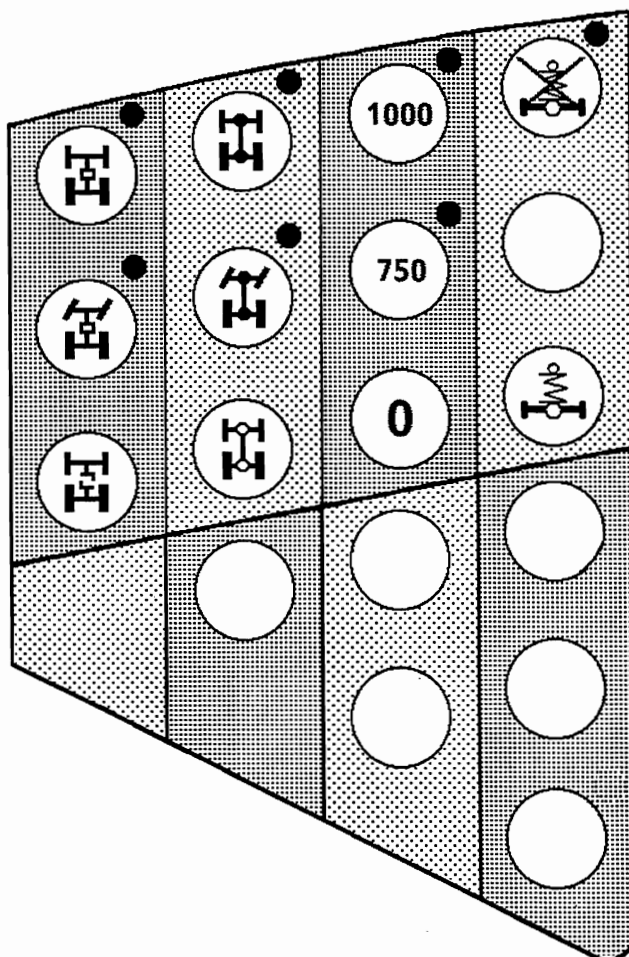




SERVICE - TRAINING

Edition 07 / 98

Powershift and Comfort Controls Favorit 816 - 824



X990 005 023 118

Contents	Seite
1. Comfort Gears - Position of Components, Pressure Measurements, Increasing the System Pressure from Gearbox Number	1 27/1
2. Comfort Gears - Hydraulic Circuit Diagram	9
3. Load Gears - Position of Components, Pressure Measurements, Towing Specifications	10, 15
4. Load Gears - Hydraulic Circuit Diagram	17
Test Report - Load Gears	19
5. 4LG Control Block for Load Gears, Removal and Replacement	21
6. Function of Load Gears Including Variofill	22
7. Function Diagrams for Changeover Gears	26
8. Notes for Adjustment of Wheel Brake Cylinder	28
Bleed Brakes	29
9. Brake System Hydraulic Diagram	30
10. Rear PTO	31
11. Front PTO	32
12. 4WD, Diff Lock, PTO, Turning Gear Operation	33
Emergency Operation of Turning Gears and Load Gears	40
Favorit up to Basic E-Box Number G 816.970.070.013	43
Emergency Operation for PTO Gears	44
13. Operation of Onboard Computer for Combi-Unit Number G 312.970.010.030	44

		Seite	
14.	Warning and Fault Messages		57
	Retrieve Fault Codes		58/2
	Emergency Running with E-Adapter Box		59/2
15.	Activate LCD Display for Container Pressure (Compressed Air System) and Radar Sensor		61
16.	Fault Code Table		63
17.	Replacement of E-Box/Adjustment of Analogue Sensors		71
18.	Position and Testing of Components		78
19.	Circuit Diagrams		
	Fuse Allocation		113
	Plug Connectors		117 - 125
	Block Circuit Diagrams E-Box		126 - 127
	Contact Allocation of E-Box		127/1
	Battery Changeover Relay		127/6
		Up to Veh. no.	From Veh. no.
		2000	2001
	Circuit Diagrams	128	169
	" Starter Control	129	129
	" E-Box Supply	130	170
	" CAN-Bus	131	131
	" Combi-Instrument	132	171
	" Load Gears	133	133
	" Road-Field Mode	134	134
	" Turning Gears	135	172
	" Brake Light	135/2	135/2
	" 4WD/Diff Lock	136	136
	" PTO Gears	137	137
	" Attachment Socket and BC Socket	138	138
	" Springing	139	139
	" Flasher System	140	140

	Seite	
	bis Fg.-Nr. 2000	ab Fg.-Nr. 2001
Circuit Diagram Road Lighting	141	173
" Heating	142	142
" Wipers	143	143
" Cold Start System (Flame Start System)	144	174
" Engine Brake and Shut Off	145	145
" Horn	146	146
" Rear Working Lights	147	147
" Front Working Lights	148	148
" Ventilation and Air Conditioning	149	149
" Driver's Cab Lighting and Radio	150	150
" Sockets and Open Interfaces	151	151
" Turbo Clutch Monitoring	---	175
" Engine	176	186
" Engine Additional Equipment	178	188
" Driver's Cab Additional Equipment	180	198
" Gears	182	192
" Cab	184	194
" Driver's Console	196	200

Emergency Operation and Workshop Assistance - Direct Supply
 from Basic E-Box G 816.970.070.014 152

Operation of Onboard Computer from Combi-Instrument
 Number G 312.970.010.040 158

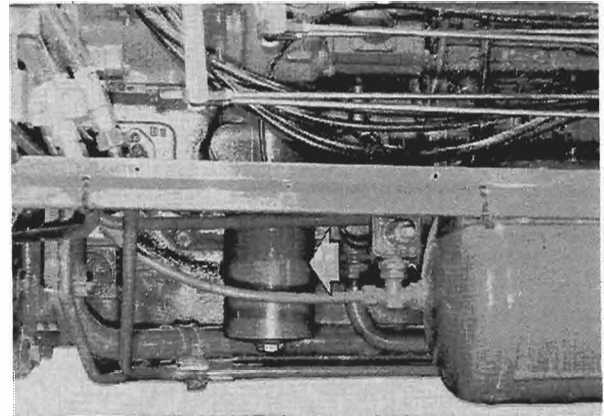
1. COMFORT GEARS - POSITION OF COMPONENTS, PRESSURE MEASUREMENTS

(See also hydraulic circuit diagrams pages 9 and 17).

In front of right rear wheel:
Suction filter (arrow) with bypass:

NOTE:

System pressure increased from gearbox number see page 27/1.

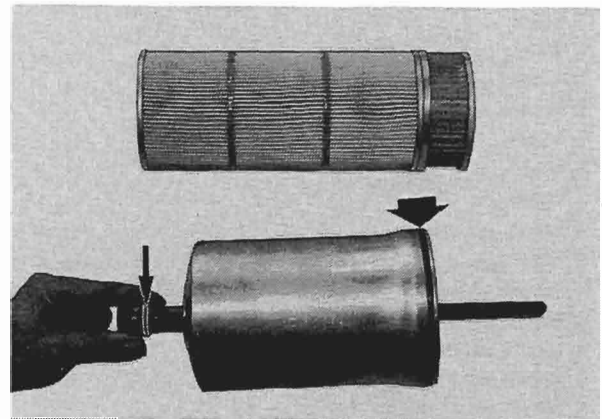


1a

When fitting a new filter insert, insert new O-rings (arrow) in the groove of the fixing screw and filter pot and lubricate.

NOTE:

Filter is two-part, it consists of a metal screen filter and a replaceable filter cartridge.

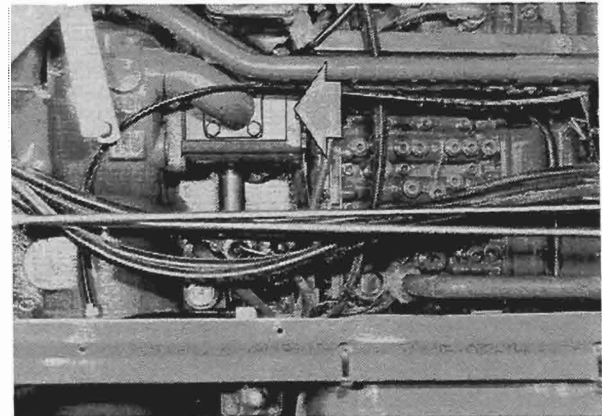


1b

In front of right rear wheel:
Gear pump (arrow) 36 cm³/h for comfort gears and gear lubrication.

Translation ratio engine : gear pump approx 1:1.

At an engine speed of around 2500 min = 90 litres.

