SEBM04190107

# SHOP MANUAL

# KOMATSU

# WA300-1
# WA320-1

| MACHINE MODEL | SERIAL No. |
|---|---|
| WA300-1 | 10001 and up |
| WA320-1 | 10001 and up |

**This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require.**
**Materials and specifications are subject to change without notice.**

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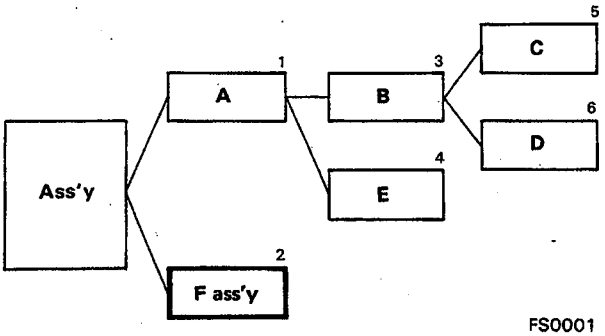
## NETWORK (Disassembly and assembly relationship drawings)

In the shop manual the following network drawings show relationship between work items and sequence for assembly and disassembly.




FS0001

In this network the sequence of disassembly is marked on the top right of each work item so that handling can be easily understood. For example, when taking **D** of the Ass'y follow the sequence **A** → **B** → **D**, when removing **E** follow the sequence **A** → **E**.

F ass'y indicates a further separate disassembly, and indicates the existance of a previous work network. For assembly the sequence is shown using the same kind of network.

## TROUBLESHOOTING CHART

As shown below, the symptoms relating to a particular trouble are described in the line designated "Problems". The probable cause of the trouble is then marked under the "Causes" column.

Example:

Symptom: Reduced tractive power or slow travel speed.

| Problems | Causes: Oil leaks in torque converter | Air suction in the hydraulic pump | |
|---|---|---|---|
| Torque converter oil pressure gauge shows lower than normal pressure. (normal 3 – 4.8 kg/cm²) | ○ | ○ | ○ |
| Transmission oil pressure gauge shows lower than normal pressure. (normal 20 – 23 kg/cm²) | | ○ | |
| | ○ | | |

## MAINTENANCE STANDARD

### Standard size, Tolerance

The dimensions of finished parts each differ a little. Therefore, when determing the finished dimensions of parts, a dimension that will be standard is determined provisionally, then the difference allowed from it is indicated. The former is called the standard size, and the latter the tolerance.

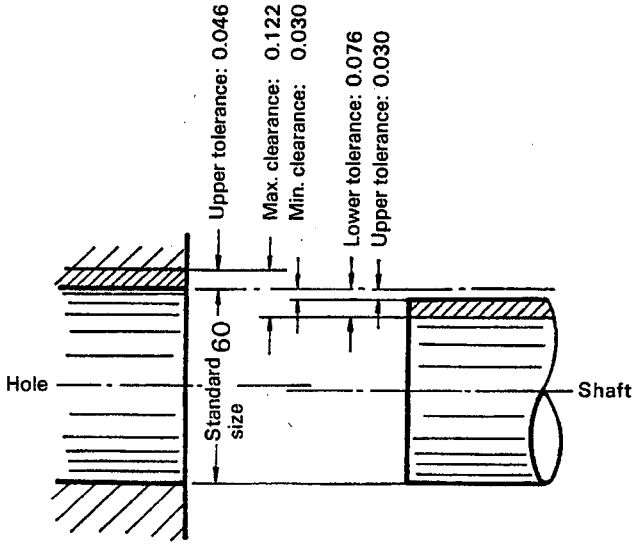
The way to show this is by a plus or a minus sign with the tolerance in smaller numerals to the right of the standard size.

Example: $120^{-0.026}_{-0.126}$

(It equals 119.874 – 119.978 mm)

Moreover, when expressing the dimensions of a hole and the shaft that goes inside it, for the sake of convenience, the standard size for the hole and the shaft are usually taken as the same, and the tolerances changed to indicate the tightness of the fit. For example, the fit of a revolving shaft is indicated as follows, and is shown in the drawing.

Hole: $60^{+0.046}_{0}$ Shaft: $60^{-0.030}_{-0.076}$

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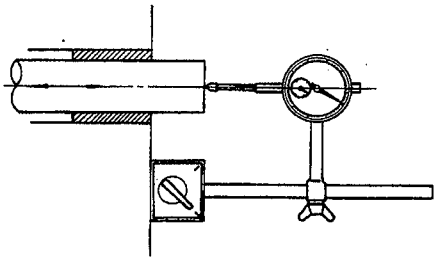
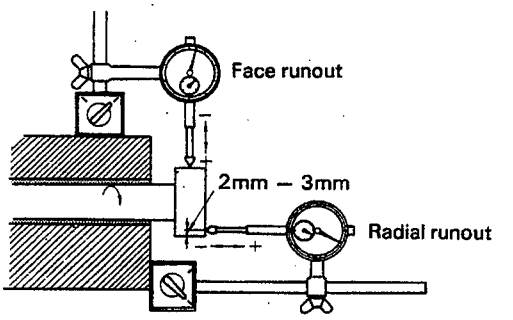
- **Measuring end play, looseness or deviation**



FS0025

Read the T.I.R. while moving the object back and forth or vertically.

- **Measuring face runout or radial runout**



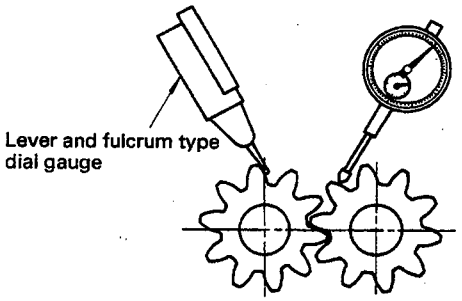

FS0026

1) Read runout at six or more positions during one complete rotation of the object.
2) At the start of each measurement, set the zero-point at the middle of the assumable range of the spindle movement. Be careful not to confuse positive and negative readings of runout.

| | Face runout | Radial runout |
|---|---|---|
| When the pointer is to the right of "0" | + | – |
| When the pointer is to the left of "0" | – | + |

3) When measuring face runout, place the contact-point on the object along a circle 2 or 3 mm smaller in diameter than the outside diameter of the object.

- **Measuring gear backlash**

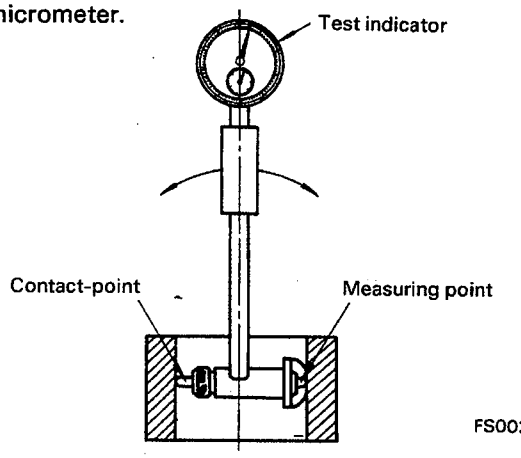



FS0027

1) Fully mesh one of two gears and place the dial gauge contact-point on a tooth of the other gear. Swing the free gear within the limits of its play in the rotational directions, and read the T.I.R.
2) Use of the lever and fulcrum type dial gauge is recommended for this purpose as the contact-point placed on the gear is moved tangentially to the gear pitch circle.
3) The lever and fulcrum type dial gauge is suitable for use in a narrow space or for a special measurement which requires placing the contact-point on an object at an angle to the spindle of the gauge.
   Since the contact-point of this type of gauge has a very narrow measuring range (usually 3 mm or less), the contact-point should be carefully checked for contact with the object during measurement.

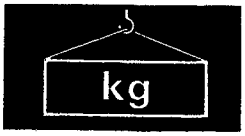
## CYLINDER GAUGES

- Install a contact-point having a length approximately equal to the cylinder bore to the measured on the cylinder gauge. Set the zero-point of the test indicator to the bore diameter of the standard cylinder measured with a reference ring gauge or a micrometer.




FS0028

# HOISTING INSTRUCTIONS




⚠ Heavy parts (25 kg or more) must be lifted with a hoist etc. In the **Disassembly and Assembly** section, every part weighing 25 kg or more is indicated clearly with the symbol kg

1. If a part cannot be smoothly removed from the machine by hoisting, the following checks should be made:
   - Check for removal of all bolts fastening the part to the relative parts.
   - Check for existence of another part causing interference with the part to be removed.

2. **Wire ropes**
   1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

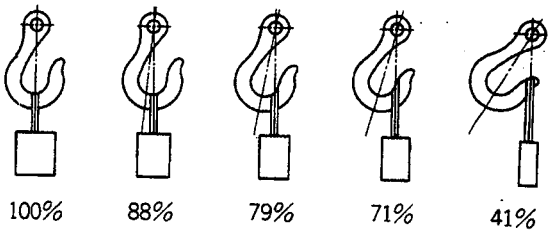
Wire ropes
(Standard "Z" or "S" twist ropes without galvanizing)

| Rope diameter (mm) | Allowable load (tons) |
|---|---|
| 10 | 1.0 |
| 11.2 | 1.4 |
| 12.5 | 1.6 |
| 14 | 2.2 |
| 16 | 2.8 |
| 18 | 3.6 |
| 20 | 4.4 |
| 22.4 | 5.6 |
| 30 | 10.0 |
| 40 | 18.0 |
| 50 | 28.0 |
| 60 | 40.0 |

The allowable load value is estimated to be one-sixth or one-seventh of the breaking strength of the rope used.

2) Sling wire ropes from the middle portion of the hook.

Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result. Hooks have maximum strength at the middle portion.

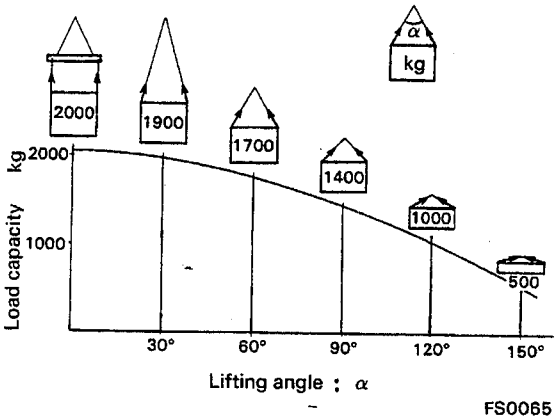



FS0064

3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmertically wound on to the load.

⚠ Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.

4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook.
When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles. The table below shows the variation of allowable load (kg) when hoisting is made with two ropes, each of which is allowed to sling up to 1000 kg vertically, at various hanging angles.
When two ropes sling a load vertically, up to 2000 kg of total weight can be suspended. This weight becomes 1000 kg when two ropes make a 120° hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 4000 kg if they sling a 2000 kg load at a lifting angle of 150°.



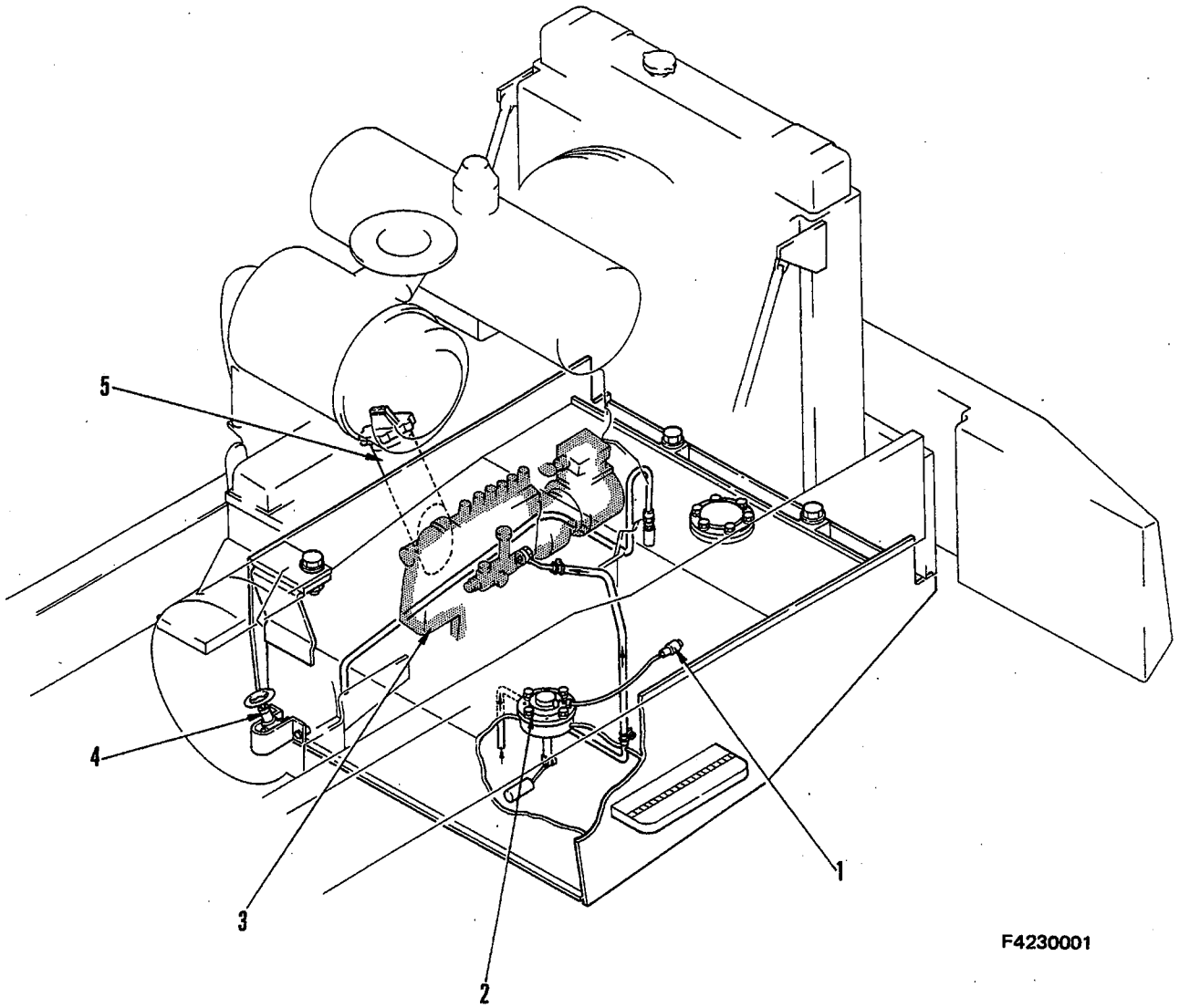

FS0065

# SPECIFICATIONS

| Machine model | | | WA300-1 |
|---|---|---|---|
| **Weight** | | | |
| • Operating weight (incl. one person's 80kg) | | kg | 12,180 |
| • Front wheel loading | | kg | 5,540 |
| • Rear wheel loading | | kg | 6,640 |
| **Dimensions** | | | |
| • Overall length (tooth length excluded) | | mm | 7,045 |
| • Overall width of machine | | mm | 2,585 |
| • Overall width of bucket | | mm | 2,685 |
| • Overall height (top edge of exhaust pipe) | | mm | 3,190 |
| • Overall height (top of cab) | | mm | 3,385 |
| • Overall height (turing bucket ascent) | | mm | 5,035 |
| • Wheel base | | mm | 3,030 |
| • Tread | | mm | 2,050 |
| • Bucket hinge pin height | | mm | 3,750 |
| • Dumping clearance (bucket base) | | mm | 2,800 |
| • Dumping reach (bucket base) | | mm | 1,060 |
| • Bucket dumping angle | | degree | 45 |
| • Bucket tilt angle (traveling posture) | | degree | 48 |
| • Excavation depth (10° dump) | | mm | 250 |
| • Minimum height above ground | | mm | 400 |
| **Performance** | | | |
| • Bucket capacity | | $m^3$ | 2.3 |
| • Operating load | | kg | 3,560 |
| • Travel speed | | | |
| Forward | 1st speed | km/h | 7.9 |
| | 2nd speed | km/h | 12.0 |
| | 3rd speed | km/h | 21.0 |
| | 4th speed | km/h | 37.0 |
| Reverse | 1st speed | km/h | 7.9 |
| | 2nd speed | km/h | 12.0 |
| | 3rd speed | km/h | 21.0 |
| | 4th speed | km/h | 37.0 |
| • Maximum traction force | | kg | 11,400 |
| • Gradeability | | degree | 25 |
| • Minimum turning radius | | | |
| • At outside of machine | | mm | 5,935 |
| • At center of outermost wheel | | mm | 5,160 |

# FUEL TANK AND PIPING

The fuel level sensor is installed in the main fuel tank.

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1. Connector
2. Fuel level sensor
3. Injection pump
4. Drain valve
5. Fuel filler port

# MEASURING BLOW-BY PRESSURE

★ Measurement condition
- Coolant temperature: Inside operating range.
- Engine valve clearance: Standard valve

Unit: $mmH_2O$

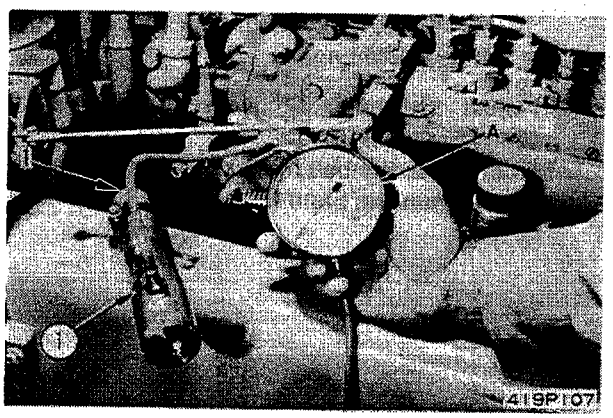
| Item | Standard value | Permissible value |
|---|---|---|
| Blow-by pressure | Max. 100 | 200 |

**Special tool**

| | Part number | Part name | Q'ty |
|---|---|---|---|
| A | 799-201-1503 | Blow-by checker | 1 |

⚠ When taking measurements, be careful not to touch the exhaust manifold or muffler, or to get caught in rotating parts.

**1. Measuring blow-by**
1) When measuring the blow-by, warm the engine up thoroughly (oil temp: min. 60°C).
2) Stop engine and install adapter ① of blow-by checker **A** on engine breather hose (1).
3) Connect adapter and pressure gauge (0 — ~~1000~~ 500 mm $H_2O$) to hose.
4) Run engine at rated output and measure blow-by pressure.

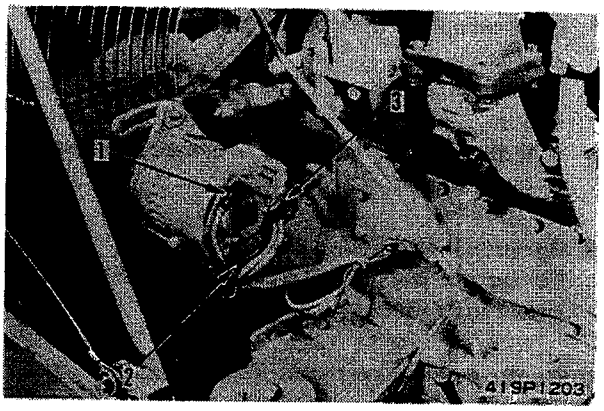


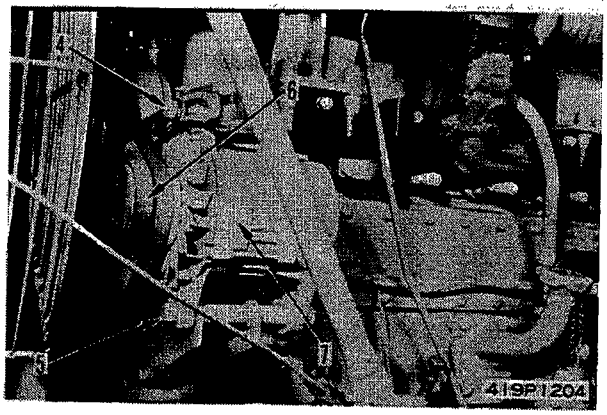

**2. Precautions when measuring blow-by**
★ Blow-by may vary greatly according to the condition of the engine, so if there is any abnormality in the reading, check for any problem related to defective blow-by, such as excessive oil consumption, defective exhaut gas color, or early deterioration or contamination of the oil.

# REMOVAL OF ALTERNATOR ASSEMBLY

⚠ Disconnect the cable from the negative (−) terminal of the battery.

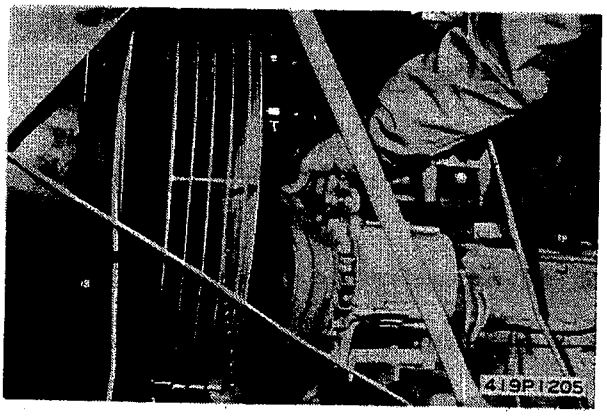
1. Remove catch, then open hood.
2. Disconnect wires (1), (2) and (3).
3. Remove bolt (4) of adjustment plate, then loosen mounting bolt and nut (5).
4. Move alternator assembly towards cylinder block to loosen belt tension, then remove belt (6).
5. Remove mounting bolt and nut, then remove alternator assembly (7).

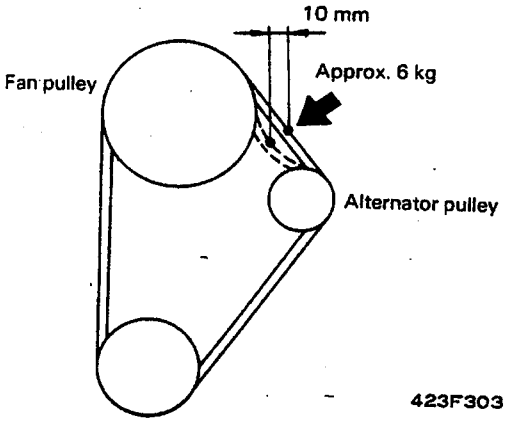



# INSTALLATION OF ALTERNATOR ASSEMBLY

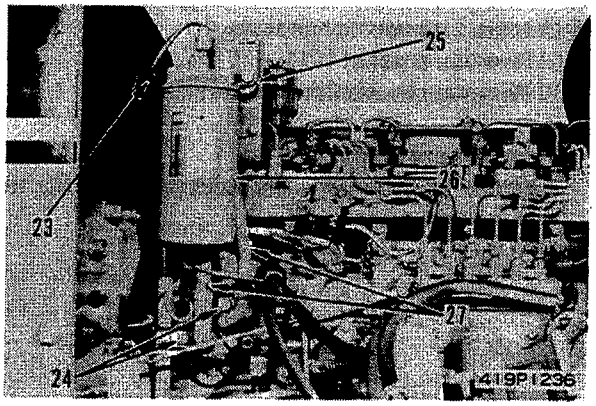
1. Install alternator assembly (7), then partially tighten mounting bolt and nut (5).
2. Fit belt (6) in pulley groove and install.
3. Partially tighten bolt (4) of adjustment plate.
4. Insert a bar between alternator assembly and cylinder block, raise alternator assembly and adjust tension of belt.
   ★ The belt should deflect about 10 mm when pushed with a finger pressure of 6 kg at a point midway between the alternator and the fan pulley.
5. Tighten bolt of adjustment plate, mounting bolt and nut.
6. Connect wires (3), (2) and (1).
7. Close hood, then lock with catch.
8. Connect cable to negative (−) terminal of battery.



**10. Oil filter**

1) Disconnect connector (23), then remove mounting bolt (24) of tube.
2) Remove oil filter (26) together with tube (27) and bracket (25).

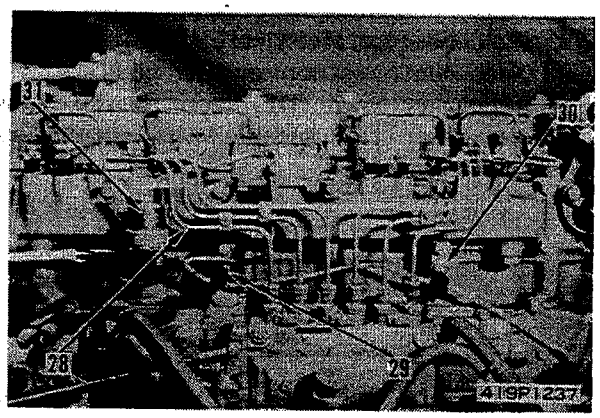



**11. Fuel injection tube**

Remove 6 fuel injection tubes (28).

**12. Electrical intake air heater switch**

Remove wiring clamps (29) and (30), then remove electrical intake air heater switch (31) and move it to outside.

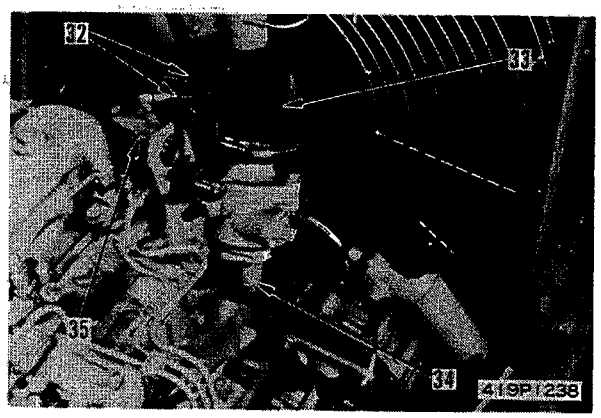



**13. Bracket, hoses**

1) Disconnect aeration hose (32), then disconnect thermostat outlet hose (33).
2) Disconnect bypass hose (34).
3) Remove bracket (35).

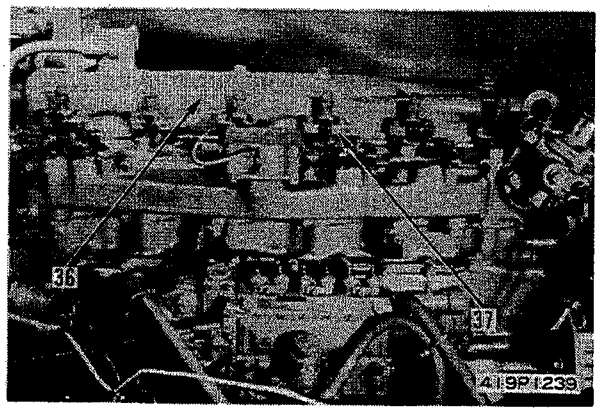
**14. Spill pipe**

Remove spill pipe (36).




**15. Nozzle holder assembly**

Remove nozzle holder assembly (37).



# REMOVAL OF RADIATOR

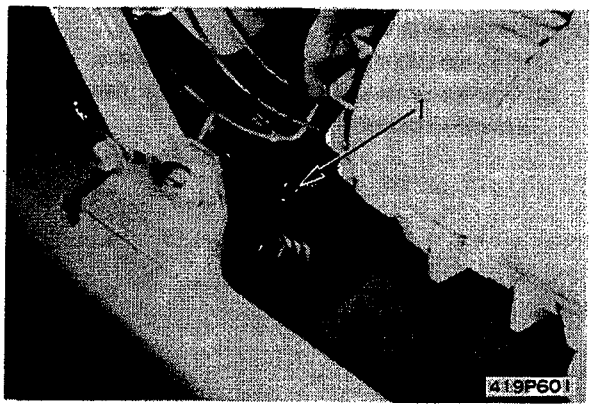
⚠ Park the machine on level ground, set the safety bar on the frame, ground the bucket, shut down the engine apply the parking brake and place blocks under the tires.

**1. Water drainage**

1) Loosen drain valve (1) and drain off the cooling water.

Cooling water: **38 ℓ**

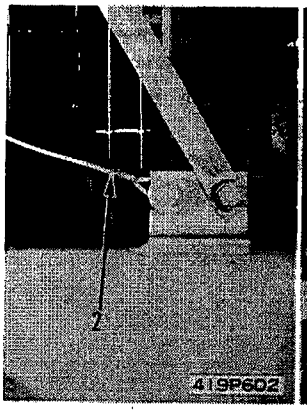
★ If the cooling water contains anti-freeze solution, treat it as a chemical reagent. Do not discard it carelessly.

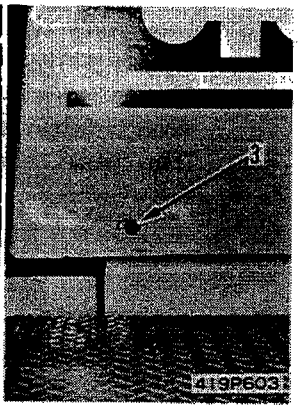



**2. Hood**

1) Open hood and remove cable (2), then close hood and install safety bolt (3).
2) Remove radiator grille (4) and exhaust pipe (5).
3) Remove mounting bolts, then remove hood (6).
   ★ Screw eye bolts into the holes for the mounting bolts of the exhaust pipe, and be careful of the balance when removing the hood.

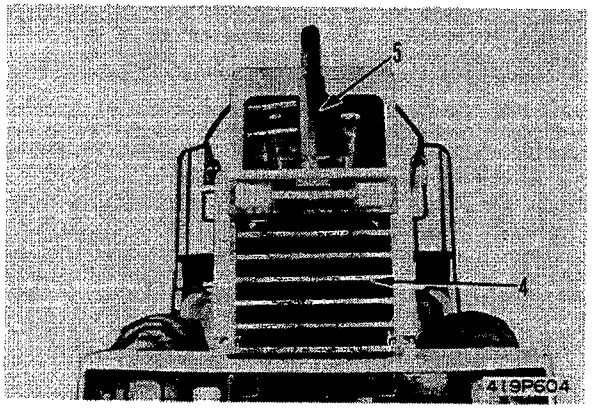
kg Hood: **110 kg**

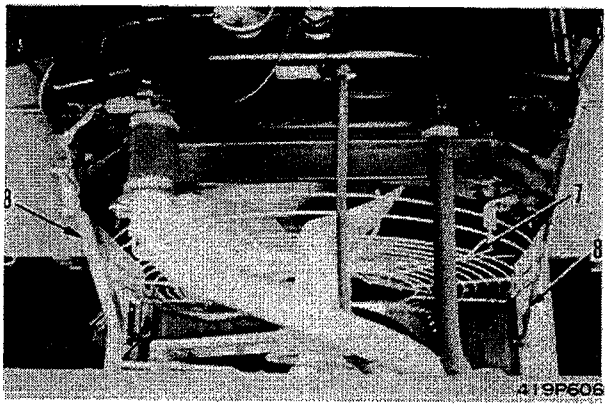


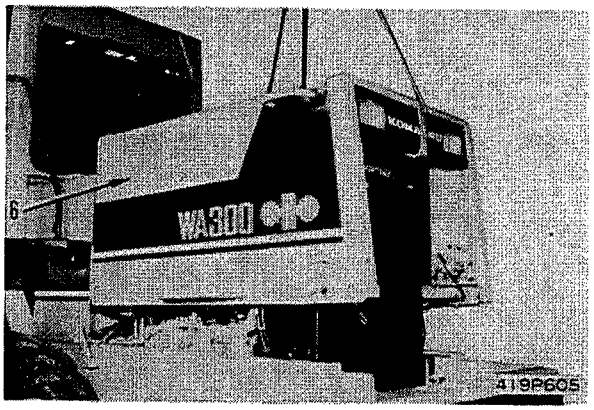




**3. Fan guard**

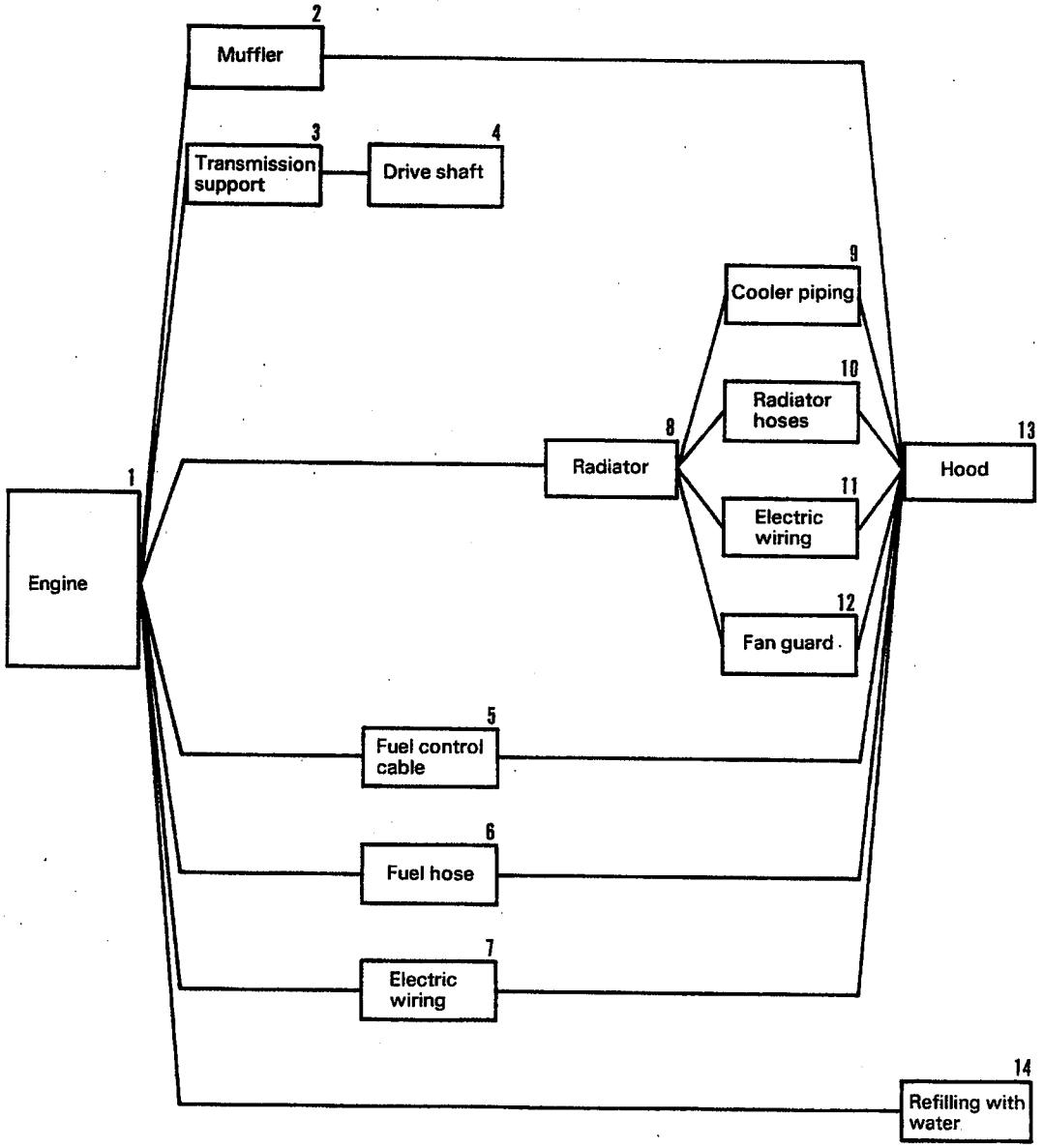
Remove fan guard (7) and radiator support (8).



