WORKSHOP SERVICE MANUAL

CONTENTS

1 . INTRODUCTION

Contents

1 A01 Introduction

CONTENTS

Introduction

A. Reading the manual

General
The aim of this manual is to assist Distributors and Dealers in the efficient installation, maintenance and repair of MASSEY FERGUSON machinery. These operations can be carried out within the times specified in the repair times schedule by following the procedures specified and using appropriate specialised tools.

Page numbering
Example: 6 B03.2
This manual is divided into sections and parts. Each page is identified with the following information:

6	=	Section
B	=	Part
03	=	Sequence number within the part
2	=	Page number within the part

The issue number and the date are shown at the bottom of the page.

Using the manual
To make information easier to find, there is an index at the beginning of each section listing the various parts in that section.
At the beginning of each part there is a table of contents which should also be used as a guide to locate information.
Items are indicated by means of identifying symbols (circles, squares, triangles).

Meaning of identifying symbols
Circle ○ (...) : identifies component part only.

Square □ [...] : identifies component part and indicates an adjustment.

Triangle Δ /...\ : identifies component part and indicates an important point to be noted during assembly and disassembly.

Amendments
Amended pages are issued with the same page numbers as the previous pages: only the issue number and the date are changed.
The old pages must be destroyed.

Service tools
When a special service tool must be used in an operation, the tool number is specified along with the instruction requiring its use.

Repairs and replacements
When parts have to be replaced, it is essential that only genuine MASSEY FERGUSON parts should be used.
Special attention should be paid to the following points concerning repairs and the fitting of replacement parts and accessories.
Safety features embodied in the tractor could be impaired if genuine parts are not fitted.
In certain countries, legislation prohibits the fitting of parts that fail to comply with tractor manufacturer's specifications. The torque wrench setting figures specified in the workshop manual must be strictly complied with. Locking devices must be installed where specified. If the efficiency of a locking device is impaired during removal, a new one must be fitted.
The tractor warranty is invalidated if parts other than genuine MASSEY FERGUSON parts are fitted. All MASSEY FERGUSON replacement parts benefit from the full backing of the manufacturer's warranty. MASSEY FERGUSON Distributors and Dealers are required to supply only genuine parts.

Repair time schedule
The sections on repair times are identical to those in the workshop manual. This repair time schedule is available under publication number 3378047M1.

B. General specifications

Engine

Characteristic	8110	8120	8130	8140	8150	8160
MF manufactured by VALMET	-	-	-	620 DS	620 DS	634 DS
PERKINS model	1006.6THR2	1006.6THR3	1006.6THR4	-	-	-
Number of cylinders	6	6	6	6	6	6
Turbocharger	yes	yes	yes	yes	yes	yes
Bore (mm)	100	100	100	108	108	108
Stroke (mm)	127	127	127	120	120	134
Cubic capacity (cm^3)	6000	6000	6000	6600	6600	7400
Maximum power DIN (KW)	99.3	106.6	114	117.7	132,4	147,1
P.T.O. power (KW)	88.3	97	103	106.6	117,6	132.3
At engine speed of rev/min	2200	2200	2200	2200	2200	2200
Maximum torque (Nm)	551	588	625	650	720	810
Engine speed at maximum torque (rev/min)	1400	1400	1400	1300	1400	1300
Idling speed (rev/min)	1000	1000	1000	1000	1000	1000
Torque at rated speed (Nm)	430	462	495	555	555	620
Maximum no load speed (rev/min)	2310	2310	2310	2370	2370	2370
Permissible front P.T.O. (KW)						
at 2200 rev/min	75	75	75		92,1	
Maximum torque (Nm)	328	328	328		400	
Lubrication	Gear type pump-strainer on suction and external canister type filters					
Valves	Overhead, push-rod operated					
Valve clearances (cold)						
- Inlet (mm-in)	0,20 / 0,08	0,20 / 0,08	0,20 / 0,08	0,35 / 0,012	0,35 / 0,012	0,35 / 0,012
- Exhaust (mm-in)	0,45 / 0,018	0,45 / 0,018	0,45 / 0,018	0,35 / 0,012	0,35 / 0,012	0,35 / 0,012
Engine oil cooler	yes	yes	yes	yes	yes	yes

Fuel system and air cleaner

Supply pump	AC DELCO	Bosch in line
Fuel filter	Yes	
Number of elements	2	
Fuel injection pump	Stanadyne	Bosch in line
Injectors and nozzle holders	Stanadyne	
Cold weather starting	Thermostart	
Air cleaner : Two stage, dry element with blockage indicator. Built-in centrifugal pre-filter, self-cleaning by exhaust extraction of dust		

Introduction

Electrical system

Voltage :	12 volts negative earth.
Batteries :	2 maintenance free batteries
Safety start :	operated by the clutch pedal.
Bulbs:	
headlights :	European code 40 / 45 W
sidelights :	5 W
rear/brake lights :	21/5 W
direction indicators :	21 W
number plate light :	10 W
work lamps :	55 W - H3
instrument panel lighting and warning lights :	3W - 2 W - 1.2 W
roof light :	10 W

Cooling

Operation :	centrifigal pump pressurised radiator, regulated by pressure cap. Opening temperature : 83 ° C (181,4° F)
controlled by thermostat.	
Fan :	Viscostatic model.
Belt driven :	centrifugal water pump.
Belt deflection :	- with belt tension gauge : 355 N - without gauge : 10 mm (3/8") (on the longest span)

Transmission

Wet clutch 230 mm ø (9.05 in)	6 discs (8110/8120/8130) 7 discs (8140/8150) 8 discs (8160)
Gearbox :	
Dynashift Gearbox :	- 32 front speeds - 32 rear speeds - Four selectable ratios without declutching - Reverse shuttle (synchronised)

Final reduction units

Reduction units:	epicyclic, in the rear axle housings.
Reduction ratios :	• 8110/8120/8130/8140 : ND 5.571:1 • 8110/8120/8130/8140 : HD 6.214:1 Sealed compartment 8140 - (8130 - option) • 8150/8160 (8140 - option) composite final drive 7.141:1

Road speeds "DYNASHIFT" at 2200 rev/min

Front

Ratio			With 20.8 - 38 tyres				With 20.8 - 42 tyres			
			8110/8120		8130		8140		8150/8160	
			KPh	MPh	KPh	MPh	KPh	MPh	KPh	MPh
	1	A	2.156	1.34	2.125	1.32	2.538	1.58	2.522	1.57
		B	2.524	1.57	2.487	1.54	2.971	1.85	2.952	1.84
		C	2.979	1.85	2.936	1.82	3.507	2.18	3.485	2.17
		D	3.486	2.17	3.437	2.14	4.105	2.55	4.079	2.54
	2	A	3.272	2.03	3.225	2.01	3.852	2.39	3.828	2.38
		B	3.830	2.38	3.775	2.35	4.509	2.80	4.480	2.79
		C	4.521	2.81	4.456	2.80	5.382	3.35	5.288	3.29
		D	5.291	3.29	5.215	3.24	6.229	3.87	6.190	3.85
	3	A	4.675	2.90	4.608	2.86	5.503	3.42	5.469	3.40
		B	5.471	3.40	5.393	3.35	6.441	4.00	6.400	3.98
		C	6.458	4.02	6.366	3.96	7.603	4.73	7.555	4.70
		D	7.559	4.70	7.451	4.63	8.899	5.53	8.843	5.50
	4	A	6.363	3.95	6.272	4.00	7.491	4.66	7.443	4.63
		B	7.447	4.63	7.340	4.56	8.767	5.45	8.712	5.42
		C	8.790	5.46	8.664	5.40	10.348	6.43	10.283	6.40
		D	10.288	6.40	10.141	6.30	12.112	7.5	12.036	7.49
	1	A	8.385	5.21	8.265	5.13	8.362	5.19	8.309	5.16
		B	9.814	6.09	9.673	5.76	9.787	6.08	9.725	5.76
		C	11.584	7.19	11.418	7.09	11.552	7.17	11.479	7.13
		D	13.558	8.42	13.364	8.30	13.521	8.40	13.435	8.34
	2	A	12.725	7.90	12.543	7.79	12.690	7.88	12.610	7.83
		B	14.894	9.25	14.681	9.12	14.852	9.23	14.759	9.17
		C	17.580	10.92	17.329	10.77	17.532	10.89	17.421	10.82
		D	20.577	12.78	20.282	12.60	20.520	12.75	20.390	12.67
	3	A	18.179	11.29	17.919	11.13	18.128	11.26	18.014	11.19
		B	21.277	13.22	20.972	13.03	21.218	13.18	21.084	13.10
		C	25.115	15.60	24.755	15.38	25.045	15.56	24.087	14.97
		D	29.395	18.26	28.975	18.00	29.314	18.21	29.129	18.10
	4	A	24.743	15.37	24.389	15.15	24.675	15.33	24.519	15.23
		B	28.960	17.99	28.546	17.74	23.880	14.84	28.697	17.83
		C	34.184	21.24	33.695	20.94	34.089	21.18	33.874	21.05
		D	40.010	24.86	39.438	24.51	39.900	24.79	39.648	26.64

Introduction

Road speeds "DYNASHIFT" at 2200 rev/min

Rear

Ratio		With 20.8 - 38 tyres				With 20.8 - 42 tyres			
		8110/8120		8130		8140		8150/8160	
		KPh	MPh	KPh	MPh	KPh	MPh	KPh	MPh
1	A	1.985	1.23	1.957	1,22	2.487	1.55	2.322	1.44
	B	2.323	1.44	2.290	1,42	2.910	1.81	2.718	1.60
	C	2.742	1.71	2.703	1,68	3.435	2.14	3.208	1.20
	D	3.210	2.00	3.164	1,97	4.021	2.50	3.755	2.34
2	A	3.012	1.87	2.969	1,85	3.774	2.35	3.524	2.19
	B	3.526	2.19	3.475	2,16	4.417	2.75	4.125	2.57
	C	4.162	2.59	4.102	2,55	5.213	3.24	4.869	3.03
	D	4.871	3.03	4.802	2,99	6.102	3.80	5.699	3.54
3	A	4.304	2.68	4.242	2,64	5.391	3.35	5.035	3.13
	B	5.037	3.13	4.965	3,09	6.310	3.92	5.892	3.66
	C	5.945	3.70	5.860	3,64	7.448	4.63	6.955	4.33
	D	6.959	4.33	6.859	4,27	8.717	5.42	8.141	5.06
4	A	5.858	3.64	5.774	3,59	7.338	4.56	6.853	4.26
	B	6.856	4.26	6.758	4,20	8.588	5.34	8.020	4.99
	C	8.092	5.03	7.977	4,96	10.137	6.30	9.467	5.88
	D	9.472	5.89	9.336	5,81	11.865	7.38	11.081	6.89
1	A	7.719	4.79	7.609	4.72	8.191	5.09	7.649	4.75
	B	9.035	5.61	8.906	5.53	9.587	5.95	8.953	5.56
	C	10.664	6.62	10.512	6.53	11.316	7.03	10.568	6.56
	D	12.482	7.75	12.304	7.64	13.245	8.23	12.369	7.68
2	A	11.715	7.28	11.548	7.17	12.431	7.72	11.609	7.21
	B	13.712	8.52	13.516	8.40	14.549	9.04	13.587	8.44
	C	16.185	10.05	15.953	9.91	17.174	10.67	16.038	9.96
	D	18.944	11.77	18.673	11.60	20.101	12.49	18.772	11.66
3	A	16.736	10.40	16.497	10.25	17.758	11.03	16.584	10.30
	B	19.588	12.17	19.308	12.00	20.785	12.91	19.410	12.06
	C	23.121	14.36	22.791	14.16	24.534	15.24	22.912	14.23
	D	27.062	16.81	26.675	16.57	28.715	17.84	26.817	16.66
4	A	22.780	14.15	22.454	13.95	24.171	15.02	22.573	14.02
	B	26.662	16.57	26.280	16.33	23.290	14.47	26.420	16.42
	C	31.471	19.55	31.021	19.27	33.393	20.75	31.185	19.38
	D	36.835	22.89	36.308	22.56	39.085	24.29	36.501	22.68

Introduction

Power take-off

P.T.O. ratio	Proportional to the engine speed. Hydraulic clutch. 540 rev/min at 1990 engine rev/min 750 rev/min at 2000 engine rev/min 1000 rev/min at 2090 engine rev/min
Speed changing	By changing shaft - 540 rev/min shaft, 35 mm (1 3/8 in) diameter 6 splines - 1000 rev/min shaft, 35 mm (1 3/8 in) diameter 21 spline
For 8160 : One speed only	1000 rev/min at 2090 engine rev/min

Front power take-off (optional extra)

Control	Hydraulic clutch mechanism controlled by a button in the cab.
Ratio	1000 rev/min at 2040 engine rev/min
Shaft	35 mm (1 3/8 in) diameter - 21 splines.

Four wheel drive front axle

Clutch mechanism	Hydraulic, electrically actuated by push button in the cab.
Differential lock	Electrically-controlled simultaneous front and rear differential lock

Hydraulics

According to countries and option, two different hydraulic systems are proposed :

1. Closed centre system with flow and pressure control :

Charge circuit :	Max. flow 160 l/mn(35.18 imp.gal - 42.27 US gal) supplies : - constant boost pressure of 5 bar to the variable displacement pump - lubrication of the gearbox and the PTO clutch - cooling system- top up of the master cylinders.
High-pressure system :	Max. flow 110 l/mn (24.19 imp.gal - 29.05 US gal) at 2200 rev/min and 180 bar, maxi pressure 200 bar supplies : - steering - trailer brake - 17-bar valve - spool valves - ELC valve
Filtration :	1 strainer, 150 micron, on suction, located to the left of the transmission housing. External main high-pressure filter, 15 micron, to the right of the housing.

2. Open centre

Two-stage gear pump, driven directly by the engine :

1st stage : This circuit supplies 21 l/mn (4.6 Imp. gal/mn) (5.5 US Gal/mn) at maximum engine speed. Maximum pressure 17 bar.
Hare/Tortoise range gear - Dynashift - Differential lock - P.T.O. - Front P.T.O. (if fitted) - Four wheel drive (if fitted)

2nd stage : This circuit supplies 54 l/mn (11.2 Imp. gal/mn) (14.2 US gal/mn) at maximum engine speed. Maximum pressure 185 bar.
Hydrostatic steering - Trailer brake system - Auxiliary hydraulic system - Hydraulic lift.

Filtration	External 20 micron throwaway, canister type filter.

Introduction

Hydraulic lift

Type : 3 point, category 2 or 3 with ball, hinged or hook-type ends.
Rams : Twin externally mounted rams
MF 8110/8120/8130/8140/8150 - Rams Ø 80 mm (3.1 in) or 89 mm (3.5 in)
MF 8160 *

Position of lift rods on lower links		Lenght of lift rods		Rams diameter 80 mm (3.1 in)				Rams diameter 89 mm (3.5 in)			
				Lower links				Lower links			
				horizontal		fully raised		horizontal		fully raised	
mm	in	mm	in	kg	Lb	kg	Lb	kg	Lb	kg	Lb
		675	(26.57)	5056	11158	6485	14312	6360	14036	8157	18002
		*		-	-	6917	15266	-	-	8701	19203
530	(20.86)	865	(34.05)	5203	11483	5612	12385	6545	14445	7060	15581
		*		5183	11439	5904	13030	6520	14389	7426	16389
		675	(26.57)	-	-	6953	15345	-	-	8747	18863
581	(22.87)	*		-	-	7374	16947	-	-	9275	20470
		865	(34.05)	5621	12921	5997	13235	7070	15603	7544	16649
		*		5577	12308	6287	13875	7015	15482	7908	17453

Brakes

Type	Oil-immersed single disc per wheel, 343 mm (13.5 in) diameter.
Operation	Hydraulic from two master cylinders, automatic adjustment servo assisted factory fitted
Handbrake	Operates on the rear axle pinion
Trailer brake	According to model.

Differential lock - Rear axle

Type	Coupler
Control	Hydraulic with electrical control

Steering

Type : hydrostatic, fixed or tiltable telescopic steering column, one double action central ram.

Theoritical turning circle *	**8110/8120/8130**		**8140**		**8150/8160**
Tyres	11.0-16	16.9-28	11.0-16	16.9-30	16.9-30
- 2 WD	•		•		
- 4 WD		•		•	•
Track adjustment - m (in)		1,97 (77.6)	1,62 (63.8)	2,17 (85.4)	2,17 (85.4)
Angle available	55°	55°	55°	51°	49°
Radius					
- without braking - m (in)	4,26 (167.7)	4,95 (195)*	4,45 (176)	5,45 (215)*	5,56 (219)*

* with 4WD disengaged

Introduction

Wheels

FRONT	2 wheel drive pressed steel
	4 wheel drive pressed steel 6 or 8 clamps
REAR	pressed steel with manual adjustment
	adjust variable track (6 or 8 rails)
	cast with manual adjustment.

Tyres

Compatibility of front/rear tyres of 4 wheel drive tractors same make and model

Tyres	Front	Rear	Front	Rear	Front	Rear
	11.2-24	16.9-34	13.6-28	18.4-34	16.9-30	26.5-34
	12.4-24	18.4-30		18.4-38		18.4-42
		13.6-38	14.9-28	18.4-32		20.8-42
	13.6-24	18.4-30		24.5-32	12.4-32	18.4-38
		15.5-38		18.4-38		18.4-42
	11.2-28	18.4-30		20.8-38	18.4-34	18.4-30
		15.5-38	16.9-28	20.8-38		15.5-38
	12.4-28	18.4-30		18.4-42		
		23.1-30				

***Note :** The data in this table is not binding. Ask your dealer for further information on other possible choices.*

Water Ballasting (75° fill)

Front tyres	Litre	Imp. gal	US gal	Front tyres	Litre	Imp. gal	US gal
10.0-16	50	11	13	18.4-38	370	81.4	96.2
11.0-16	95	20.9	24.7	20.8-38	460	101.3	121.4
14L-16.1	105	23.1	27.3	20.8-42	510	112.3	134.6
13.6-28	160	35.2	41.6				
14.9-28	190	71.8	49.4				
16.9-28	250	55	65				
16.9-30	260	57.2	68.6				

Introduction

Capacities

Fuel tank : :	8110/8120/8130	:	226 l	(49.7 Imp. gal) (58.8 US gal)
	8140/8150/8160	:	330 l	(72.6 Imp. gal) (85.8 US gal)
Cooling system :	8110/8120/8130	:	28.5 l	(6.3 Imp. gal) (7.4 US gal)
	8140/8150/8160	:	34 l	(7.5 Imp. gal) (8.8 US gal)
Engine sump :	8110/8120/8130	:	15.6 l	(3.4 Imp. gal) (4.0 US gal)
	8140/8150/8160	:	19 l	(4.2 Imp. gal) (4.9 US gal)
Transmission/rear axle :*	8110/8120/8130/8140/8150/8160	:	87.5 l	(19.3 Imp. gal) (23.2 US gal)
Front axle assemby :	8110/8120/8130/8140	:	10.9 l	(2.4 Imp. gal) (2.9 US gal)
	8150/8160	:	11.7 l	(2.6 Imp. gal) (3.09 US gal)
Front final reduction units (each) :	8110/8120/8130/8140	:	1.8 l	(0.4 Imp. gal) (0.47US gal)
	8150/8160	:	1.9 l	(0.4 Imp. gal) (0.5 US gal)
Rear final reduction units (each) :	8140/8120/8130/8140/8150	:	3.6 l	(0.8 Imp. gal) (0.9 US gal)
Double reduction (each)	8110/8120/8130/8140/8150	:	3.6 l	(0.8Imp. gal) (0.9 US gal)
	8160	:	4.5 l	(1 Imp. gal) (1.2 US gal)

* When working on steep slopes 15 l (3.3 Imp. gal.) (4.05 US gal.) of oil can be added.

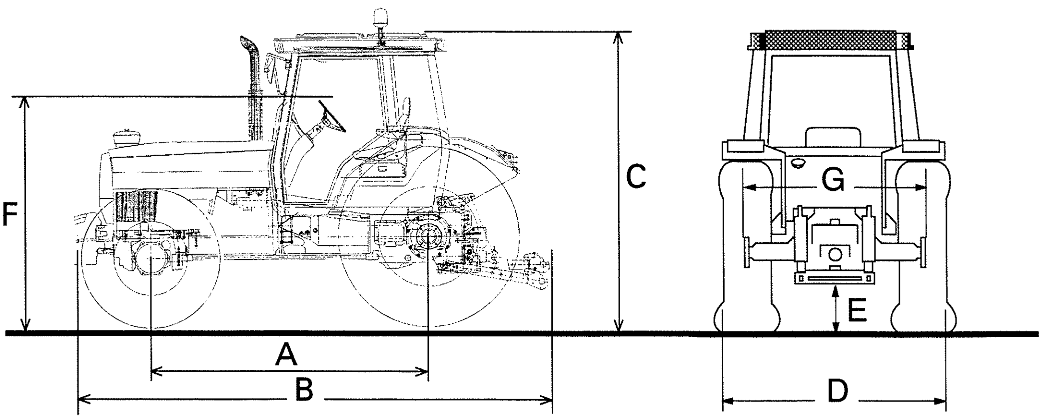
Introduction

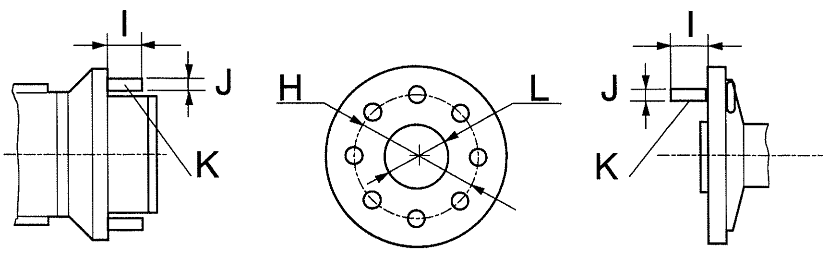
Dimensions and weights - mm (in) - Kg (lb)

	8110/8120/8130 2WD	8110/8120/8130 4WD	8140 2WD	8140 4WD	8150 2WD	8150 4WD	8160 2WD	8160 4WD
A. Wheelbase	2777 (110)	2763 (109)	2940 (115.7)	2925 (114,9)	2940 (115.7)	2925 (114,9)	2940 (115,7)	2925 (114.9)
B. Overall length with lower links	4642 (183.8)	4644 (183)	5105 (201)	5039 (198.4)	5105 (201)	5039 (198.4)	5105 (201)	5039 (198.4)
C. Height to roof (cab tractor)	2942 (115.9)	2942 (115.9)	2930 (115.3)	3013 (118.6)	2930 (115.3)	3013 (118.6)	2930 (115.3)	3013 (118.6)
D. Overall width (1)	2771 (109.1)	2832 (111.5)	2771 (109.1)	2832 (111.5)	2852 (112.3)	2852 (112.3)	2832 (111.5)	2832 (111.5)
E. Ground clearance (under drawbar frame)	385 (15.15)	385 (15.15)	550 (21.6)	550 (21.6)	550 (21.6)	550 (21.6)	510 (20)	510 (20)
F. Height to steering wheel (platform models)	2204 (86.8)	2204 (86.8)	2204 (86.8)	2204 (86.8)				
- Total weight (with full tank, without extra weight)		6285 (13856)		6285 (13856)				
Front wheel	11.0-16	14.9-28*	11.0-16	16.9-28	11.0-16	16.9-28	11.0-16	16.9-28
Rear wheel	18.4-38*	20.8-38*	20.8-38*	20.8-38*	20.8-38*	20.8-38*	20.8-38*	20.8-38*

	Rear axle		Front axle AG155	Front axle AG200
G. Normal Duty axle housing Ø 82	1909 (75.2)			
Heavy Duty axle housing sealed compartment Ø 82	1960 (77.2)		1920 (75.6)	1920 (75.6)
Heavy Duty axle housing Ø 82	1940 (76.4)			
Heavy Duty axle housing sealed compartment/composite final drive. Ø 95	1940 (76.4)			
	Diam. 82 shaft	**Diam. 95 shaft**		
H. Stud distance	203,70 (8.02)	275,25 (10.8)	325 (12.8)	
L. Centring diameter	149,35 (5.87)	220,65 (8.7)	280,80 (11.04)	
I. Stud length : - Wheel with steel hub	41 (1.6)		55 (2.2)	47 (1.85)
- Wheel with cast iron hub	66 (2.6)			
J. Stud diameter	M 18 x 1.5		M18 x 1.5	M22 x 1.5
K. Number of studs	8		8	10

(1) These dimensions are for a tractor fitted with maxi track setting
* with PAVT wheels





CONTENTS

Introduction

Static load per axle (kg) at a pressure of 1,5 bar

	Front		Rear	
	Tyres	Charge	Pneus	Charge
2 wheel drive	10.00 - 16 11.00 - 16 14L - 16.1	2380 (5254) 2640 (5828) 2320 (5121)	18.4 - 38 20.8 - 38	6420 (14172) 7810 (17241)
4 wheel drive	13.6 - 28 14.9 - 28 16.9 - 28 16.9 - 30	3320 (7329) 3850 (8499) 4800 (10596) 4920 (10861)	20.8 - 42 650/75 R34 710/75 R34	7400 (16335) 8140 (17969) 9100 (20088)

Front load limit Kg (lb) (for tractor without front linkage)

	A (Fig. 1)		
m (in)	1 (39.37)	2 (78.74)	3 (118.11)
8110/20/30/40	945 (2085)	600 (1324)	470 (1037)
8150/8160	1500 (3310)	1060 (2339)	800 (1765)

B = 2 m (78.74 in) maxi

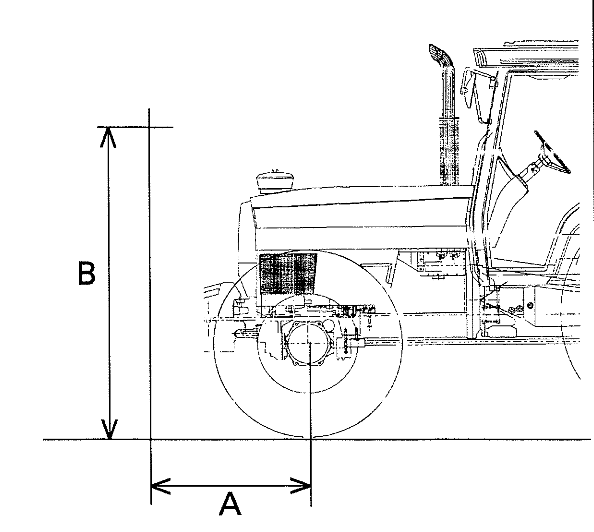


Fig. 1

C. Chassis mounting points and dimensions

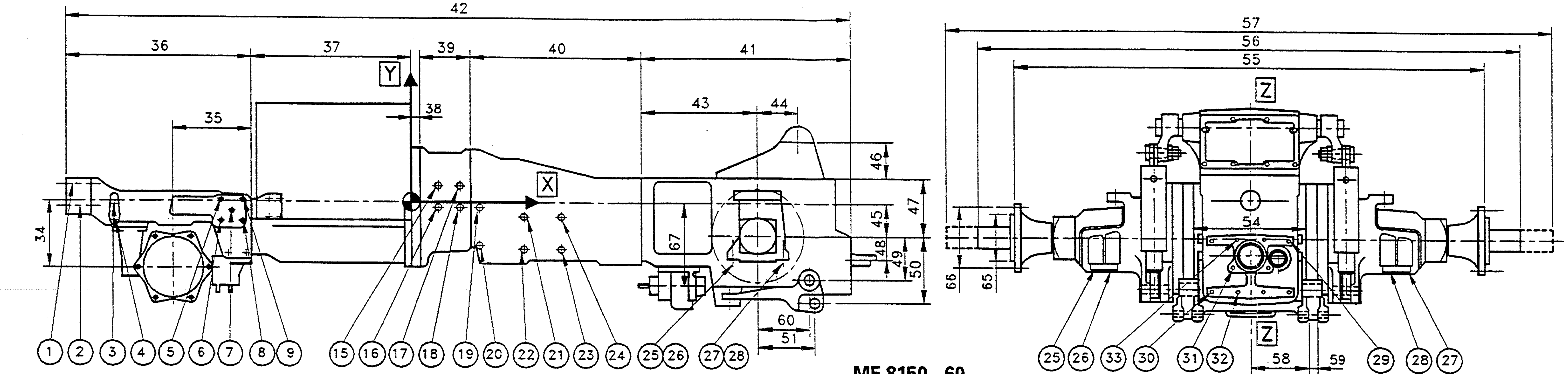
1. Mounting points

Hole N°	Machining Ø	Tapping depth	8110 to 8140 Coordinates X	Y	Z	8150 - 8160 Coordinates X	Y	Z	
1	M20	38	-1633.8	79.25	±190.5	-2067.8	4.3	±220	
2	M20	38	-1633.8	-15.97	±190.5	-2067.8	-95.7	±220	
3	M20	38	-1392.9	-20	±254	-1929.8	6.35	±254	
4	M20	38	-1392.9	-81.6	±254	-1929.8	-95.25	±254	
5	M20	38	-922.7	6.35	±254	-1869.48	-50.8	±254	
6	M20	38	-922.7	-95.25	±254	-1828.2	-95.25	±254	
7	M20	38	-862.38	-50.8	±254	-1828.2	6.35	±254	
8	M20	38	-821.1	-95.25	±254	-1594.4	-81.6	±254	
9	M20	38	-821.1	6.35	±254	-1594.4	-20	±254	
10	M20	38	-	-	-	-1124.2	6.35	±254	
11	M20	38	-	-	-	-1124.2	-95.25	±254	
12	M20	38	-	-	-	-1063.88	-50.8	±254	
13	M20	38	-	-	-	-1022.6	-95.25	±254	
14	M20	38	-	-	-	-1022.6	6.35	±254	
15	M16	32	121	77	±270	80	77	±270	
16	M16	32	121	-24.6	±270	80	-24.6	±270	
17	M16	32	222.6	77	±270	181.6	77	±270	
18	M16	32	222.6	-24.6	±270	181.6	-24.6	±270	
19	3/4-10	through	317.77	-45	±215.9	276.77	-45	±215.9	
20	3/4-10	30	317.77	-203.2	±215.9	276.77	-203.2	±215.9	
21	3/4-10	30	524.14	-63.5	±215.9	483.14	-63.5	±215.9	
22	3/4-10	30	524.14	-203.2	±215.9	483.14	-203.2	±215.9	
23	3/4-10	30	701.9	-203.2	±215.9	660.9	-203.2	±215.9	
24	3/4-10	30	701.9	-63.5	±215.9	660.9	-63.5	±215.9	
25	20.7	through	1518	-262.8	±632.7	1477	-262.8	±632.7	8150
25	20.7	through	-	-	-	1477	-262.8	±739.6	8160
26	20.7	through	1518	-262.8	±556.5	1477	-262.8	±556.5	8150
26	20.7	through	-	-	-	1477	-262.8	±663.4	8160
27	20.7	through	1759.35	-262.8	±632.7	1718.35	-262.8	±632.7	8150
27	20.7	through	-	-	-	1718.35	-262.8	±739.6	8160
28	20.7	through	1759.35	-262.8	±556.5	1718.35	-262.8	±556.5	8150
28	20.7	through	-	-	-	1718.35	-262.8	±663.4	8160
29	3/4-10	30	2065.98	-151	±149	2024.98	-151	±149	
30	3/4-10	30	2065.98	-363	±153	2024.98	-363	±153	
31	3/4-10	30	2065.98	-264	± 75	2024.98	-264	± 75	
32	3/4-10	30	2065.98	-363	± 57	2024.98	-363	± 57	
33	5/8-11	24	2065.98	-146	± 53.44	2024.98	-146	± 53.44	

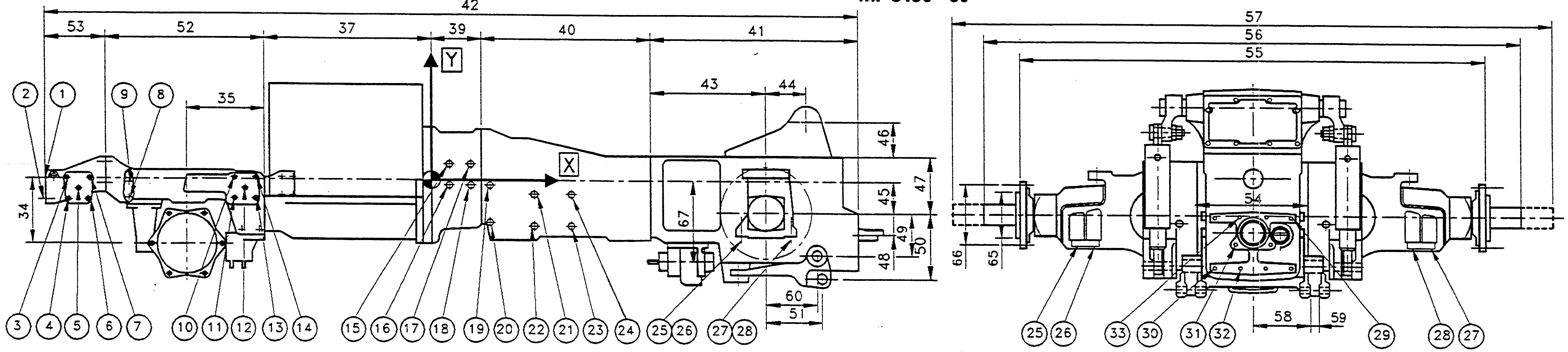
2. Chassis dimensions

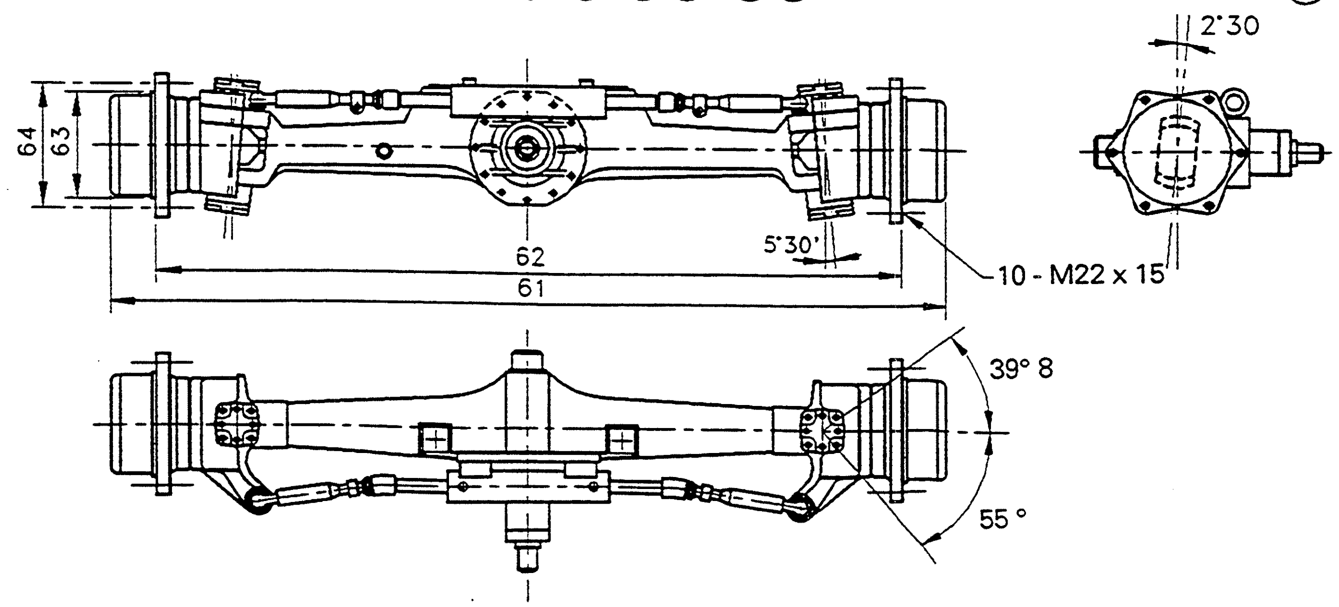
Dimens.	8110 to 8140	Dim.	8150	8160	
34	337.11	34	337.11	337.11	
35	354.6	35	354.6	354.6	
36	862.3	-	-	-	
37	771.5	37	973	973	
38	41	-	-	-	
39	234.10	39	234.10	234.10	
40	823.90	40	823.90	823.90	
41	967	41	967	967	
42	3699.8	42	4092.8	4092.8	
43	539.75	43	539.75	539.75	
44	185.41	44	185.41	185.41	
45	139.80	45	139.80	139.80	
46	168.15	46	168.15	168.15	
47	263.65	47	263.65	263.65	
48	76.20	48	76.20	76.20	
49	203.20	49	203.20	203.20	
50	300	50	300	300	
51	224	51	224	224	
-	-	52	736.8	736.8	
-	-	53	358	358	
54	444.62	54	444.62	444.62	
55	1909 (Normal Duty) 82 dia. shaft	-	-	-	
55	1941 (Heavy Duty) 82 dia. shaft	-	-		
55	1962 (Heavy Duty) sealed reduction unit	55	1962	-	
-	double reduction unit	55	-	1940	
56	double reduction unit	56	2493	2493	
56	2355 sealed reduction unit	-	-	-	
-	double reduction unit	57	2991	2991	
57	2997 sealed reduction unit	-	-	-	
58	233	58	233	233	
59	47	59	47	47	
60	204.21	60	204.21	204.21	
61	2098	61	2046	2046	
62	1920	62	1920	1920	
63	ø 280.8 - 280.6	-	-	-	
64	ø 335	64	ø 335	ø 335	
65	ø 149.35 (82 dia. shaft)	-	-	-	
65	ø 220.65 (95 dia. shaft)	65	ø 220.65	ø 220.65	
66	ø 203.20 (82 dia. shaft)	-	-	-	
66	ø 275.25 (95 dia. shaft)	66	ø 275.25	ø 275.25	
67	337.11	67	337.11	337.11	

MF 8110 - 20 - 30 - 40



MF 8150 - 60





Introduction

D. Safety precautions

When replacing a tractor part bearing a safety decal (yellow) a new safety sticker MUST be affixed onto the replacement part. A full list of the locations for all safety decals are specified below.

G.B. **CAUTION**

Before operating, read operator's instruction book thoroughly.
Do not start engine until everyone is a safe distance from tractor and equipment.
Keep all shields, covers and guards in place while engine is running.
Keep hands, feet and clothing away from power driven or moving parts.

Always drive with due care and attention.

If differential lock does not disengage automatically, depress clutch pedal.
Brake pedals must always be coupled together when independent brakes are not being used.

Before leaving tractor, apply parking brake, lower equipment, stop engine and remove key from starter switch.

When attaching equipment check operator's instruction book for front and rear axle load limits.
Put the gears lever (1-2-3-4) in neutral position and put the reverse/forward lever in forward position or reverse position in order to use the external lift controls.
Ensure that all wheel and rim nuts are tightened as specified in operator's instruction book.
On public roads, use SMV emblem and flashing warning lights where required by law.

DO NOT REMOVE OR OBSCURE DECAL 3580321 M3

1

WARNING
Gears lever (1-2-3-4) must be in his neutral position and the reverse/forward lever in forward position or reverse position:
- In order to use the external lift controls.
- When the driver is not in his seat.

DO NOT REMOVE OR OBSCURE DECAL 3713705 M1

WARNING
When the tractor is stationary, it is imperative to fully apply the handbrake because leaving the tractor in gear will not prevent movement.
When attempting to start the engine using a slave battery, ensure that the gear lever (1, 2, 3, 4) is in neutral.
Never connect a slave battery directly to the starter motor

2

G.B. **WARNING**
High pressure steam and hot water.
Remove filler cap with extreme care.
DO NOT REMOVE OR OBSCURE DECAL 3595685 M1

3

G.B. **WARNING**
Before working on the tractor, disconnect negative leads to all batteries.

WARNING
Before removing any battery, disconnect all negative leads before positive leads.
DO NOT REMOVE OR OBSCURE DECAL 3595679 M1

4

G.B. **CAUTION**
Keep all shields, covers and guards fastened in place while engine is running.

WARNING
Beware hot parts
DO NOT REMOVE OR OBSCURE DECAL 3595678 M1

5

6

G.B. 3595680 M1

DO NOT REMOVE OR OBSCURE DECAL

8

G.B. **CAUTION**
TO AVOID POSSIBLE TRACTOR OVERTURN, PULL ONLY FROM DRAWBAR OR LOWER LINKS OF THREE POINT HITCH
2752579 M1

G.B. **WARNING**
Always disengage PTO and stop engine before attaching or detaching PTO shafts or working on PTO driven equipment.

Always fit PTO cover when PTO is not in use.

CAUTION
Do not stand between tractor and equipment when operating controls.

Tow only with MF approved tractor drawbar or hitch

DO NOT REMOVE OR OBSCURE DECAL 3581563 M1

7

9

CAUTION
Belt for use only on tractors with safety structures.
DO NOT REMOVE OR OBSCURE DECAL 523784 M3

12

G.B. **WARNING**
Before working on the tractor or removing this cover, disconnect negative leads to all batteries.

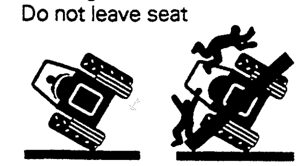
CAUTION
Do not short across starter terminals to start engine.
Never start engine while standing on the ground.
Start engine only with start key from operator's seat, ensuring that gearbox and PTO are in neutral with parking brake applied.

DO NOT REMOVE OR OBSCURE DECAL 3596432 M1

CAUTION
Use seat belt at all times.
Keep belt adjusted snugly.
DO NOT REMOVE OR OBSCURE DECAL 3580316 M1

10

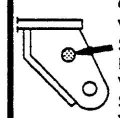
G.B. **WARNING**
If tractor is overturning, hold onto steering wheel.
Do not leave seat



DO NOT REMOVE OR OBSCURE DECAL 3580315 M1

11

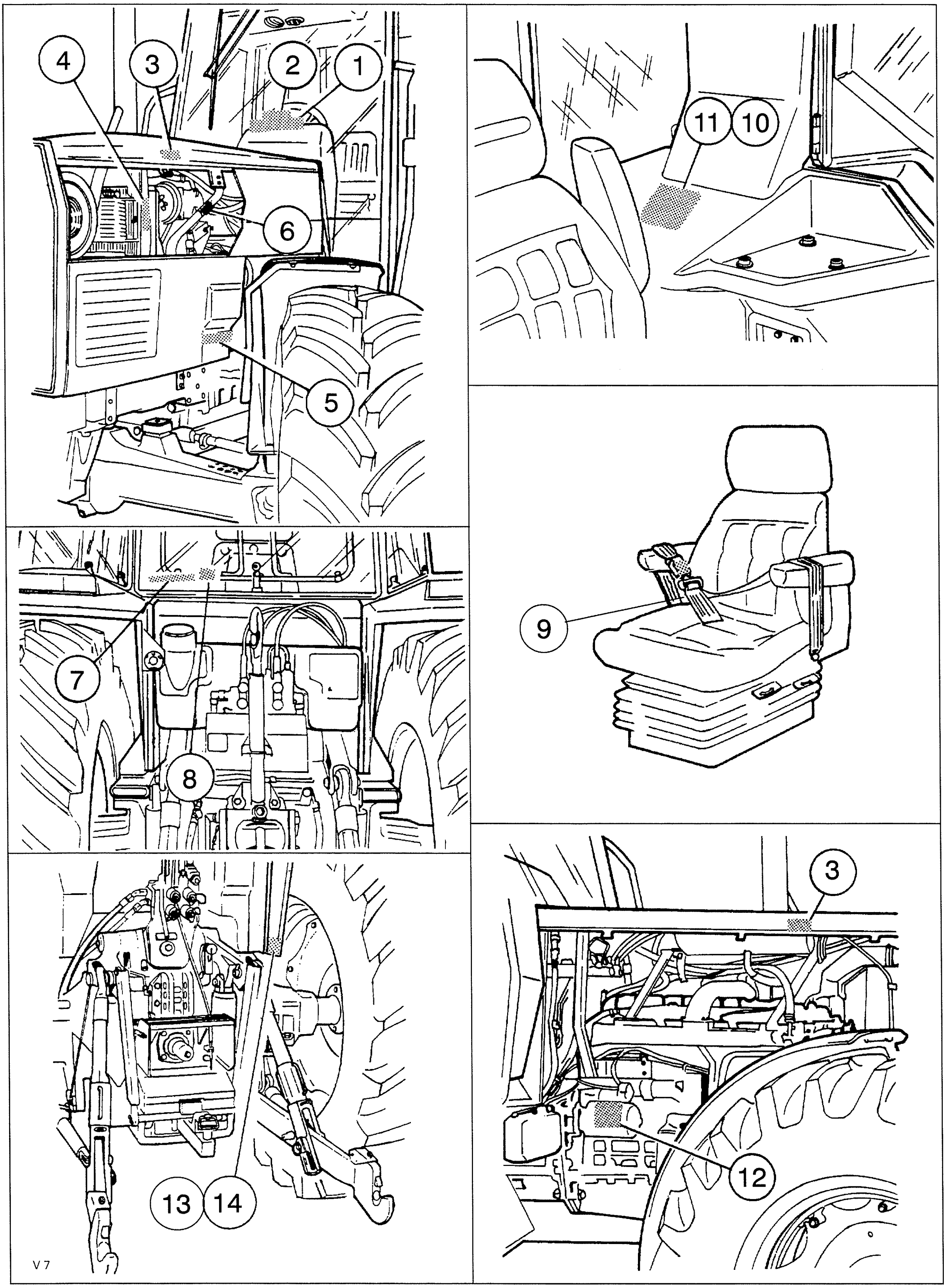
13



3617574 M1
Voir Manuel d'Utilisation.
See Operator Instruction Book.
Vedere Libretto d'Uso.
Siehe Betriebsanleitung
Ver Manual del Operador

14

IT IS IMPERATIVE TO USE THE TRANSMISSION OIL RECOMMENDED IN THE OPERATING MANUAL
3713699M1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V7

Introduction

E. Practical advice

Safety

Your safety and that of others must always be the first consideration when working around machines of any type. Safety requires a thorough understanding of the job to be done, the correct use of tools and equipment, and the application of common sense.

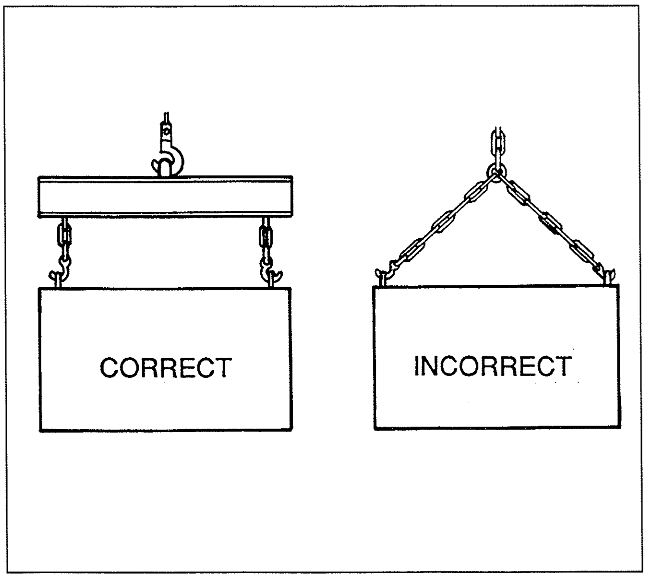
Troubleshooting

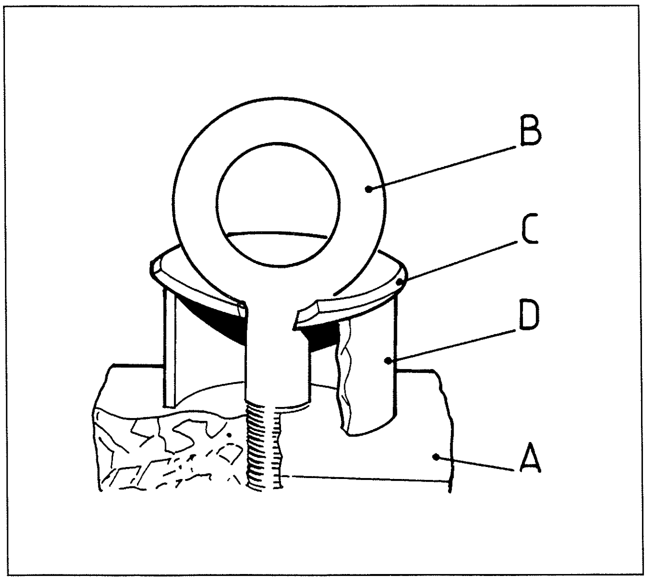
The following procedure, combined with the information contained in the workshop manual, will be helpful in accurately tracing faults occurring on the machine.
It consists in following a number of logical steps to identify, locate and correct the problem.

1. Determine the problem.
2. List its possible causes.
3. Differentiate the causes.
4. Conduct checks in a logical order to determine the exact cause.
5. Compare the approximate remaining service life with the cost of parts and labour.
6. Make any repair considered necessary.
7. Check that the parts and functions concerned operate correctly.

Handling heavy components

Unless otherwise specified, all dismantling operations should be performed using adjustable lifting equipment. All supporting slings must be parallel to each other and as near vertical as possible in relation to the object being lifted. However, in cases where the capacity of the slings is far greater than the weight of the load to be lifted, a triangular lifting arrangement may be used (2, 3 or 4 strands from a single ring beneath the hoist hook).
When removing a component at an angle, it should be remembered that the capacity of an eyebolt is reduced when the angle between the supporting members and the object become less than 90° (correct and incorrect methods of lifting).
Eyebolts and brackets must never be bent and must only work under tensile load. A length of pipe and a washer may be used to reduce tension on eyebolts.





Forged eyebolt support

A Load - B Lifting shackle - C Shackle retaining plate (3 mm thick) - D Sleeve (which may or may not be welded to plate).
In some cases, special lifting fixtures are available to obtain the required balance and ensure safe handling. Consult the relevant section of the workshop manual.
Note: If a part proves difficult to remove, check that all the nuts and bolts have been removed and that no obstruction is caused by adjacent parts.

Cleanliness

To ensure a machine's long service life, it is important to keep dirt and foreign bodies out of its vital working components. Precautions must be taken to safeguard against this. Enclosed compartments, seals and filters ensure that supplies of air, fuel and lubricant are kept clean. These protective devices must not be removed.

Whenever hydraulic fluid, fuel, lubricating oil or air lines are disconnected, the point of disconnection and the surrounding area must be cleaned. As soon as a line has been disconnected, the line or opening must be blanked with a cap, a plug or adhesive tape to prevent the ingress of foreign bodies.
The same cleaning and covering precautions should be taken when access covers or inspection plates are removed.
Clean and inspect all parts. Make sure that all passages and holes are clear. Cover all parts to keep them clean. Make sure parts are clean when they are reassembled. Leave new parts in their packaging until they are actually needed for reassembly.

Assembly

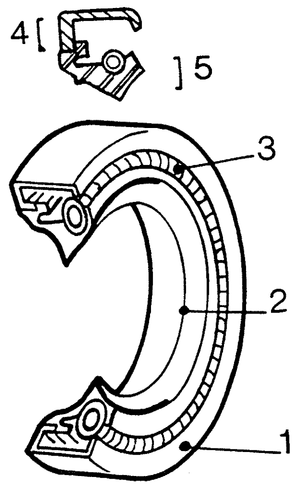
When reassembling a machine, complete each step in the right order. Never partially assemble one part and then start to assemble another. Make all recommended adjustments. Always check the job on completion to ensure that nothing has been overlooked.
Recheck the various adjustments before putting the machine back into service.
Note: Before fitting new parts, remove the anti-rust compound from all machined surfaces (usually "peel-off" substances).

Lubrication

Where applicable, fill the compartments of repaired or replaced components with the quantity, type and grade of clean lubricant recommended in the routine maintenance section of the operation instruction book.

Shims

When shims are removed, tie them together and identify their locations. Keep shims clean and take care not to bend them before refitting them.



Gaskets

Make sure that the holes in gaskets are lined up with lubricating oilways in the mating parts. If gaskets have to be made, use material of the correct type and thickness. Make sure that holes are punched in the right places. Incorrectly punched gaskets can cause serious damage.

Lip seals ("SPY" type)

Lubricate the lips of "SPY" type lip seals before fitting them. Do not use grease on seals except for grease seals.
The main parts of a "SPY" type lips seal are the case (1), the sealing element (2) and the ring spring (3). The figure above illustrates a simple "SPY" type lip seal. The cross-section shows the "heel" (4) and the "toe" (5), used to identify the sides of a single element seal. Apart from a few exceptions, the toe of a single-lip oil seal is located on the lubricant side. Some seals have a second auxiliary lip with no spring.

Introduction

Cables and wires

When removing or disconnecting a group of cables or wires, each one should be identified and labelled in order to ensure that they are correctly refitted.

Nut and bolt locking devices

The loosening of nuts and bolts is prevented by using lockwashers, tab washers and cotter pins. In addition to these mechanical means, locking agents of the Loctite type are also used.

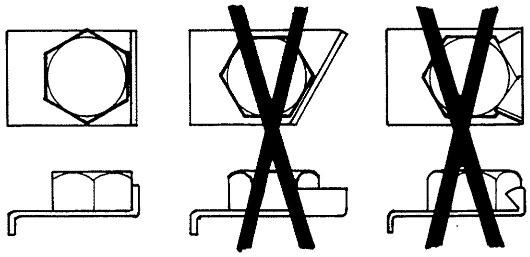
Flat retainers must be correctly installed in order to be effective. Bend one end of the retainer against the edge of the part. Bend the other end against one of the flats on the nut or bolt head.

Always fit new retainers in compartments which house moving parts. When fitting lockwashers on aluminium housing, place a flat washer between the lockwasher and the housing.

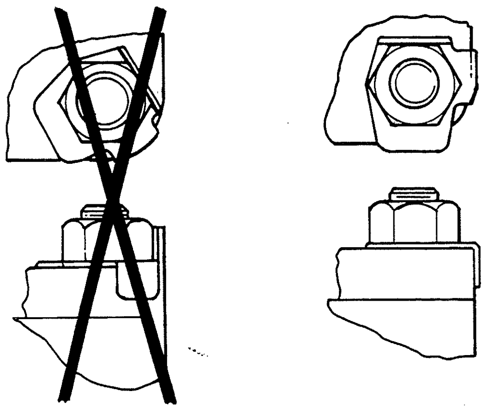
Note:

1) Never fit a lockwasher (Grower, fan, spring, etc.) under a nut or bolt head to which a specified tightening torque has to be applied (see section I).

2) Components must always be degreased before applying Loctite type locking agents.



Correct and incorrect uses of sheet metal retainers



Correct and incorrect methods of fitting and bending locking tabs

Lubrication bushes and press fits

Bushes must never be fitted with a hammer alone. Use a suitable fitting tool and a hammer or, better still, a press if possible.

When using a press, ensure that pressure is applied directly in line with the bore. When a lubrication brush has an oil hole, that hole should be aligned with the hole in the mating part.

When press fitting a part into another part, lubricate the mating surfaces. Tapered parts should be assembled dry. Before assembly, check that the tapers are dry, clean and free from burrs.

Fitting bolts in blind holes

Use bolts of the correct length. A bolt which is too long may "bottom" before the head comes into contact with the part it is intended to hold. This will cause damage to the threads.

If a bolt is too short, there may not be enough threads engaged to hold the part securely, and the bolt is therefore ineffective.

F. Installation instructions

General

In order to ensure regular servicing of the tractor during the 12 months warranty period, the supplying MF Distributor or Dealer must carry out the 50-hour and 250-hour servicing operations.
The definition of this operation is designed to provide the tractor with maximum efficiency during the whole warranty period, thus ensuring that it gives reliable service after that period.

Pre-delivery check

The performance of the following operations must be ensured by the Distributor before delivery to a Dealer and by the Dealer before delivery to an owner or operator.

1. General installation

- Clean the tops of batteries and smear the terminals with petroleum jelly.
- Charge the batteries, if necessary.
- Check all electrical connections, and cable, ducting and light attachments.
- Check and top up the oil levels in the engine and transmission housings.
- Lubricate all grease points.
- Check and adjust belt tensions, as required (alternator, fan, auxiliary pump and air-conditioning compressor).
- Unless it contains an antifreeze compound, flush the cooling system and refill with soft water.
- Check that the fuel tank contains enough fuel of the correct type.
- Check that the cylinder head attaching nuts and bolts are tightened to the required torque. Check that the inlet pipe and exhaust manifold attaching nuts and bolts are correctly tightened.
- Check and adjust the clearance between the valves and rockers and visually check the valve springs.
- Check the injectors, bleed the fuel system and tighten all fuel line connections.
- Check that the engine air filter hoses are secure.
- Check that the engine control linkages are correctly adjusted and operate freely.
- Start the engine.
- Check that the instruments and warning lights operate correctly.
- Check the engine speed on the tachometer with both the hand and foot-operated throttles.
- Hitch up a mounted implement and check that the tractor's hydraulic accessories operate correctly.
- Check and adjust the tyre pressures (road or field work).
- Check the tightness of all nuts, bolts, studs, pipe unions and attachment fittings.
- Check all pipes and hoses for leaks.
- Check that the headlights are correctly adjusted.
- Road test the tractor, checking the correct operation of the brakes and all instruments and accessories.

2. Electronic systems

- Check that the electronic lifting system operates correctly. Carry out the quick check procedure described in section 11B.
- Check all the Autotronic functions, following the test procedure in section 11C.
- Check the on-board computer installation in accordance with procedure 11D.

3. Tightening torques

- Check the tightening torque on the attaching nuts and bolts on the various chassis attachment points:
  . Front axle/engine,
  . Engine/gearbox,
  . Gearbox/rear axle
  . Trumpet sections/rear axle.
- Check the tightening torque of the attaching nuts and bolts on wheels and wheel bodies.

Introduction

Instructions to driver

Instructions on items listed below must be given to the owner or operator.

1. Safety precautions when starting the engine.
2. Location and significance of tractor and engine serial numbers.
3. Controls and instruments.
4. Running-in.
5. Starting and stopping the engine.
6. Selection of gears and use of gearshift and reverse shuttle levers.
7. Danger of towing down the hill without engine braking and correct use of gearbox.
8. Use and adjustment of brakes and brake pedal latch.
9. Use of the vehicle's clutch.
10. Use of the hydraulic differential lock device.
11. Use of the hydraulic PTO - Clutch and brake.
12. Operation of hydraulic lift system.
13. Hitching and unhitching of towed implements.
14. Grease points.
15. Changing of oil grades.
16. Replacement of engine and transmission filter elements.
17. Operation of fuel system - Bleeding of fuel and injection system - Air filter - Clogging indicator.
18. Cooling system. Frost precautions. Tension of both fan belts.
19. Maintenance of electrical equipment (batteries). System with negative earth.
20. Adjustment of front and rear track.
21. Tyre pressures.
22. Tightness of nuts, bolts and screws.
23. Fuel storage and handling.
24. Use of auxiliary hydraulic equipment.
25. Filling in of tractor and engine serial numbers in the operator instruction book.
26. Reading of the operator instruction book.

G. Conversion tables

Pressure units

1 PSI = 1 lbf/in^2 = 0.0689 bar
1 bar = 14.512 lbf/in^2 = 14.512 PSI

Bar	lbf / in²	Bar	lbf / in²	Bar	lbf / in²
0.5	7.256	9.5	137.9	35	508
1	14.51	10	145	40	588
1.5	21.77	11	159.6	45	653
2	29	12	174	50	726
2.5	36.28	13	189	60	871
3	43.54	14	203	70	1029
3.5	50.8	15	218	80	1161
4	58	16	232	90	1306
4.5	65.3	17	247	100	1451
5	72.6	18	261	200	2903
5.5	79.8	19	276	300	4354
6	87.1	20	290	400	5805
6.5	94.3	21	309	500	7257
7	101.6	22	319	600	8708
7.5	108.8	23	334	700	10160
8	116.1	24	348	800	11611
8.5	123.4	25	368	900	13235
9	130.6	30	435	1000	14514

Torque units

1 Nm = 0.7376 lbf/ft
1 lbf/ft = 1.3558 Nm

Nm		lbf/ft	Nm		lbf/ft	Nm		lbf/ft
1.3558	1	0.7376	46.0972	34	25.0784	90.8396	67	49.4912
2.7116	2	1.4752	47.4530	35	25.8160	92.1944	68	50.1568
4.0674	3	2.2128	48.8088	36	26.5536	93.5502	69	50.8944
5.4232	4	2.9504	50.1646	37	27.2912	94.9060	70	51.6320
6.7790	5	3.6880	51.5204	38	28.0288	96.2618	71	52.3696
8.1348	6	4.4256	52.8762	39	28.7664	97.6176	72	53.1072
9.4906	7	5.1632	54.2320	40	29.5040	98.9734	73	53.8448
10.8464	8	5.9008	55.5878	41	30.2416	100.329	74	54.5824
12.2022	9	6.6384	56.9436	42	30.9792	101.685	75	55.3200
13.5580	10	7.3760	58.2994	43	31.7168	103.041	76	56.0576
14.9138	11	8.1136	59.6552	44	32.4544	104.397	77	56.7952
16.2696	12	8.8512	61.0110	45	33.1920	105.752	78	57.5328
17.6254	13	9.5888	62.3668	46	33.9296	107.108	79	58.2704
18.9812	14	10.3264	63.7226	47	34.6672	108.464	80	59.0080
20.3370	15	11.0640	65.0784	48	35.4048	109.820	81	59.7456
21.6928	16	11.8016	66.4342	49	36.1424	111.176	82	60.4832
23.0486	17	12.5392	67.7900	50	36.8800	112.531	83	61.2208
24.4044	18	13.2768	69.1458	51	37.6176	113.887	84	61.9584
25.7602	19	14.0144	70.5016	52	38.3552	115.243	85	62.6960
27.1160	20	14.7520	71.8574	53	39.0928	116.600	86	63.4336
28.4718	21	15.4896	73.2132	54	39.8304	117.955	87	64.1712
29.8276	22	16.2272	74.5690	55	40.5680	119.310	88	64.9088
31.1834	23	16.9648	75.9248	56	41.3056	120.666	89	65.6464
32.5392	24	17.7024	77.2806	57	42.0432	122.022	90	66.3840
33.8950	25	18.4400	78.6364	58	42.7808	123.378	91	67.1216
35.2508	26	19.1776	79.9992	59	43.5184	124.734	92	67.8592
36.6066	27	19.9152	81.3480	60	44.2560	126.089	93	68.5968
37.9624	28	20.6528	82.7038	61	44.9936	127.445	94	69.3344
39.3182	29	21.3904	84.0596	62	45.7312	128.801	95	70.0720
40.6740	30	22.1280	85.4154	63	46.4688	130.157	96	70.8096
42.0298	31	22.8656	86.7712	64	47.2064	131.513	97	71.5472
43.3856	32	23.6032	88.1270	65	47.9440	132.868	98	72.2848
44.7414	33	24.3408	89.4828	66	48.6816	134.224	99	73.0224

Introduction

Capacity units

1 litre = 0.2199 imp. gallon
1 imp. gallon = 4.5459 litres

Note:
1 US gallon = 3.79 litres

Imp. gal.		Litres	Imp. gal.		Litres	Imp. gal.		Litres
0.2199	1	4.5459	7.4766	34	154.561	14.733	67	304.575
0.4398	2	9.0918	7.6965	35	159.107	14.9532	68	309.121
0.6597	3	13.6377	7.9164	36	163.652	15.1731	69	313.667
0.8796	4	18.1836	8.1363	37	168.198	15.3930	70	318.213
1.0995	5	22.7295	8.3562	38	172.744	15.6129	71	322.759
1.3194	6	27.2754	8.5761	39	177.290	15.8328	72	327.305
1.5393	7	31.8213	8.7960	40	181.836	16.0527	73	331.851
1.7592	8	36.3672	9.0159	41	186.382	16.2726	74	336.397
1.9791	9	40.9131	9.2358	42	190.929	16.4925	75	340.943
2.1990	10	45.4590	9.4557	43	195.474	16.7124	76	345.488
2.4189	11	50.0049	9.6756	44	200.019	16.9323	77	350.034
2.6388	12	54.5508	9.8955	45	204.566	17.1522	78	354.580
2.8587	13	59.0967	10.1154	46	209.111	17.3721	79	359.126
3.0786	14	63.6426	10.3353	47	213.657	17.5920	80	363.672
3.2985	15	68.1885	10.5552	48	218.203	17.8119	81	368.218
3.5184	16	72.7344	10.7751	49	222.749	18.0318	82	372.764
3.7383	17	77.2803	10.9950	50	227.295	18.2517	83	377.310
3.9582	18	81.8262	11.2149	51	231.841	18.4716	84	381.856
4.1781	19	86.3721	11.4348	52	236.387	18.6915	85	386.402
4.3980	20	90.9180	11.6547	53	240.933	18.9114	86	390.947
4.6179	21	95.4639	11.8746	54	245.479	19.1313	87	395.493
4.8378	22	100.009	12.0945	55	250.025	19.3512	88	400.039
5.0577	23	104.556	12.3144	56	254.570	19.5711	89	404.585
5.2776	24	109.102	12.5343	57	259.116	19.7910	90	409.131
5.4975	25	113.648	12.7542	58	263.662	20.0109	91	413.677
5.7174	26	118.193	12.9741	59	268.209	20.2308	92	418.223
5.9373	27	122.739	13.1940	60	272.754	20.4507	93	422.769
6.1572	28	127.285	13.4139	61	277.299	20.6706	94	427.315
6.3771	29	131.831	13.6338	62	281.846	20.8905	95	431.861
6.5970	30	136.377	13.8537	63	286.392	21.1104	96	436.406
6.8169	31	140.923	14.0736	64	290.938	21.3303	97	440.952
7.0368	32	145.469	14.2935	65	295.483	21.5502	98	445.498
7.2567	33	150.015	14.5134	66	300.029	21.7701	99	450.044

Capacity units

1 litre = 1.7599 imp. pints
1 imp. pint = 0.5682 litre

Note:
1 litre = 2.113 US pints

Imp. pt.		Litres	Imp. pt.		Litres	Imp. pt.		Litres
1.7599	1	0.5682	59.8366	34	19.3188	117.913	67	38.0694
3.5198	2	1.1364	61.5965	35	19.8870	119.673	68	38.6376
5.2797	3	1.7046	63.3564	36	20.4552	121.433	69	39.2058
7.0396	4	2.2728	65.1163	37	21.0234	123.193	70	39.7740
8.7995	5	2.8400	66.8762	38	21.5916	124.953	71	40.3422
10.5594	6	3.4902	68.6361	39	22.1598	126.713	72	40.9104
12.3193	7	3.9774	70.3960	40	22.7280	128.473	73	41.4786
14.0792	8	4.5456	72.1559	41	23.2962	130.233	74	42.0468
15.8391	9	5.1138	73.9158	42	23.8644	131.993	75	42.6150
17.5990	10	5.6820	75.6757	43	24.4326	133.752	76	43.1832
19.3589	11	6.2502	77.4356	44	25.0008	135.512	77	43.7514
21.1188	12	6.8184	79.1955	45	25.5690	137.272	78	44.3196
22.8787	13	7.3866	80.9554	46	26.1372	139.032	79	44.8878
24.6386	14	7.9548	82.7153	47	26.7054	140.792	80	45.4560
26.3985	15	8.5230	84.4752	48	27.2736	142.552	81	46.0242
28.1854	16	9.0912	86.2351	49	27.8418	144.312	82	46.5924
29.9183	17	9.6594	87.9950	50	28.4100	146.072	83	47.1606
31.6782	18	10.2276	89.7549	51	28.9782	147.832	84	47.7288
33.4381	19	10.7958	91.5148	52	29.5464	149.592	85	48.2970
35.1980	20	11.3640	93.2747	53	30.1146	151.351	86	48.8652
36.9579	21	11.9322	95.0346	54	30.6828	153.111	87	49.4334
38.7178	22	12.5004	96.7945	55	31.2510	154.871	88	50.0016
40.4770	23	13.0686	98.5544	56	31.8192	156.631	89	50.5698
42.2376	24	13.6368	100.314	57	32.3874	158.391	90	51.1380
43.9975	25	14.2050	102.074	58	32.9556	160.151	91	51.7062
45.7574	26	14.7732	103.834	59	33.5238	161.912	92	52.2744
57.5173	27	15.3414	105.594	60	34.0920	163.671	93	52.8426
49.2772	28	15.9096	107.354	61	34.6602	165.431	94	53.4108
51.0371	29	16.4778	109.114	62	35.2284	167.191	95	53.9790
52.7970	30	17.0460	110.874	63	35.7966	168.950	96	54.5472
54.5569	31	17.6142	112.634	64	36.3648	170.710	97	55.1154
56.3168	32	18.1824	114.394	65	36.9330	172.470	98	55.6836
58.0767	33	18.7506	116.153	66	37.5012	174.230	99	56.2518

Introduction

Length units
1 m = 3.2808 ft
1 ft = 0.3048 m

m		ft	m		ft	m		ft
0.3048	1	3.2808	10.3632	34	111.549	20.4216	67	219.816
0.6096	2	6.5617	10.6680	35	114.829	20.7264	68	223.097
0.9144	3	9.8425	10.9728	36	118.110	21.0312	69	226.378
1.2192	4	13.1234	11.2776	37	121.391	21.3360	70	229.659
1.5240	5	16.4042	11.5824	38	124.672	21.6408	71	232.940
1.8288	6	19.6850	11.8872	39	127.953	21.9456	72	236.220
2.1336	7	22.9659	12.1920	40	131.234	22.2504	73	239.501
2.4384	8	26.2467	12.4968	41	134.514	22.5552	74	242.782
2.7432	9	29.5276	12.8016	42	137.795	22.8600	75	246.063
3.0480	10	32.8084	13.1064	43	141.076	23.1648	76	249.344
3.3528	11	36.0892	13.4112	44	144.357	23.4696	77	252.625
3.6576	12	39.3701	13.7160	45	147.638	23.7744	78	255.906
3.9624	13	42.6509	14.0208	46	150.919	24.0792	79	259.186
4.2672	14	45.9318	14.3256	47	154.199	24.3840	80	262.467
4.5720	15	49.2126	14.6304	48	157.480	24.6888	81	265.748
4.8768	16	52.4934	14.9352	49	160.761	24.9936	82	269.029
5.1816	17	55.7743	15.2400	50	164.042	25.2984	83	272.310
5.4864	18	59.0551	15.5448	51	167.323	25.6032	84	275.591
5.7912	19	62.3360	15.8496	52	170.604	25.9080	85	278.871
6.0960	20	65.6168	16.1544	53	173.885	26.2128	86	282.152
6.4008	21	68.8976	16.4592	54	177.165	26.5176	87	285.433
6.7056	22	72.1785	16.7640	55	180.446	26.8224	88	288.714
7.0104	23	75.4593	17.0688	56	183.727	27.1272	89	291.995
7.3152	24	78.7402	17.3736	57	187.008	27.4320	90	295.276
7.6200	25	82.0210	17.6784	58	190.289	27.7368	91	298.556
7.9248	26	85.3018	17.9832	59	193.570	28.0416	92	301.837
8.2296	27	88.5827	18.2880	60	196.850	28.3464	93	305.118
8.5344	28	91.8635	18.5928	61	200.131	28.6512	94	308.399
8.8392	29	95.1444	18.8976	61	203.412	28.9560	95	311.680
9.1440	30	98.4252	19.2024	63	206.693	29.2608	96	314.961
9.4488	31	101.7060	19.5072	64	209.974	29.5656	97	318.241
9.7536	32	104.9870	19.8120	65	213.255	29.8704	98	321.522
10.0584	33	108.2680	20.1168	66	216.535	30.1752	99	324.803

Weight units

1 kg = 2.2046 lb
1 lb = 0.4536 kg

kg		lb	kg		lb	kg		lb
0.4536	1	2.2046	15.4224	34	74.9564	30.3912	67	147.708
0.9072	2	4.4092	15.8760	35	77.1610	30.8448	68	149.913
1.3608	3	6.6138	16.3296	36	79.3656	31.2984	69	152.117
1.8144	4	8.8184	16.7832	37	81.5702	31.7520	70	154.322
2.2680	5	11.0230	17.2368	38	83.7748	32.2056	71	156.527
2.7216	6	13.2276	17.6904	39	85.9794	32.6592	72	158.731
3.1752	7	15.4322	18.1440	40	88.1840	33.1128	73	160.936
3.6288	8	17.6368	18.5976	41	90.3886	33.5664	74	163.140
4.0824	9	19.8414	19.0512	42	92.5932	34.0200	75	165.345
4.5360	10	22.0460	19.5048	43	94.7978	34.4736	76	167.549
4.9896	11	24.2506	19.9584	44	97.0024	34.9272	77	169.754
5.4432	12	26.4552	20.4120	45	99.207	35.3808	78	171.958
5.8968	13	28.6598	20.8656	46	101.412	35.8344	79	174.163
6.3504	14	30.8644	21.3192	47	103.616	36.2880	80	176.368
6.8040	15	33.0690	21.7728	48	105.821	36.7416	81	178.573
7.2576	16	35.2736	22.2264	49	108.025	37.1952	82	180.777
7.7112	17	37.4782	22.6800	50	110.230	37.6488	83	182.982
8.1648	18	39.6828	23.1336	51	112.435	38.1024	84	185.186
8.6184	19	41.8874	23.5872	52	114.639	38.5560	85	187.391
9.0720	20	44.0920	24.0408	53	116.844	39.0096	86	189.596
9.5256	21	46.2966	24.4944	54	119.048	39.4632	87	191.800
9.9792	22	48.5012	24.9489	55	121.253	39.9168	88	194.005
10.4328	23	50.7058	25.4016	56	123.458	40.3704	89	196.209
10.8864	24	52.9104	25.8552	57	125.662	40.8240	90	198.414
11.3400	25	55.1150	26.3088	58	127.867	41.2776	91	200.619
11.7936	26	57.3196	26.7624	59	130.071	41.7312	92	202.823
12.2472	27	59.5242	27.2160	60	132.276	42.1848	93	205.028
12.7008	28	61.7288	27.6696	61	134.481	42.6384	94	207.232
13.1544	29	63.9334	28.1232	62	136.685	43.0920	95	209.437
13.6080	30	66.1380	28.5768	63	138.889	43.5456	96	211.642
14.0616	31	68.3426	29.0304	64	141.094	43.9992	97	213.846
14.5152	32	70.5472	29.4840	65	143.299	44.4528	98	216.051
16.9688	33	72.7518	29.9376	66	145.504	44.9064	99	218.255

Introduction

Conversion table

	LENGTHS 1 inch = 25.4 mm						TEMPERATURE			
Fractions of inches	Decimals	mm	Inches to mm		mm to inches		Fahrenheit to Celsius			
			Inches	mm	mm	Inches	° F	° C	° C	° F
1/64	.015625	0.3969					- 20	- 28.9	- 30	- 22
1/32	.031250	0.7937					- 15	- 26.1	- 28	- 18.4
3/64	.468750	1.1906					- 10	- 23.3	- 26	- 14.8
1/16	.062500	1.5875	0.0001	0.00254	0.004	0.00015	- 5	- 20.6	- 24	- 11.2
5/64	.078125	1.9844	.0002	.00508	0.005	.00019	0	- 17.8	- 22	- 7.6
3/32	.093750	2.3812	.0003	.00762	0.006	.00023	1	- 17.2	- 20	- 4
7/64	.109375	2.7781	.0004	.01016	0.007	.00027	2	- 16.7	- 18	- 0.4
1/8	.125000	3.1750	.0005	.01270	0.008	.00031	3	- 16.1	- 16	3.2
9/64	.140625	3.5719	.0006	.01524	0.009	.00035	4	- 15.6	- 14	6.8
5/32	.156250	3.9687	.0007	.01778	0.01	.00039	5	- 15.0	- 12	10.4
11/64	.171875	4.3656	.0008	.02032	0.02	.00079	10	- 12.2	- 10	14
3/16	.187500	4.7625	.0009	.02286	0.03	.00118	15	- 9.4	- 8	17.6
13/64	.203125	5.1594	.001	.0254	0.04	.00157	20	- 6.7	- 6	21.2
7/32	.218750	5.5562	.002	.0508	0.05	.00197	25	- 3.9	- 4	24.8
15/64	.234375	5.9531	.003	.0762	0.06	.00236	30	- 1.1	- 2	28.4
1/4	.250000	6.3500	.004	.1016	0.07	.00276	35	1.7	0	32
17/64	.265625	6.7469	.005	.1270	0.08	.00315	40	4.4	2	35.6
9/32	.281250	7.1437	.006	.1524	0.09	.00354	45	7.2	4	39.2
19/64	.296875	7.5406	.007	.1778	0.10	.00394	50	10.0	6	42.8
5/16	.312500	7.9375	.008	.2032	0.20	.0078	55	12.8	8	46.4
21/64	.328125	8.3344	.009	.2286	0.30	.01181	60	15.6	10	50
11/32	.343750	8.7312	.01	.254	0.40	.01575	65	18.3	12	53.6
23/64	.359375	9.1281	.02	.508	0.50	.01969	70	21.1	14	57.2
3/8	.375000	9.5250	.03	.762	0.60	.02362	75	23.9	16	60.8
25/64	.390625	9.9219	.04	1.016	0.70	.02756	80	26.7	18	64.4
13/32	.406250	10.3187	.05	1.270	0.80	.03149	85	29.4	20	68
27/64	.421875	10.7156	.06	1.524	0.90	.03543	90	32.2	22	71.6
7/16	.437500	11.1125	.07	1.778	1	.03937	95	35.0	24	75.2
29/64	.453125	11.5094	.08	2.032	2	.07874	100	37.8	26	78.8
15.32	.468750	11.9062	.09	2.286	3	.11811	105	40.6	28	82.4
31/64	.484375	12.3031	.10	2.540	4	.15748	110	43.3	30	86
1/2	.500000	12.7000	.20	5.080	5	.19685	115	46.1	32	89.6
33/64	.515625	13.0969	.30	7.620	6	.23622	120	48.9	34	93.2
17/32	.53125	13.4937	.40	10.160	7	.27559	125	51.7	36	96.8

LENGTHS 1 inch = 25.4 mm							TEMPERATURE			
Fractions of inches	Decimals	mm	Inches to mm		mm to inches		Fahrenheit to Celsius			
			Inches	mm	mm	Inches	° F	° C	° C	° F
35/64	.546875	13.8906	0.5	12.70	8	0.31496	130	54.4	38	100.4
9/16	.562500	14.2875	.6	15.24	9	.35433	135	57.2	40	104
37/64	.578125	14.6844	.7	17.78	10	.39370	140	60.0	42	107.6
19/32	.593750	15.0812	.8	20.32	11	.43307	145	62.8	44	112.2
39/64	.609375	15.4781	.9	22.86	12	.47244	150	65.6	46	114.8
5/8	.6250	15.8750	1	25.4	13	.51181	155	68.3	48	118.4
41/64	.640625	16.2719	2	50.8	14	.55118	160	71.1	50	122
21/32	.656250	16.6687	3	76.2	15	.59055	165	73.9	52	125.6
43/64	.671875	17.0656	4	101.6	16	.62992	170	76.7	54	129.2
11/16	.687500	17.4625	5	127	17	.66929	175	79.4	56	132.8
45/64	.703125	17.8594	6	152.4	18	.70866	180	82.2	58	136.4
23/32	.718750	18.2562	7	177.8	19	.74803	185	85.0	60	140
47/64	.734375	18.6531	8	203.2	20	.78740	190	87.8	62	143.6
3/4	.7500	19.05	9	228.6	21	.82677	195	90.6	64	147.2
49/64	.765625	19.4469	10	254	22	.86614	200	93.3	66	150.8
25/32	.781250	19.8437	11	279.4	23	.90551	205	96.1	68	154.4
51/64	.796875	20.2406	12	304.8	24	.94480	210	98.9	70	158
13/16	.812500	20.6375	13	330.2	25	.98425	212	100.0	75	167
53/64	.828125	21.0344	14	355.6	26	1.02362	215	101.7	80	176
27/32	.843750	21.4312	15	381	27	1.06299	220	104.4	85	185
55/64	.859375	21.8281	16	406.4	28	1.10236	225	107.2	90	194
7/8	.875000	22.2250	17	431.8	29	1.14173	230	110.0	95	203
57/64	.890625	22.6219	18	457.2	30	1.18110	235	112.8	100	212
29/32	.906250	23.0187	19	482.6	31	1.22047	240	115.6	105	221
59/64	.921875	23.4156	20	508	32	1.25984	245	118.3	110	230
15/16	.937500	23.8125	21	533.4	33	1.29921	250	121.1	115	239
61/64	.953125	24.2094	22	558.8	34	1.33858				
31/32	.968750	24.6062	23	584.2	34	1.37795				
63/64	.984375	25.0031	24	609.6	36	1.41732				
1	1.00	25.40	25	635	37	1.45669				
			26	660.4	38	1.49606				
					39	1.53543				
					40	1.57480				

H. Locking compounds and sealants

The Loctite compounds mentioned in this manual are referred to by their industrial names.
For the purposes of repairs, use their commercial names or the corresponding MF references as per the following chart.

Loctite industrial name	Commercial name	MF reference
242 - 241 - 542	Lock and Seal	1 633 266 M1
270	Stud lock	1 633 267 M1
510 - 221	Instant Gasket Retainer	1 633 270 M2
638 - 648	Superflex sealant.	1 633 268 M1
Silicomet	R.T.V. silicone sealant (clear)	3 405 423 M1

Note: Use the product "Form A gasket 2" when sealing between plastic material and iron (or steel). Examples: PTO sensor, vehicle speed sensor, etc..

These products can be ordered from the following address:

FRAMET
10 Avenue Eugène Gazeau
Zone Industrielle
60304 - SENLIS
FRANCE

Application method for Loctite products

1. Remove all traces of previous sealants and corrosion
   - by mechanical process: wire brush or emery cloth,
   - by chemical action: "DECAPLOC 88".

   Leave the product to take effect and then wipe clean.
2. Degrease the components with dry solvent
   - preferably, use "LOCTITE 706 Dry Super Solvent".
3. Allow the solvents to evaporate.
4. Apply the recommended type of LOCTITE sealant on the parts:
   - For blind tapped holes: apply a quantity of product on the last threads at the bottom of the hole.
   - For cylindrical fitting components, apply compound on both mating surfaces with a clean brush.
   - For gasket faces, apply a bead on one of the two faces, passing around the holes, and then tighten as quickly as possible.

Note:
a) Do not use too much of the compound in order to avoid locking adjacent parts.
b) Do not attempt to retighten after 5 minutes of curing in order to avoid breaking the film of compound.
c) If the ambient temperature is less than +10°C, and to ensure quicker setting of Loctite compounds (except for SILICOMET), use LOCTITE T 747 activator on at least one of the two parts.
Excess sealant outside the joint will not harden (anaerobic curing of compound - i.e. curing occurs only in absence of oxygen).

Grease

When grease is used in components which are in contact with transmission oil, use a grease which is miscible with oil to avoid clogging the hydraulic filters. ~~Use "Amber Technical" grease supplied by WITCO company, 76320 Saint-Pierre des Elfes, France.~~

I. Tightening torques

When tightening nuts and bolts, use the recommended tightening torques as per the charts:
- **1** and **2**: for metric threads,
- **3** and **4**: for inch threads.

When a specific torque is required, it is mentioned in the text.
Charts 1 and 3 specify the standard tightening torque values applicable to zinc-plated threaded elements with standard nuts with coarse or fine thread, with or without flat washers or lockwashers, and weld nuts deeper than 0.8 d.
Charts 2 and 4 specify the reduced tightening torque values applicable to threaded fasteners in assemblies with self-locking zinc-plated nuts, phosphated nuts or bolts, shallow nuts and weld nuts shallower than 0.8 d.
These values are applicable to dry assemblies. If the threads are oiled, reduce the tightening torques.
Note: Read the strength classification on the bolt head and determine the required torque loading.
Example:

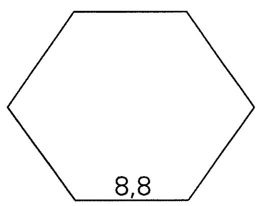


Chart 1
Tightening torque values: zinc-plated metric threads

Nominal dimension d.	Strength classification ISO 8.8 (SAE 5, BS S) Torque Nm		Strength classification ISO 10.9 (SAE 8, BS V) Torque Nm	
	Max.	Min.	Max.	Min.
M3	1.7	1.3	2.4	1
M4	4.1	3.1	5.7	4
M5	8	6	11.5	8
M6	14	10	20	14
M8	35	25	46	36
M10	70	50	96	72
M12	120	90	160	120
M16	260	200	400	300
M20	560	420	800	600
M24	960	720	1300	1000
M30	1800	1400	2800	2100
M36	3300	2500	4800	3600

Chart 2
Reduced tightening torque values: metric threads

Nominal dimension d.	Strength classification ISO 8.8 (SAE 5, BS S) Torque Nm		Strength classification ISO 10.9 (SAE 8, BS V) Torque Nm	
	Max.	Min.	Max.	Min.
M3	1.4	1	1.9	1
M4	3.3	2.5	4.6	3
M5	6.4	4.8	9.2	6
M6	11	8	16	12
M8	28	20	37	29
M10	56	40	77	57
M12	96	72	130	100
M16	210	160	320	240
M20	450	340	640	480
M24	770	570	1040	800
M30	1400	1100	2200	1700
M36	2600	2000	3800	2900

Introduction

Chart 3
Tightening torque values: zinc-plated threads in inches

Nominal dimension d.	Strength classification SAE 5 (ISO 8.8 BS S) Torque Nm		Strength classification SAE 8 (ISO 10.9 BS V) Torque Nm	
	Max.	Min.	Max.	Min.
#6	2.4	1.8	3.3	2
#8	4.4	3.4	6.3	4
#10	6.3	4.7	8.9	6
1/4	15	11	22	16
5/16	30	22	43	31
3/8	53	39	75	55
7/16	86	64	120	90
1/2	130	100	180	140
5/8	260	200	370	280
3/4	460	350	660	490
7/8	760	560	1060	800
1	1120	840	1600	1200
1 1/8	1390	1050	2200	1700
1 1/4	2000	1500	3200	2400
1 1/2	3400	2600	5400	4100

Chart 4
Reduced tightening torque values: zinc-plated threads in inches

Nominal dimension d.	Strength classification SAE 5 (ISO 8.8 BS S) Couple Nm		Strength classification SAE 8 (ISO 10.9 BS V) Couple Nm	
	Max.	Min.	Max.	Min.
#6	1.9	1.5	2.6	2
#8	3.5	2.7	5	3
#10	5	3.8	7.1	5
1/4	12	8.8	18	13
5/16	24	18	34	25
3/8	42	31	60	44
7/16	69	51	96	72
1/2	104	80	140	110
5/8	210	160	300	220
3/4	370	280	530	390
7/8	610	450	850	640
1	900	670	1280	960
1 1/8	1100	840	1760	1360
1 1/4	1600	1200	2560	1920
1 1/2	2700	2100	4320	3280

2 . SPLITTING THE TRACTOR

Contents

2 A01 Splitting the tractor between the front frame and the engine

CONTENTS

Splitting the tractor

A . Uncoupling

1. Disconnect the two 4WD front axle control hoses. Plug the pipe connections.
2. Remove the guard and the 4WD transmission shaft.
3. Remove the sheet metal panels. Disconnect the earth cables only from the batteries.
4. **Disconnect and mark the positions of hoses and flexible connections, as follows**:
   - the two Orbitrol steering hoses,
   - the hose from the cooler on the hydraulic manifold above the engine,
   - the hose from the left-hand side cover towards the cooler,
   - the harness connecting the vacuum tester, the 7.5 A and 10 A fuses and the red wire to the positive terminals of the batteries,
   - the positive cable on the starter,
   - the inlet sleeve between the turbocharger and the air filter,
   - the suction pipe between the air filter and the exhaust pipe.
5. Drain the cooling system. Disconnect the lower and upper hoses from the radiator.
6. Remove the upper attachment on the radiator.
7. Remove the air conditioning compressor and bracket assembly and tilt it forwards with its two hoses (according to option fitted).

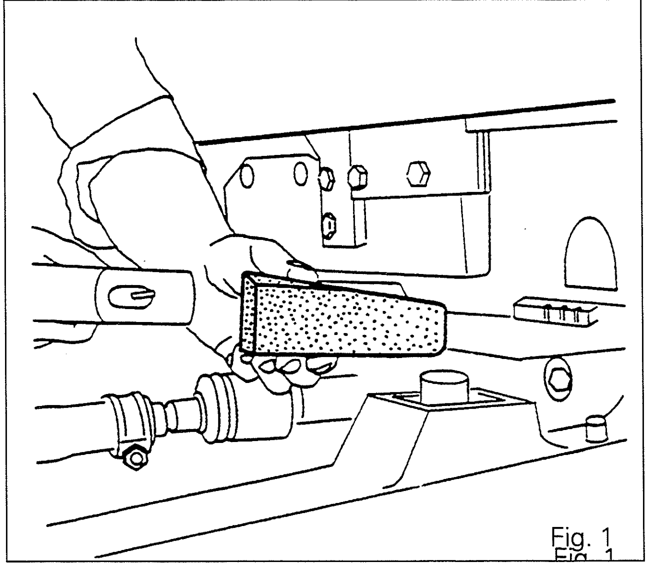


Fig. 1

8. Remove the front weights, the belly weight (if fitted) and the engine LH and RH stiffeners (if fitted).
9. Immobilise the tractor :
   - apply the handbrake
   - fit wedges between the frame and the front axle (Fig. 1)
10. Loosen the bolts attaching the engine to the front frame.
11. Support the tractor under the frame using a trolley jack and separate the engine from the frame (Fig. 2).

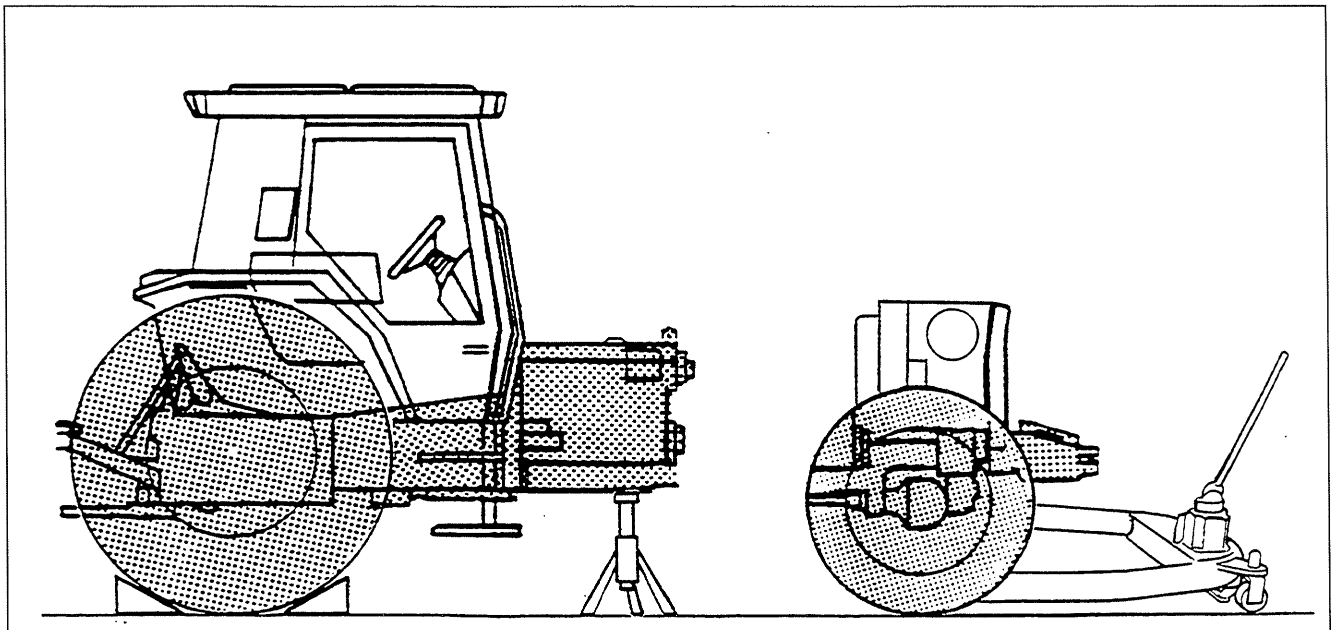


Fig. 2

Splitting the tractor

B . Recoupling

12. Screw two dowel pins (locally made) into diametrically opposite positions on the engine.
13. Fit the frame to the engine.
14. Install the bolts and tighten to the torque specified in Fig. 3.
15. Remove the wedges between the frame and the front axle.
16. Carry out procedures 4 to 8 in reverse order.
17. Reconnect the batteries. Carry out procedures 1 and 2 in reverse order.
18. Start the engine.
19. Bleed the brake and clutch systems (sections 9 G01 and 4 A01).
20. Check :
    - the hydraulic systems for leaks,
    - the correct operation of electrical circuits.
21. Reinstall the sheet metal panels.
22. Carry out road test.

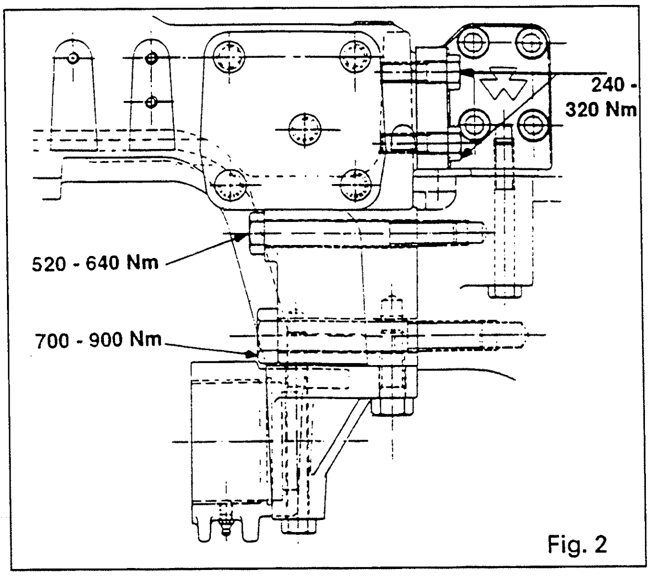


Fig. 2

2 B01 Splitting the tractor between the engine and the gearbox

CONTENTS

Splitting the tractor

A . Uncoupling

1. Disconnect the front differential lock (4WD) control hoses. Plug the pipe connections.
2. Remove the guard and the 4WD transmission shaft.
3. Remove the exhaust pipe, the sheet metal panels. Disconnect the earth cables only from the batteries.
4. Remove the hood rear bracket (Perkins series 1000 engine).
5. Disconnect and plug :
   - the two Orbitrol steering ram hoses (and mark their position),
   - the two air conditioning connections and bracket (according to option fitted),
   - the cooler hose on the hydraulic manifold above the engine,
   - the hose to the cooler on the left-hand cover,
   - the accelerator control on the injection pump,
   - the flowmeter harness (if fitted),
   - the main wiring harness connections above the engines (Perkins series 1000 engine) or on the right-hand side (Valmet engine),
   - the heating hoses (plug the openings to avoid draining the cooling system completely.)
   - the 7.5 A and 10 A fuse harness (to release this harness, slightly slacken the loosen the bar above the radiator),
   - the diesel fuel supply and return hoses.
6. Immobilise the tractor :
   - apply the handbrake,
   - fit wedges between the frame and the front axle (Fig.1).
7. Support the tractor under the gearbox using a stand.
8. Support the tractor under the sump using a trolley jack.
9. Loosen the bolts attaching the engine to the gearbox.
10. Separate the gearbox from the engine.
    Note : Remove the front weights, the belly weight (if fitted) and the RH and LH engine stiffeners (if fitted).

B . Recoupling

11. Clean the mating faces of the gearbox spacer and the engine adaptor plate.
12. Coat the spacer mating face with Loctite 510 sealing compound or equivalent.
13. Screw two dowel pins into the spacer.
14. Lightly grease the input shaft splines (with grease of type GN + Molykote).
15. Check that the two dowel pins **(4)** are fitted on the engine (See section 3 B01).
16. Fit the engine to the gearbox spacer by turning the flywheel ring gear manually.
17. Install the attaching bolts after coating them with Loctite 270.
    Tightening torque : see section 3 B01.
    Note: reinstall the RH and LH engine stiffeners (if fitted), the belly weight tightened to 300 Nm and the front weights.
18. Carry out procedures 4 to 8 in reverse order.
19. Top up the radiator.
20. Reconnect the batteries. Start the engine.
21. Check the accelerator control setting.
22. Carry out procedures 1 and 2 in reverse order.
23. Bleed the brake and clutch systems (sections 4 A01 and 9 G01).
24. Check :
    - the hydraulic systems for leaks,
    - the correct operation of electrical circuits.
25. Reinstall the sheet metal panels and the exhaust pipe.
26. Carry out road test.

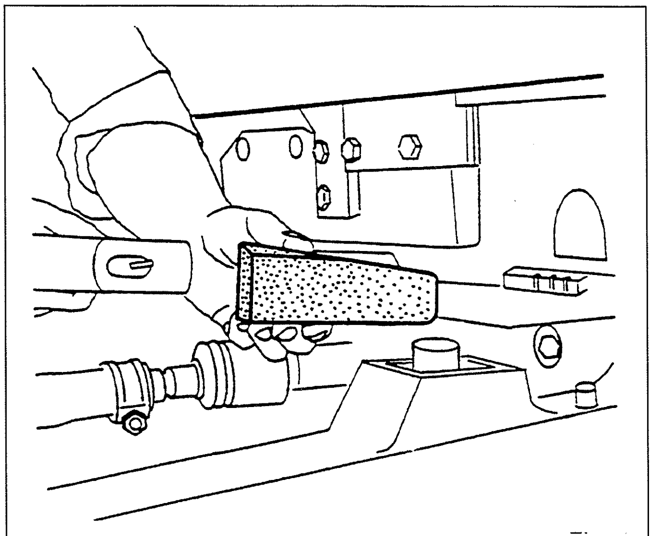


Fig. 1

C . Service tool

3376935 M91 Plug kit for air conditioning

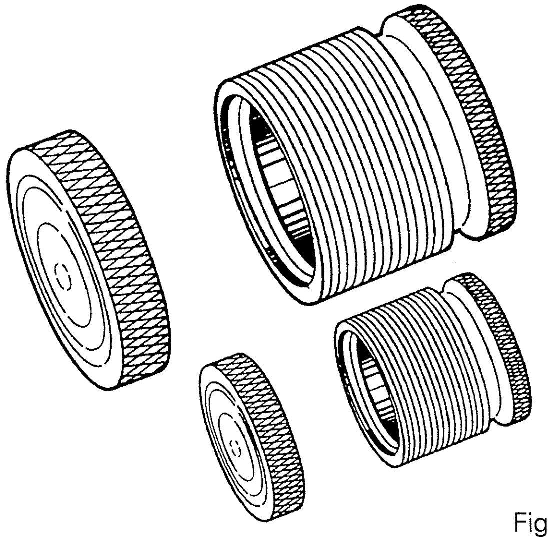


Fig. 2

2 C01 Splitting the tractor between the gearbox and the rear axle

CONTENTS

Splitting the tractor

General

Depending on the type of servicing operation, the cab can remain integral either with the rear axle assembly or with the gearbox.

1. Cab integral with the rear axle
This allows the replacement of the gearbox and operations carried out to the rear of the gearbox, such as replacing the handbrake unite or the output shaft.

2. Cab integral with the gearbox
This allows servicing action on the differential driving gear or on the rear axle housing.
The uncoupling procedure is similar for both versions but the operations marked with an asterisk (*****) should not be performed in case 2. In this case, the cab and the gearbox will be supported differently. It is necessary to remove the sheet metal panels and disconnect the brake pipes, the distributors and the probe wiring harnesses.
The cab rear end attaching nuts **(1)** and locknuts **(2)** (see Fig. 1) must be tightened to the following torques :
- nut 27 - 35 Nm,
- locknut 13 - 20 Nm (Loctite 270).

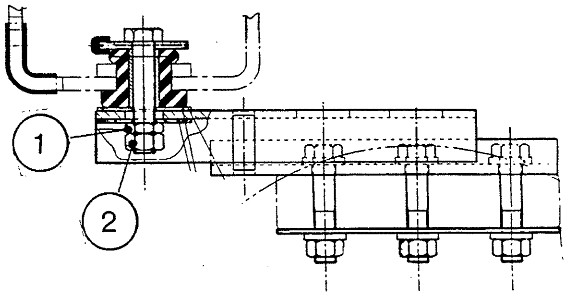


Fig. 1

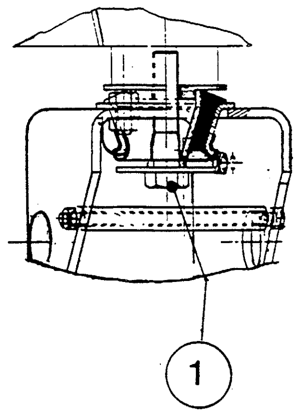


Fig. 2

A . Preliminary operations

1. Remove the additional fuel tank (if fitted), the exhaust pipe and the sheet metal. Disconnect the battery.

B . Uncoupling

2. Disconnect the two front differential lock (4WD) control hoses and protect the pipe connections.
3. Remove the guard and the transmission shaft.
4. Drain the oil from the gearbox and the rear axle. Remove the main clutch lubricating pipe fitting on the spacer and the centre housing
5. Remove the cover plate under the gearbox.

*6. Carry out procedures 4 to 6 in section 2 B01.

7. **Disconnect and plug the following tubes or hoses**:
   - Dynashift distribution unit and clutch valve.
   - Control to the Orbitrol distributor,
   - 17-bar supply for power braking (if fitted),
   - Control for the trailer brake,

   *- Hare / Tortoise range,

   *- Gearbox assembly lubrication,

   *- Clutch control from the master cylinder.

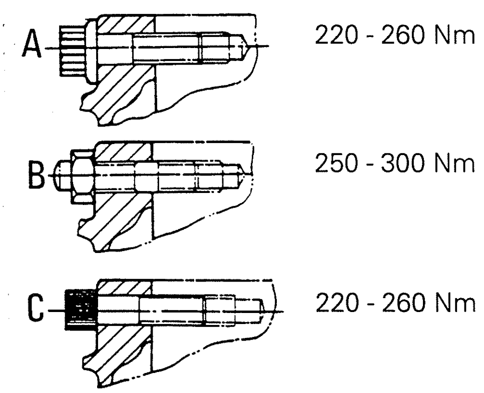


Fig. 3

*8. Disconnect the following harnesses:
- the temperature probe Dynashift,
- the hare / Tortoise solenoid valve switch,
- the earth wire,
- the solenoid valves on the Dynashift distribution unit,
- the radar harness (Datatronic).

*9. Remove the two bolts **(1)** from the front shock absorbers on the right-hand and left-hand cab supports (Fig. 2). Raise the cab and fit wedges.

10. Disconnect the power take-off clutch lubricating tube above the rear axle housing.

11. Detach the control cable from the handbrake. Remove the lever **F** and unscrew the control pin **(25)** (see section 5 H01).

12. Hold the pin with a pin wrench.

*13. Position a trolley jack under the gearbox.

*14. Place a stand at the front end of the rear axle housing.

15. If the cab is integral with the gearbox, position a stand under the gearbox and a trolley jack under the hitch hook.
Note: Do not remove the draw-bars, in order to ensure the stability of the rear axle housing.

16. Remove the bolts attaching the gearbox to the rear axle.
Note: On tractors equipped with the closed centre system it could be necessary to remove the variable displacement pump to gain access to the bolts. See section 9 F01 § D.

17. Separate the gearbox from the rear axle. If necessary, remove the PTO shaft.

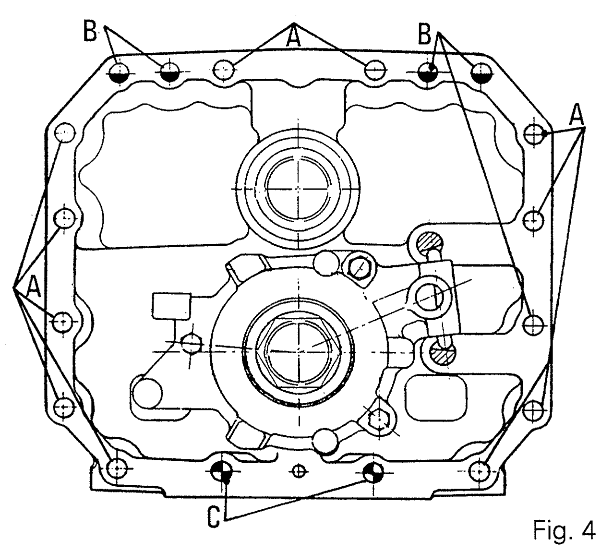


Fig. 4

C . Recoupling

18. Clean the mating faces on the gearbox and the rear axle housing.

19. Check that the dowel pins are tightened and that the locating pin is fitted on the housing.

20. Apply Loctite 510 sealing compound or equivalent on the mating face of the rear axle housing.

21. Check that the PTO shaft is fitted, recouple the tractor between the gearbox and the rear axle.

22. Carry out operation 16 in reverse order. Tighten the bolts and nuts to the torque values specified in Fig. 3 and 4.

23. Screw in and lock the pin **(25)**. Position the lever **F** and reconnect the control cable (see section 5 H01).

24. Reconnect the PTO clutch lubricating tube.

*25. Lower the cab, ensuring that the balls of the gear lever and reversing lever are correctly positioned. Install the bolts **(1)** in the shock absorbers (Fig. 2) and tighten to a torque of 200 - 270 Nm.

Splitting the tractor

26. If necessary, adjust the balls of the gear lever **(2)** and reversing lever **(3)** in the neutral position as per Fig. 5. Tighten the nuts **(1)** to a torque of 44 - 55 Nm (Fig. 5).
27. Remove the stands.
*28. Carry out procedures 4 to 6, section 2 B01, in reverse order.
*29. Top up the radiator.
30. Carry out procedures 2 to 5 in reverse order.
31. Reconnect the batteries, refit the exhaust pipe. Start the engine.
*32. Check the accelerator control setting.
33. Bleed the brake and clutch systems (see sections 9 G01 and 4 A01).
34. Check :
    - for leaks on the mating face between the gearbox and rear axle and on hydraulic unions,
    - the correct operation of electrical circuits.
35. Reinstall the sheet metal panels.
36. Carry out road test.

D . Final operations

37. Reinstall the additional fuel tank (if fitted).

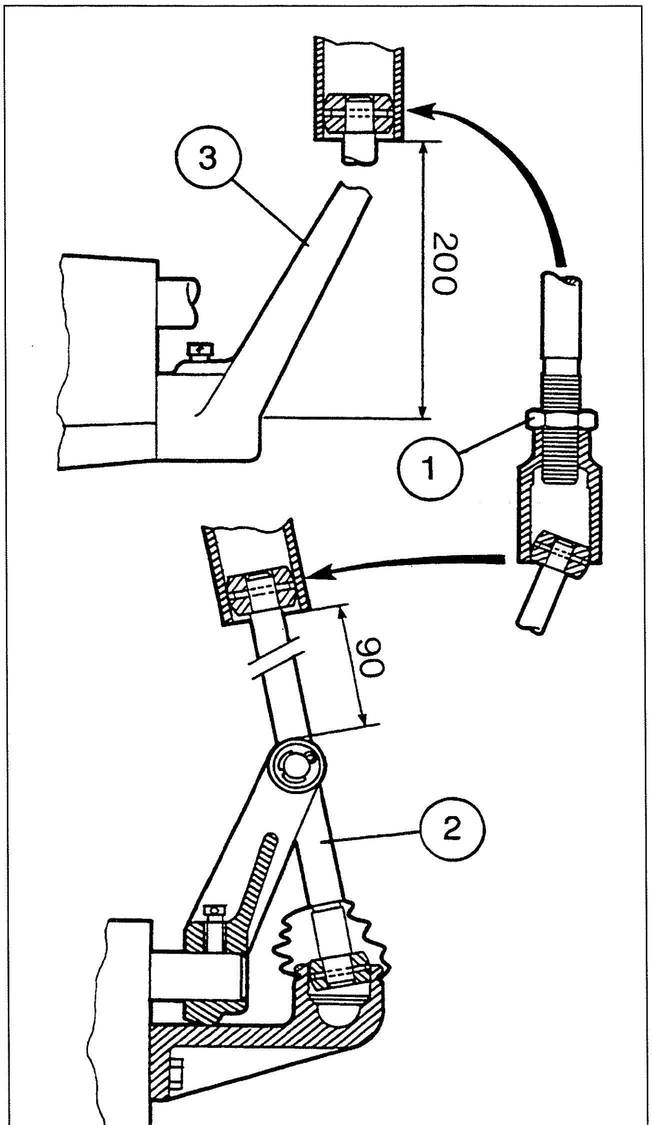


Fig. 5

2 D01 Chassis reinforcement

CONTENTS

Splitting the tractor

A. General

The chassis reinforcement, fitted on 8140 (as option) - 8150 and 8160 2WD and 4WD tractors, consists of two crossbeams attached on either side of the tractor.
These crossbeams are secured:
- at the front, by the bolts attaching the spacer onto the lower engine casing,
- at the rear, onto the 4WD housing located under the central casing.

Note : 2 WD tractors are equipped with an empty housing (10).

The adjusting screw **(6)** located at the rear end of the crossbeam and tightened to 100 Nm exerts pressure on the central casing via spacer **(5)**. This screw is, itself, locked with screw **(7)**.

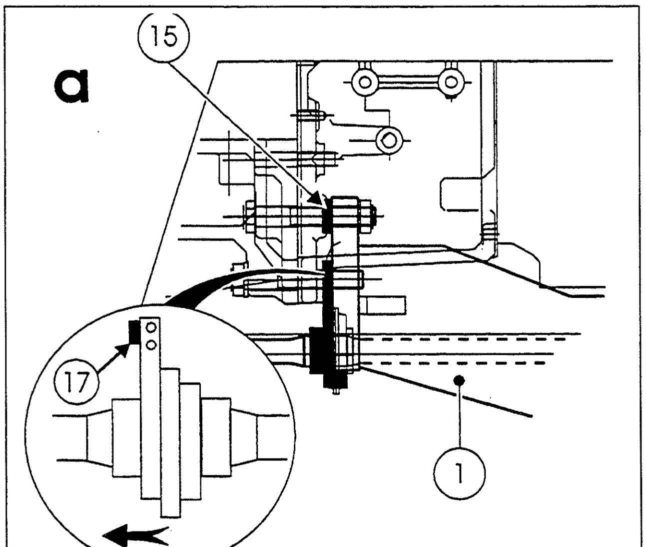


Fig. 1

B. Types of installation

Installation a (Fig. 1) - 4WD tractors
- **(15)** Spacers welded onto crossbeams **(1)**
- **(17)** Shim welded onto drive shaft support

Installation b (Fig. 2) - 2WD tractors
- **(15)** Spacers welded onto crossbeams **(1)**
- **(16)** Spacers to be fitted

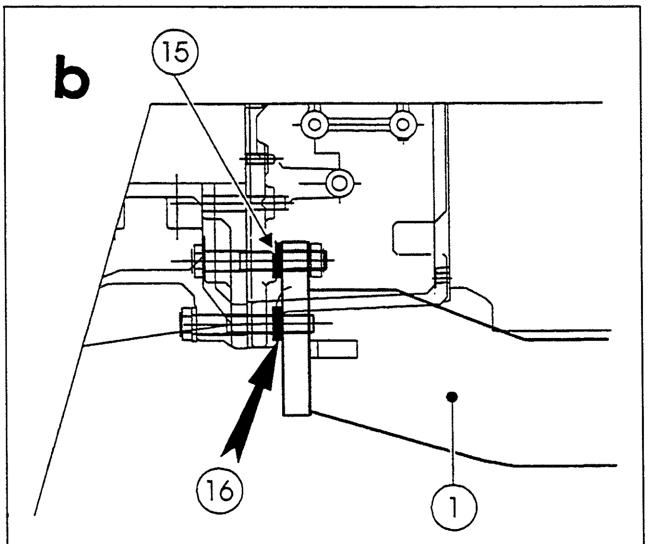


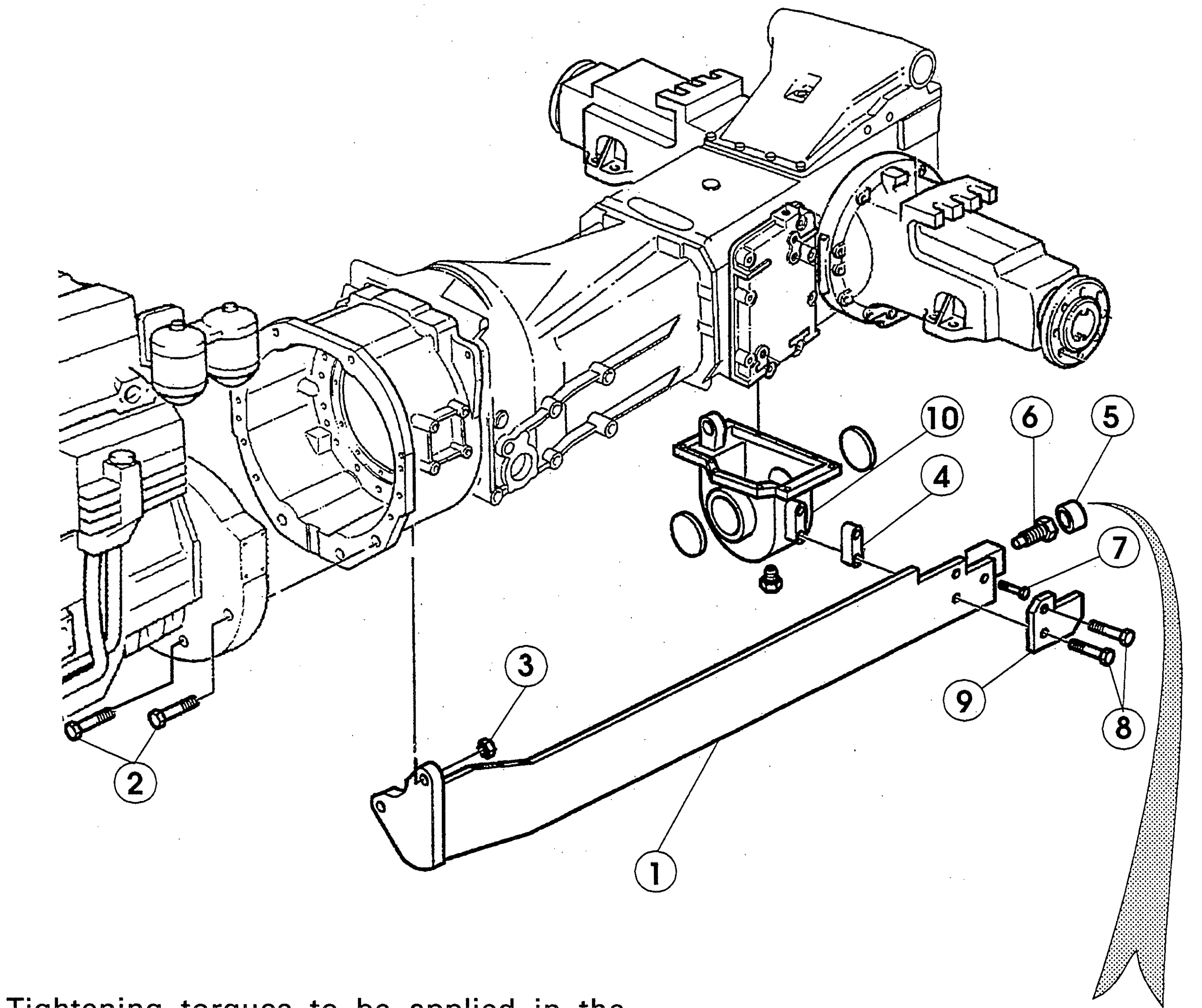
Fig. 2

C. Fitting and adjustment

For fitting and tightening torques, see Fig. 3.
- Proceed with the preliminary assembly on the tractor of the crossbeams **(1)**, plates **(9)**, bolts and shims **(17)** or spacer **(16)** according to the applicable type of installation.
- Apply Loctite 270 on bolts **(2)** and nut **(3)**. Tighten the bolts and the nut to the specified torque.
- Temporarily tighten bolts **(8)** to a torque of 20 Nm.
- Position the adjusting screws **(6)** in contact with spacers **(5)** and loosen to a torque of 100 Nm.
- Swing the plates **(9)**. Tighten the locking screws **(7)**, position the plates **(9)** and finally tighten bolts **(8)** to the specified torque.

Splitting the tractor

Exploded view



Tightening torques to be applied in the specified order:

(2) 600 to 800 Nm - Apply Loctite 270
(3) 300 to 340 Nm - Apply Loctite 270
(8) Preliminary tightening to 20 Nm
(6) In contact with spacer **(5)**, then untighten to 100 Nm
(7) 42 to 53 Nm
(8) Tighten to 340 to 450 Nm

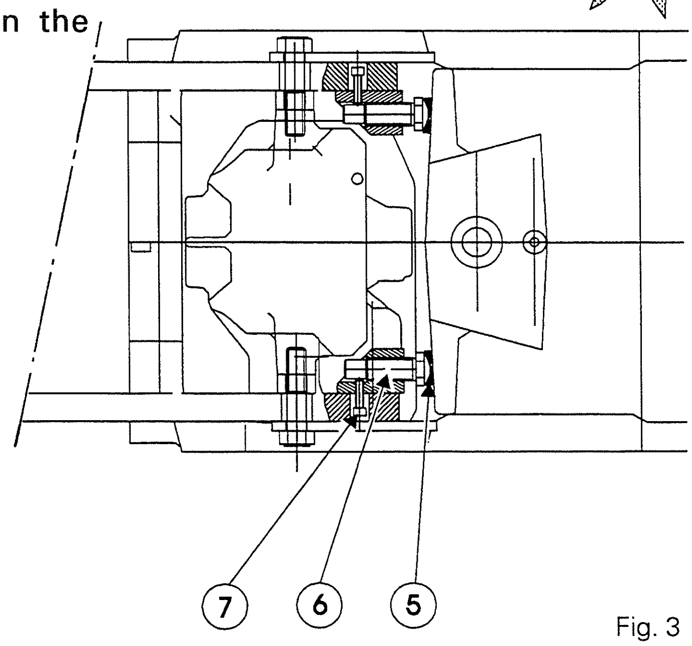


Fig. 3

3 . ENGINE

Contents

3 A01 General

CONTENTS

Engine

A. Introduction

This section is intended only to provide some general information on the engines used in the 8100 range.
If further information is required on technical data, adjustments, and disassembly and assembly procedures, the following publications should be referred to:

1. Perkins engines

a. Workshop manual covering all types of Perkins engines manufactured for MF tractors, published by Massey Ferguson under the reference 1856562M1.
b. Workshop manual specific to engines in the 1000 series, published by Massey Ferguson under the reference 1646906M1.

2. Valmet engines

Workshop manual covering engines of type 620DS and 634DS, published by Massey Ferguson under the reference 1646994M1.

B. Main specifications

Tractors fitted with Perkins engines

	MF 8110	MF 8120	MF 8130
Engine type	1006-THR2	1006-THR3	1006-THR4
Perkins list No.	YB 31262	YB 31264	YB 31263
Nbr of cylinders	6	6	6
Bore (mm)	100	100	100
Stroke (mm)	127	127	127
Capacity (liter)	6	6	6
Compression ratio	16.0/1	16.0/1	16.0/1
Power at 2,200 rpm (kW) (DIN 70020)	99,3	106,6	114
Max. torque (Nm)	551	588	625
at engine speed of (rpm)	1400	1400	1400
Idling speed (rpm)	1000	1000	1000
Nominal speed (rpm)	2200	2200	2200
Max. speed no load(rpm)	2310	2310	2310
Fuel injection pump:			
Mark and type	Stanadyne DB2	Stanadyne DB4	Stanadyne DB4
Boost control	Yes	Yes	Yes
F.I.P.	DB 2635 5109	DB 4629 5108	DB 4629 5107
Perkins Code	2643 U 607	2643 U 606	2643 U 605
Fuel pump code letters	FL	GL	LL
Governor spring position code	N/A	N/A	N/A
Rotation	Clockwise	Clockwise	Clockwise
No. 1 cylinder output	View from drive shaft 3 O' clock position		
Static timing angle (degrees)	14	12	12
Engine position	TDC	TDC	TDC
Engine check angle (degrees)	326	326	227
Pump check angle (degrees)	333	332	333
Static timing piston position	N/A	N/A	N/A
Injectors			
Mark	Stanadyne	Stanadyne	Stanadyne
Code	NU	NU	NN
Holder	2645 L 303	2645 L 303	2645 L 303
Nozzle	2645 L 605	2645 L 605	2645 L 612
Set and reset pressure (atmosphere)	220	220	230
Aspiration system	Turbo Garret	Turbo Garret	Turbo Wastegate Garret
Mini boost pressure at 2200 rpm			
full load (mm Hg)	660	635	760
(Kpa)	88	84,6	101,3
(PSI)	12,75	12,25	14,70
Valve spring	Double	Double	Double
Valve inserts (In / Ex)	Yes / Yes	Yes / Yes	Yes / Yes
Valve angle (degrees - In / Ex)	30 / 45	30 / 45	30 / 45
Valve adjustment (mm - In / Ex)	0.20 / 0.45	0.20 / 0.45	0.20 / 0.45
Engine oil cooler	Yes	Yes	Yes
Nb of thermostats	2	2	2
Opening temperature	82° C	82° C	82° C
Fan	Viscostatic	Viscostatic	Viscostatic
Piston cooling jets	Yes	Yes	Yes
Oil filters	1	2	2
Fuel filters	2	2	2

Engine

Tractors fitted with Valmet engines

	MF 8140	MF 8150	MF 8160
Engine type	620 DS	620 DS	634 DS
Build list No.	8327 48 868	8327 48 567	8328 48 943
Nbr of cylinders	6	6	6
Bore (mm)	108	108	108
Stroke (mm)	120	120	134
Capacity (liter)	6.6	6.6	7.4
Compression ratio	16.5:1	16.5:1	16.5:1
Power at 2,200 rpm (kW) (DIN 70020)	114	132.4	147.1
Max. torque (Nm)	650	720	810
at engine speed of (rpm)	1300	1400	1300
Idling speed (rpm)	1000	1000	1000
Nominal speed (rpm)	2200	2200	2200
Max. speed no load(rpm)	2370	2370	2370
Injection pump:			
Mark and type	Stanadyne DB4	Bosch in line	Bosch in line
Boost control	No	Yes	Yes
Reference	DB 4629 XX083	PES6A 95D320RS2832/0	PES6A 95D320RS2848/B
Coding	2643 U 607	2643 U 606	2643 U 605
Fuel pump code letters	-	-	-
Governor spring position code	-	-	-
Rotation	Clockwise	Clockwise	Clockwise
No. 1 cylinder output	-	-	-
Static timing angle (degrees)	14	21	20
Engine position	-	-	-
Engine check angle (degrees)	-	-	-
Pump checking angle (degrees)	-	-	-
Static timing piston position	-	5.097	5.307
Injectors			
Mark	Stanadyne	Stanadyne	Stanadyne
Code	HNS 781736	HNS 781736	HNS 781736
Holder	HNS 781649	HNS 781649	HNS 781649
Nozzle	NBS 770620	NBSS 770620	NBS 770620
Set and reset pressure (bar)	230 (+ 20)	230 (+ 20)	230 (+ 20)
Aspiration system	Turbo Schwitzer S 2B	Turbo Schwitzer S 2B	Turbo Schwitzer S 2B
Mini boost pressure at 2200 rpm			
full load (mm Hg)	-	-	-
(Kpa)	-	-	-
(PSI)	-	-	-
Valve spring	Single	Single	Single
Valve inserts (In / Ex)	No / Yes (inlet in service only)	No / Yes (inlet in service only)	No / Yes (inlet in service only)
Valve angle (degrees - In / Ex)	30 / 45	30 / 45	30 / 45
Valve adjustment (mm - In / Ex)	0.35 / 0.35	0.35 / 0.35	0.35 / 0.35
Engine oil cooler	Yes	Yes	Yes
Nb of thermostats	2	2	2
Opening temperature	79°C / 83°C	79°C / 83°C	79°C / 83°C
Fan	Viscostatic	Viscostatic	Viscostatic
Piston cooling jets	Yes	Yes	Yes
Oil filters	1- horizontal	1- horizontal	1- horizontal
Fuel filters	2	2	2

C. Viscostatic fan

Description

Engines in the 8100 series are fitted with a cooling fan equipped with a viscocoupler of the Eaton trademark. This device allows power increases in the region of between 2 and 3 hp.

The viscocoupler is made up of three main parts:

- the driving section which is powered by the engine and consists of a shaft **(1)** integral with a plate **(2)** which has annular grooves,
- the driven section comprising a hub **(6)** fitted with the fan and body **(7)** which also has annular grooves,
- the regulating section comprising a thermostatic spring **(3)** operating the valve **(4)**.

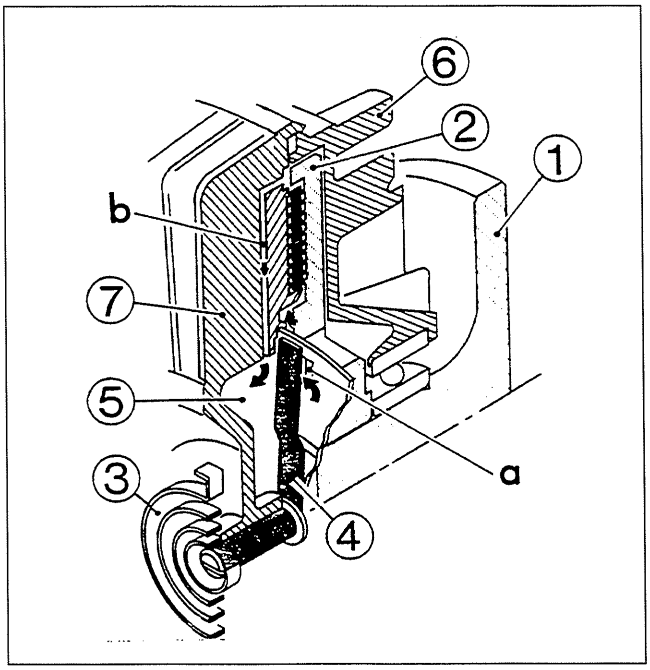
The centre of the device is fitted with a reservoir **(5)** filled with a viscous silicon fluid.

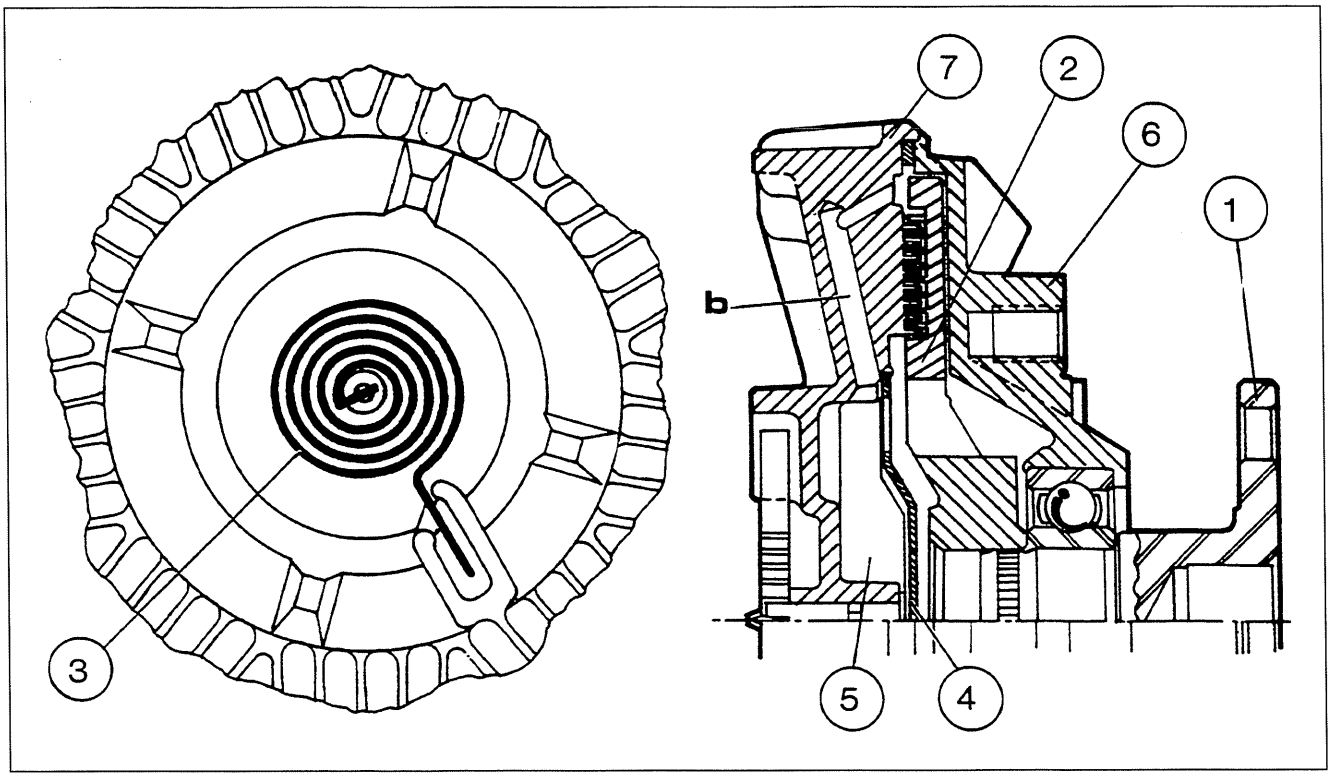
Operation

When the temperature of the air crossing the radiator reaches a preset value, the thermostatic spring **(3)** acts on the valve **(4)** which opens orifice **a**. The liquid is driven towards the annular grooves on the hub **(2)** and body **(7)** by centrifugal force. Torque is transmitted by the internal friction of the highly viscous fluid and its adhesion to the walls. The fan is then driven to provide more efficient air cooling.

The fan speed varies continuously over the whole control range depending on the temperature.

When the temperature of the air going through the radiator decreases, the spring closes the valve and prevents the fluid from coming into contact with the friction area. The fluid gradually returns to the reservoir **(5)** via pipe **b** and the fan is disengaged, leaving only a slight resistive torque.





CONTENTS

3 B01 Spacer

CONTENTS

Engine - *Spacer*

A . Removing and refitting the spacer

Removal

1. Split the tractor between the engine and the gearbox (see section 2B01).
2. Remove the four 10 dia. bolts from the front shock absorbers on the right-hand and left-hand cab supports. Raise the cab and install wedges.
3. Remove the attaching bolts **(9)** to **(11)** and **(15)** as well as the nuts **(14)** from the spacer **(16)** on the gearbox.
4. With the help of an operator, detach and remove the spacer. Recover the locating pins **(12)**.
5. If necessary, remove the cabin supports and extract the dowel pins **(13)**.

Refitting

6. Clean and check the parts, and replace any that are faulty.
   Note : The mating faces on the spacer and the gearbox must be cleaned and coated with Loctite 510.
7. Carry out procedures 1 to 5.
   Tightening torques:
   The bolts, dowel pins and nuts must be coated with Loctite 270.
   - Bolts **(15)**, dowel pins **(13)** and nuts **(14)**: 100 - 130 Nm
   - Bolts **(9)** to **(11)**: 150 - 200 Nm
   - Cab support bolts: 200 - 260 Nm (Loctite 270)
   - Shock absorber / cab attaching bolts, 10 dia.: 50 - 70 Nm
   - Bolts **(1) (2) (6)**: 240 - 320 Nm
   - Bolts **(3) (5)**: 100 - 130 Nm
   - Bolts **(7) (8)**: 600 - 800 Nm

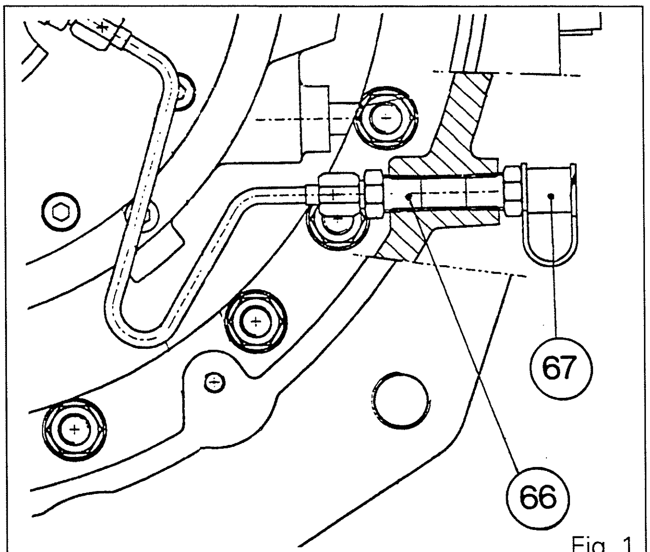


Fig. 1

If the spacer **(16)** or cover plate **(10)** is replaced, the clutch assembly must be readjusted (see section 4A01).

Special points (Figures 1 and 2)

- Apply Loctite 542 on the union **(66)** and on the bleed connector **(67)**.
- Seal the sides of the spacer with Loctite 510.

B . Removing and refitting the flywheel housing

If servicing is to be performed on the flywheel housing, see the following engine manuals:
- Perkins engines, ref. 1646906 M1, section 22,
- Valmet engines, ref. 1646994 M1, section 4C02.

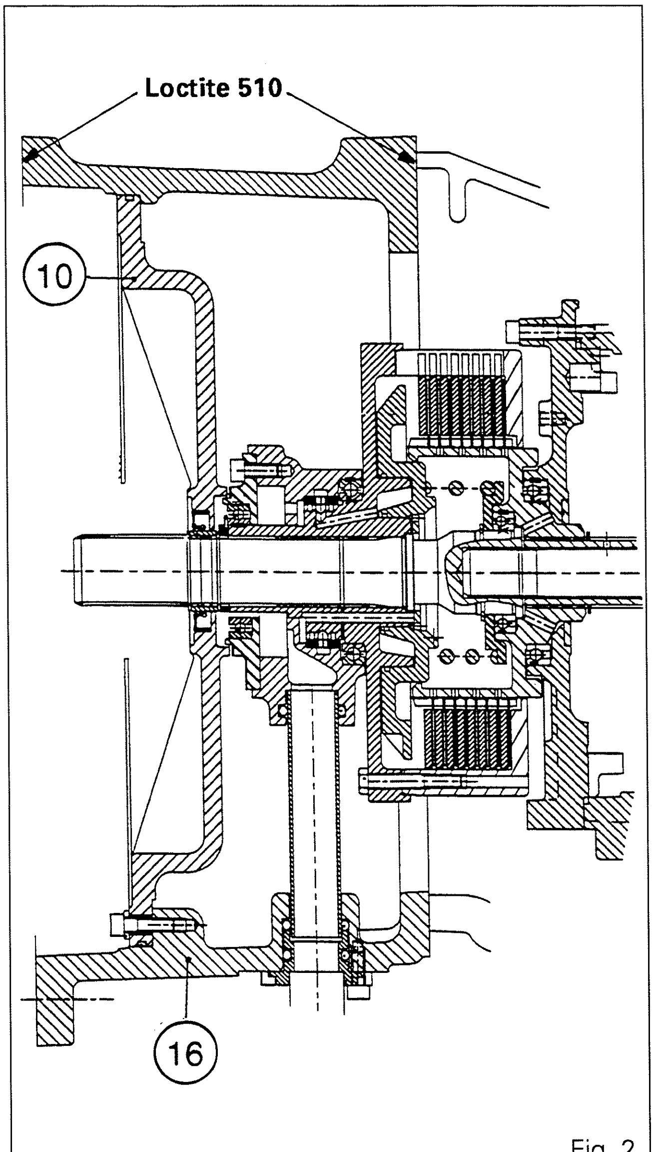
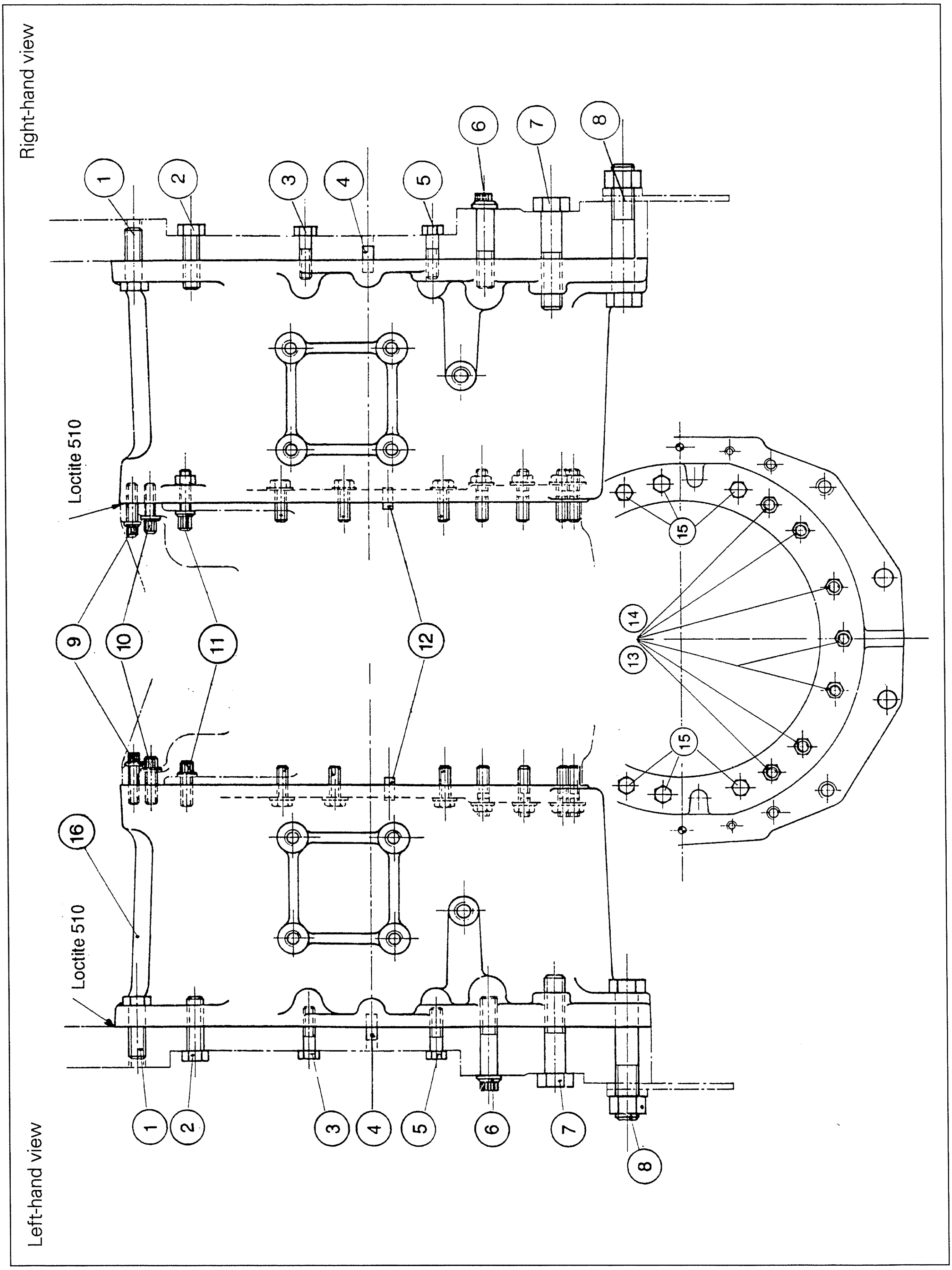


Fig. 2

Engine - Spacer



4 . CLUTCH

Contents

CONTENTS

4 A01 Wet clutch

CONTENTS

Clutch

General

Description

The engine clutch system fitted on 8100 tractors is of the oil bath multiple-disc type.
The hydraulic clutch which transmits movement is similar to a PTO clutch but on a larger scale.
This clutch is controlled by a hydraulic valve fitted on the right-hand side of the gearbox which is, itself, operated by the clutch master cylinder.
To ensure maximum reliability, the oil used for this clutch must, imperatively, comply with standards MF M1143 or MF M1144.

