KOBELCO

# SHOP MANUAL

## LOADER BACKHOE

# TLK700
# TLK800
# TLK900

TLK/US/092 NA

NOTES

NOTES

**Cooling system**

| | |
|---|---|
| Turbo-charged engines | Piston cooling by oil spray |
| Engine coolant | Water/air radiator with pump assisted thermo syphon circulation. |
| Temperature | Thermostat opens at 77-82°C (170-180°F) - fully open at 92-96°C (198-208°F) |
| System pressure | 0.7 bar (10 lbf/in$^2$) |
| Engine lubricating oil | Oil/air type cooler mounted in front of water radiator (turbo-charged engines only). |
| Powershuttle | Oil/air type cooler mounted in front of water radiator |
| Hydraulic oil cooler | Oil/air type cooler mounted in front of water radiator. |
| Air conditioning condenser | Mounted in front of oil coolers |
| Fan belt tension | 13 - 19 mm ($^1/_2$" - $^3/_4$") measured midway between fan pulley and crankshaft pulley. Twin belts fitted with air conditioning. |

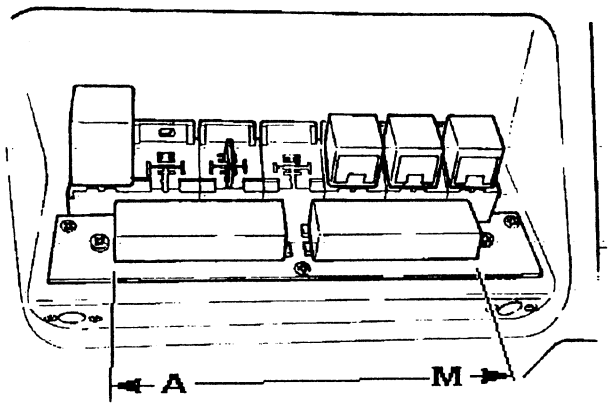
**Transmission**

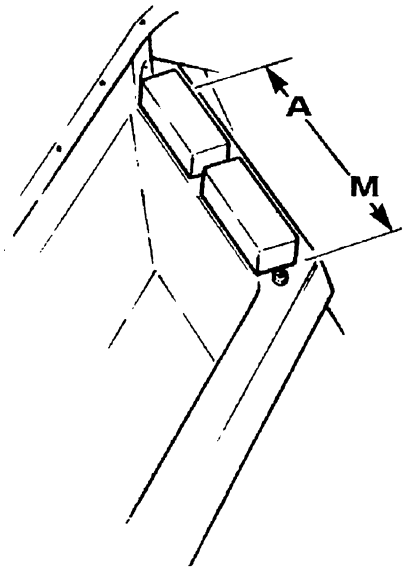
| | |
|---|---|
| Powershuttle | 4 forward and 4 reverse speeds.<br>All speed shifts are fully synchronised.<br>Forward and reverse direction shift is made by multi-plate, oil cooled, hydraulic clutches. |
| Torque converter | Single stage, two phase type, with a torque multiplication ratio 2.87:1. |
| Drive axle - rear, 750/860/865 | Spiral bevel crown wheel and pinion driving through epicyclic hubs. Mechanical differential lock. |
| Drive axle - front, 4WD-750/860/865 | Side mounted, power take - off pod containing a multi-plate, oil immersed drive clutch provides drive via a shaft, to the front axle crown wheel and pinion. Front axle drive is engaged by a switch on the main control panel. Clutch is pressure applied and spring released. |
| Axles - 965 | Side mounted, power take - off pod containing a multi-plate, oil immersed drive clutch which provides drive via a shafts, to the front and rear axles. Front axle drive is engaged by spring pressure, and released by oil pressure.<br>Mechanical differential lock in rear axle. |
| 5th speed (some models) | A direct drive gear which bypasses the torque converter for high efficiency road travel. The fifth speed is selected by a switch on the main control panel. |

## FUSES

**Fuses - Front compartment**
(top illustration)
Fuse values given below are continuous ratings, 'blow ratings' are double the continuous values.

| *Fuse position* | *Rating* | *Circuits protected* |
|---|---|---|
| A | 5 amp | Right tail and side lights, instrument illumination, No. plate light |
| B | 10 amp | Turn indicators, brake and warning lights and gauges |
| C | 15 amp | Hazard warning lights |
| D | 10 amp | Forward/reverse, 5th speed, de-clutch switches, reverse alarm |
| E | 10 amp | Horn |
| F | 5 amp | Speedometer, low servo brake pressure (965 only) |
| G | 5 amp | Left tail and side lights |
| H | 10 amp | Dip beam headlight |
| J | 10 amp | Main beam headlight |
| K | 5 amp | Handbrake warning light, audible warning |
| L | 10 amp | 4 wheel drive solenoid |
| M | 10 amp | Unloader valve |

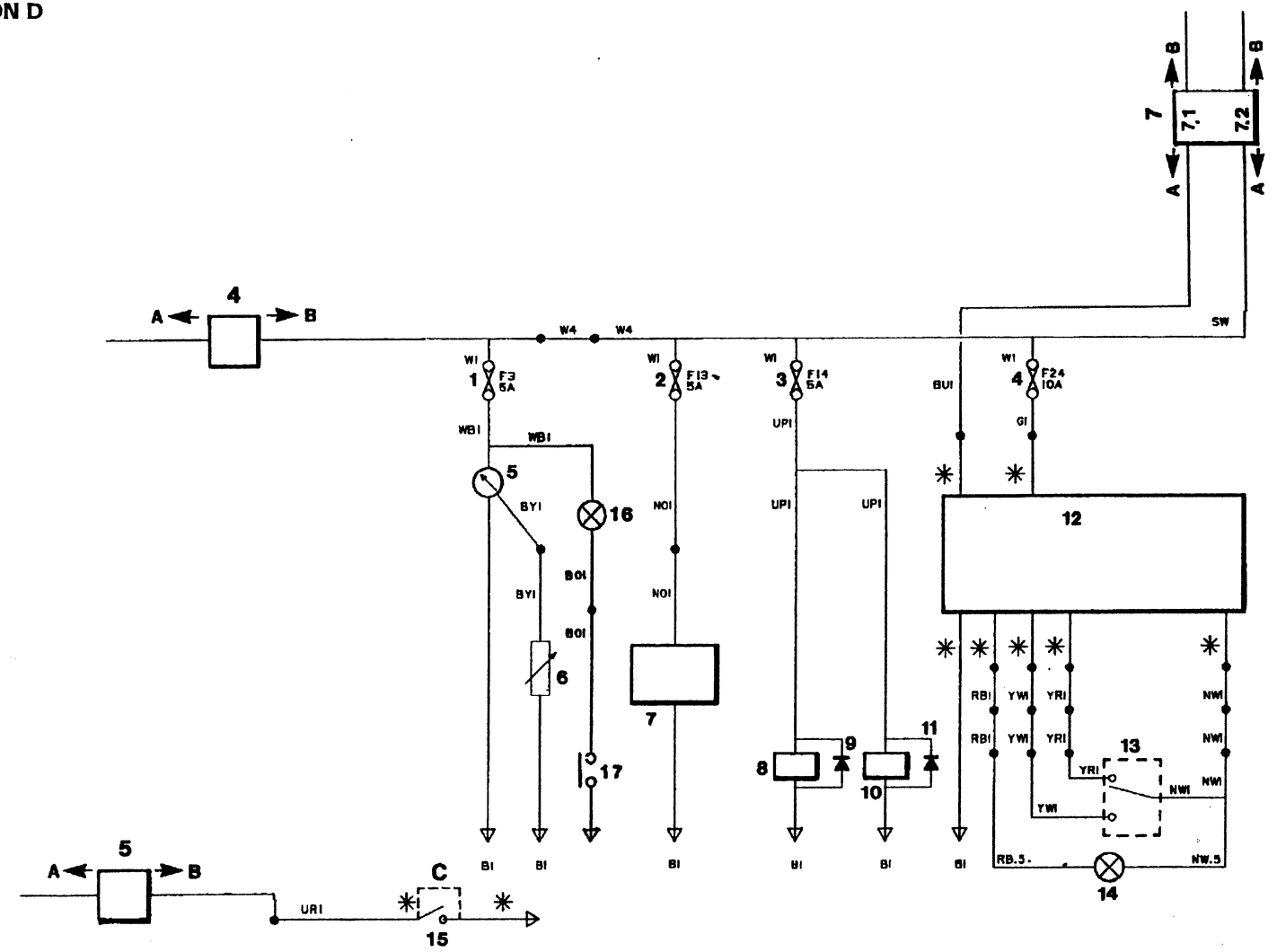



**Fuses - Side compartment**
(bottom illustration)

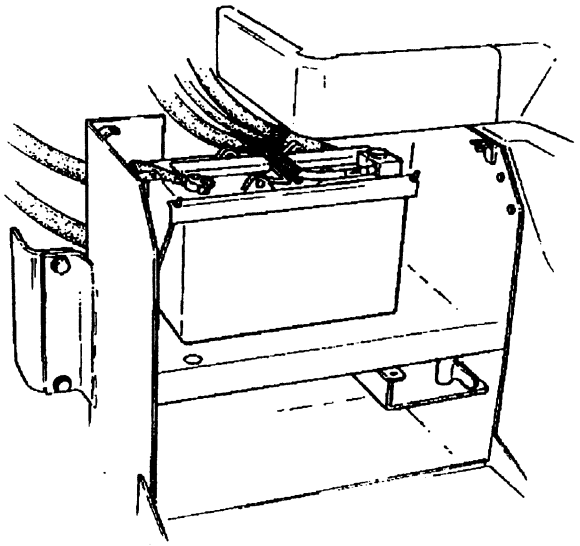
| *Fuse position* | *Rating* | *Circuits protected* |
|---|---|---|
| A | 10 amp | Hydraulic Management Unit (electronic controls) |
| B | 10 amp | Clamp or craning (boom cylinder lock) valve, backhoe Quick-Attach, aux. hydraulics, interior light, radio |
| C | 5 amp | Wash/wipe enable, heater enable |
| D | 5 amp | Fuel shut-off |
| E | 15 amp | Rotating beacons |
| F | 10 amp | Screen wipers and washers, front and rear |
| G | 25 amp | Heater, air conditioning |
| H | 25 amp | Cigar lighter |
| J | 5 amp | Tachometer, water temp. gauge, fuel gauge, warning light module |
| K | 10 amp | Rear horn, Return to Dig (mechanical controls) |
| L | 25 amp | Front and rear worklights |
| M | 15 amp | Thermostart |

**WIRING DIAGRAM**
**SECTION D**



## FITTING THE BATTERY TO A MACHINE

1. Battery must be clean and dry with the vent manifolds firmly fitted.
2. Smear the terminals with petroleum jelly or proprietary compound, (lubricating grease and silicone materials will assist electrolytic corrosion).
3. Ensure the battery tray contains no stones or objects that may crack the battery case.
4. Ensure the terminal polarity is correct.
5. Terminal connections must be tight , but do not over-tighten.
6. Check alternator belt tension.



## BATTERY SAFETY

- NEVER add electrolyte to an already charged battery.
- To avoid personal injury when checking, testing, or charging the battery, keep sparks, exposed flames, and lighted cigarettes away from the battery. Lead acid batteries generate explosive gases when charging or when the engine is running. Always check the electrolyte level with the engine stopped. Wear safety glasses and chemical resistant gloves when working with batteries.

NOTES

## 3/3 • 07
## ALTERNATOR OUTPUT
### Test

**Special equipment**

Test bench, or fitted to the machine
0 - 100 A ammeter x 2
0 - 30 V voltmeter
Photo-tachometer
Variable resistor - 70 A / 20 V capacity

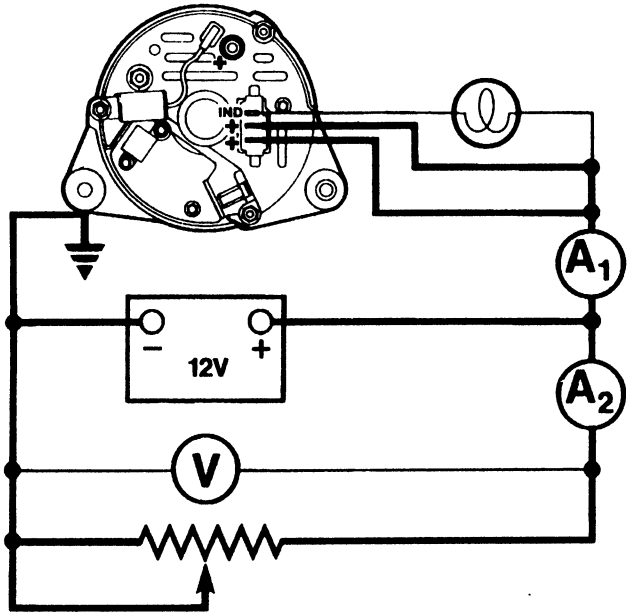
1. Connect alternator into the circuit shown, but do not run the alternator.

⚠ **NOTE: this test can be done while the alternator is still fitted to the machine, but if so disconnect all vehicle wiring from the alternator and use slave leads, battery and bulb.**

2. Adjust the variable resistance until ammeter No. 2 registers equal to or just above the alternator maximum rated output.
3. Run alternator at slowly increasing speed.
4. At approximately 1500 rev/min. (542 engine rev/min.) and 13.5 V, the warning light should extinguish. At 6000 rev/min. (2168 engine rev/min.) ammeter No. 1 should register:

   **A 127 - 55 55 amps**

   **A 127 - 65 65 amps**
5. If the proper output is not achieved, disconnect the suppression capacitor and repeat test.
6. If output still unsatisfactory, check rectifier diodes, rotor resistance and stator windings.



## SPECIFICATIONS

The M127 starter is fitted with a 2 stage power switching solenoid to provide low power indexing until the pinion fully meshes with the ring gear, when full power is switched on.

M127 starters have a roller clutch fitted to the pinion for overspeed protection.

It is essential that sealed type starter motors are fitted to machines with torque convertor transmissions.