# INSTALLATION OF ENGINE

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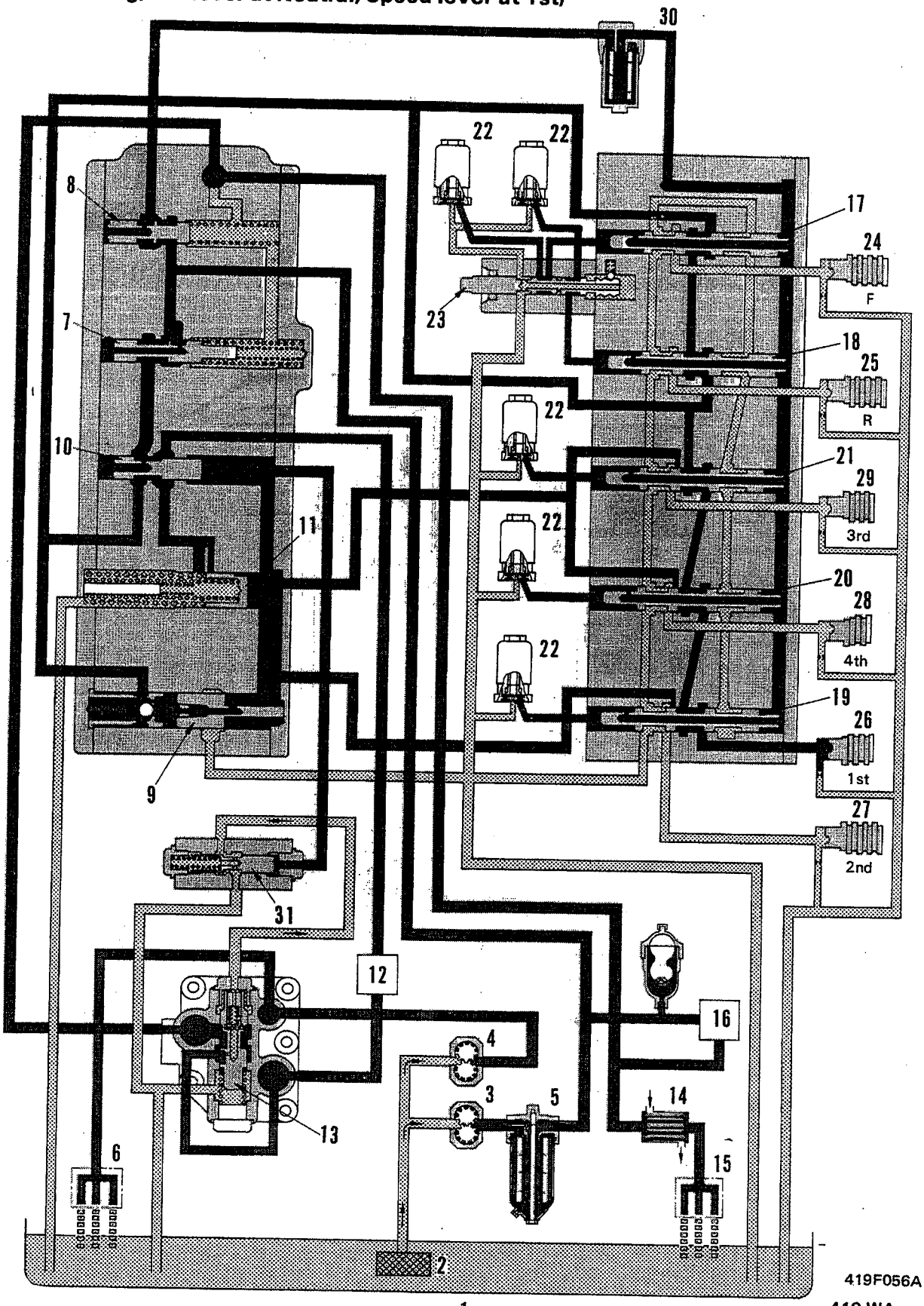
# HYDRAULIC CIRCUIT DIAGRAM FOR POWER TRAIN

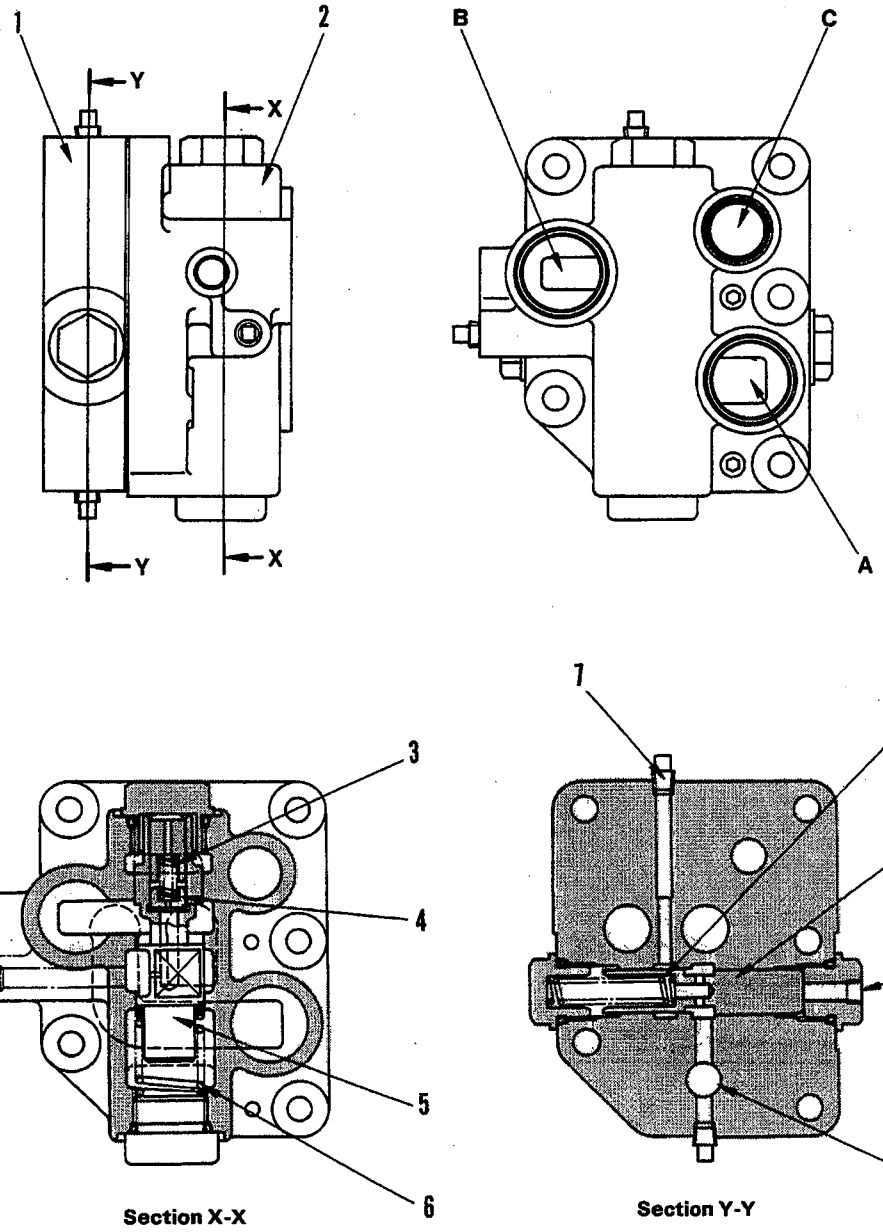
## (WA300-1 Serial No. 10001 — 19999)

**(Engine low idling, F-R lever at Neutral, Speed lever at 1st)**




419F056A

# TORQUE CONVERTER REGULATOR VALVE
## (WA300-1 Serial No. 10001 — 19999)




419F015A

1. Lower valve
2. Upper valve
3. Spring
4. Piston
5. Spool
6. Spring
7. Plug
8. Spring
9. Spool

A. Torque converter outlet port
B. Oil cooler port
C. Transmission lubrication oil port
D. To lower valve
E. Transmission control valve (from upper valve)
F. Drain port

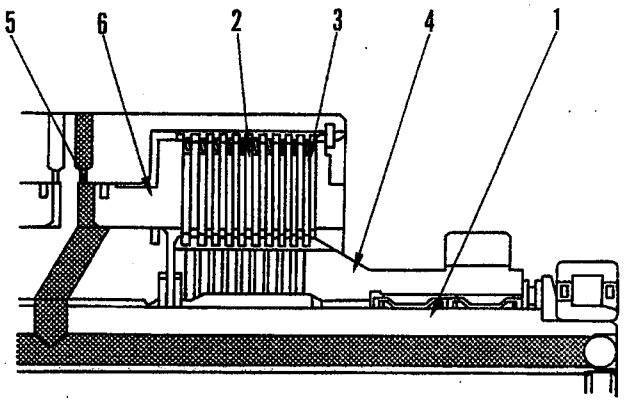
**FUNCTION**

- The torque converter regulator valve is installed at the outlet side of the torque converter. It adjusts the maximum oil pressure inside the torque converter.
- When shifting, the pressure inside the torque converter is lowered and the modulation function in the control valve is stabilized.

## OPERATION OF CLUTCH

**When engaged**

- The oil sent from the transmission valve passes through the oil passage inside shaft (1). It reaches the rear face of piston (6) and acts on the piston.
- When piston (6) is actuated, separator plate (2) and clutch disc (3) are brought into close contact. Shaft (1) and clutch gear (4) form one unit and transmit the motive force.
  When this happens, oil is drained from oil drain hole (5). However, the volume of oil drained is less than the volume of oil entering, so there is no effect on the operation of the clutch.

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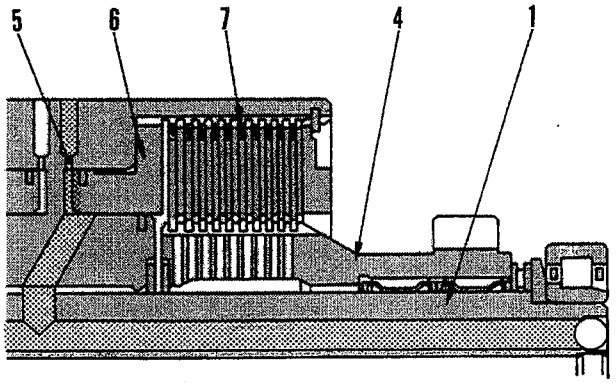
**When disengaged**

- The oil sent from the transmission valve is shut off, so the pressure of the oil acting on the rear face of piston (6) is reduced.
- The piston is returned to its original position by wave spring (7), and shaft (1) and clutch gear (4) are separated.
- When the clutch is disengaged, the oil at the rear face of the piston is drained by centrifugal force through oil drain hole (5). This prevents the clutch from remaining partially engaged.




419F025

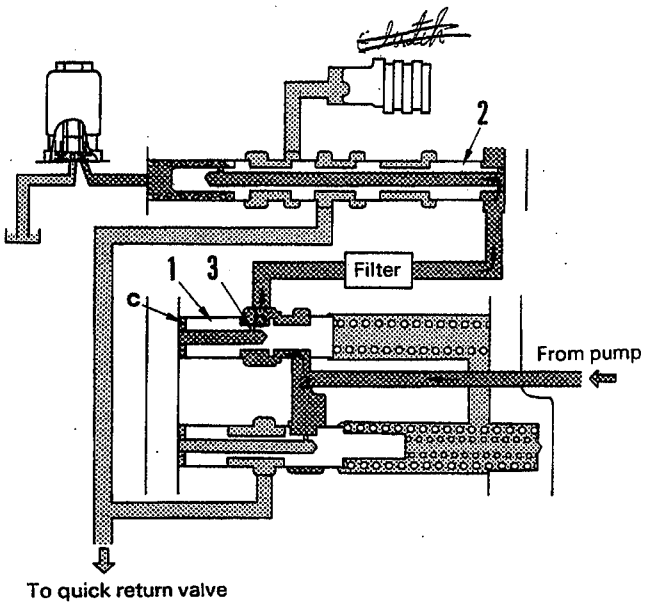
# PILOT REDUCING VALVE

## FUNCTION

- The pilot reducing valve regulates the pressure use to actuate the transmission spools.

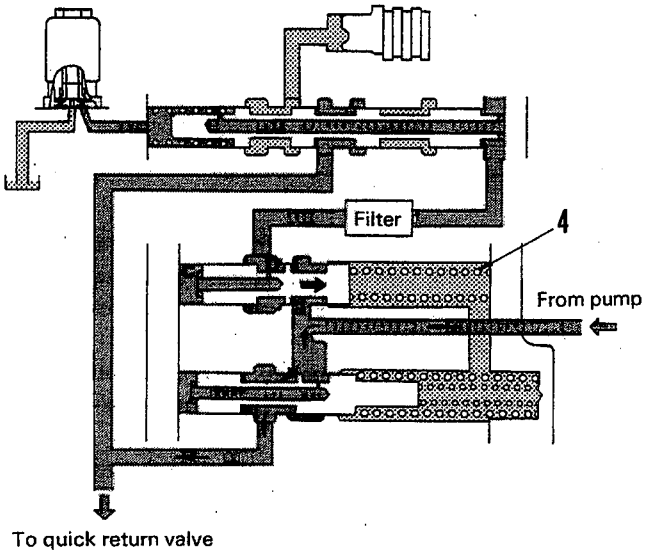
## OPERATION

- The oil from the pump enters port (a). It passes through port (b) of pilot reducing valve (1), and enters transmission spool (2) of the lower valve to fill the pilot circuit. The oil at port (b) passes through orifice (3) and goes to port (c).



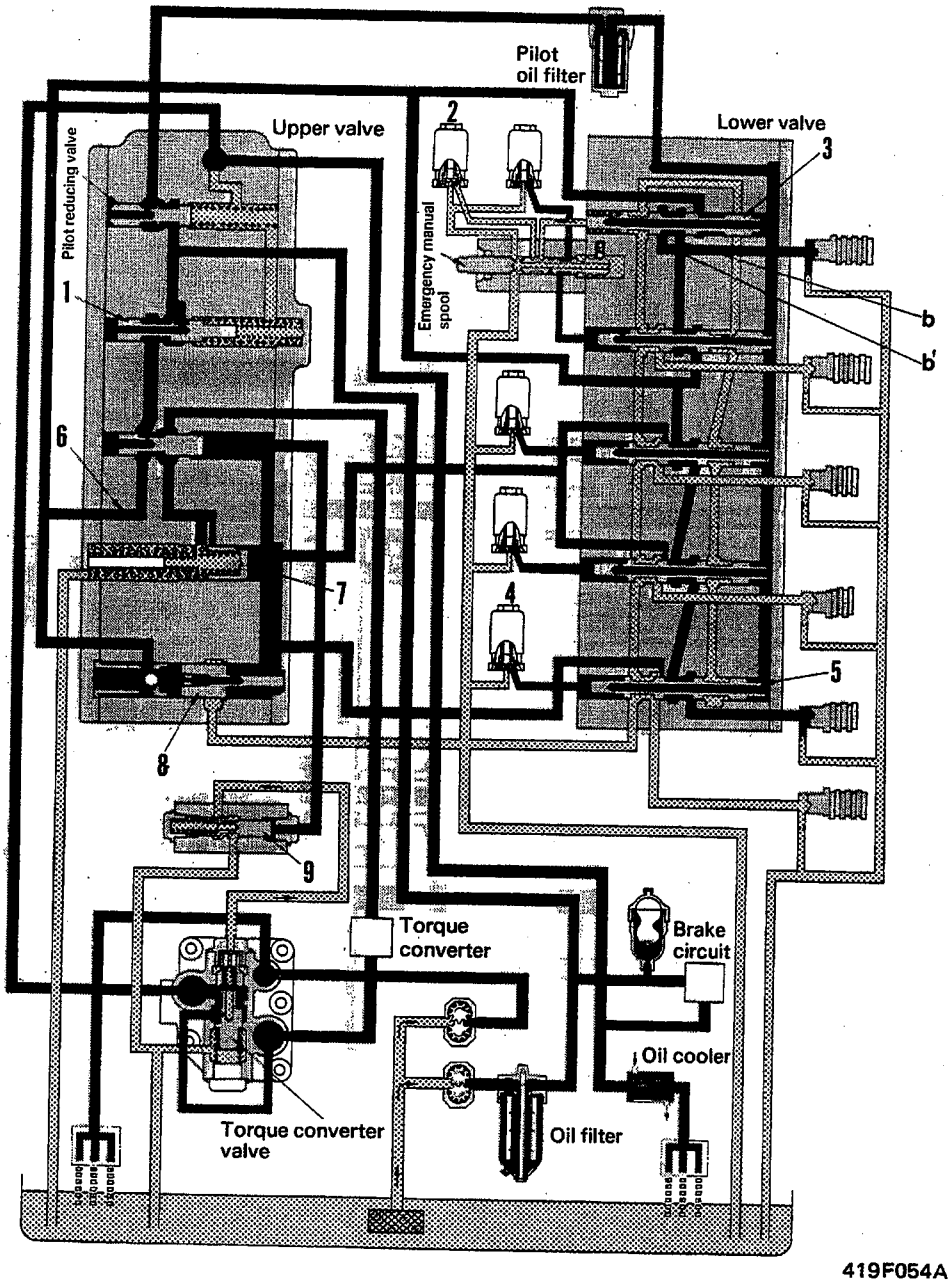

419F035

- As the pressure in the pilot circuit rises, the hydraulic pressure at port (c) also rises. It pushes against spring (4) and moves pilot reducing spool (2) in the direction of the right. Port (a) and port (b) are shut off, so the pressure at port (c) is maintained at the same level.




419F036

**FORWARD 1st**




419F054A

- The oil from the pump passes through priority valve (7), and is divided to the pilot circuit and clutch actuation circuit.
- If the transmission control levers are placed in 1st FORWARD, FORWARD solenoid valve (22B) is actuated, and the oil which fills port (a) is drained. When this happens, FORWARD spool (17) moves to the left, and the clutch oil pressure port and FORWARD clutch oil pressure port (b) are connected. 2nd speed solenoid valve (22E) is closed, so the 1st and 2nd spool is pushed to the right, and clutch oil pressure port (c) and 1st clutch port (d) are connected.
- The oil in the clutch actuation circuit passes through main orifice (e). It then passes through clutch ports (b) and (d), which are connected at the FORWARD and 1st and 2nd spools, and flows to the FORWARD and 1st clutches.
- When the oil completely fills the clutch cylinder, the oil pressure rises gradually because of the action of the accumulator valve and quick return valve. When it reaches the set pressure, the FORWARD and 1st clutches are completely engaged.

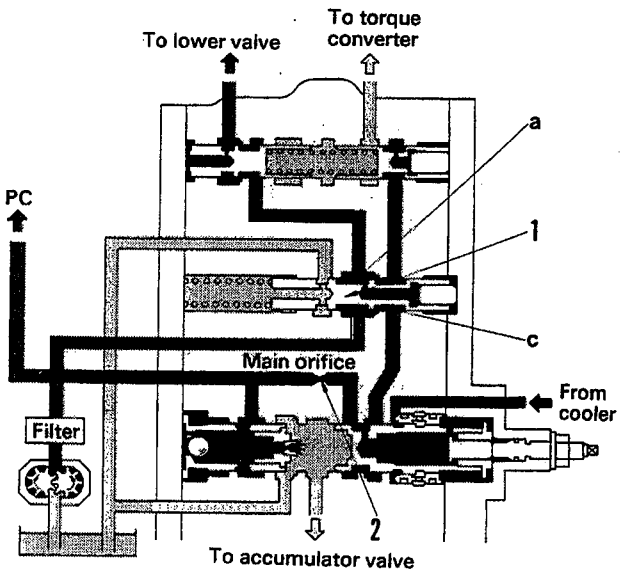
## MAIN REGULATOR VALVE

### FUNCTION

- The main regulator valve controls the amount of oil that flows to the clutch circuit. It sends any excess oil to the torque converter circuit.

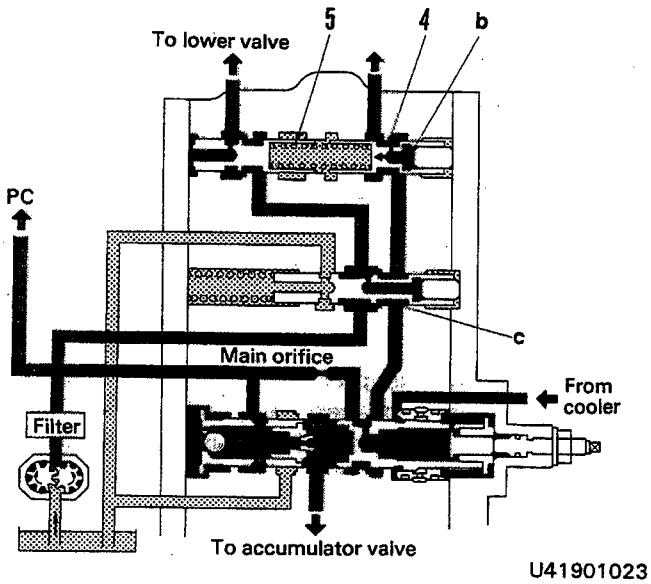
### OPERATION

- The oil from the pump enters priority valve (1). It then flows from port "a" through main orifice (2) and fills the clutch circuit.



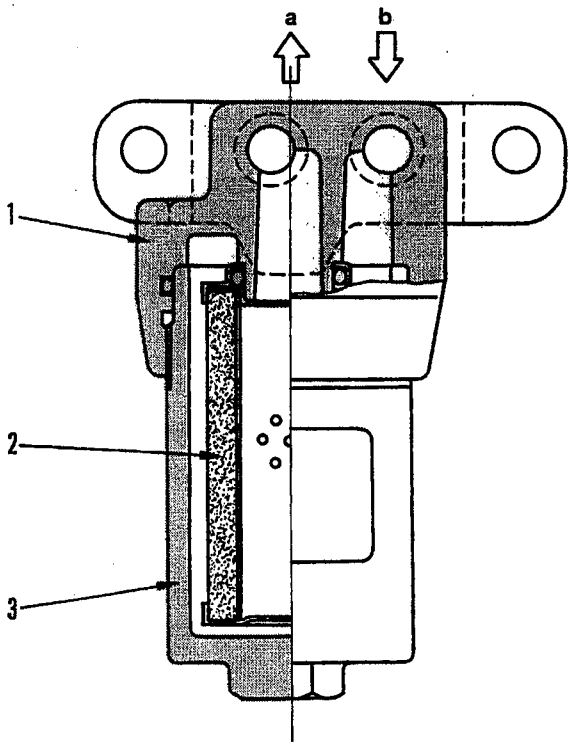

U41901022

- The oil which passes through orifice (4) and enters port "b" acts against spring (5) and moves the spool to the left . It then passes through port "c" and flows to the torque converter circuit.




U41901023

# PILOT OIL FILTER




419F053

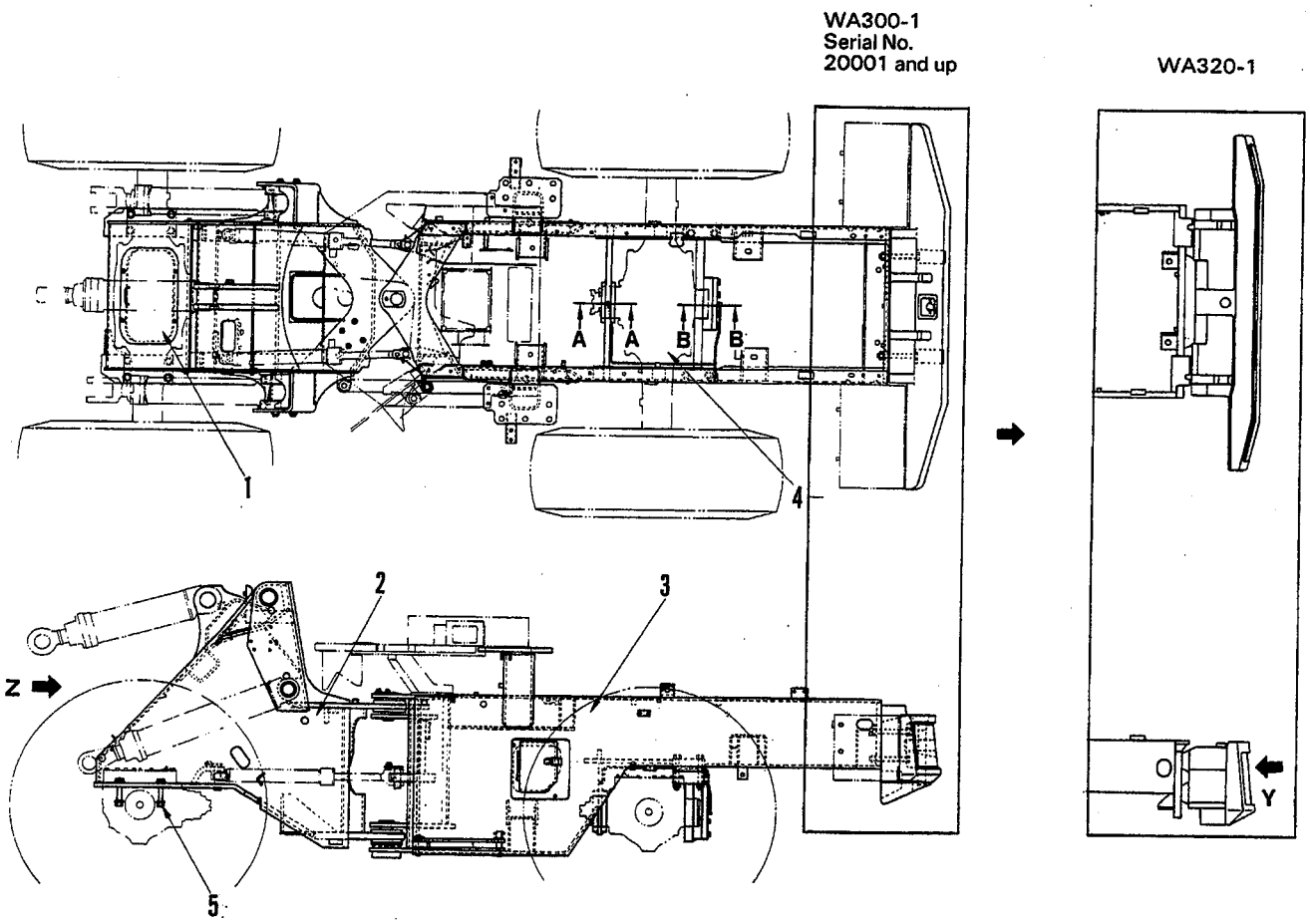
1. Head
2. Element
3. Case
a. Oil suction port
b. Oil delivery port

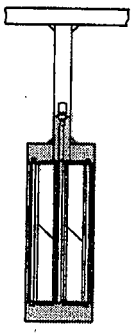
**Specifications**
- Particle size: 105 microns (150 mesh)
- Filtering area: 370 $cm^2$

**FUNCTION**
- The pilot oil filter is installed between the upper valve and lower valve of the transmission control valve. It removes dirt from the oil flowing to the pilot circuit.

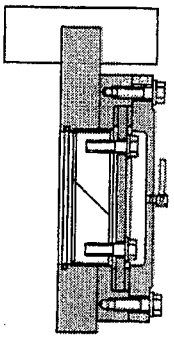
# AXLE MOUNT

## (WA300-1 Serial No. 20001 and up, WA320-1)



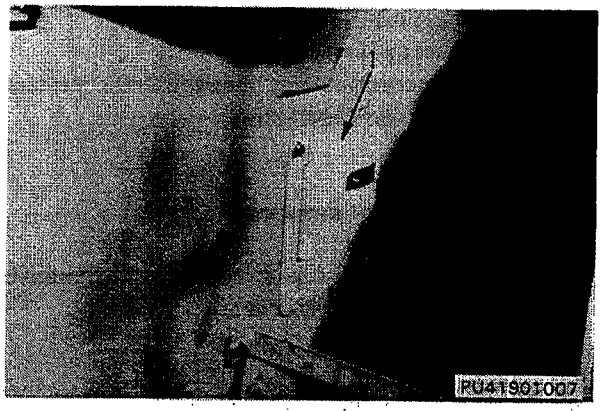
SectionA-A



Section B-B

U41901056A

# MEASURING OIL PRESSURE OF TORQUE CONVERTER AND TRANSMISSION (WA300-1 Serial No. 20001 and up, WA320-1)




★ Measurement conditions
- Engine water temperature:
  Within green range on engine water temperature gauge
- Torque converter oil temperature: 60 – 80°C

⚠ Apply the parking brake and block the wheels.

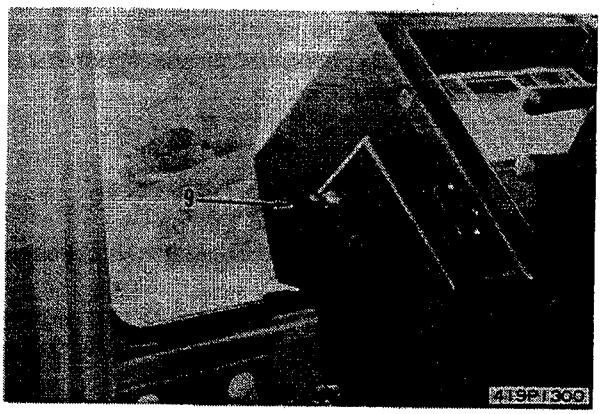
**Preparatory work**

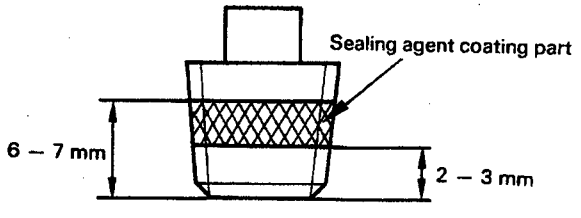
★ The following operations are necessary preparatory work for all measurements of the hydraulic system.
- Open left inspection cover (1) of the rear frame.
- Turn transmission cut-off selector switch (9) to the OFF position, and use the left brake.
  (Check that the pilot lamp has gone out.)
- Remove the plug from the measuring port of the transmission valve.
- Install hydraulic test kit (1) to the measurement port, pull the cage into the operator's compartment, then start the engine and measure the pressure.

★ Check that there is no leakage of oil from any joints.

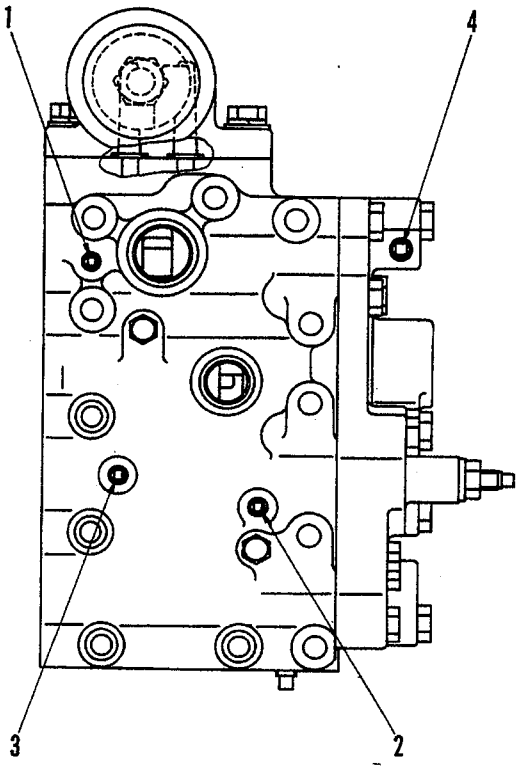
★ After removing the measurement plug, always coat the plug with adhesive.

Plug: **Sealing agent (LG-I)**




416F251




U41901037

# PREVENTING RECURRENCE OF TROUBLE

- The troubleshooting table is used to establish the direct cause of damage or breakdown of a part or piece of equipment. It is not able to establish the root cause of the damage or failure, however.
- Also, this table only describes the action to be taken with the particular part or piece of equipment. It does not mention what action should be taken to prevent a recurrence of the root cause.
- In order to remove the root cause of a fault so as to prevent a recurrence, carefully investigate the real cause while referring to the following items.
- Regarding the method of checking and adjusting each part or piece of equipment, refer to "Testing and adjusting" in the Shop Manual.

## HYDRAULIC EQUIPMENT

**1. Oil checks**

- The fundamental cause of almost all faults occurring in hydraulic equipment is the inclusion of water, air or other foreign matter in the oil. Accordingly, it is necessary to check the oil to see whether or not it contains any of the above substances, and then take appropriate action.

1) Oil checks
- Check for water ingress
  Check the oil for possible water ingress by means of a diesel engine oil checker or a hot plate.
- Check for ingress of other foreign matter
  Remove the drain plug and filter, then check the bottom of the tank and also the filter to see if any foreign matter has collected there. Check the degree of contamination by means of a contamination checker.
- Viscosity check
  Check the viscosity of the oil using a viscometer in order to confirm whether or not the oil is satisfactory.

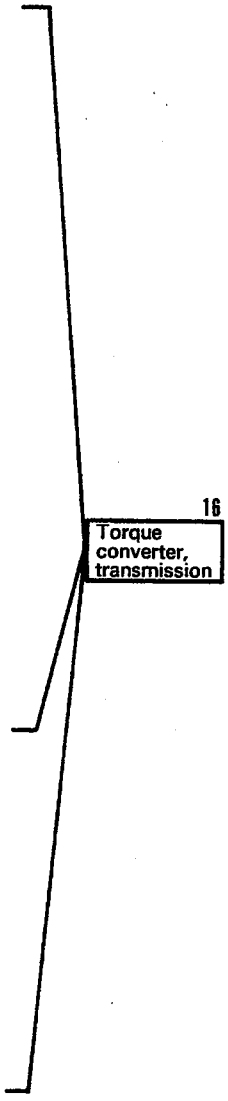
2) Check of ingress point
If, as a result of the above checks, it is discovered that the oil is contaminated by water or other foreign matter, it is necessary to find out where the contamination is occurring and also the take steps to prevent it.

| | |
|---|---|
| Water: | Oil storage tank, breather, etc. |
| Sand: | Oil replenishing or replacing method, etc. |
| Rubber: | Cylinder packing, etc. |
| Metal: | Wear or damage to hydraulic equipment such as pump and motor, as well as transmission and torque converter, etc. |

3) Oil cleaning and replacement
- If a large amount of metal particles or other foreign matter is discovered in the oil, either wash the oil using an oil refresher or replace it.
  ★ If the oil is contaminated by water, it is not possible to remove the water by means of an oil refresher.
  ★ When washing the oil, also wash or replace the strainer and replace the filter.

**2. Cleaning fragments of damaged parts**

- If a part becomes damaged, fragments may pass into the oil line. It is thus necessary to wash the oil.
- In addition, disassemble and wash such parts as valves and cylinders which are liable to collect metal fragments and other foreign matter, thus helping to prevent a recurrence of faults due to such fragments becoming lodged in various parts of the engine or hydraulic equipment.