Construction

The wet clutch assembly is installed between the engine flywheel and the primary shaft of the Dynashift gearbox.
The input shaft **(7)** passes through the cover plate **(10)** which separates the engine flywheel from the transmission oil. The shaft **(7)** is constantly driven via the hub on the engine flywheel.
It rotates with the clutch housing **(23)** through splining.
The clutch unit is equipped with friction plates **(45)** and the piston **(46)** moves inside it.
The drive hub **(37)** comprising discs **(44)** is engaged on the primary shaft **(33)**.
The fixed housing **(12)** has two functions:
- it receives the 17-bar pressure,
- it forms the casing for the lubricating and cooling pump (30 l/mn, nominal pressure 0.4 bar).

This pump is supplied with oil from the centre housing via a 500-micron strainer which cannot be replaced, a tube **(17)** located under the transmission and a second tube **(20)**.
The clutch assembly includes:
- 6 discs and 6 plates: 8110 - 8120 - 8130
- 7 discs and 7 plates: 8140 - 8150
- 8 discs and 8 plates: 8160

The discs **(44)** are equipped with paper packing for optimum progressive application and quieter operation.

Operation

Clutch engagement

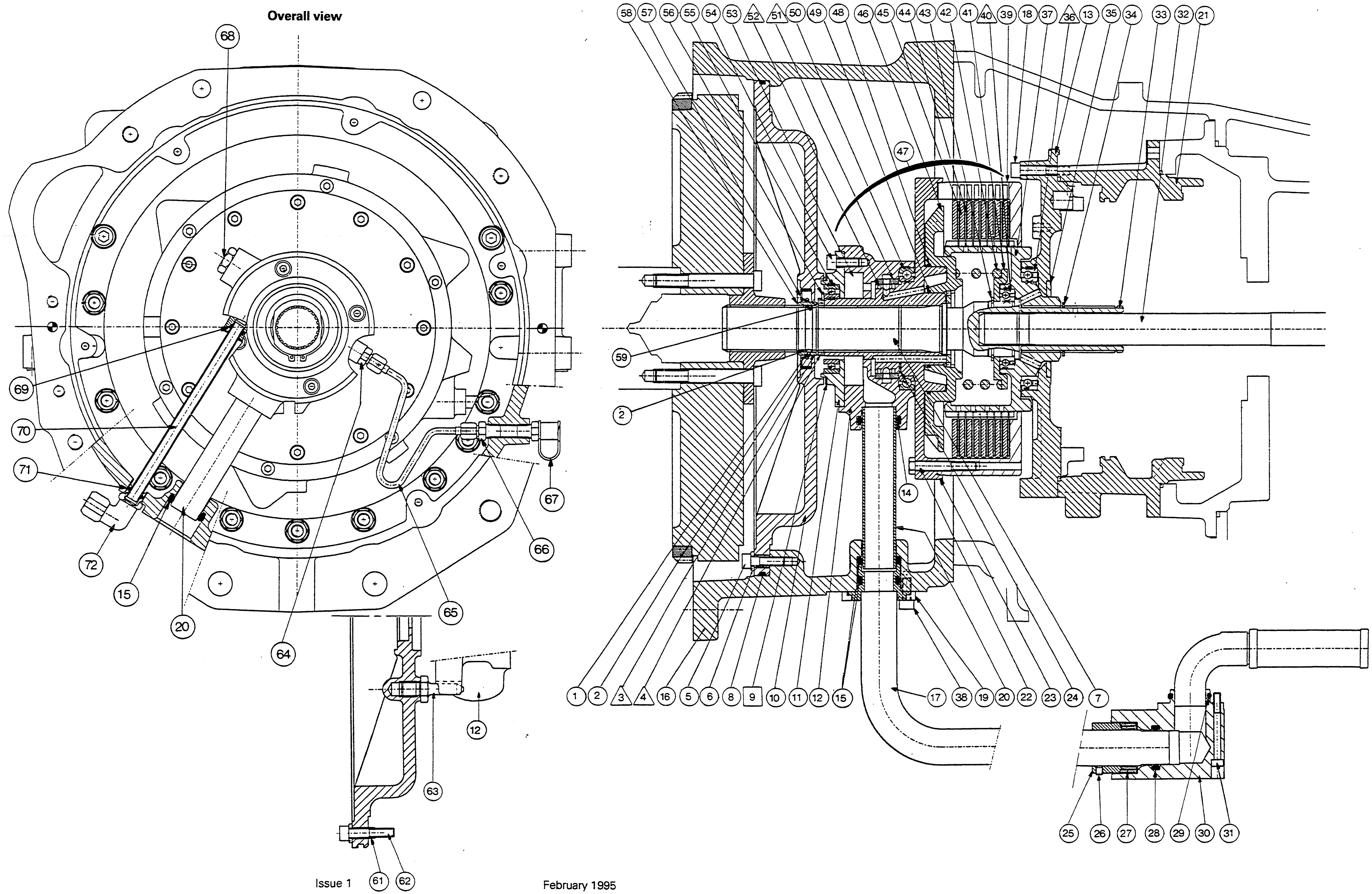
When the clutch pedal is released, the hydraulic valve located on the right-hand side of the gearbox supplies a 17-bar pressure which moves the piston **(46)** which, in turn, presses the plates **(45)** against the discs **(44)** in order to drive the primary shaft **(33)**.
The valve controls the smooth action and progressive effect of clutch engagement and modulates the pressure applied on the piston.

Clutch release

When pressure is no longer applied, the piston **(46)** is pushed back by the spring **(42)** and the plates **(45)** are no longer in contact with the discs.
The lubricating and cooling oil flow for the discs is cut off in the released position in order to avoid driving the discs by the «drag» effect. For the same reason, the discs have a bulged face to allow easier disengagement.

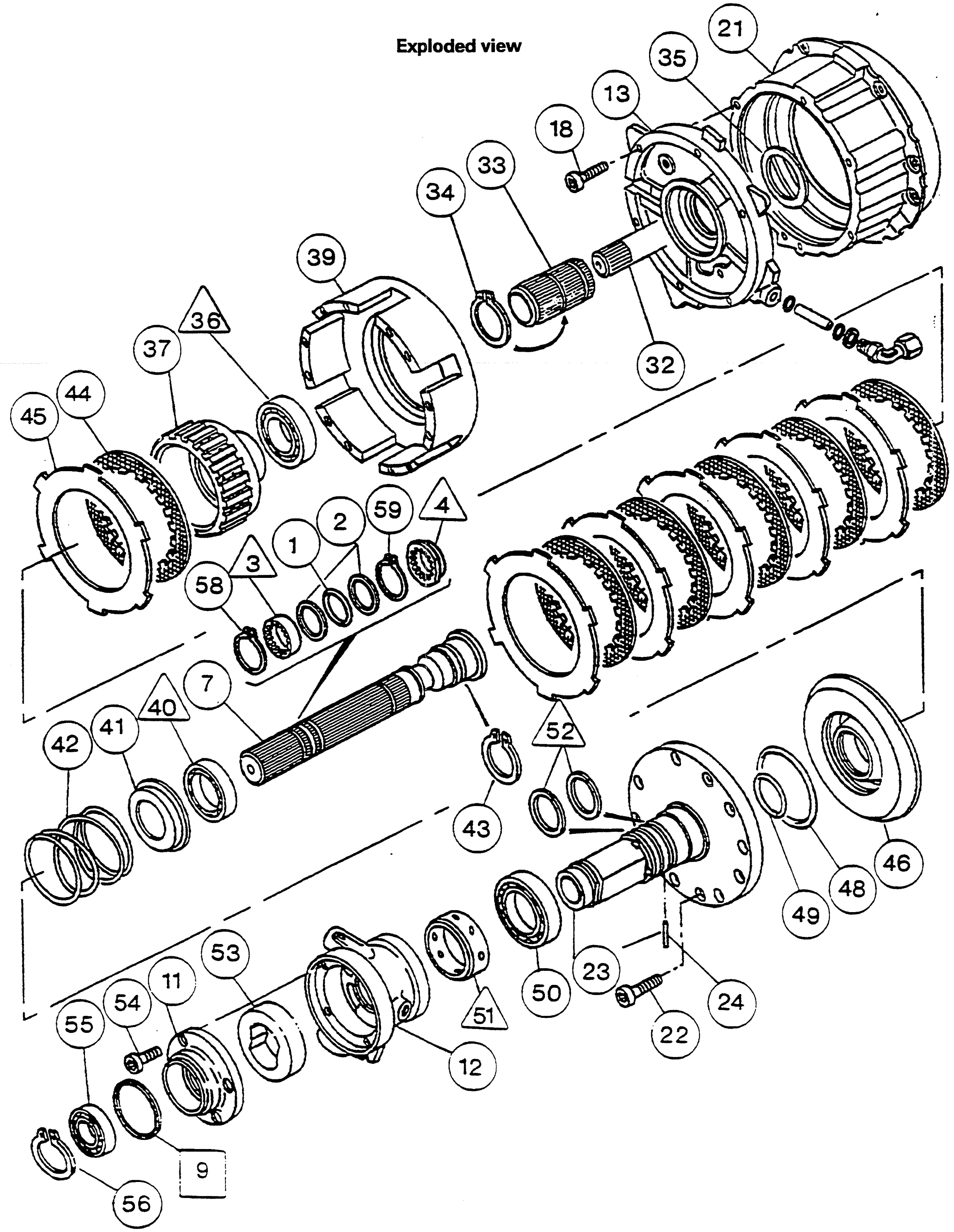
List of parts

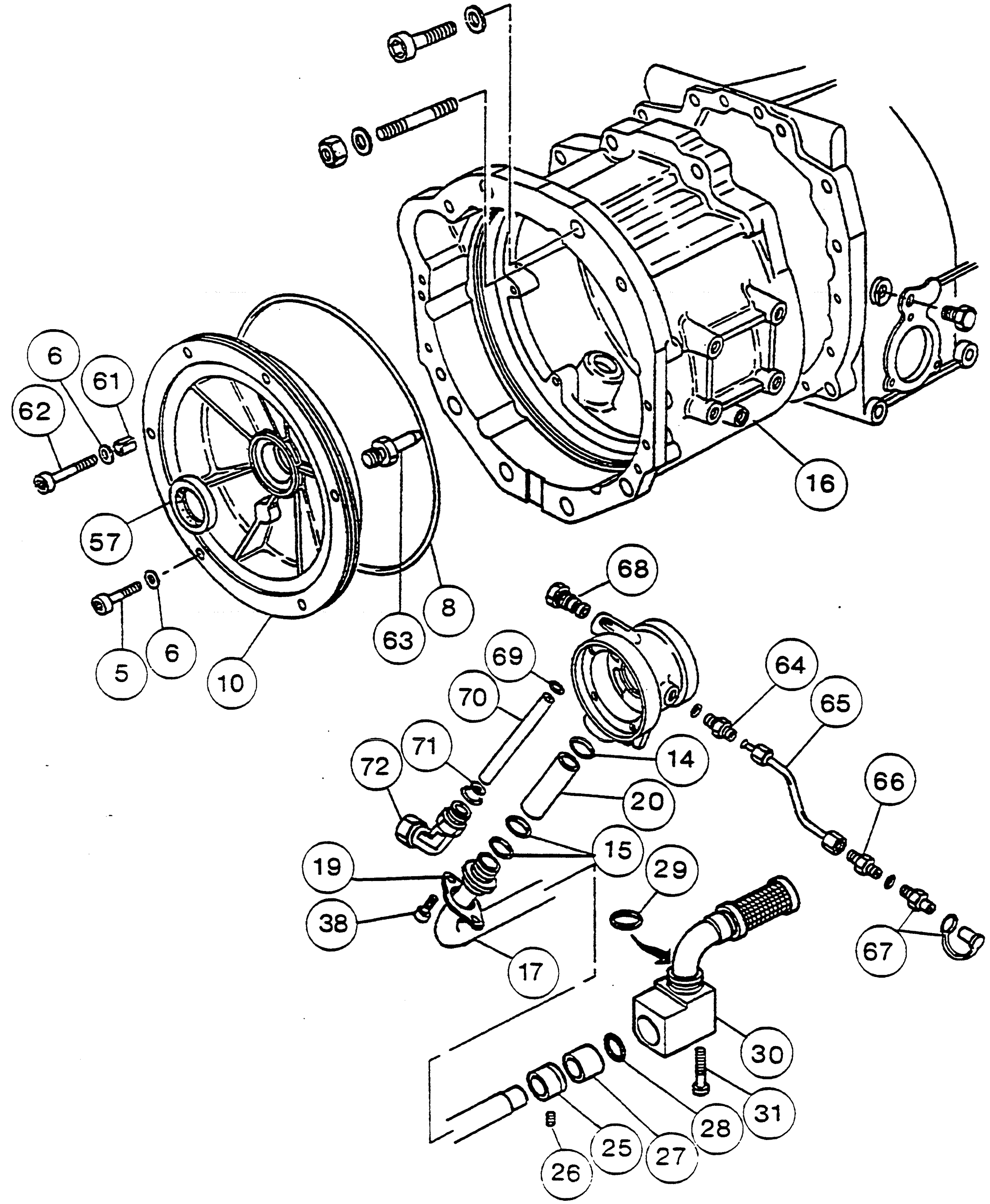
(1) O-ring
(2) Anti-extrusion rings
/3 Splined ring
/4 Locking ring
(5) Bolt
(6) Washer
(7) Input shaft
(8) O-ring
[9] Shim(s)
(10) Cover plate
(11) Pump cover
(12) Pump body
(13) Dynashift cover
(14) O-ring
(15) O-rings
(16) Spacer
(17) Tube
(18) Bolt
(19) Flange
(20) Tube
(21) Spacer housing
(22) Bolt
(23) Clutch housing
(24) Dowel
(25) Flange
(26) Bolt
(27) Dust guard
(28) O-ring
(29) O-ring
(30) Suction unit
(31) Bolt
(32) PTO shaft
(33) Primary shaft
(34) Circlip
(35) Washer
/36 Bearing
(37) Drive hub
(38) Bolt
(39) Cover
/40 Bearing
(41) Support
(42) Spring
(43) Circlip
(44) Discs
(45) Plates
(46) Piston
(47) Clutch assembly
48) Seal
(49) Seal
(50) Bearing
/51 Bush
/52 Sealing rings
(53) Lubricating pump
(54) Bolt
(55) Bearing
(56) Circlip
(57) Oil seal
(58) Circlip
(59) Circlip
(61) Locating dowel
(62) Bolt
(63) Finger
(64) Union
(65) Tube
(66) Union
(67) Diagnostic connector
(68) Valve, 1.5 bar
(69) O-ring
(70) Tube
(71) O-ring
(72) Union


Overall view
68
69
70
71
72
15
20
64
65
66
67
12
63
61
62
58 57 56 55 54 53 52 51 50 49 48 46 45 44 43 42 41 40 39 18 37 36 13 35 34 33 32 21
47
59
2
14
1 2 3 4 16 5 6 8 9 10 11 12 15 17 38 19 20 22 23 24 7
25 26 27 28 29 30 31

Clutch

Exploded view





A. Removing and refitting the engine flywheel (Fig. 3)

Removal

1. Split the tractor between the engine and the gearbox (see Section 2B01).
2. Remove the engine flywheel **(1)** and the hub **(2)**.

Refitting

3. Screw two guide studs in the holes on the crankshaft.
4. Refit the hub and flywheel.
5. Tighten the bolts **(17)** after smearing them with Loctite 241:
   - Perkins engines: 140 to 180 Nm,
   - Valmet engines: 120 to 160 Nm.

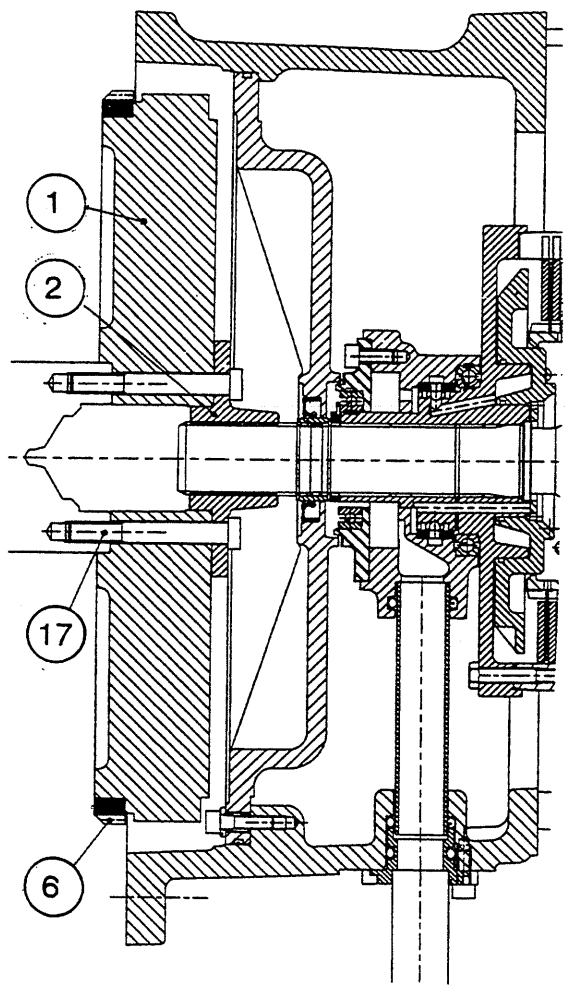


Fig. 3

B. Replacing the starting ring gear (Fig. 4)

Disassembly

6. Remove the engine flywheel.
7. Drill a hole (5 mm dia., 16 mm deep) and break the ring gear **(6)** with a chisel as shown in the diagram.
   Note: Ensure protection against metal chips when breaking the ring gear.

Reassembly

8. Heat a new ring gear to 245°C in an oven only.
9. Fit the ring gear **(6)** on the engine flywheel **(1)** (with tooth chamfer facing the engine side) and quickly push the ring gear fully home. Leave to cool slowly.

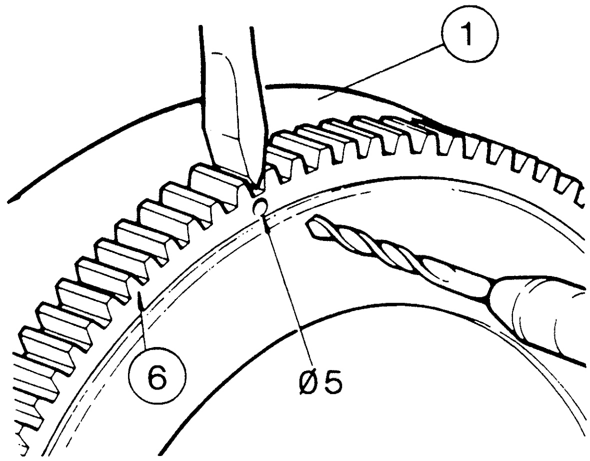


Fig. 4

C. Removing and refitting oil seal (57) and O-ring (1)

Removal

10. Split the tractor between the engine and the gearbox (see section 2B01).
11. Drain the oil from the gearbox.
12. In order to make it easier to separate the cover plate **(10)**, fit two attaching bolts in the holes tapped in the plate and remove it.
13. Take off the circlip **(58)** and remove the splined bush **/3**, bushes **(2)** and O-ring **(1)**.
14. Extract the oil seal **(57)**.

Clutch

Refitting

15. Fit the oil seal **(57)** with a suitable fixture.
16. Place the O-ring **(1)** between bushes **(2)**. Reinstall the splined bush **/3**. Replace the circlip **(58)** and position it correctly in the recess.
17. Check that the locating dowels **(61)** and shims **[9]** are in place.
18. Replace the O-ring **(8)**.
19. Apply Loctite 510 to the periphery **«P»** of the tapped holes (Fig. 5).
20. Grease the oil seal **(57)**. Fit protector 3378012M1 on the shaft **(7)**. Screw two guide studs in diametrically opposite positions on the spacer and reinstall the plate **(10)** and fit the finger **(63)** in the notch in the pump body **(12)** (Fig. 6).
21. Tighten the bolts **(5)** and **(62)** to a torque of 25 to 35 Nm.
22. Top up the oil in the centre housing.
23. Adjust the right and left-hand side chassis reinforcements if fitted (see section 2D01).

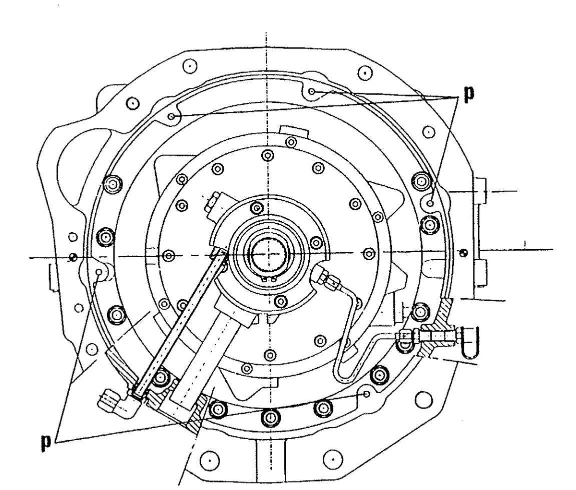


Fig. 5

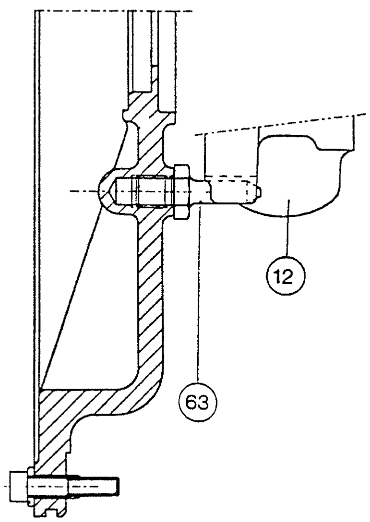


Fig. 6

D. Removing, refitting and shimming the clutch

Removal

24. Split the tractor between the engine and the gearbox (see section 2B01).
25. Drain the oil from the gearbox and rear axle.
26. If the tractor is fitted with the chassis reinforcements, remove the right-hand side.
27. Remove the tube **(17)**.
28. Remove the cover plate **(10)**.
    Repeat procedure 12.
29. Remove the tube **(20)**.
30. Remove the union **(72)** and tubes **(70)** and **(65)**.
31. Remove the clutch assembly **(47)** using a locally manufactured tool (Fig. 7).
32. Remove the PTO shaft **(32)**.

Refitting

33. Fit O-rings **(14)** and **(69)**.

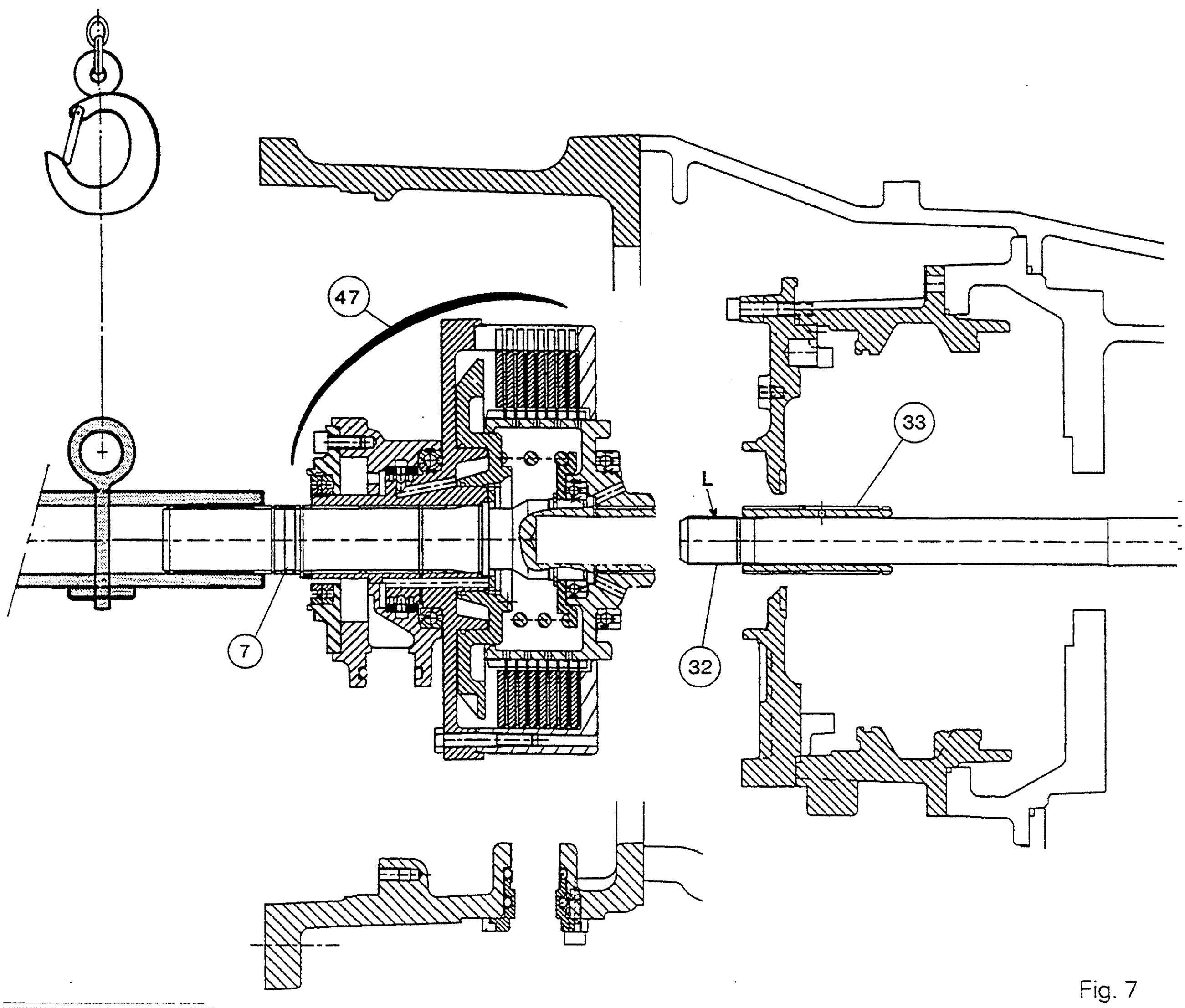


Fig. 7

Clutch

Shimming the clutch assembly (Fig. 8)

The aim of this operation is to obtain an end play of **J1 = 0.60 to 0.80** between the pump cover **(11)** and the cover plate **(10)**.

34. Remove the clutch assembly **(47)** from the primary shaft **(33)** with the tool used for procedure 31. Place a 2 mm thick shim **[9]** on the cover **(11)**.
35. Grease the oil seal **(57)**. Protect the splines on shaft **(7)** with protective device 3378012M1. Screw two studs in diametrically opposite positions on the spacer and refit the plate **(10)**.
36. Position a dial gauge at the end of the shaft **(7)** and check the play, while moving the clutch assembly sideways.
    Note: Make sure that the clutch assembly is correctly positioned in contact with the cover (13) before pulling on the shaft.
37. Remove the plate **(10)** and, according to the play measured, select a thickness of shims **[9]** to obtain a play of **J1 between 0.6 and 0.8**.
38. Remove the clutch and refit the PTO shaft **(32)**, with the long splines **L** towards the input shaft **(7)** (Fig. 7).
39. Refit the clutch assembly.
40. Replace O-rings **(15)** and **(71)**.
41. Refit the tubes **(20)**, **(65)** and **(70)** and the union **(72)**.
42. Apply miscible grease on the shims **[9]**, selected during operation 37, and place them on the pump cover **(11)**.
43. Refit the feed tube **(2)** (Fig. 12).
44. If the finger **(63)** was removed, smear it with Loctite 270 and screw it onto the cover plate **(10)**.
45. Check that the locating dowels **(61)** are in place. Replace the O-rings **(8)**.
46. Clean the periphery **«P»** of holes and apply Loctite 510 (Fig. 5).
47. Refit the cover plate with the finger **(63)** in the notch on the pump body **(12)** (Fig. 6), using the same method as for procedure 12.
48. Tighten bolts **(5)** and **(62)** fitted with washers **(6)** to a torque of 25 to 35 Nm.
    Note: The two long bolts (62) are fitted with the locating dowels (61).
49. Replace O-ring **(28)**. If O-ring **(29)** was removed, replace it and refit the suction unit **(30)**. Fit bolts **(31)** and tighten them to a torque of 14 to 20 Nm.

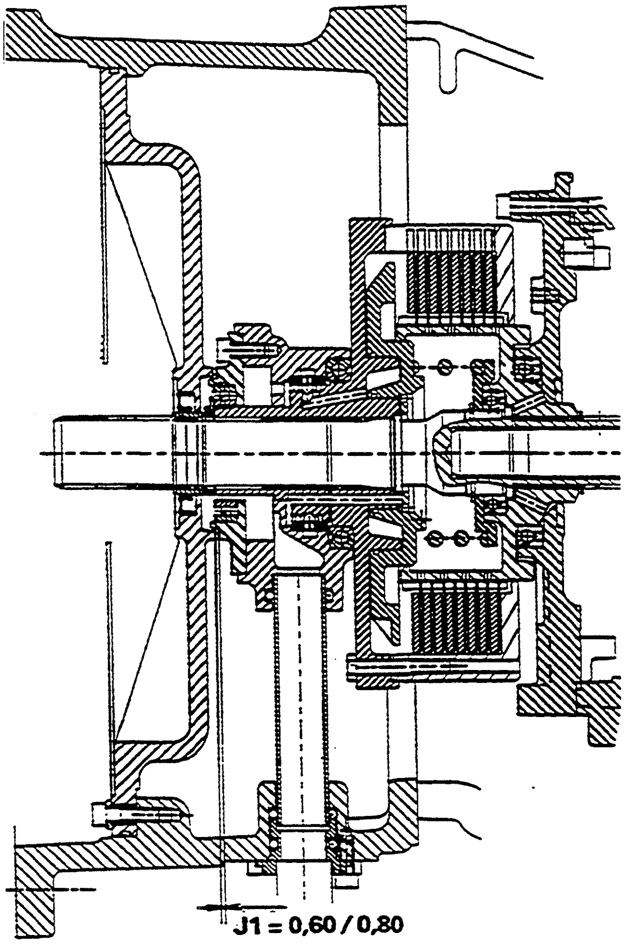


Fig. 8

50. Replace the dust guards **(27)**. Refit the tube **(17)** and flanges **(19)** and **(25)**, checking that recess **«G»** in flange **(25)** is correctly aligned with the face of block **(30)** (Fig. 9). Tighten bolt **(26)**. Tighten bolts **(38)** to between 25 and 35 Nm.
Refit the right-hand side chassis reinforcement (see section 2D01).
51. Carry out procedure 25 in reverse order.
52. Recouple the tractor between the engine and the gearbox (see section 2B01).
53. Bleed the clutch control (see part G) and check the lubricating pressure (0.4 bar minimum).
54. Check the operation of the PTO clutch.
55. Carry out a road test on the clutch.
56. Check for leaks on the flange **(19)** and suction unit **(30)**.

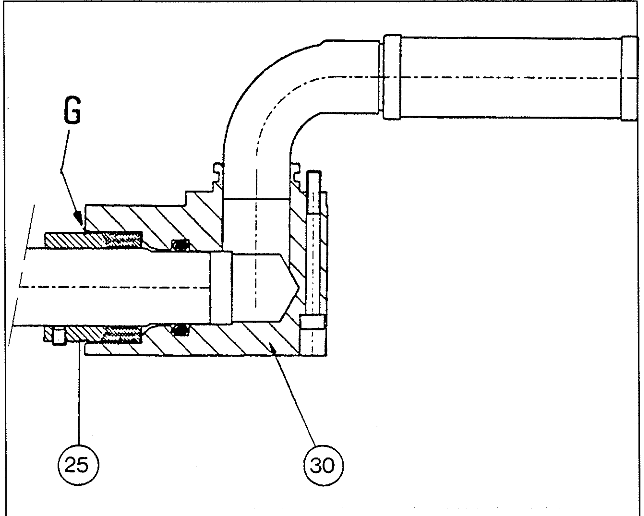


Fig. 9

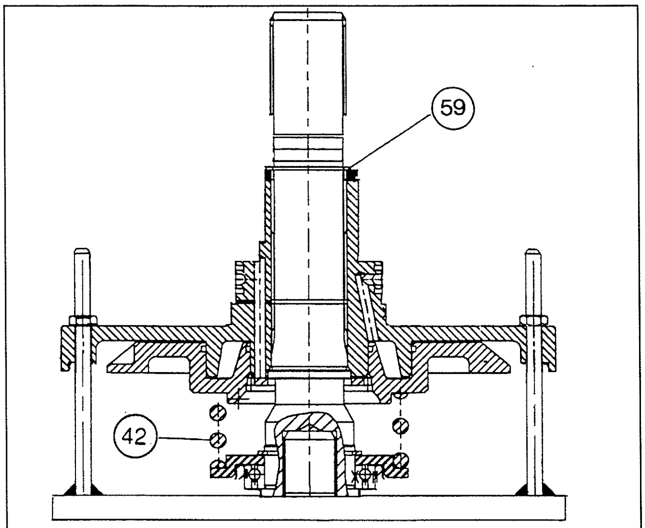


Fig. 10

E. Dismantling and reassembling the clutch

Dissassembly

57. Place the clutch in the vertical position, with the cover **(39)** resting on a suitable support.
58. Take off circlip **(58)**. Remove bush **/3**, bushes **(2)** and O-ring **(1)**.
59. Take off circlip **(56)**. Remove the pump cover **(11)** and the bearing **(55)**.
60. Extract the lubricating pump **(53)** from the pump body **(12)**. Separate the pump body from the clutch housing **(23)**.
61. Remove the sealing rings **/52**.
62. If necessary, extract bush **/51** and remove the 1.5-bar valve **(68)**.
63. Separate the clutch housing **(23)** from the cover **(39)**. Remove the discs **(44)** and plates **(45)**.
64. Remove the hub **(37)**.
65. If necessary, extract the bearing **/36**.
66. Using a suitable fixture (see section I), compress the spring **(42)**. Remove the circlip **(59)** (Fig. 10). Remove the locking ring **(4)**. Decompress the spring.
67. Separate the clutch housing **(23)** from the shaft **(7)**. Remove the spring.
68. Remove the piston **(46)**. If necessary, pull the bearing **(50)** out.
69. If necessary, remove the circlip **(43)**, the support **(41)** and the bearing **/40**.

Refitting

70. Check that the dowel **(24)** is in place.
71. If the bearing **(50)** was removed, refit it using a suitable fixture.
72. Install seals **(48)** and **(49)**.
73. Use a plastic-tipped hammer to position the piston **(46)** in the unit.
74. If the bearing **/40** was removed, refit it with the sealing face towards the Dynashift using a suitable fixture. Fit the support **(41)** and the circlip **(43)**.
75. Fit the spring **(42)** on the support **(41)**.

76. Slide clutch housing **(23)** onto the primary shaft **(7)**.
77. Compress the spring with the tool used in procedure 66. Position bush **/4**, aligning two flats with the flats on the clutch housing **(23)**. Replace the circlip **(59)** and position it correctly in its recess.
78. If the bearing **/36** was removed, fit it using a suitable fixture, with the sealing face towards the Dynashift.
79. Position the hub with the bearing in the cover **(39)**.
80. Soak the discs in a bath of transmission oil. Check that they are properly impregnated with oil.
    The number of discs and plates as well as the length of the splines on the hub **(37)** and the thickness of the cover **(39)** vary according to the type of tractor.
    . **8110 - 8120 - 8130 Tractors :**
    6 discs - 6 plates
    . **8140 - 8150 Tractors :**
    7 discs - 7 plates
    . **8160 Tractor :**
    8 discs - 8 plates
81. Position the plates **(45)** and discs **(44)** on the hub **(37)**, aligning their recesses.
82. Place the clutch housing **(23)** on the cover **(39)**. Tighten the bolts **(22)** to a torque of 25.5 to 34.5 Nm.
83. Check the rotation of the hub **(37)** by hand.
84. Check that the sealing rings **/52** turn correctly in their recesses. Fit the rings after smearing them with miscible grease, ensuring that they do not protrude beyond the circumference of the clutch unit.
85. If the 1.5-bar valve and bush **/51** were removed, tighten the valve to a torque of 28 to 30 Nm and fit the bush using a suitable fixture, with chamfer **«C»** oriented as shown in Fig. 11.
86. Lubricate the bush. Assemble the pump body **(12)** on the clutch housing **(23)**.
87. Oil the pump **(53)** and position it with its flats aligned with the flats on the clutch housing **(23)**. By hand, check the angular displacement of the rotor on the flats on the clutch housing **(23)**.
88. Refit the pump cover **(11)**. Fit the bearing **(55)**. Position the circlip **(56)**. Tighten the bolts **(54)** to a torque of 25 to 35 Nm.
89. Fit O-ring **(1)** and bushes **(2)**. Repeat procedure 16.

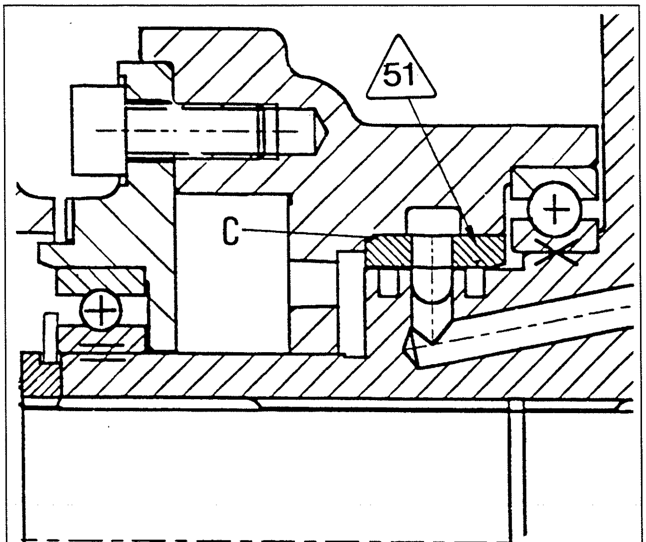


Fig. 11

F. Removing and refitting the control valve (Fig. 12)

Removal

90. Drain the oil from the gearbox.
91. Disconnect tubes **(1)** and **(2)**, the hose **(3)** and the connectors for solenoid valves **EV1** and **EV2** (and mark their positions).
92. Remove the valve.

Refitting

93. Smear the gearbox housing with a sealing compound.
94. Replace the O-rings for the 17-bar transfer tubes. Refit the valve. Smear the bolts **(5)** with a sealing compound and tighten them to a torque of 25 to 35 Nm.
95. Reconnect the tubes, hose and connectors.
96. Top up the oil in the central housing.
97. Bleed the clutch control (see part G).
98. Check the valve's modulating pressure (see section 9 I01).
99. Check for leaks on the mating surface and the unions. Check the operation of the Dynashift.

G. Bleeding the clutch control (Fig. 13 and 14)

100. Run the engine at about 1200 rpm.
101. Pinch the return hose **(1)**, taking care to protect it (Fig. 13).
102. Fit a pipe on the bleeding screw **(2)** as shown in Fig. 14.
103. Loosen the bleeding screw and slowly press the clutch pedal.
104. Check the adjustment of the clutch pedal (see part H).
105. Carry out a road test.

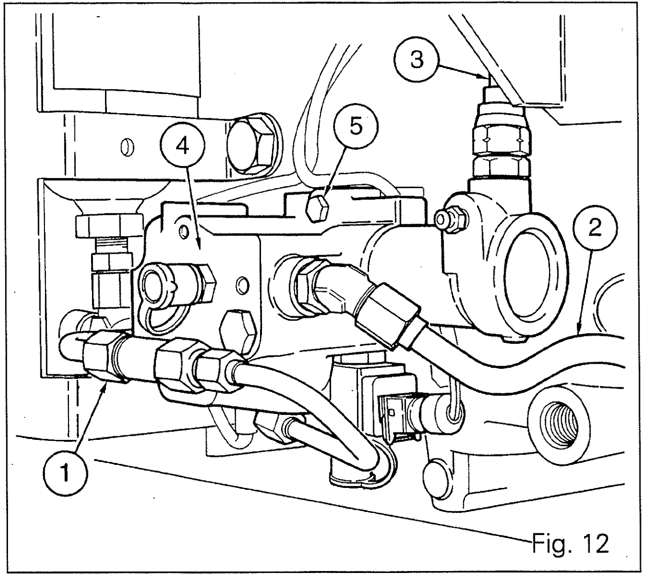


Fig. 12

H. Adjusting the clutch pedal (Fig. 15)

106. With the clutch pedal **(1)** at the stop **(2)**, adjust the push-rod **(3)** in order to obtain a clearance of 0.5 to 1 mm between the push-rod **(3)** and the master cylinder piston. Tighten the locknut **(4)** to a torque of 15 to 20 Nm.
107. Check that the pedal operates freely.

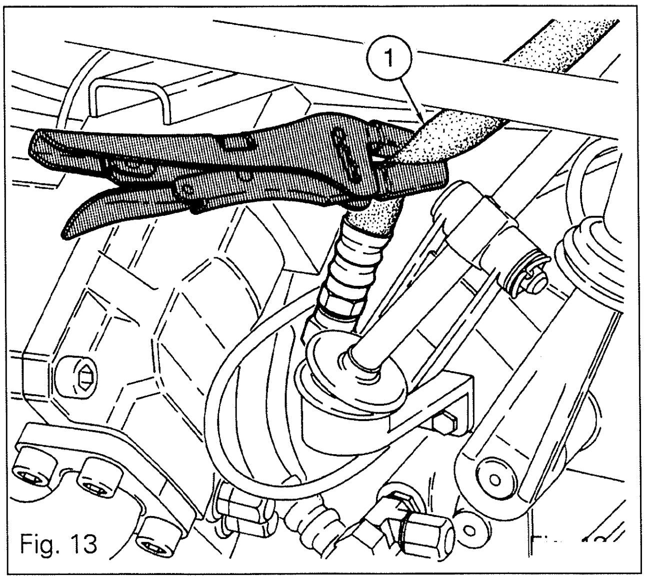


Fig. 13

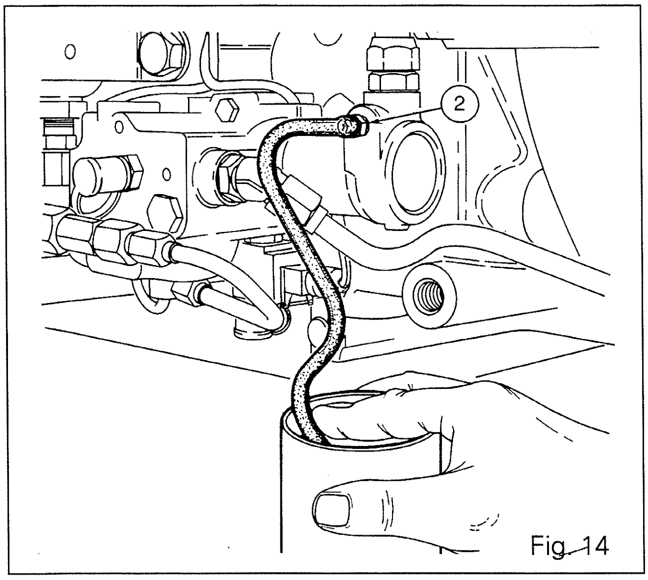


Fig. 14

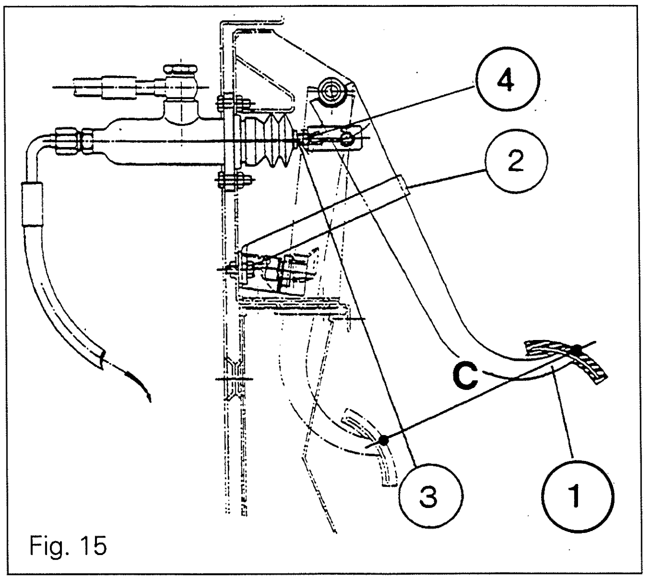


Fig. 15

I. Service tools

Tools available through the MF Network

3378012M1 - Oil seal protector (Fig. 16)

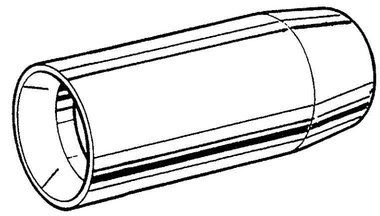
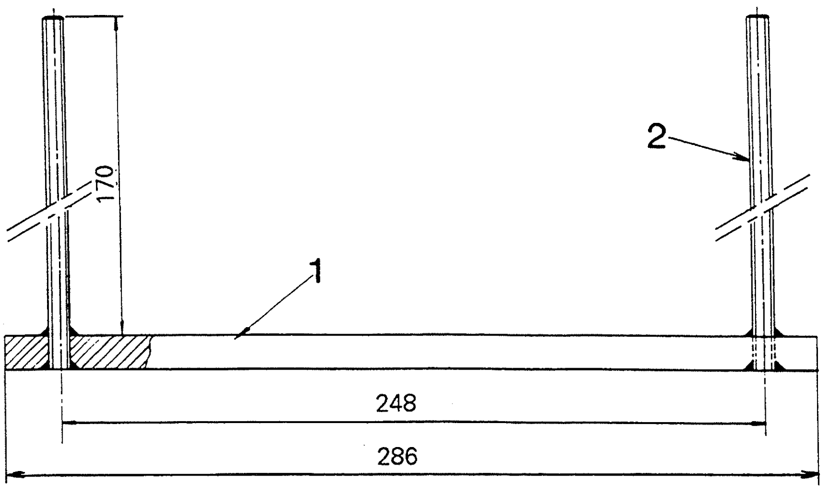


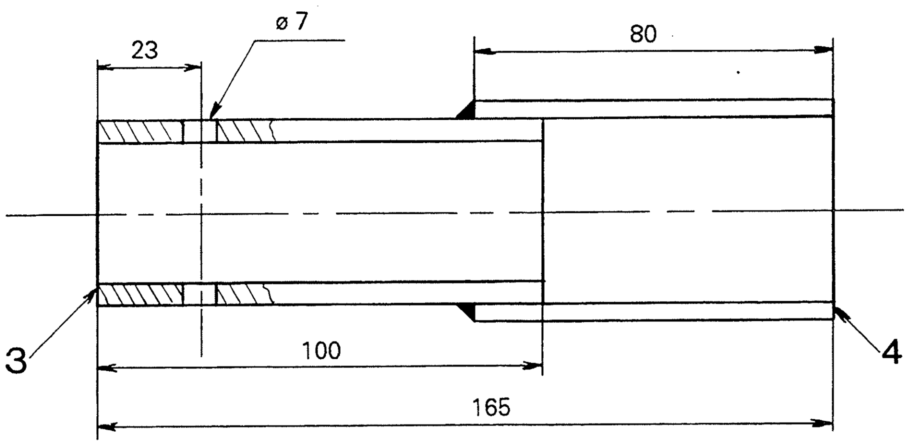
Fig. 16

Tools to be manufactured locally

- **Compression tool** (piston return spring)
  1 - Flat 60 x 12
  2 - Threaded rod, 8 dia.



- **Sleeve for removal/refitting of clutch assembly**
  3 - Tube: Tu52B, 42.4 outside dia., 5 thk
  4 - Tube: Tu52B, 48.3 outside dia., 2.9 thk



5 . GEARBOX

Contents

5 A01 General - Operation

CONTENTS

A. General

8100 series tractors are fitted with an advanced transmission with 32 forward and 32 reverse gears. The mainshaft and the output shaft are supported by two taper roller bearings and are equipped with bores, as required, for the pressure-feed lubrication of the bearings, idler gears and the Hare/Tortoise synchromesh.
The layshaft is supported at the front end by a cylindrical roller bearing and at the rear end by two taper roller bearings.
The main gearbox provides four synchronised gears.
A gear installed to rotate freely on the output shaft and attached by means of a dual cone synchromesh allows the four synchronised speeds to be doubled so as to obtain eight basic speeds.
All the gears are helical and in constant mesh. The drive shaft for the power take-off shaft crosses the layshaft.
The following assemblies are also installed on the gearbox casing :
- the Dynashift input unit located to the front of the gearbox (see section 5 B01). This unit provides four input ratios for the main gearbox.
- the parking brake control located to the rear on the output shaft (see section 5 H01).

Description

The gearbox is driven through input gear **(1)** which is locked onto mainshaft **(7)**. The two synchromesh hubs **(16)** and **/27**, and gear **(1)** are splined onto the mainshaft **(7)**. The 1st gear **(19)** and the 4th gear **(24)** run freely on the shaft **(7)**. The 2nd gear **(13)** runs freely on bush **(8)** which is splined onto the shaft **(7)**.
The 3rd gear **(35)** is mounted on taper roller bearings.
All the gears on layshaft **(51)** are splined onto it. The shaft **(51)** teeth mesh with the Tortoise gear **(40)** which rotates freely on the output shaft **(47)**.

Lubrication

The lubrication oil is supplied by a tube **(4)** linked to the input unit. It circulates in the axial oilways, one passing through the mainshaft and the other blind, machined in the output shaft. Radial oilways supply the different gears, bearings and the Hare/Tortoise synchromesh.
An oil film circulating between the power take-off shaft and the layshaft lubricates needle roller bearing **(67)** and the taper roller bearings at the ends by a radial hole drilled in the shaft **(51)**.

B. Operation

Low range (Tortoise)

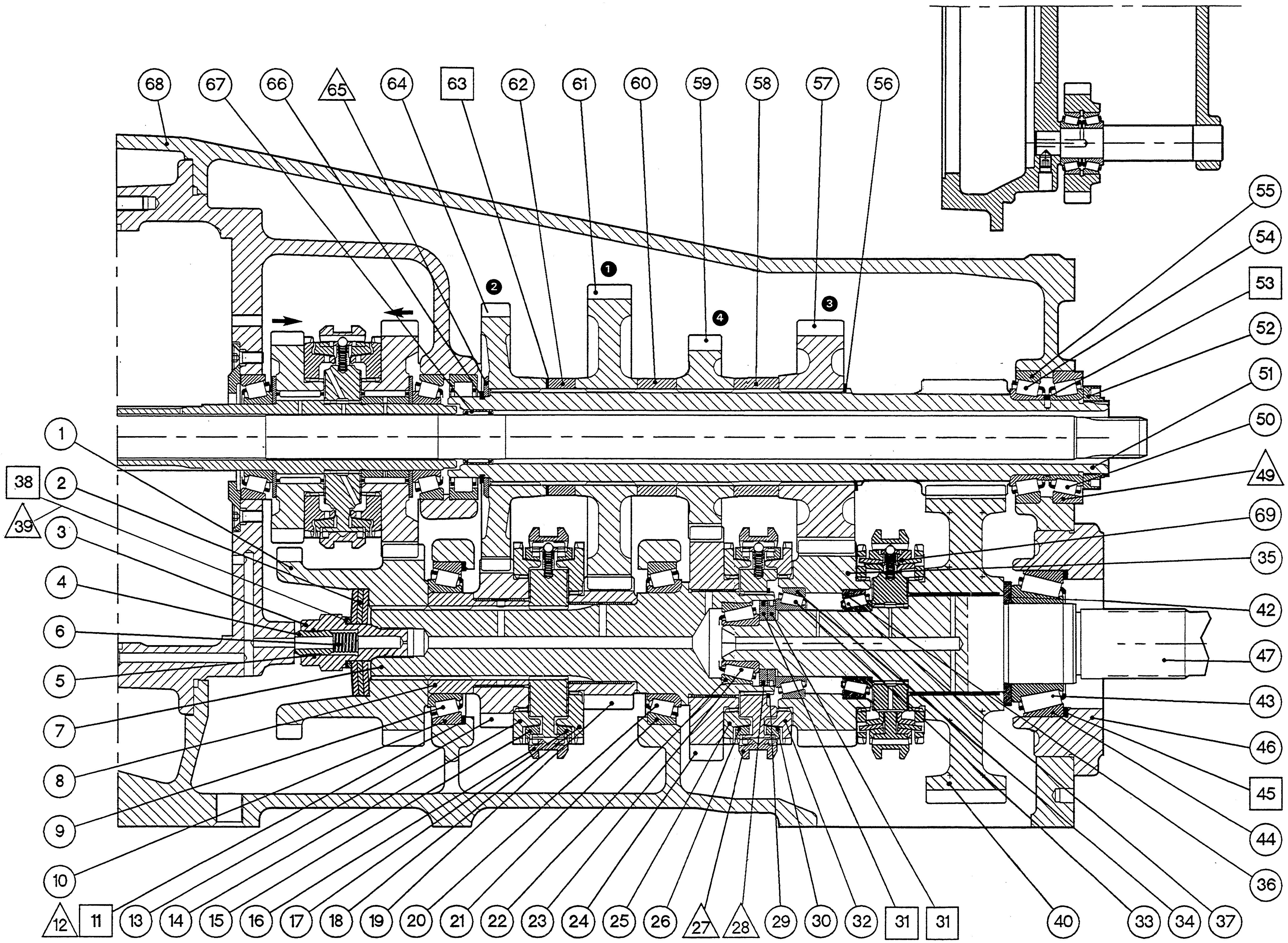
A synchronized gear is engaged by moving one of the synchro sliding couplers **(16)** or **/27** until the mainshaft **(7)** becomes integral with one of the four free running gears. Whatever the speed chosen, the drive is transmitted to the layshaft **(51)**. Output shaft **(47)** is driven by the teeth machined on the layshaft engaging with Tortoise gear **(40)** which is locked with output shaft **(47)** when the synchro sliding coupler **(69)** is moved backwards.

High range (Hare)

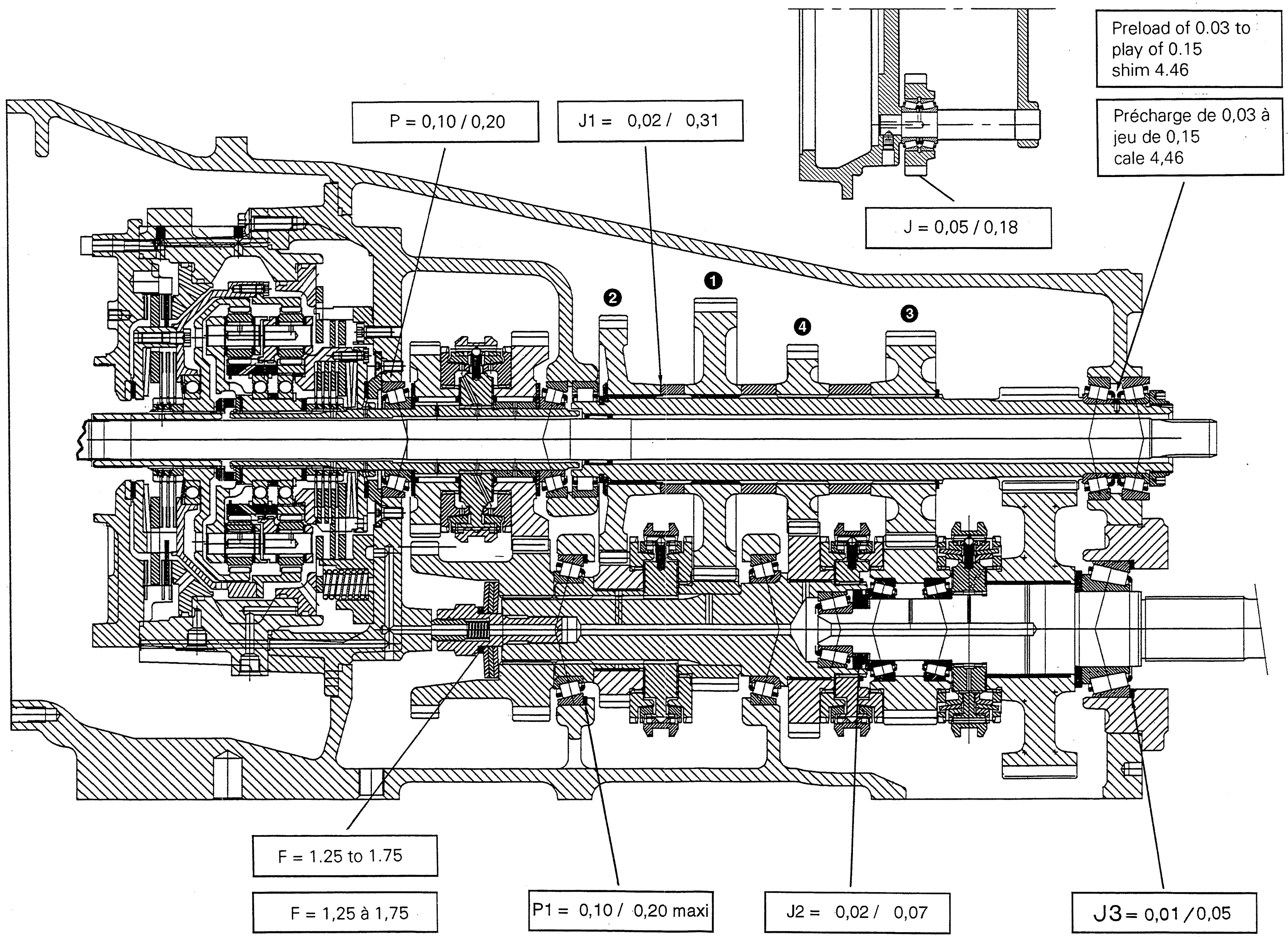
This range is selected by moving synchro sliding coupler **(69)** forwards. This directly meshes the 3rd gear **(35)** and the output shaft **(47)**.
Consequently, in 3rd gear, the layshaft **(51)** has no effect. The other speeds are obtained by moving synchro sliding couplers **(16)** or **/27** as for low range.

List of parts

(1) Input gear
(2) Spring washer
(3) Special screw
(4) Oil tube
(5) Retaining ring
(6) Spring
(7) Mainshaft
(8) Bush
(9) Bearing cone
(10) Bearing cup
[11] Shim(s)
/12 Spacer
(13) 2nd driving gear
(14) 2nd synchro cone
(15) 2nd synchro ring
(16) 1st - 2nd synchro
(17) 1st synchro ring
(18) 1st synchro cone
(19) 1st driving gear
(20) Bearing cone
(21) Bearing cup
(22) Bearing cup
(23) Bearing cone
(24) 4th driving gear
(25) 4th synchro cone
(26) 4th synchro ring
/27 3rd - 4th synchro
/28 Sealing ring
(29) Retaining ring
(30) 3rd synchro ring
[31] Shims
(32) 3rd synchro cone
(33) Bearing cone
(34) Bearing cup
(35) 3rd driving gear (Hare)
(36) Bearing cup
(37) Bearing cone
[38] Shim(s)
/39 Spacer
(40) Tortoise gear
(42) Washer
(43) Bearing cone
(44) Bearing cup
[45] Shim(s)
(46) Handbrake support
(47) Output shaft
/49 Bearing cup
(50) Taper roller bearing
(51) Layshaft
(52) Nut
[53] Spacer
(54) Bearing cone
(55) Bearing cup
(56) Circlip
(57) 3rd driven gear
(58) Spacer
(59) 4th driven gear
(60) Spacer
(61) 1st driven gear
(62) Spacer
[63] Shim(s)
(64) 2nd driven gear
/65 Washer
(66) Retaining ring
(67) Needle roller bearing
(68) Gearbox housing
(69) Hare/Tortoise synchro



Gearbox - General



C. Synchromesh assemblies (Fig. 1)

Locking position

When in the axial position, sliding coupler **(A)** presses the synchro ring **(B)** against the friction cone **(C)** via balls **(D)** and pressure components **(E)**. The difference in speed between the parts to be coupled generates a radial rotation limited by pressure components **(E)** which, in turn, cause the chamfered teeth on the synchro ring **(B)** to exert pressure on the sliding coupler **(A)** acting against any movement of the sliding coupler. The pressure exerted by the sliding coupler **(A)** and the angular offset of the synchro ring **(B)** generate axial pressure between the friction cones of the synchro ring **(B)** and the cone **(C)** via the chamfered teeth; this axial pressure ensures synchronisation by gradually reducing the difference in the speed of the parts to be coupled.

Once synchronisation has been established, the constant pressure exerted by the sliding coupler **(A)** against the synchro ring **(B)** pushes the synchro ring backwards until the teeth on the sliding coupler **(A)** are positioned opposite the spaces between the teeth on the synchro ring **(B)**. At that moment, the resistance preventing the sliding coupler **(A)** from moving while shifting is overcome and the sliding coupler **(A)** can then be meshed without any noise with the teeth on the cone **(C)** of the gear to be engaged. The rigid link between the shaft and the gear is established and the speed ratio is engaged. If two components are positioned tooth against tooth during the shifting, the chamfers provided on the tooth flanks push off the gear to be engaged until each tooth is correctly positioned facing a space.

Neutral position

The sliding coupler **(A)** is located in the mid position. The balls **(D)** are pushed into the V groove in the sliding coupler **(A)** by springs **(F)**. The gears are free to rotate on the shaft. In this neutral position, the sliding coupler **(A)** is locked by three balls **(G)** held by springs **(H)**.

Overhaul

When the synchromesh assemblies are removed, check for wear on the synchro rings **(B)** (Fig. 1).

Place the cone **(C)** on a flat surface and position the ring **(B)** against it, rotating it a few times.

Measure dimension **X** at several locations with a set of feeler gauges (Fig. 2). If it is less than 0.8 mm, fit a new ring **(B)** after checking the cone.

Refitting of the synchromesh assembly is facilitated by using tool MF 415.

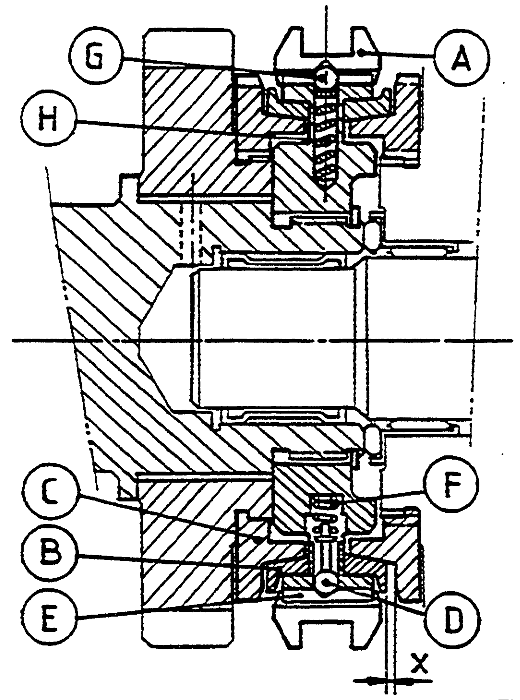


Fig. 1

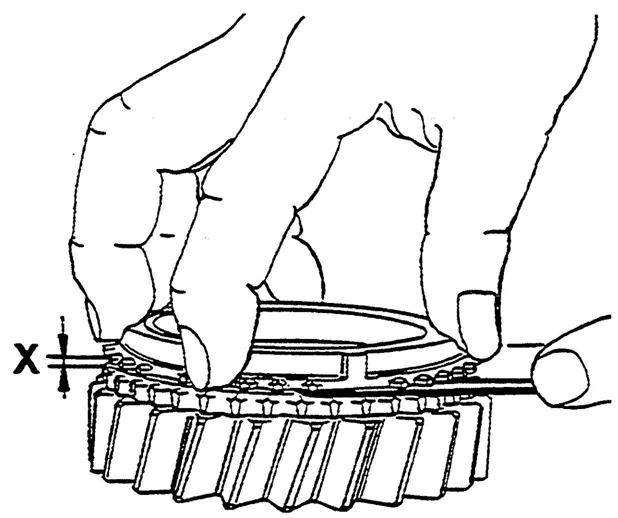
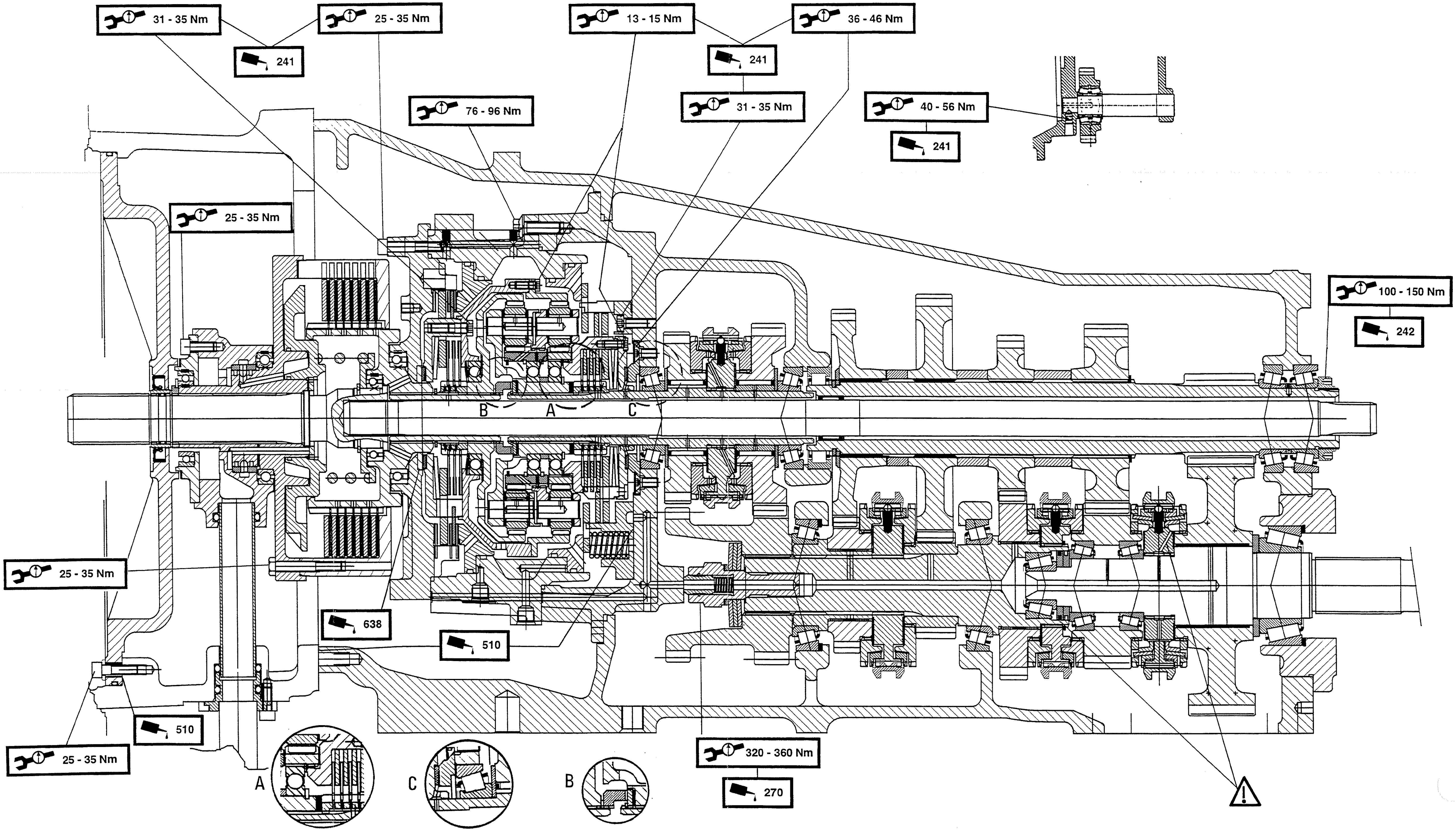


Fig. 2

D . Specifications



5 B01 *Input unit*

CONTENTS

Gearbox - *Input unit*

General description

The input unit takes the form of an interchangeable module fitted on input to the gearbox. It is comprised of two distinct parts, i. e. the Dynashift and the reverse shuttle.

The Dynashift assembly is fitted at the front of the input unit. It is a hydraulically controlled gearchange device which provides four input ratios to the main gearbox. It does this by means of two epicyclic gear trains connected to two hydraulic clutches.
The Dynashift design allows four ratios to be selected on the move, without declutching, using a control located under the steering wheel. The Dynashift unit is controlled by two solenoid valves fitted in the low flow hydraulic circuit. The two solenoid valves are themselves controlled by the tractor's Autotronic unit.

The reverse shuttle is located in the rear housing of the input unit. It includes two gears controlled by a synchromesh assembly. The gears are in constant mesh with the dual input gear of the main gearbox and the reverse idler gear respectively. For any details relating to operation, see section 5 B02.

Operation

The Dynashift input unit includes two epicyclic gear trains:
- The primary epicyclic unit is the major component of the input unit and is used to transmit engine motion to the gearbox.
- The secondary epicyclic unit controls the speed of the primary sungear.

Primary epicyclic gear train
Motion enters via the primary ring gear **(31)** which is splined onto the primary shaft **(7)**. It turns at engine speed.
The motion is transmitted via the planetary carrier **(28)** which is splined onto the secondary shaft **(53)**. The primary sungear **(64)** is driven by the secondary epicyclic gear train. The speed of this sungear determines the unit reduction ratio.

Secondary epicyclic gear train
This epicyclic gear train is controlled by hydraulic clutches and brakes.
The secondary ring gear **(34)** is:
- either locked onto the primary shaft **(7)** by the three clutch discs **(3)** and the Belleville washer **/4** located in the front part of the unit.
- or immobilized in relation to the housing by three brake discs **(15)** and one piston **(22)**.

With no pressure, the piston **(22)** is pushed to the rear by the twelve springs **(20)** and the Belleville washer **/4**, via the brake plate **(16)**.

When pressure from the 17 bar circuit acts on piston **(22)**, it moves forward, locks the brake discs **(15)** and pushes plate **(16)**, which compresses the Belleville washer **/4**.
The secondary ring gear speed is established as follows:
- speed equal to engine speed when the front piston is not under pressure.
- speed zero when the front piston is under pressure.

The sungear **(61)** is:
- either locked on the secondary shaft by means of the four clutch discs **(50)** and two Belleville washers **/52** located at the rear part of the unit.
- or immobilized in relation to the housing by means of the three brake discs **(41)** and one piston **(37)**.

With no pressure, piston **(37)** is pushed towards the front by the Belleville washers and the six springs **(65)**.

Under 17 bar pressure, piston **(37)** moves towards the rear and locks the brake discs **(41)**. It compresses the Belleville washers **/52** via the brake plate **(45)**, which frees up the secondary shaft clutch discs.

When the secondary ring gear **(34)** or sungear **(61)** is immobilized, the speed of the secondary planetary carrier **(39)** changes. The secondary planetary carrier drives the primary sungear **(64)** and produces the unit reduction ratio.

Service tools

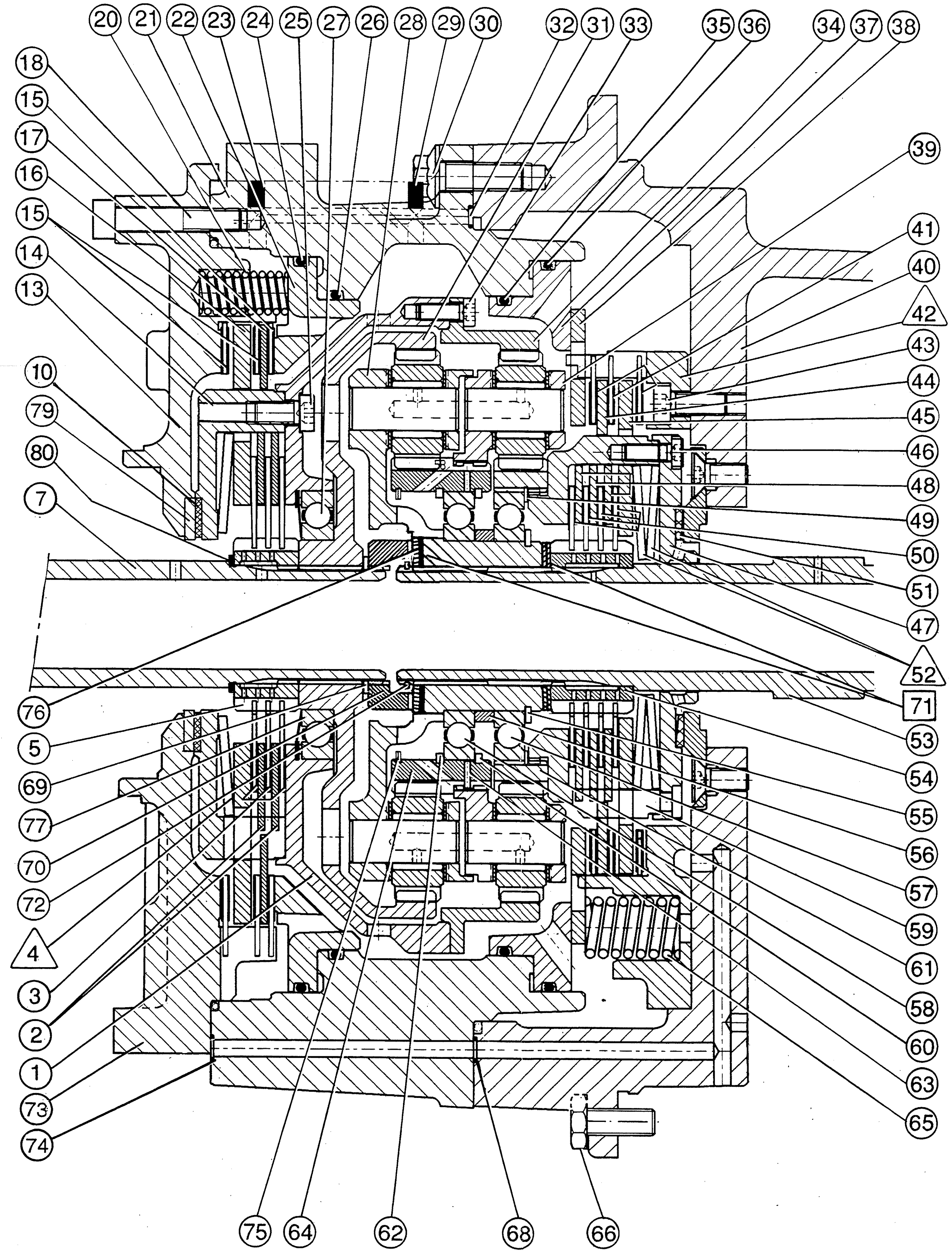
Tools available for MF dealers (See section J)

- Lifting bracket for front cover unit, No. 3376883 M1
- Centering tool, No. 3376887 M1
- Secondary ring gear retaining tool, No. 3376888 M1
- Planetary carrier compression tool, No. 3376920 M1
- Sleeve, No. 3378004 M1
- Adaptor plate, No. 3378013 M1

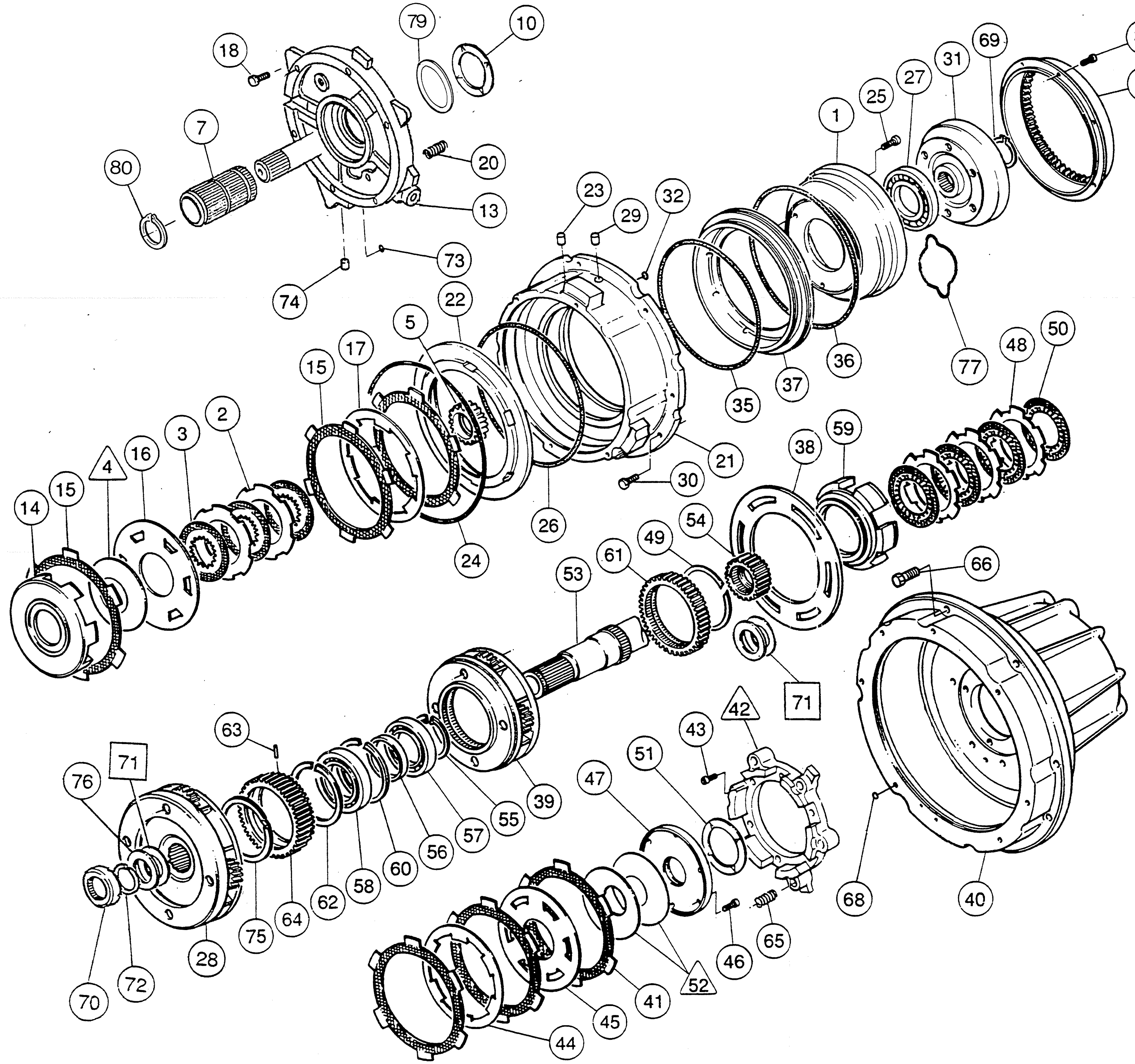
Gearbox - *Input unit*

List of parts (Fig. 1)

- **(1)** Secondary ring gear carrier
- **(2)** Clutch driven plates
- **(3)** Clutch driving plates
- **/4** Belleville spring
- **(5)** Splined hub
- **(7)** Primary shaft
- **(10)** Thrust washer
- **(13)** Front cover
- **(14)** Clutch housing
- **(15)** Front brake discs
- **(16)** Brake plate
- **(17)** Pressure plate
- **(18)** Bolt
- **(20)** Springs
- **(21)** Spacer (piston) housing
- **(22)** Front piston
- **(23)** Blanking plug
- **(24)** O-ring
- **(25)** Bolt
- **(26)** O-ring
- **(27)** Ball bearing
- **(28)** Primary planetary carrier
- **(29)** Blanking plug
- **(30)** Screw
- **(31)** Primary ring gear
- **(32)** O-ring
- **(33)** Bolt
- **(34)** Secondary ring gear
- **(35)** O-ring
- **(36)** O-ring
- **(37)** Rear piston
- **(38)** Pressure plate
- **(39)** Secondary planetary carrier
- **(40)** Reverse shuttle housing
- **(41)** Rear brake discs
- **/42** Secondary brake housing
- **(43)** Bolt
- **(44)** Pressure plate
- **(45)** Brake plate
- **(46)** Bolt
- **(47)** Cover
- **(48)** Driven plates
- **(49)** Retaining ring
- **(50)** Rear clutch driving plates
- **(51)** Thrust washer
- **/52** Belleville springs
- **(53)** Secondary shaft
- **(54)** Splined hub
- **(55)** Circlip
- **(56)** Spacer
- **(57)** Ball bearing
- **(58)** Ball bearing
- **(59)** Rear clutch housing
- **(60)** Retaining ring
- **(61)** Secondary sungear
- **(62)** Retaining ring
- **(63)** Locating needles
- **(64)** Primary sungear
- **(65)** Springs
- **(66)** Bolt
- **(68)** O-ring
- **(69)** Circlip
- **(70)** Thrust plate
- **(71)** Shim(s)
- **(72)** Retaining ring
- **(73)** O-ring
- **(74)** Plug
- **(75)** Oil deflector
- **(76)** Spring washer
- **(77)** Spring washer
- **(79)** Washer
- **(80)** Circlip



Gearbox - Input unit



Explanation of ratios

Ratio A = 1/1.620 reduction (Fig. 3)

The two pistons **(22)** and **(37)** are simultaneously under pressure from the 17 bar circuit.
The secondary ring gear **(34)** is locked onto the housing by means of the front brake.
The secondary sungear **(61)** is locked onto the housing by means of the rear brake.
As a result, the secondary epicyclic gear train is locked.
The primary sungear **(64)** is locked.

The reduction ratio is set only by the primary epicyclic gear train. It uses traditional gearing: motion enters via the ring gear and leaves via the planetary carrier, while the sungear remains fixed.

Ratio B = 1/1.386 reduction (Fig. 4)

The front piston **(22)** is under pressure.
The secondary ring gear **(34)** is locked onto the housing by means of the front brake.
The rear piston **(37)** is not under pressure.
The secondary sungear **(61)** turns with the secondary shaft **(53)** (the clutch is engaged).
The secondary planetary carrier **(39)** turns at slow speed, driving the primary sungear **(64)**.
This causes the reduction ratio to be less extensive.

CONTENTS

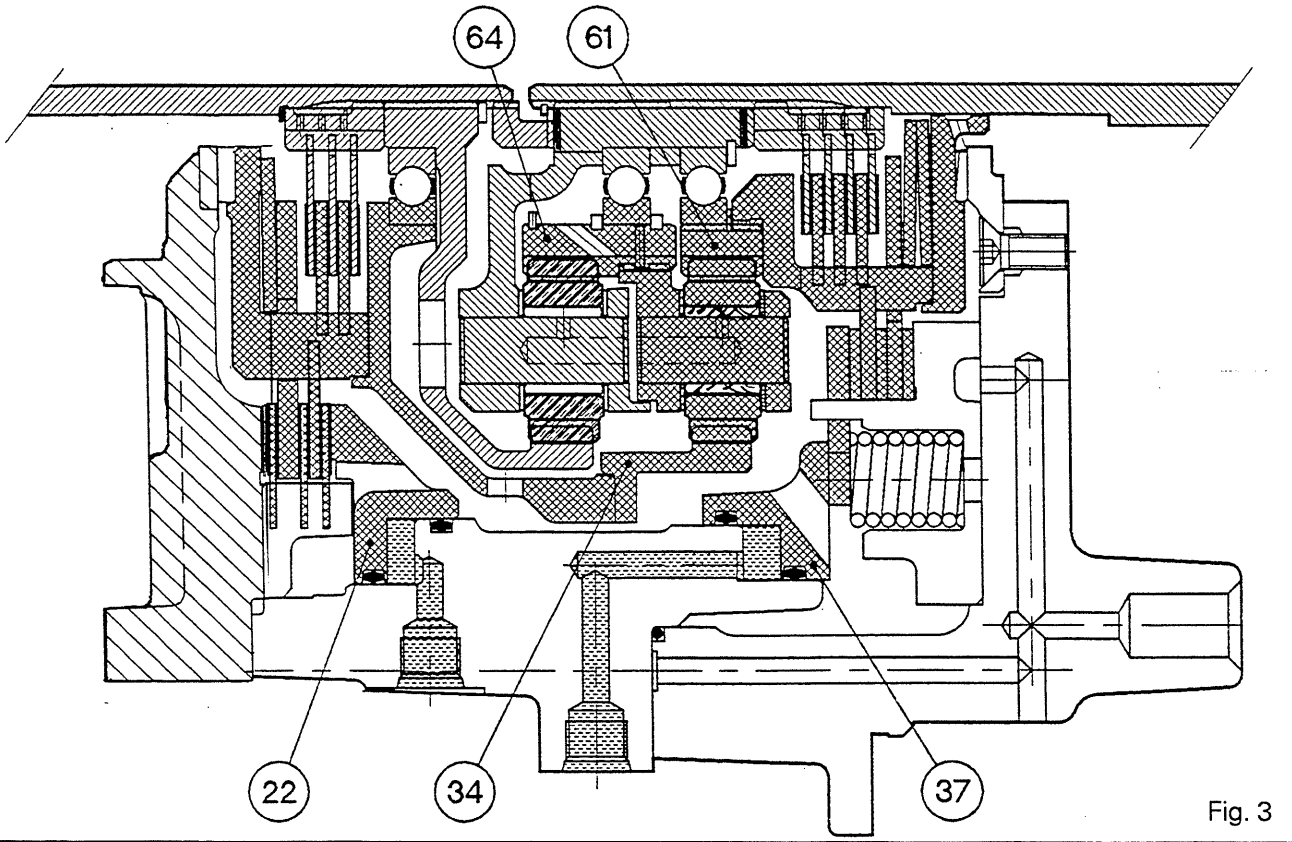


Fig. 3

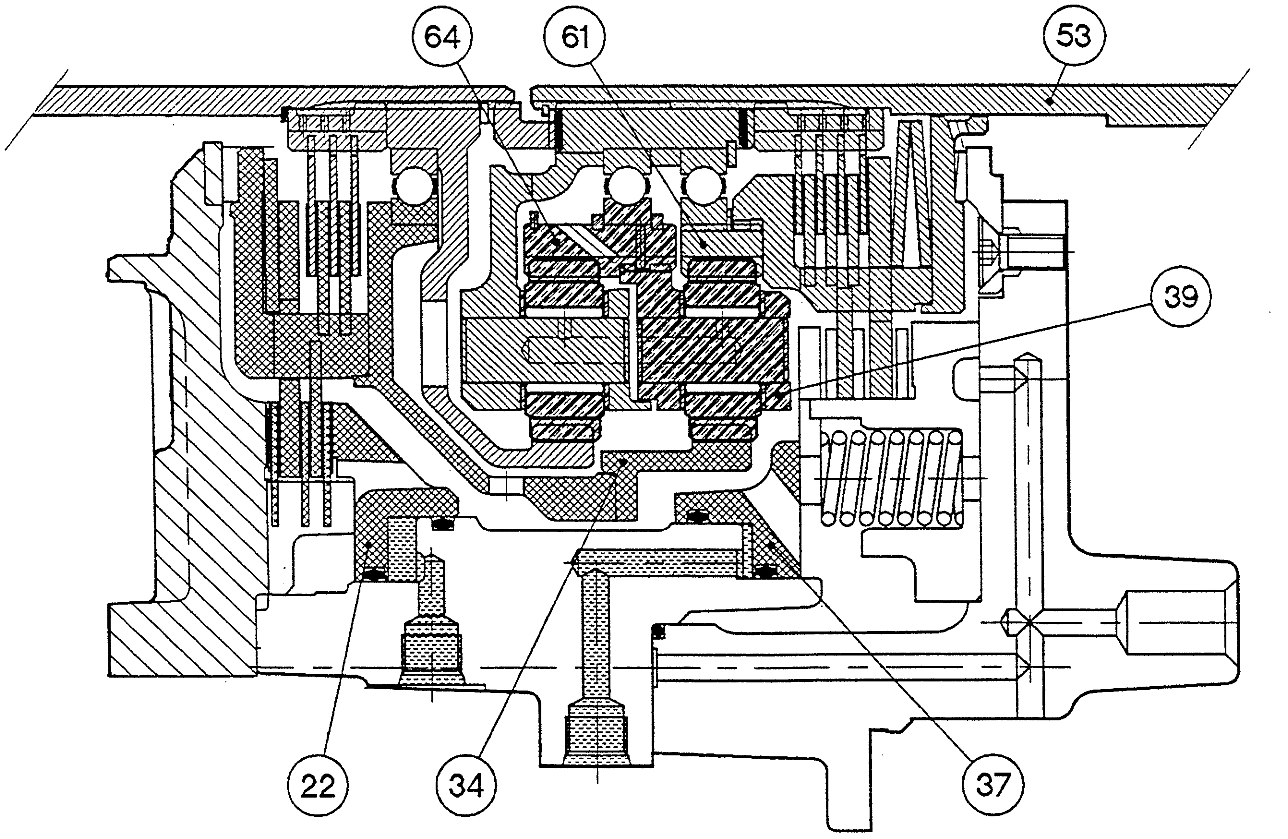


Fig. 4

Ratio C = 1/1.1704 reduction (Fig. 5)

The rear piston **(37)** is under pressure.
The secondary sungear **(61)** is locked onto the housing by the rear brake.
The front piston **(22)** is not under pressure.
The secondary ring gear **(34)** turns with the primary shaft **(7)**, thus imparting a higher speed to the secondary planetary carrier **(39)**.
The primary sungear **(64)** is driven by the secondary planetary carrier **(39)** at a higher speed than in ratio B. This therefore gives less reduction.

Ratio D = 1/1 reduction (Fig. 6)

Neither of the two pistons is under pressure. The two clutches are therefore engaged.
The secondary ring gear **(34)** turns with the primary shaft **(7)**.
The secondary sungear **(61)** is locked onto the secondary shaft **(53)** thus mechanically locking the entire system.
The ratio is therefore 1/1 (direct drive).

Gearbox - *Input unit*

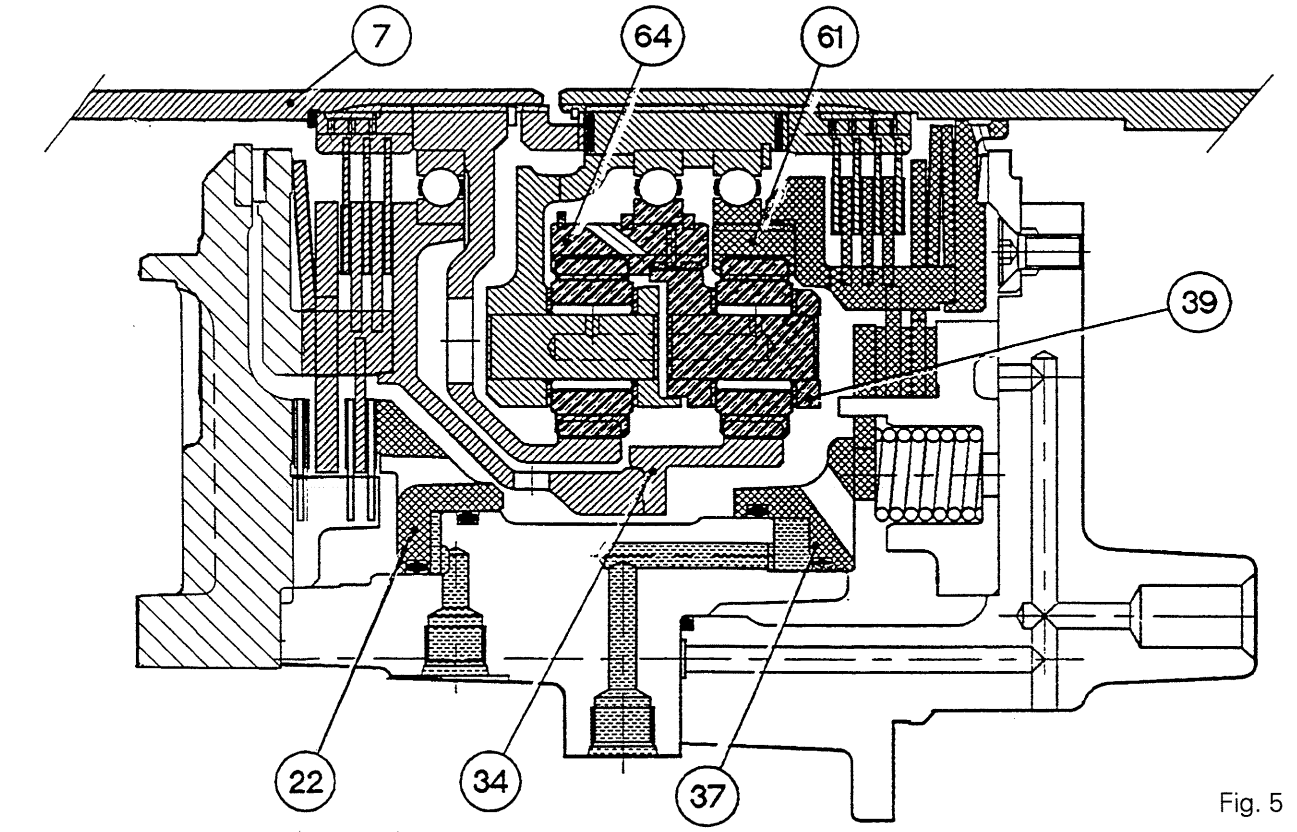


Fig. 5

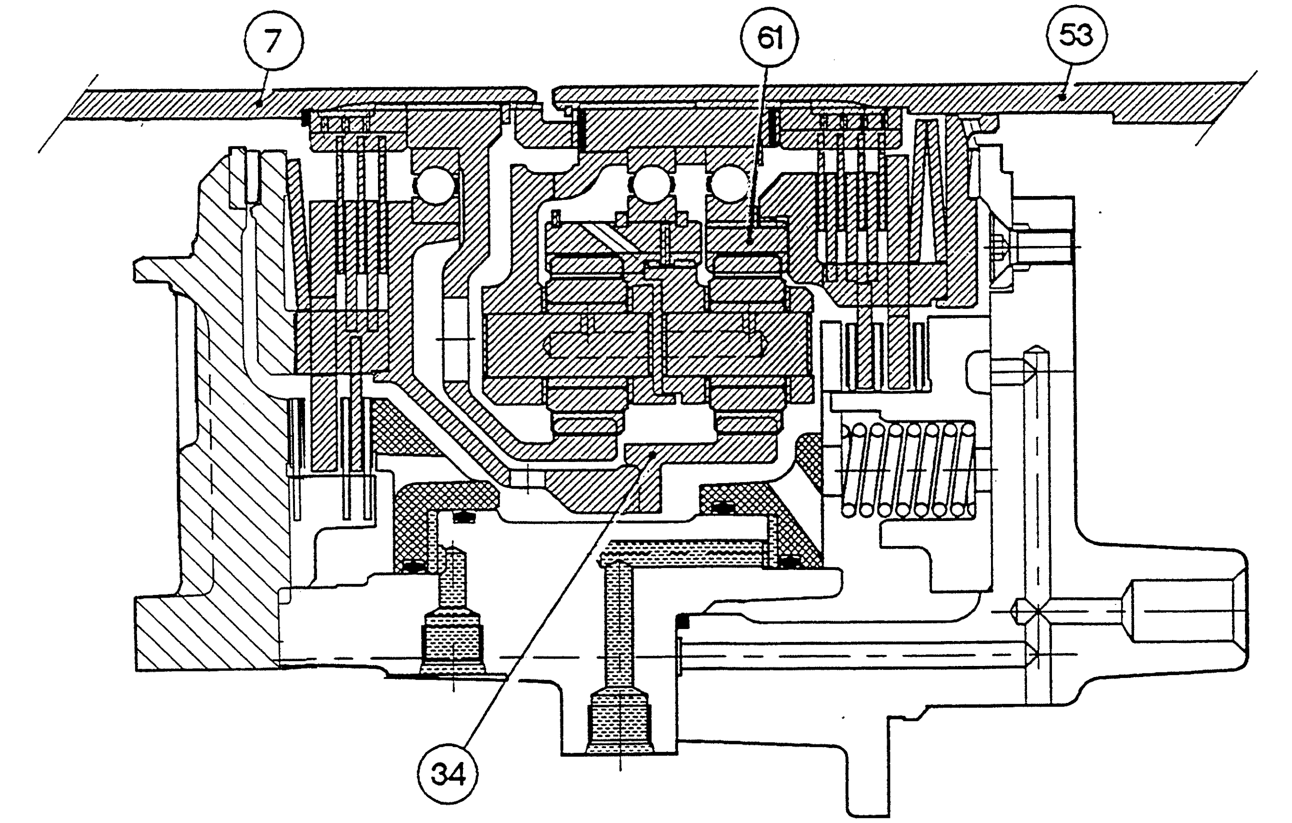


Fig. 6

Gearbox - *Input unit*

A. Removing the Input Unit

1. Split the tractor between the engine and the gearbox (section 2 B01).
2. Drain the gearbox.
3. Remove the splitpin **(1)**, the washer **(2)** and remove the shaft **(3)**. Lift up the bellows **(4)**. Remove the gear lever **(5)** (Fig. 7).
4. On the selector cover, disconnect the return hoses **(6)** (note their locations). Remove the Hare/Tortoise inlet pipe. Disconnect the harness from the solenoid valve on the switch **(7)** (Fig. 7) and on the temperature sensor.
5. Remove the bolts **(8)** (note the location of the earthing cable terminal) (Fig. 7). Separate and remove the selector cover, removing the reverse shuttle control from its lever.
6. Remove the selector **(1)** (Fig. 8).
7. Remove the clutch assembly (see section 4 A01).
8. Remove the P.T.O. drive shaft.
9. Remove the clutch control valve and the transfer tube. Using 4 bolts **A** of the correct length, fasten adaptor plate 3378013 M1 onto cover **(13)** and fit lifting bracket 3376883 M1 to the plate as shown on Fig. 9.
   Remove the bolts fastening the housing to the gearbox.

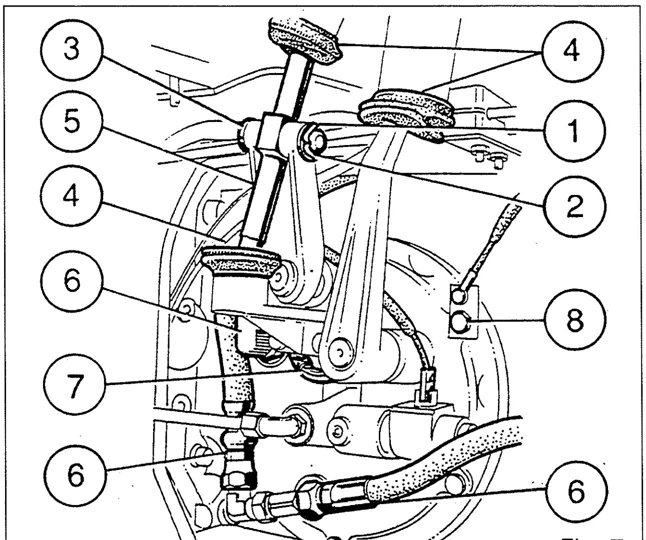


Fig. 7

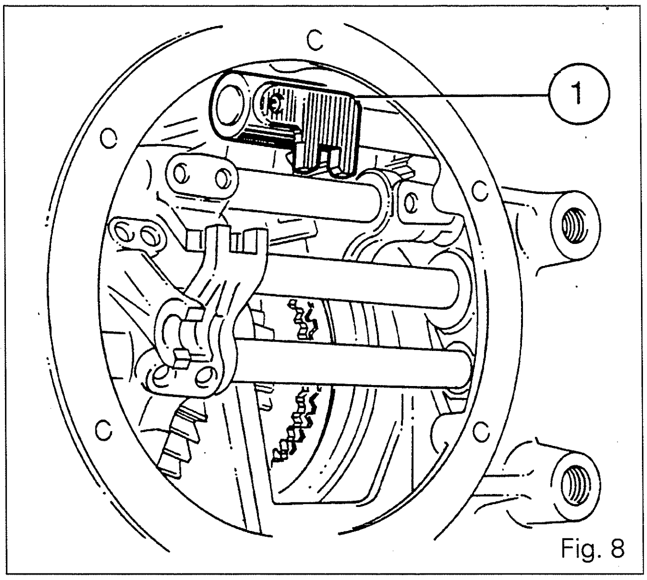


Fig. 8

Gearbox - *Input unit*

10. Separate and pull the input unit towards the front. With the help of a second operator, check via the selector cover gap that the selector rails are withdrawn from their support. Incline the housing as far as possible downwards (Fig. 11) so as to allow the support to pass the gearbox opening.
11. Retain the dowel **(1)** (Fig. 10).
12. Place the unit on a bench in the vertical position.

A . Fixing the adaptor plate on the front cover
B . Remaining bolts

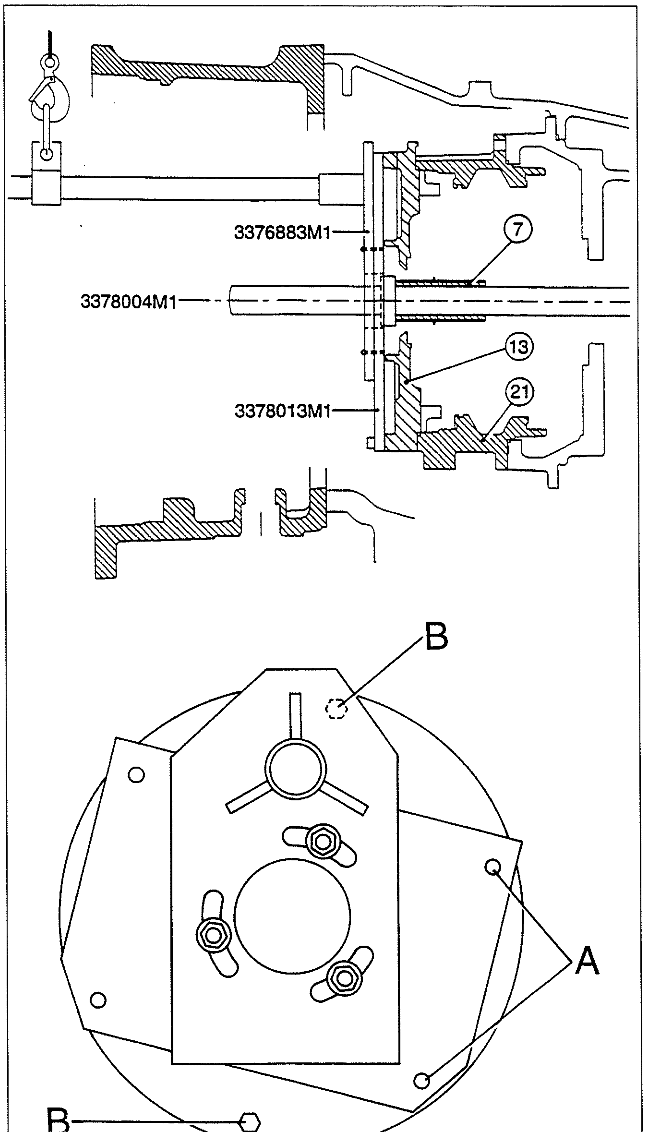


Fig. 9

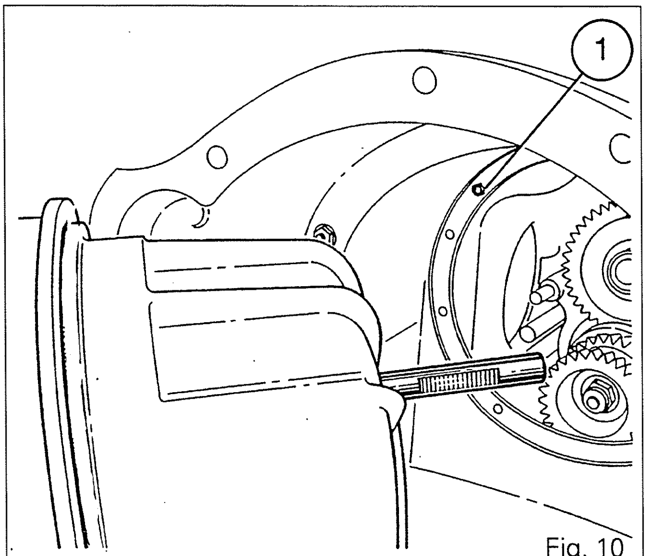


Fig. 10

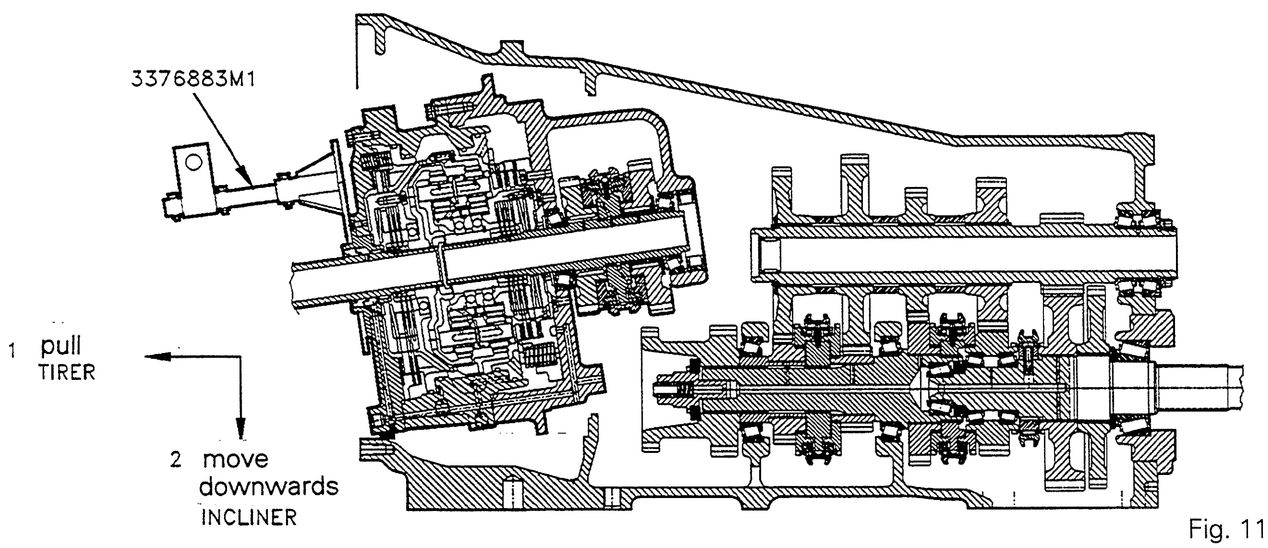


Fig. 11

CONTENTS

B. Removing and disassembling the cover, housing, front clutch and brake

13. Using locally manufactured lugs or rings, remove the primary shaft **(7)**, cover **(13)** and housing **(21)** (Fig. 12).
14. Retain the thrust washer **(70)**. Compress spring washer **(77)** by pushing on primary ring gear **(31)**. Remove the circlip **(69)** and take out the primary shaft **(7)**.
15. Take the piston **(37)** out of the housing **(21)**.
16. Using tool 3376888 M1, immobilize the secondary ring gear **(34)**. Remove the bolts **(25)** (Fig. 13).
17. Take out the secondary ring gear **(34)** and its carrier **(1)**, primary ring gear **(31)** and bearing **(27)** as an assembly.
18. Separate the secondary ring gear **(34)** from its carrier **(1)**. Remove the spring washer **(77)** and the ball bearing **(27)**.
19. Remove the piston housing **(21)** and the piston **(22)**.
20. Remove the discs **(3)** **(15)**, the driven plates **(2)** **(17)**, the hub **(5)**, the springs **(20)** and the brake plate **(16)**.
21. Take out the Belleville spring **/4**, the clutch housing **(14)** and the thrust washer **(10)**.

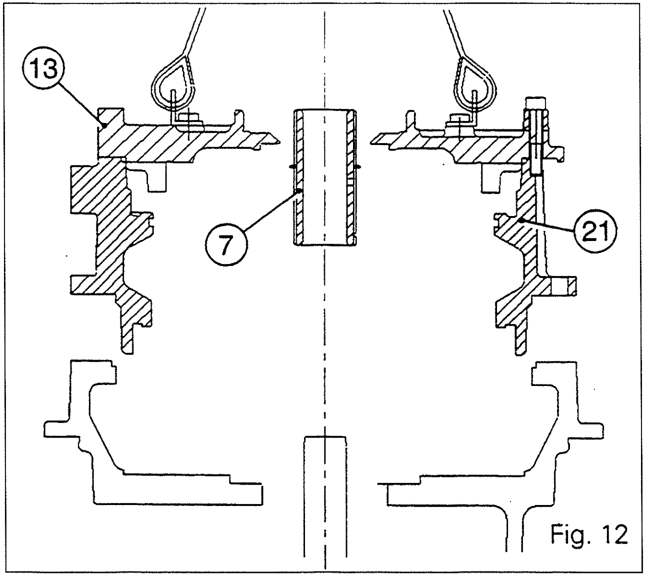


Fig. 12

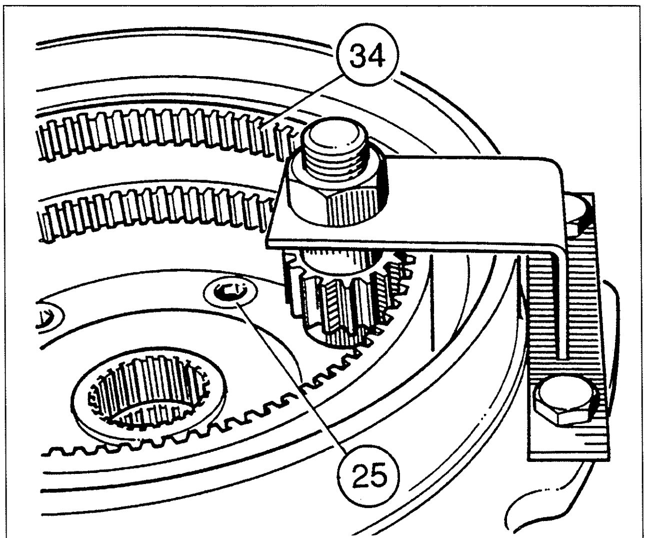


Fig. 13

C. Removing and separating the planetary carrier assembly

22. Compress the planetary carrier assembly using special tool 3376920 M1 (Fig. 14).
23. Remove the retaining ring **(72)**. Remove the spring washer **(76)**, the planetary carrier assembly and the shims **[71]**.
24. Remove the secondary sungear **(61)** and the retaining ring **(49)** (if necessary).

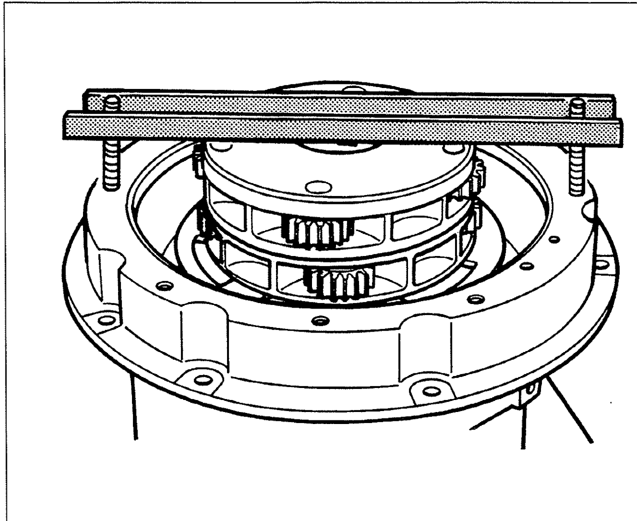


Fig. 14

25. Remove the circlip **(55)**. Remove the planetary carrier bearing **(57)** and the spacer **(56)**.
26. Separate the secondary planetary carrier **(39)** from the primary planetary carrier **(28)**.
27. Remove the retaining ring **(60)** and the bearing **(58)**.
28. Put the secondary planetary carrier in a vertical position. Tapping it lightly on a wooden block, remove the needles **(63)** (Fig. 15). Separate the planetary carrier from the primary sungear **(64)**, with the ring **(62)** and the deflector **(75)**.

D. Disassembling the rear clutch and brake

29. Remove the pressure plate **(38)**, the pressure plate springs **(65)**, the brake discs **(41)**, separated from the pressure plate **(44)**.
30. Remove the clutch housing assembly **(59)**, incorporating brake plate **(45)** and the last disc **(41)**. Remove the thrust washer **(51)**.
31. Remove the clutch cover screws **(46)**. Remove the cover **(47)** and the Belleville springs **/52**. Separate the brake plate **(45)**, the clutch discs **(50)** and the driven plates **(48)**. Remove the hub **(54)**.
32. Remove the bolts **(43)**. Separate and remove the secondary brake housing **/42**. Mark its position.

E. Assembling the planetary carriers

33. Clean and inspect the parts. Replace any which are defective.
34. Make sure that the planetary carrier shaft lubrication holes are not obstructed.
35. Check axial play and rotation of each planetary manually.
36. Fit the primary sungear **(64)** onto the secondary planetary carrier **(39)**, along with its retaining ring **(62)** and oil deflector **(75)**.
37. Slide the three needles **(63)** into each hole of the primary sungear. They must be fully home to the bottom of the groove in the secondary planetary carrier.
38. Fit the ball bearing **(58)**, and the retaining ring **(60)**.
39. Assemble the secondary planetary carrier on the primary planetary carrier **(28)**. To facilitate the entry of the gearteeth, turn the planetary gears.
40. Fit the spacer **(56)** and the ball bearing **(57)**. Install the circlip **(55)**.
41. Check the backlash between the primary planetary gears manually.
42. Fit the ring **(49)** (if it was removed) into the secondary sungear **(61)**.

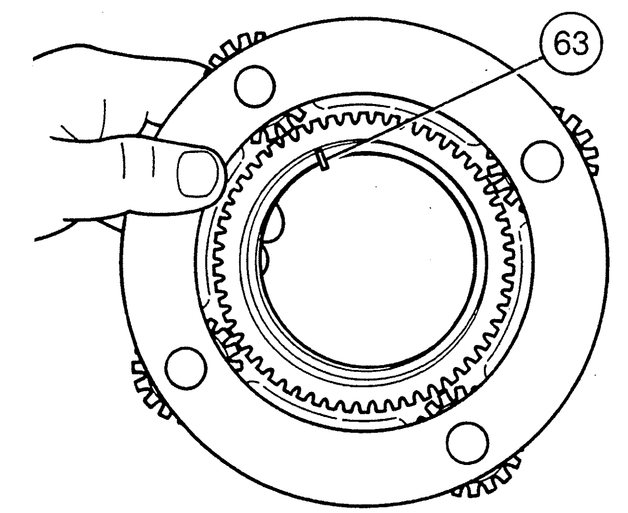


Fig. 15

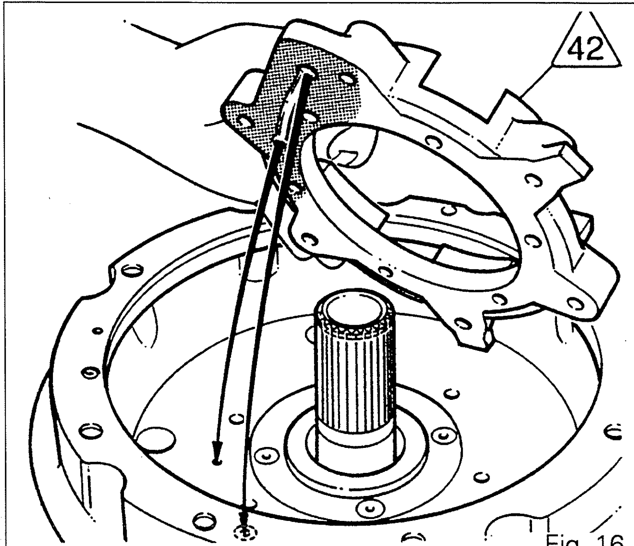


Fig. 16

F. Reassembling the rear clutch and brake

43. Clean and inspect the parts, replace any which are defective.
44. Direct a jet of compressed air into the reverse idler gear orifice to ensure that it is not obstructed.
45. Coat the «seal mating» surface of the brake housing **/42** with sealing compound in the area of the lubrication passage (Fig. 16) and proceed with assembly.
46. Coat the bolts **(43)** with Loctite 241 and tighten them to a torque of 31 - 35 Nm.

47. Turn the planetary carriers over so as to gain access to the bolts **(46)**. Fit the secondary sungear **(61)**, the housing **(59)** and the hub **(54)**, with the internal splines facing downwards (Fig. 17).
    Install the discs **(50)**, the driven plates **(48)**, the brake plate **(45)** and the Belleville springs **/52** as per Fig. 1, and then the cover **(47)**.
48. Centre the clutch housing assembly **(59)** using tool 3376887 M1 (Fig. 18). Coat the bolts **(46)** with Loctite 241 and torque them to 13 - 15 Nm. Remove the tool. Separate the housing assembly from the planetary carriers.
49. Coat the thrust washer **(51)** with miscible grease and place it on the cover **(47)**.
50. Fit a disc **(41)** in the brake housing **/42**.
51. Fit the clutch housing **(59)** and washer **(51)** assembly on the shaft **(53)**. Fit the hub **(54)**, with its internal splines pointing upwards (Fig. 19).
52. Fit the two other brake discs **(41)**, separated by the pressure plate **(44)**.

G . Reassembling the cover, front clutch, brake and spacer housing

53. Check that the plugs are fitted on the cover.
54. Place the cover onto a suitable support.
55. Check that the washer **(79)** is fitted. Place the thrust washer **(10)** on the housing **(14)** with miscible grease. Assemble the primary shaft **(7)** and the clutch housing **(14)**.
56. Fit the Belleville spring **/4** as per Fig. 1, a brake disc **(15)** and the brake plate **(16)**.
57. Fit the hub **(5)** on the primary shaft **(7)**, with the internal splines pointing upwards (Fig. 20). Fit the driving plates **(3)** and the driven plates **(2)**.
58. Fit the two other brake discs **(15)**, separated by the pressure plate **(17)**.
59. Reinstall the springs **(20)**. Fit the O-ring **(73)**.
60. Check that the blanking plugs **(23)** and **(29)** are in place. Make sure that the supply holes to the pistons **(22)** and **(37)** in the spacer housing **(21)** are not obstructed.
61. Lubricate O-rings **(24)** and **(26)** and fit them respectively in the front piston **(22)** and in the spacer housing **(21)**.
62. Position the front piston in the spacer housing and drive it in using a plastic hammer, tapping gradually and alternately around its circumference.
63. Screw two guide studs into the spacer housing **(21)** and position it on the front cover **(13)**, making sure that the spacer housing lubrication hole meets up with the corresponding passage in the cover.

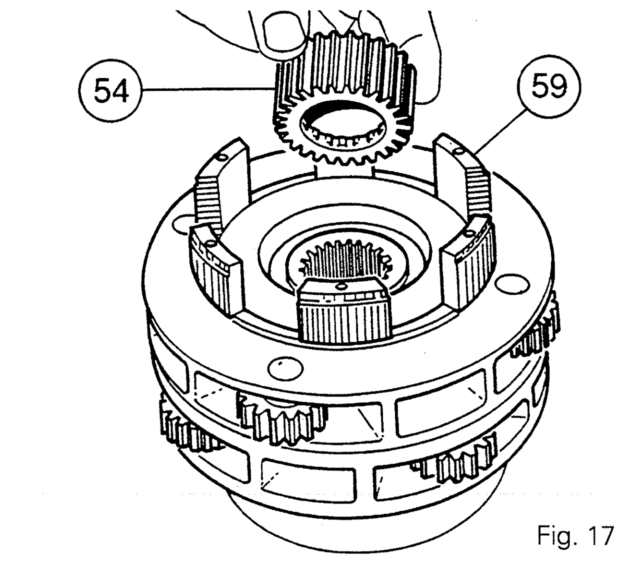


Fig. 17

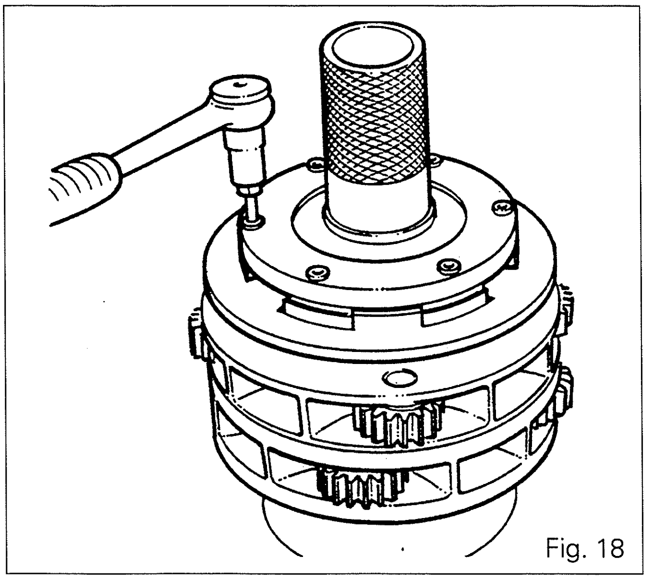


Fig. 18

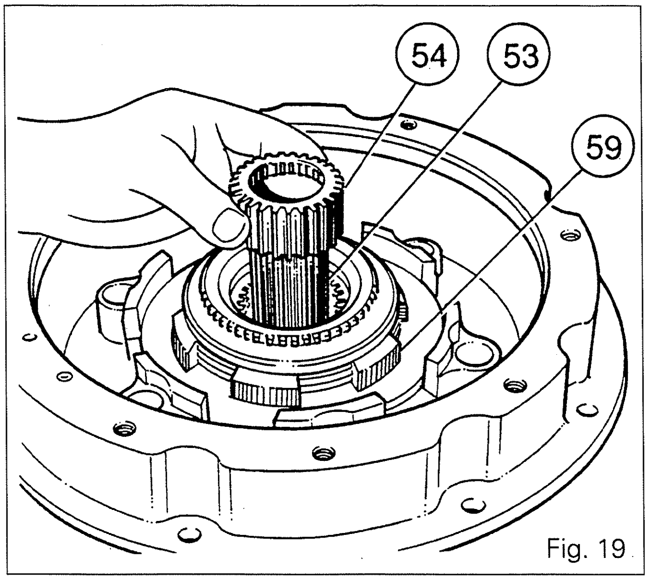


Fig. 19

CONTENTS

64. Remove the guide studs. Coat the bolts **(18)** with Loctite 241. Fit and tighten them to 25 - 35 Nm.
65. Reinstall the bearing **(27)** on the primary ring gear **(31)** and place it on the secondary ring gear carrier **(1)** with spring washer **(77)**. Fit the secondary ring gear **(34)**. Coat the bolts **(33)** with Loctite 241 and torque them to 12 - 16 Nm.
    Fit the assembled ring gears onto the primary shaft **(7)**.
    Immobilize the secondary ring gear **(34)** as per Fig. 13. Coat the bolts **(25)** with Loctite 241 and torque them to 31 - 35 Nm.
66. Compress spring washer **(77)** by pushing on primary ring gear **(31)**. Fit the circlip **(69)** and the thrust plate **(70)**, coated with miscible grease.
67. Lubricate and then fit seals **(35)** and **(36)** on the rear piston **(37)**. Position the piston in the housing and drive it home using a plastic mallet, tapping gradually around its circumference.
    Note : Replacing the front cover (13) of the spacer housing (21) or the reverse shuttle housing (40) requires that the shimming of the clutch be checked and done again if necessary (see section 4 A01).

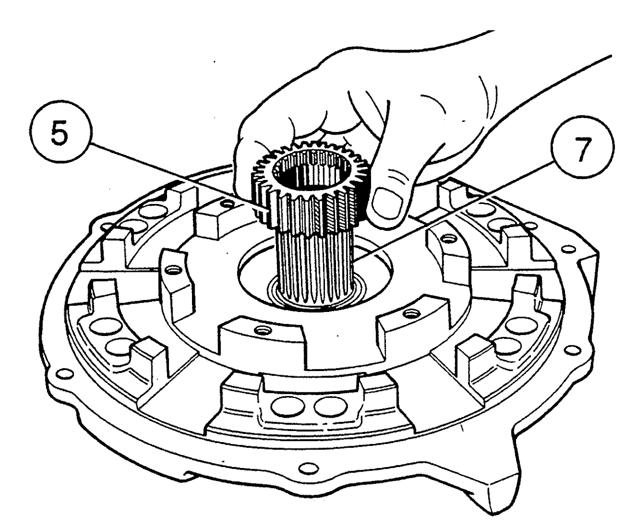


Fig. 20

H. Shimming the planetary carriers

J1 shimming (Fig. 21)

Note: To do shimmings J1 and J2 correctly, the springs (65) and the pressure plate (38) must not be fitted.

On the rear clutch housing (Fig. 23)

68. Using a depth gauge, measure dimensions **b** and **c**. Calculate dimension **A = b - c**.

On the planetary carrier assembly (Fig. 22)

69. Fit the secondary sungear **(61)** and its retaining ring **(49)** onto the ball bearing **(57)**.
70. Measure dimension **D** using a depth gauge.
71. Determine space **E** between the primary planetary carrier **(28)** and the splined hub **(54)** (Fig. 24) using the following formula: **E = A + D.**
72. Inside space **E**, place the quantity of shims **[71]** needed to obtain **E** + 0.50 min to + 0.70 max.

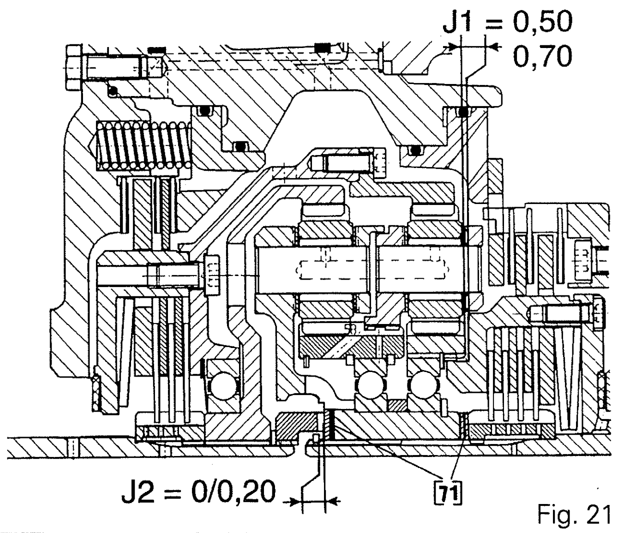


Fig. 21

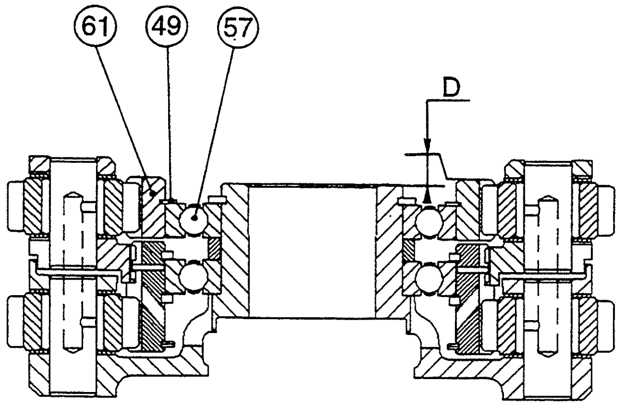


Fig. 22

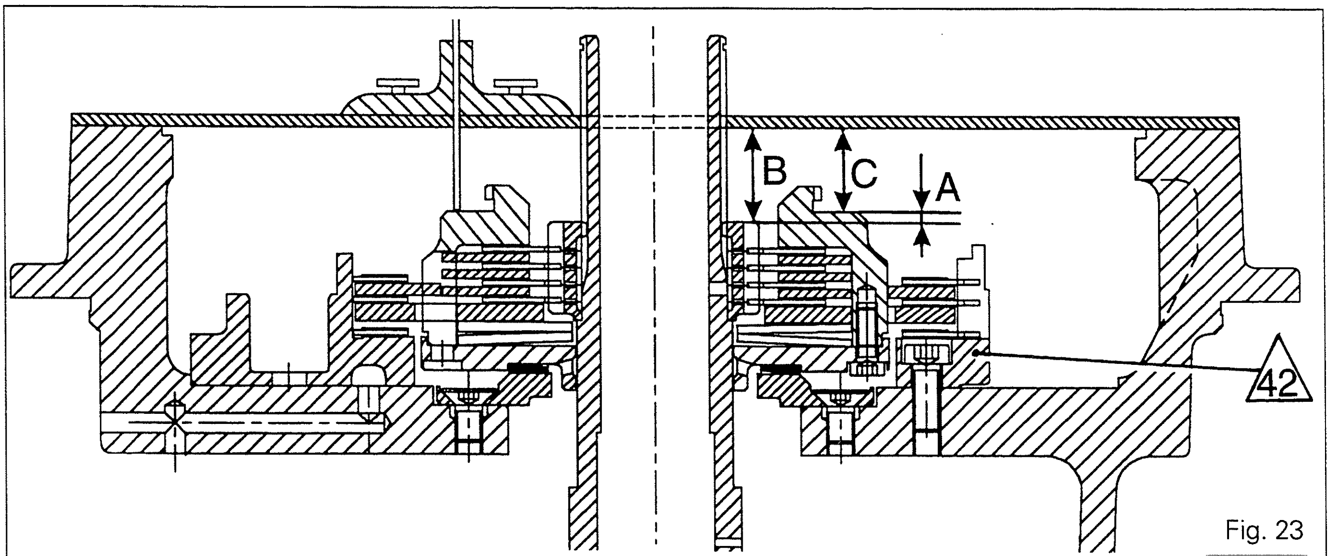


Fig. 23

J2 shimming (Fig. 21)

73. Fit the secondary sungear **(61)** onto the rear clutch housing **(59)** and the planetary carrier assembly onto the secondary shaft **(53)**. Install the spring washer **(76)** and the retaining ring **(72)**.
74. Position the tip of a dial gauge as shown on Fig. 25 and check the play while moving the planetary carrier assembly vertically.
75. Depending on the play read on the dial, select the thickness of shims **[71]** needed to obtain **J2 = 0 to 0.20.**
76. Remove the planetary carrier assembly.
77. Install the springs **(65)**. Position the pressure plate **(38)**, making sure that the notches line up with the lugs on the brake housing **/42**.
78. Check that the shims **[71]** selected during operation 72 above are indeed in place.
79. Refit sungear **(61)** and the planetary carrier assembly and compress them using tool 3376920 M1.
80. Place the shims **[71]** selected during operation 76 against the primary planetary carrier **(28)**. Fit the spring washer **(76)** and the retaining ring **(72)**.
81. Manually check the secondary planetary gears backlash.

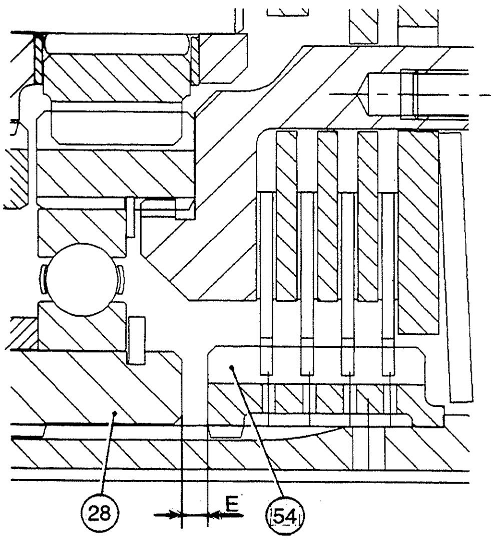


Fig. 24

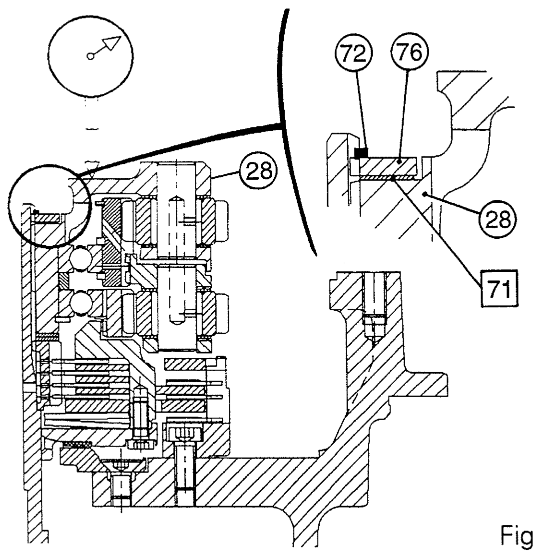


Fig. 25

I. Assembling and refitting the input unit

82. Place new O-rings **(32)** and **(68)** on the reverse shuttle housing **(40)**. Screw two guide studs in, diametrically opposed.
83. Using a sling, refit the primary shaft **(7)** - front cover **(13)** - spacer housing **(21)** assembly (Fig. 12) while ensuring that the lubrification holes line-up.
84. Turn the shaft so as to engage the planetary gears in the ring gears.
85. Remove the guide studs. Fit screws **(30)** and tighten to a torque of 72 - 96 Nm.
86. Check the rotation of the shaft.
87. Position the dowel **(1)** (Fig. 10).

    Note: To facilitate the entry of the reverse shuttle end bearing into the gearbox layshaft, coat the rollers with miscible grease so as to keep them in place.
88. Screw two guide studs (L = 80 mm) diametrically opposed on the gearbox housing. With lifting bracket 3376883 M1 and adaptor plate 3378013 M1, move the input unit into the clutch housing. Incline it as far as possible downwards to enable the selector rails support to pass the gearbox front opening.
89. With the help of a second operator, check via the selector cover opening that the rails enter their support correctly. Rotate the primary shaft **(7)** using the sleeve 3378004 M1 so that the gears engage more easily.

90. Position the housing on the dowel. Remove the guide studs. Tighten the bolts **(66)** to a torque of 39 - 54 Nm. Remove the lifting bracket and refit the four original bolts **(18)** with Loctite 241. Tighten to 25 - 35 Nm. Refit the clutch control valve and the transfer tubes.
91. Reassemble the clutch (see section 4 A01).
92. Reinstall the reverse shuttle selector. Coat the screw **(1)** with Loctite 221 and tighten it to 35 Nm torque (Fig. 8).
93. Clean the selector cover seal mating surface.
94. **On the cover:** Place the Hare/Tortoise piston in Hare position.
95. **On the gearbox:** Place the Hare/Tortoise fork in Hare position. Place the 1st/2nd - 3rd/4th and reverse shuttle forks in neutral position.
96. Coat the gearbox housing seal mating surface with sealing compound (Master joint 510 Loctite or equivalent).
97. Direct the two cover levers in parallel to the right hand side. Position the cover and engage the reverse shuttle lever in its sleeve. Check that the levers are in the correct position in the selectors.
98. Fit the earth cable terminal in the position marked at time of disassembly. Tighten the bolts **(8)** (Fig. 7) to a torque of 34 - 51 Nm.
99. Do operation 4 in reverse order.
100. Reinstall the speed-change lever **(5)**. Position the bellows **(4)**. Reinstall the shaft **(3)**, the washer **(2)** and the pin **(1)** (Fig. 7).
Note: If it is necessary to make adjustments of the sleeves on the levers, refer to section 2 C01.
101. Couple the tractor together at the engine and the gearbox (section 2 B01).
102. Fill the rear axle with oil to the correct level.
103. Bleed the brake and clutch systems. See sections 9 G01 and 4 A01.
104. Road test all controls and Dynashift A, B, C and D ratios.
105. Check for leaks at unions and at the selector cover seal mating surface.

J. Service tools

1. Tools available on the MF dealer network

- Lifting bracket for input unit, No. 3376883 M1 (Fig. 26)
- Centering tool, No. 3376887 M1 (Fig. 27)
- Secondary ring gear retaining tool, No. 3376888 M1 (Fig. 28)
- Planetary carriers compression tool, No. 3376920 M1 (Fig. 29)
- Sleeve, No. 3378004 M1 (Fig. 30)
- Adaptor plate, No. 3378013 M1, to be used with lifting bracket (Fig. 31).