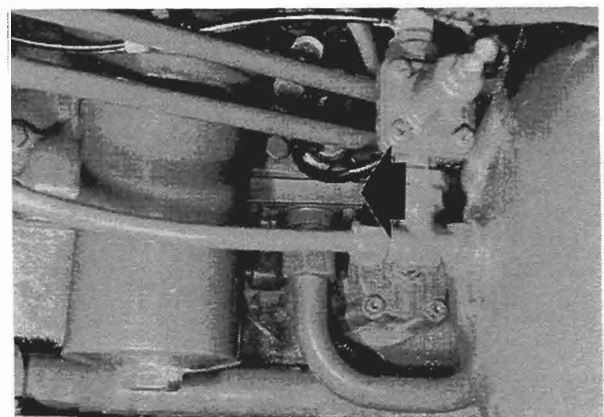


1c

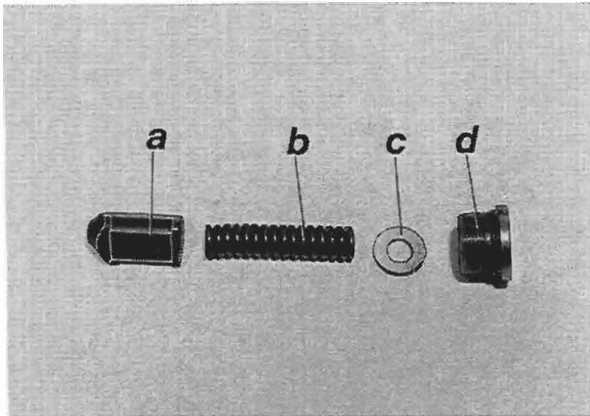
In front of the right rear wheel, remove pressure pipe and cover (arrow):

On the inside, **pressure limiting valve (DBV)** opening pressure 25 bar.

This DBV is the cold start protection for the hydraulic system. See Fig 2a for individual parts of the DBV.



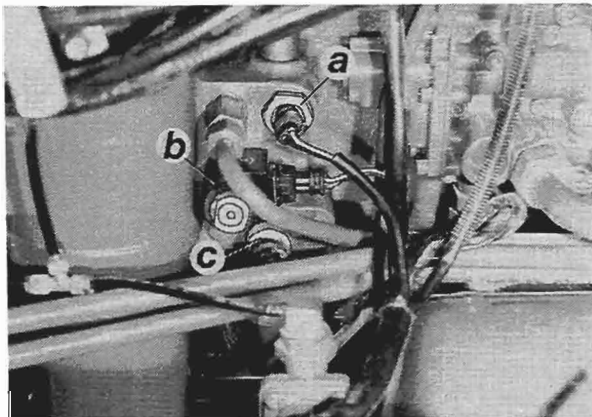
1d



2a

Individual parts of the DBV (see Fig. 1d):

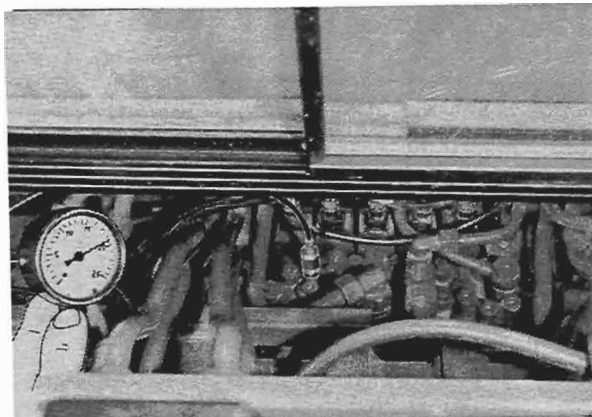
- a = sealing cone
- b = pressure spring
- c = adjustment shims
- d = sealing bolt with O-ring seal



2b

In front of right rear wheel:

- a = **temperature switch** closed at $17 \pm 3^\circ\text{C}$ ie. switches voltage for road gradient
- b = **solenoid and 3/2-way magnetic valve** for 4WD
- c = **pressure switch**, switch point 13 to 16 bar monitors system pressure. System pressureless = switch closed.



2c

Oil temperature min 50°C .

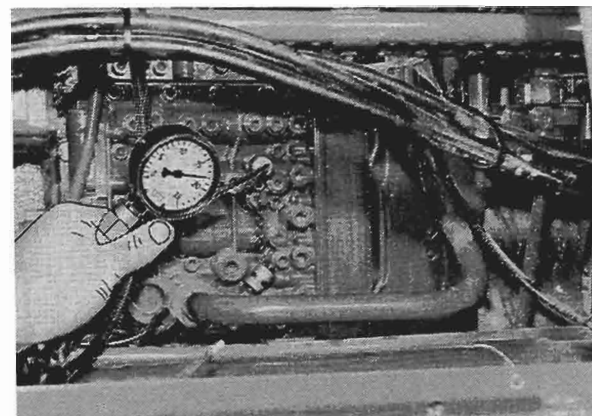
Allow engine to run at approx 1000 rpm.

Connect test connector and manometer with measurement range 0 - 25 bar from Minibox text kit X 899.980.161 to 3/2 way valve rear above the lifting gear (see also diagram page 8).

Nominal value: approx 18 bar (20 bar) **system pressure**. For deviations see fig 3a.

NOTE:

System pressure increases from gearbox number, see page 27/1.



2d

NOTE:

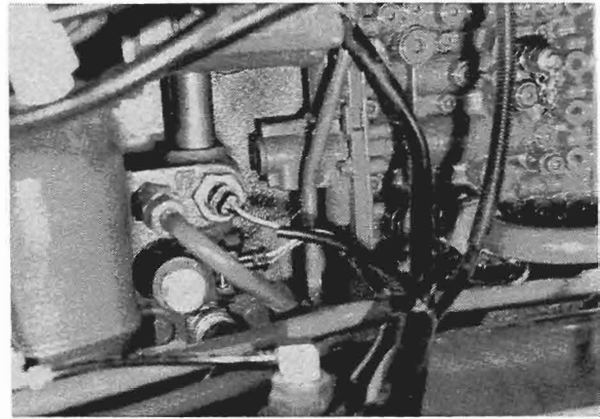
If the right rear wheel is removed, the system pressure can be measured at around 18 bar (20 bar) using the 4LG control block. For measurement conditions and special tools see fig 2c.

Remove sealing bolt no. 5 (see also diagram page 17) on 4LS control block and fit measurement connection M 10x1.

Remove right rear wheel:
Under housing flange of 4LG control block, **pressure limiting valve** (DBV) for system pressure approx 18 bar (20 bar).

NOTE:

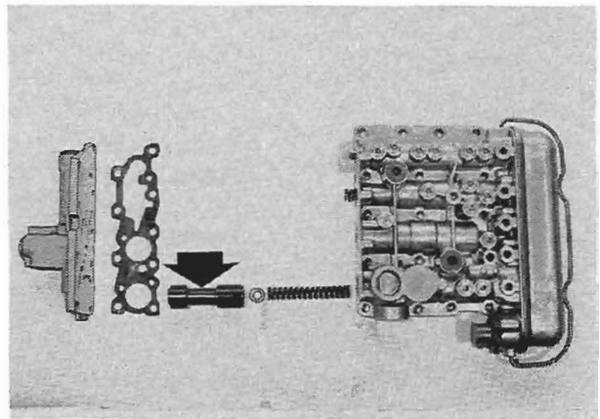
To remove the DBV, the 4LG control block must be removed. Remove 4LG control block see page 21.



3a

Components of DBV in 4LG control block (see fig 3a):

Remove housing flange from 4LG control block.
Check freedom of movement of valve (arrow) in **DBV** in housing.



3b

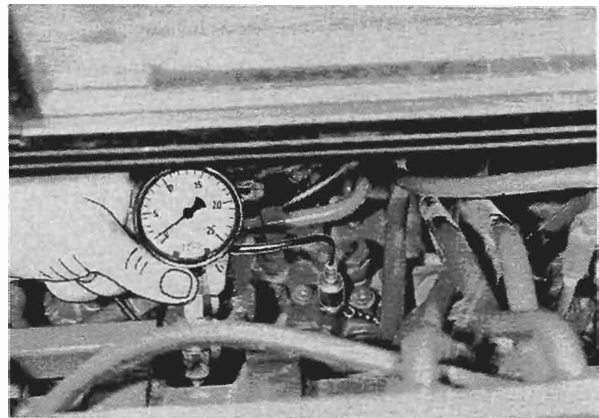
Oil temperature min 50°C.

Run engine at around 1900 rpm. Connect test connection and manometer with measurement range 0 - 25 bar from Minibox test kit X 899.980.161 to valve block rear above the lifting gear (see also diagram page 8).

Nominal value: approx 1 bar **gear lubricant pressure**.

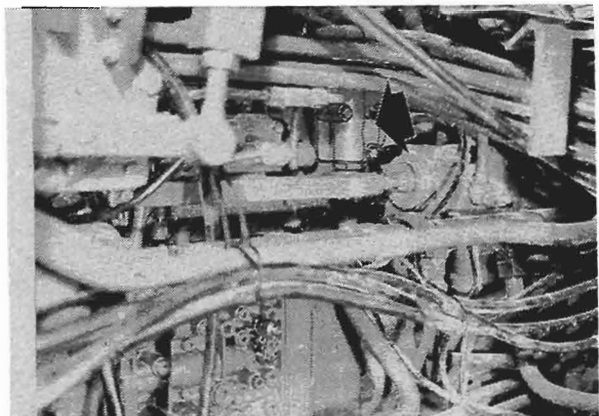
See also fig 5d.

If this value is not reached, test system pressure, see from fig 2c.