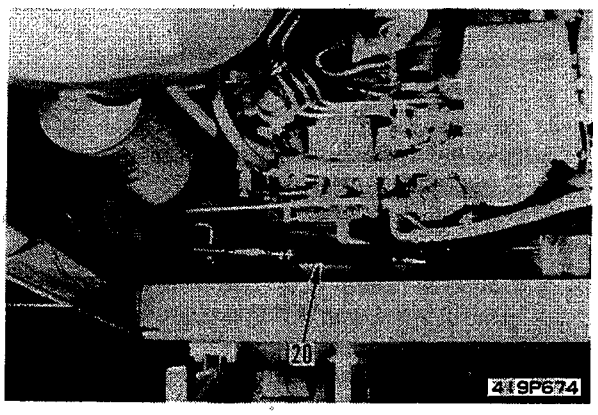

419F205

**9. Fuel control cable**

Set fuel control cable (20) in mounting position, then secure with lock nut.

★ Install the clamp at the bottom of the hydraulic tank.

★ For details of adjusting the fuel control cable, see 12 TESTING AND ADJUSTING.




**10. Steering linkage**

Connect steering linkage (19) to center lever.

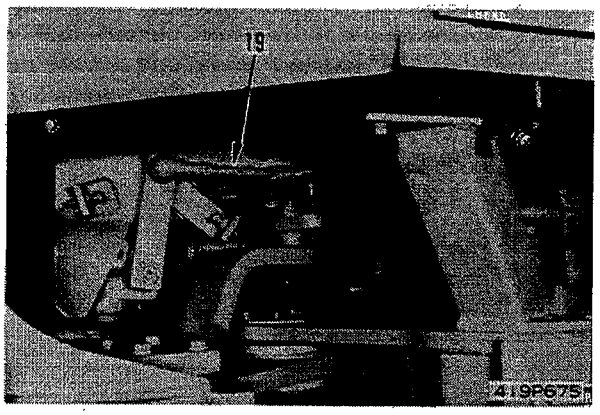
kgm Mounting nut: **12.5±1.0 kgm**

**11. Main control valve linkage, brake hose**

1) Connect hose (18) between brake oil tank and brake booster at brake oil tank end.

2) Connect main control valve linkage (17) to main control valve.

★ Connect the washer liquid hose to the tank.

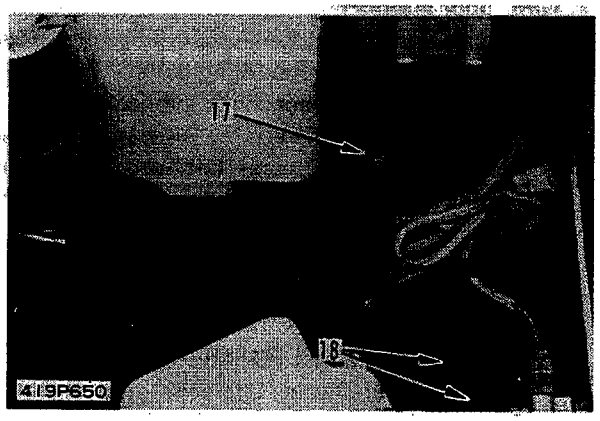


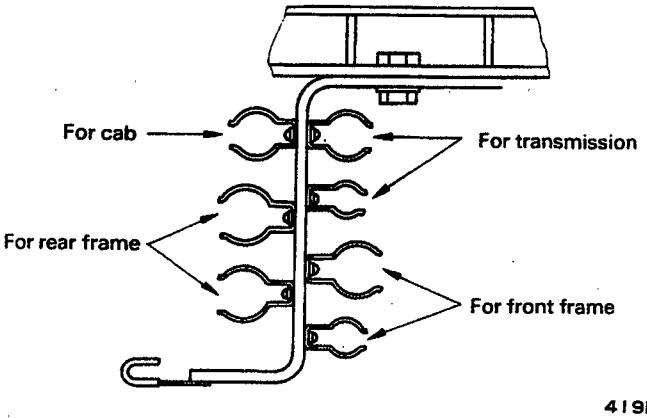

**12. Electric wiring**

Connect the following wiring to the connector.

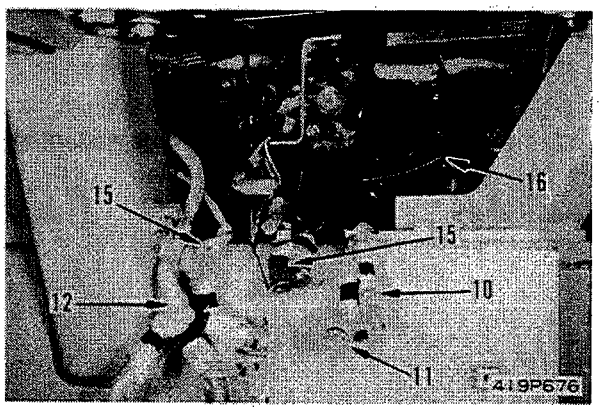
- Ground connection (16).
- Wire (15) for cab.
- Wire (14) for transmission.
- Wire (12) for rear frame.
- Wires (10) and (11) for front frame.

★ Apply the connector lock securely.




419F403



**Special tools**

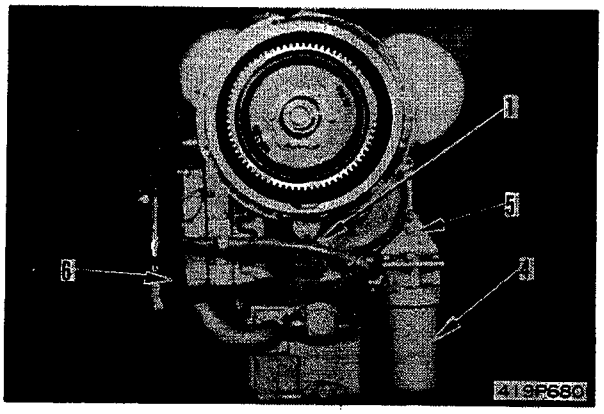
| | Part number | Part name | Q'ty |
|---|---|---|---|
| A | 793-305-1600 | Lifting tool | 2 |
| B | 793-310-2100 | Lifting tool | 1 |
| C | 793-520-2900 | Lifting tool | 1 |

**1. Hydraulic piping**

Disconnect the following hydraulic piping.

- Tube between transmission control valve and torque converter regulator valve.
- Hose (1) between filter and transmission valve.
- Tube (2) between pump and filter.
- Hose (3) between transmission and brake booster.

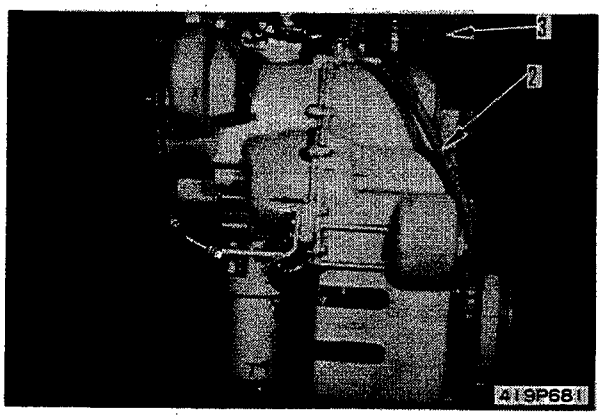
★ After removing the tubes, fit covers to protect the threads.




**2. Filter**

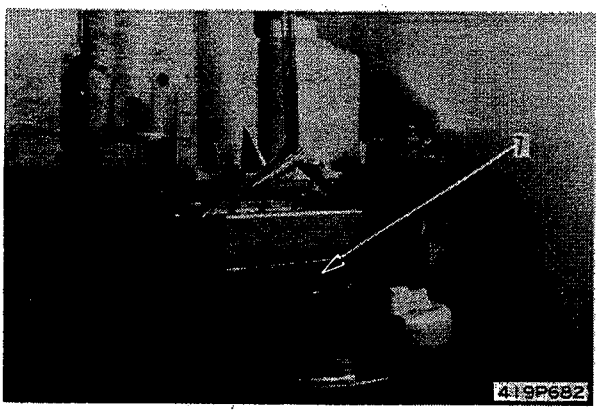
1) Remove filter (4), then remove bracket (5).
2) Remove oil filler (6).

★ Remove the rear coupling.

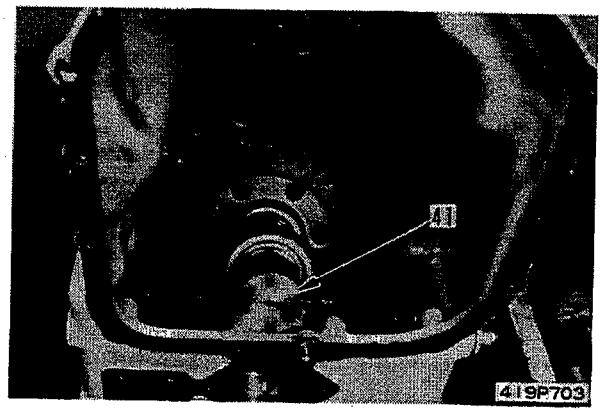



**3. Transmission control valve**

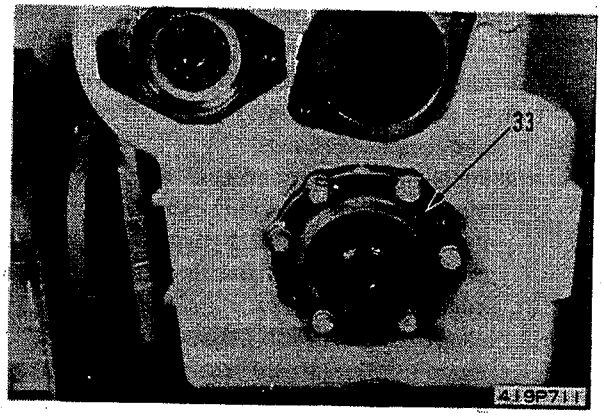
Remove transmission control valve (7).



3) Assemble shaft (41) in housing.
★ Insert the shaft at an angle as shown in the photograph.

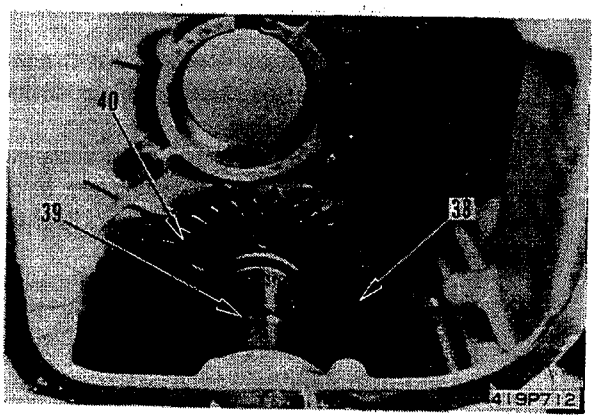


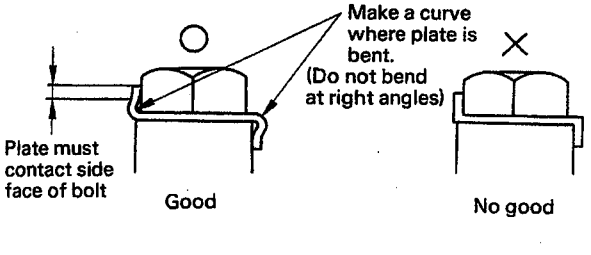

4) Partially tighten mounting bolts of shaft retainer (33).

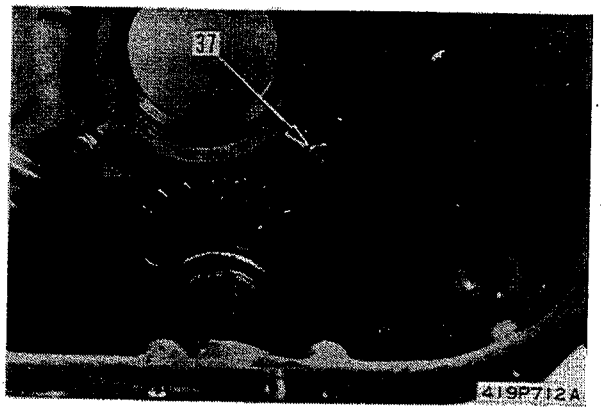



5) Inseet gear (40) in shaft spline, then set shroud (38) in mounting position.
6) Secure with ring (39).
7) Fit lock plate (37) and install shroud.
★ Bend the lock plate securely.
★ Check that the gear does not contact the shroud.

kgm Mounting bolt: **11.5±1 kgm**

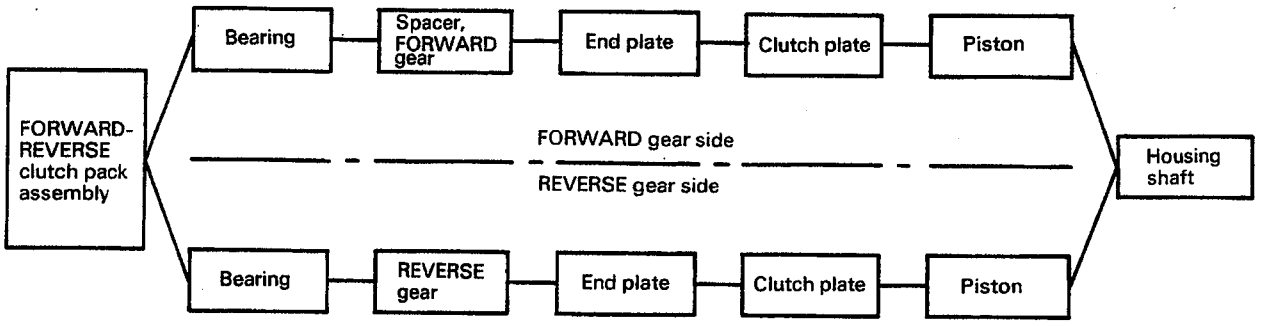


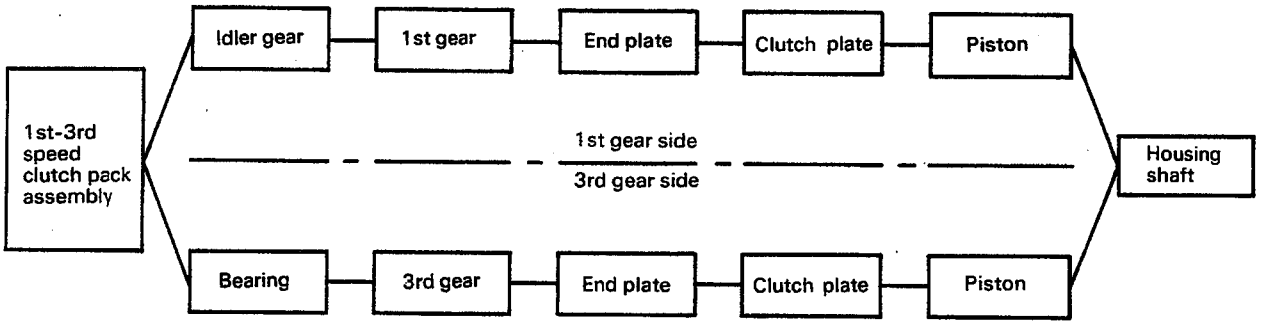



# DISASSEMBLY OF CLUTCH PACK

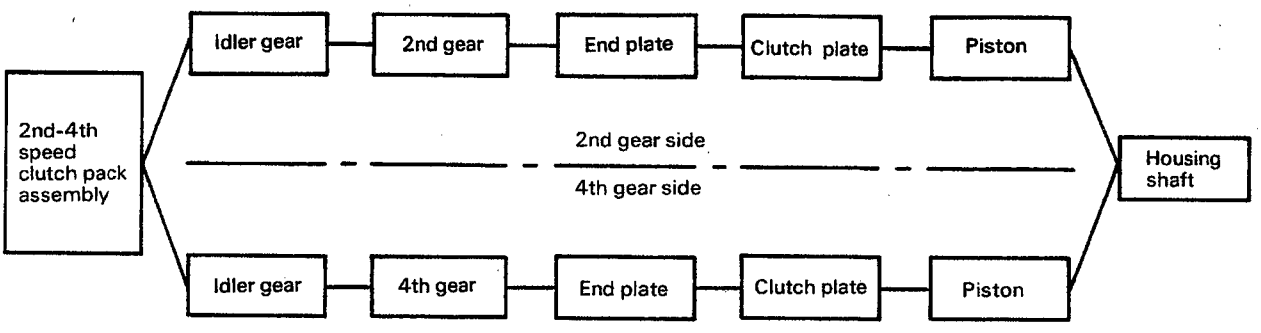
## DISASSEMLBY OF FORWARD-REVERSE CLUTCH PACK




## DISASSEMBLY OF 1ST-3RD SPEED CLUTCH PACK



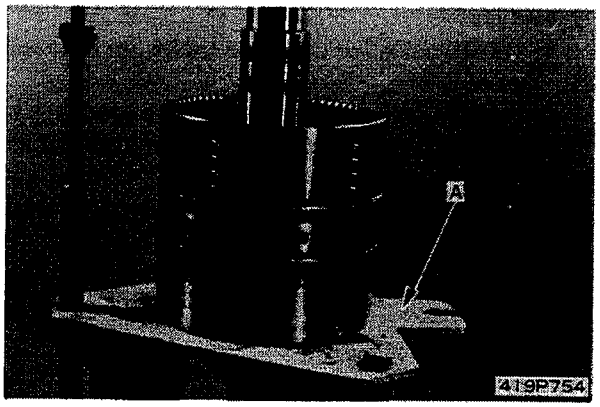

## DISASSEMBLY OF 2ND-4TH SPEED CLUTCH PACK




419F209

**Special tools**

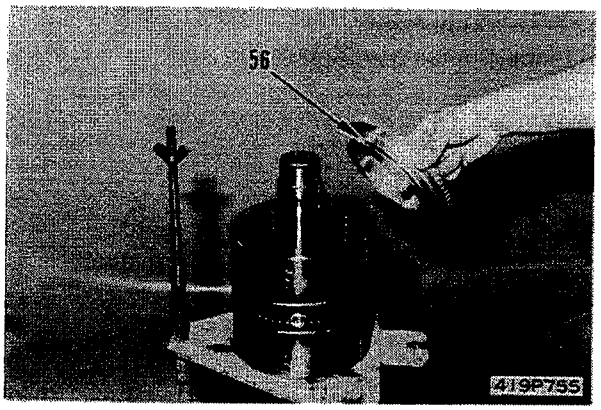
| | Part number | Part name | Q'ty |
|---|---|---|---|
| A | 793-310-1300 | Stand | 1 |
| $A_1$ | 793-310-1370 | Guide pin | 5 |
| $A_2$ | 793-310-1330 | Plate | 1 |
| $A_3$ | 01541-1260 | Nut | 2 |
| $A_4$ | 793-310-1360 | Bar | 2 |




## ASSEMBLY OF FORWARD-REVERSE CLUTCH PACK ASSEMBLY

⚠ When setting the clutch pack on the stand, wipe off all oil to prevent the pack from slipping, and be careful not to get your fingers caught between the stand and the clutch pack.

★ Set the shaft and housing on stand **A** with the REVERSE side at the top.



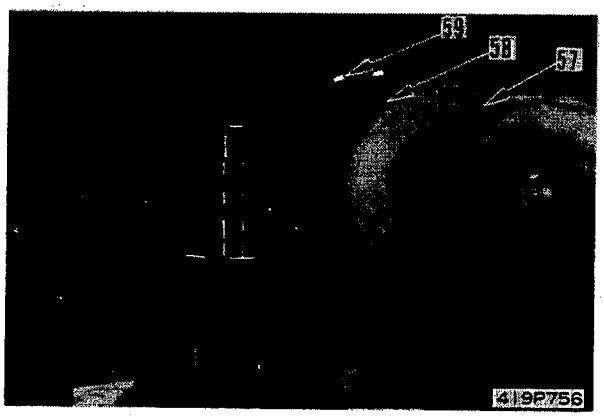

**1. REVERSE piston**

Install REVERSE piston (56).

★ Be careful not to damage the piston seal.

★ Check that the spring pin is not protruding from the circumference of the shaft.

Sliding surface of piston seal: **Transmission oil**




**2. Clutch plate**

Insert tool $A_1$ in housing, then assemble plate (57), disc (58) and spring (59) in turn.

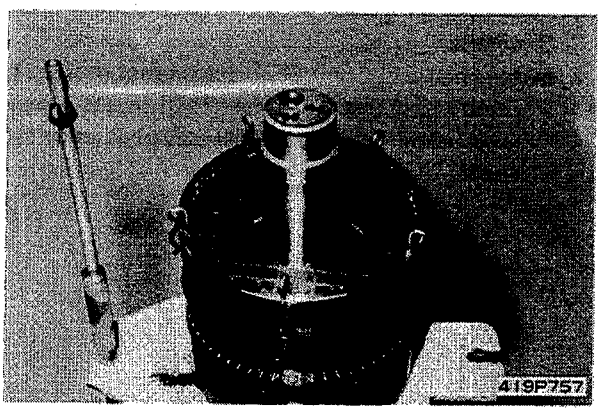
★ Soak plate (57) in clean transmission oil for at least two minutes before assembling.

**(WA300-1 Serial No. 10001 – 19999)**

★ Assemble spring (59) in sets of two springs.

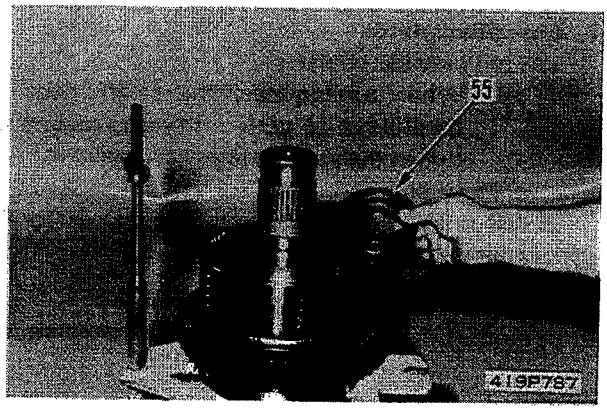
★ Be careful not to let spring (59) and plate (57) catch on each other.

★ Do not let the plate or spring catch in the ring groove of the clutch housing when assembling.



**4. Thrust bearing**

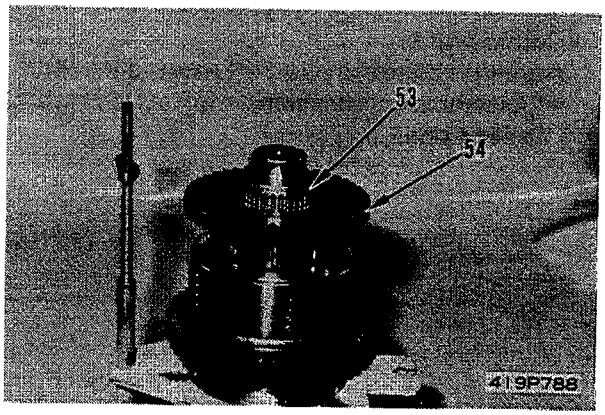
Install thrust bearing (55).




**5. 2nd speed gear**

Install 2nd gear (54), then assemble needle bearing (53).

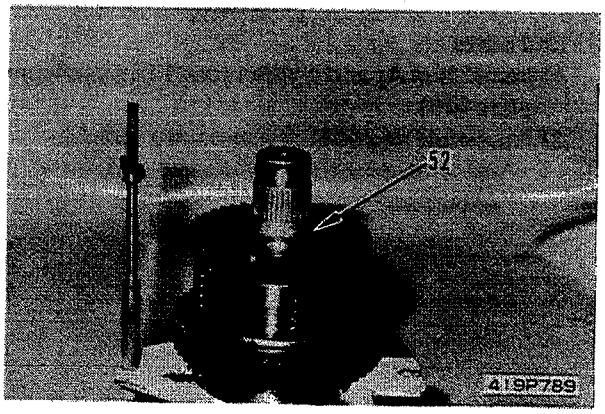
★ If the spline of the gear cannot be aligned, rotate the gear lightly. Never try to force the gear into position.




**6. Bearing**

Install thrust bearing (52).

★ Check that the end face of the thrust bearing is level with or below the stepped part of the shaft.

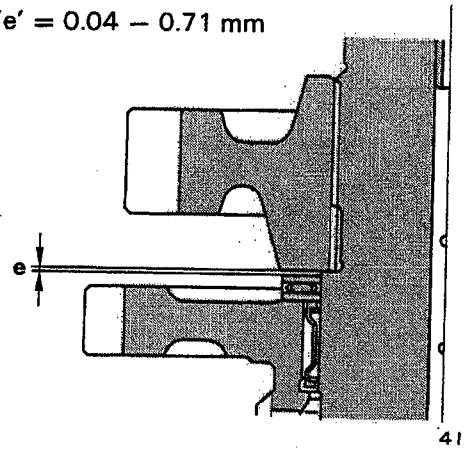


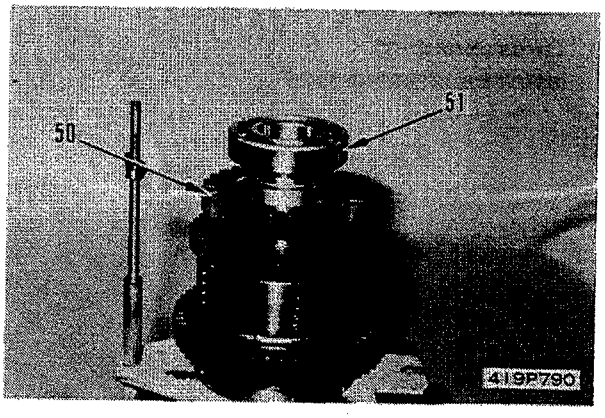

**7. Bearing**

Assemble idler gear (50), then press fit bearing (51).

★ After press fitting the bearing, check that clearance 'e' between the thrust bearing and the idler gear is within the standard range.

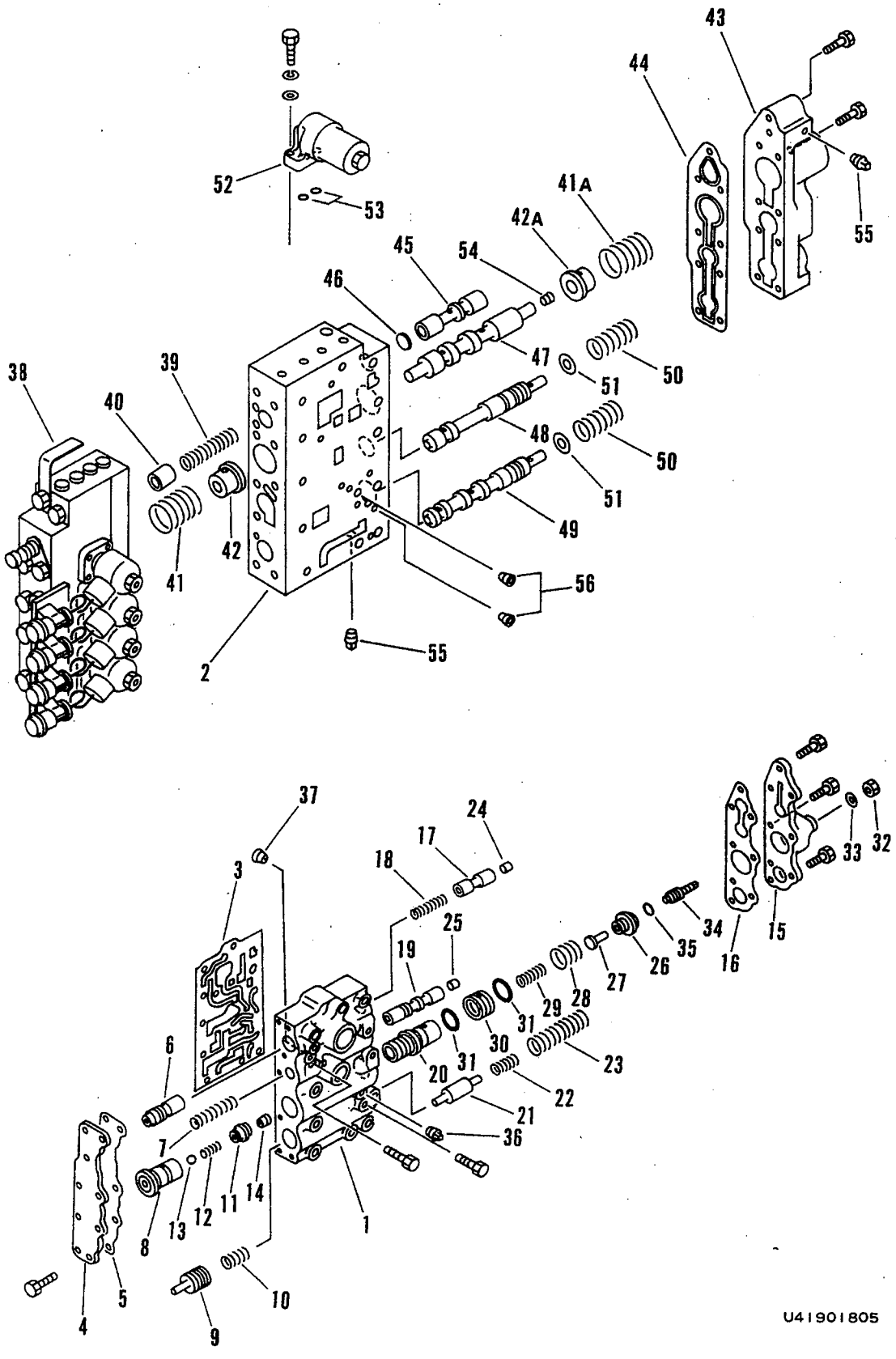
'e' = 0.04 – 0.71 mm



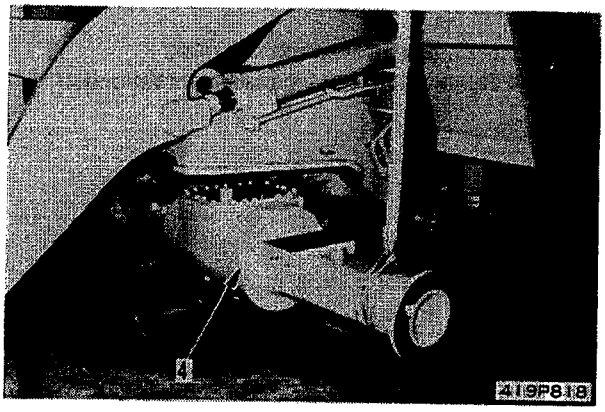
# DISASSEMBLY OF TRANSMISSION CONTROL VALVE

**(WA300-1 Serial No. 20001 and up, WA320-1)**

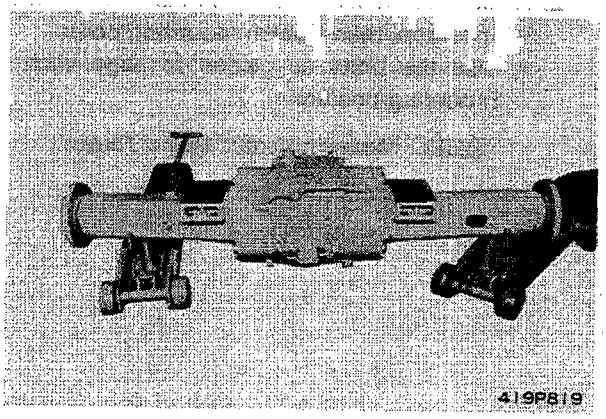


**5. Axle**

1) Using jack and hoist, sling axle (4), then remove mounting bolts and lower axle.
   ★ Use the jack to adjust the height when removing the mounting bolts.
   kg Axle: **690 kg**

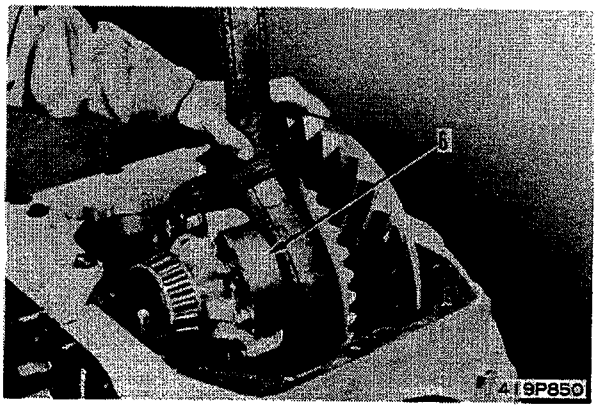



2) Pull out axle assembly from machine.

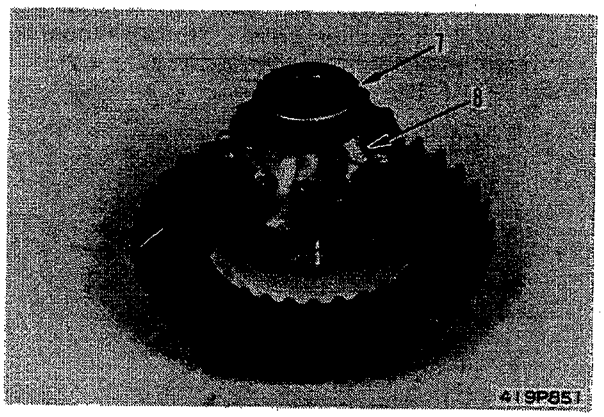


**5. Differential carrier**

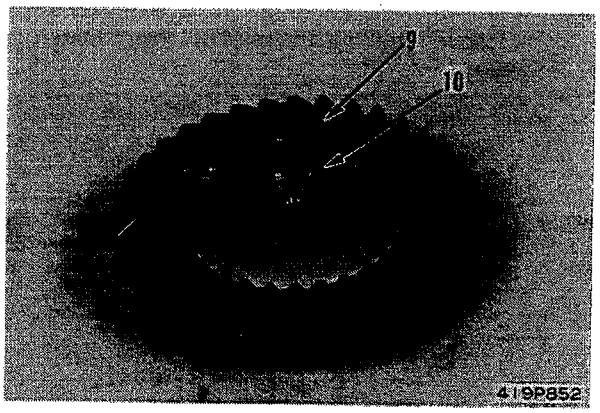
1) Lift off differential carrier (6) from housing.
   ★ Be careful not to let the lifting tool slip out of place when removing.
   kg Differential carrier: **85 kg**



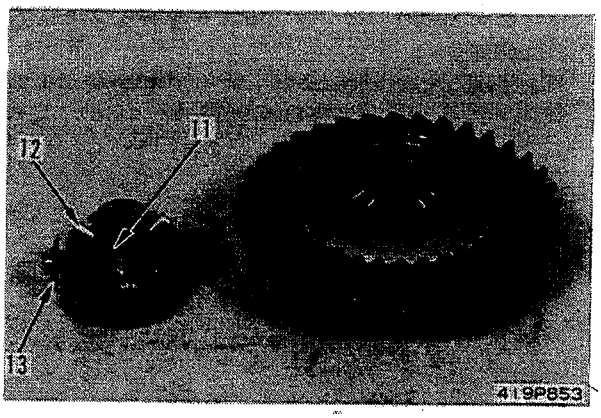

2) Remove bearing cone (7) from differential carrier, remove mounting bolts, then remove differential case (8).




3) Remove thrust washer (9), then remove side gear (10).

