

KOBELCO

SERVICE MANUAL

WHEEL LOADER

LK550 II

Applicable: LK550 II RM02201~

S5RM0004E-00

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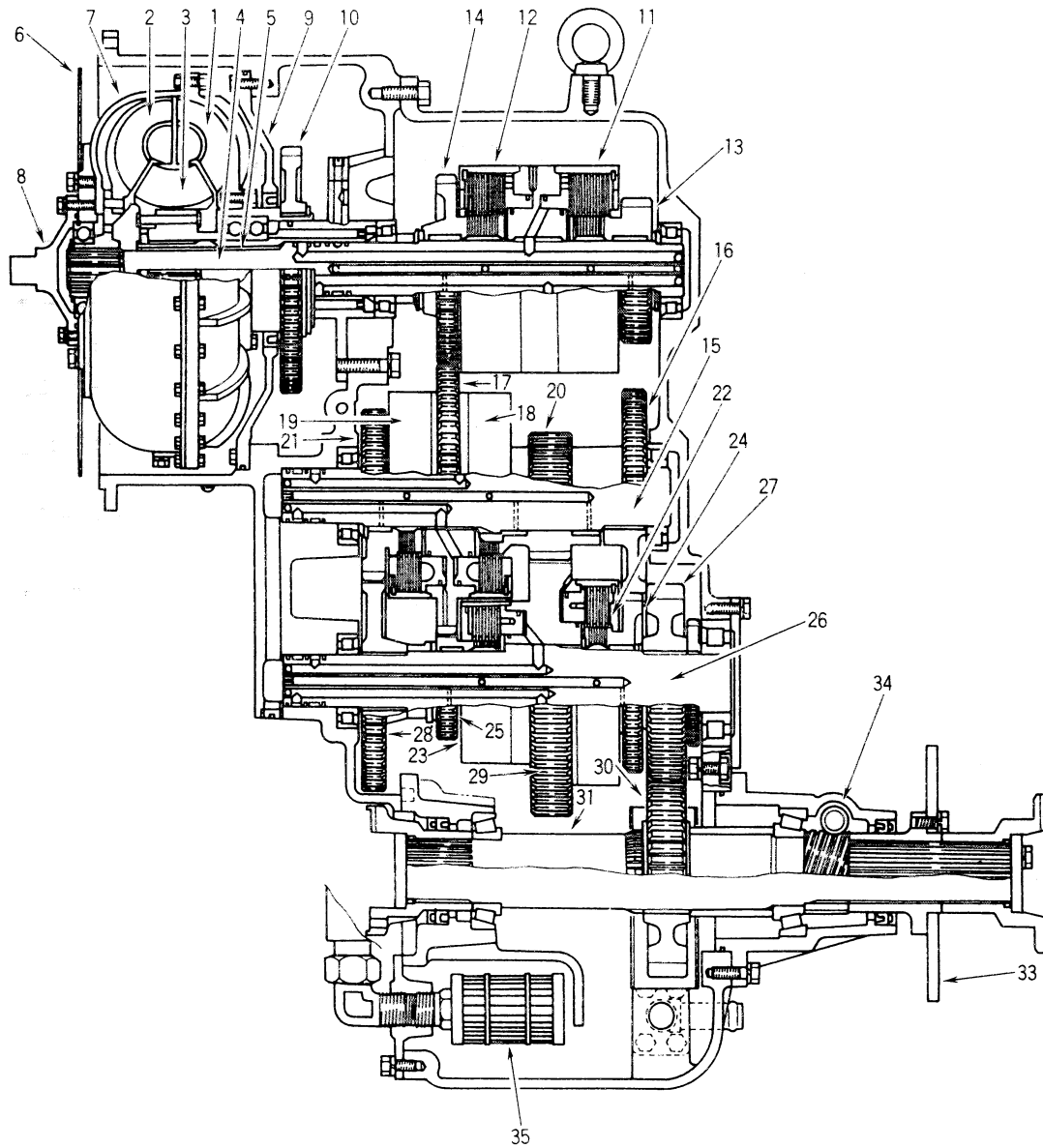
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MEMO

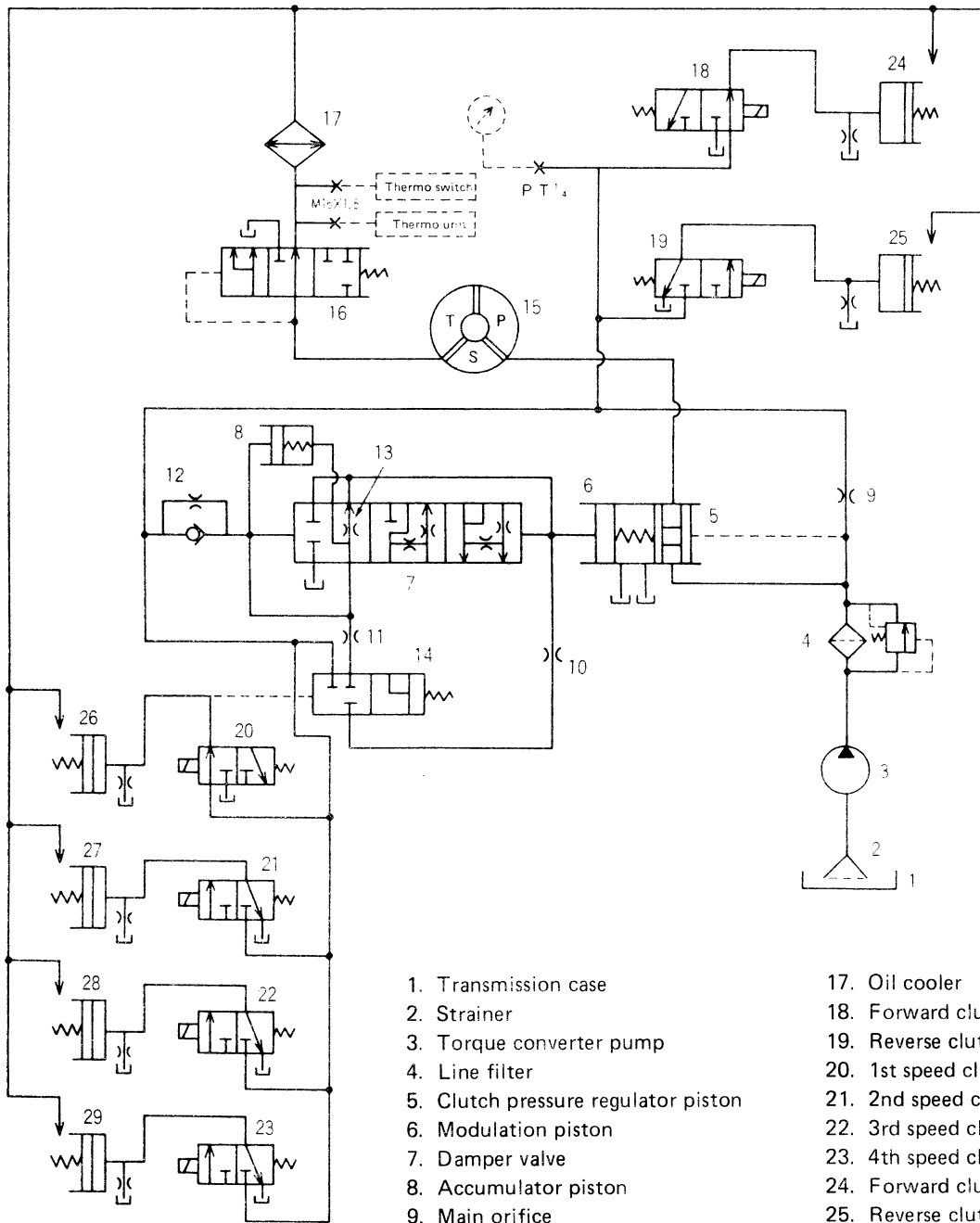
TORQUE CONVERTER AND TRANSMISSION

CONSTRUCTION



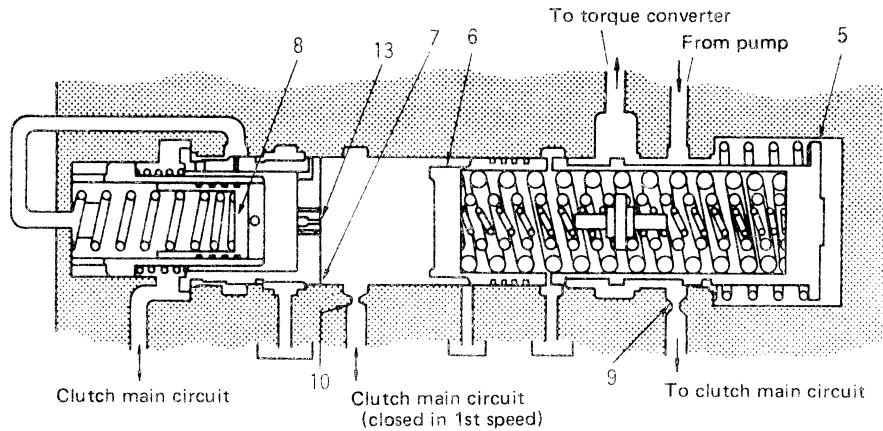
- | | | | |
|---------------------|-------------------------|---------------------------|------------------------|
| 1. Pump impeller | 10. PTO drive gear A | 19. 2nd-speed clutch | 28. Counter gear D |
| 2. Turbine impeller | 11. Forward clutch | 20. 1st-speed clutch gear | 29. Counter gear E |
| 3. Stator | 12. Reverse clutch | 21. 2nd-speed clutch gear | 30. Output shaft gear |
| 4. Turbine shaft | 13. Forward clutch gear | 22. 3rd-speed clutch | 31. Output shaft |
| 5. Stator shaft | 14. Reverse clutch gear | 23. 4th-speed clutch | 33. Parking brake disk |
| 6. Flexible plate | 15. Counter shaft A | 24. 3rd-speed clutch gear | 34. Speedometer drive |
| 7. Drive cover | 16. Counter gear A | 25. 4th-speed clutch gear | 35. Suction strainer |
| 8. Pilot boss | 17. Counter gear B | 26. Counter shaft B | |
| 9. Seal disk | 18. 1st-speed clutch | 27. Counter gear C | |

Torque Converter and Transmission Hydraulic Circuit Diagram (When in 1st speed forward) (Except for U.S.A & Canada spec.)



- | | |
|--|-------------------------------------|
| 1. Transmission case | 17. Oil cooler |
| 2. Strainer | 18. Forward clutch solenoid valve |
| 3. Torque converter pump | 19. Reverse clutch solenoid valve |
| 4. Line filter | 20. 1st speed clutch solenoid valve |
| 5. Clutch pressure regulator piston | 21. 2nd speed clutch solenoid valve |
| 6. Modulation piston | 22. 3rd speed clutch solenoid valve |
| 7. Damper valve | 23. 4th speed clutch solenoid valve |
| 8. Accumulator piston | 24. Forward clutch |
| 9. Main orifice | 25. Reverse clutch |
| 10. Regulator orifice | 26. 1st speed clutch |
| 11. Accumulator orifice | 27. 2nd speed clutch |
| 12. Check valve orifice | 28. 3rd speed clutch |
| 13. Damper orifice | 29. 4th speed clutch |
| 14. Specialized valve for 1st speed clutch | |
| 15. Torque converter | |
| 16. Torque converter regulator valve | |

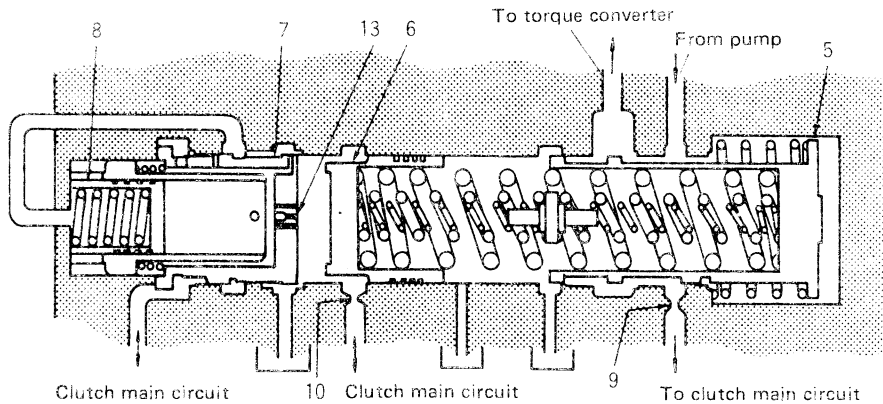
Pressure control when shifting from 1st speed forward to 1st speed reverse



Position of each piston before gear change from forward 1st to reverse 1st

- Releasing the forward clutch and charging the reverse clutch piston chamber
 The forward clutch solenoid valve is de-energized in response to the electrical signals produced by the operation of the shift lever, and the oil in the forward clutch piston chamber is drained into the transmission casing through the control valve. On the other hand, the reverse clutch solenoid valve is energized, and oil adjusted by the clutch pressure regulator for pressure flows into the reverse clutch piston chamber.

*** Reducing the main pressure to reduce the shock of clutch engagement.**



Position of each piston at lowest main pressure

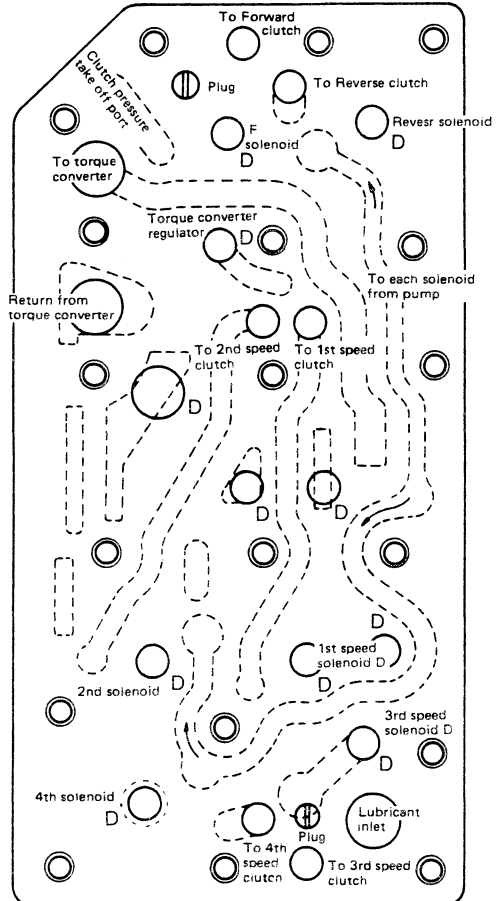
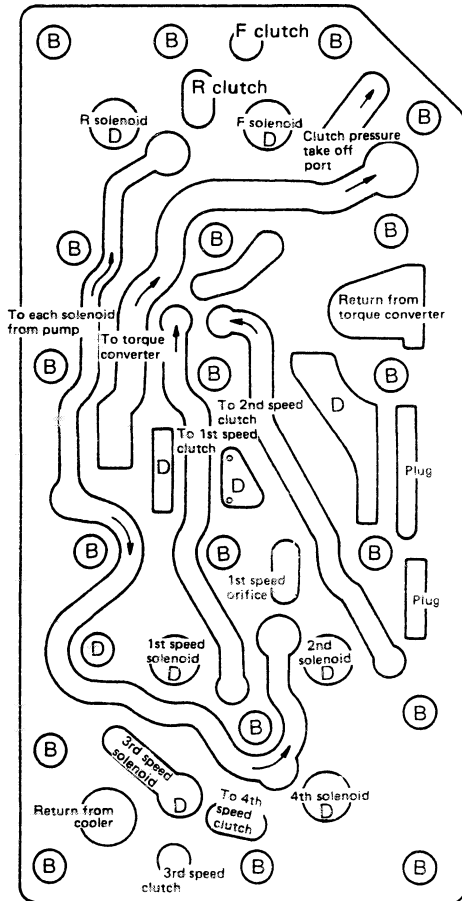
As oil flows into the reverse clutch piston chamber, the main pressure drops since the reverse clutch piston chamber has been empty until then and also since a small amount of oil is drained out through the residual pressure prevention orifice in the chamber even after the start of oil flow into the chamber.