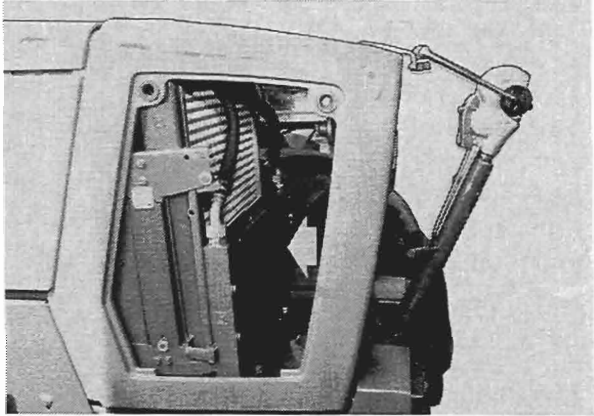


3c

In front of right rear wheel at top of gear housing:
Bypass valve (arrow) for gear oil cooler. Opening pressure approx 3.5 bar.



3d

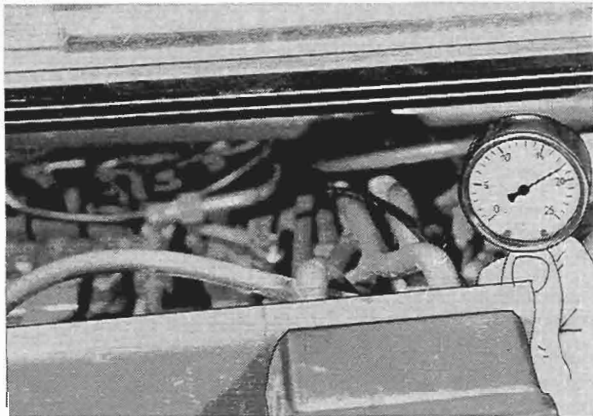


4a

In front of engine oil cooler or charge air cooler:
Gear oil cooler (arrow).

NOTE:

The diagram shows the design without air conditioning system but with charge air cooling.



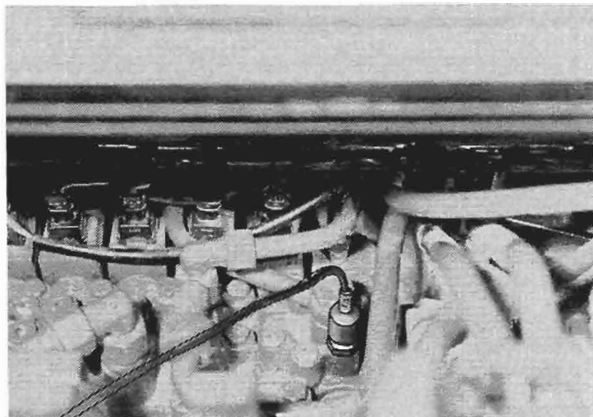
4b

Measurement conditions for figs 4b to 5c.

Oil temperature min 50°C.

Run engine at approx 1000 rpm. Connect test connection and manometer with measurement range 0-25 bar from Minibox test kit X 899.980.161 to the measurement connection rear above the lifting gear.

Nominal value for all tests up to fig 5c: approx 18 bar (20 bar).

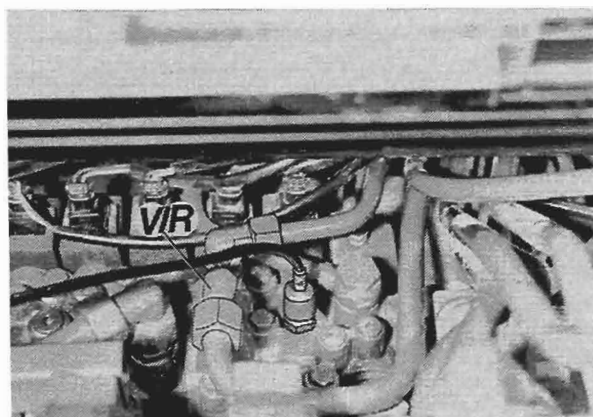


4c

Measurement point:

Brake relay valve

Activate footbrake fully during test (see also sketch page 8).



4d

Measurement point:

Rear PTO proportional valve.

During the test connect the PTO clutch (see also sketch page 8).

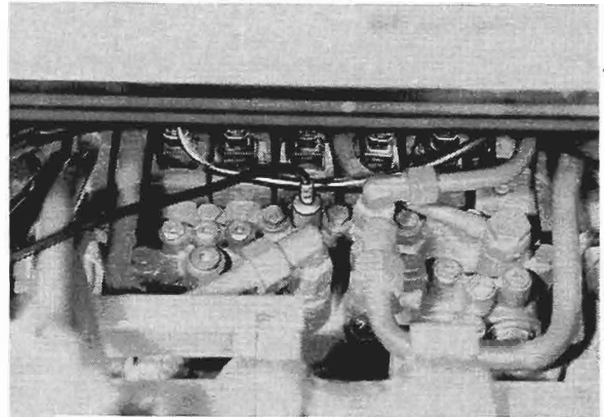
NOTE:

See also fig 5d.

V/R = **F/R neutral valve**, switches to neutral on incorrect operation or fault. On fault the magnet of F/R neutral valve has no current.



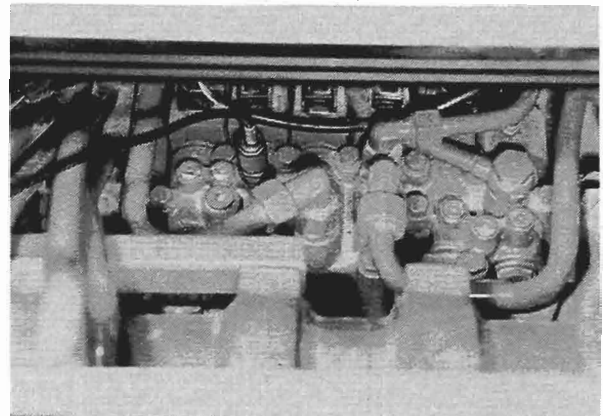
Measurement point:
3/2-way valve, PTO gears, rear PTO 750.
 During the test engage 750 PTO (see also sketch page 8).
NOTE:
 See also figs 5d and 6a.



5a



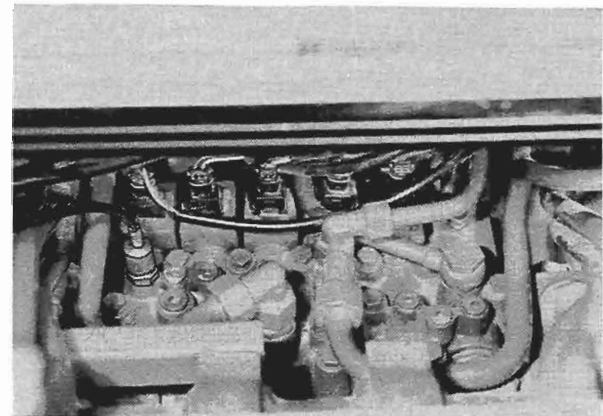
Measurement point:
3/2-way valve, PTO gears, rear PTO 1000.
 For the test connect the PTO 1000 (see also sketch page 8).



5b



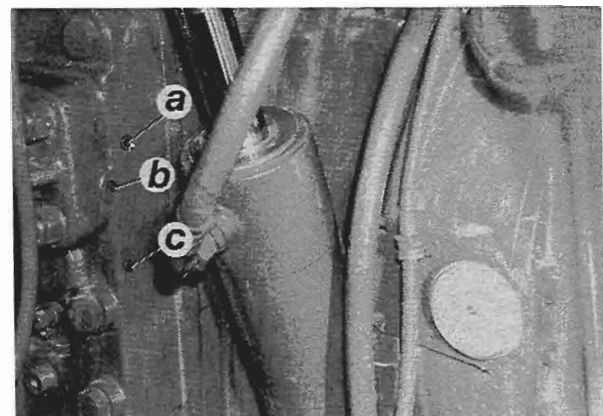
Measurement point:
3/2-way valve, rear and front diff lock.
 During the test engage differential lock.



5c

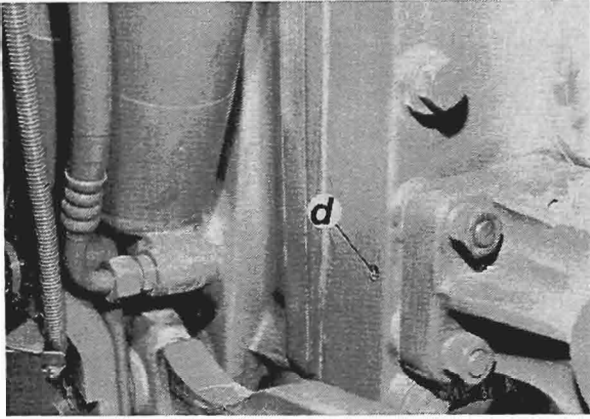


If there are threaded bores on the rear right of the closing cover on the rear axle housing, the following pressures can be measured:
 a = rear PTO clutch
 b = gear lubricant pressure
 c = 750 PTO gears
 For measurement conditions see fig 3c and 4b.