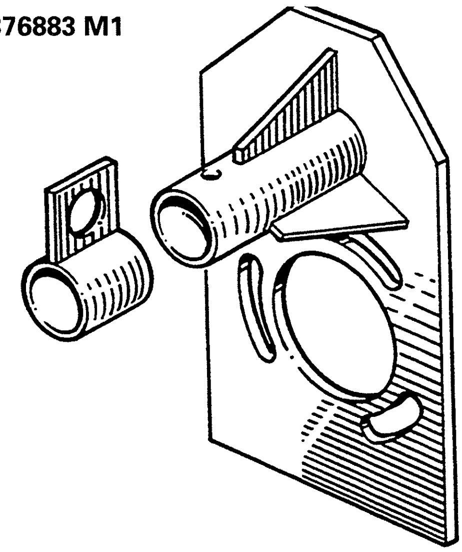


Fig. 26

3376887 M1

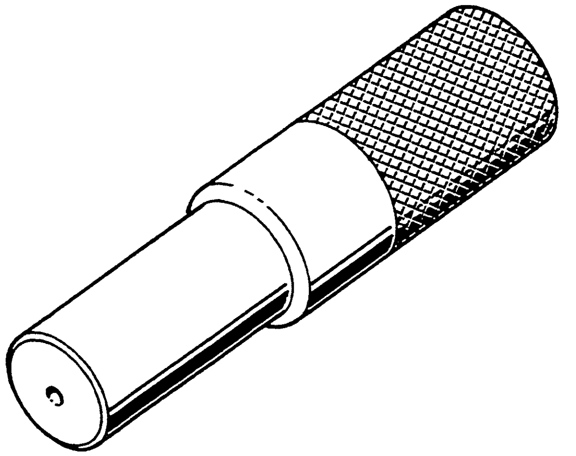


Fig. 27

3378004 M1

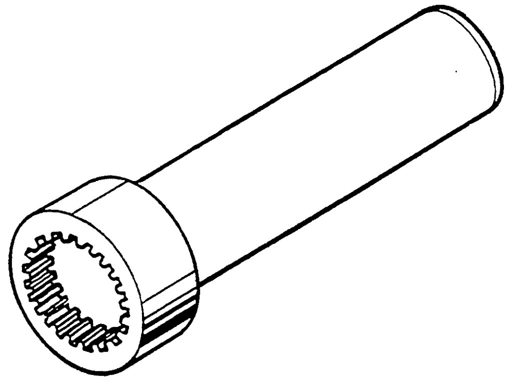


Fig. 30

3376888 M1

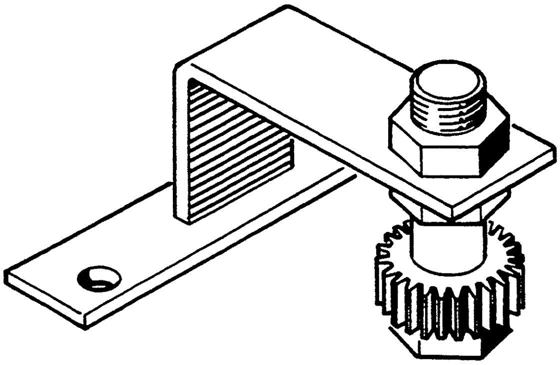


Fig. 28

3378013 M1

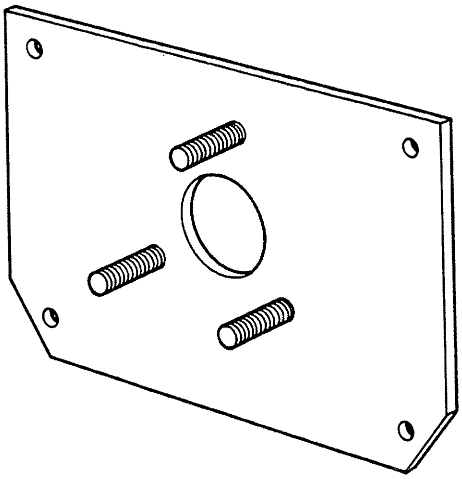


Fig. 31

3376920 M1

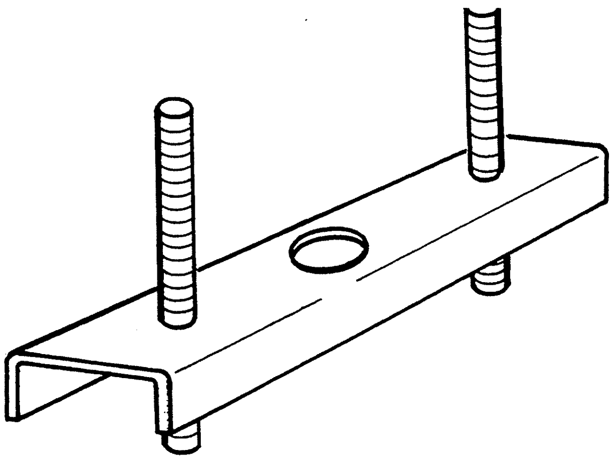


Fig. 29

5 B02 Reverse shuttle

CONTENTS

Gearbox - *Reverse shuttle*

General

The reverse shuttle transmits drive from the Dynashift to the mainshaft via the forward, the reverse and idler and the compound gears to the mainshaft.

The reverse shuttle assembly is located at the rear of the Dynashift unit. It comprises :

- two helical gears **(19)** and **(25)** running on two needle roller bearings **(4)** and **(5)**. These gears are in constant mesh with the main gearbox compound gear and the reverse idler gear **(17)** respectively.
- a synchromesh assembly **(31)** is splined onto the secondary shaft **(2)**.
- a synchromesh selector rail and fork assembly.
- the secondary shaft **(2)** is mounted on two taper roller bearings.
- the reverse idler gear **(17)** runs on two taper roller bearings mounted on a shaft **(14)** that is supported at both ends in the housing.

The reverse idler gear is in constant mesh with the front teeth of the mainshaft compound gear.

Operation

Forward drive

The synchromesh coupler is moved to the rear and the drive is transmitted to the forward drive gear **(19)** which is in constant mesh with the rear teeth of the mainshaft compound gear.

Reverse drive

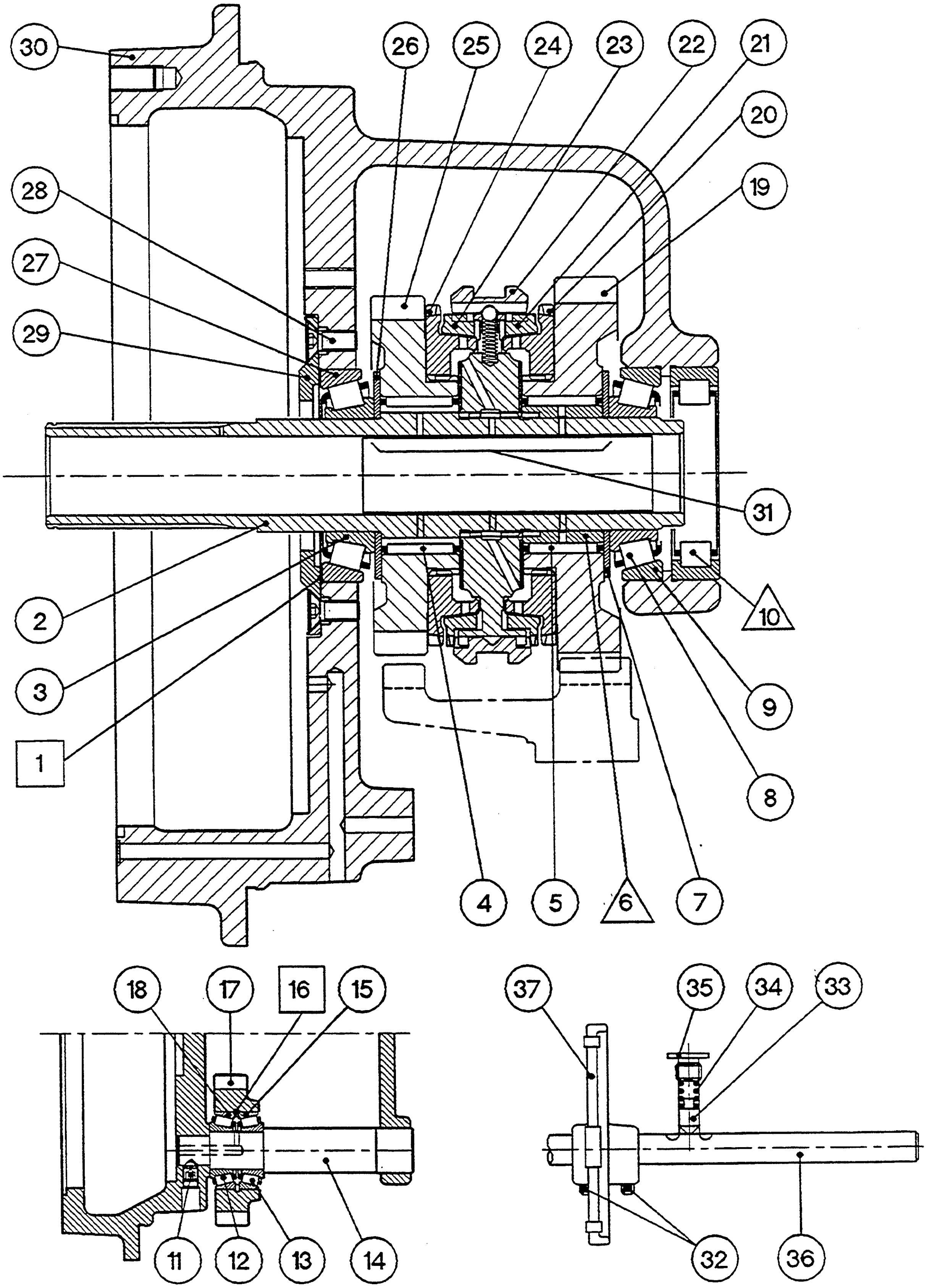
The reverse drive gear **(25)** is in constant mesh with the idler gear **(17)** which in turn is in constant mesh with the forward teeth of the mainshaft compound gear.

List of parts

[1] Shims
(2) Secondary shaft
(3) Front bearing cone
(4) Needle roller bearing
(5) Needle roller bearing
/6 Bush
(7) Washer
(8) Bearing cone (rear)
(9) Bearing cup (rear)
/10 Roller bearing (layshaft)
(11) Screw
(12) Bearing cone (idler)
(13) Bearing cone (idler)
(14) Idler gear shaft
(15) Bearing cup (idler)
[16] Shim
(17) Reverse idler gear
(18) Bearing cup (idler)
(19) Forward drive gear
(20) Synchromesh cone
(21) Synchromesh ring
(22) Synchromesh
(23) Synchromesh ring
(24) Synchromesh cone
(25) Reverse drive gear
(26) Washer
(27) Front bearing cup
(28) Screw
(29) Retaining plate
(30) Reverse shuttle housing
(31) Synchromesh assembly
(32) Screw
(33) Plunger
(34) Spring
(35) Plug
(36) Selector rail
(37) Selector fork

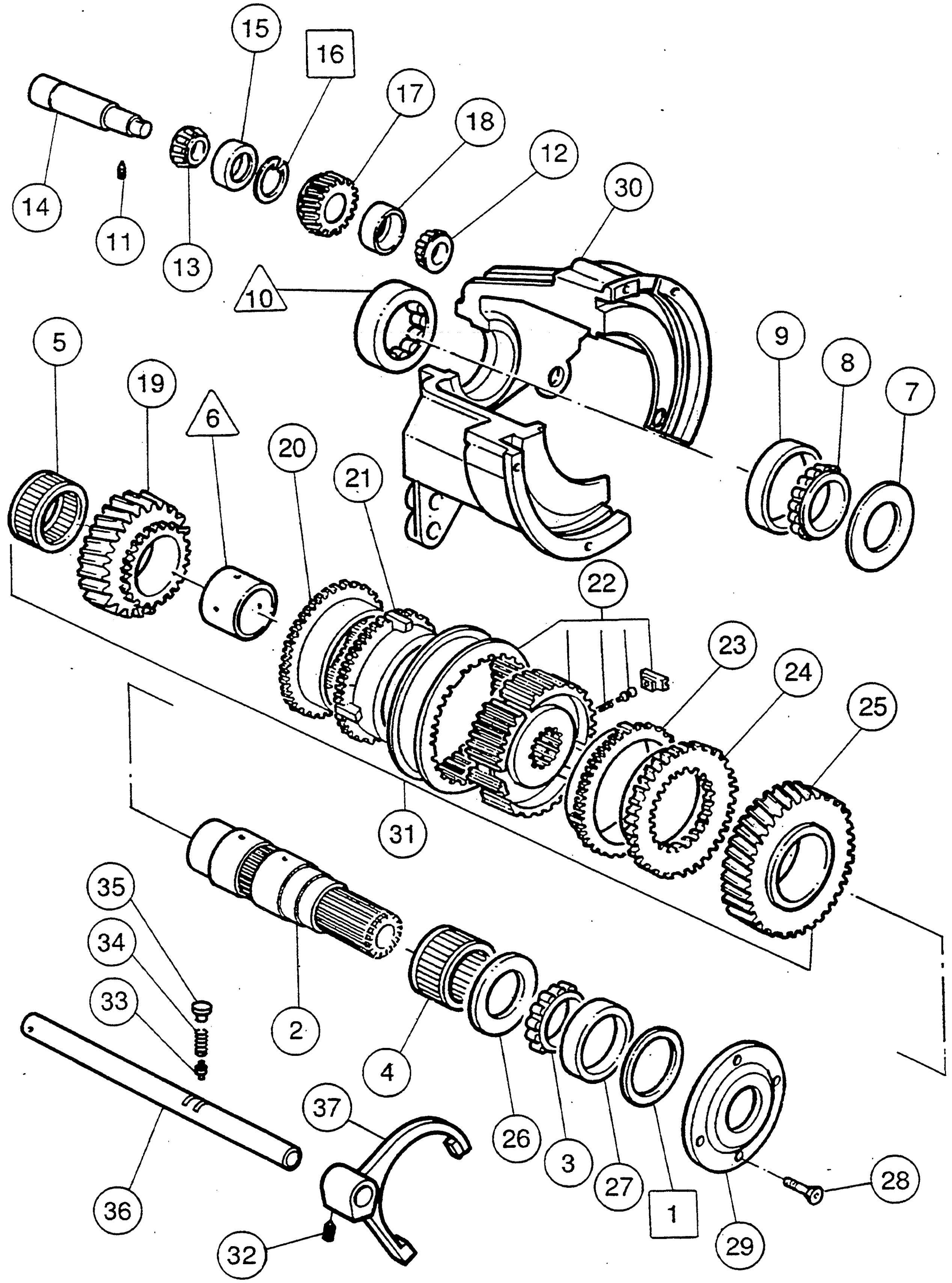
Gearbox - *Reverse shuttle*

Overall view



Gearbox - *Reverse shuttle*

Exploded view



A. Input unit removal

1. Split the tractor between the engine and the gearbox (Section 2 B01) and carry out operations 2 to 11, section 5 B01.
2. Remove plug **(35)**, spring **(34)** and locking pin **(33)**. Remove screws **(32)**. Remove the selector rail **(36)** and fork **(37)** (Fig. 1).
3. Place the unit in vertical position on a bench. Remove the sling.

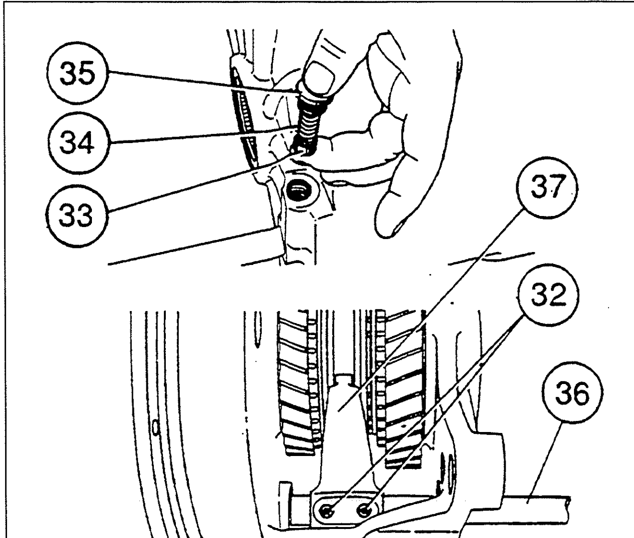


Fig. 1

B. Dynashift dismantling

4. Remove the cover and housing assembly, the front clutch and the brake, carry out operations 13, section 5 B01.
5. Remove the planetary carrier assembly, carry out operations 22 and 23, section 5 B01.
6. Remove the rear clutch and the brake, carry out operations 29, 30 and 32, section 5 B01.

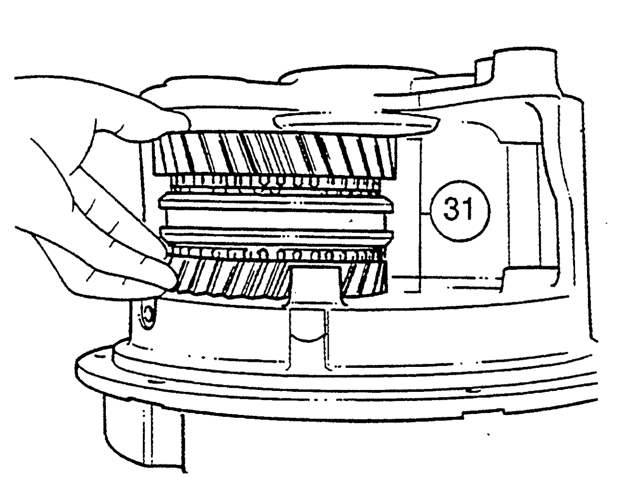


Fig. 2

C. Reverse shuttle dismantling and reassembly

Dismantling

7. Remove the reverse idler shaft retaining screw **(11)**, then the shaft **(14)**. Remove idler gear **(17)** and cones **(12)** **(13)**.
8. Take out the cups **(15)** and **(18)**. Remove shim **[16]**. ***Note: Keep the cones and cups paired if they are to be reused.***
9. Remove screws **(28)**. Remove retaining plate **(29)**, shims **[1]** and bearing cup **(27)**.
10. Remove the gears and synchromesh assembly **(31)** (Fig. 2) and the rear washer **(7)**.
11. Remove rear bearing cone **(8)** and cup **(9)**.
12. Drive out bearing **/10**.

13. **On the gear/synchromesh assembly, separate:** gear **(19)**, bush **/6**, needle roller bearing **(5)**, synchromesh cone **(20)**, ring **(21)**, synchro **(22)**, ring **(23)**, cone **(24)**, gear **(25)** and needle roller bearing **(4)**. Make sure that bush **/6** is free on shaft **(2)**.
14. If necessary, extract cone **(3)** from the shaft and remove washer **(26)**.

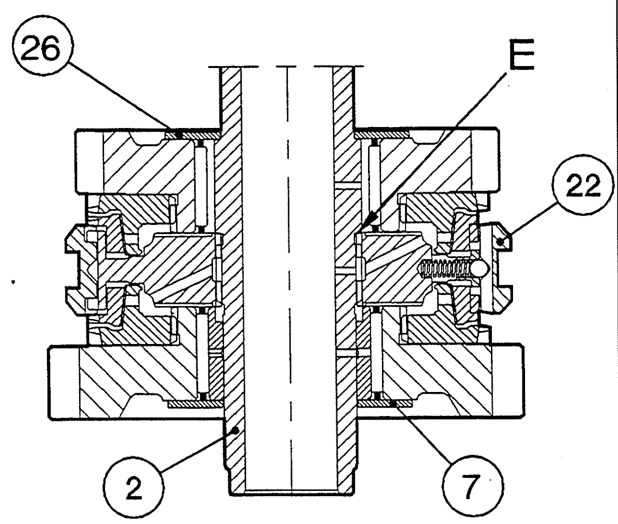


Fig. 3

Reassembly

15. Clean and inspect the parts, replace any parts which are defective.
16. On the secondary shaft **(2)**, shaft **(14)** and housing **(30)**, check that the holes and oilways are all clear.
17. Lubricate shaft, bearing cones and cups.
18. Check the clearance between the synchro rings and the cones (Section 5 A01).
19. If removed, place washer **(26)** on the shaft **(2)** and press on the cone **(3)** until the washer is tight against the step on the shaft.
20. Fit gear **(19)**, bush **/6** with its collar facing towards the synchro **(22)**. Fit needle roller bearing **(5)**, synchro cone **(20)**, ring **(21)**, synchro, ring **(23)**, synchro cone **(24)**, gear **(25)** and needle roller bearing **(4)**.
21. Carry out operations 10 and 11 in reverse order.
22. Centre the rear washer **(7)**. Insert secondary shaft **(2)** into the synchro assembly **(31)** through the bore in the front of the unit.
23. Fit the shaft **(2)** whose recess "**E**" must be fully home on the synchro hub (Fig. 3)
24. Position cup **(27)** and retaining plate **(29)** without the shims **[1]**.
25. Fit and tighten screws **(28)** to a torque of 36 - 46 Nm.
26. Place the unit in a vice.
27. Shim to obtain a preload as follows:
    P1 = 0.10 to 0.20 (Fig. 4)
28. Place the tip of the dial gauge on the end of shaft **(2)** (Fig. 5).
29. Pull on the shaft while turning it alternately from right to left to seat the cone correctly in the cups.
30. Set the dial gauge to zero.

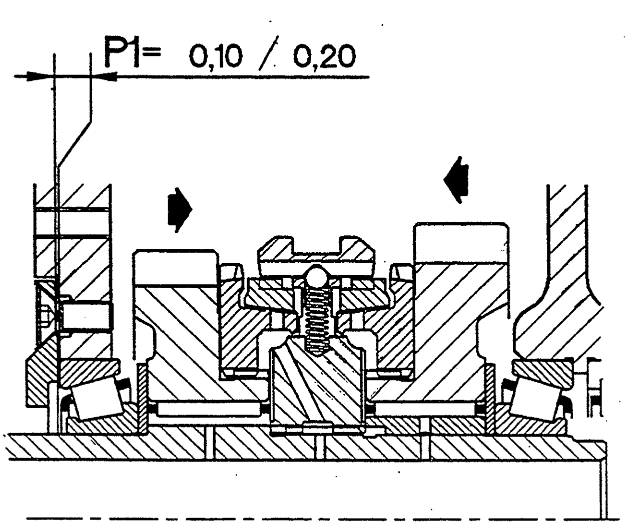


Fig. 4

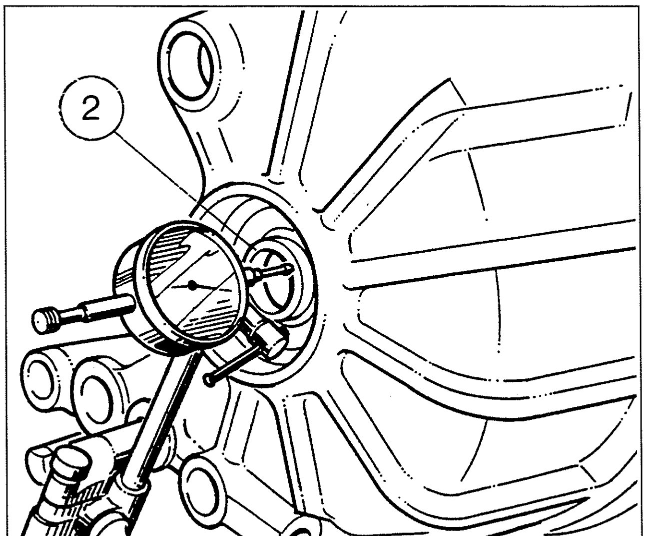


Fig. 5

31. Repeat operation 29 while pushing.
    Note: To get the correct preload, reduce the end float to get a value of between 0.10 and 0.15.
32. Depending on the end float noted, select shims **[1]** to obtain **P1**.
33. Place the unit in vertical position. Remove the screws **(28)**. Remove retaining plate **(29)**.
34. Install the shims selected during operation 32 making sure that they are correctly centered on the cup **(27)**.
35. Refit retaining plate **(29)**. Fit and tighten screws **(28)** coated with Loctite 241 to a torque of 36 - 46 Nm.
36. Manually check shaft **(2)** rotation and the axial clearance of gears **(19)** and **(25)**.

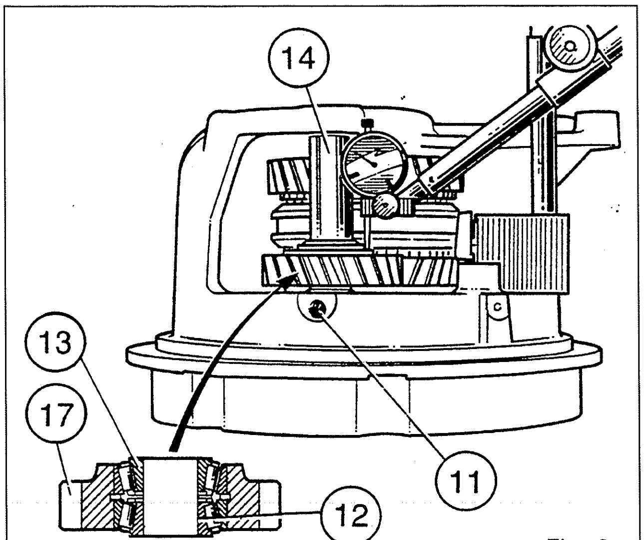


Fig. 6

D . Reverse idler gear reassembly and shimming

37. Fit the min. thickness spacer **[16]** in gear **(17)**, and slide on cups **(15)** and **(18)**.
38. Install the idler gear **(17)** as shown in Fig. 6, and the cones **(12)** and **(13)** on the housing. Slide shaft **(14)**.
39. Fit and tighten screw **(11)** (Fig. 6) to a torque of 40 - 56 Nm.
40. Shim (Fig. 7) to obtain a clearance
    J2 = 0.05 to 0.18
41. Place the dial gauge tip on gear **(17)** (Fig. 6).
42. Push on the gear while rotating it in alternately from right to left to seat the cones correctly in the cups.
43. Zero the dial gauge.
44. Repeat operation 42 while pulling.
45. Depending on the end float noted, select shim **[16]** to obtain **J2**.
46. Remove gear **(17)**. Drive out cups **(15)** and **(18)**. Remove ring **[16]**.
47. Install the shim selected during operation 45. Slide the cups in to the reverse idler gear.
48. Carry out operation 38.
49. Fit and tighten screw **(11)** coated with Loctite 241 to a torque of 40 - 56 Nm.

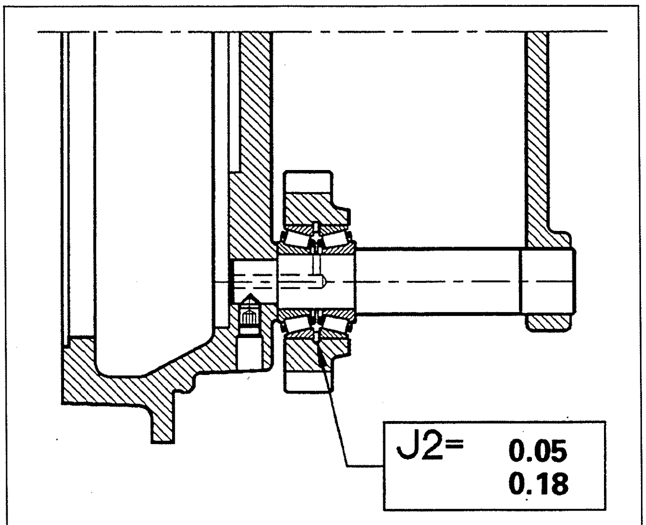


Fig. 7

Gearbox - Reverse shuttle

50. Manually check the backlash of gear **(17)**, and that all the gears rotate correctly.
51. Slide on layshaft roller bearing **/10**, with the **"C"** cage (Fig. 8) facing the rear of the unit.

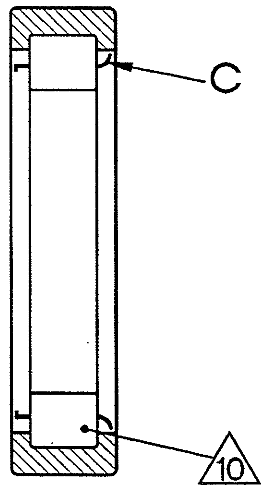


Fig. 8

E. Dynashift reassembly

52. Refit the rear clutch and the brake, carry out operations 43, 46 and 49 to 52, section 5 B01. Position the secondary sun gear, the springs, the plate and the planetary carrier assy.
    Note: Shimming of the planetary carriers must be carried out after maintenance on the following parts: reverse shuttle housing (30), retaining plate (29) or secondary shaft (2).
    If shimming is necessary (see § H, section 5 B01).

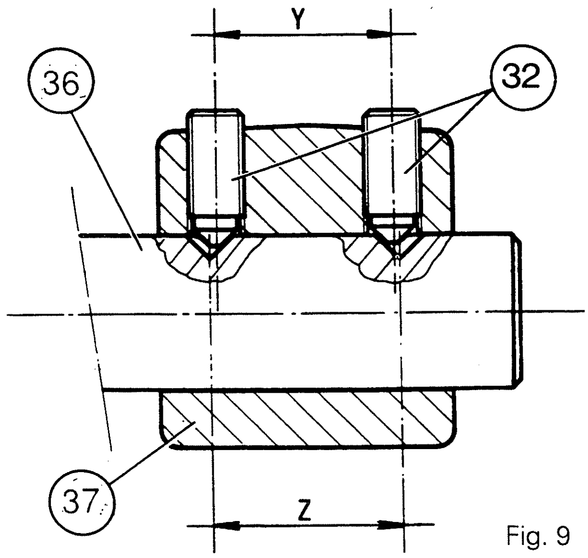


Fig. 9

F. Input unit reassembly and refitting

53. Carry out operations 82 to 86, section 5 B01.
54. Fit and adjust the reverse shuttle fork as follows: The reverse shuttle fork **(37)** position is obtained by a different centre to centre distance of **Y** and **Z** (Fork **(37)** and selector rail **(36)** respectively).
    We obtain a different displacement of the fork by acting on screw **(32)** (front or rear), depending on the setting desired Fig. 9.
55. Fit the fork **(37)**, locking plunger **(33)**, spring **(34)** and plug **(35)** and tighten to a torque of 50 - 70 Nm.
56. Fit the screws **(32)** coated with Loctite 221.
57. Position the fork locked forwards. Hold the synchro ring to the gear.
58. Check that a clearance exists between the synchro ring and the fork pads.
59. Repeat the operation, the fork locked rearwards. Check that a clearance exists between the synchro rings and the fork pads. If not set the fork by acting on screws **(32)**.
60. Tighten the screws **(32)** to a torque of 35 Nm without modifying the setting.
61. Refit the input unit, carry out operations 87 to 103, section 5 B01.
62. Road test all the controls, forward and reverse selection and the A-B-C-D Dynashift speeds.
63. Check for leaks at unions and at the selector cover seal mating surface.

5 C01 Selector cover

CONTENTS

Gearbox - *Selector cover*

General

The selector cover fitted on the right-hand side of the gearbox housing has two separate levers each of which performs one of two different functions:

- Front lever : this lever controls the reverse shuttle.
- Rear lever : this lever selects the four basic speeds and the two Hare/Tortoise (Hi-Lo) ratios.

Operation

Reversing lever

When lever **(72)** is pushed forwards (reverse) or backwards (forward motion), selector rail **(85)** is pivoted. The finger on that rail moves the selector and the fork which engages the reversing synchromesh.

Note : The control lever in the cab is moved in the opposite direction to the lever on the selector cover. For example: when the cab lever is in the forward position, forward motion is selected.

Gear lever

Selection of 1st/2nd gear

Lever **(77)** is first pushed and the finger on rail **(84)** is engaged in selector **(63)**. The lever is then moved forwards and the finger on rail **(84)** then moves selector **(63)** which shifts the 1st/2nd gear fork onto first gear. 2nd gear is engaged by moving lever **(77)** backwards.

Selection of 3rd/4th gear

Lever **(77)** is held in the intermediate position. The finger on rail **(84)** is engaged in the notch in fork **(61)** which selects 3rd or 4th gear when the lever **(77)** is moved forwards or backwards.

Hare/Tortoise function

The Hare/Tortoise position (Hi-Lo) is obtained by pulling the lever **(77)**. The finger on rail **(84)** then presses on switch **(68)** which controls solenoid valve **(86)** by means of the "Autotronic" system.

Hare position

The solenoid valve **(86)** installed on cover **(67)** is closed and this causes a pressure drop in chamber **B**. The constant pressure (17 bar) prevailing in chamber **A** acts on the annular face of piston **(88)** which is moved forwards and moves fork **(65)** to the Hare position, by means of selector **(92)**. The oil contained in chamber **B** is returned to the housing via solenoid valve **(86)**.

Tortoise position

When switch **(68)** is pressed again, the solenoid valve **(86)** is opened.

The oil under 17 bar pressure enters chamber **B**. As the pressure acting on the large diameter of the piston is greater, then that applied on the annular face, this forces the piston back. Selector **(92)** and fork **(65)** are shifted to the Tortoise position. The oil contained in chamber **A** is returned to the 17 bar circuit.

List of parts

(21) Coupler
(59) Lug
(60) Sealing bush
(61) 3rd and 4th gear fork
(62) Sealing bush
(63) 1st and 2nd gear selector
(64) Pin
(65) Hare/Tortoise fork
(66) Cover attaching bolt
(67) Selector cover
(68) Contractor
(69) Support
(70) Attaching bolt
(71) Bolt
(72) Reversing lever
(73) Ball
(74) Ball
(75) Dust boot
(76) Link rod
(77) Lever
(78) Spring seat
(79) Spring
(80) Spring seat
(81) Bolt
(82) Rack
(83) Spring
(84) Gear selector rail
(85) Reverse selector rail
(86) Solenoid valve
(87) O-ring
(88) Piston
(89) Bearing
(90) O-rings
(91) Circlip
(92) Hare/Tortoise selector

Gearbox - Selector cover

Overall view

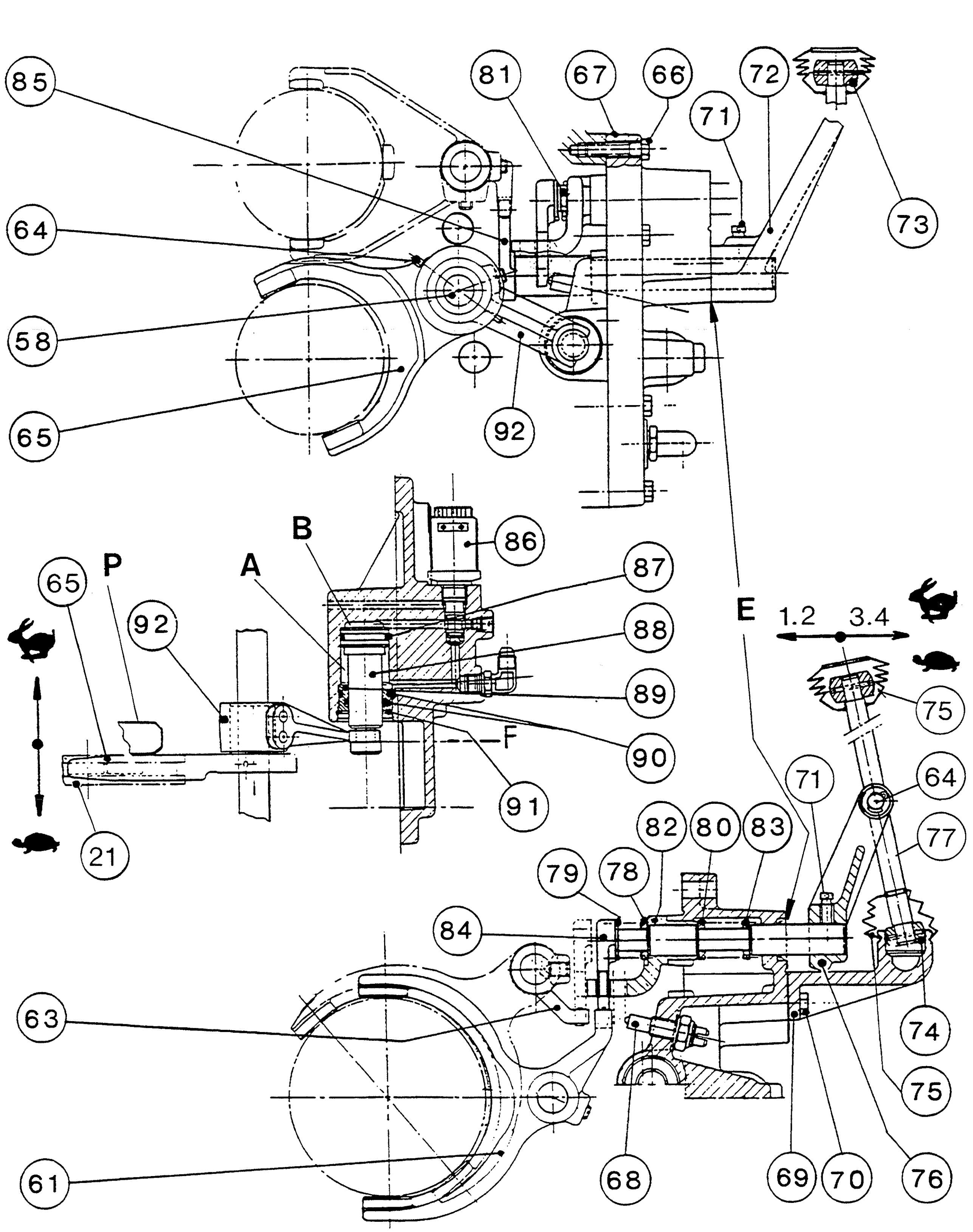


Fig. 1

CONTENTS

Gearbox - Selector cover

Exploded view

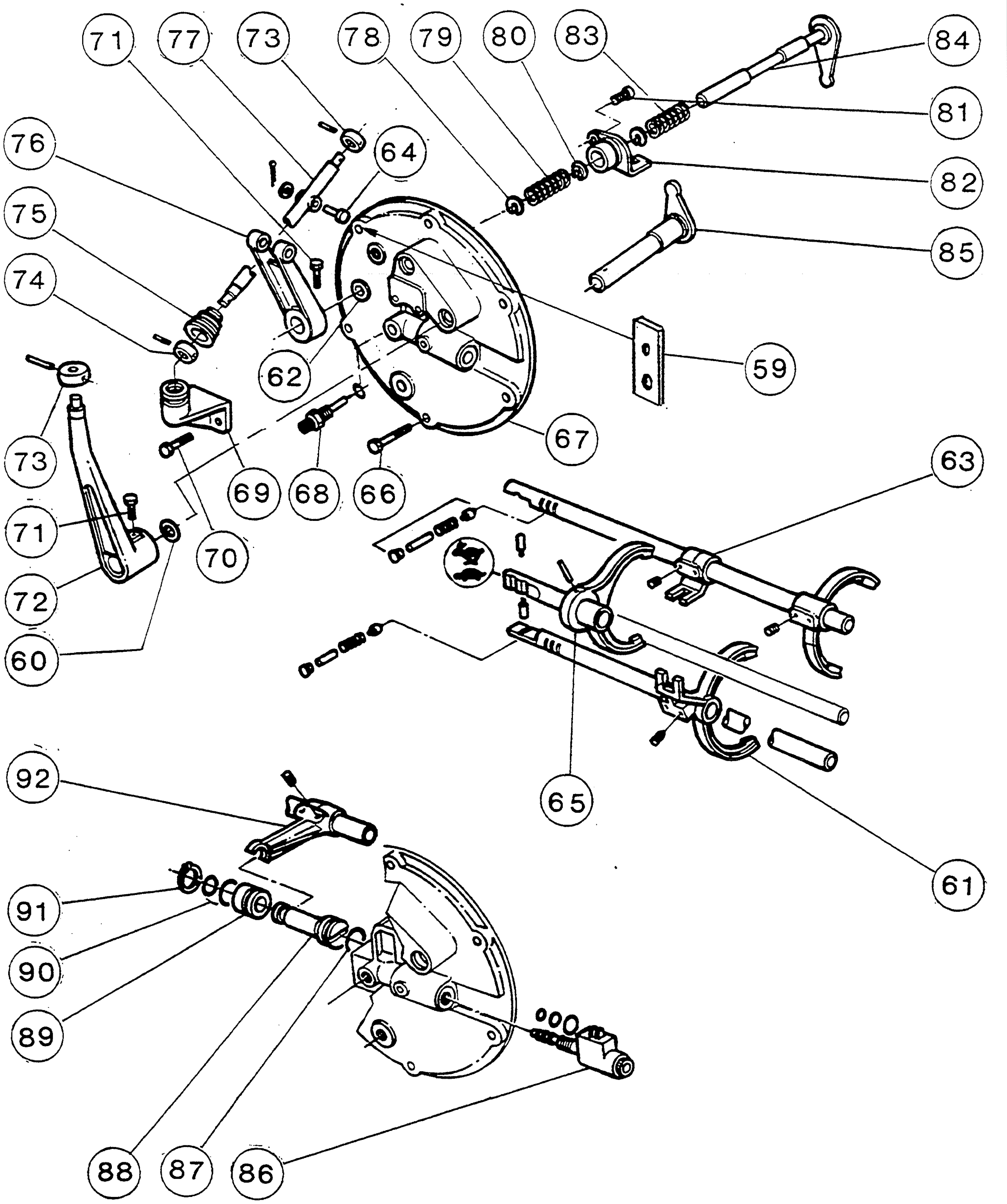


Fig. 2

Gearbox - Selector cover

A . Removing and refitting the cover

Removal

1. Immobilise the tractor. Fit wedge blocks under the left-hand rear wheel. Apply the handbrake.
2. Remove the wheel, if necessary. Drain the gearbox.
3. Disconnect the wiring harnesses from the cover.
4. Unscrew the pipe and hoses.
5. Extract the cotter pin and washer. Remove pin **(64)**. Lift dust boots **(75)**. Remove the gear lever **(77)**.
6. Remove bolts **(66)**. Mark the location of the earth wire lug **(59)**. Detach and remove the selector cover, freeing the reversing control linkage from its lever.

Refitting

Note: The mating faces and cover must be cleaned and balls (73) and (74) must be coated with Anti Seize grease.

7. **On the cover** : Place the Hare/Tortoise piston in the Hare position.
8. **On the gearbox** : Place the Hare/Tortoise fork in the Hare position, with the 1st, 2nd, 3rd, 4th gear and reverse forks in the neutral position.
9. Coat the mating face on the gear box housing with a sealing compound (Master Joint 510 Loctite or equivalent).
10. Orient the two cover link rods to the right and in parallel. Position the cover, engaging the reversing link rod in its bell-type housing. Check that the link rods are correctly positioned in the selectors.
11. Fit the earth wire lug in the position that was marked during dismantling. Tighten bolts **(66)** to a torque of 34 - 51 Nm.
12. Carry out procedures 1 to 5 in reverse order.
13. Road test the gears, reverse shuttle and Hare/Tortoise controls. Check the unions and mating face on the cover for leaks.

B . Replacing piston seals

Disassembly

14. Remove the cover (see part A of this section).
15. Remove circlip **(91)**. Extract piston **(88)** with bearing **(89)**. Discard O-rings **(87)** and **(90)**.

Reassembly

16. Clean and check the parts, and replace any that are faulty.
17. Carry out procedure 15 in reverse order. Reinstall the selector cover (see part A).
Note : When piston (88), bearing (89) and circlip (91) are replaced, the adjustment of the Hare/Tortoise range selector should be checked or rectified (see part D).

C . Disassembling and reassembling the gear and reversing levers

Disassembly

Remove the selector cover (see part A).

Gear lever

18. Remove bolts **(71)** and **(81)**. Remove and dismantle gear selector rail **(84)**.
19. Extract sealing bush **(62)**.

Reversing lever

20. Remove bolt **(71)**. Remove lever **(72)** and rail **(85)**.
21. Extract sealing bush **(60)**.

Reassembly

22. Carry out the following procedures in reverse order : procedures 18 and 19 for the gear lever and procedures 20 and 21 for the reversing lever.
Tightening torques
- Bolt **(81)** : 25 - 35 Nm (Loctite 270)
- Bolt **(71)** : 28 - 43 Nm
- Solenoid valve body : 18 - 20 Nm
- Solenoid knurled nut : 5 Nm
- Hare/Tortoise switch and temperature sensor : 15 Nm

Note : Fit sealing bushes (60) and (62) fully home on the cover shoulder, with their outside diameter coated with Loctite 542. Coat the faces on the collar marked "E" with grease (Anti Seize Loctite or equivalent) (Fig. 1). When the selector cover is replaced, the adjustment of the Hare/Tortoise range selector should be checked or rectified (see part D).

23. Reinstall the selector cover (see part A).

Gearbox - Selector cover

D. Adjusting the Hare/Tortoise range

On the cover (Fig. 3)

24. Place piston **(88)** fully pressed into the chamber (Hare position).
25. Position the arm of service tool MF 462A in the piston groove and place in contact with face "**F**" as indicated.
Note : Ensure that piston (88) is firmly held in position before tightening the bolt "V" on the tool's slider.

On the gearbox (Fig. 4)

26. Place the tool on the gearbox housing.
27. Place sliding coupler **(21)** against the 3rd speed gear "**P**" (Hare position) (Fig. 1). The pads of fork **(65)** must bear against sliding coupler **(21)** on the 3rd speed gear side.
28. Adjust selector **(92)** so that face "**F**" is offset from the tool arm by at least 0.2 mm.
29. Refit the selector cover. Use compressed air at a pressure of at least 3 bar to move piston **(88)** to the Tortoise position.
30. Through the opening in the 4WD control box, check the play on fork **(65)** in sliding coupler **(21)**. Maximum play: 1 mm.

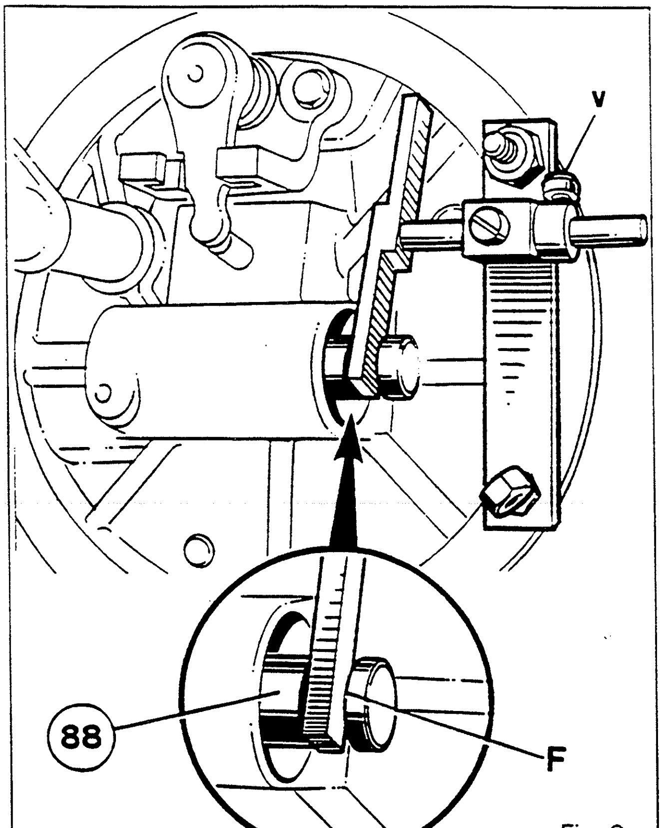


Fig. 3

E. Service tool

MF 462A Setting gauge for Hare/Tortoise selector adjustment (Fig. 5).

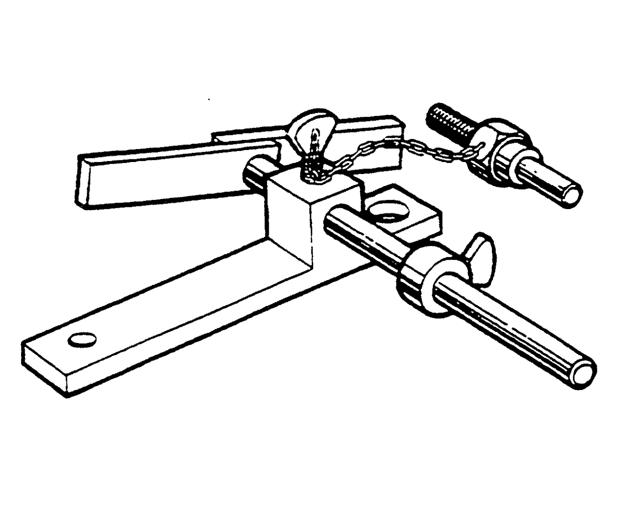


Fig. 5

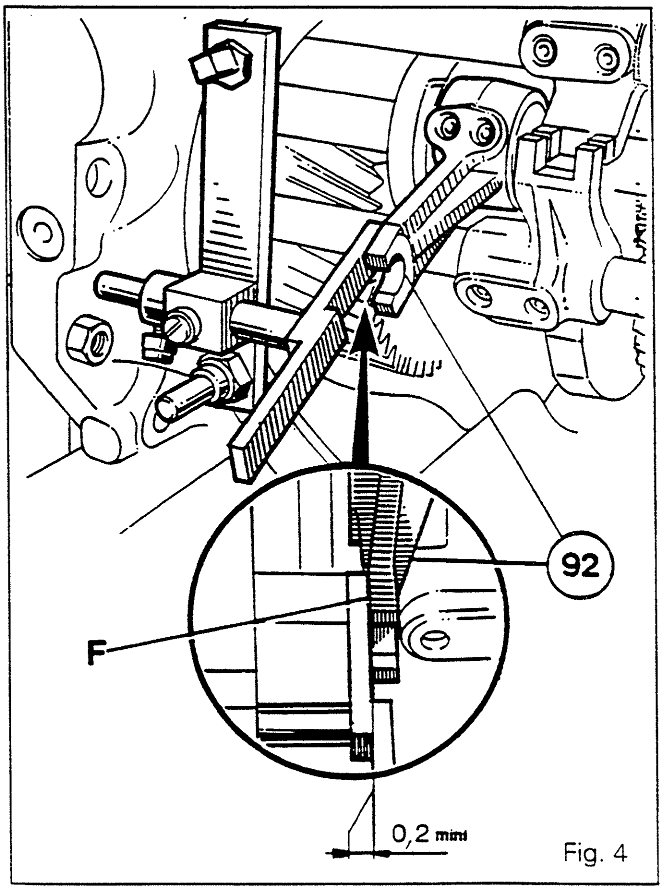


Fig. 4

5 D01 Selector rails

CONTENTS

Gearbox - Selector rails

A . Preliminary operations

1. Split the tractor between the gearbox and the rear axle (see section 2 C01).
2. Remove the selector cover (see section 5 C01).

B . Disassembly and reassembly

Disassembly

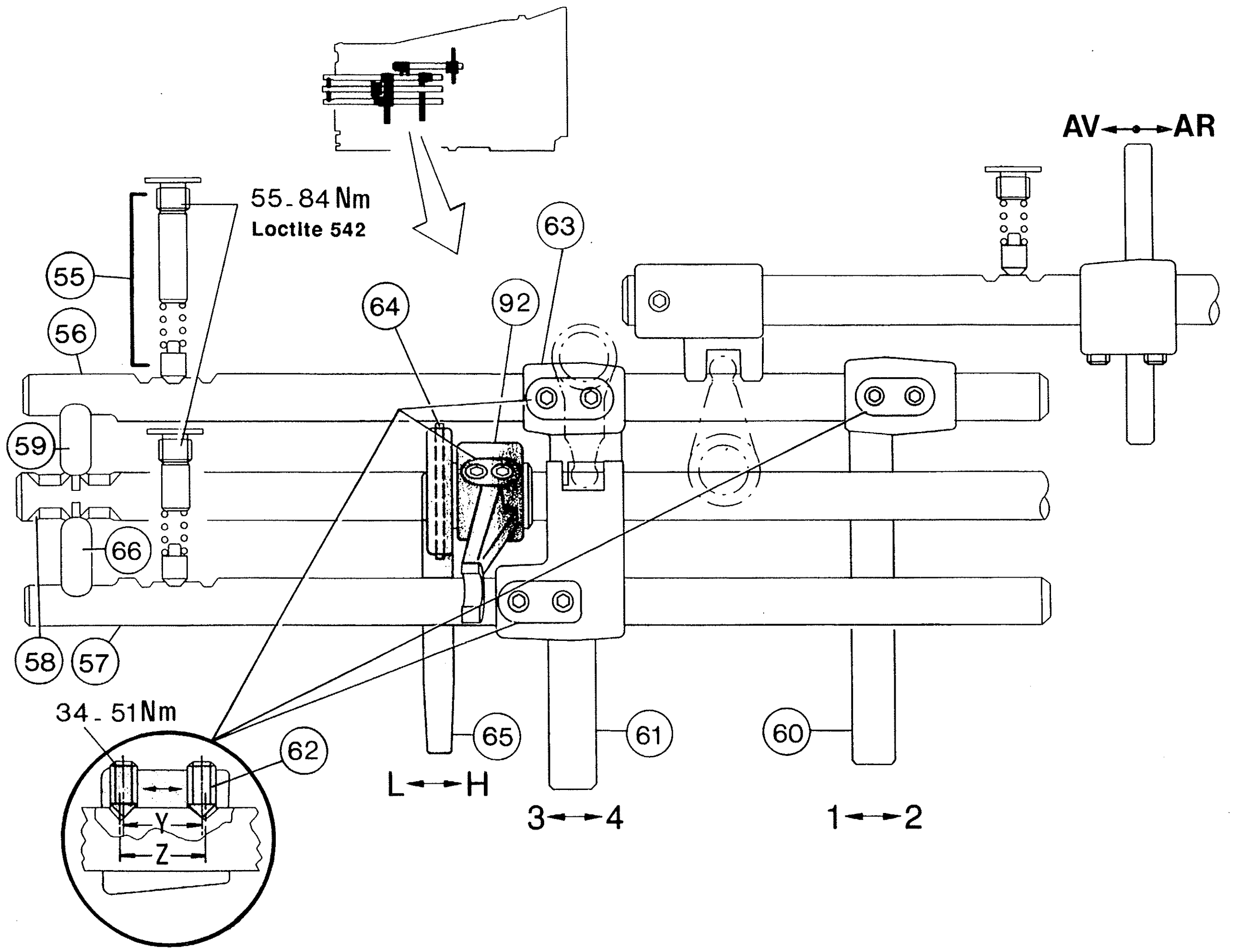
3. Remove the selector and fork bolts.
4. Remove the indexing assembly **(55)** and cotter pin **(64)**.
5. Push selector rail **(56)** towards the inside. Remove the lock **(59)**.
   Proceed in the same manner with selector rail **(57)** and lock **(66).**
6. Extract the selector rails **(56)**, **(57)**, **(58)** towards the rear.

Reassembly

7. Reassemble the selector rails, the forks and the selectors in the reverse order from their disassembly.

Overall view

AV = Forward
AR = Rear



CONTENTS

C . Adjusting the forks and selector

Principle

The correct positioning of the forks **(60)**, **(61)** and the selector **(63)** is obtained on the basis of difference between the distances between the tapped holes **Y** and the contact areas **Z** on selector rails **(56)** and **(57)**.
The forks and the selector can be displaced by acting on the front or rear bolts **(62)**, according to the adjustment required.

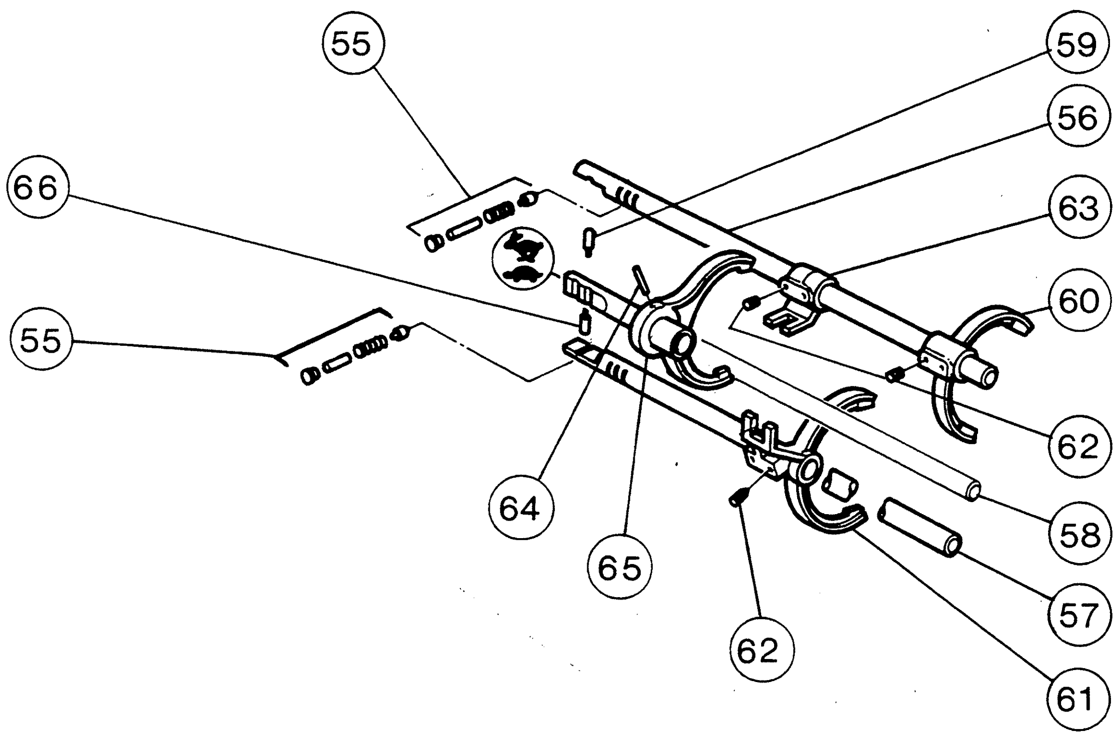
Gearboxes are equipped with GT synchros. The forks are adjusted with the gear engaged.

8. Coat the plugs of the indicating assemblies **(55)** with Loctite 542 and screw them in. Lock the fork **(60)** first. Keep the synchro ring resting on the gear. Check that the rear pads of the fork are not in contact with the synchro ring.
9. Repeat the operation (fork locked in 2nd gear), checking that the front pads are not in contact with the synchro ring. If they are, adjust the fork by adjusting bolts **(62)** coated with Loctite 221.
10. Proceed in the same manner to adjust fork **(61)**.
11. Adjust the selector **(63)** in line with the notch of the selector of fork **(61)**.
    Adjust the Hare/Tortoise selector **(92)** (see section 5C01).

D . Final operations

12. Reinstall the selector cover (see section 5 C01).
13. Recouple the tractor between the gearbox and the rear axle (see section 2 C01).
14. Carry out road test. Check :
    - that the gears can be engaged,
    - that the reverse shuttle operates correctly,
    - that the Hare/Tortoise range operates correctly.
15. Check for leaks on the mating surfaces between the gearbox and rear axle,on the selector cover and on hydraulic fittings.

Exploded view



5 E01 Output shaft

CONTENTS

Gearbox - Output shaft

General

The output shaft transmits the movement supplied by the different gears to the rear axle transfer shaft. It is mounted on the lower transmission line at the rear of the gearbox.

The output shaft is supported by two taper roller bearings the first of which is centered in the bore of the mainshaft, and the second in the handbrake support.

The shaft supports:
- the 3rd/hare gear **(35)** mounted on two taper roller bearings comprised of taper roller cone/cup assemblies **(33)**, **(34)** and **(37)**, **(36)**.
- the Hare/Tortoise synchromesh assembly **(69)**.
- the Tortoise gear **(40)** which rotates freely on the shaft **(47)**.

Shimming of the 3rd/hare gear bearings is via the two shims **(31)**, the front one of which has a sealing ring **(28)** to maintain the lubricating oil pressure in the oilway.

Shimming is carried out using a shim pack **(45)** placed behind the cup **(44)**.

Parts List

(22) Bearing cup
(23) Bearing cone
(28) Sealing ring
(30) 3rd synchromesh ring
(31) Shims
(32) 3rd synchromesh cone
(33) Bearing cone
(34) Bearing cup
(35) 3rd/hare gear
(36) Bearing cup
(37) Bearing cone
(40) Tortoise gear
(42) Washer
(43) Bearing cone
(44) Bearing cup
(45) Shim(s)
(46) Handbrake support
(47) Output shaft
(69) Dual cone synchromesh assembly
(70) Cover

General view

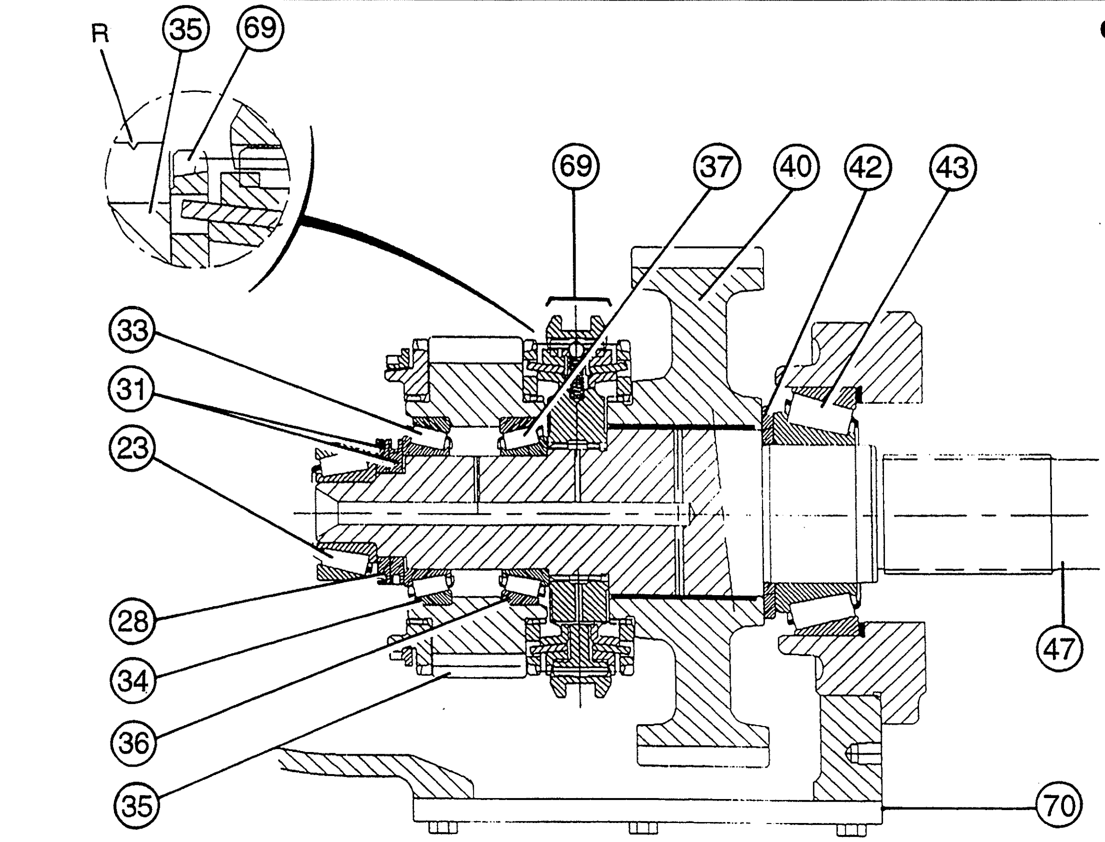


Fig. 1

Gearbox - Output shaft

Exploded view

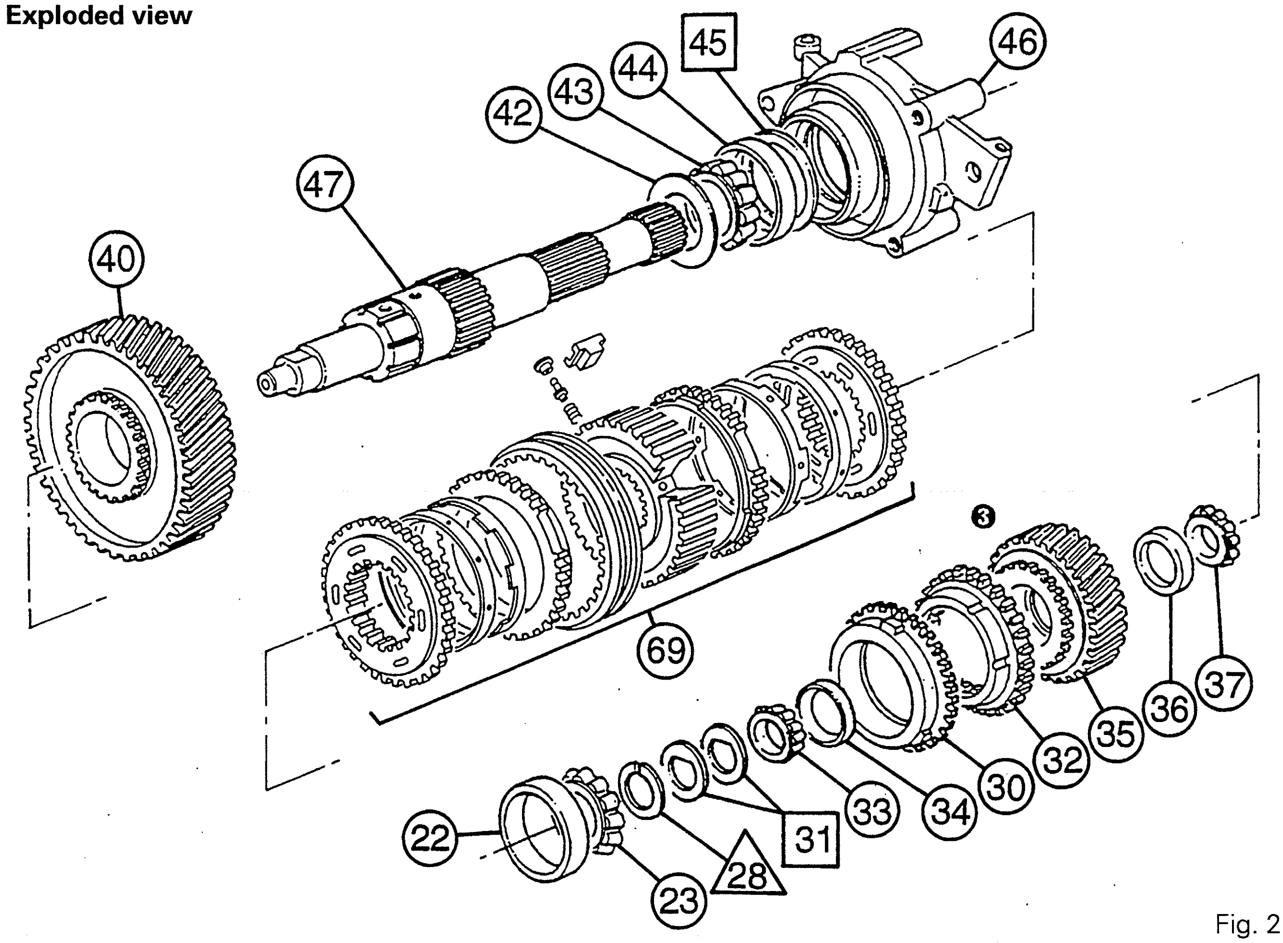


Fig. 2

A. Disassembly

1. Split the tractor between the gearbox and the rear axle (chapter 2 C01).
2. Remove the selector cover (see section 5 C01) and remove the selector rails (section 5 D01).
3. Remove the handbrake unit cover plate, the pressure plates, the disks and the mechanism (chapter 5 H01).
4. Screw the locally manufactured studs **"G"** (dia. 1/2-13, total length 150, thread length 70) so that they come into contact with Tortoise gear **(40)** without blocking it (Fig. 3). Remove the handbrake unit. Pull the output shaft and remove it.

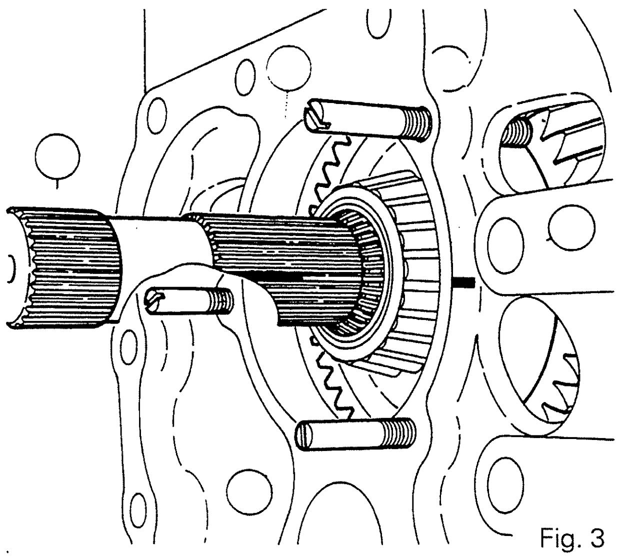


Fig. 3

Gearbox - Output shaft

5. Remove the studs. Via the selector cover aperture, remove the complete synchromesh assembly **(69)**, the 3rd/hare gear **(35)** with the bearing cones **(33) (37)**, the shims **(31)**, the bearing cone **(23)** and the Tortoise gear **(40)**.

B. Reassembly

6. Clean and inspect the parts, replace any parts which are defective.
7. Check that the output shaft **(47)** lubrication oilway is not blocked.
8. If necessary, fit:
   - bearing cup **(22)** onto the mainshaft
   - bearing cups **(34)** and **(36)** into 3rd/hare gear **(35)**
   - bearing cone **(43)** onto the output shaft **(47)** (after fitting washer **(42)**.
9. On output shaft **(47)**, slide on the bearing cones **(33) (37)**, the preassembled gear **(35)** and two min. thickness shims **(31)**. Fit bearing cone **(23)**.
10. Place the assembled shaft in a vertical position, a locally manufactured spacer «**E**», which must only contact the ring of bearing cone **(23)**. Using a press, apply moderate pressure to the spacer to seat the cone correctly on its shoulder (Fig. 4).
11. Shim (Fig. 5) to obtain a clearance of:
    J2 = +0.02 to +0.07
12. Place a dial gauge on the machined face of the 3rd/hare gear **(35)** (Fig. 4).
13. Push on the gear while rotating it alternately from right to left to seat the cones correctly in the cups.
14. Zero the dial gauge.
15. Repeat operation 13 while pulling.
16. Depending on the end float found, select the thickness of shims **(31)** necessary to obtain **J2**.
17. Fit sealing ring **(28)** into the groove of a shim **(31)**. To facilitate reassembly of the gears, remove cover plate **(70)**.
18. Coat shims **(31)** and bearing cone **(23)** with miscible grease. On output shaft **(47)**, slide shims **(31)**, sealing ring **(28)** assembled as per Fig. 1 and bearing cone **(23)**.

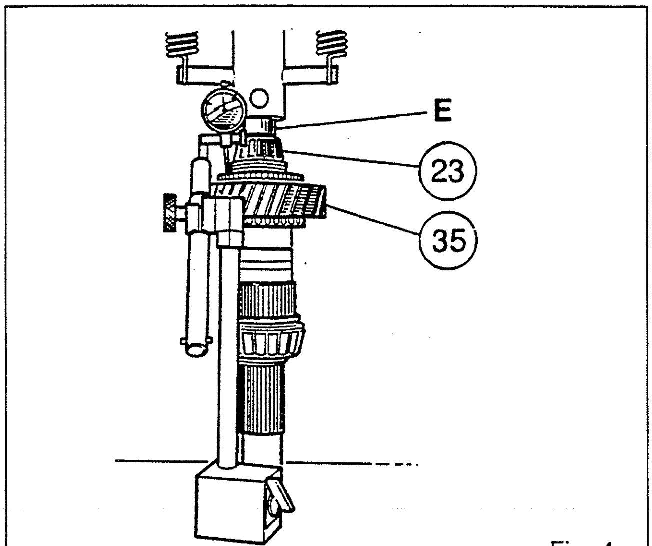


Fig. 4

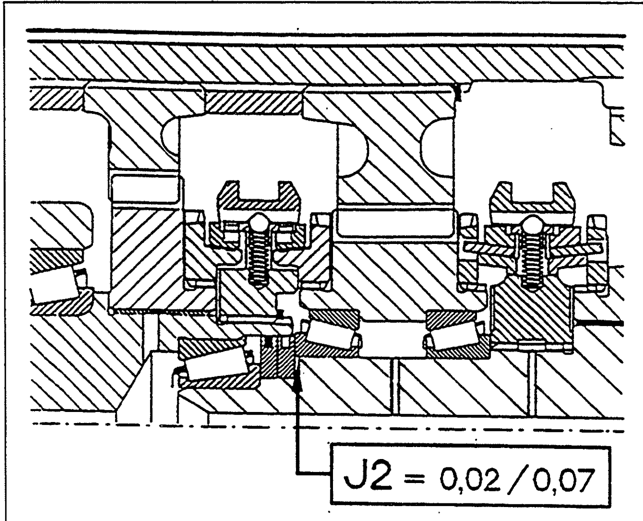


Fig. 5

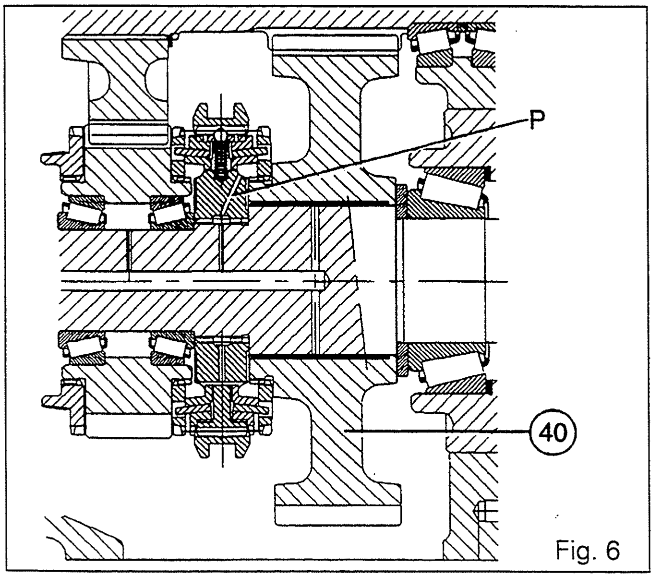


Fig. 6

19. Engage output shaft **(47)** in shaft **(7)**. Draw a line of paint showing the position of shims across the walls, the synchromesh **(27)** and the output shaft **(47)** (Fig. 7).
20. Remove output shaft **(47)** while maintaining the shims and bearing cone **(23)** onto shaft **(7)**.
21. Into the housing, insert:
    - the Tortoise gear **(40)**,
    - the 3rd/hare gear **(35)**, with the "**R**" mark oriented towards synchromesh assembly **(69)** (Fig. 1) with the bearing cones **(33) (37)** coated with miscible grease.
22. Fit the synchromesh rings to the Hare/Tortoise gears.
23. Coat the synchromesh cones with miscible grease.
24. Install the synchromesh assembly, with channel "**P**" or the paint mark oriented towards the Tortoise gear **(40)** (Fig. 6).
25. Position the Tortoise gear and centre it. Use studs to retain it without blocking it.
26. Engage the shaft with washer **(42)** and bearing cone **(43)** while aligning the paint marks on the shaft, the synchromesh assembly and the walls (Figs. 3 and 8).
27. Place bearing cup **(44)** in the support **(46)** without shims **[45]**. Position the support with pin **(3)** on the housing using bolt **(1)** and bolts **(2)** fitted with locally manufactured spacers «**E**». Tighten to a torque of 85 to 128 Nm (Fig. 10).
28. Shim (Fig. 9) to obtain a play of:
    J3 = 0.01 / 0.05

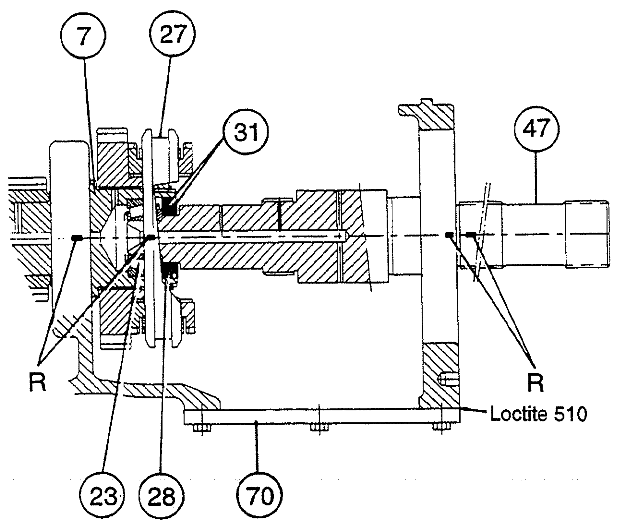


Fig. 7

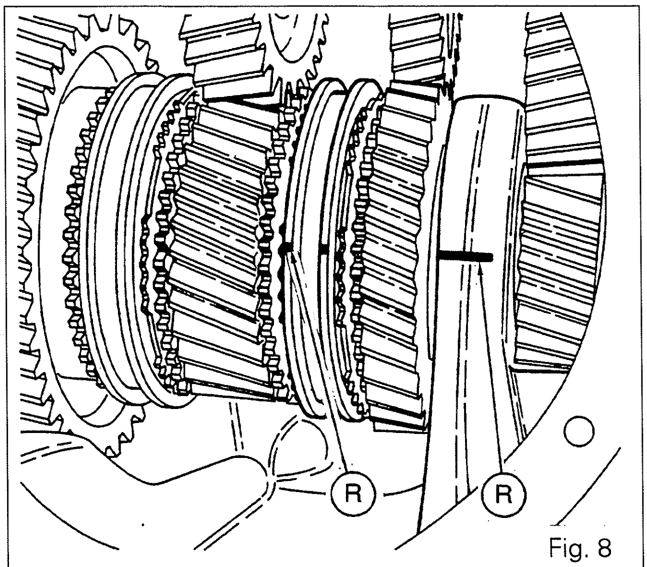


Fig. 8

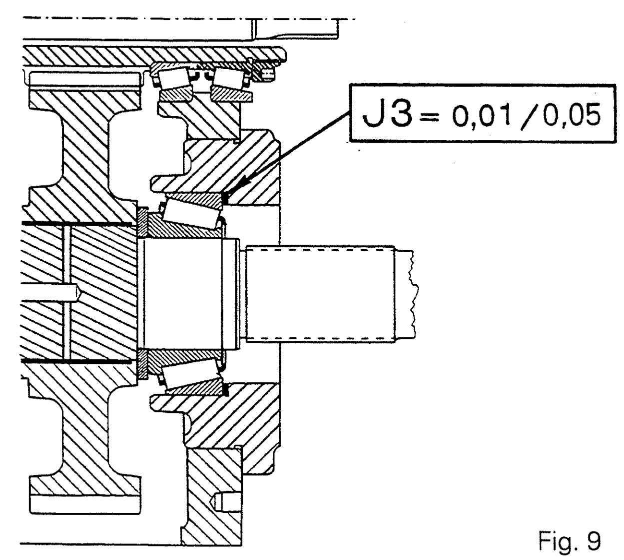


Fig. 9

Gearbox - Output shaft

29. Place the dial gauge tip at the end of output shaft **(47)** (Fig. 10).
30. Push on the shaft while rotating it from right to left to seat the cones in the cups.
31. Zero the dial gauge.
32. Repeat operation 30 while pulling.
33. Depending on the end float found, select the thickness of shims **(45)** required to obtain **J3**.
34. Remove screws **(1)** **(2)** and support **(46)** (Fig. 10).
35. Remove cup **(44)** and install shims **(45)** selected during operation 33.
36. Reassemble the cup. Refit the support. Tighten screw **(1)** to a torque of 85 - 128 Nm (Fig. 10).
37. In the handbrake support, position the pressure plates, the disks and the mechanism (chapter 5 H01).
38. Manually check the rotation of the shaft and of its gears.
39. Check that the 3rd/4th synchromesh and the Hare/Tortoise synchromesh operate normally.
40. Refit the selector rails, adjust the forks and the 1st/2nd selector (chapter 5 D01).
41. Adjust the Hare/Tortoise selector (chapter 5 C01).
42. Refit the reverse shuttle selector.
43. Refit selector cover (chapter 5 C01).
44. Connect the tractor between the gearbox and the rear axle (chapter 2 C01).
45. Bleed the clutch and brake systems (see sections 9 G01 and 4 A01).
46. Check for leaks of the joint faces and the hydraulic connections.
47. Carry out a road test and check clutch controls, Dynashift ratios A - B - C - D, the reverse shuttle, the gears and the Hare/Tortoise range.

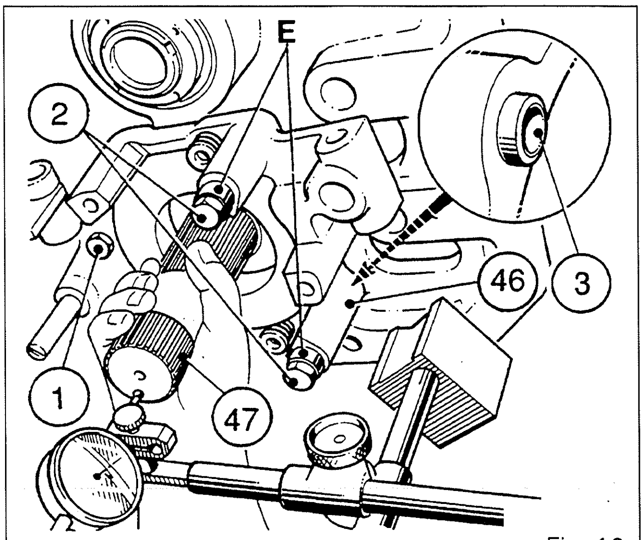


Fig. 10

5 F01 Mainshaft

SUMMARY

Gearbox - Mainshaft

General

The mainshaft **(7)** is mounted on two cone roller bearings **(9) (10)** and **(20) (21)** that rest on the two lower bearing of the main housing. The input gear **(1)**, located in the front, is connected to the shaft by means of splines. It is supported by Belleville washers **(2)** held by the special screw **(3).**

Between the two lower bearings, the shaft supports the free mounted 2nd gear **(13)** and 1st gear **(19)**, as well as the 1st and 2nd gear synchronizer assembly whose hub is splined on the shaft. Behind, it supports the free mounted 4th gear **(24)** and the synchronizer assembly of the 3rd and 4th gears.

The rear bore houses the cup of the cone bearing **(22)** on the output shaft.

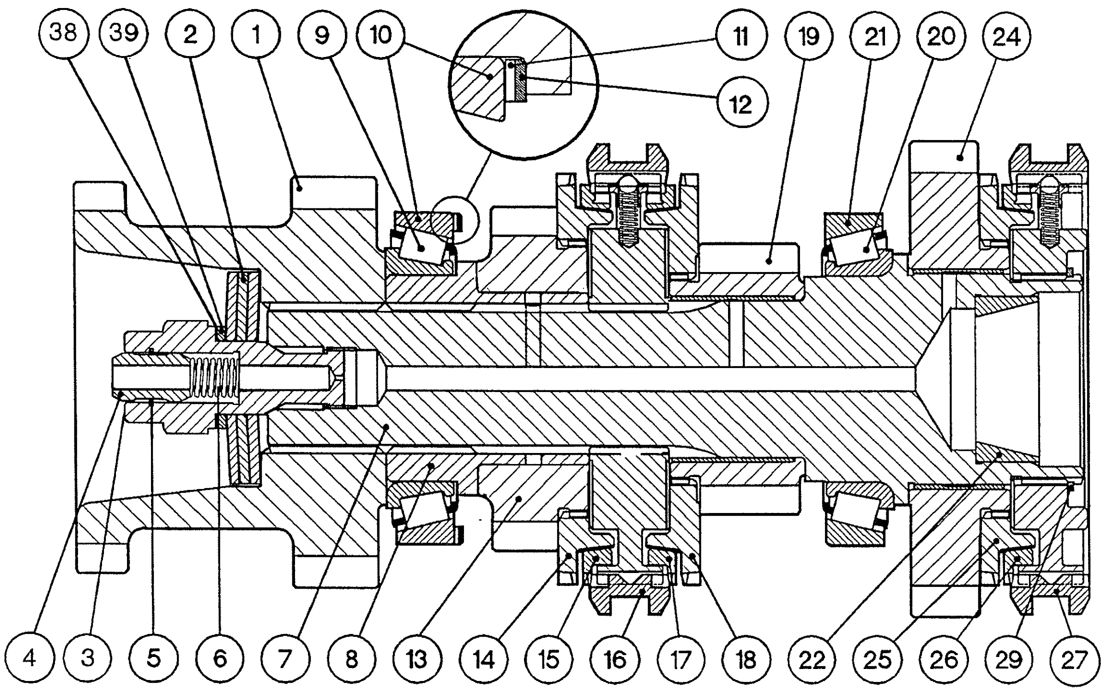
Central line and radial ducts ensure lubrication of the 1st gear and the bush of the 2nd gear.
The preload of the roller bearing is adjusted by placing shims **(11)** behind the bearing cup **(10)**.

The input gear **(1)** is blocked by means of shims **(38)(39)** placed on the special screw **(3)**, to obtain a compression of the Belleville springs **(2)**.

List of parts

(1) Input shaft
(2) Belleville spring
(3) Special screw
(4) Lubrication tube
(5) Snap ring
(6) Spring
(7) Mainshaft
(8) Bush
(9) Bearing cone
(10) Bearing cup
(11) Shim(s)
(12) Spacer
(13) 2nd gear
(14) 2nd synchromesh cone
(15) 2nd synchromesh ring
(16) 1st-2nd synchromesh
(17) 1st synchromesh ring
(18) 1st synchromesh cone
(19) 1st gear
(20) Bearing cone
(21) Bearing cup
(22) Bearing cup
(24) 4th gear
(25) 4th synchromesh cone
(26) 4th synchromesh ring
(27) 3rd-4th synchromesh
(29) Snap ring
(38) Shim(s)
(39) Shim

General view



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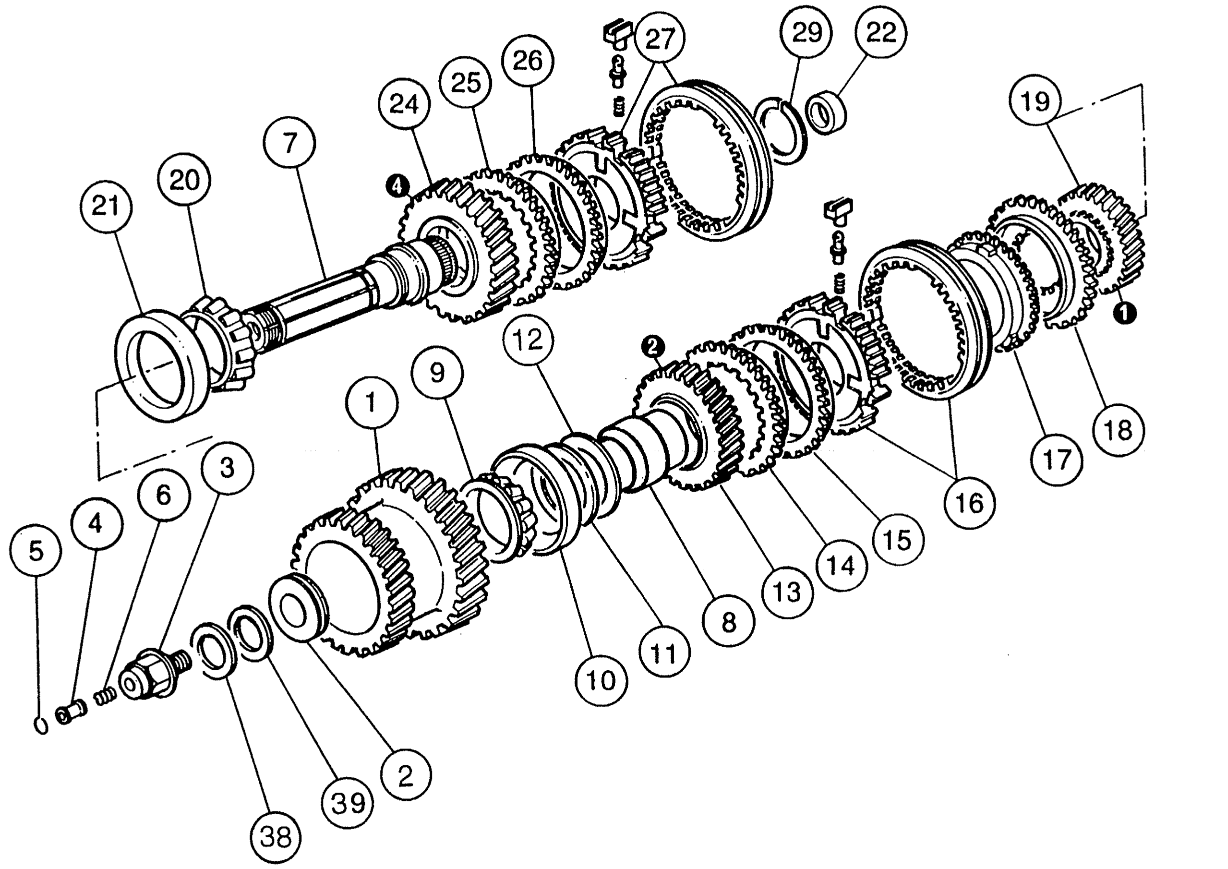
Explosed view



A. Preliminary operations

The gear box needs to be removed in order to dismantle the mainshaft.

1. Split the tractor between the gear box and the rear axle (section 2 C01).
2. Separate the gear box from the engine (section 2 B01).
3. Remove the selection cover (section 5CO1).
4. Remove cover plate of the handbrake housing, the counterplates, the discs and the mechanism (section 5 H01).
5. Place the gearbox on an adequate support. Remove the input unit and resume the operations section 5 B01.
6. Disjoint the guide studs and the forks (section 5 D01).
7. Disjoint the output shaft and resume operations 4 to 5, section 5 E01.
8. Remove the circlip **(56)** from its recess on the lay schaft without twisting it. Move the gear backwards **(57)** (Fig. 1).

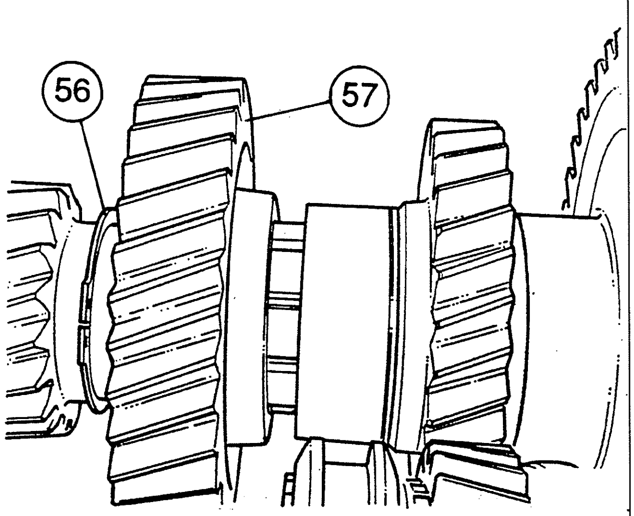


Fig. 1

Gearbox - *Mainshaft*

B. Dismantling the shaft

9. Remove the snap ring **(29)**. Extract the 3rd and 4th synchromesh **(27)** noting its position.
10. Remove the synchromesh ring **(26)**, the cone **(25)** and the gear **(24)**.
    Note: Match the synchromesh ring and cone in case they are to be re-used.
11. Hold the shaft using locally made tool using a clutch cover 4 RM, ref. 3384428 M1 (Fig. 2).
12. If necessary, remove the lubrication tube **(4)** and the spring **(6)**.
13. Loosen the screw **(3)** using a 32 mm socket and a spanner of appropriate length.
14. Remove the shims **(38) (39)**, the Belleville springs **(2)** and the input gear **(1)**.
15. Remove the bush **(8)** together with the cone **(9)**.
16. Remove the tool. Move the shaft out of the casing with the 1st gear **(19)** (Fig. 3) backwards, holding the fork, gear and synchromesh together.
17. Remove the complete assembly (synchromesh, 2nd gear unit and fork) (Fig. 4).
    Note: The gears must be removed in order to extract the fork.
18. Remove the cups **(10)** and **(21)**.
    Note: Match the cups and the cones in case they are to be re-used.
19. Remove the shims **(11)** and the spacers **(12)**, observing the direction of the chamfer **C** (Fig. 5).
20. Remove the cones **(9)** and **(20)** and the cup **(22)**, if necessary. Remove the snap ring **(5)** from the screw **(3)**.

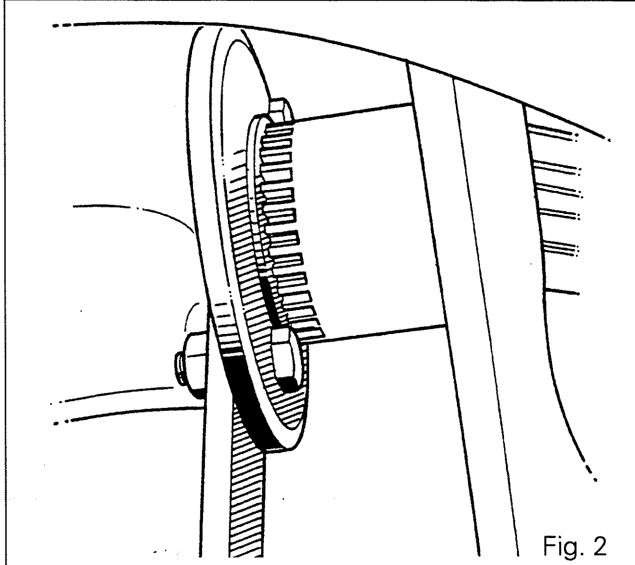


Fig. 2

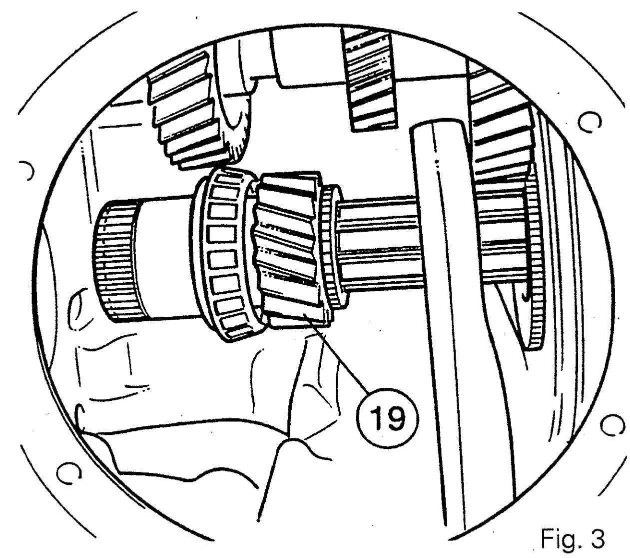


Fig. 3

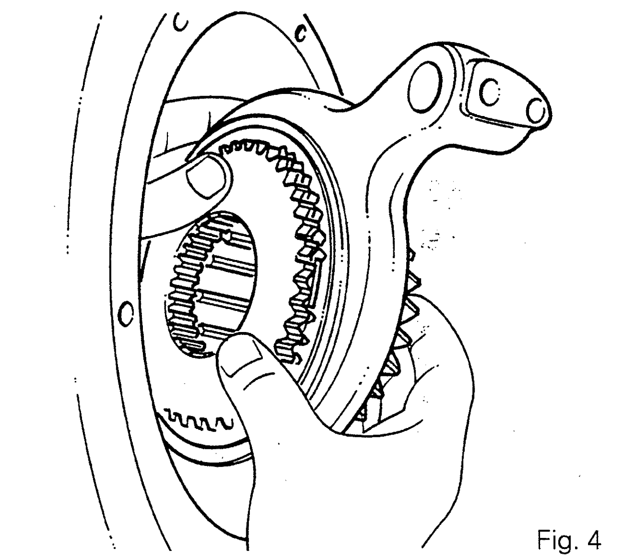


Fig. 4

C. Shimming the input gear

21. Clean and check the parts. Replace any that show defects.
22. Ensure that the shaft **(7)** lubrication channels are not blocked.
23. Lubricate the cones and the cups.
24. If they have been dismounted, using a press, refit the cones **(9)** and **(20)** respectively on the bush **(8)** and shaft **(7)**. Place the snap ring **(5)** in the screw **(3)**. Fit the cup **(22)** in the shaft **(7)**.
25. Place the shaft **(7)** in a vice. Fit the gears and synchromesh as shown in Fig. 6, without the shims **(38)** and **(39)**.
26. Tighten the special screw **(3)** to 30 Nm.
27. Using a comparator measure the axial play of the gear **(1)** (Fig. 6).
28. According to the play observed and the thickness of the shim **(39)**, choose the appropriate shim thickness(es) **(38)** in order to obtain a compression of the Belleville springs ranging **between 1.25 and 1.75 mm.**

    Note: If the play observed exceeds 1 mm, it should be reduced by adding just one shim (38) and measured again more precisely.

29. Remove the screw **(3)**, the Belleville springs **(2)**, the gears unit and the synchromesh.
    Note: Should the input gear (1) be changed on the tractor, the shimming method is the same. First remove the adjustment shims (11).
    Once the input gear has been adjusted, place the shims (11) as shown in Fig. 5.

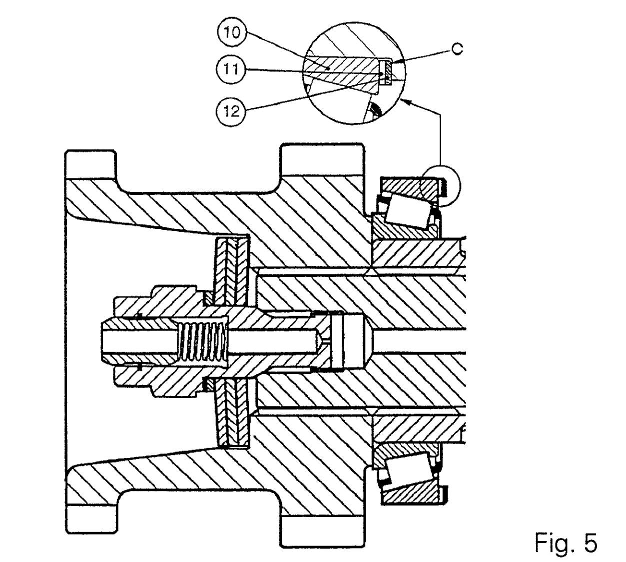


Fig. 5

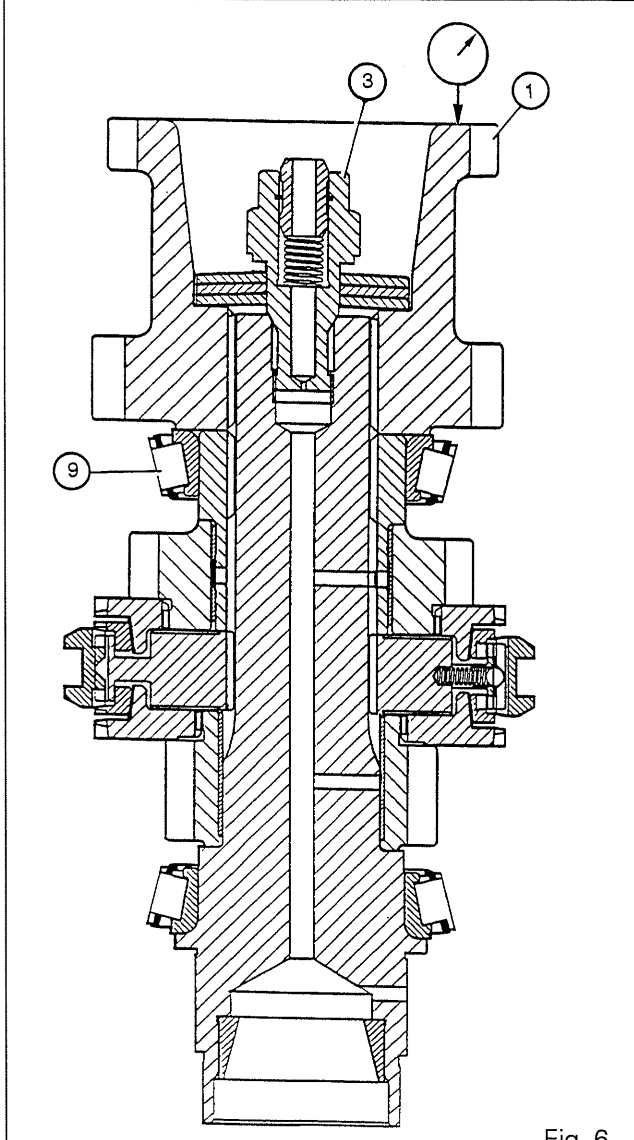


Fig. 6

D. Assembling and shimming the shaft

30. Place the spacer **(12)** with the chamfer **(C)** facing the casing (Fig. 5).
31. Refit the cups **(10)** and **(21)**.
32. Check the wear on the synchromesh rings **(15)** and **(17)** with the cones **(14)** and **(18)**. Go to section 5 A01.
33. Assemble the 2nd gear **(13)**, the cone **(14)**, the synchromesh ring **(15)**, the 1st-2nd synchromesh **(16)**, the ring of the first gear **(17)** and the cone **(18)**.
34. Refit the complete assembly with the fork of the 1st and 2nd gears correctly placed (Fig. 4) between the two walls.
35. Engage the shaft and the 1st gear **(19)** from behind the casing (Fig. 3) holding onto the gears-synchromesh assembly.
36. Slide the bush **(8)** with the cone **(9)** onto the shaft **(7)**.
37. Fit the gear **(1)**, the Belleville springs, **(2)** as shown in Fig. 7, the shims **(39)**- **(38)** choosen during operation 28, followed by the screw **(3)**.
    Note : The shims (38) must be imperatively placed against edge of the screw (3).
38. Fit the blocking tool (Fig. 2). Tighten the screw **(3)** to a torque of 320-360 Nm. Take off the tool.
39. Perform the shimming in order to obtain a preload (Fig. 8) : **P1 = 0.10 a 0.20 max.**
40. Place the contact of the comparator at the end of the shaft (Fig. 9).
41. From the front of the housing, pull the shaft while turning it alternatively to the left and to the right in order to seat the cones correctly in the cups.
42. Put the comparator at 0.
43. Repeat operation 41, but pushing.
    Note: In order to perform a correct preload, reduce the axial play to obtain a value ranging between 0.10 and 0.15, by placing a thickness of shims (11) between the shim (12) and the cup (10).
44. According to the play observed, select the thickness of shims needed to obtain **P1**.
45. Place the blocking tool. Loosen the screw **(3)**. Remove the shims **(38)** and **(39)**, the Belleville springs **(2)** and the gear **(1)**.
46. Take off the bush **(8)** together with the cone **(9)** and the cup **(10)**.
47. Place the shims **(11)** selected during operation 44, between the correctly mounted spacer **(12)** (Fig. 5) and the cup **(10)**.

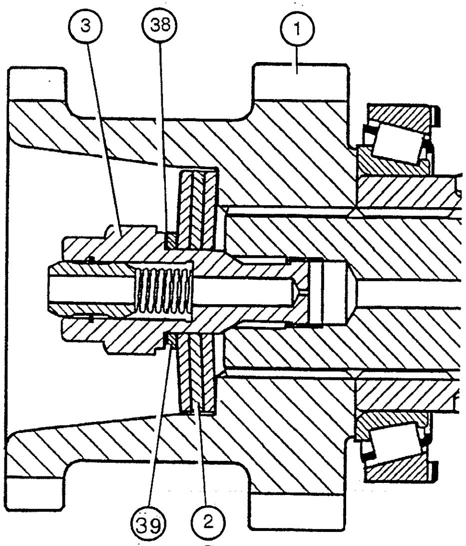


Fig. 7

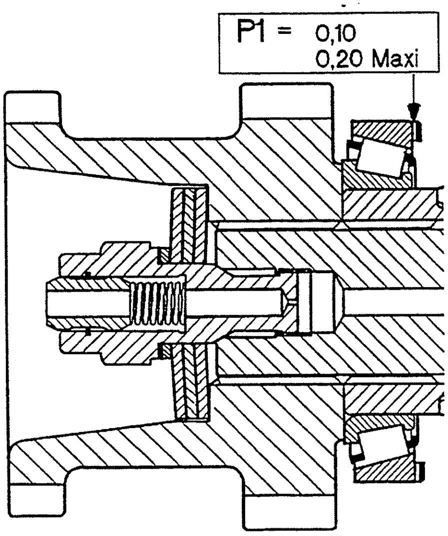


Fig. 8

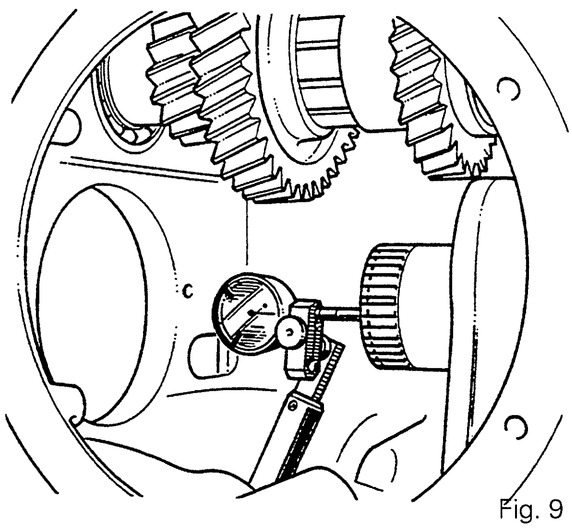


Fig. 9

CONTENTS

Gearbox - *Mainshaft*

48. Install the bush **(8)** together with the cone **(9)**, the gear **(1)**, the Belleville springs **(2)** and the shims **(39) (38)**.
49. Smear Loctite 270 on the screw **(3)** and tighten it to a torque of 320-360 Nm. Remove the tool.
50. In case they were dismantled, place the spring **(6)** and the lubrication tube **(4)** in the screw **(3)**.
51. Check the wear of the ring **(26)** with the cone **(25)**; see section 5 A01.
52. Fit the gear **(24)**, the cone **(25)**, the ring **(26)** and the 3rd-4th synchromesh **(27)**, respecting the direction of assembly.
53. Move the gear **(57)** forward on the lay schaft and install the circlip **(56)** (Fig. 1), without deforming it. Ensure that it is correctly placed.
54. Place the snap ring **(29)**.
55. Manually check:
    - The axial play of the gears
    - The rotation of the shaft and its gear unit
56. Make sure that the 1st-2nd synchromesh works normally.
57. Refit the output shaft. Repeat operations 6 to 36, section 5 E01.
58. Check the rotation of the output shaft and its gear unit manually.
59. Check that the 3rd-4th synchromeshes and the Hare/Tortoise work normally.
60. Place the gearbox on an appropriate support.

E. Refitting the input unit and the gearbox

61. Refit the input unit. Carry out operations 87 to 90 of section 5 B01. Refit the clutch, see section 4 A01.
62. Position the counterplates, the discs, the mechanism and the cover plate (section 5 H01).
63. Refit the guide studs and adjust the forks and the selector of the 1st and 2nd (section 5 D01).
64. Adjust the Hare/Tortoise selector . Carry out operation 92, section 5 C01.
65. Refit the reverse gear selector . Carry out operation, section 5 B01.
66. Refit the selection cover (section 5 C01).
67. Recouple the gearbox on the engine (section 2 B01).
68. Recouple the tractor between the gearbox and the rear axle (section 2 C01).
69. Bleed the brake and clutch control circuits, see section 9 G01 and 4 A01.
70. Check for leaks on the seals and hydraulic connectors.
71. Carry out on road to test the clutch controls of the A, B, C, D ratios of the Dynashift, the reverse gear, the gears and the Hare/Tortoise range.

CONTENTS

5 G01 Layshaft

CONTENTS

Gearbox - *Layshaft*

General

The layshaft and its gears form the upper transmission line of the gearbox.

The layshaft **(51)** supports the following driven gears in order: 2nd **(64)**, 1st **(61)**, 4th **(59)** and 3rd **(57)**. These gears are splined to the shaft and are separated by spacers **(62)**, **(60)** and **(58)**. The end float of the gear assembly is obtained by the shim(s) **[63]**.

The rear gear teeth on the shaft **(51)** run in constant mesh with the Lo range (Tortoise) gear fitted on the output shaft.

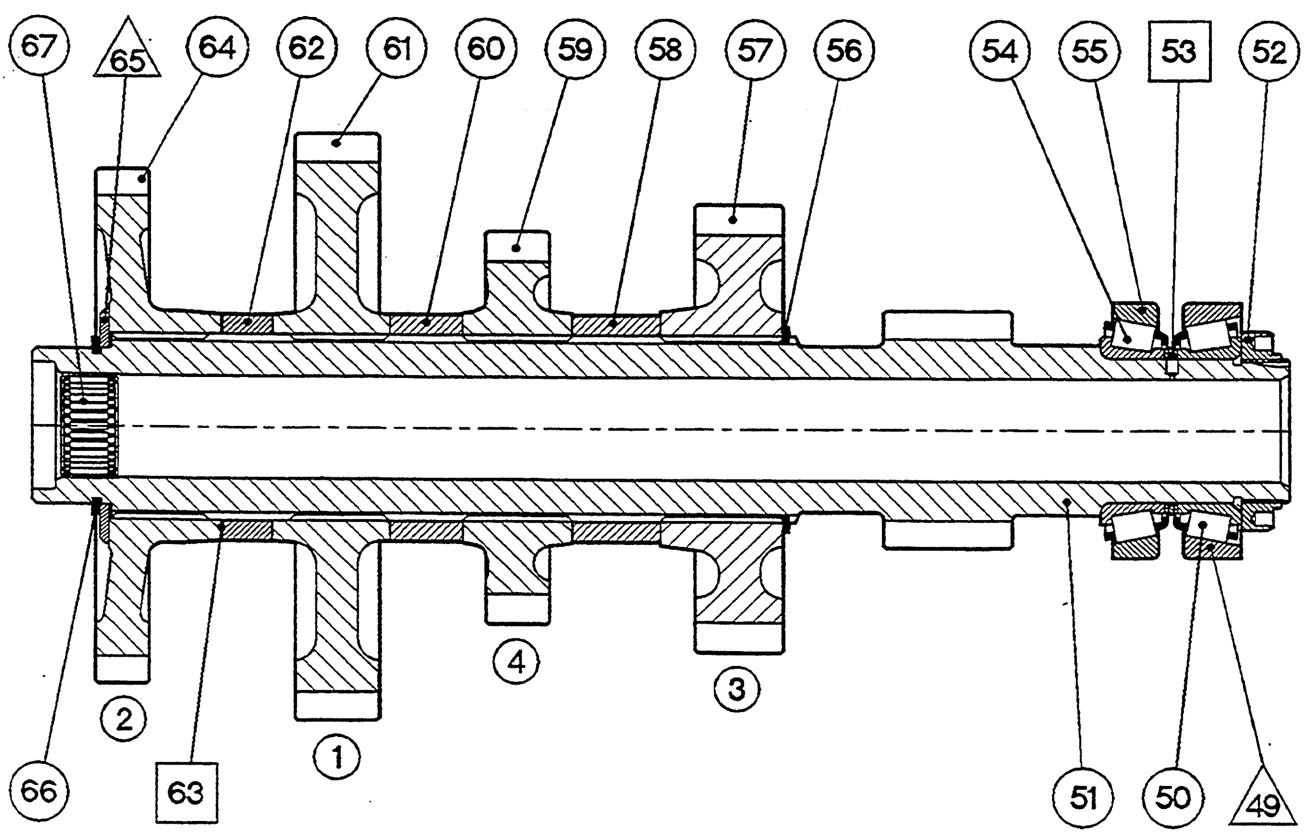
The front of the shaft is supported by a roller bearing mounted at the rear of the Dynashift input unit. The rear of the layshaft is located by two taper roller bearings **/49\ (50)** and **(54) (55)**.

The setting for these bearings is obtained using a shim **[53]** located between the bearing cones **(50)** and **(54)** and the torque of nut **(52)**.

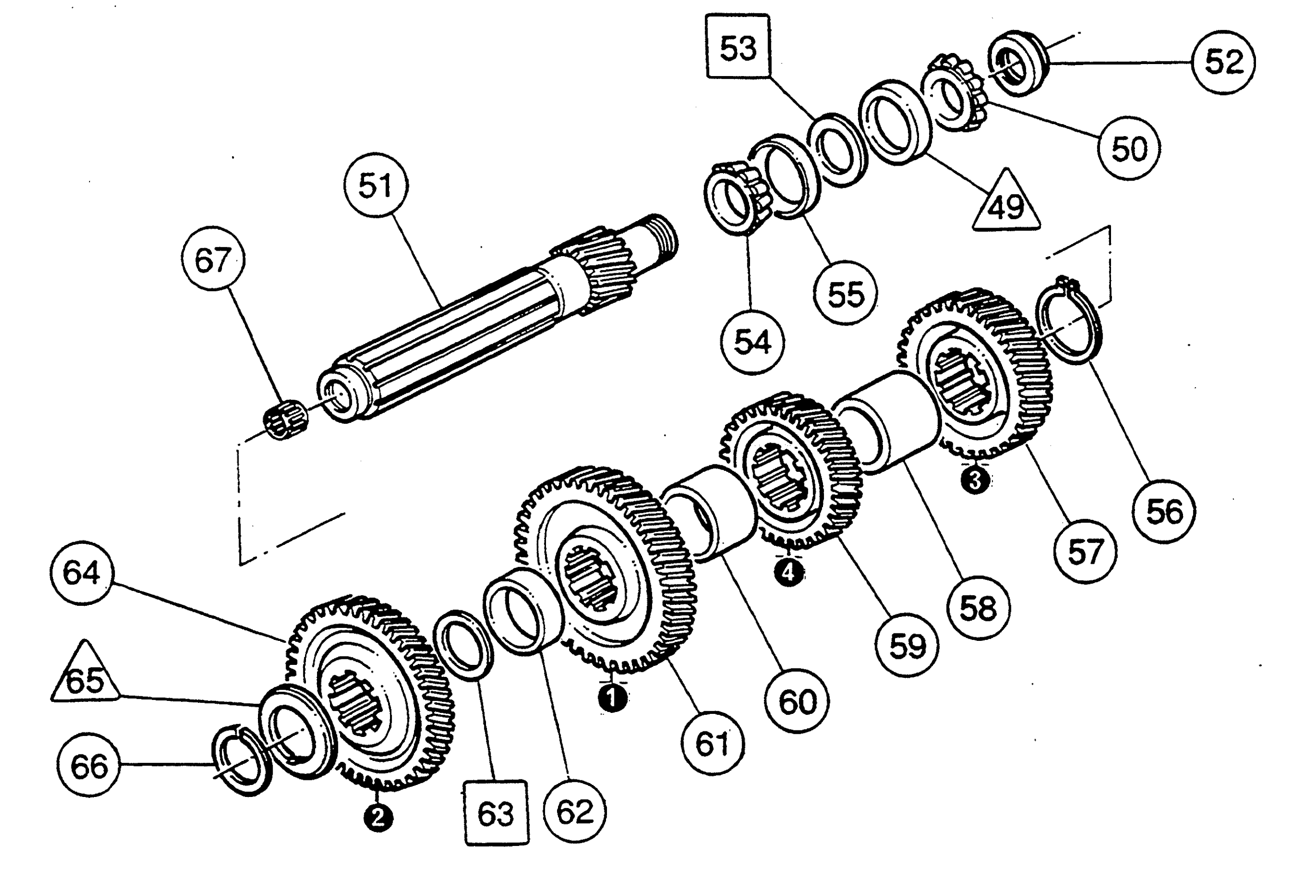
List of parts

/49 Bearing cup
(50) Bearing cone
(51) Layshaft
(52) Nut
[53] Shim
(54) Bearing cone
(55) Bearing cup
(56) Circlip
(57) 3rd/high range gear
(58) Spacer (4th/3rd gear)
(59) 4th gear
(60) Spacer (1st/4th gear)
(61) 1st gear
(62) Spacer (2nd/1st gear)
[63] Shim(s)
(64) 2nd gear
/65 Washer
(66) Snap ring
(67) PTO shaft needle roller bearing

Overall view



Exploded view



A . Preliminary operations

The gearbox must be removed before dismantling the layshaft.

1. Split the tractor between the gearbox and the rear axle (section 2 C01).
2. Separate the gearbox from the engine (section 2 B01).
3. Remove the selector cover (section 5 C01).
4. Remove the handbrake cover plate, the pressure plates, the discs and the mechanism (section 5 H01).
5. Place the gearbox on an appropriate support. Remove the input unit, carry out operations 6 to 11 of section 5B01.
6. Remove the selector rails and the forks (section 5 D01).
7. Unlock and slightly slacken the nut **(52)** by immobilizing the Tortoise gear using a drift. (Fig. 1). This operation simplifies nut removal when the output shaft and mainshaft are dismantled.

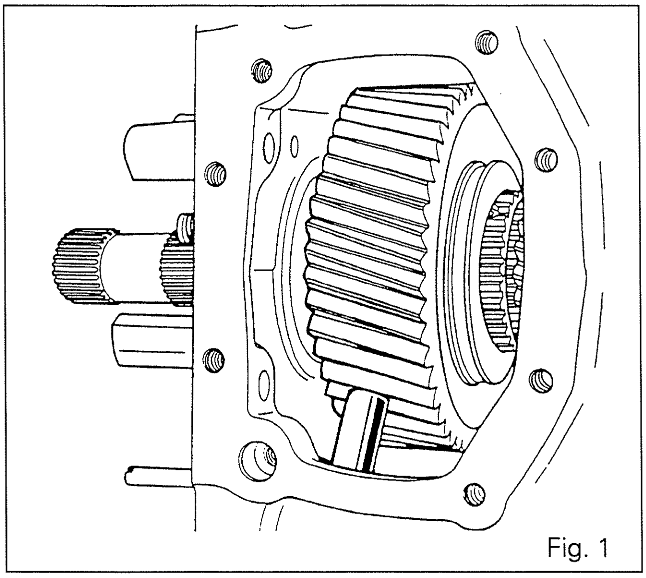


Fig. 1

Gearbox - *Layshaft*

8. Remove the output shaft. Carry out operations 4 and 5, section 5 E01.
9. Remove the mainshaft. Carry out operations 8 to 19, section 5 F01.

B . Disassembly

10. Remove the layshaft nut **(52)** and the bearing cone **(50)**.
    Note: Keep the bearings cones and cups paired if they are to be reused.
11. Remove the assembled layshaft **(51)** with its gears (Fig. 2).
12. Remove shim **[53]** and remove the bearing cone **(54)**.
13. If necessary drive out cups **/49** and **(55)** noting their positions.(Fig. 5).
14. On the layshaft **(51)**, remove snap ring **(66)** and washer **/65** noting its position. Remove 2nd gear **(64)**, shim(s) **[63]**, spacer **(62)**, 1st gear **(61)**, spacer **(60)**, 4th gear **(59)**, spacer **(58)**, 3rd gear **(57)** and circlip **(56)** (Fig. 3).
15. If necessary, drive out the needle roller bearing **(67)** (Fig. 3).

C . Reassembly and shimming

16. Clean and inspect the parts. Replace those which are defective.
17. Ensure that the rear bearing cones **(50) (54)** lubrication holes in the shaft are not blocked.
18. Lubricate the cones and the cups.
19. If removed, press in the roller bearing **(67)** until it meets the shoulder of shaft **(51)**.
    Note : Ensure that the needle rollers rotate freely in the cage.
20. Fit a new circlip **(56)** the correct way round.
    Refit 3rd gear **(57)**, spacer **(58)**, 4th gear **(59)**, spacer **(60)**, 1st gear **(61)** and spacer **(62)**.
    Refit 2nd gear **(64)** without shims **[63]** (Fig. 3).
21. Install washer **/65** and snap ring **(66)** (Fig. 3). Ensure that they are the correct way round.
    - Washer chamfer away from the gear face.
    - Snap ring point not to be against the washer.

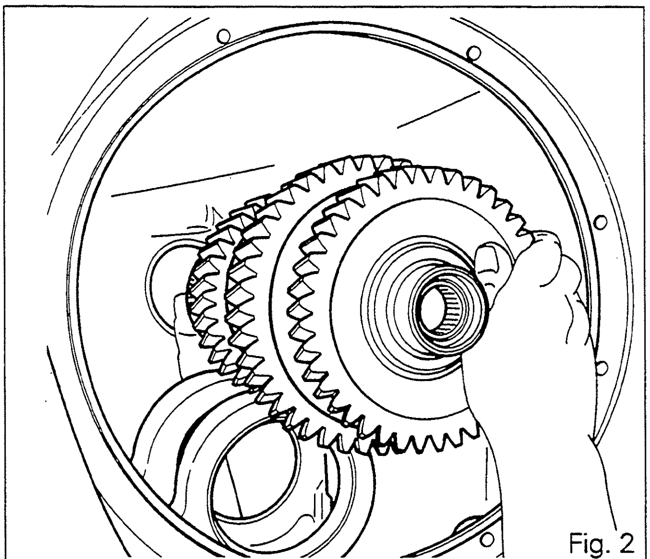


Fig. 2

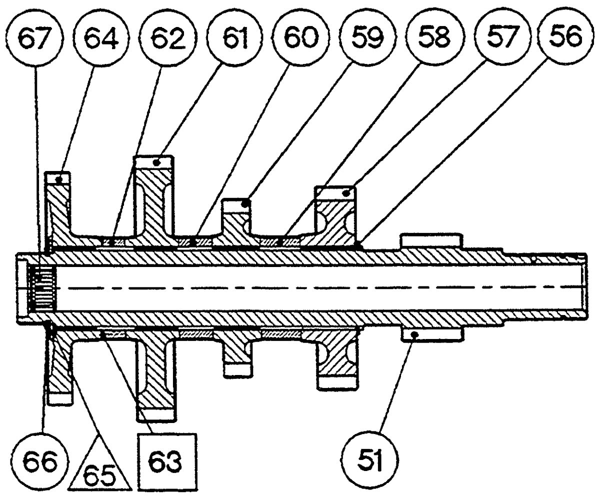


Fig. 3

22. Using feeler gauges, measure the gap between 2nd gear **(64)** and the spacer **(62)**.
    Depending on the measurement, select a thickness of shims to obtain a clearance (Fig. 4) :
    J1 = 0.02 to 0.31
23. Remove snap ring **(66)** and the washer **/65**, remove 2nd gear.
24. Slide the shims, selected during operation 22, onto the shaft.
25. Fit 2nd gear and the washer **/65** with the chamfer facing outwards. Replace and fit the ring **(66)**.
    Note: Ensure that the ring is correctly seated in its groove.
26. To simplify reassembly of the output shaft gears, remove circlip **(56)** from its groove without distorting it and move 3rd gear **(57)** backwards.
27. If removed, press in the cups **/49** and **(55)** until they are in contact with the shoulder of the housing.
    Note : The large cup /49\\ must be fitted in the rear bore of the gearbox (Fig. 5).
28. Place bearing cone **(54)** and shim **[53]** on the layshaft **(51)**.
29. Clean and degrease the layshaft **(51)** thread and the new nut **(52)**.
30. Insert the assembled shaft into the housing. Install the cone **(50)**. Temporarily tighten the nut.
    Note: The cones (50) and (54) and the cups /49\\ and (55) must be one of the "Set right" type.
    Due to the machining tolerances of the housing, a shim **[53]**, thickness 4.46 is used for shimming (Fig. 6).
    This sets the bearings as follows :
    Preload of 0.03 to end float of 0.15
    The input unit **must be** refitted if the shimming check is necessary. This ensure that the front of the layshaft **(51)** is correctly supported.

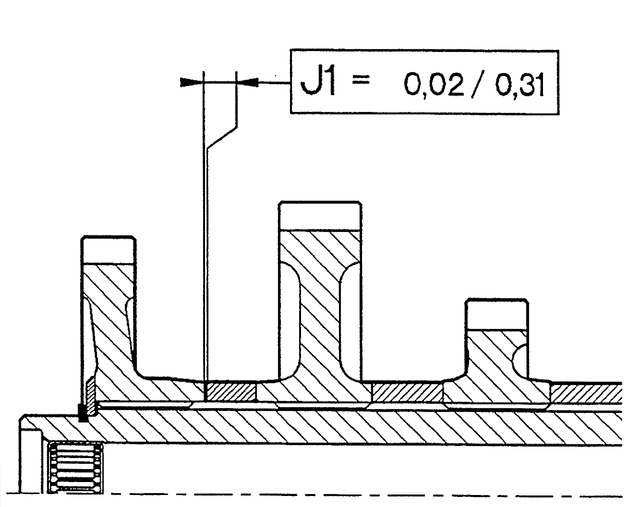


Fig. 4

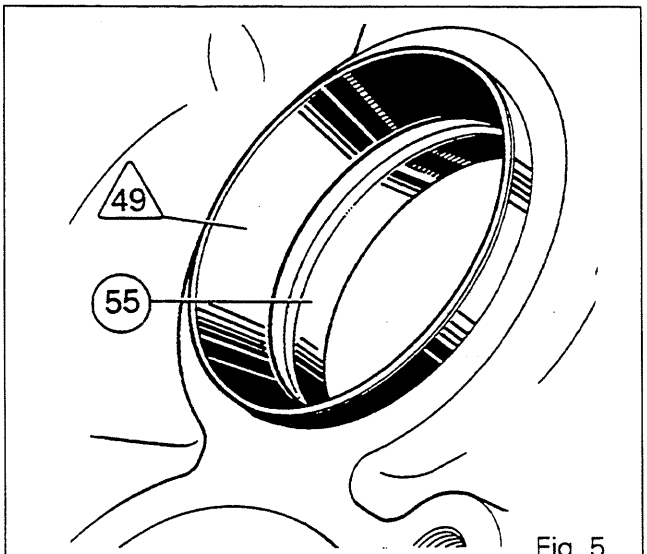


Fig. 5

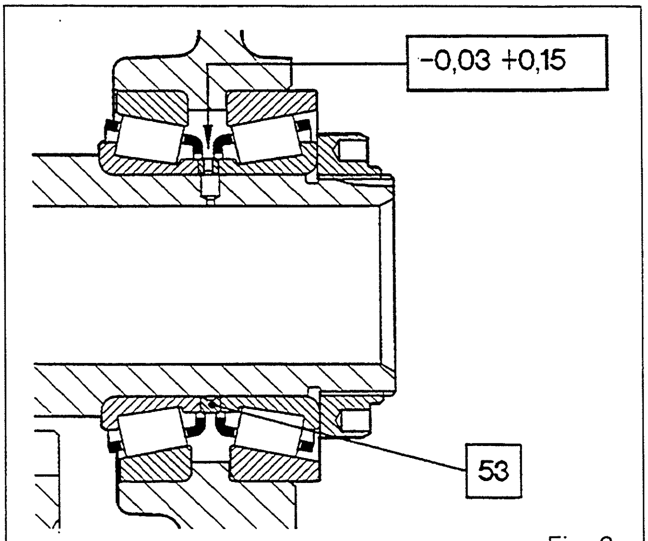


Fig. 6

31. Refit the mainshaft. Carry out operations 21 to 56, section 5 F01.
32. Refit the output shaft. Carry out operations 6 to 36, section 5 E01.
33. Manually check that the output shaft and its gears rotate correctly.
34. Check that the 3rd/4th and Hare/Tortoise synchro operate normally.
35. Immobilize the gear using a drift (Fig. 7). Coat the nut **(52)** with Loctite 270 and tighten to a torque of 100 - 150 Nm using socket MF391. Lock the nut by deforming its collar in the slot using a pin punch. Wipe any traces of Loctite from the external diameter of the nut.

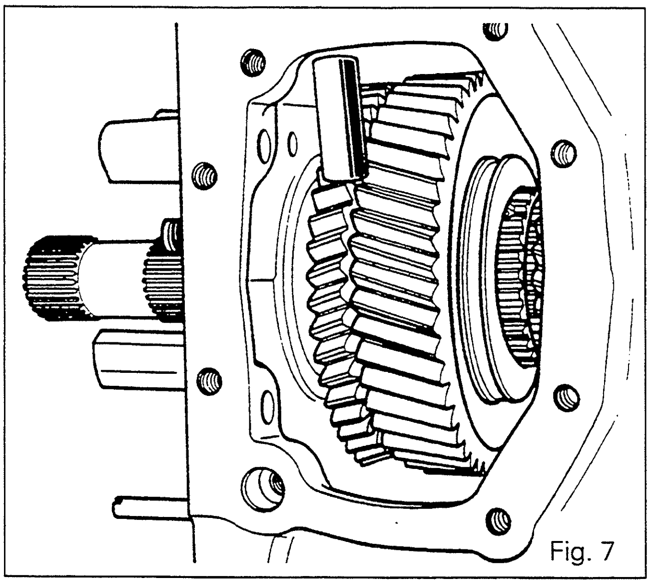


Fig. 7

D . Input unit and gearbox refitting

36. Place the gearbox on an appropriate support. Refit the input unit. Carry out operations 87 to 90, section 5 B01. Refit the clutch (see section 4 A01).
37. Install the pressure plates, discs, mechanism and cover plate in the handbrake support (section 5 H01).
38. Refit selector rails, adjust forks and 1st - 2nd selector (section 5 D01).
39. Adjust Hare/Tortoise selector (section 5C01).
40. Refit reverse shuttle selector. Carry out operation 92, section 5 B01.
41. Refit selector cover (section 5 C01).
42. Connect the gearbox to the engine (section 2 B01).
43. Connect the tractor between the gearbox and the rear axle (section 2 C01).
44. Bleed the brake and clutch systems (see section 9 G01 and 4 A01).
45. Check at unions and seal mating surfaces for leaks.
46. Carry out a road test and check the clutch controls, A, B, C, D Dynashift speeds, the reverse shuttle, gears and Hare/Tortoise range.

5 H01 Handbrake unit and control

CONTENTS

Gearbox - Handbrake

General

The handbrake mechanical control assembly is installed to the rear of the gearbox on the output shaft. It consists of a mechanism placed between the five friction discs splined onto the output shaft, and three intermediate plates.
The mechanism consists of two cast iron plates held by springs and separated by balls housed in rails.
It is actuated by a control rod fitted with a cam which is, itself, controlled by a link operated by the handbrake lever located in the cab.
Five oil ways drilled in the unit **(1)** provide oil to the intermediate plates and the friction discs.

List of parts

(1) Unit
(2) Discs
/3 Intermediate plates
(4) Mechanism
(5) Closing plate
(6) Bolt
(7) Bolt
/8 Bolt
(9) Finger
(10) Pin
(11) Bush
(12) Spring
(13) Nut
(14) Bolt
(15) Locating dowel
(16) Clevis
(17) Pin
(18) Link
/19 Rectangular plate
(20) Adjusting nut
(21) Circlip
(22) Flat washer
(23) Spring washer
(24) Cam
(25) Control rod
(26) O-ring
(27) Pin
(28) Seal

Operation

When the handbrake lever is pulled, the cable pulls the link **F** (Fig. 3) which is splined onto the control rod **(25)**. The control rod **(25)** pivots and moves the cam **(24)** which pushes the link **(18)**, causing the mechanism to push outwards **(4)**.
The discs **(2)** are then compressed between the mechanism, the closing plate **(5)**, the intermediate plates **/3** and the support **(1)**, thus preventing the output shaft from rotating.
When the handbrake lever is released, the spring **M** returns the link **F** (Fig. 3) which operates the control rod **(25)** to return the cam **(24)** and free the mechanism.

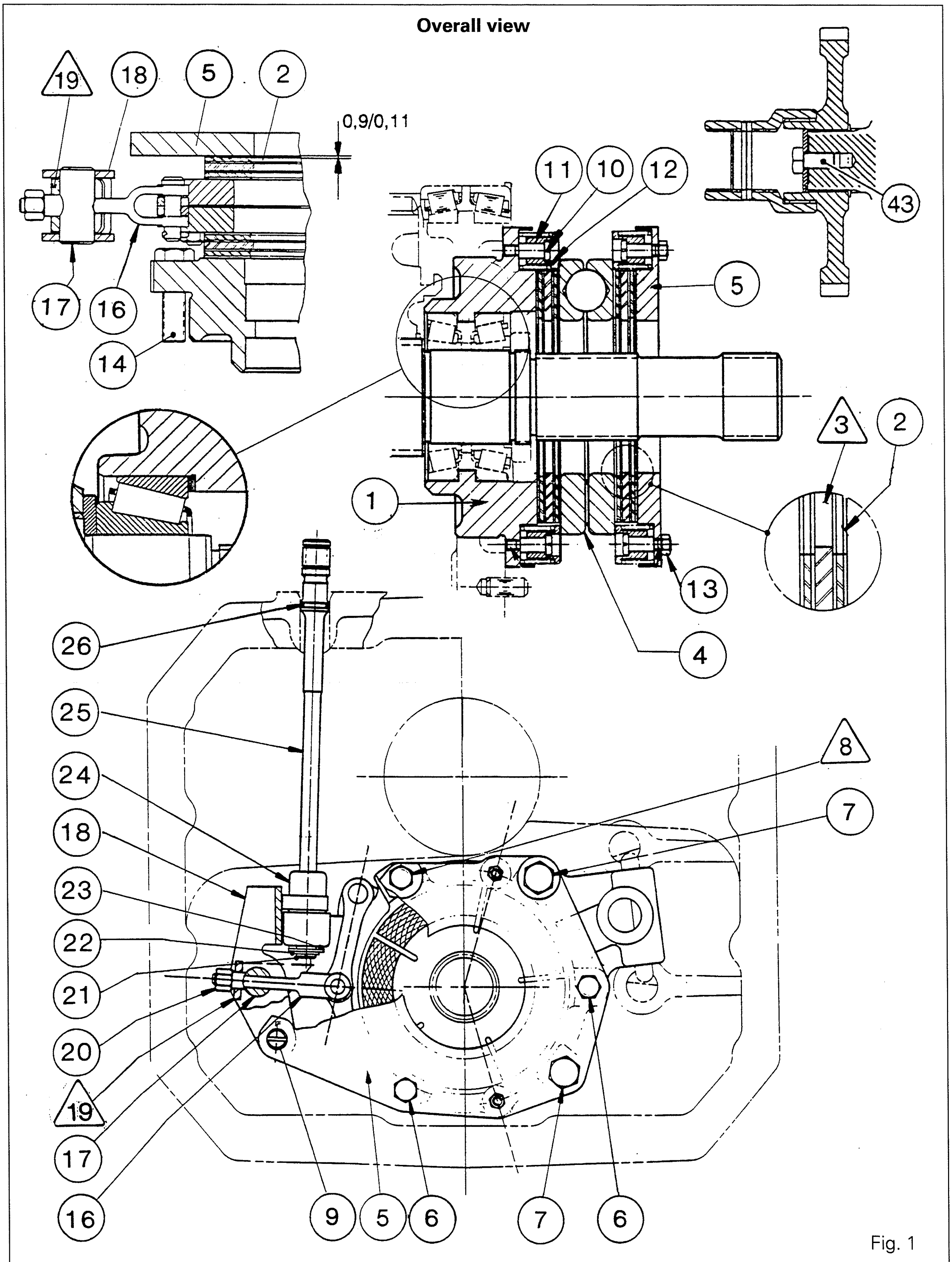

Overall view
19
18
5
2
0,9/0,11
11
10
12
5
43
17
16
14
1
3
2
13
4
26
25
24
18
23
22
21
20
19
17
16
8
7
9
5
6
7
6

Fig. 1

Gearbox - Handbrake

Exploded view

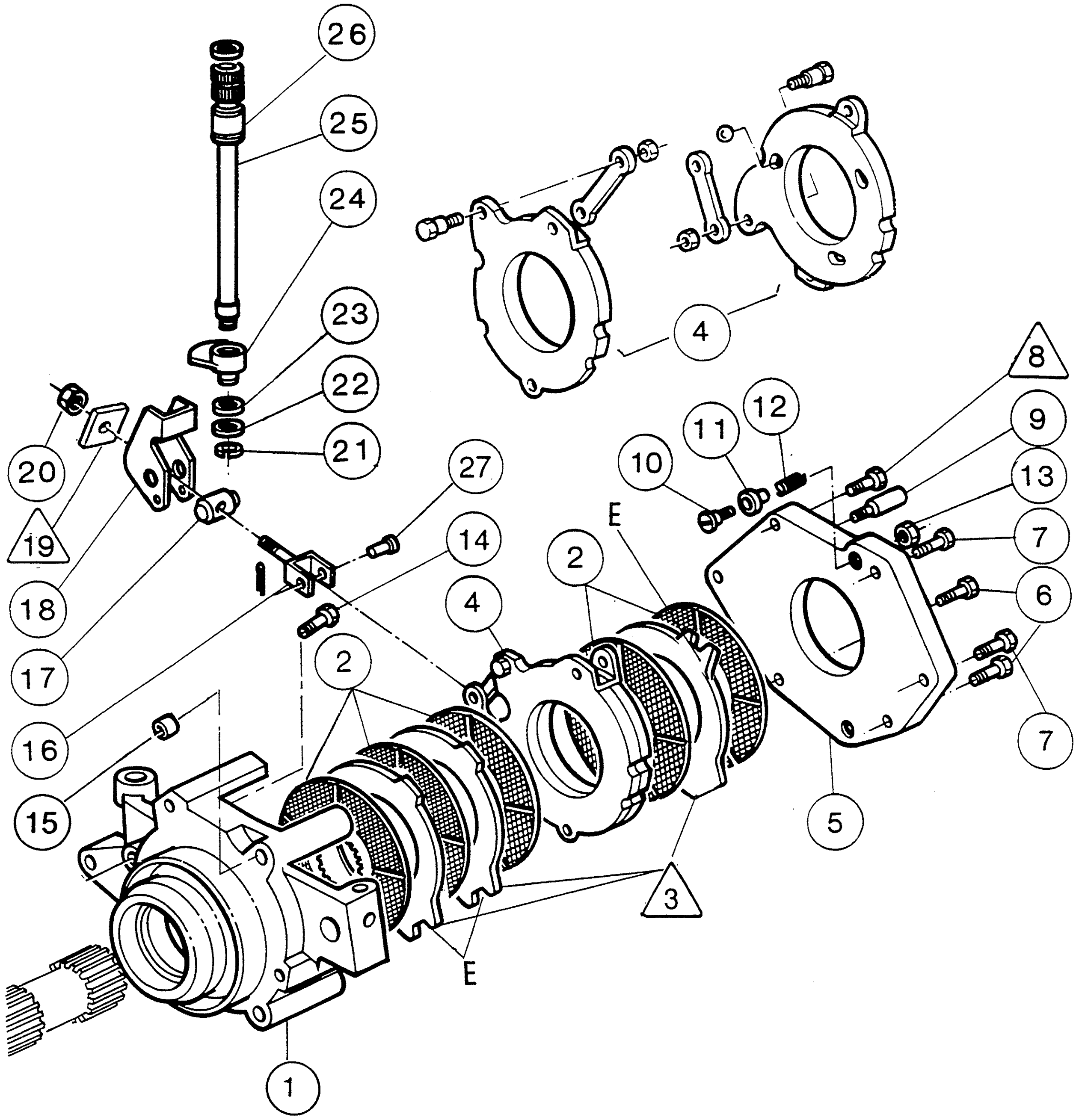


Fig. 2

A . Disassembling and reassembling the handbrake unit

Disassembly

The discs **(2)** and the intermediate plates **/3**, the mechanism **(4)** and the closing plate **(5)** can be removed without uncoupling the rear axle from the gearbox.
Simply remove :

- the left hand cover (section 9 F02 or 9 R02)
- the 3rd point support (section 7 B01)
- the transfer pipe (closed centre version)
- the dowel from the sleeve of the gearbox output shaft
- the 4 WD driving gear **P** from the driving pinion after pushing the sleeve **M** onto the output shaft
- the PTO clutch after pushing the sleeve onto the driving pinion (section 7 A01)
- the hydraulic pump manifold (opened centre version)

- Unscrew the bolts **(6)**, **(7)** and **/8**.
- Remove the discs **(2)**, the plates **/3**, the mechanism **(4)** and the closing plate **(5)** passing between the output shaft and the driving pinion.
- Check for any sign of excess wear. Replace any damaged parts.
  Note: The discs (2) are to be replaced as complete sets.
- The cab must be raised in order to remove the control rod **(25)**.
- In order to remove the unit **(1)**, the tractor must be split between the gearbox and the rear axle (see section 2 C01).
- If the unit **(1)** is to be replaced, proceed with shimming of the output shaft (see section 5 E01).

Reassembly

Carry out the same operations as for disassembly but in the reverse order.