Location of ports at back of control valve

Location of ports on control valve mounting side

(B) = bolt hole
 (D) = drain port to torque converter case

⊙ = bolt hole
 D = drain port to torque converter case

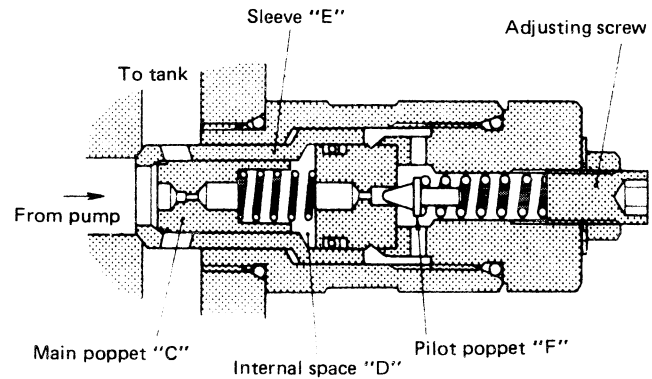


MAIN RELIEF VALVE

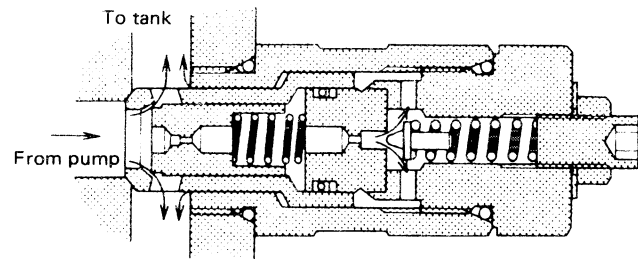
This valve is installed between the pump and the main control valve plungers to limit the maximum pressure of oil being delivered to the lift cylinders and tilt cylinder. When abnormal pressures are reached as in the case of a cylinder reaching it's maximum stroke. This valve opens preventing any further increase in pressure. Thus preventing damage to the pump, piping and cylinders. Set to 195 kg/cm² (2773 psi).

Operation

- When oil pressure is lower than the set level:
Oil discharged from the pump passes through the orifice of the main poppet "C" and reaches into the internal space "D". The main poppet so bears the same pressure on both sides and is pushed leftwards as the result of difference in area.
The sleeve "E" receives a larger pressure from the internal space "D" than from the pump side as the result of difference in area, thus being steadily seated at the pump port.



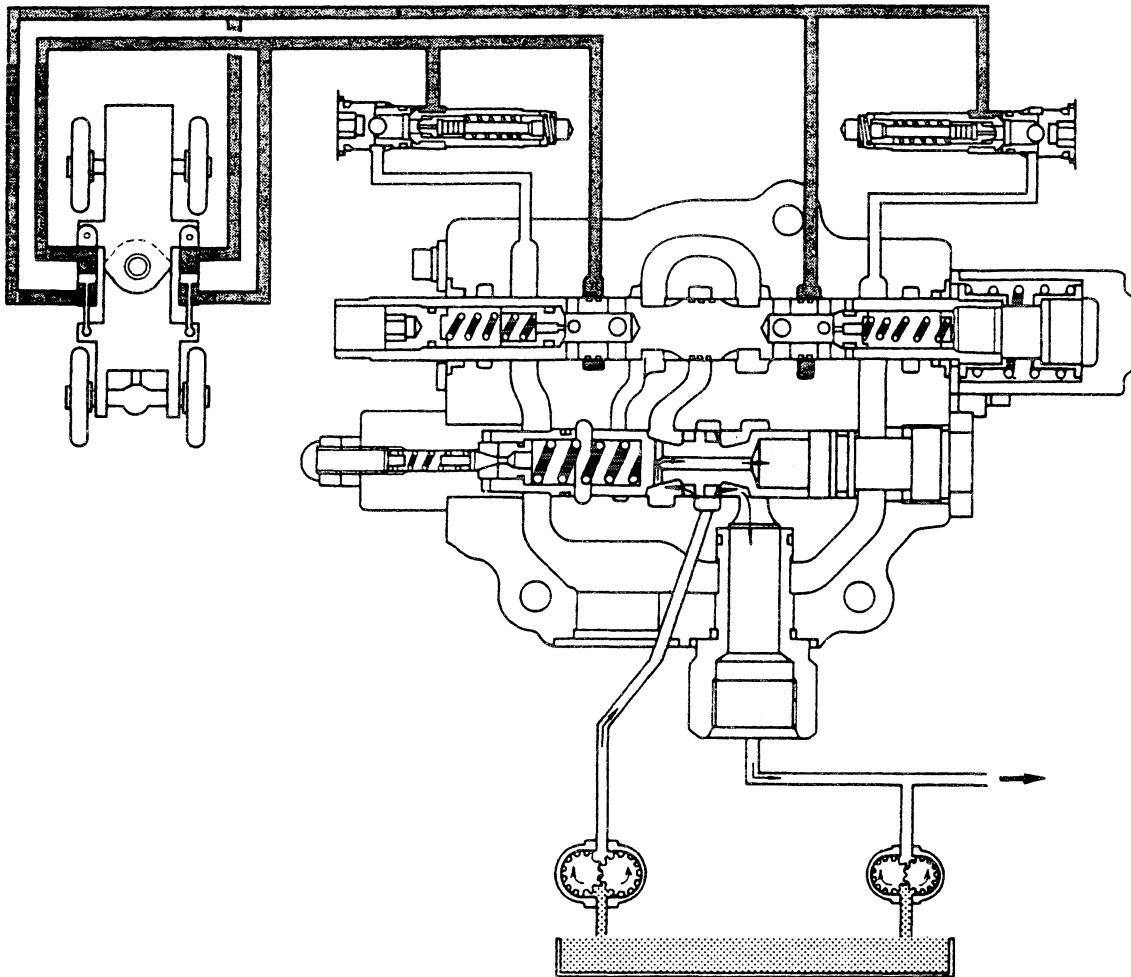
- When oil pressure exceeds the set level:
When the pumped oil pressure surpasses the set spring pressure of the pilot poppet, the pilot poppet "F" opens to allow oil to pass around the sleeve and escape into the tank. In result, the oil pressure decreases in the chamber "D" and thereby the main poppet moves rightwards, leading high-pressure oil staying in the pump line into the tank line.



Adjust to the set pressure at 195 kg/cm² (2773 psi) using the adjusting screw.

■ CONSTRUCTION AND PRINCIPLE OF OPERATION

- When the Vehicle is Moving in a Straight Line
(Steering Plunger in the Central Position)



- When the steering plunger is in the central position, the variable throttle is closed off so that the pressurized hydraulic oil from the steering pump cannot flow and the pressure in the pump circuit rises.
- This pressure acts in chamber A on the right of the flow controller plunger through the small holes in the plunger pushing the

plunger to the left, opening the carryover port i.e. the load circuit.

- The oil in chamber B on the left of the flow controller plunger flows to the tank drain through the steering plunger.
- Consequently, the entire flow from the pump flows to the loading line through the carryover port.

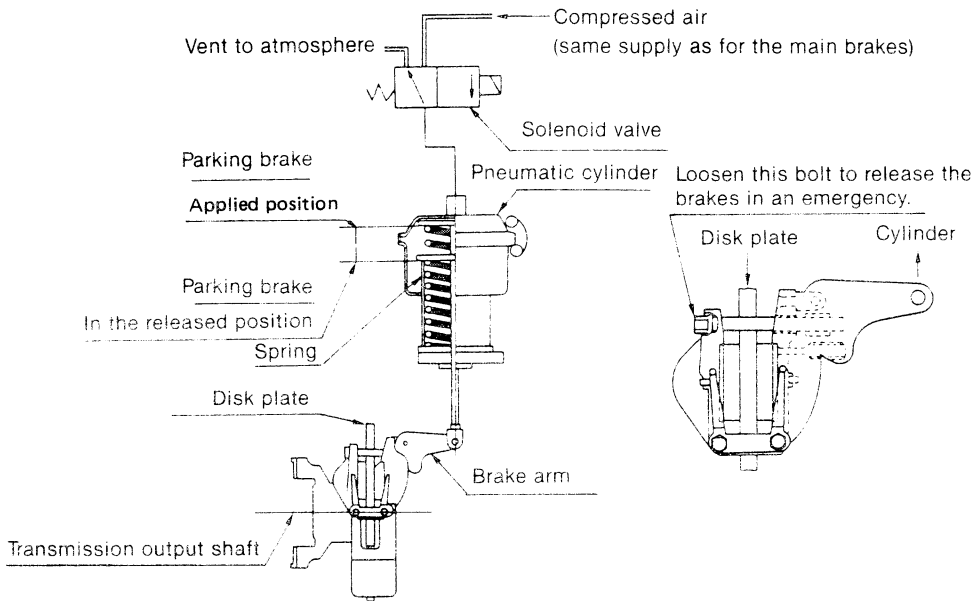
MEMO

PARKING AND EMERGENCY BRAKE

Construction

When the solenoid valve operates it empties or fills the pneumatic cylinder with air to release or apply the brakes. The brakes are released when current is flowing in the solenoid valve. The brake

is a dual purpose parking and emergency brake and operates on receiving signals from either of the brakes.



Principle of Operation

The parking brake is a spring-operated air disk brake connected to the vehicle transmission output shaft. The parking brake is operated by venting the compressed air in the pneumatic cylinder to

atmosphere so that the spring incorporated into the cylinder pulls the brake arm upwards to apply the brake.

Principle of Operation of the Emergency Brake

The emergency brake is automatically applied when an abnormality occurs in the normal brake system.

Conditions under which the brake operates.

Reason	Pilot lamp lights up	Buzzer warning	Brake operates	Conditions to release the brake
Parking switch ON	○	—	○	Turn the switch OFF. However, the air pressure must be above 5 kg/cm ² (71 psi). Loosen the disk caliper bolt in emergencies.
Air master stroke warning indicator operates	—	○	○	Turn the switch ON-OFF, after repairing the oil leak.
Air pressure drops below 5 kg/cm ² (71 psi)	○	○	—	
Air Pressure Drops Below 3.5 kg/cm ² (50 psi)	○	○	○	Turn the switch ON-OFF, after repairing the air leak.

MEMO

Parking Brake and Emergency Brake

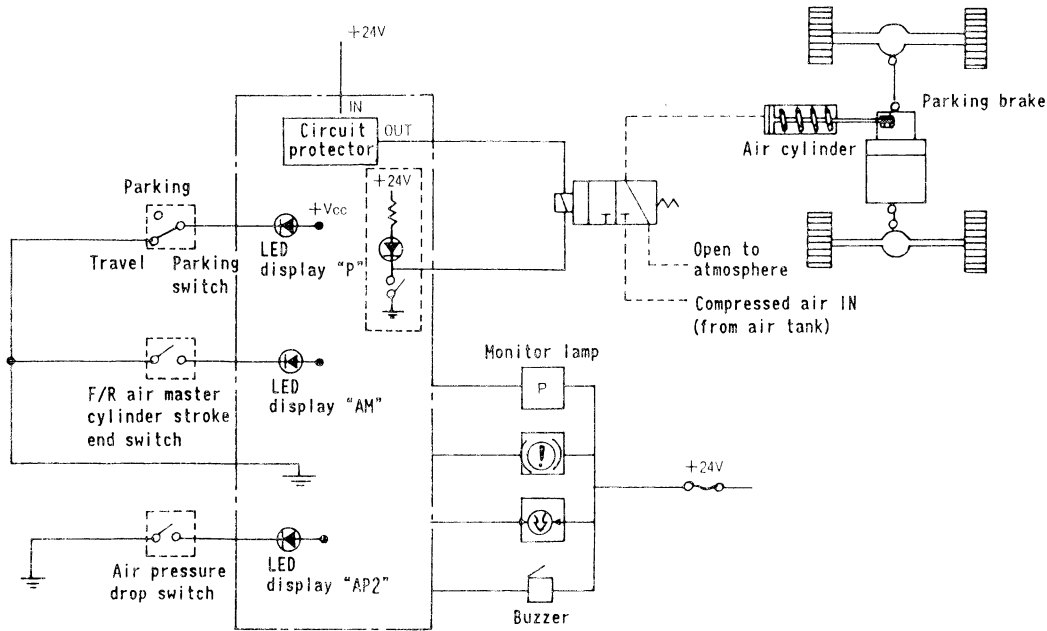
The parking brake (doubling as the emergency brake) is applied by the parking brake solenoid valve.

When Parking (when emergency braking)

When the parking brake solenoid valve is de-energized, no compressed air is sent to the air cylinder of the parking brake, and the drum brake is applied under the force of the spring in the cylinder.

At Start of Travel

When the solenoid valve is energized, air is sent into the air cylinder and compresses the spring, releasing the drum brake.



Parking brake operation

	Parking switch	Monitor lamp	Buzzer	Solenoid valve	Controller LED
Parking	At PARKING position		Alarm given if shift lever in F or R	De-energized	Input/output LED "P": OFF
Travel	At TRAVEL position	OFF	No alarm given	Energized	Input/output LED "P": ON

* When parking switch is in PARKING, forward and reverse clutches are disengaged and placed in neutral.

Emergency brake operation

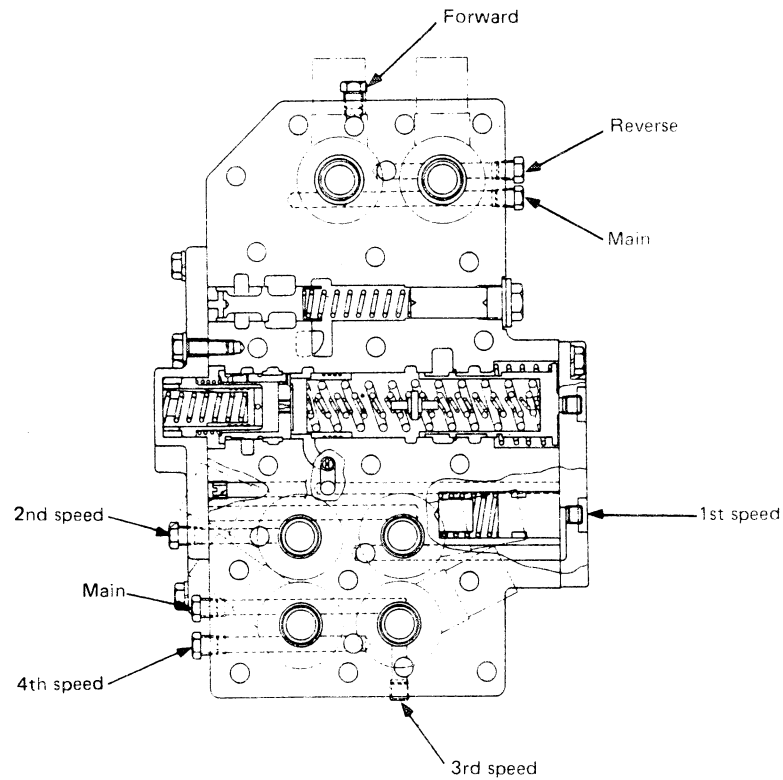
Actuating condition	Monitor lamp	Buzzer	Parking solenoid valve	Controller LED	Self-holding
If air pressure drops (below 35kg/cm ² (497 psi) for 3 sec. or more) .		Alarm given	De-energized	Input LED "AP2" ON. Output LED "P" OFF. Output LED "BUZ" ON.	Even if actuating condition is removed, emergency brake remains applied for safety. This self-holding function is canceled by turning the parking switch ON then OFF.
When air master cylinder stroke end switch is actuated.		Alarm given	De-energized	Input LED "AM" ON. Output LED "P" OFF. Output LED "BUZ" ON.	
In case of controller abnormality (self-diagnosis function).	No abnormal indication given	Alarm given	De-energized	Output LED "XX" and "BUZ" ON. All other output LEDs OFF.	