5d



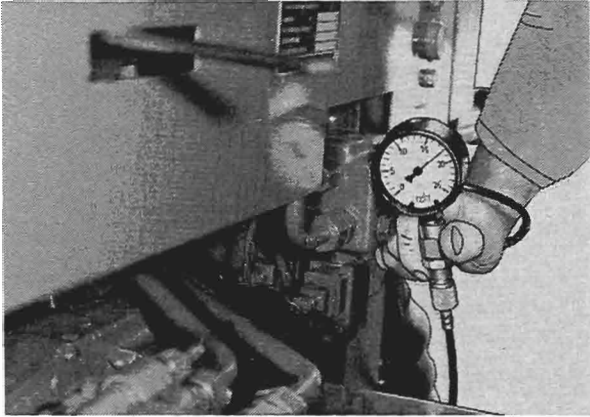


6a

If there are threaded bores on the rear left of the closing cover of the rear axle housing, the following pressure can be measured:

d = 750 PTO gears.

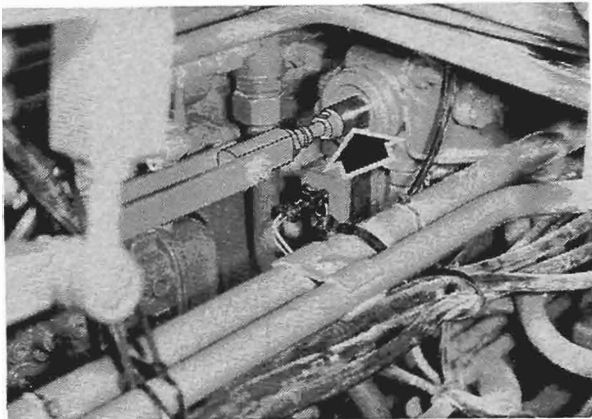
Measurement condition, see fig 4b.



6b

Front right below front axle block:

Proportional valve for front PTO clutch with **measurement point** and **3/2 way valve** for front PTO brake. Measurement conditions see fig 4b.

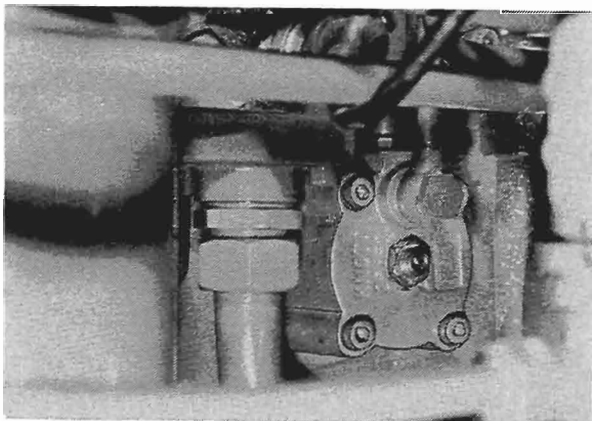


6c

Top right at separation point of clutch housing and changeover gears:

Road-field switch module with two 3/2-way valves.

When selecting the road-field gears, the piston rod (arrow) of the control cylinder must move.



6d

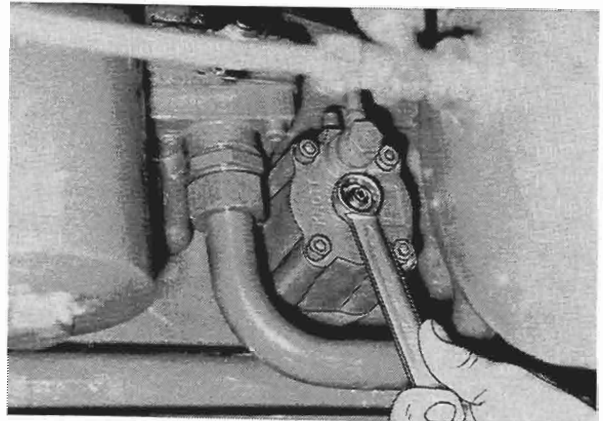
Bottom right on changeover gearbox housing:

carrier cylinder for cardan shaft brake.

To adjust carrier cylinder, see fig 7a.

After replacing the carrier cylinder and/or parts of the cardan shaft brake, adjust the carrier cylinder.

1. Turn in threaded rod to stop.
2. Tighten threaded rod 2.5 to 5.0 Nm using torque wrench X 899.980.151.
3. Now turn the threaded rod 3.6 turns back and lock with locknut.

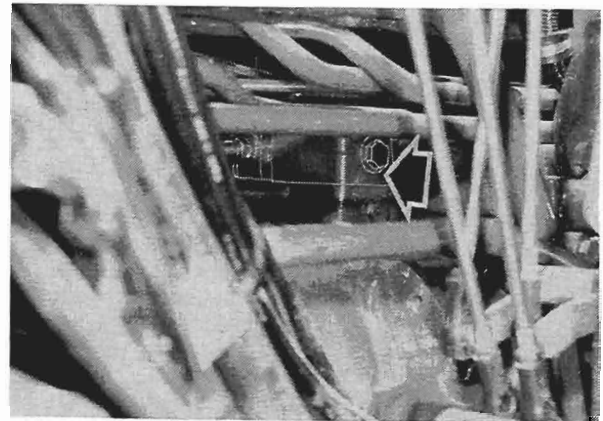


7a



Top right on changeover gear:

Relay valve (arrow) for drive clutch, supports the drive clutch control with the engine running.

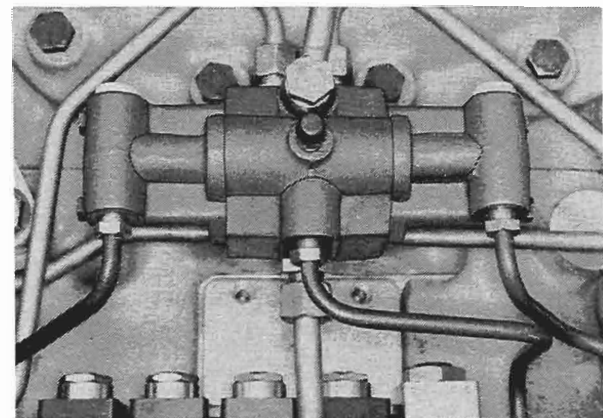


7b



Top of rear axle housing:

Steering brake valve, also called the engagement valve, for engaging the cardan shaft brake with the brake pedal locked.



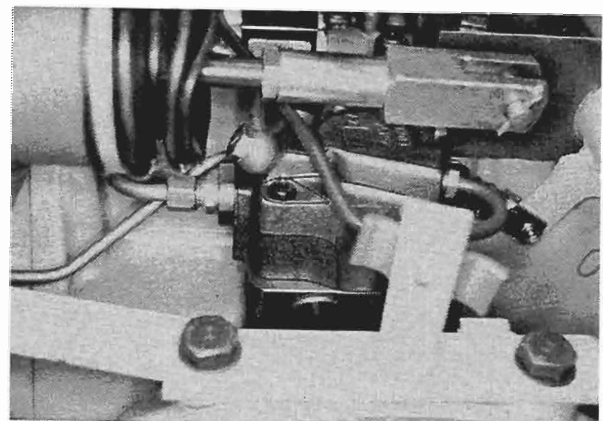
7c



Top left and right of rear axle housing:

Wheel brake cylinders.

To adjust wheel brake cylinders, see page 28.