**M127 Starter motor**

| | |
|---|---|
| Yoke diameter | 127 mm (5.0 inch) |
| Lock torque | 45 Nm (33 lbf ft) |
| Lock torque current/voltage | 1160 A at 5.0 V |
| Torque at 1000 rev/min | 20,8 Nm (15 lbf ft) |
| Current/voltage at 1000 rev/min | 640 A at 8.0V |
| Light running speed | 5500 - 8000 rev/min |
| Light running current/voltage | 115 A at 11 V |
| Pinion, end clearance when engaged | 0,14 - 1,14 mm (0.005 - 0.045 inch) |
| New brush length | 24,5 mm (1.0 inch) |
| Renew brushes at | 8 mm (0.3 inch) |
| Spring pressure in working position with new brushes | 11,6 - 15,5 N (42.6 oz) |
| Armature end float | 0,14 - 0,60 mm (0.005 - 0.025 inch) |
| Commutator, minimum diameter | 38 mm (1.5 inch) |

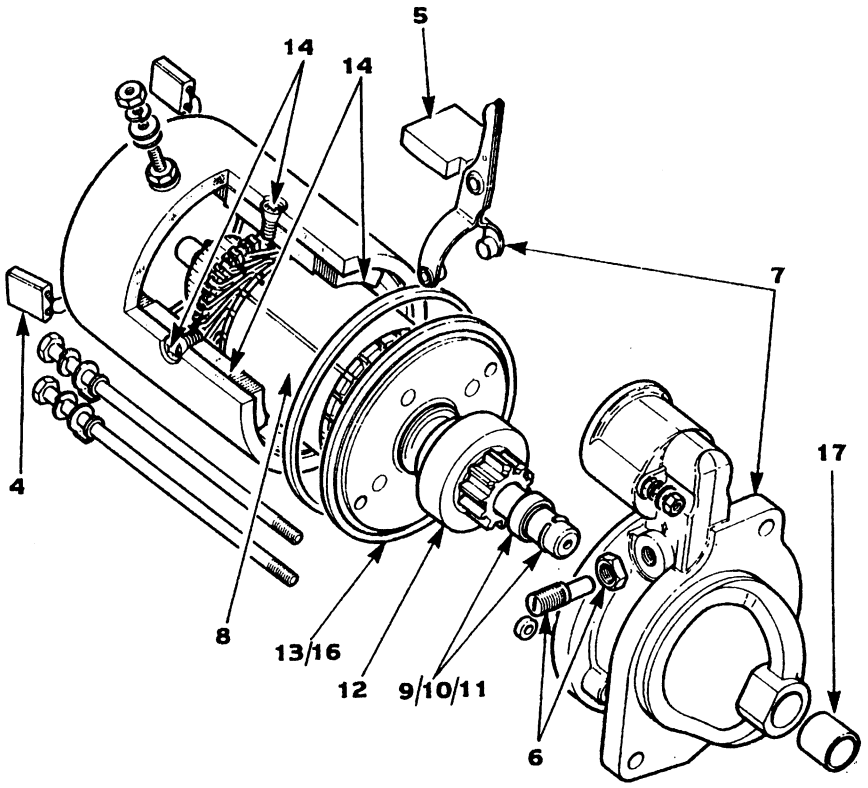
## 3/4 • 12
## STARTER MOTOR
### Service

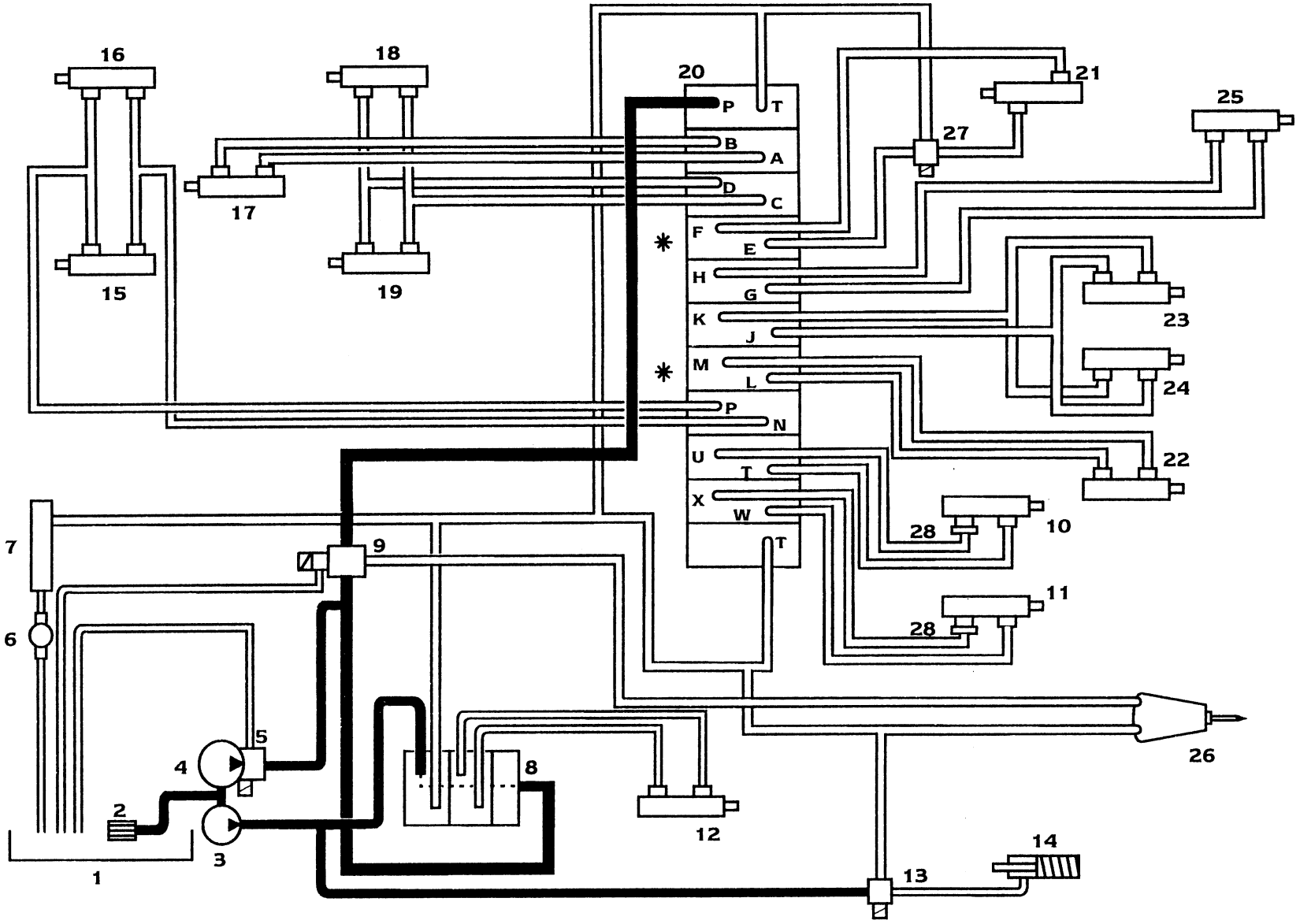
**Special equipment:**

110 volt insulation tester or ohmmeter

**Strip**

1. Remove starter motor.
2. Remove solenoid assembly per operation 3/4•11
3. Remove end-cover per operation 3/4•10.
4. Remove field winding brushes, from brush plate.
5. Remove rubber grommet.
6. Slacken lock-nut and remove pivot pin. (Pivot is eccentric to screw thread to allow adjustment of pinion gear, end-clearance.)
7. Remove housing and pinion engagement lever.
8. Remove the armature and pinion assembly, from the motor body.
9. Use a suitable tube to punch the thrust-collar towards the pinion and expose the snap-ring.
10. Remove snap-ring.
11. Remove thrust-collar.
12. Pull the pinion and roller clutch, off the armature shaft.
13. Pull the intermediate plate off the armature shaft.
14. Remove 4 screws and carefully pull the field windings from the motor body.






**750 & 860 MACHINES WITH CENTER MOUNTED BACKHOE - STANDARD (SAE) BACKHOE CONTROL PATTERN**

5

## 4/1 • 03
## SERVO PRESSURE
## Test

**Special tools**

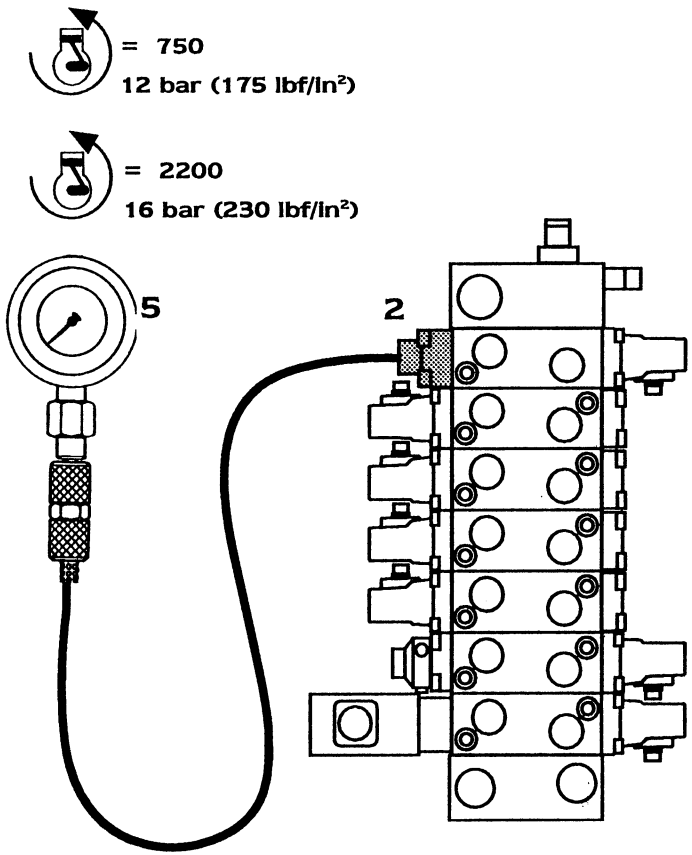
FS4 #3 Pressure test kit
(Use a gauge with a range of 0 to 50 bar)

FS4 #6 Servo pressure test plate

**Test**

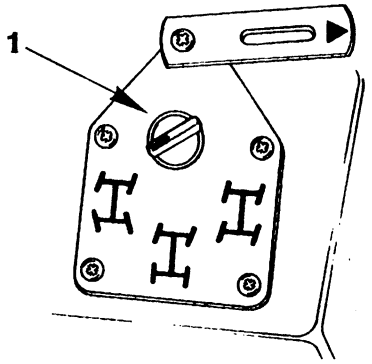
NOTE: Sideshift valve shown, use the same procedure for center mount machines.

1. Thoroughly depressurize the hydraulic system, by moving both control levers in all directions, a number of times.
2. Remove the cover plate from the clamshell bucket valve section, which is accessible from the rear of the machine, and fit the special test plate FS4 #6
3. Fit a tee adaptor and connect the hose and pressure gauge to FS4 #6.
4. Start the engine.
5. With warm oil, the gauge should read:
   **At engine idle 12 bar (175 lbf/in²)**
   **At 2200 rev/min. 16 bar (230 lbf/in²)**
6. If only 3 - 4 bar (43 - 58 lbf/in²) return line pressure is indicated, the servo valve is faulty and this low pressure will not drive the spools. Service the servo valve per operation 5/1•12
7. A pressure of approximately 18 bar (260 lbf/in²) indicates that the servo pressure maintaining valve is stuck in the closed position and the safety valve is operating instead. Service the servo valve per operation 5/1•12.



## OPERATION OF THE SYSTEM AND CONTROLS

1. **Steering mode switch** - 965 only.
   2 wheel steer.
   4 wheel steer.
   Crab steer.
   Before driving the machine on a road, select 2 wheel steer and flip down the plate to lock the switch in that position.

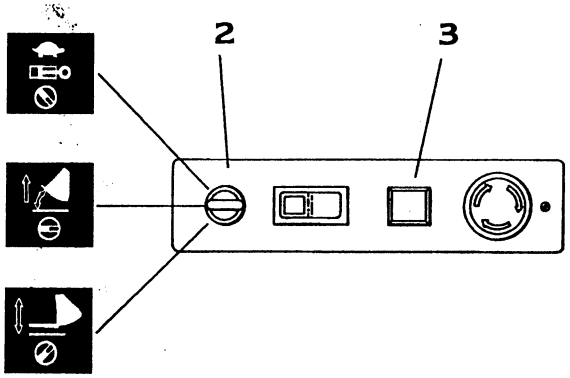



2. **Mode control switch**
   This provides three modes of operation.

Switch in this position provides flow from the smaller pump only.

Switch in this position provides normal bucket operation with two pumps in circuit.

Switch in this position provides true parallel lift for use with forklift attachments or the 7 in 1 bucket with optional forks. The angle of the forks can be changed using the joystick and immediately the electronic system will maintain the new angle while lifting or lowering.

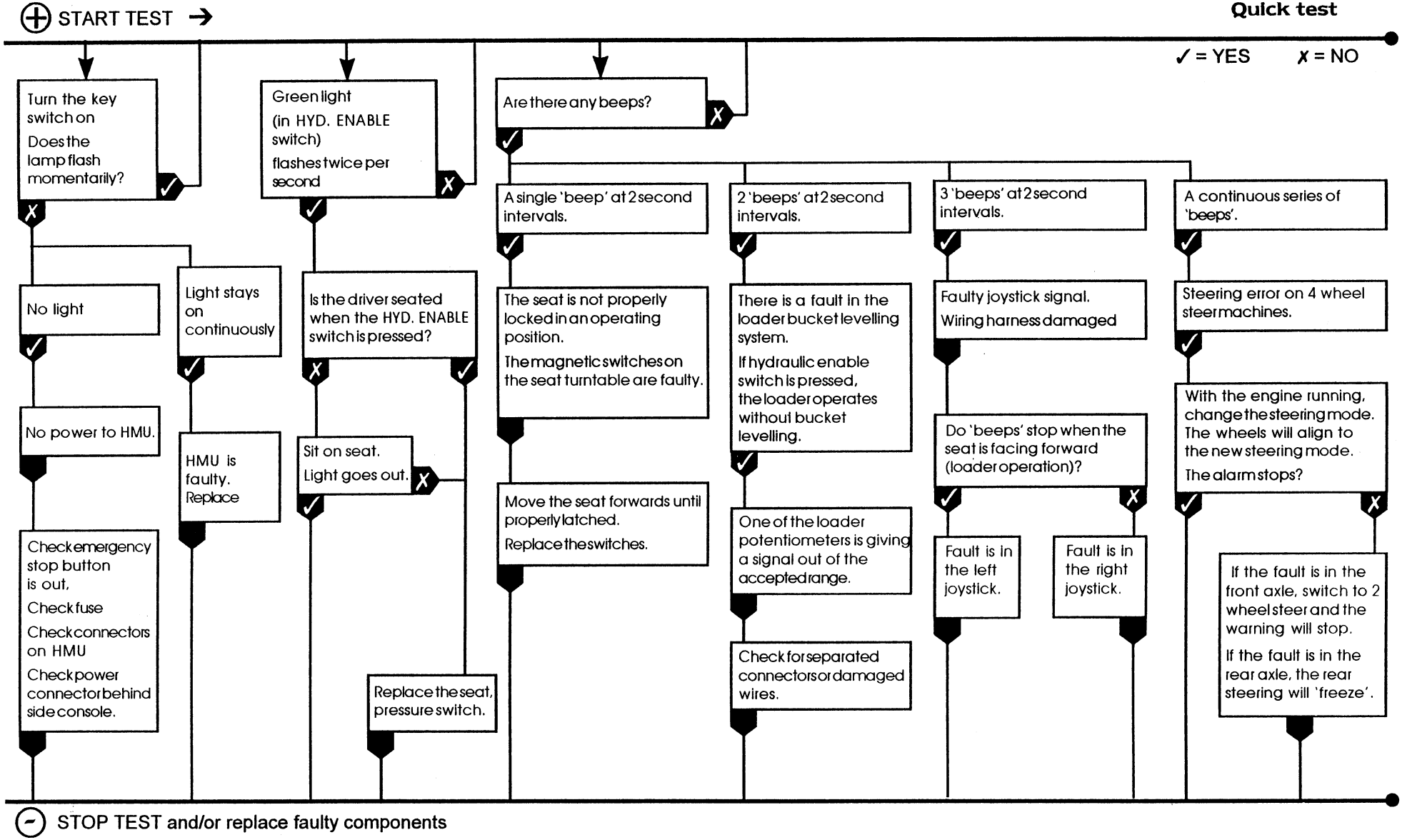



3. **Fault warning light.**
   This red light flashes momentarily at switch-on, to show that both the computer and warning light are functioning. If the light glows continuously there is a fault within the computer.

