check for leaks. If air leaks or other defects are evident, replace the element.

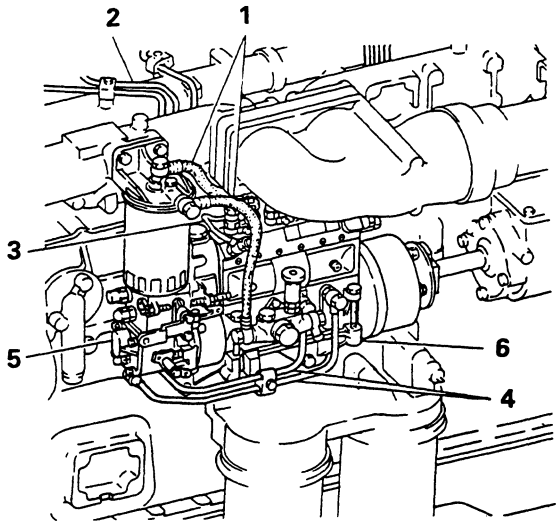
NOTE:
Make sure that the specified air pressure is not exceeded.

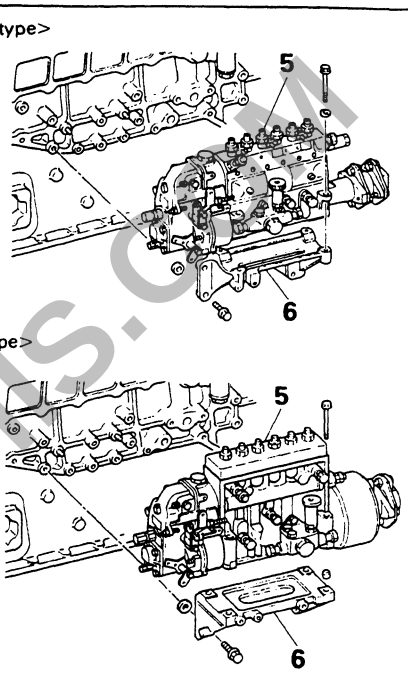
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5.1 INJECTION PUMP

5.1.1 Removal



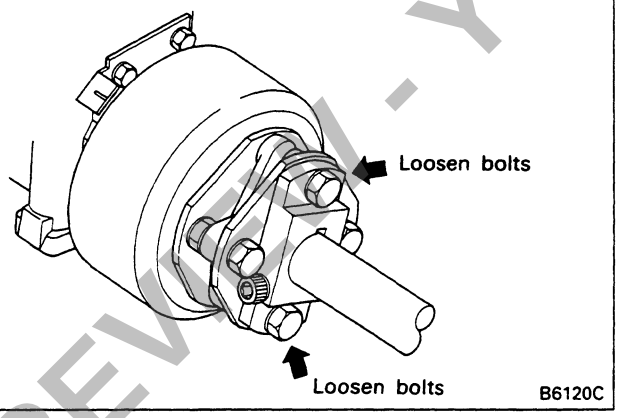


1 Fuel hose
2 Injection pipe
3 Overflow pipe
4 Oil pipe
⑤ Injection pump
6 Injection pump bracket

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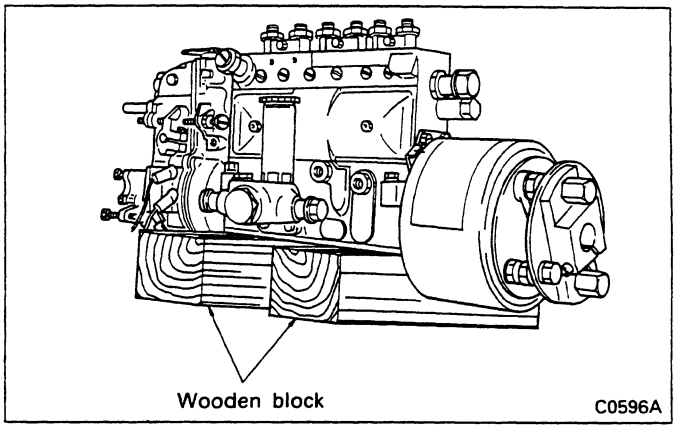
Note:
Never remove the injection pump bracket unless it is unavoidable due to cracks, etc.

B9153C



B6120C

(1) At removal, first loosen bolts indicated by arrows in figure from coupling.



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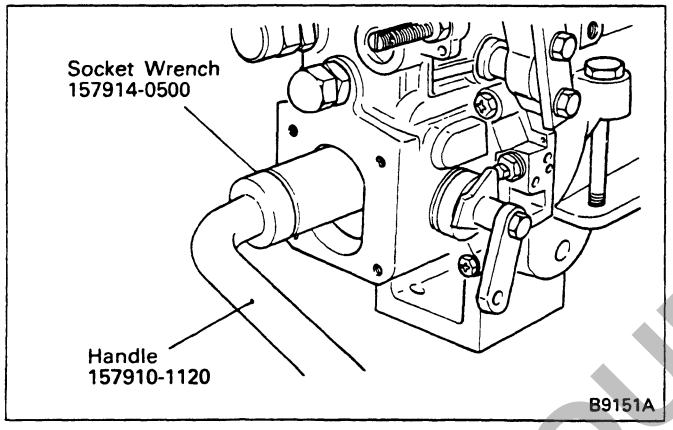
(2) Use a wood block to store injection pump lest excess force might be applied to timer.