7d

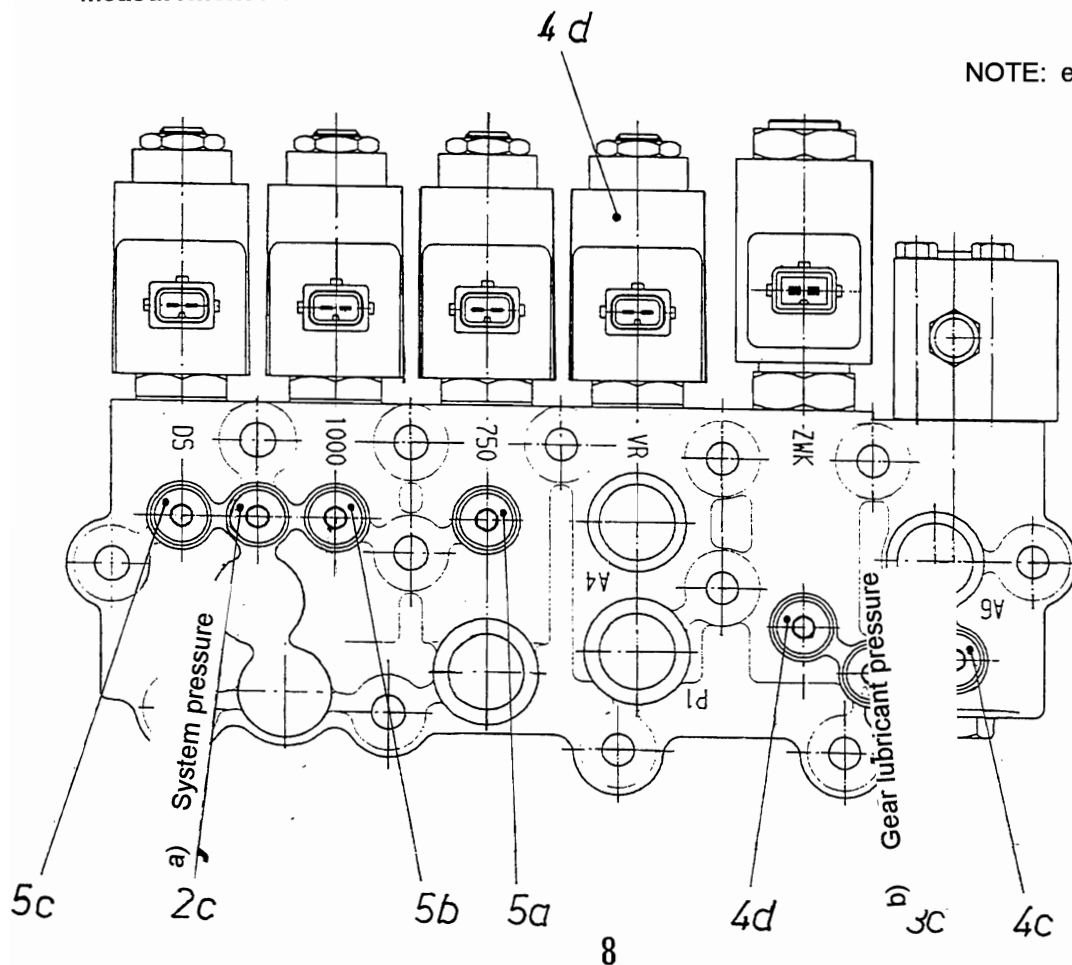


Components from page 9

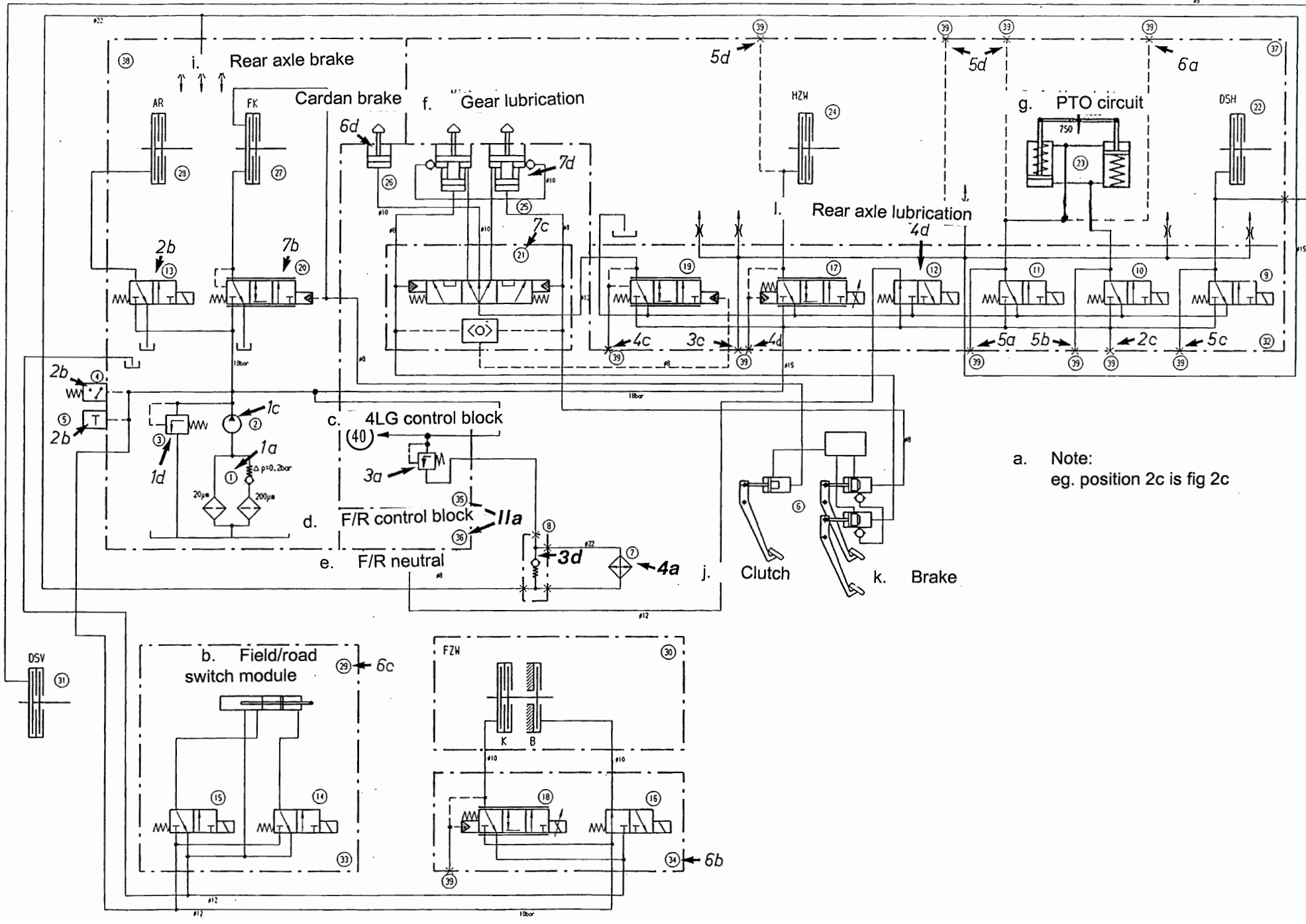
1. Intake filter with bypass
2. Gear pump 36 cm³/h
3. Pressure limiter valve 25 bar (cold start protection)
4. Pressure switch 13-16 bar
5. Temperature switch +17°C
6. Clutch pedal with emitter cylinder
7. Gear oil cooler
8. Bypass valve lubrication 3.5 bar
- 9-16 3/2 way magnetic valve
- 17,18 Pressure control valve
19. Control valve, brake
20. Control valve, drive clutch
21. Steering brake valve
22. Hydraulic rear diff. lock
23. Hydraulic PTO gear
24. Hydraulic rear PTO
25. Brake cylinder rear axle
26. Cardan brake cylinder
27. Hydraulic drive clutch
28. Hydraulic front wheel drive
29. Hydraulic selection cylinder road/field
30. Hydraulic front PTO
(clutch and brake operated separately)
31. Hydraulic front diff. lock
32. Valve block comfort hydraulics
33. Switch module road/field gear
34. Valve block front PTO
35. 4LG control block
36. F/R control block
37. Rear axle
38. Gear selector
39. Measurement points
40. Supply 4LG control block
- A. Pressure input for 4LG control block