# FAULT DIAGNOSIS

**no test equipment**





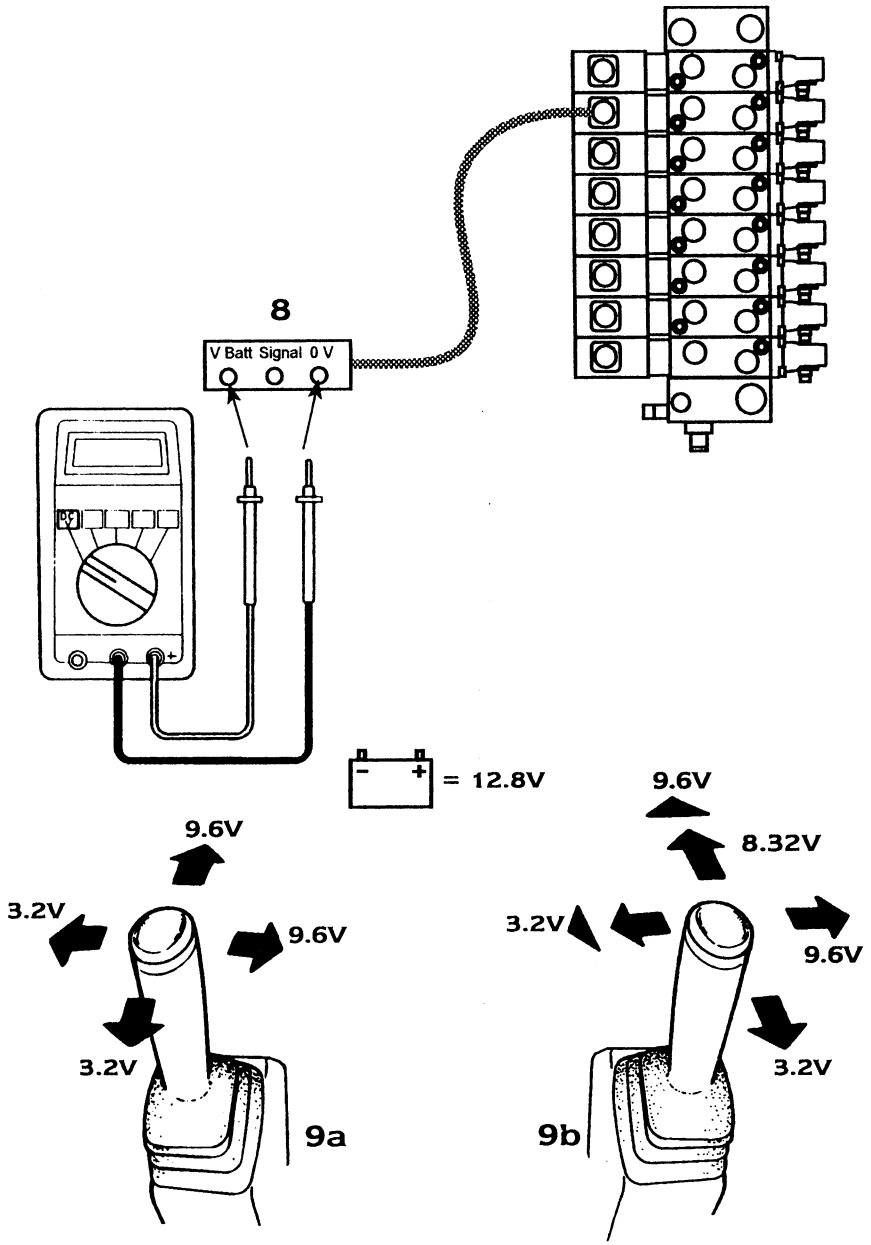
8. Plug the multimeter '+' lead into the signal socket.

9a. Standard Spool Sections - Move the appropriate joystick and note how the voltage changes and the limits it reaches.
The voltage should range from 25% to 75% of battery voltage.
A tolerance of ± 3% is allowed.

9b. Loader Spool Section - Move the right joystick back and the voltmeter should show a smooth reduction of signal voltage down to 25% of battery voltage.
Move the joystick forwards until additional spring pressure is felt and the meter should show 65% of battery voltage.
Move the joystick fully against the forward travel limit and the meter should indicate 75% of battery voltage.

10. Move the opposite joystick to measure the neutral voltage which should be 50% of battery voltage. By moving the opposite joystick there is no risk of accidental movement causing a false reading.

11. If no signal voltage is shown there may be a broken or disconnected wire.



**Test 5**

1. Press 

   The screen will show three values. With the joystick in neutral, the values shown are typical.

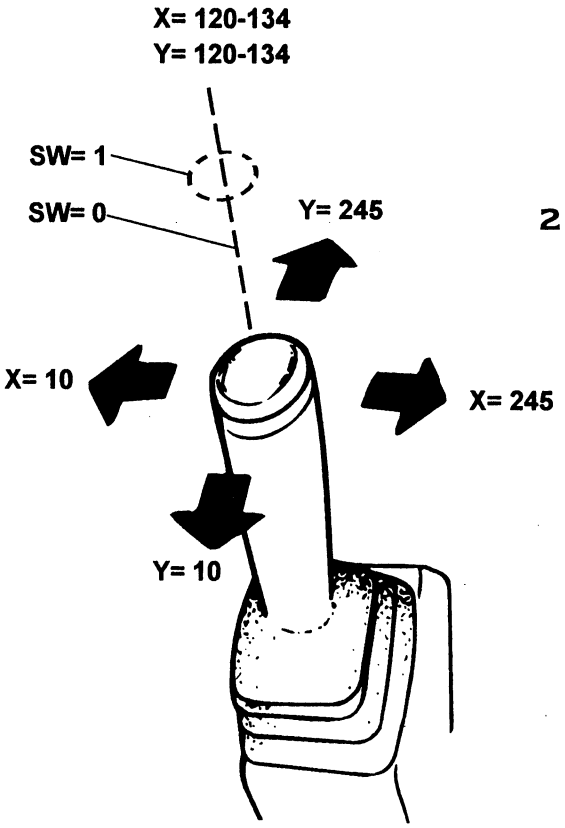
   **5: LH JOYSTICK**
   **X=127 Y=125 SW=0**

2. The diagram shows the appropriate values that should be displayed as the lever is moved through each axis. Values for X and Y should increase and decrease smoothly as the joystick is moved.

   Displayed values less than 5 or greater than 250, indicate a broken/ disconnected wire or faulty joystick.

3. The switch is 'off' in neutral and 'on' when the joystick is moved in any direction.

1




2

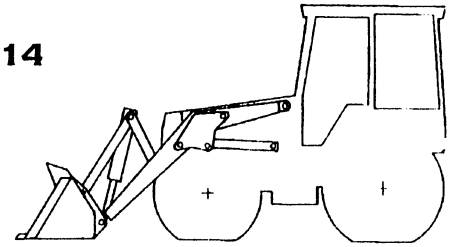
14. The display will show:

> **Use RH joystick. Lower loader to safe posn. Then press HYD ENABLE**

Lower the bucket flat on the ground.

Press 

14



**If a 2 wheel steer machine is being calibrated, the Elektron terminal will now jump to step number 19.**

**Steps 15 thro' 18 are for 4 wheel steer machines only.**

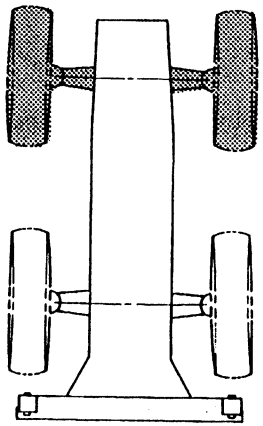
15. The display will show:

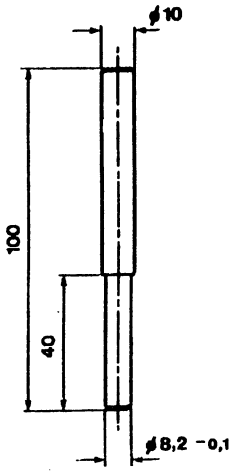
> **Steer front axle straight. Then press HYD.ENABLE**

Steer the front wheels to the straight ahead position, by aligning the outside edge of the front wheels with the top corners of the bucket.

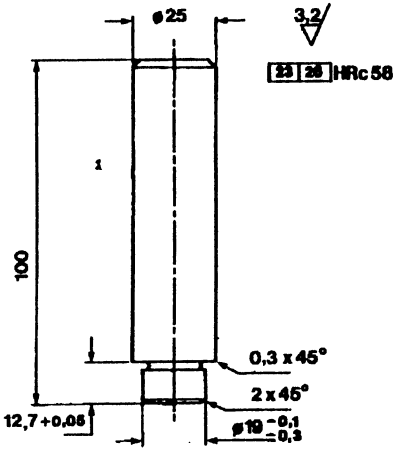
Press 

15

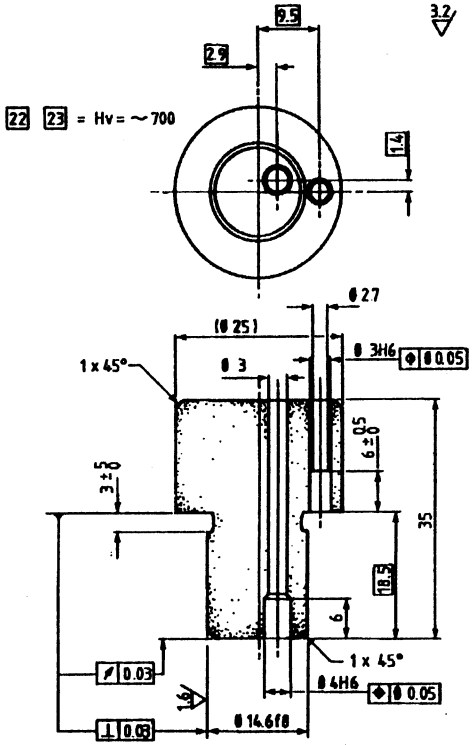




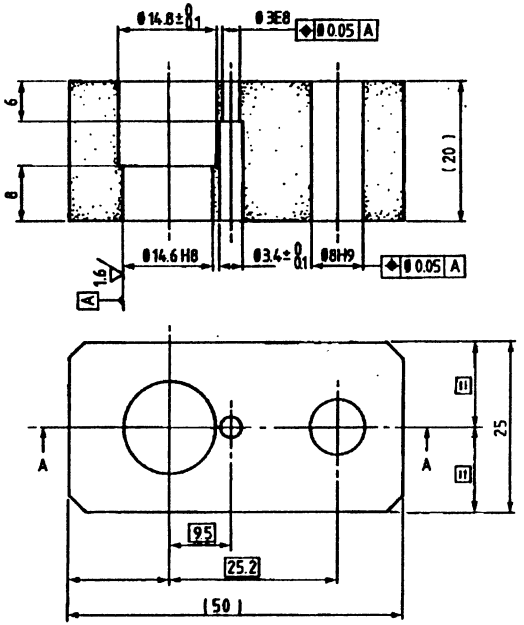

FS5 #1




FS5 #4




FS5 #3



**Caution**

A spool can be removed for inspection while the valve is still on the machine, but it is very important to thoroughly clean the valve assembly and surrounding area, before removing a spool and then take particular care to avoid introducing dirt into the valve during service work.