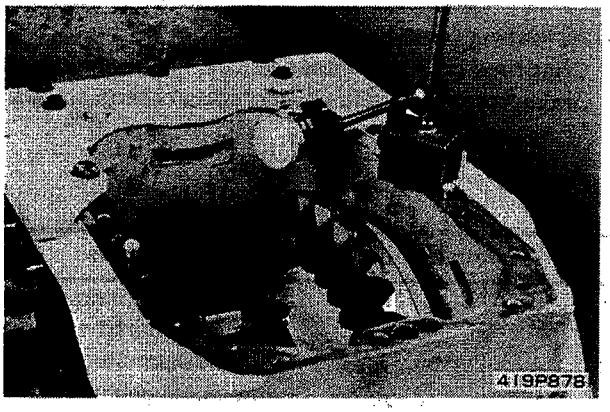



4) Remove cross shaft (11), pinion gear (12) and washer (13).

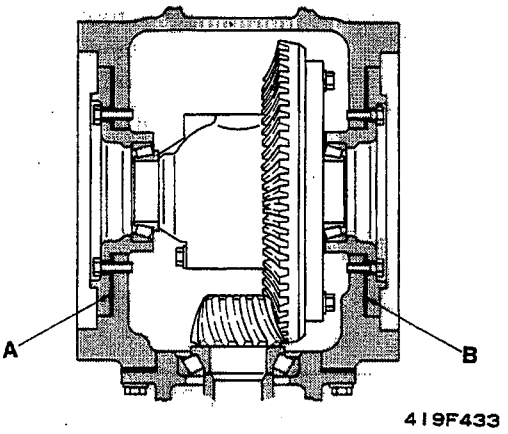


**8. Adjusting backlash**

1) Measure backlash of bevel gear with dial gauge.
   - ★ Measure first with all the shims installed on the bevel gear side.
   - ★ Measure the backlash at three places around the circumference of the bevel gear. The variation between measurements must be within 0.1 mm.
     Backlash of bevel gear: 0.3 – 0.41 mm

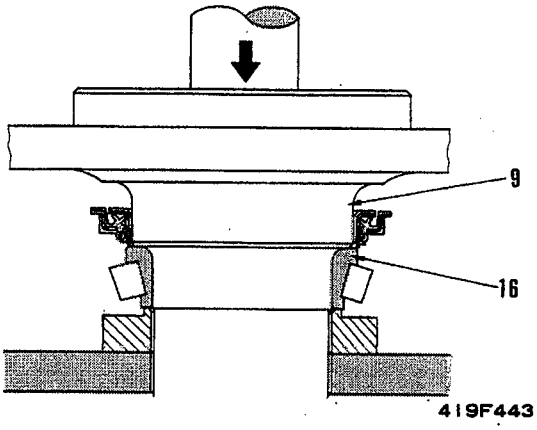



2) To make backlash within specified range, move some of shims from bevel gear side to opposite side.
   - ★ When moving the shims, do not change the total shim thickness.
   - ★ If the backlash is too large, move shims from **B** to **A**.
   - ★ If the backlash is too small, move shims from **A** to **B**.



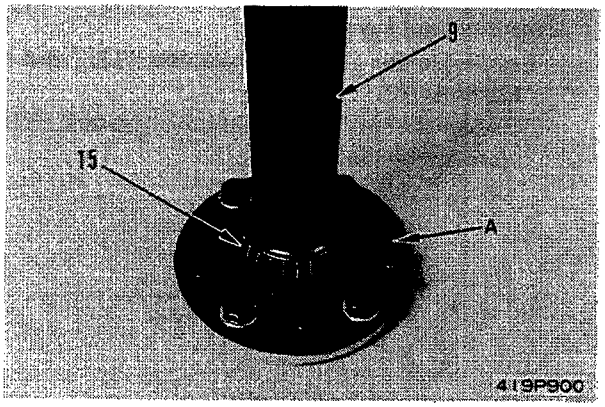
3) Set bearing (16) on press stand, and press fit axle shaft (9).
   ★ Be careful not to let the bearing slip out of position.

   Press-fitting portion of bearing: **Axle oil**



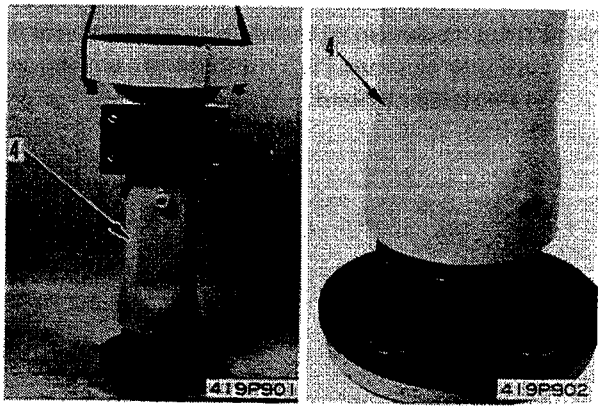

**5. Housing**

1) Stand shaft (9) on end, and install tool **A**.
   ★ Adjust the height with the adjustment bolt so that the top of tool **A** touches seal (15) lightly with a uniform clearance.
   ★ Secure tool **A** firmly so that it does not slip out of position.

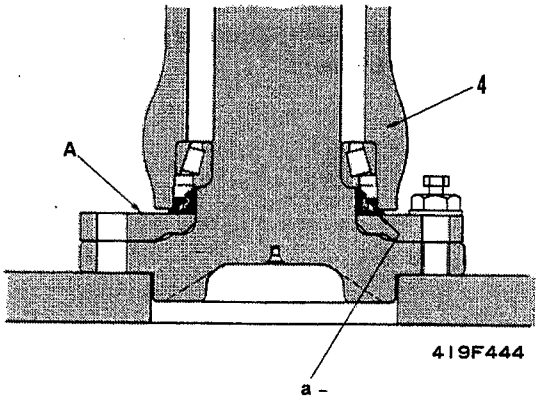



2) Raise housing (4) horizontally and insert carefully on shaft.
   ★ Stop housing (4) before press fitting the oil seal.

   Press-fitting portion of oil seal: **Axle oil**



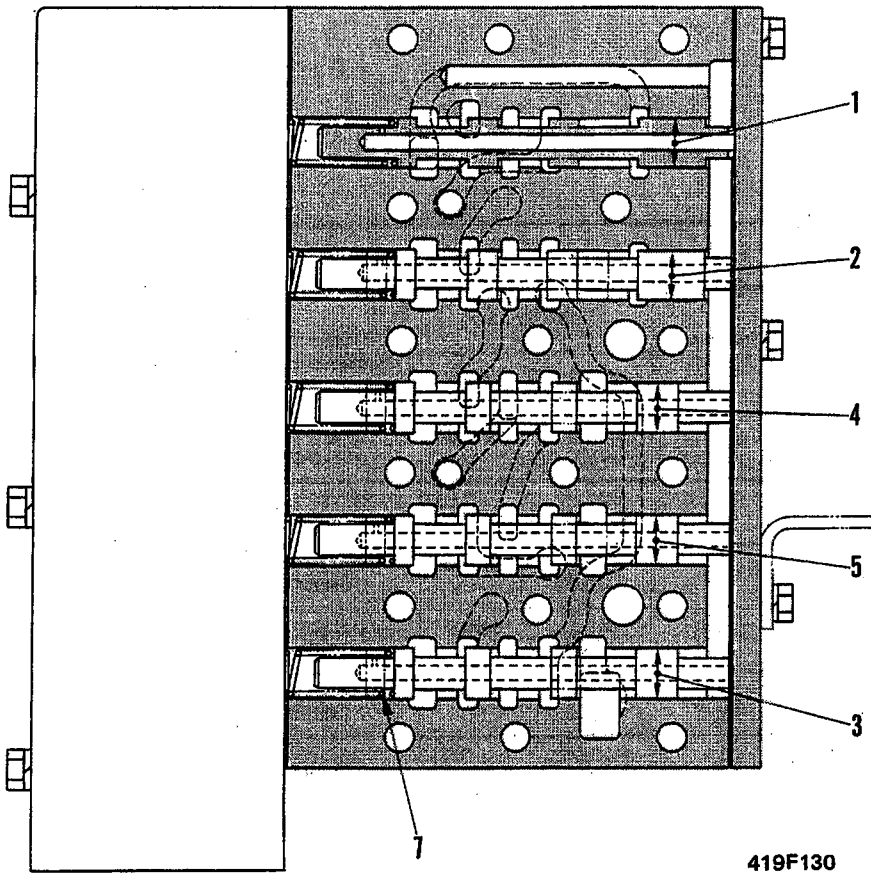

3) Align housing (4) with press-fitting portion of oil seal and lower housing slowly.
   ★ Use the weight of the housing to insert it.
   ★ After installing the housing, seal surfaces (a) and (A) must be level. In addition, if there is any clearance at 'a', the clearance must be uniform.
4) Remove tool **A**.



Unit: mm

| No. | Check item | Criteria | | | | Remedy |
|---|---|---|---|---|---|---|
| | | Standard size | Tolerance | | Standard clearance | |
| | | | Shaft | Hole | | |
| 1 | Clearance between idle shaft and bearing | 60 | 0<br>−0.012 | 0<br>−0.015 | −0.015 –<br>0.012 | Replace |
| 2 | Clearance between idle gear and bearing | 110 | 0<br>−0.015 | −0.020<br>−0.042 | −0.042 –<br>−0.005 | |
| 3 | Clearance between pump drive shaft and bearing | 45 | +0.013<br>+0.002 | 0<br>−0.012 | −0.025 –<br>−0.002 | |
| 4 | Clearance between pump drive gear bearing and housing | 85 | 0<br>−0.015 | +0.022<br>−0.013 | −0.013 –<br>0.037 | |
| 5 | Clearance between pump drive shaft and bearing | 45 | +0.013<br>+0.002 | 0<br>−0.012 | −0.025 –<br>−0.002 | |
| 6 | Clearance between pump drive gear bearing and housing | 100 | 0<br>−0.015 | +0.022<br>−0.013 | −0.013 –<br>0.037 | |
| 7 | Clearance between output shaft oil seal and housing | 100 | +0.400<br>+0.200 | +0.054<br>0 | −0.400 –<br>−0.146 | |
| 8 | Clearance between output shaft oil seal and housing | 100 | +0.400<br>+0.200 | +0.054<br>0 | −0.400 –<br>−0.146 | |
| 9 | Clearance between output shaft bearing and housing | 110 | 0<br>−0.015 | −0.015<br>−0.040 | −0.04 –<br>0 | |
| 10 | Clearance between output shaft and bearing | 60 | +0.035<br>+0.015 | 0<br>−0.015 | −0.05 –<br>−0.015 | |
| 11 | Clearance between output shaft bearing and housing | 110 | 0<br>−0.015 | −0.015<br>−0.040 | −0.04 –<br>0 | |
| 12 | Clearance between output shaft and bearing | 60 | +0.035<br>+0.015 | 0<br>−0.015 | −0.05 –<br>−0.015 | |
| 13 | Clearance between Forward-Reverse clutch bearing and housing (R) | 90 | 0<br>−0.015 | +0.022<br>−0.013 | −0.013 –<br>0.037 | |
| 14 | Clearance between Forward-Reverse clutch bearing and housing (F) | 90 | 0<br>−0.015 | +0.022<br>−0.013 | −0.013 –<br>0.037 | |
| 15 | Clearance between 1st·3rd clutch bearing and housing (R) | 100 | 0<br>−0.015 | +0.022<br>−0.013 | −0.013 –<br>0.037 | |
| 16 | Clearance between 1st·3rd clutch bearing and housing (F) | 100 | 0<br>−0.015 | +0.022<br>−0.013 | −0.013 –<br>0.037 | |
| 17 | Clearance between 2nd·4th clutch bearing and housing (R) | 90 | 0<br>−0.015 | +0.022<br>−0.013 | −0.013 –<br>0.037 | |
| 18 | Clearance between 2nd·4th clutch bearing and housing (F) | 130 | 0<br>−0.018 | +0.026<br>−0.014 | −0.014 –<br>0.044 | |

## LOWER VALVE (WA300-1 Serial No. 10001 – 19999)

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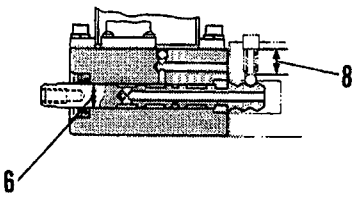


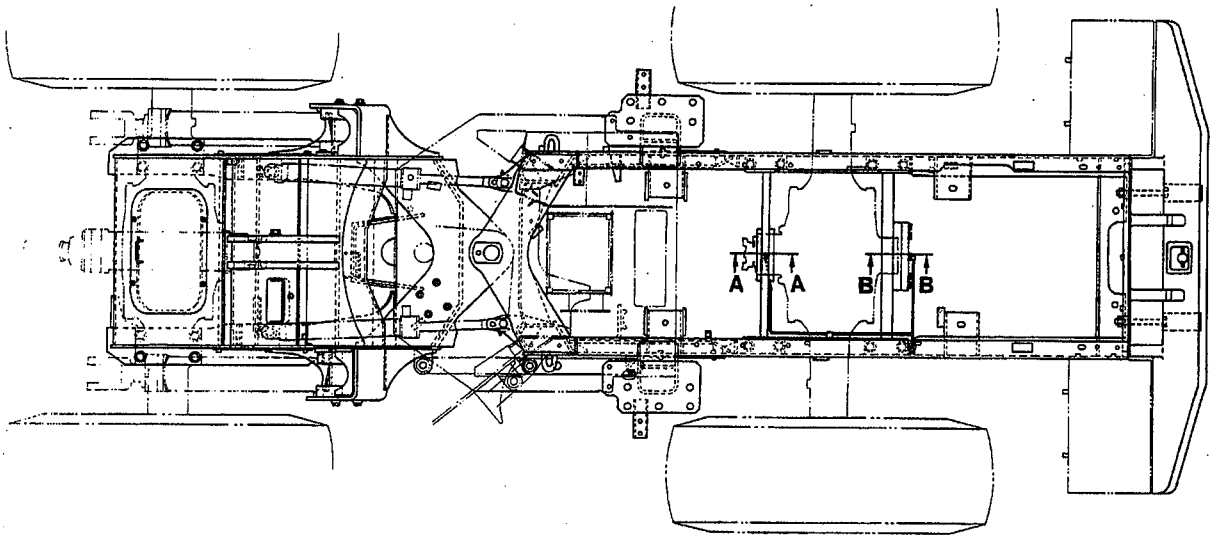

Section A-A
(See page 24-15-1)

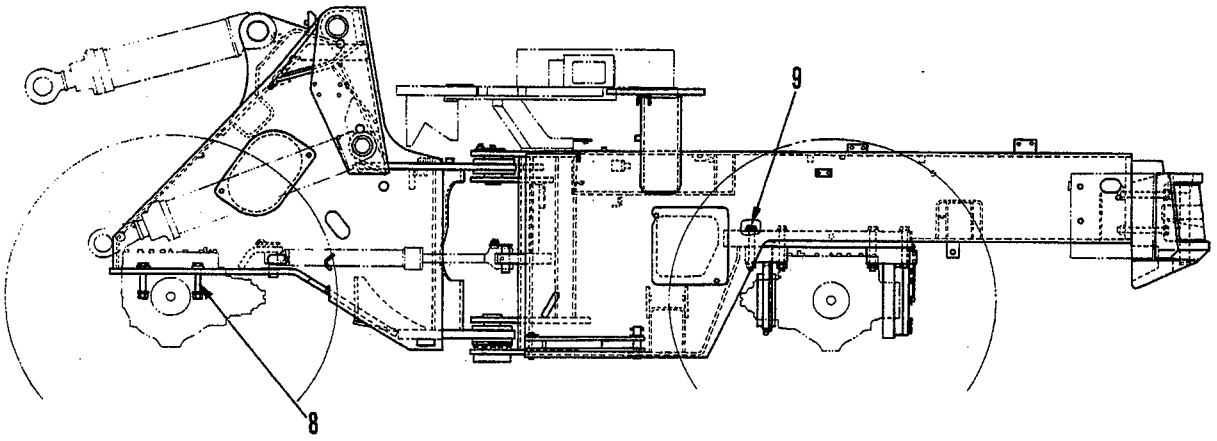
E419F131

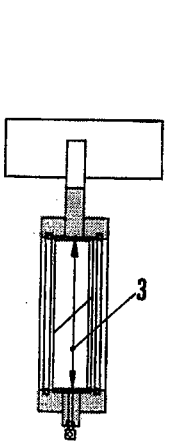
Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| | | Standard size | Tolerance | | Standard clearance | Clearance limit | |
| | | | Shaft | Hole | | | |
| 1 | Clearance between forward spool and body | 19 | −0.024<br>−0.032 | +0.013<br>+0.004 | 0.028 –<br>0.045 | 0.050 | Replace |
| 2 | Clearance between reverse spool and body | 19 | −0.024<br>−0.032 | +0.013<br>+0.004 | 0.028 –<br>0.045 | 0.050 | |
| 3 | Clearance between 1st-2nd speed spool and body | 19 | −0.024<br>−0.032 | +0.013<br>+0.004 | 0.028 –<br>0.045 | 0.050 | |
| 4 | Clearance between 3rd speed spool and body | 19 | −0.024<br>−0.032 | +0.013<br>+0.004 | 0.028 –<br>0.045 | 0.050 | |
| 5 | Clearance between 4th speed spool and body | 19 | −0.024<br>−0.032 | +0.013<br>+0.004 | 0.028 –<br>0.045 | 0.050 | |
| 6 | Clearance between emergency manual valve spool and body | 19 | −0.024<br>−0.032 | +0.013<br>+0.004 | 0.028 –<br>0.045 | 0.050 | |
| 7 | Forward-Reverse and 1st, 2nd, 3rd, 4th spool spring | Standard size | | | Repair limit | | |
| | | Free length | Installation length | Installation load (kg) | Free length | Installation load (kg) | |
| | | 51.52 | 28 | 18.3±0.9 | 49.2 | 16.5 | |
| 8 | Emergency manual valve detent spring | 18.42 | 15.32 | 6±0.3 | 18.1 | 5.4 | |

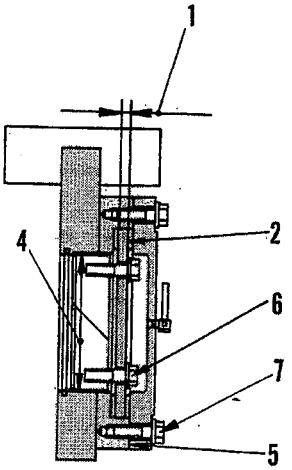
# AXLE MOUNT
## (WA300-1 Serial No. 10001 — 19999)




Section A-A




Section B-B

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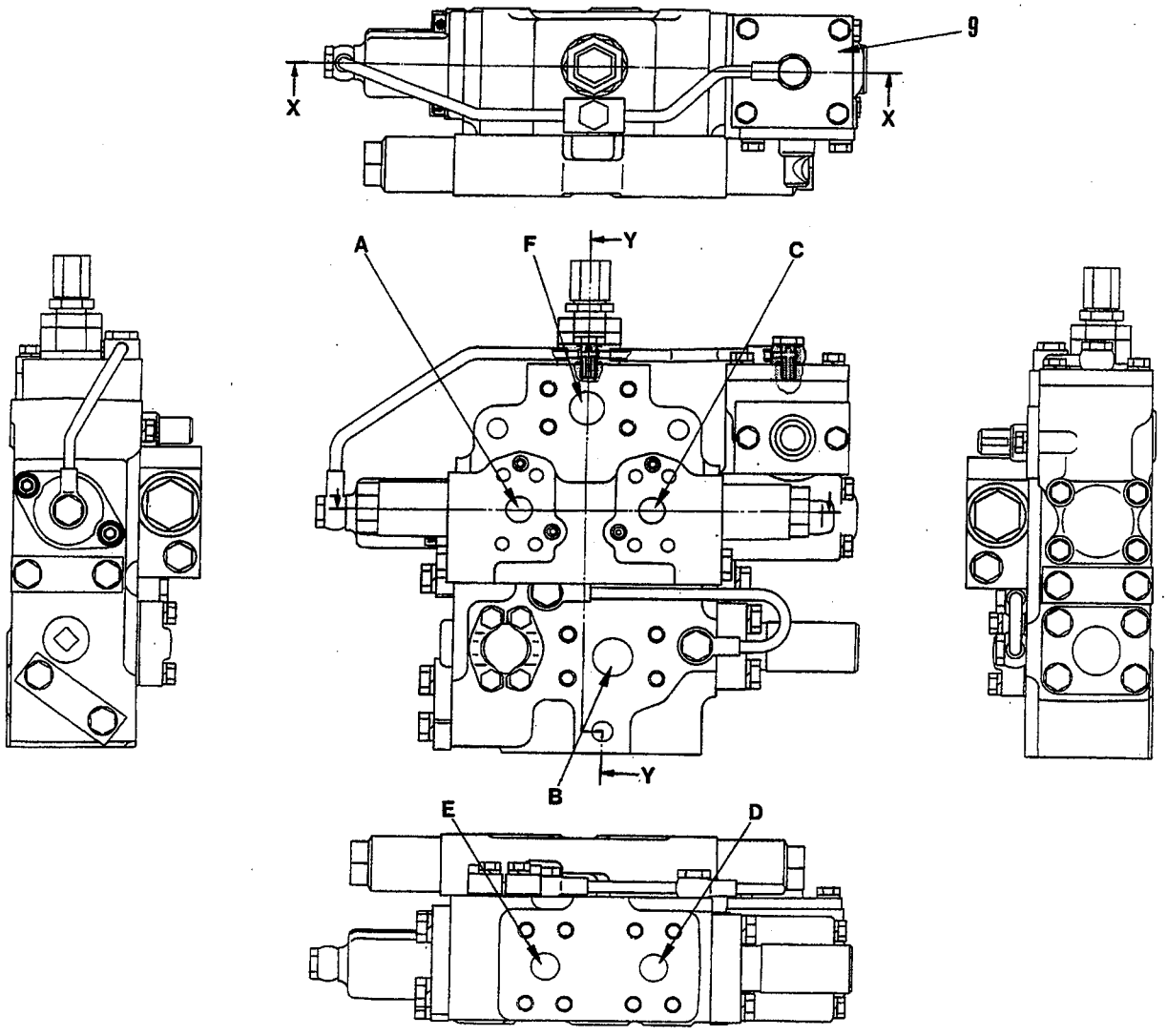
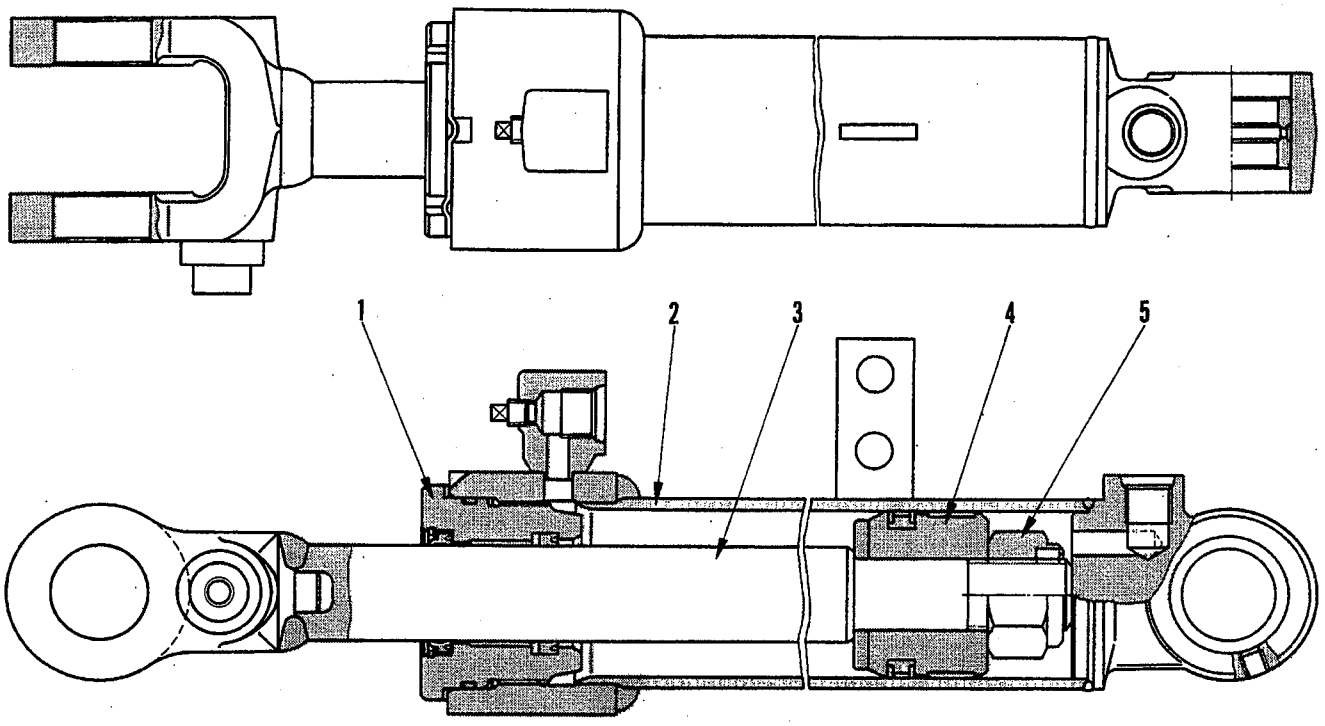
# STEERING VALVE




423F074B

A. To steering cylinder
B. To hydraulic circuit
C. To steering cylinder
D. From hydraulic pump
E. From steering pump
F. To hydraulic tank

# STEERING CYLINDER




419F076

1. Cylinder head
2. Cylinder
3. Piston rod
4. Piston
5. Lock nut

**Specification**

Cylinder bore: 70 mm
Rod diameter: 40 mm
Stroke: 460 mm
Width across flats of lock nut: 46 mm
Cylinder min. length: 818 mm
Cylinder max. length: 1,278 mm

# STANDARD VALUE TABLE

| Testing and measuring item | Measurement condition | Unit | Standard value | Permissible value |
|---|---|---|---|---|
| Steering wheel<br>• Steering wheel play<br>• Steering wheel operating force<br>• Operating time of steering wheel (Low idling)<br>(High idling) | • Road surface: Flat, horizontal, dry, paved surface<br>• Hydraulic temperature: 45 – 55°C<br>• Machine posture: Facing straight | mm<br>kg<br>Sec. | 20 – 70<br>Max. 2.5<br>2.5 – 3.5<br>2.5 – 3.5 | 20 – 100<br>Max. 3.8<br>Max. 5.3<br>Max. 5.3 |
| Steering linkage<br>• Clearance between front frame and rear frame | • Tire inflation pressure: Specified pressure | mm | 20 – 30 | – |
| Steering oil pressure<br>• Main relief oil pressure | • Hydraulic temperature: 45 – 55°C<br>• Engine speed: High idling | kg/cm$^2$ | 210±10 | 210±20 |

# TOOL LIST FOR TESTING AND ADJUSTING

| No. | Testing and measuring item | Tool | Part number | Remark |
|---|---|---|---|---|
| 1 | Steering wheel operating force | Push-pull scale | 7A0-262-0020 | 0 – 25 kg |
| 2 | Steering wheel operating play | Convex scale | Commercially available | 0 – 2 m |
| 3 | Steering wheel operating time | Stop watch | Commercially available | 1/10 second |
| 4 | Clearance between front frame and rear frame | Convex scale | Commercially available | |

⚠ When carrying out testing, adjusting or troubleshooting, stop the machine on level ground, install the safety bar on the frame, lower the bucket to the ground, and stop the engine.
Then apply the parking brake and block the tires.

⚠ When installing or removing gauges, loosen the oil filler cap slowly to release the pressure inside the hydraulic tank. Then operate the control levers several times to release the remaining pressure in the hydraulic piping.

⚠ When taking measurements, do not allow unauthorized persons near the machine.

⚠ The oil in the circuit is hot, so be careful not to get burnt.

### 3. Steering wheel moves unsteadily or is subjected to large shock.

**Checks before troubleshooting**

- Is oil level in hydraulic tank and also oil type satisfactory?
- Is there any damage to the steering gearbox mounting part, steering column or linkage?
- is there any play in the center pin hinge bearing or steering cylinder pin bushing?
- Does tire pressure fluctuate?

**Fault check**

Operate the wheel loader in a safe place and check the conditions under which the steering wheel becomes unsteady.

★ If, in addition to the steering wheel being unsteady, there are other faults such as sluggishness, etc., refer to item 2 "Steering wheel is sluggish".

| No. | Problem \ Remedy / Cause | Safety valve | Faulty steering valve | Incorrect positioning of steering valve changeover spool | Faulty 2-way restricter valve | Internal fault in steering cylinder (inside surface of cylinder, piston seal, nut, bolt) |
|---|---|---|---|---|---|---|
| | | Valve | | | | |
| | | a | b | c | d | |
| | | △A X | △ X | X | △ X | |
| 1 | Machine body is unsteady when traveling on bumpy road surface. | ○ | ○ | | ○ | |
| 2 | Steering wheel becomes unsteady if suddenly turned when working or traveling. | | | ○ | ○ | |
| 3 | Machine body becomes unsteady when traveling at high speed. | ○ | ○ | | ○ | |
| 4 | Machine body becomes unsteady during engine starting. | | ○ | | | |

The following symbols are used to indicate the action to be taken when a cause of failure is located.
X: Replace △: Repair
A: Adjust C: Clean

### 4. Machine tends to turn naturally in one particular direction when traveling.

**Cause:** Faulty steering valve
- Incorrect positioning of spool.
- Faulty safety valve.
- Oil leakage in steering cylinder.
- Does tire pressure fluctuate?

### 5. Left and right turning radii are different.

**Cause:** Incorrectly adjusted steering linkage.
Left and right steering balance, lock position of stopper.
(Valve relief noise can be heard upon completion of turning.)

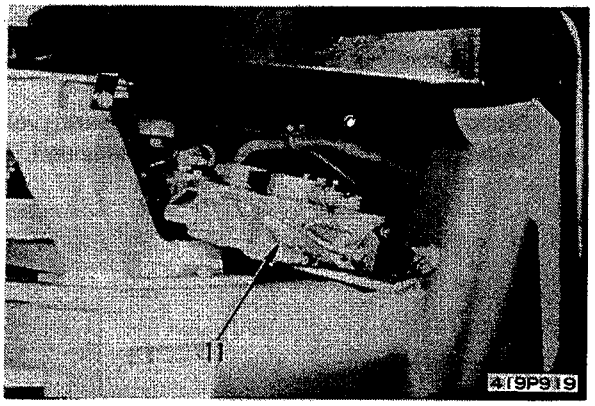
# INSTALLATION OF STEERING VALVE

**1. Steering valve**

Set steering valve (11) in mounting position, then tighten mounting bolts.

★ Tighten the mounting bolts fully after connecting the hydraulic piping.

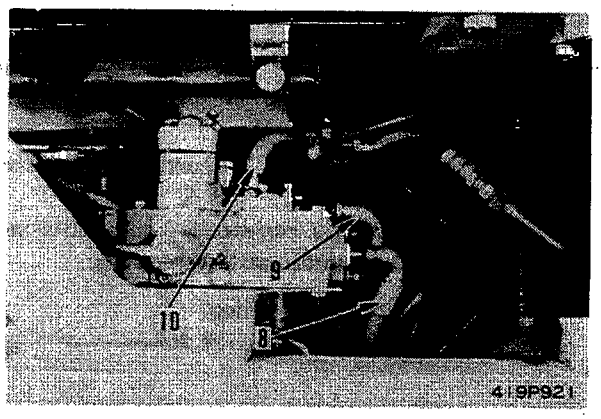
★ Insert the mounting bolts of tube (6) of the steering cylinder before installing.



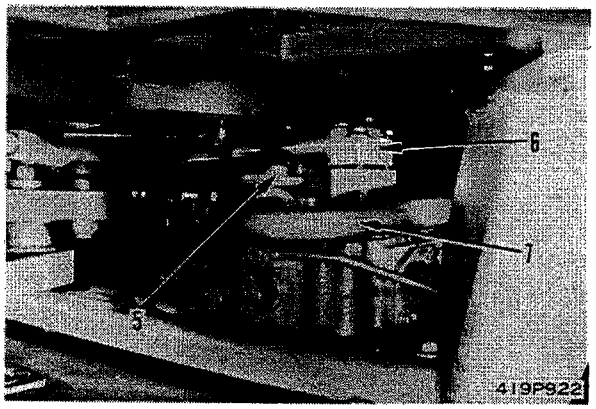

**2. Hydraulic piping**

Connect the following piping

- Connect hose (10) between steering valve and main control valve at steering valve end.
- Connect hoses (8) and (9) between steering and hydraulic pump and steering valve at steering valve end.




- Connect tube (7) between steering valve and hydraulic tank at steering valve end.
  ★ Install the tube clamp.
- connect tubes (5) and (6) between steering valve and steering cylinder at steering valve end.

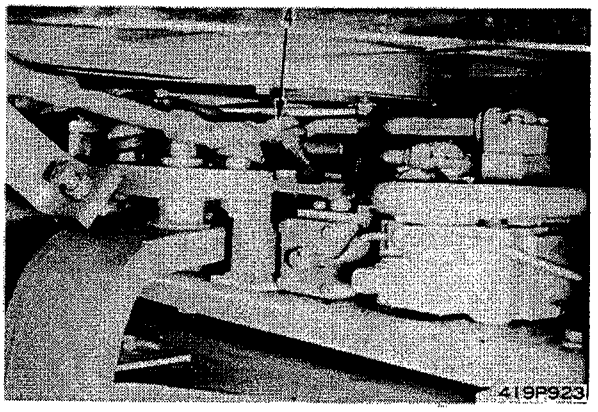



**3. Linkage**

Connect linkage (4) between center lever and steering valve at steering valve end.

★ Check that the steering valve is at NEUTRAL.

kgm Mounting nut: **12.5±1.0 kgm**



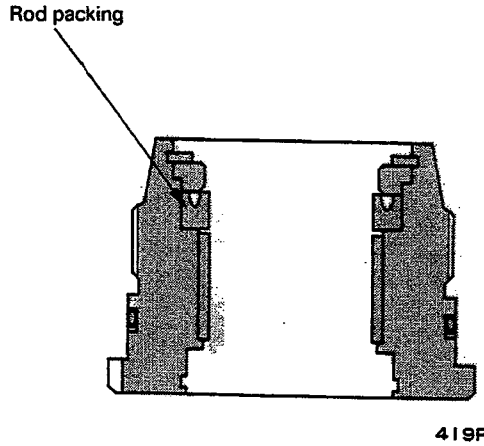
# ASSEMBLY OF STEERING CYLINDER

**Special tools**

| | Part number | Part name | Q'ty |
|---|---|---|---|
| A | 790-502-1001 | Cylinder repair stand | 1 |
| B | 790-100-1200 | Wrench | 1 |
| C | 790-702-1000 | Expander | 1 |
| D | 796-720-1640 | Ring | 1 |

★ Coat the sliding surface of all parts with engine oil. Take care not to damage rod packings, dust seals or assembly (6) on rod, then install nut (5).