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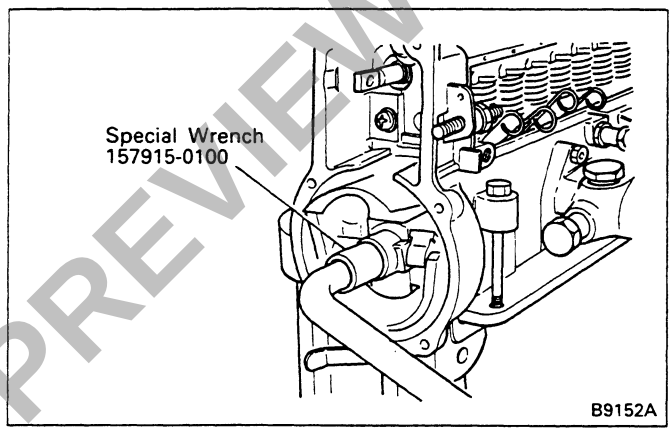
NOTE:

1. **Do not disassemble the shackle and governor sleeve from the guide lever, unless replacement is necessary.**
2. **Do not remove the governor housing unless removal is necessitated for correction of oil leaks, parts replacement, etc.**
   Before removing the housing, use Tappet Insert (special tool) to separate the camshaft from the tappet.



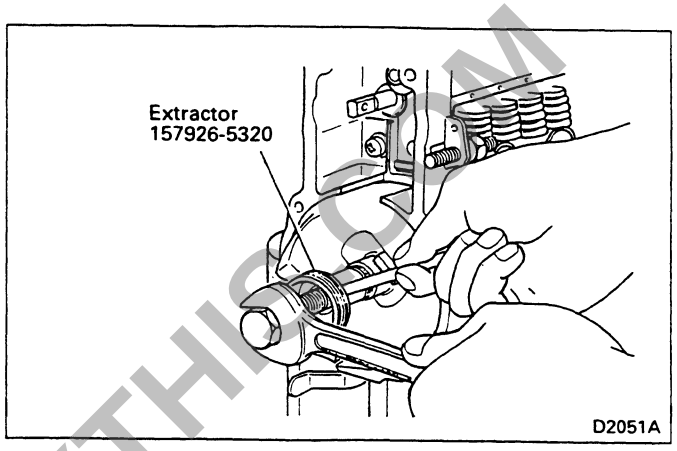
(a) Removal of ungleich spring assembly

Using Socket Wrench (special tool), loosen the nut tightening the ungleich spring assembly to the tension lever, and remove the ungleich spring capsule.



(b) Removal of flyweight

Using Special Wrench (special tool), remove the round nut tightening the flyweight. At this time, hold the drive side to prevent it from turning.



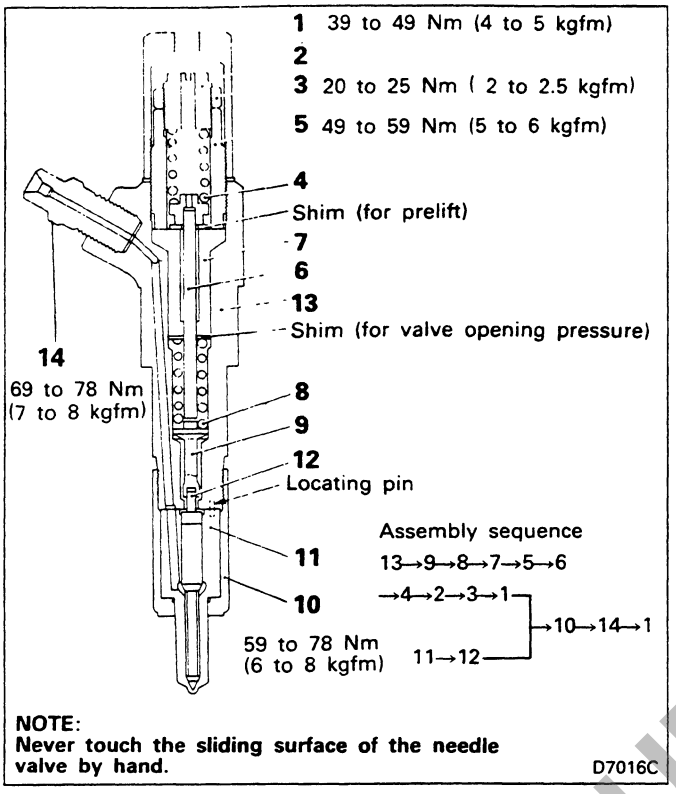
Thread Extractor (special tool) into the flyweight. After the bolt end has touched the camshaft, lightly strike the bolt head and turn down the bolt to remove the flyweight.

NOTE:

Do not attempt disassembly to remove the swivel lever except when replacement of parts is necessary or when unsmooth operation is evident. In addition, disassembly of parts for the stop device and torque spring mechanism of the governor is not generally required.

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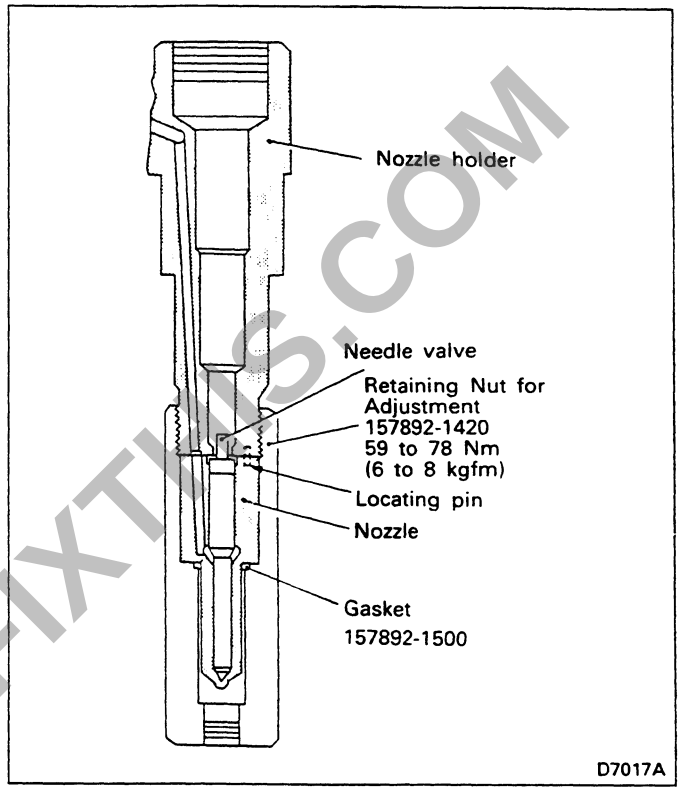