Fitting specifications

- Smear the thread on the finger **(9)** and the pins **(10)** with Loctite 270.
- The recesses on the intermediate plates must be placed on the bosses machined on the unit **(1)**.
  The recesses in the front plate must be oriented towards the lower boss and the recess in the rear plate must be oriented towards the upper boss (Fig. 2).
  This layout avoids interference between the plates and the bolts on the mechanism **(4)**.
- The short bolt **/8** must be fitted in the spotface in the closing plate **(5)** (Fig. 1).
- Plate **/19** is rectangular in shape. It must be positioned horizontally so that the pin **(17)** bears correctly on the link **(18)**.

Tightening torques

- Bolts **(7)** **(14)** : 85 - 128 Nm
- Rod **(25)** : 180 Nm, after setting of the mechanism
- Bolts **(6)** **/8** : 34 - 51 Nm
- Bolts **(43)** : 91 - 122 Nm - Loctite 241

Adjusting the mechanism

- Act on the nut **(20)** and adjust the clearance of the mechanism **(4)** by sliding a 0.5 shim on each side of the mechanism (Fig. 1) in order to obtain a total play between 0.9 and 1.1.

B . Control

Fitting

- Feed the cable **(V)** from below towards the inside of the cab and attach it with the circlip **(W)**.
- Secure the cable onto the handle **(A)** when the brake is released, with the pin **(P)**, washer **(Q)** and dowel **(R)**.
- Insert the cable into the sheath stop **(D)**.
- Fit the lever **(F)**, complying with the dimension 230 + 12, which corresponds to the handbrake released position, with the cam **(24)** pressing on the link **(18)**.
- Attach the end of the cable **(V)** onto the lever **(F)**.
- Position the spring **(M)** in accordance with the position indicated in Fig. 3. Adjust the nut **(T)** and lock the locknut **(U)**.

Checking for correct operation

- Pull the lever **(A)**. The initial braking travel must be seven or eight notches under a load of approximately 30 daN.
- The indicator light must come on and the buzzer sound.
- Release the lever **(A)**. The assembly must return to the brake released position.
- The assembly must operate freely without binding or friction points.

In released position : The buzzer must be off and the indicator light must go out.

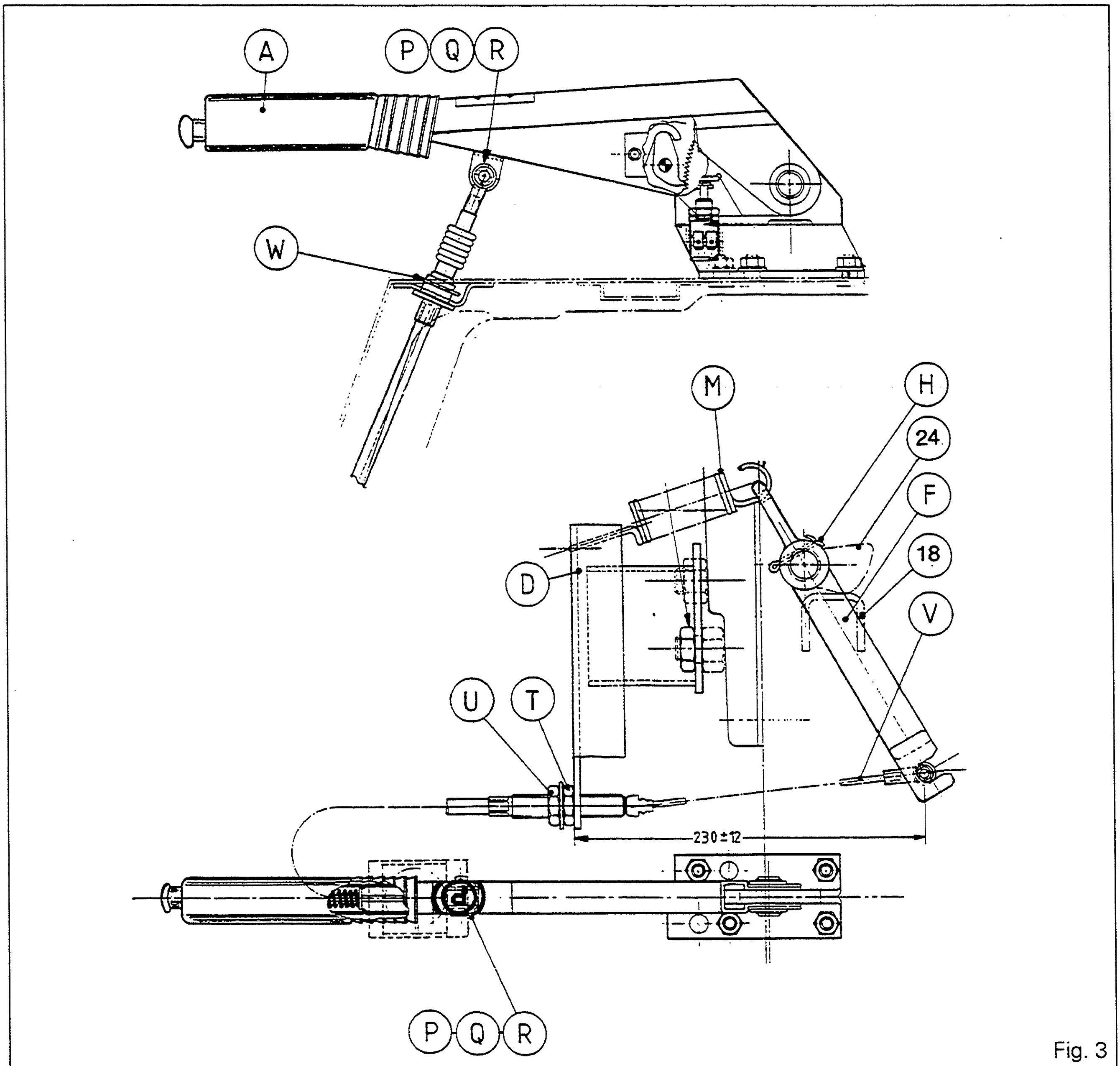
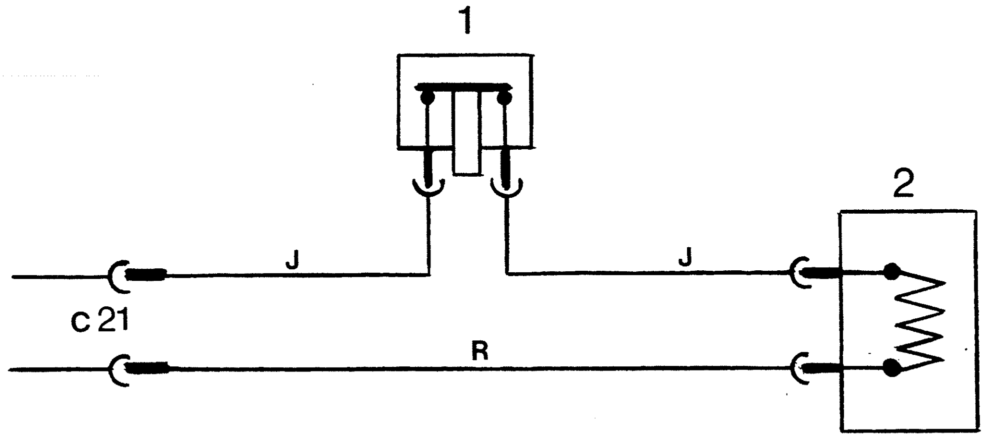


Fig. 3

C . Buzzer wiring diagram

C21 - 2 ways - black connector
1 - Clutch pedal upper switch
2 - Handbrake buzzer

Wire colours
J : Yellow
R : Red



6 . REAR AXLE

Contents

6 A01 Description of rear axle

CONTENTS

Rear axle - *Description*

General

The rear axle is made up of four main housings :
- The centre housing which contains the bevel gear, the 540 and 1000 rpm or 750 and 1000 rpm PTO transmission and the main brakes.
  It also supports the two trumpets, the lift cover and the side covers as well as the 3rd point support (see sections 7D01, 9F01 and 9F02 or 9R01 and 9R02 in according to version).
- The right-hand and left-hand trumpets attached on either side of the centre housing, acting as a housing for the rear wheel drive system (depending on the version, see sections 6B01, 6B02 and 6B03).
- The lift cover installed on the upper section of the centre housing supports the lift arms linked to the tractor's hitch links (see section 6H01).

Power take-off drive

The rotation of the shaft passing through the gearbox, which is proportional to the engine speed, is transmitted to the hydraulic clutch located at the front of the centre housing (see 6E02).
In the engaged position, drive is transmitted by a countershaft and a set of driving and driven gears,a 540/ 750 or 1000 rpm PTO shaft. Speeds are selected by a system of interchangeable shafts (see 7C01).
A hydraulic braking system stops the rotation of the PTO shaft in the disengaged position.

Main brakes

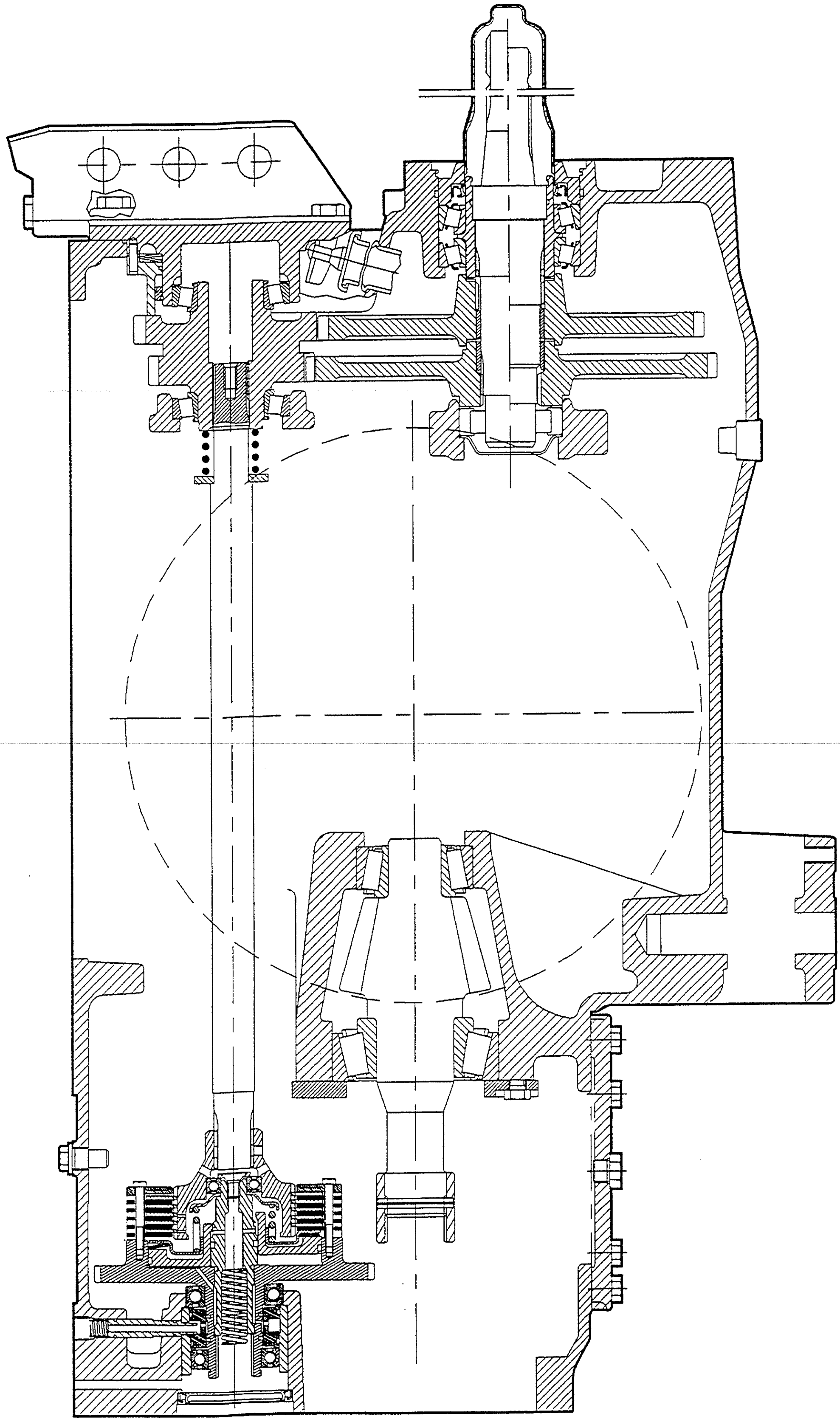
Two pistons mounted laterally in two cavities in the centre housing act on two discs which are rigidly coupled with the trumpet input planet gears. The brake pistons are activated hydraulically.

A . Centre housing assembly

Differential

The input bevel gear is driven by the gearbox output shaft via a splined sleeve. The helical bevel crown wheel and pinion set transmits the drive to the final trumpet reduction units. A dog-type differential locking system actuated by hydraulic pressure is incorporated into the casing (see 6C01).
The differential lock is controlled by the Autotronic system.

Rear axle - *Description*

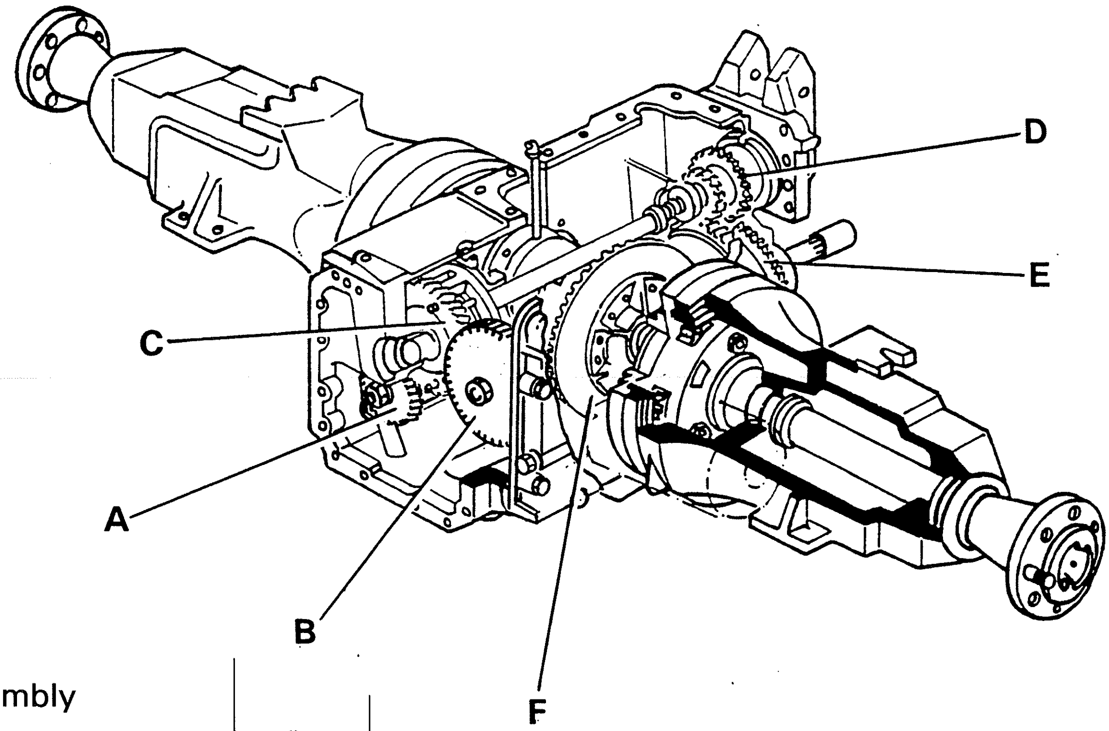


Rear axle - Description

B. Disassembly guide, open centre

Note: Figures 1 to 9 indicate the dismantling order.

For the dismantling of the main assemblies, see the table below.



Servicing on assembly

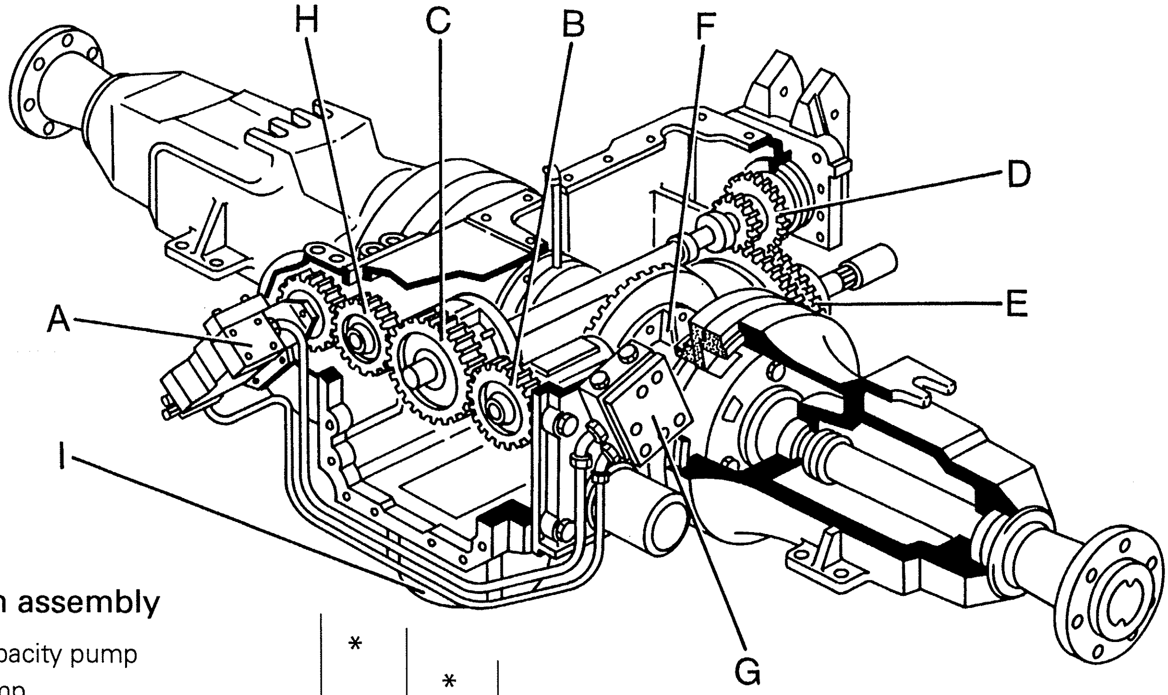
- **A** RH hydr. pump
- **B** LH hydr. pump (if fitted)
- **C** PTO clutch
- **D** Driving gear
- **E** PTO gears
- **F** Differential - Crownwheel pinion

Servicing on assembly	A	B	C	D	E	F
	*	*	*	*	*	*
Components to be disassembled						
Draining	1	1	1		1	1
RH cover	2					
LH cover		2	2			
Remove hood - Raise cab					2	2
Spool valves support					3	3
Fuel tank					4	4
Lift cover					5	5
3rd point support			3	1	6	6
Driving gear / Countershaft			4		7	7
PTO output shaft					8	
Trumpets						8

C . Disassembly guide, closed centre

Note : Figures 1 to 9 indicate the dismantling order.

For the dismantling of the main assemblies, see the table below.



Servicing on assembly

- **A** Variable capacity pump
- **B** Charge pump
- **C** PTO clutch
- **D** Driving gear
- **E** PTO gears
- **F** Differential - Crownwheel pinion
- **H** Idler gear (variable capacity pump driving)
- **I** 4 WD housing

Components to be disassembled	A	B	C	D	E	F	H	I
	*	*	*	*	*	*	*	*
Draining	1	1	1		1	1	1	1
RH cover							3	
LH cover		2	2					
Remove hood - Raise cab	2				2	2	2	
Spool valves support					3	3		
Fuel tank					4	4		
Lift cover					5	5		
3rd point support			3	1	6	6		
Driving gear / Countershaft			4		7	7		
PTO output shaft					8			
Trumpets						8		

6 B01 Standard trumpet housings

CONTENTS

Rear axle - *Standard trumpet housings*

General

Description

The trumpet housings support the right-hand and left-hand axle shafts and house the final reduction units which transmit the drive from the differential assembly. The two trumpet housings are symmetrical and are fitted on either side of the centre housing.

Construction

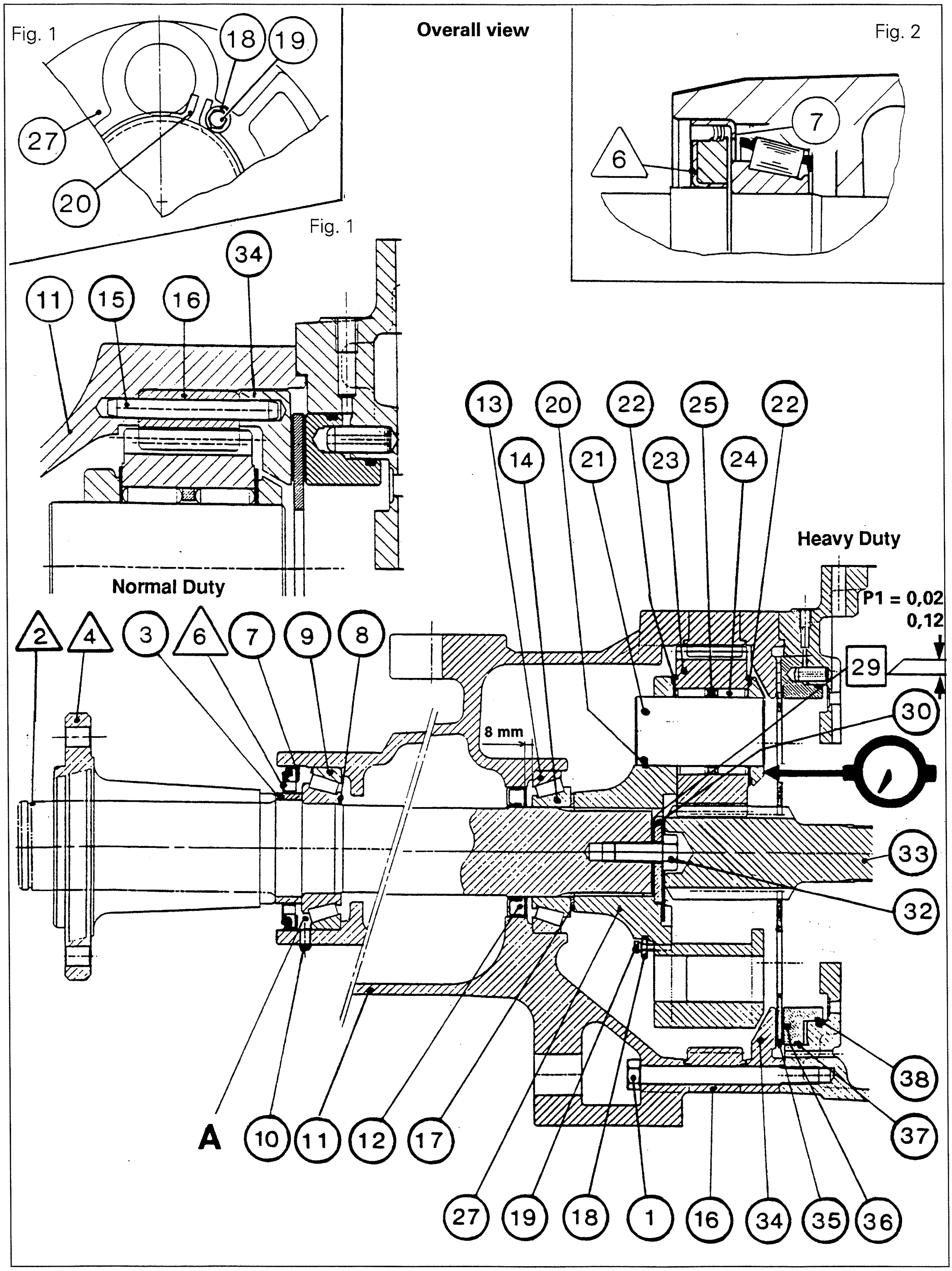
The plain axle shaft **/2** of flanged axle shaft **/4** is supported by two taper bearings comprising cups **(9)** and **(13)** and cones **(8)** and **(14)** fitted opposite one another.
The final reduction unit is sealed by means of a lip seal **(12)**. The triple lip seal **/6** protects the outer bearing.
The planetary carrier **(27)** is splined onto axle shaft **/2** or **/4** and comprises three planet gears **(23)** which are meshed with the ring gear **(16)** and sun gear **(33)**.

In the Normal Duty version, the ring gear **(16)** is force fitted in the trumpet housing **(11)** and secured by five locating dowels **(15)** (Fig. 4).
In the Heavy Duty version, the ring gear is positioned between the trumpet housing **(11)** and the brake plate **(34)** (Fig. 4). The preload on the taper bearings is obtained by means of shims **[29]** positioned at the end of the axle shaft.
The axle shaft **/2** or **/4** and the planetary carrier **(27)** are held by washer **(30)** and bolt **(32)**.

List of parts

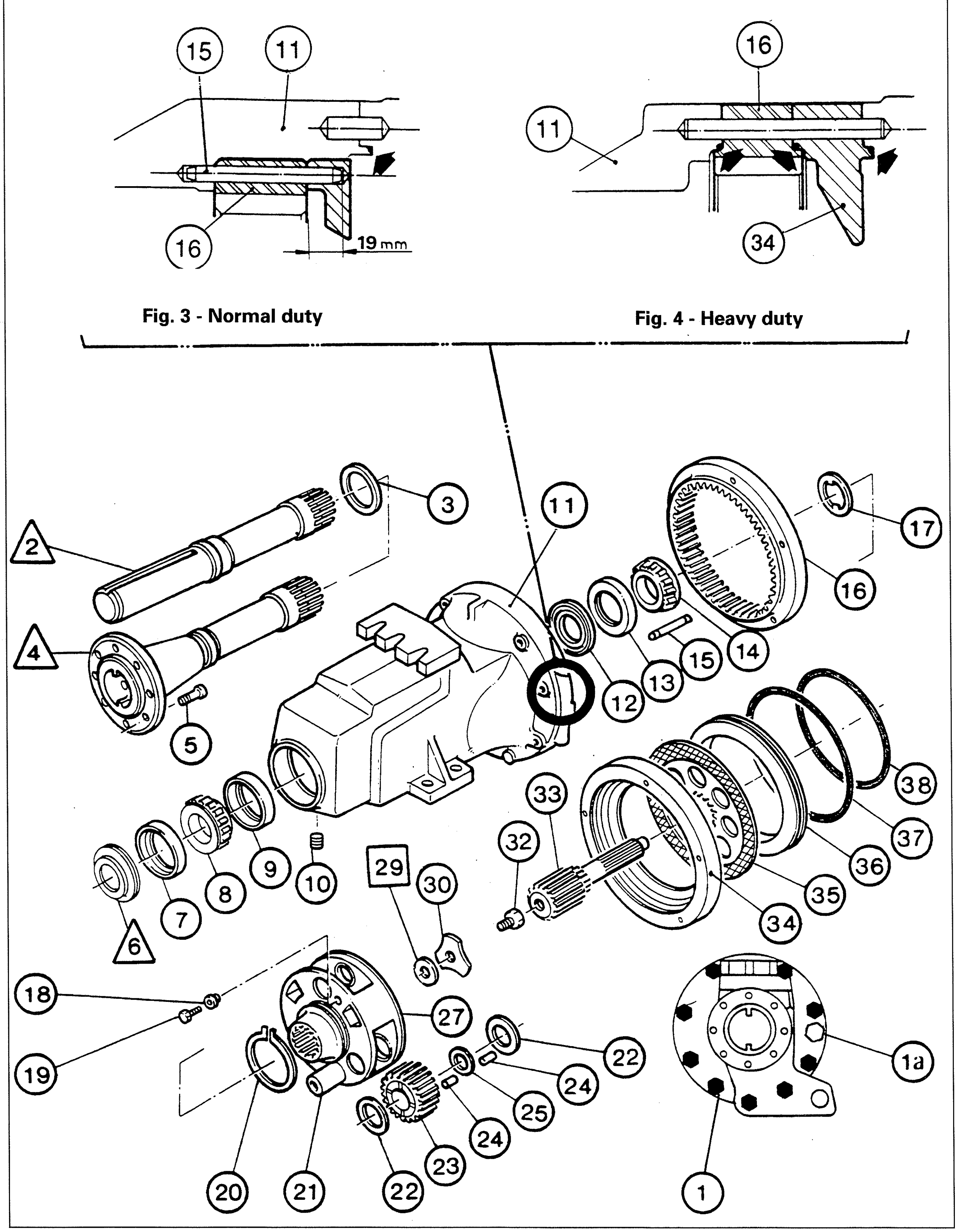
- **(1)** Bolt
- **(1A)** Bolt (Heavy Duty version)
- **/2** Plain axle shaft
- **(3)** Bush (plain axle shaft, 85 dia.)
- **/4** Flanged axle shaft
- **(5)** Wheel stud
- **/6** Triple lip seal
- **(7)** Seal housing
- **(8)** Bearing cone
- **(9)** Bearing cup
- **(10)** Threaded plug
- **(11)** Trumpet housing
- **(12)** Seal
- **(13)** Bearing cup
- **(14)** Bearing cone
- **(15)** Locating dowel
- **(16)** Ring gear
- **(17)** Spur washer
- **(18)** Spacer
- **(19)** Bolt
- **(20)** Circlip
- **(21)** Planetary gear pin
- **(22)** Washer
- **(23)** Planetary gear
- **(24)** Needle-roller
- **(25)** Spacer
- **(27)** Planetary carrier
- **[29]** Shim(s)
- **(30)** Retaining washer
- **(32)** Bolt
- **(33)** Sun gear
- **(34)** Brake plate
- **(35)** Brake disc
- **(36)** Brake piston
- **(37)** O-ring
- **(38)** O-ring

Rear axle - Standard trumpet housings



Rear axle - Standard trumpet housings

Exploded view



A. Removing and refitting the trumpet housing assembly

Removal

1. Drain the rear axle only.
2. Immobilise the tractor. Remove the wheel. Position a supporting stand.
3. Remove the cab attaching bolts and the stabiliser bracket.
4. Remove the lifting ram pin.
5. Support the trumpet housing with a suitable support and a trolley jack.
6. Remove bolts **(1)** without removing bolt **(1A)**, (Heavy Duty version).
7. Separate the trumpet housing assembly from the centre housing. Remove the disc **(35)**, the brake plate **(34)** (Normal Duty version) and the sun gear **(33)**. The piston **(36)** and seals **(37)** and **(38)** remain in the housing.
   Note : Do not press the brake pedal.

Refitting

8. Clean the mating faces of the trumpet housing and the centre housing. Remove any traces of old sealing compound. Dry the parts.
9. Apply a bead of silicon sealing compound (of the «Silicomet» type) to the inner edge of the centre housing. The diameter of the bead applied must not exceed 3 mm in order to avoid blocking the oil return hole in the housing.
10. Reinstall the sun gear **(33)**, the brake plate **(34)** (Normal Duty version) and the brake disc **(35)**.
11. Support the trumpet housing with a suitable supporting stand and a trolley jack. Fit the trumpet housing onto the two locating studs screwed into the centre housing. Turn the axle shaft and push the trumpet housing until it comes into contact with the centre housing.
12. Remove the locating studs. Coat bolts **(1)** with a sealing compound of the «Plastex» or «Hylomar» type and tighten to a torque of 175 - 270 Nm.
13. Carry out procedures 1 to 4 in reverse order.
14. Check the lift operation. Carry out a road test on the brake circuit. Check for leaks between the trumpet housing and the centre housing.

B. Disassembling and reassembling the trumpet housing assembly

Disassembly

1. Remove the trumpet housing (see part A).
2. Remove bolt **(1A)** (Heavy Duty version) and the brake plate **(34)** (all types).
3. Immobilise the axle shaft and the planetary carrier.
4. Move bolts **(32)**, retaining washer **(30)** and shim or shims **[29]**. If required, remove parts **(18)** to **(27)** and **/2** to **(17)**.
   Note: To disassemble the ring gear (16) (Normal Duty version), see part D.

Reassembly

5. Reassemble parts **/2** to **(17)** and **(18)** to **(27)** and shim the bearings (see part C).
   Note:
   - ***To reassemble the ring gear (16) (for the Normal Duty version), see part D.***
   - ***To reassemble the ring gear (16) (for the Heavy Duty version), clean the mating faces of the ring gear, the trumpet housing and the brake plate with a solvent. Remove any traces of old sealing compound. Dry the parts.***
     Apply a silicon sealing compound (of the «Silicomet» type) on the inner edge of the trumpet housing (11) and on the brake plate (34) as per the arrows (Fig. 3).
   - ***Install seal (12) 8 mm back from the cup mating face with the spring towards the reduction gearbox.***
   - ***Protect the splines in shaft /2\\ or /4\\ in order to avoid damaging the seal (12).***
   - ***Replace plug (10) with a grease nipple. Partly fill cavity A at the end of the trumpet housing with grease (Agricharge or equivalent) (see Fig. 2). Remove the grease nipple and refit the plug (10).***
   - ***Position the spacer (18). Coat bolt (19) with Loctite 270 (see Fig. 1). Tighten to a torque of 34 - 50 Nm.***
6. Refit the trumpet housing (see part A).

Rear axle - *Standard trumpet housings*

C . Axle shaft bearings preload

1. Immobilise the axle shaft and the planetary carrier. Remove bolt **(32)** and washer **(30)**.
2. Seat the cone **(8)** and the shaft **/2** or **/4** on the cup **(9)**.
3. Fit shims [29] to provide a thickness greater than the recess in order to obtain play on the planetary carrier **(27)**. Fit washer **(30)** and lock bolt **(32)**.
4. Using a dial gauge positioned at the end of the planetary carrier (see Fig. 2) check the play by moving the planetary carrier laterally.
5. Remove the required number of shims **[29]** to obtain a preload of :
   P1 = 0.02 to 0.12
6. Install the washer and coat bolt **(32)** with Loctite 270 before tightening it to a torque of :
   - 85 dia. shaft : 270 - 440 Nm,
   - 95 dia. shaft : 340 - 550 Nm.

   Tightening torques :
   (1A) 90 - 130 Nm
   (19) 34 - 50 Nm

D . Replacing the ring gear (Normal Duty version)

Disassembly

If the ring gear **(16)** is force fitted, it is possible to replace it.

- Remove the trumpet housing (see part A).
- Remove bolt **(32)**, retaining washer **(30)** and shim or shims **[29]**. Remove the planetary carrier assembly.
- Remove the axle shaft.
- Extract the ring gear **(16)** using a 30-tonne press, with a round section of 60 dia. by 900 and a flat bar as per Fig. 6.

Reassembly

- Use a 15 T press and the special flat bar to fit the ring gear **(16)** in the trumpet housing **(11)**, after lubricating the trumpet housing.
- Check that the five holes in the ring gear are offset from the existing holes in the trumpet housing by at least 20 mm.
- After fitting them, counterbore five 9.5 diameter holes.
- The total length of the drill bit engaged must not exceed 75.5 mm.

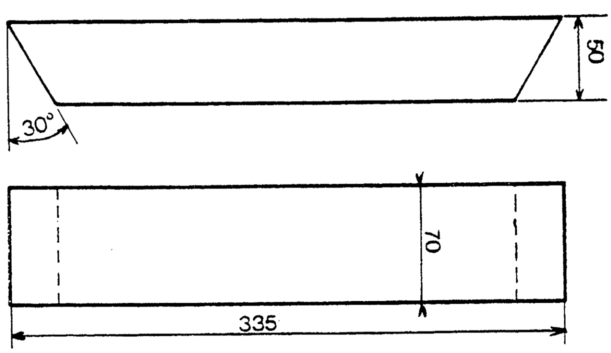


Fig. 6

- Fit five locating dowels **(15)**, applying Loctite 270 (Fig. 4). The locating dowels must exceed the height of the ring gear by 19 mm (Fig. 4).
  Note: The ring gear can also be reinstalled by means of shrinkage, using liquid nitrogen (at - 178°C).
- Refit the planetary carrier assembly. Position the adjusting shim or shims and retaining washer **(30)**. Apply Loctite 270 on bolt **(32)** and tighten it to a torque of :
  - 85 dia shaft : 270 - 440 Nm
  - 95 dia. shaft : 340 - 500 Nm.

Check the normal backlash on the planetary gears. Refit the trumpet housing (see part A).

E . Replacing a wheel stud on a flanged shaft

1. Drive out the damaged stud.
2. Check the stud and its recess in the flange.
3. Apply a few drops of Loctite 270 on the ridges on the new stud and fit it with a hammer and drift.

6 B02 Trumpet with sealed compartment

CONTENTS

Rear axle - *Trumpet with sealed compartment*

General

The general design of the trumpet with sealed compartment is the same as the standard trumpet (Heavy Duty), see section 6 B01.
The difference consists of the final drive unit which is located into a compartment sealed from the centre housing and contains oil of SAE 85W140 viscosity.
This compartment is sealed by means of a spacer housing **(30)** with lip seals **/31** fitted back to back and another seal **(11)** identical to the standard trumpet. Drive from the differential is transmitted to the planetary gears **(22)** through the sun gear **(29)** onto which a snap ring **(33)** maintains the splined sleeve **(32)** driving the brake disc **(34)**.

Service tools

Tool available from the MF network
- Spacer oil seal protector, ref. 3376885 M1

Tool to be made up locally (see section I)
- Snap ring fitting tool

List of parts

(1) Bolt
(1A) Bolt
/2 Straight axle shaft
/3 Flanged axle shaft
(4) Wheel stud
/5 3 lip seal
(6) Cage
(7) Bearing cone
(8) Bearing cup
(9) Plug
(10) Trumpet housing
/11 Oil seal
(12) Bearing cup
(13) Bearing cone
(14) Dowels
(15) Ring gear
(16) Spur washer
(17) Spacer
(18) Screw
(19) Circlip
(20) Planetary gear pin
(21) Washer
(22) Planetary gear
(23) Needle rollers
(24) Spacer
(25) Planetary carrier
[26] Shim(s)
(27) Special washer
(28) Screw
(29) Sun gear
(30) Spacer housing
/31 Lip seals
(32) Splined sleeve
(33) Snap ring
(34) Brake disc
(35) Brake piston
(36) O'ring
(37) O'ring
(38) Breather

Rear axle - *Trumpet with sealed compartment*

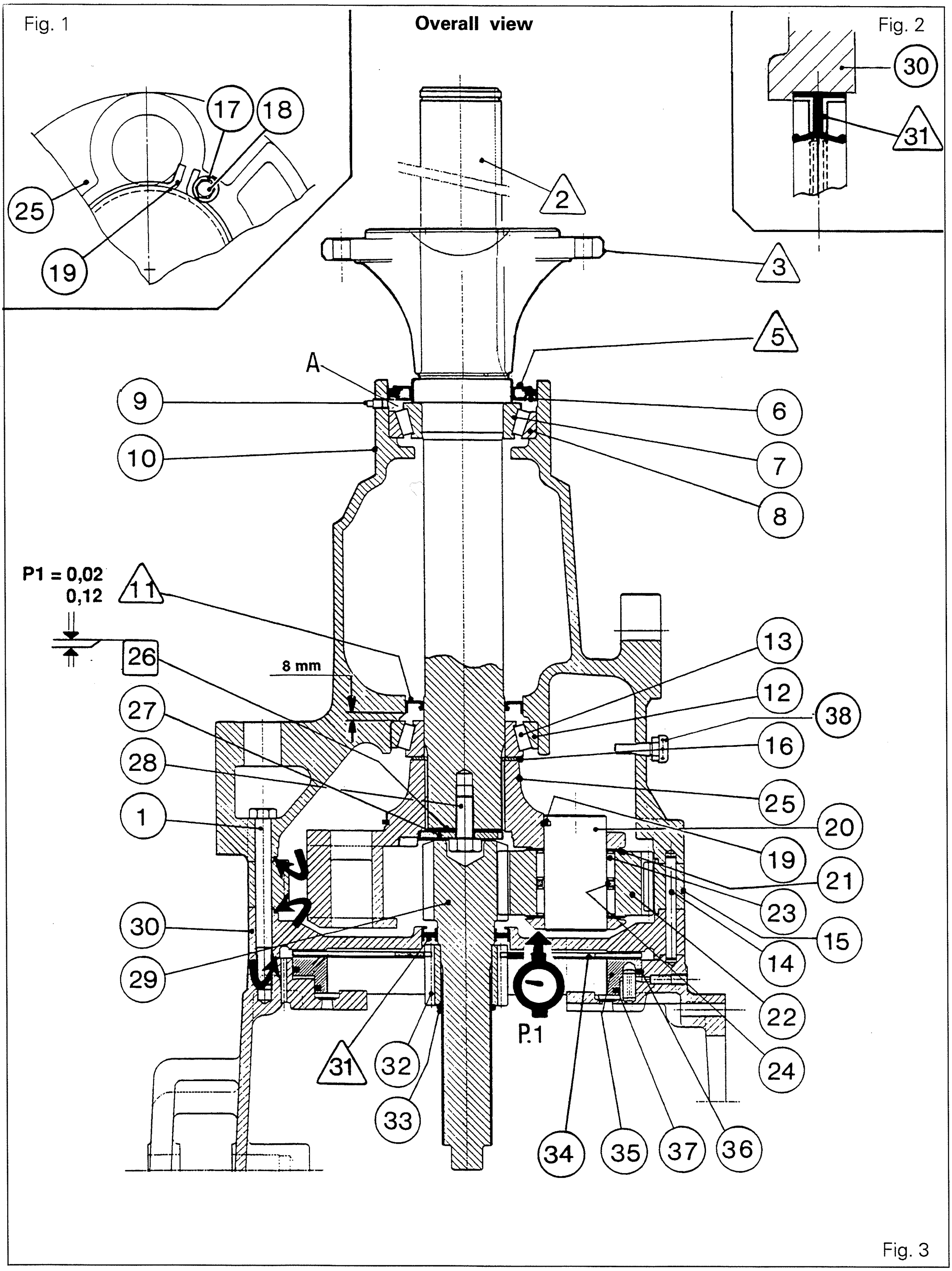
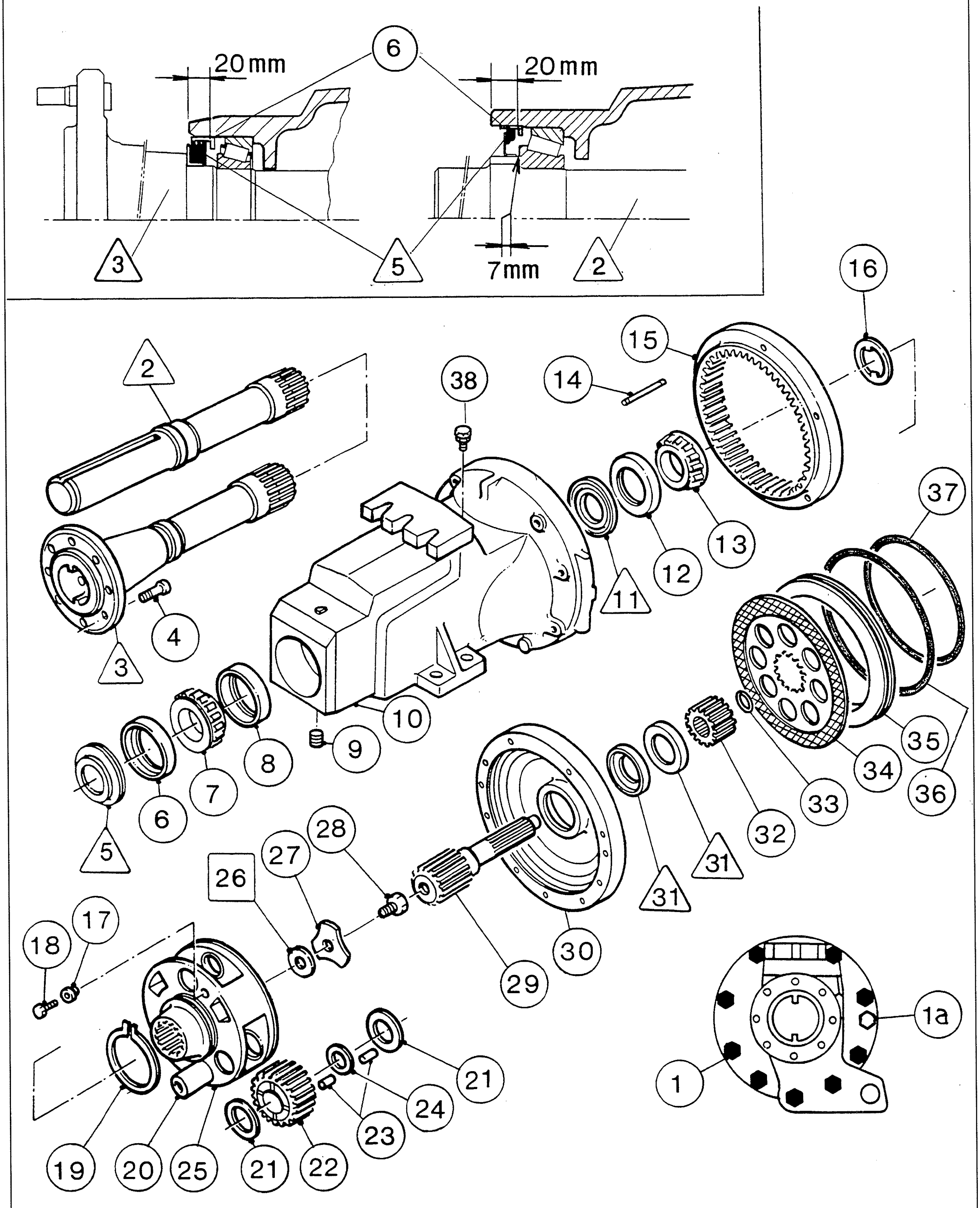


Fig. 3

Rear axle - Trumpet with sealed compartment

Fig. 4

Exploded view



A . Removing and refitting the trumpet housing assembly

Removal

1. Drain the rear axle only and the final drive involved
2. Immobilise the tractor. Remove the wheel. Position a supporting stand.
3. Remove the cab attaching bolts and the stabiliser bracket.
4. Remove the lifting ram pin.
5. Support the trumpet housing with a suitable support and a trolley jack.
6. Remove bolts **(1)** without removing bolt **(1A)**.
7. Using the trolley jack, carefully pull the trumpet housing assembly away with sun gear **(29)**, spacer housing **(30)** including items **/31** to **(34)**, the ring gear **(15)**.
   The brake piston **(35)** stays into the centre housing with O'rings **(36)** and **(37)**.

Refitment

8. Clean the trumpet housing and centre housing mating surface with "white spirit". Remove the previous trace of sealing joint and dry with compressed air.
9. Apply a coat of Silicomet or silicon based sealant to the inner edge of the centre housing recess (as indicated by arrow (Fig. 3)). The sealant diameter must not exceed 3 mm in order do not obstruct the oil return in the centre housing.
10. Reinstall the brake disc **(34)** on sun gear.
11. Support the trumpet housing with a suitable supporting stand and a trolley jack. Fit the trumpet housing onto two locating studs screwed into the centre housing. Turn the axle shaft and push the trumpet housing until it comes into contact with the centre housing.
12. Remove the locating studs. Coat bolts **(1)** with a sealing compound of the "Plastex" or "Hylomar" type and tighten to a torque of 175 - 270 Nm.
13. Carry out procedures 1 to 4 in reverse order.
14. Check the lift operation. Carry out a road test on the brake circuit. Check for leaks between the trumpet housing and the centre housing.

B . Removing and refitting the spacer housing

Removal

1. Remove the trumpet housing (see part A)
2. Remove the bolt **(1A)**, the snap ring **(33)** and the splined sleeve **(32)**.
   Remove the spacer housing **(30)** and sun gear **(29)**.

Refitment

3. Clean the trumpet housing, the ring gear **(15)** and spacer housing **(30)** mating surfaces with "white spirit". Remove the previous trace of sealing joint and dry with compressed air.
4. Apply a coat of Silicomet or silicon based sealant to the inner edge of the ring gear recess (as indicated by arrow (Fig. 3)).
5. Refit the sun gear. Protect the splines using oil seal protector 3376885 M1, fit the spacer housing **(30)**, the splined sleeve **(32)**, the snap ring **(33)**. Fit and tighten the bolt **(1A)** to the torque of 90 - 130 Nm.
6. Refit the trumpet housing, carry out operations 10 to 12 and reverse operations 1 to 4, part A.

C . Replacing the spacer housing oil seals

7. Remove the trumpet housing assembly (see part A).
8. Remove the spacer housing **(30)**, see operation 2, part B.
9. Remove oil seals **/31**.
10. Fit the first new seal **/31** against the shoulder of spacer housing **(30)** and fit the second seal back to back.
11. Refit the spacer housing, see operations 3 to 5, part B.
    Refit the trumpet housing. Carry out operations 10 to 12 and reverse operations 1 to 4, part B.

D . Removing and disassembling the planetary carrier

1. Remove the trumpet housing assembly (see part A).
2. Remove the spacer housing **(30)** (see operation 2, part B).
3. Immobilise the axle shaft and the planetary carrier.
Remove bolt **(28)**, washer **(27)**, shim or shim(s) **[26]**.
4. Remove the planetary carrier assembly **(25)**. Remove bolt **(18)** and spacer **(17)**.
5. Remove the circlip **(19)** by opening out its ends.
6. Extract the pins **(20)**. Remove the thrust washers **(21)** and planetary gears **(22)**.

E . Reassembling and refitting the planetary carrier

1. Fit the needle rollers **(23)** coated with miscible grease.
2. Refit the planetary gears. Reverse operations 5 and 6, part D.
Place the spacer **(17)**. Coat bolt **(18)** with Loctite 270 (Fig. 1). Tighten to a torque of 34 - 50 Nm.
3. Check for the presence of the spur washer **(16)**. Refit the planetary carrier assembly **(25)**. If necessary, preload the axle shaft bearings (see part G).
4. Immobilise the axle shaft and the planetary carrier. Fit shim or shim(s) **[26]**, special washer **(27)**. Fit and tighten bolt **(28)** coated with Loctite 270 to the torque of 340 - 500 Nm.
5. Refit the spacer housing unit, see operations 3 to 5, part B.
Refit the trumpet housing, carry out operations 10 to 12 and reverse operations 1 to 4, part A.

F . Replacing the axle shaft bearings

1. Remove the trumpet housing (see part A).
2. Remove the spacer housing **(30)**, see operation 2, part B.
3. Remove the planetary carrier assembly **(25)**, see operation 3, part D.
4. Remove the spur washer **(16)** and the axle shaft **/2** or **/3** (cone **(13)** is free on shaft).
5. Remove the cone **(13)**. Extract cone **(7)** and seal **/5** from the shaft.
6. Using an extractor, remove the cups from bearing **(8)** **(12)** and cage **(6)**.
7. Drive out seal **/11**.

Reassembly

8. Clean and check the parts. Replace any parts showing signs of damage or excessive wear.
9. Apply Loctite 542 on the outside diameter of seal **/11** and fit it to 8 mm from the cup shoulder (Fig. 3).
10. Press fit :
    - cups **(8)** **(12)** against their respective shoulder.
    - cage **(6)** according to fig. 4.
    - cone **(7)** (after being oiled) in contact with the shoulder of axle shaft **/2** or **/3**.
    - the three lip seal **/5** in contact on flanged axle shaft **/3** and fitted according (Fig. 4) (straight axle shaft).

    Note : Be careful of the fitting direction of the seal /5\\.
11. Slightly grease the cone, lips of seals **/5** and **/11**.
12. Protect the splines of the axle shaft to avoid damaging the seal **/11**. The lips of seal **/5** must be facing outwards.
13. Fit the cone **(13)**.
14. Refit washer **(16)** and planetary carrier assembly **(25)**.
15. Preload the bearings, see operations 2 to 5, part G.
16. Refit the spacer housing, see part G.
17. Remove the plug **(9)** and replace it by a greaser. Fill the cavity **A** (Fig. 3) at the end of the trumpet with "BP Agricharge" or "Mobilgrease MS1105". Remove the greaser and refit the plug.
18. Refit the trumpet housing, carry out operations 10 to 12 and reverse operations 1 to 4, part A.

G . Axle shaft bearings preload

1. Immobilise the axle shaft and the planetary carrier. Remove bolt **(28)** and washer **(27)**.
2. Seat the cone **(7)** in the cup **(8)**. Place a thickness of shims **[26]** greater than recess to obtain a play of the planetary carrier **(25)**. Fit the washer **(27)** and tighten bolt **(28)** to a torque of 340 - 500 Nm.
3. Using a dial gauge fitted at the end of the planetary carrier, check the end play by moving the planetary carrier (Fig. 3).
4. Remove the shims **[26]** in excess to obtain a preload of :
   P1 = 0,02 to 0,12
5. Fit washer **(27)** and bolt **(28)** coated with Loctite 270 to the torque of 340 - 500 Nm.

I . Service tools

Tool available from the MF network

- Spacer oil seal protector, ref. 3376885 M1 (Fig. 5)

Tool to be made up locally

- Snap ring fitting tool

H . Replacing a wheel stud on flanged shaft

1. Drive out the damaged stud using a hammer and a bronze drift.
2. Clean the marks left by the stud ridges with a paint brush dipped in solvent. Dry with compressed air.
3. Apply a few drops of Loctite 270 to the new stud ridges. Make sure that ridges are properly engaged and then knock the stud head up against the shaft flange with a bronze mallet.

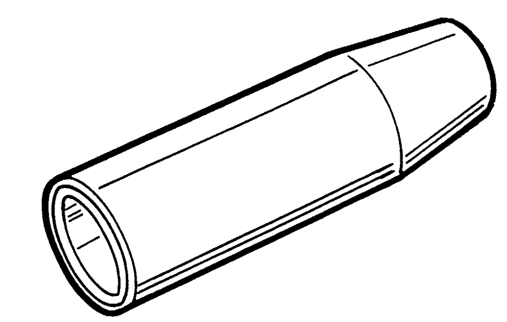
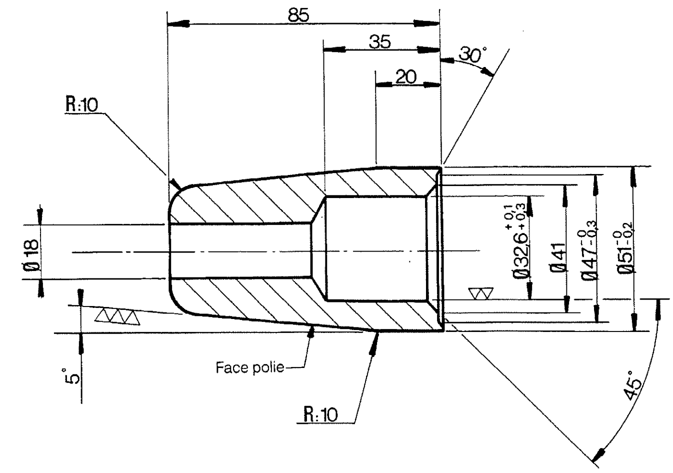
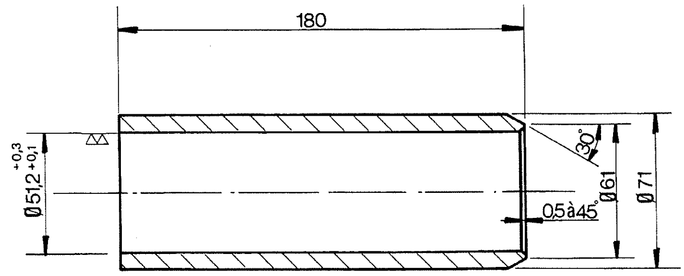


Fig. 5





6 B03 Trumpets with composite final drive

CONTENTS

6B03.2 **Rear axle** - *Composite final drive trumpets*

General

Description

The trumpets contain the right and left-hand axle shafts and also the final drive units which transmit the drive from the differential assembly. The two trumpets are symmetrical and are fitted on either side of the centre housing.
The tractors equipped with the composite final drive have a spacer located between the trumpet and the centre housing.

Construction

The axle shaft **(2)** is held by two taper roller bearings which consist of cups **(5)** and **(8)** and cones **(5A)** and **(8A)** fitted opposite each other.
The final drive unit sealing is assured by the lip seals **/7\ (37)** and the O'rings **(33) (34)**. The three lip seal **/3** protects the outer taper roller bearing which consist of the bearing cup **(5)** and the bearing cone **(5A)**.
The breather **(35)** ensures the free venting of the final drive unit.
The planetary carrier assembly **(21)** is separated from the centre housing by a spacer **(26)**. The final drive unit housing contains SAE 85W140 oil of different viscosity from the one used in the transmission.
An axial and radial hole in the planetary gear pin **(16)** allows the lubrication of the needle bearings **(20)** of the compound planetary gear.
The planetary carrier fitted with three compound gears **(18)** is splined onto the axle shaft **(2)**. End play of these gears is obtained by shims **[17]** located on the pin **(16)** against the 17 tooth gear.
Shims **[22]** located at the end of the axle shaft allow the taper roller bearing pre-load to be adjusted. The shaft **(2)** and the planetary carrier **(21)** are held by the washer **(23)** and the bolt **(24)**. The ring gear **(10)** placed between the trumpet housing **(6)** and the spacer **(26)** is located by the dowel **(9)**. Drive from the differential is transmitted to the compound planetary gears through the sun gear **(25)** onto which a snap ring **(39)** maintains the hub **(38)** driving the brake disc **(27)**.

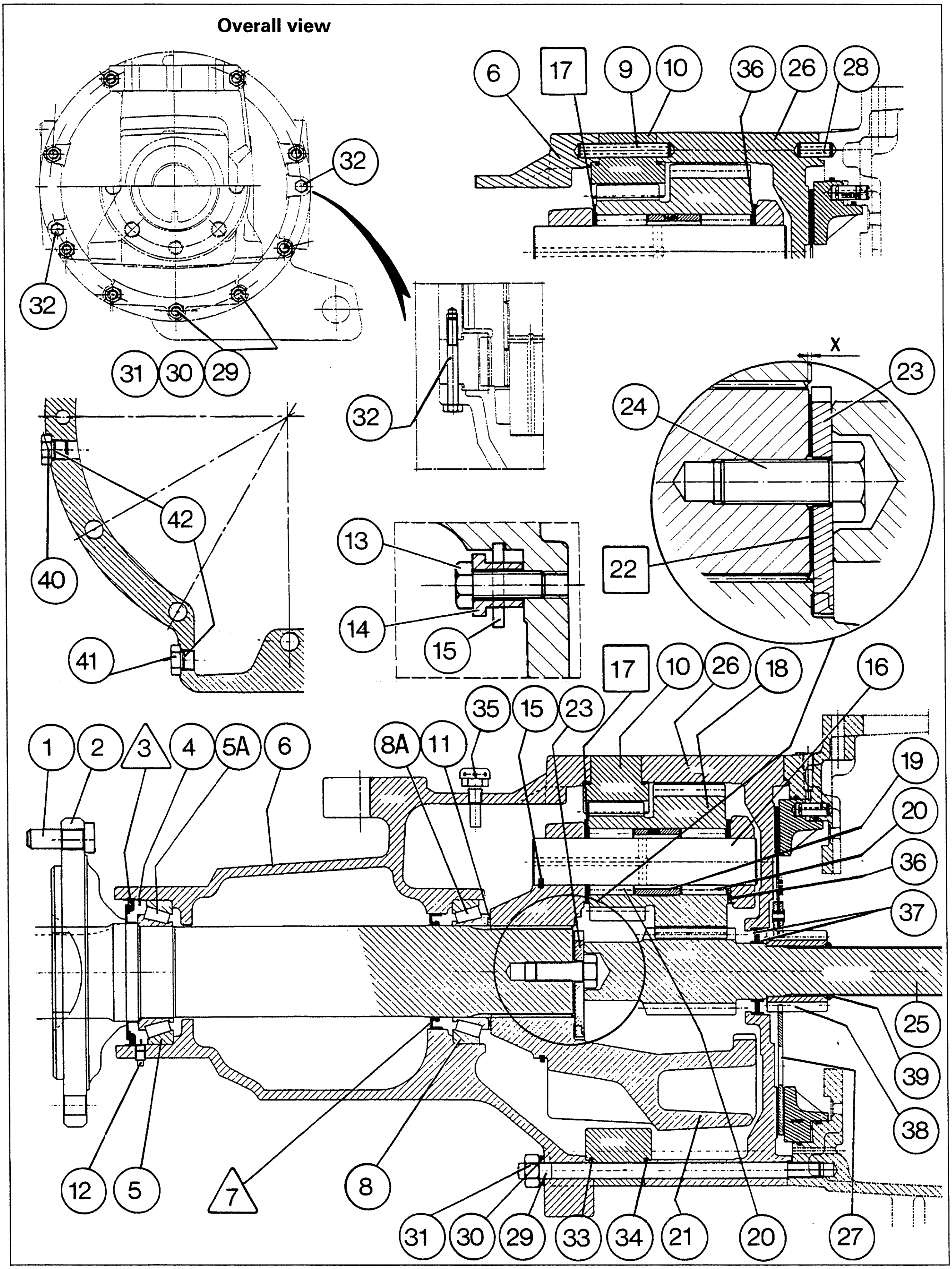
Service tools

Tool available from the MF network
- Spacer oil seal protector ref. 3376885 M1

Tool to be made up locally (see section G)
- Snap ring fitting tool

List of parts

(1)	Wheel stud
(2)	Axle shaft
/3	Three lip seal
(4)	Seal cage
(5)	Bearing cup
(5A)	Bearing cone
(6)	Trumpet housing
/7	Seal
(8)	Bearing cup
(8A)	Bearing cone
(9)	Dowel
(10)	Ring gear
(11)	Spur washer
(12)	Plug
(13)	Bolt
(14)	Spacer
(15)	Circlip
(16)	Planetary gear pin
[17]	Shim(s)
(18)	Compound planetary gear
(19)	Spacer
(20)	Needles
(21)	Planetary carrier
[22]	Shim(s)
(23)	Retaining washer
(24)	Bolt
(25)	Sun gear
(26)	Spacer
(27)	Brake disc
(28)	Dowel
(29)	Stud
(30)	Washer
(31)	Nut
(32)	Bolt
(33)	O'ring
(34)	O'ring
(35)	Breather
(36)	Washer
(37)	Oil seals
(38)	Hub
(39)	Snap ring
(40)	Plug
(41)	Magnetic plug
(42)	O'rings


Overall view
6
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X
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8A
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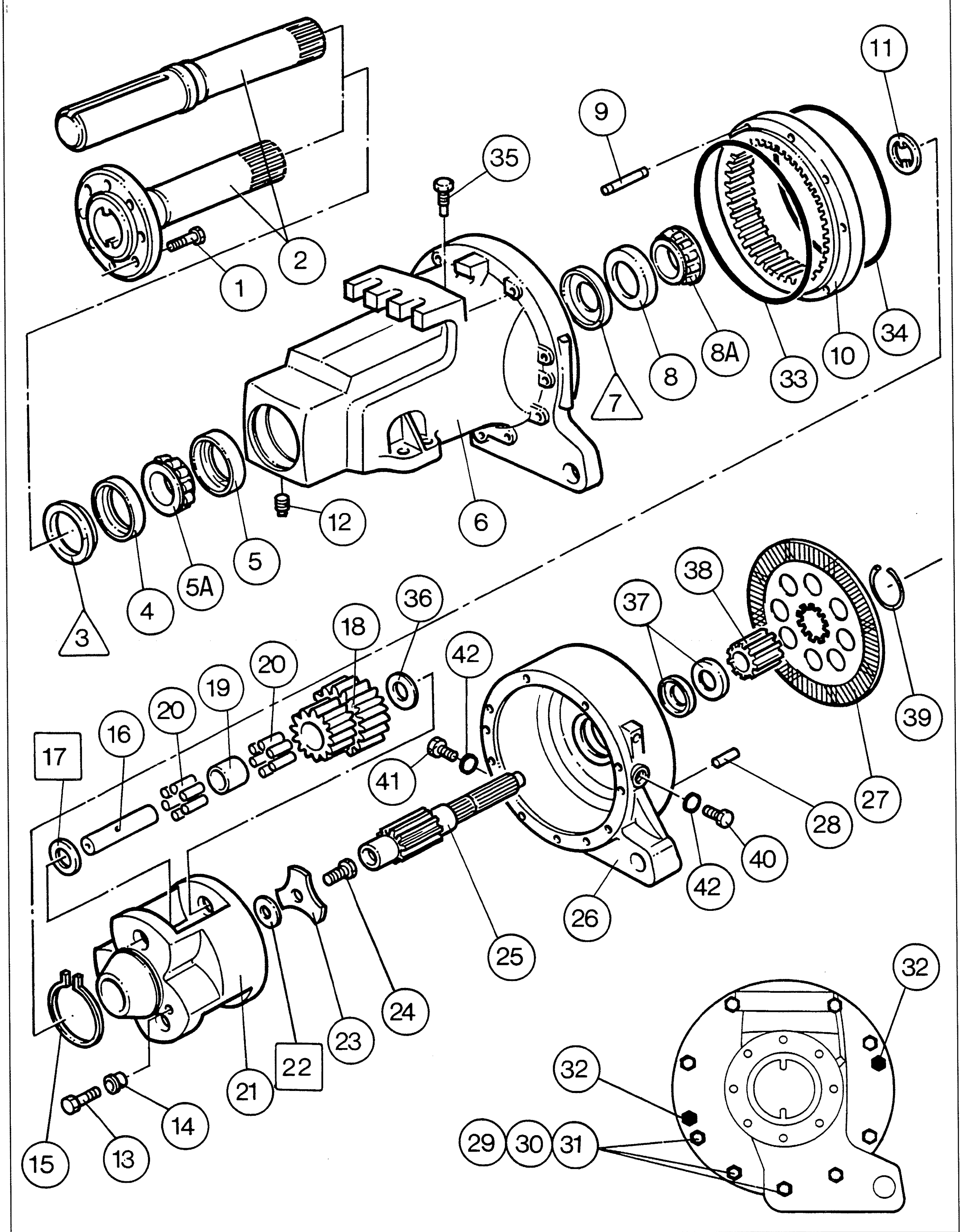
27

Rear axle - Composite final drive trumpets

Exploded view



A . Trumpet housing assembly

Removal

1. Stop the tractor. Apply the handbrake. Fit chocks between the frame and the front axle (Fig. 1).
2. Drain the rear axle and the final drive involved.
3. Using a trolley jack, lift the tractor's side involved.
4. Place a jack under the rear axle
5. Remove the wheel.
6. Remove the stabilizer bracket.
7. Remove the shield **(1)** (Fig. 2). Extract the draft sensor harness from the fastener **(1)** (Fig. 3) and separate it from the trumpet housing.
8. Remove the retaining ring **(1)** (Fig. 4). Push the lift ram pin **(2)** to the outside and remove it.
9. Separate the trumpet housing from hoses and harnesses.

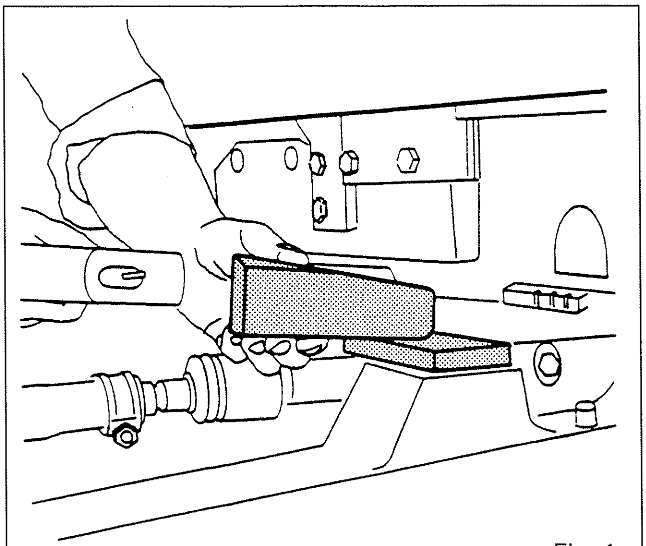


Fig. 1

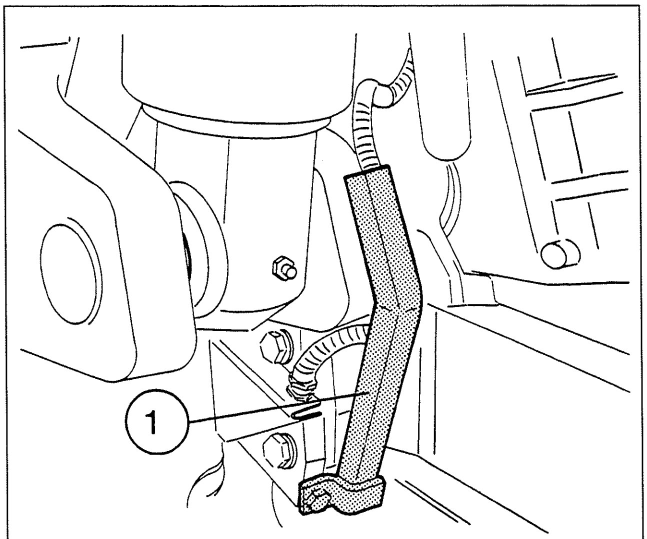


Fig. 2

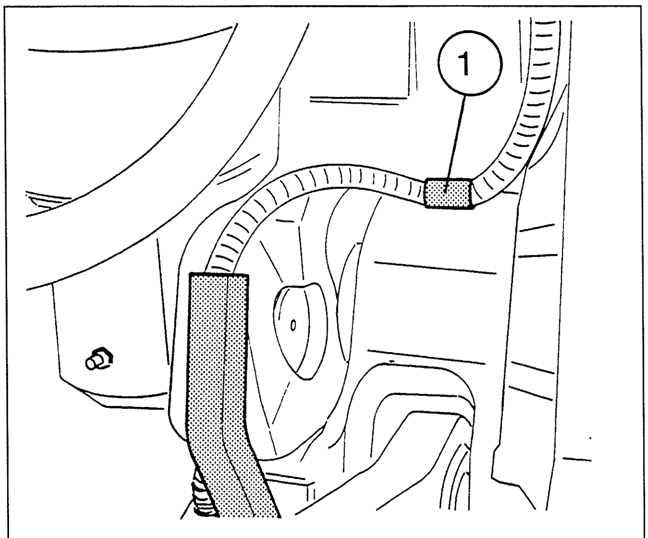


Fig. 3

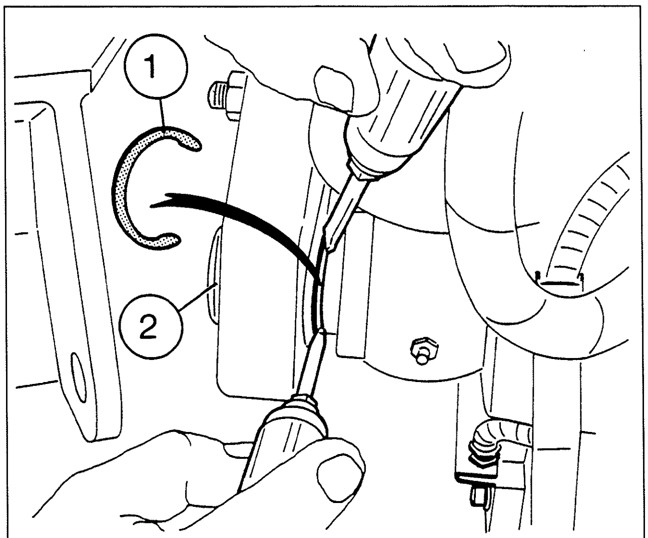


Fig. 4

Rear axle - *Composite final drive trumpets*

10. Remove the bolts **(1)** from the cab support (Fig. 5). Slightly raise the cab observing the gap between the hood and the windscreen. Fit a jack.
11. Place a suitable support and trolley jack to support the trumpet housing.
12. Untighten the nuts **(31)**, remove the washers **(30)**.
13. Using the trolley jack, carefully pull the trumpet housing away from the rear axle.
14. Remove the brake disc **(27)** and the dowel **(28)**.
    Note : To prevent the piston (C) from coming out of the housing, it is advisable to hold it in place by two bolts (Fig. 6).
    Each hole «P» diametrically opposite on the piston should be in the horizontal position (Fig. 7).

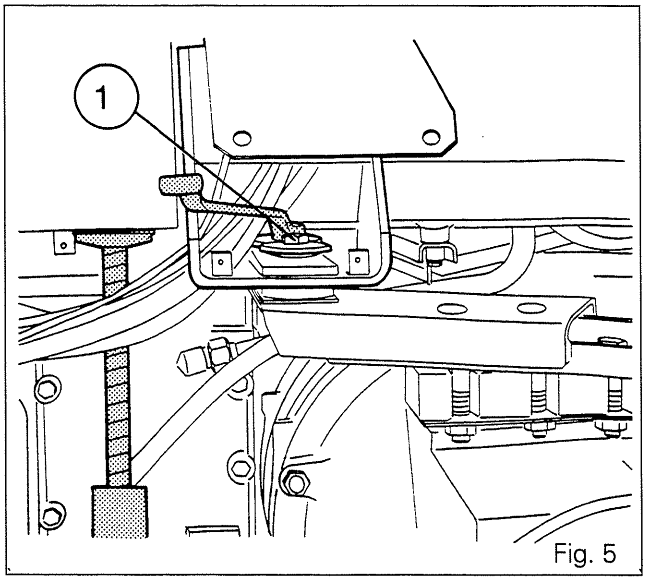


Fig. 5

Refitting

15. Clean the mating faces of the centre housing and the spacer with white spirit.
16. Apply a bead of oil resistant silicone (Silicomet type) to the inner edge of the centre housing (Fig. 8).
    Note : Do not block up the oil drain hole in the housing.
17. Check that the disc **(27)** slides freely on the hub **(38)**.

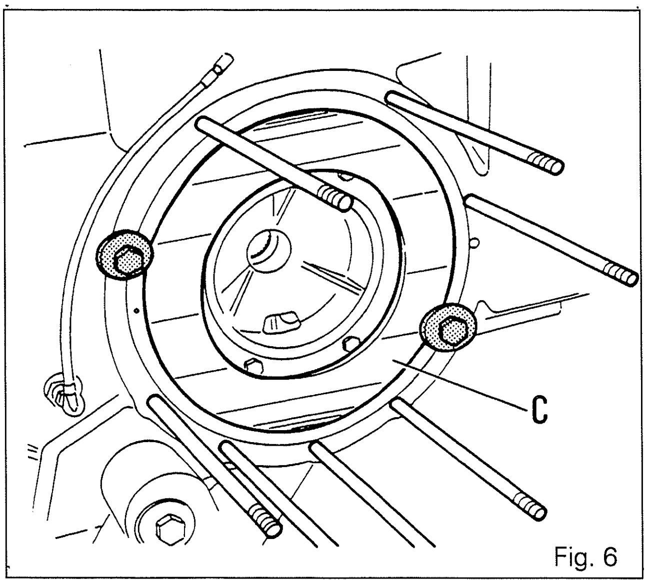


Fig. 6

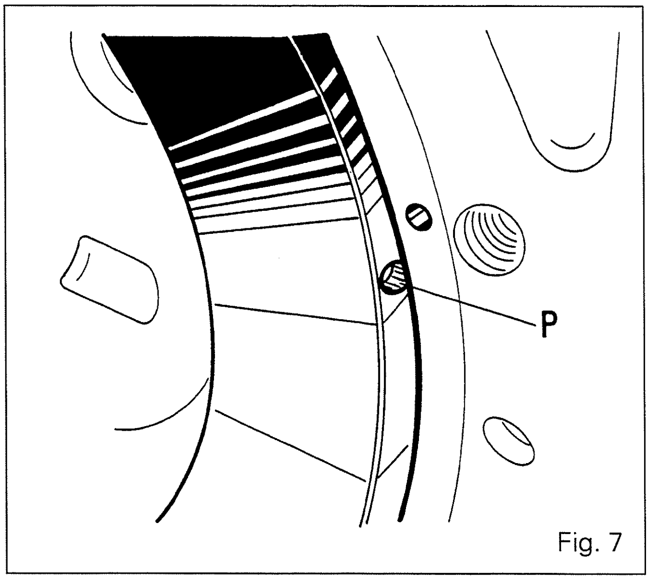


Fig. 7

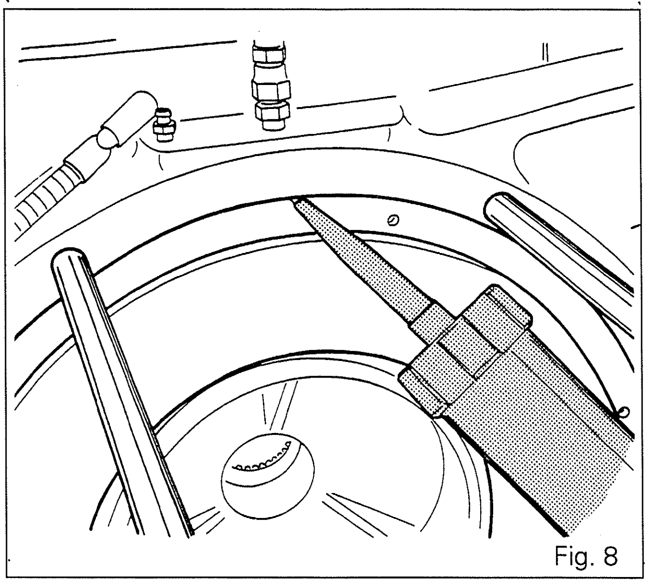


Fig. 8

18. Refit the disc **(27)** on the hub **(38)**. Replace the dowel **(28)** (Fig. 9).
19. Check the tightening of studs **(29)**.
    Note : If one or many studs need to be replaced, take care of the length of their fixing threads. The fixing thread «l» of the lower studs is longer than the one of the upper studs (Fig. 10). Before fitting on the housing, clean them and lightly smear with Loctite 270 (Fig. 11).
20. Engage the trumpet housing on the studs and push until the trumpet and rear axle come into contact.
    Note : Turn the axle shaft (2) to align the splines of sungear (25) with the splines of the differential.
21. Fit the washers **(30)** and the nuts **(31)**. Tighten to a torque of 220 - 300 Nm.
22. Remove the trolley jack with its support.
23. Remove the jack and lower the cab. Refit the bolts of the cab support **(1)** (Fig. 5). Tighten the nuts and lock nuts to a torque of :
    - nut 27 - 35 Nm
    - lock nut 13 - 20 Nm (Loctite 270)
24. Fit the lift ram pin **(2)**. Replace the retaining ring **(1)** (Fig. 12).
25. Position the draft sensor harness in its fastener **(1)** (Fig. 3). Fit the shield **(1)** (Fig. 2).
26. Refit the stabilizer bracket.
27. Refit the wheel. Tighten to a torque of 400 - 450 Nm.
28. Remove the jack under the rear axle and the trolley jack.

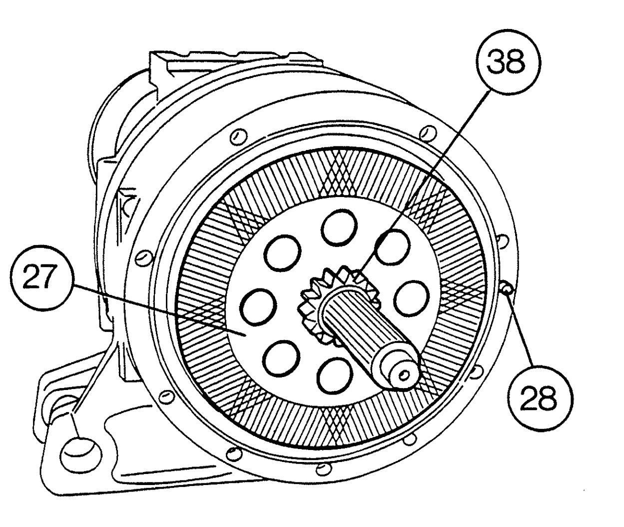


Fig. 9

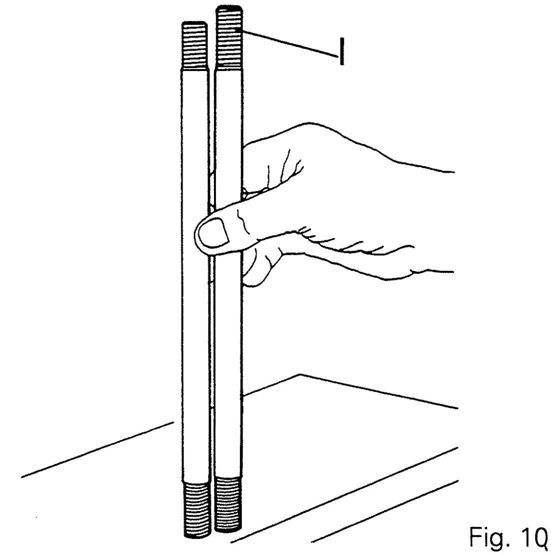


Fig. 10

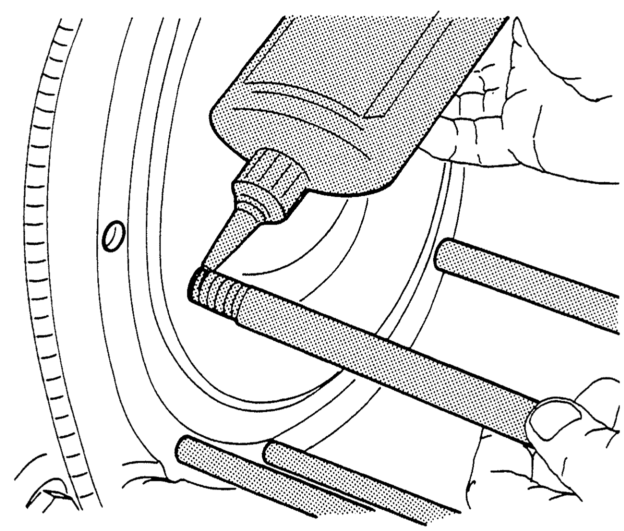


Fig. 11

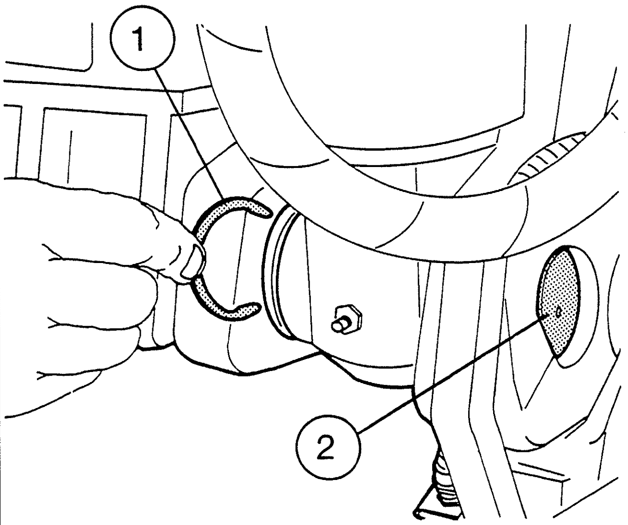


Fig. 12

29. Carry out procedures 1 and 2 in reverse order.
30. Test the lift system and the brake system.
31. Check sealing :
    - at the trumpet seals and the silicone bead between the spacer and the centre housing.
    - at the auxiliary spool valve hoses (if loosened).

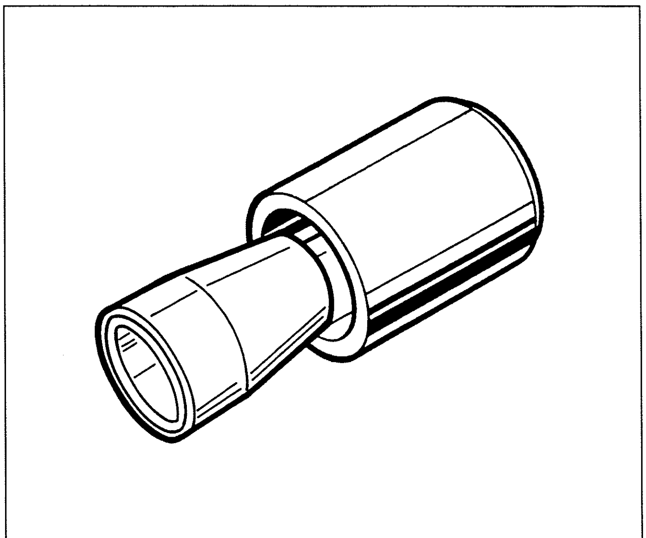


Fig. 13

B. Spacer

Removal

1. Remove the trumpet housing (see section A)
2. Remove the brake disc **(27)**. Place the trumpet housing assembly in a vertical position.
3. Remove two bolts **(32)** holding the ring gear and the spacer on the trumpet housing.
4. Remove the snap ring **(39)**. Remove the hub **(38)**. Separate the spacer **(26)** from the trumpet housing and remove the sun gear **(25)**. Discard 'O'ring **(34)**.

Refitting of seals (37)

5. Extract and discard the seals.
6. Clean and check the components. Replace those which are defective.
7. Using a suitable tool, fit one seal **(37)** against the spacer shoulder and the second back to back on the first. Lubricate the lips.

Refitting

8. Replace the O'ring **(34)** and check that the dowel **(9)** is present.
9. Fit sun gear **(25)** against the washer **(23)**.
10. Protect the sun gear splines using the oil seal protector 3376885 M1 and mount the spacer. Tighten the bolts **(32)** to a torque of 100 - 130 Nm.
11. Remove the shaft protection. Engage the hub **(38)**, fit the snap ring **(39)** with the tool locally manufactured (Fig. 13).
12. Refit the brake disc **(27)**.
13. Refit the trumpet housing (see section A).

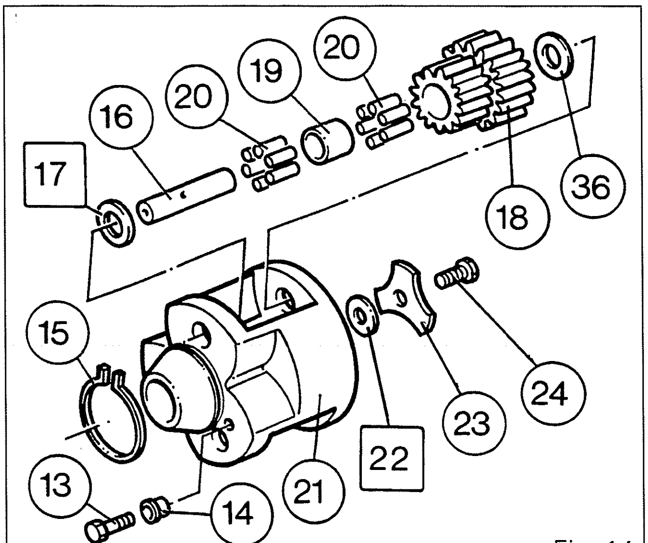


Fig. 14

C . Ring gear and planetary carrier

Removal

1. Remove the trumpet housing (see section A) and the spacer (see section B).
2. Remove the bolt **(24)**.
3. Remove the retaining washer **(23)**, the shims **[22]** (Fig. 14).
4. Due to the planetary carrier weight, hold it in a sling before removing it.
5. Remove the ring gear **(10)**. Discard the 'O'ring **(33)**.

Planetary carrier disassembly

6. Remove the bolt **(13)** and the spacer **(14)** (Fig. 15).
7. Open out the circlip **(15)** (Fig. 16).
8. Using a hammer, tap lightly on the three pins **(16)**.
9. Extract the three pins and the circlip (Fig. 16).
10. Remove the three planetary gears **(18)**, the needles **(20)**, the spacers **(19)**, the washers **(36)** and the shims **[17].**

Refitting

11. Clean and check the parts, replace those which are defective.
12. Coat the needles **(20)** with grease miscible with oil. In each planetary gear **(18)**, insert two rows of needles separated by a spacer **(19)**.
13. Shim the planetary gears.
    Note : Three thicknesses of shims [17] are available.
14. Fit the planetary gears **(18)** with the17 tooth gears facing the circlip **(15)**, place the washers **(36)** and the shims **[17]** of medium thickness towards the 17 tooth gears.
15. Engage the three planetary gear pins **(16)**, the radial hole facing the circlip **(15)**.
16. Using a feeler gauge, determine the thickness of shims **[17]** to obtain a gap between 0,15 and 0,60 on each planetary gear (Fig. 17).
17. Partially extract the three pins, fit the selected shims (Fig. 18).
    Note : The thickest shim should be placed against the 17 tooth pinion.

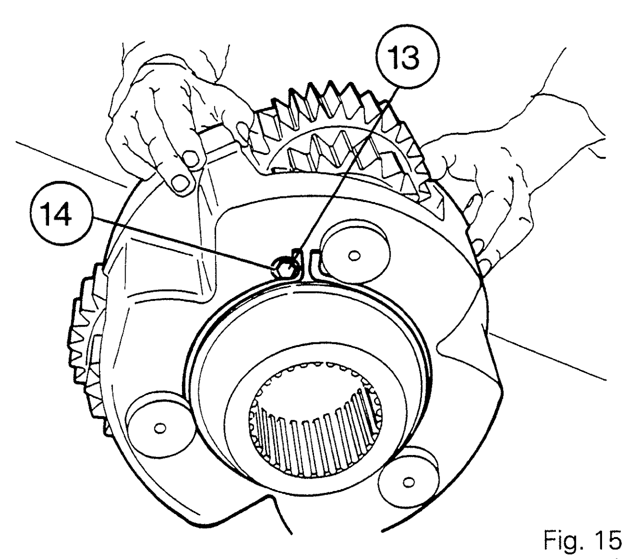


Fig. 15

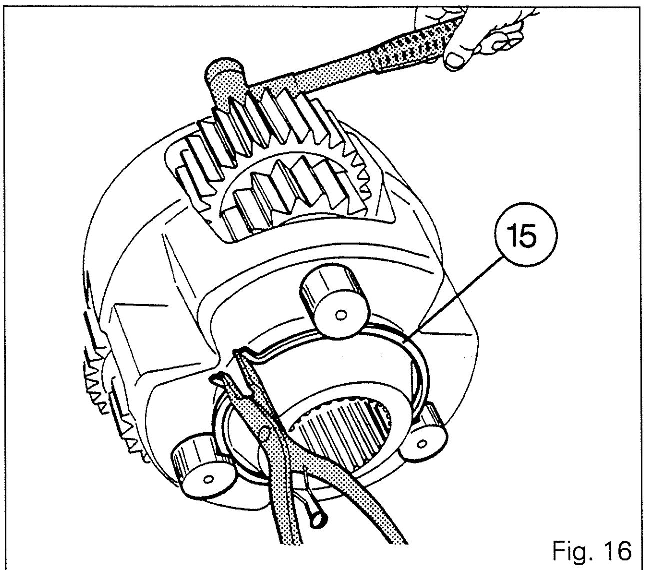


Fig. 16

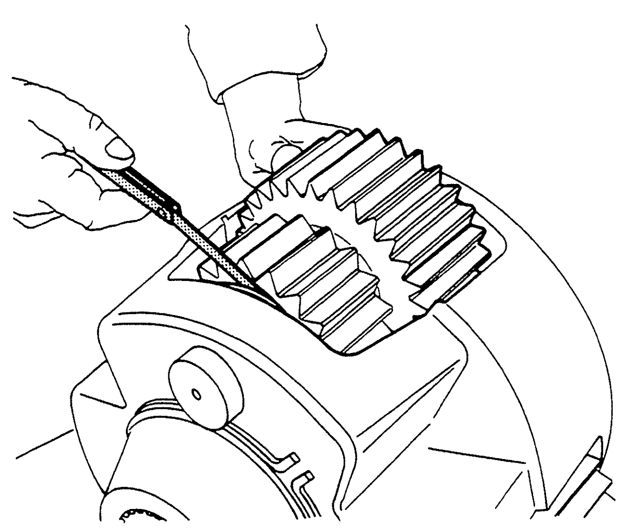


Fig. 17

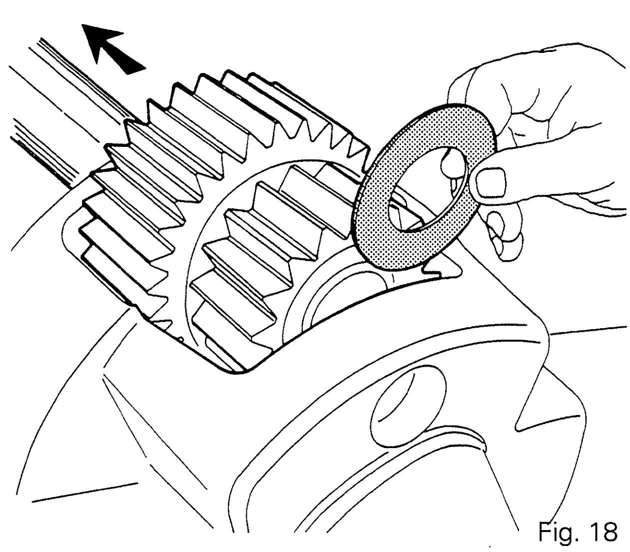


Fig. 18

18. Replace the three pins.
19. Open out the circlip.
20. Tap lightly on the three pins to insert the circlip into the planetary carrier groove (Fig. 19).
21. Clean the bolt **(13)** and the planetary carrier threads. Place the spacer **(14)**. Coat the bolt with Loctite 270 and tighten to a torque of 34 - 50 Nm (Fig. 15).
22. Replace the 'O'ring **(33)**, check that the dowel **(9)** and the spur washer **(11)** are present. Refit the ring gear **(10)** and the planetary carrier **(21)**.
    Note : Position the planetary gears as shown (Fig. 20).
23. Shim to obtain the required pre-load (see section E).
24. Refit the spacer (see section B) and the trumpet housing (see section A).

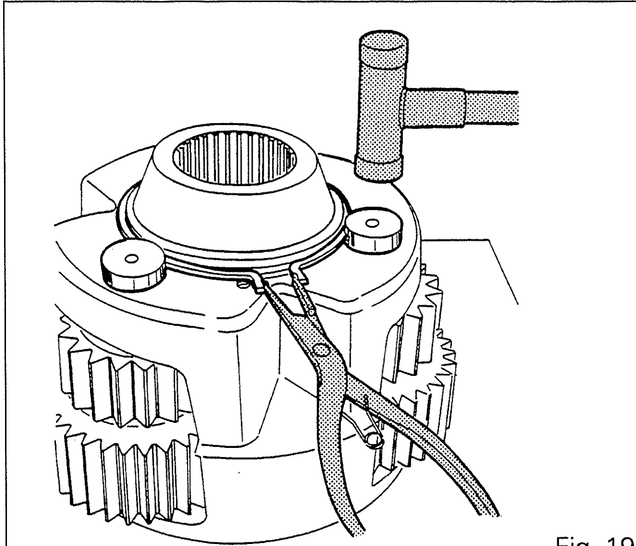


Fig. 19

D . Bearing and seals

Removal

1. Remove the trumpet housing from the rear axle (see section A).
2. Remove the planetary carrier (see section C).
3. Remove :
   - the spur washer **(11)**
   - the bearing cone **(8A)** (runs free on shaft)
4. Withdraw the axle shaft **(2)** from the trumpet housing.
5. Extract the bearing cone **(5A)**
6. Drive out the three lip seal **/3**.
7. Using an extractor, remove :
   - the bearing cup **(5)**
   - the cage **(4)**
   - the bearing cup **(8)**
8. Drive out the seal **/7**.

Reassembly

9. Clean the seal contact surfaces, the cup and cone seats in the trumpet housing and on the shaft. The seals, cups and cones contact surfaces must be free from burrs and damage.
10. Position the seal **/7** respecting the correct fitting procedure.
11. Replacement of seal **/7** :
    a) Without replacing the axle shaft **(2)**.
    So that the seal lip is not in the same place on the shaft, press on the seal until it is 9 mm from the shoulder of the cup (Fig. 21).

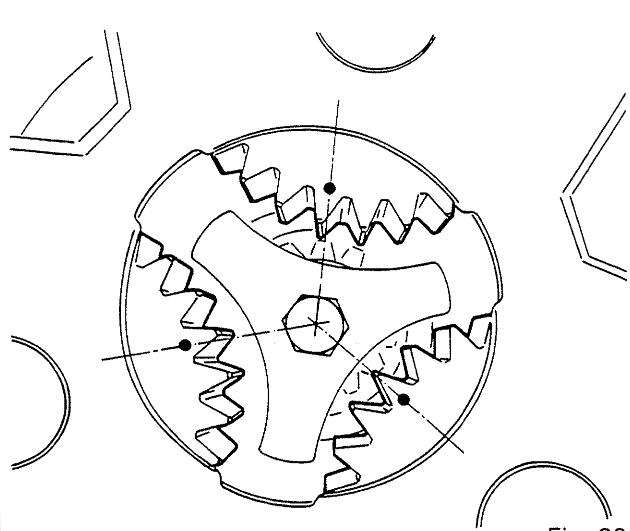


Fig. 20

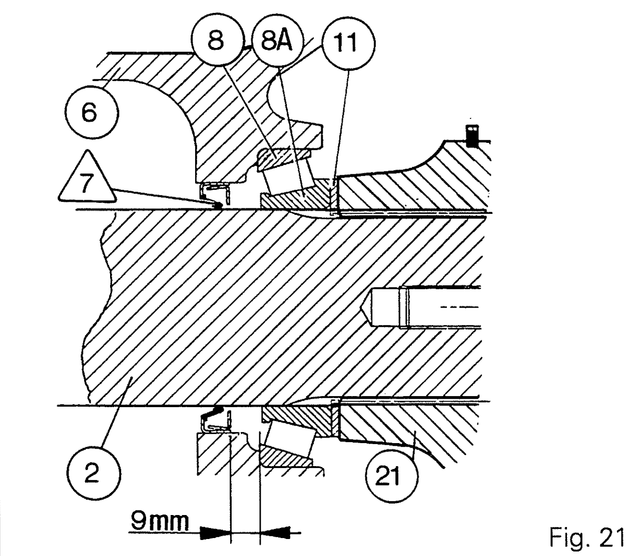


Fig. 21

b) With replacement of axle shaft **(2)**
Position the seal 8 mm from the shoulder of the cup (Fig. 22).

12. Lubricate the cups **(8)** and **(5)**, press them fully on to the shoulder.
13. Press the cage **(4)** to within 8 mm of the trumpet housing (Fig. 23)
14. Push the three lip seal **/3** up against the shaft shoulder.
    Note : Ensure that the seal is fitted the correct way round (Fig. 23).
15. Lubricate the shaft **(2)** and press the cone **(5A)** against the shoulder.
16. Lightly coat the cone **(5A)** and the lips of seals **/3** and **/7** (using BP Agricharge or an equivalent grease).
17. Protect splines of shaft **(2)** and insert it into the trumpet housing.
    Note : The lips of the seal /3\\ must face outwards.
18. Remove the protection from the shaft and lightly lubricate the cone **(8A)**.
19. Carry out procedure 3 in reverse order.
20. Replace 'O'ring **(33)**. Check that dowel **(9)** is present. Refit the ring gear **(10)** and planetary carrier **(21)**. Position the planetary gears as shown Fig. 20.
21. Fit shims to obtain the required pre-load (see section E).
22. Replace the plug **(12)** by a grease nipple. Partly fill the cavity at the end of the trumpet housing between the cone **(5A)** and the seal **/3** with BP Agricharge or an equivalent grease. Remove the grease nipple, refit the plug (Fig. 23).
23. Refit the spacer (see section B) and the trumpet housing (see section A).

E . Axle shaft bearings pre-load

1. Place the trumpet housing assembly in a vertical position.
2. Remove the bolt **(24)** and the washer **(23)**.
3. Seat the cones **(5A)** and **(8A)** in their cups by turning the trumpet housing on its shaft.
4. Determine the thickness of shims **[22]** greater than dimension **X** required to obtain a maximum end play (Fig. 24).
5. Fit the washer **(23)** and the bolt **(24)**. Tighten to a torque of 340 - 540 Nm.

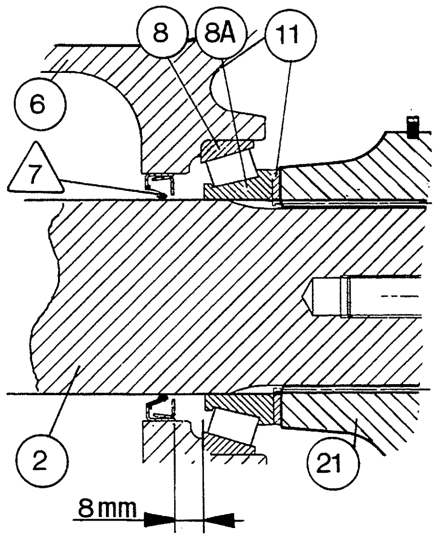


Fig. 22

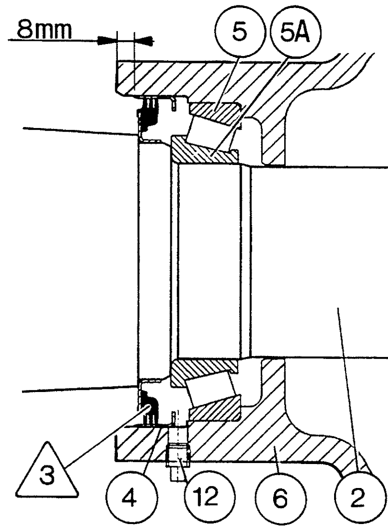


Fig. 23

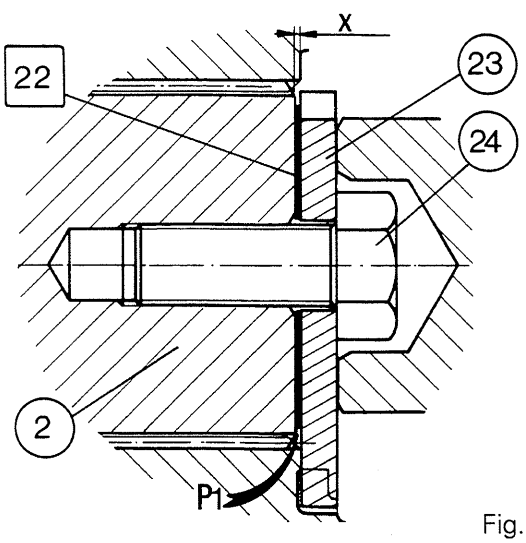


Fig. 24

6. Using a dial gauge, check the end play by moving the planetary carrier vertically (Fig. 25).
7. Remove the bolt **(24)** and the washer **(23)**. According to the reading, remove the shim pack **[22]** required to obtain a pre-load of :
P1 = 0,025 to 0,125 (Fig. 24)
8. Clean the threads at the end of the shaft **(2)**.
9. Refit the washer **(23)**.
10. Clean the bolt **(24)** and apply Loctite 241. Tighten to a torque of 340 - 540 Nm.

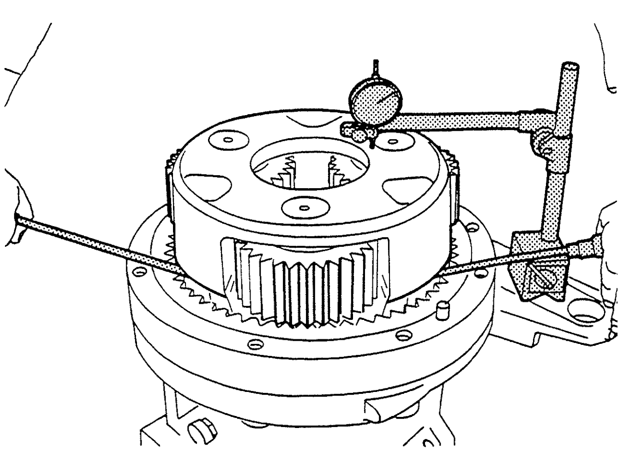


Fig. 25

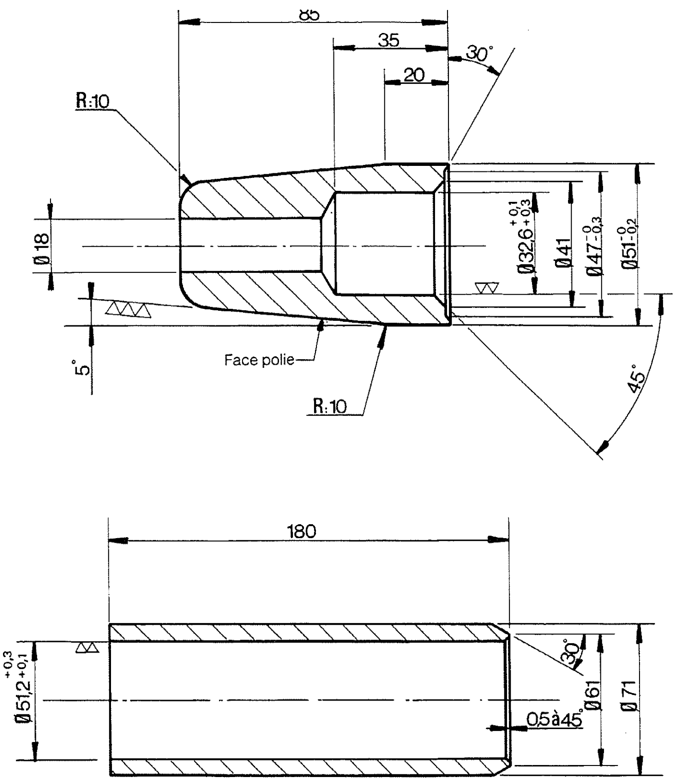
F . Wheel stud replacement

1. Drive out the damaged stud using a hammer and a bronze drift.
2. Clean the marks left by the stud ridges with a paint brush dipped in solvent.
3. Dry with compressed air.
4. Apply a few drops of Loctite 270 to the new stud ridges.
5. Place the new stud in the ridge marks left by the old stud.
6. Make sure that the ridges are properly engaged and then knock the stud head up againt the half shaft flange with a bronze mallet.

G . Service tools

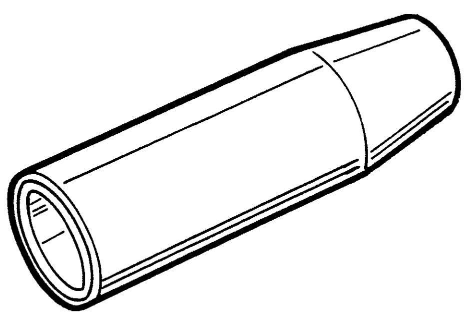
Tool to be made up locally

- Snap ring fitting tool



Tool available from the MF network

- Spacer oil seal protector ref. 3376885 M1



6 C01 Differential

CONTENTS

Rear axle - Differential

General

The rear axle is driven by the crown wheel and pinion assembly whose movement is provided by the gearbox output shaft.
The helical driving pinion is supported on either side of its teeth by two taper roller bearings **(30) (31)** and **(33) (34)** which are installed in opposition.
The bearing cones are force-fitted on the driving pinion and the rear bearing cup **(30)** is also force-fitted in the rear axle housing. The front bearing cup **(34)** rotates freely in its bore to allow adjustment of the driving pinion.
The crown wheel is secured to the differential housing by rivets. The differential assembly turns on two taper roller bearings **(15) (16)** and **(12) (28)**, supported by two side carriers which are bolted onto the rear axle housing.
The differential assembly comprises two housing halves containing four planetary pinions and two sun gears.
The driving pinion which supports the 4 WD driving gear is fitted in the rear axle housing. The preload obtained by means of shims **[35]** placed between the backing plate **(36)** and the rear axle housing is verified by means of a torque.
The preloading of the differential assembly is adjusted by means of deflector shims **[11]** of different thicknesses, placed behind the left-hand bearing cup **(12)**.

Differential lock

The left-hand carrier houses the differential lock mechanism.
This system consists of a piston **(5)** and a splined sliding coupler which rotates with the sun gear in the left-hand trumpet housing. The piston acts on the sliding coupler when pressure from the 17-bar hydraulic circuit is supplied by the solenoid valve fitted onto the right-hand cover. The piston moves, pushing the sliding coupler and compressing the spring **(10)**.
The teeth on the face of the sliding coupler engage with a fixed coupler **(26)** attached to the housing **(25)**. In this position, the sun gears in the right-hand and left-hand trumpet housings rotate at the same speed. When the pressure is released, the coupler is pushed back towards the rear by the spring.

Service tool

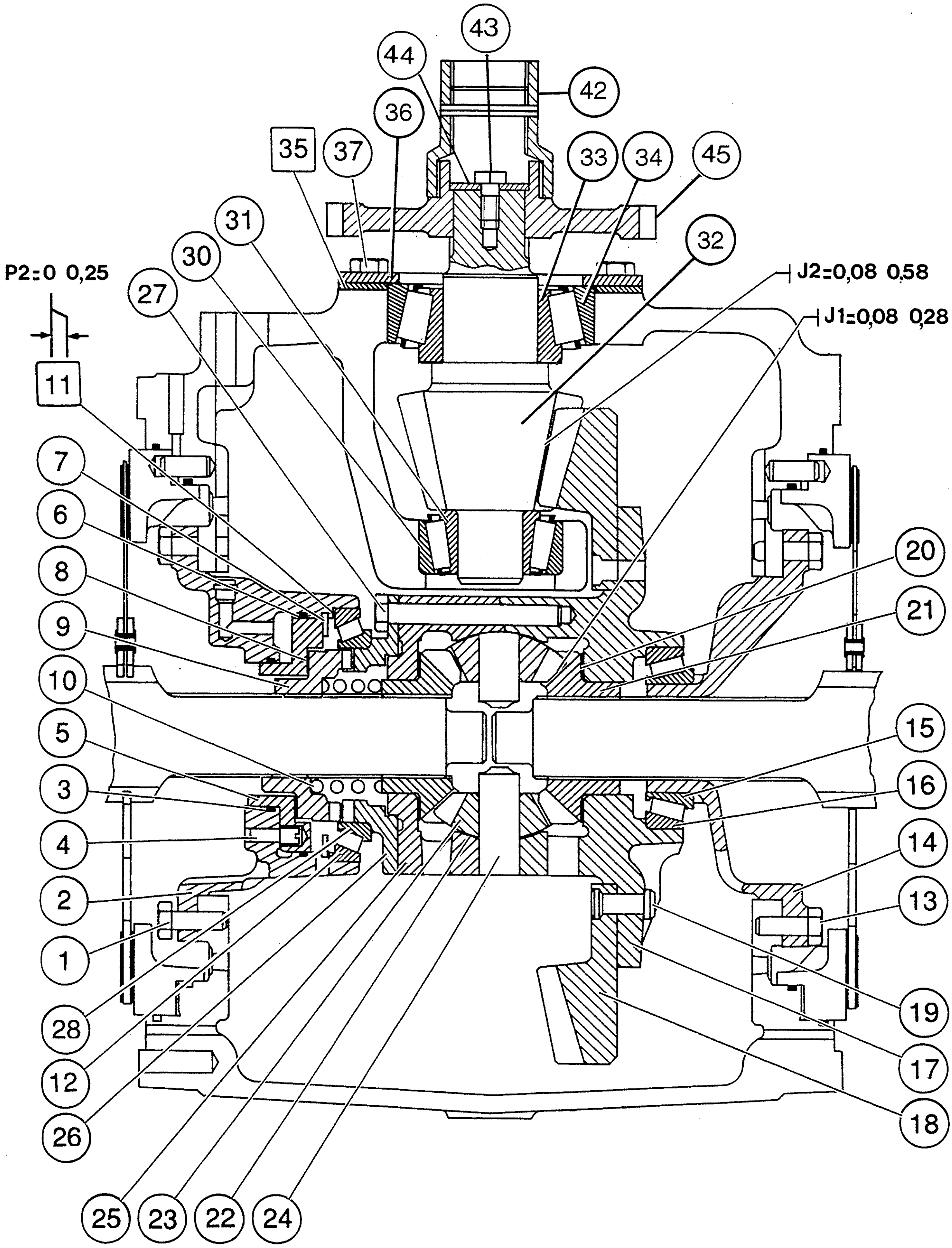
3376847M91: Shimming tool (see p. 12).

List of parts

(1) Bolt
(2) Left-hand carrier
(3) O-ring
(4) Finger
(5) Piston
(6) O-ring
(7) Circlip
(8) Friction ring
(9) Sliding coupler
(10) Spring
[11] Deflector shim
(12) Bearing cup
(13) Bolt
(14) Right-hand carrier
(15) Bearing cone
(16) Bearing cup
(17) Housing
(18) Crown wheel
(19) Rivet
(20) Friction ring
(21) Sun gear
(22) Friction ring
(23) Planet pinion
(24) Cross joint
(25) Housing
(26) Fixed coupler
(27) Bolt
(28) Bearing cone
(29) Locating pin
(30) Bearing cup
(31) Bearing cone
(32) Driving pinion
(33) Bearing cone
(34) Bearing cup
[35] Shim(s)
(36) Bearing plate
(37) Bolt
(39) Connector
(40) Differential lock supply pipe
(41) O-ring
(42) Sleeve
(43) Bolt
(44) Washer
(45) 4 WD driving gear

Rear axle - *Differential*

Overall view

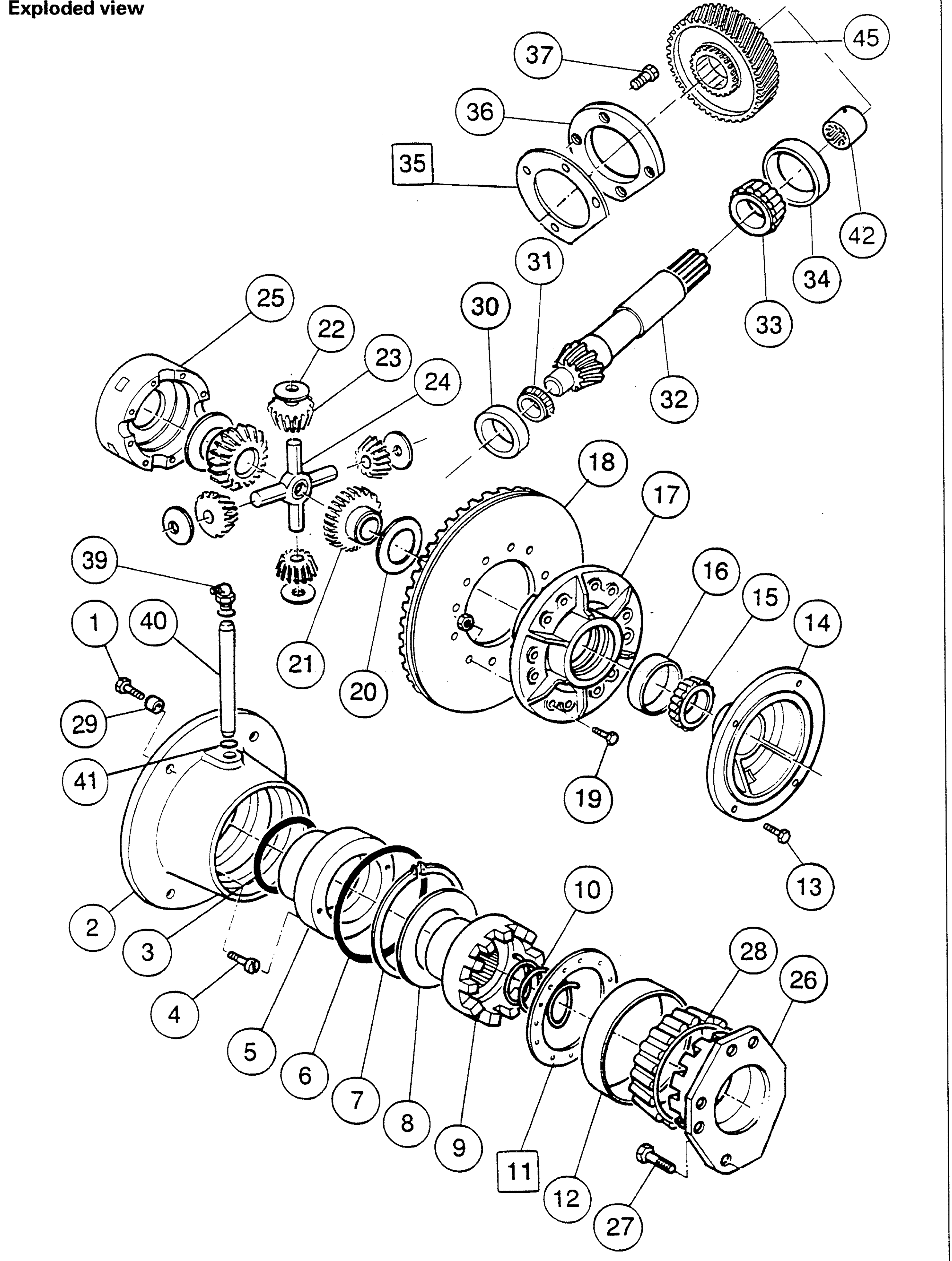


CONTENTS

6C01.4

Rear axle - *Differential*

Exploded view



CONTENTS

A. Removing the left-hand carrier and differential lock assembly

Note: Only the left-hand trumpet housing need to be removed to work on the differential lock hydraulic assembly.

1. Remove the left-hand trumpet housing (see sections 6B01 - 6B02 - 6B03, according to the version).
2. Disconnect the supply pipe, unscrew the connector **(39)** and remove the pipe **(40)**.
3. Loosen the bolts **(1)** alternately in order to gradually release the tension on the spring **(10)**.
4. Remove the carrier **(2)**, the friction ring **(8)**, the sliding coupler **(9)** and the spring.

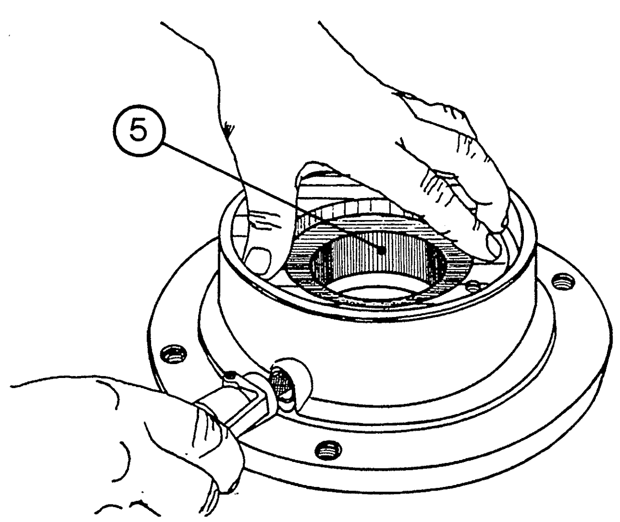


Fig. 1

B. Disassembling and reassembling the differential lock assembly

Disassembly

5. Remove the bearing cup **(12)** and the deflector shim **[11]**.
   Note: Mark the deflector shim fitting direction.
6. Remove the circlip **(7)**.
7. Remove the piston **(5)** with a blast of compressed air (Fig. 1).
8. Remove the O-rings **(3)**, **(6)** and **(41)**.
9. Unscrew the finger **(4)** (if necessary).

Reassembly

10. Check the parts and replace any that are faulty.
11. Clean the finger **(4)** and smear it with Loctite 221. Then fit it onto the carrier **(2)** and tighten.
12. Smear the O-rings **(3)** and **(6)** with miscible grease («Amber Technical» or equivalent) in order to position them correctly at the bottom of their respective grooves.
13. Using a plastic mallet, fit the pistons **(5)** in the carrier **(2)** (Fig. 2), paying attention to the position of the finger **(4)**.
14. Fit the circlip **(7)**, the deflector shim **[11]**, ensuring that it is fitted the right way round, and the bearing cup **(12)** (Fig. 3).

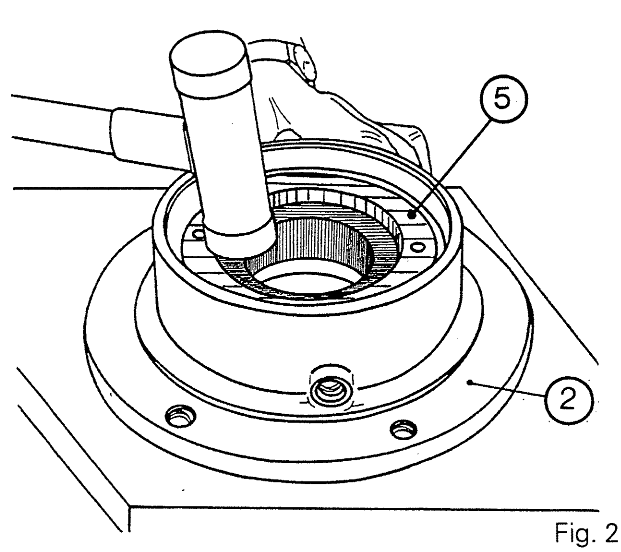


Fig. 2

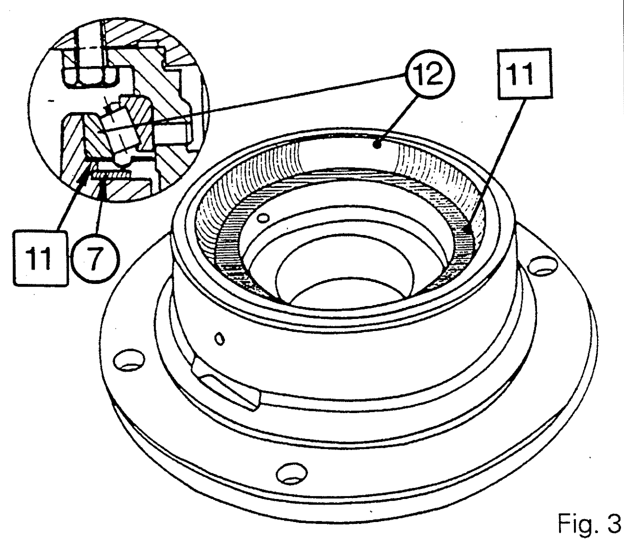


Fig. 3

C. Refitting the left-hand carrier and the differential lock assembly

15. Fit the O-ring **(41)**.
16. Screw in two diametrically opposite guide studs «G» on the housing (Fig. 4).
Check that the locating pin **(29)** is in position.
17. Refit the spring **(10)**, the sliding coupler **(9)**, the friction ring **(8)** and the carrier **(2)**.
Note: Ensure that the differential lock supply port in the carrier is pointing upwards.
18. Fit and tighten two bolts **(1)** to a torque of 85 to 130 Nm. Remove the guide studs. Fit the other two bolts and tighten them to the same torque (Fig. 4).
19. Fit the pipe **(40)** and the connector **(39)**.

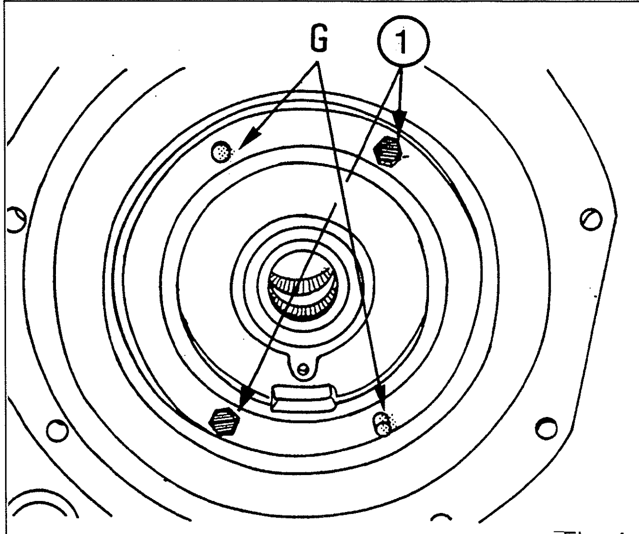


Fig. 4

Leak test

After working on the piston **(5)**, the seals **(3)** and **(6)**, and the carrier **(2)**, the assembly must be checked for leaks.

20. Fit a pressure gauge onto the supply connector **(39)** (Fig. 5).
21. Supply the system with compressed air at approximately 5 bar in order to check that the piston moves correctly. Reduce the pressure to 0.3 bar to carry out the leak test.
22. Close the valve. The pressure gauge must not show any pressure drop for one minute.
23. Remove the pressure gauge and connect up the supply pipe.
24. Refit the left-hand trumpet housing. See sections 6B01 - 6B02 - 6B03 according to the version.
25. Check for leaks from the supply pipe and the operation of the differential lock.

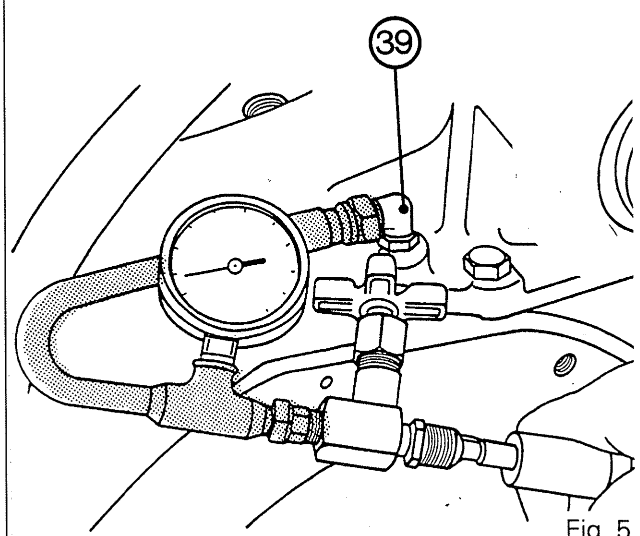


Fig. 5

D. Removing and disassembling the differential lock

Removal

26. Immobilise the tractor. Apply the handbrake. Chock the front wheels and the axle frame.
27. Drain the rear axle assembly only.
28. Lift the rear end of the tractor with a trolley jack.
29. Position stands under the rear axle housing.
30. Remove the wheels.

31. Remove the left-hand and right-hand trumpet assemblies (see sections 6B01 - 6B02 - 6B03, according to the version).
32. Disconnect the fuel supply and return hoses and the harness on the main fuel tank gauge.
    Note: Mark the harness connection position.
33. Drain and remove the main fuel tank and the tank support. If necessary, remove the auxiliary fuel tank (if fitted).
    Note: Check the space between the hood and the windscreen. (If the space is too narrow, remove the sheet metal).
    The cab must be supported on both sides with suitable stands positioned in front of the main fuel tank front support (Fig. 6). Take care of the heating pipes on the right-hand side. If necessary, unscrew the attaching brackets.
34. Remove the lift cover (see section 6E01).
35. Remove the top link support, the PTO driving gear and layshaft (see section 7B01).
36. Remove the pipe **(40)**.
37. Hoist the differential assembly with a clamp.
38. Loosen the bolts **(1)** alternately in order to gradually release the tension on the spring **(10)**.
39. Remove the carrier **(2)**, the spring **(10)**, the coupler **(9)** and the friction ring **(8)**.
40. Remove the bolts **(13)**.
41. Remove the right-hand carrier **(14)**.
42. Extract the differential assembly from the housing.

Disassembly

43. Place the assembly on a workbench.
44. Extract bearing cone **(28)** and, if necessary, bearing cone **(15)**. Extract the bearing cup **(16)**.
45. Remove the bolts **(27)**.
46. Remove the fixed coupler **(26)**.
47. Separate the two sections of the housing **(17)**.
    Note: Both of these parts have the same number. They must be kept as a pair.
48. Remove the washers **(20)**, the sun gears **(21)**, the planetary pinions **(23)**, the washers **(22)** and the cross joint **(24)** (Fig. 7A).

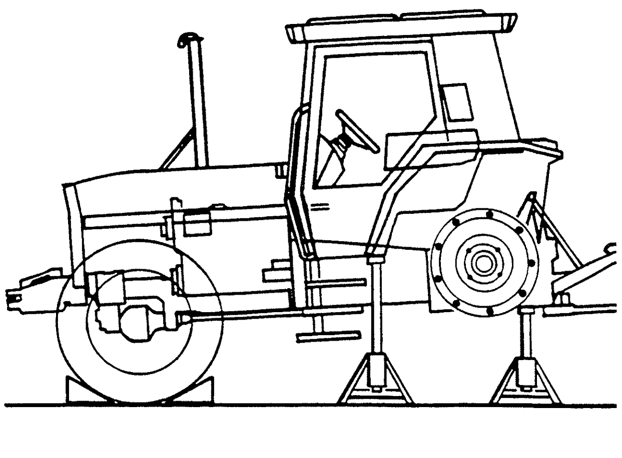


Fig. 6

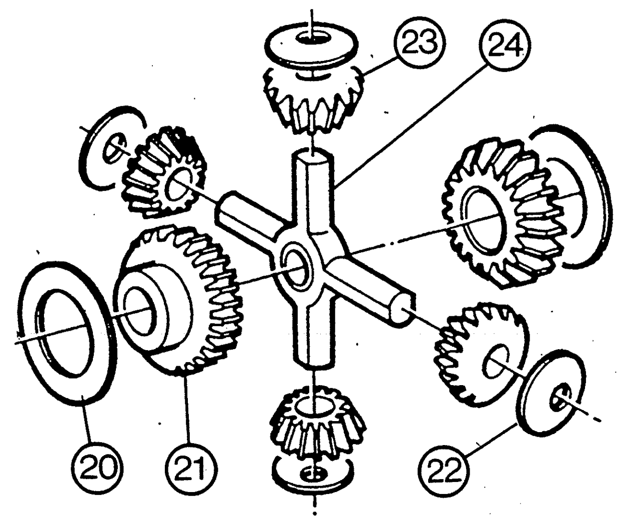


Fig. 7A

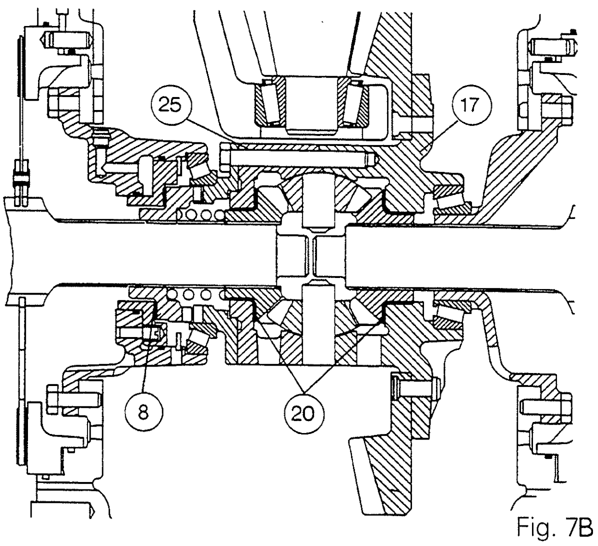


Fig. 7B

E. Reassembling and refitting the differential assembly

Reassembly

49. Check the parts and replace any that are faulty.
50. Carry out procedures 46 to 48 in the reverse order.
Note: As from serial number E110044, housings (17) and (25) are equipped with new friction washers (20) (Fig. 7B). These washers must be coated with Loctite 648 (or equivalent) and fitted with a press. As from serial number D263024, the bronze washer (8) is replaced by a Vespel polyamide washer (Fig. 7B).
51. Smear the bolts **(27)** with Loctite 270 and then tighten them to a torque of 85 to 130 Nm.
Note: The clearance J1 between the planetary pinions and sun gears must be between 0.08 and 0.28.
52. Fit bearing cone **(28)** and, if necessary, bearing cup **(16)** and bearing cone **(15)** fully home against the shoulder.

Refitting

53. Position the differential assembly in the housing.
54. Screw in two diametrically opposed guide studs and fit the right-hand carrier **(14)**.
Note: Ensure that the oil supply port in the carrier is facing downwards.
55. Fit two bolts and tighten them to a torque of 85 to 130 Nm. Remove the two guide studs. Fit the other two bolts and tighten them to the same torque.
56. Remove the bearing cup **(12)** and the deflector shim **[11]** from the carrier **(2)**. Place the bearing cup on the bearing cone **(28)**.
57. Fit tool 3376847M91 on the housing with two bolts **(1)** tightened to a torque of 85 to 130 Nm (Fig. 8).
Note: For 8100 tractors, use the longest finger D on the tool (see section H).
58. Tighten the centre bolt on the tool to a torque of 10 Nm.
Note: Rotate the crown wheel through a few turns in order to seat the bearing cones correctly in the cups. Then, check the tightening torque on the centre bolt on the tool again.
59. Fit the round calibrated spacers **A** in the other two holes and tighten them moderately (Fig. 8). Check that they are in contact with the housing.
60. Proceed with shimming (Fig. 9) to obtain the following preloading:
P2 = 0 to 0.25
61. Position a rule against the two calibrated spacers.
62. Using a set of feeler gauges, measure the clearance **J** between the finger of the tool and the rule **B** (Fig. 10).

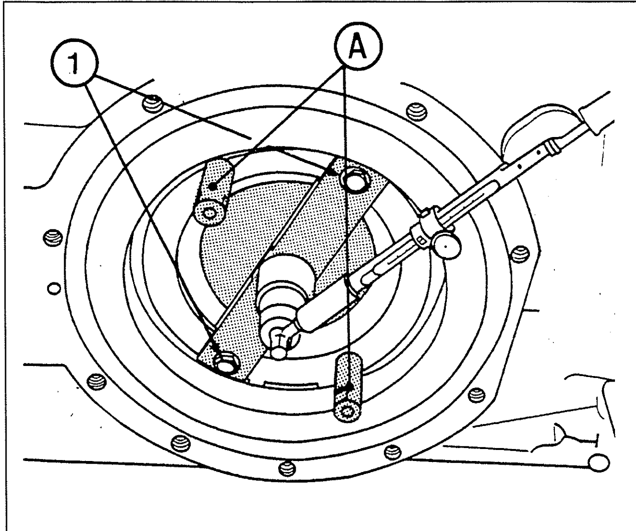


Fig. 8

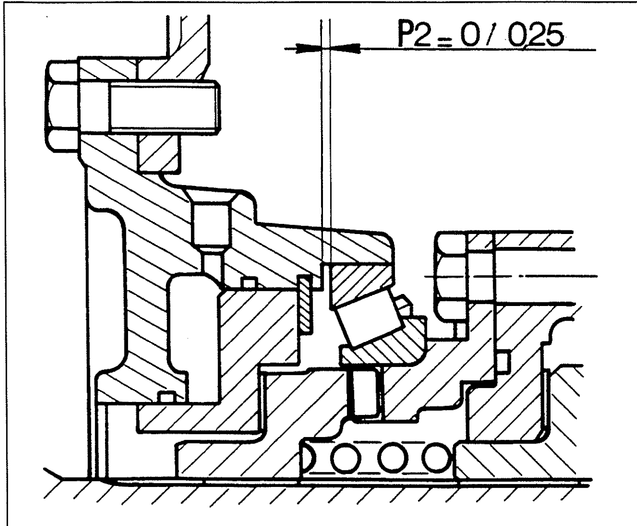


Fig. 9

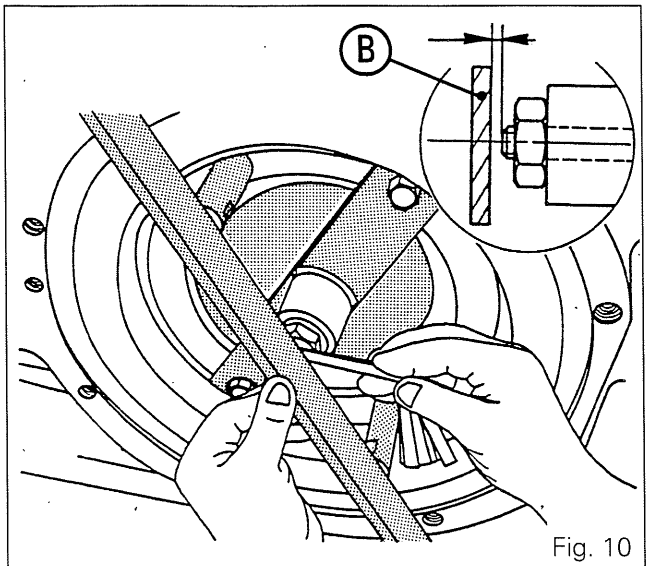
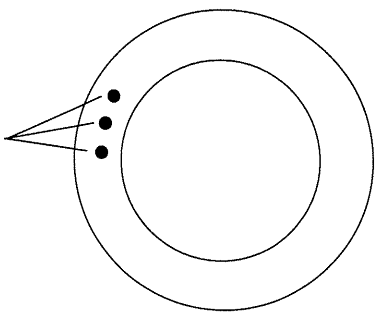


Fig. 10

63. Calculate distance **C** between the bearing cup **(12)** and the mating face on the carrier **(2)** (Fig. 11):
C = (154 + J) - 70
64. Measure distance **Y** on the carrier **(2)** with a depth gauge and a rule (Fig. 12).
65. Select the required thickness of deflector shim **[11]** (see table) to obtain:
P2 = C - Y
Note: Eight types of deflector shim, with different thicknesses, can be used for shimming P2.
66. Remove the tool and the bearing cup **(12)**.
67. Position the deflector shim **[11]** selected in operation 65 and the cup **(12)** in the carrier **(2)**.
Note: Ensure that the deflector shim is fitted the right way round (Fig. 13).
68. Screw two guide studs in diametrically opposite positions on the housing.
Assemble: the friction ring **(8)**, the sliding coupler **(9)** and the spring **(10)** into the carrier **(2)**. Fit the assembly with the differential lock supply port facing upwards.
69. Fit two bolts and tighten them to a torque of 85 to 130 Nm. Remove the two guide studs. Fit the other two bolts and tighten them to the same torque.
70. Check the backlash **J2** between the crown wheel and the drive pinion:
J2 = 0.08 to 0.58



Reference	Number of dots	E (mm)
187 689 M1	0	0.73 - 0.78
892 173 M1	1	0.864 - 0.914
892 172 M1	2	0.991 - 1.041
892 171 M1	3	1.118 - 1.168
892 170 M1	4	1.245 - 1.295
191 124 M1	5	1.37 - 1.42
191 125 M1	6	1.49 - 1.54
521 401 M1	7	0.61 - 0.66

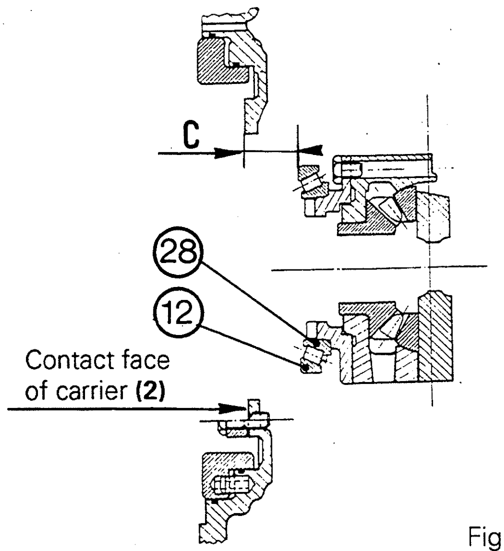


Fig. 11

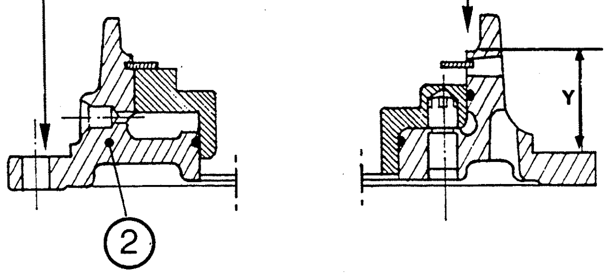


Fig. 12

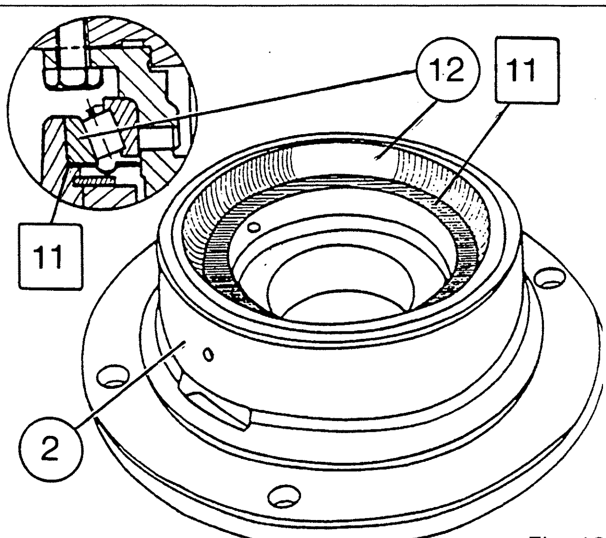


Fig. 13

71. Place the tip of the dial gauge on a tooth on the crown wheel (Fig. 14).
    Note: Carry out this operation on four diametrically opposite points on the crown wheel. J2 is obtained according to the machining tolerances. If this clearance exceeds the maximum tolerance after shimming P2 has been carried out, the thickness of the deflector shim [11] can be reduced. Place a shim of suitable thickness between the bearing cup (16) and the housing (17).
72. Check clearance **J2** again.
73. Refit the PTO layshaft, the PTO driving gear and the top link support (see section 7B01).
74. Refit the lift cover (6E01). Secure the harnesses with a clamp.
75. Refit the fuel tank or tanks. Reconnect the fuel supply and return hoses as well as the fuel gauge harness (in accordance with the marking made when disassembling).
76. Refit the left-hand and right-hand trumpet housings (see sections 6B01 - 6B02 - 6B03, according to the version).
77. Refill with fuel. Refit the support with the auxiliary spool valves.
78. Lift the rear end of the tractor with a trolley jack. Refit the wheels. Remove the stands from under the rear axle assembly. Tighten the wheel nuts to a torque of 400 to 450 Nm.
79. Top up the oil in the housing and remove the chocks. Refit the sheet metal (if removed).
80. Start the engine. Carry out a road test. Check the operation of the controls and electrical circuits.
81. Check for leaks on the mating faces between the trumpet sections and the central housing, on the covers and on the hydraulic connectors.