Transmission

Oil pressure for each clutch

1. Measuring point

Measure at measuring port in the control valve directly connected with the transmission.



2. Measuring port: PT 1/8"

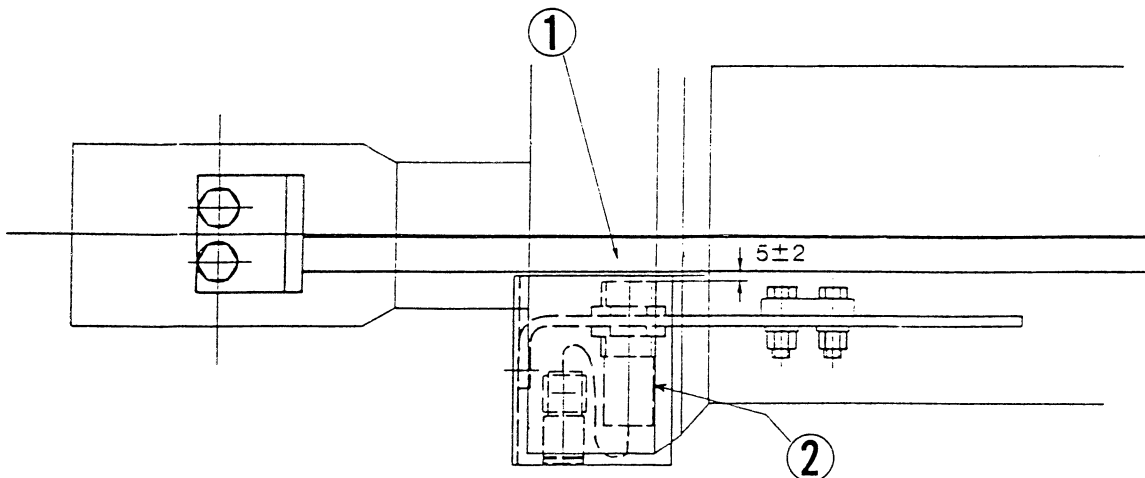
3. Tool: Gauge set 50 kg/cm² (1000 psi)

4. Measurement: 20~26 kg/cm² (284.5~369.8 psi) (at 1600 rpm engine speed)

BUCKET POSITIONER

1. Inspection and Adjustment on Attachment

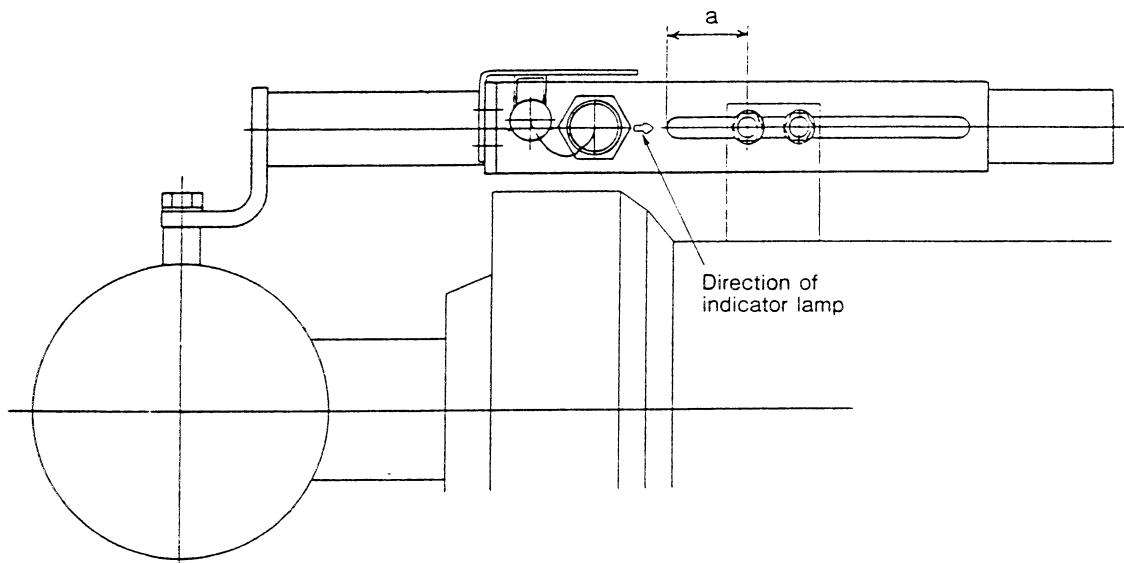
The clearance between the operating rod (1) and switch (2) is to be 5 ± 2 mm (0.197 ± 0.079 in)



2. Adjusting the Bucket Pick Up Angle

The bucket pick up angle can be freely adjusted by adjusting the dimension a.

Bucket pick up angle	Dimension a mm (in)
16	134
0	46
-7	6



Connections of the Individual Gauges		
Measuring Instruments	Circuit tester	
Before checking	Turn the starter switch OFF and remove the connection from the T terminal	
Procedure	Measure the resistance between each of the terminals.	
Standard (normal) values	Across A - T 95Ω Across A - E 105Ω Across T - E 100Ω	

Operation of the Individual Gauges		
Measuring Instruments	Variable resistor or fixed resistors (10Ω and 80Ω)	
Procedure	<ol style="list-style-type: none"> Remove the connection from the T terminal Connect the resistors to the T terminal <ol style="list-style-type: none"> Set the voltage to a low value when using a variable resistor. The resistors must be changed when using fixed resistors. Turn the starter switch ON. The gauge is operating correctly if the readings agree with those given in the table below. 	

	Engine cooling water temperature	Torque converter oil temperature	Air tank pressure
Resistance(Ω) ± 3	a 80 b 19.2 c 10	80 — 10	80 29.5 10
Reading (the gauge reading when the resistance given above is connected) →			

The (b) value is set when using a variable resistor. 20-026

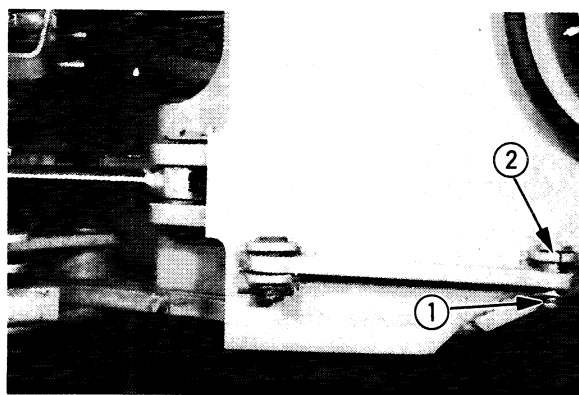
Articulation Stopper

⚠ Do not enter the articulating part of the machine when the engine is running. Before transporting on a trailer, lifting or repairing, set the articulation stopper between the front and rear chassis.

Before driving the machine, disconnect the articulation stopper and stow it in its original position.

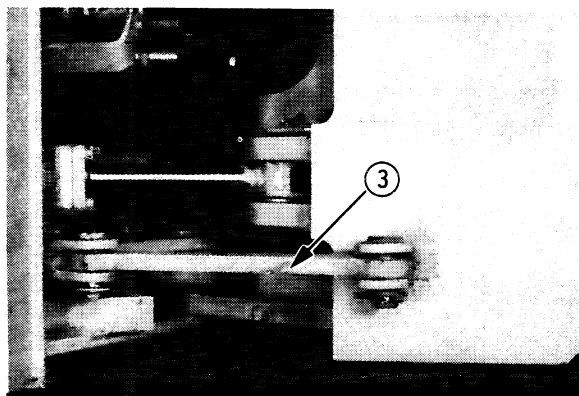
Setting the articulation stopper

1. Park the machine facing straight forward.
2. Remove the clip (1) and pull out the pin (2).
3. Fit the rod (3) to the rear chassis.

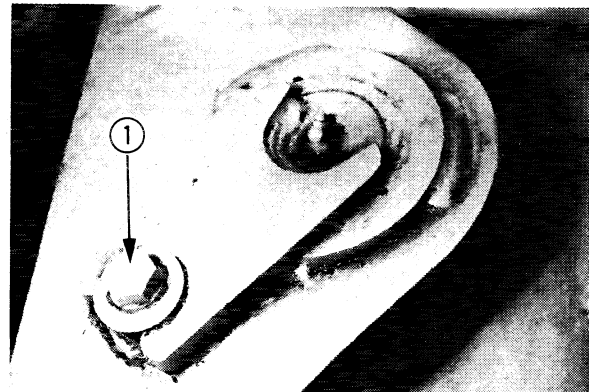


Stowing the articulation stopper

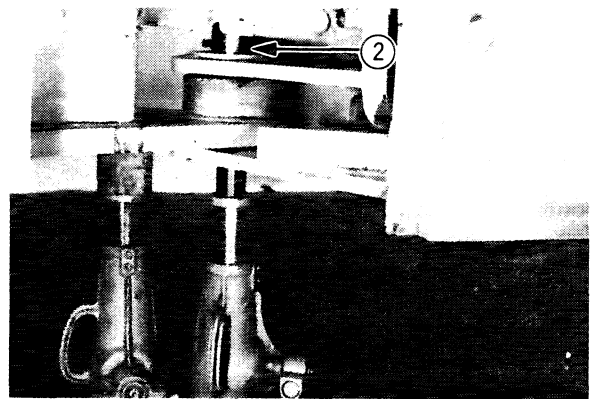
1. Stow the rod (3) on the front chassis.



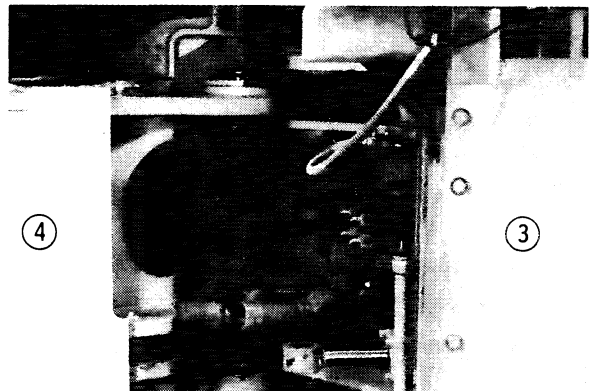
13. Remove the lock bolt (1) for the lower center pin.



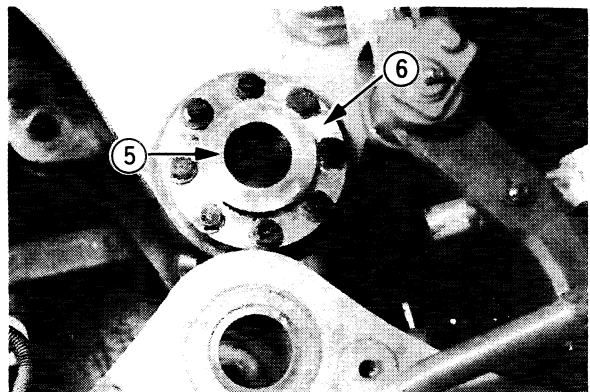
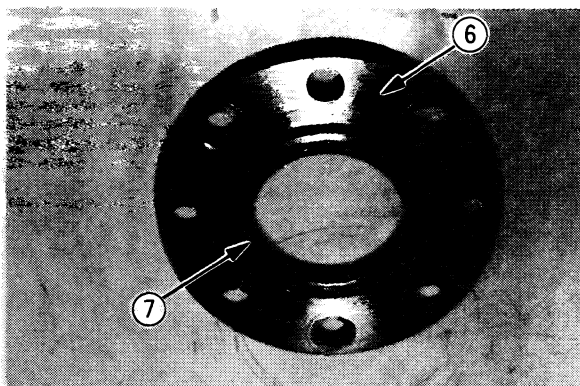
14. Remove the lower center pin (2) using a hydraulic jack.



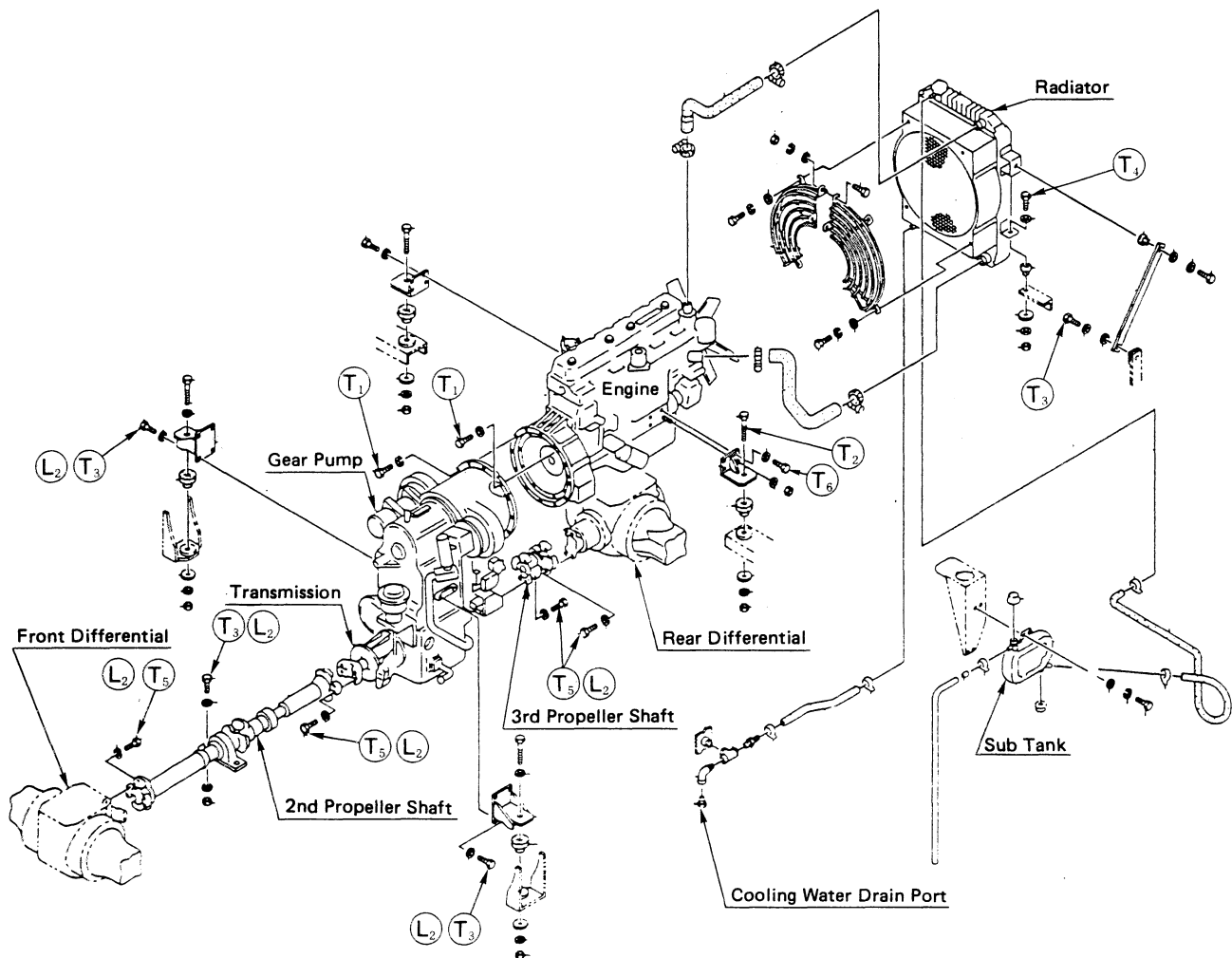
15. Separate the rear chassis (3) from the front chassis (4).