**Do not drop a spool, it may never work properly again.**

**Careless handling and dirt ingress can cause serious damage.**

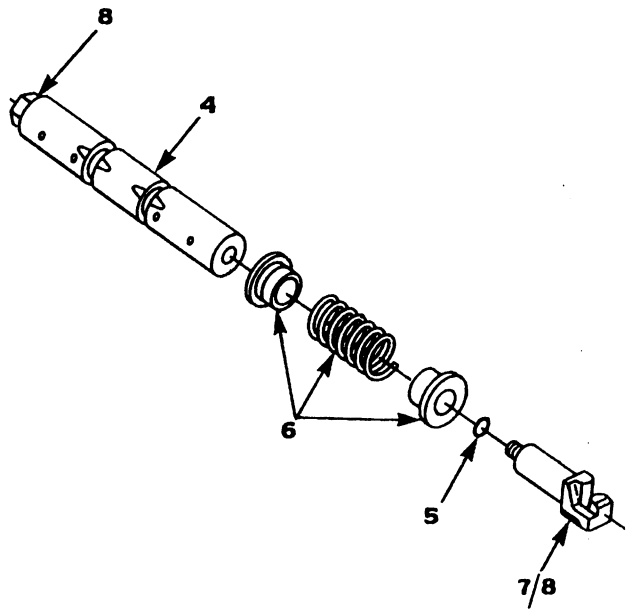
**Remove**

1. De-pressurize the hydraulic system by moving the control levers in all directions, refer to operation 4/2•03 for electronic controls.
2. Position a drain tray under the manual actuator that is to be removed.
3. Remove manual actuator housing per operation 5/1•02
4. Pull the spool out of the valve body

**Further stripping of the spool is not recommended due to the difficulty of holding the spool without damage to the working surface and edges. However, it may be that the actuator hook has loosened or has been stripped in error and if so, assemble the spool as follows:**

**Standard spring** (all spools except loader beam spool)

5. Fit a new "O" ring.
6. Slide one spring cap onto the actuator hook, followed by the spring and the second cap. (Both spring caps are identical)



## 5/1 • 09
## BASIC VALVE SECTION
## Service

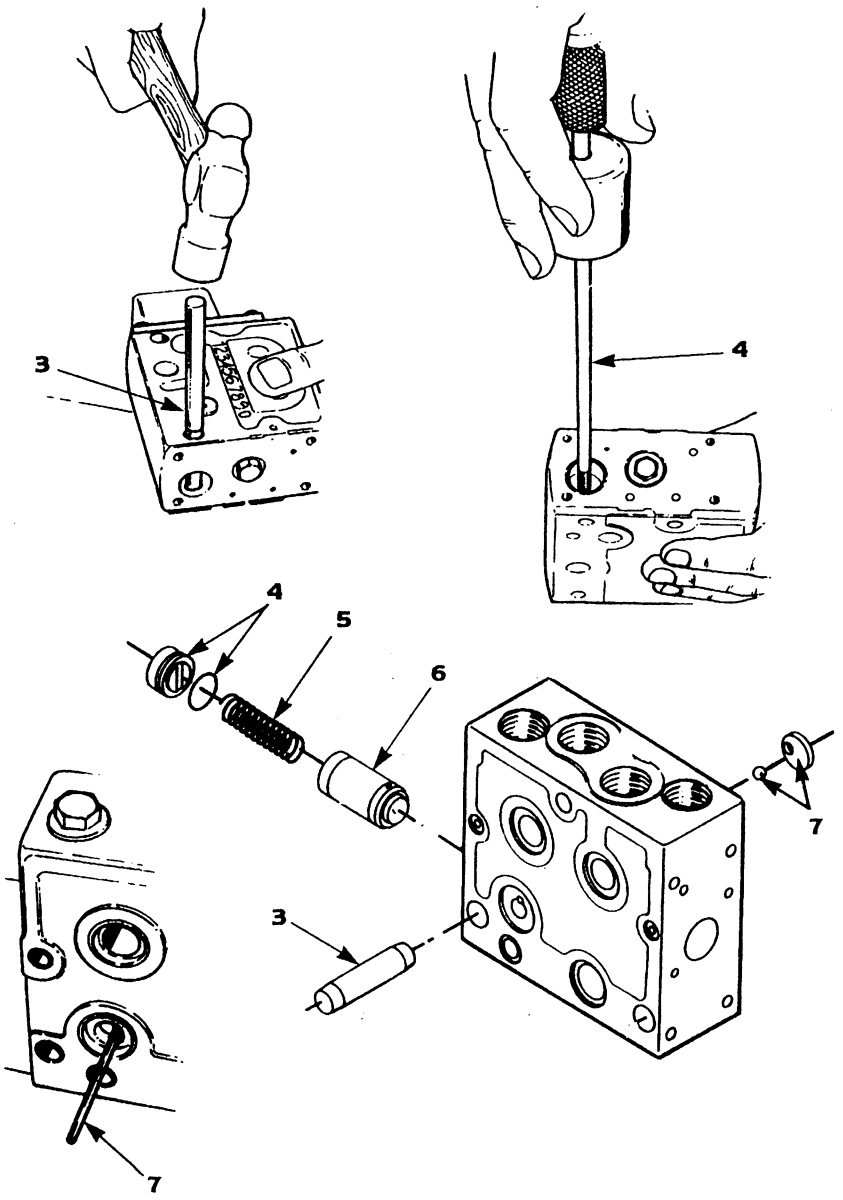
**Strip**

Valve sections are similar for the purpose of strip and rebuild except for the backhoe slew section, and this is covered separately.

Refer to the valve assembly charts to ensure the correct components are used during assembly and for the location and pressure setting of circuit relief valves.

1. Remove valve assembly from the machine per operation 5/1•04 or 5/1•05.
2. Strip the valve stack per operation 5/1•06.
3. Fit special tool FS5 #1 into the tube and gently punch it out of the valve body.
4. Remove plastic cap. Fit special tool FS5 #2 to the plug and remove the plug. Discard the 'O' ring.
5. Remove spring.
6. Remove check valve.
7. Insert a small diameter punch (approx. Ø 4 mm) through the pressure compensating port and carefully knock out the shuttle valve and seat from the opposite side of the valve section.

⚠ **Do not remove this shuttle valve unless the proper special tool FS5 #3 is available for assembly.**



## 5/2 • 06

## CHECK VALVE

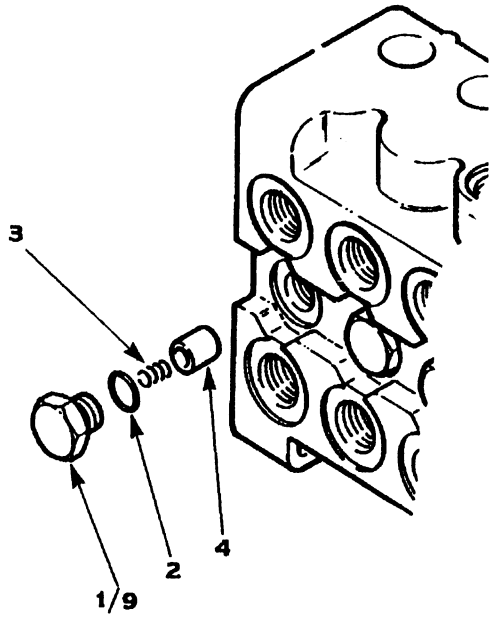
### Remove and Refit

**Remove**

1. Unscrew plug.
2. Remove and discard the 'O' ring.
3. Remove the spring.
4. Remove check valve poppet.
5. Inspect poppet and seat for any wear, dents or erosion.

**Refit**

6. Centre the poppet in the cavity.
7. Insert the spring into the hole in the poppet.
8. Lubricate the new 'O' ring with oil and install it on the check plug. Do not cut or over stretch the 'O' ring.
9. Tighten the check valve plug to 20 to 27 Nm (15 to 20 lbf ft).



NOTES

## 5/5 • 02
## SOLENOID VALVE
### Seals

Maintenance is limited to replacement of the external seals on the valve spool.

1. Remove the nut and coil from the valve spool.
2. Unscrew the valve spool.
3. Remove and discard 'O' rings and back-up ring.
4. Check the valve bore and seal groove for damage.
5. Fit new 'O' rings and backup ring as shown.

   A. 'O' ring

   B. Back-up ring
6. Install the valve spool into the body then fit the coil and nut.

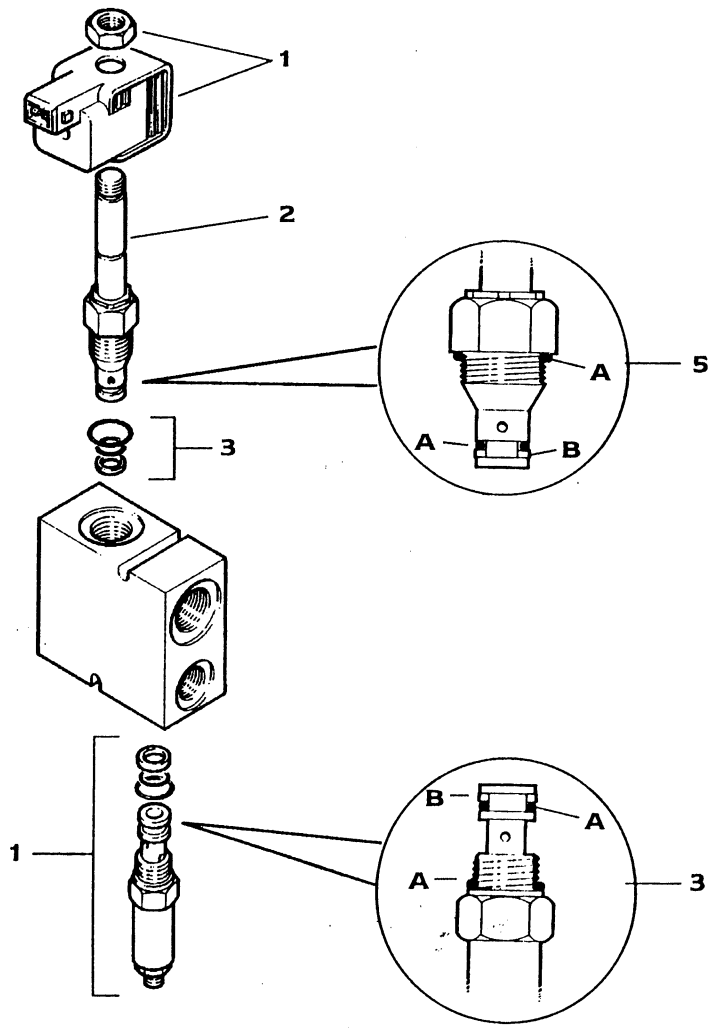
## 5/5 • 03
## RELIEF VALVE
### Seals

Maintenance is limited to replacement of the external seals on the valve cartridge.

1. Remove the valve cartridge from the valve body and discard the 'O' rings and back-up ring.
2. Check the valve bore and seal groove for damage.
3. Fit new 'O' rings and back-up ring as shown.

   A. 'O' ring

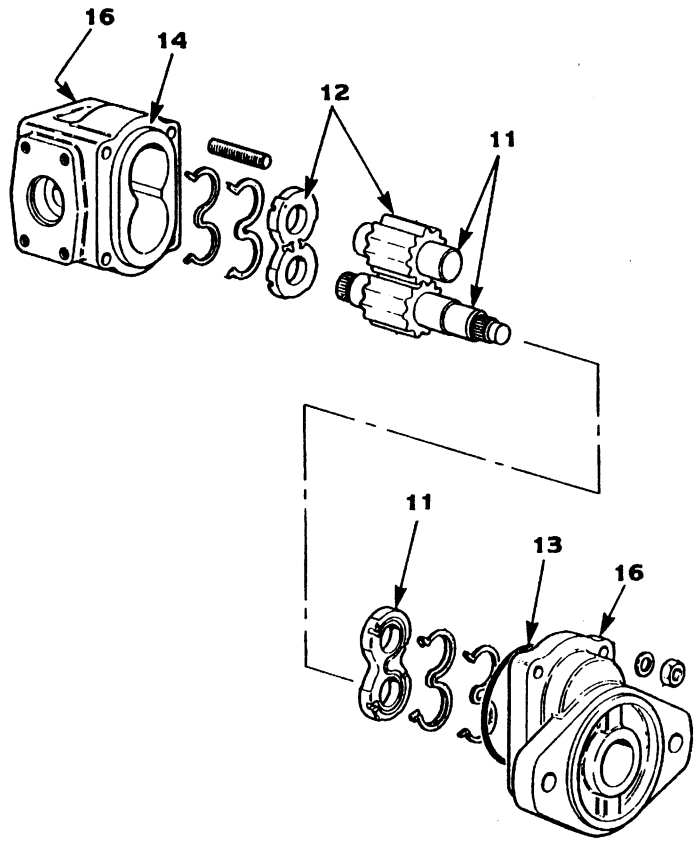
   B. Back-up ring
4. Install the valve cartridge into the valve body.



11. Note positions of gears in the body and the position of the side plates, for correct assembly. Pull the driveshaft and side plate from the body.
12. Remove the driven gear and other side plate. Note position for correct assembly.
13. Remove and discard all 'O' rings and seals and clean all sealant from flange/ body and end-cover/body, joints.

**Inspection**

14. Inspect for damage, the 'O' ring grooves and the recess for the seal in the mounting flange.
15. The pumps must be renewed if:
    a) The gear "cut-in" on the low pressure side of the body, is deeper than 0.15 mm (0.006 in.) or has a scored and matt appearance.
    b) The gear side faces are scored. Operation in contaminated hydraulic oil often results in a distinct wear step, coincident with the root diameter of the gear teeth, coupled with corresponding wear on the side plates.
    c) There is a noticeable wear groove on the driveshaft, where the seal touches.
    d) The driveshaft splines are worn or damaged by fretting.
    e) The bushes are worn so that the bronze backing is visible through the PTFE coating. The bush faces should also be free from marks.
16. Ensure that the mounting flange and end-cover faces, which contact the 'O' rings, on the body, are free from marks which could cause external leakage.



NOTES

## 7/1 • 06

## HYDRAULIC CYLINDER

### Service

Application

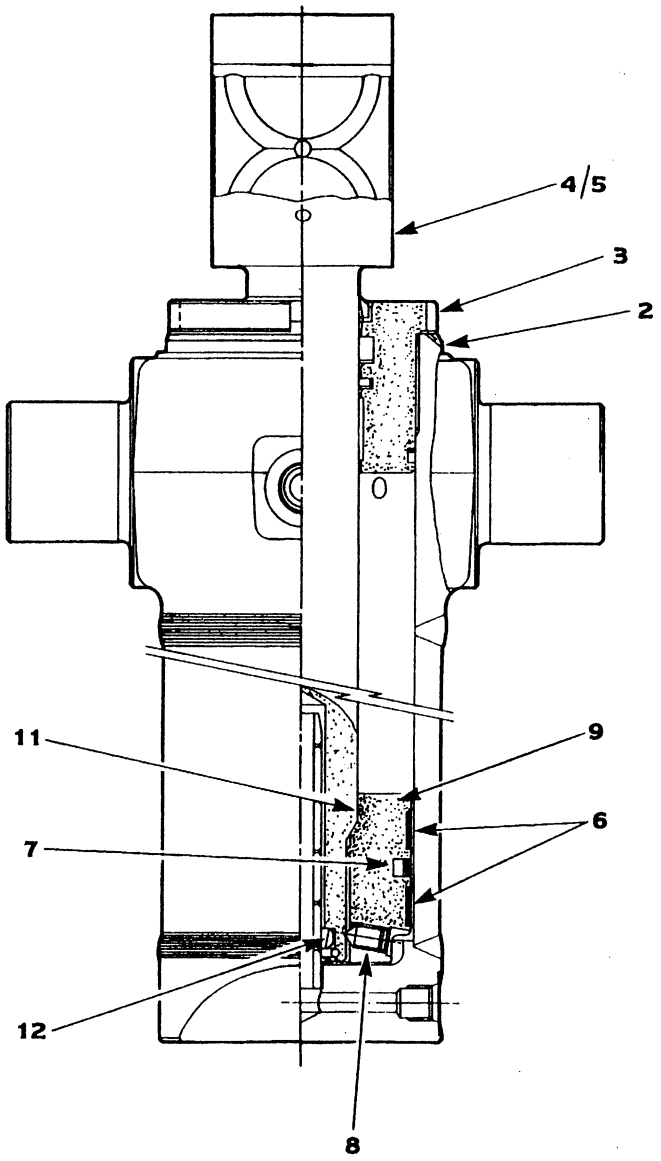
Slew cylinder - 3622 124 M91
3622 137 M91

**Special tools:**

'C' Wrench
Cylinder clamp
Torque wrench
Torque multiplier

**Strip**

1. Remove hydraulic cylinder from machine and drain oil from it. Mount the trunnions in the cylinder clamp.
2. Knock back the tab washer.
3. Unscrew the bearing assembly using a heavy duty 'C' wrench, (minimum release torque 420 Nm / 310 lbf ft).
4. Pull the piston rod, piston and bearing assembly from the cylinder.
5. Mount the rod end into the cylinder clamp.
6. Remove both bearing elements.
7. Remove piston seal.
8. Remove grub screw. The piston grub screw is fitted with Loctite and may require heating to 200-250°C (390-480°F) to degrade the Loctite.
9. Unscrew piston from rod, (minimum release torque 1100 Nm / 810 lbf ft).
10. Remove 'O' ring from inside piston.
11. Prise out snap-ring from piston.
12. Note orientation of restrictor plate before removing it from the piston.