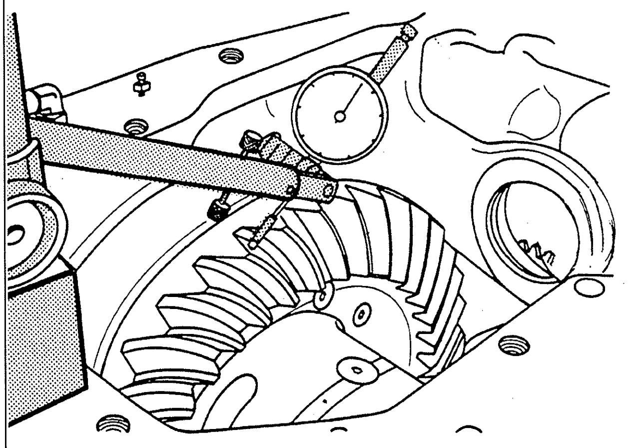


Fig. 14

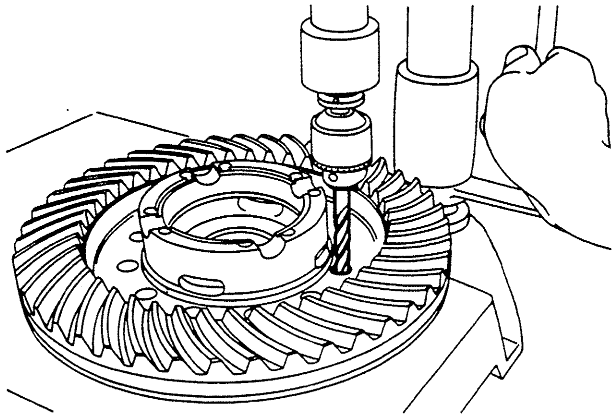


Fig. 15

F. Removing and disassembling the crown wheel and the driving pinion

Note: When the crown wheel is replaced, the driving pinion must also be replaced. Both of these parts are identified with the same number and they must be kept in pairs.
In the factory, the crown wheel and the carrier are assembled by means of rivets.
For the purpose of repair, the rivets are replaced with nuts and bolts.
The tractor must be split in order to replace the crown wheel and the driving pinion.

Preliminary operations

82. Split the tractor between the gearbox and the rear axle assembly (cab integral with the gearbox, see section 2C01).
83. Remove the wheels. Remove the left-hand and right-hand trumpet housings (sections 6B01 - 6B02 - 6B03, according to the version).
84. Remove the lift cover (section 6E01).
85. Remove the top link support, the PTO driving gear and layshaft (see section 7B01).

Removing and disassembling the crown wheel

86. Carry out procedures 36 to 48.
87. Strike the centre of each rivet **(19)** with a punch (on the crown wheel teeth side).
    Drill the rivets to a depth of 10 mm with a 5 mm diameter drill (Fig. 15).

CONTENTS

Then drill out to a diameter of 12 mm and to the same depth.
Drive out the rivets with a suitable rivet punch (Fig. 16).

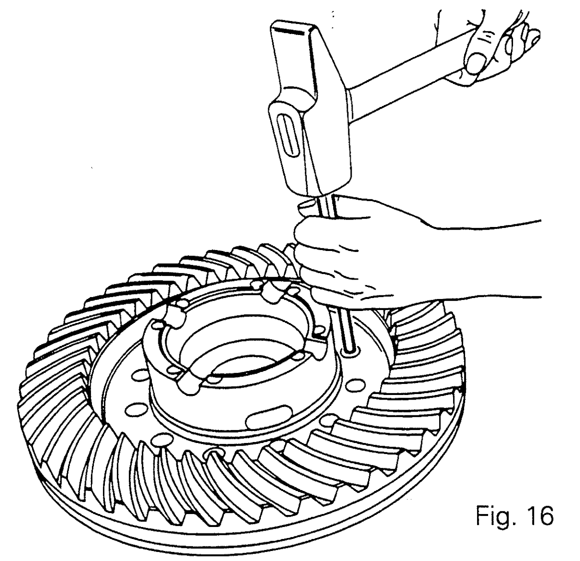


Fig. 16

Removing and disassembling the driving pinion

88. Remove the right-hand cover (sections 9F01 or 9R01) and left-hand cover (sections 9F02 or 9R02).
89. Remove the bolt **(43)**, the washer **(44)**, the gear **(45)**, the bolts **(37)**, the backing plate **(36)** and the shims **[35]**.
90. Remove the bearing cup **(34)** and the driving pinion equipped with bearing cones **(31)** and **(33)**.
91. Extract the bearing cup **(30)** and cones **(31)** and **(33)**.

G. Reassembling and refitting the driving pinion and crown wheel

Reassembling the driving pinion

92. Check the parts and replace any that are faulty.
93. Using a press and a suitable fixture, fit the bearing cones **(33)** and **(31)** fully home against the shoulder on the driving pinion.

Refitting the driving pinion

94. Apply Loctite 603 on the outside diameter of the bearing cup **(30)** and fit it fully home against the shoulder in the housing.
    Note: The bearing cones and cups must be cleaned and lubricated before fitting.
95. Fit the driving pinion and the bearing cup **(34)**.
96. Screw two guide studs onto the housing.
97. Check the torque on the driving pinion.
    The principle consists in removing or adding shims **[35]** in order to obtain a rotating torque of 1.80 to 3.80 Nm, measured with a dynamometer and a suitable splined sleeve, ref. 1626464M3.
    Each time the bolts **(37)** are reinstalled, the torque of 85 to 130 Nm must be complied with. On final refitting, apply Loctite 270 on the bolts **(37)** and tighten them to a torque of 85 to 130 Nm.
    Fit the gear **(45)** and the washer **(44)**. Tighten the bolt **(43)** to a torque of 91 to 122 Nm - Loctite 241.

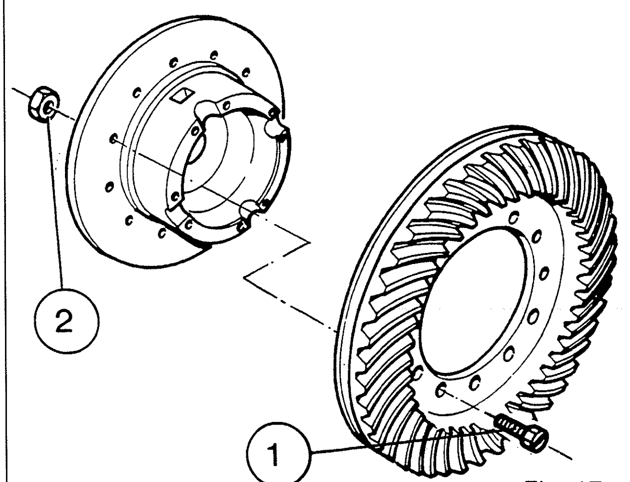


Fig. 17

Refitting the crown wheel

98. Clean the mating faces on the new crown wheel **(18)** and on the housing **(17)**, the bolts and the nuts specified in the spare parts catalogue.
99. Apply Loctite 270 on the leading threads of bolts **(1)** and position them in the crown wheel and the housing (Fig. 17).
100. Tighten and lock the nuts **(2)** (Fig. 17) to a torque of 150 to 160 Nm.

Reassembling and refitting the differential assembly

101. Check the parts and replace any that are faulty.
102. Carry out procedures 46 to 48 in the reverse order. Carry out procedures 51 to 74.

Final steps

103. Refit the right-hand and left-hand covers (sections 9F01 or 9R01 and 9F02 or 9R02), the right-hand and left-hand trumpet housings (sections 6B01 - 6B02 - 6B03, according to the version).
104. Reinstall the support with the auxiliary spool valves.
105. Refit the wheels. Tighten the nuts to a torque of 400 to 450 Nm.
106. Recouple the tractor between the gearbox and the rear axle assembly (cab integral with the gearbox, see section 2C01).
107. Check the operation of the differential lock, the lift system and the spool valves.

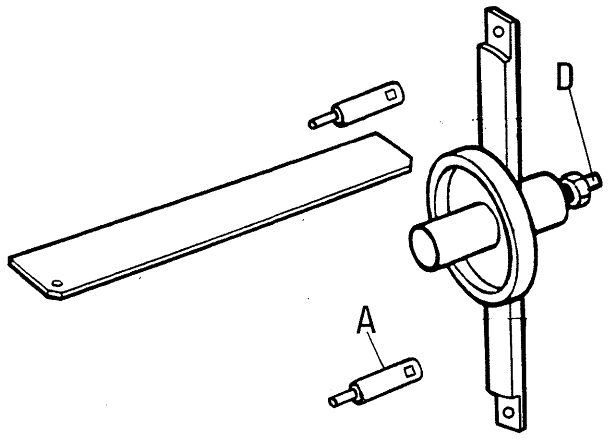


Fig. 18

H. Service tool

3376847M91: Shimming tool, available through the MF network (Fig. 18).

For MF 8100 tractors, use round spacers **A** and the longest finger **D**.

6 D01 Rear hitch mechanism

CONTENTS

Rear axle - Rear hitch mechanism

A. Disassembly

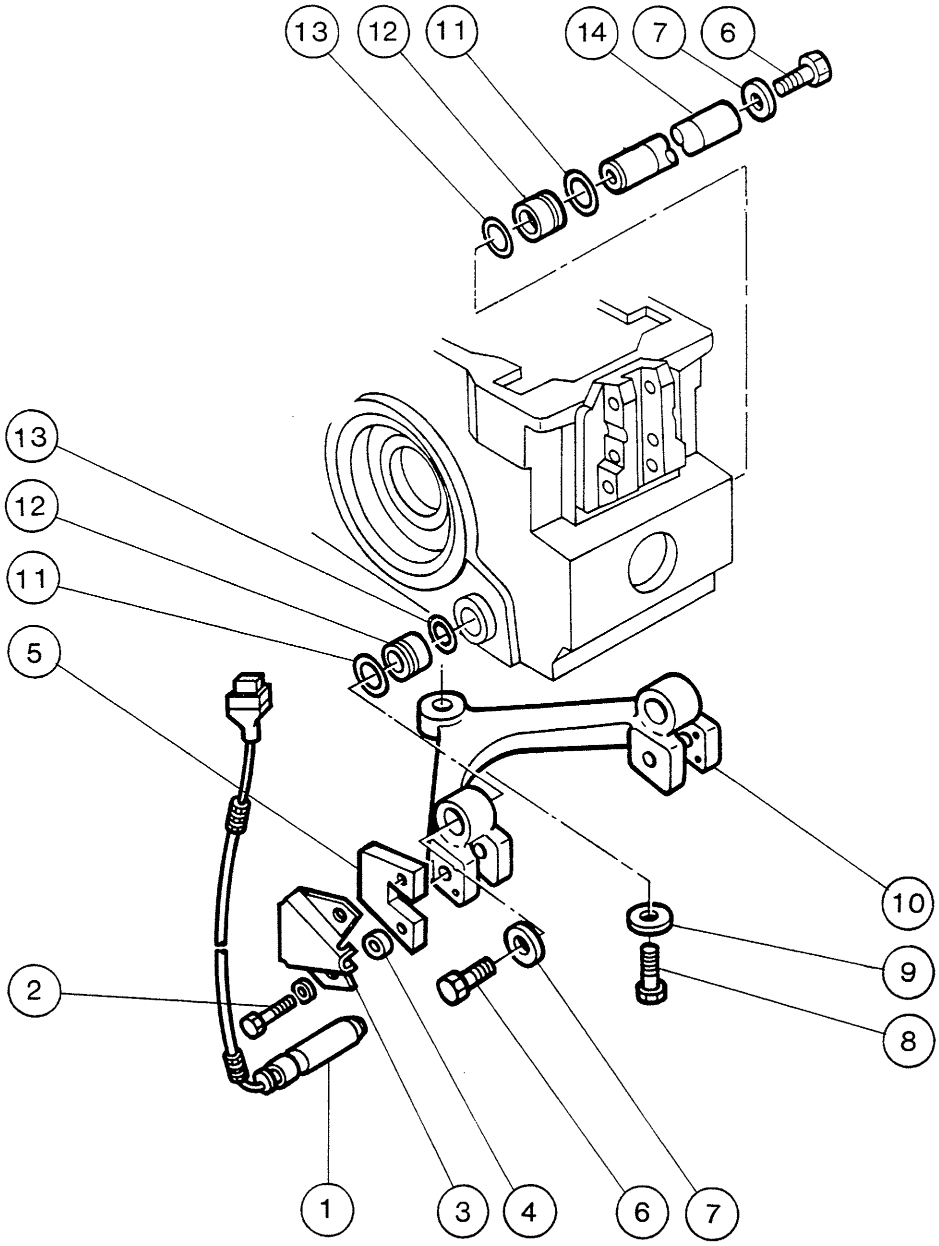
Preliminary operations

1. Remove the right-hand or left-hand wheel.
2. Disassemble the lifting tie-rods and the stabilisers.
3. Remove the circlips **(18)** and extract the ram pins **(15)**.
4. Uncouple the load sensors and the lower draw-bars.
5. Drain the housing.
6. Remove the right-hand or left-hand trumpet housing.

Disassembly

7. Loosen the bolts **(2)**, disassemble the guard **(3)**, the spacer **(4)**, the lock plate (5) and the load sensor **(1)** on both sides.
8. Loosen the bolts **(8)** and **(6)** on both sides.
9. Extract the shaft **(14)**. Disassemble the support **(10)**.
10. Extract the two sleeves **(12)** along with seals **(11)** and **(13)**.

Exploded view



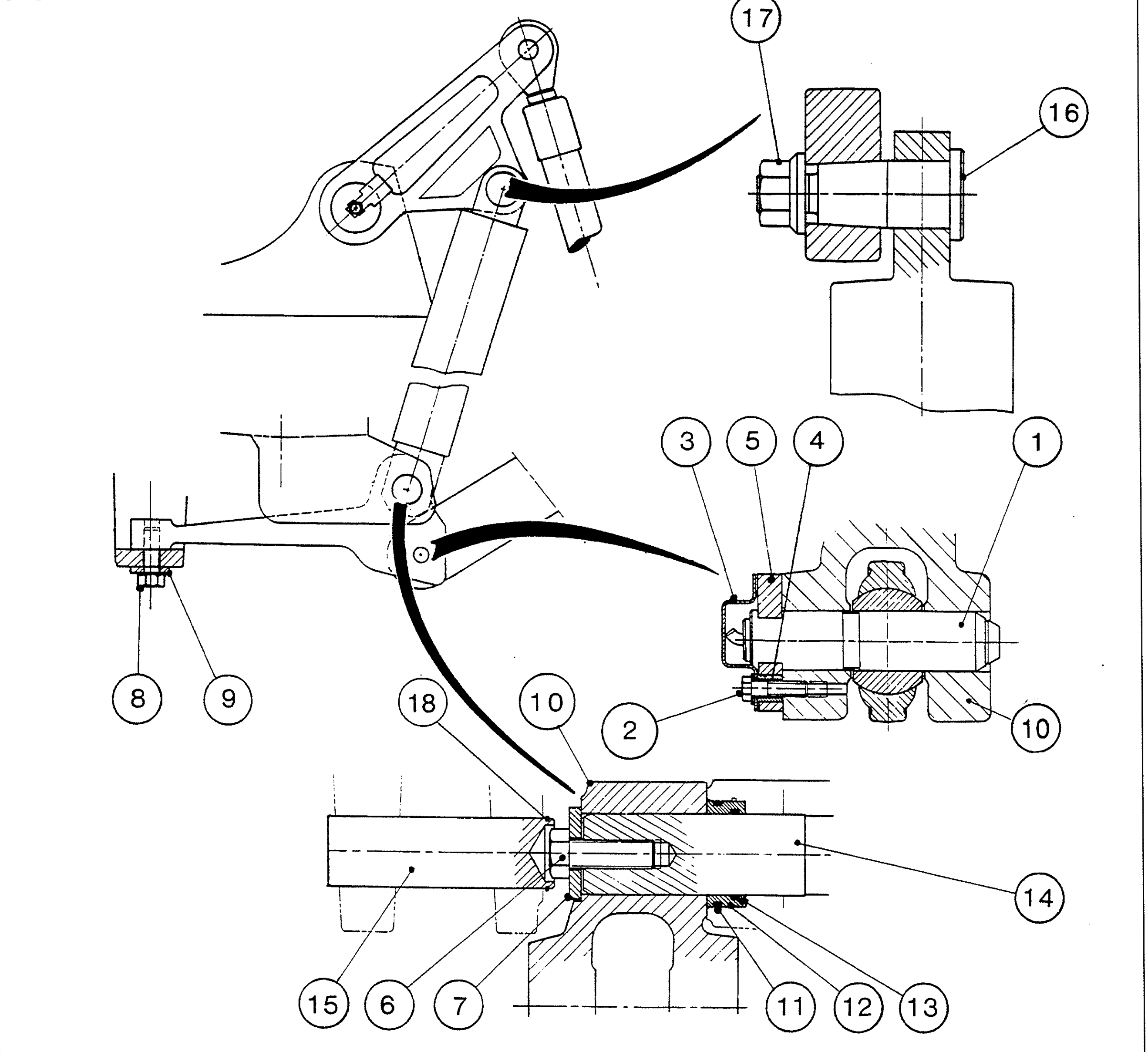
B. Reassembly

11. Clean and check the parts, and replace any that are faulty.
12. Replace the seals **(11)** and **(13)** and reinstall them on the sleeves **(12)**.
13. Position the sleeves in the housing, ensuring that they are installed the right way in order to avoid leaks.
14. Fit the support **(10)**. Lubricate the shaft **(14)** and insert it into the sleeves.
15. Coat the bolts **(6)** with Loctite 270, fit the washers **(7)** and tighten to a torque of 370 - 420 Nm.
16. Fit the bolt **(8)** with washer **(9)**.
17. Reinstall the load sensors **(1)** and the lock plates **(5)** with spacers **(4)**.
    Fit and tighten the bolts **(2)** to a torque of 100 Nm.
18. Check the operation of the lifting function. Check the shaft **(14)** for leaks.

General specifications

- On reassembly, apply Loctite «Anti-seize» grease on shaft **(15)** in order to avoid any seizure of the lifting ram.
- If it was dismantled, apply a coat of dry molybdenum disulphide varnish on the pin **(16)**.
- Tighten the nut **(17)** to a torque of 450 - 550 Nm.

Overall view



6 E01 Lift cover

CONTENTS

Rear axle - *Lift cover*

General

The lift cover is mounted on the upper face of the rear axle housing. It is fitted with two bushes **(17)** which support the lift shaft **(1)** which is splined at both ends and drives the two arms **(6)**.

The cam **(4)**, bolted onto the shaft, indicates the various positions of the lift arms.

These positions are recorded by a position sensor **(12)** which transmits information to the computer located on the console in the cab.

The support for the auxiliary spool valves is mounted on the rear face of the cover. The lift spool valve is also fitted on this support.

The speed sensor **(26)** is bolted onto the front of the cover.

List of parts

(1) Lift cover
(2) O-rings
(3) Retaining rings
(4) Cam
(5) Bolt
(6) Lift arms
(7) Bushes
(8) Washers
(9) Retainers
10) Bolt
(11) Bolt
(12) Position sensor
(13) Nut
(14) Seal
(15) Sealing bush
(16) Bush
(17) Bush
(18) Lift cover
(19) Bolt
(20) Bolt
(21) Stud
(22) Stud
(23) Nuts
(24) Spool valve support
(25) Housing
(26) Speed sensor
(27) Nut

Rear axle - Lift cover

Exploded view

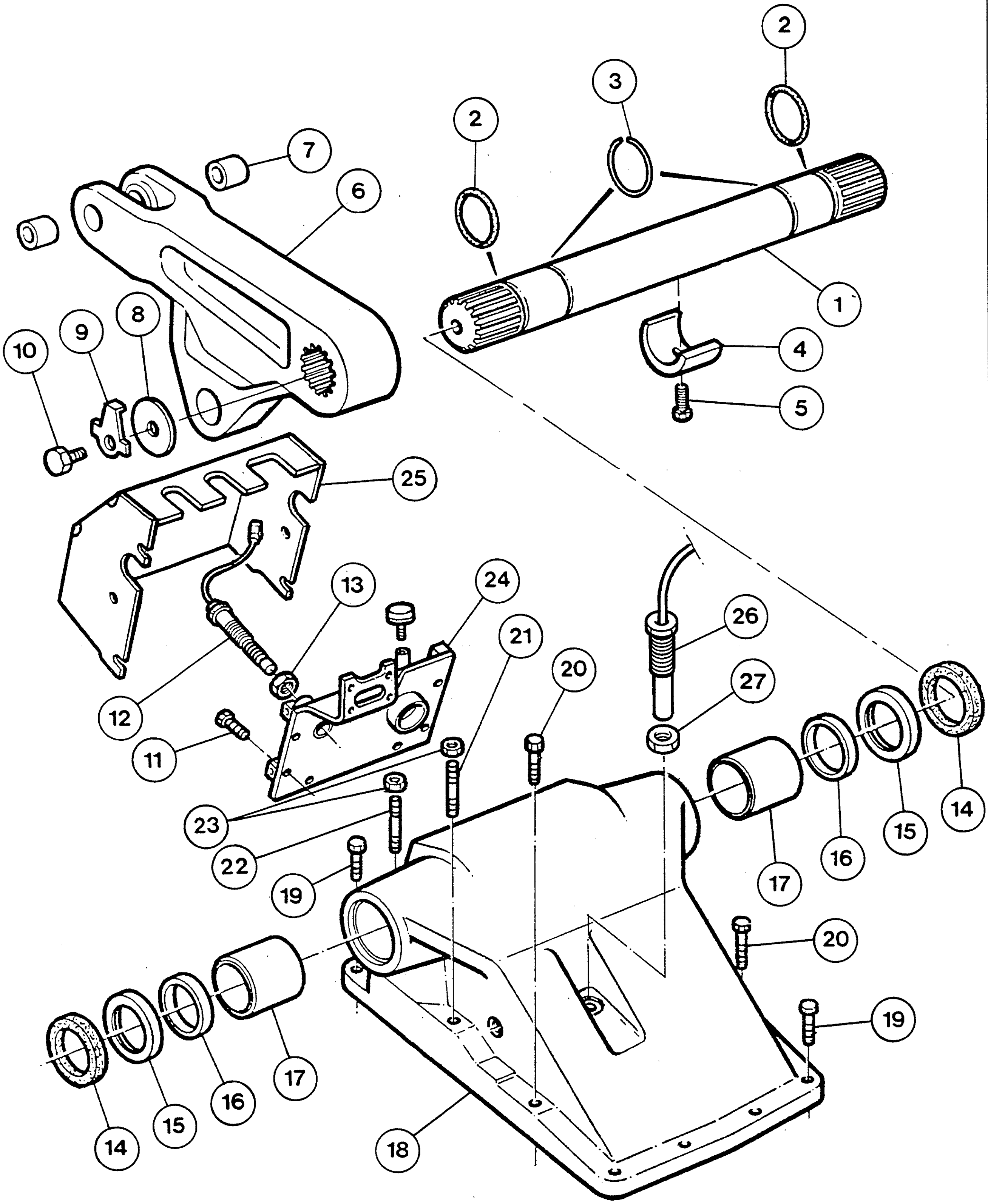


Fig. 1

Rear axle - Lift cover

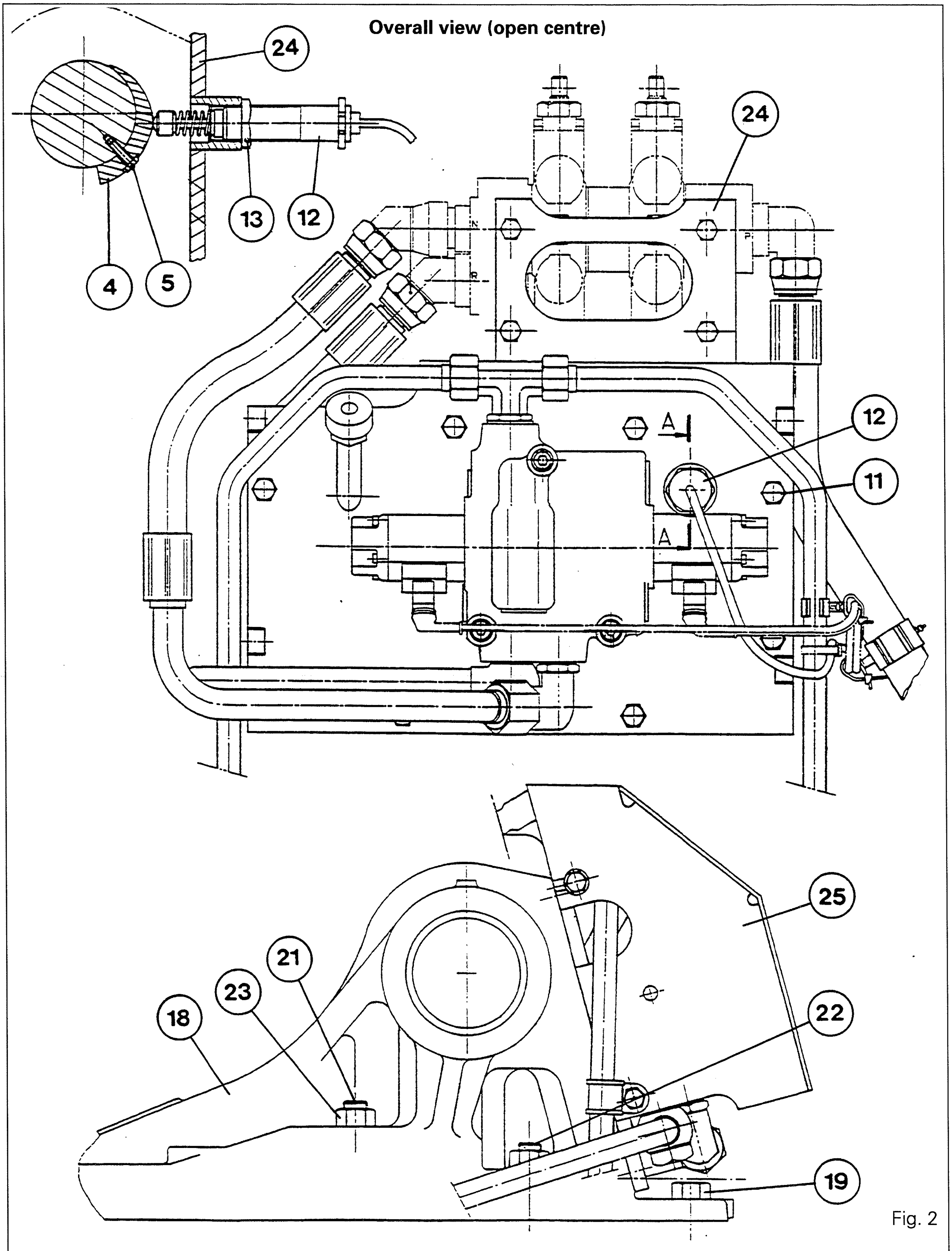


Fig. 2

Overall view (closed centre)

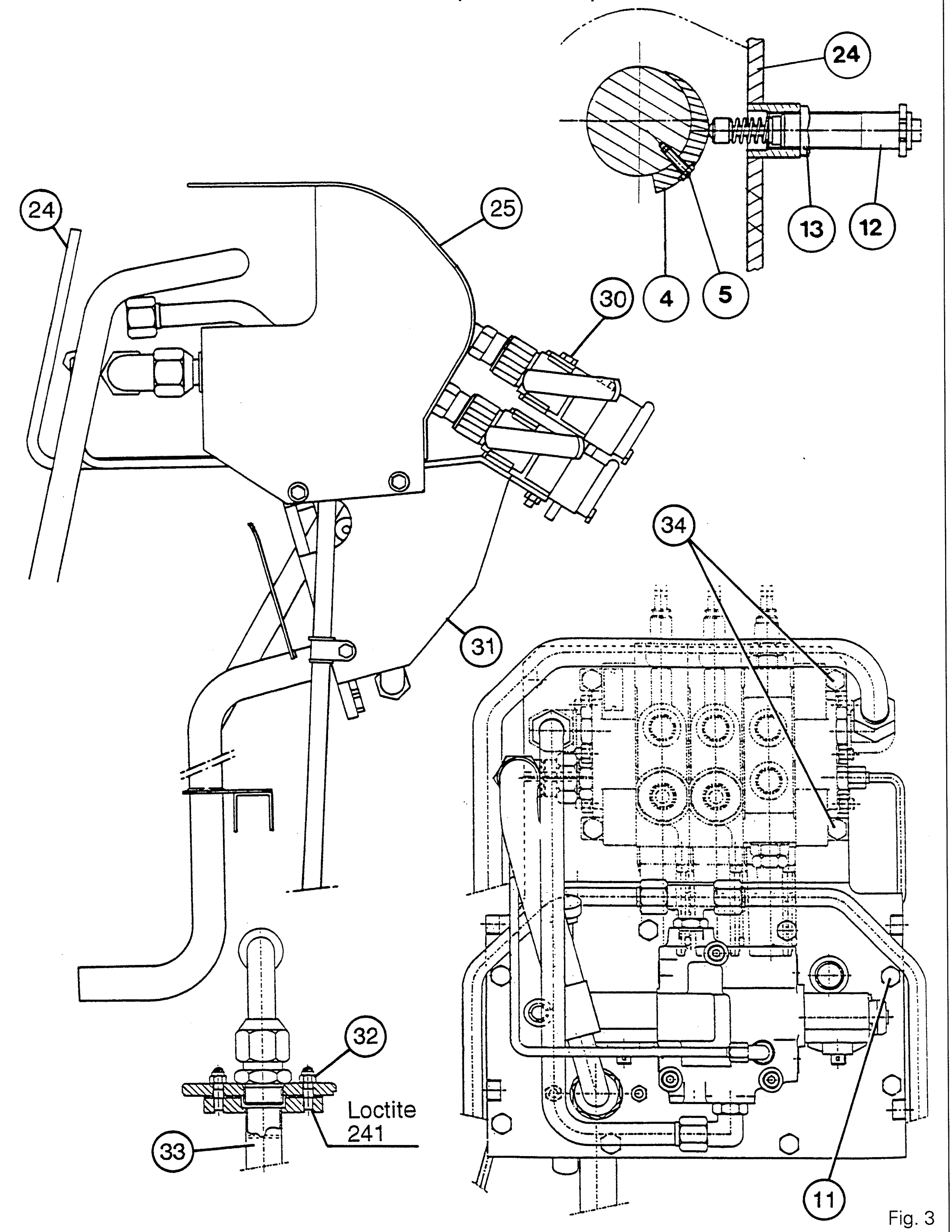


Fig. 3

Rear axle - Lift cover

A . Removing and refitting the cover

Removal

1. Place the lift arms in the low position. Remove the housing **(25)** of the lift valve.
2. **Open centre version** :
   - Remove the lower quick couplers from spool valves 1 and 2 (No 1 on the flow divider side).
   Disconnect the lowering/raising connectors, the pipes on the lift valve and on the spool valves. Remove the spool valve assy without disconnecting the controls. Remove support **(24)**.
3. **Closed centre version (Fig. 3)** :
   - Remove the bolts **(30)**
   - Remove the support **(31)**
   - Remove the nuts **(32)** to loosen the pipe **(33)**.
   Disconnect the lowering/raising connectors, the pipes on the lift valve and on the spool valves.
   - Remove the bolts **(34)** and remove the spool valves without dismantling the controls.
   - Remove the support **(24)**.

Every version

4. Drain the fuel tank or tanks (according to type).
5. Remove the sheet metal. Remove the rear attaching bolts and loosen the front attaching bolts on the cab.
6. Raise the cab.
7. Remove the main fuel tank.
8. Disconnect the connectors for the speed and position sensors.
9. Remove the differential lock supply pipe.
10. Extract the upper pins from the rams.
11. Remove the upper pins from the lift rods.
12. Remove the link tube **(1)** from the differential lock (Fig. 4).
13. Remove the attaching bolts **(19) (20)** and nuts **(23)** from the cover. Detach and remove the cover using mobile tackle.

Refitting

14. Carry out procedures 1 to 13 in the reverse order.
   Tightening torques:
   - Bolts **(19) (20)** : 214 - 235 Nm
   - Nuts **(23)** : 214 - 235 Nm
   - Cab rear supporting nuts and locknuts :
     . nuts : 27 - 35 Nm
     . Locknuts : 13 - 20 Nm (with Loctite 270)
   - Cab front attaching bolts : 200 - 270 Nm
   - Ram upper pin nuts : 450 - 550 Nm
     (Do not lubricate the tapered section of the pins when fitting).

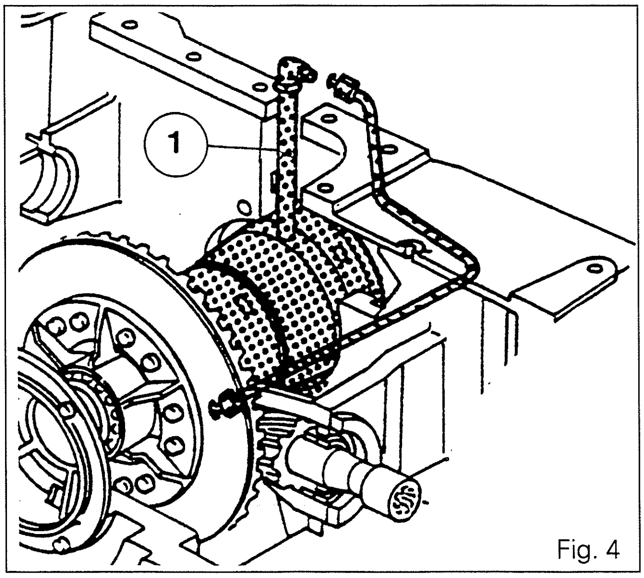


Fig. 4

Note : The mating faces on the housing, lift cover (18) and spool valve support (24) must be cleaned. Apply Loctite 510 on the mating face of the lift cover and Loctite 518 on the mating face of the spool valve support.

15. **Check for leaks on**:
   - the mating faces on the lift cover and spool valve support,
   - hydraulic unions.
   - check the operation of the lift system, the spool valves and the speed sensor.

B . Replacing the cover

Disassembly

16. Remove the cover (see part A). Disassemble the speed sensor.
17. Remove the lift arms **(6)**.
18. Remove and discard the seals **(14)**. remove the cam **(4)**. Extract the retaining rings **(3)** from their grooves.
19. Remove the lift shaft **(1)**, sliding it on the retaining rings.
20. Extract the sealing bushes **(15)**. Remove the bushes **(16)** and the O-rings **(2)**.
21. If necessary, extract bushes **(17)**.

Reassembly

22. Clean and check the parts, and replace any that are faulty.
23. If they were removed, fit the bushes **(17)** after smearing them with Loctite 542 in accordance with Fig. 5, with the chamfer directed towards the outside.
24. Apply Anti-seize grease on the bearing surfaces of the shaft **(1)** and refit it with the retaining rings **(3)**.
25. Position the O-rings **(2)** and bushes **(16)**, with the chamfer directed towards the seal **(2)**.
26. Protect the splines on the lift shaft. Apply Loctite 542 on the sealing bushes **(15)** and fit them as per Fig. 5.
27. Apply Anti-seize grease on the seals **(14)** and position them on the lift shaft. Remove the protection. Fit the lift arms, washers **(8)**, retainers **(9)** and bolts **(10)** coated with Loctite 270. Lock a bolt **(10)** at the end of the shaft and fold down the tabs on the retainer. Tighten the other bolt until the arms can be raised or lowered freely. Fold down the tabs on the retainer.
28. Refit the cam **(4)**. Tighten bolt **(5)** smeared with Loctite 270 to a torque of 11 to 16 Nm. Refit the lift cover (see part A). Fit and adjust the speed sensor (see part C).
29. Smear the mating face on the spool valve support with loctite 518. Tighten the bolts **(11)** to a torque of 34 to 51 Nm.
30. Fit and adjust the position sensor (see part D).
    Tightening torque :
    - Studs **(21) (22)** : 214 - 235 Nm (Loctite 270)
31. **Check for leaks on**:
    - The mating face on the spool valve support.

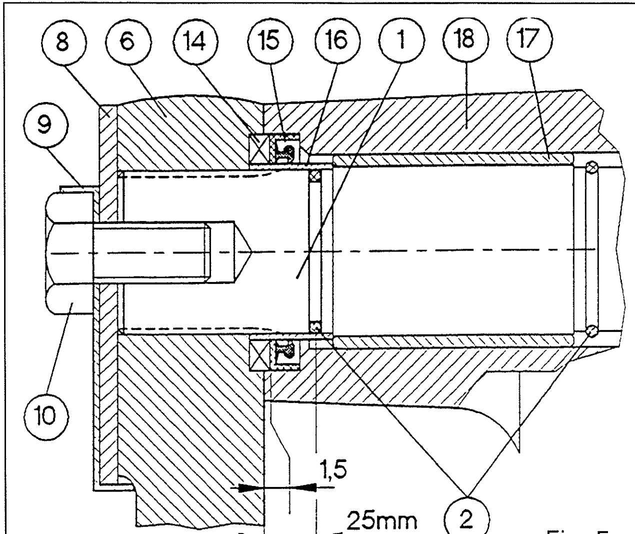


Fig. 5

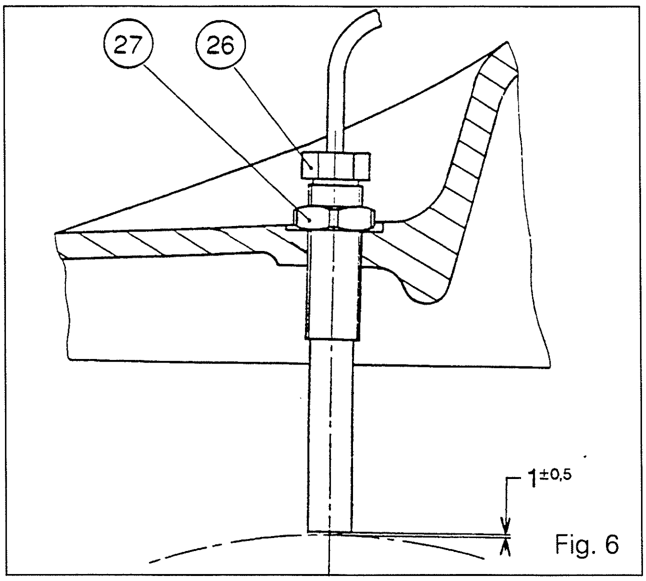


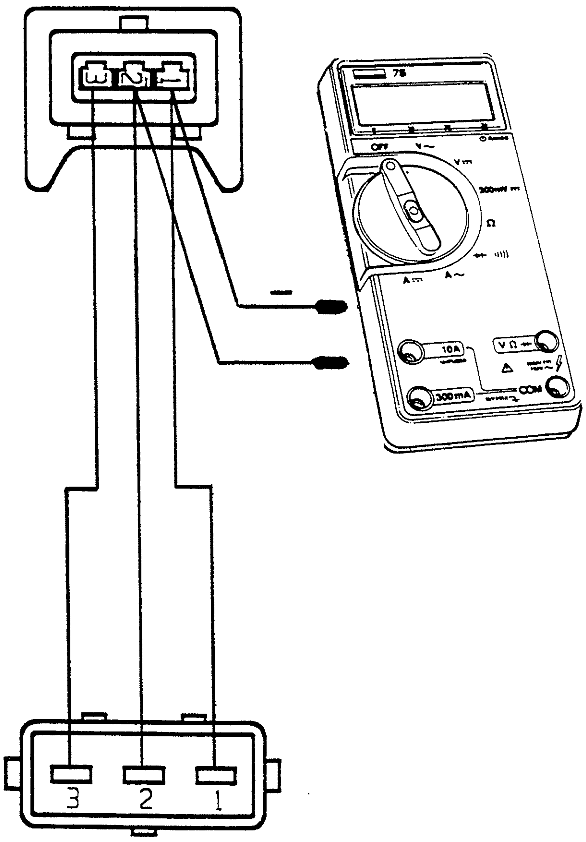
Fig. 6

C . Adjusting the speed sensor (Fig. 6)

32. Fit the speed sensor with Loctite 577 Sensor Sealing or equivalent. Screw the sensor without forcing in contact with the differential ring gear. Unscrew the sensor by 3/4 of a turn in order to obtain a clearance of approximately 1 mm between the sensor and the ring gear. Tighten the nut **(27)** moderately. Connect the sensor wiring harness.

D . Adjusting the position sensor

33. Fit the position sensor with Loctite 577 Sensor Sealing or equivalent. Screw the sensor by a few turns.
34. Start the engine.
35. Using the external control or pushing on the end of the raising solenoid, make sure that the lift arms are in the fully raised position (relief valve blowing). Stop the engine.
36. Screw in the sensor (without forcing it) until it meets the cam **(4)**. Connect the sensor to the female connector of a locally made test harness as shown Fig. 7. Connect the other connector of the test harness to the tractor harness.
37. Connect pins **(1)** and **(2)** to the MF 3005 multimeter. Lower the lower links of 3 to 5 cm at the ball ends or hook. Unscrew the sensor to obtain a voltage **between 6.92 and 6.96 volts**. Reconnect the tractor sensor.



1 . Earth
2 . Signal
3 . Sensor power supply 9.5 V

Fig. 7

E . Replacing the lift arm

Note: The lift arm, seals and bushes (16) are replaced without removing the lift cover.
If work is necessary on bushes (7), fit them coated with Loctite 270 flush with face «F» of the lift arm (6) (Fig. 7).

Disassembly

38. Remove the spool valves and carry out procedures 1 to 3 (see part A).
39. Remove the upper pins from the rams and the lift rods.
40. Disconnect the position sensor connector.
41. Detach and remove the auxiliary spool valve support **(24)**. Remove the lift arm, seals and bushes. Carry out procedures 17 to 20 (see part B).

Reassembly

42. Clean and check the parts, and replace any that are faulty.
43. Refit the lift arm, seals and bushes. Carry out procedures 24 to 27 (see part B).
44. Refit the cam **(4)**. Apply Loctite 270 on bolts **(5)** and tighten to a torque of 11 to 16 Nm.
45. Smear the mating face of support **(24)** on the lift cover with Loctite 518. Refit the support. Tighten the bolts **(11)** to a torque of 34 to 51 Nm. Reconnect the pipes and hoses.
46. Reconnect the position sensor connector.
47. Refit the upper pins on the rams and lift rods.
48. Refit the spool valves. Carry out procedures 1 to 3 (see part A) and adjust the position sensor (see part D).
49. Check for leaks on :
    - the mating face of the spool valve support,
    - the hydraulic unions.
50. Check the operation of the lifting system and of the auxiliary spool valves.

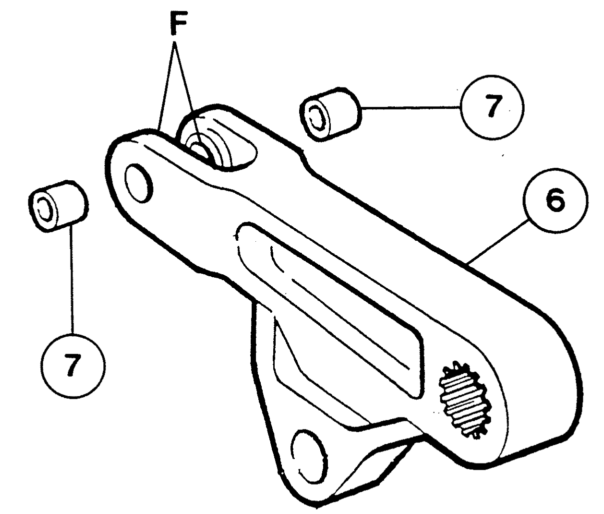


Fig. 8

6F01 Brake pistons and seals

CONTENTS

Rear axle - *Brake pistons and seals*

General

The brake pistons are housed in two lateral recesses in the rear axle housing, concentric with the supporting face of each trumpet housing.
They comprise a shouldered part and are guided by three locating dowels which are force-fitted in the housing.
Sealing is provided by two O-rings mounted in grooves on the rear axle housing. Each piston is controlled by a master cylinder maintained at a constant level by a residual oil flow from the oil cooler.
Each piston acts directly on a friction disc mounted on the planetary shaft at the entrance of the trumpet housing and a plate centred by dowels and supported on the ring gear of the reduction unit (standard trumpet housing). In the case of trumpet housings with a sealed partition or dual reduction unit, the plate is replaced by a spacer with a different design. When the brake is released, there is minimum clearance between the piston and the disc. The brakes are self-adjusting and maintain a constant pedal travel. The discs are constantly lubricated by oil from the rear axle; an oil film is maintained on the braking surfaces when they are not in use and cools the brakes when they are used.

Remarks :

The brake discs are equipped with inserted hubs.
The disc friction surfaces vary according to the types:
- 8110 to 8150 = 332 cm^2
- 8160 = 463 cm^2

Preliminary operation

1. Remove the trumpet housings (see Sections 6 B01, 6 B02 or 6 B03 according to the version).

Rear axle - *Brake pistons and seals*

A . Disassembly

2. Disconnect the brake pipe. Remove the piston **(1)** from the housing with a jet of compressed air connected onto union **(2)** (Fig. 1).
3. Remove the O-rings **(1)** and **(2)** on the housing (Fig. 2) and discard them.
   Note : If it proves necessary to replace the brake plate (standard version trumpet housings) or the spacer (trumpet housings with sealed bulkhead or dual reduction unit), see Sections 6 B01, 6 B02 or 6 B03 according to the version.

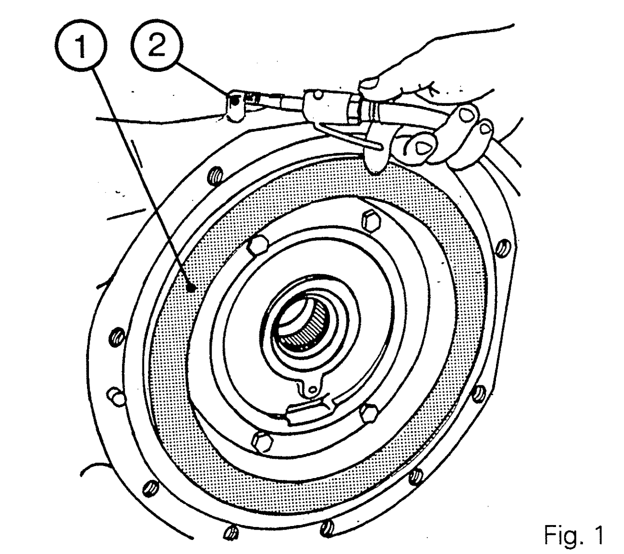


Fig. 1

B . Reassembly

4. Clean and check the parts, and replace any that are faulty.
5. Fit the pistons **(1)** without seals in the housing **(2)** (Fig. 3) and check that it slides freely in the bore in the housing and over the dowels without any friction points.
6. Remove the piston, fit new O-rings **(1)** and **(2)** (Fig. 2) after applying a light coat of miscible grease (technical Amber or equivalent) in order to keep them correctly positioned at the bottom of the groove.

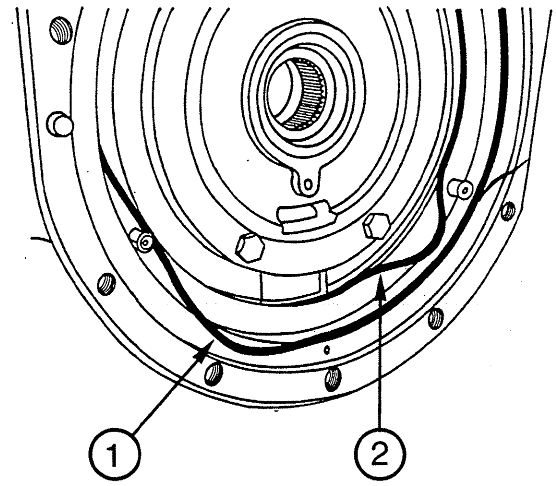


Fig. 2

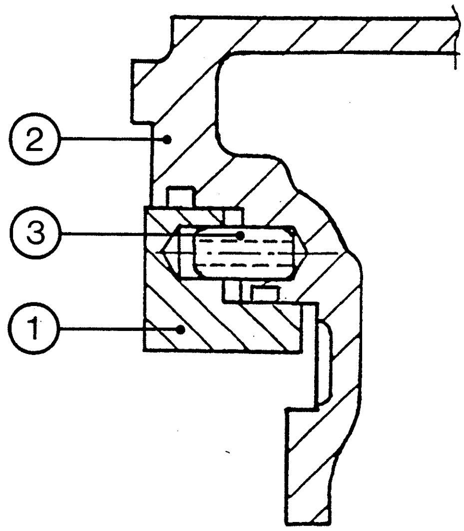


Fig. 3

CONTENTS

Rear axle - Brake pistons and seals

7. Position the piston on the dowels and then fit it in place by means of a plastic mallet, striking alternate points around the circumference (Fig. 4).
   Note : On tractors equipped with trumpet housings with dual reduction units, the lateral bores «P» positioned diametrically opposite on the piston, must be along the horizontal axis (Fig. 5).

Leak test

If work is carried out on the brake pistons and O-rings, it is necessary to check for leaks.
Secure the piston with two wide washers and two bolts in diametrically opposite positions (Fig. 6).
Install a pressure gauge on the connector.
Supply the circuit with compressed air at approximately 5 bar in order to ensure operation of the piston. Reduce the pressure to 0.3 bar to carry out the test.
Close the pressure reducing valve. No pressure drop should be indicated on the pressure gauge for one minute.
Disconnect the pressure gauge. Remove the holding bolts and washers.

8. Reconnect the brake pipe.

Final operations

9. Refit the trumpet housings (see Section 6 B01, 6 B02 or 6 B03 according to the version).
10. Bleed the main brakes and the trailer brake (if fitted).
    Carry out the procedures in sections 9G01 and 9B01 or 9M01 according to the version.

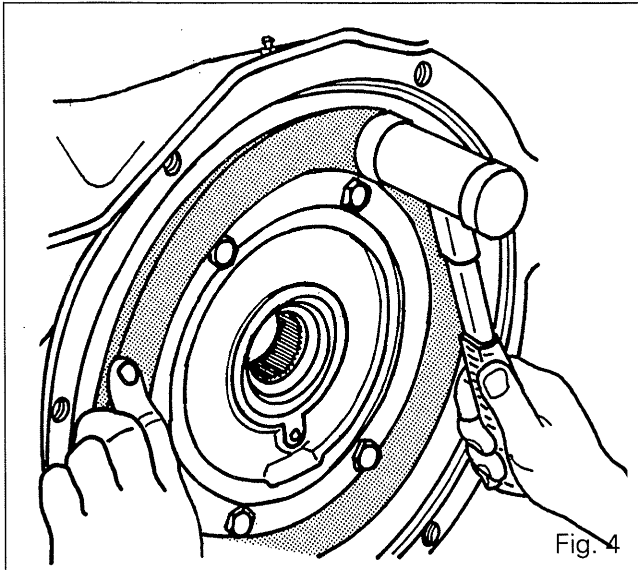


Fig. 4

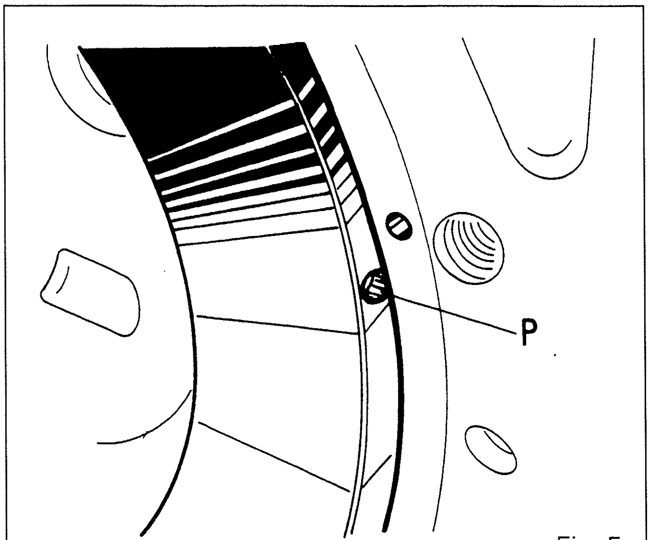


Fig. 5

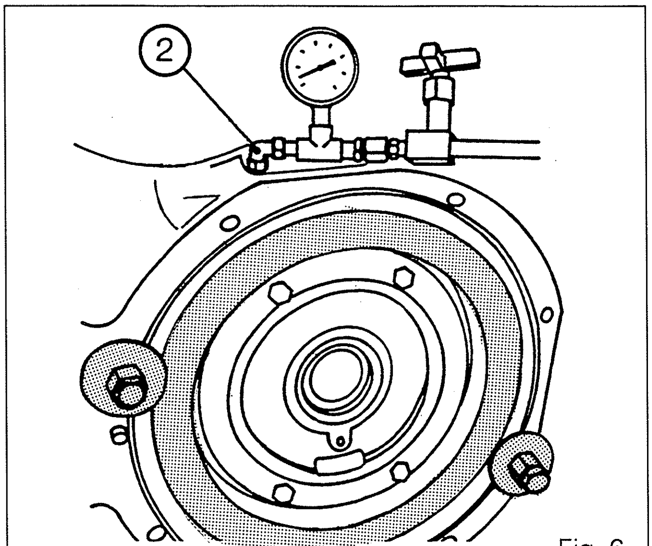


Fig. 6

7 . POWER TAKE-OFF

Contents

7 A01 Clutch

CONTENTS

General

The power take-off clutch, fitted on the front of the rear axle housing, is driven by the rear end of the PTO shaft via the clutch input shaft. This shaft is splined to a sleeve mounted on the engine flywheel. The PTO shaft is splined onto the clutch shaft at the front end. It crosses the Dynashift, the reverse shuttle and the gearbox layshaft.

The clutch assembly consists of the following principal components:

- a housing **(9)** supported by two ball bearings **(7)** and **(2)**, separated by a sleeve **(4)** and respectively centred in a bore and in a bush which is force fitted in the centre housing. The clutch housing contains a force fitted shaft supporting the ball bearing **(22)** for hub **(21)**,
- a piston **(10)** sliding inside the housing,
- a set of driving plates **(17)** and driven plates **(14)**,
- a driving hub **(21)**,
- a cover **(15)**.

The housing has exterior helical teeth which drive the gear(s) of the hydraulic pump (depending on the version). For greater efficiency, the bearings and driving plates are lubricated by oil supplied from an external pipe **(47)**, which has one end mounted on top of the centre housing (Fig. 2) and the other on the lubricating coupler on the front left-hand part of the gearbox.

Operation

PTO engagement

The clutch is fed by the 17 bar hydraulic circuit through the PTO solenoid valve situated on the right hand side cover and by an external tube **(40)** connected to the top of the centre housing (Fig. 2).

The oil enters the clutch housing **(9)** through channels **a** and **c** and chamber **b**. It pushes the piston **(10)** which presses the driven plates **(14)** against the driving plates **(17)**. The driven plates **(14)** are secured onto the cover **(15)** by means of lugs and bolts **(16)**. The driving plates **(17)** are splined onto the hub **(21)**. Motion is transmitted to the driving hub **(21)** which houses the shaft actuating the PTO driving gear. At the same time, the pressure which was acting on the PTO brake piston also presses the Belleville springs situated in the top link support, enabling the 540 and 1000 rpm gears to turn freely. When the clutch is engaged, the driving plates are cooled and lubricated.

PTO braking

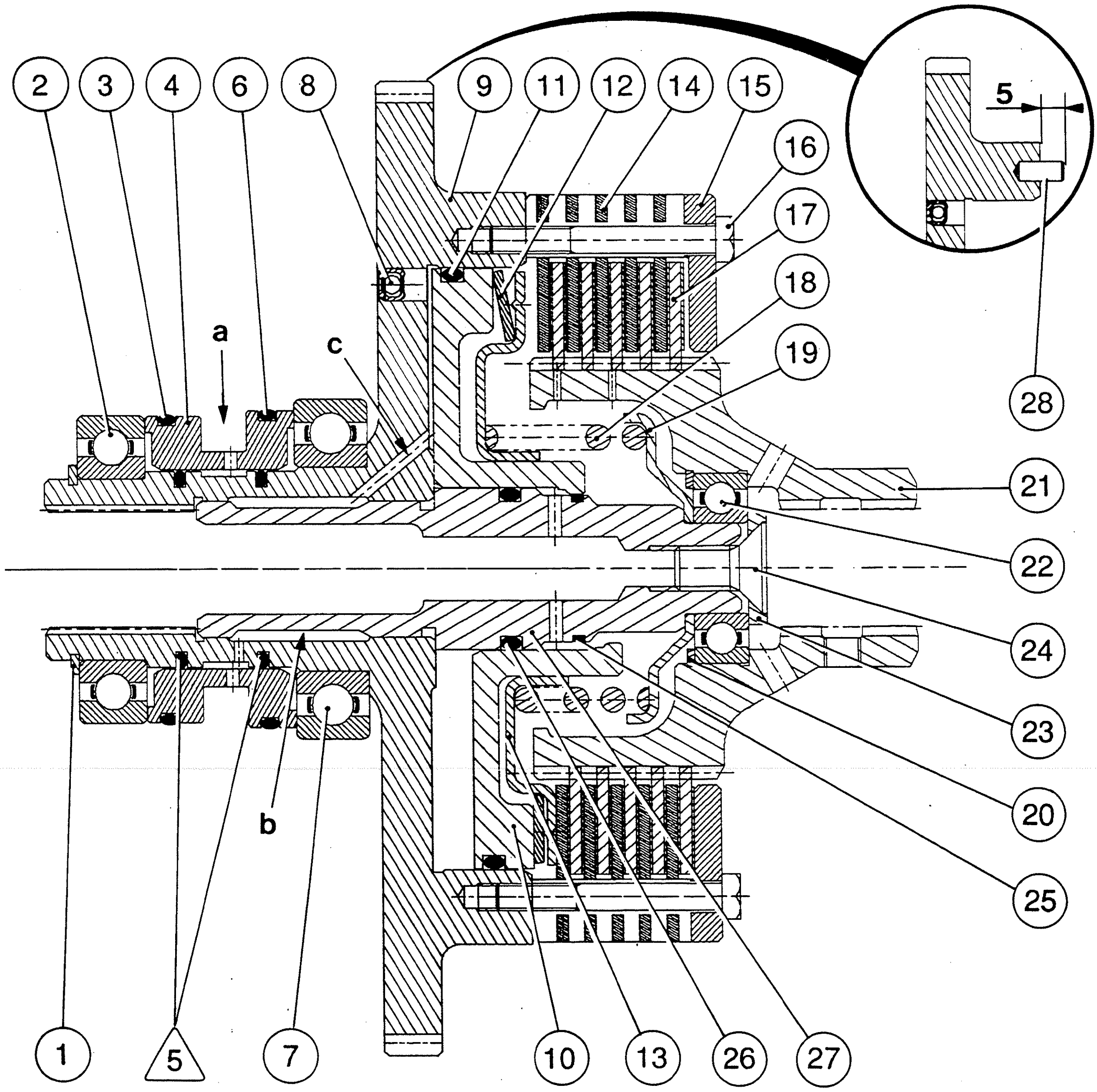
When the supply is cut off, the spring **(18)** pushes the piston against the housing **(9)**.
At the same time, the Belleville springs act on the piston located in the top link support, progressively stopping the driving gear.

Service tools

Tools to be made up locally

- Spring tube compression lever (section C)
- Clutch spring retaining support (section C)

General arrangement

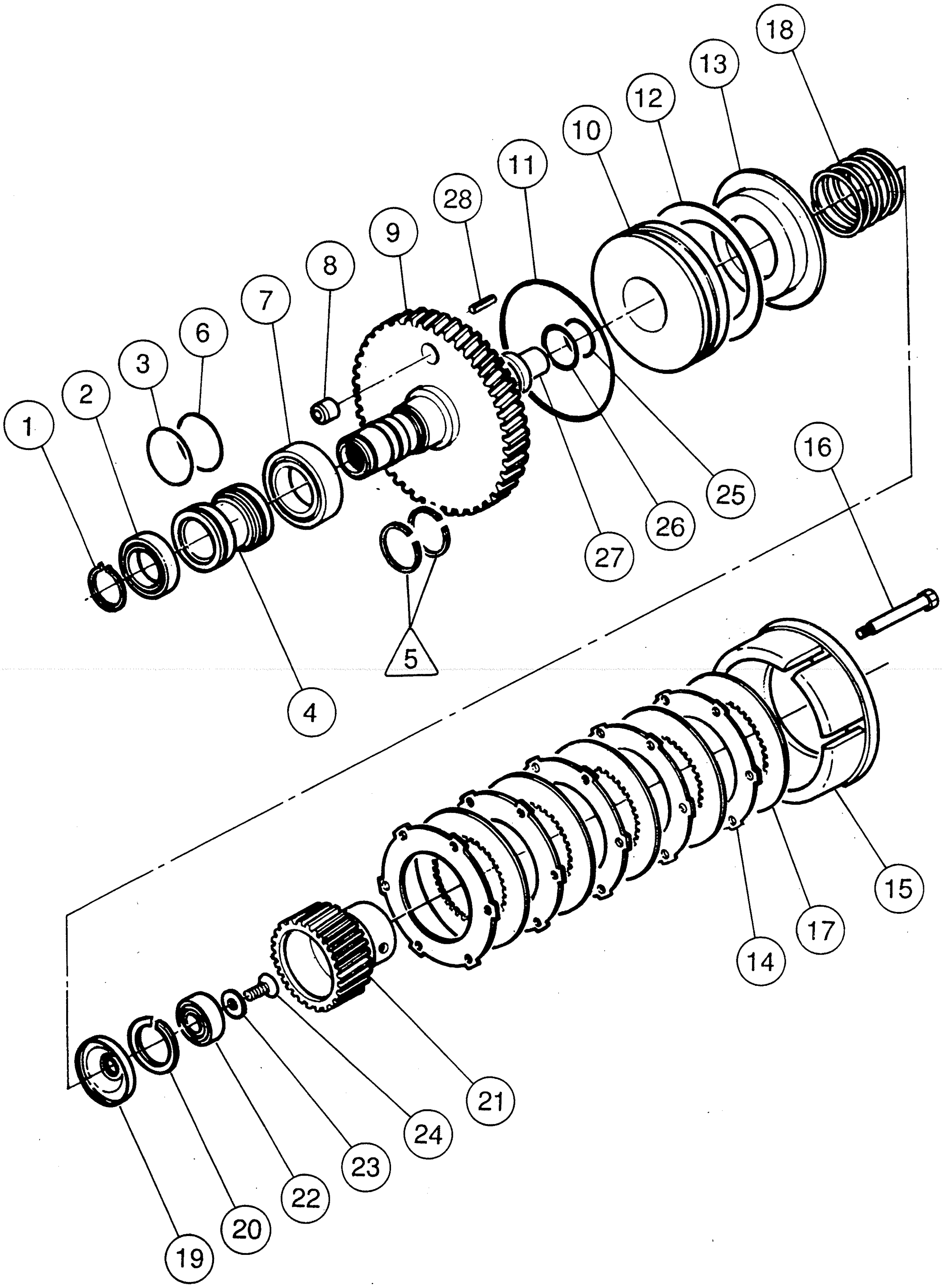


Key

(1) Circlip
(2) Ball bearing
(3) O-ring
(4) Sleeve
/5 Seal rings
(6) O-ring
(7) Ball bearing
(8) Valve
(9) Clutch housing
(10) Piston
(11) O-ring
(12) Belleville washer
(13) Retainer
(14) Driven plate
(15) Cover
(16) Bolt
(17) Driving plate
(18) Spring
(19) Spring seat
(20) Retaining ring
(21) Hub
(22) Ball bearing
(23) Washer
(24) Screw
(25) O-ring
(26) O-ring
(27) Sleeve
(28) Dowels

PTO - Clutch

Exploded view



A. Removal and refitting of clutch (Fig. 1 to 4)

Removal

1. Remove the wheel. Install a stand. Remove the left-hand cover (as from serial number D255024): see section 9F02. For earlier serial numbers: Remove the wheels. Install stands. Remove the right and left-hand covers. See sections 9F01 and 9F02.
   Note: On tractors fitted with a hydraulic system of the open centre type, remove the wheels and install stands. Remove the right and left-hand covers (section 9R01 and 9R02) and the anti-emulsion plate located above the 4WD clutch).
2. Remove the transfer pipe.
3. Remove the dowel from the coupling sleeve fitted between the gearbox output shaft and the driving gear. Slide the sleeve onto the output shaft.
4. Remove the screw and the washer of the 4 WD pinion. Remove the pinion passing through the output shaft and the driving pinion.
5. Move the sleeve backwards towards the driving pinion.
6. Disconnect the PTO brake tube. Remove the top link support, the drive gear **(46)** with intermediate shaft **(45)**.
7. Hold the clutch **(30)** using a lever (Fig. 3). Release tube **(37)** from sleeve **(33)** by compressing ring **(38)** with the locally made tool (Fig. 4) (see section C).

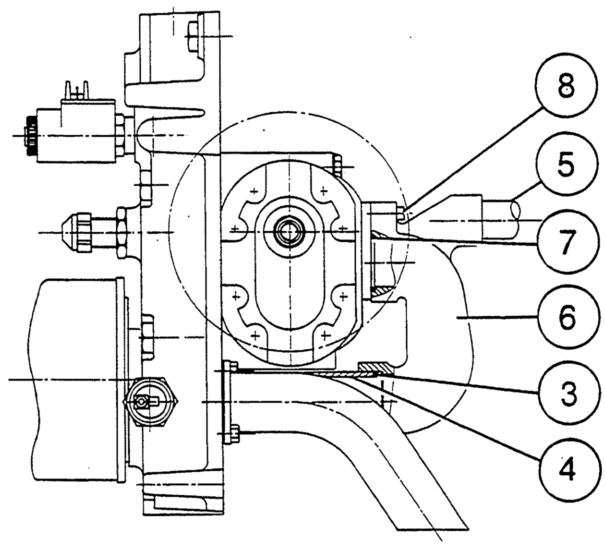


Fig. 1

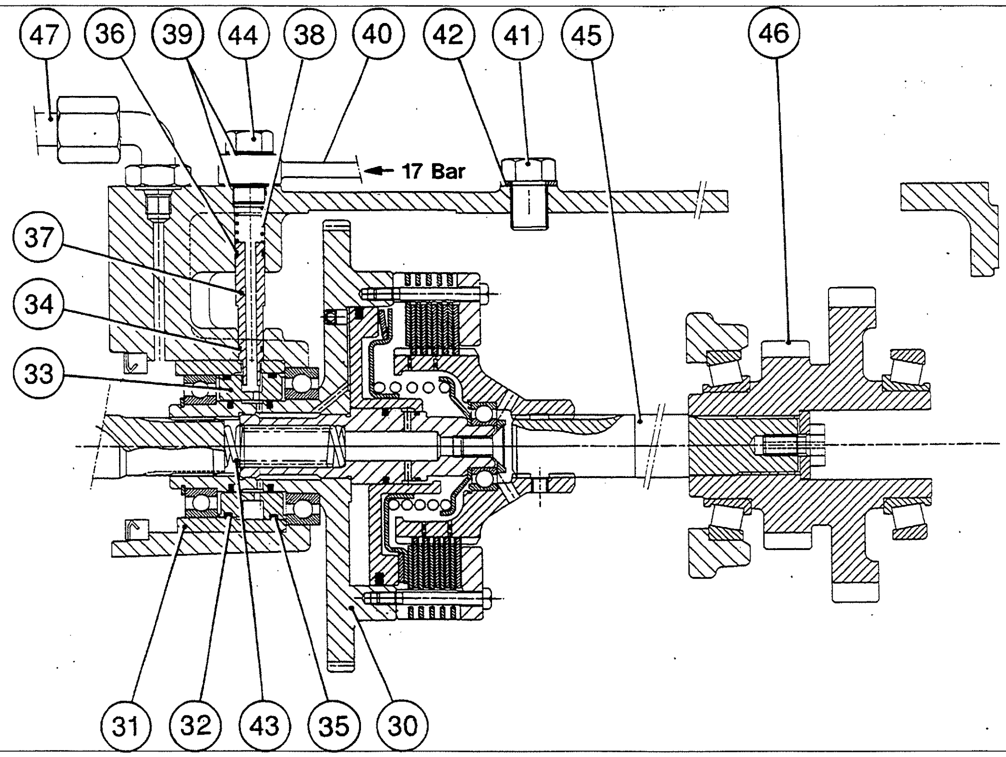


Fig. 2

8. Remove clutch and spring **(43)** by the gap of the cover.
   Note: To replace the seals (34) and (36), raise the cab on the left-hand side, checking the space between the bonnet and the windscreen. Remove the bolts (44), the spring (38) and tube (37). The bush (31), smeared with Loctite 610, is force fitted in the housing.

Refitting

9. Clean and check the parts. Replace those which are defective.
10. If necessary, replace the seals **(34)**, **(36)** and **(39)**. Refit the tube **(37)** and the spring **(38)**. Reconnect the 17-bar pipe **(40)**. Tighten the bolts **(44)**.
11. Check that the O-rings **(32)** and **(35)** are not damaged.
12. Place spring **(43)** in the sleeve. Compress spring **(38)** by tube **(37)** using the locally made tool (Fig. 4).
13. Refit the clutch using a lever (Fig. 3) to compress spring **(43)**.
14. Remove the tool and make sure that the tube **(37)** is correctly engaged in the sleeve groove **(33)**.
15. Carry out operation 2 to 5.
    Note : Coat the 4 WD gear bolt with Loctite 241 and tighten to 91 - 122 Nm. Position the transfer tube with the notch facing the pin (closed centre system). Fit a new pin on the coupling sleeve.
16. Refit the compound drive gear, the intermediate shaft and the top link support.
17. Reconnect the PTO brake pipe (if fitted).
18. Reinstall the cover or covers, according to the tractor serial number or the type of hydraulic system (see the respective sections stated in operation 1).
19. If work is required on the seals **(34)**, **(36)** and **(39)**, reinstall the cab and refit the front and rear support bolts.
    Rear support:
    - nut 27 to 35 Nm
    - lock nuts: 13 to 20 Nm, with Loctite 270
    Front support:
    - bolt 200 to 270 Nm
20. Refit the wheel. Torque the nuts to 400 - 450 Nm.
21. Check the operation of the clutch, the PTO brake and the lift.
22. Check for leaks at the top link support and at the hydraulic connectors.

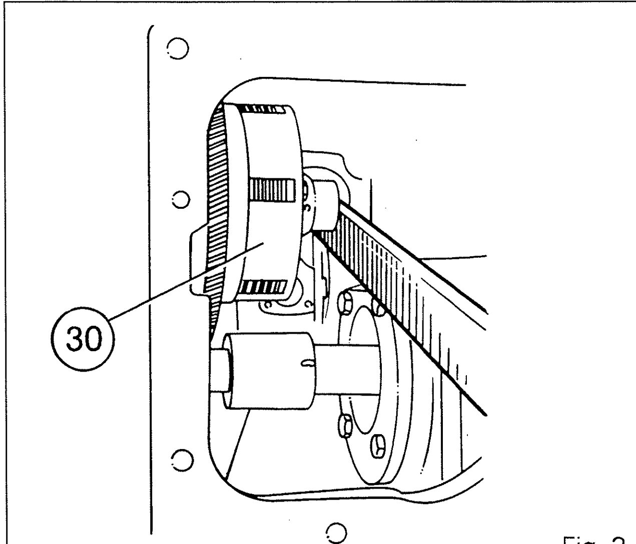


Fig. 3

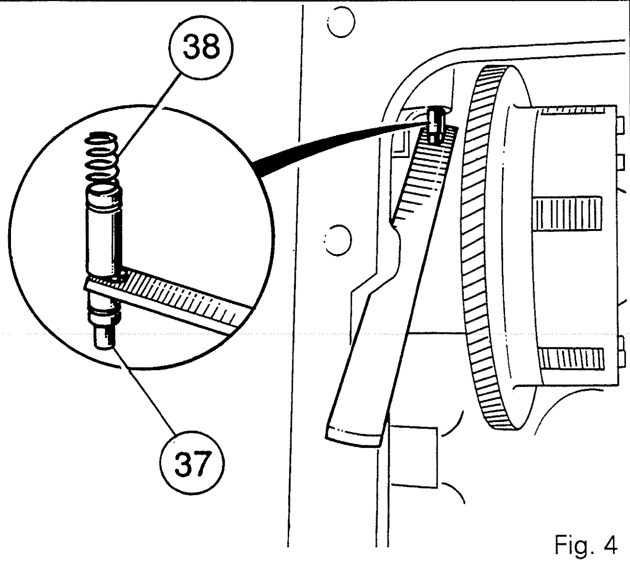


Fig. 4

CONTENTS

B. Removal and refitting of clutch

Removal

23. Remove bolts **(16)**.
24. Remove cover **(15)**, driving plates **(17)** and driven plates **(14)**.
25. Place housing **(9)** in a vice.
26. Remove O-rings **(3)** and **(6)**.
27. Remove circlip **(1)**.
28. Extract ball bearing **(2)** with sleeve **(4)**.
29. Remove seal rings **/5** (Fig. 7), extract ball bearing **(7)**.
30. Hold hub **(21)** using the locally made tool (Fig. 5).
31. Remove screw **(24)** and take out washer **(23)** (Fig. 5). Progressively release the spring **(18)** with the tool.
32. Remove the hub, spring seat **(19)**, spring **(18)**, retainer **(13)** and Belleville washer **(12)**.
33. Remove retaining ring **(20)**.
34. Extract ball bearing **(22)**.
35. Take out piston **(10)**.
36. Remove O-rings **(11)**, **(25)** and **(26)**.

Refitting

Note: The valve (8) is crimped in housing (9). The sleeve (27), coated with Loctite 648, is force fitted into the housing. If it has been removed, check that the oil way is not blocked by the Loctite when refitting. Two dowels (28) are fitted in the housing (9) at 5 mm from face (Fig. 6).

37. Check and clean the parts. Replace those which are defective.
38. Using a suitable device and a press, push the ball bearing **(7)** in until it meets the shoulder of the housing.
39. Place the seal rings **/5** in their grooves and join up the ends (Fig. 7). Ensure that they turn freely.
40. Slide the sleeve **(4)** onto the seal rings, taking care not to damage them.
    Note: Position the larger diameter end of the sleeve towards the ball bearing (7).
41. Using a suitable device and a press, push the ball bearing **(2)** in until it meets the shoulder of the housing **(9)**.
42. Fit the circlip **(1)**.
43. Replace and oil O-rings **(11)**, **(25)** and **(26)**.

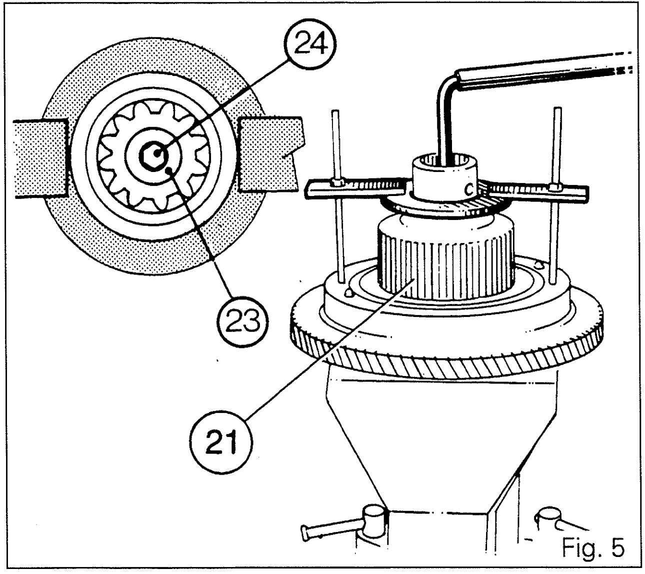


Fig. 5

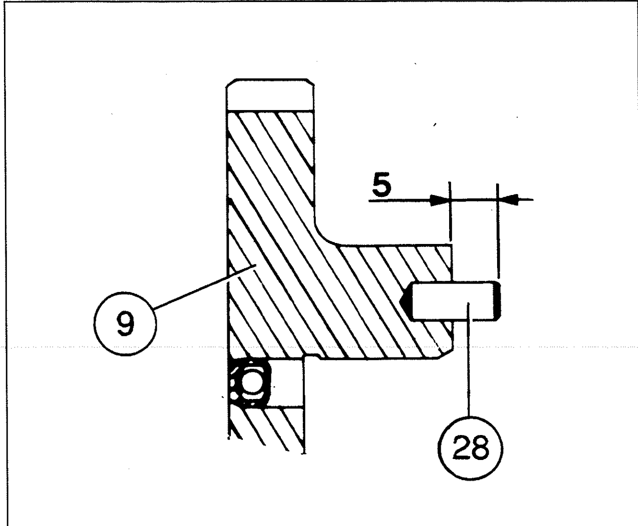


Fig. 6

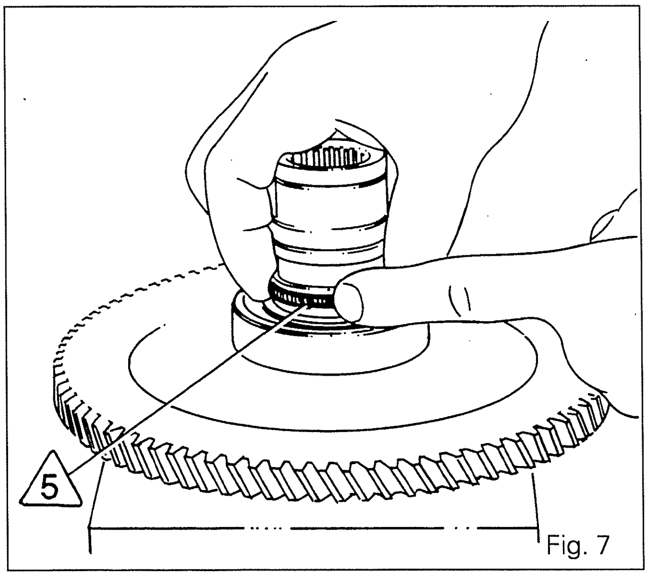


Fig. 7

44. Oil the sleeve **(27)** and the piston **(10)** and insert into a housing with a plastic mallet (Fig. 8).
45. Using a suitable device and a press, insert the ball bearing **(22)** into the hub **(21)**. Fit the retaining ring **(20)**.
46. Refit the Belleville washer **(12)**, the support **(13)**, the spring **(18)**, the spring seat **(19)** and the hub **(21)**.
47. Compress the spring **(18)** with the tool (Fig. 5). Mount the washer **(23)** and tighten the screw **(24)**, coated with Loctite 242, to a torque of 24 - 28 Nm.
48. Place the driven plates **(14)** and the driving plates **(17)** on the hub **(21)**.
49. Position the clutch housing **(15)** on the two pins **(28)**. Fit the bolts **(16)** lightly coated with Loctite 542 and tighten them to a torque of 15 - 18 Nm.
50. Manually check that the driving plates and driven plates do not bind together.
51. Oil and fit the O-rings **(3)** and **(6)**.
    Note: The O-rings have different diameters.

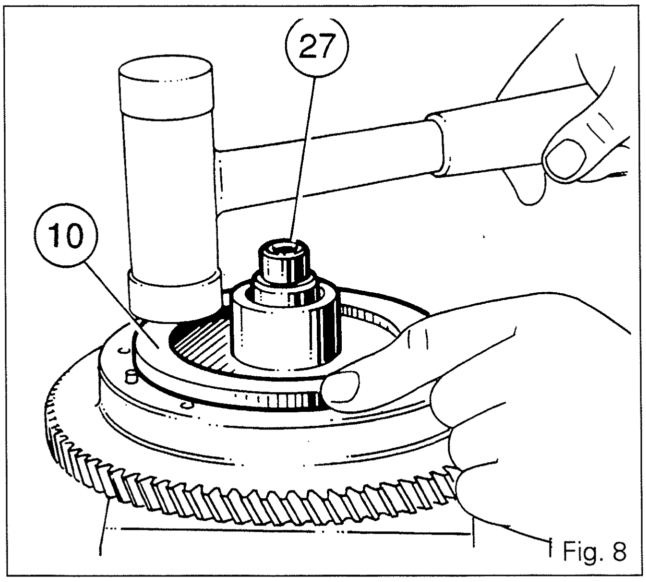


Fig. 8

C. Service tools

Tools made up locally

- Spring tube compression lever (Fig. 9).
- Clutch spring retaining support (Fig. 10).

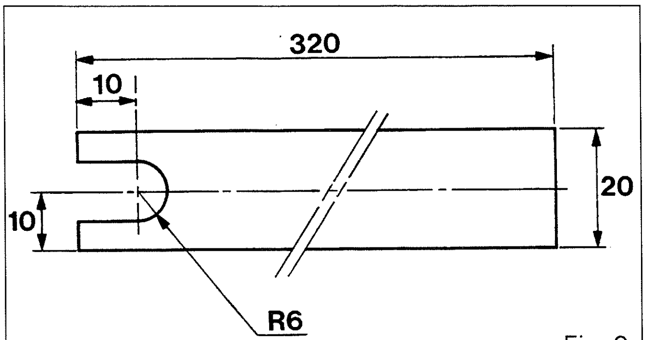


Fig. 9

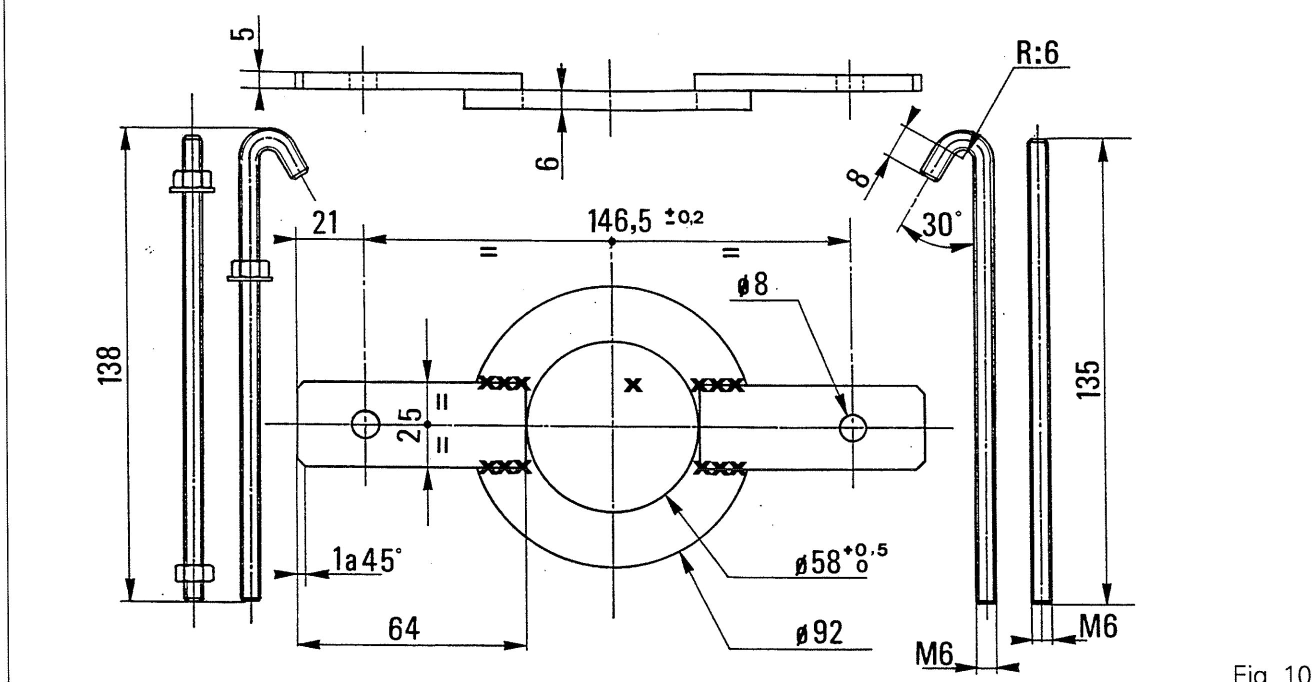


Fig. 10

7 B01 PTO brake (option) - Layshaft - Driving gear

CONTENTS

A. PTO brake (option)

Preliminary operations

Remove the thrust bar, the hitch hook and the 3rd point support.
Disconnect the supply pipe from the PTO brake.

Disassembly

1. Gradually loosen the bolts **(1)** to release the pressure on the Belleville washers /**4**\.
2. Remove the 3rd point support assembly and piston, parts numbered **(2)** to **(13)**.
3. Remove the retaining ring **(11)** with a screw driver, pushing back the bush **(8)**.
4. Extract the bush **(8)** and discard the seals **(9)** and **(10)**.
5. Remove the Belleville washers /**4**\.
6. Discard the seal **(7)**.

Reassembly

7. Carry out the same operations in reverse order. Tighten the bolts **(1)** to a torque of 175 - 270 Nm. ***Note: Check that the ball (18) is present in the bush (8) and check that the PTO brake operates correctly.***

B. Layshaft

Disassembly

8. Carry out procedures 1 and 2.
9. Remove the driving gear assembly **(15)**, fitted with cones **(14)**, and the layshaft **(16)**.
10. Remove the bolt and washer assembly **(17)** and separate the layshaft from the driving gear **(15)**.

Reassembly

11. Carry out the same procedures in reverse order.
    Tightening torques:
    - Bolt **(17)** : 50 Nm
    - Bolts **(1)** : 175 - 270 Nm.

    Check the operation of the PTO output shaft.

C. Driving gear

Disassembly

If the bearings **(14)** or driving gear **(15)** are to be replaced, the auxiliary distributor support must be removed in order to shim the driving gear.

12. Carry out procedures 1, 2 and 9.
13. Remove the cup **(13)** and shim or shims **[12]** from the 3rd point support.
14. Remove the cones **(14)** using an extractor.
15. Remove the cup **(13)** from the housing using an extractor.

Reassembly

16. Fit the cup **(13)** in the housing, using a bronze drift.
17. Fit the cones **(14)** onto the driving gear **(15)** with a press or a bronze drift.
18. If necessary, shim the driving gear (see part D).

D. Shimming

19. Fit the driving gear **(15)** and cones **(14)** assembly without the layshaft **(16)**.
20. Position the cup **(13)** in the support **(2)** without shims **[12]**.
21. Reinstall the support **(2)** using bolts **(1)** and tighten to a torque of 175 - 270 Nm.
22. Connect up a pipe linked to a hand-operated calibrating pump. Apply a pressure of approximately 17 bar to free the driving gear **(15)**.
23. Measure the play, using a dial comparator seated on the face of the driving gear **(15)** (Fig. 1).
24. Remove the support **(2)** and the cup **(13)**.
25. Fit the required number of shims **[12]** to obtain a thickness ensuring a play of:
    J2 = 0.02 to 0.23

Reassembly

26. Carry out procedures 2 to 9 and 10 in reverse order.
    Note: Tighten bolt (17) to a torque of 50 Nm.
27. Fit and tighten bolts **(1)** to a torque of 175 - 270 Nm.
28. Remove the auxiliary distributor support.
29. Check the operation of the lift function and check the hydraulic unions for leaks.

List of parts

- **(1)** Bolts
- **(2)** 3rd point support
- **(3)** Flange seal
- /**4**\ Belleville washers
- **(5)** Piston
- **(6)** Locating pin
- **(7)** O-ring
- **(8)** Bush
- **(9)** O-ring
- **(10)** O-ring
- **(11)** Retaining ring
- **[12]** Adjusting shims
- **(13)** Bearing cups
- **(14)** Bearing cones
- **(15)** Driving gear
- **(16)** Layshaft
- **(17)** Bolt and washer assembly
- **(18)** Ball

Overall view

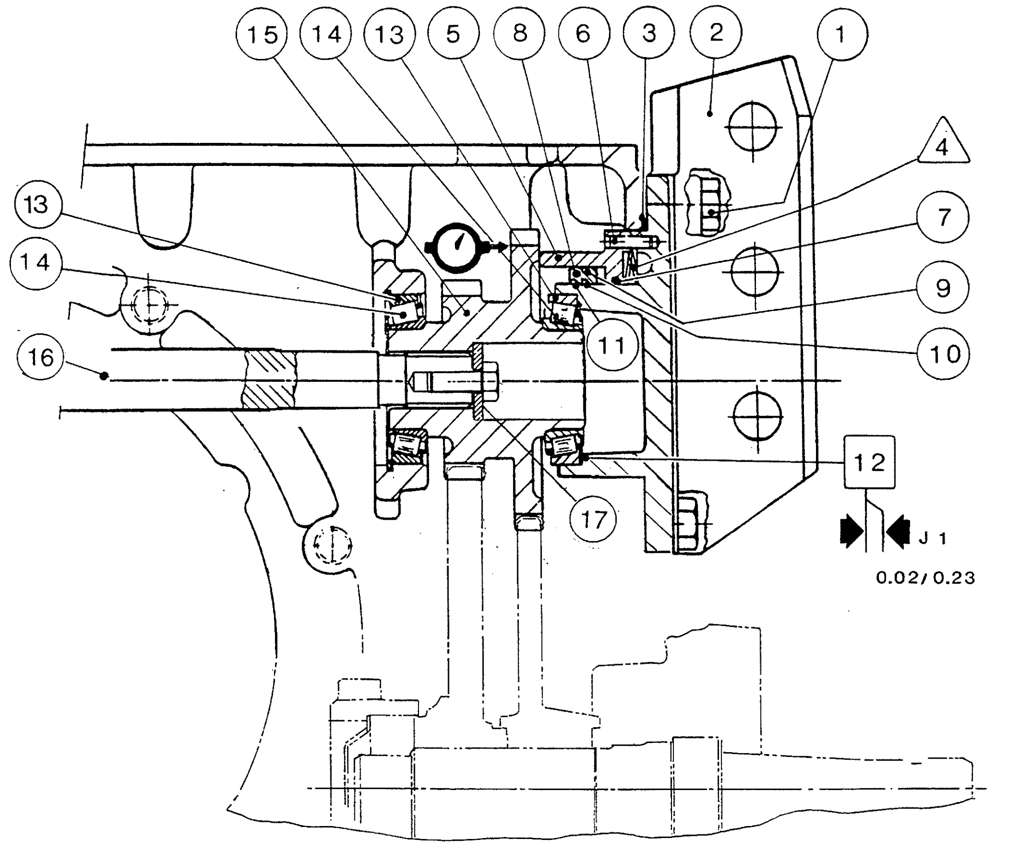


Fig. 1

Exploded view

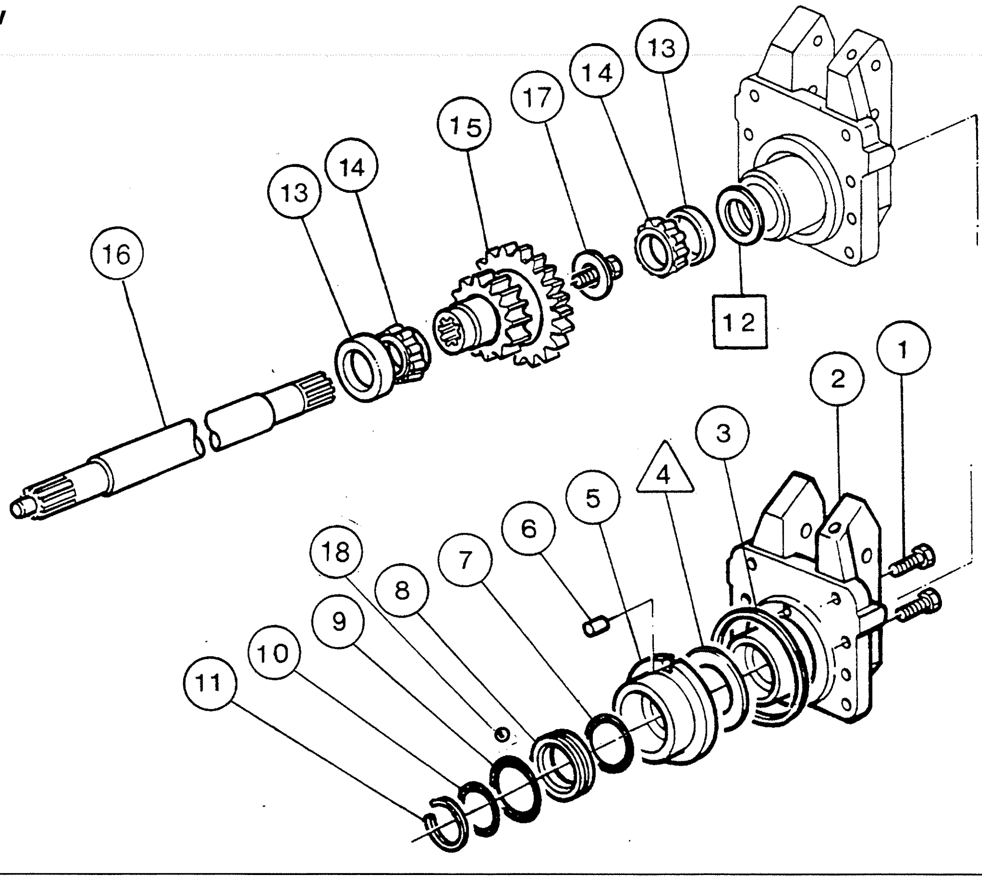


Fig. 2

7 C01 Bearings and gears 540 - 1000 rpm or 750 - 1000 rpm

CONTENTS

Power Take Off - Bearings and gears

A . Replacing the 540/750 - 1000 rpm PTO shaft

Disassembly

1. Raise the rear end of the tractor to avoid losing oil.
2. Remove the retaining ring **(19)**. Withdraw the shaft. Discard the O-ring **(28)**.

Reassembly

3. Carry out procedures 1 and 2 in the reverse order.

B . Disassembling and reassembling the taper bearings

Disassembly

4. Remove the 3rd point support and the PTO guard. Drain off some of the oil from the rear axle.
5. Remove the circlip **[22]**.
6. Remove the shaft assembly **(20)** or **(21)**, the sleeve **(29)**, the cones and cups **(27) (26)**, the seal holder **(23)** with the sealing bush **(24)**. Discard the O-ring **(25)**.
7. Extract the cones **(27)** from the sleeve **(29)** and, if necessary, extract the bush **(24)** from the seal holder **(23)**.

Reassembly

8. Place the inner cup **(26)** in the housing.
9. Fit the cones **(27)** on the sleeve **(29)** and fit the sealing bush **(24)** (if it was removed) in the seal holder **(23)** using a press and suitable fixtures.
10. Check that the washers **(30)** and **(35)** are present.
11. On the shaft **(20)** or **(21)**, position the sleeve **(29)** with the O-ring **(28)**, the cones **(27)** and the cup **(26)**. Engage the shaft assembly in the housing without O-ring **(25)**.
12. Fit the seal holder **(23)** with a suitable tube.
13. Install the circlip **[22]**. Check the end play on the assembly in order to obtain the following play (Fig. 1) :
    J2 = 0.02 to 0.23
    Note : If the adjustment is incorrect, change the circlip [22] (three different thicknesses are available).
14. Remove the seal holder **(23)**. Fit a new O-ring **(25)**.
15. Fit the seal holder and the circlip **[22]**.
    Note: The V bolt prevents the seal holder (23) from rotating.
16. Carry out procedure 4 in reverse.
17. Check that the PTO operates correctly and check for leaks on the seals.

C . Disassembling and reassembling the 540 - 1000 rpm or 750 - 1000 gear set

Disassembly

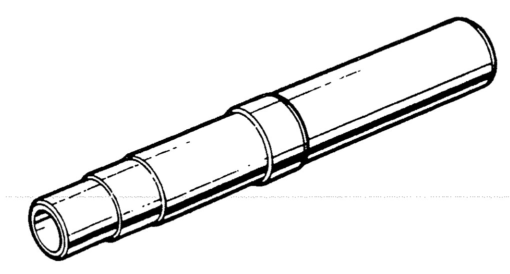
18. Drain some of the oil from the rear axle housing.
19. Remove the lift cover (see Section 6 E01) and the layshaft with the driving gears (see Section 7 B01).
20. Remove the retaining ring **(19)**, the PTO shaft **(20)** or **(21)** with the sleeve **(29)** and cones **(27)**.
21. Remove the 540 or 750 and 1000 rpm gears **(33)** and **(31)** with a hook.
22. Remove the washers **(30)** and **(35)**.
23. Extract the cylindrical roller bearings **(36)** and the plug **(37)**.
24. If necessary, extract the bushes **(32)** and **(34)**.
    Note: When replacing the bushes (32) and (34), ref. 1610247M1, bore to a diameter of 46.164 - 46.139 after fitting.

Reassembly

25. Carry out the procedures followed for disassembly in the reverse order.
    Note: Align the washers (30) and (35) and the gears (33) and (31) with centring tool MF 464
26. Check that the Power Take-off operates correctly and check for leaks on the mating faces and unions.

D . Service tool

MF 464 : Centring sleeve for rear PTO gears



List of parts

(19) Retaining ring
(20) Shaft 540/750 rpm
(21) Shaft 1000 rpm
[22] Circlip
(23) Seal holder
(24) Sealing bush
(25) O-ring
(26) Bearing cups
(27) Bearing cones
(28) O-ring
(29) Splined sleeve
(30) Washers
(31) Gear 1000 rpm
(32) Bush
(33) Gear 540 or 750 rpm
(34) Bush
(35) Washer
(36) Bearing
(37) Plug

Power Take Off - Bearings and gears

Overall view

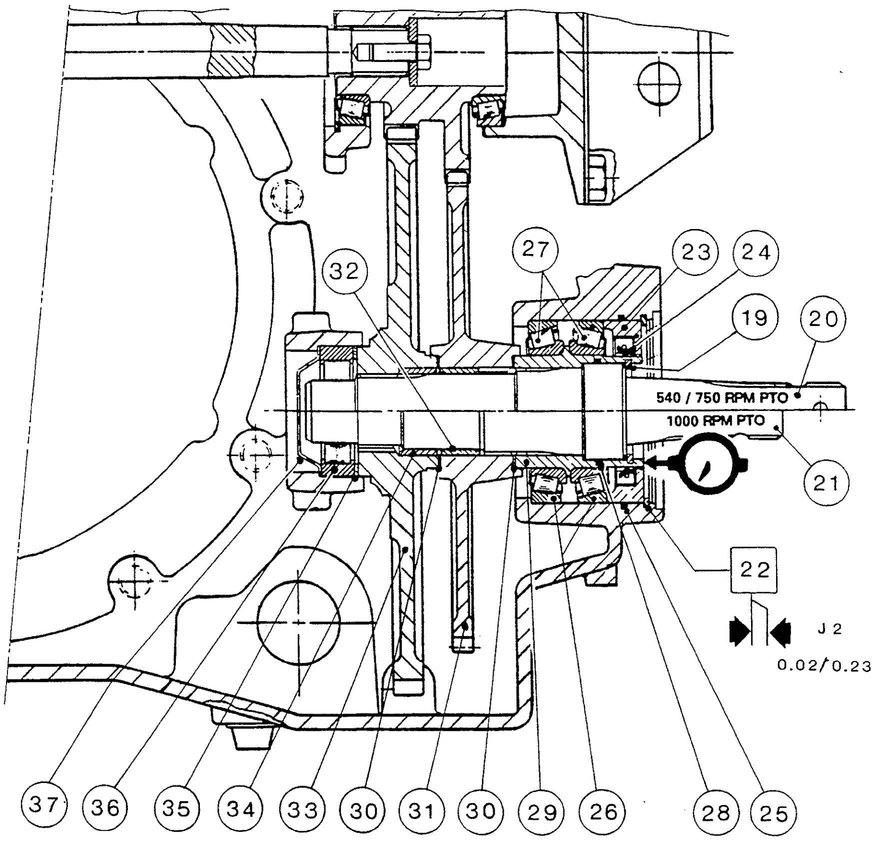


Fig. 1

Exploded view

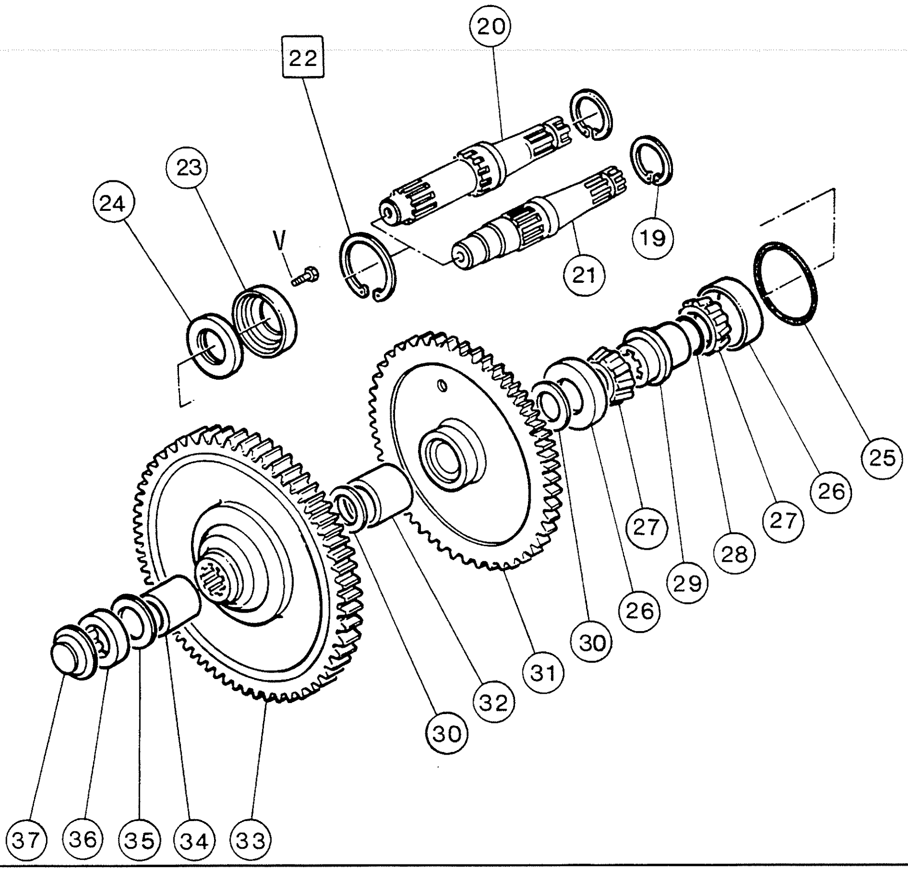


Fig. 2

8 . FRONT AXLE

Contents

8 A01 Bearings

CONTENTS

A. Removing and refitting the bearings

Removal

Nota : If necessary, remove the belly weight (if fitted).

1. Immobilize the rear wheels with chocks and apply the handbrake.
2. Disconnect the two hoses supplying the front differential lock.
   Remove the guard and the drive shaft.
3. Lift the tractor with a jack placed along the centreline of the axle housing. Position a stand under the crankcase (Fig. 1). Remove the wheels.
4. Disconnect the hoses supplying the steering ram, and mark their positions.
5. Hoist the front axle with strap slings (Fig. 1).
6. Remove the grease nipple **(3)** and the bolts **(1)**. Remove the bearing **(2)** (Fig. 2), the washer **(4)** and the seal **(9)**.
7. Remove the bolts **(12)** and **(13)**. Remove the front axle with the bearing **(6)** (Fig. 3).
8. Dismount the bearing from the front axle. Remove the washer **(7)** and the seal **(8)**.

Refitting

9. Replace the seal **(8)**. Position the washer **(7)** with the chamfer facing the axle housing **(52)**. Assemble the bearings **(6)** on the front axle.
10. Hoist the front axle with slings. Fit the front axle assembly and the bearing. Fit the bolts **(12)** and **(13)**.
11. Replace the seal **(9)**. Position the washer **(4)** with the chamfer facing the axle housing **(52)**. Fit the bearing **(2)**. Fit the bolts **(1)**.

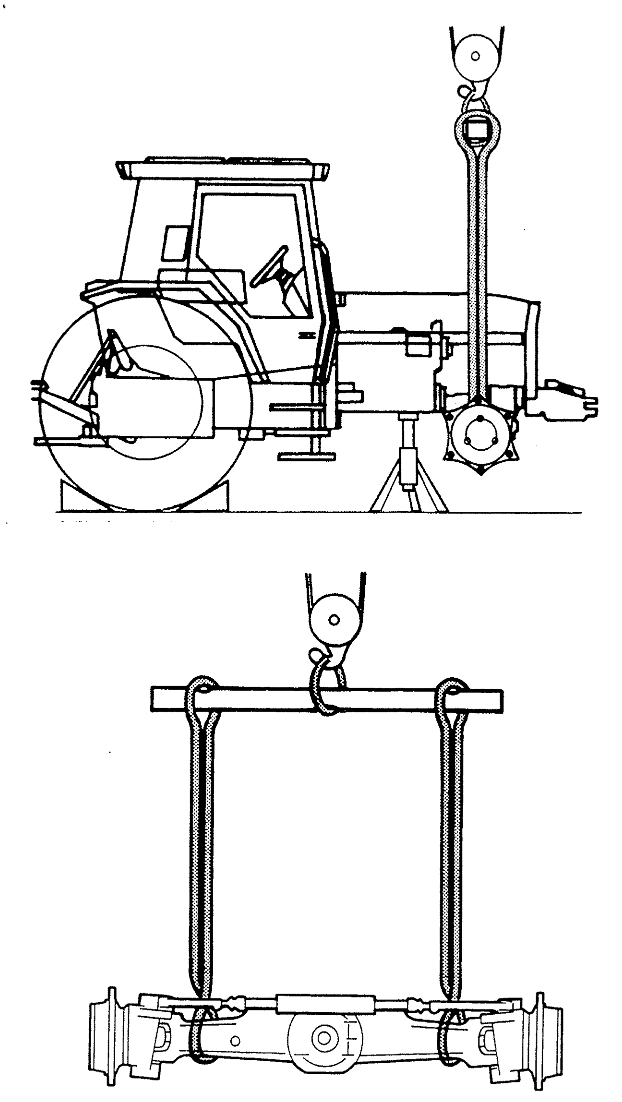


Fig. 1

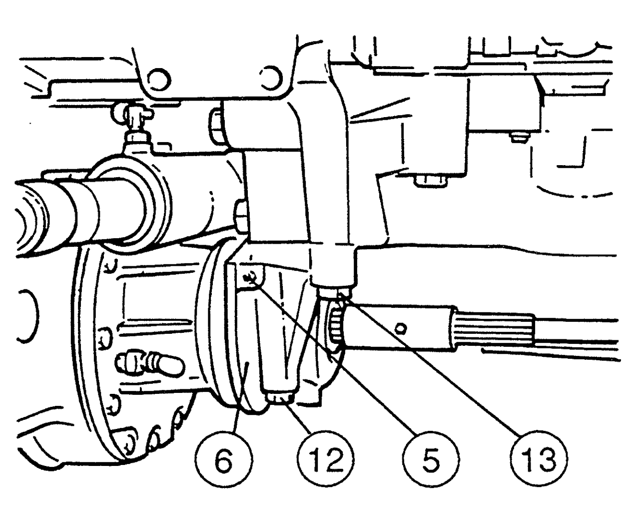


Fig. 3

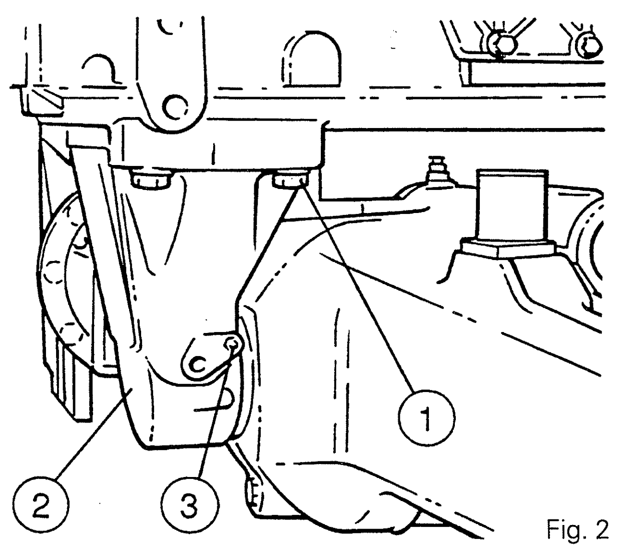
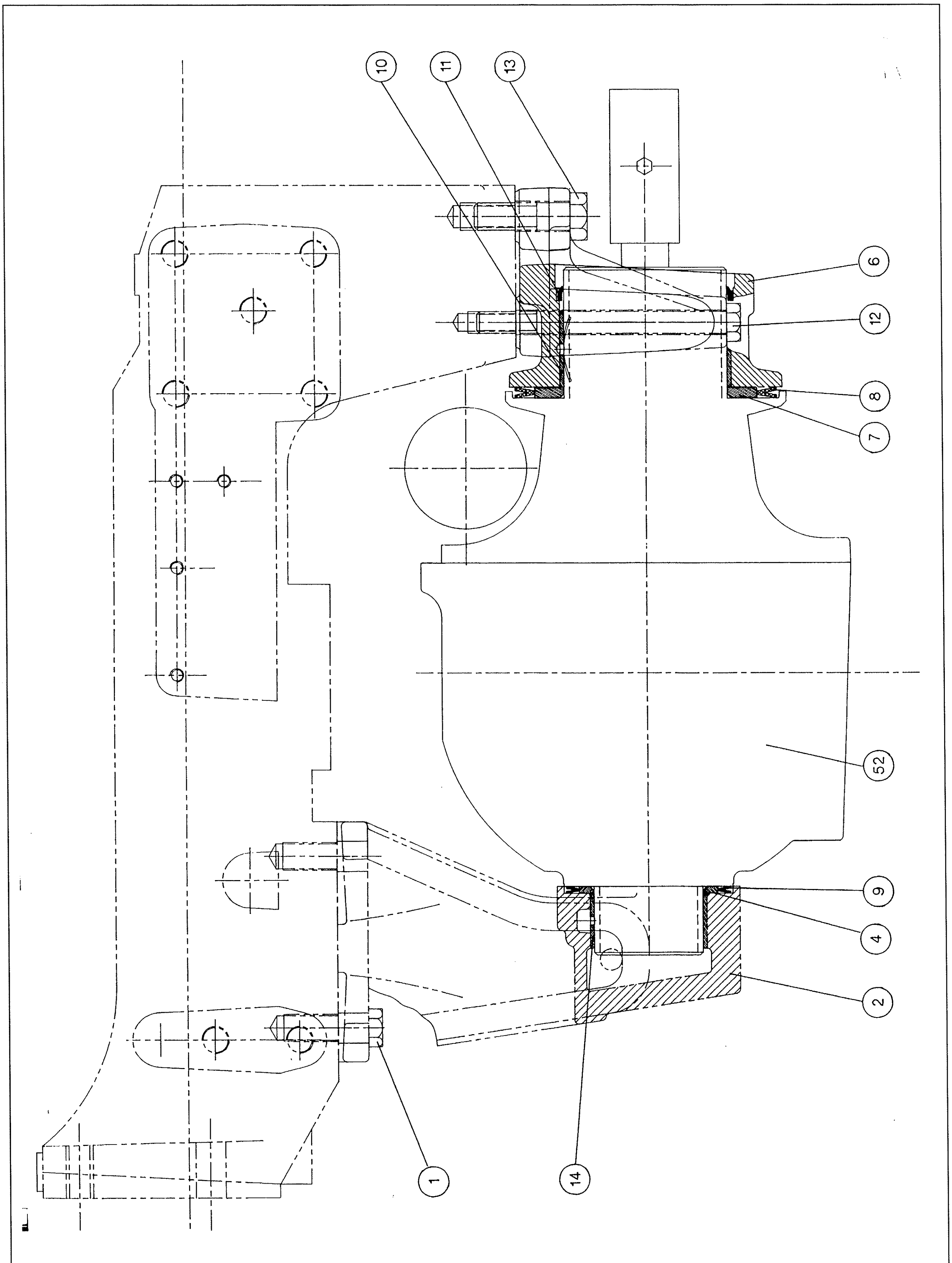


Fig. 2

Front axle - Bearings



Front axle - Bearings

12. Smear the bolts **(12)** and **(13)** with Loctite 270. Tightening torque:
    - **(12)**: 240 to 320 Nm
    - **(13)**: 520 to 640 Nm.
13. Press the bearing **(2)** onto the washer **(4)** so as to take up as much play as possible. Smear the bolts **(1)** with Loctite 270 and tighten them to a torque of 520 to 640 Nm.
14. Fit the grease nipples on the bearings **(2)** and **(6)**.
15. Connect up the hoses for the steering ram. Smear the two drive shaft sleeves with «Anti-Seize» grease or equivalent.
    Reinstall the transmission shaft and the guard.
    Connect up the two hoses for the front differential lock. Fit the wheels and tighten to a torque of 800 to 850 Nm.
16. Using a pump, grease the bushes **(10)** and **(14)**.

B. Replacing the bushes (10) and (14) and the seal (11)

Removal

17. Extract the seal **(11)** and the worn bushes **(10)** and **(14)**.

Refitting

18. Clean the parts, using a press and a suitable fixture, fit the bushes **(10)** and **(14)** in their respective supports flush with face «**F**» (Fig. 4) with opening «**O**» facing upwards (Figures 5 and 6) and aligned with the lubricating channel.
    Fit the seal **(11)** fully home on the shoulder of the support **(6)**.

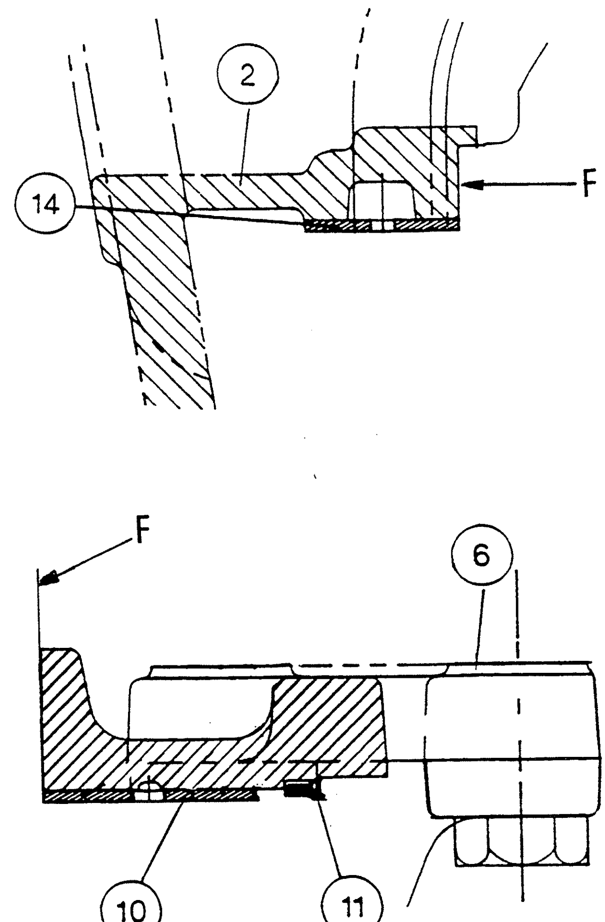


Fig. 4

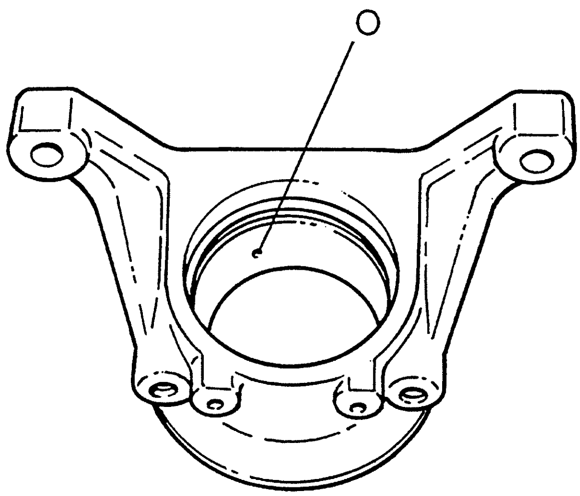


Fig. 5

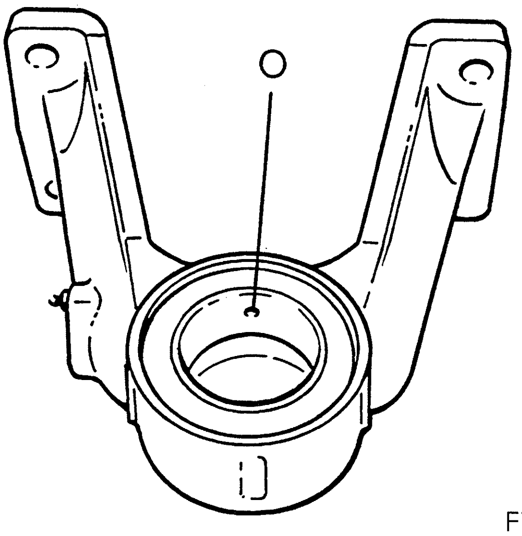


Fig. 6

8 B01 4WD control unit

CONTENTS

Front axle - *4WD control unit*

General

The front axle drive shaft control unit (4WD) is mounted under the rear axle housing.
It comprises a bell gear and a hydraulic clutch which is integral with a shaft rotating on two taper roller bearings.
The tight sealing of the drive shaft has been improved for work in paddy fields or in especially wet conditions.
The helical-toothed bell gear **(22)** is driven by a gear **P** installed on the driving pinion. It is in constant mesh with a hydraulic clutch which is driven by a hub **(10)** in rotation with the shaft **(1)**.

Operation

A. Disengaging

The 4WD solenoid valve sends oil at a pressure of 17 bar inside the shaft **(1)**. The cover **(14)** moves on the hub **(10)** and pulls the bell **(16)** which compresses Belleville washers **/15** and releases the discs **(18)**. The bell gear **(22)** then runs freely on the shaft **(1)**.

B. Engaging

When the pressure ceases, the Belleville washers **/15** are released and push back the bell **(16)** and lock up gear **(22)** with the bell **(16)** and drives the shaft **(1)**.

List of parts

(1) 4WD drive shaft
(2) Housing
(3) Circlip
(4) O-ring
(5) Cap
/6 Seal
[7] Shim(s)
(8) Bearing cup
(9) Bearing cone
(10) Hub
(11) Circlip
(12) O-ring
(13) O-ring
(14) Cover
/15 Belleville washers
(16) Bell
(17) Inner plates
(18) Discs
(19) Locating dowels
[20] Shim(s)
(21) Circlip
(22) Bell gear
(23) Bush
(24) Plug
/25 Rings
(26) Bolt
(27) Bolt
(28) Protector
(29) Seal
(30) Clutch assembly
(31) O-ring
(32) Cover
(33) Plug
(34) Bush
(35) Bearing cup
(36) Bearing cone
(37) Nut
(38) Stud

Front axle - 4WD control unit

Overall view

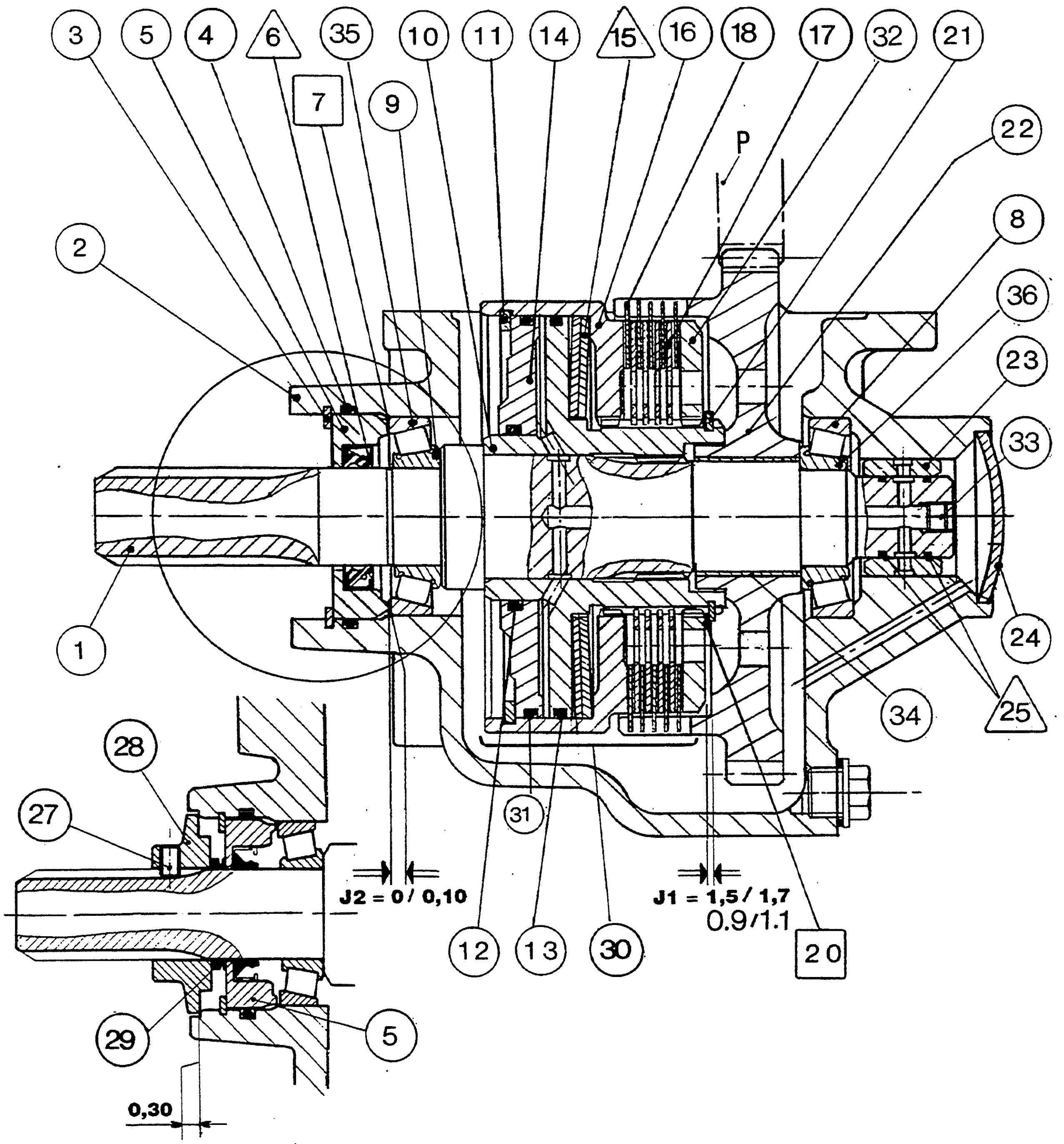


Fig. 1

Front axle - 4WD control unit

Exploded view

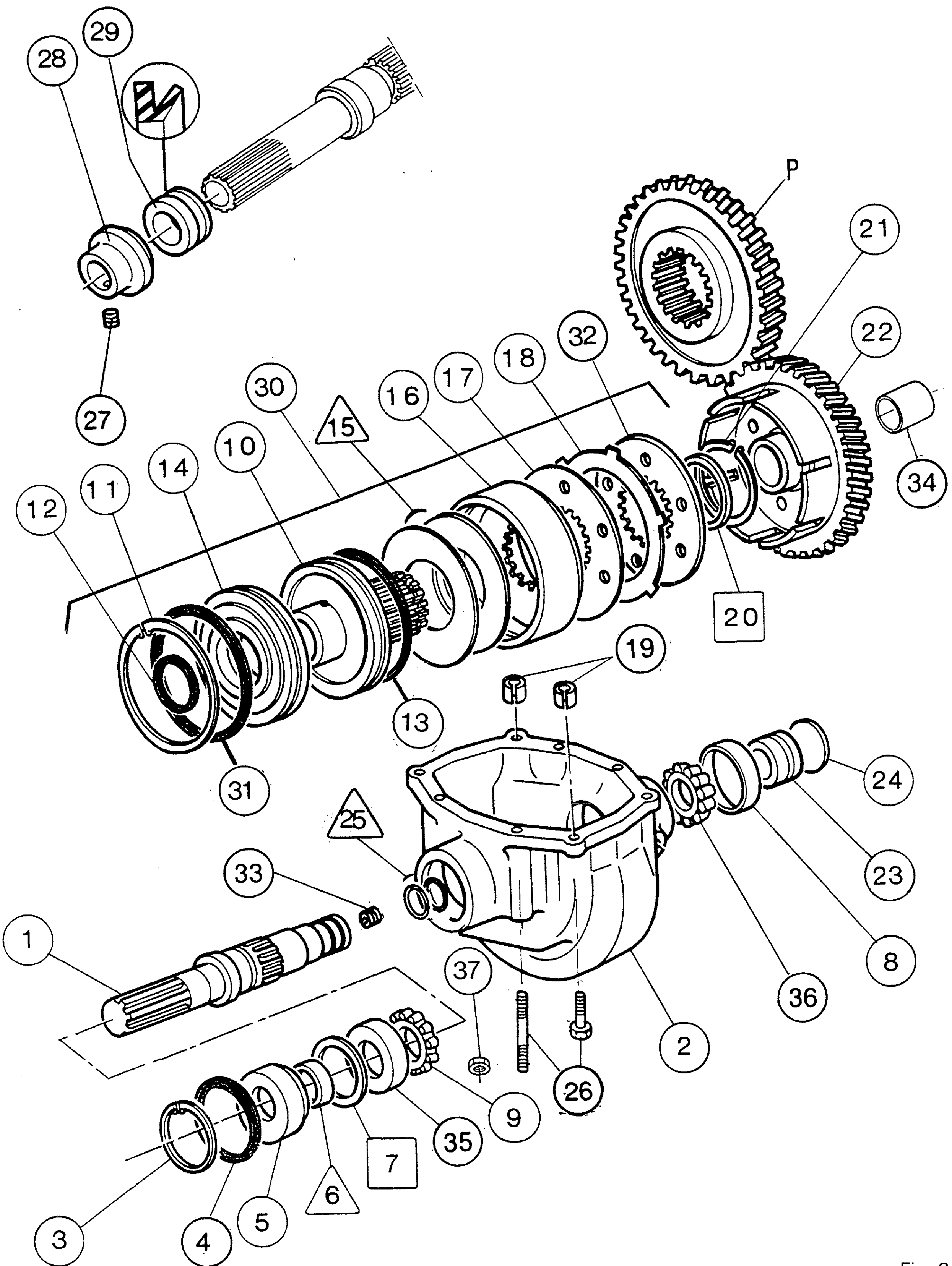


Fig-2.

A . Preliminary operations

1. Immobilise the tractor with chocks. Drain the 4WD control unit.
2. Disconnect the two front differential lock actuating hoses (and plug the channels). Remove the guard and the drive shaft.
3. Disconnect the 17 bar supply pipe.
4. Position a trolley jack under the housing.
5. Remove bolts **(26)**. With the help of a second operator, detach and remove the unit.

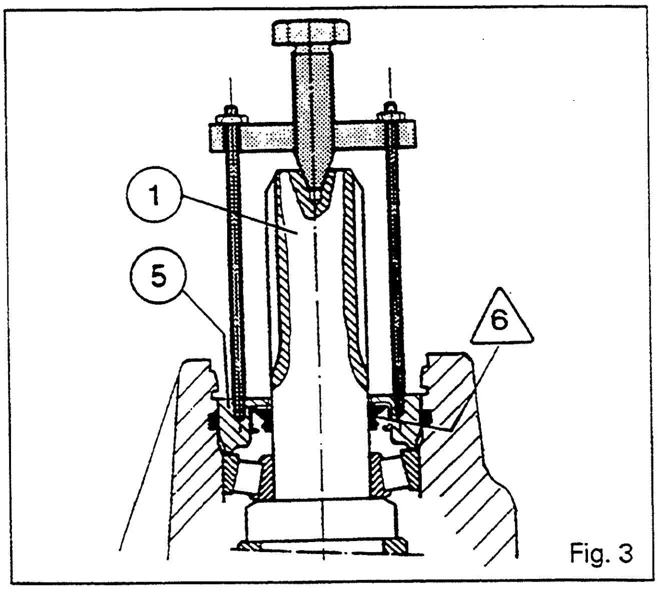


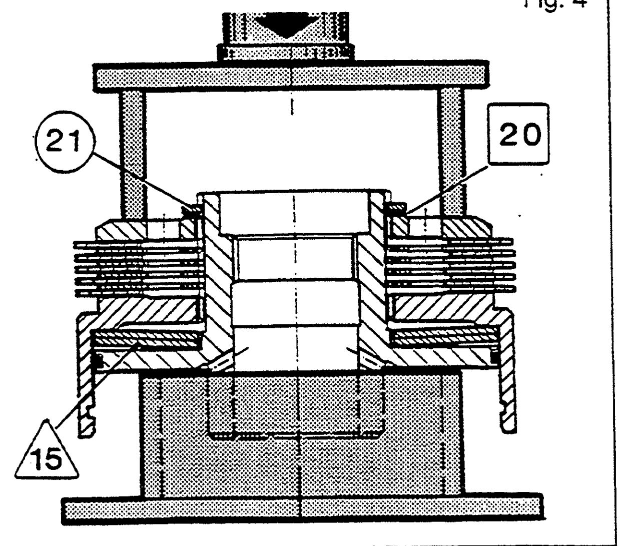
Fig. 3

B . Disassembling and reassembling the clutch and shaft

Disassembling the clutch

6. Place the unit on a suitable support.
   Note: On tractors equipped with a protective flange with reinforced sealing, remove bolt (27), protective flange (28) and seal (29).
7. Remove the circlip **(3)**.
8. Protect the splined section of the shaft **(1)**. Extract the cap **(5)** with its seal **/6** (Fig. 3) using a locally manufactured tool (see part D). If necessary, remove the seal.
9. Remove the O-ring **(4)**.
10. Remove the shims **[7]** and the cup **(35)**.
11. Withdraw the shaft assembly **(1)** and bearing cone **(9)**.
12. Remove the clutch assembly **(30)** with the bell gear **(22)** and cone **(36)**.
13. If necessary, remove the plug **(24)**. Extract the bush **(23)** and cup **(8)**.
14. Separate the bell gear **(22)** from the clutch assembly **(30)**.
15. Take off the circlip **(11)** and remove the cover **(14)**.
16. Remove the O-rings **(12)** and **(31)**.
17. Using a press and a suitable fixture, compress the Belleville washers **/15**, remove the circlip **(21)** and the shim or shims **[20]** (Fig. 4).
18. Remove the fixture.

Fig. 4



19. Remove the cover **(32)**, discs **(18)** and inner plates **(17)**.
    Note: The cover (32) and the number of discs and inner plates differ according to the type of tractor.
    5 discs - 4 inner plates : 8110 - 8120 - 8130 - 8140.
    6 discs - 5 inner plates, slimmer cover (32) : 8150 - 8160.
20. Separate the hub **(10)** from the bell **(16)**, and remove the O-ring **(13)**.
21. Remove the Belleville washer **/15**.

Front axle - 4WD control unit

Disassembling the shaft

Note: At the location of the rear coupling sleeve on the 4WD shafting, the six-spline drive shaft of the 4WD control unit is replaced by a 24-spline shaft. This new shaft is fitted on 8100 series tractors as from the following serial numbers:
- Tractors 8110 to 8140: D089019,
- Tractors 8150 to 8160: D086030.

22. Remove the rings **/25**.
23. Extract the cone **(9)** using a press and a suitable fixture. Remove the plug **(33)**.

Reassembling the clutch

24. Check and clean the parts, and replace any that are faulty.
Check that the 17 bar channel in the hub **(10)** is not obstructed.
25. Position the Belleville washers **/15** in the bell **(16)** as per Fig. 1.
26. Lubricate and fit the O-ring **(13)** on the hub **(10)**.
27. Position the hub in the bell **(16)** bearing against the Belleville washers.
28. According to the type of tractor, fit the discs **(18)**, aligning the lugs, and the inner plates **(17)**. Install the cover **(32)**.
29. **Shimming J1 (Fig. 5)**
Note: On 8100 series tractors, the 4WD clutch may be of the standard or heavy duty type. To identify the type of clutch, measure the splined shims [20] and refer to the table on this page.
Using a press and a suitable fixture, apply a pressure equivalent to a load of 2,000 daN so as to fully compress the Belleville washers **/15** (Fig. 4). Fit the circlip **(21)**. Using a set of shims, measure the clearance **X** between the cover **(32)** and the circlip. Select the shim or shims **[20]** in order to obtain the following clearance **J1**:
- standard clutch: 1.5 to 1.7 mm,
- heavy duty clutch: 0.9 to 1.1 mm.

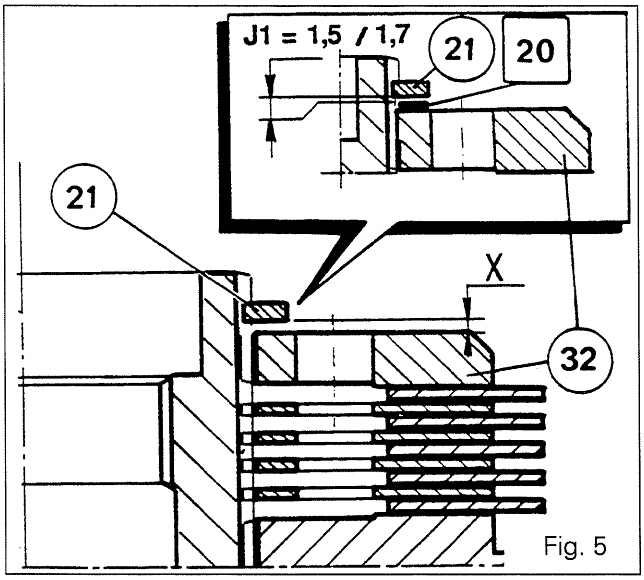


Fig. 5

	Standard clutch	Heavy duty clutch
Belleville washers **/15**	3619147M01	3619473M01
Disk **(18)**	1.8 thk ± 0.08 mm	2 thk ± 0.05 mm
Splined shims **[20]**	2. or 2.3 mm thk	1.4 or 1.7 mm thk

30. Remove the circlip. Position the shim or shims selected in procedure 29, placing the splined shim against the circlip.
31. Refit the circlip.
32. Lubricate and fit the O-rings **(12) (31)** on the cover **(14)** and reinstall the cover.
33. Refit the circlip **(11)**.
34. Fit the clutch assembly **(30)** on the bell gear **(22)**.
Note: Bush (34) is force-fitted in the bell gear (22) and then counterbored.
35. If they were removed, fit the cup **(8)** and the bush **(23)** using a suitable fixture so that a hole in the bush is lined up with the channel in the housing.
36. Degrease the bore in the housing and the circumference of the plug **(24)**. Apply a bead of Loctite 510 in the inside angle of the housing and use a press to install the plug.

Reassembling and shimming the shaft

37. Check that there is no obstruction in the channel in the shaft.
38. Fit plug **(33)** after coating it with Loctite 542.
39. Fit bearing cone **(9)** fully home on the shoulder of the shaft **(1)**.
40. Place the sealing rings **/25** in the grooves on the shaft **(1)**. Secure the ends of the rings and check that they rotate freely.
41. Position bearing cone **(36)** in cup **(8)**. Install the shaft **(1)** after fitting the clutch assembly **(30)** and the bell gear **(22)** in the housing. Fit cup **(35)**.
42. Protect the splines on the shaft.
43. Fit the cap **(5)** and circlip **(3)** without the seal **(4)**.
44. Remove the protection. Shim to obtain a play of: **J2 = 0 to 0.10 mm** (Fig. 6)
45. Position the comparator feeler at the end of the shaft **(1)** (Fig. 6).
46. Pull on the shaft, turning it alternately to the right and left in order to seat the cones correctly in the cups.
47. Reset the comparator.
48. Repeat procedure 46, pushing on the shaft.
49. According to the play measured, select the required thickness of shims **[7]** required to obtain **J2**.
50. Protect the splines on the shaft. Remove the circlip **(3)** and cap **(5)**. Apply grease on the shim or shims **[7]** selected. Place the shim or shims in the unit.
51. Fit the O-ring **(4)** in the groove on the housing.
52. Fit the cap **(5)** and circlip **(3)**. Remove the protection on the shaft splines.
53. On tractors with reinforced sealing, grease seal **(29)** and fit it with the lip directed towards the cap **(5)**.
    Fit the protector **(28)**, ensuring that there is a functional clearance of approximately 0.30 mm between the protector and the housing (Fig. 1).
    Tighten bolt **(27)** after coating it with Loctite 241.
54. Remove the unit from the support.