1. Assemble cylinder head assembly as follows;
   1) Using a push tool, press fit bushing (19) on cylinder head (20).
      ★ Take particular care not to deform the bushing when press fitting.
   2) Assemble rod packing (18).
      ★ Be careful to install the rod packing facing in the correct direction.



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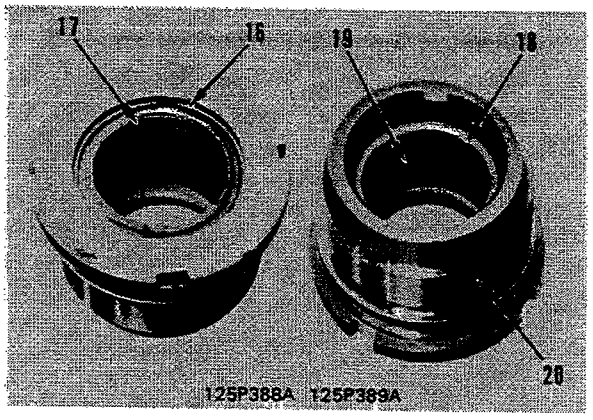
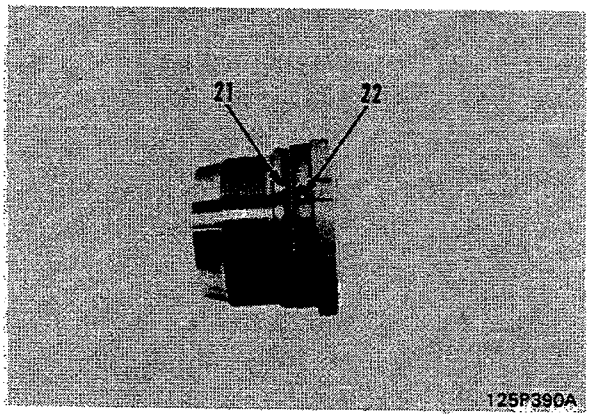
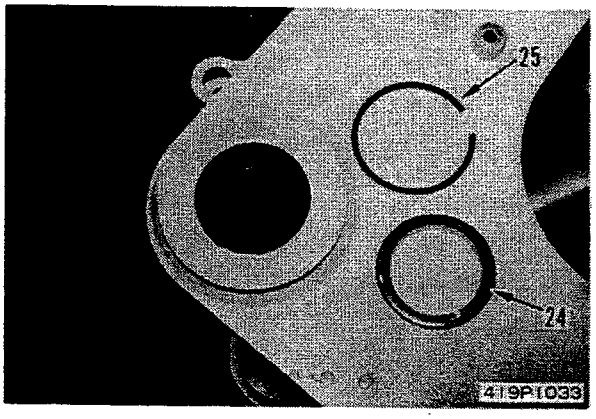



   3) Using a push tool, install dust seal (17) on head (20).
   4) Install snap ring (16).
   5) Install back-up ring (22) and O-ring (21).
      ★ Do not force back-up ring. Heat in hot water (50 – 60°C) before inserting.



# INSTALLATION OF CENTER HINGE PIN
## (WA300-1 Serial No. 10001 – 19999)




**Special tools**

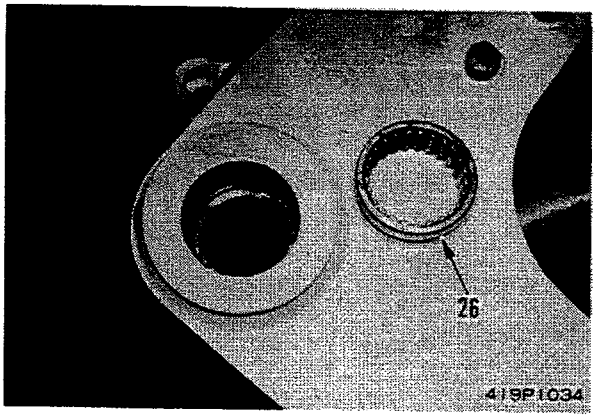
| | Part number | Part name | Q'ty |
|---|---|---|---|
| A | 793-840-1410 | Push tool | 1 |
| B | 793-101-5221 | Glip | 1 |
| C | 793-840-1310 | Push tool | 1 |
| D | 793-840-1430 | Guide | 1 |
| E | 793-840-1420 | Push tool | 1 |

**1. Upper hinge**

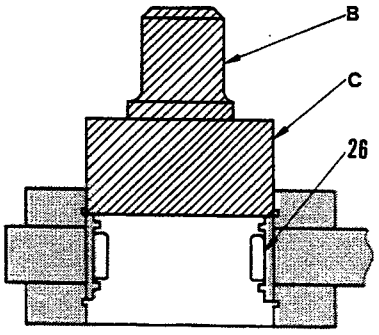
1) Install ring (25) at bottom of upper hinge, then assemble dust seal (24).
   ★ Be careful to install the seal lip facing in the correct direction.

   Lip of seal: **Grease (G2-LI)**

   ★ Insert ring (25) inside the planetary carrier before starting.




2) Using tools **B** and **C**, press fit bearing (26).
   ★ After press fitting, check that there is no clearance at the ring.

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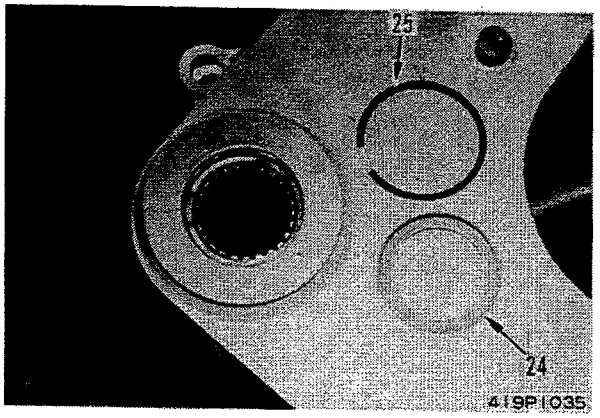
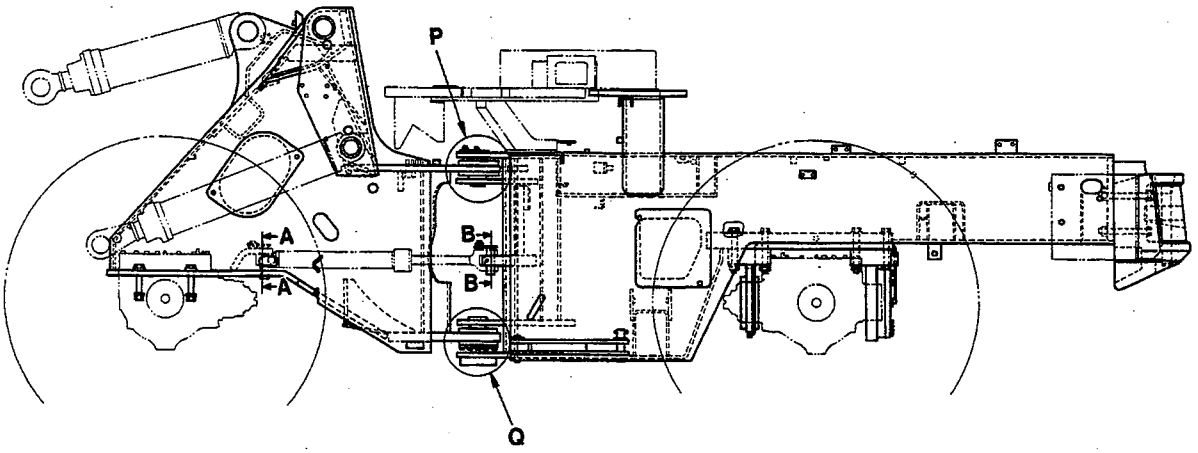
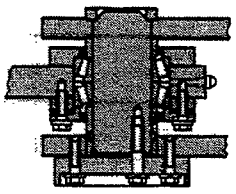
3) Install ring (25), then press fit dust seal (24).
   ★ Be careful to install the seal lip facing in the correct direction.

   Lip of dust seal: **Grease (G2-LI)**

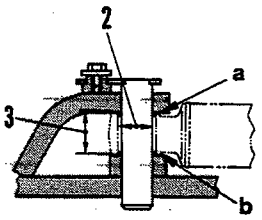


# STEERING CYLINDER MOUNT

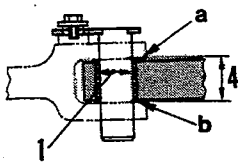


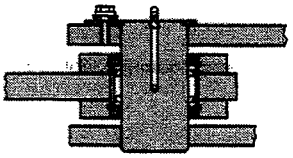
Detail P




Section A-A




Section B-B



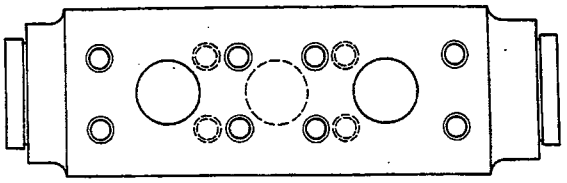
Detail Q

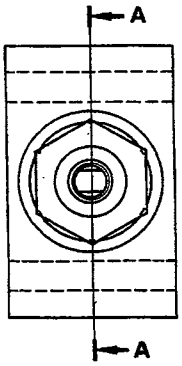
419F138

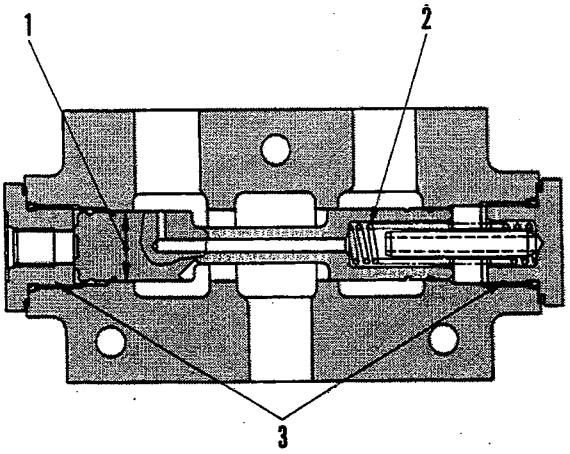
Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| | | Standard size | Tolerance | | Standard clearance | Clearance limit | |
| | | | Shaft | Hole | | | |
| 1 | Clearance between mounting pin and bushing at connection of steering cylinder rod and frame | 40 | 0<br>−0.025 | +0.142<br>+0.080 | 0.080 –<br>0.167 | – | Replace |
| 2 | Clearance between mounting pin and bushing at connection of steering cylinder bottom and frame | 40 | 0<br>−0.025 | +0.150<br>+0.050 | 0.050 –<br>0.175 | – | |
| 3 | Connection of steering cylinder and front frame | Width of boss | | Width of hinge | | Standard clearance (clearance a+b) | |
| | | $50^{+0.8}_{0}$ | | – | | After adjusting with shim: Less than 0.5 | |
| 4 | Connection of steering cylinder and rear frame | 50 | | 54±0.8 | | After adjusting with shim: Less than 0.5 | |

# SECURITY VALVE (If equipped)






Section A-A

419F494

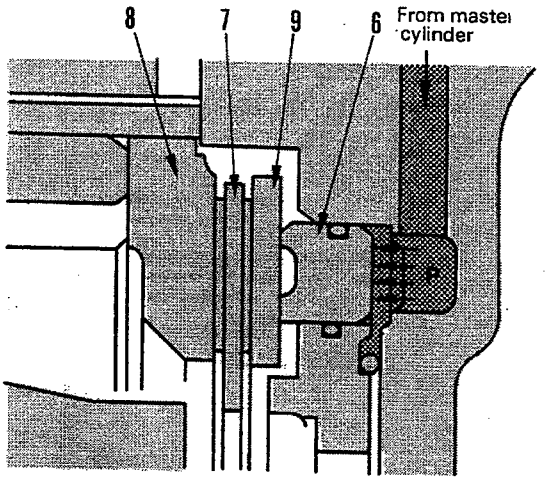
Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| 1 | Clearance between body and spool | Standard size | Tolerance | | Standard clearance | Clearance limit | Replace |
| | | | Shaft | Hole | | | |
| | | 26 | – | +0.015 +0.009 | 0.017 – 0.027 | – | |
| 2 | Spool spring | Standard size | | | Repair limit | | |
| | | Free length | Installation length | Installation load | Free length | Installation load | |
| | | 116.7 | 70 | 13.3 kg | 113.9 | 12.5 kg | |
| 3 | Tightening torque of plug | 11.0 ± 1.5 kgm | | | | | Retighten |

## OPERATION

### Brake operated

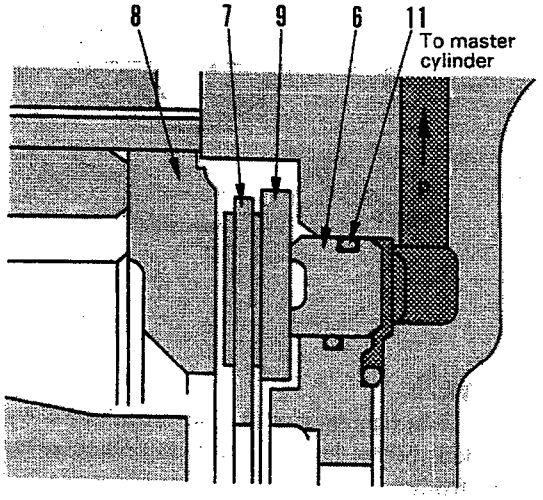
- When the brake pedal is depressed, the rod of the master cylinder is pushed. Oil pressure **P** is generated, and this acts on the piston inside the brake cylinder to slide piston (6) slightly.
  Therefore, the rotation of disc (7), which is between inner ring (9) and outer ring (8), is stopped, and the brakes are applied to stop the machine.




419F089

### Brake released

- When the oil pressure is released, piston (6) moves back slightly because of the return force of piston O-ring (11). A gap is created between inner ring (9) and outer ring (8), so disc (7) is free.
  Grooves are cut in a lattice pattern on the lining stuck to disc (7). When the disc is rotating, oil flows in these grooves to cool the lining.




419F090

# MEASURING WEAR OF BRAKE DISC

★ Measurement condition
- Coolant temperature: Inside operating range

Unit: mm

| Item | Standard value | Permissible value |
|---|---|---|
| Disc wear (one side) | 1.02 – 1.14 | Min. 0.7 |

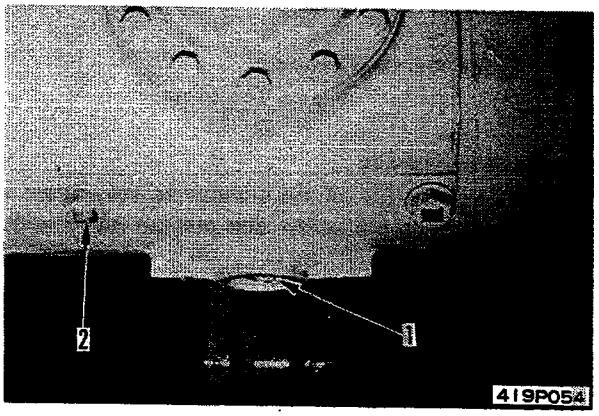
**Special tool**

| | Part number | Part name | Q'ty |
|---|---|---|---|
| | Commercially available | Feeler gauge | 1 |

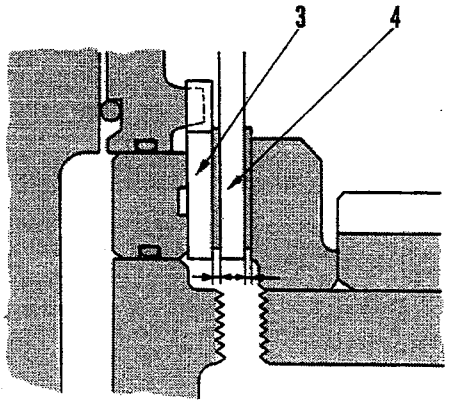
⚠ Apply the parking brake and block the tires.

**Measuring**

1. Loosen drain plug (1) and drain the axle oil.
   Axle oil: **24** ℓ
2. Remove measuring plug (2).
3. Depress the brake pedal lightly.
   ★ Check that the piston is in close contact with the disc.
4. Insert a feeler gauge between disc (3) and plate (4), and measure the clearance.
5. Tighten the drain plug and add axle oil through the oil filler to the specified level.
   Axle oil: **24** ℓ



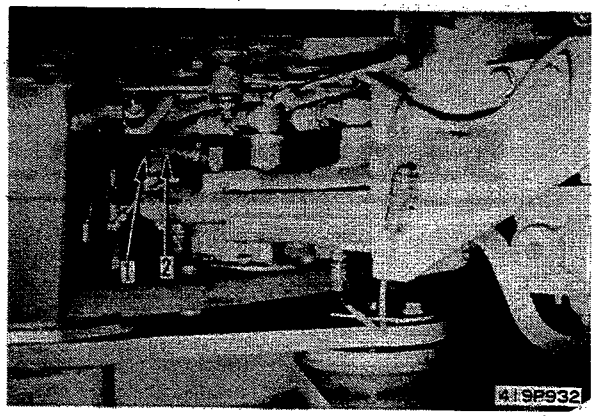





419F308

# REMOVAL OF BRAKE BOOSTER

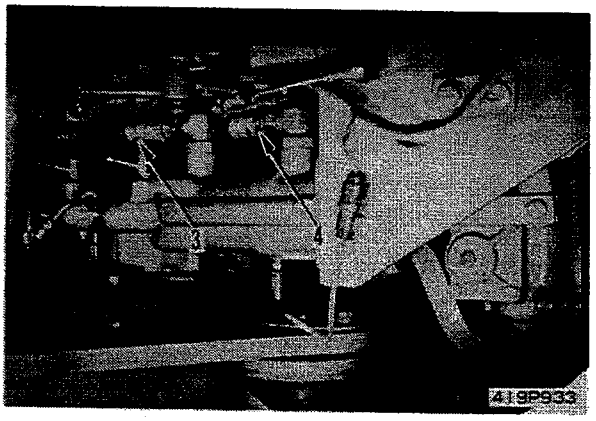
⚠ Park the machine on level ground, set the safety bar on the frame, ground the bucket, shut down the engine, apply the parking brake and place blocks under the tires.




**1. Draining oil**

Disconnect hoses (1) and (2) between brake oil tank and brake booster, and drain brake oil.

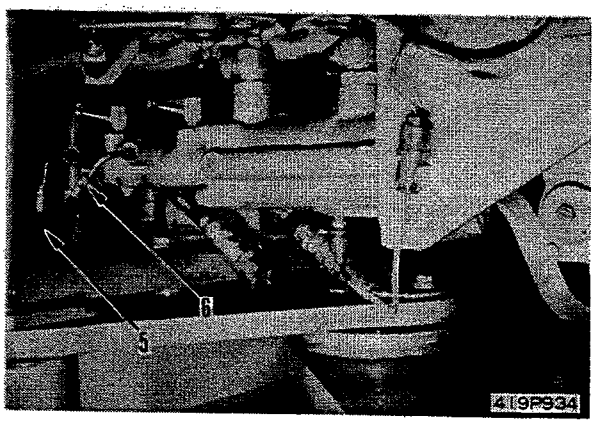
Brake oil: 1 ℓ




**2. Hydraulic hoses, tubes**

1) Disconnect hoses (3) and (4) between transmission and brake booster at brake booster end.

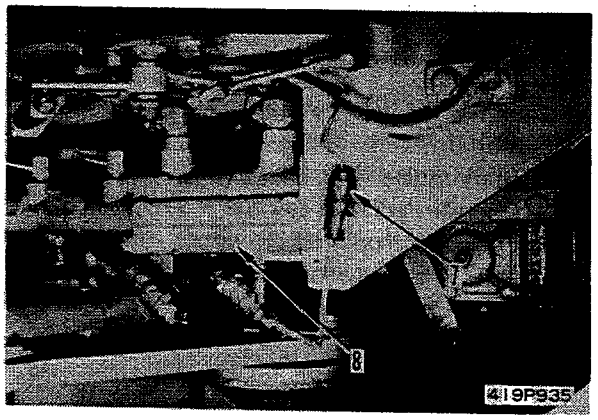
2) Disconnect brake tubes (5) and (6) from brake booster.




**3. Brake booster**

1) Remove cotter pin of rod linkage, then remove pin.
2) Disconnect connector (7) of transmission cut-off sensor.
3) Remove mounting bolts, then remove brake booster (8).

kg Brake booster: **15 kg**



# REMOVAL OF PARKING BRAKE PAD

⚠ Park the machine on level ground, set the safety bar on the frame, ground the bucket, shut down the engine, apply the parking brake and place blocks under the tires.

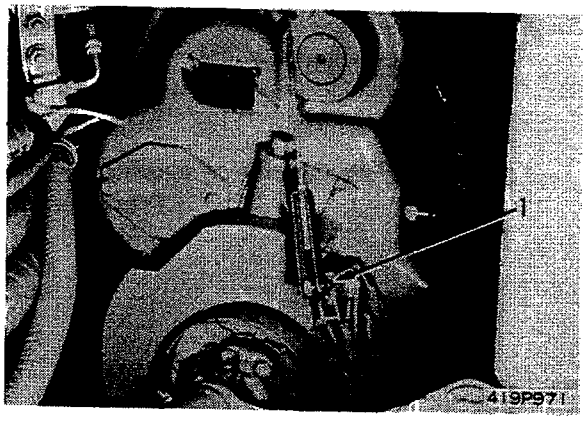
**1. Linkage**

Remove pin (1).

★ Check that the parking brake is in the RELEASED position.

**2. Pads**

1) Extend lock plate (2) with a chisel, and remove bolts (3).
2) Remove calipers (4) and (5).
3) Remove nut from calipers (4) and (5), then remove pads (6) and (7).



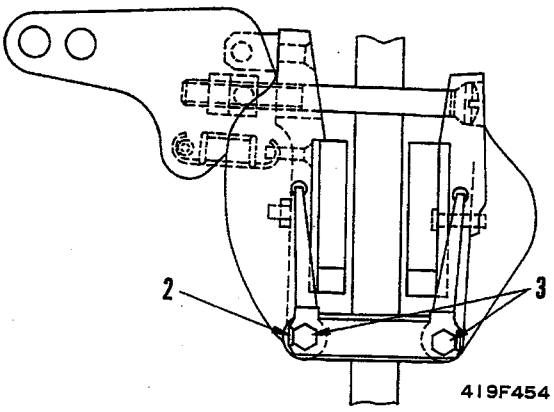

# INSTALLATION OF PARKING BRAKE PAD

**1. Pads**

1) Set pads (6) and (7) in mounting position, then secure with nut.
2) Set calipers (4) and (5) in mounting position, install lock plate (2), then tighten mounting bolts.
   ★ Knock the tip of the lock plate into the caliper mount hole up to the root.

   kgm Mounting bolt: **1.2±0.1 kgm**

3) Bend lock plate (2) with a chisel to lock bolt (3).



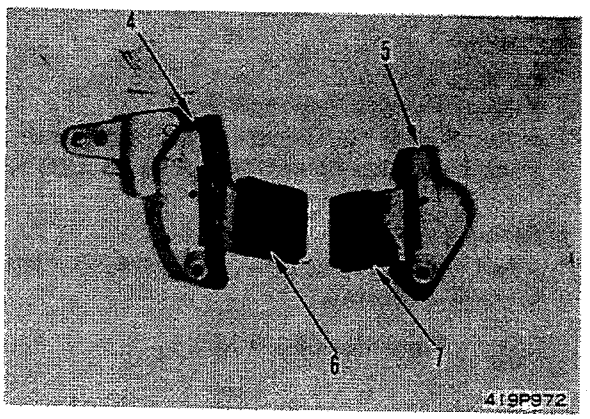

**2. Linkage**

Install pin (1).

★ Bend the cotter pin securely.

**3. Adjusting linkage**

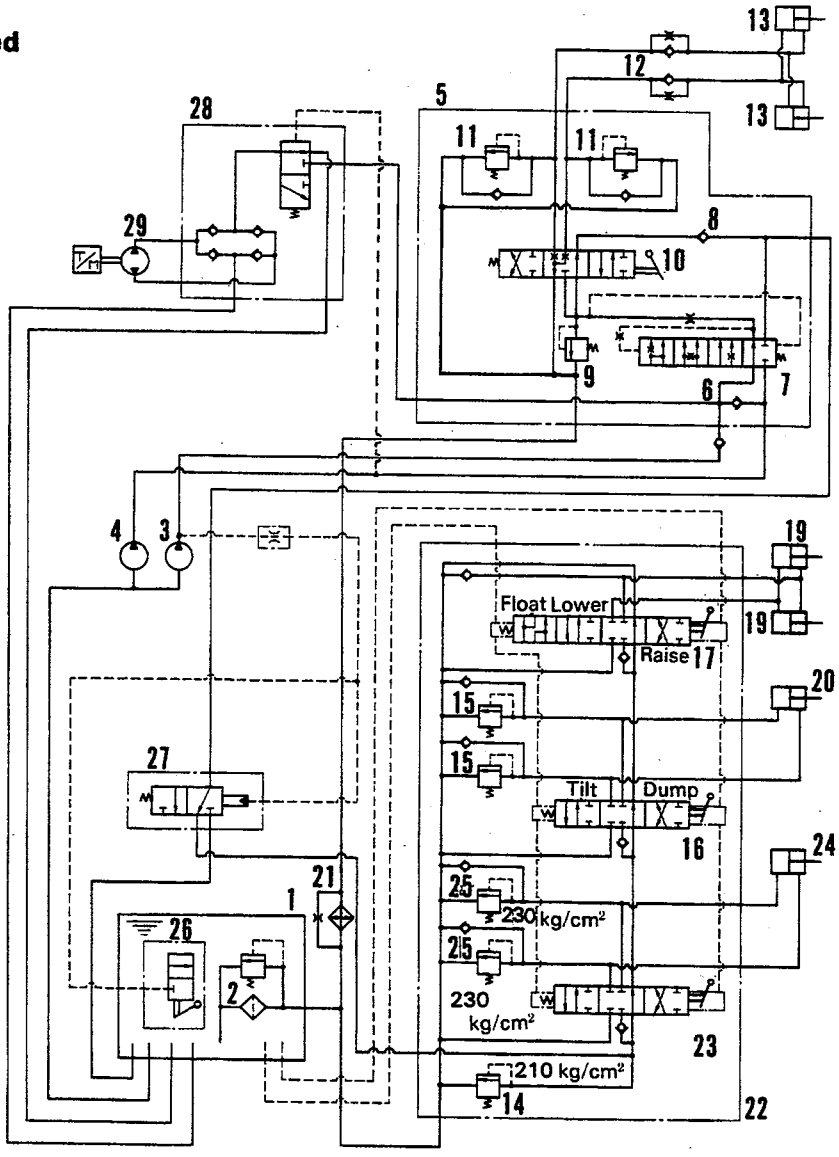
★ For details of adjusting the linkage, see 52 TESTING AND ADJUSTING.



# HYDRAULIC CIRCUIT DIAGRAM

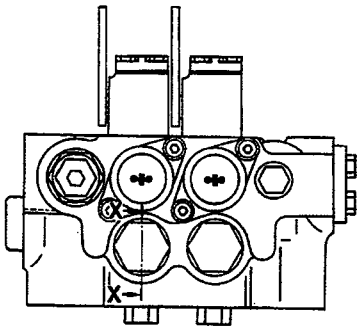
**(For 3-Spool, with emergency steering (if equipped))**

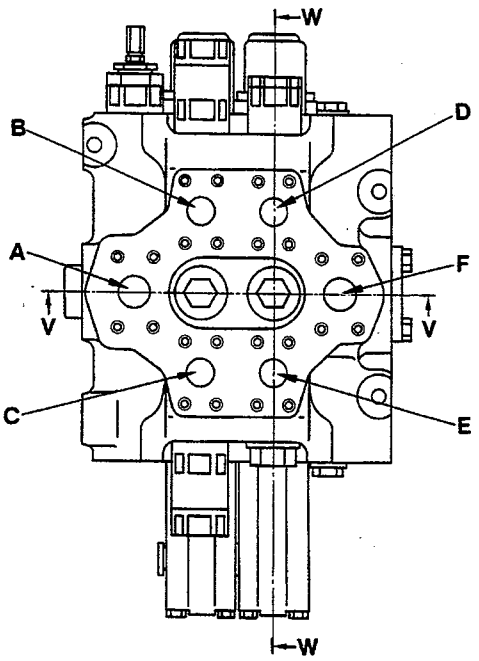
**Engine stopped**

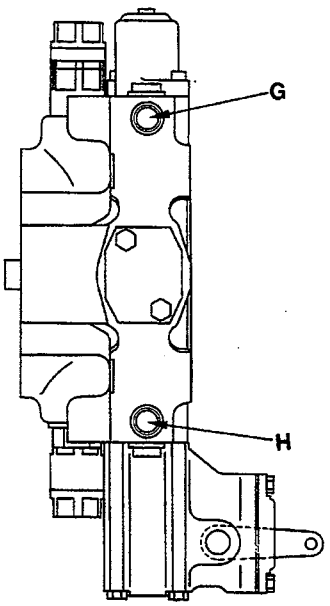


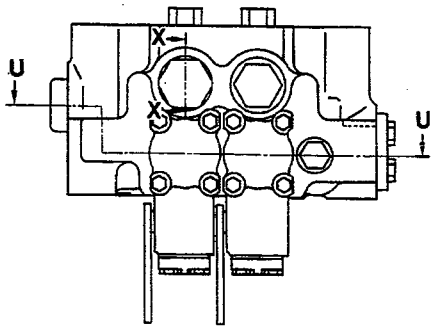

1. Hydraulic tank
2. Oil filter
3. Hydraulic pump (SAR(3)-80)
4. Steering pump (SAR(3)-50)
   (SAR(3)-40: Serial No. 11118 and up)
5. Steering valve
6. Check valve
7. Demand spool
8. Check valve
9. Steering relief valve
10. Steering spool
11. Safety valve (with suction)
12. Two-way restrictor valve
13. Steering cylinder
14. Relief valve
15. Safety valve (with suction)
16. Dump spool
17. Lift spool
18. Suction valve
19. Lift cylinder
20. Dump cylinder
21. Oil cooler
22. Main control valve
23. Attachment spool
24. Attachment cylinder
25. Safety valve (with suction)
26. Float valve
27. Security valve
28. Diverter valve
29. Emergency pump

# MAIN CONTROL VALVE (For 2-Spool)



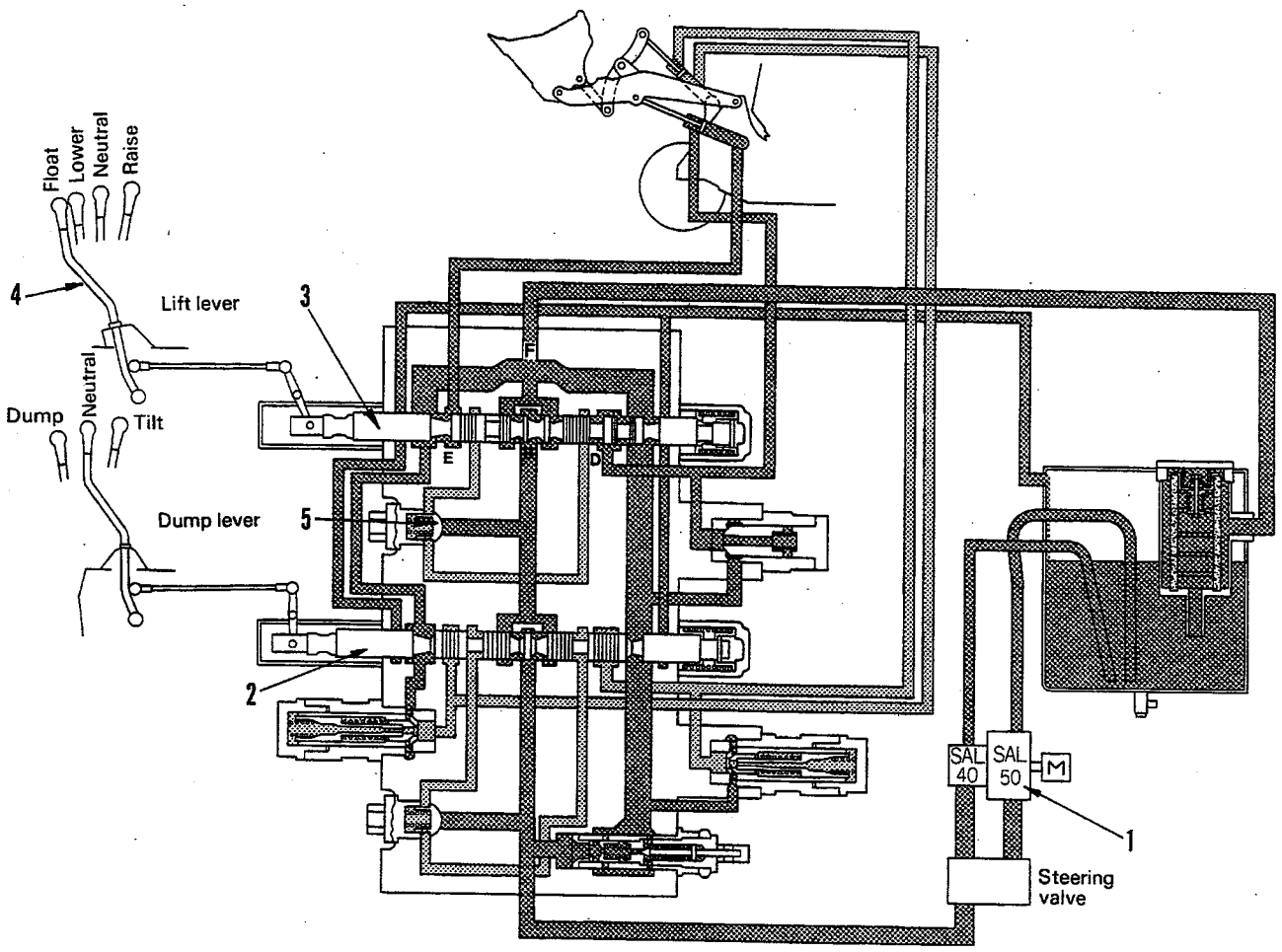




419F097

A. From steering valve
B. To dump cylinder rod side
C. To dump cylinder bottom side
D. To lift cylinder rod side
E. To lift cylinder bottom side
F. Drain port (To tank)
G. Drain port
H. Drain port

## Lift spool at "FLOAT position"




F4190008

### OPERATION

- When lift control lever (4) is pushed down further from the LOWER position, lift spool (3) is pushed into the FLOAT position.
- The oil flows from pump (1) through the steering valve. It then flows around the bypass circuit of dump spool (2) to the lift spool bypass circuit. The oil in the bypass circuit flows to the drain circuit because of the spool, but it cannot push open check valve (5).

  In addition, RAISE circuit **E** and LOWER circuit **D** of the lift cylinder are connected to the drain circuit, so the lift arm goes down under its own weight.
- When the bucket is in contact with the ground, it can move up and down in accordance with the shape of the ground.