Adjusting steps

① Adjustment of nozzle opening pressure
② Selection of prelift adjusting shims
③ Adjustment of 2-spring adjusting pressure
*④ Check of needle valve full lift
⑤ Installation of prelift shims
*⑥ Checking of prelift
*⑦ Checking of 2-spring adjusting pressure
⑧ Inspection

Inspection make operations marked with * as necessary for inspection or confirmation.

(1) Adjustment of Nozzle Valve Opening Pressure



(a) Using the Retaining Nut for Adjustment (special tool) install the nozzle and needle valve to the nozzle holder.

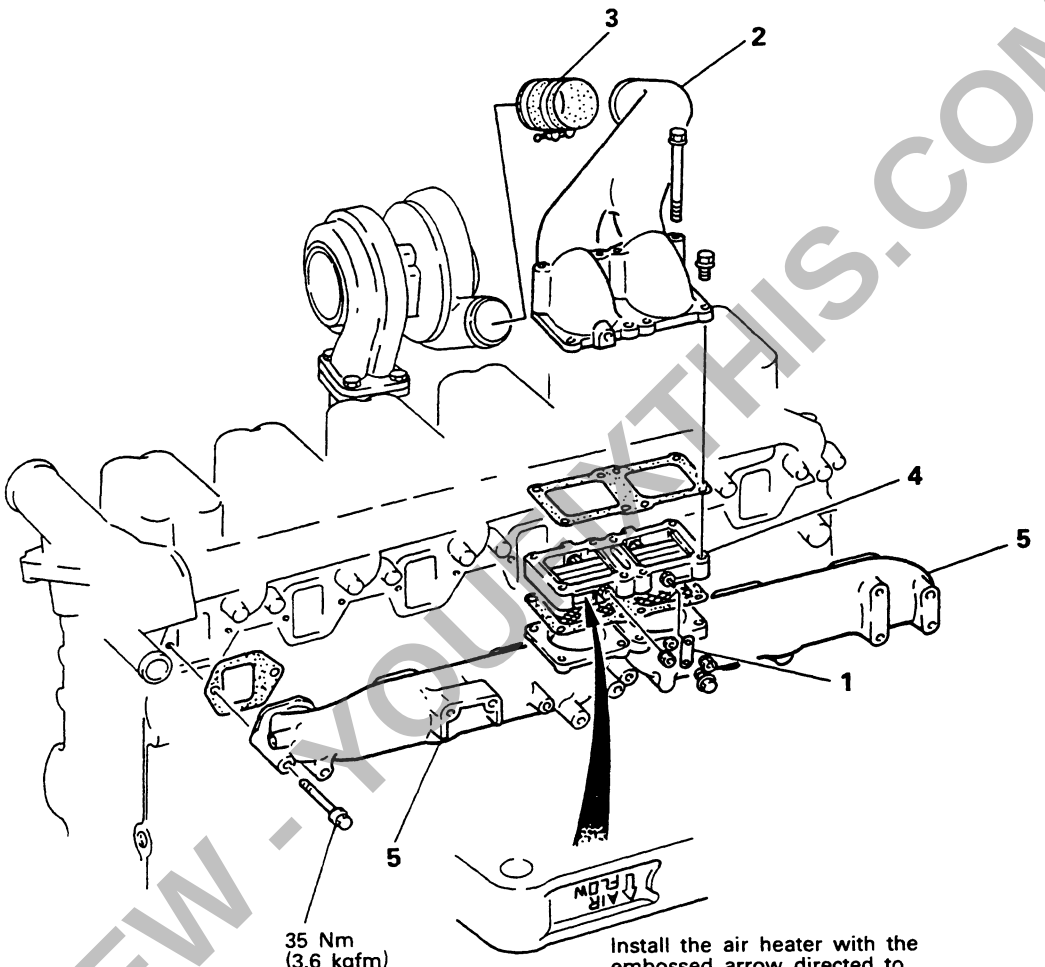
NOTE:

1. **Make sure that the knock pin has seated completely in the nozzle before tightening the retaining nut for adjustment. Tighten the retaining nut finger tight and then tighten to specified torque using a torque wrench.**
2. **Remove the bolt from the tip of the retaining nut.**

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1 Earth plate
2 Inlet pipe
3 Rubber hose
4 Air heater
5 Inlet manifold