16. Remove the washer (5), bearing cover (6) and dust seal (7) for the front chassis upper center pin.



POWER GROUP

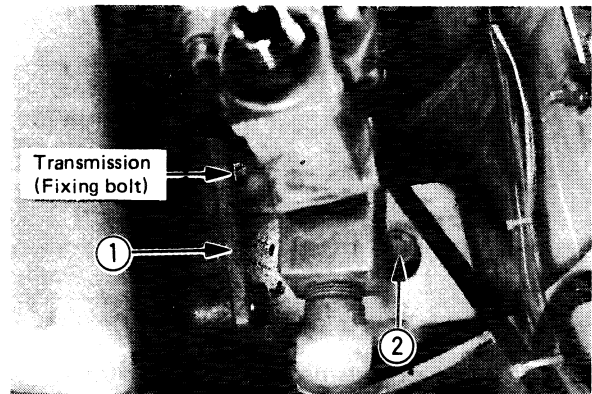


- T₁ : 4.64 ~ 5.57 kg-m (33.6 ~ 40.3 lb-ft)
 T₂ : 36.3 ~ 43.6 kg-m (262.6 ~ 315.4 lb-ft)
 T₃ : 18.4 ~ 22.1 kg-m (133.1 ~ 159.8 lb-ft)
 T₄ : 7.67 ~ 9.20 kg-m (55.5 ~ 66.5 lb-ft)
 T₅ : 6.38 ~ 7.66 kg-m (46.1 ~ 55.4 lb-ft)
 T₆ : 4.88 ~ 5.86 kg-m (35.3 ~ 42.4 lb-ft)
 L₂ : AB02 liquid adhesive

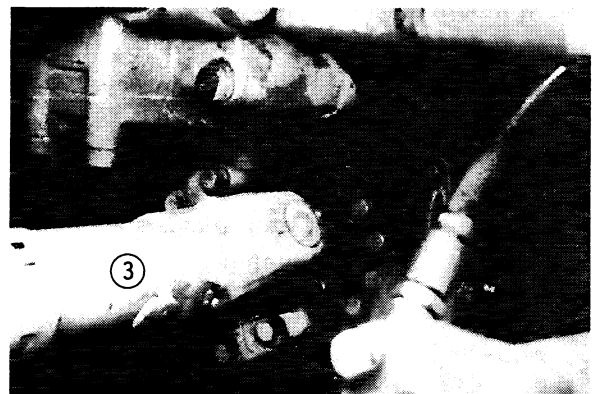
MEMO

4. Attach the right and left transmission brackets (1). Attach to the chassis using the bolt (2).
Tightening torque: 18.4 ~ 22.1 kg-m
(133 ~ 160 lb. ft.)

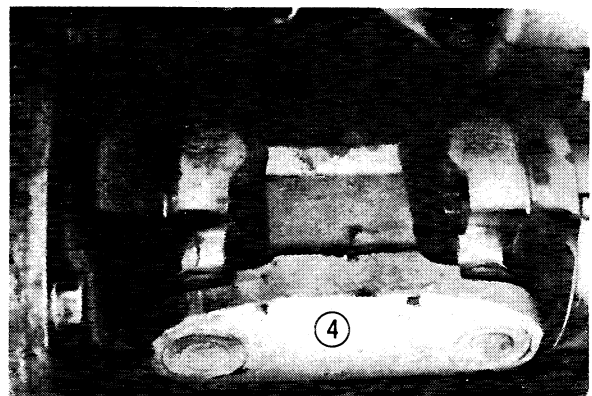
Note: a) Apply liquid adhesive (AB02) to transmission mounting bolts.
b) Remove the block under the engine flywheel.



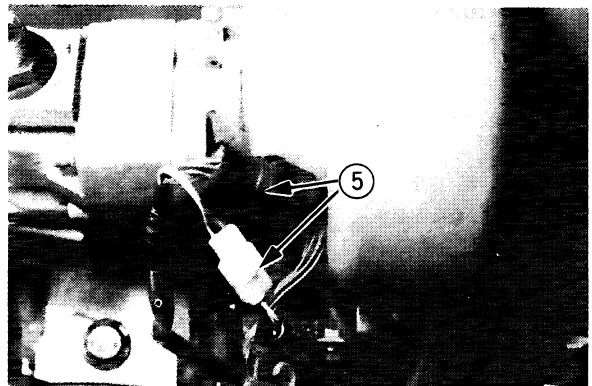
5. Attach the second propeller shaft (3).
Note: Use AB02 liquid adhesive.
Tightening torque: 6.38 ~ 7.66 kg-m
(46~55 lb. ft.)



6. Attach the third propeller shaft (4).
Note: Use AB02 liquid adhesive.
Tightening torque: 6.38 ~ 7.66 kg-m
(46.0~55 lb. ft.)



7. Connect the transmission control valve couplers (5).

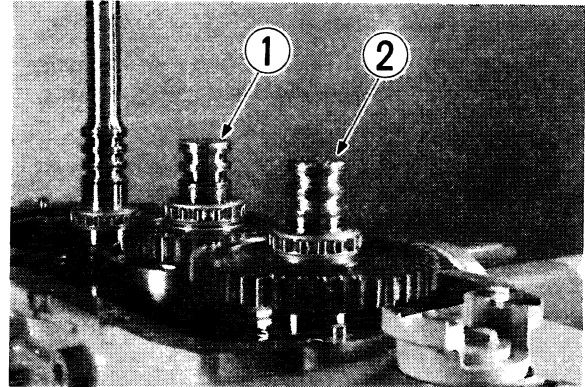


DISASSEMBLY AND REASSEMBLY OF THE TRANSMISSION ASSEMBLY

Disassembling the transmission

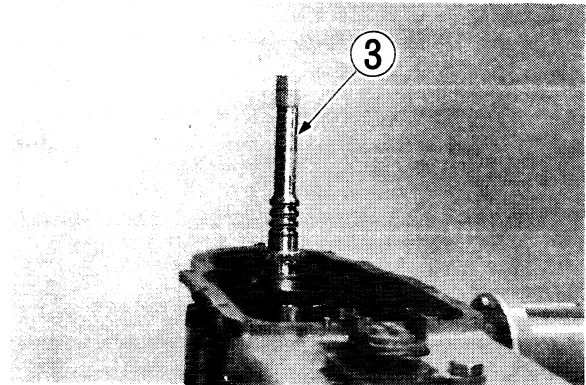
Before starting

- a) Remove the transmission assembly from the machine.
- b) Remove the torque converter.



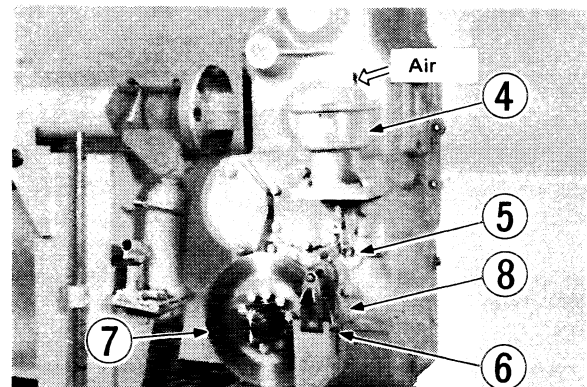
1. Remove the 1st-2nd gear clutch pack assembly (1) and the 3rd-4th gear clutch pack assembly (2).

2. Remove the forward and reverse clutch pack assembly (3).

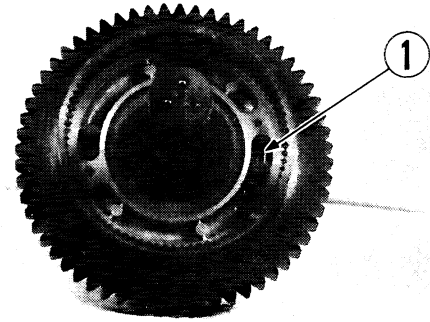


3. Introduce air into the air cylinder (4), and remove the pin (5).

Remove the brake assembly (6), air cylinder assembly (4), disk (7), and seal retainer (8).



9. Remove the clutch piston (1).

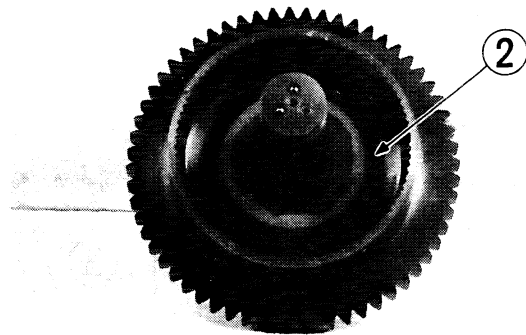


Reassembling the 1st-2nd gear clutch pack

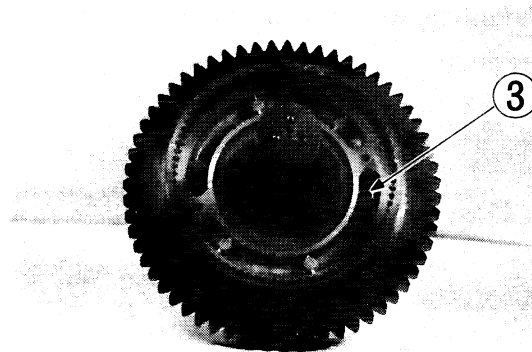
Before starting

- a) Clean and inspect each part; replace parts if necessary.
- b) During reassembly apply torque converter oil to each part.

1. Attach the piston ring (2).



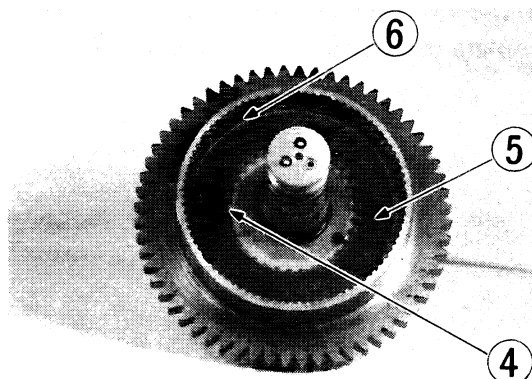
2. Attach the clutch piston (3).



3. Assemble one at a time, in the following order, steel clutch plate (4), spring (6), paper clutch plate (5).

Note: 2 springs comprise 1 set.

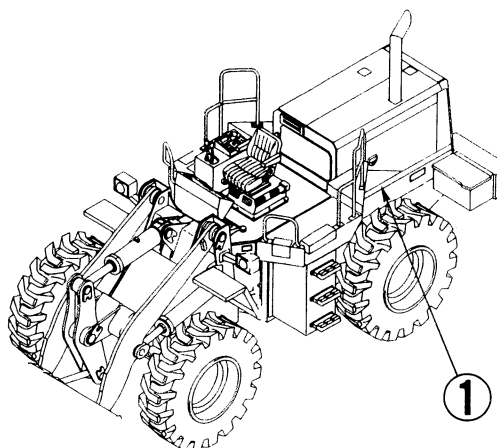
: Insert springs according to the procedure on page 33-027.



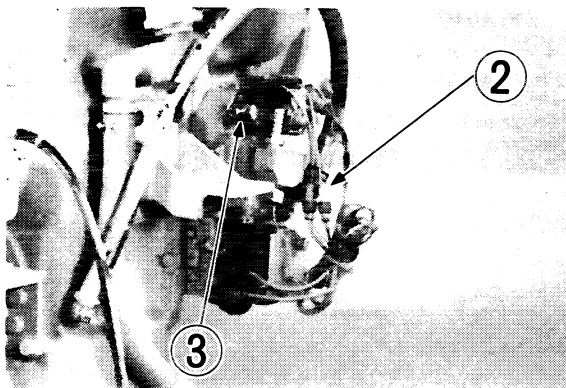
REMOVAL AND INSTALLATION OF THE CONTROL VALVE ASSEMBLY

REMOVING OF THE CONTROL VALVE ASSEMBLY

1. Remove the left body fender (1).



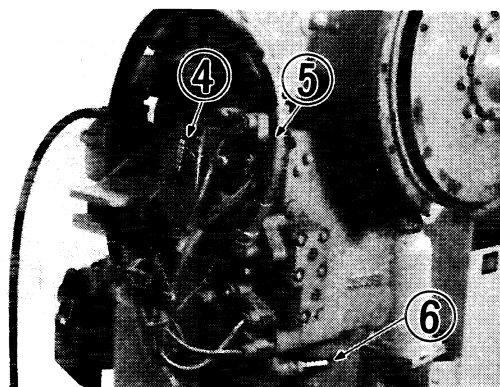
2. Disconnect the electrical coupler (2) for the solenoid valve.
(Disconnect in six places.)



3. Disconnect the hoses (3), (4), (5), (6).

CAUTION: Loosen the line filter side of hose (5) and disconnect at the control valve side.

4. Loosen nipple (7) with a pipe wrench.
(Turn approximately 90° counterclockwise.)

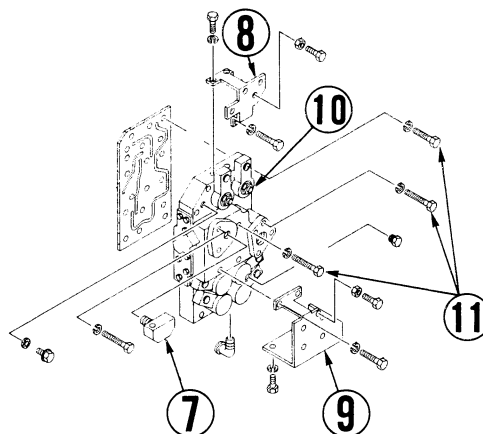


5. Remove the covers (8) and (9).

6. Loosen the solenoid valve nut (10).
(There are six valve nuts.)

CAUTION: The solenoid valve nut is loosened to remove the mounting bolt for the control valve housing. Loosen it enough so that the solenoid valve turns easily.