## 2. Adjusting

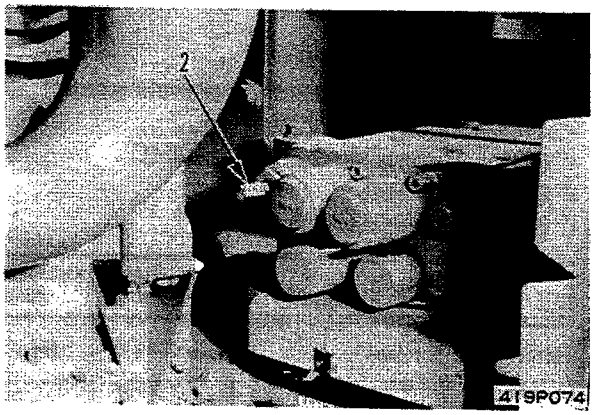
⚠ Always stop the engine before adjusting the hydraulic pressure.

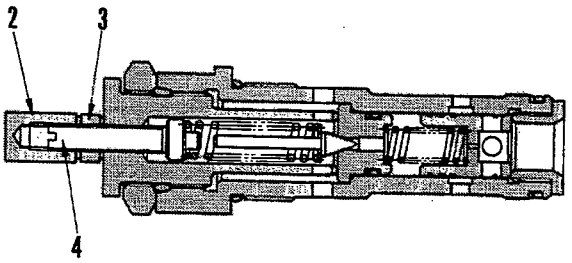
1) Stop the engine, open the engine hood and inspection cover, then remove the side cover.
2) Remove cap nut (1) of the relief valve.
3) Loosen lock nut (2), and turn adjustment screw (3) to adjust.
   ★ Amount of adjustment for 1 turn of screw

   1 turn: **Approx. 35.7 kg/cm²**

   ★ Turn the adjustment screw as follows.
   To INCREASE pressure, TIGHTEN screw.
   To DECREASE pressure, LOOSEN screw.

★ If the relief pressure cannot be measured accurately, do not try to adjust the pressure.




419F312

## 9. Bucket moves slowly or has insufficient tilt back power.

**Checks before troubleshooting**

- Is the oil quantity in the hydraulic tank and the type of oil satisfactory?
- Is the stroke of the bucket control lever and the main control valve spool correct?
- Seizure of bushing in work equipment linkage.
- Was an unusualy noise produced?

**Fault check**

- Check the amount of deficient tilt back force by performing actual work.
- Measure the operating speed of the bucket and check it against the judgement criterion table to determine whether or not it is normal.

| No. | Problem \ Remedy | | Cause: Blockage on suction side of pump ro excessive amount of air contained in oil | Faulty work equipment pump | Faulty steering pump | Faulty demand valve | Faulty or incorrectly adjusted main relief valve | Faulty safety with suction valve on bottom of the dump cylinder | Internally worn or damaged valve body (dump spool) | Damaged dump cylinder piston seal |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Tank to pump | | | De-mand valve | Control valve | | | Cyl-inder |
| | | | a | b | c | d | e | f | g | h |
| | | | C △ | △ X | △ X | △ X | △A X | △ X | X | X |
| 1 | Lift arm lifting force and lifting speed are abnormal and also bucket tilt back force and tilt back speed are abnormal. | | ○ | ○ | ○ | ○ | ○ | | | |
| 2 | Lift arm lifting force and lifting speed are normal but bucket tilt back force and tilt back speed are abnormal. | | | | | | | ○ | ○ | ○ |
| 3 | Phenomena of item 1 become particularly bad when the oil temperature increases. | | | ○ | ○ | | | | | |
| 4 | The hydraulic pump emits an unusual noise. | | ○ | ○ | ○ | | | | | |
| 5 | Steering action is light and excessively fast when the engine is at full throttle. | | | | | ○ | | | | |
| 6 | Steering action is heavy and slow when the engine is at full throttle. | | ○ | | ○ | | | | | |
| 7 | The dump cylinder has a large amount of hydraulic drift. | | | | | | | ○ | ○ | ○ |
| 8 | The relief pressure of main relief valve is low when the engine is at full throttle. | | | | | | ○ | ○ | ○ | ○ |
| 9 | The discharge volume of the hydraulic pump is low. | | | ○ | ○ | | | | | |

The following symbols are used to indicate the action to be taken when a cause of failure is located.
X: Replace △: Repair
A: Adjust C: Clean

# INSTALLATION OF HYDRAULIC, STEERING PUMP

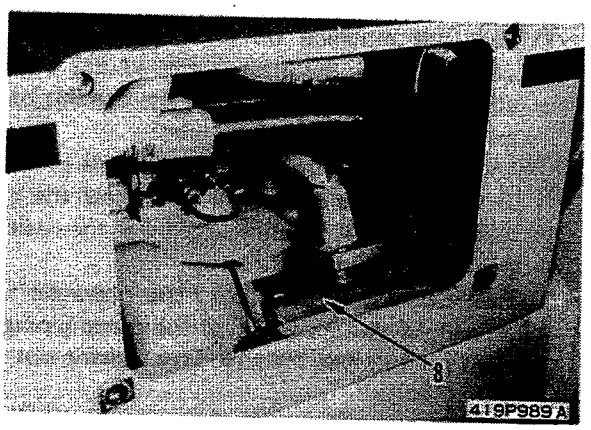
**1. Steering and hydraulic pump**

Set pump (8) in mounting position, then tighten mounting bolts.

★ Check that there is an O-ring installed between the pump and housing.

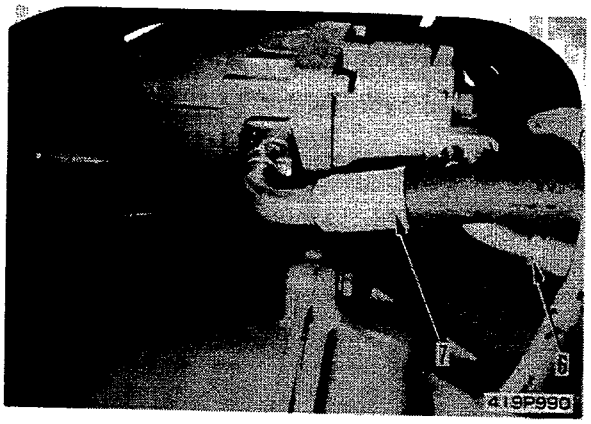
★ This operation should be carried out by two workers.

★ There is little space, so be careful when working.

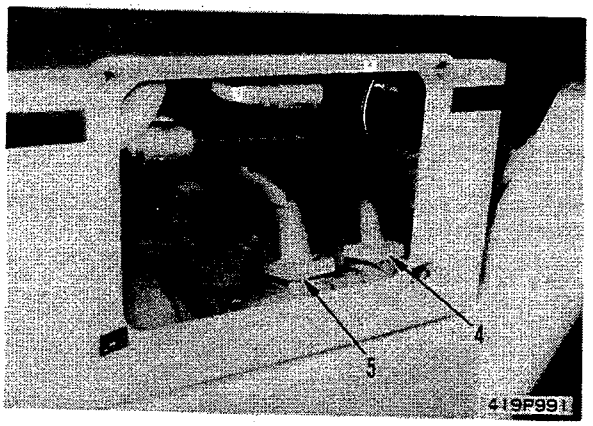



**2. Hydraulic piping**

1) Connect hoses (6) and (7) between hydraulic and steering pump and steering valve at pump end.



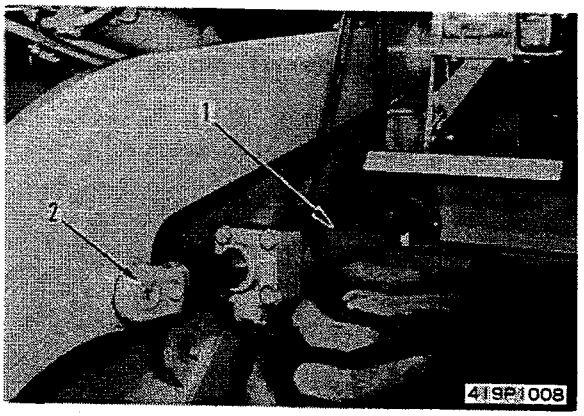

2) Connect tubes (4) and (5) between hydraulic tank and hydraulic and steering pump at pump end.



# REMOVAL OF LIFT CYLINDER

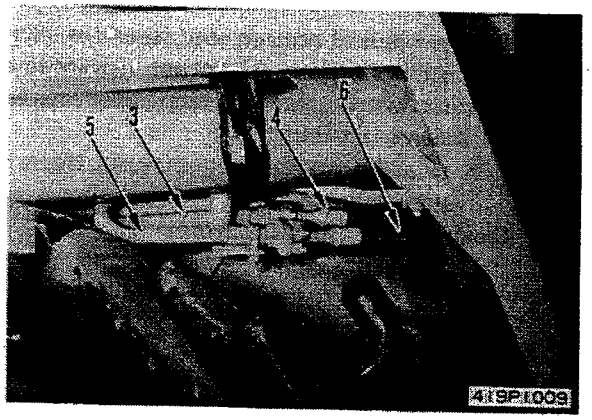
⚠ Park the machine on level ground, set the safety bar on the frame, ground the bucket, shut down the engine, apply the parking brake and place blocks under the tires.

⚠ Loosen the oil filler cap to relieve the pressure in the hydraulic oil tank, then operate the control lever 2 or 3 times to eliminate the residual pressure in the piping.



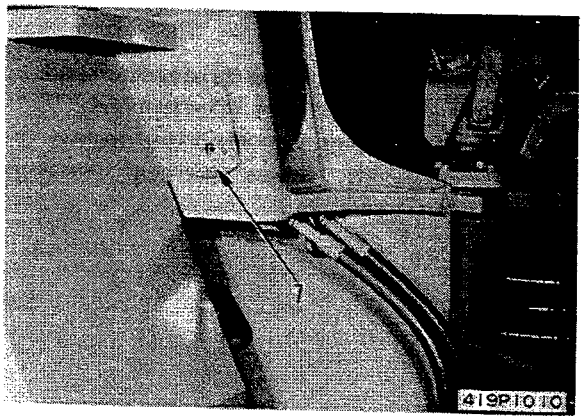

**1. Rod pin**

1) Sling lift cylinder (1), remove lock bolt, then remove pin (2).
2) Start engine, and operate control levers to retract cylinder rod on side where pin has been removed.
   ★ Do not retract the rod fully. Stop about 20 mm from the end of the stroke.




**2. Hydraulic piping**

1) Disconnect tube (3) and hose (4) at rod end from connector.
2) Disconnect tube (5) and hose (6) at bottom end from connector.
   ★ Fit covers to prevent dirt or dust from entering the hoses or connections.

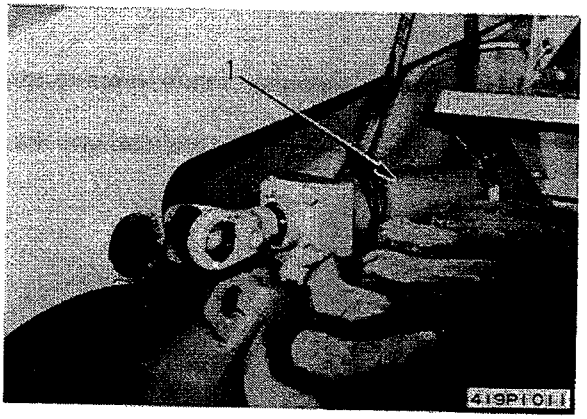



**3. Lift cylinder**

1) Remove lock bolt, then remove pin (7) at bottom end.
   ★ There are shims installed, so check the number and thickness of the shims, and keep in a safe place.

2) Remove lift cylinder (1).
   ★ Be careful of the center of gravity, and remove slowly.
   ★ Be careful not to damage the cylinder rod.

kg Lift cylinder: **115 kg**



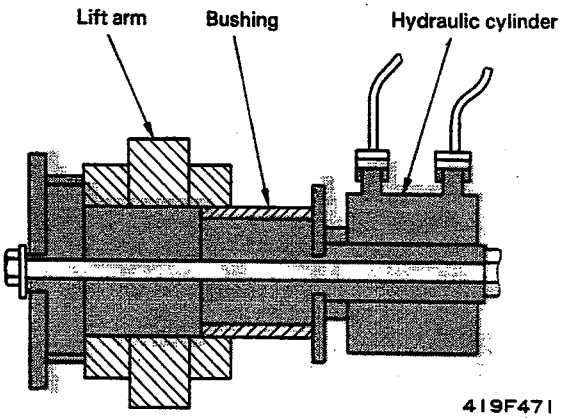
# INSTALLATION OF WORK EQUIPMENT

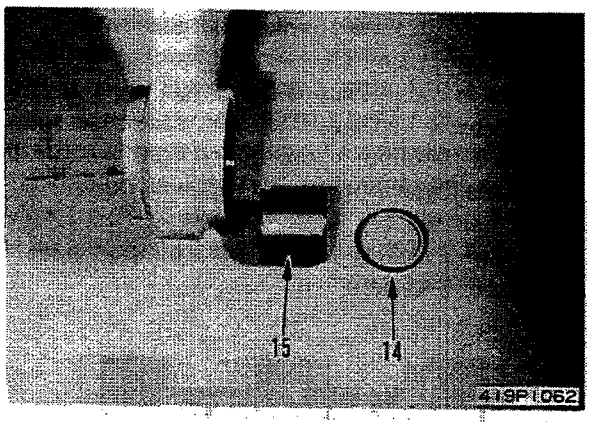
⚠ Use a bar to align the pin holes. Never use your fingers.

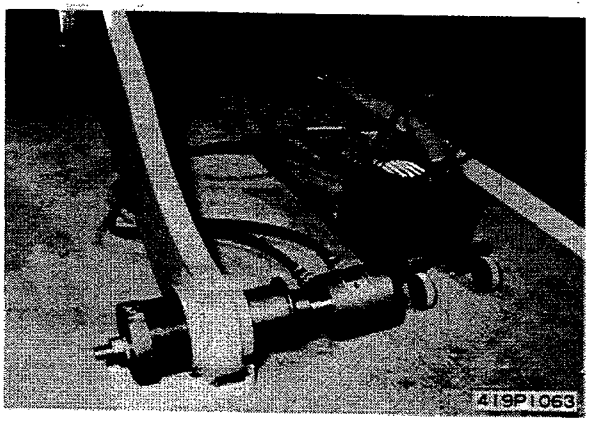
**1. Dust seal, bushing**

Press fit bushings (15) in bucket link, tilt lever, and lift arm, then assemble dust seal (14).

Bushing: **Grease (G2-L1)**

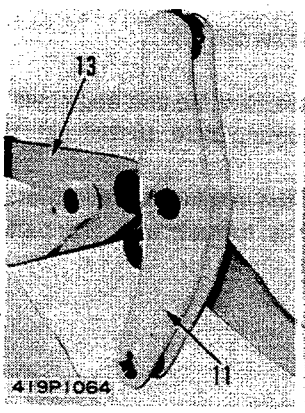


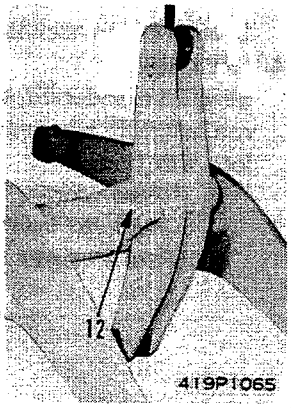



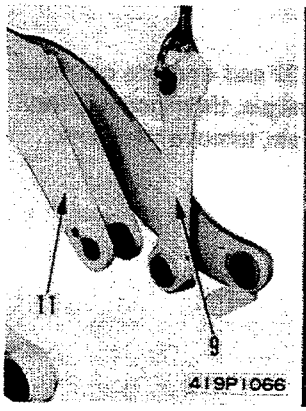

**2. Tilt lever, bucket link**

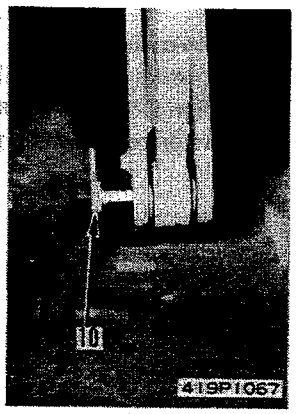
1) Align holes of tilt lever (11) and lift arm (13), then install mounting pin (12) and lock with bolt.



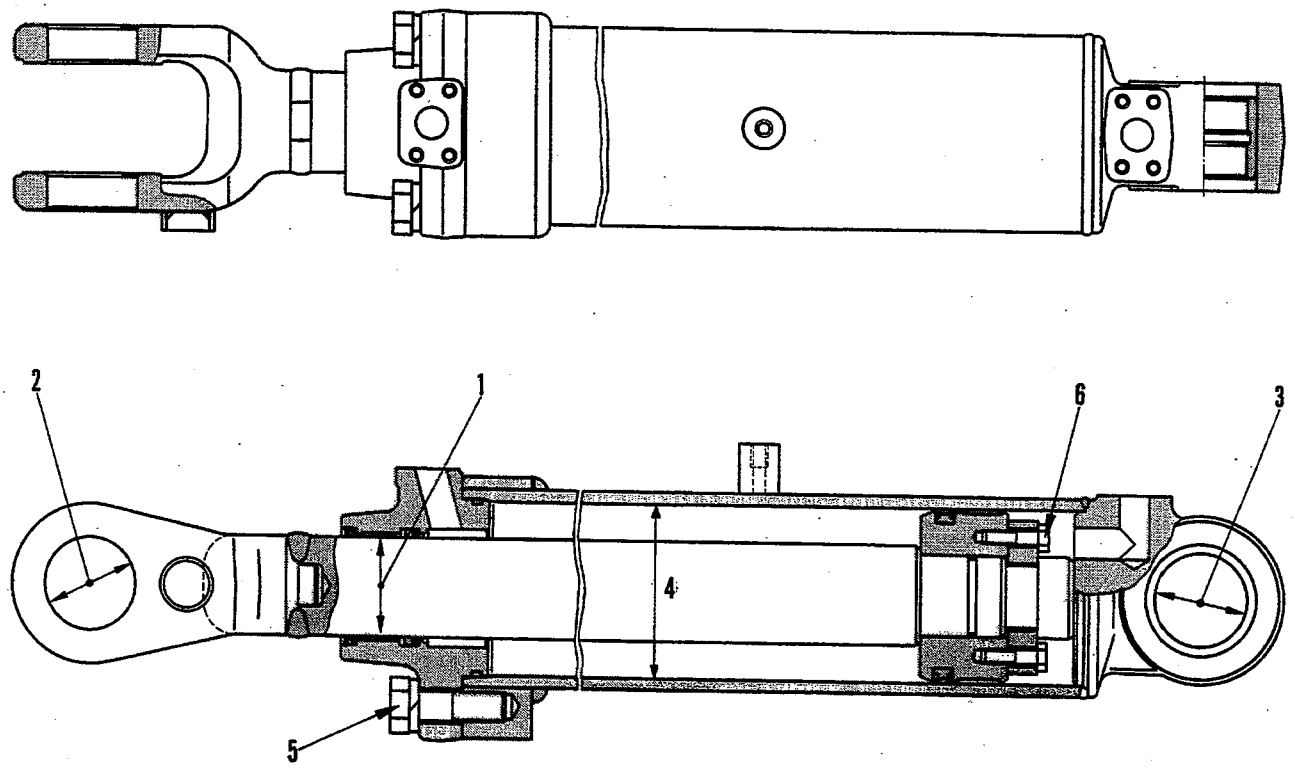




2) Assemble cord ring on bucket link (9), align holes of tilt lever (11), then install pin (10) and lock with bolt.
   - ★ Tie the bucket link to the tilt lever with wire.
   - ★ Be careful not to let the cord ring get caught when installing.



# LIFT CYLINDER




E419F144

Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| | | Standard size | Tolerance | | Standard clearance | Clearance limit | |
| | | | Shaft | Hole | | | |
| 1 | Clearance between rod and bushing | 80 | −0.100<br>−0.174 | +0.271<br>+0.061 | 0.445<br>−0.161 | 0.745 | Replace bushing |
| 2 | Clearance between piston rod mounting pin and inside diameter of hole | 75 | – | +0.219<br>+0.145 | – | – | Replace |
| 3 | Clearance between cylinder bottom mounting pin and bushing | 75 | – | +0.174<br>+0.100 | – | – | Replace bushing |
| 4 | Cylinder bore | 140 | – | +0.35<br>0 | – | – | Replace |
| 5 | Tightening torque of cylinder head mounting bolt | 83±22 kgm | | | | | Retighten |
| 6 | Tightening torque of piston mounting bolt | 11.5±1.0 kgm | | | | | |

# ENGINE STARTING CIRCUIT

## OPERATION

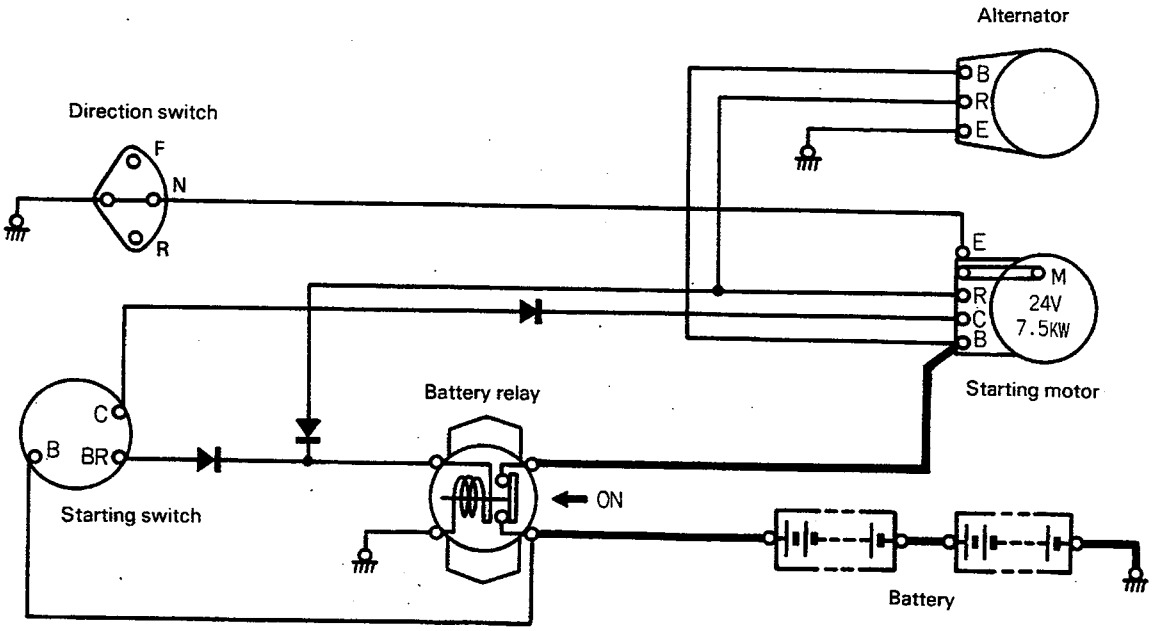
When the FORWARD-REVERSE lever is placed at N (neutral), the neutral contacts of the direction lever switch are closed. When this happens and the starting switch is turned to START, electric current flows in the following circuit.

(1) Battery (+) → starting switch terminal **B** → starting switch terminal **C** → safety relay terminal **E** → terminal **N** of direction lever switch → ground connection.

When this happens, the safety relay is actuated and following circuit is formed.

(2) Battery (+) → battery relay → starting motor terminal **B** → starting motor terminal **C**. The engine then starts.

If the FORWARD-REVERSE lever is any in position except **N** (neutral), the circuit in (1) is not formed, so the engine does not start.

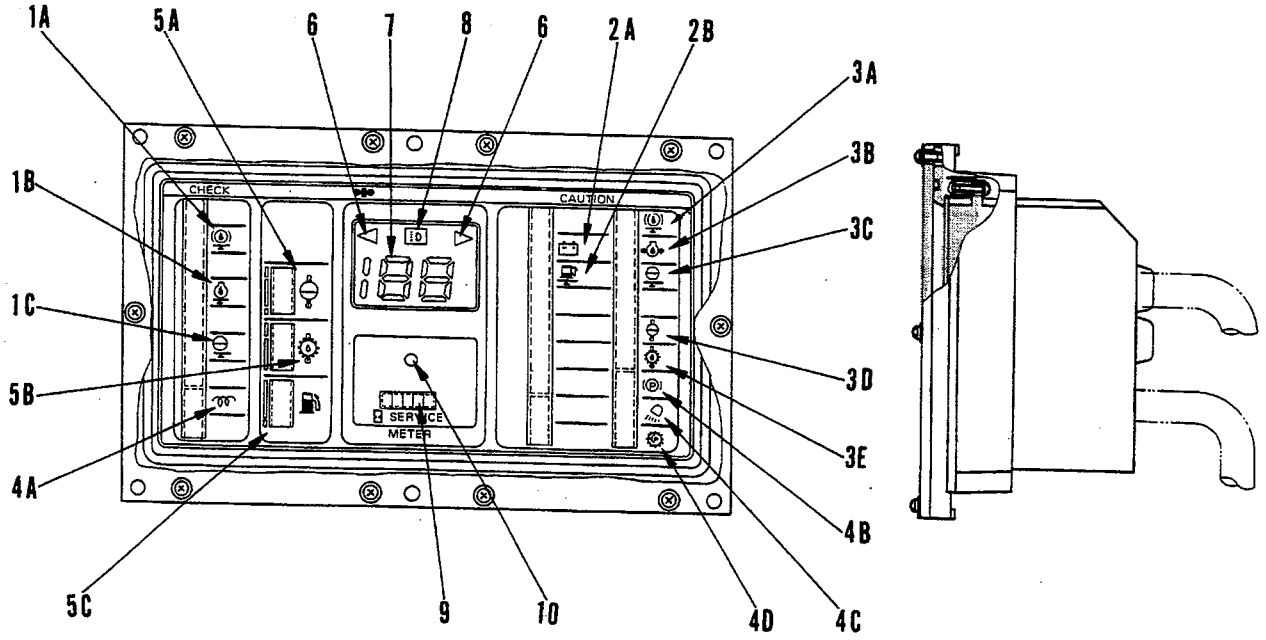



419F117A

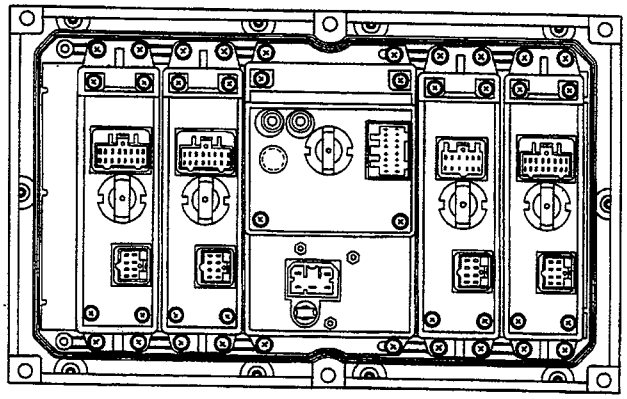
# MONITOR PANEL

- The monitor consists of the following components. CHECK module (1), CAUTION module (2), CAUTION module (3), gauge module (5), speedometer module (including service meter), the case, and various other components.
- Each module (excluding the service meter) has its own microcomputer which processes the signals from the sensor and gives a display.
  The panel uses a liquid crystal display.
- CHECK (1), and CAUTION (2) and (3) modules all use common parts.
  The microcompter judges which module it is from the wiring harness to which it is connected.

**Note:** Serial No. 20001 and up machines are equipped two modules.
(See Fig. U41901060).

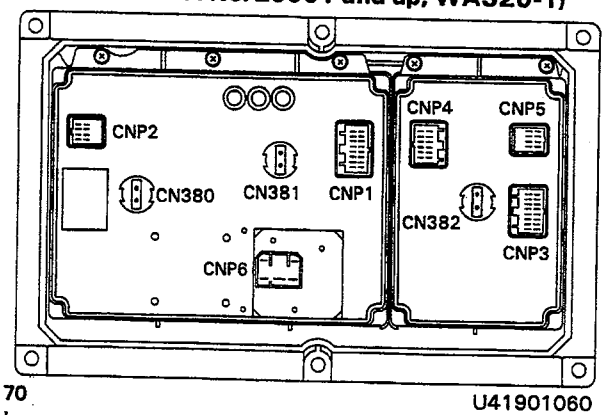



**(WA300-1 Serial No. 10001 – 19999)**



E423F170

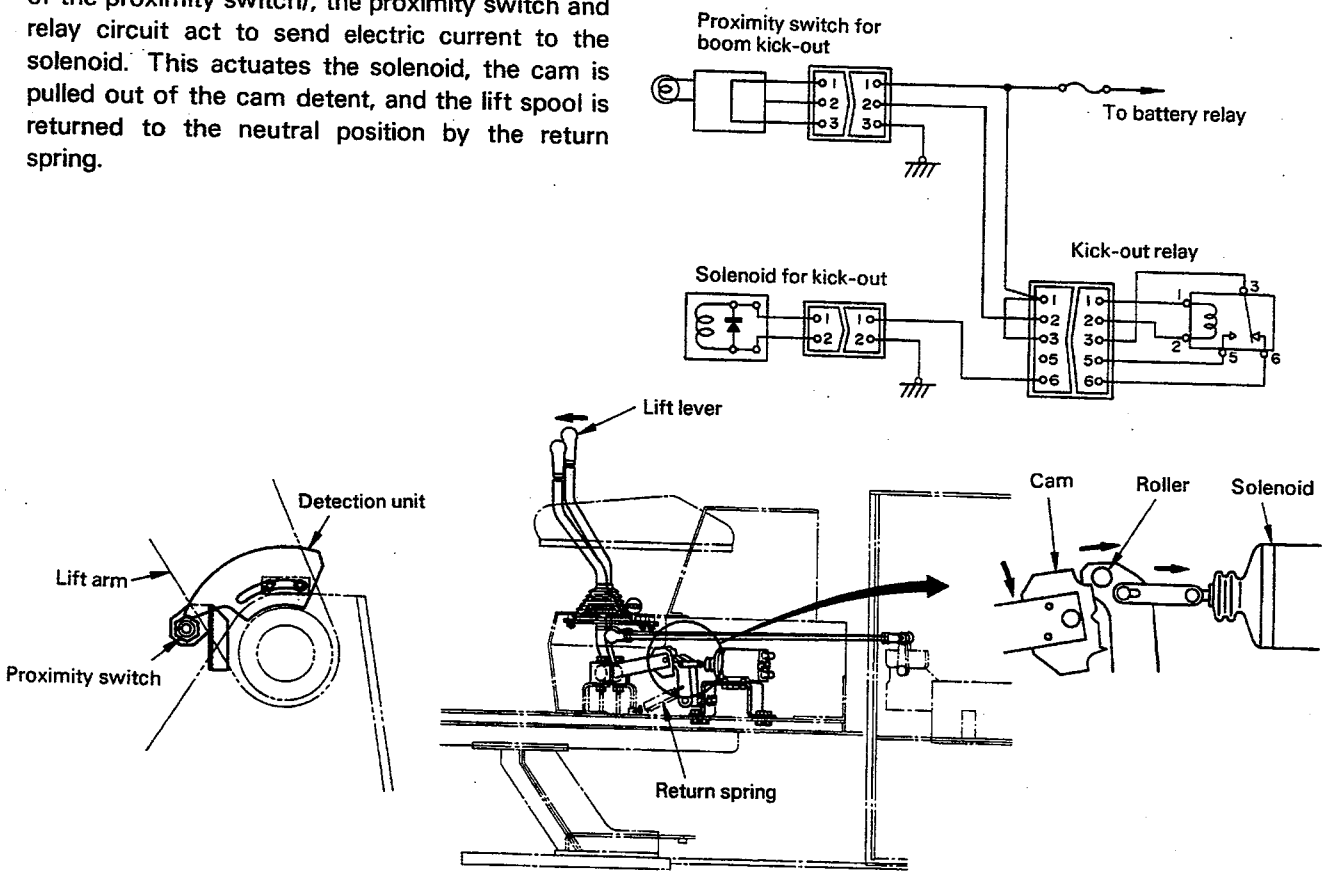
**(WA300-1 Serial No. 20001 and up, WA320-1)**




U41901060

1. Check (Be fore starting)
   1A. Brake oil level
   1B. Engine oil level
   1C. Coolant level
2. Caution (Warning)
   2A. Battery charge
   2B. Fuel level
3. Caution (Emergency warning)
   3A. Brake oil level
   3B. Engine oil pressure
   3C. Coolant level
   3D. Coolant temperature
   3E. Torque converter oil temperature
4. Pilot indicator
   4A. Preheat monitor
   4B. Parking brake
   4C. Work lamp
   4D. Transmission cut off selector
5. Gauge
   5A. Coolant temperature
   5B. Torque converter oil temperature
   5C. Fuel
6. Winkers
7. Speedometer
8. Head lamp (High beam)
9. Service meter
10. Service meter indicator

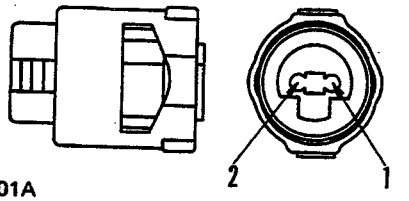
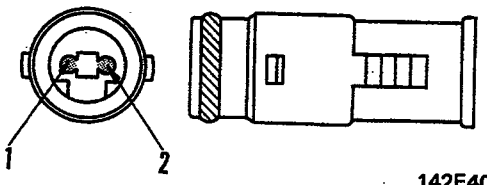
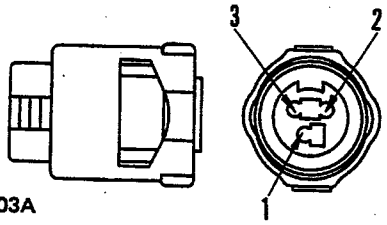
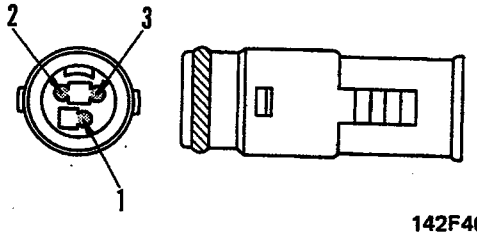
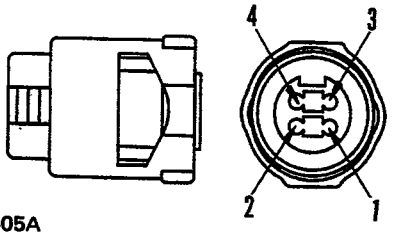
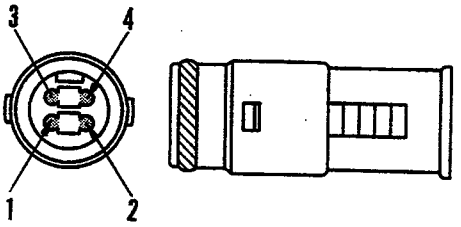
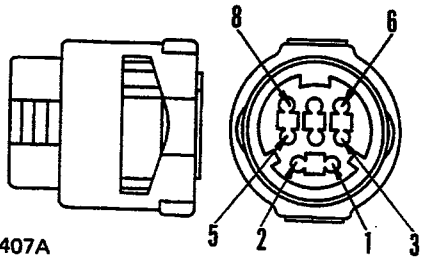
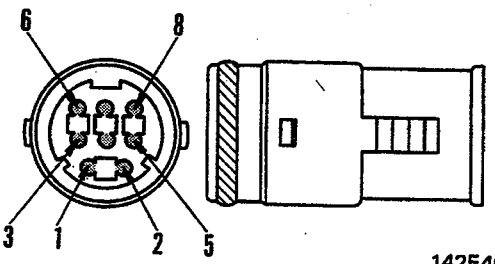
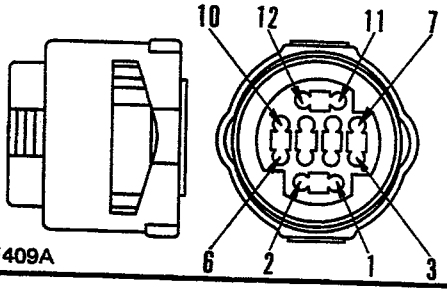
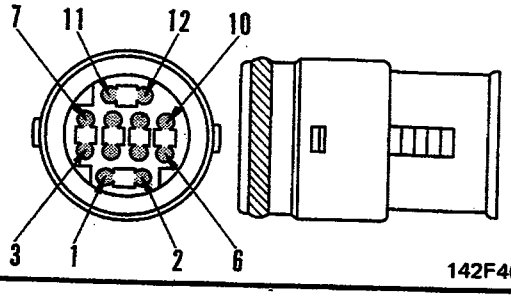
- When the lift arm goes up and reaches the set position for the kick-out (that is, the detection unit (steel plate) is separated from the sensing surface of the proximity switch), the proximity switch and relay circuit act to send electric current to the solenoid. This actuates the solenoid, the cam is pulled out of the cam detent, and the lift spool is returned to the neutral position by the return spring.