NOTES

## GENERAL

### Filtration

Following oil changes or repairs to the steering hydraulic system, start the engine, run at low idle speed and wait at least 20 seconds before turning the steering wheel. This will flush any particles through the steering valve back to the reservoir for filtering. If the steering wheel is turned prematurely, particles will be directed into the steering cylinders and take many hours to be circulated back through the filters; during which time damage to the Orbitrol steering valve may occur.

### Pressure testing

Steering and transmission systems are integrated into one hydraulic circuit on machines fitted with Powershuttle transmissions, and therefore will interact with each other. In addition to the tests described below, reference should also be made to the diagnostic processes described in the Powershuttle transmission section 13/1.

## 8/1 • 06
## STEERING PUMP
## Service

**Special tools:**

General purpose three legged puller

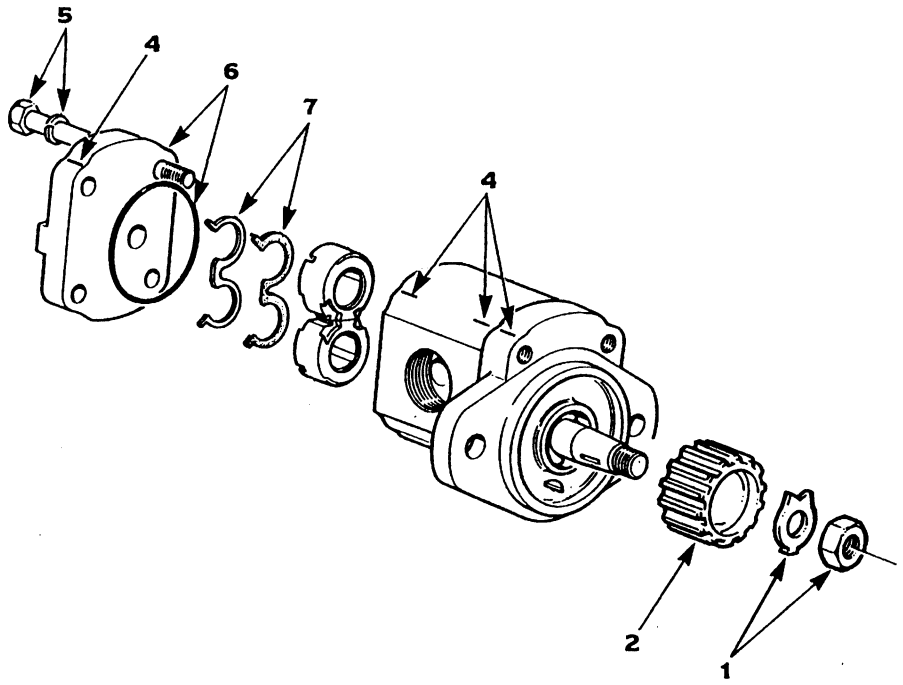
**Strip**

Steering pump is an Ultra IPX 100 A and is driven by the engine timing gears. The pump runs at twice engine speed.

Prior to removing the pump from the engine thoroughly clean the exterior of the pump and surrounding area.

1. Remove pump from engine per operation 8/1•03.
2. Remove nut and tab washer.
3. Use the three leg puller to remove the drive gear from the shaft. Do not lever or hammer the gear off the shaft, as this will damage internal components. Remove the key.

   Check for any burrs or sharp edges on the drive shaft which may cause damage to the seal during removal.
4. Mark the end-cover, body and flange to ensure correct assembly.
5. Remove bolts and spring washers.
6. Remove end-cover and body 'O' ring. Use a plastic faced mallet to seperate the end-cover from the pump body. Do not prise them apart, this will damage the mating faces.
7. Remove the bush, seal and back-up element.



**SPECIAL TOOLS:**

Cylinder fixture

Peg wrench

**Sealants**

Silicone rubber sealant.

Loctite 242

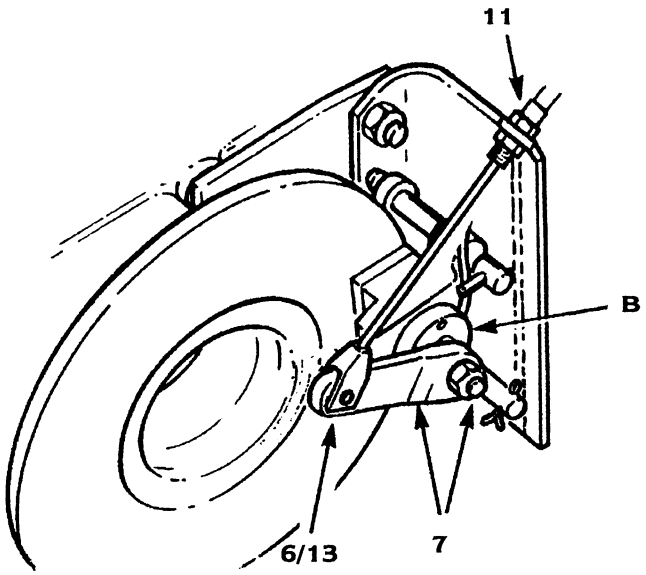
NOTES

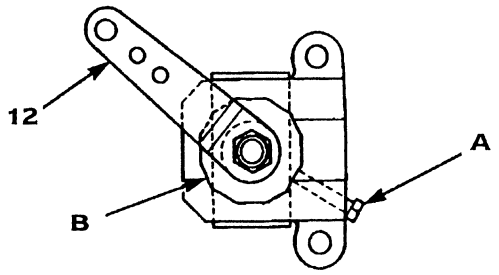
## 9/2 • 01

## PARKING BRAKE ADJUSTMENT

**Adjust**

1. Park the machine on a level area.
2. Fully dump the bucket and lower it to the ground.
3. Lower the backhoe stabilisers until they are in firm contact with the ground, but without lifting the rear wheels.
4. This operation involves working under the machine, therefore remove the start-key and attach a note to the steering wheel.
5. Release the handbrake.
6. Disconnect the cable from the lever on the brake caliper.
7. Remove the nut and lever from the splined adjuster shaft.
8. Slacken the lock screw 'A' then turn the adjuster 'B' clockwise until the pads make contact with the brake disc.
9. Back off the adjuster 'B' one flat (approx. 36°). Carefully tighten the lock screw 'A' making sure that it seats on one of the adjuster flats, not the threads. If necessary the adjuster can be unscrewed a further one flat to make sure that the lock screw is seated correctly.
10. Fully tighten the lock screw.
11. Adjust the outer cable to give maximum protrusion through the caliper mounting bracket.
12. Pull the cable clevis and align with the outer hole in the lever. Install the lever onto the splined adjuster shaft so that the cable is tight.

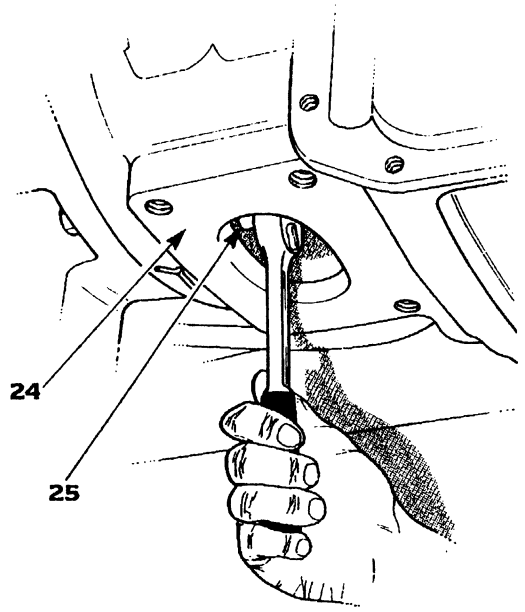


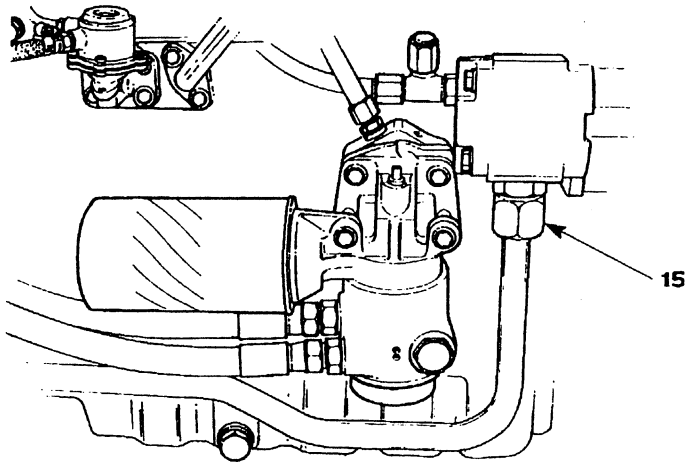




13. Fit the clevis pin and a new split pin.
14. Adjust the outer cable to eliminate all free play.
15. Check the brake disc to pad clearance with the handbrake lever fully disengaged. It should be a total of 0.3 to 0.5 mm (0.012 to 0.020 in)
16. Make sure that the handbrake fully engages by the 7th notch on the rachet.

NOTES

11. **Mechanical control machines -** disconnect and remove the feed-back linkage to the hydraulic control valve. There is a spring clevis at either end of the linkage.
12. Position a drain tray under the transmission, then remove three bolts from the flange of the pump intake pipe and drain the oil.
13. Remove the rear propshaft.
14. Disconnect the front shaft from the flange of the four wheel drive pod.
15. Disconnect the hose from the transmission filter (left side of the transmission).
16. Remove the torque converter hose completely.
17. Remove the throttle cable and bracket from the fuel injection pump.
18. Remove the engine dipstick tube assembly.
19. Remove the transmission oil dipstick tube assembly.
20. Remove the gear box oil filler tube.
21. Disconnect the wiring to the starter motor.
22. Remove the starter motor.
23. Disconnect the intake hose from the transmission pump, and remove the intake pipe complete.
24. Remove four bolts and the torque convertor inspection plate from under the bell housing.
25. Remove all eight torque convertor mounting bolts from the flywheel.



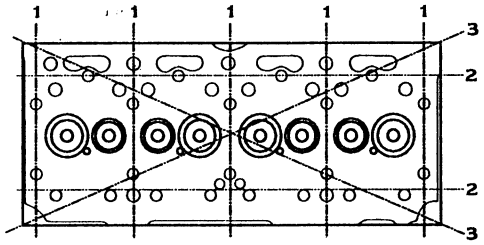
NOTES

**Cylinder head**

Maximum permissable distortion of cylinder head along the axis shown

1 ..... 0,08 mm (0.003 in)
2 ..... 0,15 mm (0.006 in)
3 ..... 0,15 mm (0.006 in)

Gasket type ..... Asbestos free gasket specially treated to be 'dry fit'. After correct fitment there is no need for further checks on the tightness of cylinder head screws




**Cylinder liners**

- Production ..... Dry, interference fit, flanged
- Service ..... Dry, transition fit, flanged

Material ..... Cast iron
Liner flange to cylinder block face ..... 0,10 mm (0.004 in) above
0,10 mm (0.004 in) below

**Pistons**

Type ..... "Quadram" combustion bowl, controlled expansion, inserted top ring groove and reduced diameter top land. Pistons to be fitted with the arrow, or the word 'FRONT', towards the front of the engine

Piston height above top face of cylinder block ..... 0,14-0,36 mm (0.005-0.014 in)

**Piston ring layout**

Top compression ..... Barrel face, molybdenum insert, with chamfer at the top of the inner face
Gap ..... 0,40-0,85 mm (0.016-0.033 in)
Second compression ..... Taper face, cast iron
Gap ..... 0,30-0,76 mm (0.012-0.030 in)
Oil scraper ..... Coil spring loaded, chromium face
Gap ..... 0,38-0,84 mm (0.015-0.033 in)

Gudgeon pin ..... Fully floating (warm piston in oil to 40 - 50°C for easy removal of gudgeon pin)

**Connecting rods**

Type ..... "H" section, wedge shaped small end
Cap location ..... Serrated face

**Crankshaft**

Crankshaft heat treatment ..... Nitrocarburised. The crankshaft can be reground to the sizes shown but must be nitrocarburised again afterwards, or if this process is not available, it can be nitrided for 20 hours. If neither process is available fit a new crankshaft.