Measurement Points on Valve Block Comfort Control

NOTE: e.g. item 4C is Fig. 4C

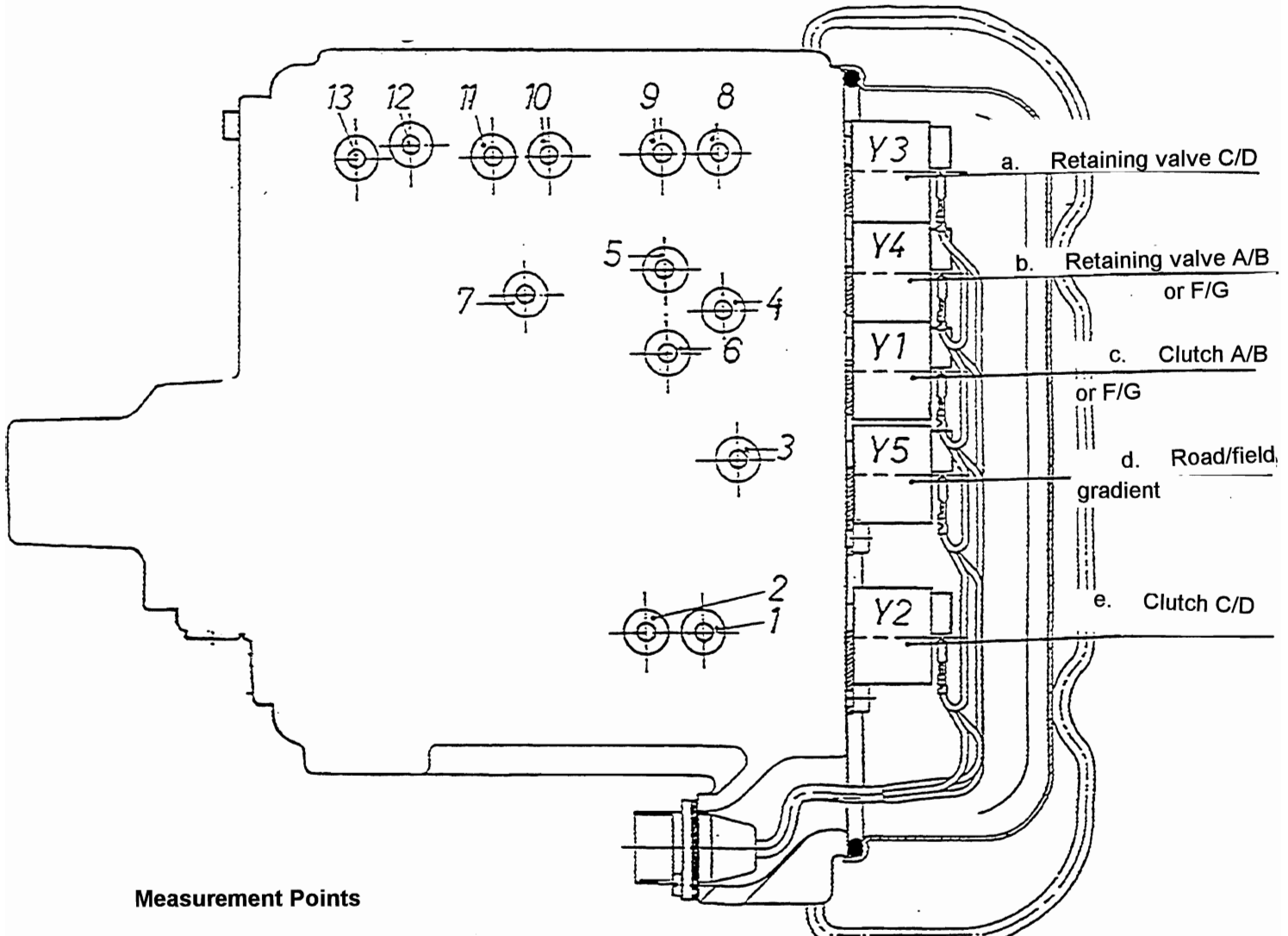


2. COMFORT GEARS Hydraulic Diagram



a. Note: eg. position 2c is fig 2c

3. Load Gears
Position of Components
Pressure Measurements
4LG Control Block



Measurement Points

Meas. Point	Name	Pressure		Condition
		Nominal	Actual	
1	Clutch D	18/20		When selected
2	Clutch C	18/20		
3	Precontrol pressure	10		Constant
5	System pressure	18/20		
6	Retaining pressure A/B, F/G	18/20		Briefly depending on change direction
7	Control pressure	0-12/20		0-12 controlled, 12-20 uncontrolled
8	Retaining pressure C/D	18/20		Briefly depending on change direction
11	Pressure MV Y3 or Y4			
12	Clutch B/G	18/20		When selected
13	Clutch A/F	18/20		

(See also hydraulic circuit diagram page 17)
 Remove right rear wheel, right on change-over gear housing, top, **F/R control block** and below for a **LG control block** with measurement point.
 Measurement conditions for all pressure measurements up to fig 14c: oil temperature min 50°C. Run engine at 1000 rpm.

NOTE:

Measurement is possible only with gear engaged for E-box G 816.970.070.013. If E-box G 816.970.070.014 is fitted, press clutch pedal once (forwards or reverse LED must light).
 Use test connection and manometer with measurement range 0 - 25 bar from Minibox test kit X 899.980.161 for all pressure measurements.

Remove sealing bolt no. 5 (see also diagram page 10), connect manometer.
 Nominal value approx 18 bar (20 bar) = system pressure.

If this value is not reached, check precontrol pressure, see fig 11c, or test DBV, see fig 3b.

NOTE:

System pressure increases from gearbox number see page 27/1.

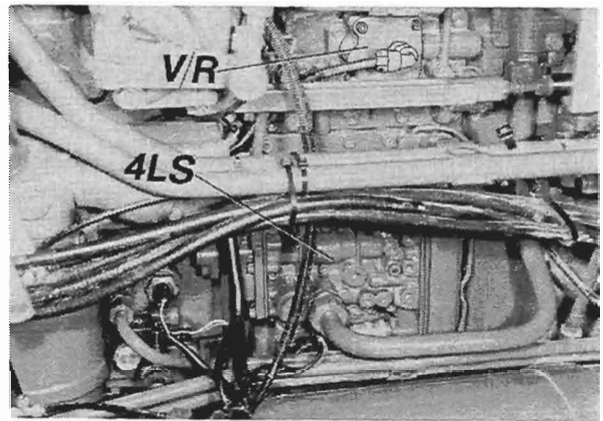
Remove sealing bolt no. 3 (see also diagram page 10), connect manometer.
 Nominal value approx 10 bar = precontrol pressure.
 If this value is not reached, check system pressure, see fig 11b, or test DBV, see fig 11d.

Press down spring bracket. Remove 4LG control block. Remove cover from 4LG control block. Remove 10 bar DBV, check freedom of movement of valve.

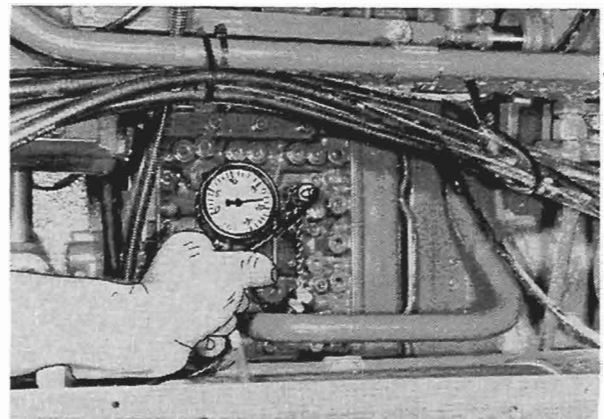
Fit 10 bar DBV in arrangement shown.

NOTE:

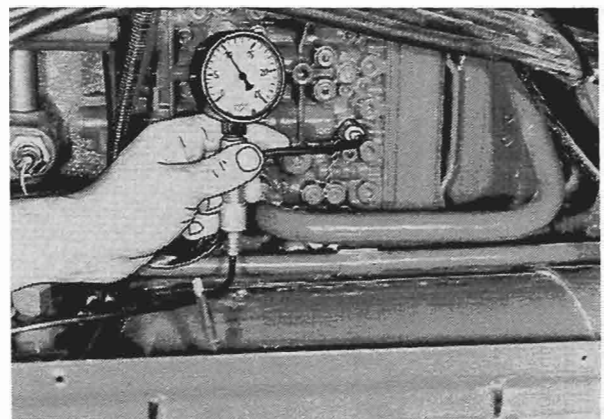
Shown with 4LG control block removed for clarity.



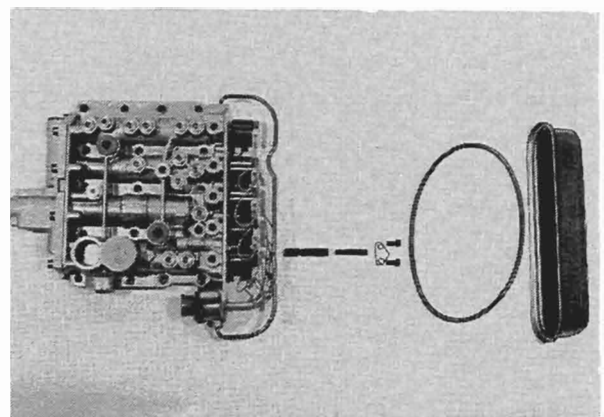
11a



11b

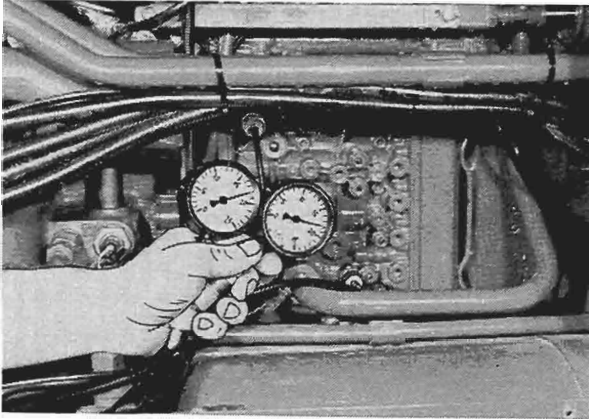


11c



11d



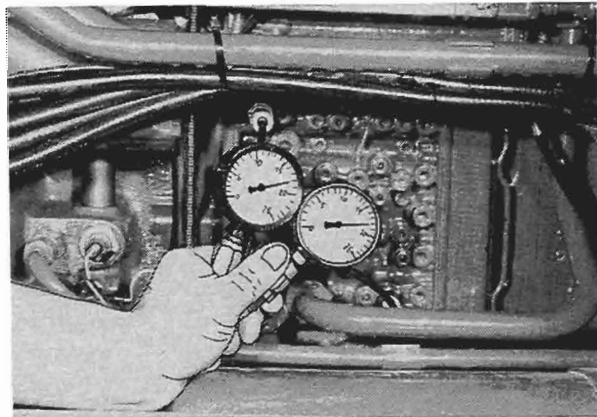


12a

Pressure measurement load gears. **Gear I forwards.** Clutches A and C are closed (see also diagram page 19). Remove sealing bolts nos. 13 and 2 (see diagram page 10), connect manometer. Nominal value: for both clutches approx 18 bar (20 bar).

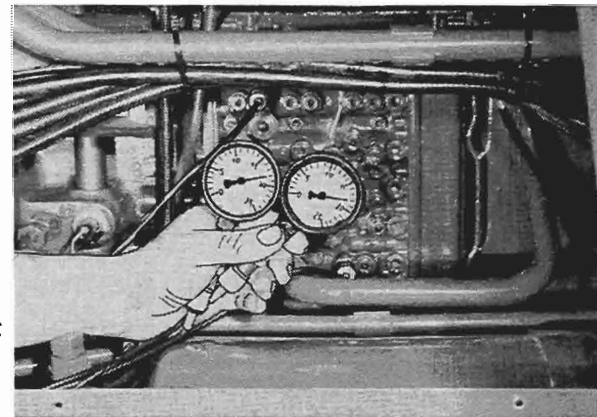
NOTE:

System pressure increased from gearbox number see page 27/1.