7. Remove the mounting bolt (11) for the control valve housing.



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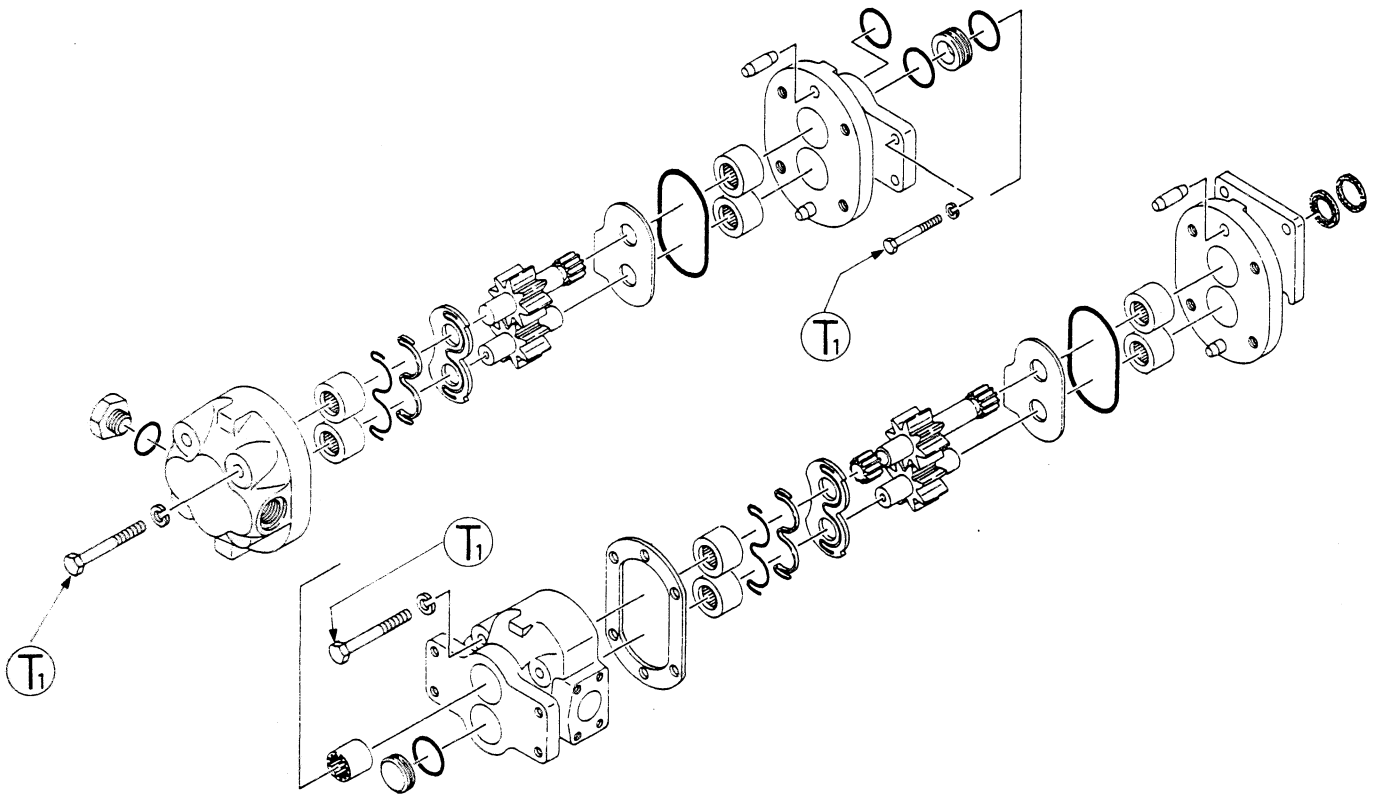
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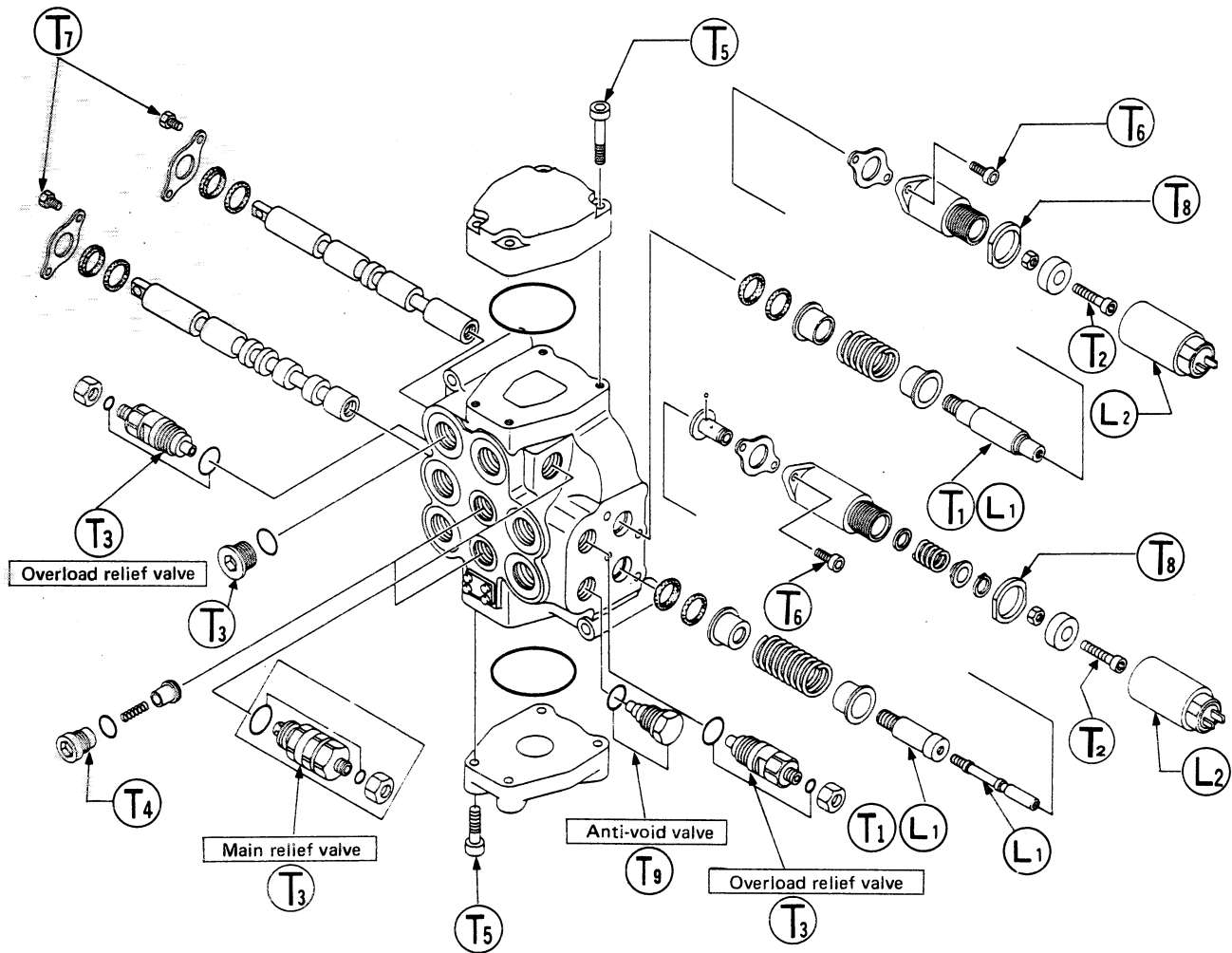
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GEAR PUMP (DOUBLE)



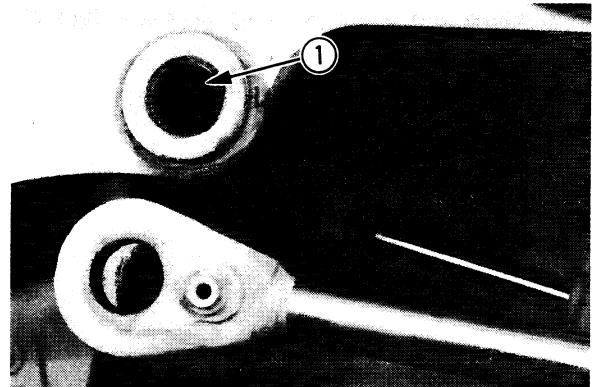
T_1 : 16.6 kg-m (120 lb-ft)

MULTIPLE CONTROL VALVE ASSEMBLY

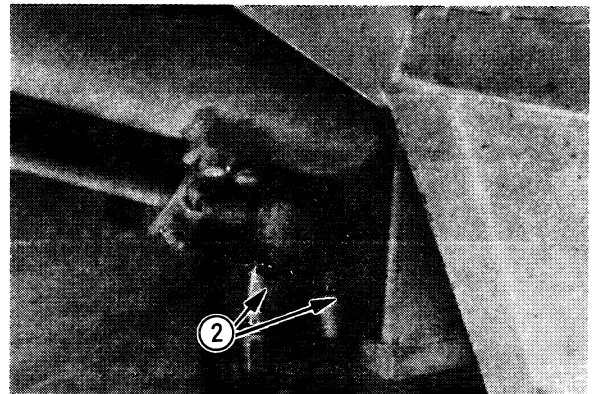


- T₁ : 1 ~ 1.2 kg-m (7~9 lb. ft.)
- T₂ : 0.9 ~ 1.4 kg-m (6.6~10 lb. ft.)
- T₃ : 8 ~ 9 kg-m (58~65 lb. ft.)
- T₄ : 9 ~ 10 kg-m (65~72 lb. ft)
- T₅ : 9.5 kg-m (68.7 lb. ft.)
- T₆ : 2 ~ 2.5 kg-m (15~18 lb. ft.)
- T₇ : 1.5 ~ 2 kg-m (11~14 lb. ft.)
- T₈ : 5.6 ~ 6.2 kg-m (41~45 lb. ft.)
- T₉ : 9.5 ~ 11.0 kg-m (69~80 lb. ft.)
- L₁ : Loctite #271 or equivalent
- L₂ : Loctite #242 or equivalent

3. Line up the rod side of the lift cylinder with the hoist arm pin hole and insert the pin (1).



4. Attach the hydraulic hoses (2).



After finishing

- a) Remove the support stand (A).
- b) Check hydraulic fluid level.

REMOVAL AND INSTALLATION OF THE SETEERING VALVE ASSEMBLY

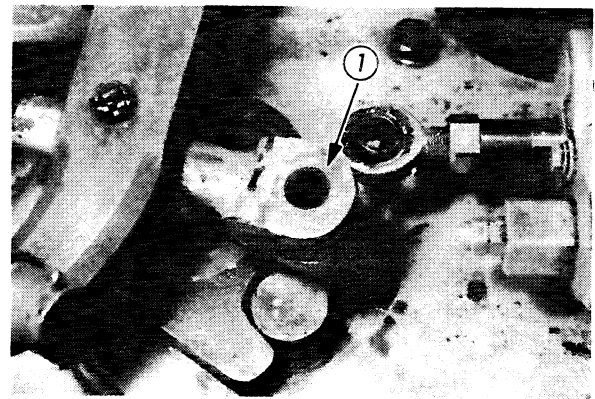
Removing the steering valve assembly

Before starting

- a) Lower the bucket to the ground.
- b) Move the control levers back and forth several times to relieve residual pressure.
- c) Remove the floor board assembly.

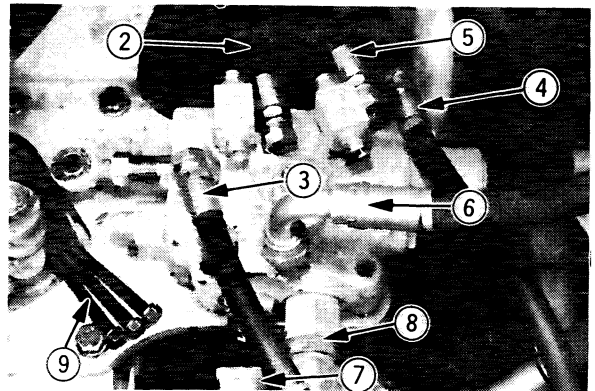
1. Remove the pin (1).

Note: If the pin is difficult to pull out, remove the 3 steering valve attachment bolts, move the steering valve in the forward direction and then pull out the pin.



2. Remove each hose and pipe (2) ~ (8).

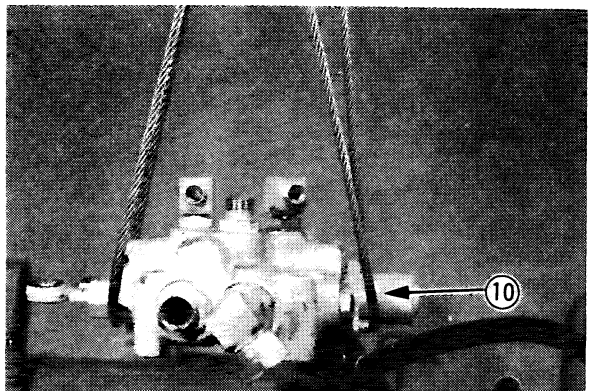
Note: Hydraulic fluid will flow out, so catch it in a can.



3. Remove the 3 bolts (9) fixing it to the chassis.

Weight of steering valve assembly: 19 kg (42 lb.)

4. Remove the steering valve assembly (10).



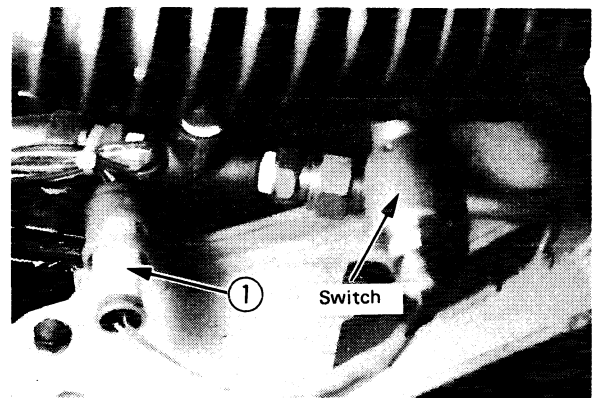
REMOVAL AND INSTALLATION OF THE BRAKE VALVE ASSEMBLY

Removing the brake valve assembly

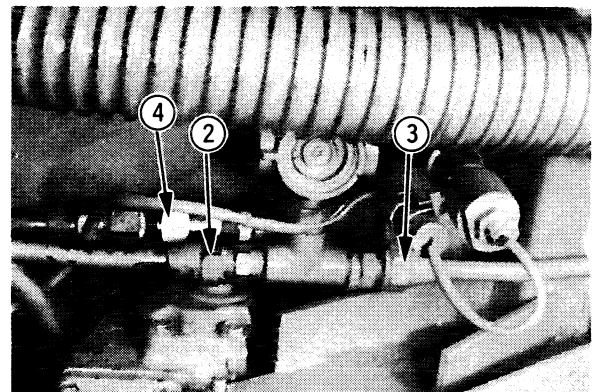
Before starting

- a) Purge air from the air tank.

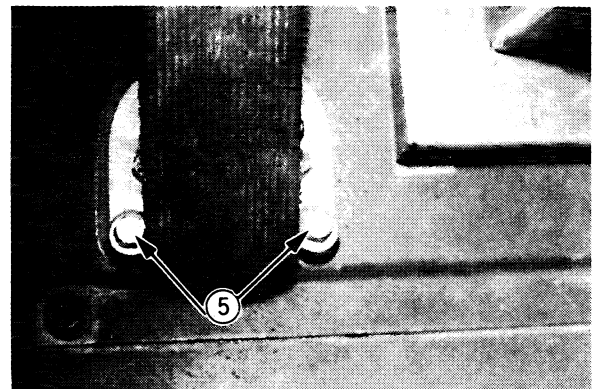
1. Disconnect the pressure switch wiring couplers (1).



2. Remove the brake valve piping connectors (2), (3) and (4).



3. Remove the 3 brake valve fixing bolts (5), then remove the brake valve.



DISASSEMBLY AND REASSEMBLY OF THE AIR MASTER CYLINDER ASSEMBLY

Disassembling the air master cylinder assembly

Before starting

- a) Remove any mud, dirt, oily water, etc. stuck to the surface with a brush, compressed air, etc.
- b) Put match-marks on joints of components in order to facilitate reassembly.

Note on disassembly

- * Maintain the parts in the order in which they were removed. Be careful not to cut, dent or bend.

1. Disassembling the brake chamber

- 1) Remove the nut (12) and disassemble into brake chamber and cylinder.
- 2) Remove the switch unit (26) by loosening the screw.
- 3) Grip the brake chamber in a vice, then loosen the bolt (7) and nut (8) of the clamp ring (6).
- 4) Hold one ear of the clamp ring (6) with a pliers and pull it away from the brake chamber. Do the same with the other ear.

- ⚠ When removing the brake chamber from the vice, be careful that the return spring (4) does not pop out.

2. Disassembling the cylinder

- 1) Remove the C-ring (23) with the piston (19) pushed in, and remove the internal parts from the cylinder.
- 2) Remove the return spring (14) and seals (15-18) from the piston & valve unit.

- Note:** * Do not remove the ST seal (16) unless replacing.
- * Do not disassemble the internal parts of the valve unit (20) any further.
 - * Do not remove the nipple (24) unless necessary.

DISASSEMBLY AND REASSEMBLY OF THE AXLE ASSEMBLY

Disassembling the axle assembly

Before starting

- a) Remove the axle assembly from the machine.
 - b) Drain out the gear case oil.
 - c) Place the axle assembly on a work bench.
 - ⚠ Support the axle assembly so it doesn't tilt.
- Note:** If there is no repair table, carry out disassembly on a clean surface.