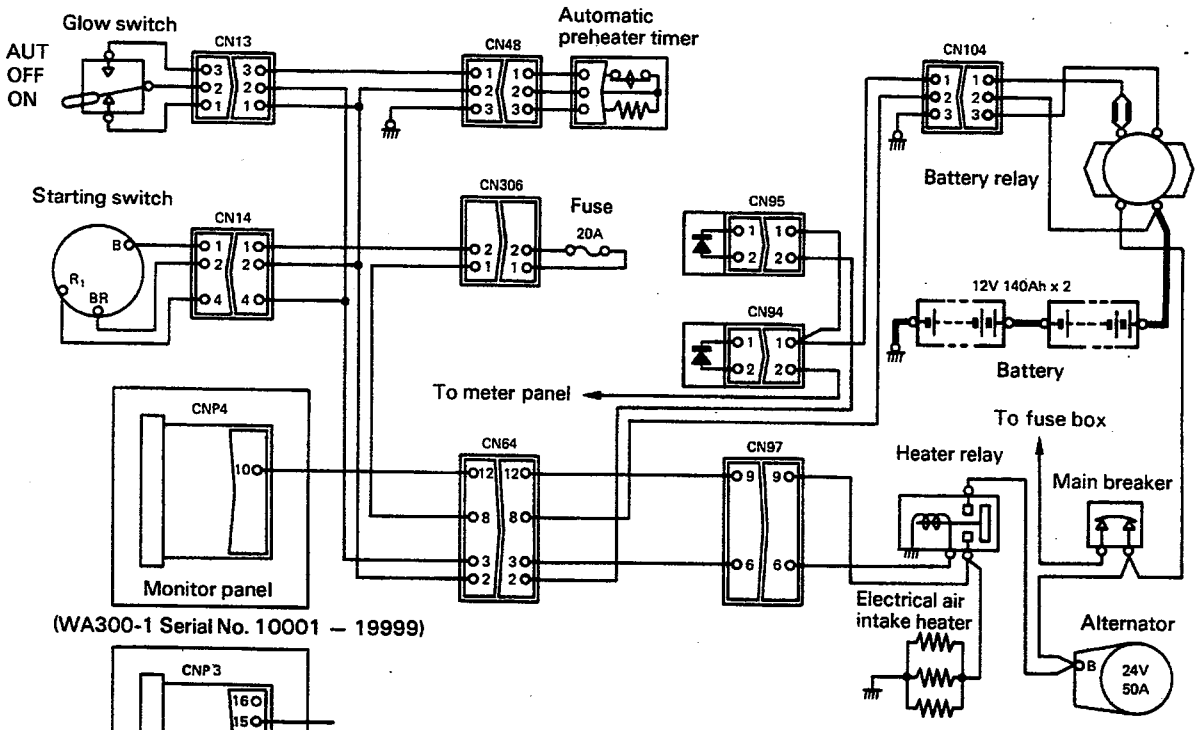

**Movement of proximity switch**

| Position | Sensing surface of proximity switch is in contact with detection unit | Sensing surface of proximity switch is separated from detection unit |
|---|---|---|
| Operation display of proximity switch | ON | OFF |
| Proximity switch load circuit (relay switch circuit) | Current flows | Current shut off |
| Relay switch load circuit (solenoid circuit) | Current shuts off | Current flows |

# CONNECTOR TERMINAL NUMBERS

| Connector | ECONOSEAL CONNECTOR | |
|---|---|---|
| | Female terminal (Socket) | Male terminal (Pin) |
| CN17,CN21<br>CN83,CN84<br>CN86,CN101<br>CN105,CN107<br>CN163,CN96<br>CN310 |  142F401A |  142F400A |
| CN41<br>CN42<br>CN102<br>CN104 |  142F403A |  142F402A |
| CN14<br>CN43 |  142F405A |  142F404A |
| CN63<br>CN75<br>CN302<br>CN303<br>CN306 |  142F407A |  142F406A |
| CN15,CN16<br>CN64,CN97<br>CN304 |  142F409A |  142F408A |

## 4. PREHEATING CIRCUIT SYSTEM

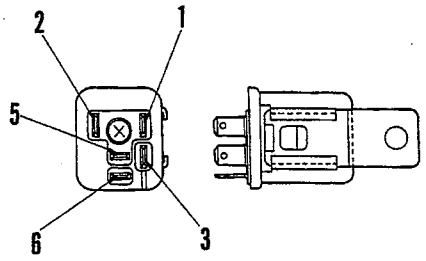


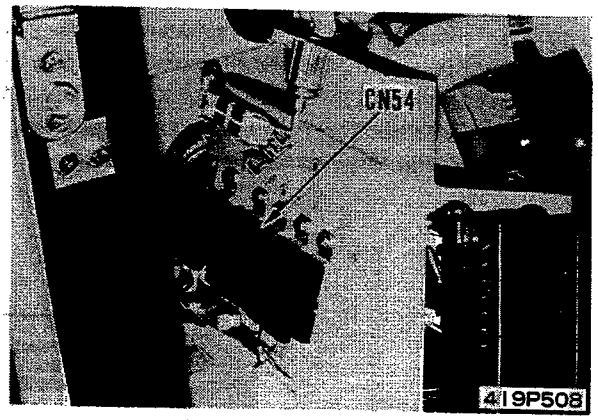

(WA300-1 Serial No. 10001 – 19999)

(WA300-1 Serial No. 20001 and up, WA320-1)

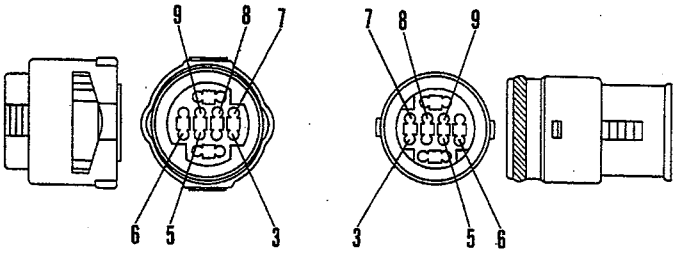
419F319A

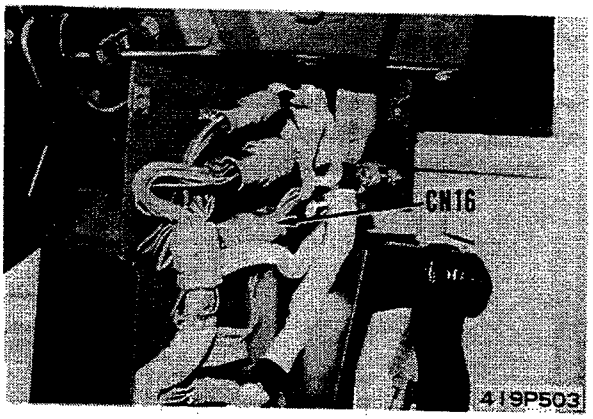
**CN54**



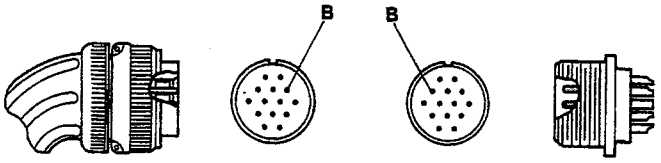



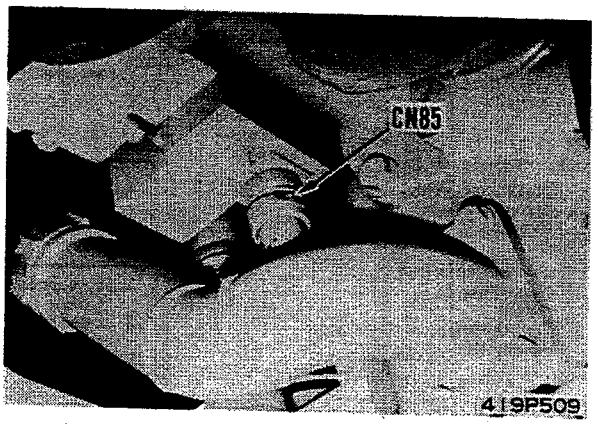
## CN16



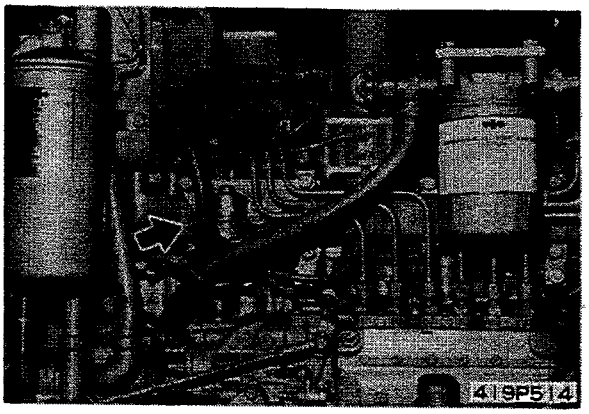




## CN85

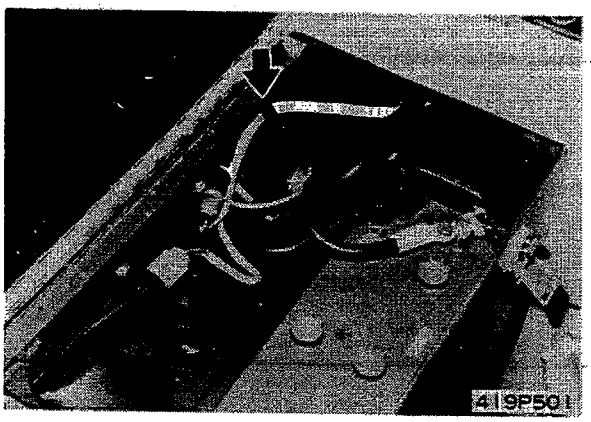


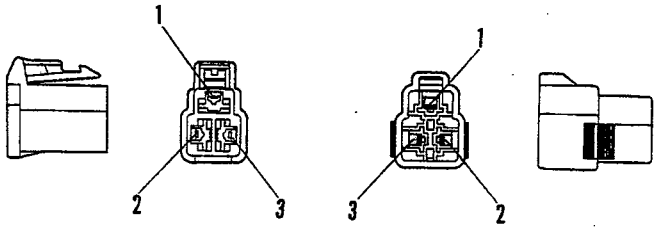
**Heater relay**

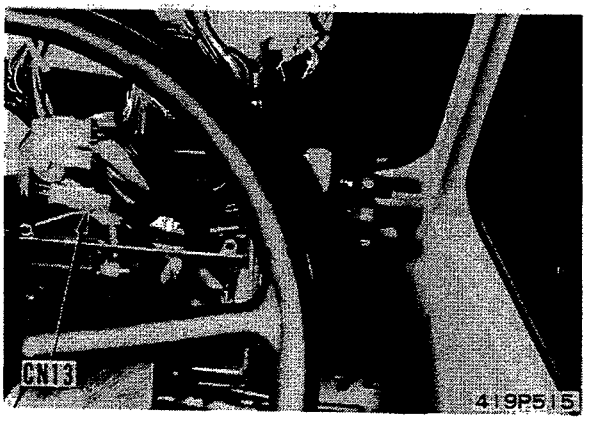



**Battery relay**




**CN13**



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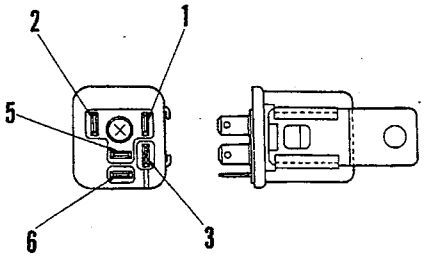


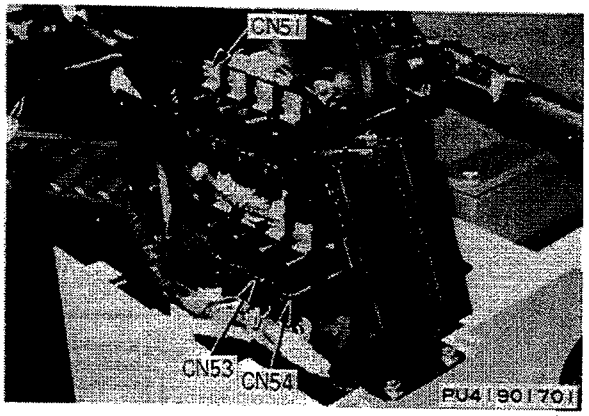

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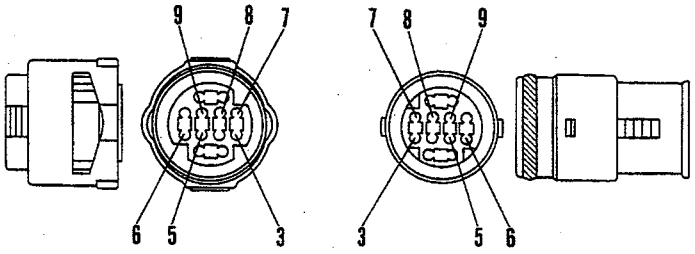
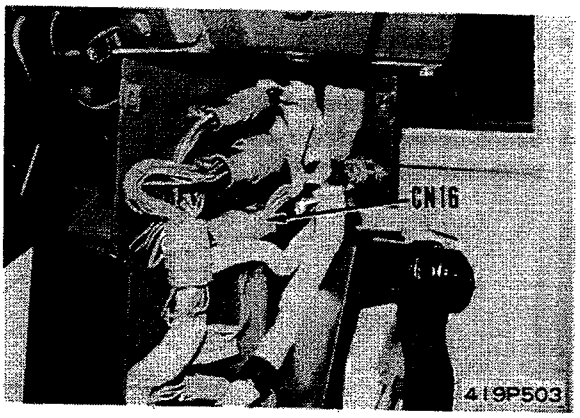
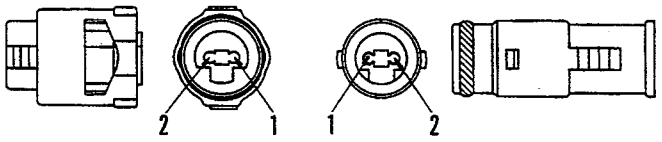
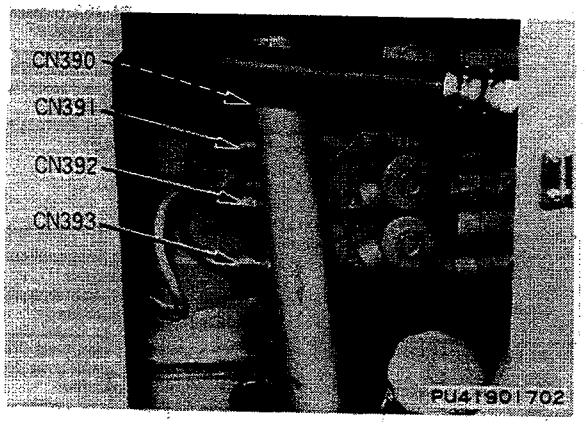


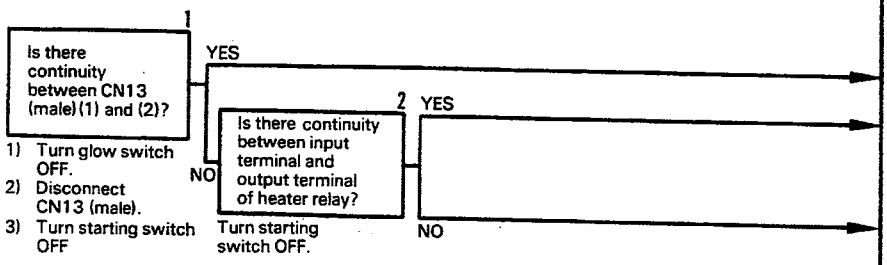

**CN391, CN392, CN393**



## E-15 PREHEATING DOES NOT STOP

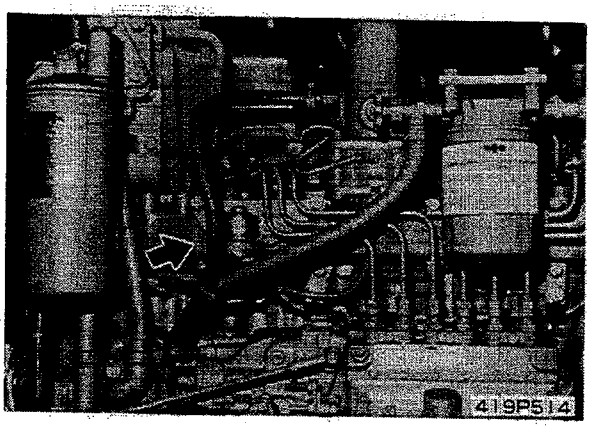
★ When disconnecting or connecting the T-adapter (or socket adapter) or short connector, or when disconnecting the connector for checking, turn the starting switch OFF to prevent accidents.
★ When connecting the T-adapter (or socket adapter), connect to the connector specified. (CNxx ( ))
★ When disconnecting connectors or connecting T-adapters, return them to the original condition immediately after checking, then go to the next check.



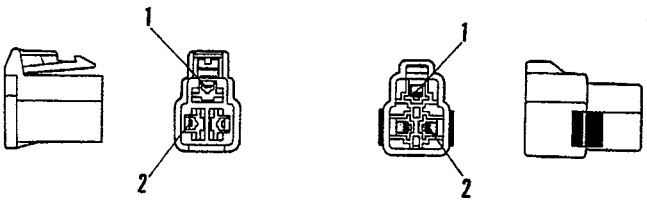

| Cause | Remedy |
|---|---|
| Defective glow switch | Replace |
| Defective heater relay | Replace |
| Contact between +24V wiring harness and heater relay output terminal — input terminal of electrical intake air heater or contact between +24V harness and CN13(2) — heater relay, CN13(3) — auto-preheating timer, or defective auto-preheating timer. | Repair or replace |

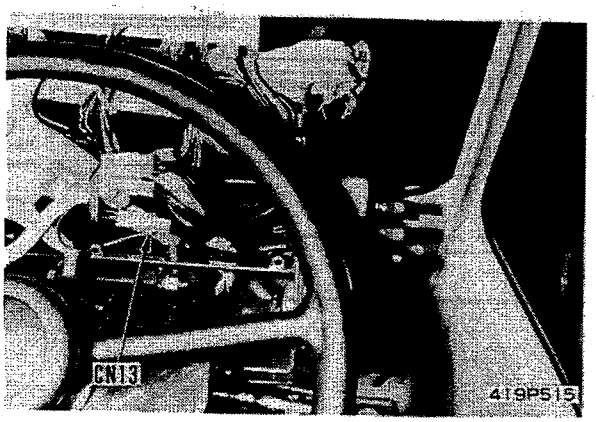
| Troubleshooting tools | Tester | |
|---|---|---|
| | | |

**Heater relay**

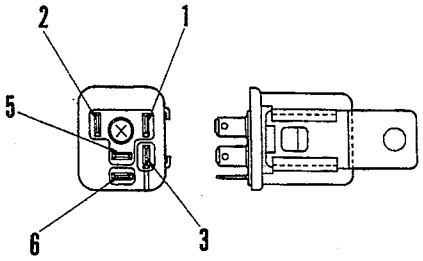


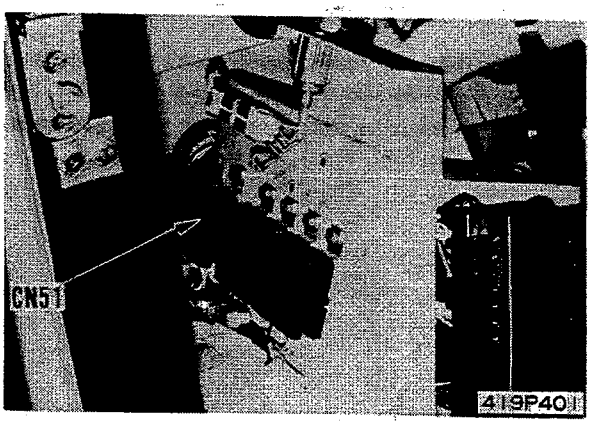

**CN13**



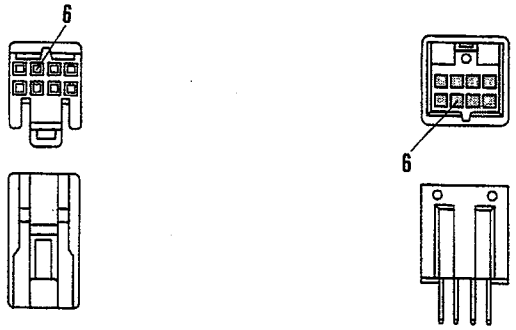



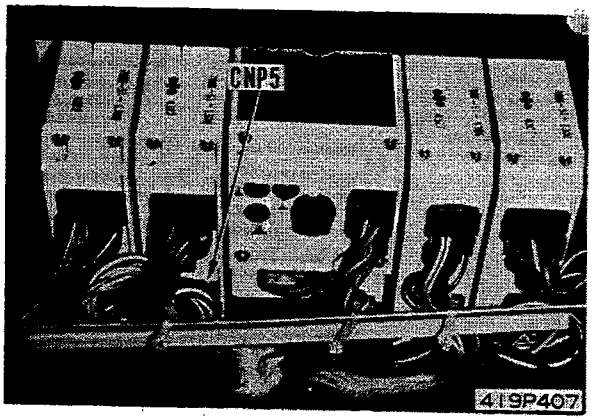
## CN51



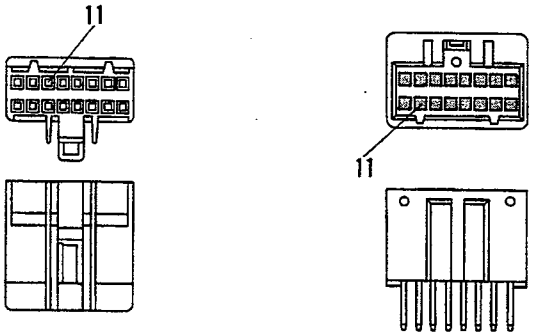



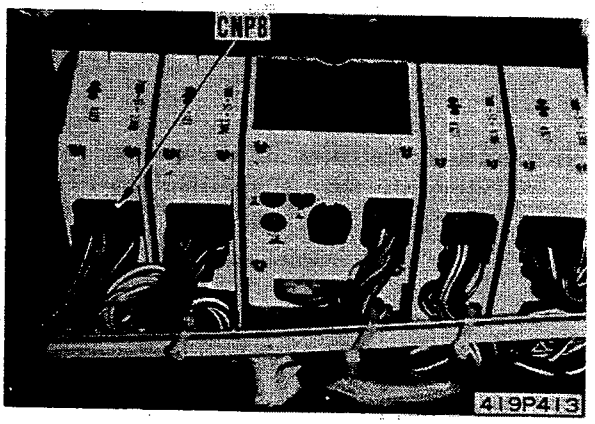

## CNP5



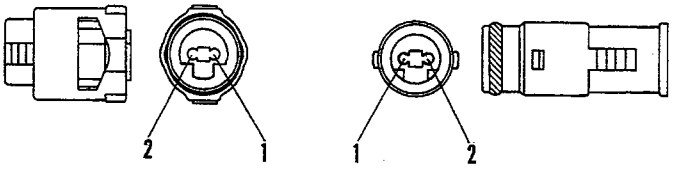




## CNP8




## CN86



## M-14 (PREHEAT) LIGHTS UP OR DOES NOT LIGHT UP

★ When disconnecting connectors to connect the T-adapter (or socket adapter), turn the starting switch OFF.
★ When connecting the T-adapter (or socket adapter), connect to the connector specified in ( ).
★ After checking, connect the disconnected connectors again immediately.

### a) lights up.

| Cause | Remedy |
|---|---|
| 1 Is there continuity between CNP4 (female)(6) and chassis ground?<br>1) Connect T-adapter to CNP4 (female).<br>2) Turn starting switch OFF.<br>YES: Defective CHECK BEFORE STARTING module | Replace |
| NO: Defective contact, or disconnection in wiring harness between CNP4 (female)(6) and chassis ground, or between CNP4 (female)(10) — CN64 (12) — CN97 (6) — electrical intake air heater | After inspection repair (clean) or replace |

### b) does not light.

Note: The engine oil pressure or the battery charged value is indicated on the meter (which makes us think that the engine has run), even though the engine remains at rest.
In this case, the engine is not preheated. (See failures [oil] or [battery].)

| Cause | Remedy |
|---|---|
| See M-22 | |
| 1 Is the circuit between receptacle CNP4 (10) and the chassis ground continuous (unbroken)?<br>1) Disconnect (+)terminal of the electrical air intake heater.<br>2) Connect T-adapter to CNP4 (female)<br>YES: Contact between chassis ground and electrical intake air heter (+) — CN97 (9) — CN64 (12) — CNP4 (female)(10). | Replace |
| NO: Defective CHECK BEFORE STARTING module. | After inspection repair (clean) or replace |

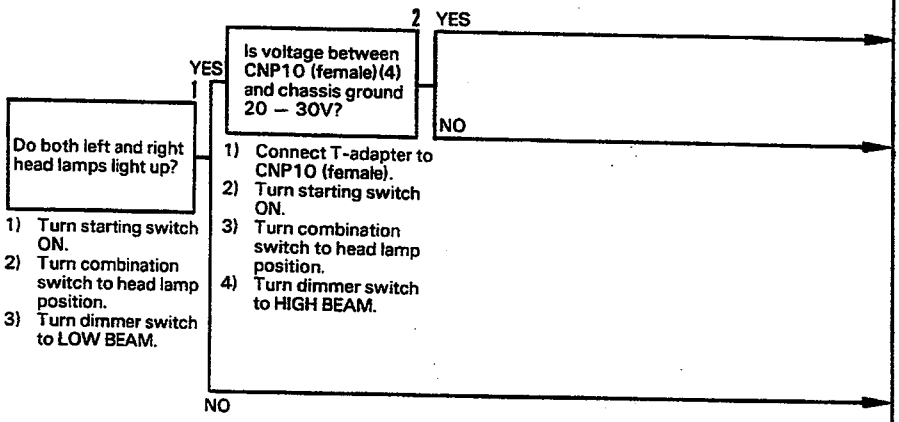
| Troubleshooting tools | Tester | |
|---|---|---|
| | T-adapter (for DLI) | |

## M-18 TURN SIGNAL LAMPS, HIGH BEAM LIGHT UP OR DO NOT LIGHT UP

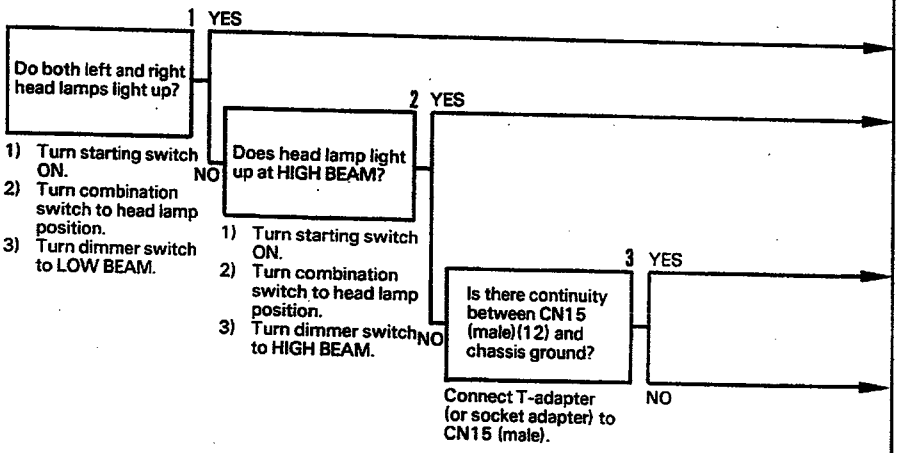
★ When disconnecting connectors to connect the T-adapter (or socket adapter), turn the starting switch OFF.
★ When connecting the T-adapter (or socket adapter), connect to the connector specified in ( ).
★ After checking, connect the disconnected connectors again immediately.

### e) HIGH BEAM pilot lamp does not light up.

Note: If the head lamp cannot be switched to HIGH BEAM, see Troubleshooting for machine.




### f) HIGH BEAM pilot lamp does not go out.



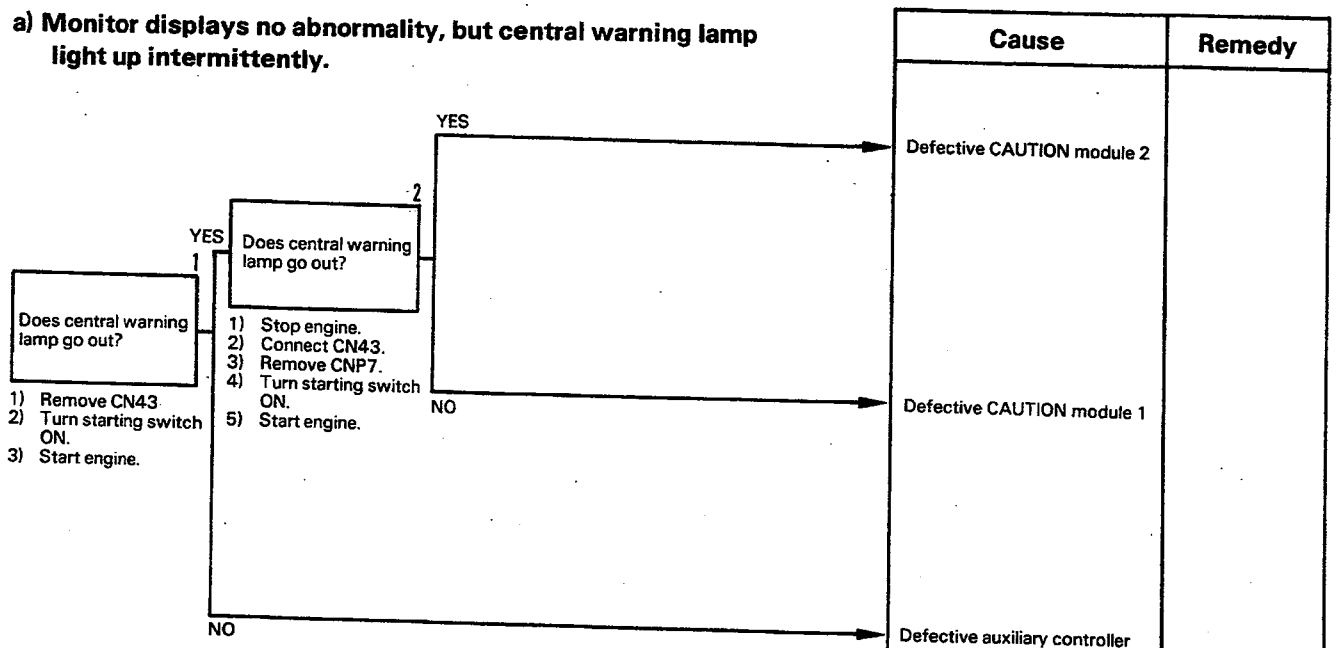

| Cause | Remedy |
|---|---|
| Defective speedometer module | Replace |
| Defective contact, or disconnection in wiring harness between CNP10 (female)(4) and CN39 (female)(1) | After inspection, repair (clean) or replace |
| Bulbs broken in both head lamps (low beam lamps) (If the low beam bulb is broken, the pilot lamp will not light up even if the switch is turned to HIGH BEAM.) | After inspection, repair (clean) or replace |
| Defective speedometer module | Replace |
| Defective contact, or disconnection in wiring harness between CN15 (female)(9) and combination switch | After inspection, repair (clean) or replace |
| Defective contact, or disconnection in wiring harness between CN15 (female)(12) and combination switch | After inspection, repair (clean) or replace |
| Defective contact, or disconnection in wiring harness between CN15 (male)(12) chassis ground | After inspection, repair (clean) or replace |

| Troubleshooting tools | Tester | |
|---|---|---|
| | T-adapter (for DLI) | T-adapter or socket adapter (for Econoseal) |

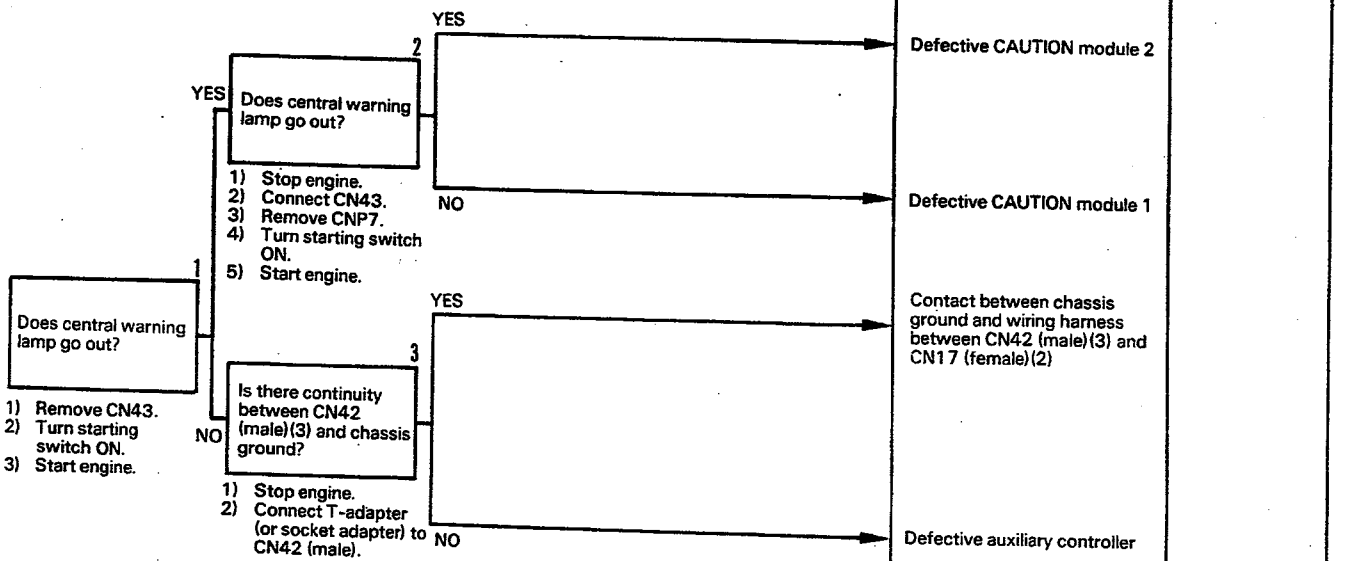
## M-24 CENTRAL WARNING LAMP DOES NOT GO OUT

★ When disconnecting connectors to connect the T-adapter (or socket adapter), turn the starting switch OFF.
★ When connecting the T-adapter (or socket adapter), connect to the connector specified in ( ).
★ After checking, connect the disconnected connectors again immediately.