Regrind sizes ..... -0,25 mm (-0.010 in)
-0,51 mm (-0.020 in)
-0,76 mm (-0.030 in)

End float ..... 0,05-0,38 mm (0.002-0.015 in)
Maximum pemmissible end-float ..... 0,51 mm (0.020 in)
Maximum ovality or wear of journals and crank pins 0,04 mm (0.0016 in)

**Lubricating oil pressure**

Minimum at maximum engine speed ..... 2 bar (30 lbf/in²)
Piston cooling jets ..... One per cylinder

**Bolt torques**

Cylinder head ..... See engine workshop service manual
Connecting rod nuts ..... 125 Nm (92 lbf ft)
Main bearings ..... 265 Nm (196 lbf ft)
Rear oil seal housing (M8) ..... 22 Nm (16 lbf ft)
Rear oil seal housing to bridge piece (M6) .... 18 Nm (13 lbf ft)
Bridge piece to cylinder block ..... 9 Nm (6 lbf ft)
Flywheel ..... 105 Nm (77 lbf ft)
Crankshaft pulley ..... 115 Nm (85 lbf ft)
Idler gear hub ..... 44 Nm (33 lbf ft)
Camshaft gear ..... 78 Nm (58 lbf ft)
Fuel injection pump nut ..... 80 Nm (59 lbf ft)
Injector retaining nuts ..... 12 Nm (9 lbf ft)
Timing case to block ..... 22 Nm (16 lbf ft)

NOTES

## 13/1 • 01

## STALL TORQUE SPEED

### Test

The stall torque test should only be carried out on a fully run-in engine (after 100 hours) as a low reading may be obtained from a new or newly rebuilt engine.

1. Check oil level then run machine until transmission oil is at normal operating temperature.
2. Check maximum no-load engine speed which should be 2420 rpm.
3. **Attention**

   **Firmly apply the hand brake and select 4th gear.**
4. With the engine at low idle speed select FORWARD drive and then using the foot throttle, accelerate the engine to maximum speed:-

   A = Torque converter stall speeds in rev/min.

   B = Torque converter stall + hydraulics stall in rev/min.

   C = Torque converter stall + hydraulics + steering stall in rev/min.
5. Repeat operation in reverse drive. There should be no difference at all in the stall speeds. If there is, it indicates that one of the clutches may be slipping. Further testing is then required.
6. Leave the engine idling for a few minutes to cool the transmission oil.

| | | | |
|---|---|---|---|
| **A** | | | |
| | 750 | = | 1850 - 1900 |
| | 860/865/965 | = | 1960 - 2010 |
| **B** | | | |
| | 750 | = | 1610 - 1660 |
| | 860/865/965 | = | 1740 - 1790 |
| **C** | | | |
| | 750 | = | 1330 - 1380 |
| | 860/865/965 | = | 1400 - 1450 |

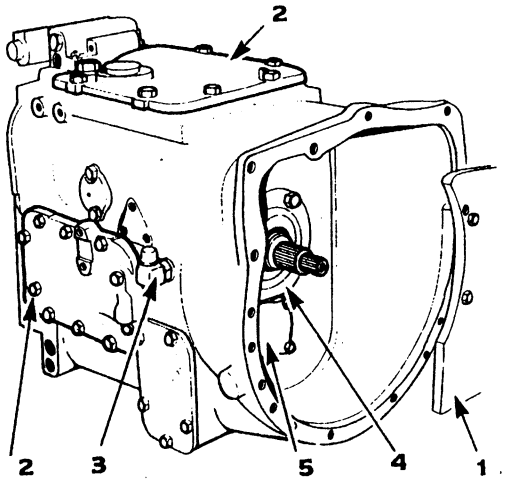
## 13/1 • 10
## POWERSHUTTLE TRANSMISSION
### Service

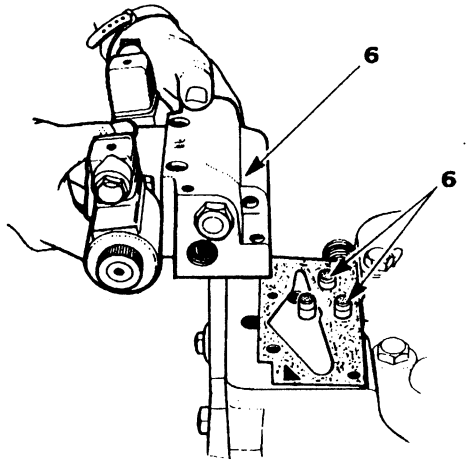
**Special Tools:**

MF 414/1 Synchromesh alignment tool.
CR 375 Rolling torque gauge.
Dial indicator with magnetic base.

**Strip**

1. Mount transmission on a suitable rotating stand.
2. Remove side and top covers.
3. Remove torque converter input elbow and feed
4. Remove input housing and input shaft (except if p.t.o. fitted, when input shaft can only be removed at instruction 17).
5. Remove power-take-off shaft cover, block gears and unscrew retaining bolt from the power take-off shaft. (This instruction applies only to transmissions fitted with power-take-off option.)
6. Remove direction-shift control valve and all three transfer tubes.

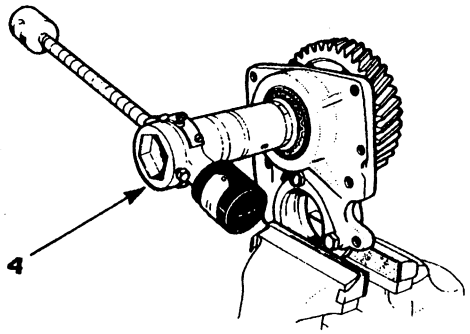


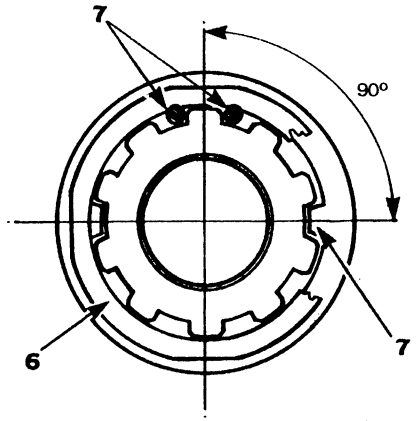



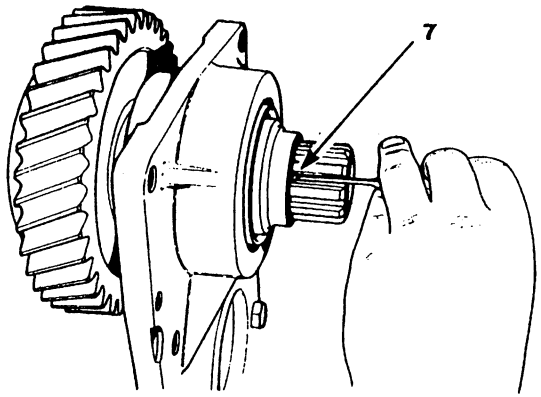
**Rebuild**

Reverse procedures 1-3 except:

4. Anchor housing securely and fit special tool CR 375 to the shaft splines by using a spare shear-tube.
5. Refit tab washer, noting into which spline the tab is fitted .
6 Fit a new ring nut and tighten to give 1.5-2.5 Nm (16-30 lbf inch) rolling torque, equivalent to a spring balance reading of 7-12 kg (15-26 lbf) when pulling string wound around the shaft splines.
7. Punch in both pins, in adjacent splines **at 90° to the washer tab.**



## 13/1 • 17
## TRANSMISSION PRESSURE MAINTAINING VALVE
### Service

This valve regulates the pressure to the clutches.

**Strip**

1. Remove cap and 'O' ring seal which must be renewed if distorted or damaged.
2. Remove shims and spring.
3. Remove guide pin and valve.

**Examination**

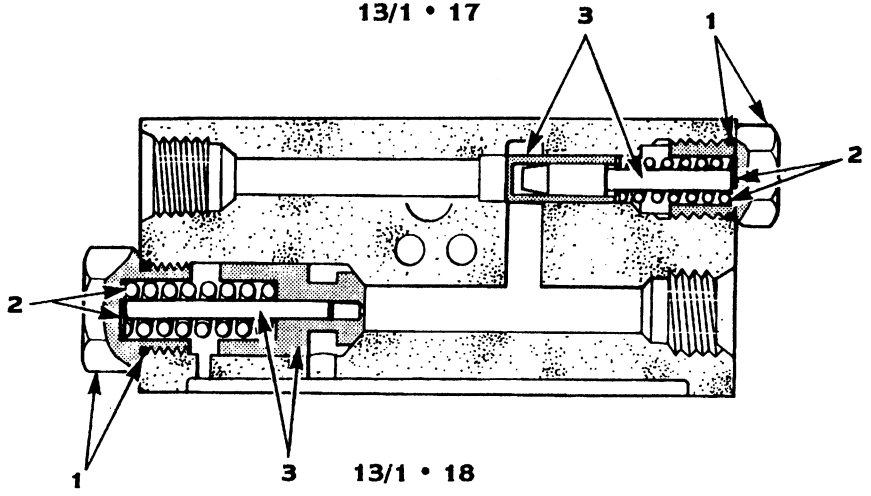
4. Inspect the valve and body, if scoring is evident establish the source of debris and check the filter condition.
5. Check the guide-pin for scoring and the corresponding bore of the valve.
6. Spring free length should be 38.2 mm (1.5 inch).

**Rebuild**

Reverse instructions 1-3.

7. Pressure test per operation 13/1 • 04

13/1 • 17



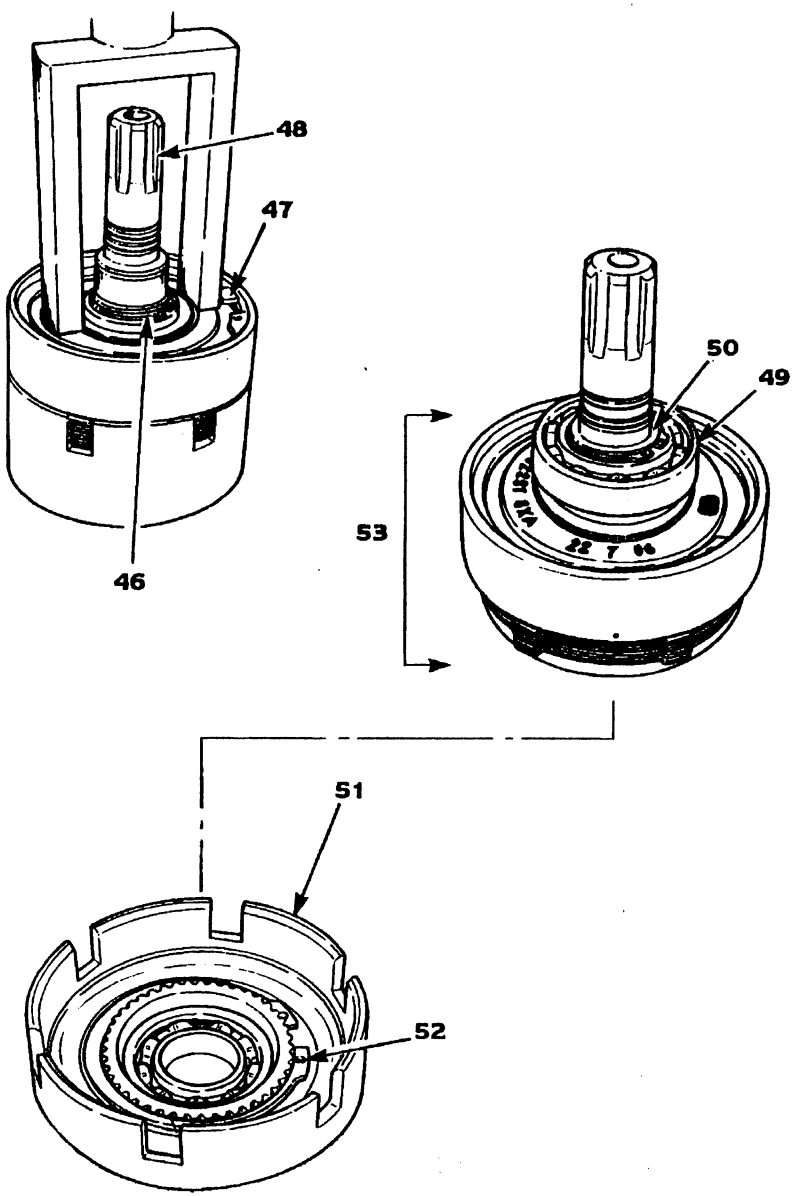

13/1 • 18

NOTES

46. Remove the circlip and fit the shim pack. Ensure that a thick shim is on the top of the shim pack to reduce the risk of a shim sliding into the circlip groove.

**Fit a new circlip and ensure that it is fully seated, it must retain a 5000 Kg (4.9 ton) force.**

47. Fit the large circlip.
48. Remove the clutch shaft assembly from the press.
49. Fit the ball bearing race (light press fit only).
50. Fit the circlip.
51. Stand the housing on the end already assembled and fit the clutch drum onto the constant mesh gear.
52. Fit the circlip.
53. Fit the assembled clutch into the clutch drum.



NOTES

21. Press the bearing cone onto the spigot of the epicyclic hub.
22. Assemble the planet gears and the sun gear in the epicyclic hub, operation 16/1•03.
23. Use an hydraulic press to push the epicyclic hub onto the wheel axle.
24. Bolt the ring gear to the outer housing with four bolts from the epicyclic unit and four wheel nuts as spacers. These bolts should be equally spaced around the ring gear.