1. Suspend with a hoist, remove the axle housing fixing bolts (1) and remove the axle housing (2).

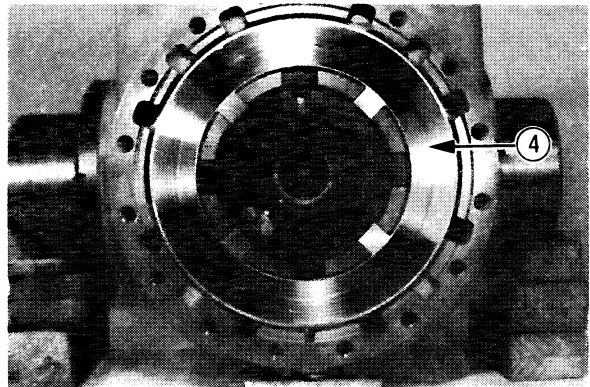
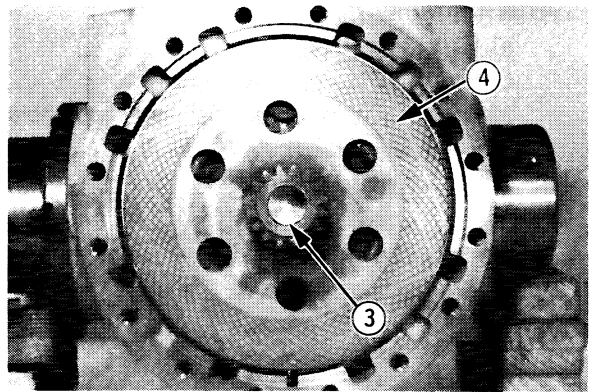
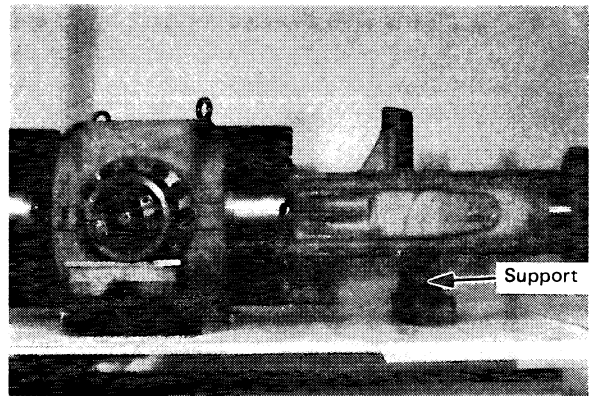
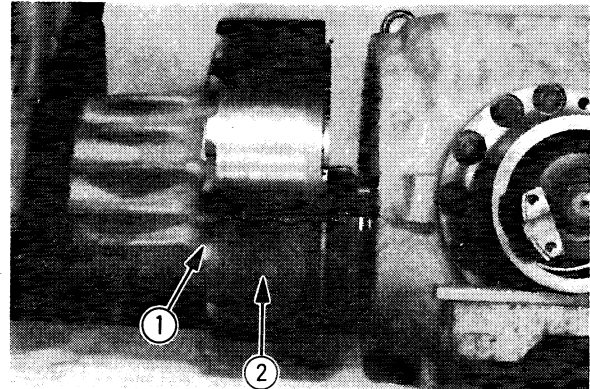
Note: If difficult to remove, tap lightly with a hammer where the two parts meet.

- ⚠ Before removing the axle housing, place supports to prevent the axle assembly from tilting towards the opposite axle housing.

* Remove the opposite axle housing according to the same procedure.

2. Remove the differential side sun gear (3) and disk plate (4).

3. Remove the retainer (4).



DISASSEMBLY AND REASSEMBLY OF THE DIFFERENTIAL ASSEMBLY

Disassembling the differential assembly

Before starting

- a) Remove the differential assembly from the axle assembly.
- b) Support the differential assembly so that it doesn't tilt.

For disassembly and reassembly of the differential cage, refer to "Disassembly and reassembly of the Differential Cage"

1. Insert a puller bolt into the brake piston (1), put air in through the brake pipe connecting inlet, and pull out the brake piston.

- a) Use low air pressure (1 ~ 2 kg/cm²) (14 ~ 28 psi).
 - b) The brake piston may fly off, so take care.

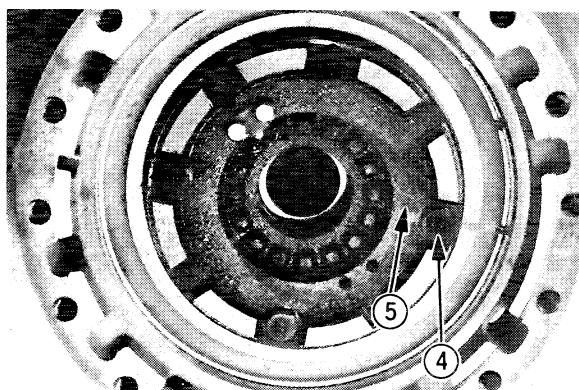
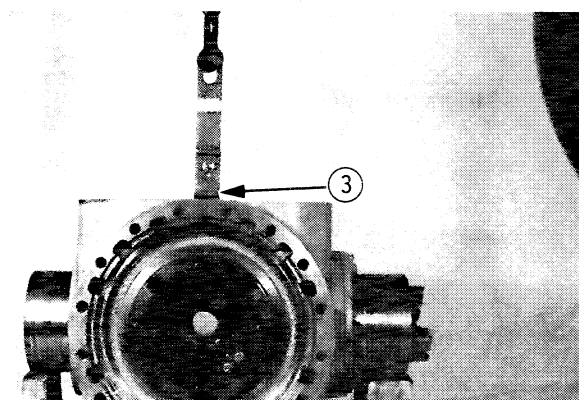
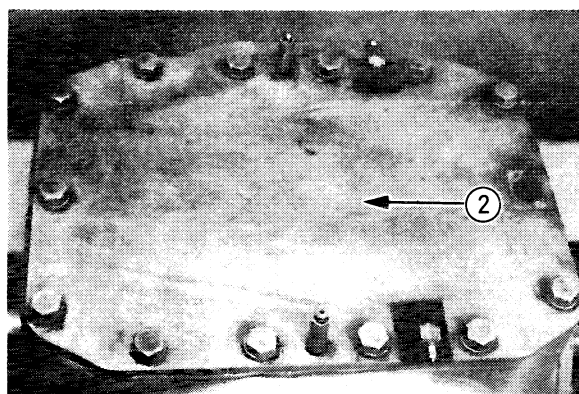
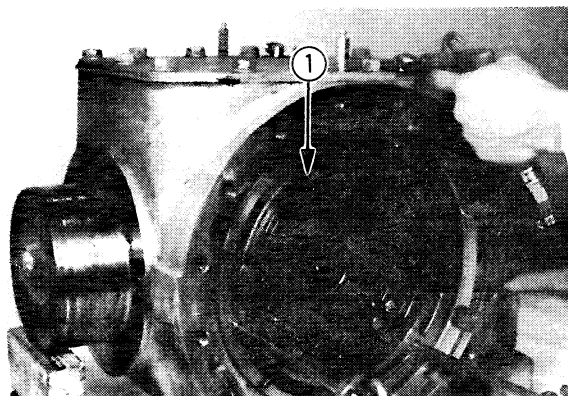
2. Remove the differential case cover (2).

3. Gently lift the differential cage (3) with a hoist.

4. Remove the bearing carrier fixing bolts (4) and then remove the bearing carrier (5).

- a) Make sure that the differential cage is suspended.

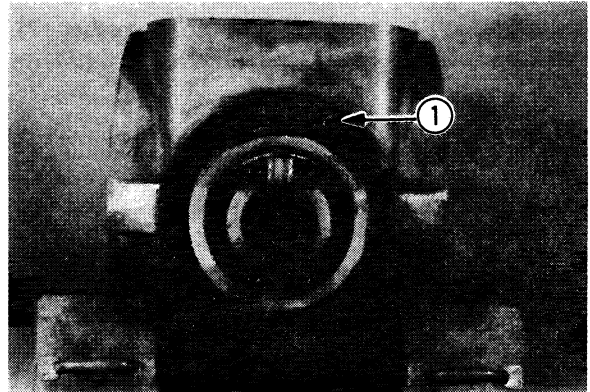
Note: If the spiral bevel assembly is not to be replaced, do not remove the lock plate.



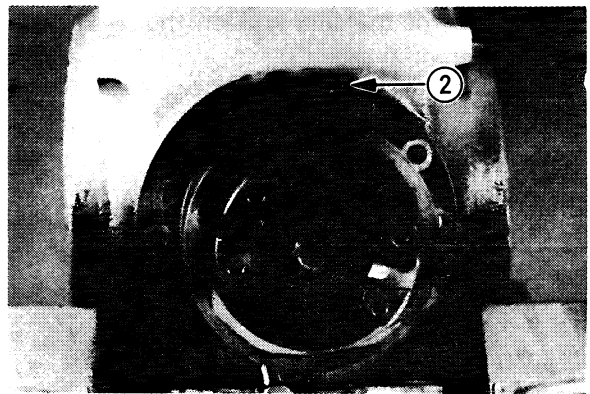
DISASSEMBLY AND REASSEMBLY OF THE PINION ASSEMBLY

Disassembling the pinion assembly

1. Remove the bolts (1) holding the pinion assembly to the differential carrier.

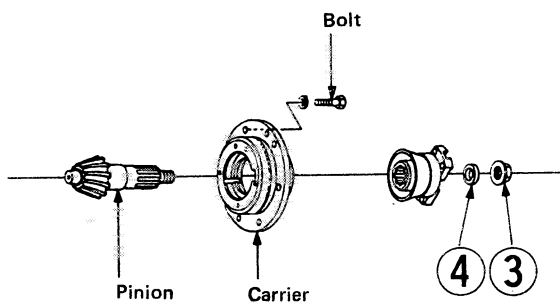


2. Insert a puller bolt (2) and pull the pinion assembly from the differential carrier.

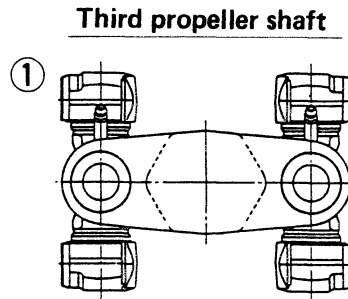
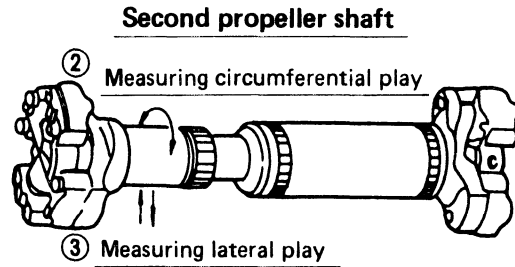
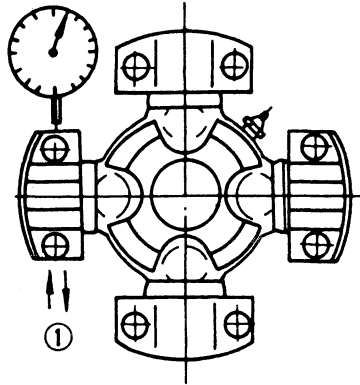


3. Mount the pinion assembly on a working jig and fix in a vise.

4. Remove the nut (3) and packing (4).



PROPELLER SHAFT

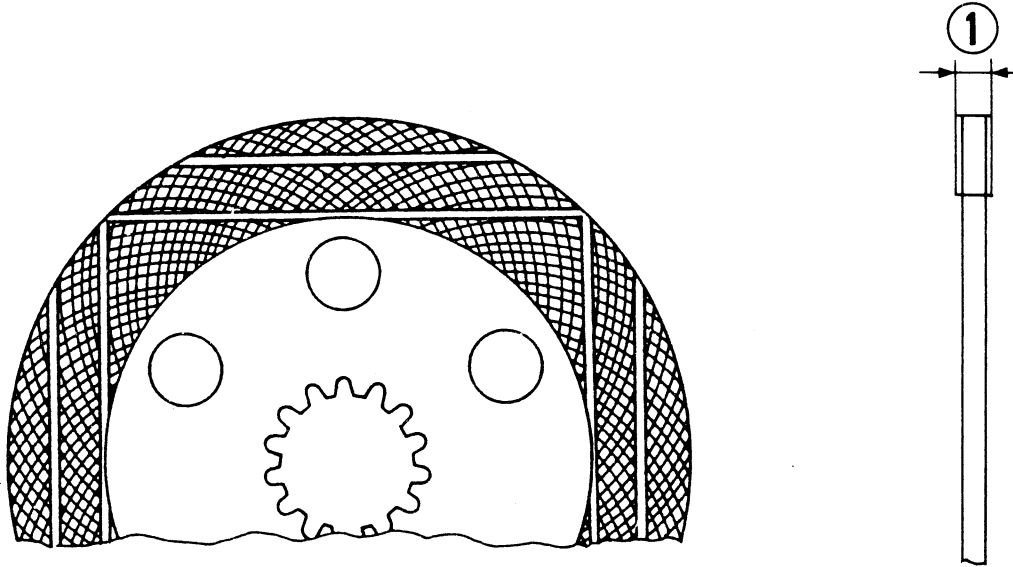


mm (in.)

Symbol	Item		Allowable limit	Remedy
1	Play of spider bearing	No.2 and 3 propeller shafts	0.25 (0.001")	Replace
2	Circumferential play of spline	No. 2 propeller shaft	0.80 (0.003")	Replace
3	Lateral play of spline	No. 2 propeller shaft	1.00 (0.039")	Replace

BRAKE

Disk plate



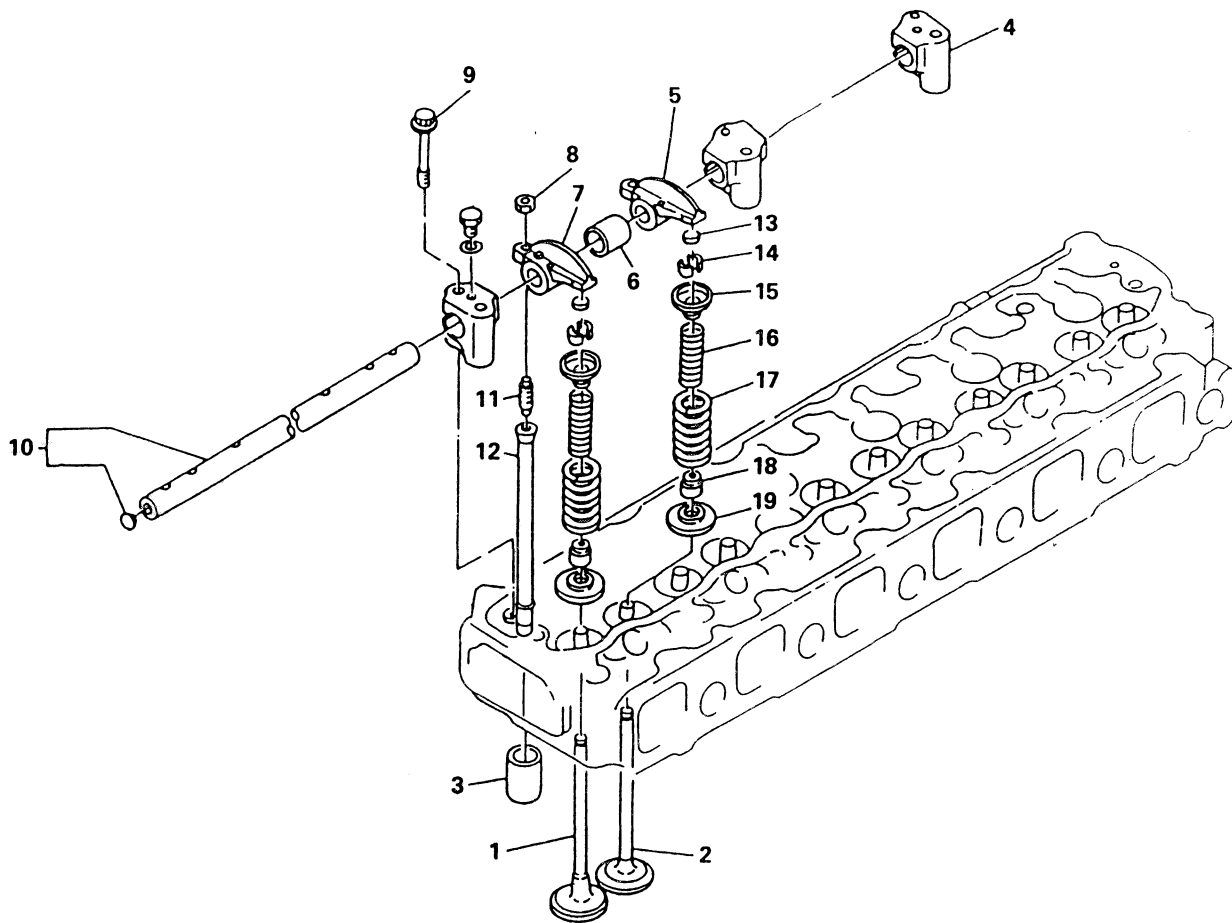
mm (in.)