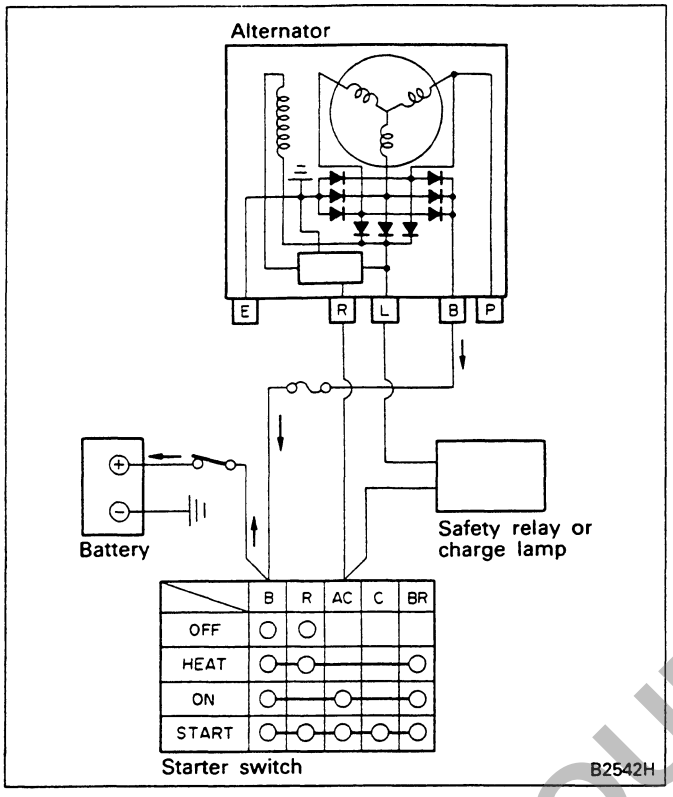
NOTE:
1. Remove all harnesses before disassembly.
2. Pay attention to air heater mounting direction.
3. For inspection of air heater, see "Groupe 16".

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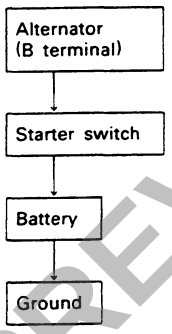
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2) Starting the engine

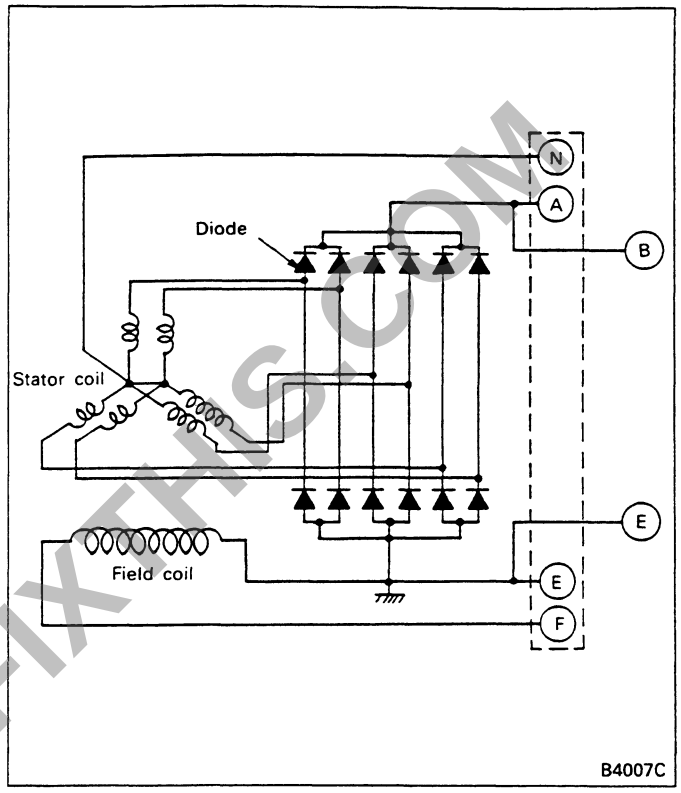


When the engine is started and the alternator starts generation so that the voltage at the alternator "B" terminal becomes higher than the battery voltage, the current flows as shown below.



In this way, battery charge is started and at the same time, the charge lamp (if provided) goes out.

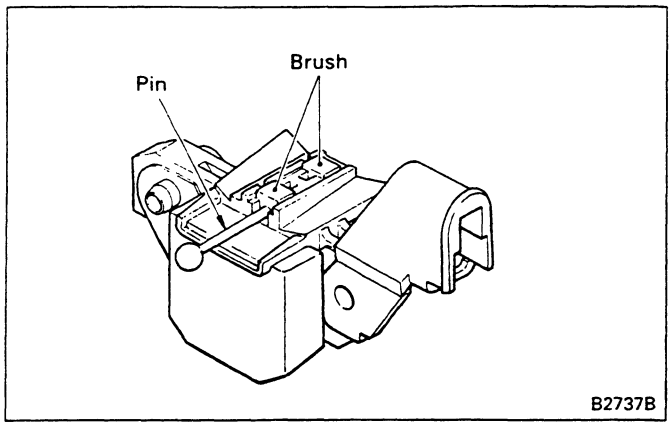
(2) 60A Alternator



The 60A alternator is an open type three-phase alternator. The three-phase AC generated in the stator coil is converted into DC by the silicon diodes.
A total of 12 diodes (6 on the positive side and 6 on the negative side) are housed in 6 heat sinks, two in each heat sink.
The alternator generated voltage is controlled by the regulator.

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2) When soldering the brush, insert a pin into the brush hole and fix to the regulator assembly.

NOTE:
When soldering or unsoldering, work quickly (within about 5 seconds) with a soldering iron.