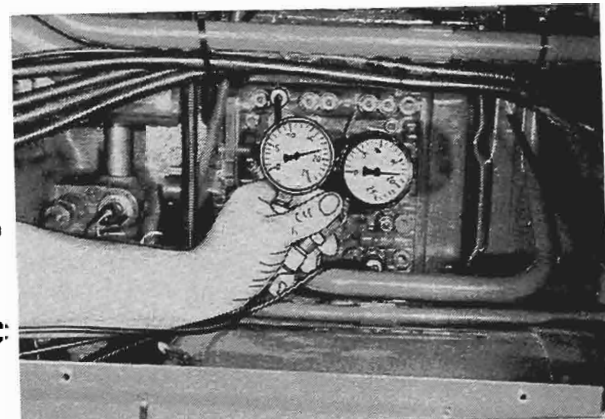
12b

Pressure measurement load gears. **Gear II forwards.** Clutches A and D are closed (see also diagram page 19). Remove sealing bolts nos. 13 and 1 (see diagram page 10), connect manometer. Nominal value: for both clutches approx 18 bar (20 bar).



12c

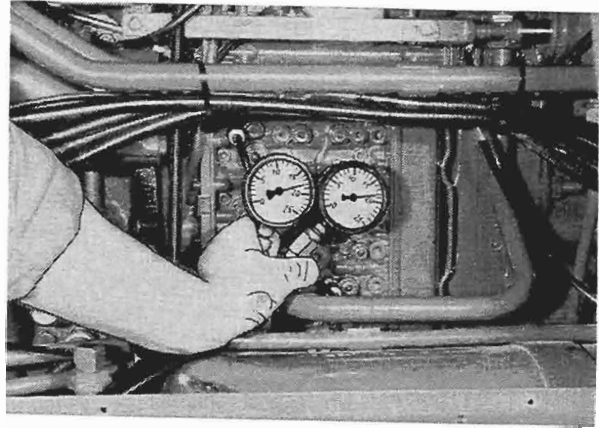
Pressure measurement load gears. **Gear III forwards.** Clutches B and C are closed (see also diagram page 19). Remove sealing bolts nos. 12 and 2 (see diagram page 10), connect manometer. Nominal value: for both clutches approx 18 bar (20 bar).



12d

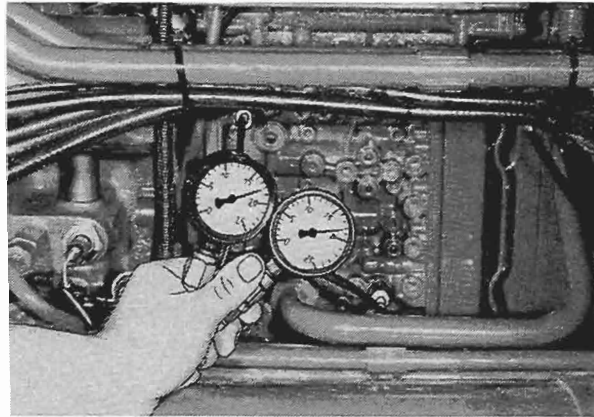
Pressure measurement load gears. **Gear IV forwards.** Clutches B and D are closed (see also diagram page 19). Remove sealing bolts nos. 12 and 1 (see diagram page 10), connect manometer. Nominal value: for both clutches approx 18 bar (20 bar).

Pressure measurement load gears. **Gear I reverse.** Clutches F and C are closed (see also diagram page 19). Remove sealing bolts nos. 13 and 2 (see diagram page 10), connect manometer. Nominal value: for both clutches approx 18 bar (20 bar).



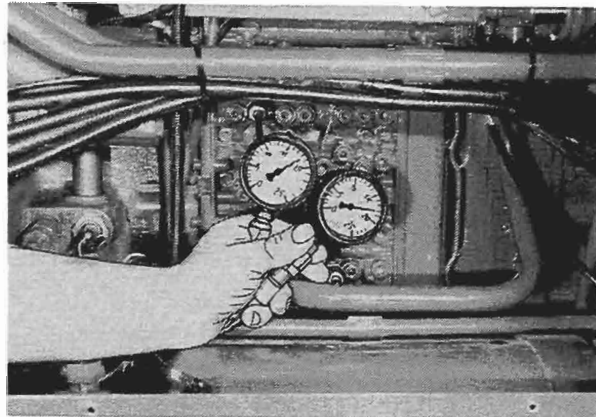
13a

Pressure measurement load gears. **Gear II reverse.** Clutches F and D are closed (see also diagram page 19). Remove sealing bolts nos. 13 and 1 (see diagram page 10), connect manometer. Nominal value: for both clutches approx 18 bar (20 bar).



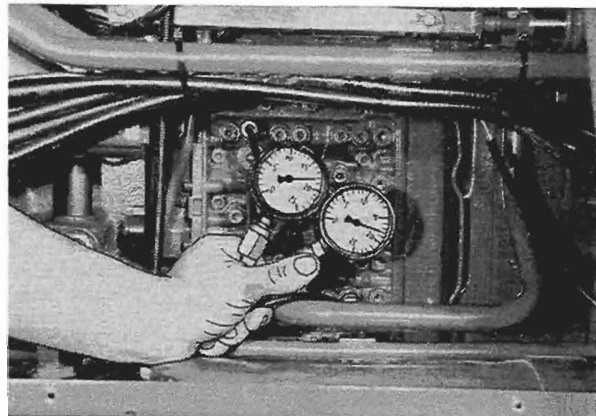
13b

Pressure measurement load gears. **Gear III reverse.** Clutches G and C are closed (see also diagram page 19). Remove sealing bolts nos. 12 and 2 (see diagram page 10), connect manometer. Nominal value: for both clutches approx 18 bar (20 bar).

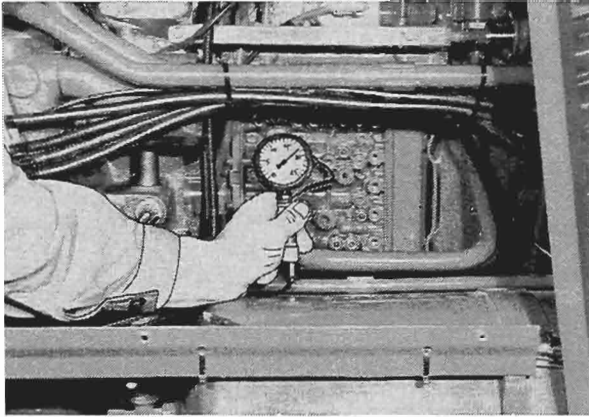


13c

Pressure measurement load gears. **Gear IV reverse.** Clutches G and D are closed (see also diagram page 19). Remove sealing bolts nos. 12 and 1 (see diagram page 10), connect manometer. Nominal value: for both clutches approx 18 bar (20 bar).

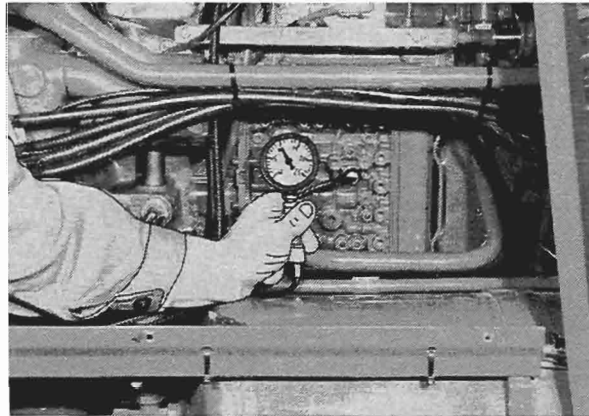


13d



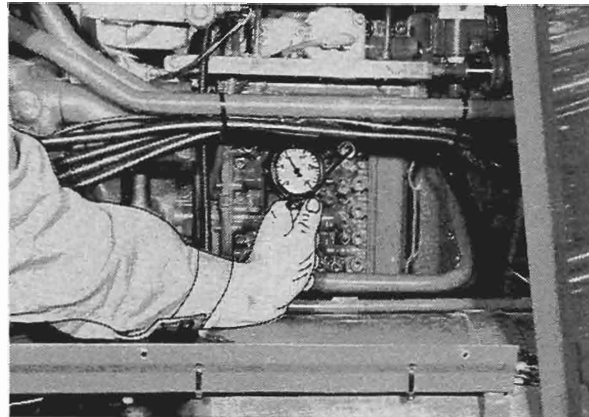
14a

Remove sealing bolt no. 7 (see also diagram page 10), connect manometer. Nominal pressure approx 18 bar (20 bar) = controlled pressure for load gear clutches. If a pressure of approx 18 bar (20 bar) is not reached, measure system pressure see fig 11b.



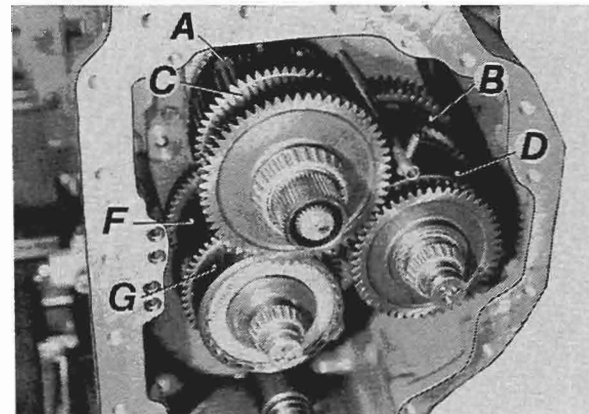
14b

Remove sealing bolts nos. 6 (see also diagram page 10), connect manometer. Nominal value: max 18 bar (20 bar) = retaining pressure for clutches A, B, F and G. Measurement conditions: Select load gears II and III repeatedly. Manometer pulses up to approximately 10 bar. **NOTE:** Engage gear and do not press clutch pedal.