**NOTE: Ensure that the ring gear is correctly fitted i.e., with the teeth in full engagement.**

25. Place the bearing cup on the spigot in the centre of MF 267A, but do not fit the shims.
26. Place the epicyclic unit on MF 267A and use two feeler gauges to measure the gap at points 'A'. Both measurements must be equal.
27. Select a shim or shims from the table shown, where :

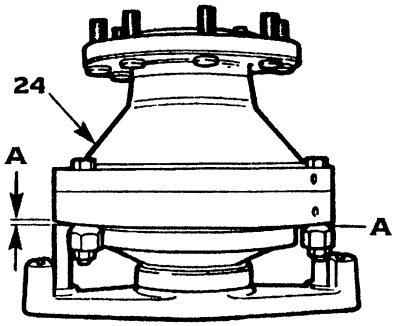
    A = The gap measured with the feeler gauges

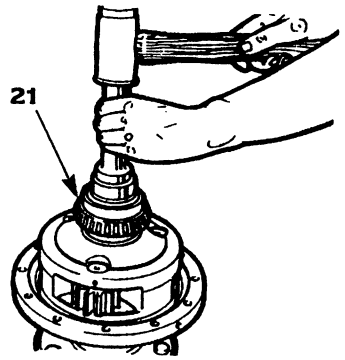
    B = The shim thickness required

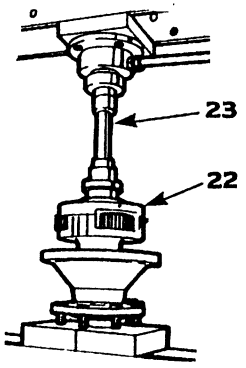
    C = The shim thicknesses available

    D = Shim part numbers

28. Fit the shims to the trumpet housing.
29. Fit the inner bearing cup, and ensure it is fully seated.




| C | | D |
|---|---|---|
| mm | In | |
| 0,13 | 0.005 | 894 757 MI |
| 0,25 | 0.001 | 894 758 MI |
| 0,38 | 0.015 | 894 759 MI |

| A | | B | |
|---|---|---|---|
| mm | In | mm | In |
| 0,025 - 0,13 | 0.001 to 0.005 | 0.76 | 0.030 |
| 0.15 - 0,25 | 0.006 to 0.010 | 0.64 | 0.025 |
| 0,28 - 0,38 | 0.011 to 0.015 | 0.51 | 0.020 |
| 0,41 - 0,51 | 0.016 to 0.020 | 0.38 | 0.015 |
| 0,53 - 0,64 | 0.021 to 0.025 | 0.25 | 0.010 |
| 0,66 - 0,76 | 0.026 to 0.030 | 0.13 | 0.005 |
| 0,79 - 0,89 | 0.031 to 0 035 | 0.0 | 0.0 |

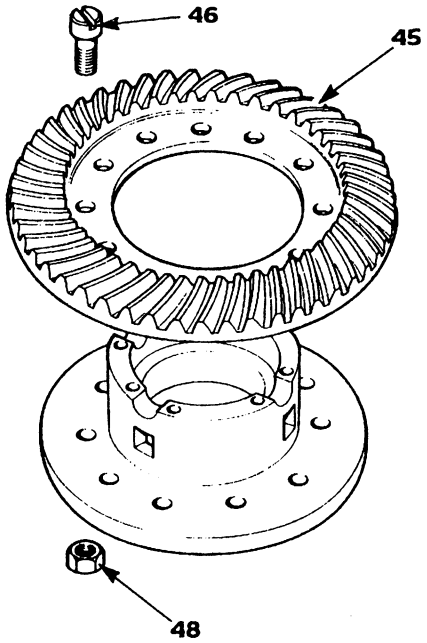
40. Thoroughly degrease the crown-wheel, differential case flange, bolts and nuts.
41. Collect together all items necessary for rapid assembly. These items are:
    Torque wrench,
    3/4" A/F socket
    Loctite 270.
42. Open the epoxy resin kit 1852 913 M91. It contains:
    - One jar containing 10 ml of resin. (This jar is also used as a mixing vessel.)
    - One jar containing 5 ml of hardener.
    - One glass stirring rod.
    - One brush.

**Caution: Avoid excessive, or repeated skin contact. Observe the directions on the container.**

43. Pour the hardener into the resin jar and mix thoroughly using the glass rod.
44. Apply an even coating of adhesive to both mating surfaces.
45. Press the differential case on to the crownwheel.

**Note: These two components are an interference fit and must, therefore, have their bolt holes aligned accurately before being fitted together.**

46. Fit the twelve bolts with their heads adjacent to the crownwheel teeth.
47. Apply two drops of Loctite 270 to the first thread of each bolt.



18. Remove tool MF 467.
19. Fit the 3 screws and tighten to 14 Nm (10.5 lbf ft).
20. Purge air from the brake system see 9/1•02
21. Adjust the brakes, see 9/1•01.

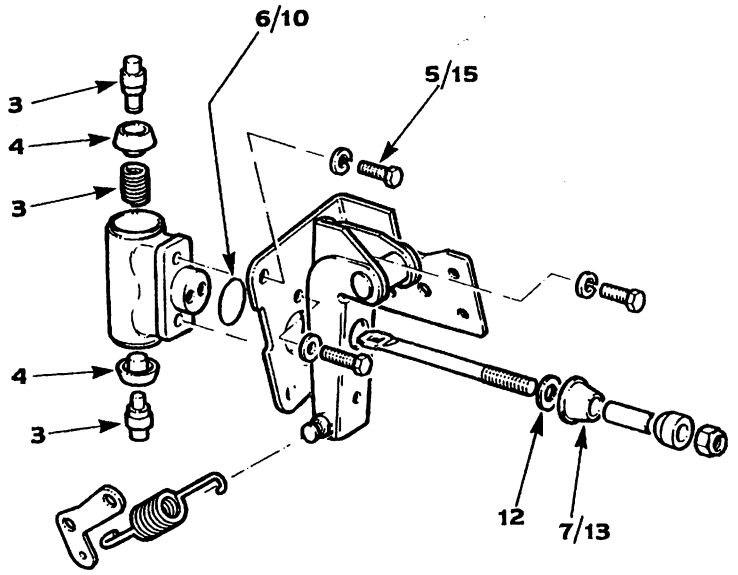
## 16/1 • 11
## BRAKE SLAVE CYLINDER
### Service

**Strip**

1. Remove brake actuator assembly, see operation 16/1•10.
2. Unscrew one of the bleed screws to allow the piston to extend.
3. Remove the pistons and spring.
4. Use a small screwdriver, the tip of which has been rounded and polished, to remove the seals from the pistons.
5. Remove two screws which retain the slave cylinder to the bracket.
6. Remove the 'O' ring from the manifold.
7. Carefully remove the rubber seal from the bracket, but avoid damage to the bracket.

**Inspection**

8. Thoroughly clean all metal parts in new brake fluid. (Aftercare LHM fluid Part No 3621 170 M1).
9. Do not attempt to repair worn or damaged components.



## TORQUE SETTINGS

| Description | Nm | (lbf ft) |
|---|---|---|
| Hub cover screws | 80 | ( 60) |
| Drain plugs—refill plugs | 40 | ( 29) |
| Adjustment screws - steering lock | 120 | ( 89) |
| Ring gear carrier to steering knuckle, bolts | 235 | (173) |
| King pin cover screws | 190 | (140) |
| Bolts - Differential bearing caps | 266 | (196) |
| Screws - Differential ring, lock plate | 10 | (7.5) |
| bolts - Differential to axle case | 169 | (125) |
| Bolts - Bevel gear/differential case. Use Loctite 270 | 78 | ( 58) |
| Pinion shaft cover screws | 12 | (8.8) |
| Nuts - Track rod ball joints | 135 | (100) |
| Nuts - Track rod clamps | 70 | (52) |
| Nuts—wheel disc to hub | 300 | (220) |

## 17/1 • 07

## DIFFERENTIAL UNIT

### Service

**Special tools**

Dial gauge with magnetic stand
Measuring bar
Spring balance and cord

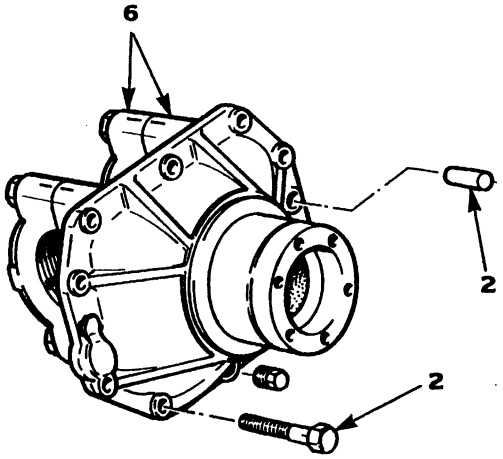
FS17 #1 Measuring bar

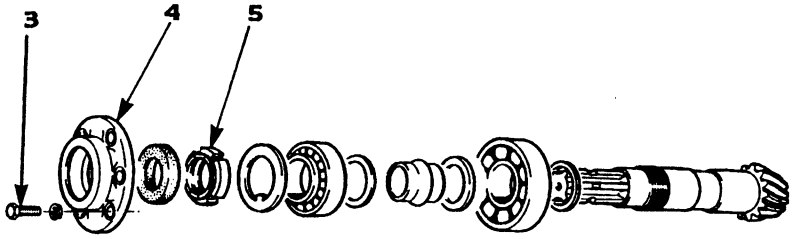
FS17 #2 Wrench - pinion shaft ring nut

FS17 #5 Wrench - differential ring nuts

**Strip**

1. Remove final drive hubs and drive shafts per operation 17/1•03.
2. Remove all 10 bolts and fit two screws into the threaded holes provided on the differential carrier. Proceed to jack the differential carrier off the dowels. The combination of dowels and silicone rubber sealant makes removal of the differential carrier from the axle very difficult unless the 'screw jack' process is used.
3. Remove the screws from pinion shaft end-cover.
4. Use a soft-faced mallet to separate cover from carrier housing. This joint is sealed with a silicone rubber gasket material.
5. Prise open the staked lip on the ring nut and unscrew it with wrench FS17 #2. The ring nut is tight, so a soft metal wedge must be used to prevent the pinion shaft turning.
6. Mark the bearing caps and carrier, for correct assembly.



NOTES

## 17/2 • 03

## POTENTIOMETER AND DRIVE

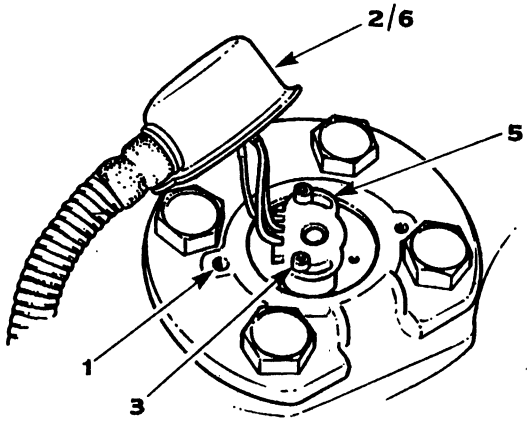
### Remove and refit

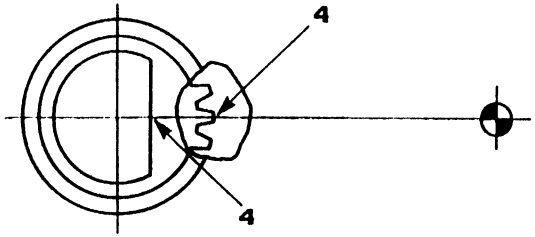
**Remove**

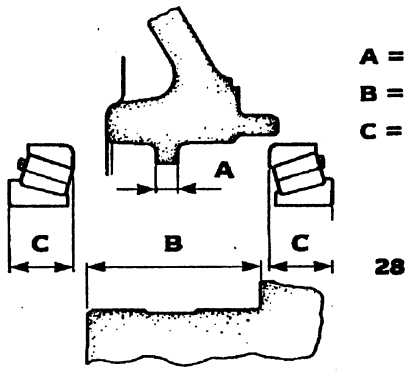
1. Remove both screws.
2. Carefully remove the protective cap. On earlier axles this cap has a narrow flange and is sealed with Sealastic 732 with no gasket. Later axles use a gasket and a cap with a wider flange.
3. Remove two screws and washers and lift off the potentiometer.

**Refit**

4. Ensure the driveshaft is installed with the flat face aligned as shown.
5. Fit the potentiometer and adjust its position so that the screws are in the middle of the slots. Tighten the M4 screws to 3 Nm (2.2 lbf ft) DO NOT OVERTIGHTEN.
6. Fit the cap with the appropriate gasket or sealant and tighten the screws to 10 Nm (7.4 lbf ft).