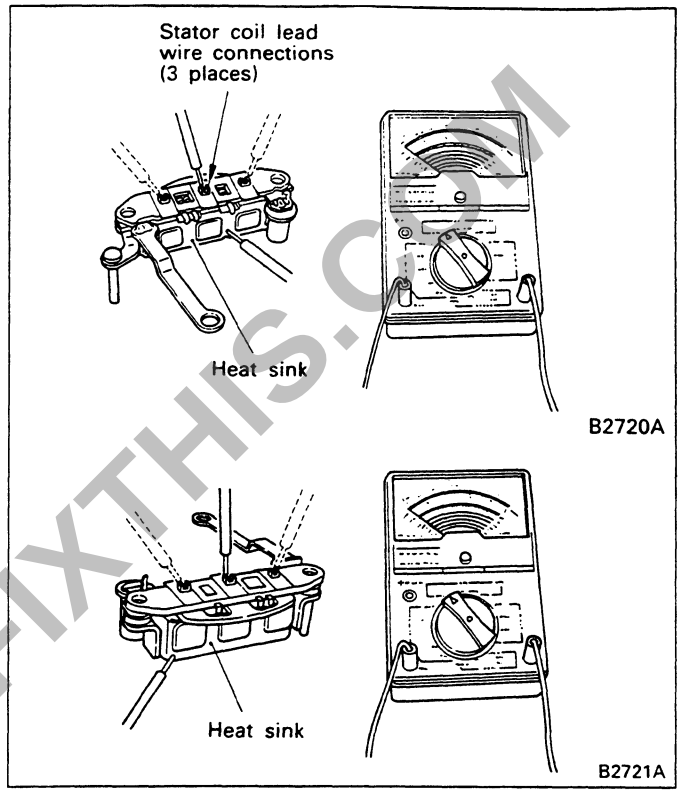
(4) Inspection of Rectifier

Measure resistance of each diode. Measure both when with the circuit tester (+) probe applied to the diode and when with the (–) probe applied to the diode.

- If resistance is infinite in both cases, the diode is open.
- If resistance is close to zero in both cases, the diode is shorted.

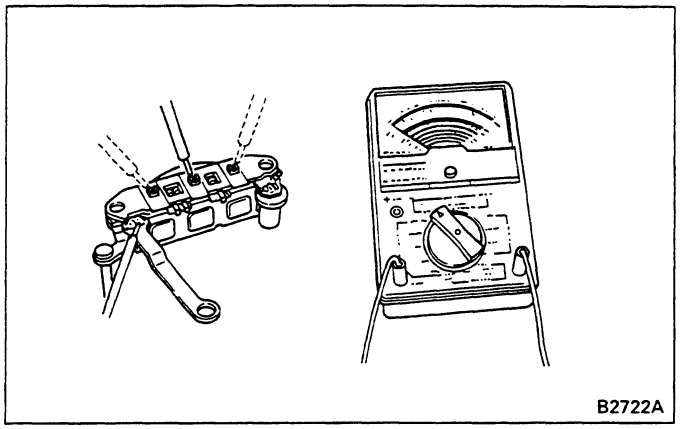
In the case of open or shorted diode, replace the rectifier.
Measure according to the following procedures.

(a) Measurement of diode mounted to heat sink (6 places)



Measure between the heat sink and stator coil lead connections.

(b) Measurement of diode trio (3 places)