Symbol	Item	Criteria		Remedy
		Standard value	Allowable limit	
1	Disk plate thickness	9.0±0.1 (0.354±0.004)	8 (0.32") or until groove in one face of lining disappears	Replace

Brake line

Item	Service life	Remedy
Brake hose	1 year	Replace
Seals for air master and brake valve	1 year	Replace in units of repair kit.

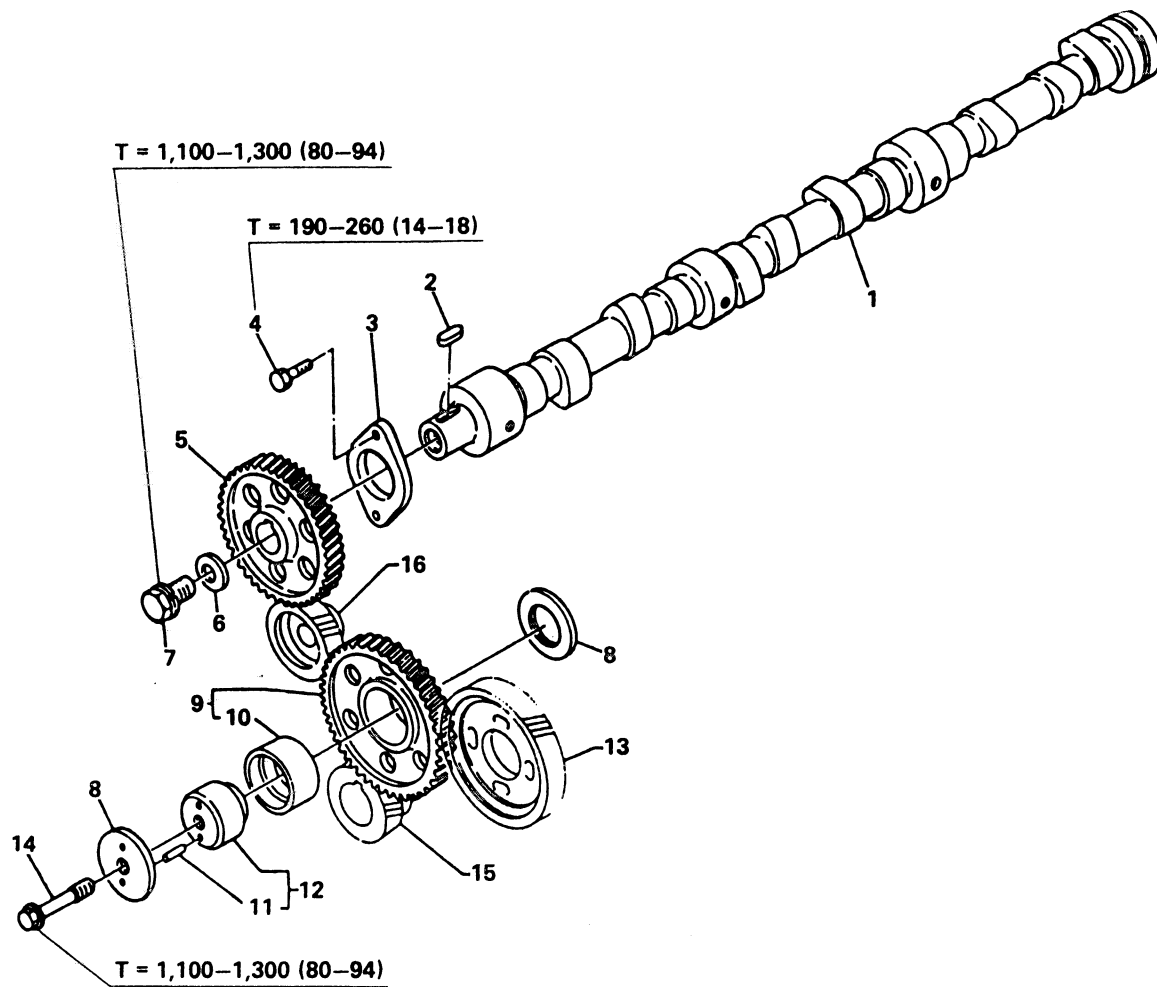
<u>Symptom</u>	<u>Possible cause</u>	<u>Remedy/Prevention</u>
Leakage of exhaust	Head gasket	
	<ul style="list-style-type: none"> • Fatigued gasket (aging) • Damage • Improper installation 	<ul style="list-style-type: none"> Replace gasket. Replace gasket. Replace gasket.
	Head bolts	
	<ul style="list-style-type: none"> • Loose bolts • Elongated bolts • Improper tightening torque or tightening sequence 	<ul style="list-style-type: none"> Tighten bolt. Replace bolt. Tighten properly.
	Cylinder block	
	<ul style="list-style-type: none"> • Cracking • Surface distortion • Fretting of cylinder liner insertion portion (insufficient projection of cylinder liner) 	<ul style="list-style-type: none"> Replace cylinder block. Repair or replace. Replace cylinder liner or cylinder block
	Cylinder head	
	<ul style="list-style-type: none"> • Cracking • Surface distortion 	<ul style="list-style-type: none"> Replace cylinder head. Repair or replace.
	Cylinder liners	
	<ul style="list-style-type: none"> • Cracking • Corrosion. • Insufficient projection of cylinder liner 	<ul style="list-style-type: none"> Replace cylinder liner. Replace cylinder liner. Replace cylinder liner.
	Other problems	
	<ul style="list-style-type: none"> • Incorrect injection timing 	<ul style="list-style-type: none"> Adjust injection timing.



VALVE MECHANISM AND RELATED PARTS

SM3-1259

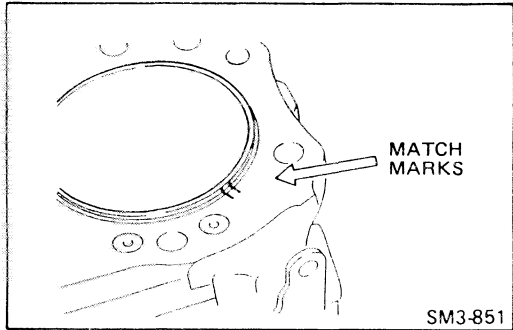
- | | |
|------------------------|-----------------------------|
| 1. Intake valve | 11. Adjusting screw |
| 2. Exhaust valve | 12. Push rod |
| 3. Tappet | 13. Valve stem cap |
| 4. Rocker arm support | 14. Valve seat key |
| 5. Rocker arm, exhaust | 15. Valve spring upper seat |
| 6. Collar | 16. Valve spring, inner |
| 7. Rocker arm, intake | 17. Valve spring, outer |
| 8. Adjusting screw nut | 18. Stem seal |
| 9. Bolt | 19. Valve spring lower seat |
| 10. Shaft | |



T = Tightening torque: kg-cm (lb.ft) SM3-1268

TIMING GEAR AND RELATED PARTS

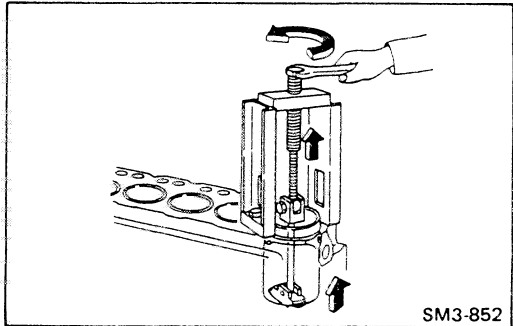
- | | |
|-------------------|-------------------------------|
| 1. Camshaft | 9. Idler gear |
| 2. Woodruff key | 10. Bushing |
| 3. Thrust bearing | 11. Straight pin |
| 4. Bolt | 12. Idler gear shaft |
| 5. Camshaft gear | 13. Injection pump drive gear |
| 6. Plain washer | 14. Bolt |
| 7. Bolt | 15. Crank gear |
| 8. Thrust plate | 16. Oil pump drive gear |



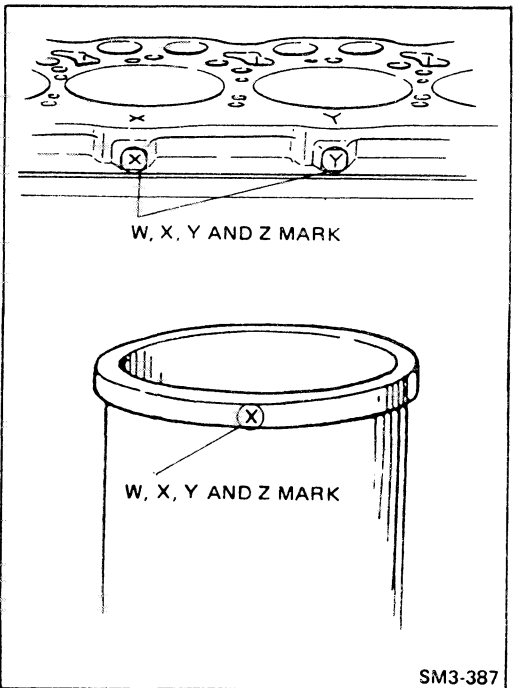
REMOVE THE CYLINDER LINER.

Before removing the cylinder liners, be sure to put match marks on the cylinder block and liner flange.

- NOTE:**
- Do not make match marks with a punch. Using a pen.
 - After removing the cylinder liners, put numbers on their periphery or arrange them in sequence.



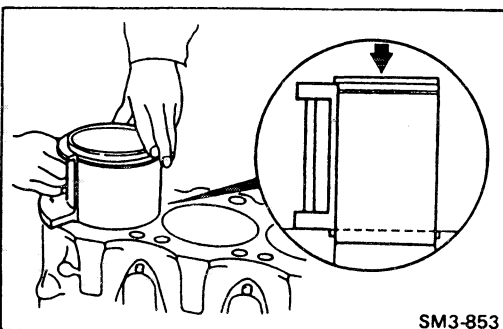
Special Tool: Cylinder Liner Puller (09420-1460)



IMPORTANT POINT (S) – ASSEMBLY

INSERT THE CYLINDER LINER INTO THE CYLINDER BLOCK.

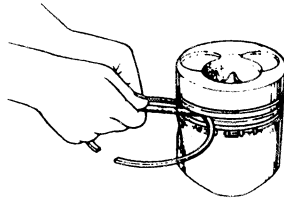
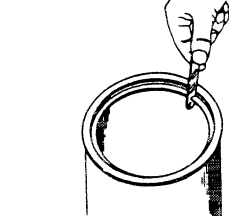
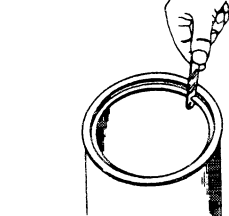
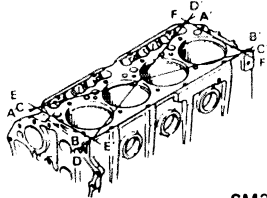
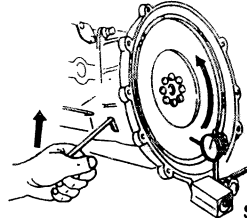
1. Make sure that the liner has the same mark as the mark on the cylinder block.
2. When using new cylinder liner, insert with mark on liner facing toward mark on block.

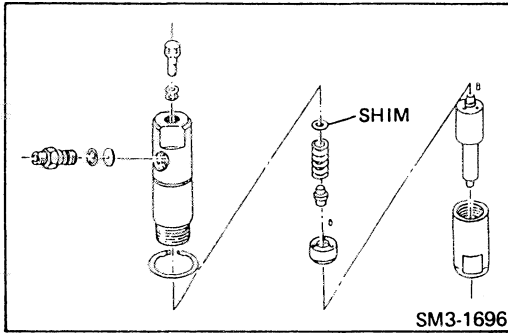


- NOTE:**
- Apply a small amount of fresh engine oil on the outer periphery of the liner.
 - The recommended special tool should be used as liner is extremely thin and easily damaged.

Special Tool: Cylinder Liner Guide (09480-1120)

Unit: mm (in)

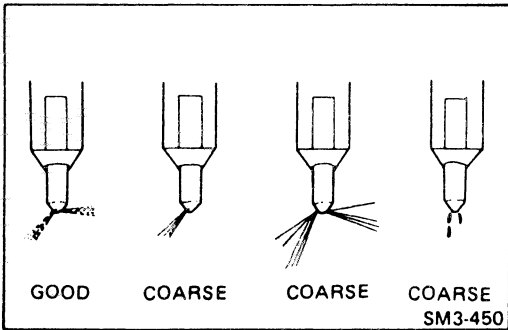
Inspection Item	Standard	Limit	Remedy	Inspection Procedure
Piston Ring Groove Breadth Ring No.:	Top: 2.57–2.59 (0.1012–0.1019)	2.74 (0.1078)	Replace piston ring and/or piston	 SM3-301
	2nd: 2.03–2.05 (0.0800–0.0807)	2.2 (0.0866)		
	Oil: 5.01–5.03 (0.1973–0.1980)	5.08 (0.2000)		
Clearance between Piston Ring and Piston Ring Breadth Ring No.:	Top: 0.08–0.12 (0.0032–0.0047)	0.3 (0.0118)		 SM3-302
	2nd: 0.04–0.08 (0.0016–0.0031)	0.3 (0.0118)		
	Oil: 0.02–0.06 (0.0008–0.0023)	0.08 (0.0031)		
Piston Ring Gap All Rings: * Insert the Piston Rings Where the Wear of the Liner is Small.	0.3–0.45 (0.0119–0.0177)	1.2 (0.0472)	Replace	 SM3-302
Cylinder Block Flatness	0.05 (0.0019)	0.1 (0.0039)	Regrind and/or replace	 SM3-216
Flywheel Face Alignment	—	0.15 (0.0059)	Regrind and/or replace	 SM3-908



2. If the injection pressure is not within specification, change the shim.

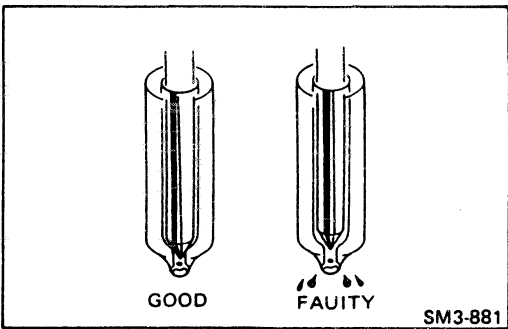
TEST THE SPRAY PROFILE

In the case of the new nozzle, operate the lever at the rate of 30 to 60 strokes per minute, and for a used nozzle, operate the lever at the rate of 15 to 60 strokes per minute.

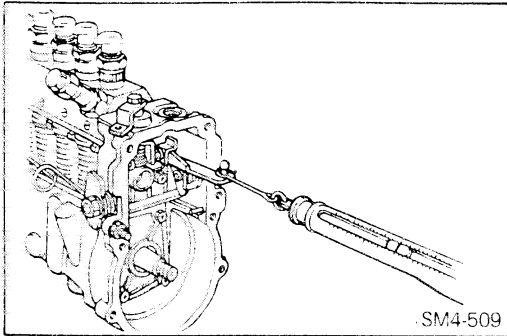


TEST THE FUEL LEAKAGE

When checking for fuel leakage from the nozzle, apply a pressure of about 10 to 20 kg/cm² (284 lb/sq.in) lower than the correct injection pressure to the nozzle by means of the nozzle tester. If there is no fuel leakage, the nozzle is normal.