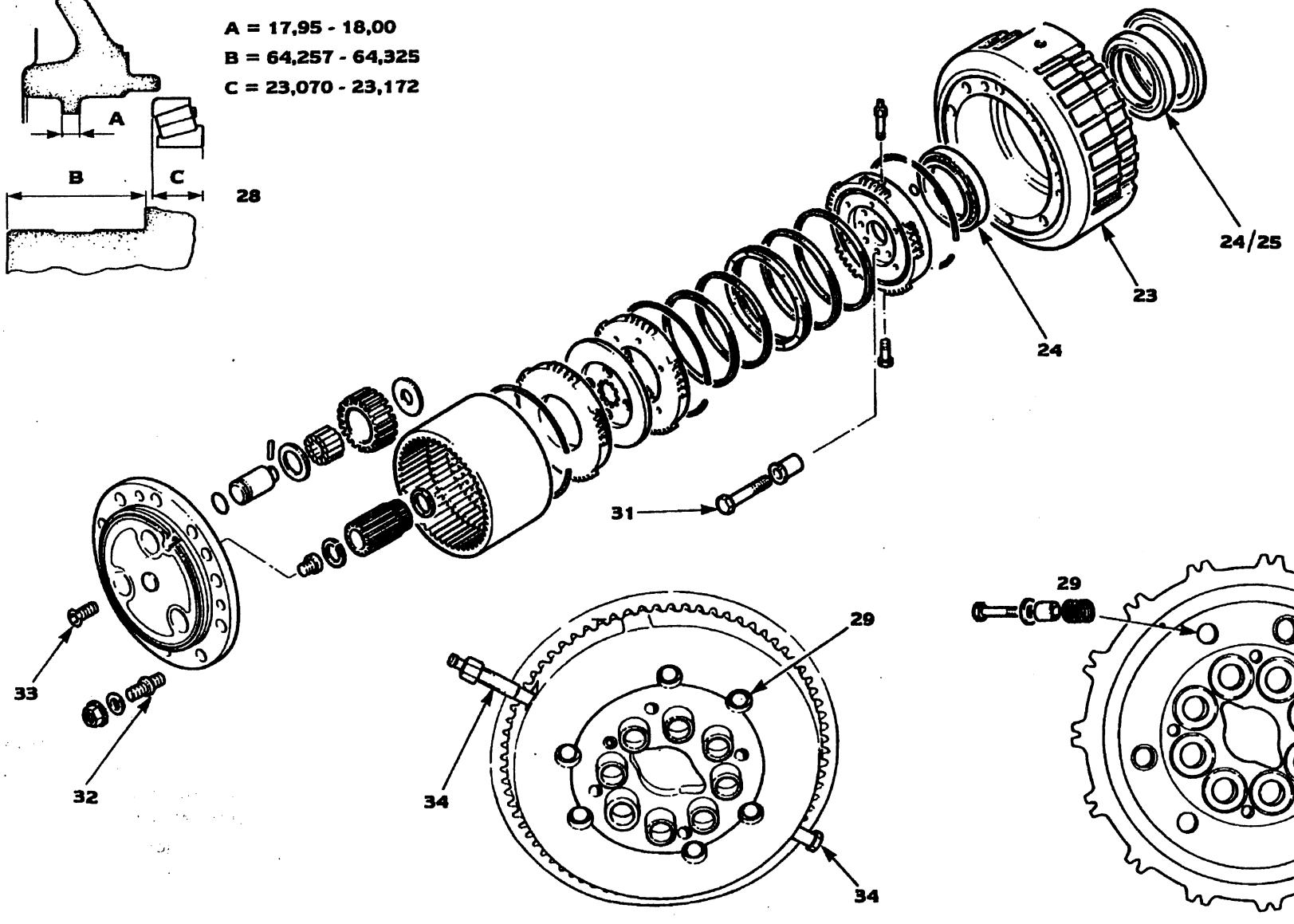





A = 17,95 - 18,00
B = 64,257 - 64,325
C = 23,070 - 23,172

28



**Refit**

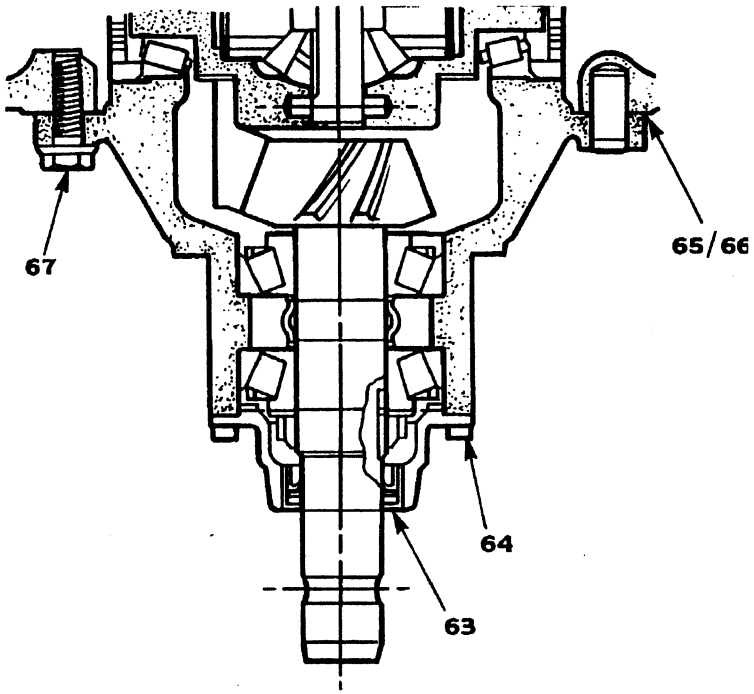
63. Install a new seal in the pinion shaft cover.
64. Thoroughly de-grease the mating surfaces of the pinion bearing housing and cover. Apply Sealastic 732 Liquid Gasket and fit cover. Tighten bolts to 12 Nm (9 lbf ft).
65. Clean mating surfaces on axle housing and differential carrier.
66. Apply Sealastic 732 Liquid Gasket to one surface and refit differential assembly into axle housing.
67. Tighten ten bolts to 169 Nm (125 lbf ft).
68. Refit final drive hub and drive shafts per operation 17/2•04.

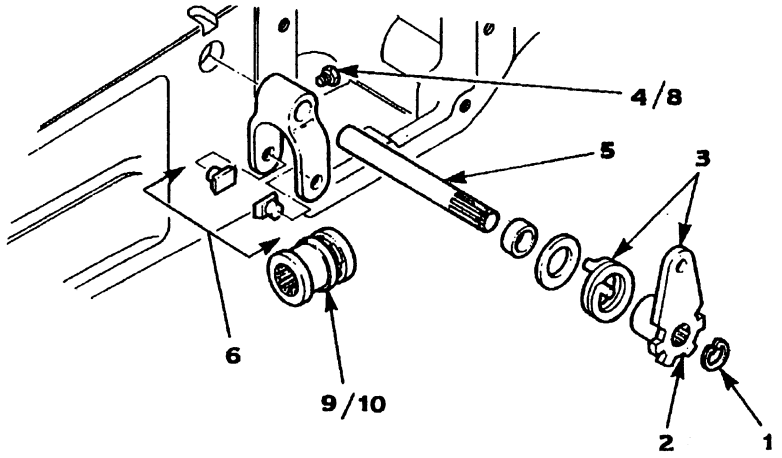
## 17/2 • 09
## DIFFERENTIAL LOCK
## Remove & refit

**Remove**

This job is additional to 17/2•08 when servicing the rear axle.

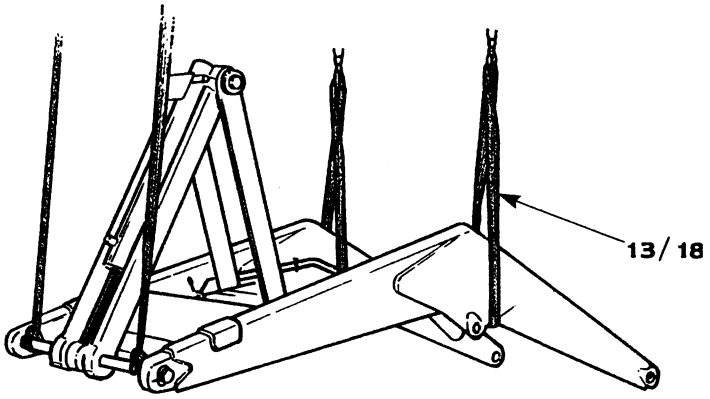
1. Remove the circlip.
2. Note which notch the recoil spring engages then prise the lever out of engagement with the spring.
3. Remove lever and spring from the shaft.
4. Remove the peg bolt from the fork.
5. Slide the shaft out of the housing.
6. Remove the fork and shoes.
7. Remove the seal from the axle housing.

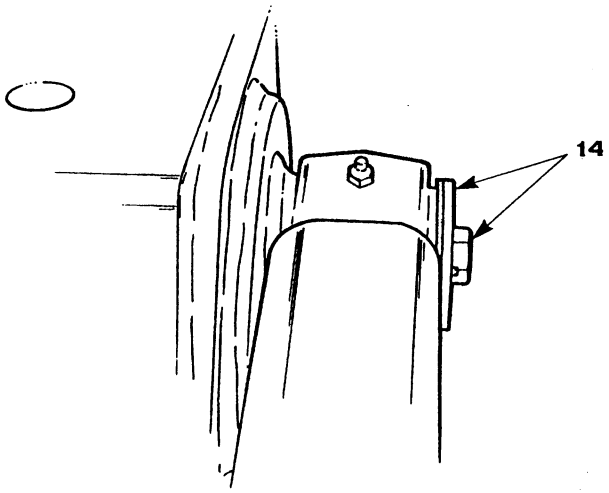


9. Remove the pin from the rod end of the right cylinder and lower it carefully away from the loader beam.
10. Loosely tie the front of the safety strut to the loader beam.
11. Remove the pin from the rod end of the left, beam lift cylinder.
12. Disconnect the hoses from the steel pipes that run along the inside faces of the loader beam. Fit steel plugs to the hoses.
13. Attach a lifting frame as shown, but note that the two front slings are approximately 800 mm (31 ins.) longer than the rear pair. The frame should have a rated capacity of at least 1000 Kg (2200 lbs).
14. Remove the bolt, washer and shims from the left pivot pin of the loader beam. Be careful to avoid damage to roll-pin which locates the washer. Save shims for assembly.
15. Remove the bolt, (Mechanical controls - A special pin is used in place of the bolt), washer and shims. Avoid damage to the roll-pin. Save the shims for assembly.
16. Remove the roll-pin from the end of each pivot pin.
17. Remove the self-locking nuts and bolts from the inner ends of the pivot pins.
18. Hoist the loader beams until both ends are approximately level.
19. Remove both pivot pins.

**Take precautions to prevent the loader beams swinging towards the cab.**



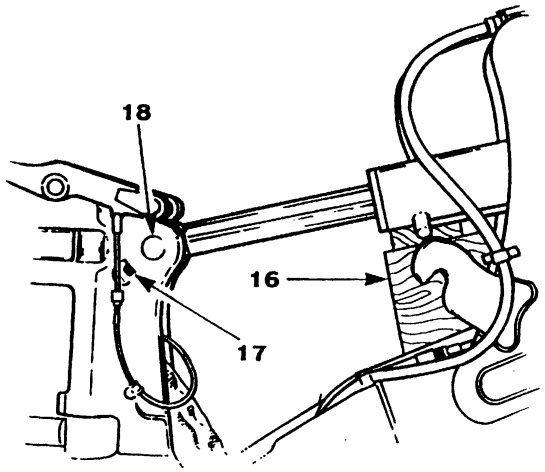



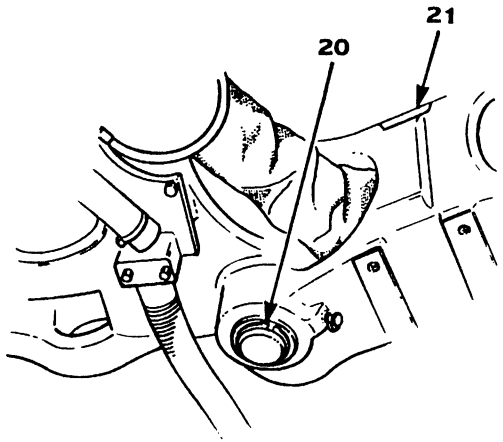
16. Fit a block of wood under the boom cylinder and use wedges to bridge any gap remaining between the wood and the cylinder.
17. Remove the bolt and nut which retain the pivot pin for the boom cylinder rod end.
18. Use a hammer and soft punch to drive out the pivot pin.
19. Take the weight of the boom and dipper assembly on the hoist.
20. Remove the circlip from the boom pivot pin. Use a large hammer and soft punch to drive out the boom pivot pin.
21. Move the boom and dipperstick assembly away from the swing casting.

**Refit**

Refitment is the reverse of steps 1 to 21 except:

22. Ensure that the hoses are correctly reconnected with no twists or kinks induced.
23. Do a complete function test of the backhoe to check the correctness of the hose routing.



## 19/2 • 01
## BOOM
## Remove & Refit

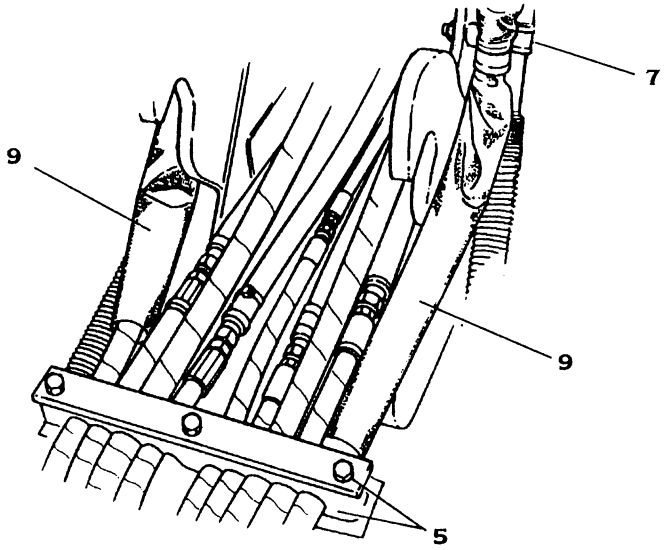
**Special tools:**

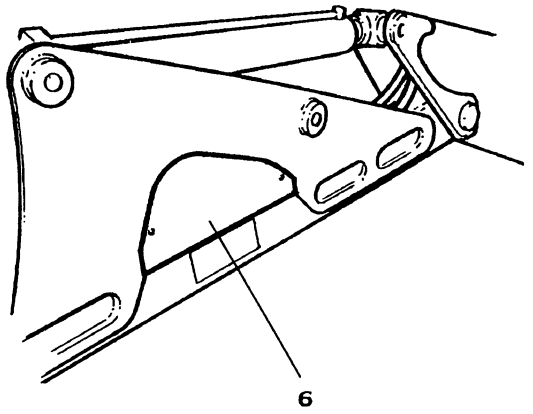
Robust hoist and slings.

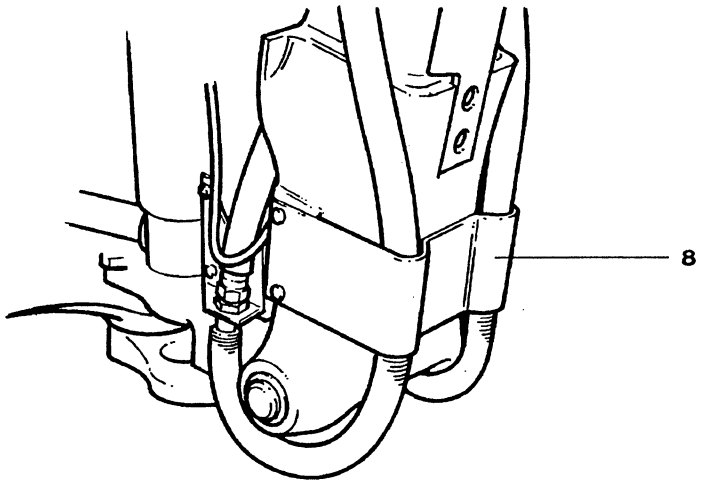
**Remove**

1. Remove backhoe bucket.
2. Lower the stabiliser legs.
3. Position the boom at 90° to the backframe, extend the dipper fully and lower it onto the ground then stop the engine.
4. Fully depressurize the hydraulic system, by moving the control levers in all directions, refer to operation 4/2•03 for electronic controls.
5. Remove three bolts which secure the hose clamp at the base of the boom assembly. Lift off the steel bar and plastic bushings.
6. Remove three bolts from the cover plates each side of the boom and lift off the cover plates.
7. Remove the 'P' clips from each of the boom side plates.

   NOTE: If a rock breaker is fitted there will be two 'P' clips attached with the same bolt.
8. If a rock breaker is fitted there is a U-shaped bracket at the base of the boom which must be removed. There are two bolts and washers on each side.
9. Label each of the hoses attached to the dipperstick cylinder and disconnect the hoses.
10. Label and then disconnect the hoses from the boom cylinder.



Section

# 20/1

## CAB / ROPS

## 22/1 • 01

## EXTENSION CYLINDER

### Remove and Refit

**Remove**

1. Move the boom and dipperstick into the maximum reach position and extend the dipperstick until the cylinder rod pin is accessible, then lower the boom until the bucket rests on the ground.
2. Position a support under the boom/ dipperstick hinge and then depressurize the hydraulic system.
3. Remove circlips from each side of the pin at the head-end of cylinder and drive out pin with a soft metal bar.
4. Start engine and extend cylinder until the head of the cylinder just emerges from dipperstick tube then insert a long bar through the cylinder eye.
5. Remove circlips from each end of the pin at the rod-end of cylinder and drive out pin with a soft metal punch.
6. Fully retract cylinder, stop the engine and depressurize the hydraulic system.
7. Disconnect both hoses from the cylinder.
8. Use the long bar as a handle and slinging point to pull the cylinder out of the dipperstick.

**Refit**

Reverse instructions 1 to 8 except:

9. Install cylinder with ports on the underside.