14c

Remove sealing bolts nos. 8 (see also diagram page 10), connect manometer. Nominal value: max 18 bar (20 bar) = retaining pressure for clutches C and D. Measurement conditions: Select load gears II and III repeatedly. Manometer pulses up to approximately 10 bar. **NOTE:** Engage gear and do not press clutch pedal.



14d

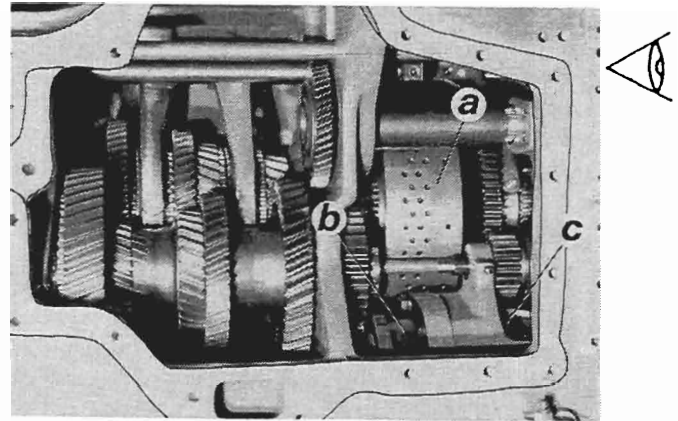
Position of clutches, see figs 14d to 15b. Separate tractor between clutch housing and changeover gears. Remove end wall cover from changeover gears. For force flow in gear selection process, see page 17.

Right on changeover gears, remove 4LG control block and large side cover.

- a = drive clutch
- b = 4WD clutch
- c = cardan shaft brake

NOTE:

The drive clutch and 4WD clutch are closed by spring plate force and opened by oil pressure.



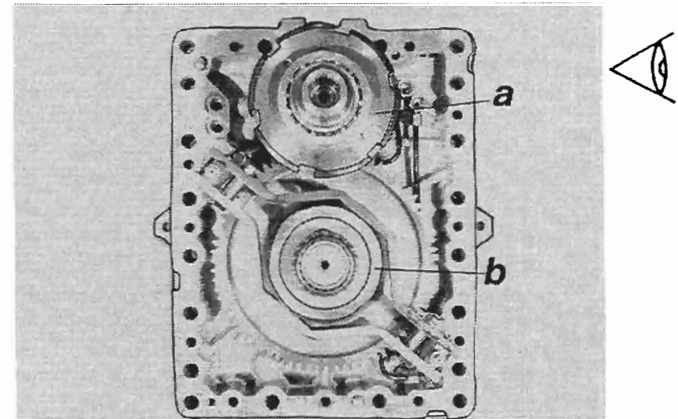
15a

Remove housing cover rear on rear axle housing.

- a = PTO clutch with brake
- b = PTO gear 750/1000

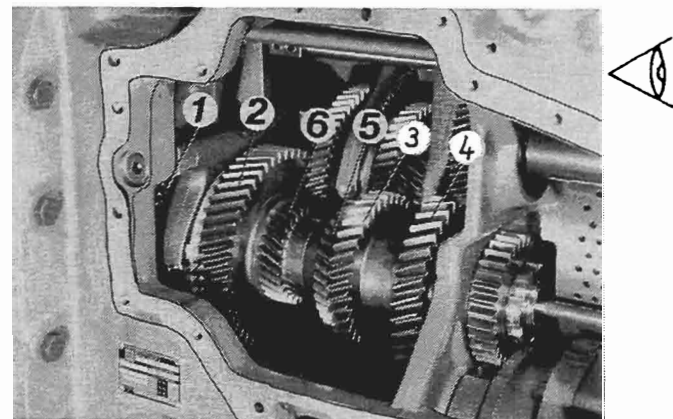
NOTE:

The PTO clutch is closed by hydraulic pressure from around 18 bar. To measure pressures see figs 4d and 5d.



15b

For preliminary work, see fig 15a.
Changeover gears with gear wheels for gears 1 to 6.



15c

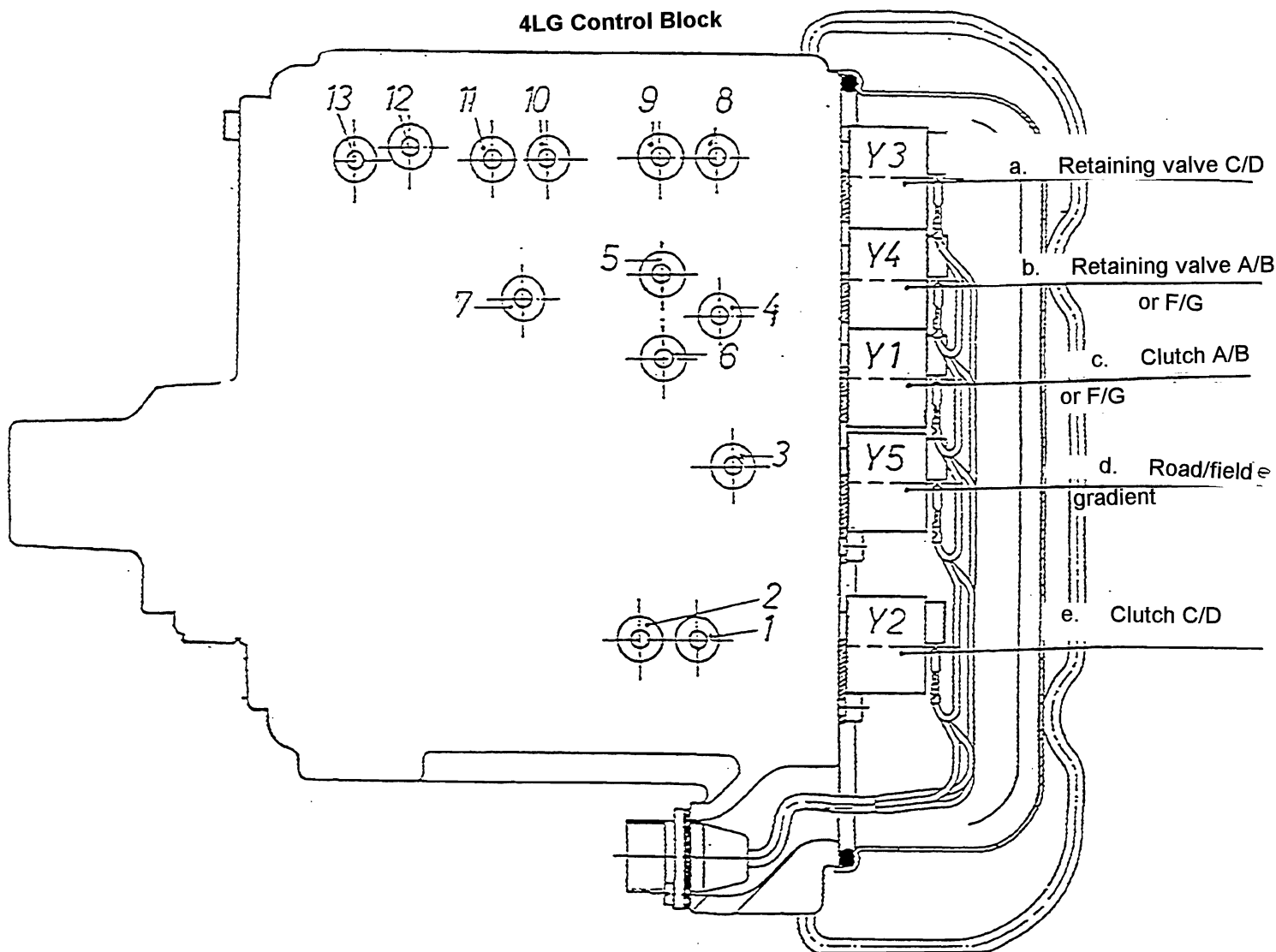
Towing Specification

With engine running and intact gear lubrication:

- a) Main select lever to neutral.
- b) Towing distance not limited.
- c) Do not tow above 40 km/h.

With engine stopped and/or faulty gear lubrication:

- a) Gear selector lever to neutral.
- b) Towing period max 1 hour.
- c) Do not tow above 10 km/h.



Measurement Points

Meas. Point	Name	Pressure		Condition
		Nominal	Actual	
1	Clutch D	18/20		When selected
2	Clutch C	18/20		
3	Precontrol pressure	10		Constant
5	System pressure	18/20		
6	Retaining pressure A/B, F/G	18/20		
7	Control pressure	0-12/20		0-12 controlled, 12-20 uncontrolled
8	Retaining pressure C/D	18/20		Briefly depending on change direction
11	Pressure MV Y3 or Y4			
12	Clutch B/G	18/20		When selected
13	Clutch A/F	18/20		