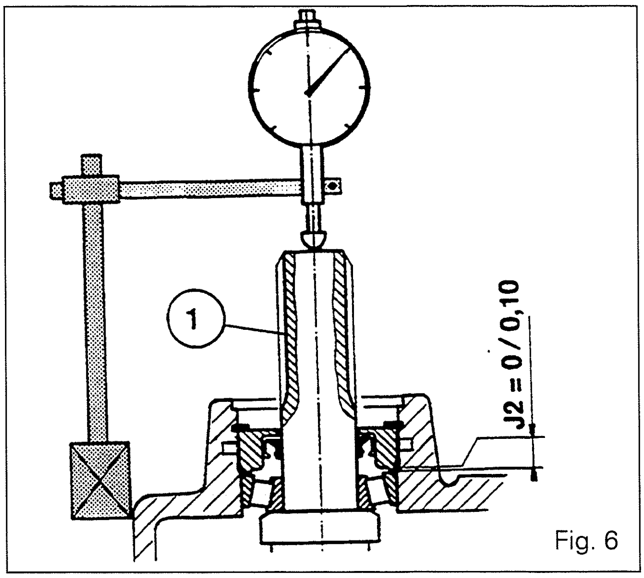


Fig. 6

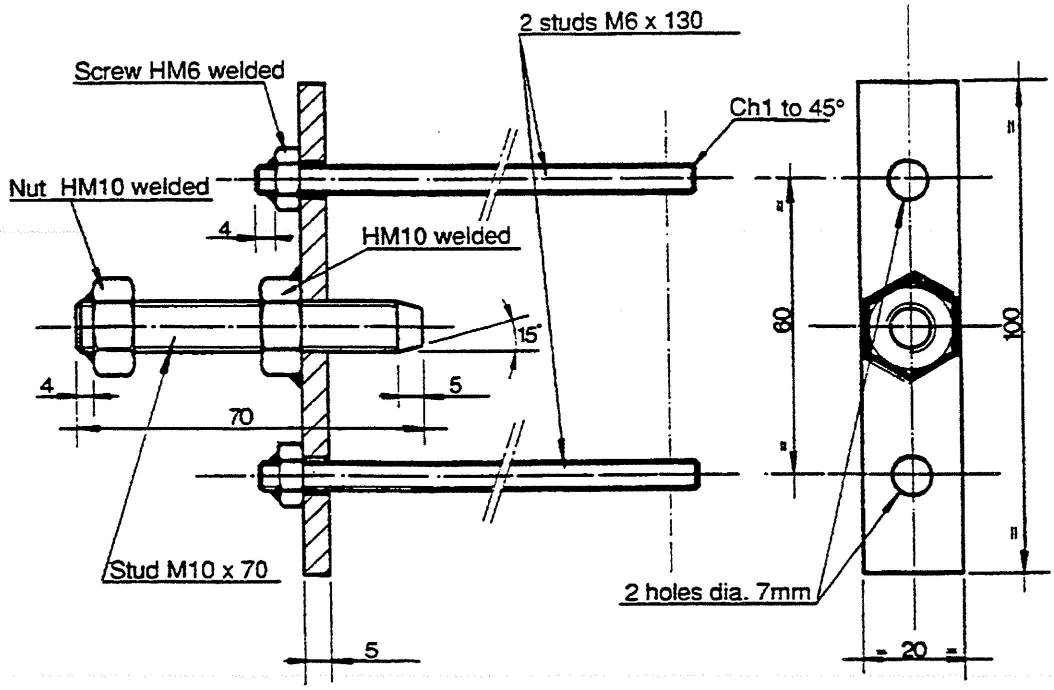
C . Final operations

55. Clean and degrease the mating faces on the unit and on the rear axle housing.
56. Check that the locating dowels **(19)** are present.
57. Smear the mating face on the rear axle housing with a sealing compound (Master Joint 510 or equivalent).
58. Place the unit on a trolley jack and refit it with the help of a second operator.
59. Fit and tighten bolts **(26)** and nuts **(37)** to 100 - 130 Nm.
60. Refit the 4WD drive shaft and the guard.
61. Reconnect the two hoses for the front differential lock.
62. Top up the oil in the rear axle and remove the shims.
63. Check the operation of the clutch. Check for leaks on:
    - the mating face for the unit on the rear axle housing,
    - the hydraulic couplings and the plug **(24)**.

Front axle - 4WD control unit

D . Tools to be manufactured locally

1. Cap extractor



8 C01 Final drive units

CONTENTS

Front axle - *Final drive units*

General

Tractors in the 8100 Series are equipped with two categories of front axle:
- AG 155 on tractors 8110 to 8140
- AG 200 on tractors 8150 and 8160.

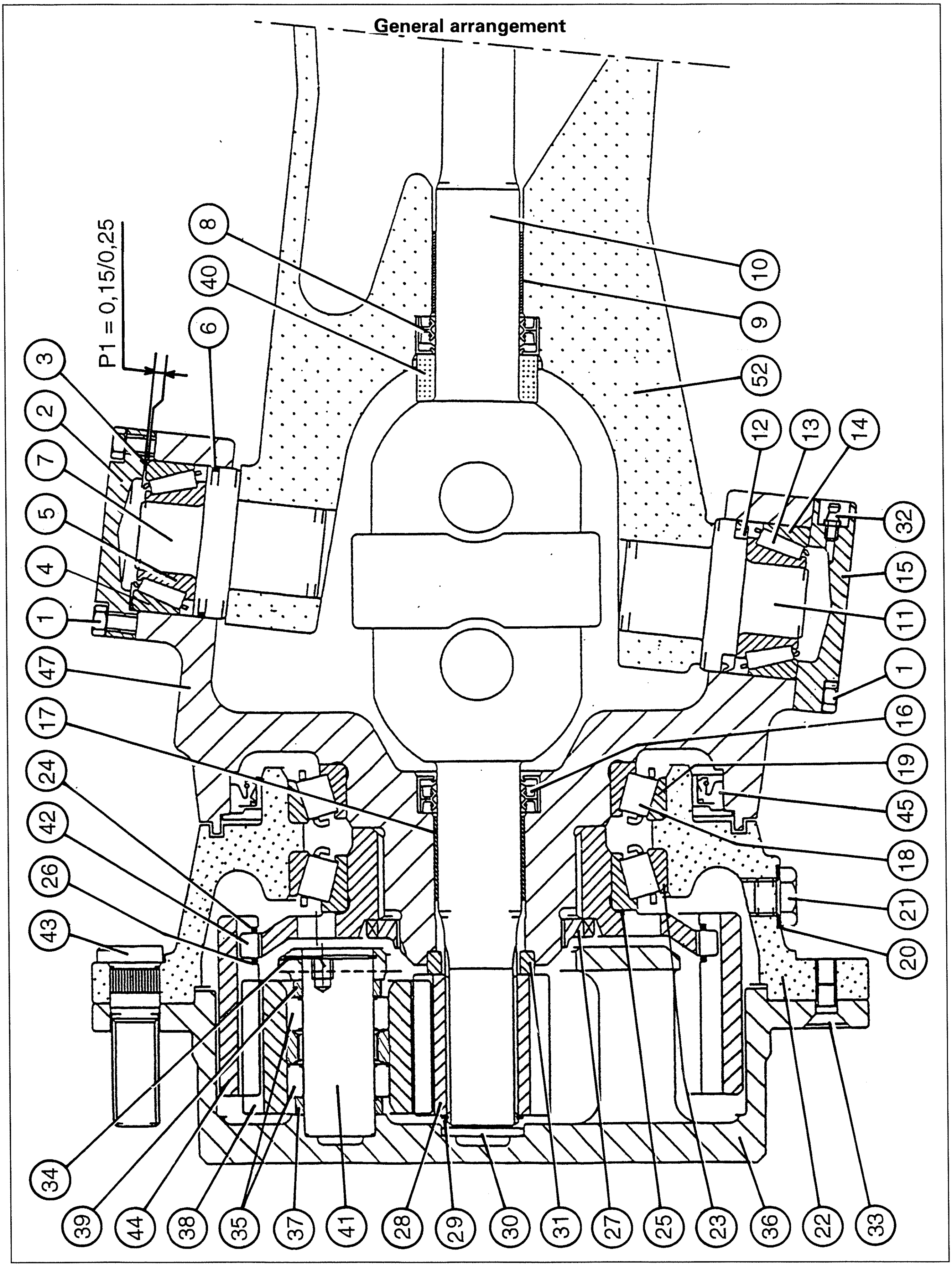
AG 200 front axles have a reinforced final drive unit.
Axle category and serial number are indicated on a plate riveted to the axle housing.
The final drive unit has a swivel housing **(47)** which articulates on the front axle round the two swivel pins **(7)** and **(11)**. The wheel hub **(22)** turns on two taper roller bearings whose cups **(23)** and **(19)** are force fitted in the hub. The bearing cones **(18)** and **(25)** are also force fitted.
The taper roller bearings **(18)**, **(19)**, **(23)** and **(25)** are not adjustable. The components are produced with machining tolerances which do not require adjustment or shimming.
The drive from the front differential is transmitted to the wheel through the universal drive shaft assembly **(10)**, the sungear **(28)**, the planetary gears **(38)** and the ring gear **(44)**. This ring gear is held by two rings **(24)** and **(26)** onto its carrier **(42)** which is force-fitted onto the swivel housing **(47)**. It is splined onto the swivel housing and locked in position by the central nut **(27)**.
Double lip seals are used for better sealing.
Oil seal **(45)** ensures sealing between the hub and housing while oil seal **(8)** and protective bush **(40)** seal the axle housing on the universal drive shaft. The configuration of oil seal **(45)** is different on front axles AG 155 and AG 200.
The swivel housing is sealed on the final drive unit by means of oil seal **(16)** and the two swivel pins are sealed in the housing by O-rings **(6)** and **(12)**.

Service tools (section I)

MF 451B Swivel pin puller
MF 451B3 Extractor for puller Ø M18
3378028M1 Socket for ring gear carrier nut.
3378038M1 Ring gear carrier puller **(42)**
3378039M1 Fitting tool for ring gear carrier and seal
3378056M1 Fitting ring for oil seal **(45)** (for axle AG 155
3378057M1 Fitting ring for oil seal **(45)** (front axle AG 200)

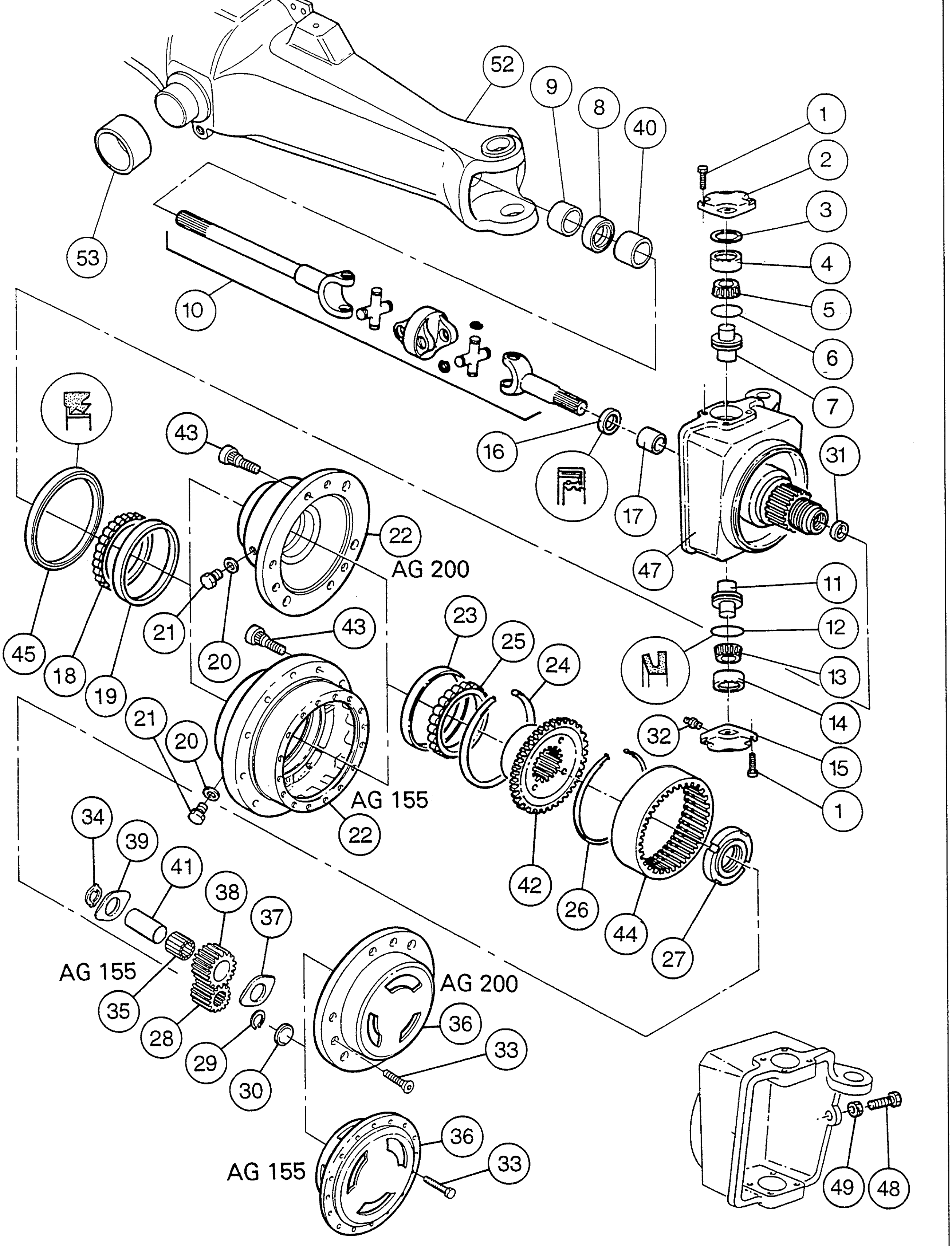
Parts list

(1) Bolt
(2) Cover
(3) Shim(s)
(4) Bearing cup
(5) Bearing cone
(6) O-ring
(7) Swivel pin
(8) Oil seal
(9) Bush
(10) Universal drive shaft
(11) Swivel pin
(12) O-ring
(13) Bearing cone
(14) Bearing cup
(15) Cover
(16) Oil seal
(17) Bush
(18) Bearing cone
(19) Bearing cup
(20) Seal
(21) Plug
(22) Wheel hub
(23) Bearing cup
(24) Ring
(25) Bearing cup
(26) Ring
(27) Nut
(28) Sun gear
(29) Circlip
(30) Thrust washer
(31) Bush
(32) Grease nipple
(33) Bolt
(34) Circlip
(35) Needles
(36) Planetary carrier
(37) Bush
(38) Planetary gear
(39) Bush
(40) Protective bush
(41) Planetary gear pin
(42) Ring gear carrier
(43) Wheel stud
(44) Ring gear
(45) Oil seal
(47) Swivel housing
(48) Stop screw
(49) Nut
(52) Axle housing
(53) Sintered bush


General arrangement
P1 = 0,15/0,25

Front axle - *Final drive units*

Exploded view



Note: The work procedure is the same for the final drive units of both AG 155 and AG 200 front axles.

A. Removal of planetary carrier, sun gear, ring gear

1. Block the rear wheels. Apply the handbrake.
2. The 4 WD clutch being engaged, lift the two wheels to allow the wheel hub **(22)** to turn freely. Position props.
3. Remove the wheel on the relevant side.
4. Drain the final drive unit.
5. Remove bolts **(33)**.
6. Separate and remove the planetary carrier with the thrust washer **(30)**.
7. Remove the circlip **(29)** and the sun gear **(28)**.
8. To avoid damaging the swivel housing (47) thread, it is recommended to unlock and unscrew the nut (27) using the socket 3378 028 M1 (Fig.1). Sling the wheel hub (22). Pull out the wheel hub and the ring gear carrier (42) then the ring gear (44) using the puller 3378 038 M1 (Fig.3) and the sleeve used for this type of front axle
   Note: Coat puller cone and screw with graphite grease. Remove the rings (24) and (26) from the ring gear carrier (42). Separate the ring gear (44) from the carrier.

Disassembly of planetary carrier (Fig. 2)

9. Place the planetary carrier **(36)** on a bench.
10. Remove the circlips **(34)**
11. Using a bolt, extract the planetary gear pins **(41)** and remove the planetary gears **(38)**.
   Recover the needles **(35)** and the bushes **(37)** and **(39)**.

Reassembly of planetary carrier

12. Clean and check the parts, replace those which are defective.
13. In each planetary gear **(38)**, place the needles and the bushes coated with bearing grease.
14. Once prepared, install the planetary gears in the planetary carrier **(36)**.
15. Centre the planetary gears and the bushes. Position and insert the planetary gear pins **(41)**, with the orifice oriented towards the notches "**E**" in the planetary carrier as shown on Fig. 2. Fit the circlips **(34)**.
16. Manually check the end play and rotation of the planetary gears.

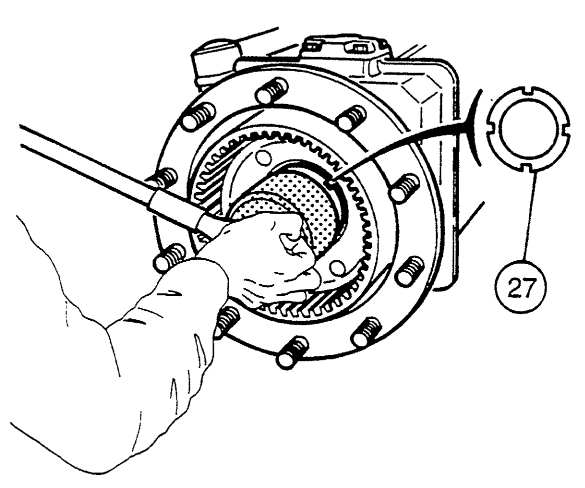


Fig. 1

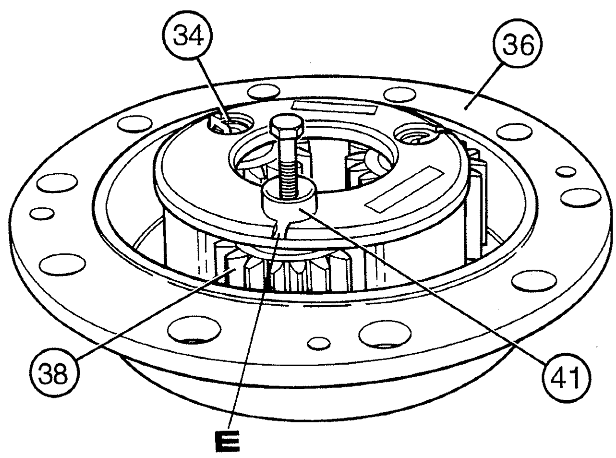


Fig. 2

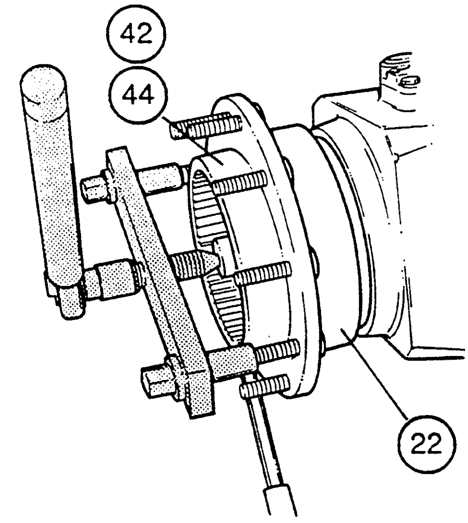


Fig. 3

B. Refitting of ring gear, sun gear, planetary carrier

17. Assemble the ring gear **(44)** on the ring gear carrier **(42)** with rings **(24)** **(26)** ensuring that they are properly engaged in their grooves.
18. Fit the the wheel hub **(22)** and the ring gear carrier **(42)** assembly equipped with the ring gear. Repeat the operations 38 and 39.
19. Manually check rotation of the wheel hub **(22)**
20. Install and tighten nut **(27)** coated with Loctite 270 (400 - 450 Nm).
21. Lock the nut by bending its lock tab into the slot.
22. Fit sun gear **(28)** and circlip **(29)**.
23. Coat the joint face of the planetary carrier with a sealing compound (Loctite 510 or equivalent).
24. Check that the thrust washer **(30)** is present.
25. Refit the planetary carrier.
26. Fit the bolts **(33)** and torque them to:
    - 70 - 85 Nm (AG 155)
    - 40 - 60 Nm (AG 200)
27. Turn the wheel hub to place the filler plug in a horizontal position. Top up the oil level of the final drive unit. Refit the plug **(21)** with its seal **(20)**.
28. Refit the wheel. Remove the props and the trolley jack. Tighten nuts to torques:
    - 800 - 850 Nm up to serial number D 152 009,
    - 640 - 680 Nm from serial number D 152 010.
29. Remove the shims and release the handbrake.
30. Carry out a road test of front axle. Check the sealing of the joint face of the planetary carrier and of the filler plug.

C. Disassembly of wheel hub

31. Remove the planetary carrier. carry out operations 1 to 6.
32. Remove the circlip **(29)** and the sun gear **(28)**.
33. To avoid damaging the swivel housing **(47)** thread, it is recommended to unlock and unscrew the nut **(27)** using the socket 3378 028 M1 (Fig.1).
34. Sling the wheel hub (22). Remove the hub and the ring gear carrier **(42)** then the ring gear **(44)** using puller 3378 038 M1 (Fig.3) and the sleeve used for this type of front axle.
    Note: Coat puller cone and screw with graphite grease.
35. If necessary, extract the bearing cones **(18)** and **(25)**. Disassemble the bearing cups **(19)** **(23)**.

D. Reassembly of wheel hub

36. Clean and check the parts, replace those which are defective.
37. If the bearing cones **(18) (25)** and the bearing cups **(19) (23)** have to be replaced, fit the bearing cones **(18)** and **(25)** in their respective locations and the bearing cups on the wheel hub.
    Note: The bearing cones (18) (25) and the bearing cups (19) (23) must imperatively be from series N (width tolerance = 0.1 instead of 0.2 mm). The shimming of these bearings is determined by the machining tolerances of the swivel housing (47), the wheel hub (22) and the ring gear carrier (42). Each part can be replaced separately. If the rotation of the wheel hub (22) is incorrect after fitting, investigate to find the defective part.
38. For correct guiding of wheel hub **(22)** onto seal **(45)**, fit the ring gear carrier **(42)** with the hub as described in the following procedure:
    Procedure
39. Grease the splines of the swivel housing **(47)**. Use four "B" flanges (manufactured locally according to the front axle type) screwed diametrically opposite in the wheel hub holes and assemble the ring gear carrier **(42)** with the wheel hub **(22)** (Fig.4).
    Fit the ring gear carrier/hub assembly using tool 3378039M1 (Fig. 5) until the ring gear carrier is in contact with the housing.
    Note: Tighten the tool A (§I) home against the swivel housing. Coat nut D and bearing plane with graphite grease.
40. Manually check wheel hub **(22)** rotation.
41. Clean nut threads on the swivel housing. Coat the nut **(27)** with Loctite 270 or similar and tighten to torque 400-450 Nm.
42. Lock the nut by bending its lock tab into the slot.
43. Refit the sun gear **(28)** and the circlip **(29)**.
44. Refit the planetary carrier. Carry out operations 23 to 30.

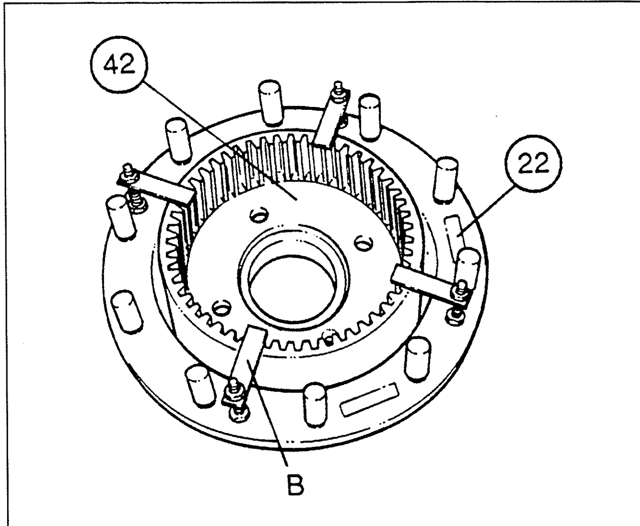


Fig. 4

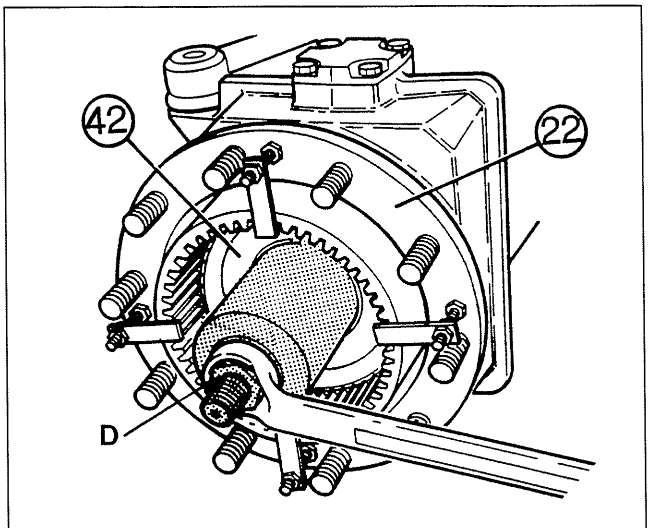


Fig. 5

E. Replacement of a wheel stud

45. Block the rear wheels. Apply the handbrake.
46. Lift the relevant side with a trolley jack. Position a prop and remove the front wheel.
47. Remove the faulty stud.
48. Lightly coat the new stud with Loctite 270 and fit it.
49. Lubricate the stud. Refit the wheel. Remove the prop and the jack. Tighten the nuts to the same torque values as in operation 28.

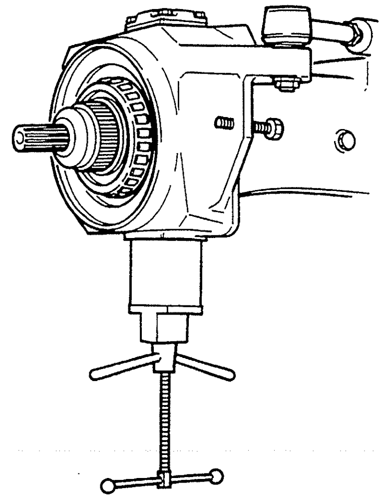


Fig. 6

F. Disassembly of swivel housing

50. Remove the planetary carrier. Carry out operations 1 to 6.
51. Remove the wheel hub. Carry out operations 32 to 35.
52. Remove seal **(45)** if necessary using the relevant puller or a system locally designed. Remove the pin and the nut from the steering ball joint. Extract the ball joint.
53. Place the swivel housing **(47)** in a suitable sling.
54. Remove the bolts **(1)**. Remove the cover **(15)** and the bearing cup **(14)**. Pull swivel pin **(11)** (Fig. 6) out using puller MF 451B and extractor MF 451B3 (refer to section I).
55. Remove the bolts **(1)**. Remove the cover **(15)**, the shims **(3)** and the bearing cup **(4)**. Extract the swivel pin **(17)** as described above for the lower swivel pin (Fig. 6). If necessary, extract the bearing cones **(5)** **(13)** of the swivel pins.
56. Protect the splines of the universal drive shaft so as not to damage the oil seal **(16)**.
57. Remove the swivel housing **(47)**.
58. If necessary, remove the oil seal **(16)** and drive out the bush **(17)**.
    Note: The bush (31) is fitted with Loctite 270.
59. If necessary, remove the universal drive shaft. Remove the oil seal **(8)** and extract the bush **(9)**.

G. Reassembly of swivel housing

60. Clean and check the parts, replace those which are defective.
61. If removed, fit the bush **(9)** and the new oil seal **(8)** against the shoulder of the axle housing **(52)**, oil the seal **(8)**. Refit the universal drive shaft. Introduce a guide through the filling hole to align the left drive shaft with the differential.
62. If removed, fit the bush **(17)** and the new oil seal **(16)** against the shoulder of the axle housing **(47)**.
63. Replace the O-ring **(12)**. Orient its lip as shown on Fig. 7. Drive the bearing cone **(13)** against the shoulder of swivel pin **(11)**.
64. Steering lock adjustment (Fig. 8) is by way of screw **(48)**, according to the turning circle required. Refer to the table below. Once adjustment is completed, lock the nut **(49)**.

Dimension X	Turning circle
77 mm	35°
63 mm	40°
34 mm	50°

65. Refit the swivel housing **(47)**. Install a new O-ring **(6)** on swivel pin **(7)** coated with anti-seize grease. Position the swivel pin so that the swivel housing assembly is aligned with the axle housing **(52)**. Fit the swivel pin.
66. Fit the bearing cup **(4)**, the shims **(3)**, the cover **(2)**. Fit the bolts **(1)** and tighten them evenly and alternately.
67. Fit the swivel pin **(11)** coated with anti-seize grease while ensuring that the lip of O-ring **(12)** comes into position correctly. Install the bearing cup **(14)**, the cover **(15)**. Fit the bolts **(1)** and torque them to 115 - 140 Nm in the same way as during operation 66. Check that swivel pins **(7)** and **(11)** are properly in contact with the axle housing.
68. Once the swivel pins have been pushed in, remove the shims **(3)**. Refit the cover **(2)** and tighten the bolts to a torque of 115 - 140 Nm.

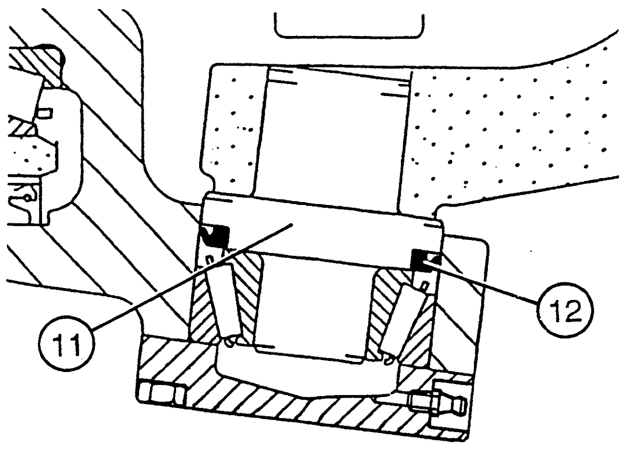


Fig. 7

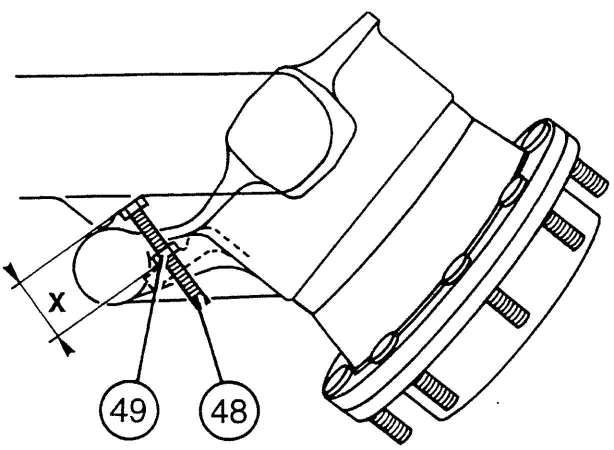


Fig. 8

Front axle - *Final drive units*

Shimming P1 (Fig. 10)

69. Using a dial gauge, measure the axial play with a lever inserted between the axle housing and the swivel housing (Fig. 9).
70. Remove any play found during the above operation using a pack of shims **(3)** of corresponding thickness. To obtain **P1**, add supplementary shims up to a thickness of 0.15 to 0.25 (where 0.15 to 0.25 is the pre-load value).
71. Remove the bolts **(1)**, the cover **(2)**, the cup **(4)**, coat the cone **(5)** with bearing grease. Refit the cup, the shims **(3)** selected during operation 70. Refit the cover. Tighten bolts **(1)** to 115 - 140 Nm.
72. Using a pump, grease the bearing **(13)** and **(14)**.
73. Coat the outside diameter of seal **(45)** with Loctite 542 (Fig. 11) and oil the lips.
    Fit the seal (Fig. 11) using the tool 3378039M1 and the rings :
    - 3378056M1 front axle AG 155
    - 3378057M1 front axle AG 200

    Note: The tool A (§I) must be screwed fully home . The oil seal (45) does not rest against the shoulder of the housing. The ring determines the insertion length. Coat nut D (§I) and bearing plane with graphite grease.

    Oil seal **(45)** positioning:
    - AG 155: 11.5 mm from face F (Fig. 11A)
    - AG 200: 0.5 mm from face E (Fig. 11B)

    Refit the steering ball joint. Torque nut to
    - AG 155: 155 - 130 Nm
    - AG 200: 140 - 155 Nm

    Lock the nut using a new pin.
74. Refit the wheel hub. Carry out operations 37 to 42.
75. Remove the protection on the splines of the drive shaft. Fit the sun gear **(28)** and the circlip **(29)**.
76. Refit the planetary carrier. Carry out op. 23 to 30.

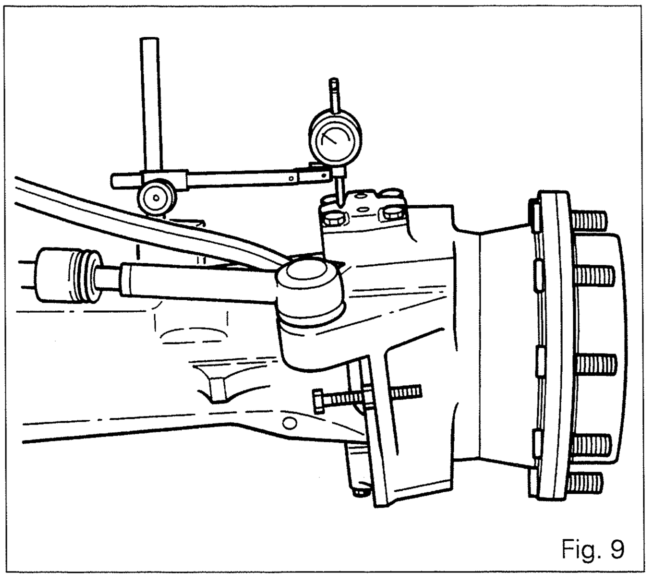


Fig. 9

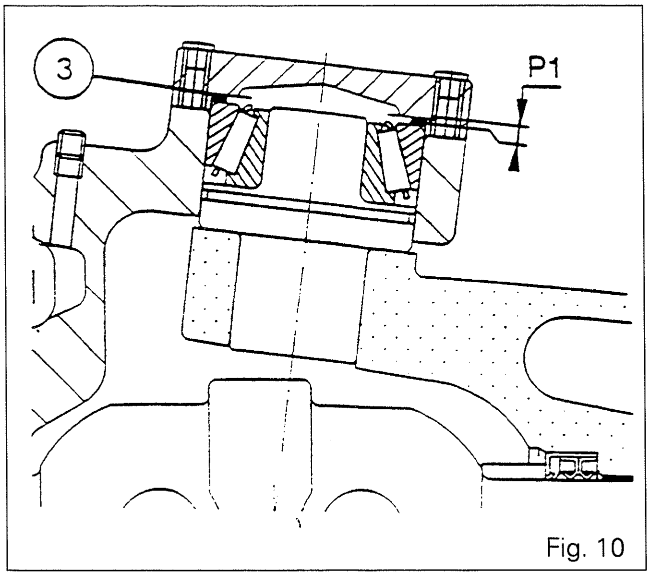


Fig. 10

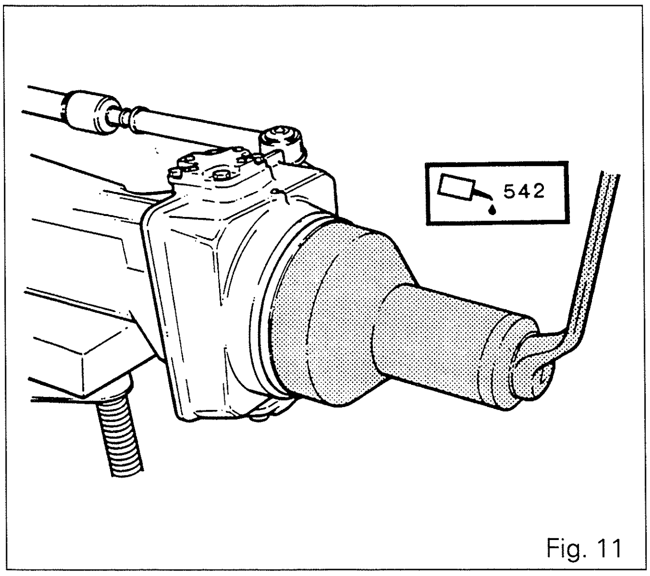


Fig. 11

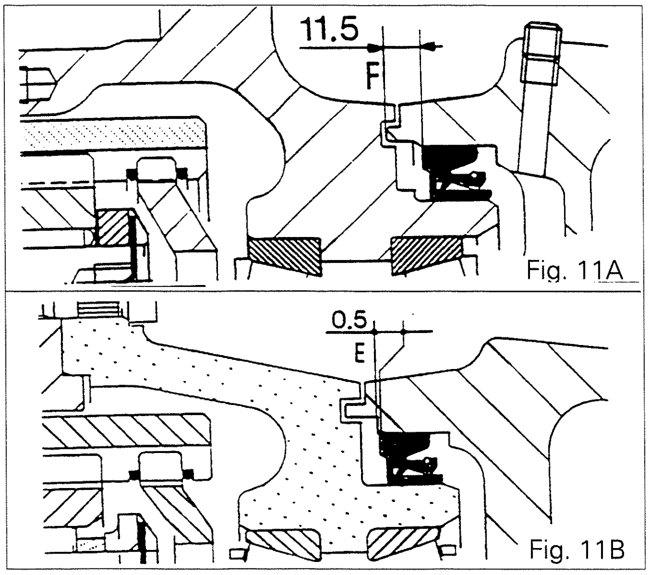


Fig. 11A

Fig. 11B

H. Removal and refitting of universal drive shaft

Removal

77. Remove the planetary carrier. Carry out operations 1 to 6.
78. Remove the circlip **(29)**, the sun gear **(28)** and extract the steering ball joint.
79. To remove the swivel housing **(47)** and wheel hub **(22)** assembly, use the procedure for extracting swivel pins **(7)** and **(11)**, described in § **F**.
80. Remove the universal drive shaft **(10)**.

Disassembly of universal joint (Fig. 12)

81. Maintain the external section **(1)** of the universal drive shaft in a vice with soft jaws.
82. Remove the four circlips **(3)** from each end of the universal joint.
83. Use a plastic mallet to drive the central yoke **(2)** downwards until the bearing sleeve protrudes.
84. Place the bearing sleeve in a vice and tap the central yoke from the bearing.
85. Remove the opposite bearing sleeve in the same way as above and remove the external section of the shaft.
86. Turn the shaft assembly through 90°, then repeat operations 83 to 85 to disengage the universal joint from the shaft.
87. Place the inner section of the drive shaft in the vice and repeat operations 82 to 86.

Reassembly of universal joint

88. Clean and check the parts. Replace the universal joint assembly comprising the spiders, the seals, the bearings, the sleeves and the circlips.
89. Coat the needles with bearing grease and ensure that they are all in the sleeves.
90. Position the universal joint **(1)** in the yoke and move it sideways as far as possible (Fig. 13) so that the end of the spider can serve as a guide for installing the needle rollers of the bearing sleeve.
91. Drive the sleeve **(1)** deep enough into the yoke, while holding the spider (Fig. 14), to permit insertion of the circlip.
92. Fit the other sleeves and spider in the same way.

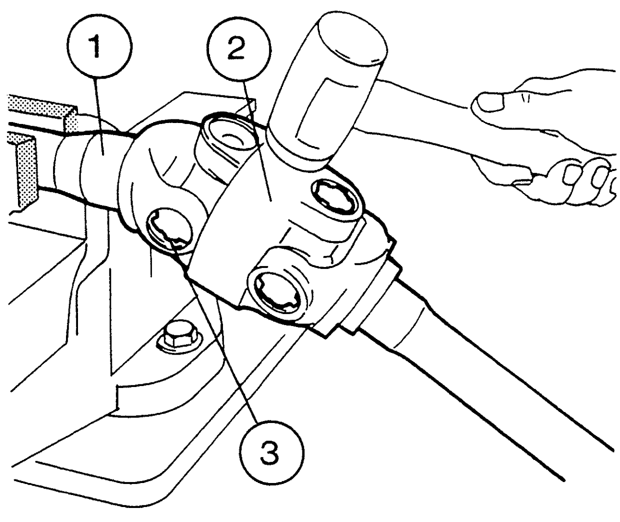


Fig. 12

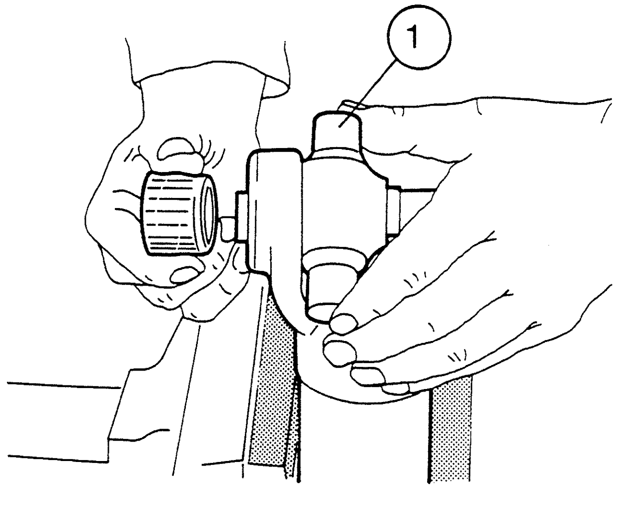


Fig. 13

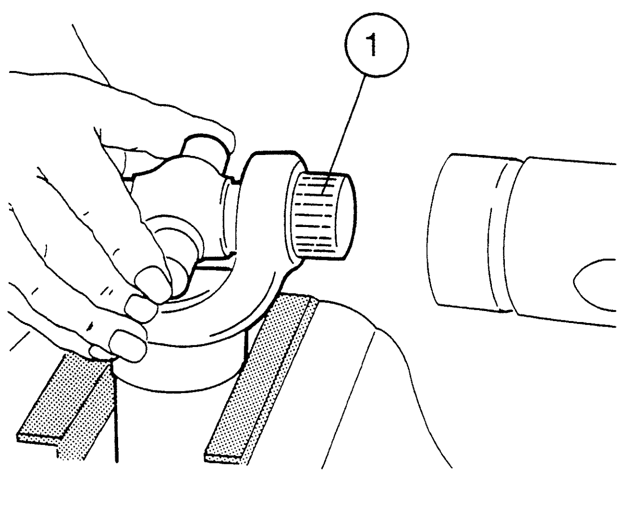


Fig. 14

Refitting

93. Refit the universal drive shaft. Introduce a guide through the filling hole to align the left drive shaft with the differential.
94. Refit the swivel housing and wheel hub assembly. Put a new O-ring **(6)** on swivel pin **(7)** coated with anti-seize grease. Position the swivel pin in order to have the swivel housing assembly aligned with the axle housing **(52)**.
95. Fit the bearing cup **(4)**, the shims **(3)** and the cover **(2)**. Fit the bolts **(1)** and torque them evenly and alternately.
96. Replace the O-ring **(12)**. position its lip as shown on Fig. 7. Drive bearing cone **(13)** onto swivel pin **(11)** until it rests against the shoulder.
97. Fit swivel pin **(11)** coated with anti-seize grease while ensuring that the lip of O-ring **(12)** comes into position correctly. Fit the bearing cup **(14)** and the cover **(15)**. Fit the bolts **(1)** and torque them (to 115 - 140 Nm) in the same way as during operation 95. Check that swivel pins **(7)** and **(11)** are properly in contact with the axle housing **(52)**.
98. Remove the bolts **(1)**, the cover **(2)** and the bearing cup **(4)**, coat the bearing cone **(5)** with bearing grease. Refit the bearing cup, the shims and the cover. Torque the bolts to 115 - 140 Nm.
99. Using a grease pump, grease the bearing made up of **(13)** and **(14)**.
100. Refit the steering ball joint. Torque the nut to:
    - 115 - 130 Nm (AG 155)
    - 140 - 155 Nm (AG 200)

    Lock the nut with a new pin.
101. Remove the protection of the shaft. Refit the sun gear **(28)** and the circlip **(29)**.
102. Refit the planetary carrier. Carry out operations 23 to 30.

I. Service tools

Tools available on the MF dealer network

MF451B - Swivel pin puller (Fig. 15)

MF451B/3 - Adaptor for puller M18 (Fig. 15)

3378 028 M1 - Socket for ring gear carrier nut (Fig. 16)

3378 038M1 - Ring gear carrier (42) puller (Fig. 17)

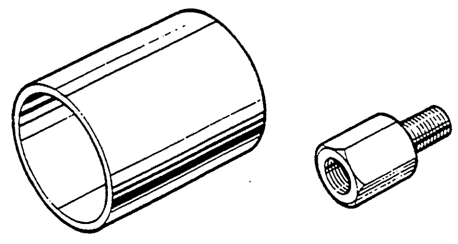


Fig. 15

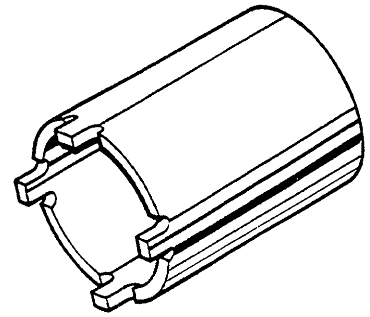


Fig. 16

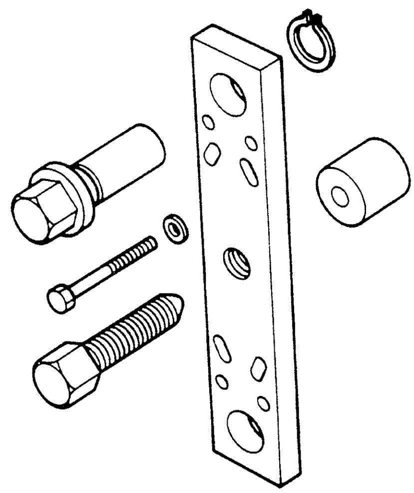


Fig. 17

3378039M1 - Fitting tool for ring gear carrier and seal (Fig. 18)

*** 3378056M1 - Seal (45) fitting ring front axle AG 155 (Fig. 19)**

*** 3378057M1 - Seal (45) fitting ring front axle AG 200 (Fig. 19)**

* These rings must be used with tool 3378039M1

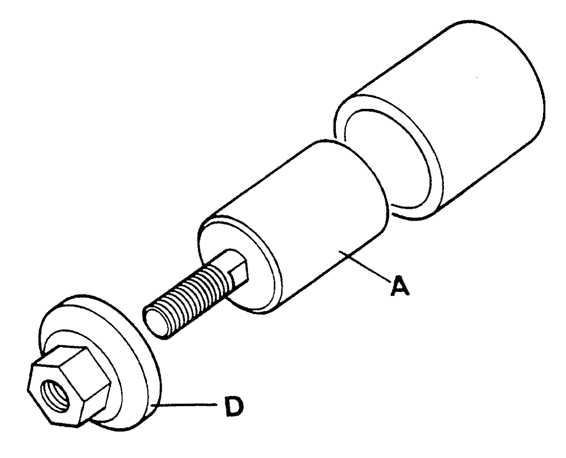


Fig. 18

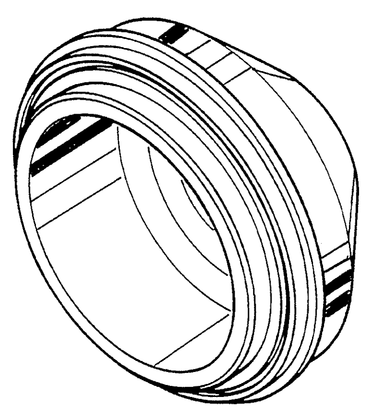


Fig. 19

8 D01 Differential

CONTENTS

Front axle - *Differential*

General

The bevel crownwheel and pinion assembly containing the differential lock device (hydralock) is mounted in a casing **(7)** comprising two bearing halves **(43)** fastened by bolts **(42)**.
The bevel drive pinion is mounted at the rear of the casing on two opposed taper roller bearings. Its position can be adjusted by means of shims **(8)** located behind the head roller bearing. The preload on the roller bearings is adjusted by means of a shim **(2)** positioned between the spacer **(45)** and the bearing cone **(5)**.
The assembly is sealed by means of a seal **(4)** and an O-ring **(40)** installed on the bevel drive pinion.
Axles AG 155 and AG 200 have four planetary pinions **(38)** and two pins **(36)**.
Clearance between the crownwheel and bevel drive pinion is adjusted with shims **(22)** positioned behind the cup **(29)**.
Preload of the case and crownwheel assembly is obtained by means of a splined nut **(32)**.
A plate riveted on the right-hand side of the axle housing indicates the category and serial number.

Service tools (see Section M)

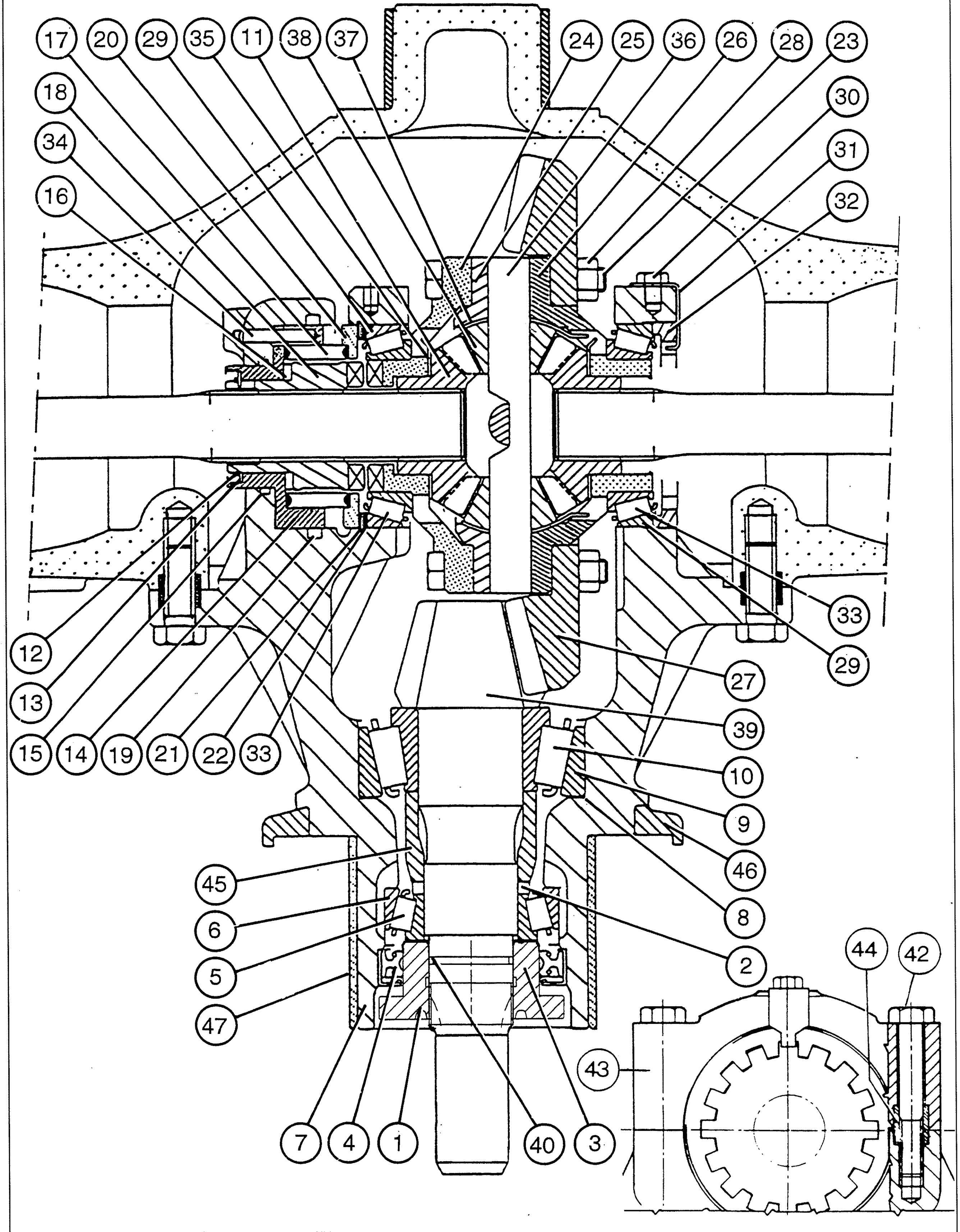
MF451.B - Swivel extractor (Fig. 20)
MF451.B3 - End fitting for extractor M18 (Fig. 20)
MF471 - Differential locking spring compression tool (Fig. 21)
3376881M1 - Clamping tool for bevel drive pinion nut (Fig. 22)

List of parts

(1) Slotted nut
(2) Shim
(3) Spacer
(4) Seal
(5) Bearing cone
(6) Bearing cup
(7) Housing
(8) Shim(s)
(9) Bearing cup
(10) Bearing cone
(11) Sun gear
(12) Lug washer
(13) Retaining ring
(14) Piston
(15) O-ring
(16) Thrust washer
(17) Spring
(18) Dog tooth coupler
(19) O-ring
(20) Guide washer
(21) Washer
(22) Shim(s)
(23) Bolt
(24) Cover
(25) Housing half
(26) Housing half
(27) Crownwheel
(28) Nut
(29) Bearing cup
(30) Bolt
(31) Locking plate
(32) Splined nut
(33) Bearing cone
(34) Locating dowel
(35) Washer
(36) Planetary pinion pin
(37) Spherical washer
(38) Planetary pinion
(39) Bevel drive pinion
(40) O-ring
(42) Bearing bolt
(43) Bearing half
(44) Centring bush
(45) Spacer
(46) Deflector

Front axle - Differential

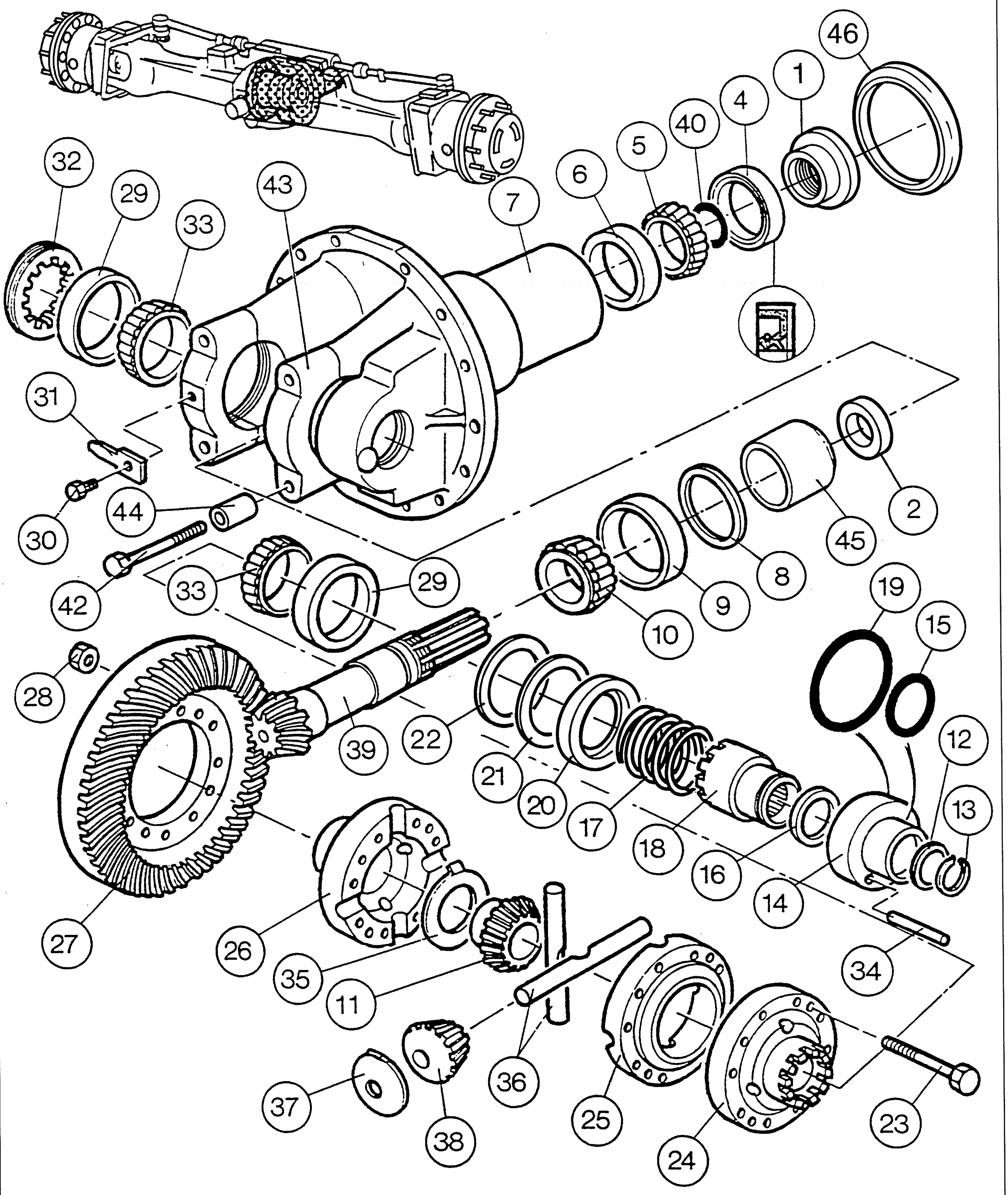
Overall view



CONTENTS

Front axle - *Differential*

Exploded view



CONTENTS

A. Splitting between the front axle and the frame

1. Drain the oil from the axle housing.
2. Disconnect the axle and its bearings from the front frame (see Section 8A01 §A).

B. Removal of swivel housings, wheel hubs and universal drive shafts

Note: Care must be taken when carrying out this operation.

3. Remove the steering ball joints.
4. Place the swivel housing assembly in a suitable sling.

Removal of swivel housings (Figures 1 and 2)

5. Remove bolts **(1)**, the cover **(15)** and cup **(14)**. Extract the swivel pin **(11)** (Fig. 2) using extractor MF451.B and end fitting MF451.B3 (§M).
6. Remove bolts **(1)**, the cover **(2)**, shims **(3)** and cup **(4)**. Extract swivel pin **(7)** as described above for the lower pin (Fig. 2).
7. With the help of another person, remove the assemblies.
8. If necessary, remove the seals **(8)** and O-rings **(40)** (Fig. 1).

C. Removal of differential case assembly

9. Remove the attaching bolts from the steering ram and remove it.
10. Remove the bolts **(1)**. Detach and remove the differential case assembly **(7)** (Fig. 3). If necessary, remove the deflector **(46)**.

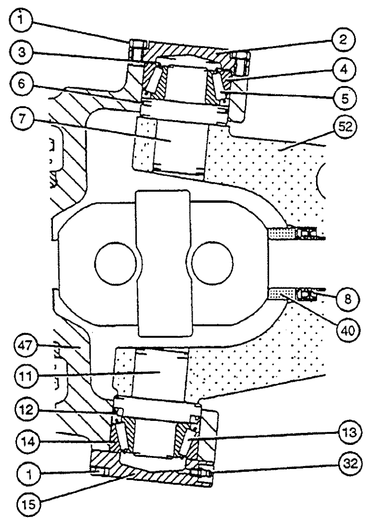


Fig. 1

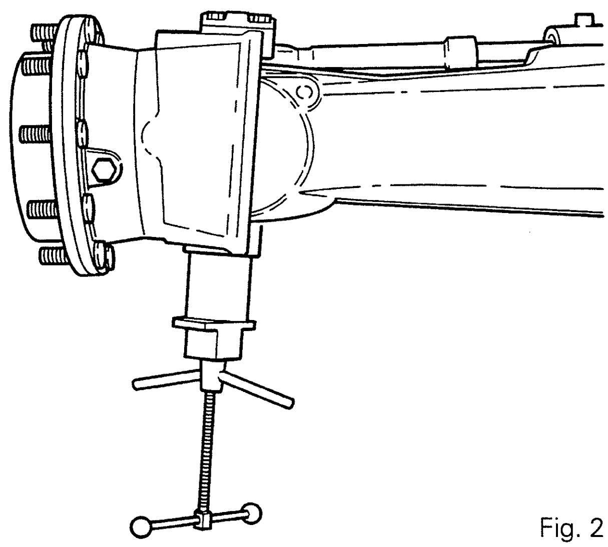


Fig. 2

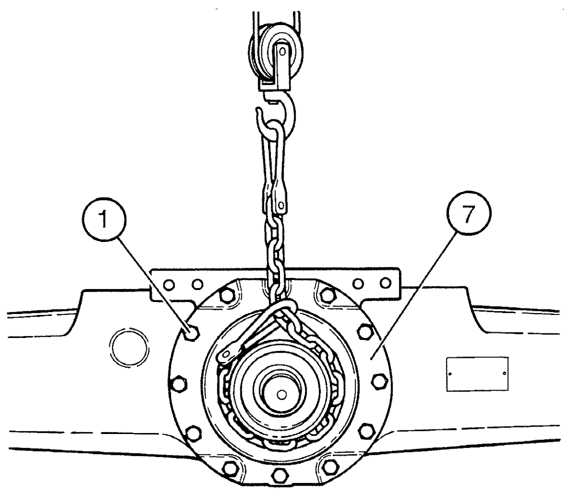


Fig. 3

D. Disassembly of differential

11. Place the casing **(7)** in a soft-jawed vice (Fig. 4).
12. Remove the bolt **(30)** and its retainer **(31)** (Fig. 4).
13. Remove the splined nut **(32)** using the special locally-manufactured spanner (see Section M).
14. Remove the four bolts **(42)**, and remove the bearing halves **(43)** (Fig. 4).
    Note: Carefully remove the bearing half on the lock control side, with spring (17) compressed; the washer (21) should remain in the casing (7).
15. Remove the complete differential assembly with the bearing cones **(33)** and cups **(29)** (Fig. 5). Separate the cups from the cones. Remove the shim or shims **(22)**.
    Note: Keep the bearing cones and cups paired if they are to be reused.
16. If necessary, extract the two bearing cones **(33)**.
17. Place the differential assembly in a soft-jawed vice. Remove the nuts **(28)**. Take out the bolts **(23)**.
    Note: Prior to disassembly, mark the position of the housing halves (25) and (26) and of the cover (24) so they can be correctly paired when refitting.
18. Separate the housing halves **(25)**, **(26)** and the cover **(24)**.
19. Remove the sun gear **(11)** and washer **(35)**.
20. Separate the two pins **(36)**, the planetary pinions **(38)** and the spherical washers **(37)** (Fig. 6).

E. Removal of differential lock (Fig. 7)

21. Using tool MF471 (§M) correctly centred, compress the spring **(17)** until the supporting washer **(21)** is free.
22. Remove the washer **(21)**.
23. Gradually release the spring **(17)**.
24. Remove the service tool.
25. Remove the guide washer **(20)** from the spring.
26. Remove the spring **(17)**.
27. Disassemble the retaining ring **(13)** from the dog tooth coupler **(18)**.
28. Remove the coupler **(18)**, the thrust washer **(16)** and the lug washer **(12)**.
29. Remove the piston **(14)**.
30. Remove the O-rings **(15)** and **(19)**.

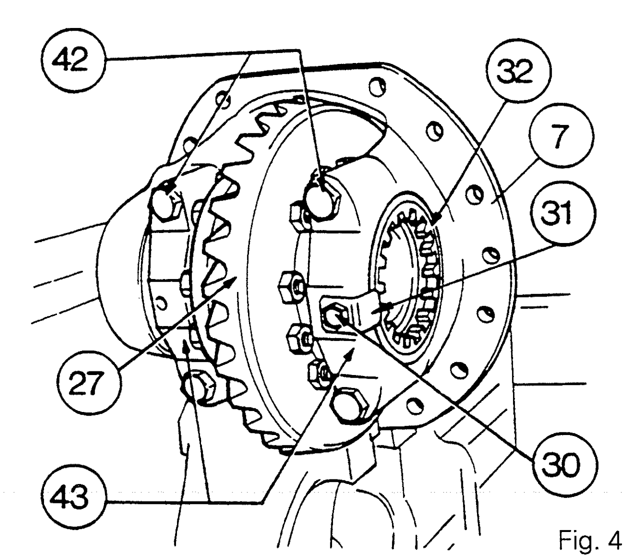


Fig. 4

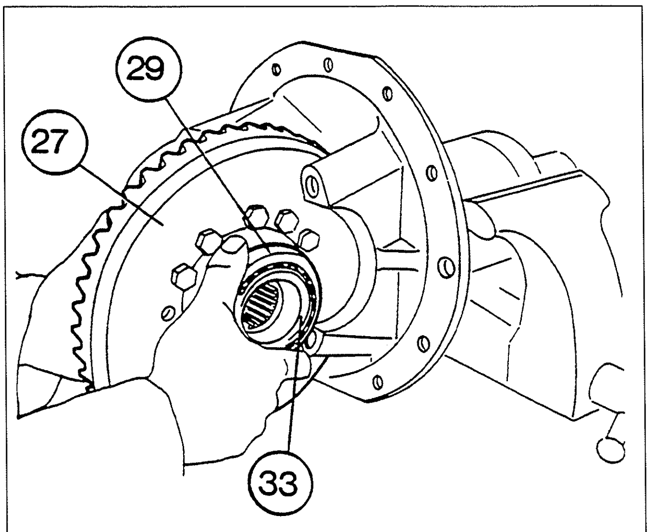


Fig. 5

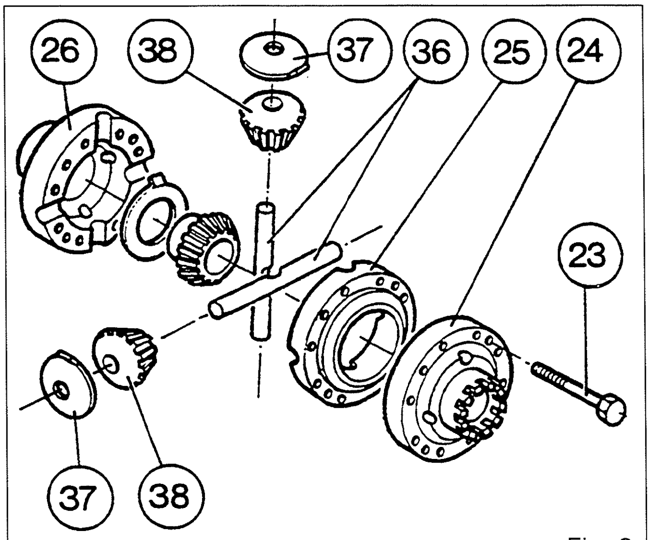


Fig. 6

CONTENTS

F. Removal of bevel drive pinion

Tractors in series 8100 are equipped with a reinforced 4WD shafting.
At the location of the front coupling, the six-splined drive pinion of the differential unit is replaced with a 24-splined pinion.
This new pinion is fitted on tractors with the following serial numbers onwards:
- tractors 8110 to 8140: D089019,
- tractors 8150 to 8160: D086030.

31. Unlock the nut **(1)** and untighten it with the special spanner 3376881 M1 (Figures 8 and 9). Unscrew the bevel drive pinion in the clockwise direction (Fig. 9) using the special locally-manufactured «C» sleeve (Fig. 8) (See §M).
32. Remove the bevel drive pinion assembly, the bearing cone **(10)**, the spacer **(45)**, the shim **(2)** and the O-ring **(40)** from the housing.
33. Detach O-ring **(40)**, shim **(2)** and spacer **(45)** from the bevel drive pinion.
34. Extract the bearing cone **(10)** from the bevel drive pinion.
35. Extract the cup **(9)** and remove the shims **(8)**.
36. Remove the spacer **(3)**, drive out the cup **(6)** with its cone **(5)** and then extract the seal **(4)**.

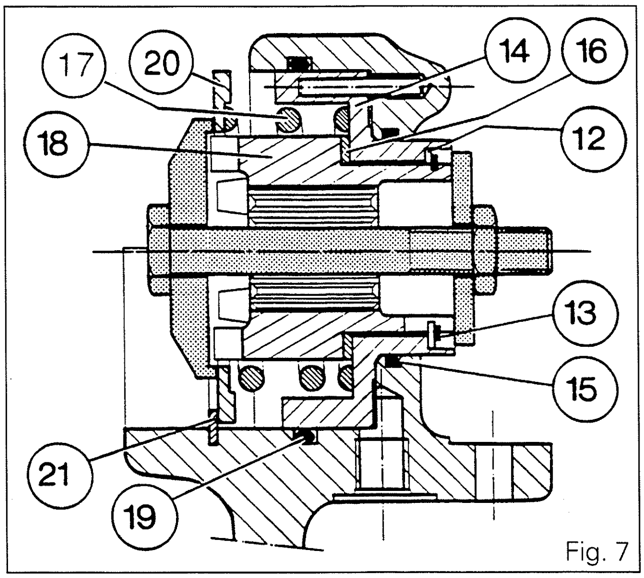


Fig. 7

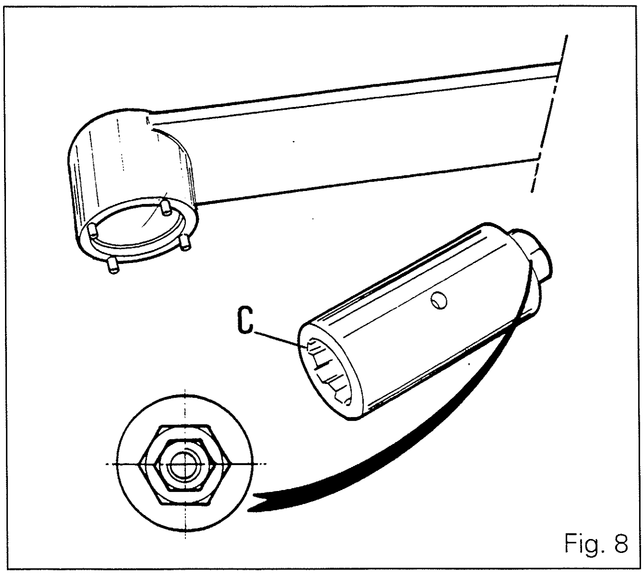


Fig. 8

G. Reassembly of bevel drive pinion

37. Before reassembly, clean the parts and replace any which are faulty. Check that the differential lock channel is not obstructed.
Note: If it should prove necessary to replace the crownwheel (27) or the bevel drive pinion (39), these two parts should both be replaced together.
The parts are paired as indicated by a number marked on the front face of the bevel drive pinion and on the crownwheel.

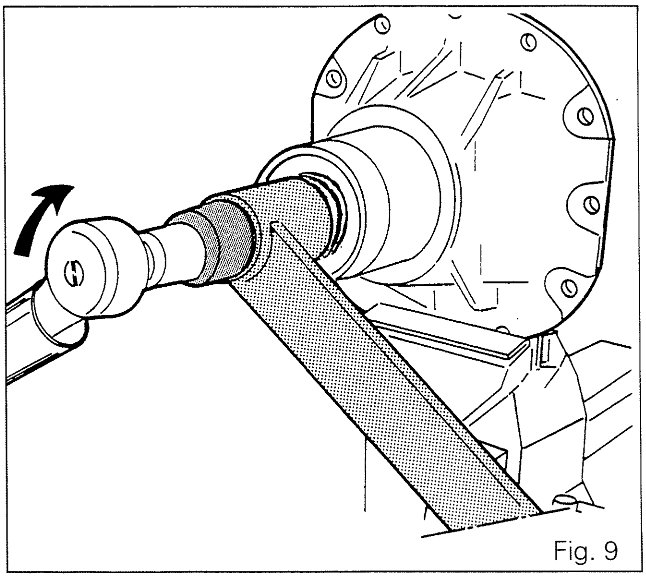


Fig. 9

Front axle - *Differential*

38. Adjust the position of the drive pinion (Fig. 10). The thickness of shims required to position the drive pinion correctly is calculated using the formula:
SP = C-D ((d±r)
SP: Required thickness of shims **(8)**
C: Dimension measured between the mating face of the cup **(9)** on the housing **(9)** and the machined face **F**.
d: Nominal dimension of positioning of the drive pinion
AG 155: 133.5 ± 0.10
AG 200: 139 ± 0.10
E: Thickness of the bearing **(9)**, **(10)**
r: Actual dimension marked on the drive pinion (Fig. 11).
This value may be positive or negative (to be added to or subtracted from the nominal dimension **d**).

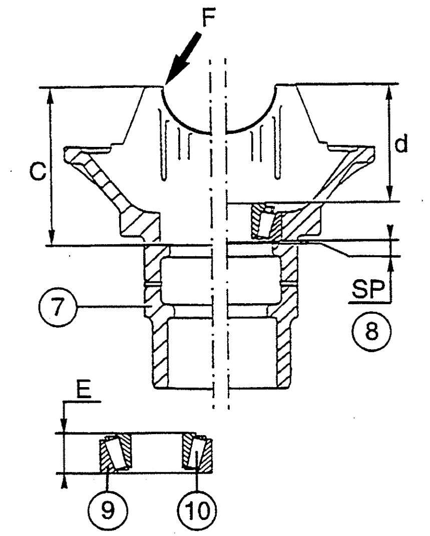


Fig. 10

Operating procedure

39. Measure dimensions ***C** and **E** with a depth gauge.*
Note: Make sure that the bearing cone (10) is correctly seated in the cup (9).
40. After measuring the dimensions, apply the formula to determine the required thickness of shims.
41. Fit the cone fully home against the shoulder on the drive pinion, using a press and a suitable fixture (Fig. 12).
42. Place previously calculated thickness of shims **(8)** in the housing.
43. Fit the cup **(9)** using a suitable fixture.

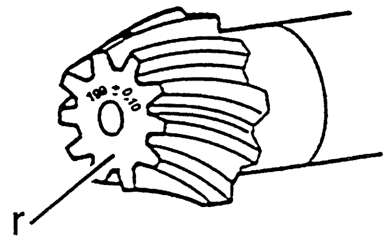


Fig. 11

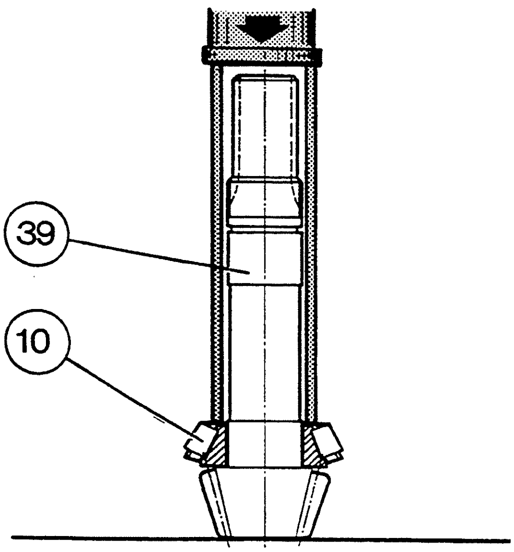


Fig. 12

44. Shim the bearings **(9)**, **(10)** and **(5)**, **(6)**.

Method

45. Place the prepared bevel drive pinion in the casing **(7)** as shown in Fig. 13. Rotate the housing through several turns in order to correctly seat the bearing cone **(10)** in the cup **(9)**. Slide the spacer **(45)** into position with its chamfered edge towards the splines on the bevel drive pinion.
46. Using a depth gauge, measure dimension **'F'** according to the formula: **A - B** (Fig. 13).
47. Press on the cup **(6)** while turning it alternately to the right and to the left in order to seat it correctly on bearing cone **(5)**. Measure dimension «G» (Fig. 13).
48. Determine the shim **(2)** thickness **SP1** (Fig. 13) according to the formula:
    (G+F)-0.05 (0.05 being the preload value).
49. Position the cup **(6)** fully home in the casing.
50. Slide the shim **(2)** defined in procedure 48 on the bevel drive pinion. Fit the bearing cone **(5)**, the O-ring **(40)** and the spacer **(3)** (Fig. 14).
51. Fit the nut **(1)** and fully tighten with spanner 3376881M1. Using a special sleeve and a torque wrench, turn the bevel drive pinion until a torque of between 450 and 500 Nm is obtained (Fig. 15).
52. Check that there are no burrs on the nut **(1)**. Grease the lips of seal **(4)** and fit it fully home on the shoulder using a locally-manufactured drift (See §M).
53. Check the torque on the bevel drive pinion.

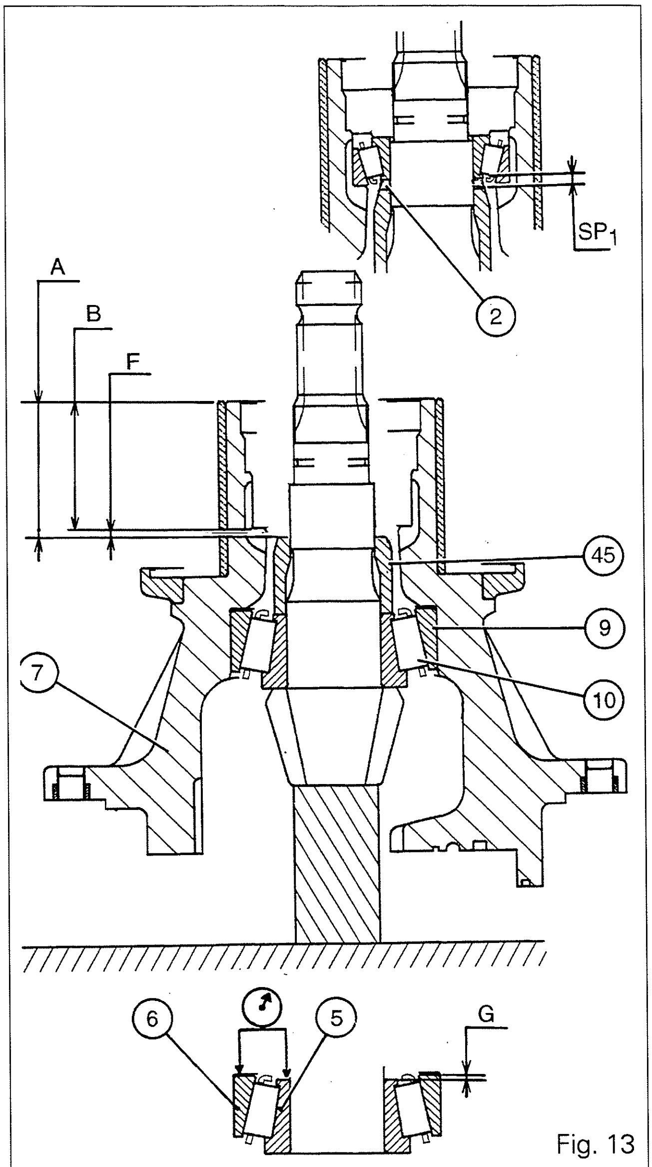


Fig. 13

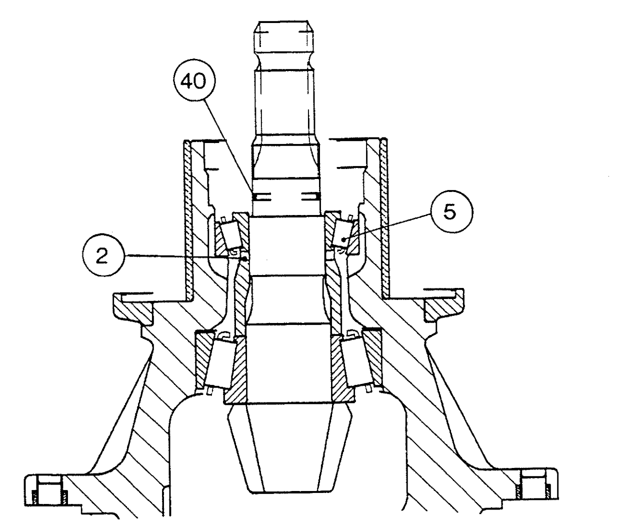


Fig. 14

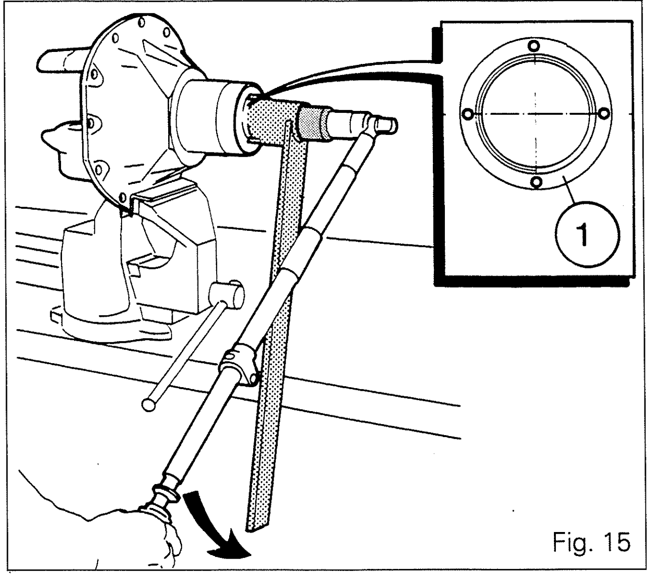


Fig. 15

Method:

54. Rotate the bevel drive pinion through several turns using a dial type torque wrench and the special sleeve (Fig. 16). Then, check that the torque is between 2 and 4 Nm.
55. After checking the torque, remove the nut **(1)** and coat it with Loctite 270.
Tighten the nut as described in procedure 51.

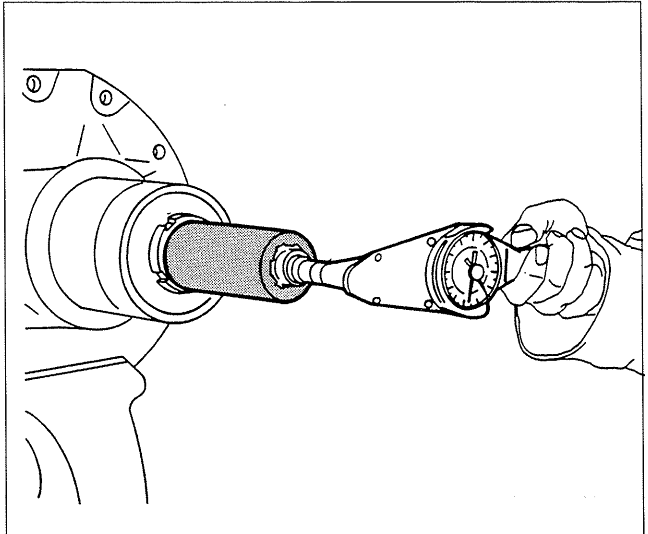


Fig. 16

H. Reassembly of differential lock

56. Remove the thrust washer **(16)** on the sliding dog tooth coupler **(18)**, and then fit the assembly in the piston **(14)**. Fit the lug washer **(12)** and position the retaining ring **(13)** in the groove on the coupler.
57. In the casing without seals, install the piston **(14)** with the coupler **(18)**.
Note: The dowel (34) is force-fitted in the piston. Check that the piston and the dowel slide freely in the casing. When this check has been carried out, remove the piston with the coupler.
58. Fit new O-rings **(15)** and **(19)**. Position the piston with the coupler and then insert it by striking it around the edge with a plastic mallet.
59. Position the spring **(17)** and the washer **(20)**, with the shoulder of the washer facing the spring. Tighten the assembly using tool MF471 until the washer **(21)** slides freely in the groove on the housing.
60. Loosen the tool, taking care that the spring does not escape.
61. If the bearing cone **(33)** was removed, fit it on the housing half **(26)** using a press or a suitable fixture (Fig. 17).
62. Fit the other bearing cone **(33)** on the cover **(24)**, if it was removed.
63. Assemble the housing half **(25)** in the cover **(24)** (with the coupler teeth) in accordance with the markings made before disassembly.
64. Position the washer **(35)** on the planetary pinion **(11)**, and place the assembly in the housing half **(25)**, engaging the lug on the washer in one of the holes in the housing half.
65. Place the four sun gears **(38)** and the four spherical washers **(37)** on the two pins **(36)**. Then position the assemblies in the housing half **(25)**, engaging the lugs on the washers **(37)** in the holes in the housing half **(25)** (Fig. 6).

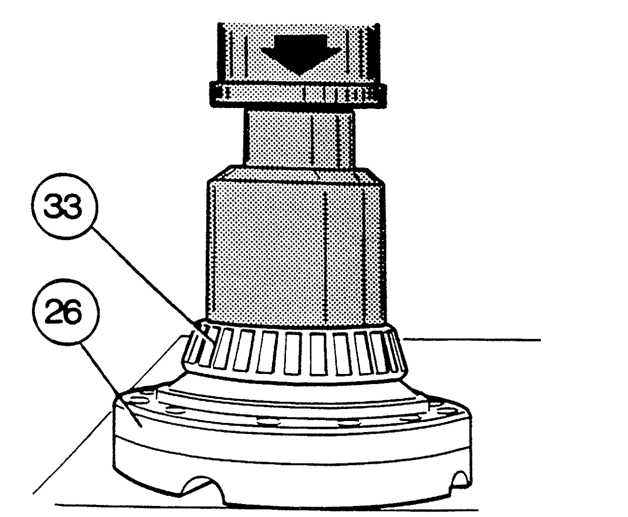


Fig. 17

66. Place the other washer **(35)** on the other sun gear **(11)**. Fit the assembly in the housing half **(26)**, making sure that the lug of washer **(35)** is correctly positioned.
67. Position the half housing assembly **(26)** on housing half **(25)**, in accordance with the assembly position marked before disassembling.
68. Position the crownwheel **(27)** on the housing half **(26)**. Assemble the housing halves **(25)** and **(26)**, the cover **(24)** and the crownwheel.
    Fit the bolts **(23)** and apply Loctite 270.
    Tighten the nuts **(28)**:
    AG 155: 82 to 90 Nm,
    AG 200: 125 to 140 Nm.
69. Position the bearing cups **(29)** on their cones **(33)**.
70. Place the shims **(22)** on washer **(21)**.
71. Place the crownwheel assembly in the casing **(7)** (Fig. 5). Check that the centring bushes **(44)** are in place. Position the bearing halves **(43)**.
    Moderately tighten the bolts **(42)** so that the cups **(29)** can be moved freely.
72. Install the housing in the horizontal position in a soft-jawed vice, with the crownwheel facing upwards (Fig. 18).
73. Install a dial gauge. Tighten the nut **(32)** (Fig. 18) and rotate the crownwheel through several turns in order to correctly seat the bearing cones in the cups. Retighten the screw in order to take up the end play.
74. Tighten the nut **(32)** by three more slots in order to obtain a satisfactory preload.
75. Check the backlash on the crownwheel and the bevel drive pinion with a dial gauge (Fig. 19). Take three readings at three equidistant points. Calculate the average of the three readings to obtain a backlash of 0.18 to 0.23.
    If the measured value is too high, reduce the thickness of shims **(22)**. If it is too low, increase the thickness of shims until a satisfactory reading is obtained.
76. Disassemble the bearing screws **(42)** one by one, coat them with loctite 270 and tighten them to between 115 and 127 Nm.
77. Refit the locking plate **(31)** with the bolts **(30)** coated with Loctite 270, and tighten to between 16 and 25 Nm. Lock the nut **(32)** by bending the lug of the locking plate in the appropriate groove.

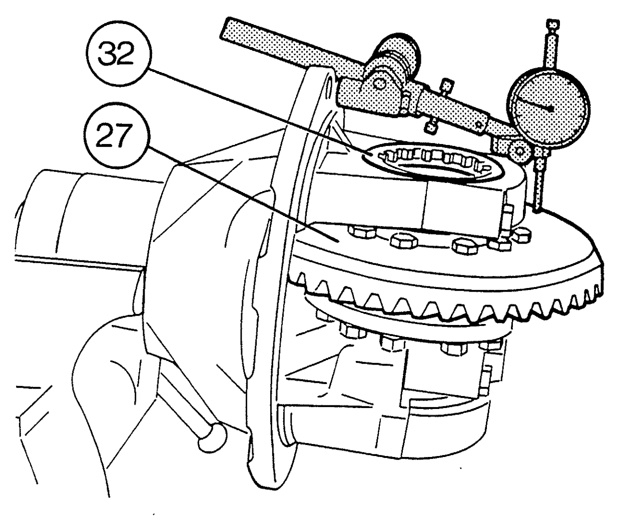


Fig. 18

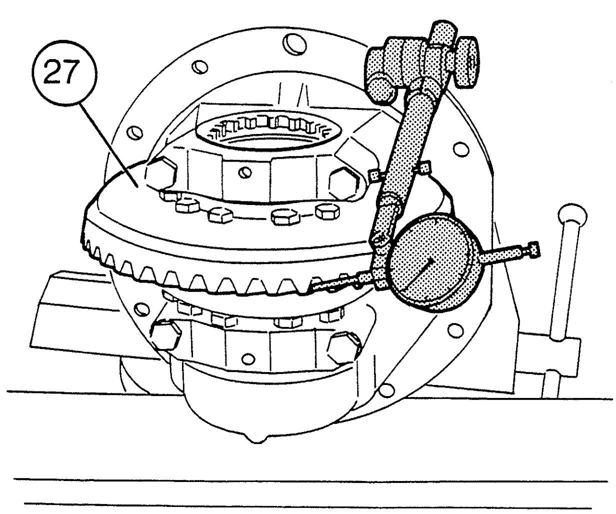


Fig. 19

Front axle - *Differential*

I. Piston leak test

78. Connect a pressure gauge equipped with a valve to the supply connector of the differential lock
79. Supply the circuit with compressed air at approximately 5 bars and check the movement of the piston **(14)**.
    Reduce the pressure to 0.3 bar and close the valve. The pressure gauge should not show any pressure drop for 1 minute.
80. Remove the pressure gauge and valve assembly.

J. Refitting of differential case assembly

81. Clean and check the parts. Replace any which are faulty.
82. Check that the centring bushes are installed on the axle housing.
83. Smear a sealing compound, Loctite 510 or equivalent, on the differential case mating face with the axle housing, and screw in two diametrically opposed guide studs.
    Refit the differential case assembly **(7)** (Fig. 3).
84. Remove the guide studs. Fit and tighten the bolts **(1)**:
    AG 155: 125 to 140 Nm,
    AG 200: 215 to 235 Nm (Fig. 3).
85. Refit the steering ram. Smear the attaching bolts with Loctite 270 and tighten them to between 180 and 200 Nm.

K. Refitting of swivel housings, wheel hubs and universal drive shafts (Fig. 1)

86. If the seals **(8)** were removed, fit them fully home against the shoulder. Replace the O-rings **(40)** and seals **(6)** and **(12)**.
87. Lubricate seal **(8)**. With the help of another person, fit the assemblies. Slide the universal drive shafts in the axle housing without damaging the seals. Insert a guide through the oil filling hole to align the left-hand drive shaft with the differential.
88. Turn the wheel hubs in order to engage the drive shafts.
89. Smear the pin **(7)** with anti-seize grease and position it so that the swivel housing assembly **(47)** is aligned with the axle housing **(52)**. Fit the pin.
90. Fit the bearing cup **(4)**, the shims **(3)** and the cover **(2)**. Fit and tighten the bolts **(1)** evenly and alternately.
91. Fit the pin **(11)** smeared with anti-seize grease, checking that the lip of seal **(12)** (Fig. 1) is correctly positioned.
    Position the bearing cup **(14)** and the cover **(15)**. Fit the bolts **(1)** and tighten them to between 115 and 140 Nm in the same way as in procedure 90.
92. Check that the swivel pins **(7)** and **(11)** are correctly in contact with the casing.
93. Remove the cover **(2)**. Take out the shims **(3)** and the cup **(4)**. Smear the cone **(5)** with bearing grease. Refit the top, the shims and the cover. Tighten the bolts **(1)** to between 115 and 140 Nm. Using a pump, grease the bearing **(13)**, **(14)**.
94. Refit the steering ball joints.
    Tighten the nuts:
    AG 155: 115 to 130 Nm,
    AG 200: 140 to 155 Nm.
    Lock the nuts with new pins.

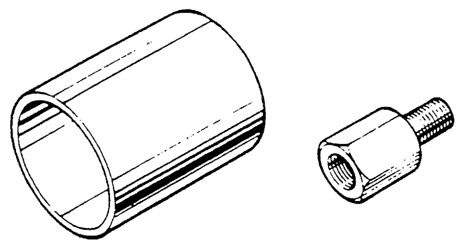
L. Reassembly of front axle / frame

95. Recouple the axle and its bearings on the front frame (see Section 8A01 §A).
96. Top up the oil level in the front axle housing and check the oil level in the reduction units.
97. Carry out a road test on the front axle and the differential lock control.
98. Check the following for leaks:
    - seals and the mating face of the differential housing,
    - hydraulic couplings.

M . Service tools

1. Tools available from the MF network

MF 451.B - Pivot extractor (Fig. 20)
MF451.B3 - End fitting for extractor M18 (Fig. 20)
MF471 - Differential locking spring compression tool (Fig. 21)
3378051M1 - Clamping tool for bevel drive pinion nut (Fig. 22)



Used with MF195C

Fig. 20

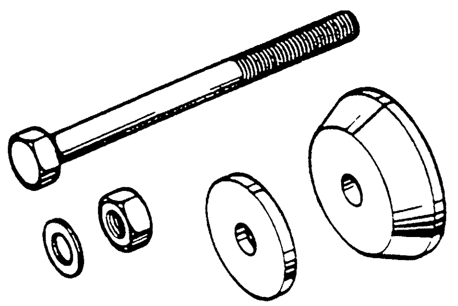


Fig. 21

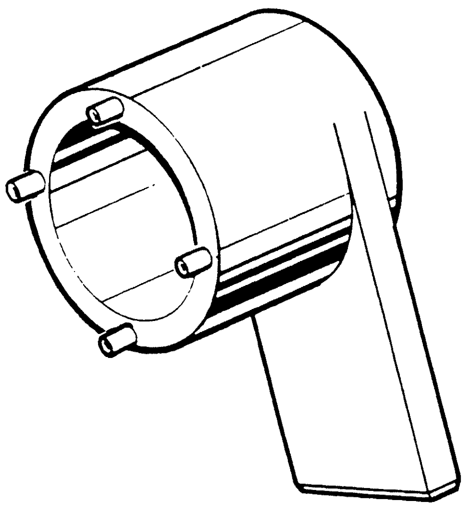
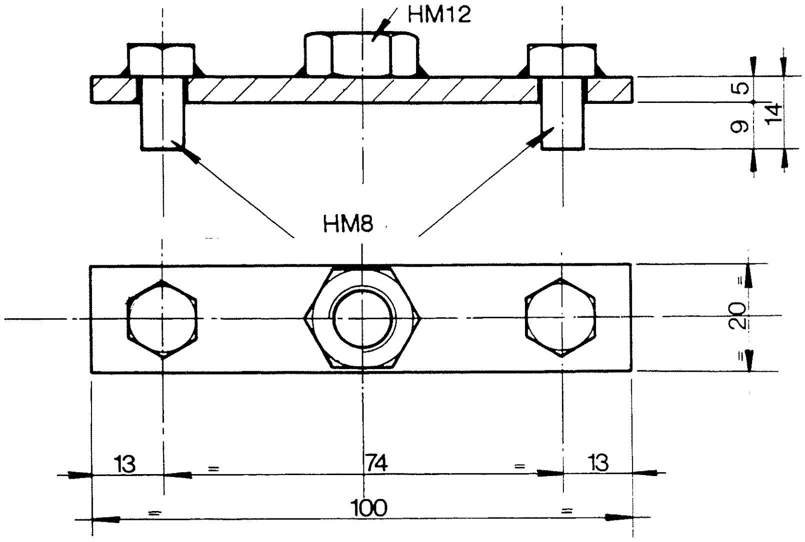


Fig. 22

Front axle - *Differential*

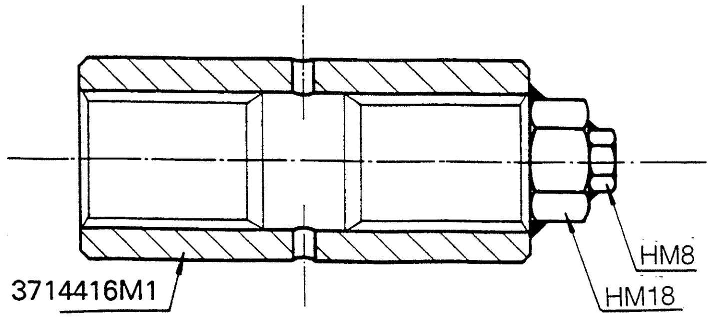
2. Tools to be manufactured locally

Special spanner for splined nut.

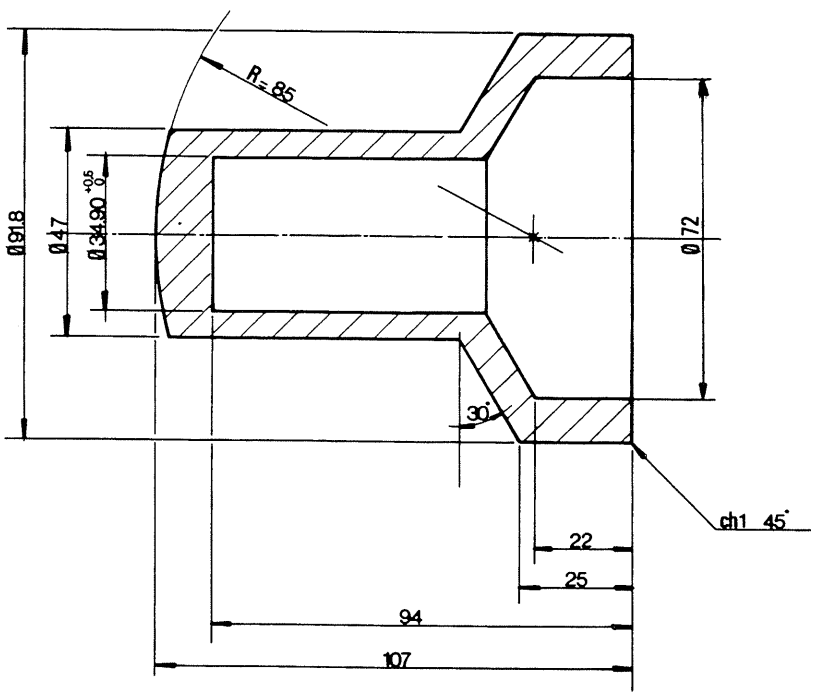


Special sleeve for tightening and torque of bevel drive pinion

Sleeve 3714416M1



Seal fitting drift



8 E01 2WD front axle

CONTENTS

Front axle - 2WD front axle

General

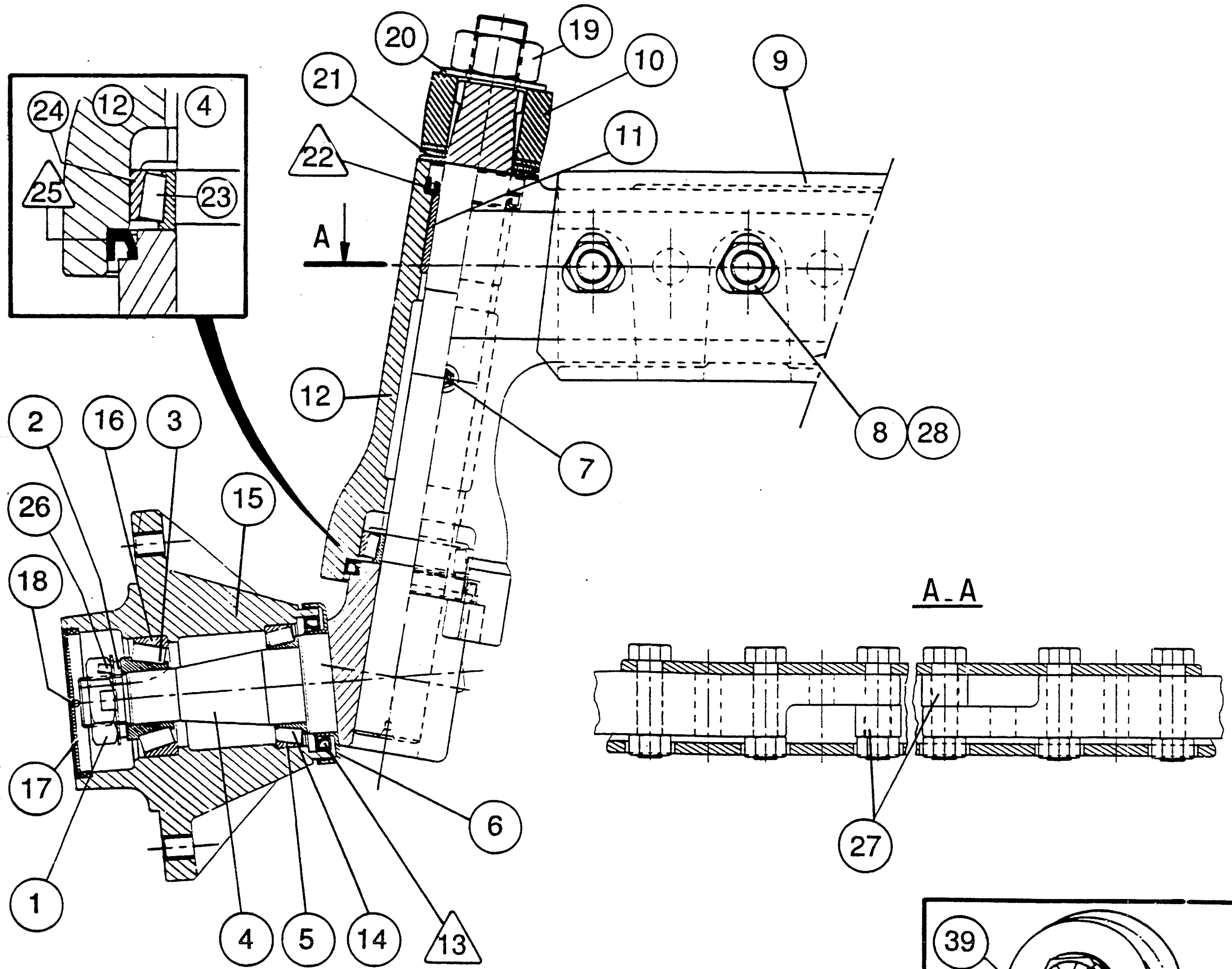
The front axle comprises the following assemblies:
- a cast iron support identical to that on the four-wheel drive version, the lower rear section of which includes a bearing supporting the 2nd removable steering swivel pin,
- a front bearing fixed on the cast iron support and holding the 1st steering swivel pin,
- an axle beam articulated on two swivels,
- two spindle arms,
- two spindles mounted in the bores of the spindle arms,
- a double-acting ram linked to the spindles by two steering arms.

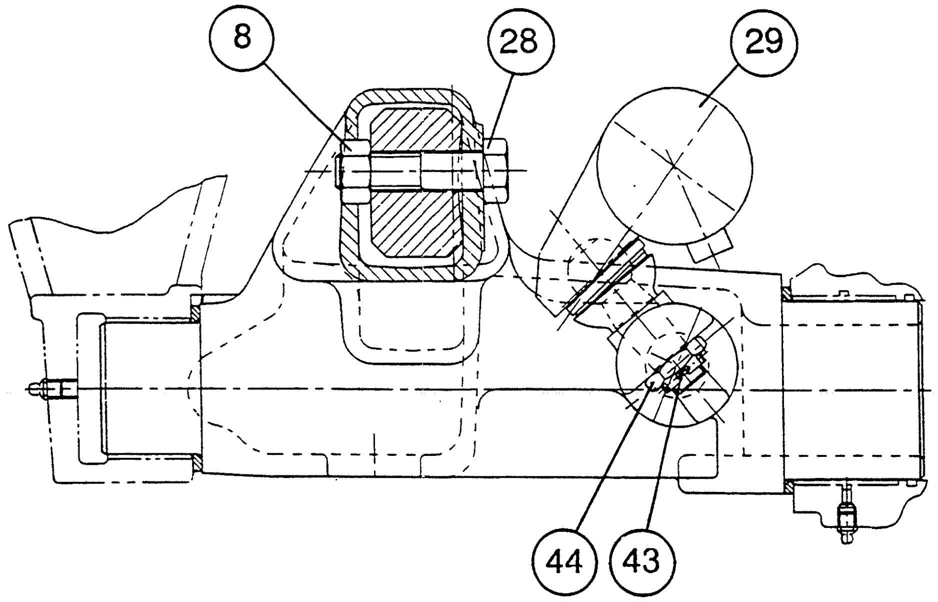
Series 8100 tractors are fitted with a heavy-duty axle with 8-hole hub.

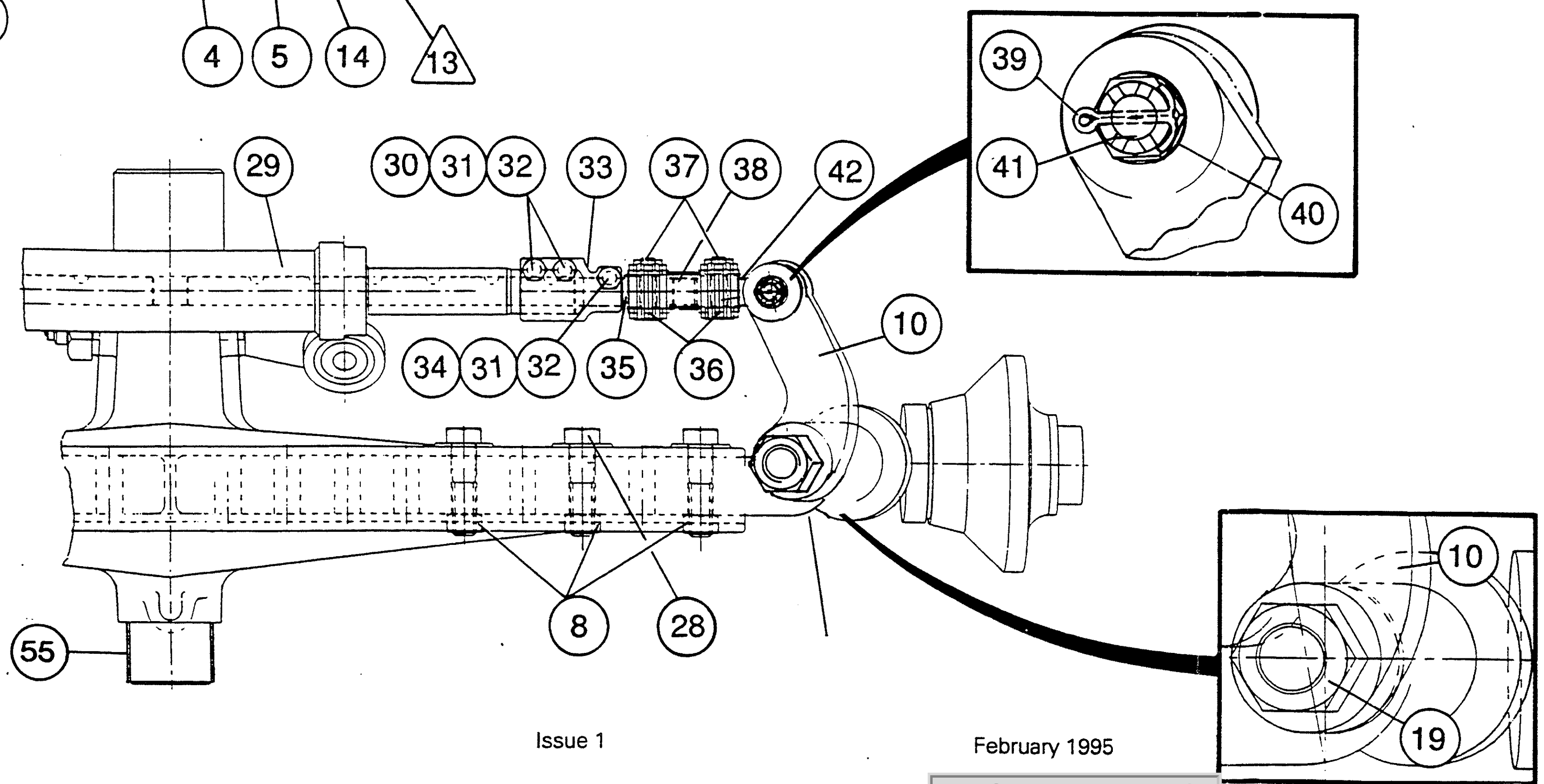
List of parts

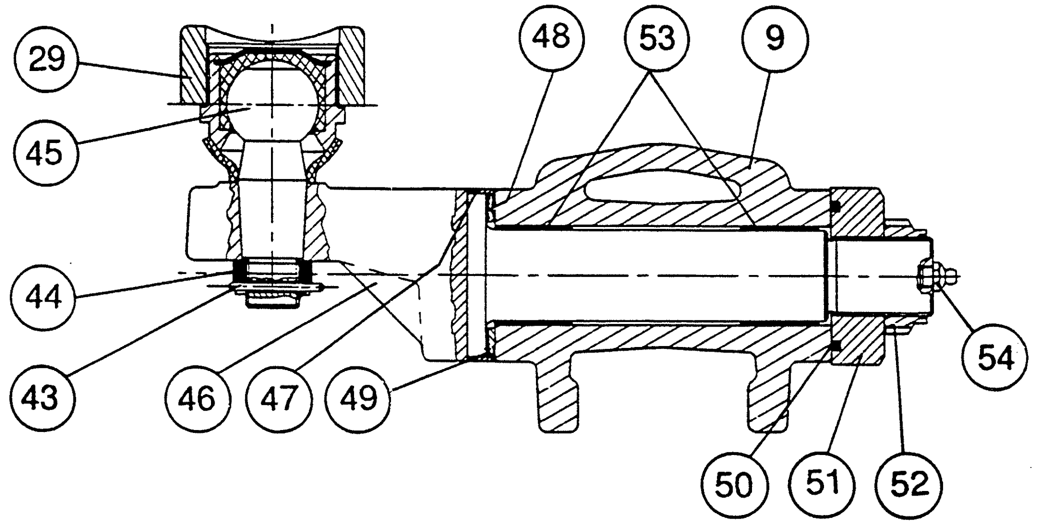
(1) Nut
(2) Washer
(3) Bearing cone
(4) Spindle
(5) Bearing cup
(6) Dust cap
(7) Grease nipple
(8) Nut
(9) Axle beam
(10) Steering arm
(11) Bush
(12) Spindle arm
/13 Sealing ring
(14) Bearing cone
(15) Hub
(16) Bearing cup
(17) Cover
(18) Rivet
(19) Nut
(20) Washer
(21) Belleville washers
/22 Sealing ring
(23) Bearing cone
(24) Bearing cup
/25 Sealing ring
(26) Lock washer
(27) Spacers
(28) Bolt
(29) Ram
(30) Bolt
(31) Washers
(32) Nuts
(33) Sleeve
(34) Bolt
(35) Steering rod
(36) Bolt
(37) Nuts
(38) Sleeve
(39) Split pin
(40) Washer
(41) Nut
(42) Ball joint
(43) Split pin
(44) Nut
(45) Ball joint
(46) Support
(47) Bush
(48) Thrust washer
(49) O-ring
(50) O-ring
(51) Nut
(52) Locknut
(53) Bushes
(54) Grease nipple
(55) Bush
(56) Washer
(57) Spacer

Front axle - 2WD front axle

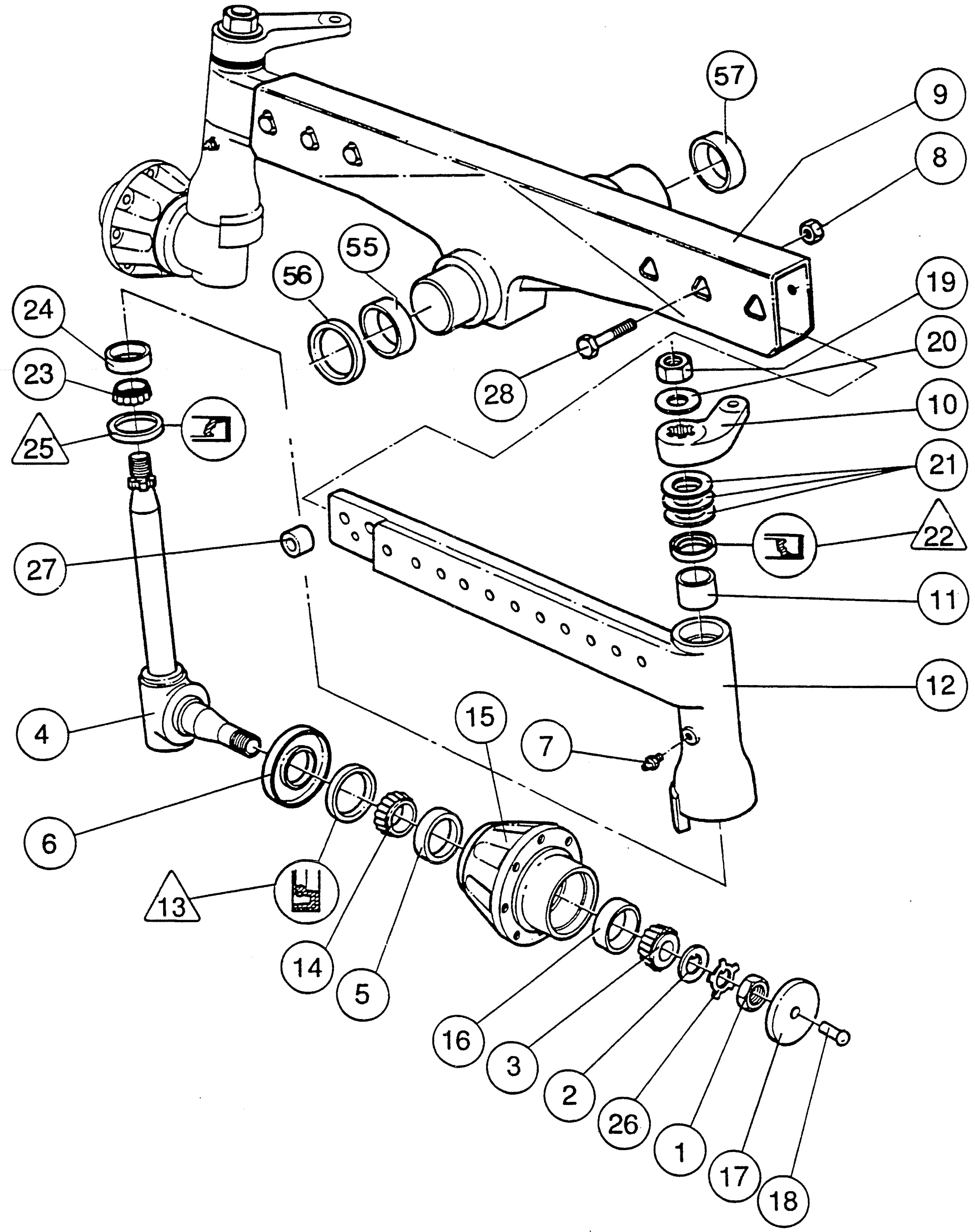


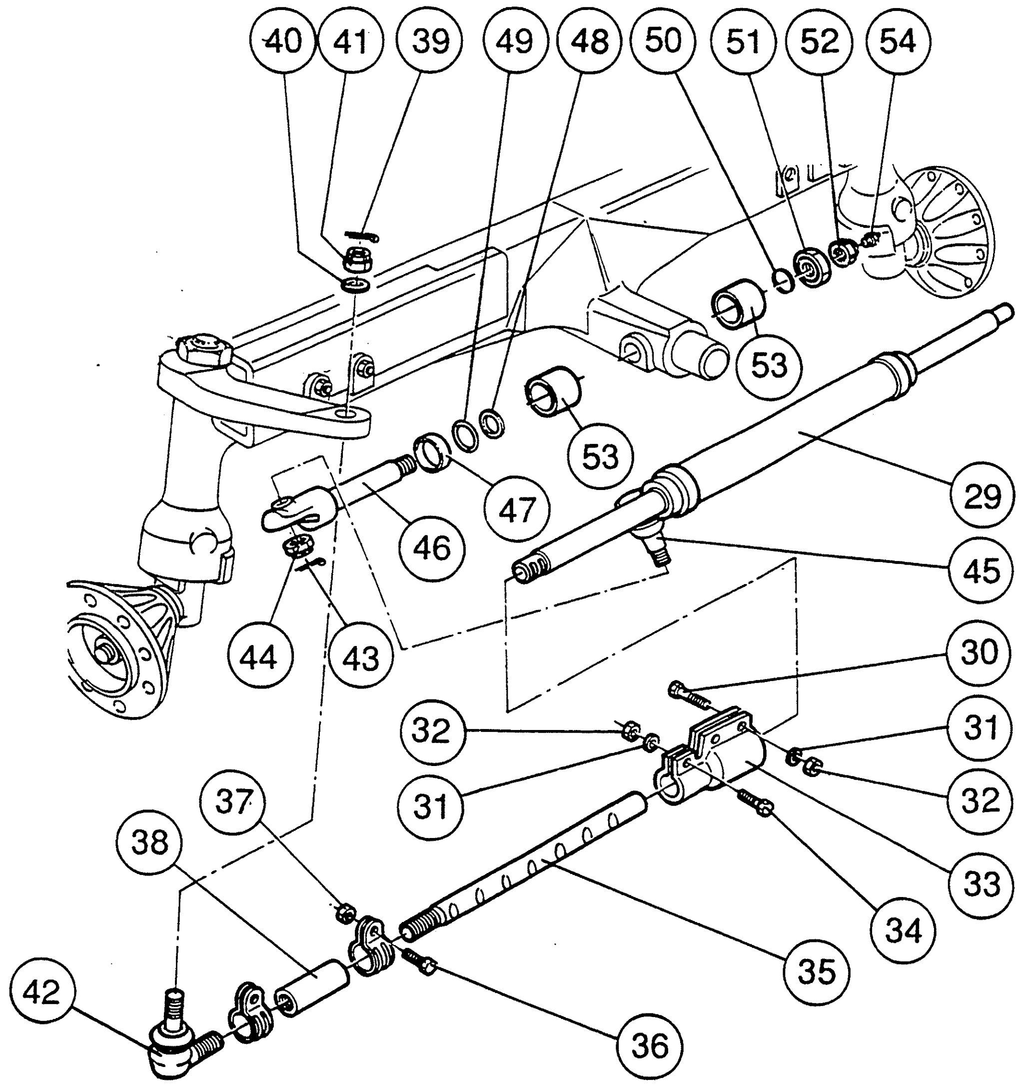






Front axle - 2WD front axle





Front axle - 2WD front axle

A. Removing and refitting the steering arm ball joint

Removal

1. Immobilise the rear wheels with chocks and apply the handbrake.
2. Lift the relevant wheel with a jack. Remove the split pin **(39)**, the nut **(41)** and the washer **(40)**.
3. Extract the ball joint **(42)** from the steering arm **(10)**.
4. Loosen the nuts **(37)**, turn the sleeve **(38)** to separate the ball joint **(42)** from the steering rod **(35)**.

Refitting

5. Clean and check the parts, and replace any that are faulty.
6. Install the ball joint **(42)** in the steering arm **(10)**.
7. Couple the sleeve **(38)** to the steering rod **(35)** and to the ball joint **(42)**.
8. Position the washer **(40)**, tighten the nut **(41)** to a torque of 108 to 122 Nm and lock it with the split pin **(39)**.
9. Remove the jack.
10. Remove the chocks and release the handbrake.
11. Adjust the toe-in (see section E).

B. Removing and refitting the hub, the spindle and the spindle arm

Removal

12. Immobilise the rear wheels with chocks and apply the handbrake.
13. Lift the front of the tractor with a jack positioned along the axle centreline and install stands.
14. Remove the relevant wheel.
15. Extract the cover **(17)**.
    Release and loosen the nut **(1)**, remove the lock washer **(26)** and remove the washer **(2)**.
16. Remove the bearing cone **(3)**.
17. Remove the wheel hub **(15)** from the spindle **(4)**.
18. Extract the sealing ring **/13** and remove the bearing cone **(14)**.
19. Extract the bearing cups **(5)** and **(16)** from the hub **(15)**.
20. Remove the dust cap (6).

Removing the spindle

21. Remove the nut **(19)** and the washer **(20)**. Extract the ball joint **(42)** from the steering arm **(10)**. Remove the steering arm and the Belleville washers **(21)**.
22. Withdraw the spindle **(4)** from the spindle arm **(12)**.
23. Separate the bearing cone **(23)** from the spindle.
24. Extract the sealing rings **/25** and **/22** from the spindle arm **(12)**.
25. Extract the bush **(11)** from the bearing cup **(24)** on the spindle arm **(12)**.

Removing the spindle arm

26. Remove the bolts **(28)** and nuts **(8)**.
27. Withdraw the spindle arm **(12)** from the axle beam **(9)** and remove the grease nipple **(7)**.

Front axle - 2WD front axle

Refitting the spindle arm

28. Clean and check the parts, and replace any that are faulty.
29. Fit the spindle arm **(12)** in the axle beam **(9)**, and secure it with bolts **(28)** and nuts **(8)** placed in the seats on the axle beam. Tighten to a torque of 400 to 600 Nm.

Refitting the spindle

30. Using a drift, fit the bush **(11)** fully home against the shoulder in the spindle arm **(12)**.
31. Fit the sealing ring **/22** fully home against the shoulder in the spindle arm, with the lip facing outwards.
32. Fit the dust cap **(6)** onto the spindle **(4)**.
33. Position the bearing cup **(24)** in the spindle arm.
34. Fit the sealing ring **/25** in the spindle arm, with the lip facing outwards.
35. Fit the bearing cone **(23)** on the spindle **(4)**, then insert the spindle into the spindle arm.
36. Position the Belleville washers **(21)**, the steering arm **(10)** and the washer **(20)**. Smear the nut **(19)** with Loctite 241 and tighten to a torque of 550 to 580 Nm.

Refitting the hub

37. Using a press or a suitable device, fit the bearing cups **(5)** and **(16)** fully home against the shoulder in the hub **(15)**.
38. Grease the bearing cone **(14)** (with MF1105 grease or equivalent) and place it in the bearing cup **(5)**.
39. Fit the sealing ring **/13** fully home into its seat against the shoulder, with the lip facing outwards (Fig. 1).
40. Fill the cavity in the hub **(15)** with MF1105 grease or equivalent.
41. Install the wheel hub on the spindle **(4)**.
42. Grease the bearing cone **(3)** (with MF1105 grease or equivalent) and place it on the spindle in contact with the bearing cup **(16)**.
43. Position the washer **(2)**, the lock washer **(26)** and the nut **(1)**. Tighten the nut to a torque of 81 Nm and then loosen it by 1/12th to 1/16th of a turn to obtain a play of between 0 and 0.13.
44. Fold down the tab of the lock washer **(26)** on the nut **(1)**.
45. Check that the hub turns smoothly.
46. Fill the cavity in the hub **(15)** (on the nut side) with MF1105 grease or equivalent.

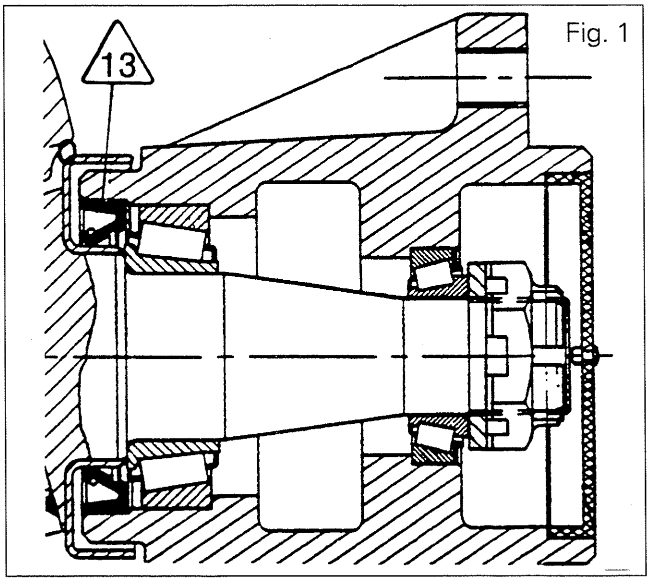


Fig. 1

47. Close the hub with the cover **(17)**.
48. Install a rivet **(18)** in the hole in the cover. Fit the grease nipple **(7)**.
49. Refit the wheel, remove the stands and tighten the bolts to a torque of 140 to 200 Nm. Grease the spindle arms **(12)**.
50. Remove the chocks and release the handbrake.
51. Adjust the toe-in (see section E).

C. Removing and refitting the steering ram

Removal

52. Immobilise the rear wheels with chocks and apply the handbrake. Lift the front of the tractor with a jack positioned along the axle centreline.
53. Disconnect and block the ram supply hoses.
    Note: Mark the position of the hoses before removing them.
54. Loosen the nuts **(37)**, turn the sleeves **(38)** to separate the ball joints **(42)** from the steering rods **(35)**.
55. Remove the split pin **(43)** and the nut **(44)**. Extract the ball joint **(45)** from the support **(46)**.
56. Remove the steering ram assembly.
57. Unscrew the ball joint **(45)** if necessary.
58. Dismantle the nuts **(32)**, washers **(31)** and bolts **(30)** and separate the sleeves **(33)** equipped with rods **(35)**.

Refitting

59. Clean and check the parts, and replace any that are faulty.
60. Assemble the sleeves **(33)** equipped with rods **(35)** on the ram. Fit the bolts **(30)** and washers **(31)** and tighten the nuts **(32).**
61. Screw the ball joint **(45)** onto the steering ram (if it was removed).
62. Refit the ram assembly on the support **(46)**.
63. Tighten the nut **(44)** on the ball joint to a torque of 100 to 120 Nm and fit the split pin **(43)**.
64. Couple the sleeves **(38)** with the rods **(35)** and ball joints **(42)**.
65. Connect up the ram supply hoses.
66. Withdraw the jack, remove the chocks and release the handbrake.
67. Check the toe-in (see section E).
68. Check the ram couplings for leaks.

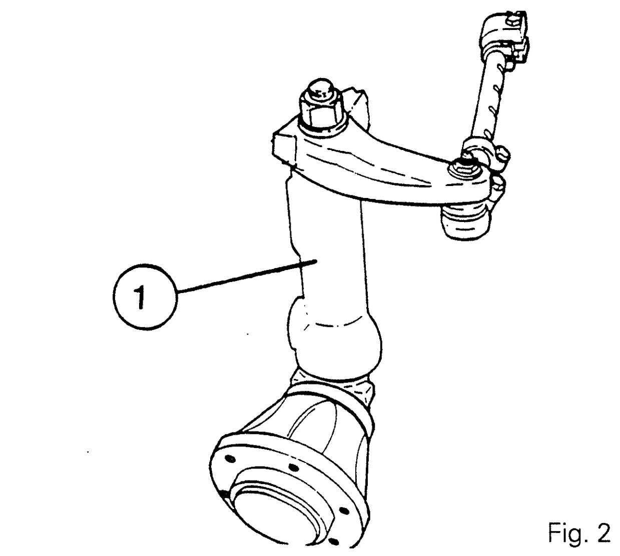


Fig. 2

D. Removing and refitting the front axle

Removal

69. Immobilise the rear wheels with chocks and apply the handbrake.
70. Lift the tractor with a jack placed along the axle centreline.
71. Position a stand under the crankcase.
72. Remove the front wheels.
73. Remove the bolts **(28)** and nuts **(8)**.
74. Remove the nuts **(32)**, washers **(31)** and bolts **(30)**.
75. Remove the assemblies **(1)** (Fig. 2).
76. Remove the split pin **(43)** and the nut **(44)**. Extract the ball joint **(45)** from the support **(46)**. Detach the ram **(29)** from the axle beam **(9)**.
77. Hoist the axle with slings (Fig. 3).

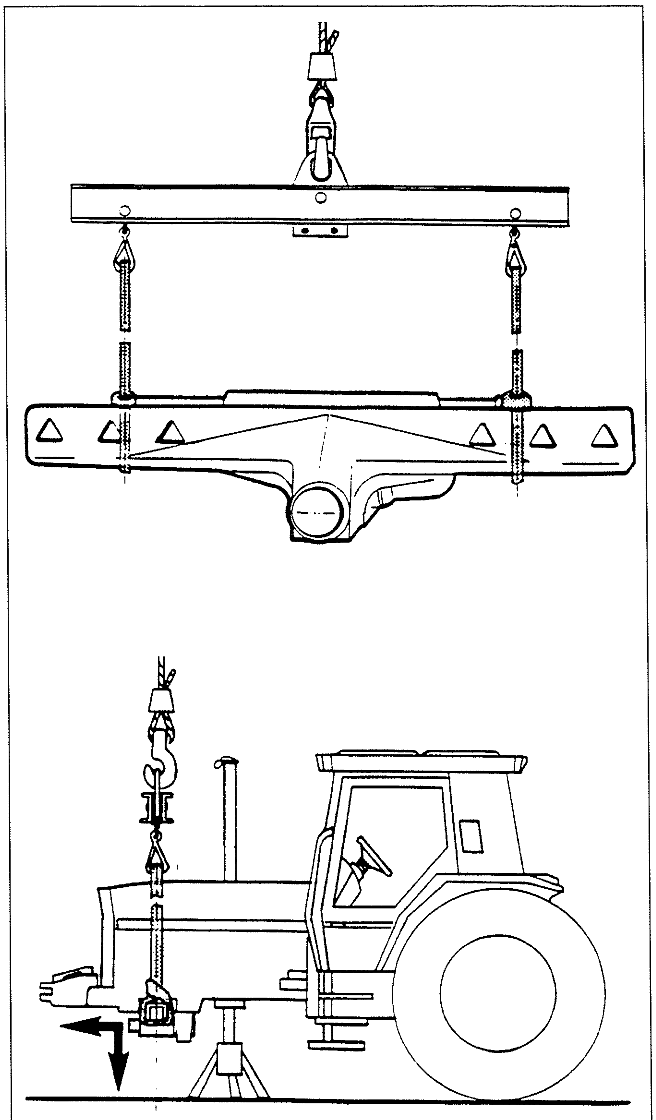


Fig. 3

Front axle - 2WD front axle

78. Remove the bolts **(1)** and the grease nipple **(3)**. Remove the front bearing **(2)** and the washer **/4** (Fig. 4).
79. Remove the front axle, disengaging it from its rear bearing **(5)** with the washer **/6** (Fig. 4).
80. Remove the locknut **(52)** and the nut **(51)** with its seal **(50)**. Remove the support **(46)**. The bush **(47)** the thrust washer **(48)** and the seal **(49)** are left on the support **(46)**.
81. If necessary, extract the bushes **(53)** from the axle.

Refitting

82. Clean and check the parts, and replace any that are faulty.
83. If necessary, fit the bushes **(53)** with a locally manufactured tool (see section G).
84. Position the bush **(47)**, the thrust washer **(48)** and the seal **(49)**, and refit the support **(46)**.
85. Tighten the nut **(51)** with its O-ring **(50)** on the support **(46)** and then loosen it in order to obtain an axial play of 0.05 to 0.25.
86. Using a pin wrench, tighten the locknut **(52)** to 120 to 150 Nm. Check that the support swivels freely.
87. Hoist the axle with slings and position the washer **/6** with the chamfer facing the axle side (as in Fig. 4). Fit the axle in the support **(5)**.
88. Position the washer **/4** (with the chamfer facing the axle side as in Fig. 4). Fit the front bearing **(2)** so as to obtain minimum play between the washers and the axle.
89. Smear the bolts **(1)** with Loctite 270. Tighten to a torque of 520 to 640 Nm. Remove the slings.
90. Fit the grease nipple **(3)** (Fig. 4).
91. Refit the ram assembly **(29)** on the support **(46)**. Tighten the nut **(44)** to a torque of 100 to 120 Nm and fit the split pin **(43)**.
92. Grease the bearings **(2)** and **(5)** (Fig. 4) and the ram support **(46)**.
93. Lubricate the rods **(35)** with molybdenum disulphide grease. Refit the assembly **(1)** (Fig. 2).
    Fit the nuts **(8)** and bolts **(28)**. Tighten to a torque of 400 to 600 Nm.
94. Fit the bolts **(30)**, washers **(31)** and nuts **(32)**. Tighten to a torque of 75 to 81 Nm.
95. Refit the front wheels and remove the stand from under the crankcase. Tighten the bolts to a torque of 140 to 200 Nm.
96. Remove the chocks and release the handbrake.
97. Check the toe-in (see section E).

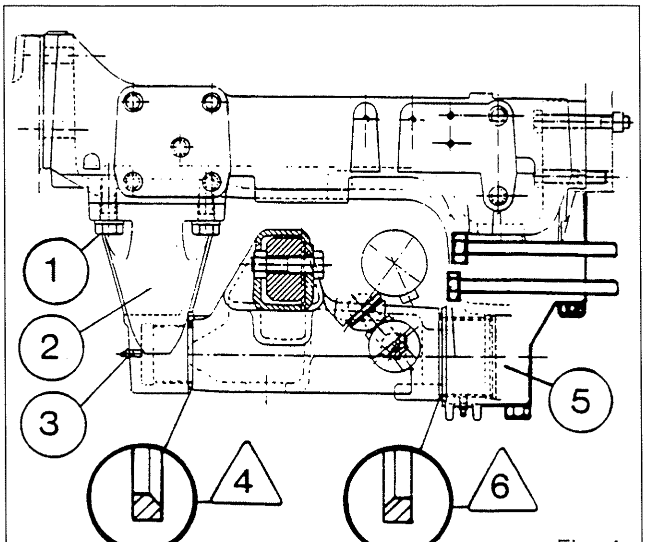


Fig. 4

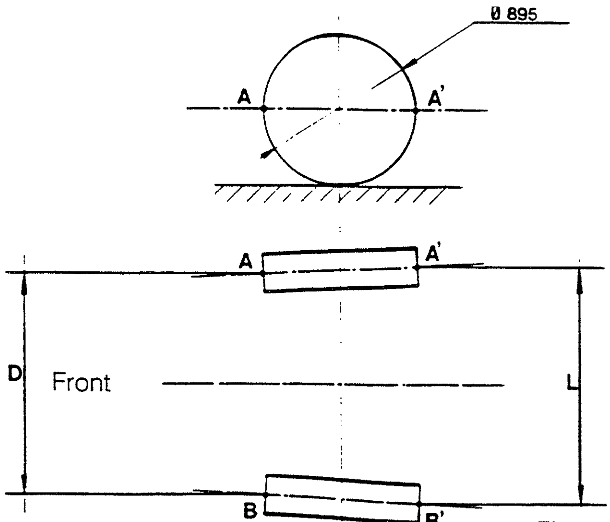


Fig. 5

E. Adjusting the wheel alignment

98. Set the steering to the central position. The sleeves **(38)** must be adjusted in order to obtain a toe-in of between 0 and 14 mm.
    This toe-in is measured from points A, A' and B, B' which are determined by a diameter of 895 mm drawn on the flanks of the tyres (Fig. 5).
    It is obtained from the difference between the two values L and D.
    Note: If the toe-in is measured on a diameter other than 895 mm, its value must be corrected accordingly. Once the adjustment has been made, tighten the nuts (37) to a torque of 45 to 55 Nm.

F. Adjusting the track

99. Lift the front of the tractor along the axle centreline.
100. Remove the bolts **(28)** and **(34)** and nuts **(8)** and **(32)** (Fig. 6).
101. Place the spindle arms in the required position.
102. Fit the bolts **(28)** and tighten them to a torque of 400 to 600 Nm.
103. Fit the rods **(35)** according to the position of the arms.
Fit the bolts **(34)**, washers **(31)** and nuts **(32)**. Tighten to a torque of 75 to 81 Nm.
Note: When the tractor is used with the widest track, the spacers (27) must be used when fitting the 3rd bolt (28) (Fig. 7).

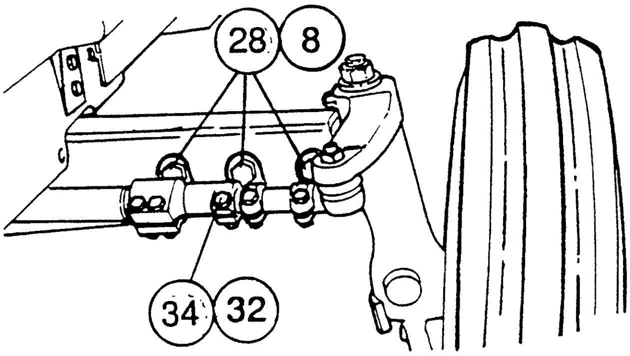


Fig. 6

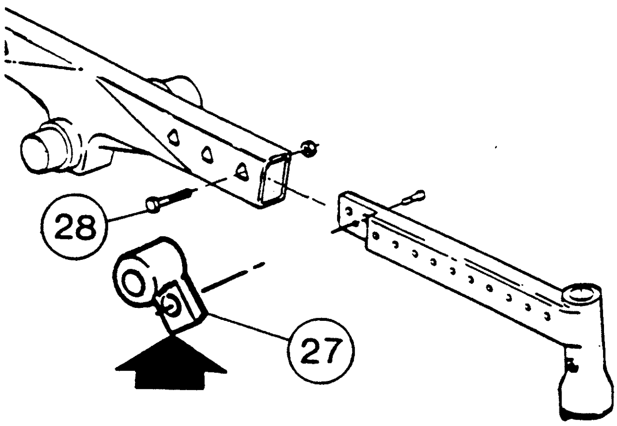
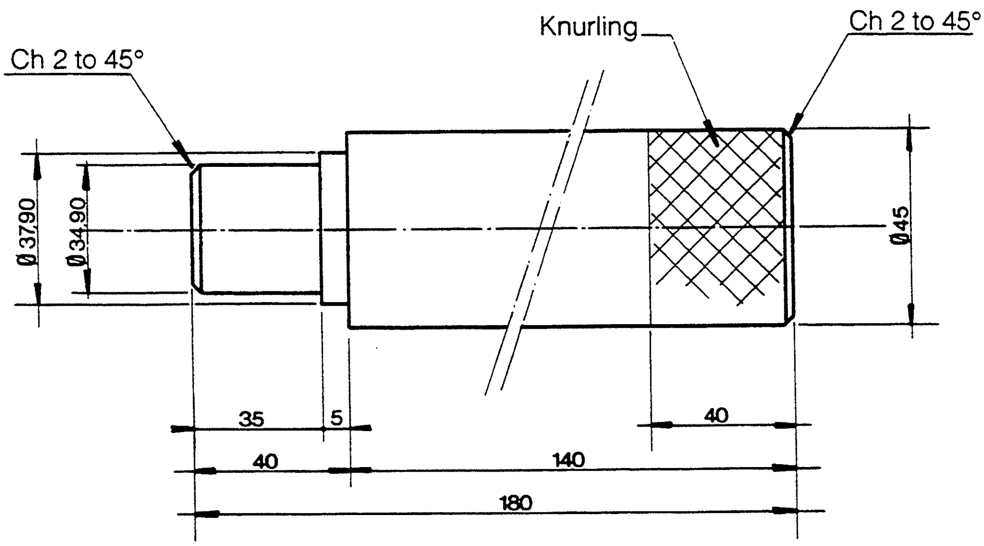


Fig.7

G. Service tool

Tool to be made locally



8 F01 Steering column

CONTENTS

Front axle - Steering column

General

The steering column assembly consists of the following two sections:
- the fixed lower section comprising a tube and an attaching base plate,
- the moving upper section comprising a tube and a welded yoke as well as a housing including the steering wheel height and tilt adjusting mechanisms.