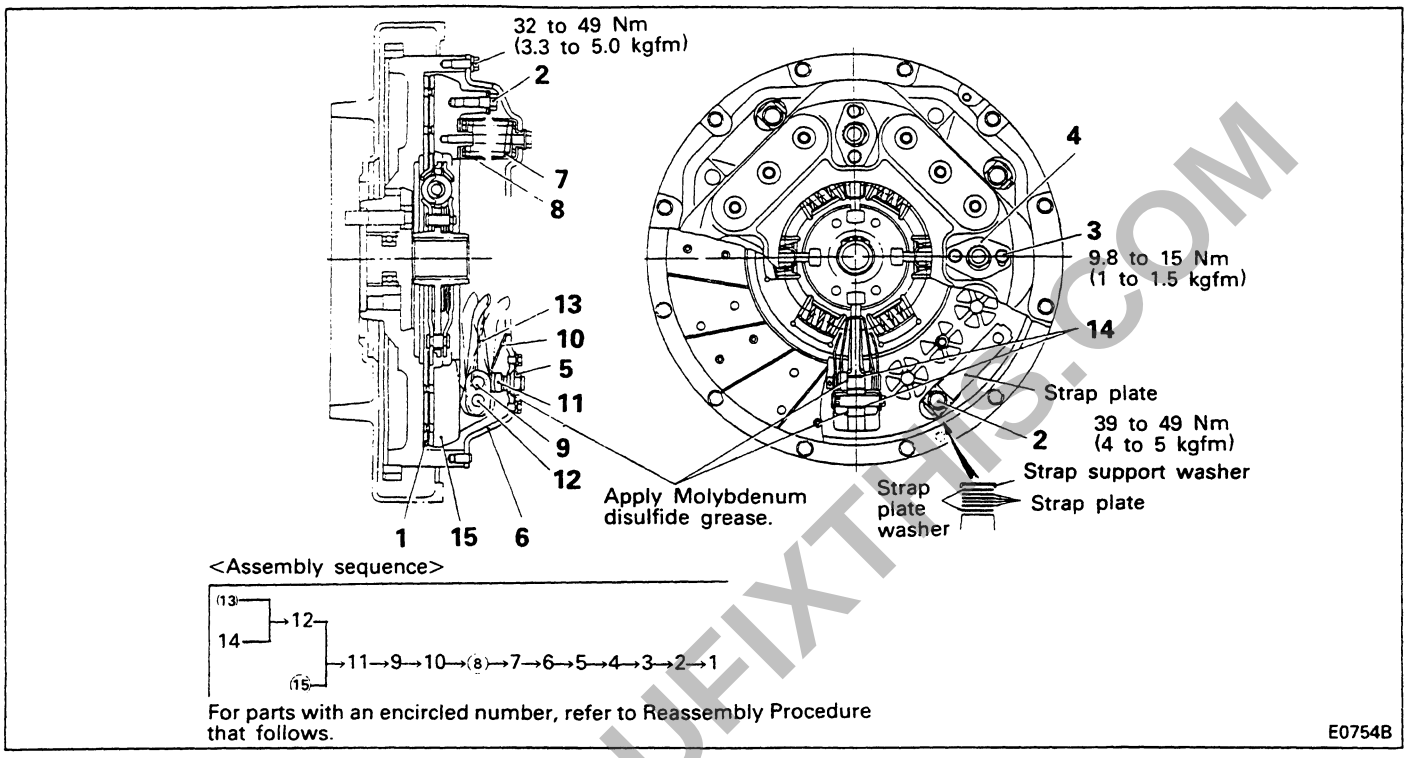


Measure between the plate connecting to the regulator and the stator coil lead connections.

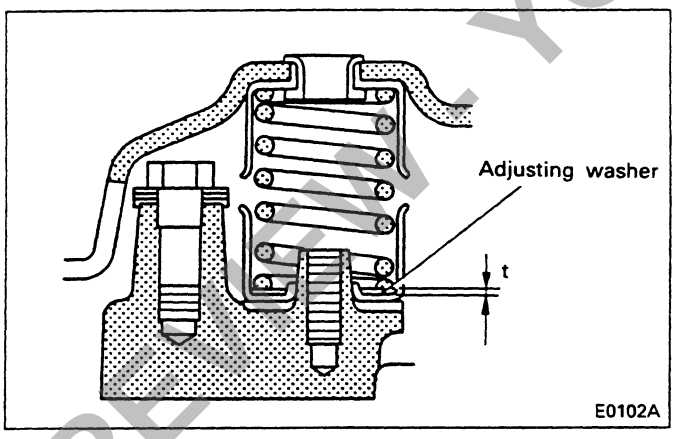
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5.2.2 Reassembly and Adjustment

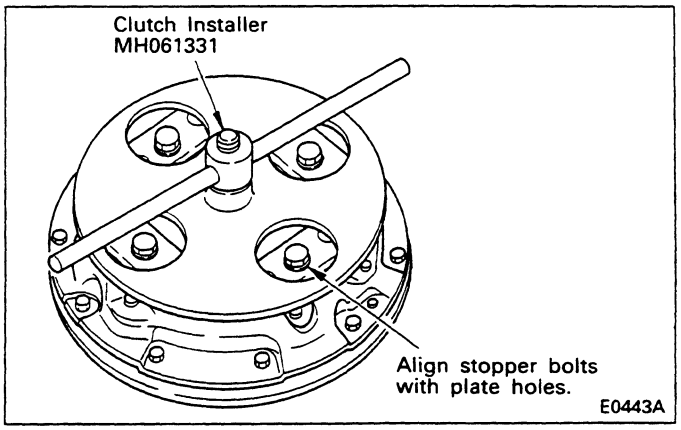


Reassembly Procedure



(1) Whenever the pressure plate friction surface is corrected, insert adjusting washers of thickness equivalent to correction amount.

Friction surface correction amount	Adjusting washer thickness
Less than 1	None required
1 or more and less than 2	One 1.2
2 or more and less than 3	Two 1.2 or one 2.3



(2) To install the clutch cover, align the alignment marks and, using the special tool, Clutch Installer, temporarily tighten the stopper bolts.

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SECTION INDEX - FUEL SYSTEM

Section Title	Section Number

See Mitsubishi Motors Shop Manual in Tab 2

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TENNECO

Bur 7-47490

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56 ATTACHMENT CUSHION CONTROL SWITCH

Check Points	Reading	Possible Cause of Bad Reading
NOTE: *Put the key switch in the ON position.*		
Terminal for brown wire to ground.	24 volts	Bad circuit between the attachment cushion control switch and the 10 ampere fuse in the fuse panel (41). Also check the fuse panel (41).
NOTE: *Hold the attachment cushion control switch in the CUSHION position as the reading is taken.*		
Terminal for sky blue wire to ground.	24 volts	Bad attachment cushion control switch.
NOTE: *Hold the attachment cushion control switch in the NORMAL position as the reading is taken.*		
Terminal for white wire to ground.	24 volts	Bad attachment cushion control switch.
Terminal for gray/blue wire to ground.	24 volts	Bad circuit between the attachment cushion control switch and the cushion relay (69). Also check the cushion relay (69).
Terminal for gray/blue wire to terminal for black/white wire.	24 volts	Bad ground circuit between the attachment cushion control switch and the cushion hold-in relay (68). Also check the cushion hold-in relay (68).

NOTE: *If the readings are good, check the attachment cushion control solenoid (5).*

57 TRAVEL ALARM SWITCH

Check Points	Reading	Possible Cause of Bad Reading
NOTE: *Run the machine at low idle for thirty seconds to make sure that the pilot system is pressurized. Lower the tool to the floor and stop the engine. Disconnect the connector from the travel alarm switch, and check for voltage at the wiring side of the connector. Put the key switch in the ON position. Put the travel alarm switch in the ON position. Have another person move the travel control levers forward or reverse as the reading is taken.*		
Terminal for blue/black wire to ground.	24 volts	Bad circuit between the travel alarm switch and the travel control switch (14). Also check the travel control switch (14).
Terminal for blue/black wire to terminal for blue/red wire.	24 volts	Bad circuit between the travel alarm switch and the travel alarm (19). Also check the travel alarm (19).
NOTE: *Run the machine at low idle for thirty seconds to make sure that the pilot system is pressurized. Lower the tool to the floor and stop the engine. Put the key switch in the OFF position. Connect the connector. Put the travel alarm switch in the OFF position. Have another person move the travel control levers forward or reverse as the reading is taken.*		
Terminal for pink wire to ground.	24 volts	Bad travel alarm switch.
Terminal for yellow wire to ground.	24 volts for 10 to 20 seconds	Bad circuit between the travel alarm switch and the delay relay (70). Also check the delay relay (70).