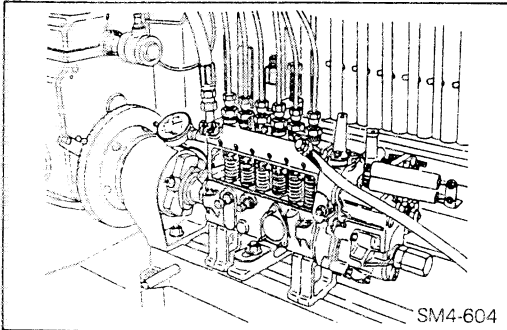
<u>Symptom</u>	<u>Possible cause</u>	<u>Remedy/Prevention</u>
Excessive smoke	Black smoke	
	• Excessive fuel delivery caused by incorrect adjustment of fuel load stopper screw.	Adjust fuel delivery on test stand.
	• Excessively advanced injection timing.	Correct it.
	• Large spread in fuel delivery	Adjust it.
	• Bad nozzle fuel spray characteristics	Check and correct them.
	White smoke	
	• Improperly retarded injection timing.	Advance injection timing.
• Water in fuel	Check and clean fuel lines.	
Low idle speed irregular	Improper adjustment of idle button	Correct it.
	Bad fuel spray characteristic of nozzles.	Check and repair them.
	Incorrect injection timing	Correct it.
	Incorrect initial tension setting of idling spring or the spring broken.	Adjust or replace it.
	Control rack not smoothly move	Disassemble pump and repair it.
	Large spread in fuel delivery	Adjust it.
	Plunger worn	Replace it.
	Governor linkage not smoothly move.	Correct it.
Defective feed pump	Disassemble and repair it.	
Engine always runs at high speed	Accelerator cable sticking	Check and correct it.
	Governor linkage sticking	Disassemble and repair the governor.
	Control rack sticking	Check and correct it.
Engine starts and stops	Fuel lines clogged	Clean or replace fuel lines.
	Air in fuel caused by damaged fuel lines or improper connection of fuel lines.	Repair fuel lines or replace fuel lines and gaskets.



MEASURE THE SLIDING RESISTANCE OF THE CONTROL RACK.

Assembly Standard: Less Than 150 g (5.29 oz)

NOTE: Make sure that the control rack slides smoothly and without catching.

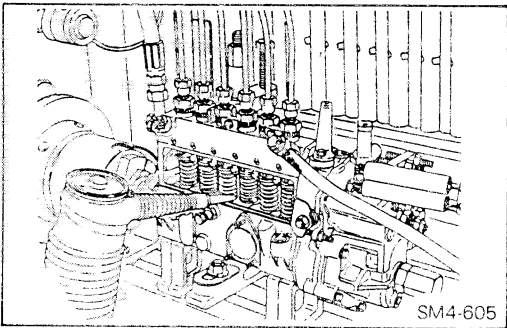


ADJUSTMENT

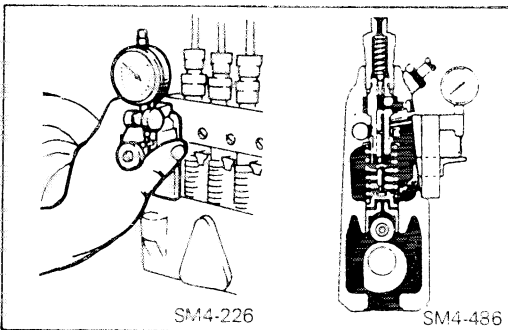
PREPARATION

1. Mount the injection pump correctly on the pump tester.
2. Attach a rack measuring device to the control rack and set to "0".
3. Install calibration nozzles and lines.

Nozzles and Lines: Refer to the chart "CALIBRATION."

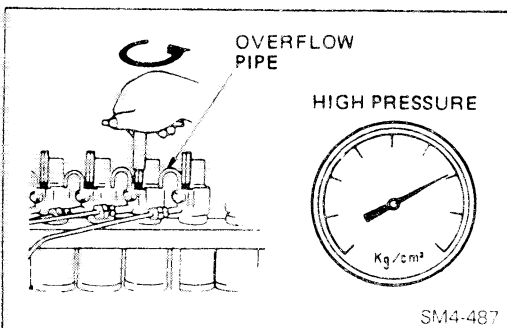


4. Install the cover on the feed pump mounting surface and fill the pump camshaft chamber with engine oil.

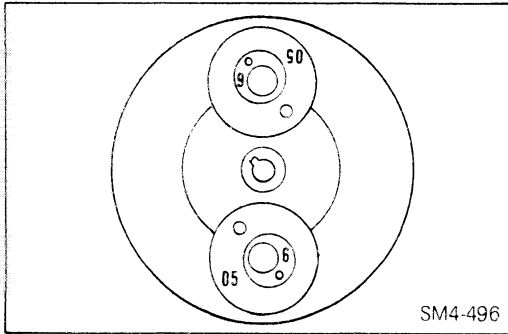


ADJUSTING THE INJECTION TIMING

1. Preparation of the pre-stroke.
 - a) Remove the plate cover.
 - b) Install a pre-stroke measuring instrument. Bring the tappet of the first cylinder to its bottom dead center, and set the pointer tip on the tappet.

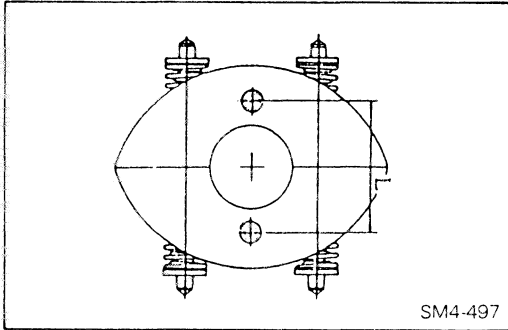


2. Measure the pre-stroke (No.1 plunger)
 - a) Set the control rack at full-load position.
 - b) Loosen the overflow screw of each nozzle holder.
 - c) Operate the high-pressure pump of the pump tester and let fuel run out of the overflow line.



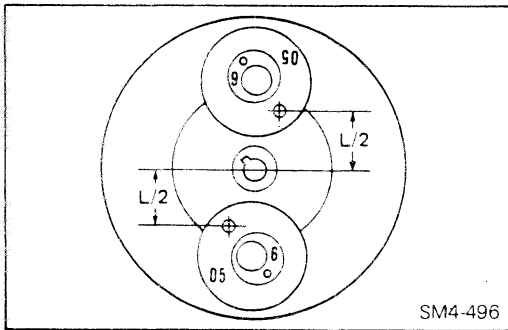
INSTALL THE CAMS.

Install the large and small cams on the timer hub as shown in the figure (as seen from the side of the timer cover).

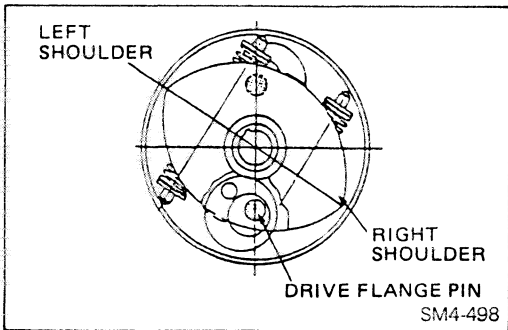


INSTALL THE FLYWEIGHT ASSEMBLY.

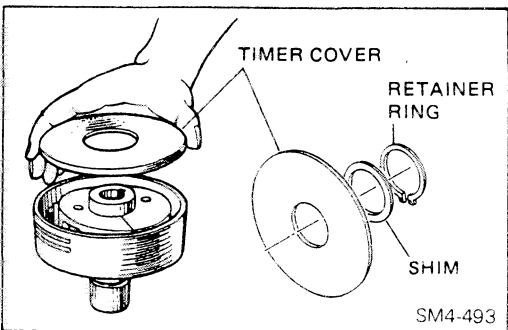
1. Measure the distance (L) between the flyweight pin centers after the flyweight spring has been installed.



2. Turn the large cam so that the same dimension is obtained on the left and the right for the distance (L/2) between the large cam hole center and the timer hub rotation centers.



3. Install the flyweight assembly.
4. To confirm correct installation of the flyweight, check that the right shoulder part of the flyweight is lowered when the two pins of the driving hub are in the vertical axis position, as shown in the figure (as seen from the side of the timer cover).

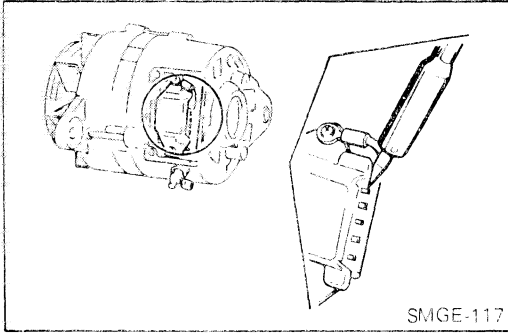


INSTALL THE TIMER COVER.

1. Install the timer cover, shim, and retainer ring.

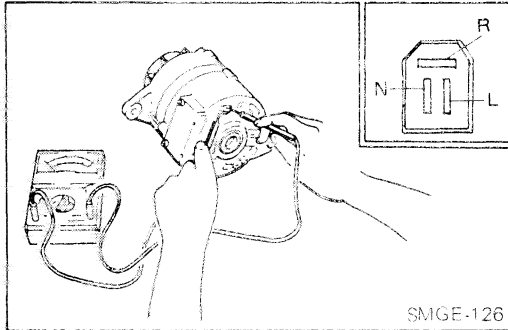
MEMO

(K.P.)



INSTALL THE REGULATOR AND THE BRUSH HOLDER ASSEMBLY.

1. Install the brush holder assembly and regulator.
2. Solder the lead wire to the regulator.



AFTER ASSEMBLING THE GENERATOR, MEASURE THE RESISTANCE BETWEEN EACH TERMINAL.

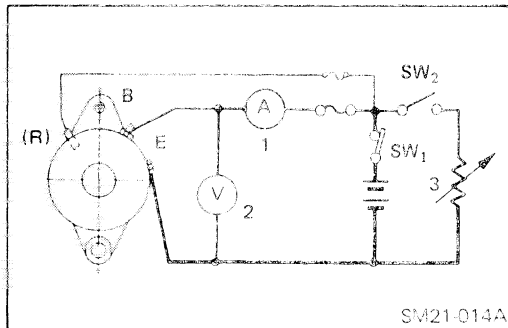
Tester		Resistance	Tester		Resistance
+ Lead	- Lead	(Ω)	+ Lead	- Lead	(Ω)
B	R	∞	N	E	7-10
B	N	7-10	N	B	∞
R	L	400-500	E	R	∞
R	E	∞	E	L	∞
L	E	∞	E	N	∞

PERFORMANCE TEST

NOTE: ○ Note the battery polarity carefully so as not to make reverse connections.

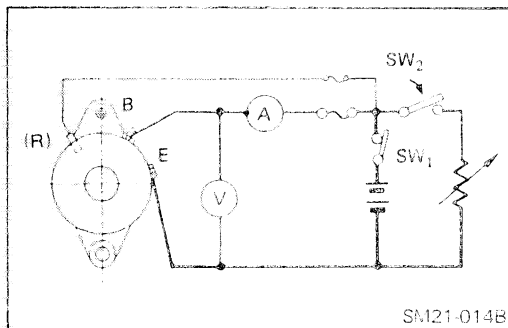
If the connections are reversed, the diodes will short the circuit and allow large current to flow through and damage the diodes and IC regulator as well as burn up the wiring harness.

- Use care not to make wrong connections of terminals.
- When charging the battery with a quick charge. Disconnect the battery terminals.
- Do not perform tests with high voltage insulation resistance tester.
- When in operation, never disconnect the battery.



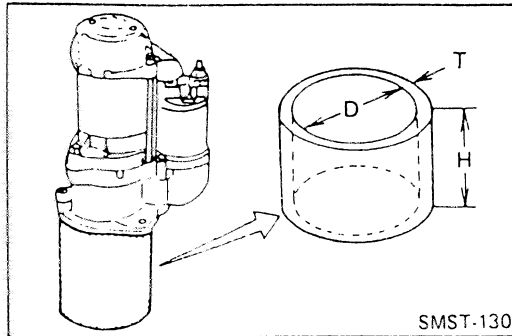
GENERATOR PERFORMANCE TEST.

1. Turn on switch SW₁ and off SW₂ to increase the rotation of the alternator slowly.



2. When voltage reaches 28V, turn on switch SW₂ regulate load resistance. Increase the rotation of the rotor keeping voltage at 28V.

Generator Speed: Less than 5,000 rpm at 28V, 20A

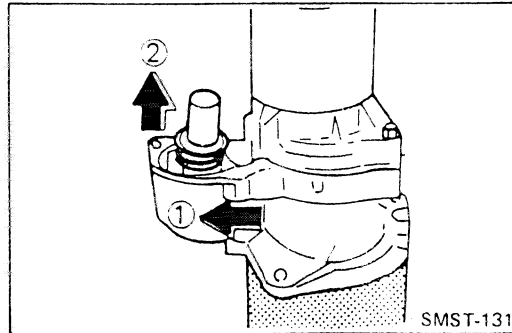
**IMPORTANT POINT(S) – DISASSEMBLY**

When disassembling the starter, prepare a work stand as shown in the figure.

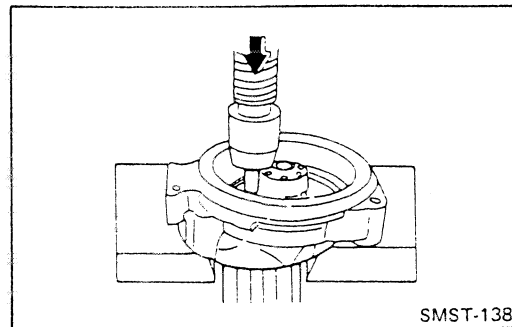
D: Diameter = 110 mm (4.331 in)

T: Thickness = 10 mm (0.394 in)

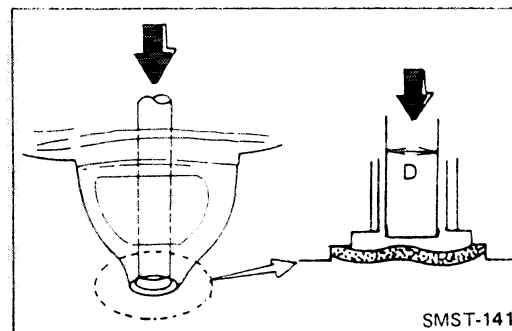
H: Height = 120 mm (4.724 in)

**REMOVE THE MOVING CORE.**

Remove the moving core in the direction of the marked arrow in the order ① and ②.

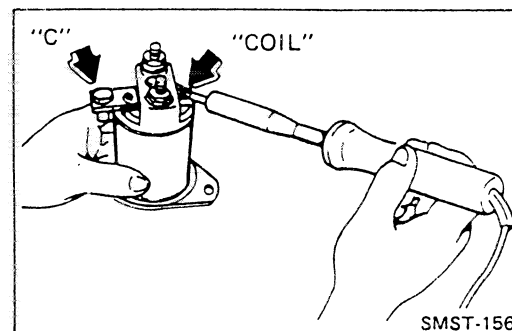
**REMOVE THE ARMATURE ASSEMBLY.**

Using a press, remove the armature assembly.

**REMOVE THE PLUG**

Remove the drive housing plug using a press.

D: Diameter = 16 mm (0.620 in)

**REMOVE THE MAGNETIC SWITCH.**

Unsolder the "COIL" terminal and "C" terminal.

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