Operation

Height adjustment

When the control rod **(4)** is moved to the high position, rod **T** causes the elbow lever **(8)** to swivel and lower arm **(15)** which is hinged on pin **(14)**.
Adjusting screw **[5]** attached to the arm bears on the lock plate **(16)** which is released, allowing the upper section of the steering column to move.
The spring **(3)** returns the control lever **(4)** to its initial position.
The stop **(25)** limits the movement of both sections.

Tilt adjustment

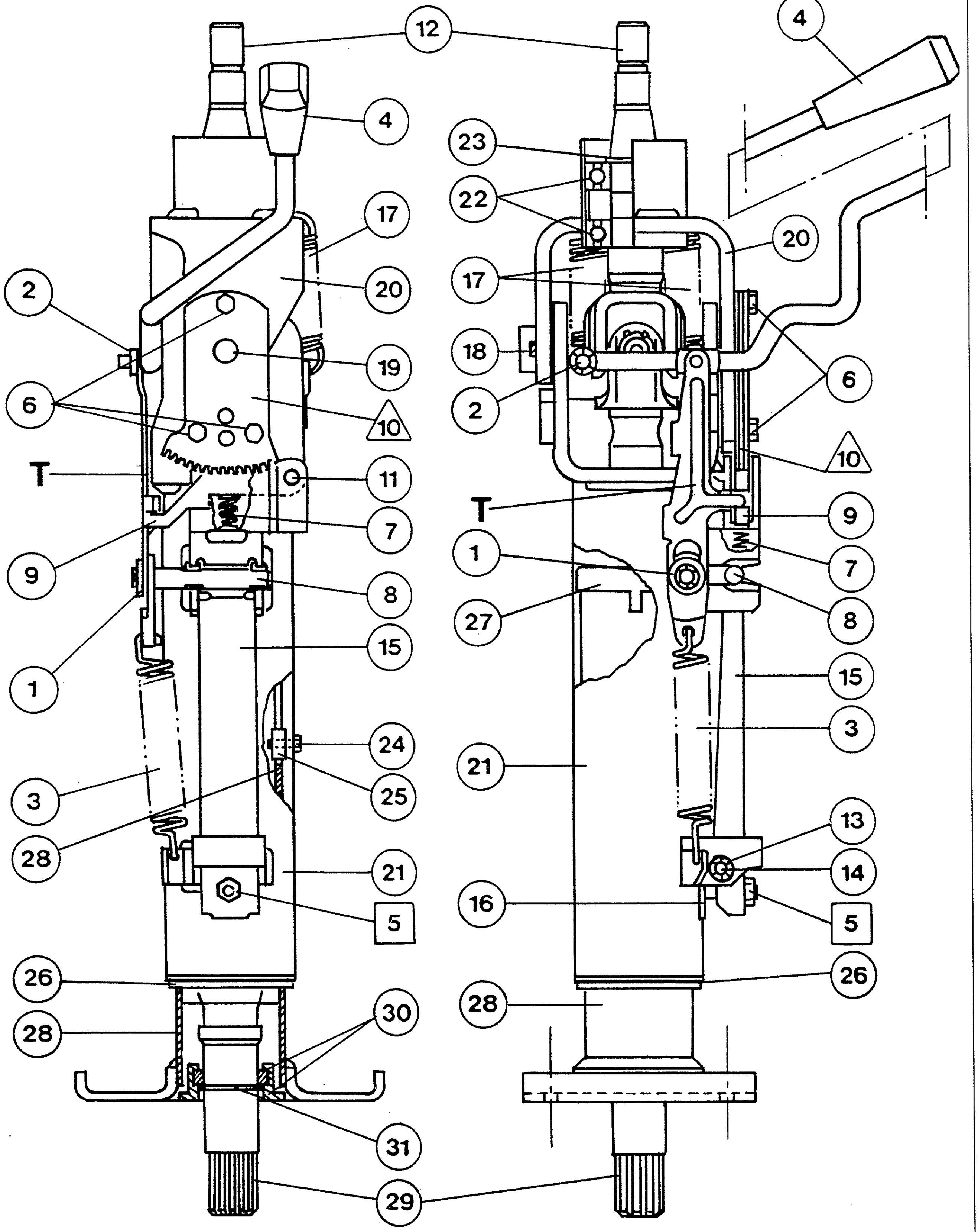
When the control lever **(4)** is moved to the low position, it presses on rod **T** which pushes on the end of the notched lever **(9)** and frees it from the rack **/10** allowing it to tilt the housing **(20)**. The two return springs **(17)** allow the positioning of the steering wheel.
Adjusting screw **[5]** allows the meshing of the teeth on the rack **/10** and notched lever **(9)** to be adjusted.

List of parts

(1) Retaining washer
(2) Retaining washer
(3) Spring
(4) Control lever assembly
[5] Adjusting screw
(6) Bolt
(7) Spring
(8) Elbow lever
(9) Notched lever
/10 Rack
(11) Pin
(12) Upper shaft
(13) Retaining washer
(14) Pin
(15) Arm
(16) Lock plate
(17) Springs
(18) Pin
(19) Pin
(20) Housing
(21) Moving column
(22) Bearings
(23) Circlip
(24) Bolt
(25) Stop
(26) Bush
(27) Bush
(28) Fixed column
(29) Lower shaft
(30) Bushes
(31) Circlip

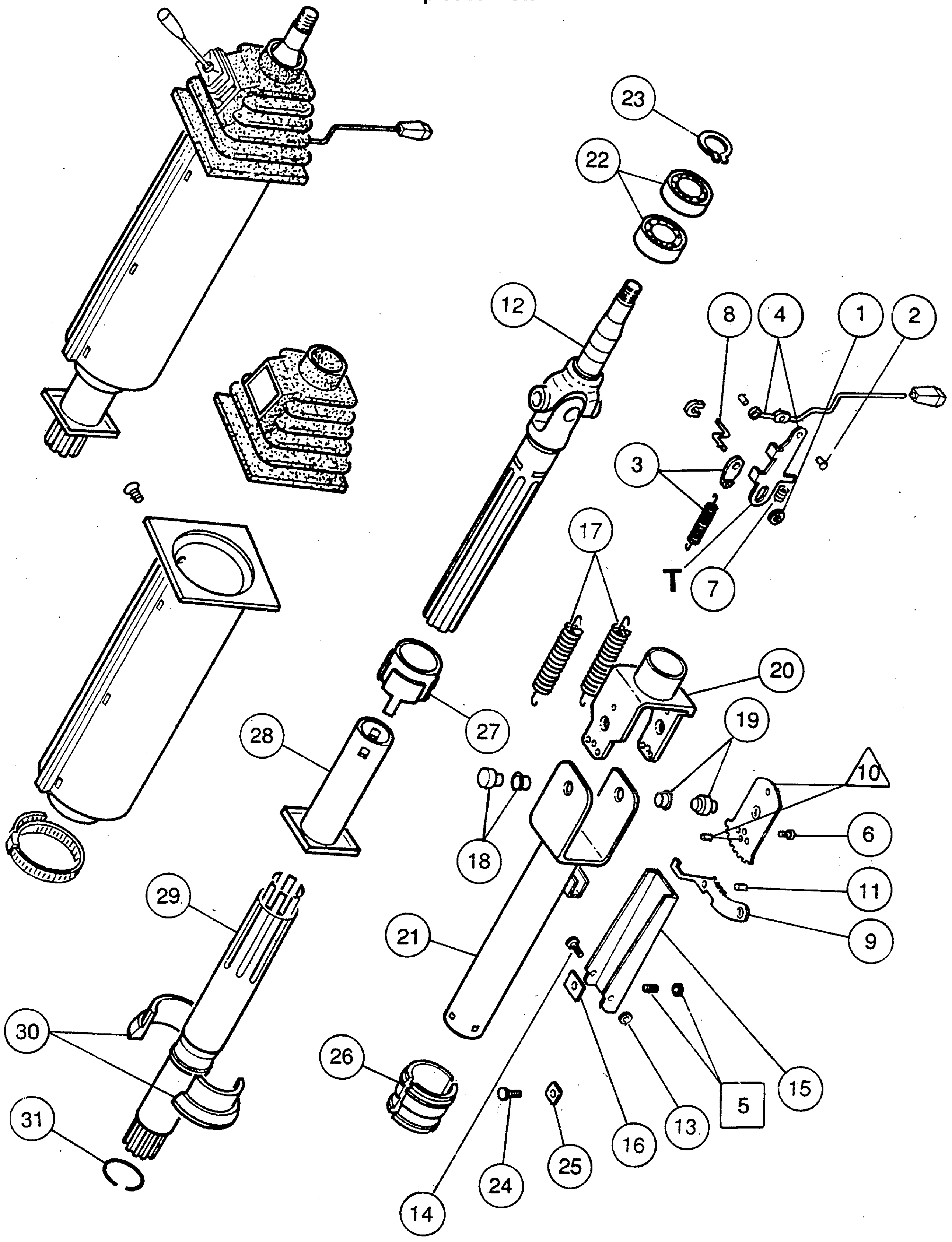
Front axle - *Steering column*

Overall view



Front axle - *Steering column*

Exploded view



A. Removing and refitting the steering column

Removal

1. Using the lever on the right-hand side under the steering wheel, pull the steering column as far towards the driver as possible.
2. Remove the steering wheel and the dashboard covering.
3. Disconnect the Dynashift control switch **(1)** located under the dashboard (Fig. 1).
4. Take out the bolts **(2)** attaching the base of the column onto the cab support (Fig. 1).
5. Remove the assembly by tilting it so that the base is withdrawn via the dashboard support.

Refitting

6. Check the operation of all the positions of the steering column.
7. Lightly coat the splines in shaft **(29)** with Loctite «Anti-Seize» grease or equivalent.
8. Carry out procedures 2 to 5 in reverse order.
   Note: Tighten the steering wheel nut to a torque of 57 - 78 Nm.
9. Check the operation of the electrical equipment and the A, B, C, D Dynashift speeds.

B . Disassembling and reassembling the control lever assembly

Disassembly

10. Remove the steering column. Carry out procedures 1 to 5.
11. Remove the housing in two halves around the steering column. Remove the Dynashift control.
12. Remove and discard the retaining washers **(1)** and **(2)**. Remove the spring **(3)**, lever **(4)** with the dust cover and lever **(8)**.

Reassembly

13. Refit the levers **(4)** and **(8)** and the spring **(3)**. Replace the retaining washers **(1)** and **(2)**.
14. Adjust the lever **(4)**, rod **T** in contact with the notched lever **(9)** using the adjusting screw **[5]** (3 mm Allen wrench).
15. Carry out procedure 11 in reverse and carry out procedures 6 to 9.

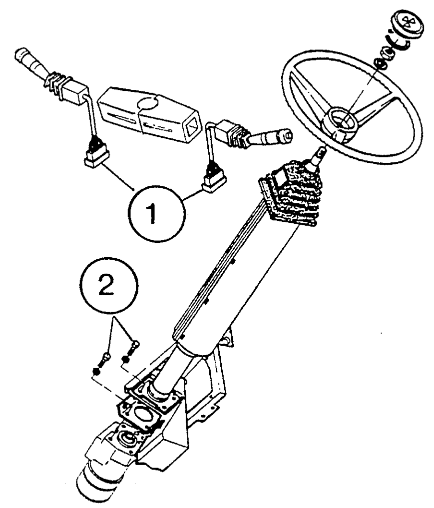


Fig. 1

C . Removing and refitting the notched lever and rack

Removal

16. Remove the steering column. Carry out procedures 1 to 5.
17. Remove the housing in two halves around the steering column. Remove the Dynashift control.
18. Remove and discard the retaining washers **(1)** and **(2)**. Remove the spring **(3)**, lever **(4)** with the dust cover.
19. Compress spring **(7)** by pressing on the notched lever **(9)**. Take out the bolts **(6)**. Remove the rack **/10**.
20. Drive out pin **(11)**. Remove the notched lever **(9)** and spring **(7)**.

Front axle - *Steering column*

Refitting

21. Carry out procedure 20 in reverse.
22. Compress spring **(7)**. Position the rack **/10** as per Fig. 2 to avoid any interference with lever **(4)**. Fit and tighten bolts **(6)** after coating them with Loctite 241.
23. Refit the lever **(4)**, rod **T** and spring **(3)**. Replace the retaining washers **(1)** and **(2)**.
24. Adjust the lever **(4)**, with rod **T** in contact with the notched lever **(9)**, using the adjusting screw **[5]** (3 mm Allen wrench).
25. Carry out procedure 17 in reverse and carry out procedures 6 to 9.

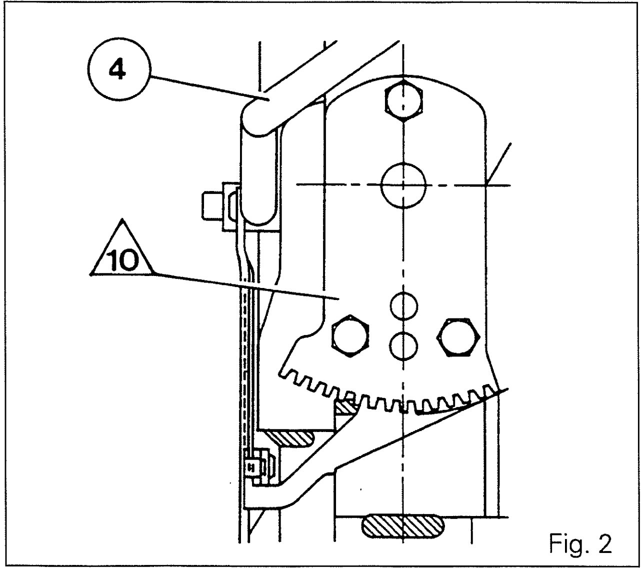


Fig. 2

D. Disassembling and reassembling the locking assembly

Disassembly

26. Remove the steering column. Carry out procedures 1 to 5.
27. Remove the housing in two halves around the steering column.
28. Remove the adjusting screw **[5]** (3 mm Allen wrench). Remove and discard the retaining washer **(13)**. Drive out the pin **(14)**.
29. Remove the arm **(15)** and lock plate **(16)**.

Reassembly

30. Carry out procedure 29 in reverse.
31. Fit the pin **(14)**. Replace the retaining washer **(13)**.
32. Fit and set the adjusting screw **[5]** and lever **(4)** with rod **T** in contact with the notched lever **(9)**.
33. Carry out procedure 27 in reverse and carry out procedures 6 to 9.

E. Replacing the shafts and bearings

Disassembly

34. Remove the steering column. Carry out procedures 1 to 5.
35. Remove the housing in two halves around the steering column. Remove the Dynashift control.
36. Slide the dust cover over the control lever **(4)**.
37. Compress spring **(7)** by pressing on the notched lever **(9)**. Remove the bolts **(6)**. Remove the rack **/10**.
38. Remove the springs **(17)**.
39. Uncrimp pin **(18)**. Drive out pins **(18)** and **(19)**.
40. Separate the housing **(20)** from the moving column **(21)**.
41. Remove the circlip **(23)**. Separate the upper shaft **(12)** from the housing **(20)**.
42. Drive out the lower shaft **(29)** from the moving column **(21)**.
43. Extract the bearings **(22)** from the housing **(20)**.

Reassembly

44. Fit the bearings **(22)** in the housing **(20)** using a suitable fixture.
45. Assemble the upper shaft **(12)** on the bearings **(22)**. Fit the circlip **(23)**.
46. Assemble the lower shaft **(29)** equipped with bushes **(30)** and circlip **(31)** on the fixed column **(28)**.
    Note: Deform the column tube by striking it with a punch so as to lock the bushes (30) in position.
47. Reassemble the housing **(20)** and mobile column **(21)** assemblies. Fit pins **(18)** and **(19)**. Crimp pin **(18)**.
48. Refit the springs **(17)**.
49. Compress spring **(7)**. Position the rack **/10** as per Fig. 2 to avoid any interference with lever **(4)**. Fit and tighten the bolts **(6)** after coating them with Loctite 241.
50. Adjust the lever **(4)**, rod **T** in contact with the notched lever **(9)** using the adjusting screw **[5]** (3 mm Allen wrench).
51. Carry out procedure 35 in reverse and carry out procedures 6 to 9.

F. Replacing the guide bushes (26) (27) (30)

Disassembly

52. Remove the steering column. Carry out procedures 1 to 5.
53. Remove the housing in two halves around the steering column.
54. Loosen the adjusting screw **[5]** (3 mm Allen wrench). Remove the lock plate **(16)**.
55. Remove the bolt **(24)** from the stop **(25)**.
56. Extract the bush **(26)**.
57. Separate the moving column **(21)** from the fixed column **(28)**.
58. Extract the bush **(27)**.

Reassembly

59. Position bush **(27)**.
60. Place the stop **(25)** in the groove on the fixed column **(28)**.
61. Assemble the mobile column **(21)** with the fixed column **(28)**.
62. Fit the bolt **(24)** without tightening it so that bush **(26)** can be installed. After installing the bush, tighten the bolt moderately. Check that the moving column **(21)** slides freely.
63. Refit the lock plate **(16)**. Adjust the lever **(4)**, rod **T** in contact with the notched lever **(9)** using the adjusting screw **[5]**.
64. Carry out procedure 53 in reverse and carry out procedures 6 to 9.

9 . HYDRAULICS

Contents

9 A01 Description of circuit

CONTENTS

A. General

The new hydraulic circuit for 8100 tractors is a closed centre with controlled flowrate and pressure. It is made up of two separate HP and LP circuits supplied by a variable displacement pump which is, itself, supplied by a booster pump.
Both pumps are driven by the external teeth on the PTO clutch.
The booster pump installed on the left-hand cover sucks the oil, through a strainer, into the common reservoir formed by the centre housing and the gearbox. The booster flow is then conveyed to the right-hand cover and passes through the main filter before flowing to the variable displacement pump, and to the cooling and gearbox lubricating circuit. The booster pressure is maintained by a valve mounted on the right-hand cover and calibrated at 5 bars.

The variable displacement pump provides supply to either one or two override units installed on the left-hand cover, as applicable:
- one unit for tractors without trailer braking,
- two units for tractors with trailer braking.

The first override unit ensures supply to:
- the steering system (or the steering system and trailer braking) as first priority,
- the 17-bar circuit as second priority.

The second override unit, if fitted, shares its first priority between the steering system and the trailer brake circuit. When supply has been provided for these priority functions, the remaining flow is available for the auxiliary spool valves and the lift control valve.
It is impossible for the whole output from the variable displacement pump to be absorbed by the override units.
All the pilot signals from the various HP valves are sent to the override units and then transmitted to the variable displacement pump controller.

The controller responds to the pilot signal corresponding to the function requiring the highest pressure.

Characteristics of components

Suction strainer (16)
- Cartridge type
- Filtration threshold: 150 μ

Booster pump (14)
Trademark: Rexroth
Capacity: 60 cm^3 per revolution
Output: 160 litres/mn at 2,200 rpm

Main filter (34)
- Filtration threshold: 15 μ
- With bypass
- With differential pressure switch

Safety valve (40)
- Calibration: 5 bars
- Directly connected to housing

5-bar switch (K)
- Opening at 3 bars - Closing at 2 bars
- Fitted in parallel with the filter
- Connected to the indicator light on the dashboard

Variable displacement pump (12)
- Trademark: Brueninghaus
- Type: Axial pistons (9)
- Capacity: variable from 0 to 45 cm^3 per revolution
- Output: 0 to 110 litres/mn at 2,200 rpm
- Pressure: 22 bars min.
  200 bars max.
- Lubrication: internal, with return to housing

B. Principle

The principle of the closed centre hydraulic system is to limit the power absorbed by the engine. If no hydraulic slave device is actuated, no output is discharged from the variable displacement pump. When one function is engaged, the pump supplies only the output required for that function.

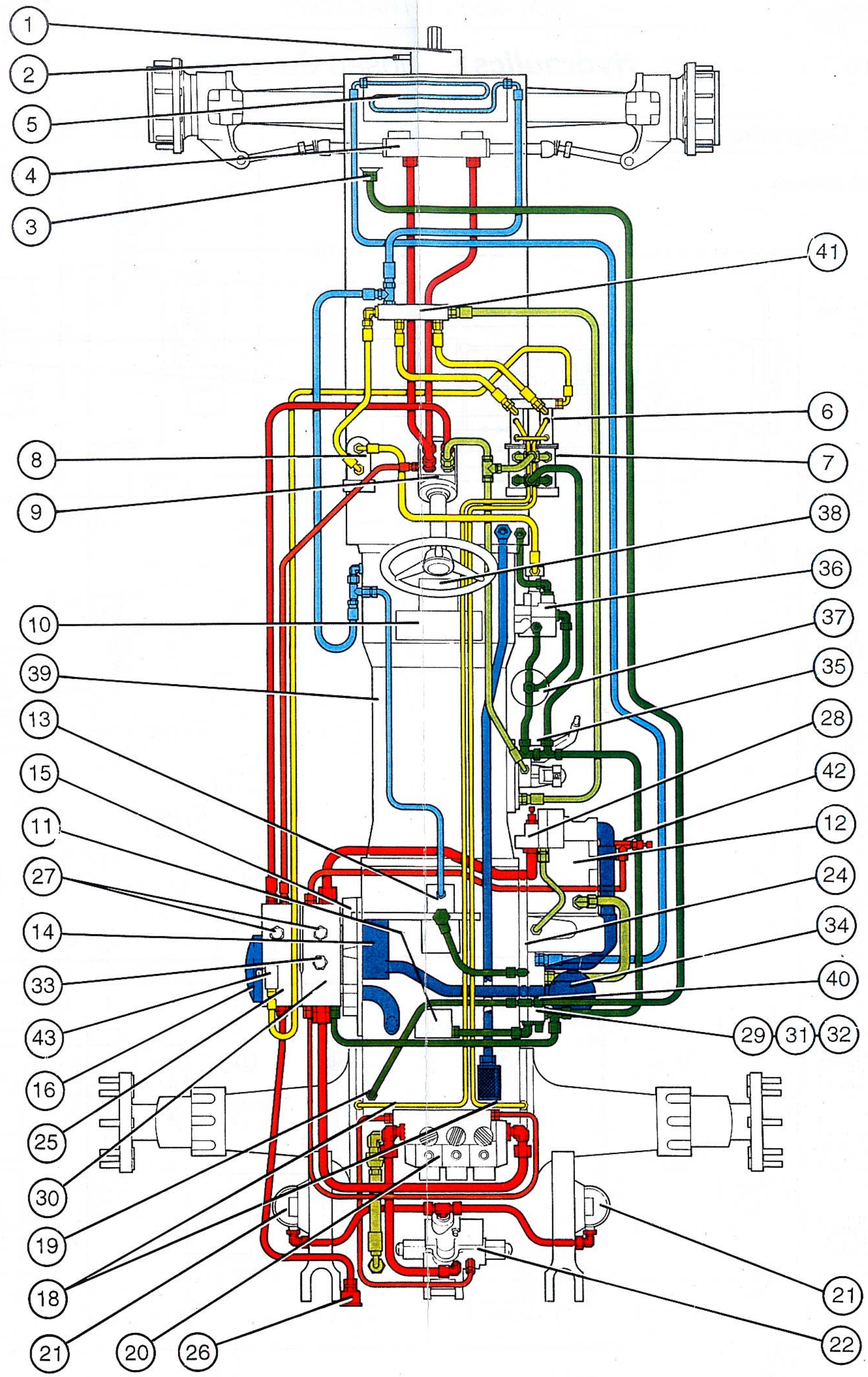
Note: When the housing is drained, the high-pressure filter is replaced or any servicing operation resulting in the intake of air is performed on the circuit, the hydraulic circuit must be primed.
Disconnect the electrical stop device on the injection pump and turn the engine with the starter motor until the 5-bar pressure indicator light goes out on the dashboard.

C. Layout of parts

List of parts

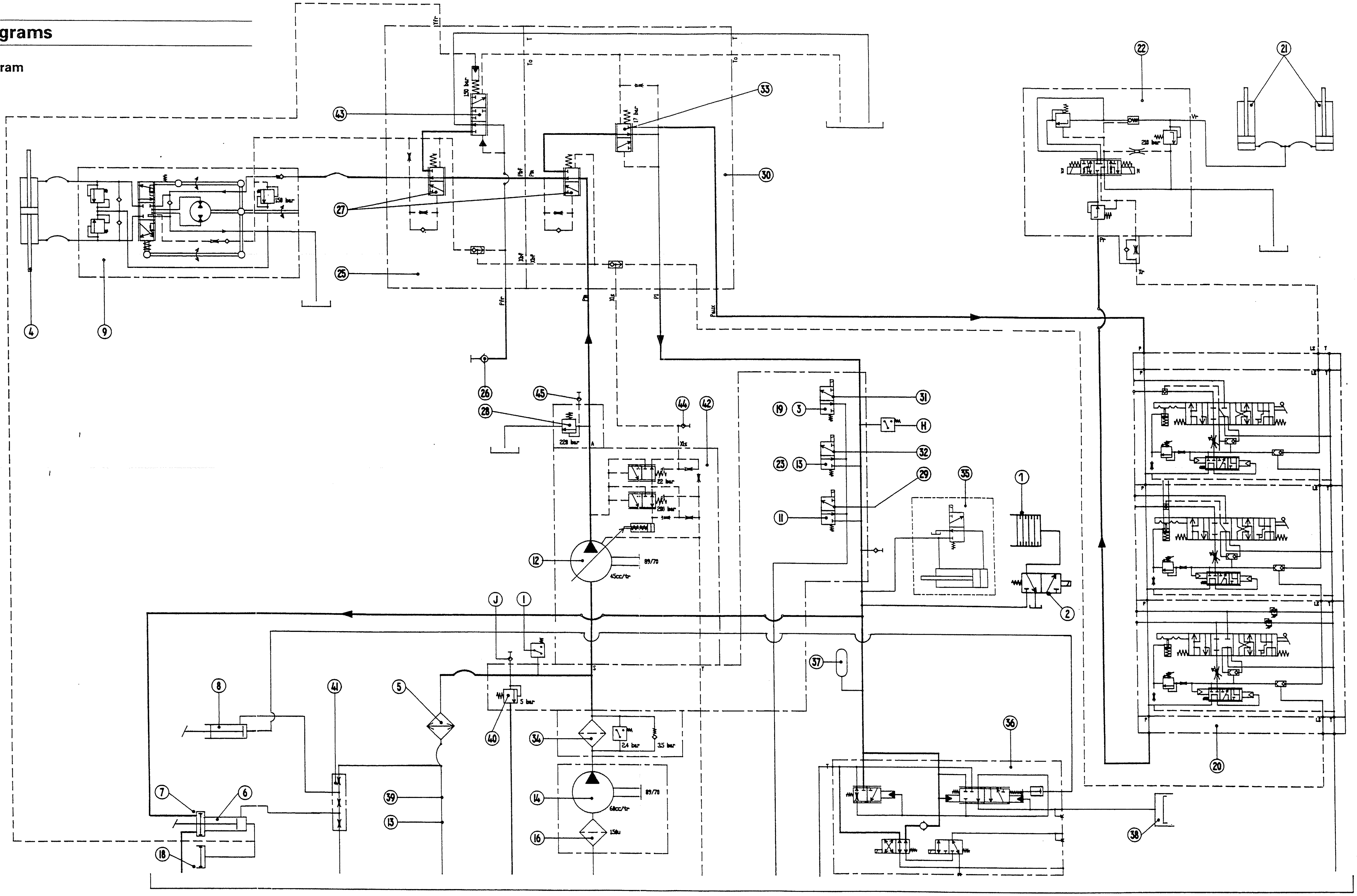
(1) Front PTO (if fitted)
(2) Front PTO solenoid valve (if fitted)
(3) Front differential lock
(4) Steering ram
(5) Oil cooler
(6) Brake master cylinders
(7) Servo brake
(8) Clutch master cylinder
(9) Hydrostatic steering unit (Orbitrol)
(10) Dynashift unit
(11) 4WD clutch
(12) Variable displacement pump
(13) PTO clutch
(14) Booster pump
(15) Left-hand cover
(16) Suction strainer, 150 micrometres
(18) Right-hand and left-hand brakes
(19) Rear differential lock
(20) Auxiliary spool valves
(21) Lift rams
(22) Lift valve
(23) PTO brake
(24) Right-hand hydraulic cover
(25) Trailer brake unit
(26) Trailer brake connector
(27) Steering override valve
(28) Pressure relief valve
(29) 4WD solenoid valve
(30) Override unit
(31) Differential lock solenoid valve
(32) PTO solenoid valve
(33) Pressure control valve, 17 bar
(34) Main filter, 15 micrometres
(35) Hare/Tortoise solenoid valve
(36) Engine clutch and Dynashift control valve
(37) Accumulator
(38) Engine clutch
(39) Gearbox
(40) Safety valve, 5 bar
(41) Manifold
(42) Pump controller
(43) Trailer brake valve
(44) XLS diagnostic connector

High pressure
Low pressure
Lubrication
Suction
Return
Brake - Clutch
Pilot flow

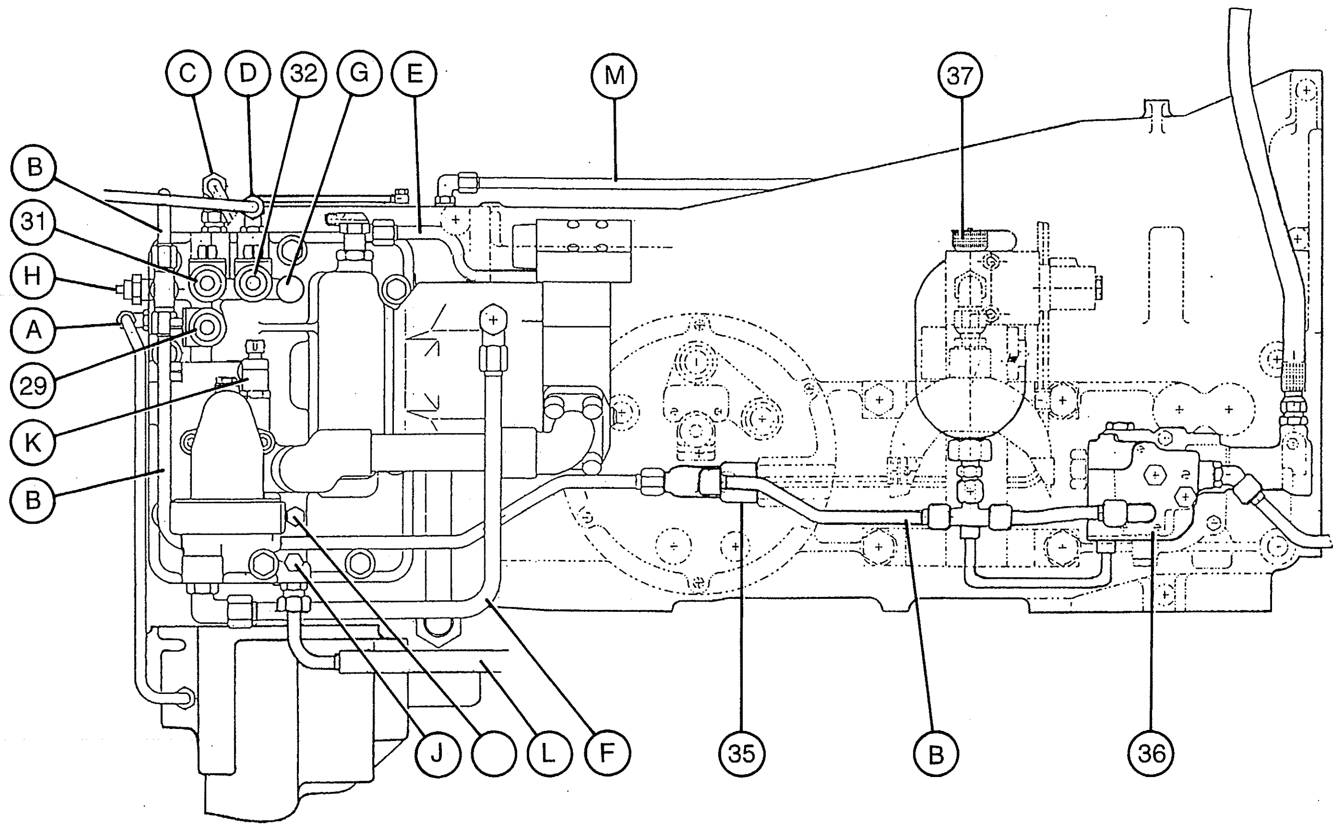


D. Diagrams

ISO diagram



Low-pressure circuit



List of parts

(29) 4WD solenoid valve
(31) Differential lock solenoid valve
(32) PTO solenoid valve
(35) Hare/Tortoise solenoid valve
(36) Engine clutch and Dynashift control valve
(37) Accumulator

(A) 4WD pipe
(B) 17-bar pipe
(C) Differential lock pipe
(D) PTO clutch and brake pipe
(E) Pressure relief valve return pipe
(F) Pump lubrication return pipe
(G) LP diagnostic pipe
(H) LP switch

(I) Lubrication switch
(J) Lubrication diagnostic connector
(K) Clogging indicator
(L) Lubrication hose to cooler
(M) PTO clutch lubrication pipe

9 B01 Trailer braking

CONTENTS

Hydraulics - Closed centre

General

The distribution block unit which includes two spools installed on the left-hand cover receives flow from the variable displacement pump. It ensures that priority flows are provided to the steering circuit via the trailer brake unit (if fitted) and the low-pressure circuit (17 bar). The oil is then conveyed to the auxiliary spool valves and to the lift control valve.

Tightening torque (Fig. 1)

Bolts **(6)**: 25 to 35 Nm, Loctite 542.

Special points

- Check for leaks from seals and hydraulic unions.
- Carry out hydraulic tests (see Section 9J01) and check that the controls operate correctly.
- Carry out a road test.

A. Identification of ports

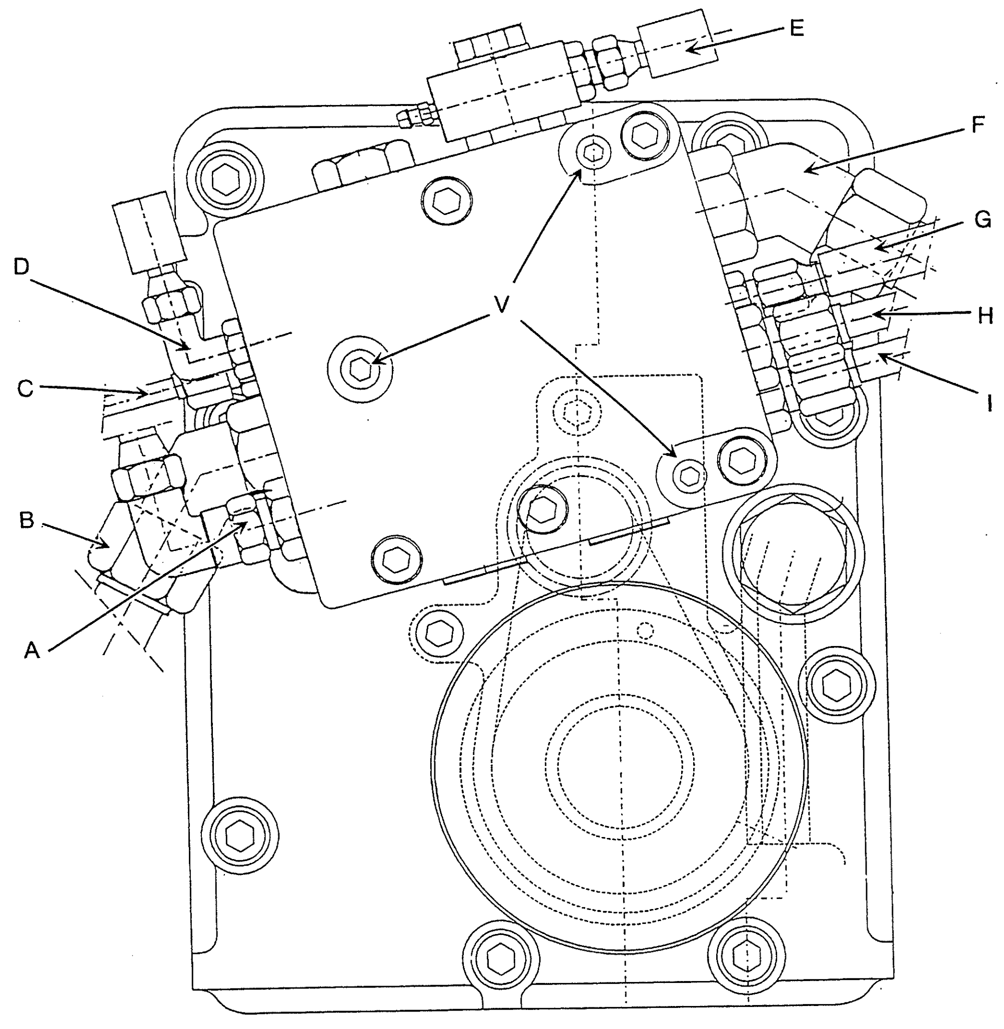
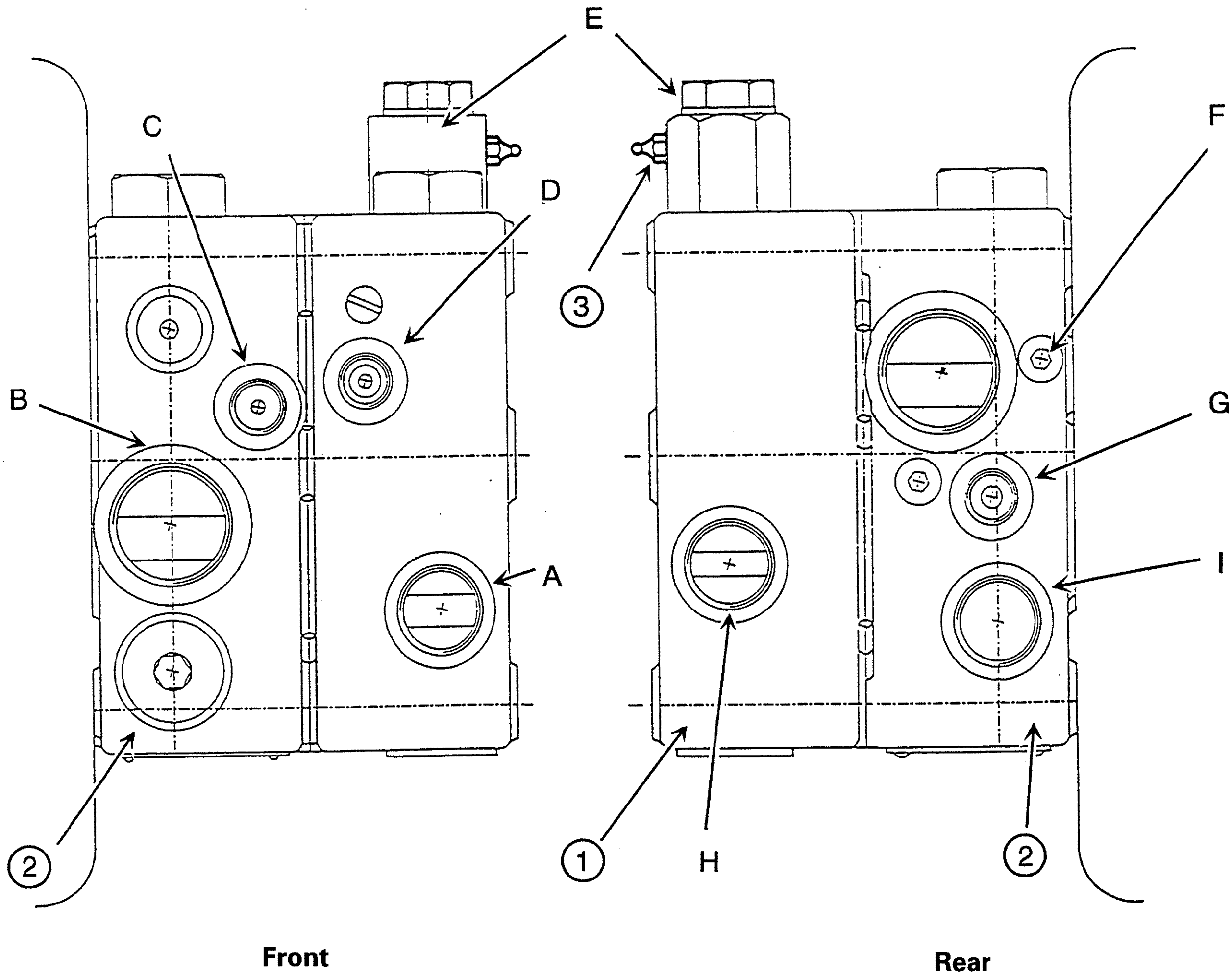


Fig. 1

A: Supply to Orbitrol
B: Supply from variable displacement pump
C: XLS piloting to regulator
D: XLS piloting from Orbitrol
E: Supply for auxiliary spool valves and lift control valve
F: XLS piloting from auxiliary spool valves and lift control valve
G: 17-bar outlet to right-hand cover

Tubes and hoses identification



(1) Trailer steering and braking priority block
(2) 17 bar, auxiliary and lifting priority block
(3) Bleed screw

Fig. 2

B. Spools Operation

Steering priority spool (4) (Fig. 3)

Spool moves downwards under spring **(5)** pressure.
Flow coming from **B** gallery is transferred in priority to Orbitrol spool valve through **A** gallery.
When steering is in neutral position, no oil flows in this gallery. Pressure rise forces spool to move upwards while compressing spring **(5)** so that flow can be diverted to **J** gallery.
During operation, pilot pressure coming from Orbitrol enters **D** gallery and pushes back spool downwards so that the flow needed for steering may pass through **A** gallery.
Remaining flow is directed to **J** gallery.

Trailer braking spool (6) (Fig. 3)

When brake is not applied to trailer, there is no pressure inside **K** gallery and the spool allows communication between **L** and **R** galleries.
As soon as brake is applied on tractor, pressure inside **K** gallery moves pin **(7)**, which in turn pushes spool downwards so that flow may pass between **J** and **L** galleries.
Pressure rise inside **L** gallery is transmitted to spool end **(6)** and compresses spring **(8)** to restore balance so that pressure may be maintained within **L** gallery according to **K** gallery pressure.
This constant pressure is obtained by allowing communication between **L** gallery and either **J** gallery or **R** port.
N.B.: As with priority (1) block, (Section 9B02), a 0.5 l flow passes from A gallery to D gallery (dynamic type steering) through a bore and a limiter inside the spool (4).

Tightening Torques (Fig. 1)

V Screw: 25-35 Nm, Loctite 542.

Specific operations

- Check seals and fittings watertightness
- Carry out hydraulic tests described in Section 9J01.

C. Bleeding the trailer brake

N.B.: Main brake should always be bled before trailer brake.

1. Operate tractor engine at approximately 1200 tr/mn. Pinch return hose **(1)** using necessary security device (Fig. 4).
2. Connect hose to bleed screw **(1)** according to Fig. 5.
3. Loosen bleed screw and slowly press coupled brake pedals. Repeat operation several times.
4. Shut bleed screw and release return hose.
5. Check trailer braking pressure (Section 9J01).
6. Road test.

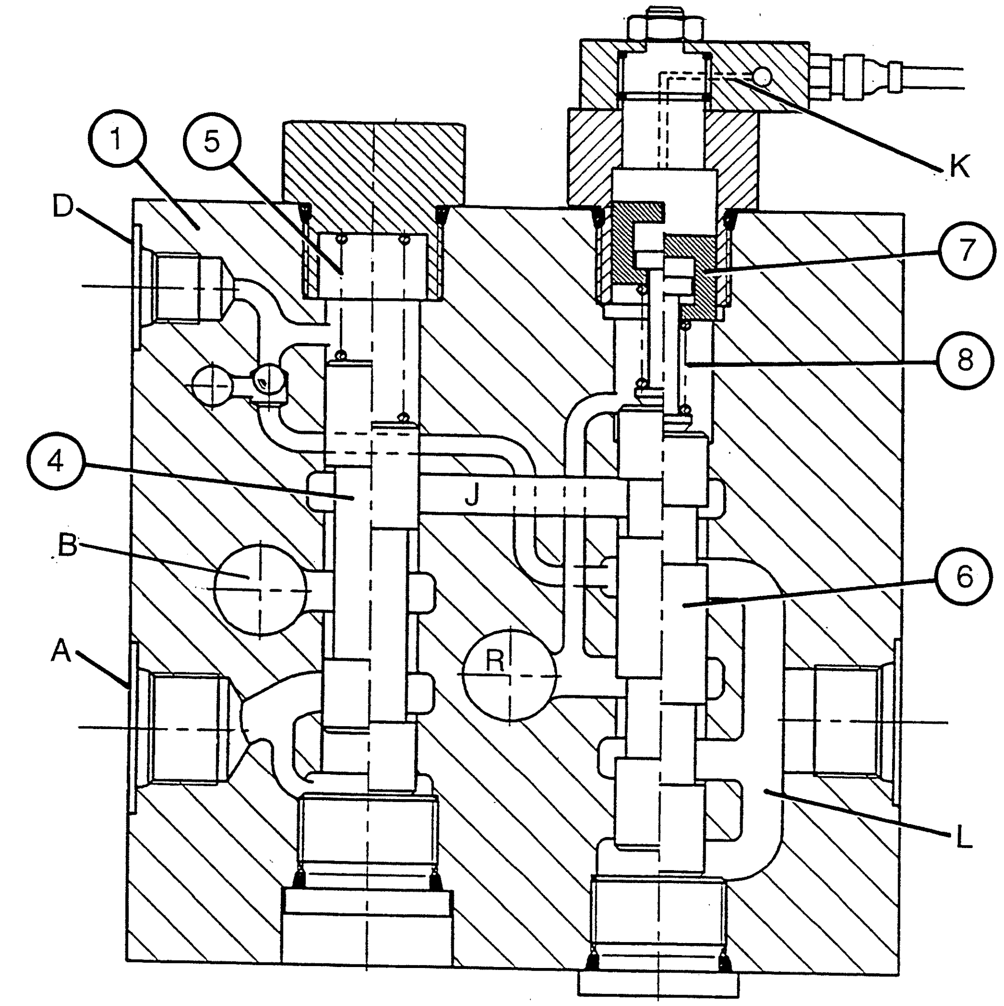


Fig. 3

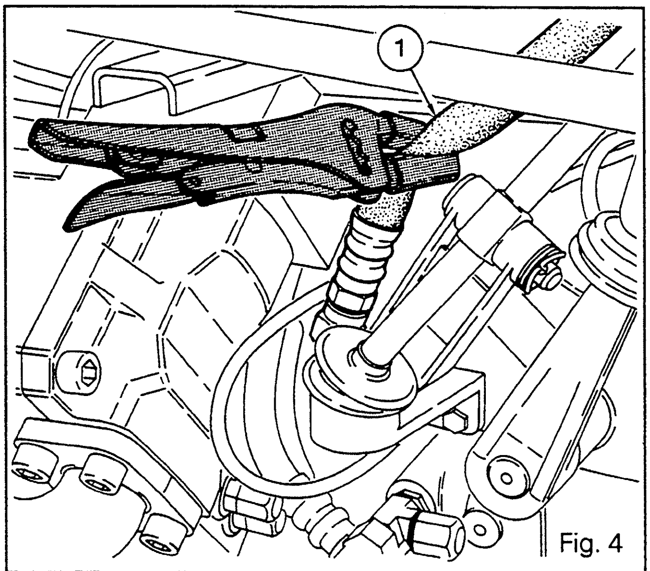


Fig. 4

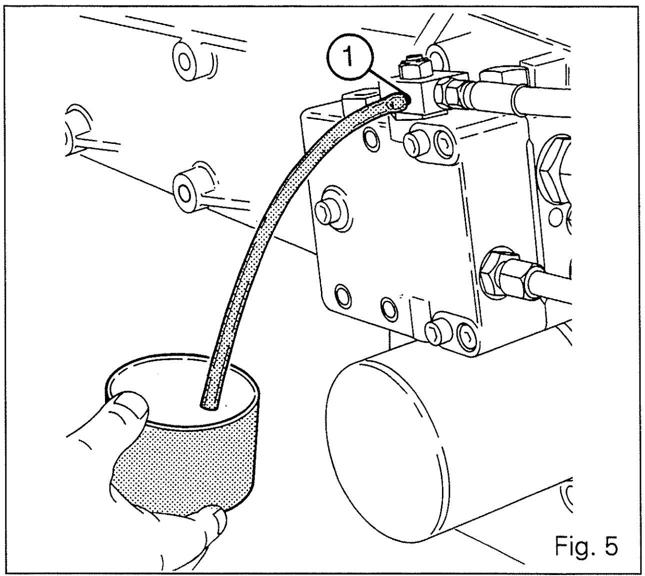


Fig. 5

9 B02 Distribution block

CONTENTS

General

The override unit which includes two spools installed on the left-hand cover receives flow from the variable displacement pump. It ensures that priority flows are provided to the steering circuit via the trailer brake unit (if fitted) and the low-pressure circuit (17 bars). The oil is then conveyed to the auxiliary spool valves and to the lift control valve.

Tightening torque (Fig. 1)

Bolts **(6)**: 25 to 35 Nm, Loctite 542.

Special points

- Check for leaks from seals and hydraulic unions.
- Carry out hydraulic tests (see Section 9J01) and check that the controls operate correctly.
- Carry out a road test.

A. Identification of ports

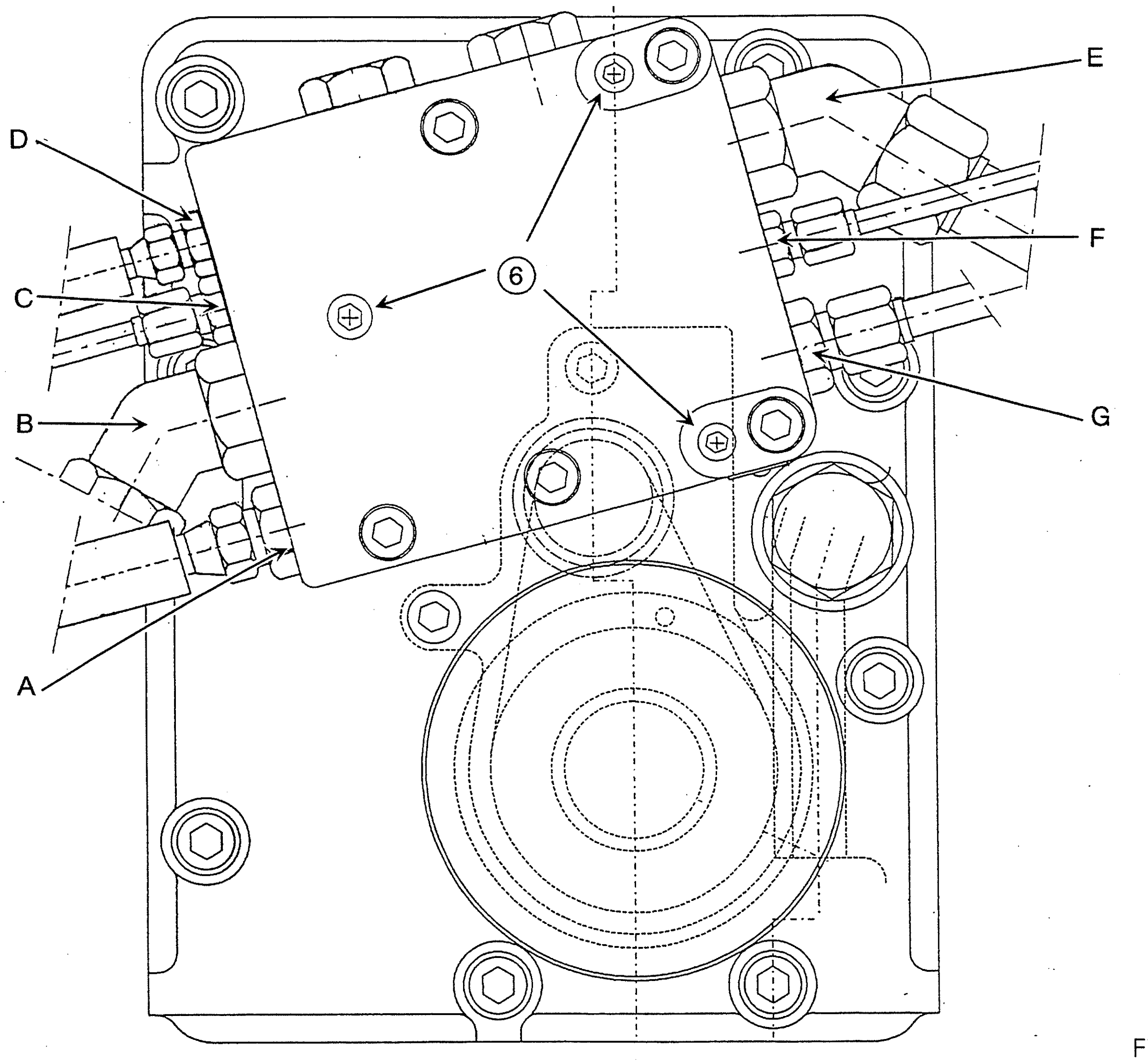


Fig. 1

A: Supply to Orbitrol
B: Supply from variable displacement pump
C: XLS piloting to regulator
D: XLS piloting from Orbitrol

E: Supply for auxiliary spool valves and lift control valve
F: XLS piloting from auxiliary spool valves and lift control valve
G: 17-bar outlet to right-hand cover

B. Operation

1st priority: Steering (or 2nd unit if equipped with trailer braking)

Spool **(2)** moves downwards to the action of spring **(3)**. The flow sent along channel **B** from the variable displacement pump is conveyed, as priority, to the Orbitrol spool valve through channel **A**.

- **Steering in neutral**: The steering spool valve (Orbitrol) is in the closed position. Pressure from the pump lifts spool **(2)** and the flow is directed to channel **H**.
- **Steering actuated**: A pilot pressure from the Orbitrol spool valve arrives at port **D** and pushes spool **(2)** back downwards, allowing flow through to port **A** supplying the Orbitrol unit.

Note: A flowrate of approximately 0.5 l/mn passes from port A to port D via a hole and a restrictor in spool (2). This flow produces a pressure of approximately 6 bars at port D. The XLS line carries that pressure to the pump regulator, set at 22 bars, to obtain a standby pressure of 28 bars.

In the version equipped with trailer braking, ports **A** and **D** are closed with blanking plugs.

2nd priority: 17-bar pressure control valve

Spool **(4)** is moved downwards due to the action of spring **(5)** allowing flow from channel **H** to reach port **G** (17-bar low pressure). As soon as the pressure at this port reaches 17 bars, the spool is in equilibrium allowing low pressure to be maintained and permitting flow to port **E** (auxiliary and lift).

When the auxiliary spool valves and lift control valve are used, an XLS pilot pressure is sent to the unit via port **F** to join the XLS line at port **C**.

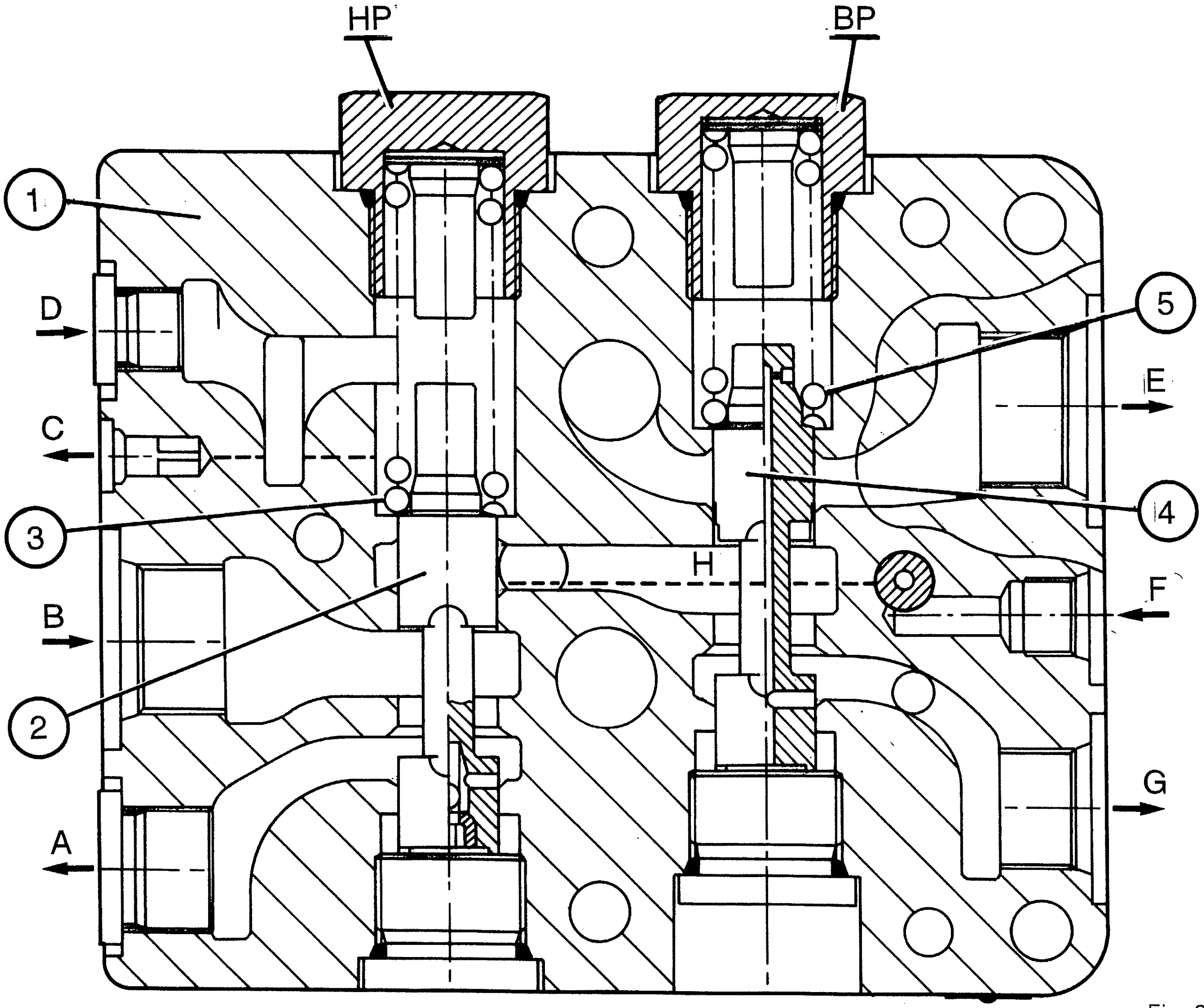


Fig. 2

9 C01 Auxiliary spool valves

CONTENTS

General

The auxiliary spool valves, of the Rexroth MP 18 type, are fitted on the high-pressure, high-flow circuit. They are supplied with oil from the override units.
If no function is engaged, the flow is directed to the spool valves. If oil is supplied to certain priority functions, the remaining flow is then available for the auxiliary spool valves.
Each spool valve is equipped with a flow control system actuated by a button located on a guard over the spool valves unit.
The main spool of the valve is actuated by a cable connected to a lever in the cab. The spool sends the oil to one or another of the outlet ports. Each outlet port is linked to the XLS pilot line of the variable displacement pump controller via override units.

Various types of spool valves

a - 3 positions - Return to neutral by spring action, zero leak
b - 4 positions - Automatic return to neutral (kickout)
c - 4 positions - Automatic return to neutral (kickout), zero leak
d - 4 positions - Special type for hydraulic motors

Three configurations of factory mounted assemblies:
GP030: a + b
GP032: a + b + c
FP034: d + c + c

Couplers

The oil flow can be locked by means of a lever system. When the lever is moved to the backward position, the circuit is open. When the lever is moved forwards, the circuit is closed. This position allows a circuit to be connected under pressure.

Operation (Fig. 1)

Compensated pressure flow control

This system comprises:
- flow control pipe **(6)**,
- compensating spool **(7)**,
- rod **(5)**,
- compensating spring **(10)**.

The purpose of this system is to establish a constant 4.5-bar (65 PSI) pressure drop in the flow control pipe as far as the outlet port in order to limit the flow from 9.5 l/mn to 114 l/mn.
The pressure provided by the variable displacement pump passes via chamber **D** and enters inside the pipe. This pressure then reaches the right-hand end of the spool via a central hole. The pressure in intake chamber **E** becomes 4.5 bars higher than the XLS pilot pressure acting on the spring. The compensating spool is therefore moved backwards and closes the intake, thus causing the pressure to drop in chamber **E** so that the spool moves upwards.

This regulation of the compensating spool ensures a constant pressure drop in the pressure control pipe and in the work port. This pressure drop allows the flow to remain constant whatever pressure is applied.
The maximum flow is limited by a notch **F** in the control pipe. This notch opens or closes the flow to the spool valve body when the rod **(5)** is turned. When the pipe is in the minimum position, a small opening surface is created and a greater percentage of the 4.5-bar pressure acts on the flow control pipe. The rest of the 4.5-bar pressure drop acts on the main spool. This has the effect of creating a 9.5 l/mn flow at the work port. When the rod **(5)** is turned in the other direction, the opening increases and produces a lower pressure in the flow control pipe and a higher pressure in the main spool, thus allowing an increase in flow at the work port.

Position B
The main spool **(2)** is pulled by 9.50 mm (0.375 in) and held in position by the trigger mechanism. It establishes communication between port **A** and the pilot chamber **G** with the tank. The main spool closes chamber **G** and connects pressure port **B** to the shuttle valve **(11)** in communication with the spring side of the compensating spool. The shuttle valve is also connected to a second shuttle valve **(13)** and to the trigger mechanism housing **(20)**. Shuttle valve **(13)** closes to transmit the XLS pilot pressure to the pump controller. The main spool establishes communication between the pressure chamber **H** and the outlet port **B**.

Position A
The main spool is pushed by 9.50 mm (0.375 in) and held in position by the trigger mechanism. It establishes communication between port **B** and the pilot chamber **J** with the tank. The main spool closes the return chamber from **A** and establishes communication between port **A** and the primary shuttle valve, connected to the spring side of the compensating spool. The primary shuttle valve is also connected to a secondary shuttle valve **(13)** and to the trigger mechanism housing **(20)**. The secondary shuttle valve, **(13)** closes to transmit the XLS pilot pressure to the pump controller. The main spool opens to allow flow between chamber **H** and port **A**.

Automatic return to neutral
The pilot pressure acts on the nonreturn valve **(25)** in the trigger mechanism housing. When the pressure is great enough, the nonreturn valve is raised and the pressure moves the piston **(26)** which relieves the trigger spring and allows the centring spring to return the spool to the neutral position. When the spool is in the neutral position, the piston's trigger pressure flows towards the tank via port **K** in the trigger mechanism housing. The spring then returns the piston to its original position. The return pressure can be adjusted by a screw **(27)**.
The more compressed the spring is, the greater the return pressure will be.

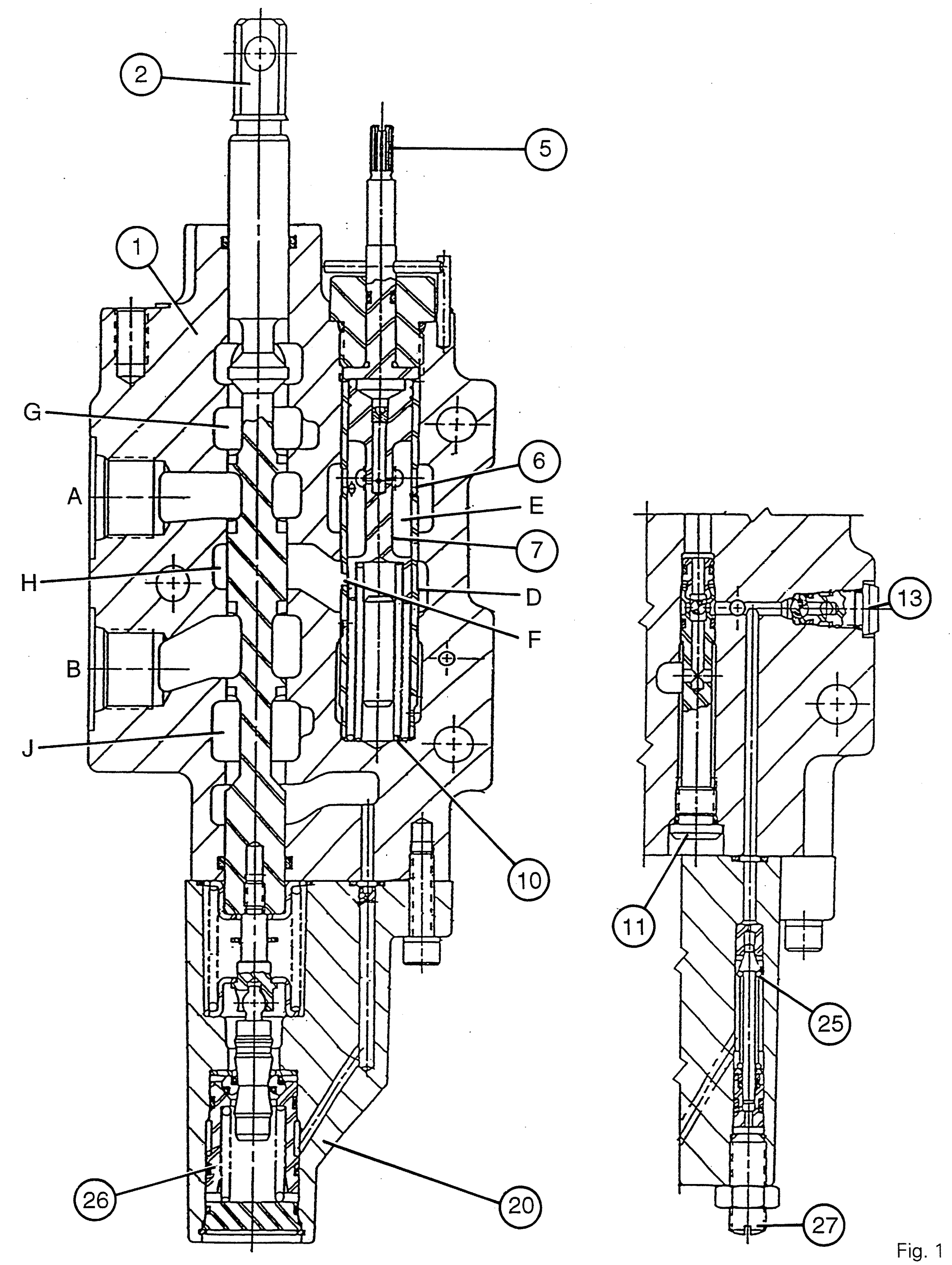


Fig. 1

A. Various types of spool valves

a - 3 positions - Return to neutral by spring action, zero leak

The spool, pulled into position **B**, allows the pressure to act on the piston **(12)** which holds the nonreturn valve **(23)** open.

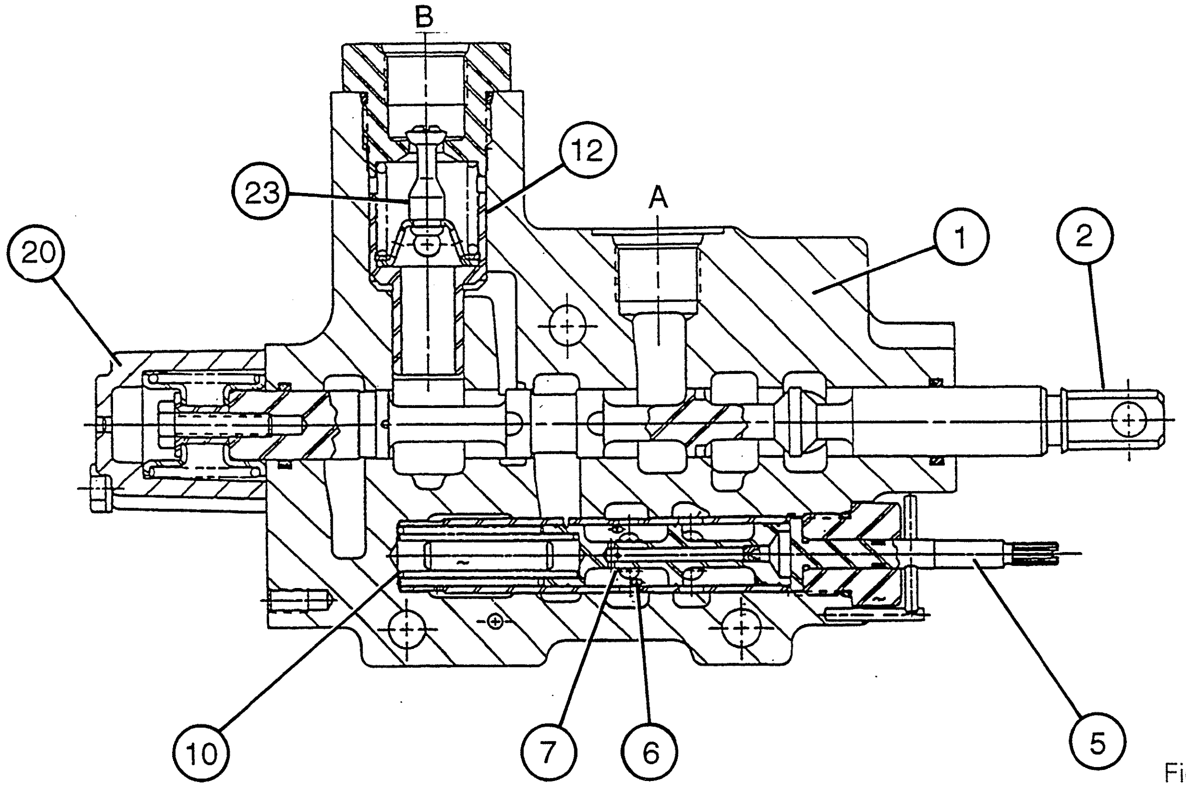


Fig. 2

b - 4 positions - Automatic return to neutral (kickout)

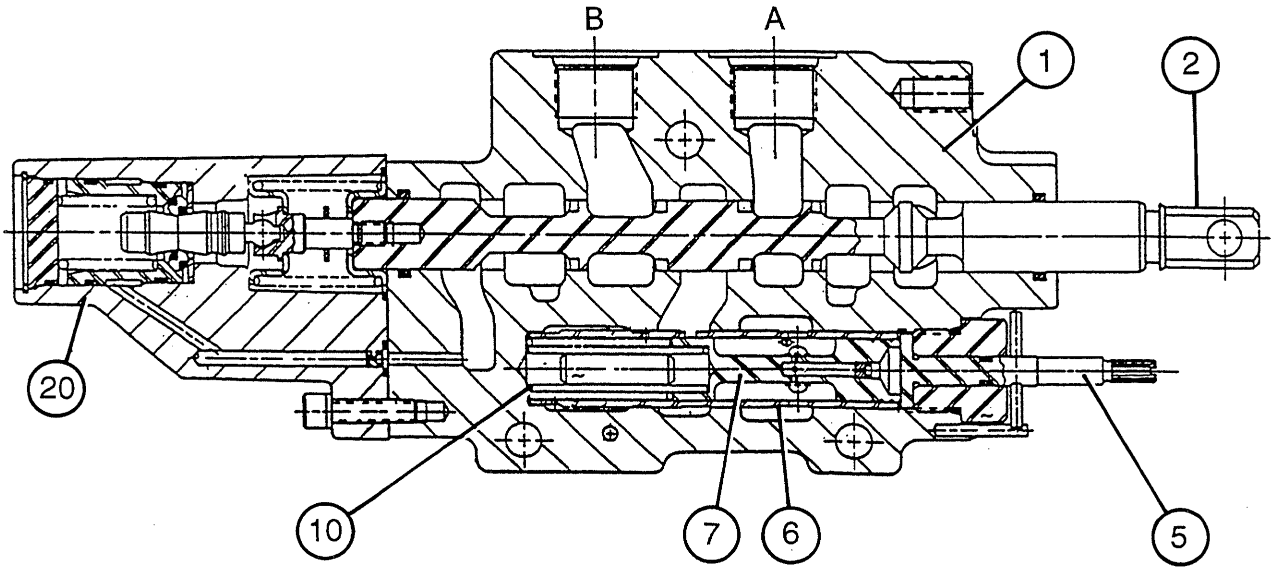


Fig. 3

c - 4 positions - Automatic return to neutral (kickout), zero leak

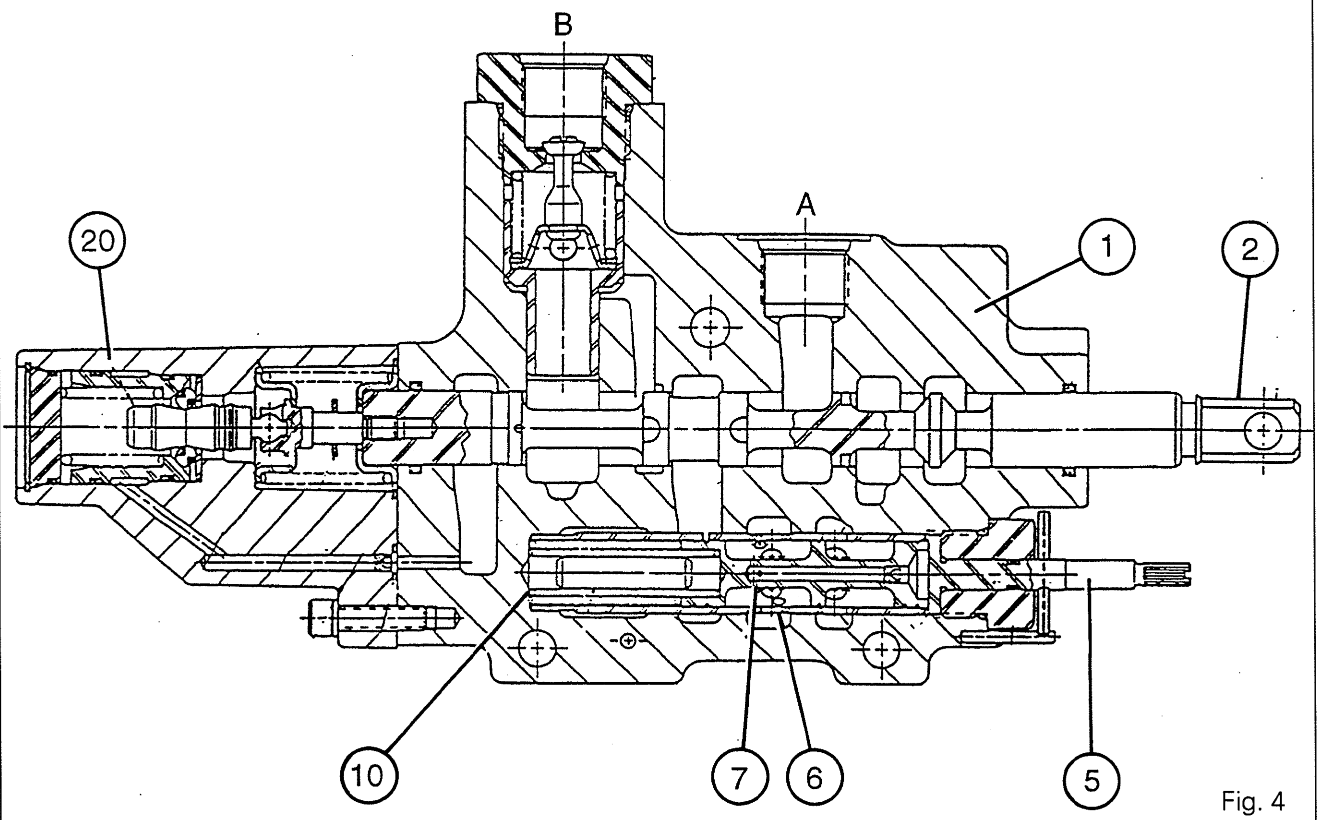


Fig. 4

d - 4 positions - For hydraulic motors

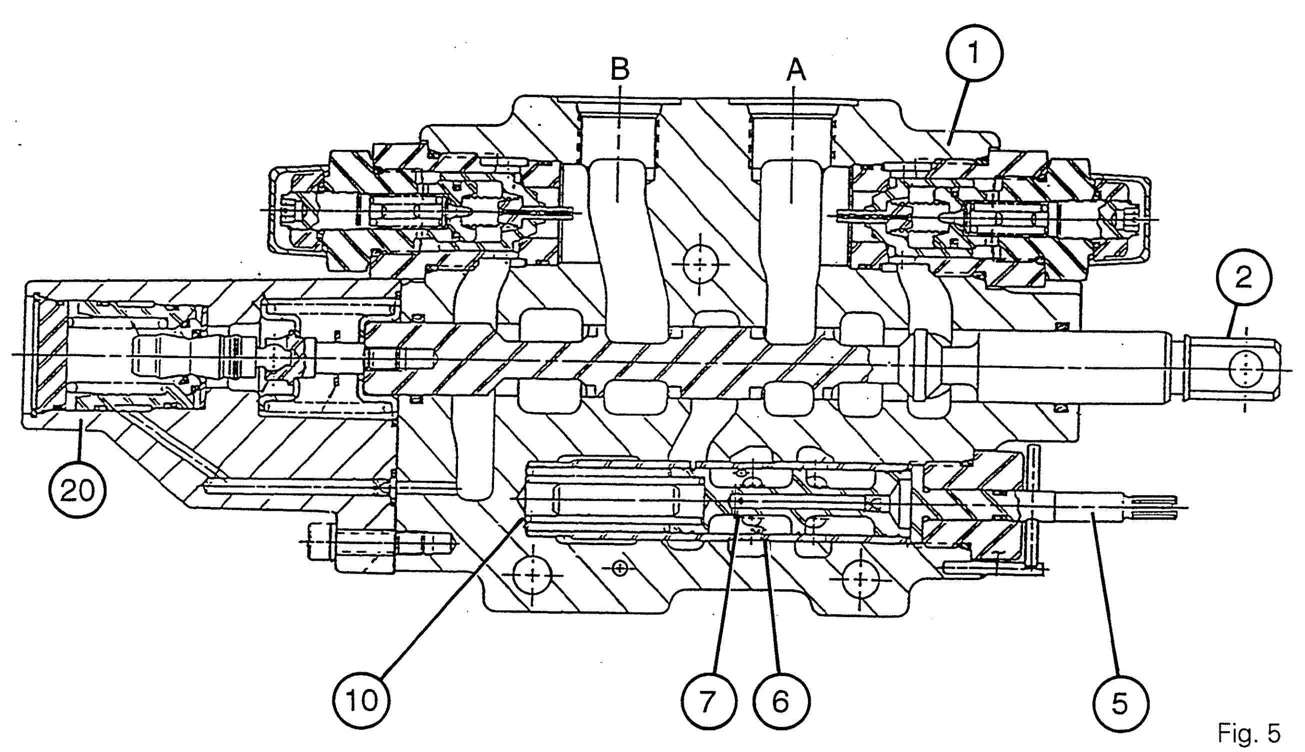


Fig. 5

B. Removing and refitting the spool valve unit (Fig. 6 and 7)

Removal

1. Remove the auxiliary spool valves guard and the quick couplings support.
2. On each spool valve, disconnect the control cable **(2)** and the adjusting rods **(10)** of the pressure compensating valves.
3. Remove the pipes **(3)** **(4)** and **(8)** and the hoses **(5)** and **(9)**.
4. Remove the spool valve unit.

Refitting

5. Carry out the same opèrations as for removal in the reverse order.

Special points

- Connect the hoses between the spool valve unit and the quick couplings as shown in Fig. 6.
- Fit the knob **(7)**, leaving a space "**E**" between the nut and the support (Fig. 6).

Tightening torque

Bolt **(6)** : 0,5 to 1 Nm.
- Check the operation of the spool valve unit and check for leaks from the seals and hydraulic unions.

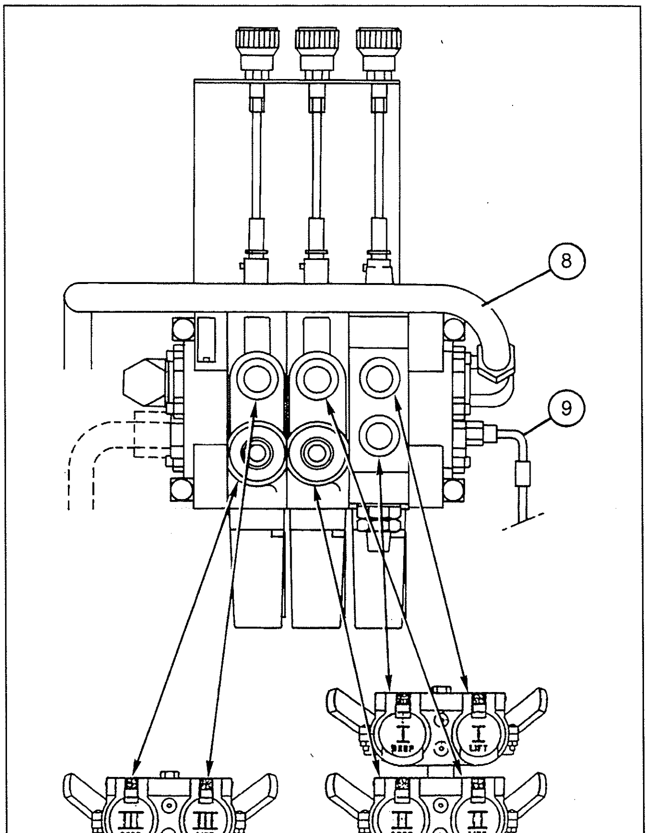


Fig. 6

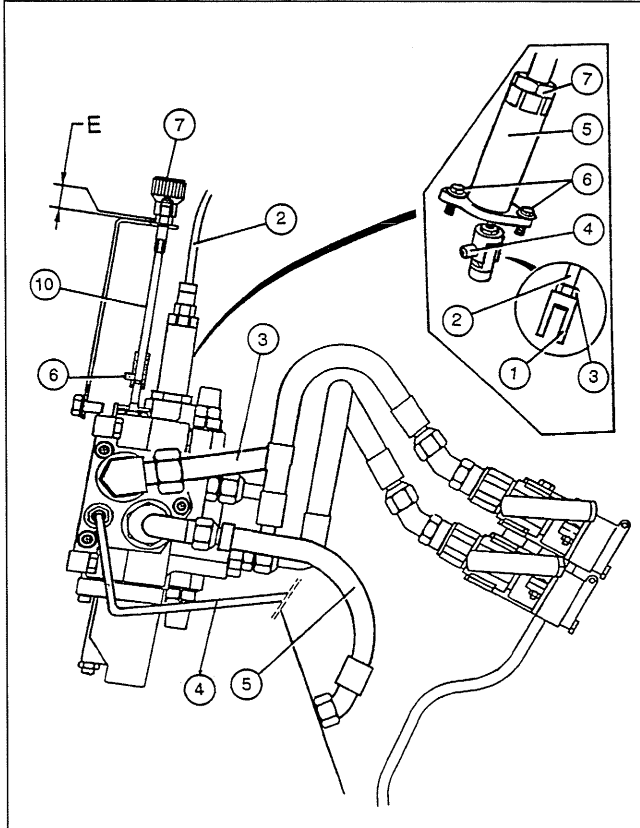


Fig. 7

CONTENTS

Fitting instructions (Fig. 8 and 9)

To ensure correct fitting of the O-rings (1) and the shims (2), each spool valve must be fitted vertically, as shown in Fig. 8.

Important : The shims (2) allow the tightening load to be evenly distributed on the three studs and not on the valve contact surfaces. To avoid seizing of the spools, it is mandatory to comply with requirements on the fitting of shims and the tightening torque applied on the nuts (3).

Screw on the nuts **(3)** in contact with the closing plate **(4)**.
Position the spool valve assembly with the attaching faces "**F**" resting on the flat surface to ensure satisfactory flatness.
Tighten the nuts to 27 Nm. Fit the unions.

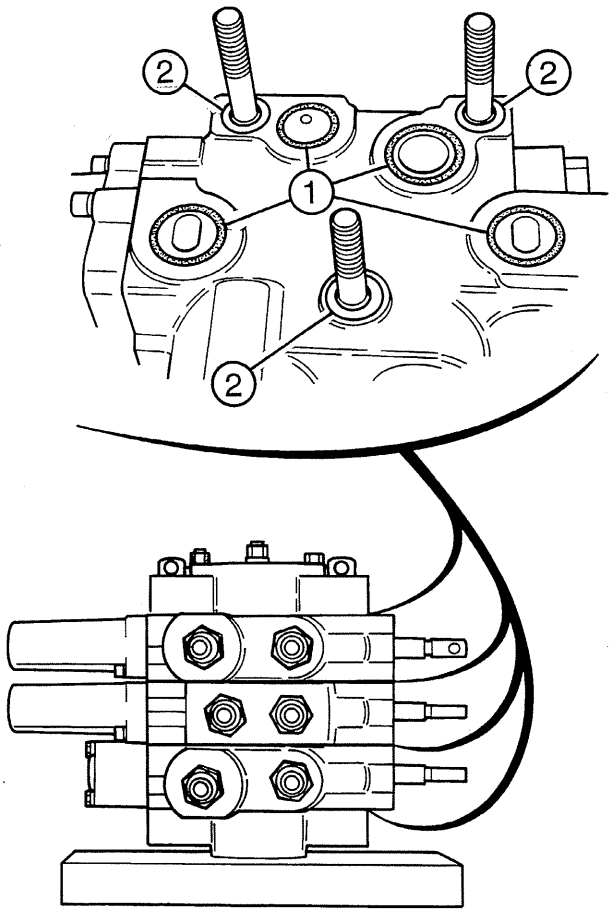


Fig. 8

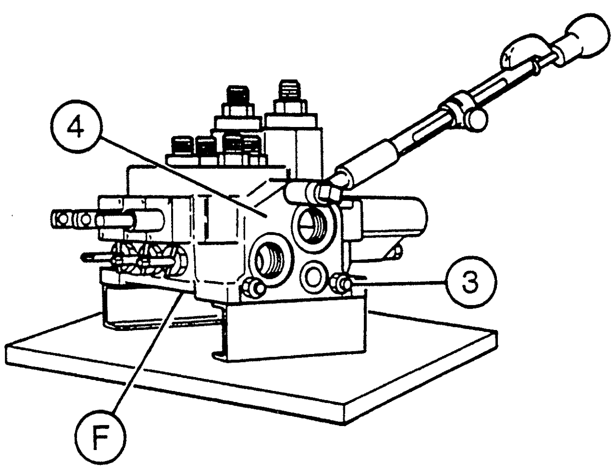


Fig. 9

9 D01 Lift control valve

CONTENTS

General

The lift control valve is attached onto the auxiliary spool valve support mounted to the rear of the lift cover.
Its function is to regulate the flow of hydraulic fluid to and from the lift rams according to the signals transmitted to it by the computer of the electronic lifting system.
The lift control valve is equipped with an LS pilot port for the load sensing system (closed system).
The pilot port allows the valve to send pressure data to the variable displacement pump regulator via the spool valves and the override unit.
This valve is not equipped with the communicating port found on the classic lift control valve.

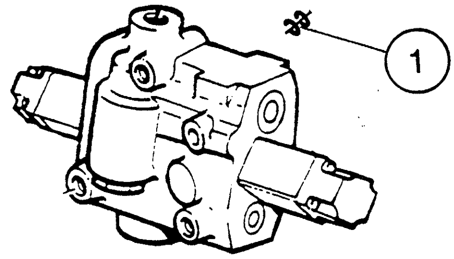


Fig. 1

A. Removing and refitting the lift control valve

Removal

1. Remove the guard protecting the auxiliary spool valves and the quick couplings support.
2. Mark and disconnect the harnesses from the lifting and lowering solenoid valves.
3. Disconnect the lines from the lift control valve.

Refitting

4. Carry out the same operations as for removal but in the reverse order.

Special points

- Clean the mating faces on the valve.
- Change the O-ring **(1)** (Fig. 1).
- Check the operation of the lifting system and check for leaks on the seals and hydraulic union.

Tightening torque

Valve attaching bolts: 25 to 35 Nm, with Loctite 542.

Description (Fig. 2 to 4)

The BOSCH hydraulic valve controlling supply to the lift rams is made up of two sections:

Hydraulic section (lift control valve)

(1) Non-return valve
(2) Servo piston
(3) Non-return valve
(4) Control spool
(5) Flow regulating spool
(6) Surge-damping valve
(9) Flow regulating spool spring
(10) Control spring
(11) Control spring
(12) Non-return valve ball
(13) Restrictor

Electrical section (solenoid valves)

(7) Lowering solenoid valve
(8) Lifting solenoid valve

Designation of ports:

A: Auxiliary spool valves
B: Distribution unit
P: Pressure
R: Return to housing
V: Supply to rams
LS: To pump regulator via the auxiliary spool valves and distribution unit

Note: To distinguish between a hydraulic fault and an electrical fault, simply operate the push-buttons at the ends of the solenoid valves in order to deactivate the electronic lifting system.

B. Neutral position (Fig. 2)

When the engine is stopped, the lift control valve is in the neutral position. Spool **(4)** is held in position by springs **(10)** and **(11)**.
The flow regulating spool **(5)** is pushed to the left by spring **(9)**.

When the engine is running, with the lift control valve in the rest position, the variable displacement pump does not receive any pressure data from the pump controller. In this case, there is no flow to port **P**.

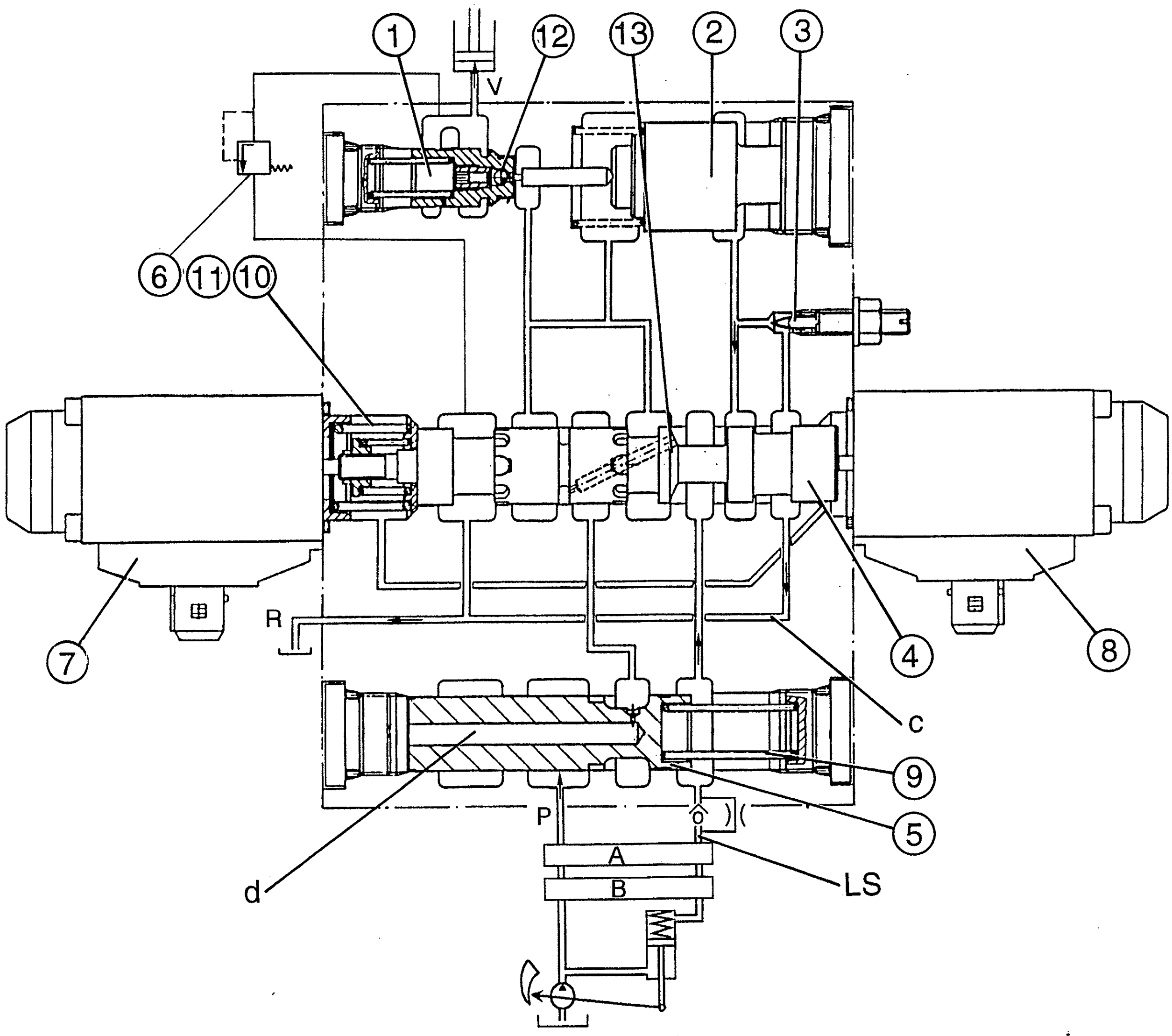


Fig. 2

C. Lifting position (Fig. 3)

The lifting solenoid valve **(8)** is actuated to raise the tractor hitch system. The control spool **(4)** moves to the left and stops the pilot flow by placing the chamber of spring **(9)** under pressure and pushing spool **(5)** to the left.

The movement is d,amped by the volume of hydraulic fluid flowing through port **d**.

When spool **(5)** has been moved to the left, this allows the main flow to be directed to spool **(4)** and to non-return valve **(1)**.

The **LS** pressure data is transmitted onto the face of the spool **(5)** and to the variable displacement pump controller.

As soon as the pressure on the non-return valve **(1)** exceeds the pressure in the channels of the rams, the non-return valve opens and the hitch system is raised.

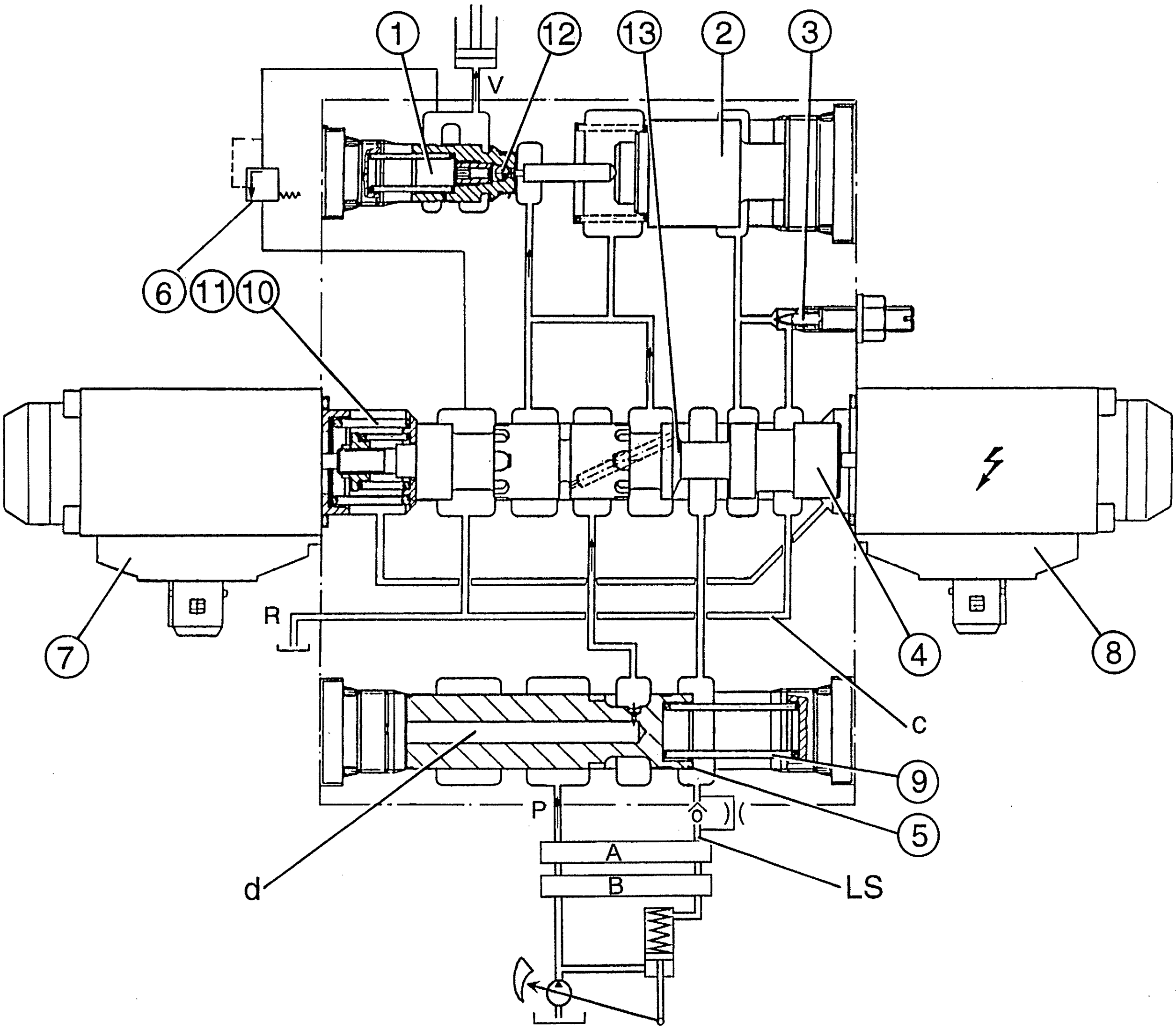


Fig. 3

D. Lowering position (Fig. 4)

The lowering solenoid valve **(7)** is actuated to lower the tractor hitch system.
Control spool **(4)** moves to the right. The pilot flow is stopped and the return channel from piston **(2)** is closed. The **LS** pressure data is transmitted onto the face of the spool **(5)** and to the variable displacement pump controller.
Hydraulic fluid under pressure is then directed through hole **a**, port **b** and the restrictor **(13)** towards the piston **(2)** which is moved to the left.

The rod at the end of the piston **(2)** lifts the ball **(12)** of the non-return valve **(1)** from its seat. This first causes a pressure drop in the ram circuit. The next step is that the piston **(2)** opens the non-return valve **(1)** enabling the fluid returning from the rams to be directed towards the return port **R**.

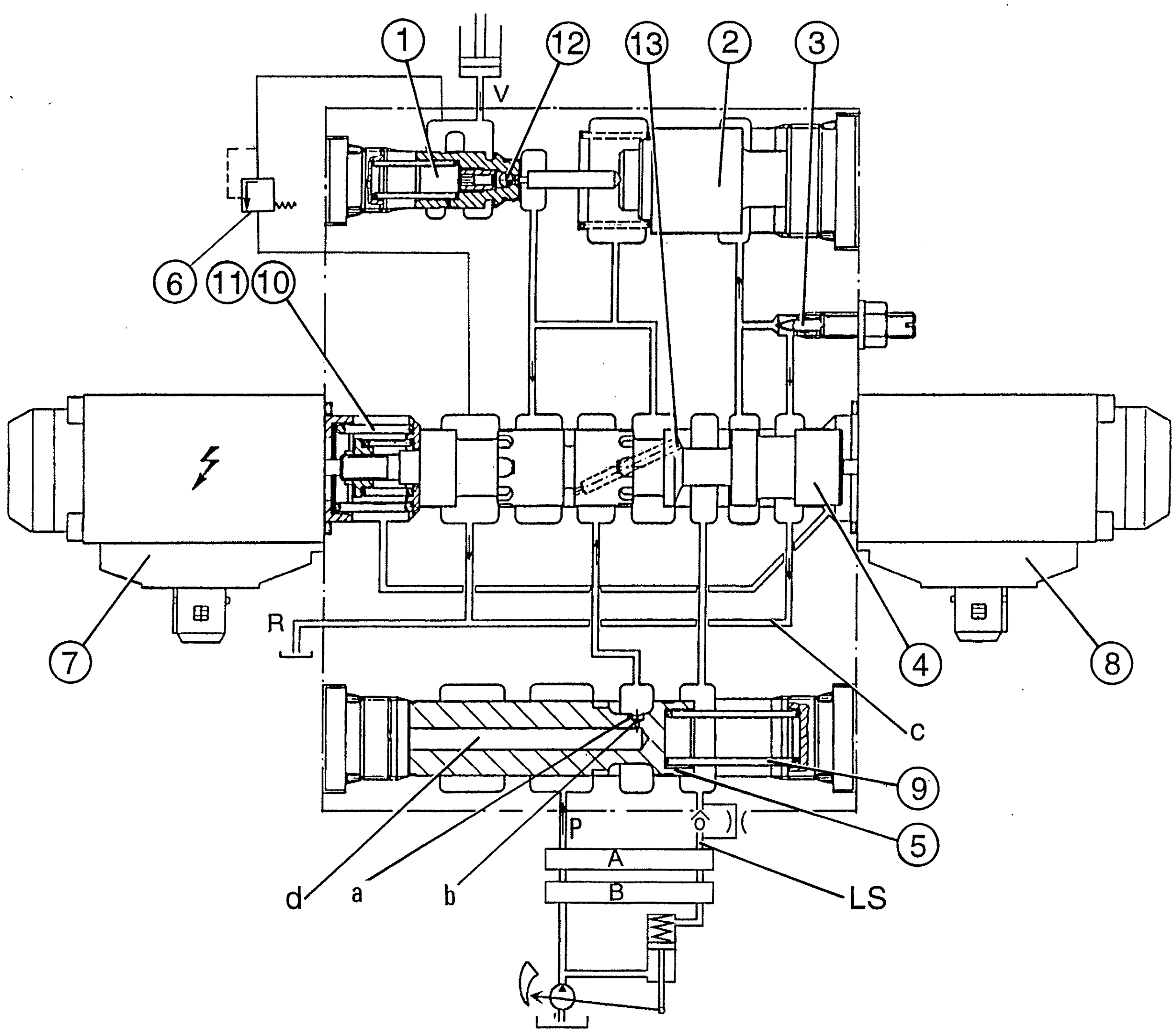


Fig. 4

9 E01 Hydrostatic steering

CONTENTS

Hydraulics - Closed centre

General

The steering system used on 8100 series tractors is of the hydrostatic type (constant flow 0.5 l/mn - stand-by pressure 6 bar - see Sections 8Q01 and 8R01) with no mechanical linkage between the steering wheel and the steering cylinder.

Its control is based on the principle of «Load Sensing». The main components of the system are:

- a pressurised oil feed supplied by the high-pressure stage of the variable displacement pump,
- a steering unit (Dynamic LS Orbitrol OSPC 200) with closed centre, installed in parallel,
- a double-acting steering ram fitted on the 4WD front axle or the 2WD axle.

The Orbitrol unit is supplied by the high-flow circuit via the distribution units. When the steering wheel is turned, the required oil flow is sent to the relevant side of the steering ram. The excess flow not required by the ram is then directed via return ports to the selector cover installed on the gearbox, forming a reservoir with the rear axle housing.

In the case of failure of the engine or the variable displacement pump, the Orbitrol unit acts as a hand-operated pump so that the steering can be controlled.

Description of the distribution valve (Orbitrol)

The Orbitrol unit consists of a selector spool valve, a supply sleeve which is centred by springs and a drive shaft connected to the steering column. The Orbitrol unit has five ports, as follows:

- a pressure port,
- a port for return to the selector cover,
- two supply ports for the steering cylinder,
- a Load Sensing port.

The circuit is protected by a safety valve and two shock valves as well as two suction valves.

A. Principle of «Load Sensing»

Steering unit

Like the classic unit installed on 8100 series tractors with an open centre hydraulic system, the LSD steering unit is equipped with a fifth LS port.
This port is either connected to the Orbitrol closed circuit when the steering is in the neutral position or connected with the supply pressure line when the steering wheel is turned.

List of parts

(1) Bolt
(2) Bolt
(3) O-ring
(4) Cover plate
(5) O-ring
(6) Stator
(7) Pin
(8) O-ring
(9) Rotor
(10) Spacer
(11) Link shaft
(12) Washer
(13) Centring springs
(14) Needle-roller bearing
(15) Bush
(16) Washer
(17) O-ring
(18) Relief valve
(19) Seal
(20) Shock valve
(21) Orbitrol distribution valve
(22) Non-return valve
(23) Suction valves
(24) Ring
(25) Spool valve
(26) Check valve
(27) Sleeve
(28) O-ring
(29) Distributor plate

Overall view

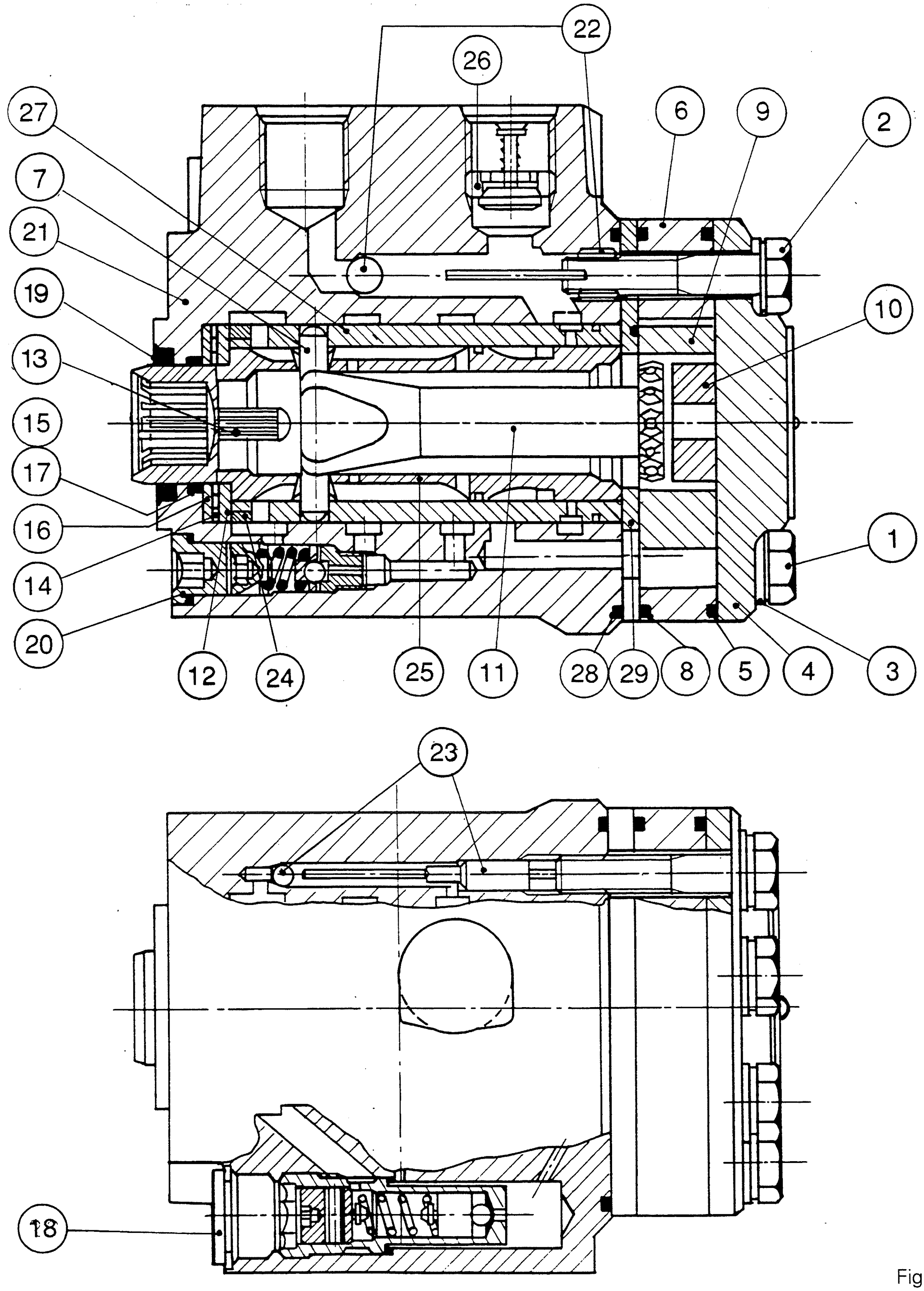
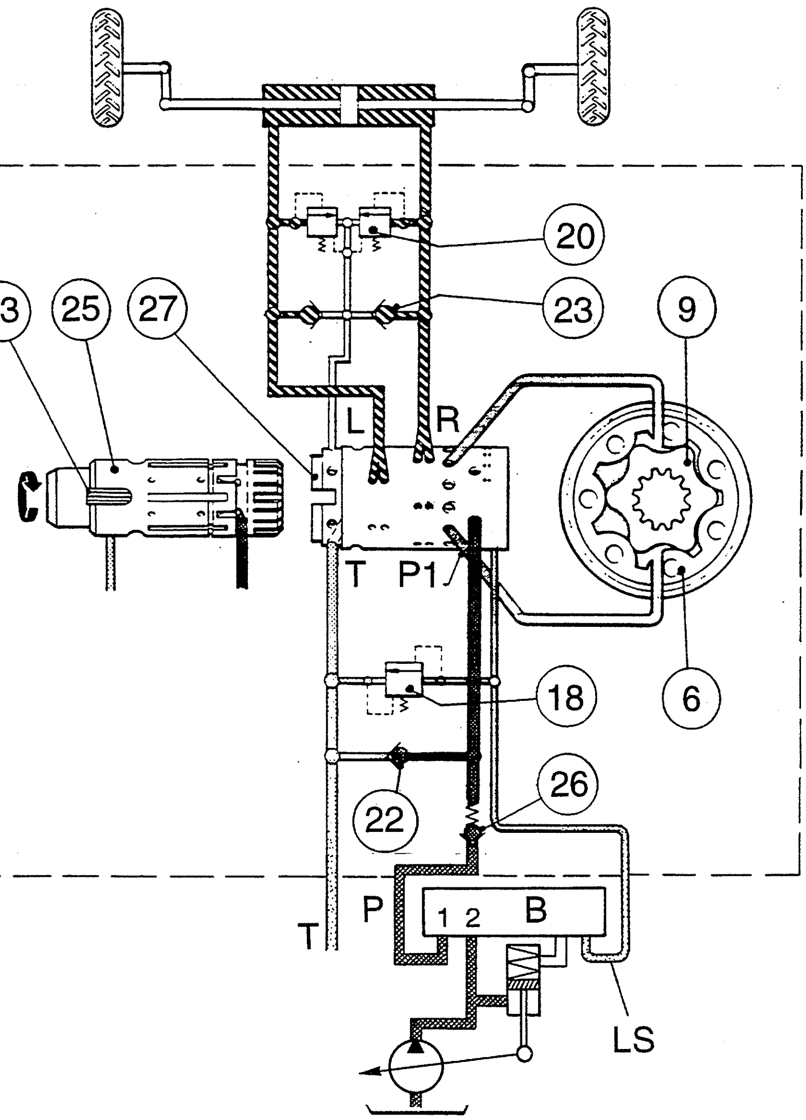


Fig. 1

B. Neutral position (engine running) (Fig. 2)

In this position, the spool valve **(25)** is centred with respect to the sleeve **(27)** by means of springs **(13)**. There is no supply to channels **P1-L-R**.
The flow coming from the variable displacement pump via channel **(2)** is directed, as priority, to the Orbitrol distributor via channel **(1)**.
When the steering is in the neutral position, there is no flow in this channel.

Two shock valves **(20)** and two suction valves **(23)** are placed in ports **L** and **R** of this distribution valve.
The shock valves **(20)** protect the circuit between the steering ram and the distribution valve from any impact on the wheels.
The suction valves **(23)** allow the oil released by the shock valves **(20)** to flow from the right-hand channel to the left-hand channel or vice versa, depending on the displacement of the piston in the steering ram.



B	Override unit
L	Supply to left-hand side of steering ram
LS	Control
P	High-flow supply from variable displacement pump
P_1	Supply to metering device (stator **(6)**)
R	Supply to right-hand side of steering ram
T	Return to housing

Fig. 2

C. Steering wheel turning (engine running) (Fig. 3)

Action on the steering wheel (movement to the right or left) causes an angular shift of the spool valve **(25)** with respect to the sleeve **(27)** and opening of the Orbitrol closed circuit.

A pilot pressure from the Orbitrol unit is established in channel **(4)** and allows the flow required for the metering device (stator **(6)** and rotor **(9)** to pass into channel **(1)**).

The rotor **(9)** is driven in rotation and supplies the ram with a quantity of oil that is proportional to the angle of rotation. The rotation of the rotor **(9)** is equal to that of the steering wheel.

Example: Let us suppose that the steering wheel is turned through an angle of 5°. This causes an angular shift of 5° of the spool valve **(25)** with respect to the sleeve **(27)**.

The rotor **(9)** is driven in rotation as long as it is supplied. It drives, with it, the link shaft **(11)** and the sleeve **(27)**. When these have turned through 5°, the spool valve **(25)** and sleeve **(27)** are again centred by the springs **(13)**. The rotor is no longer supplied and stops rotating. This reasoning can be extended to greater angles. The quantity of oil delivered by the steering unit to the ram is, thus, proportional to the angle of rotation of the steering wheel.

Depending on whether the steering wheel is turned to the left or to the right, the spool valve **(25)** directs the oil delivered by the metering device (stator **(6)** and rotor **(9)**) to port **L** or **R**.

During the rotation, the sleeve **(27)** ensures that the cavities in the metering device are set into synchronous communication with the circuit from the pump, on the one hand, and the circuit to the ram, on the other hand.

A check valve **(26)** is screwed into the distribution valve supply port. This is a one-way valve which prevents excess pressures exerted on the wheels from being transmitted to the pump when the wheels are turned.

If the pressure in the steering system is too high, the relief valve **(18)**, located in the distribution valve, is actuated and the excess pressure is routed to channel **T**.

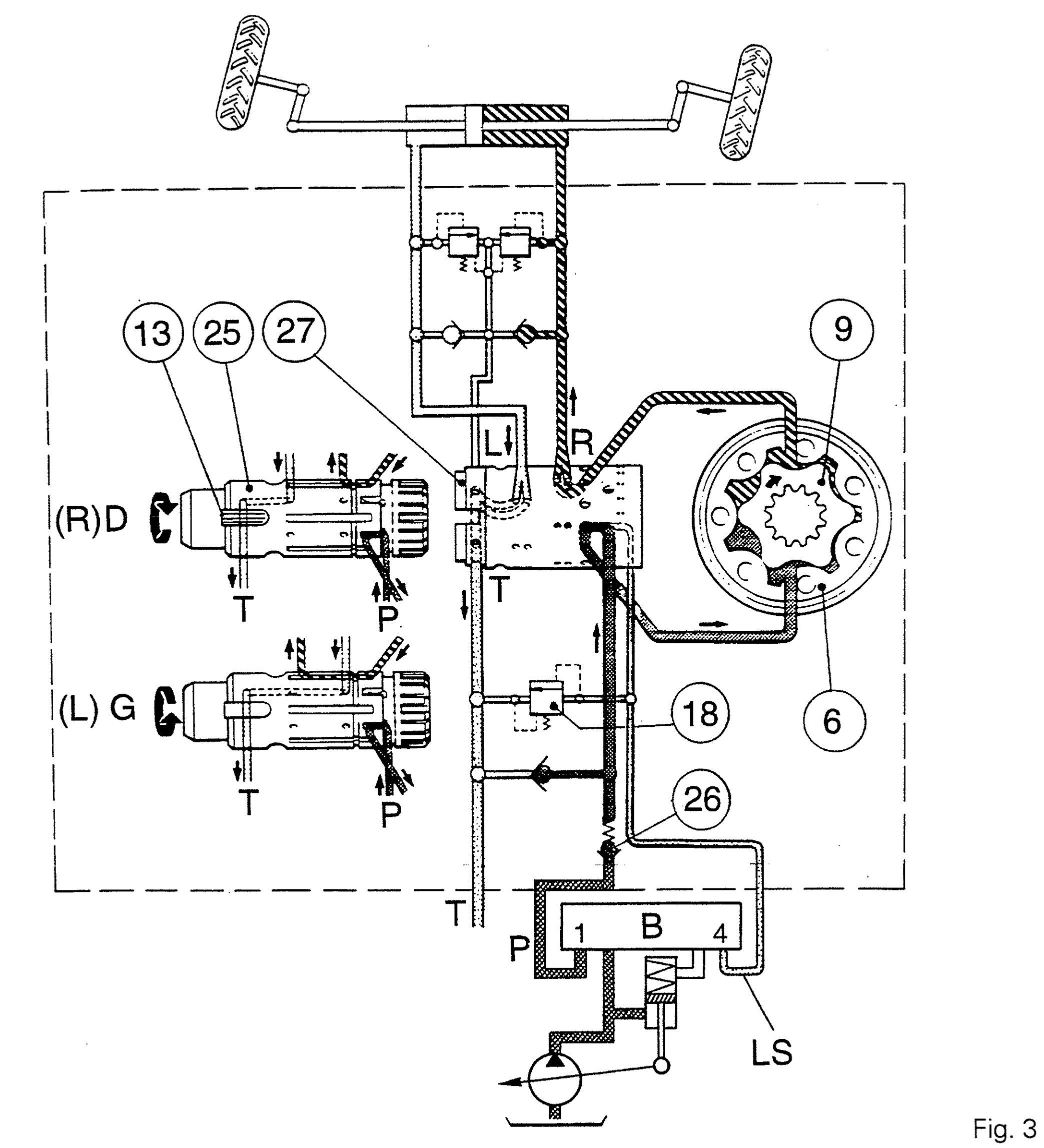


Fig. 3

D. Manual steering (engine stopped) (Fig. 4)

When there is no more flow from the pump or when the available pressure is too low, the rotor **(9)** is no longer driven hydraulically. Power assistance is no longer provided.
In this case, action on the steering wheel compresses the centring springs **(13)**. The angular play between the pin **(7)** and the sleeve **(27)** is taken up and the metering device (stator **(6)** and rotor **(9)**) is driven mechanically. The distribution valve then functions like a hand-operated pump.

The oil returning from the cylinder passes via the non-return valve **(22)** and supplies the metering device.

The pressure generated is proportional to the torque applied on the steering wheel. In this case, considerable force is required on the steering wheel.

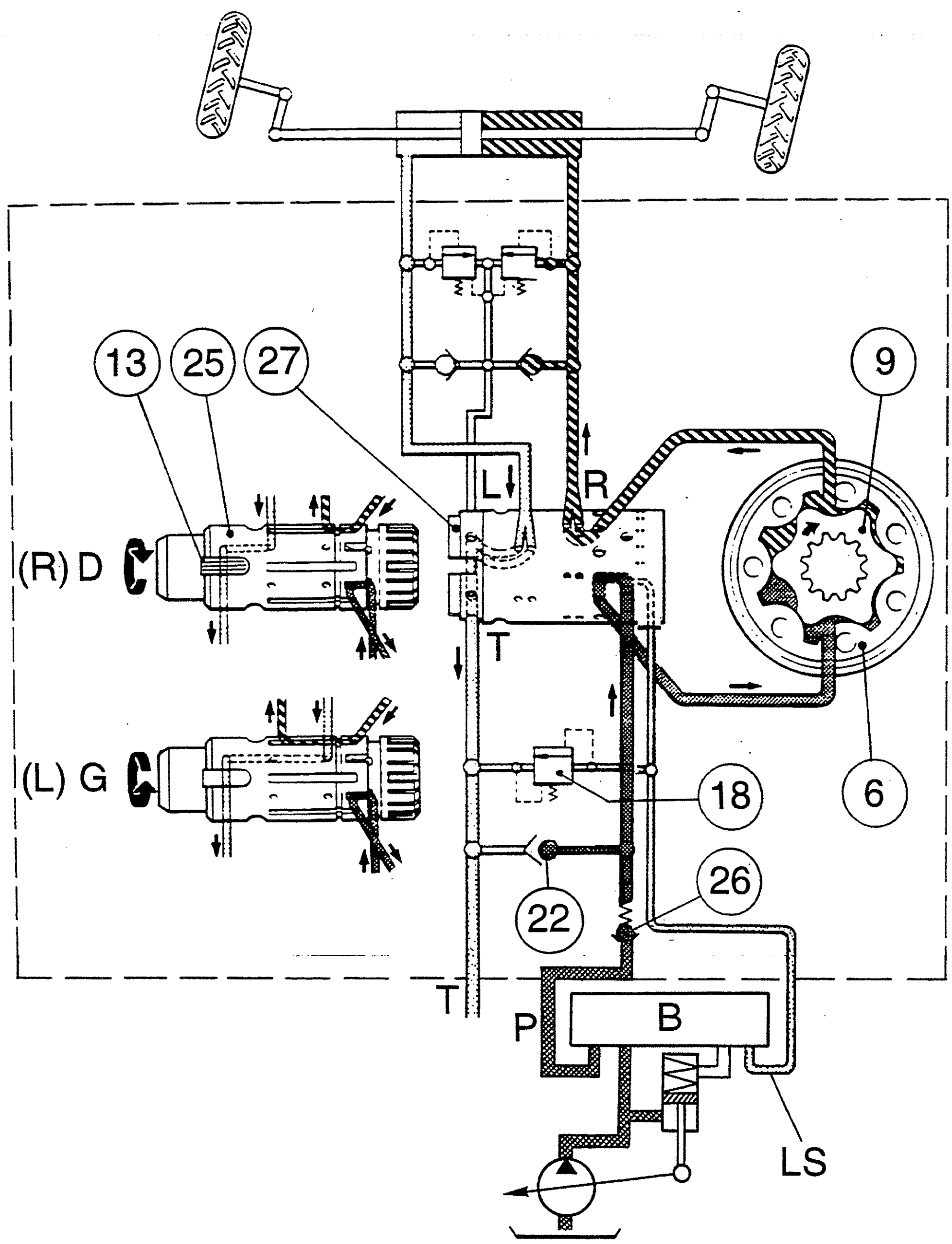


Fig. 4

Exploded view

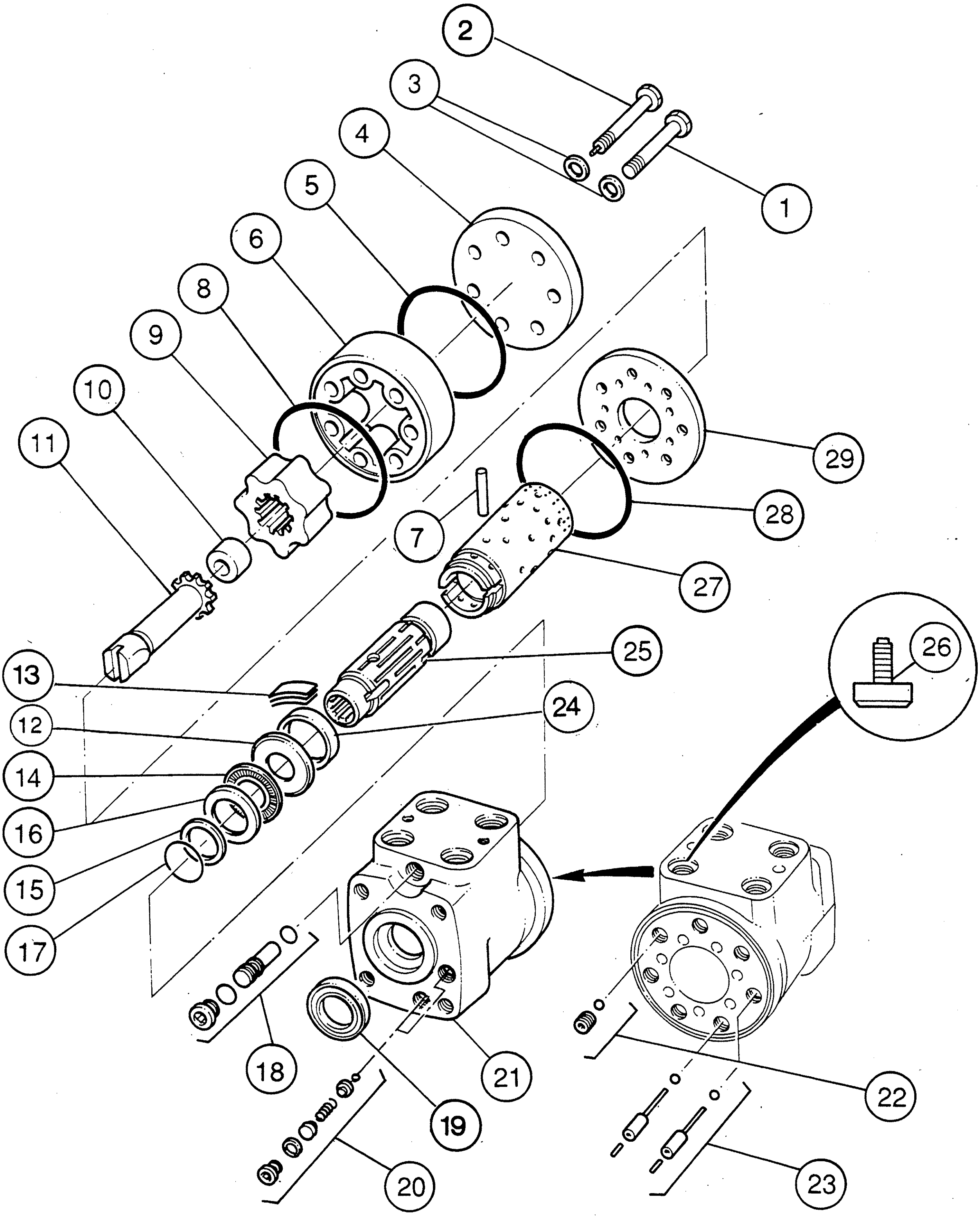
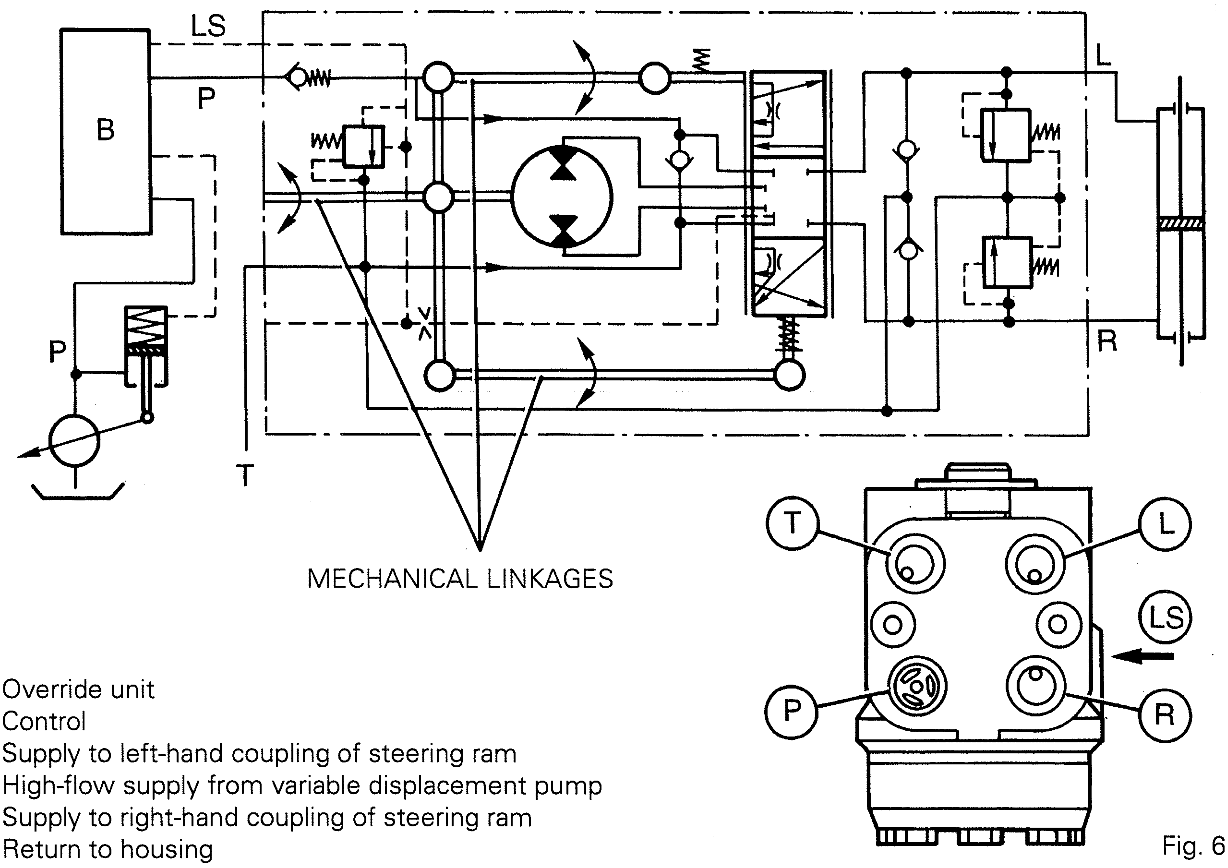


Fig. 5



B : Override unit
LS : Control
L : Supply to left-hand coupling of steering ram
P : High-flow supply from variable displacement pump
R : Supply to right-hand coupling of steering ram
T : Return to housing

Fig. 6

E. Disassembling and reassembling the distribution valve (Orbitrol) (Fig. 1)

Disassembly

1. Remove the distribution valve from the tractor.
2. Place the distribution valve in a vice fitted with plastic jaws.
3. Remove bolts **(1)**. Mark the position of bolt **(2)** and remove it.
4. Remove the cover plate **(4)**, O-ring **(5)**, the stator **(6)** and O-ring **(8)**.
5. Remove the spacer **(10)**, rotor **(9)**, distributor plate **(29)** and O-ring **(28)**.
6. Withdraw the splined link shaft **(11)**.
7. Unscrew the threaded bush and recover the ball from the non-return valve **(22)**.
8. Withdraw the two pins and the two balls from the suction valves **(23)** of the distribution valve.
9. Extract the sleeve **(27)** and spool valve **(25)** assembly by pushing it, making sure that the pin **(7)** is horizontal.
10. Remove the washers **(12)** and **(16)**, the needle-roller bearing **(14)** and the ring **(24)** from the sleeve/spool valve assembly.
    Remove the pin **(7)** and the centring springs **(13)** by pressing on one of their ends. Separate the sleeve **(27)** from the spool valve **(25)**.
11. Unscrew the cap of the relief valve **(18)**. Using an 8 mm Allen key, remove the threaded bush and take out the seal, the spring and the valve. (The crimped seat is not removable).
12. Unscrew the two caps from the shock valves **(20)**, and remove the seals.
    Using a 6 mm Allen key, remove the threaded bushes and take out the springs, the balls and their seats. (The crimped seats are not removable).
13. Extract the seal **(19)**, the bush **(15)** and O-ring **(17)**.
14. Remove the check valve **(26)**.

Reassembly

15. Check and clean the parts, and replace any that are faulty. Lubricate parts with clean transmission oil before reassembling.
16. Refit the check valve **(26)**.
17. Fit seal **(19)**, O-ring **(17)** and bush **(15)**.
18. Place the balls and springs in the recesses for the shock valves **(20)**. Screw in the threaded bushes, position the seals and tighten the caps.
19. Place the valve and spring in the recess for the relief valve **(18)** and screw in the threaded bush. Position the seal and tighten the cap to a torque of 40 to 60 Nm.
20. Insert the spool valve **(25)** in the sleeve **(27)**. Position the centring springs **(13)** as shown in Figure 7 and fit the pin **(7)**.
21. Position the ring **(24)** on the sleeve and spool valve assembly so that the chamfer facilitates assembly in the distribution valve.
22. Fit washers **(12)** and **(16)** with the chamfer on washer **(12)** directed towards the centring springs **(13)** and with the needle-roller bearing **(14)** positioned between them.
23. Fit the sleeve and spool valve assembly in the distribution valve, applying a slight oscillating movement. Check that the pin **(7)** is held horizontally.
24. Place the two balls and the two pins in the recesses for the suction valves **(23)**.
25. Place the ball in the recess for the non-return valve **(22)** and screw in the threaded bush.
26. Position the splined link shaft **(11)**.
27. Fit O-ring **(28)** and the distributor plate **(29)**.
28. Fit the rotor **(9)** so that the two hollows **«C»** are in line with the slot in the splined shaft **(11)** (Fig. 8). Refit the spacer **(10)**.
29. Place O-rings **(5)** and **(8)** on the stator **(6)**.
30. Taking care not to move the rotor **(9)**, fit the stator **(6)**. Then move the stator so that its attachment holes coincide with those of the distribution valve. ***Note: The rotor (9) and pin (7) must be in the position shown in Figure 9.***
31. Refit the cover plate **(4)**.
32. Refit bolt **(2)** (in the position marked during disassembly) and bolts **(1)** fitted with their seals **(3)**. Tighten them alternately to a torque of 30 to 35 Nm.
33. Using a test bench or a suitable fixture, check the adjustment and operation of the distribution valve.
34. Refit the distribution valve on the tractor.
35. Check the couplings for leaks.

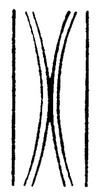


Fig. 7

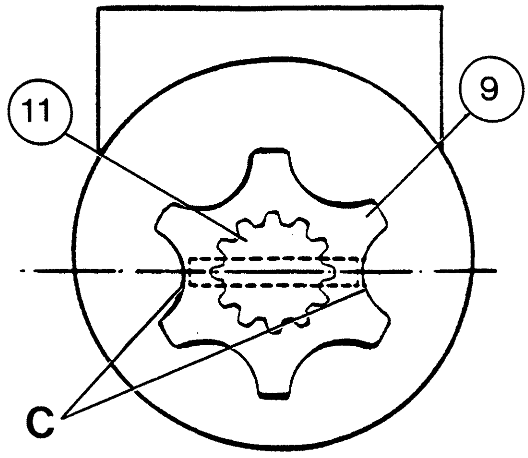


Fig. 8

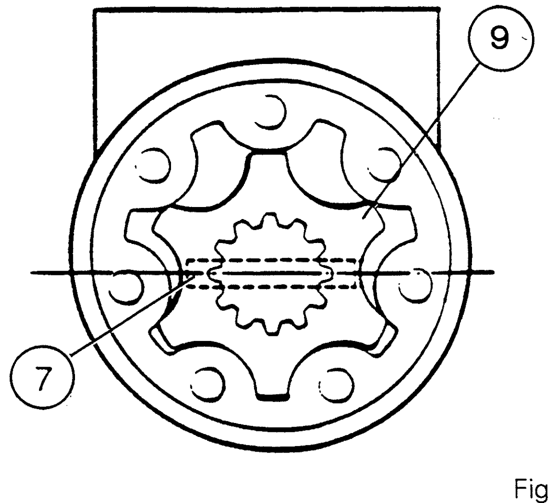


Fig. 9

CONTENTS

CONTENTS

9 F01 Right-hand cover

CONTENTS

General

The right-hand cover fitted on the rear axle housing has the same functions as the cover for the open centre type hydraulic system:
- It serves as a support for numerous components.
- It comprises various channels of the charge, lubricating and low flow circuits.

The internal face of the cover is fitted with:
- the variable-displacement pump driving idler gear, the pin of which is installed on taper roller bearings shimmed with play, the 17-bar, 0.15 l/mn low-pressure circuit
- the variable displacement pump driving gear,
- the 5-bar safety valve.

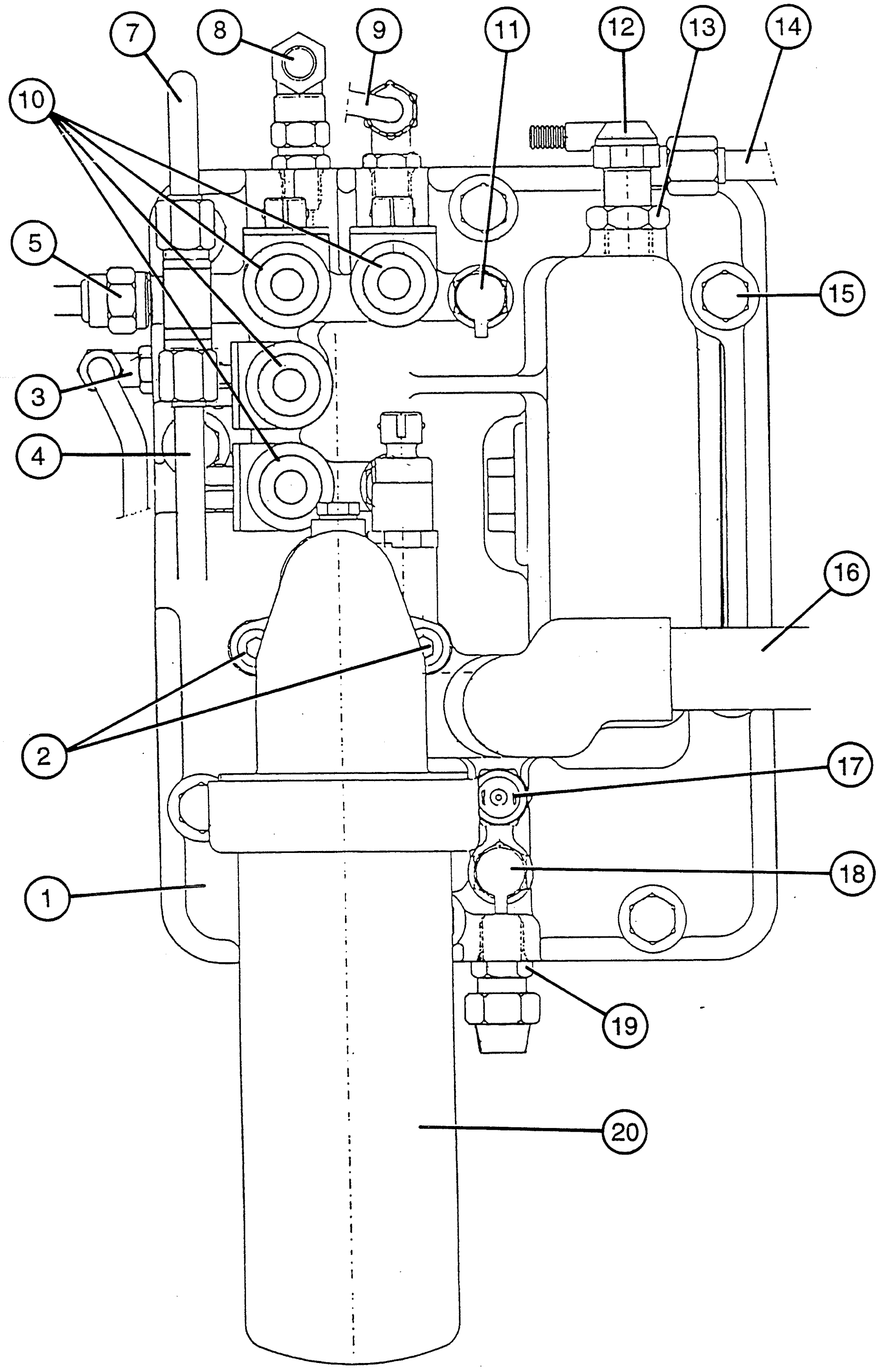
On its external face, it is fitted with:
- the variable displacement pump,
- the main filter,
- the three or four solenoid valves controlling the low-pressure functions (depending on the model),
- the diagnostic, low pressure and booster connectors,
- the engine speed sensor,
- the 5-bar contactor.