NOTE: *If the readings are good, replace the travel alarm switch.*

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SPECIFICATIONS

Track
- Track deflection ..... 2.8 to 3.6 inches (70 to 91 mm)
- Special Torques
  - Bolts that hold the track shoes ..... 579 to 651 pound-feet (784 to 882 Nm)

Sprocket
- Special Torques
  - Cap screws that hold the sprocket (apply Loctite 262 on the threads of the cap screws) ..... 664 to 775 pound-feet (900 to 1050 Nm)

Track Roller
- Special Torques
  - Cap screws that hold the end caps for the track roller to the track frame (apply Loctite 262 on the threads of the cap screws) ..... 664 to 775 pound-feet (900 to 1050 Nm)
- Lubrication
  - Type of lubricant ..... Shell Rimula Oil No. 30 or equivalent to API Class CD, SAE 30
  - Capacity ..... 14.5 ounces (440 cc)

Carrier Roller
- Special Torques
  - Cap screws that hold the brackets for the carrier roller to the track frame (apply Loctite 262 on the threads of the cap screws) ..... 664 to 775 pound-feet (900 to 1050 Nm)
  - Cap screws that hold the retainer ..... 46 to 54 pound-feet (62 to 73 Nm)
  - Cap screws that hold the cover ..... 46 to 54 pound-feet (62 to 73 Nm)
- Lubrication
  - Type of lubricant ..... Shell Rimula Oil No. 30 or equivalent to API Class CD, SAE 30
  - Capacity ..... 6.6 ounces (200 cc)

Idler Wheel
- Lubrication
  - Type of lubricant ..... Shell Rimula Oil No. 30 or equivalent to API Class CD, SAE 30
  - Capacity ..... 11.9 ounces (360 cc)

Recoil Spring
- Special Torques
  - Cap screws that hold the yoke to the brackets on the idler wheel (apply Loctite 262 on the threads of the cap screws) ..... 197 to 230 pound-feet (267 to 312 Nm)
- Compressed length of recoil spring ..... 31.69 inches (805 mm)

Track Adjustment Cylinder
- Special Torques
  - Check valve assembly ..... 43 pound-feet (58.3 Nm)
- Lubrication
  - Type of lubricant ..... Case No. 2 Lithium Grease
  - Capacity ..... as required

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TYPES OF CONTAMINATION

There are two types of contamination, microscopic and visible. Microscopic contamination occurs when very fine particles of foreign materials are in suspension in the hydraulic oil. These particles are too small to see or feel. Microscopic contamination can be found by the identification of the problems the microscopic contamination causes, or by testing in a laboratory. Examples of problems caused by microscopic contamination include the following.

1. Cylinder rod seals leak.

2. Control valve spools do not return to neutral.

3. The hydraulic system has a high operating temperature.

4. Rapid wear of components.

Visible contamination is foreign material that can be found by sight, touch, or odor. Visible contamination can cause sudden failure of a component. Examples of visible contamination include the following.

1. Particles of metal or dirt in the oil.

2. Air in the oil.

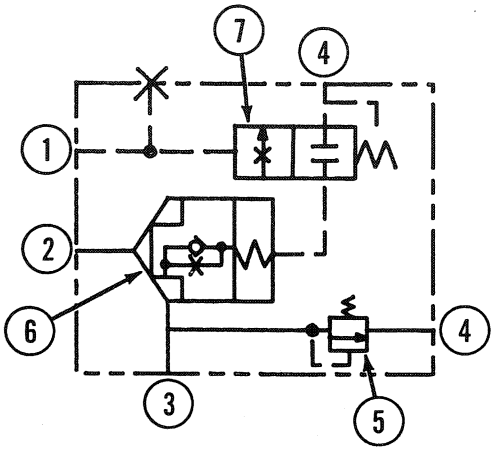
3. Odor of burned oil.

4. Water in the oil. See Flushing Water From The Hydraulic System on page 5.

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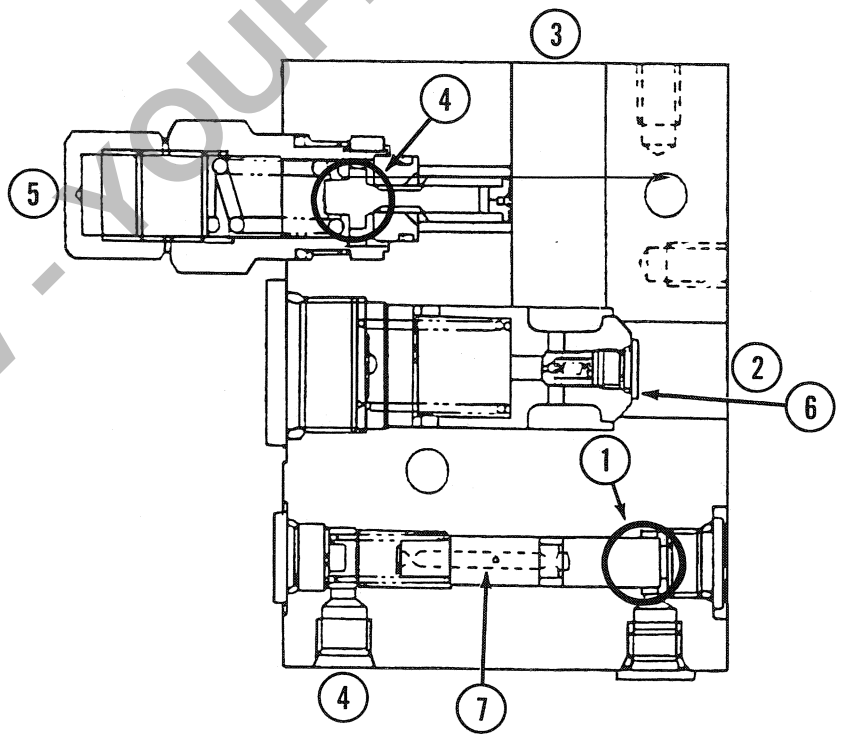
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(2) BOOM HOLDING VALVE