**a) Monitor displays no abnormality, but central warning lamp light up intermittently.**

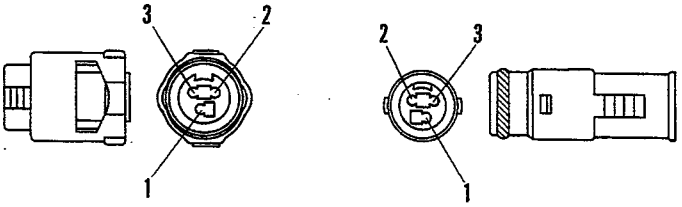


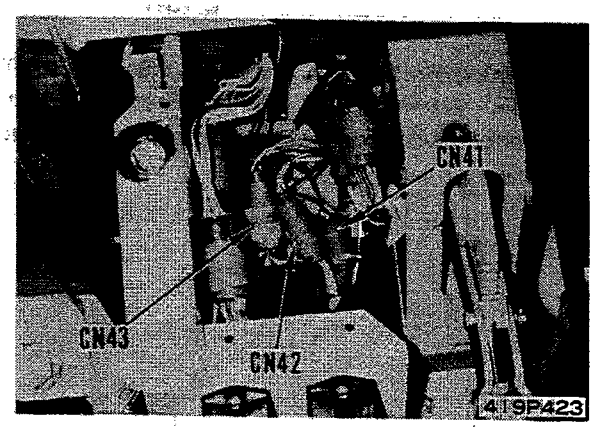

**b) Central warning lamp stays on continuously.**



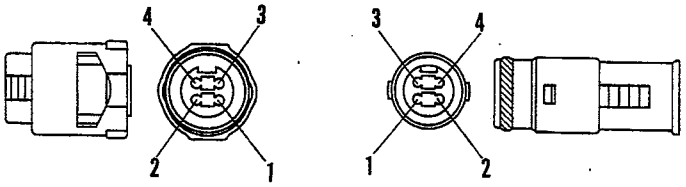

| Troubleshooting tools | Tester | |
|---|---|---|
| | T-adapter or socket adapter (for Econoseal) | |

## CN42

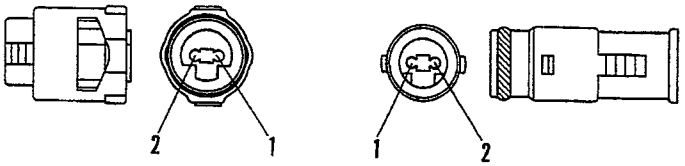


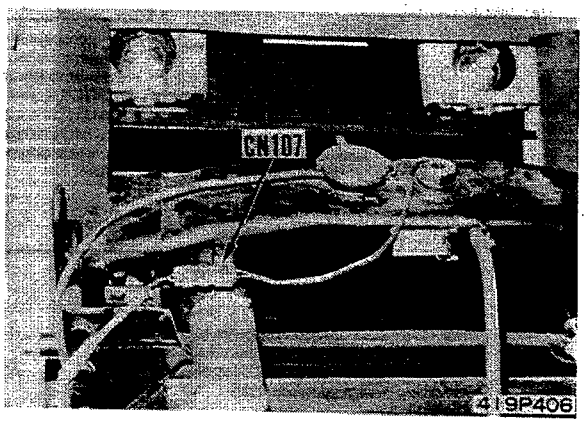




## CN43




## CN107

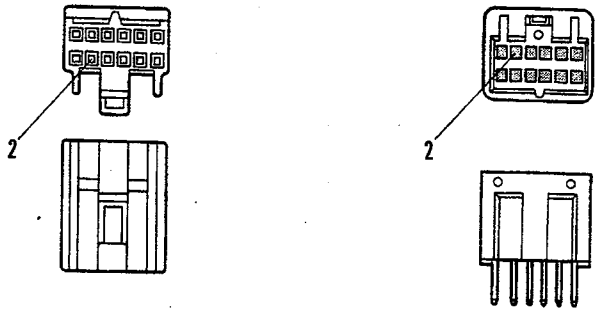


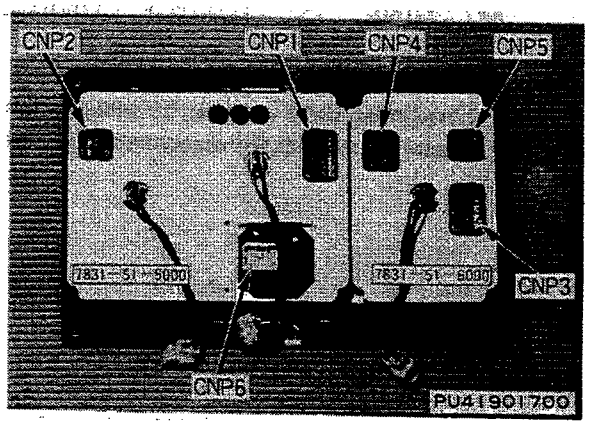



# TROUBLESHOOTING CHART FOR ELECTRONIC VEHICLE MONITORING SYSTEM (M-1 TO M-32)

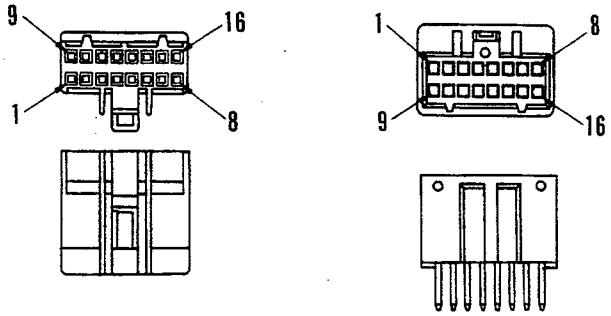
## WA300-1 Serial No. 20001 and up, WA320-1

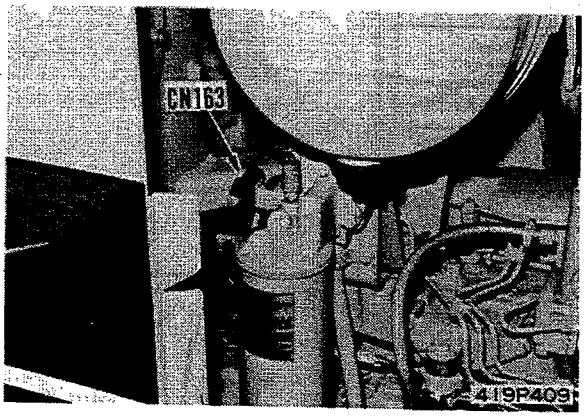
### CNP2



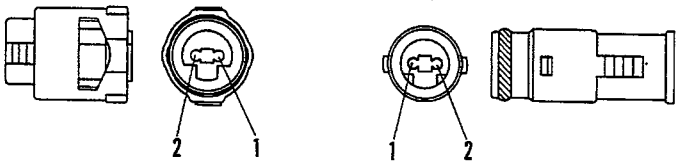




### CNP3



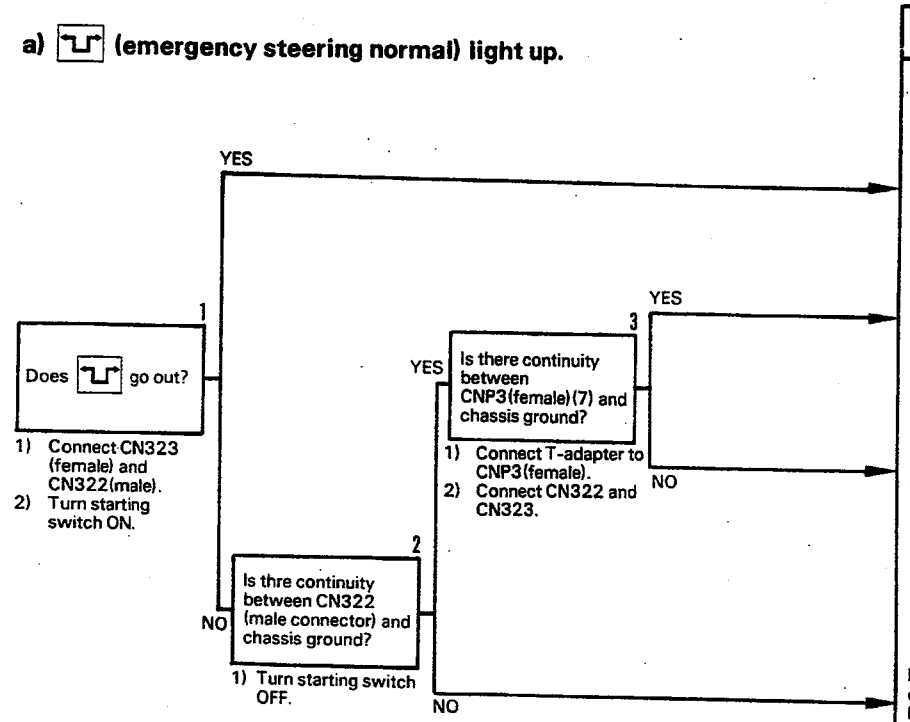

### CN310



## M-16 [ ] (EMERGENCY STEERING NORMAL) LIGHTS UP OR DOES NOT LIGHT UP (IF EQUIPPED)

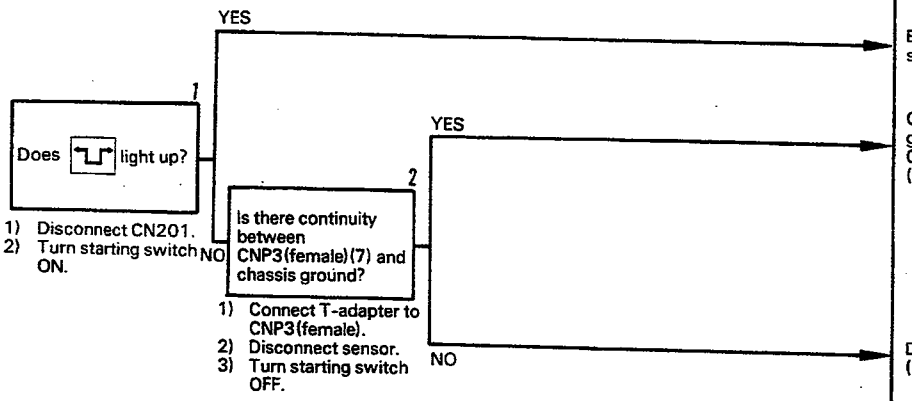
★ When disconnecting connectors to connect the T-adapter (or socket adapter), turn the starting switch OFF.
★ When connecting the T-adapter (or socket adapter), connect to the connector specified in ( ).
★ After checking, connect the disconnected connectors again immediately.

### a) [ ] (emergency steering normal) light up.




| Cause | Remedy |
|---|---|
| Emergency steering NORMAL sensor defective | Replace |
| Defective module (7851-51-6000) | Replace |
| Defective contact, or disconnection in wiring harness between chassis ground—CN322(male)—CN323(female)—CN149 connector—CNP3(female)(7) | After inspection, repair (clean) or replace |
| Defective contact, or disconnection in wiring harness between CN322 and chassis ground | After inspection, repair (clean) or replace |

### b) [ ] (emergency steering normal) does not light up.

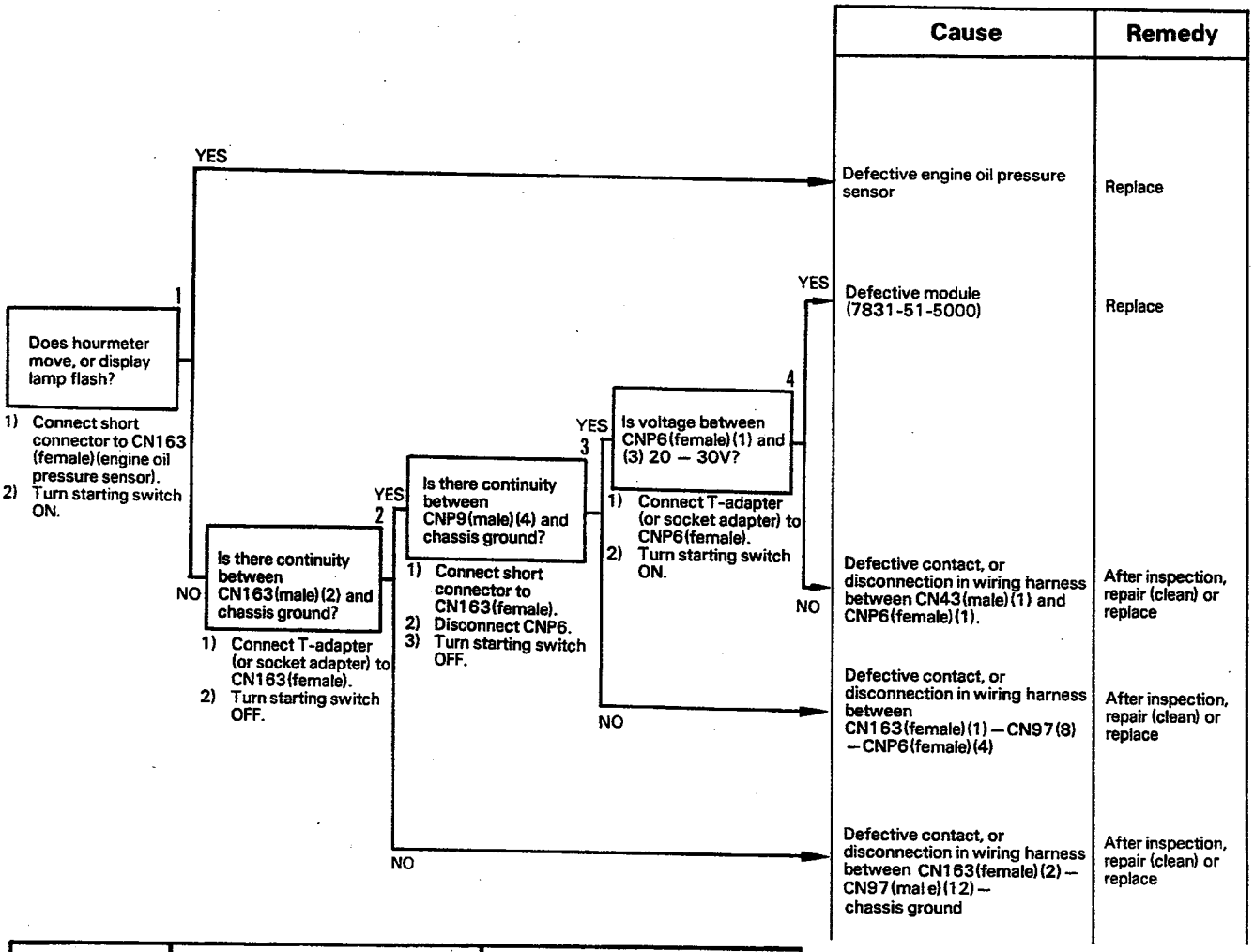



| Cause | Remedy |
|---|---|
| Emergency steering NORMAL sensor defective | After inspection, repair (clean) or replace |
| Contact between chassis ground and CN323(female) — CN149(connector) — CNP3 (female)(7). | After inspection, repair (clean) or replace |
| Defective module (7851-51-6000) | Replace |

| Troubleshooting tools | Tester | |
|---|---|---|
| | T-adapter (for DLI) | |

## M-20 HOURMETER DOES NOT WORK NORMALLY

★ When disconnecting connectors to connect the T-adapter (or socket adapter), turn the starting switch OFF.
★ When connecting the T-adapter (or socket adapter), connect to the connector specified in ( ).
★ After checking, connect the disconnected connectors again immediately.

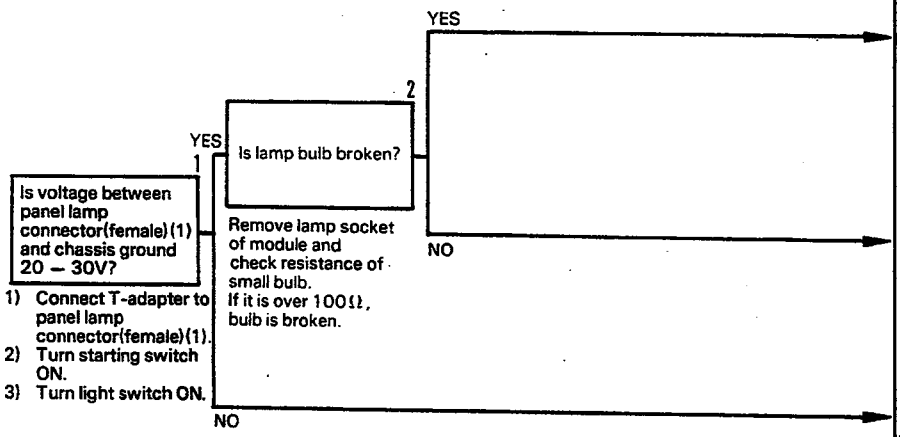



| Troubleshooting tools | Tester | Short connector |
|---|---|---|
| | T-adapter (for DLI) | T-adapter or socket adapter (for Econoseal) |

## M-27 SOME OF PANEL LAMPS ON MACHINE MONITOR DO NOT LIGHT UP

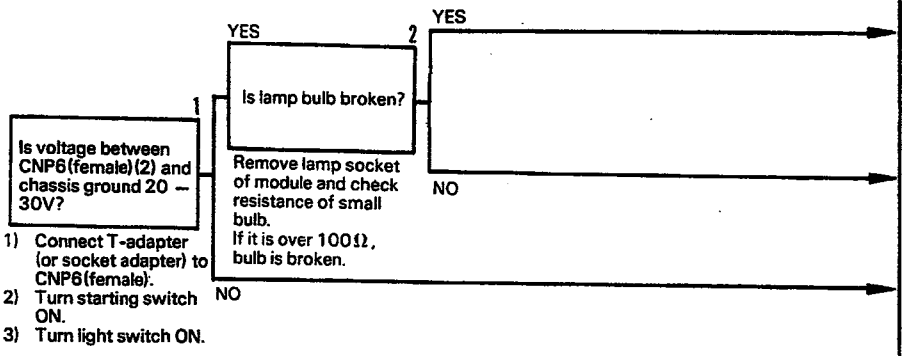
★ When disconnecting connectors to connect the T-adapter (or socket adapter), turn the starting switch OFF.
★ When connecting the T-adapter (or socket adapter), connect to the connector specified in ( ).
★ After checking, connect the disconnected connectors again immediately.

### a) Panel lamps of monitor module do not light up.




| Cause | Remedy |
|---|---|
| Defective lamp | Replace |
| Defective contact, or disconnection in wiring harness between lamp socket and connector. | After inspection, repair (clean) or replace |
| Defective contact, or disconnection in wiring harness between panel lamp connector (1) – CNP1(10). | After inspection, repair (clean) or replace |

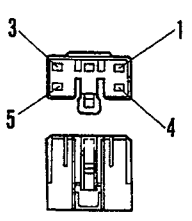
### b) Panel lamps of service meter do not light up.

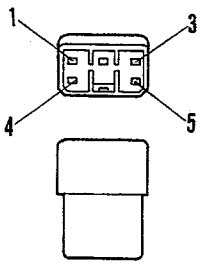


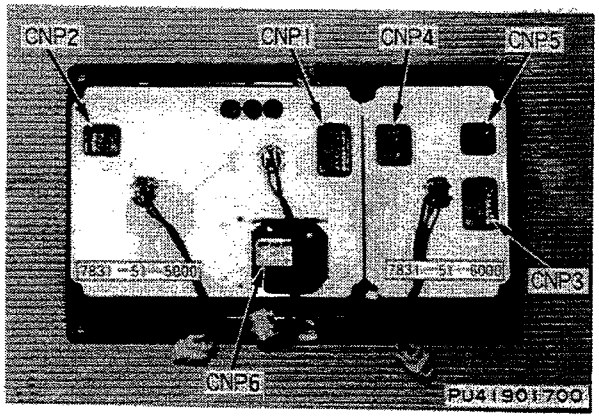

| Cause | Remedy |
|---|---|
| Defective lamp | Replace |
| Defective service meter module | Replace |
| Defective contact, or disconnection in wiring harness between CN26(female)(1) – CN25(female)(1) – CNP6 (female)(2). | After inspection, repair (clean) or replace |

| Troubleshooting tools | Tester | T-adapter or socket adapter (for MIC) |
|---|---|---|
| | T-adapter (for DLI) | T-adapter or socket adapter (for Econoseal) |

### CNP6



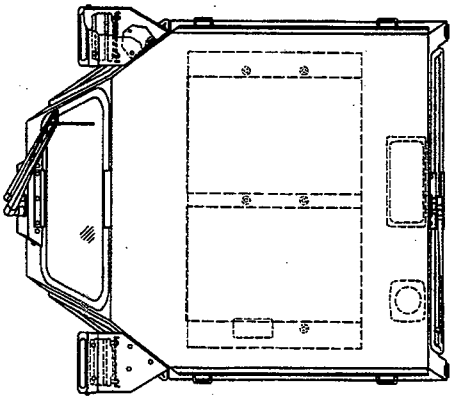



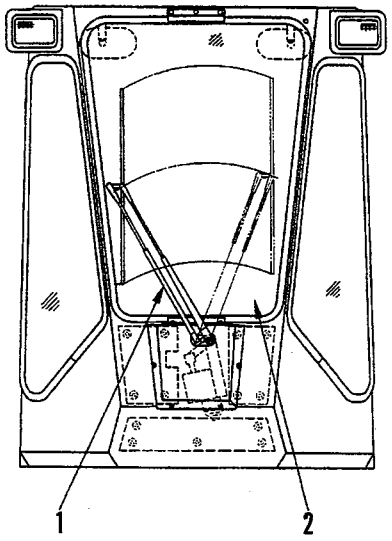



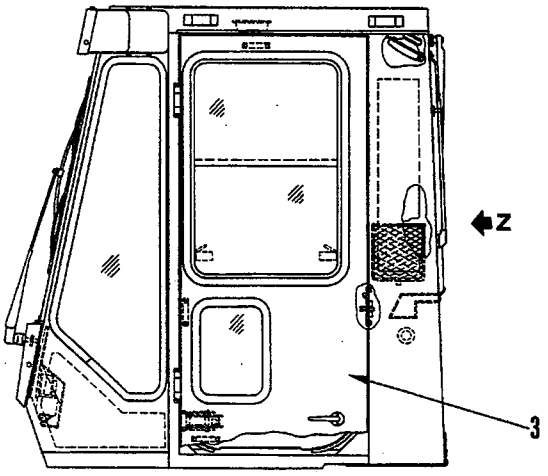
# TABLE OF MONITOR REFERENCE VALUES

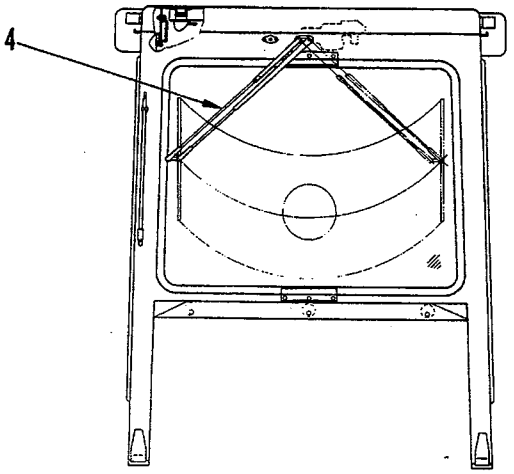
| System | Equipment name | Connector No. | Inspection method, Judgement | Condition for measurement |
|---|---|---|---|---|
| Vehicle monitor | Brake fluid level sensor | CN86(male) | **Shorting connector**<br>1) Case where a shorting connector is used; The sensor is faulty if the indication is as follows.<br>When shorting connector is connected — Monitor is out<br>When CN86 is disconnected — Monitor is lit | 1) Starter switch "ON" |
| | | | **Continuity**<br>1) Case of continuity test; The sensor is normal if the indication is as follows.<br>When brake fluid level is normal — No continuity<br>When brake fluid level is low — Continuity | 1) Starter switch "OFF" |
| | Engine oil level sensor | CN96(male) | **Shorting connector**<br>1) Case where a shorting connector is used; The sensor is faulty if the indication is as follows.<br>When shorting connector is connected — Monitor is out<br>When CN96 is disconnected — Monitor is lit | 1) Starter switch "ON" |
| | | | **Continuity**<br>1) Case of continuity test; The sensor is normal if the indication is as follows.<br>When engine oil level is normal — Continuity<br>When engine oil level is low — No continuity | 1) Starter switch "OFF" |
| | Radiator water level sensor | | **Shorting connector**<br>1) Case where a shorting connector is used; The sensor is faulty if the indication is as follows.<br>When shorting connector is connected — Monitor is out<br>When CN107 is disconnected — Monitor is lit | 1) Starter switch "ON" |

# CAB






1. Front wiper
2. Front glass
3. Door
4. Rear wiper

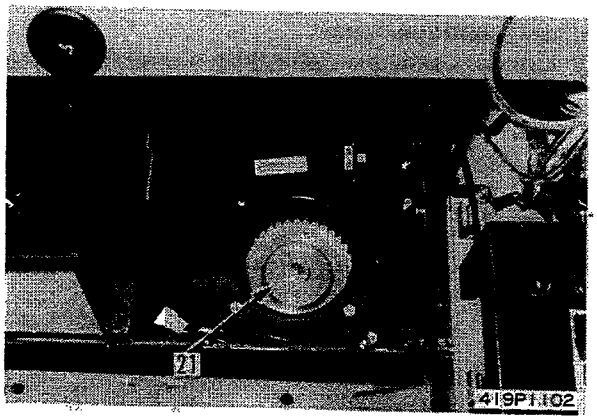
View Z

419F114

**6. Air blower**

Remove mounting bolts, then remove air blower (21).

★ Be careful not to damage the seal at the contact face between the air blower and the air conditioner unit.



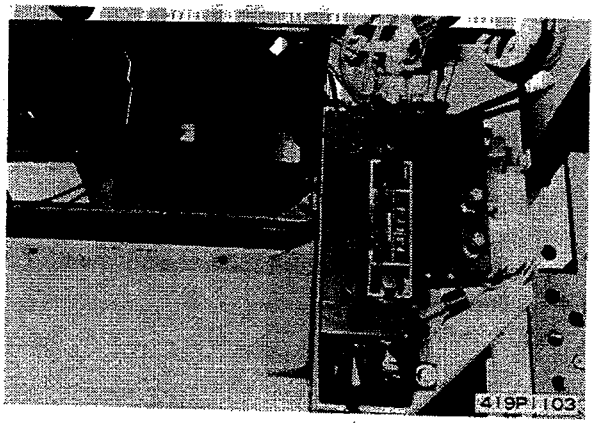

**7. Air conditioner unit**

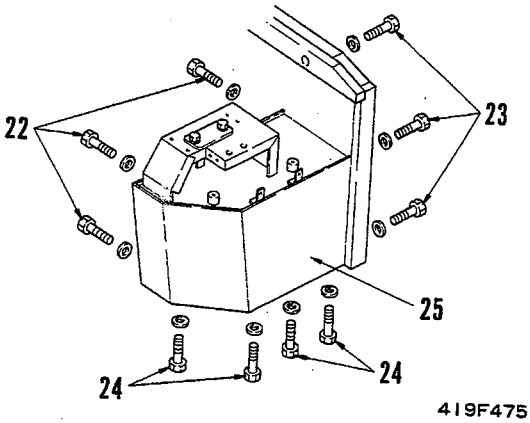
Remove mounting bolts (22), (23) and (24), then remove air conditioner unit (25).

★ Move the air conditioner unti outside the cab, then lift off.

★ Be careful not to damage the connector of the air conditioner hoses.

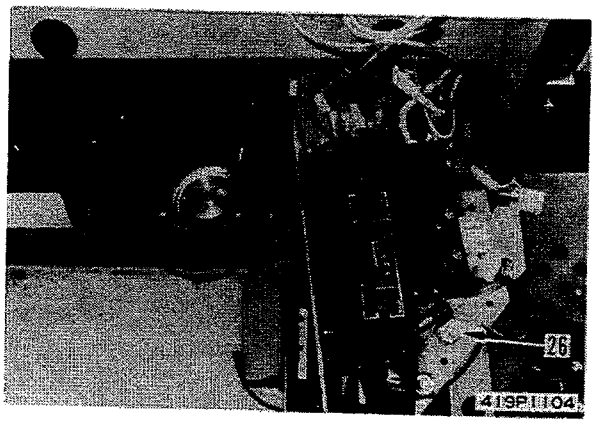
kg Air conditioner unit: **80 kg**




★ When repairing the inside of the air conditioner unti, follow Steps 1 – 4, then remove cover (26).

- When removing the cover, disconnect the connectors of the air conditioner wiring and the temperature regulator cable, then remove the cover.



- **"TRAPPING" PHENOMENON OF THE OIL**

When a gear pump is rotating with the gears in mesh as shown in the drawing at right, in some instances two sets of gear teeth are in mesh while in other instances only one set of the gear teeth is in mesh. When two sets of the teeth are in mesh simultaneously, the oil in the space between the meshed gear teeth will be trapped inside – the front and rear exits will be completely shut.

This is called the "trapping" phenomenon of oil.

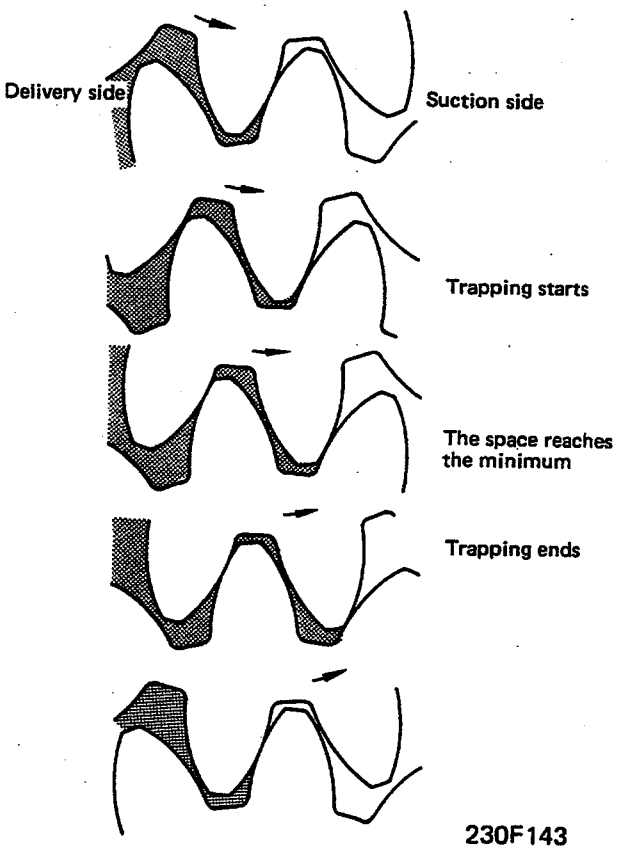
The space in which the oil is trapped moves from the suction side to the delivery side as the gears rotates. The volume of the space gradually decreases from the start of trapping until the space reaches the center section, and then gradually increases after leaving the center section until the end of trapping.

Since the oil itself is non-shrinkable, a reduction of the volume of space will greatly increase the oil pressure, unless some prosion is made to relieve oil pressure. The high pressure oil will cause the pump to make noise and vibrate.

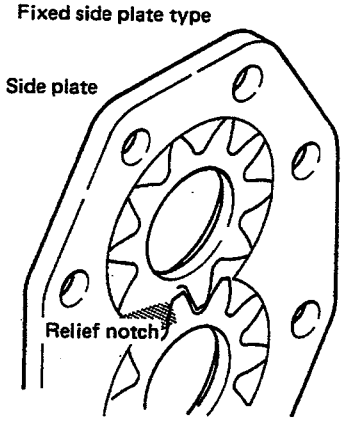
To prevent this, relief notches are provided on the side plates to release the oil to the delivery side.

As shown in the drawing below, the relief notches are provided in such a way that the oil can be relieved from the trapping space to the delivery side when the volume of the space is reduced.

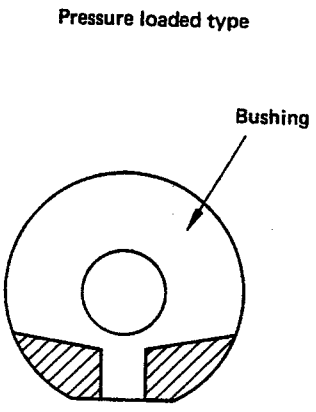
Relief notches are also provided on the suction side to prevent the formation of a vaccum in the space by allowing the oil to enter the space from the suction side when the space is expanded.




230F143




230F144




230F145

Note 1) If it is impossible to raise the pump speed to the value shown in the table because of limitations of the test bench, calculate the allowance for the delivery from the following formula:

$$Q = Q_0 - \frac{(N_0 - N)\,Qth}{1000}$$

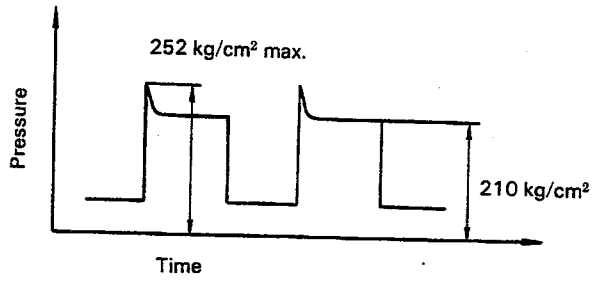
however, N≧ 1000 rpm
where, N: RPM of test bench
Q: Repair limit for delivery at N rpm (liters/min)
$N_0$: RPM in the table (liters/min)
$Q_0$: Repair limit for delivery in the table
Qth: Capacity code

Note 2) If the test bench allows the pump to raise its delivery pressure above 140 kg/cm² but not above 210 kg/cm², use the repair limit for delivery given in Table, No. 1.

Note 3) For pumps whose service pressure exceeds 50 kg/cm² in operation, use Table, No. 1. (Do not use Table, No. 2)

Note 4) The volumetric efficiency of a pump decreases after the pump is reassembled. After reassembly, therefore, perform the following tests with a test bench or flowmeter kit (790-303-1001).

(1) Shock test
20 times




(2) Performance test (measure the delivery)