1. From Pilot Control Circuit
2. From Main Control Valve
3. To Boom Cylinders
4. To Hydraulic Reservoir
5. Circuit Relief Valve for Boom Up Circuit
6. Plunger
7. Spool

Prevents boom from lowering from force of load.



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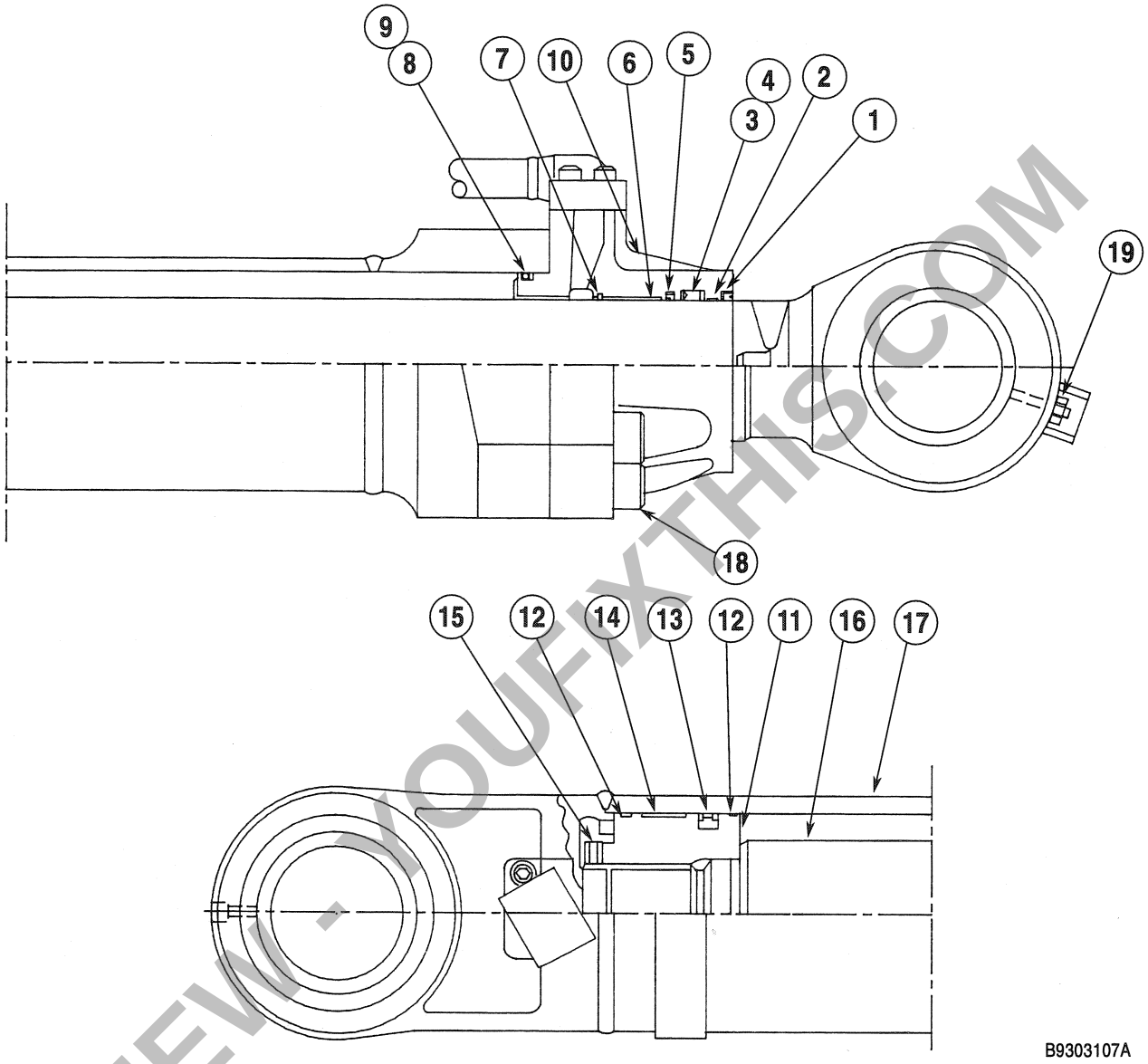
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BUCKET CYLINDER



1. *Wiper Seal*
2. *Wear Ring*
3. *Backup Ring*
4. *Seal*
5. *Seal*
6. *Bushing*
7. *Snap Ring*
8. *Backup Ring*
9. *O-ring*
10. *Gland*
11. *Piston*
12. *Wear Ring*
13. *Seal Assembly*
14. *Wear Ring*
15. *Set Screw*
16. *Piston Rod*
17. *Cylinder Tube*
18. *Socket Head Screw*
19. *Grease Fitting*

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