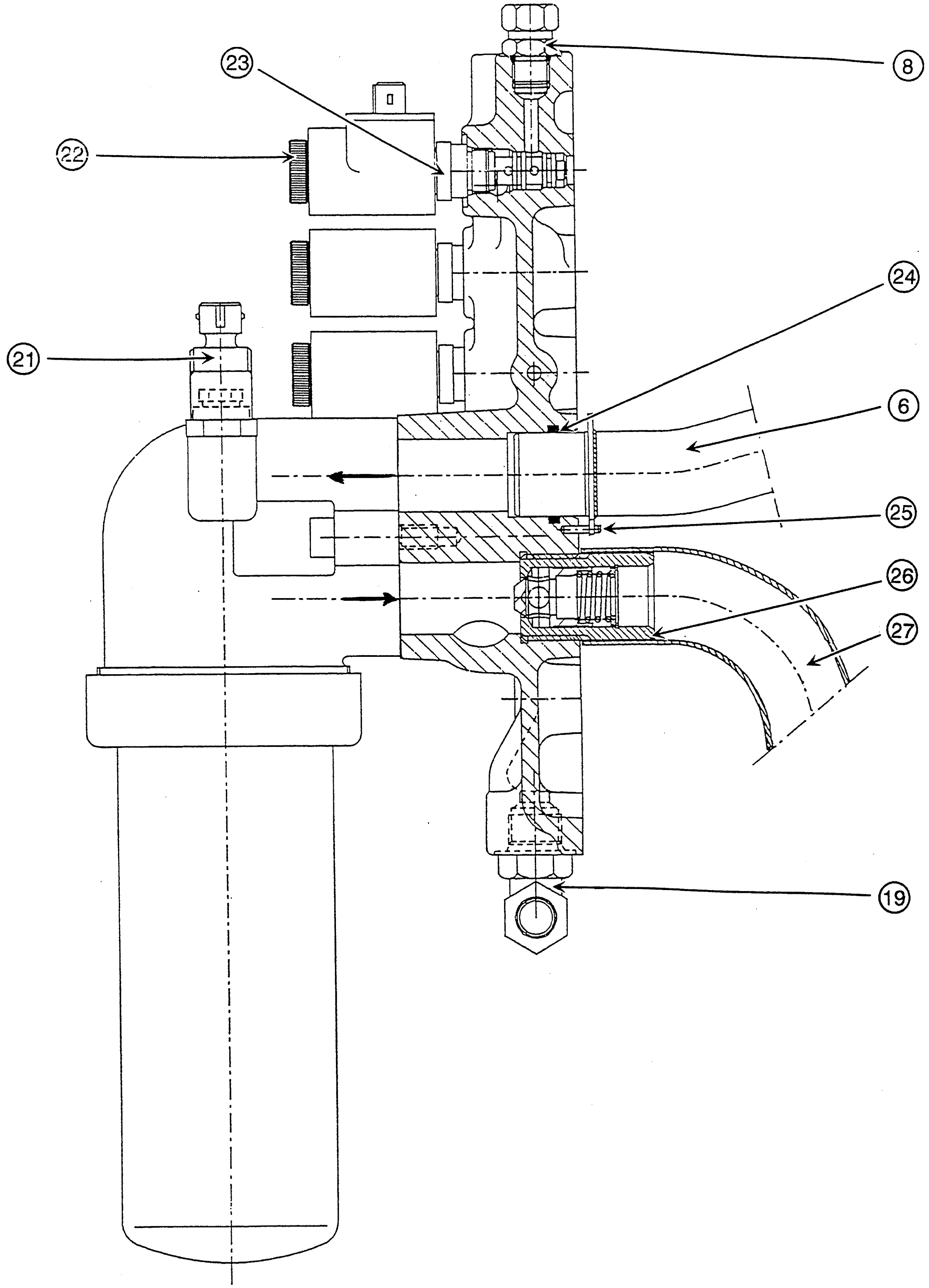
Important: Do not unscrew the restrictor plug (66) when the cover is installed on the rear axle assembly.

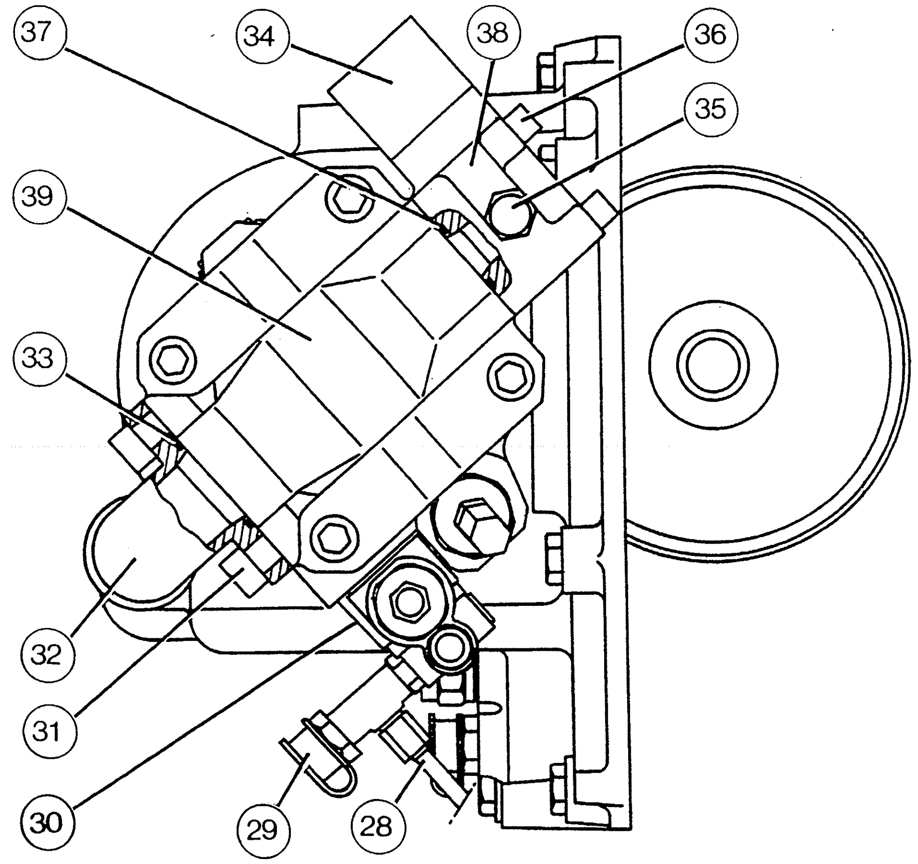
List of parts

(1) Cover
(2) Bolt
(3) Union (4WD supply)
(4) 17-bar union (supply to Hare/Tortoise, wet clutch valve and Dynashift)
(5) Low pressure contactor
(6) Transfer pipe
(7) 17-bar supply pipe
(8) 2WD or 4WD differential lock union
(9) PTO supply union
(10) Solenoid valves
(11) Low pressure diagnostic connector
(12) Engine speed sensor
(13) Nut
(14) Pressure relief return pipe
(15) Bolt
(16) Link pipe
(17) Charge pressure contactor
(18) Charge pressure diagnostic connector
(19) Union to cooling system
(20) Main filter
(21) 5-bar contactor
(22) Knurled nut
(23) Solenoid valves
(24) O-ring
(25) Dowel
(26) 5-bar valve
(27) Pipe
(28) Pipe XLS
(29) Diagnostic connector (XLS)
(30) Pump controller
(31) Bolt
(32) Intake manifold
(33) O-ring
(34) Pressure relief valve
(35) High pressure diagnostic connector
(36) Bolt
(37) O-ring
(38) Outlet unit
(39) Variable displacement pump
(40) Plug
(41) Seal
(42) Nut
(43) Washer
(44) Pump gear
(45) O-ring
(46) Key
(47) Spacer
(48) Layshaft
(49) PTO clutch gear
(50) Idler gear
(51) Bearing cup
(52) Shims
(53) Spacer
(54) Bearing cones
(55) Washer
(56) Bolt
t**(57)** O-rings
(58) Lubrication return pipe
(59) Washer and bolt
(60) High pressure flow pipe
(61) Union
(62) O-ring
(63) Union
(64) Bolt
(65) Lubrication pipe
(66) Restrictor plug
(67) O-rings

Overall view



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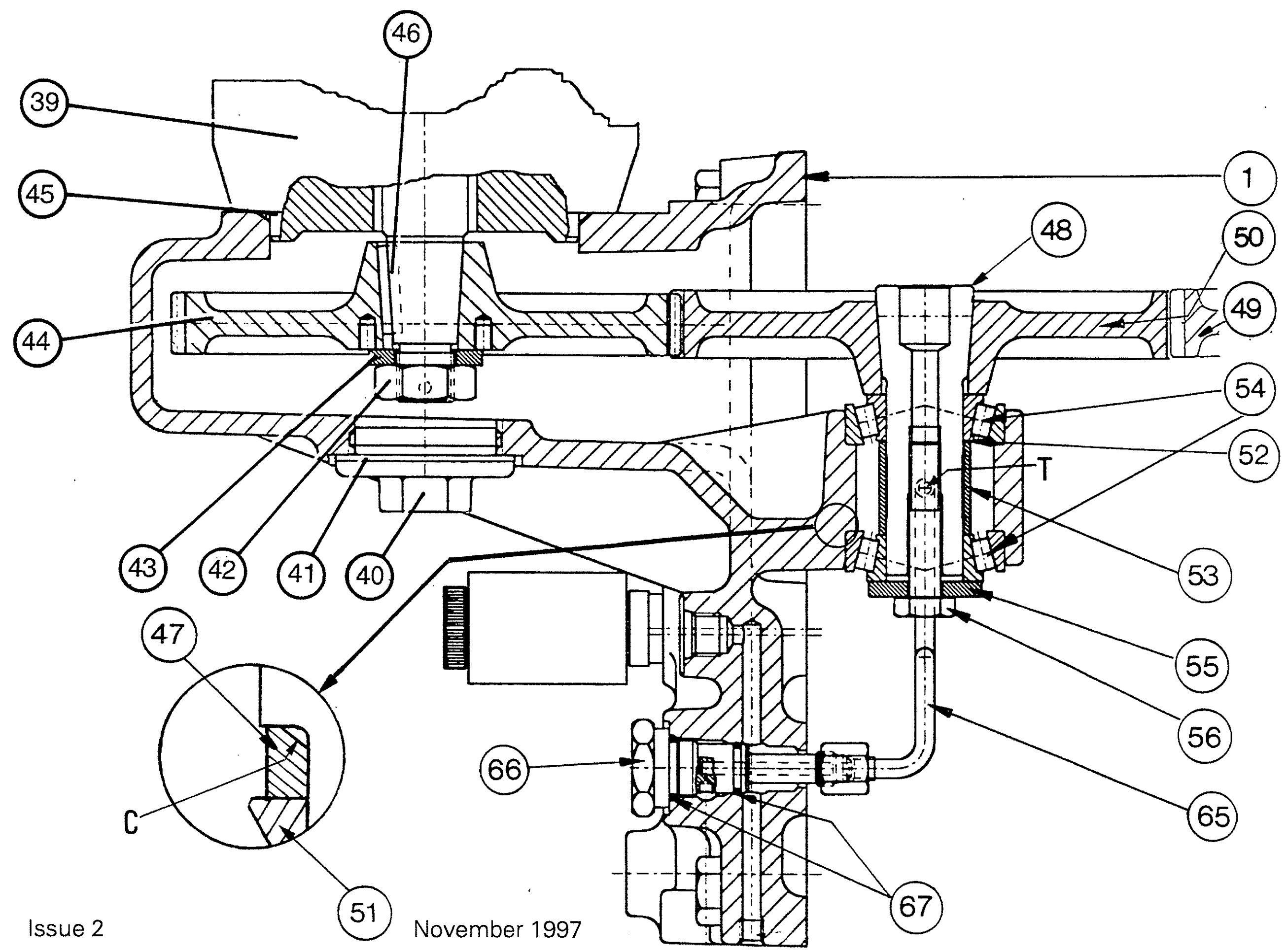
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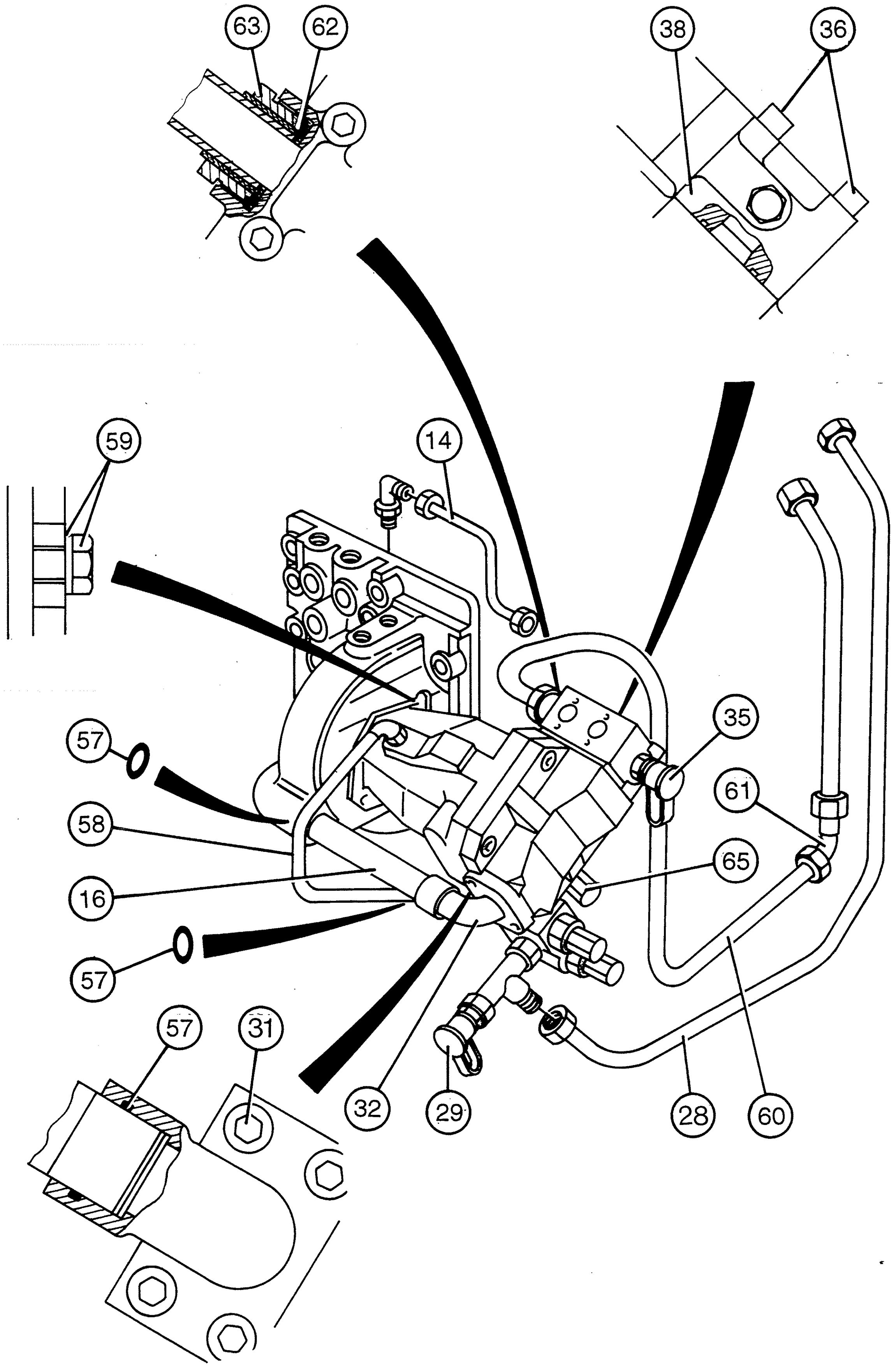
CONTENTS

Exploded view



A. Removing and refitting the cover

Note: In order to make it easier to remove the cover, it is advisable to remove the pump (39).

Removal

1. Remove the pump (operations 15 to 22).
2. Disconnect the pipes **(3)** and **(7)** to **(9)** and the hose on union **(19)**.
3. Disconnect:
   - the solenoid valves (and mark their positions),
   - the low pressure switch **(5)** (making red marking) and boost pressure switch **(17)** (making green marking).
4. Detach and remove the cover.

Refitting

5. Carry out the removal procedures in the reverse order. Replace the O-rings **(24)**, **(45)** and **(57)**.

Special points

- Smear the mating face for the cover **(1)** on the housing with a sealing compound, Loctite 510 or equivalent.
- Place the transfer pipe **(6)** on the cover, position the dowel **(25)** in the recess in the flange (Fig. 3), and refit the cover, with the valve **(26)** in the pipe **(27)**.

Tightening torques

Bolts **(15)**: 105 to 117 Nm.
Spools of solenoid valves **(23)**: 18 to 20 Nm. Knurled nuts **(22)**: 5 to 8 Nm.
5-bar valve **(26)**: 10 to 20 Nm (with Loctite 241).
Screw plugs: (with Loctite 542).
Other torques: See Section D.

6. Check the following functions:
   - low pressure switch **(5)**,
   - boost pressure switch **(17)**,
   - 5-bar switch **(21)**,
   - Solenoid valves **(10)**.
7. Check for leaks on the unions and seals.

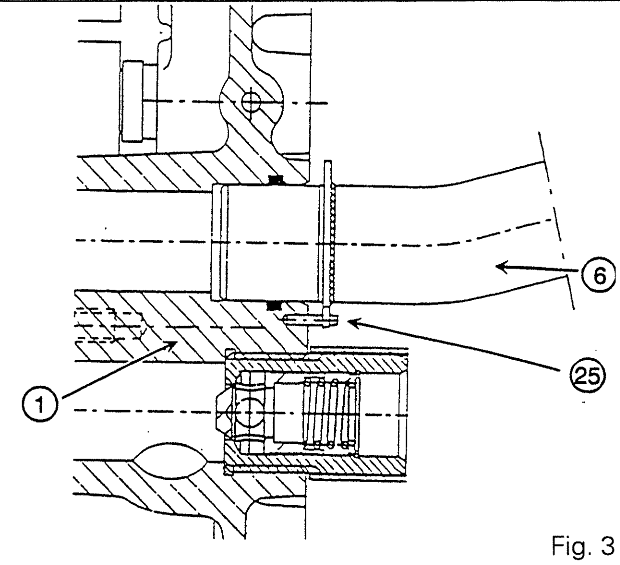


Fig. 3

B. Disassembling, reassembling and shimming the idler gear shaft

8. Remove the pump. Carry out procedures 15 to 22. Remove the right-hand cover. Repeat procedures 2 to 4.

Disassembly

9. Remove the lubrication pipe **(65)**. Loosen the bolt **(56)**, remove the washer **(55)**, bearing cone **(54)**, spacer 53) and shims **(52)**.
10. Release the tapered shaft **(48)** from the idler gear **(50)**.
11. Remove the shaft, the idler gear and the second bearing cone **(54)**.
12. If necessary, extract the bearing cups **(51)** and remove the spacers **(47)**.

Refitting

Note: The bearing (51) to (54) on the layshaft (48) are lubricated by means of a tube and a restrictor plug (66) screwed onto the cover and in communication with the low-pressure circuit (17 bars).

13. Place the cover **(1)** in a vice with the inner face upwards.
    Position the spacers **(47)** in the bores in the cover with the chamfers **"C"** facing the casting radii (see Fig. 4).

Shimming the idler gear shaft (Fig. 4)

Fit the idler gear **(50)** and the bearing cones **(54)** resting on the shims **(52)** and the spacer **(53)** as shown in the figure.

Note: Increase the thickness of existing shims (52) so as to obtain a play of 0.10 to 0.15 mm in order to perform shimming J1. Place a dial gauge as shown. According to the play measured, determine the thickness of shims required to obtain a final play of 0 to 0.05 mm. When shimming has been completed, remove bolt (56) and lightly coat it with Loctite 270 or equivalent and then tighten it to a torque of 55 to 67 Nm. Check the rotation of the idler gear (50) by hand.

14. Reinstall and the pipe **(65)** and tighten it to 15 Nm with the end pointing towards the hole **"T"** in the cover.

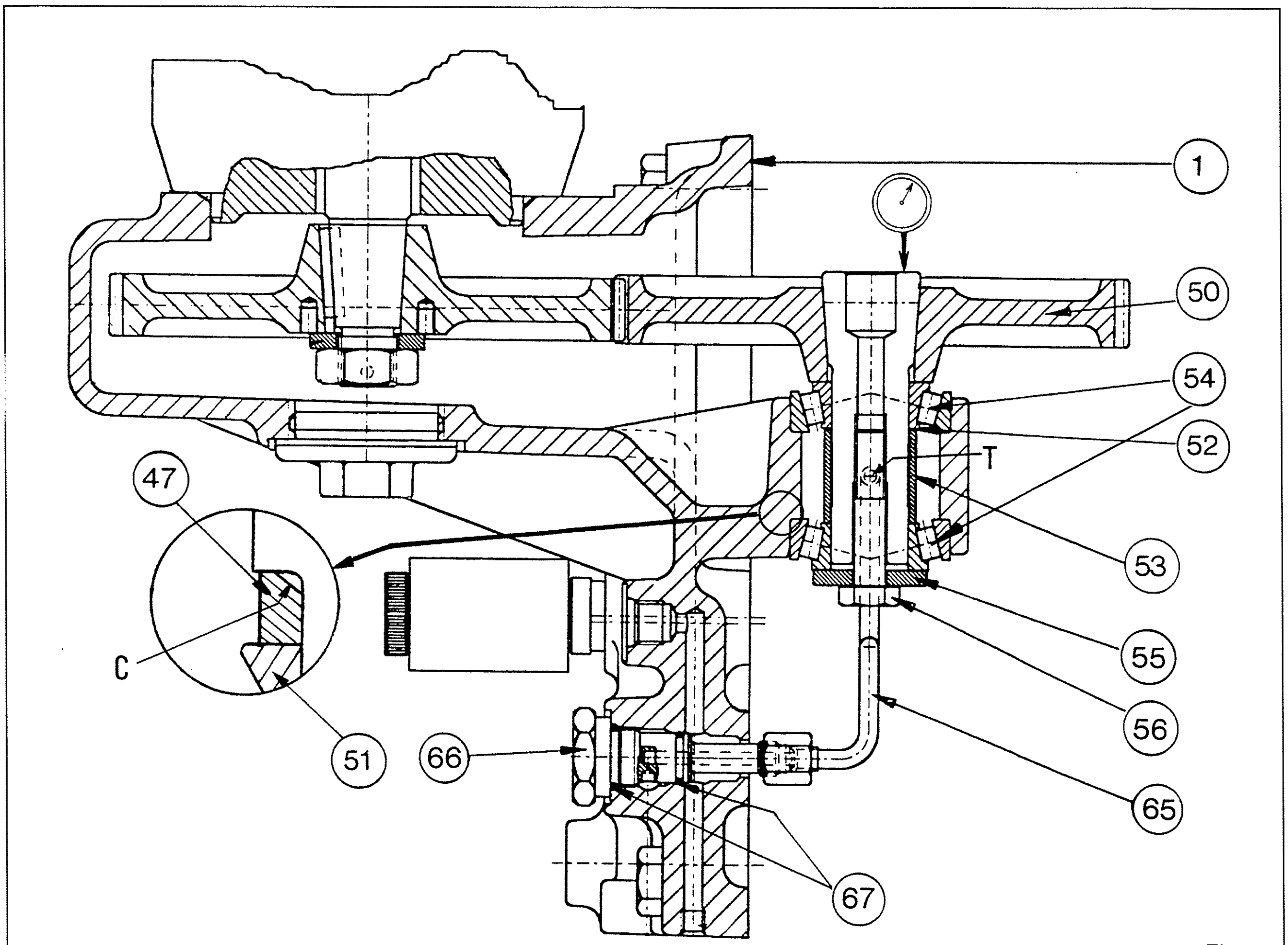


Fig. 4

C. Description and operation of the variable displacement pump

Description (Fig. 5)

The variable displacement pump is fitted on the outside of the right-hand cover. It is driven by an idler gear which is, itself, driven by the external teeth of the PTO clutch.
The pump comprises a body **(1)** and a barrel **(3)** driven by shaft **(2)**. The barrel comprises nine axial pistons **(4)** bearing on the ball joints **(5)**, which are themselves supported by plate **(6)** via pads **(7)**.
The plate is inclined by equilibrium between the spring **(8)**, pusher **(9)** and piston **(10)** actuated by a regulator which receives the pilot pressure (signal XLS) from the HP components via the distribution units.
The stroke of the axial piston **(4)** is modified according to the plate inclination, so that the flow rate can be adapted to operating conditions. The pump displacement is governed by screw **(11)**.
The distribution plate **(12)**, located to the rear of the barrel allows communication between the piston chambers and the pump's suction and discharge ports.
The ball joints **(5)** are fitted with oilways to ensure lubrication between the pads **(7)** and plate **(6)**. The oil is then directed to the return pipe **(58)**.

The pump is fitted with the following components:
- intake manifold **(32)**,
- pressure relief valve **(34)** mounted on the outlet unit **(38)**,
- diagnostic connectors **(29)** and **(35)** (signal XLS and HP),
- controller **(30)**.

Operation (Fig. 5)

Stand-by position

When the engine is stopped, the pump is automatically set to its maximum output position. When the engine is started, no pump output is, theoretically, necessary. The pressure in line **P** increases and, when it reaches 22 bar, it pushes the spool **a** and communication is established with port **R** of the regulator. The pressure acts on the piston **(10)** and the pusher **(9)** of the regulator which inclines the plate **(6)** moving into the zero output position. In practice, a low flow rate under 6 bar is maintained in the steering system, increasing the stand-by pressure to 28 bar.

Principle of working function

The spool **a** is in equilibrium between pressure XLS and the spring on one side, and the pump's output pressure **P** on the other side.
The pump provides supply to the receiver to maintain the spool **a** in its equilibrium position (pressure **P** = pressure XLS + 22 bar).

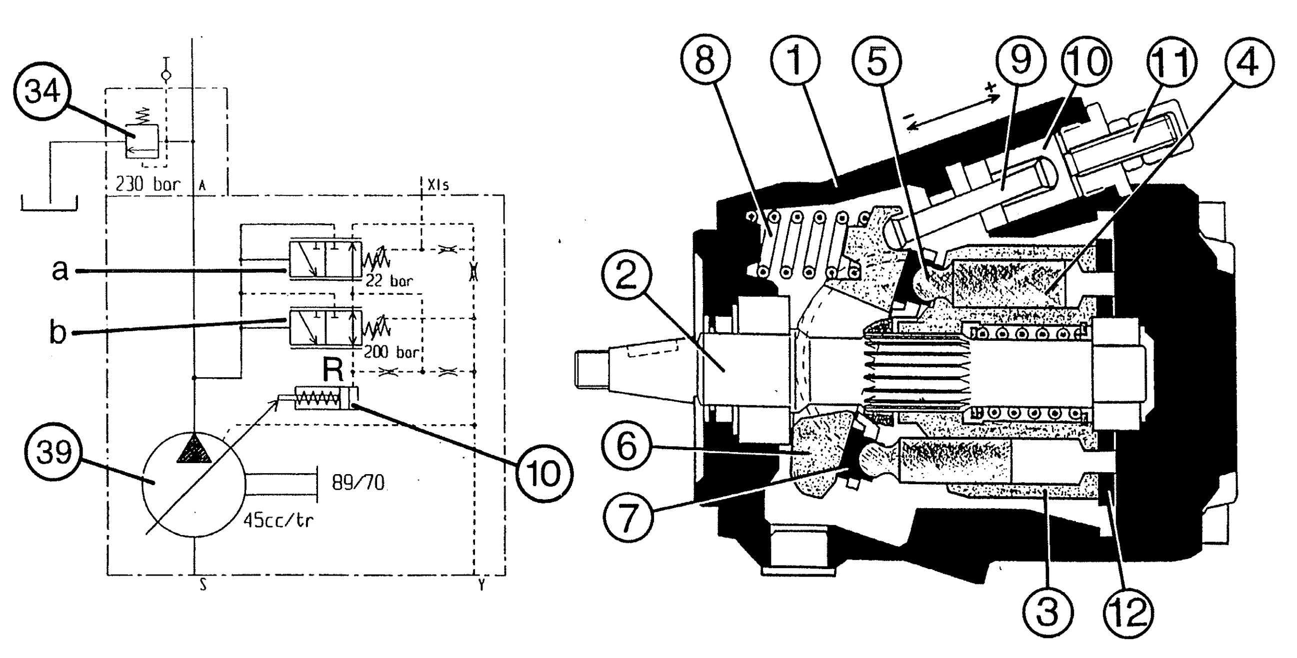


Fig. 5

Working position - Full capacity
When a HP, high flow rate function is operated, e.g. an auxiliary spool valves, the pump switches from the stand-by position to maximum output. The flow rate in the spool valves is not slowed down enough to allow the pressure of the pump to compress the 22-bar spring of **a**. The pump remains in the maximum output position. Pilot pressure XLS is slightly greater than the pump pressure, minus 22 bar.

Working position - Partial capacity
Partial opening of a spool valves causes a pressure increase which generates a pilot pressure XLS which is conveyed to the pump. This pressure pushes spool **a**, so that the pump is set to full capacity. The pump pressure increases and pushes spool **a** back to its position of equilibrium where the pressure of the pump is 22 bar greater than pilot signal XLS.
If the receiver load increases, pilot pressure XLS rises on the side where the spring of spool **a** is located, and communication is established between ports **R** and **S**. The pressure on the piston **(10)** decreases, the spring **(8)** pushes back the plate **(6)** and increases the pump output before stabilizing in a position where spool **a** is in a position of equilibrium.
If a higher output is required, the spool valves must be opened more. The pressure drops and the pump output increases to reach another point of equilibrium.

Maximum pressure - Zero output
When the pressure at port **P** reaches 200 bar, spool **b** is pushed forwards, compressing its spring.
Communication is established between ports **P** and **R**, and the piston **(10)** is returned to the zero output position.
The regulator **(30)** (Fig. 6) fitted on the pump **(39)** controls the pump output and pressure in accordance with the data transmitted by signal XSL.

Identification of channels (Fig. 6)

C: 22-bar adjusting screw
D: 200-bar adjusting screw
O: Decompression port
P: Pump pressure
R: To piston **(10)**
S: Return
XSL: Signal

Important: Screws C and D are adjusted in the factory. These settings must not be modified.

Pressure relief valve (Fig. 7)
The high-pressure output discharged by the variable-displacement pump passes into the outlet unit **(38)** and is directed via a pipe passing under the centre housing to the override unit or to the trailer brake unit (if fitted), which is mounted on the left-hand cover. The pressure relief valve **(34)**, calibrated at 230 bar and mounted on the outlet unit, ensures safe operation of the high-pressure circuit.
In the case of an abnormal pressure increase, the valve shutter **(1)** is raised and oil flowing from the pump via port **O** is directed to the return pipe **(14)**.
The diagnostic connector **(35)** allows the pump high pressure to be measured.

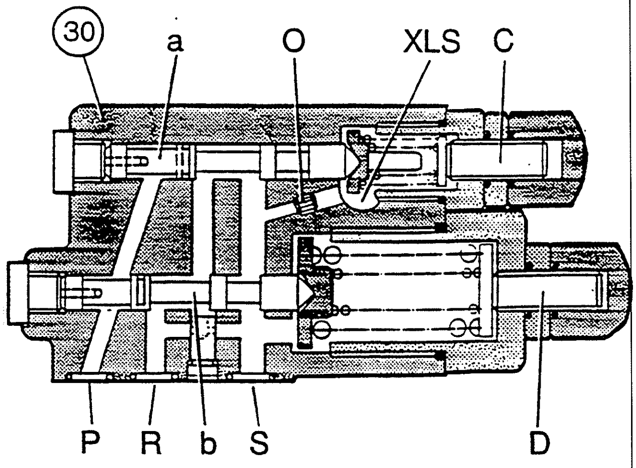


Fig. 6

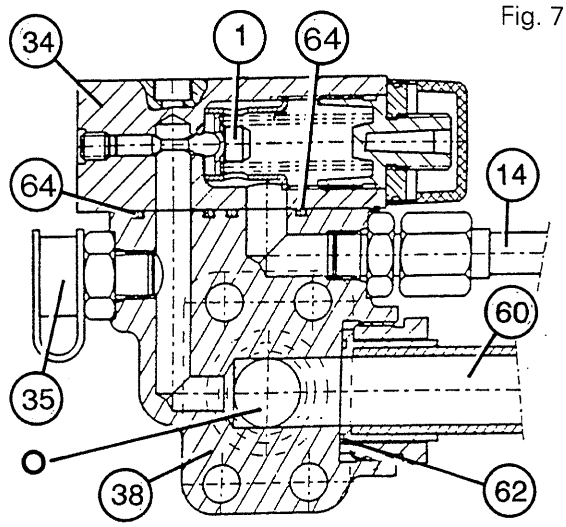


Fig. 7

D. Removing and refitting the pump

Preliminary operations

15. Remove the wheel on the side concerned. Partially drain the oil from the centre housing.

Removal

16. Disconnect and unscrew the 5-bar switch **(21)** and the engine speed sensor **(12)**.
17. Disconnect the parts **(4)**, **(14)**, **(28)** and **(58)** and, if necessary, the return hoses on the selector cover.
18. Unscrew the plug **(40)** and the nut **(42)**.
19. Extract the gear **(44)** using extractor PD 155 C and suitable bolts (Fig. 9).
20. Remove the bolts **(36)** and **(59)**.
21. Dismantle the intake manifold **(32)** and the link pipe **(16)**.
22. Remove the pump. Recover the key **(46)**.

Refitting

23. Carry out the same operations as for removal in the reverse order. Replace the O-rings **(33)**, **(37)**, **(45)** and **(57)**.

Tightening torque

Union **(63)**: 50 Nm
Nut **(42)**: 50 to 60 Nm, with Loctite 241
Bolt **(59)**: 116 to 150 Nm, with Loctite 542
Bolt **(36)**: 50 to 70 Nm
Bolt **(64)**: 116 to 150 NM
Cab front support bolt: 200 to 270 Nm
Rear support nut and lock nuts
- Nut: 27 to 35 Nm
- Lock nuts: 13 to 20 Nm, with Loctite 270

Wheel nuts: 400 to 450 Nm

Sensor adjusting method (12)
Screw the sensor, smeared with Loctite 577 or equivalent, fully home without forcing it. Loosen by three-quarters of a turn in order to obtain a play of about 1 mm between the sensor and the pump gear **(44)**. Tighten the nut **(13)** to between 10 and 15 Nm.

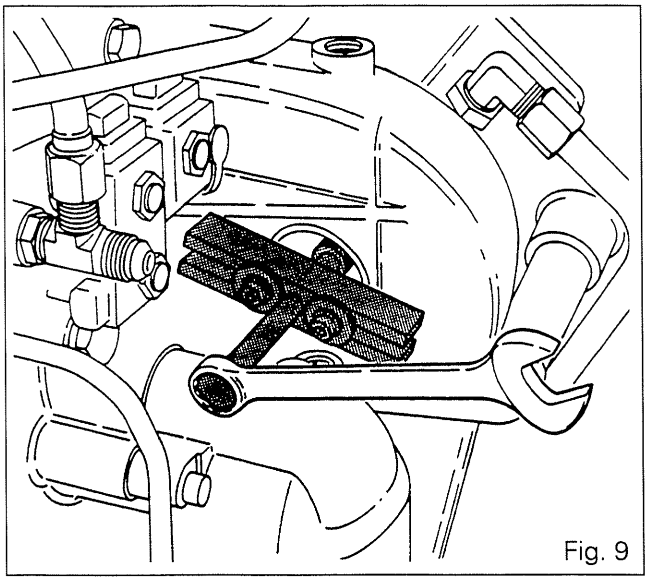


Fig. 9

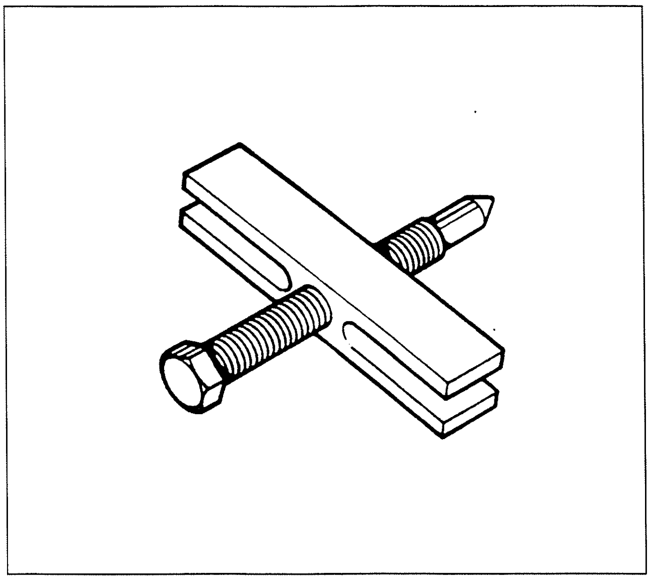
24. Top up the centre housing with oil. Check for leaks on unions and seals. Check that the 5-bar switch **(21)** and the sensor **(12)** operate correctly.

Important:
Before starting the tractor, fill the pump with transmission oil through the port of pipe (58).

E. Service tools

Tools available through the MF network

- **Extractor PD 155 C**



9 F02 Left-hand cover

CONTENTS

General

The left-hand cover (Fig. 1) installed on the centre housing supports the following components:
On its inside face:
- suction pipe **(3)**,
- booster pump **(16)**.

On its outside face:
- suction strainer (150 micrometres) **(2)**,
- override unit **(11)** providing for the various functions of circuits (low and high delivery rate),
- the trailer brake unit **(12)** (if fitted).

Oil is sucked in at the rear end of the centre housing via pipe **(3)**. It is conveyed to the strainer **(2)** and booster pump **(16)** via a channel inside the cover.

The oil is then discharged to the variable displacement pump through the transfer pipe **(6)** and via the main filter.

List of parts

(1) Cover
(2) Strainer
(3) Suction pipe
(4) Nut
(5) O-ring
(6) Transfer pipe
(7) Washer
(8) Key
(9) Bolt
(10) Locating dowel
(11) Override unit
(12) Trailer brake unit (if fitted)
(14) Nut
(15) Gear
(16) Booster pump
(21) Gasket
(25) Bolt
(28) O-ring
(29) Locating pins
(30) Bolt

Overall view

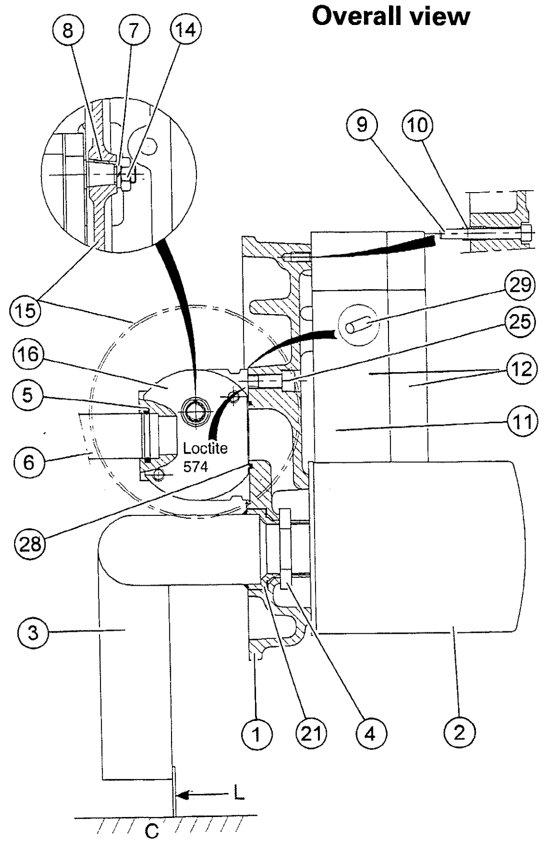


Fig. 1

Exploded view

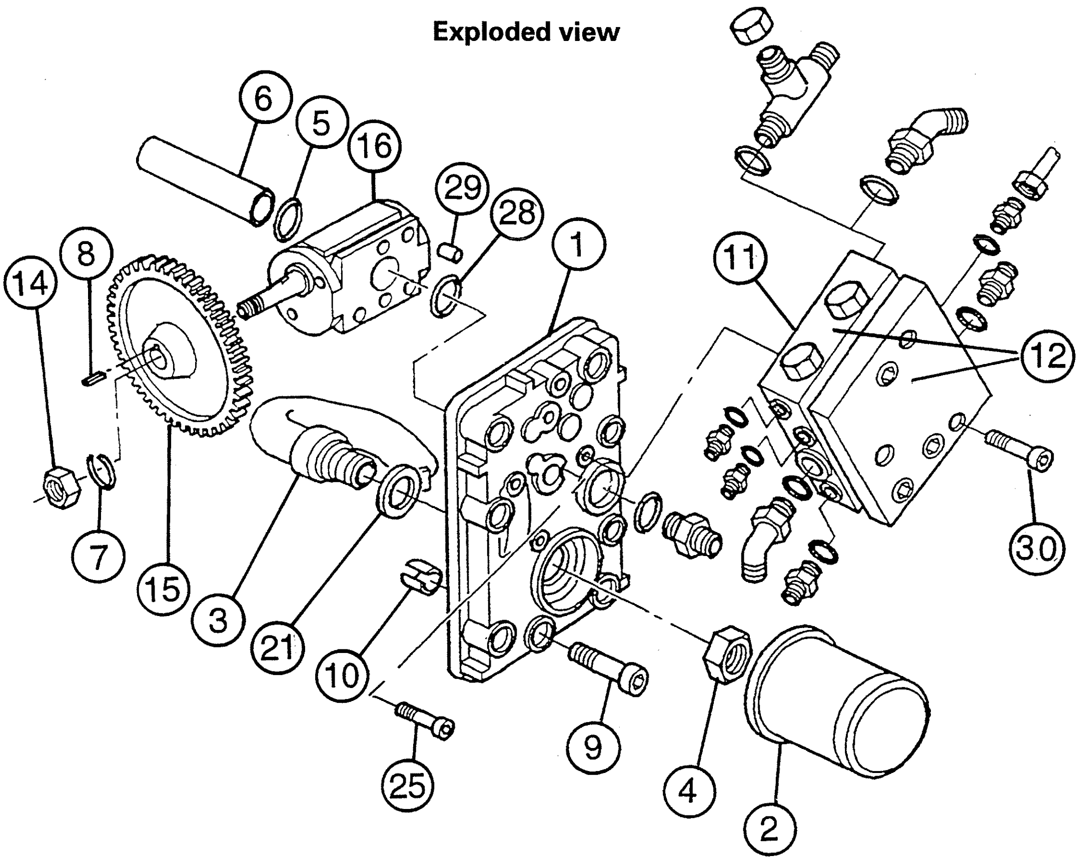


Fig. 2

A. Removing and refitting the cover (Fig. 1)

Removal

1. Remove the wheel, and disconnect the pipes and hoses.
2. Drain the oil from the rear axle housing and remove the strainer **(2)**.
3. Take out bolt **(4)** and remove the cover.
4. If necessary, take the suction pipe **(3)** out of the centre housing.
   Note: On tractors equipped with an auxiliary tank, remove the override unit or the trailer brake unit before removing the cover.

Refitting

5. Replace the O-ring **(5)** of the transfer pipe **(6)**.
6. Clean the mating face between the housing and the cover. Apply Loctite 510 or equivalent on the housing mating face.
7. Check that the pin in the right-hand cover is placed in the slot in the transfer pipe.
8. Position the suction pipe and the gasket **(21)**.
9. Reset the cover, positioning the transfer and suction pipes in their respective ports. Tighten the bolts **(9)**.
10. Clean the thread on the suction pipe. Apply Loctite 241 on the nut **(4)** and tighten it to a torque of 40 to 50 Nm, with the tab **'L'** pressed against the centre housing **'C'** (Fig. 1).
11. Carry out procedures 1 and 2 in the reverse order.
12. Check for leaks from the cover mating face and hydraulic unions.

Tightening torques

- Bolts **(9)**: 130 to 150 Nm
- Strainer **(2)**: lubricate the seal and tighten through one-quarter of a turn after contact with the cover.
- Wheel nuts: 400 to 450 Nm.

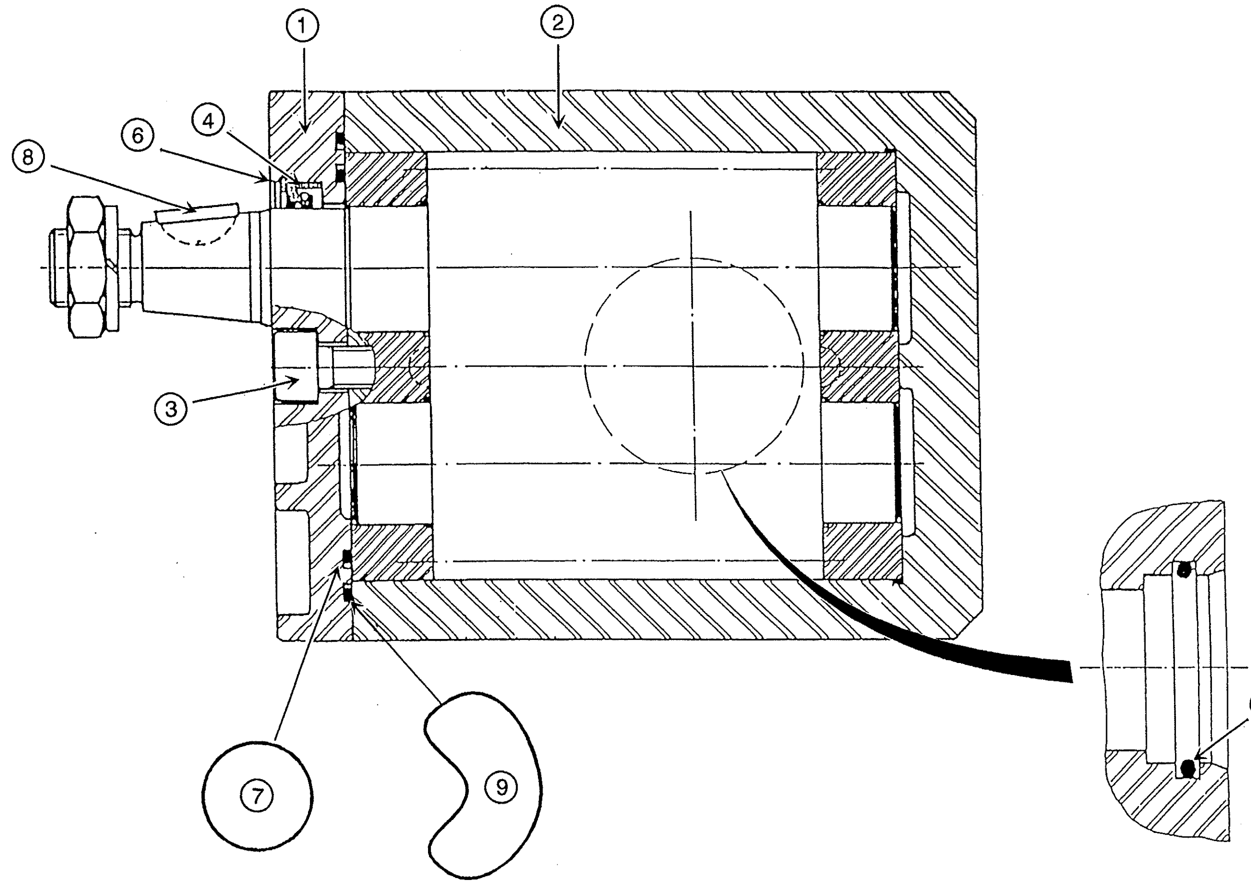


Fig. 3

B. Replacing pump seals (Fig. 3)

Seals can be replaced using kits the contents of which are specified in the spare parts list.

Preliminary operations (Fig. 1)

13. Remove the cover §A, the override unit or the trailer brake unit (if fitted), the hydraulic pump, the gear **(15)** and the key **(8)**.

Removal

Note: The gear can be removed without removing the pump.

A new pump body was introduced as from serial number C188047.

14. Clamp the pump in a vice fitted with plastic jaws.
15. Mark the cover **(1)** and the pump body **(2)** with paint lines.
16. Remove the key **(8)**, bolts **(3)** and the cover **(1)**.
17. Remove the circlip **(6)** and the lip seal **(4)**.

Refitting

18. Lubricate the seal **(4)** and fit it using a suitable fixture. Install the circlip **(6)**.
19. Lightly smear the O-rings **(7)** and **(9)** with miscible grease and position them in the cover **(1)**.
20. Fit the cover **(1)** in accordance with the markings made during removal. Tighten bolts **(3)** to a torque of 30 to 40 Nm.

Final operations (Fig. 1)

21. Position the key **(8)** and refit the gear **(15)**. Fit the washer **(7)** and tighten the nut **(14)** to between 50 and 60 Nm (after applying Loctite 241).
22. Position the locating pins **(29)**.
23. Inside the cover, apply a bead of Loctite 574 or equivalent around the bolt holes **(25)**.
24. Replace the O-ring **(28)**. Refit the pump. Tighten bolts **(25)** to between 40 and 50 Nm (after applying Loctite 221). Refit the override unit or the trailer brake unit (if fitted). Tighten bolts **(30)** to between 25 and 35 nm (after applying Loctite 542).
25. Manually check rotation of the pump.
26. Refit the cover §A and carry out hydraulic tests (see Section 9 J01).

9 G01 Brake and clutch master cylinders

CONTENTS

Hydraulics - *Master cylinders*

General

The brake and clutch master cylinders are supplied and kept at a constant level by a residual flow from the oil cooler.

In the power-assisted braking version, the servo-brake is supplied by the 17 bar circuit.

The brake system is available in the following versions:
- with braking servo-assistance, without trailer brake (Fig. 1),
- with braking servo-assistance, with trailer brake (Fig. 2),
- without braking servo-assistance, without trailer brake (Fig. 3),
- without braking servo-assistance, with trailer brake (Fig. 4).

For closed centre system, see section 9 A01.

List of parts

(1) Supply from oil cooler
(2) Outlet to lubrication
(3) Outlet to clutch master cylinder
(4) Supply bar
(5) Return
(6) Pressure balancing junction
(7) Supply to brakes
(8) Trailer brake control
(9) Orbitrol return
(10) Braking assistance return
(11) Combined return (Orbitrol + braking assistance)
(12) Supply to servo-brake
(13) Bleed screw
(14) Right-hand master cylinder
(15) Left-hand master cylinder
(16) Right-hand servo-brake
(17) Left-hand servo-brake
(18) Trailer braking valve
(19) Trailer junction valve

With braking servo-assistance, without trailer brake (open centre)

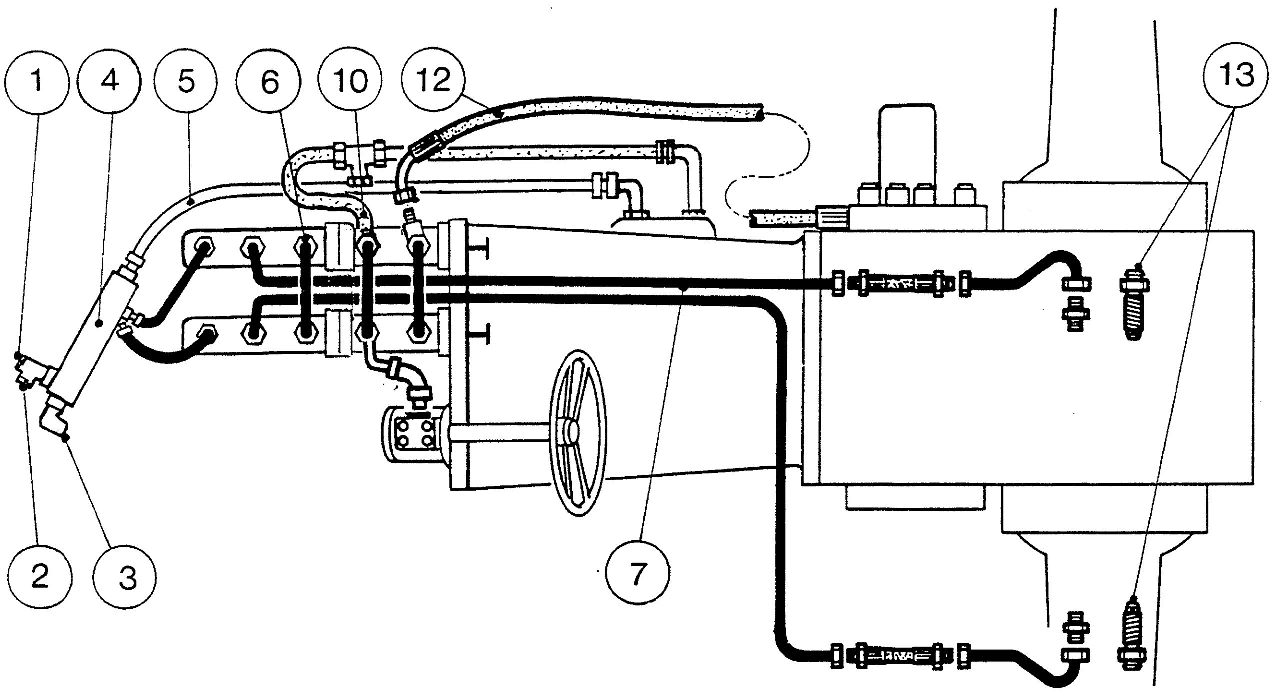


Fig. 1

With braking servo-assistance, with trailer brake (open centre)

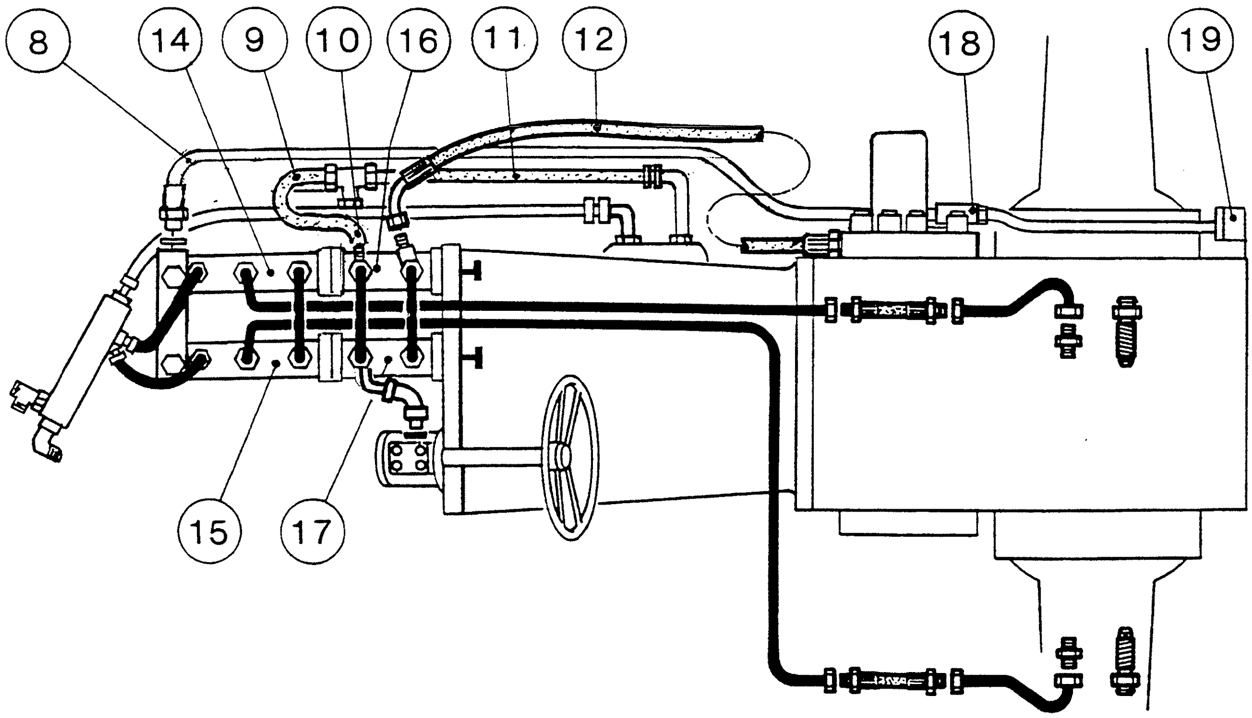


Fig. 2

Hydraulics - *Master cylinders*

Without braking servo-assistance, without trailer brake (open centre)

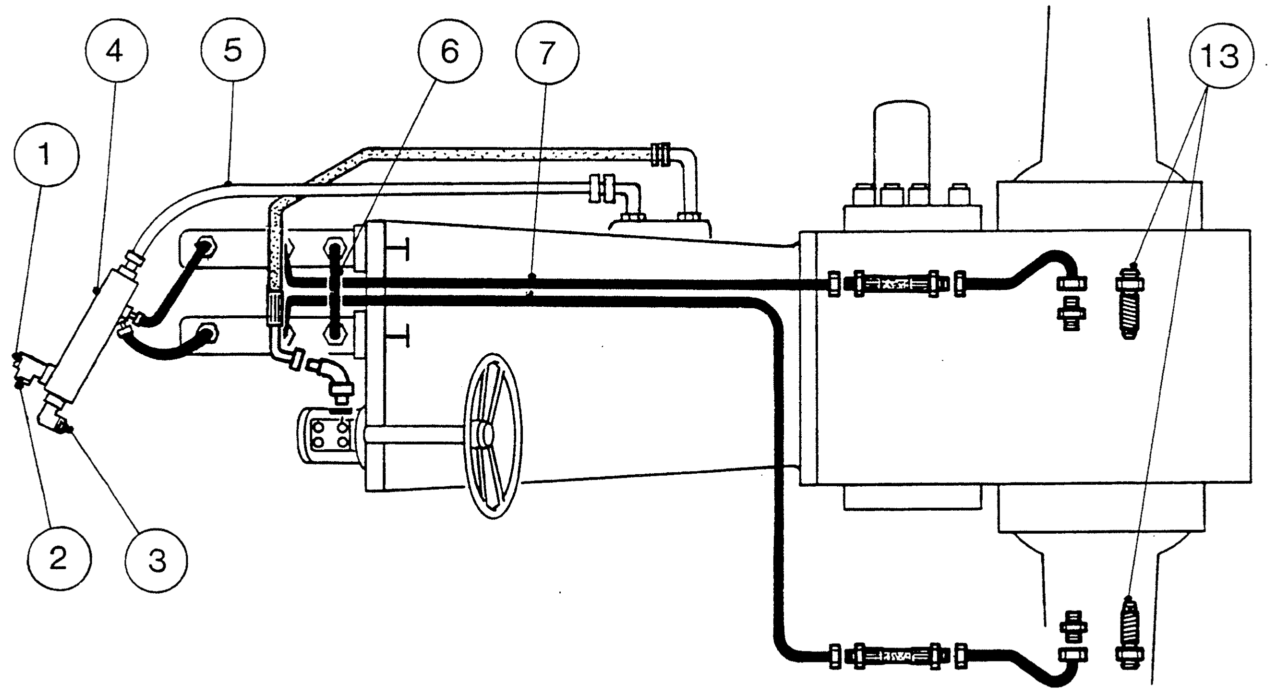


Fig. 3

Without braking servo-assistance, with trailer brake (open centre)

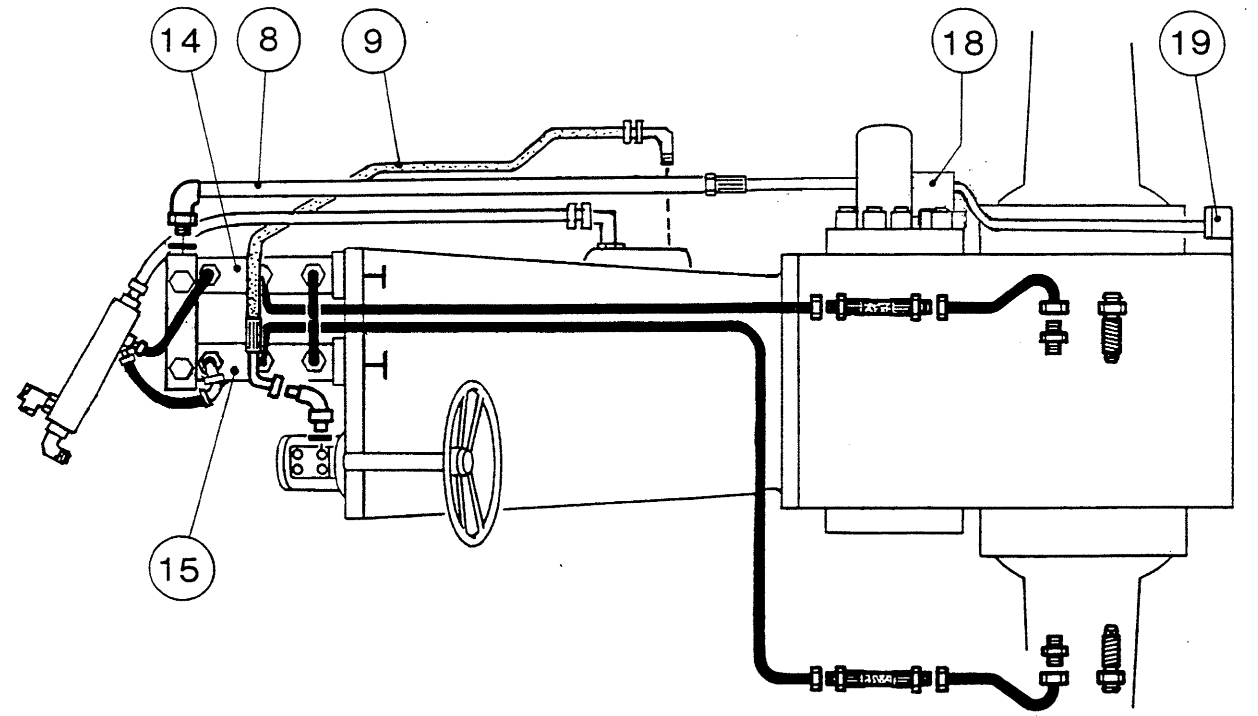


Fig. 4

A. Working on brake and clutch master cylinders

If it should prove necessary to dismantle the master cylinders, clean all parts carefully. Replace any parts which are scratched or deformed.
Brake and clutch master cylinder repair kits can be found in the spare parts catalogue.
After disassembling or replacing brake master cylinders, bleed the main brake circuit and the trailer brake circuit (if fitted). Proceed as described in section 9 B01 or 9 M01 depending on the version. Check the adjustment of servo-brake rods and pedals (see parts D and E).
After disassembling or replacing the clutch master cylinder, bleed the circuit and proceed as described in section 4 A01. Check the pedal adjustment (see section 4 A01).

B. Master cylinder without servo-assistance, with trailer brake

Operation with pedals unlatched (Fig. 5)

The effort applied on a pedal, transmitted by rod **(5)**, moves the piston **(4)** in the bore of the active master cylinder. The valve **(1)** closes the feed port, the balancing valve **(3)** is opened by the piston **(4)** and the ball **(2)** and oil is fed under pressure to the ports of the main brake **C** and of the pressure balancing junction **D**.
Through the junction, the pressure closes the valve **(3)** of the passive master cylinder.
Action on piston **(4)** also causes the movement of piston **(6)** and the closing of valve **F**. The oil contained in chamber **E** is channelled via the connecting bar to chamber **E'** and to port **B'** via the open valve **F'** in the passive master cylinder.
The assembly comprising valve **F** and piston **(6)** quickly reaches the end of the active master cylinder.
In this position, only the tractor brake is actuated, and the trailer is not braked.

Operation with pedals latched

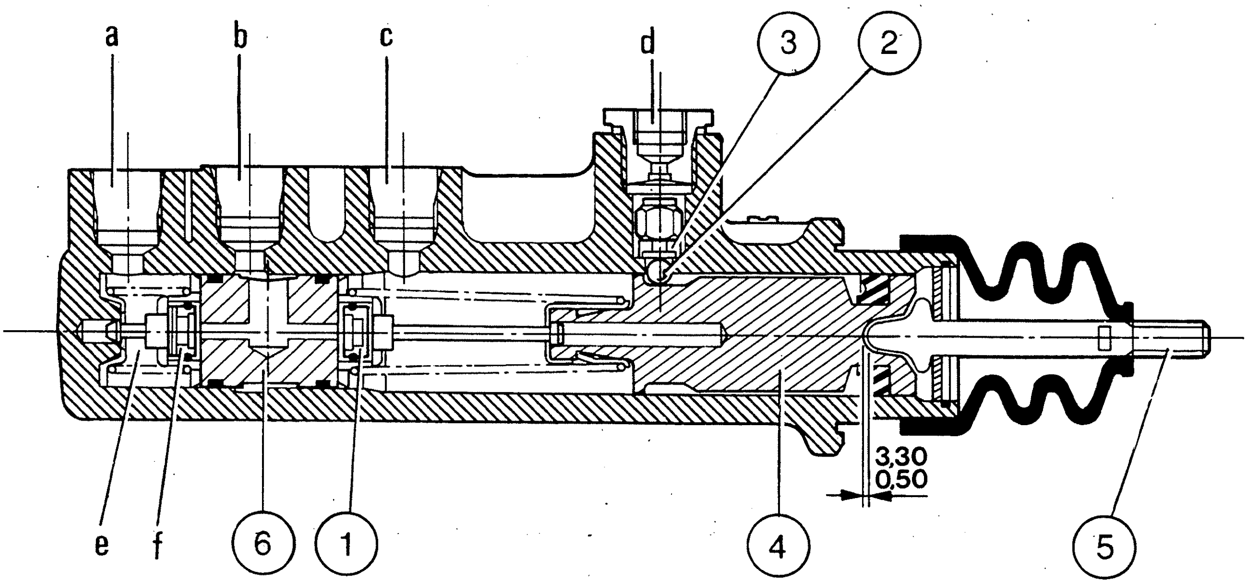
Braking and pressure balancing

The effort applied on both pedals, transmitted by the push rods **(5)** moves the pistons **(4)** in the bores of the two master cylinders. The two valves **(1)** close the feed ports, the two balancing valves **(3)** are opened by the pistons **(4)** and balls **(2)**. The pressure is balanced in the two master cylinders by the balancing junction **D**.
The pressurised oil is also directed to ports **C** and **C'** of the main brake circuit.

Trailer braking

Continuous action of pistons **(4)** and **(6)** closing valves **F** and **F'**. Chambers **E** and **E'** are pressurised and feed the control valve of the trailer brake via ports **A** and **A'**.

Fig. 5



a Control of trailer brake valve
b Supply to master cylinders via bar
c Supply to main brake
d Pressure balancing junction
e Trailer brake pressure chamber
f Valve

C. Master cylinder and servo-brake assembly (Fig. 6)

Description

The servo-brake is located between the brake pedal and the master cylinder. It is fitted to the rear of the master cylinder and uses the pressure of the 17 bar circuit to help move the piston of the master cylinder.
A. Servo-brake supplied with 17-bar pressure
B. Master cylinder with trailer brake control port

Designation of ports

a - Trailer braking control
b - Supply from bar
c - To main brake
d - Pressure balancing valve
e - To housing return
f - 17-bar supply

1. Operation of servo-brake

Rest position

Piston **(9)** is pushed to the right by the action of spring **(12)**.
The 17-bar pressure passes via port **f** to groove **(2)** where it is blocked by slide valve **(5)**. Chamber **T** is linked to the return **e** by hole **(8)**, the central channel **(4)** and the open port **(1)**.

Operating position

When the brake pedal is operated, force is transmitted to the slide valve **(5)** via piston **(6)**. The slide valve **(5)** is pushed to the left and shuts off the link to the reservoir via the supply port **(1)**. Communication is established between hole **(3)** and groove **(2)**. The pressurised oil passes through the supply opening to the rear of piston **(9)** via the channel **(4)** and hole **(8)** and builds up in front of piston **(6)** until balance is achieved between the resistance of the master cylinder, via the push rod **(11)**, and the force applied on piston **(9)**.
The pressure exerted on the face of piston **(6)** produces a force in reaction to the effort on push rod **(7)**. This balance gives a waiting position where the slightest modification in the force on the pedal corresponds to an increase or reduction in pressure, until the balance is restored. The system's boosting factor is the ratio between the surfaces of pistons **(6)** and **(9)** 1/4-4.

Maximum braking position

In this position, full communication is established between the groove **(2)** and hole **(3)**. The slide valve **(5)** is at the end of its travel on pad **(10)**, the total possible pressure (17 bar) is exerted on the rear of piston **(9)** and the maximum assistance power is obtained. The booster is then at saturation point and the force on the master cylinder can only be increased by a greater force on the pedal.

Maintenance

The servo-brake does not require any maintenance. Faulty parts must be completely replaced.

2. Operation of master cylinders with trailer brake

Pedals unlatched (Fig. 6)

Tractor braking and balancing

The effort applied on a pedal, transmitted by slide valve **(11)** via the servo-brake, moves piston **(13)** in the bore in the active cylinder. Valve **(14)** closes the supply port, the balancing valve **(17)** opens and the oil is sent under pressure to ports **c** and **d**. The pressure via port **d** closes valve **(17)** of the passive master cylinder.

Trailer braking

Action on piston **(13)** also causes the movement of piston **(15)** and the closing of valve **(16)**. The oil contained in chamber **V** is channelled to chamber **V'** of the passive cylinder and to port **B'** via the open valve **(16')**. The assembly comprising valve **(16)** and piston **(15)** quickly reaches the end of the active master cylinder.
In this position, only the tractor brake is actuated, and the trailer is not braked.

Pedals latched

Braking and pressure balancing

The effort applied on the two pedals, transmitted by rods **(11)** via the servo-brake, moves pistons **(13)** in the bores in the two master cylinders. The beginning of the travel of each piston displaces a volume of oil and closes the two valves **(14)**. The simultaneous movement of pistons **(13)** opens the balancing valves **(17)** and prevents them from closing again. The pressures are balanced in the two master cylinders by the connecting pipe screwed onto port **d**. The pressurised oil is also directed to the tractor brake ports **c**.

Trailer braking

Continuous action on pistons **(13)** and **(15)** closes valves **(16)** and **(16')**. Chambers **V** and **V'** which are pressurised, supply the trailer braking valve via ports **a** and **a'**.
In the case of failure on the tractor brake circuit, the trailer is still braked although the tractor is not.
In case of failure of the trailer braking valve or of its pipes, the tractor is still braked.
Note: In versions without trailer braking, the master cylinder has no port «a» or valve (16) and piston (15).

Hydraulics - Master cylinders

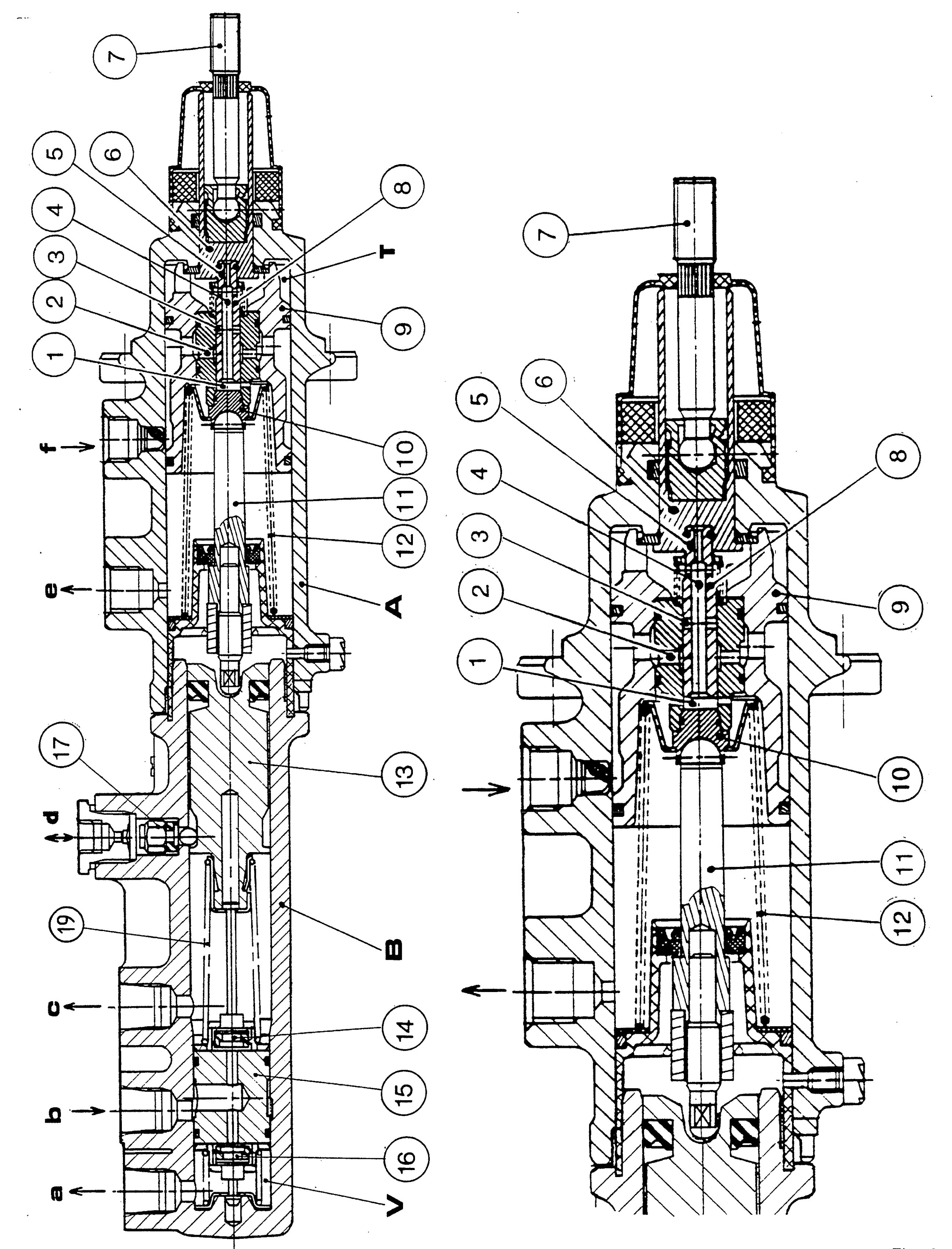


Fig. 6

Hydraulics - Master cylinders

D. Adjusting the servo-brake rod (Fig. 7)

1. Measure the position of the piston **(13)** in the master cylinder with respect to the flange, on side **A**. Do not compress the spring **(19)** (Fig. 6).
2. Apply Loctite 542 on the thread of the nut on the push rod.
3. Position the push rod in the brake servo-assistance mechanism.
4. Measure the position of the end of the push rod **(11)** from the servo-brake flange on side **B**. Do not compress the spring **(12)** of piston **(9)**.
5. Correct the length of the push rod in order to obtain a play of: **J = 0.5 ± 0.25 mm** between the push rod **(11)** and piston **(13)**.

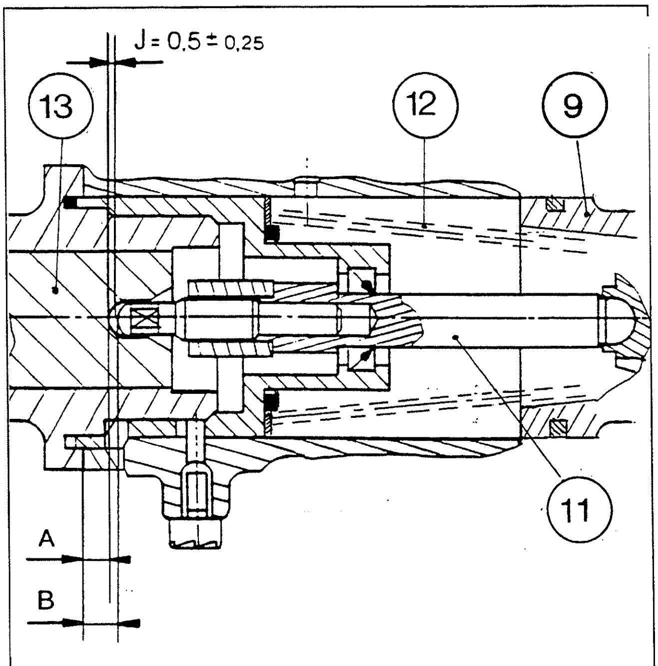


Fig. 7

E. Adjusting the brake pedals (Fig. 8)

1. Coat the pins **(5)** and **(6)** with molybdenum bisulphide.
2. Apply Loctite 542 on the clevis **(1)** and screw it onto the rod **(2)**.
3. Fit the return spring **(3)**.
4. Adjust the clevis **(1)** in order to obtain a distance of **X** or **Y** between the support **(4)** and the clevis attaching pin.
   X = 113 ± 0.5 without servo-brake
   Y = 139 ± 0.5 with servo-brake
5. Proceed in the same manner for the second clevis and check that the twinning mechanism operates smoothly.
6. Manually check the operation of each pedal to ensure that it operates freely.

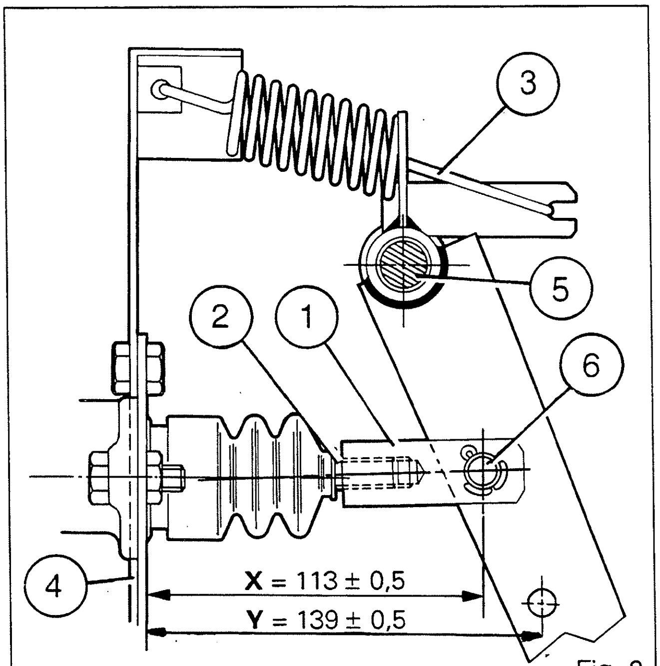


Fig. 8

F. Bleeding the main brake circuit

1. Connect a transparent pipe (with an inside diameter of 6 mm) onto each right-hand and left-hand bleed screw on the axle housing.
2. Plunge the end of both pipes into a receptacle partially filled with transmission oil.
3. Run the engine at approximately 1,200 rpm. Turn the steering wheel several times in order to drive out the air from the steering circuit.
4. Using a clamp and suitable protection, block the return hose **(1)** (Fig. 9).
5. Open the right-hand bleed screw. Check that there are no leaks between the pipe and the bleed screw.
6. Uncouple the brake pedals.
7. Press **slowly** on the right-hand pedal until it reaches its end of travel and then release it in the same manner. Repeat this operation several times until the oil flowing out does not contain any air bubbles.
8. Close the bleed screw.
9. Open the left-hand bleed screw and carry out the same operations as described above.
10. Close the bleed screw and remove the clamp from the return hose.
11. Recouple the brake pedals.
12. Operate each pedal several times in order to position the brake pistons.
13. Check the hardness of each pedal when an effort is applied.
    Note: If an operating problem occurs, carry out the bleeding procedure a second time.
    If the problem persists, check for leaks on:
    - ***the circuit,***
    - ***the master cylinders,***
    - ***the piston seals.***
14. Bleed the trailer brake circuit and check the pressure (see section 9 B01 or 9 M01 depending on the version).

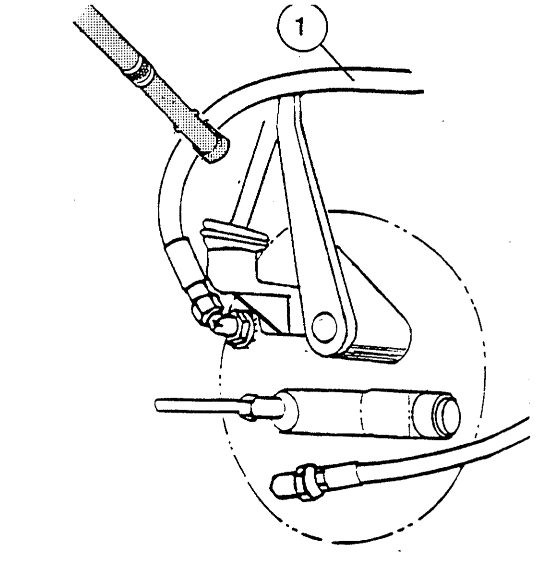


Fig. 9

9 H01 Dynashift control

CONTENTS

Hydraulics - *Dynashift control*

General

The system control assembly consists of the three following main parts (Fig. 1) :

- **The distribution unit (1)** fitted on the right side of the gearbox, consists of two distinct parts which control the clutch and the four Dynashift ratios. The Dynashift part includes two internal oilways A and B (Fig. 3) allowing the oil to circulate from one solenoid valve to the other.

- **The solenoid valves (2)** are screwed into the distribution unit, they include:
  . the lower solenoid valve EV1 with four ports and two positions.
  . the upper solenoid valve EV2 with three ports and two positions.

- **The accumulator (3)** fitted on the distribution unit, on the inlet line, enhances the oil flow to fill the Dynashift unit piston chambers when necessary. Thus piston reaction is maintained.

Make	:	Olaer
Type	:	1/20
Capacity	:	1 litre
Gas	:	Nitrogen
Pressure	:	9 ± 1 bar (must be checked every 6 month, with engine stopped)

Note: When the engine is stopped, the accumulator maintains a pressure of 17 bars for a short period. If immediate maintenance action is necessary on the system, proceed with caution.

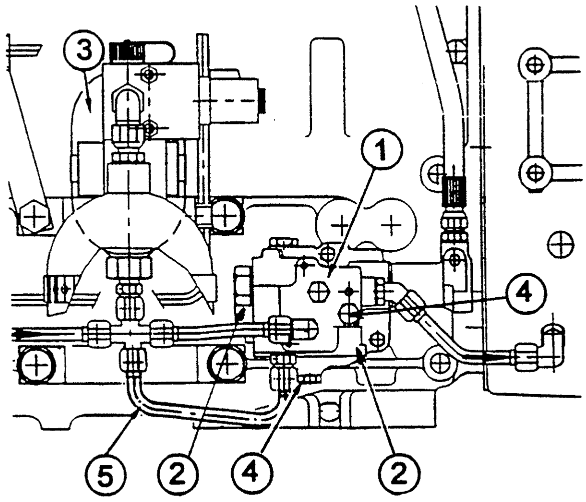


Fig. 1

Two test couplers **(4)** may be fitted to check the pressure in the piston chambers.
The distribution unit oil is supplied by the pipe **(5)**. The return oil, from the piston chambers goes directly inside the gearbox housing.

Lubrication

The oil flow coming from the cooler lubricates the mechanical elements of the Dynashift, reverse shuttle unit, gearbox and P.T.O. shaft which pass through the transmission (see section 5 A01).
An external pipe (T) (Fig. 2) fitted above the centre housing also directs the oil to the P.T.O. clutch.

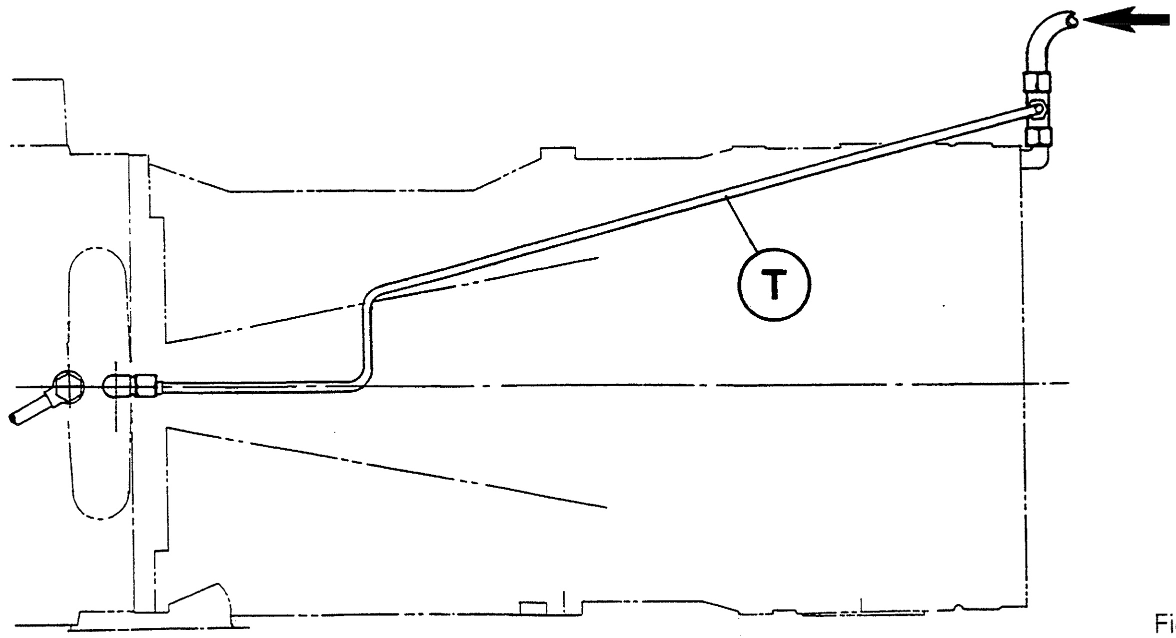
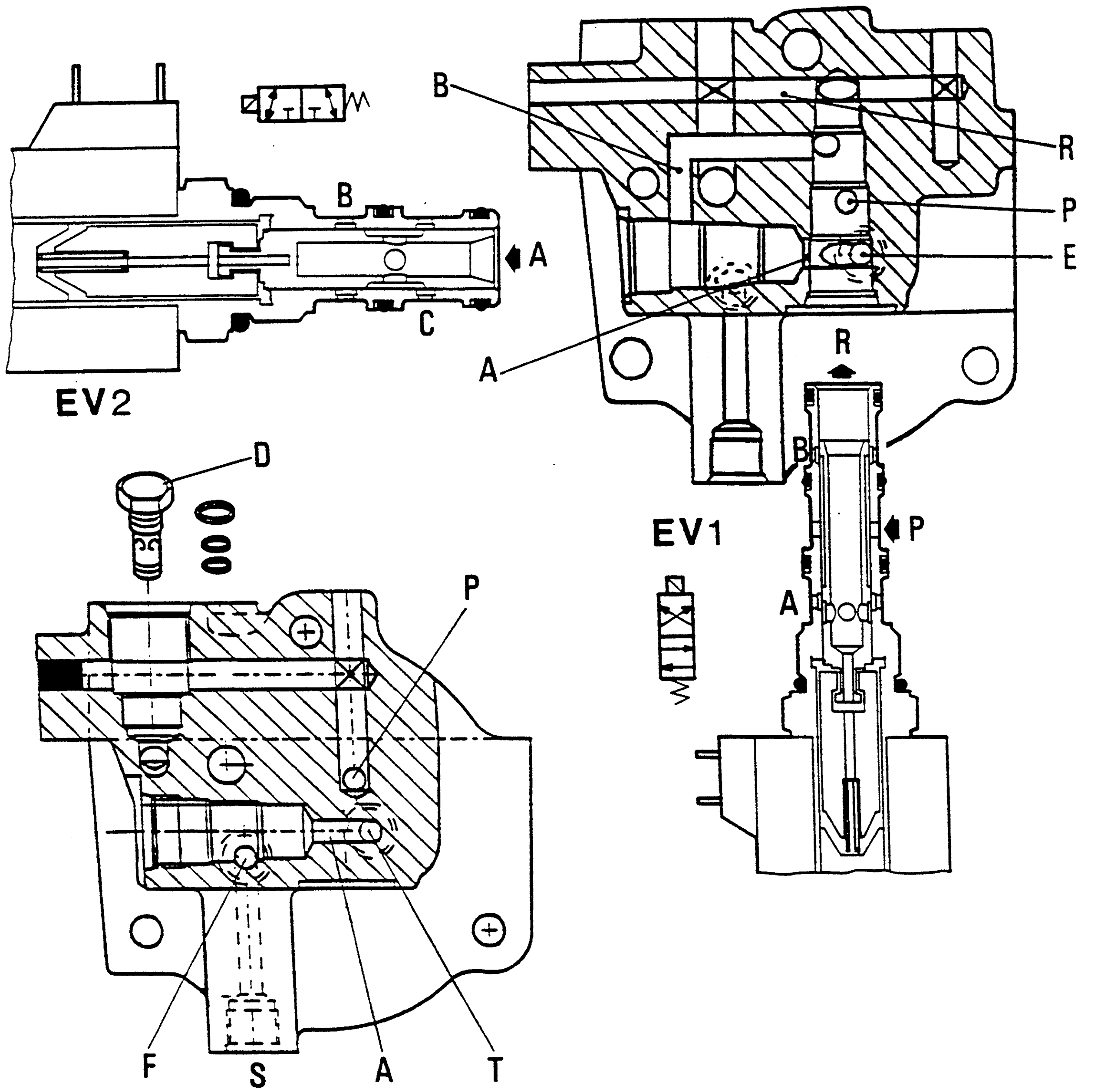


Fig. 2

Description of ports and galleries



A : Internal oilway
B : Internal oilway
C : To S
D : Non-return valve
E : Port to front piston
F : Port to rear piston
P : Pressure (17 bar)
R : Return
S : Rear piston test coupler
T : Front piston test coupler
EV1 : Solenoid valve 4 x 2
EV2 : Solenoid valve 3 x 2

Fig. 3

A . Ratios explanation

Refer to chapter 5 B01 for the theoretical operation and the mechanical explanation of the ratios.

Ratio A (Fig. 4)

Solenoid valve EV1 is supplied, thus allowing oil under pressure to reach gallery A. This gallery directs the oil to the front piston via orifice E, and also, to solenoid valve EV2. Since EV2 is in neutral position, the oil can circulate through the spool valve and orifice F to the rear piston chamber. Both pistons are thus under pressure.

Ratio B (Fig. 5)

A gear change from A to B is obtained when both solenoid valves are supplied. The oil flow to the rear piston is thus interrupted. The rear piston is pushed back by springs which send oil back into gallery B. This gallery communicates with the sump via solenoid valve EV1.

Ratio C (Fig. 6)

A gear change from B to C is obtained by interrupting the electrical supply to solenoid valve EV1, solenoid valve EV2 remains energized. Gallery A is no longer under pressure but is connected to the sump. Consequently, the front piston can return to neutral position.
Gallery B is under pressure. The oil circulates to the rear piston through solenoid valve EV2.

Ratio D (Fig. 7)

Ratio D is obtained by cutting the electrical supply to EV2. The two pistons are connected to the sump by gallery A.

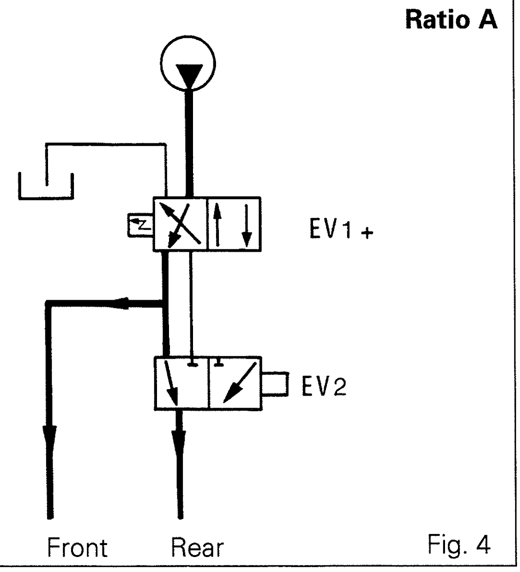


Fig. 4

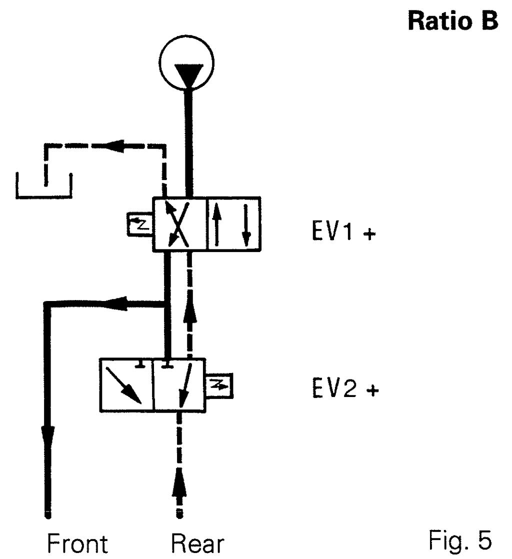


Fig. 5

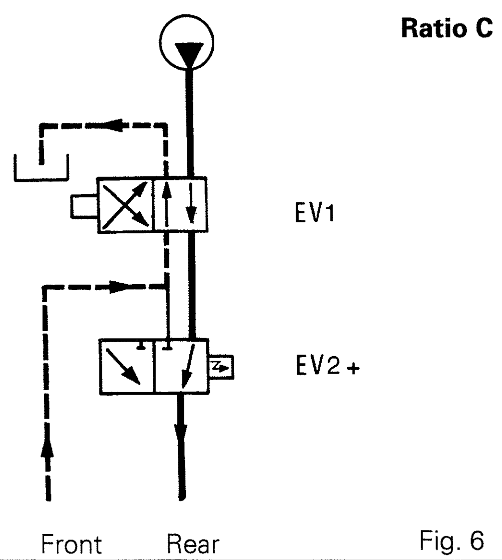


Fig. 6

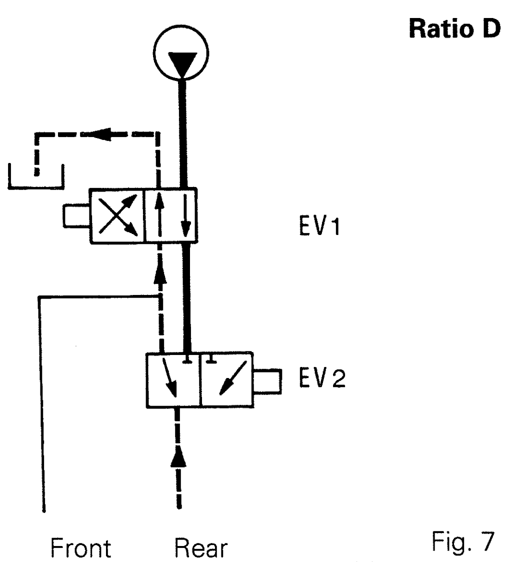


Fig. 7

B. Checking the pressure of Dynashift pistons (Fig. 8)

1. Remove the guard preventing access to the connectors (30 kph tractors).
2. Remove plugs **(1)** from the distribution unit.
3. Screw in two male connectors **(2)** and **(3)**, ref. 3384387M1, and connect them to the couplers, ref. 3582045M1, fitted onto pressure gauges with a capacity of about 30 bar.
4. Start the engine.
5. Operate the lever under the steering wheel to select each ratio (A, B, C and D).
6. Check that the pressures are correct, using the following table :

Ratio	Front piston connector **(2)**	Rear piston connector **(3)**
A	17 bar	17 bar
B	17 bar	0
C	0	17 bar
D	0	0

7. If the pressures are not correct, check the movement of the spool of the solenoid valves, refer to the electrical tests.
8. Refit the guard and seal the fixing bolt with lead.

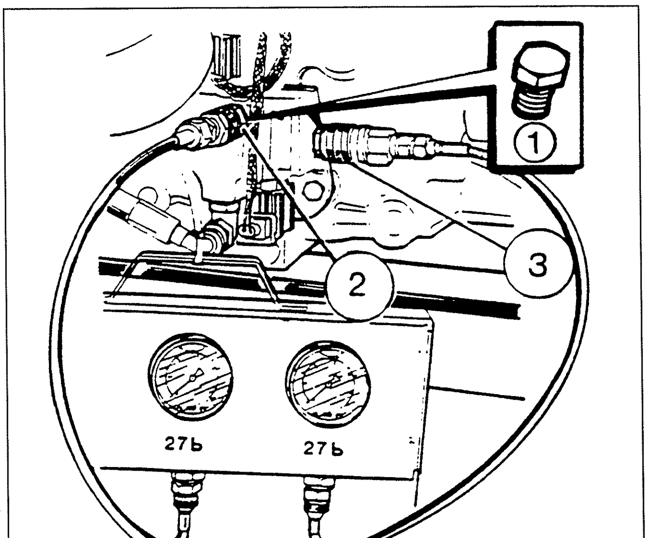


Fig. 8

9 I01 Wet clutch control valve

CONTENTS

Hydraulics - *Wet clutch valve*

General

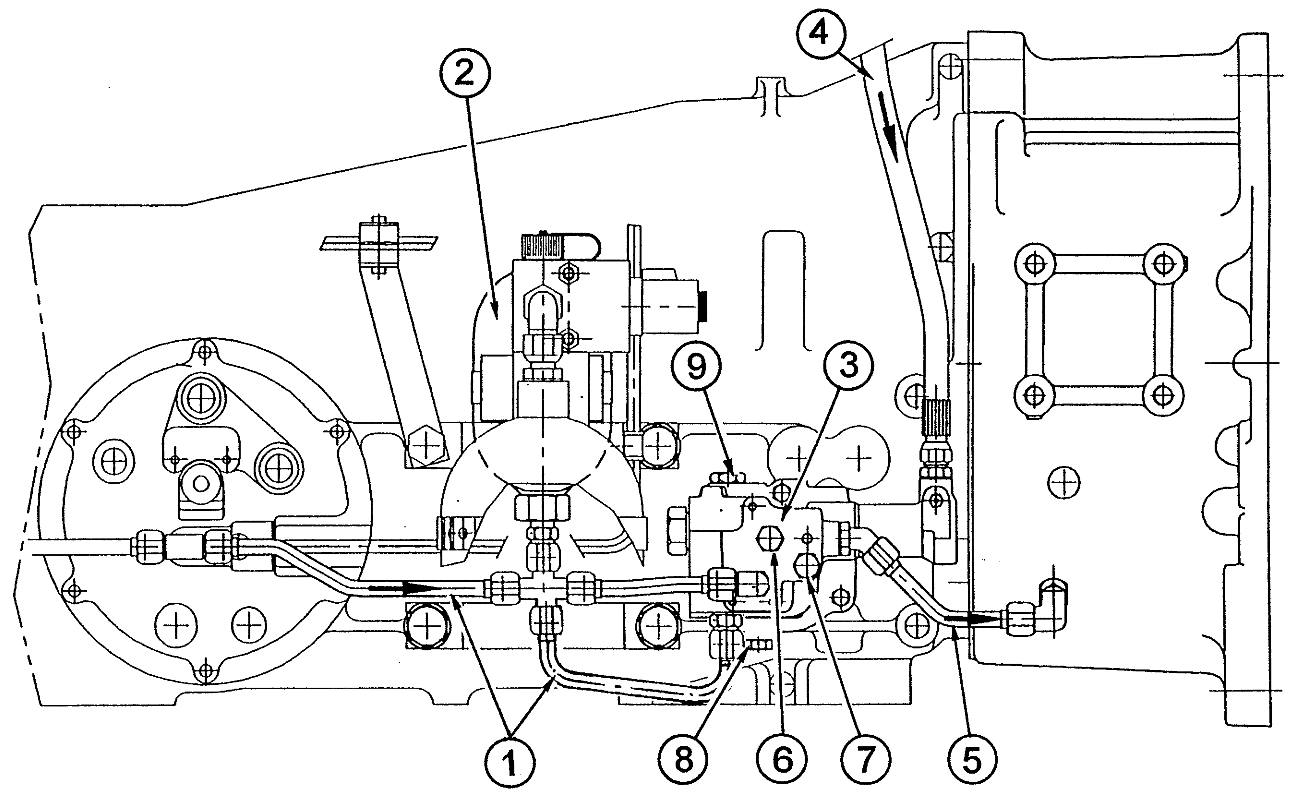
The new distribution unit **(3)** (Fig. 1) installed on the front right-hand side of the gearbox consists of two separate sections, one for clutch control and the other controlling the four Dynashift ratios.

- **Clutch section**: This consists of a series of spools, seals, a check valve and a piston, which are replaceable using kits the contents of which are described in the spare parts catalogue.
- **Dynashift section**: see section 9H01.

Purpose of the control valve

This valve installed on the 17-bar system performs the following functions:

- Supply to the clutch at 17 bars when the clutch pedal is released (in clutch engaged position).
- Modulation of clutch engagement pressure: 0 to 11 bars.
- Starting safety when the tractor is started up by external means. To activate the clutch, the clutch pedal must be pressed once.
- Low hydraulic pressure safety on starting the tractor. The clutch only works if the supply pressure is more than 12 bars. The clutch is automatically disengaged if the pressure falls below 3 bars.
- The ports «**O**» (Fig. 2) allow the return of leaks to the housing.



1. 17-bar supply
2. Accumulator
3. Distribution unit
4. Master cylinder hose
5. Clutch supply pipe
6. Clutch diagnostic connector
7. Dynashift front diagnostic connector
8. Dynashift rear diagnostic connector
9. Dynashift non-return valve

Fig. 1

Description

The valve comprises two spools. The upper spool actuated by the clutch master cylinder controls supply to the clutch.

The lower spool actuated by the inlet pressure ensures the system's hydraulic safety function.

A . Clutch valve operating phases

Neutral position, engine running (Fig. 2)

If the tractor is started without pressing on the clutch pedal, the pressure rises to 17 bars but all the intake ports are closed and the clutch is not hydraulically supplied.

Clutch disengagement before switching the safety valve (Fig. 3)

The main spool **(5)** is pushed rearwards and compresses the spring **(2)** under the action of the piston **(19)** actuated by the master cylinder. The pressure from the 17-bar system passes via the shoulder of the main spool **(5)** and starts to act on the front face of spool **(4)**. The clutch is then connected to the return.

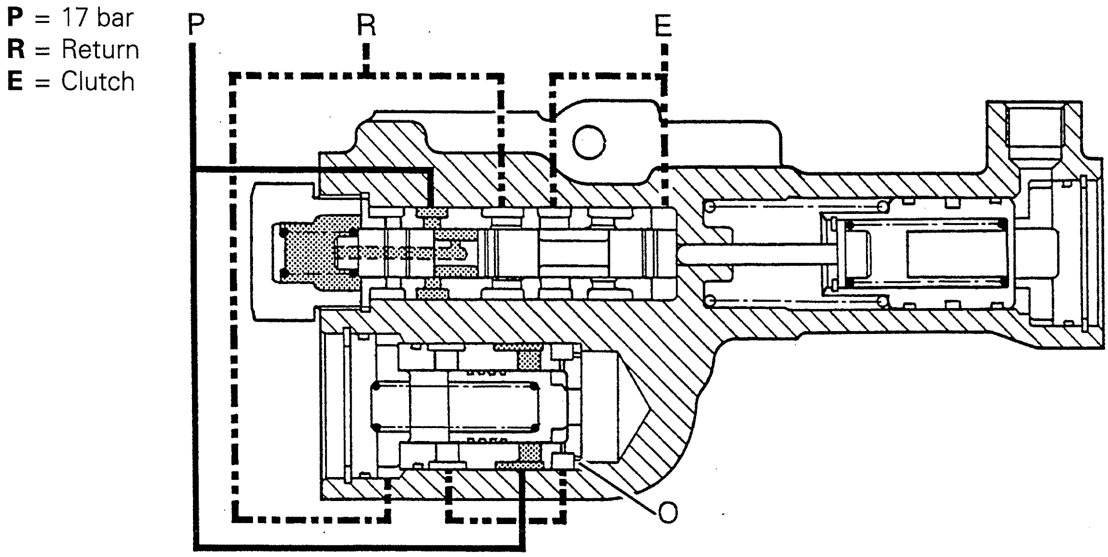


Fig. 2

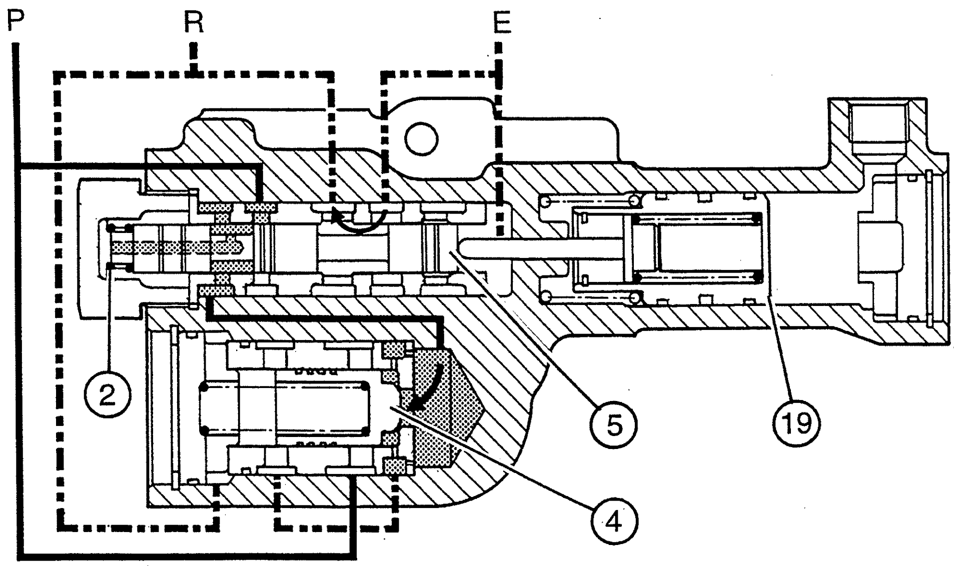


Fig. 3

Hydraulics - Wet clutch valve

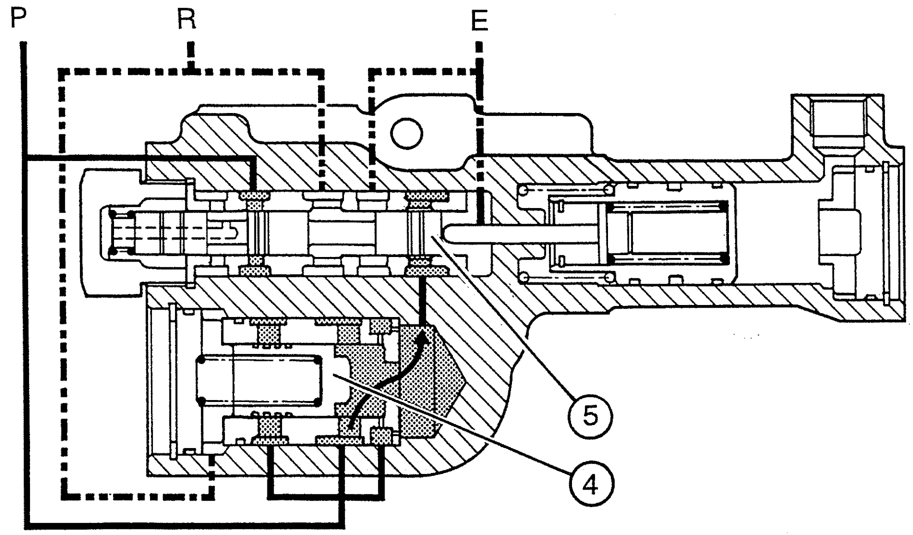


Fig. 4

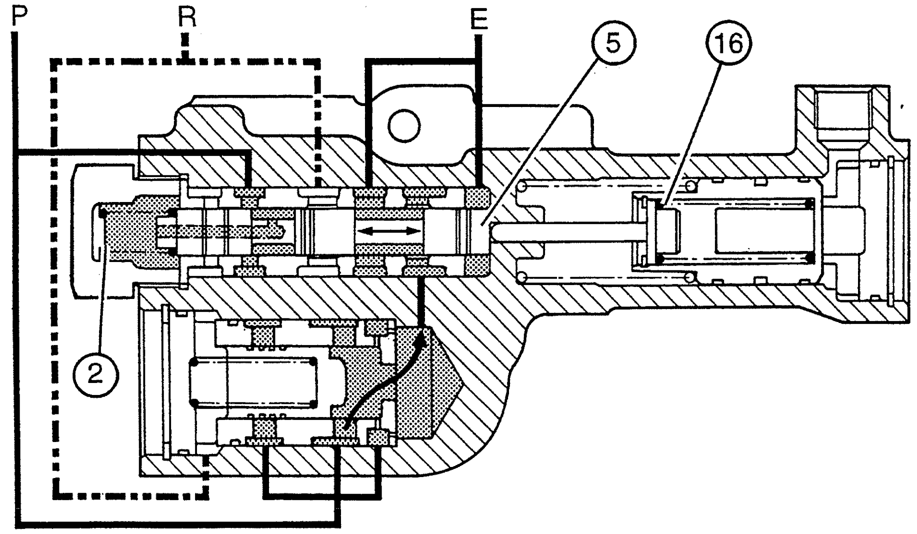


Fig. 5

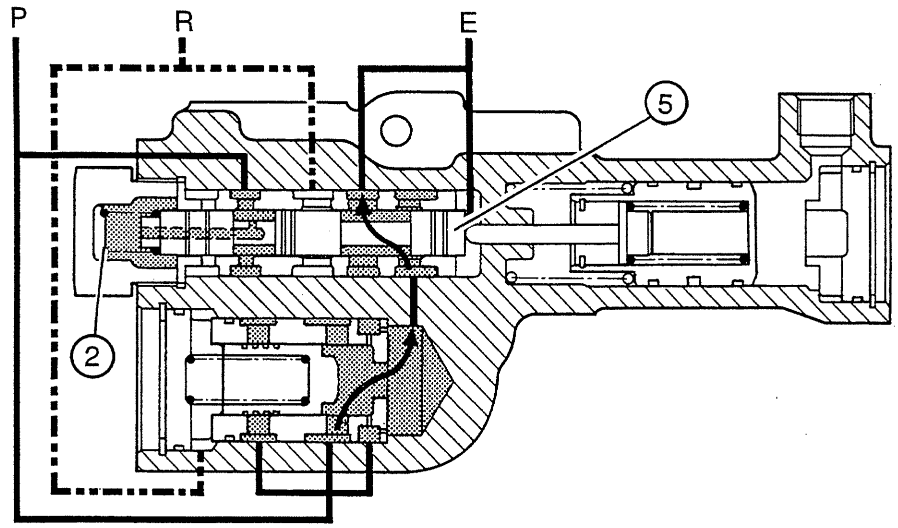


Fig. 6

Clutch disengagement, switching of safety valve (Fig. 4)

Spool **(4)** moves rearwards when the pressure is greater than 12 bars. When fully open, spool **(4)** allows communication with the front of the main spool **(5)**.

Clutch engagement, modulation phase (Fig. 5)

When the clutch pedal is released, the pressure supplying the clutch is modulated by the position of the main spool **(5)**.
This position is regulated:
- at the rear, by the 17-bar pressure and spring **(2)**,
- at the front, by the clutch engagement pressure and spring **(16)**.

When the pedal is slightly released, the tension of spring **(2)** decreases. The main spool **(5)** moves forward and allows communication between the 17-bar line and the clutch.

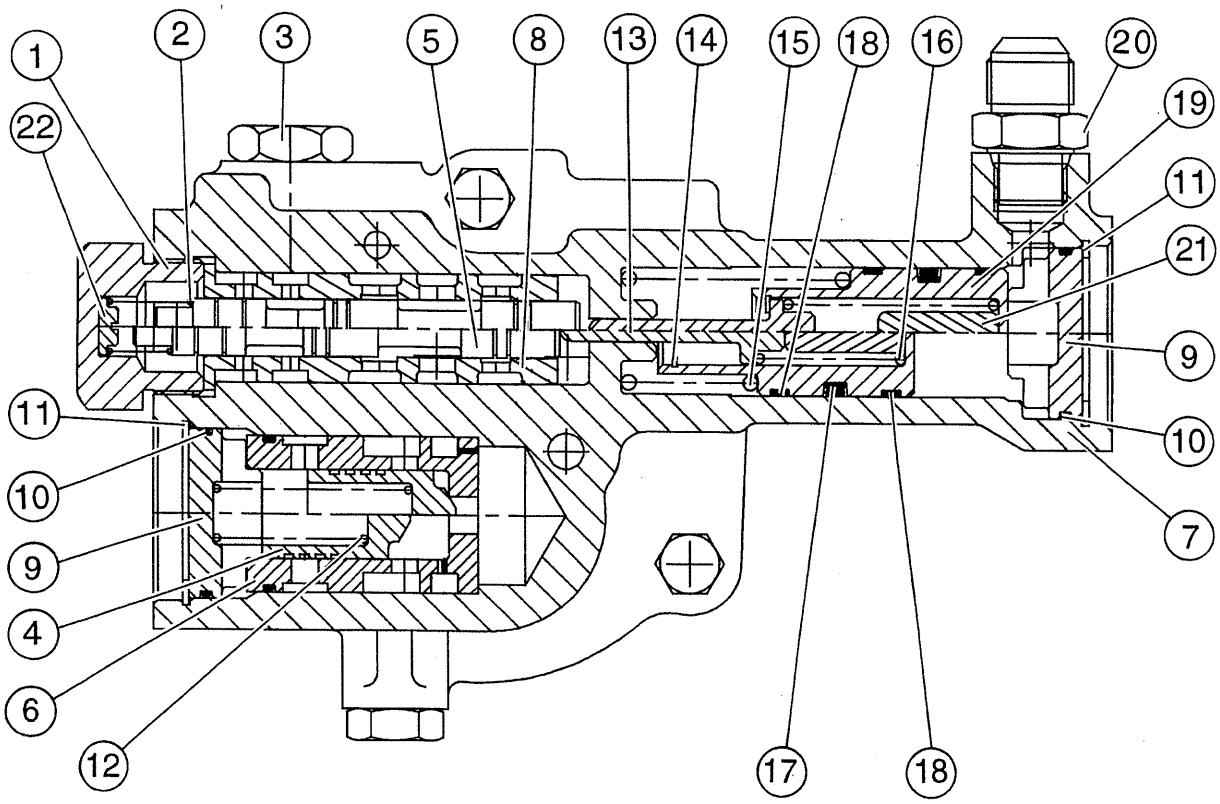
The pressure in the clutch increases, pushing the spool rearwards in its position of equilibrium.
From this intermediate position, while slightly pressing the pedal, the load on spring **(2)** increases. The spool moves rearwards, opening communication between the clutch and return.
The pressure in the clutch decreases and the spool moves forwards to its position of equilibrium.
Modulation is actuated when the pedal has been depressed by about 25 mm. The fully disengaged position is reached 25 mm before the pedal end of travel (Fig. 10).

Clutch fully engaged position (Fig. 6)

When the pedal is completely released, spring **(2)** pushes spool **(5)** forwards causing the 17-bar system to open fully to the clutch.

Hydraulics - *Wet clutch valve*

Overall view



List of parts

- **(1)** Plug
- **(2)** Spring
- **(3)** Non-return valve
- **(4)** Safety valve spool
- **(5)** Main spool
- **(6)** Main spool sleeve
- **(7)** Valve body
- **(8)** Pressure valve sleeve
- **(9)** Plugs
- **(10)** O-ring
- **(11)** Circlip
- **(12)** Spring
- **(13)** Pusher
- **(14)** Circlip
- **(15)** Spring
- **(16)** Modulation spring
- **(17)** Quadring seal
- **(18)** Guide rings
- **(19)** Piston
- **(20)** Calibrated coupling
- **(21)** Modulation limit stop
- **(22)** Spool limit stop

Fig. 7

Exploded view

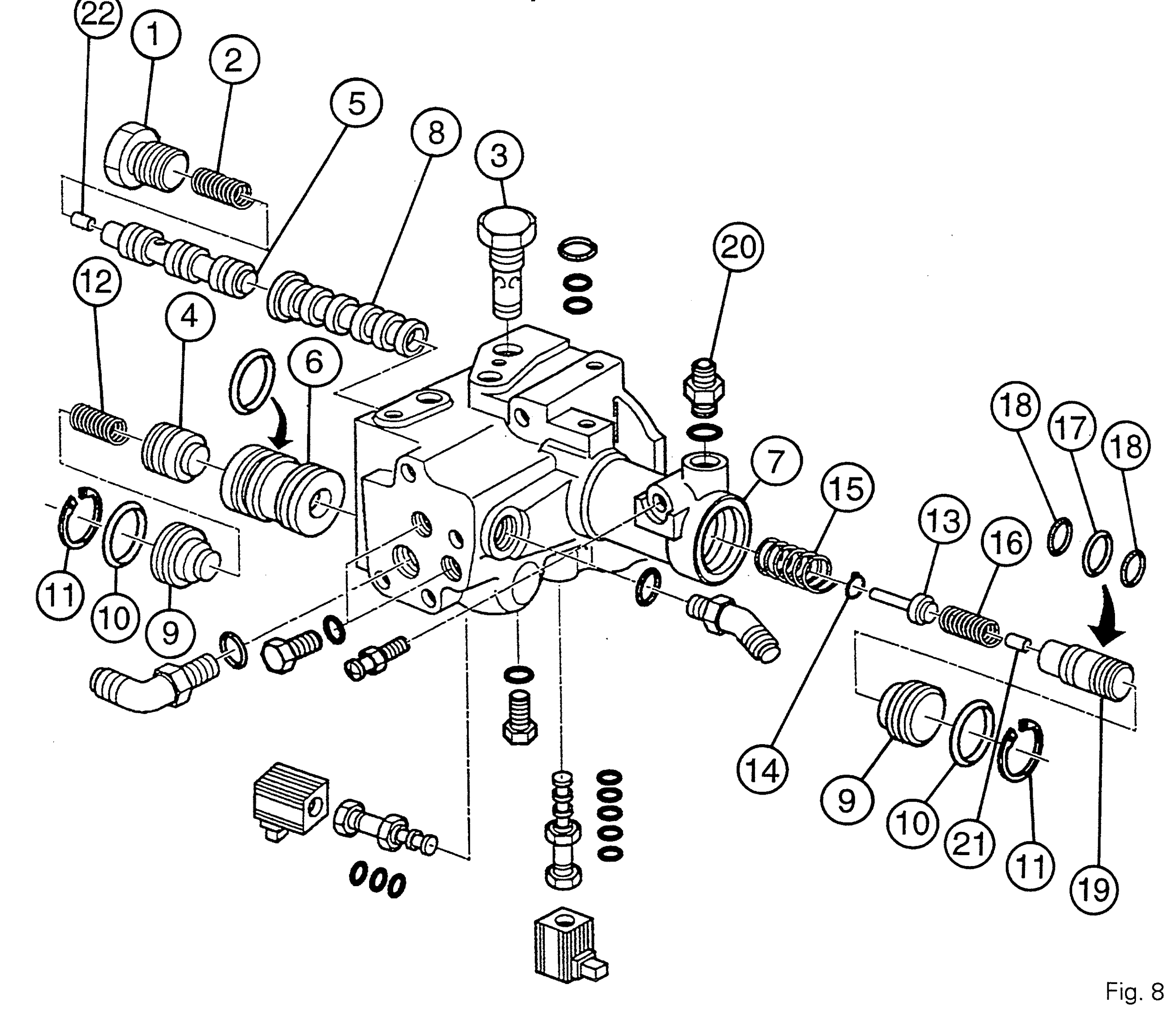


Fig. 8

B . Dismantling and reassembling the valve (Fig. 11)

Dismantling

To remove and refit the valve, see Part F, Section 5B05.

1. Using the locally manufactured tool described in Part E, remove the circlip **(11)** and remove the plug **(9)** (Fig. 9) from assembly **A**. Remove the plug from assembly **B** in the same manner. Remove assemblies **A** and **B**, taking visual note of their positions.
2. Unscrew plug **(1)** and remove assembly **C** in the same way as in the previous operation.

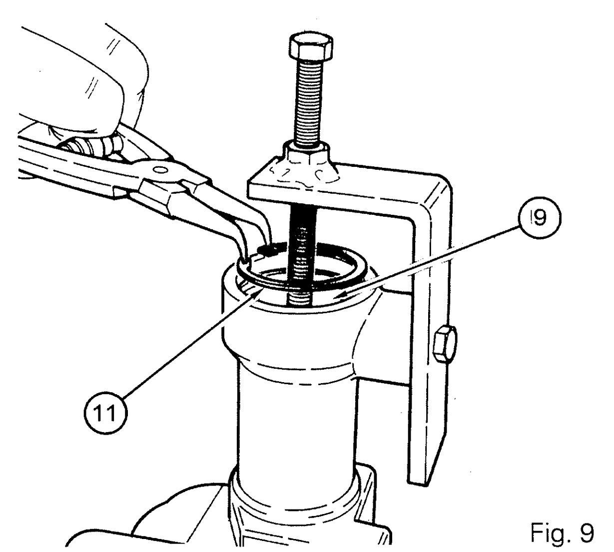


Fig. 9

Hydraulics - *Wet clutch valve*

Reassembly

3. Check and clean the parts. Replace any parts that are scored or deformed. Check that the check valve **(4)** and spool **(5)** slide freely in sleeves **(6)** and **(8)**. Before reassembling, lubricate the seals with transmission oil.
4. Replace the O-rings **(10)** and assemblies **A**, **B** and **C** with repair kits. Fit the circlips **(11)**.
   Note: Before fitting the piston in assembly A, preform the guide rings (18) in circular shapes, with the knurled side facing valve body (7). Lubricate the rings with miscible grease and position them in the grooves on the piston. The bore in coupling (20) is calibrated.
5. **Checking the modulation pressure**
   - Make sure that all the solenoid valves are not hydraulically supplied.
   - The front axle assembly (if fitted) must be engaged (hydraulic pressure being used for clutch disengagement only).
     Place the range change lever in the Tortoise position and the Dynashift lever in position **D**.
   - On the diagnostic connector **(1)**, connect a pressure gauge (approx. 30 bars) equipped with a coupler 3582045M1 (Fig. 10).
   - Press the pedal and check the modulation pressure from 0 to 11 bars through its travel. When the pedal is released, the clutch is under a pressure of 17 bars.

Tightening torques (Fig. 11)

- Plug **(1)** smeared with Loctite 542: 50 Nm.
- Non-return valve **(3)**: 28 to 30 Nm.

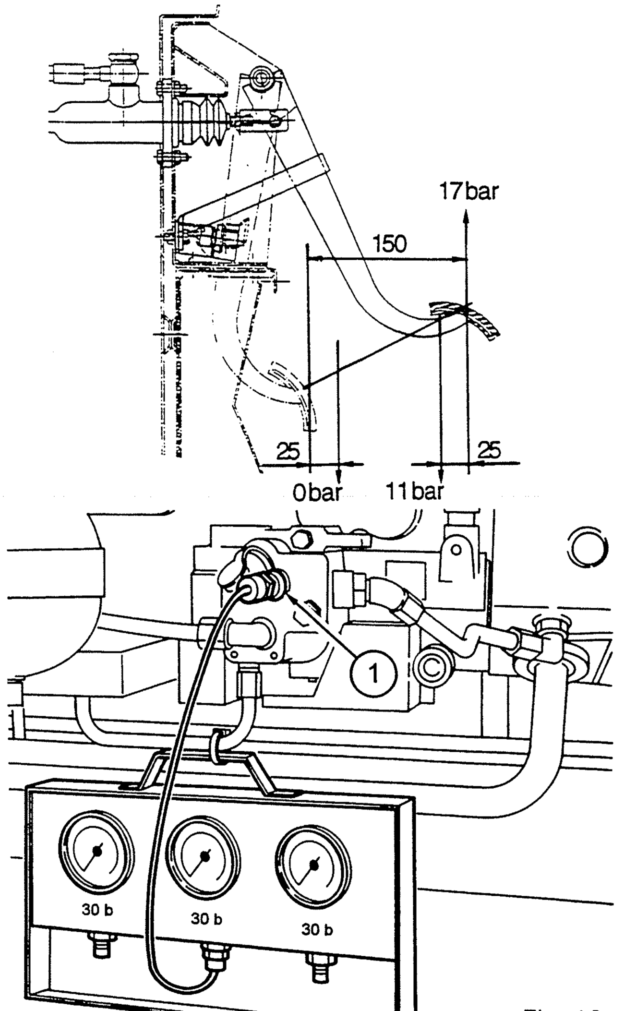


Fig. 10

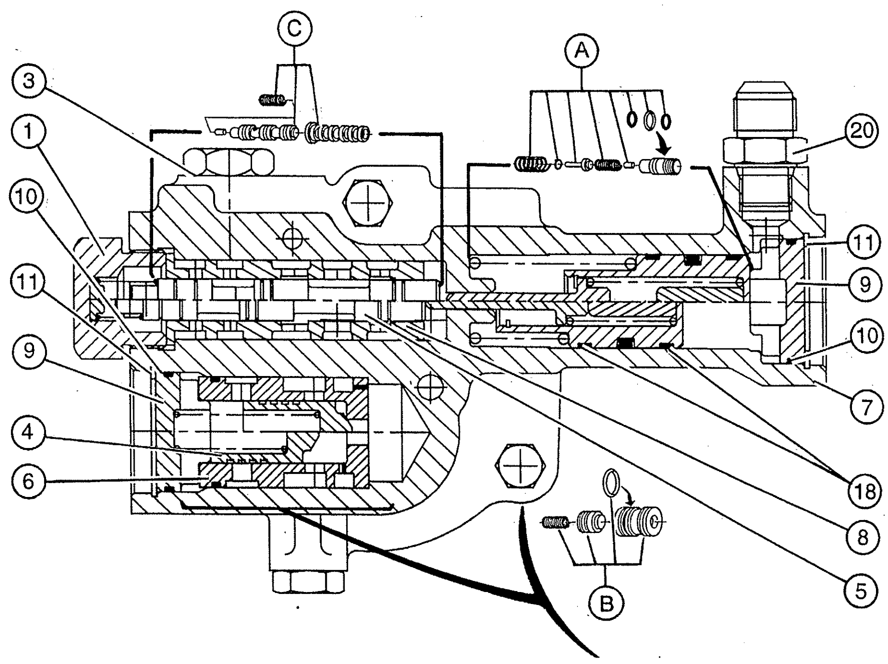


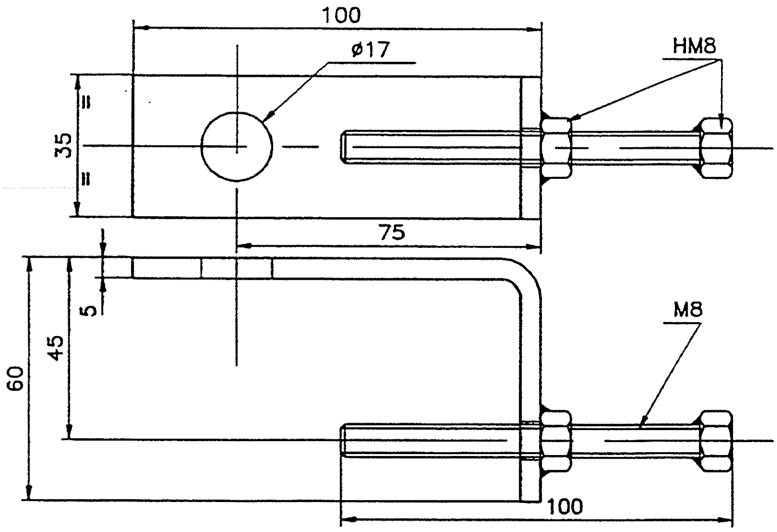
Fig. 11

CONTENTS

C . Service tool

Tool to be manufactured locally

- Spring compression tool.



CONTENTS

9 J01 Hydraulic tests

CONTENTS

Preparation

Before beginning the tests, the engine should be run to bring the oil **temperature up to** a minimum of **80°C** (176°F).

To help increase the oil temperature:
- Run the engine at 2,000 rpm.
- Connect a flowmeter onto an auxiliary spool valve.
- Keep that auxiliary spool valve actuated.
- Limit the flow in the flowmeter.
- As soon as the oil temperature rises to above 80°C (176°F), release the auxiliary spool valve and open the flowmeter valve.

The following equipment is recommended for the tests described in this section. This equipment is available through the MF network:
- MF 3001: Pressure gauge kit
- MF 3002: Hoses and unions kit
- MF 3004: Flowmeter assembly with turbine
- 3582045 M1: Diagnostic coupler

Otherwise, use suitable equivalent equipment.

In all cases, make sure of the direction of flow of the oil to avoid damaging the flowmeter.

Choose pressure gauges, hoses and unions of sufficient capacity and strength.

Values measured during tests:
- max. flowrate: 120 l/mn,
- min. flowrate: 6 l/mn,
- max. pressure: 220 bar,
- min. pressure: 0.4 bar.

A. High-pressure circuit

The high-pressure circuit supplies the following systems:
- the steering,
- the brakes,
- the auxiliary spool valves,
- the lifting system.

1. Charge pressure of the main variable-displacement pump

- Connect a pressure gauge to the diagnostic connector located on the right-hand hydraulic cover (Fig. 1) and check **P1**.

Engine speed rpm	**P1** (bar)
1,000 2,200	4.8 5.5

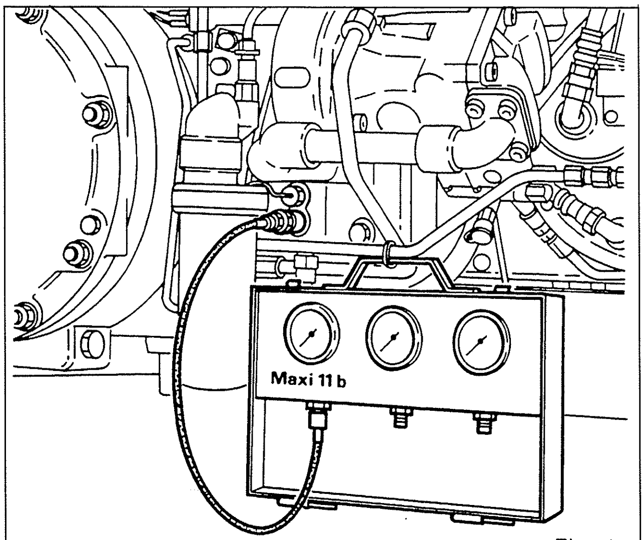


Fig. 1

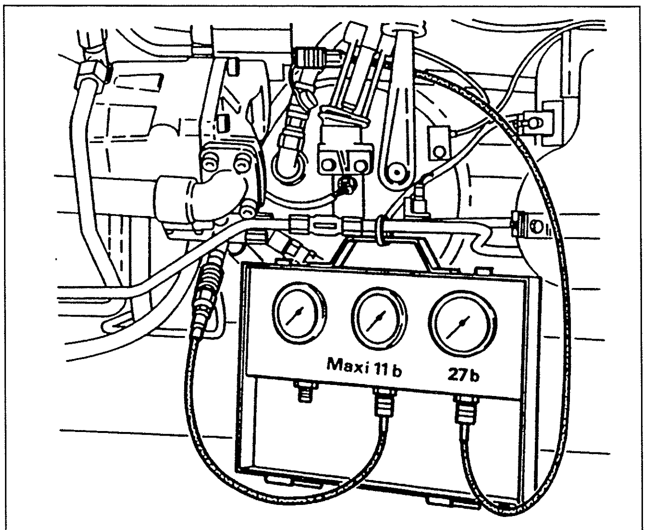


Fig. 2

2. Standby pressure and XLS pressure

- Connect a pressure gauge to each diagnostic connector (Fig. 2) located:
  . under the main pump: XLS pressure = **P2**,
  . under the outlet unit: pump pressure = **P3.**
  Important: Do not actuate high-pressure components (such as the steering) as this may damage the pressure gauges connected at P2 or P3.

Engine speed rpm	**P2** (bar)	**P3** (bar)
1,000 2,000	3 - 5 3 - 5	25 - 27 25 - 27

Pump pressure = XLS pressure + 22 bar
P3 = P2 + 22 bar

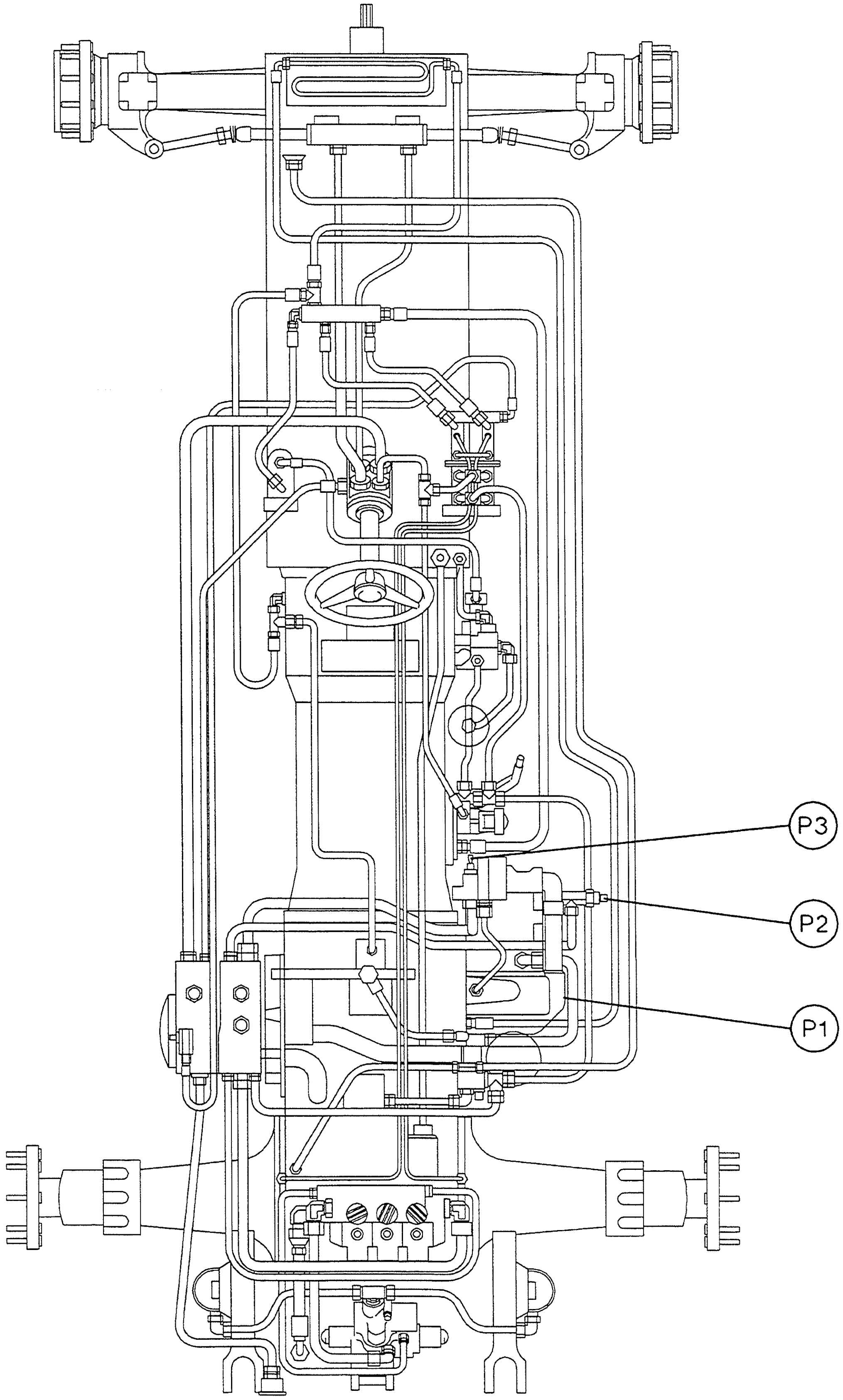


Fig. 3

3. Maximum flow and pressure

- Connect a flowmeter onto an auxiliary spool valve (Fig. 5) to obtain **Q1**.
- Do not use a valve with automatic return to neutral.
- Make sure that the levers for the auxiliary couplers are in the open position (towards the rear).
- Connect a pressure gauge to each diagnostic connector located (Fig. 4):
  . under the main pump: XLS pressure = **P4**,
  . under the outlet unit: pump pressure = **P5**.
- Set the flow controller of the auxiliary spool valve to maximum flowrate.
- Actuate the auxiliary spool valve and gradually close the flowmeter valve to reduce the flowrate and increase the pressure.

Engine speed rpm	**Q1** (l/mn)	**P4** (bar)	**P5** (bar)
2,200	110	90	110
2,200	110	110	130
2,200	110	130	150
2,200	110	160	170
2,200	100	170	180
2,200	0	190	190

Note: Do not take the pressure indicated in the flowmeter into account.

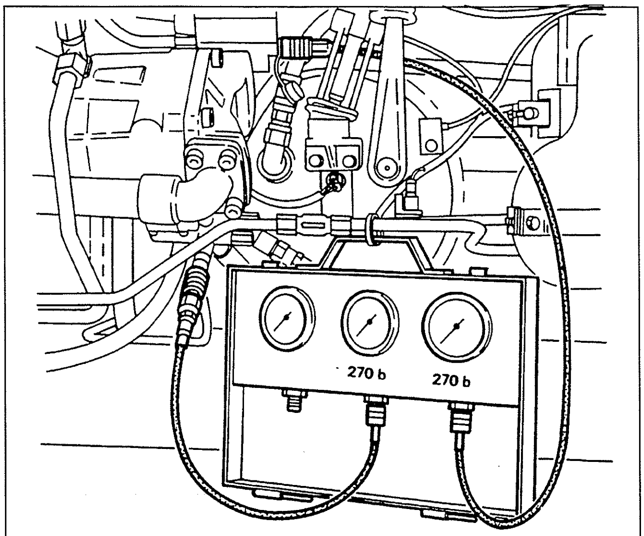


Fig. 4

4. Adjusting the auxiliary spool valves flowrate controller

- Connect the flowmeter onto an auxiliary spool valve (Fig. 5) to obtain **Q2**.
- Make sure that the levers of the auxiliary couplers are in the open position (towards the rear).
- Connect a pressure gauge to each diagnostic connector located (Fig. 4):
  . under the main pump: XLS pressure = **P6**,
  . under the outlet unit: pump pressure = **P7**.
- Close the flowrate controller to obtain:
  P8 = 130 bar

Controller setting	Engine speed rpm	**P6** (bar)	**P7** (bar)	**Q2** l/mn
Max.	2,200	110	130	110
Min.	2,200	110	130	5

If the flowrate is not correct, see Section 9 C01 for its adjustment.

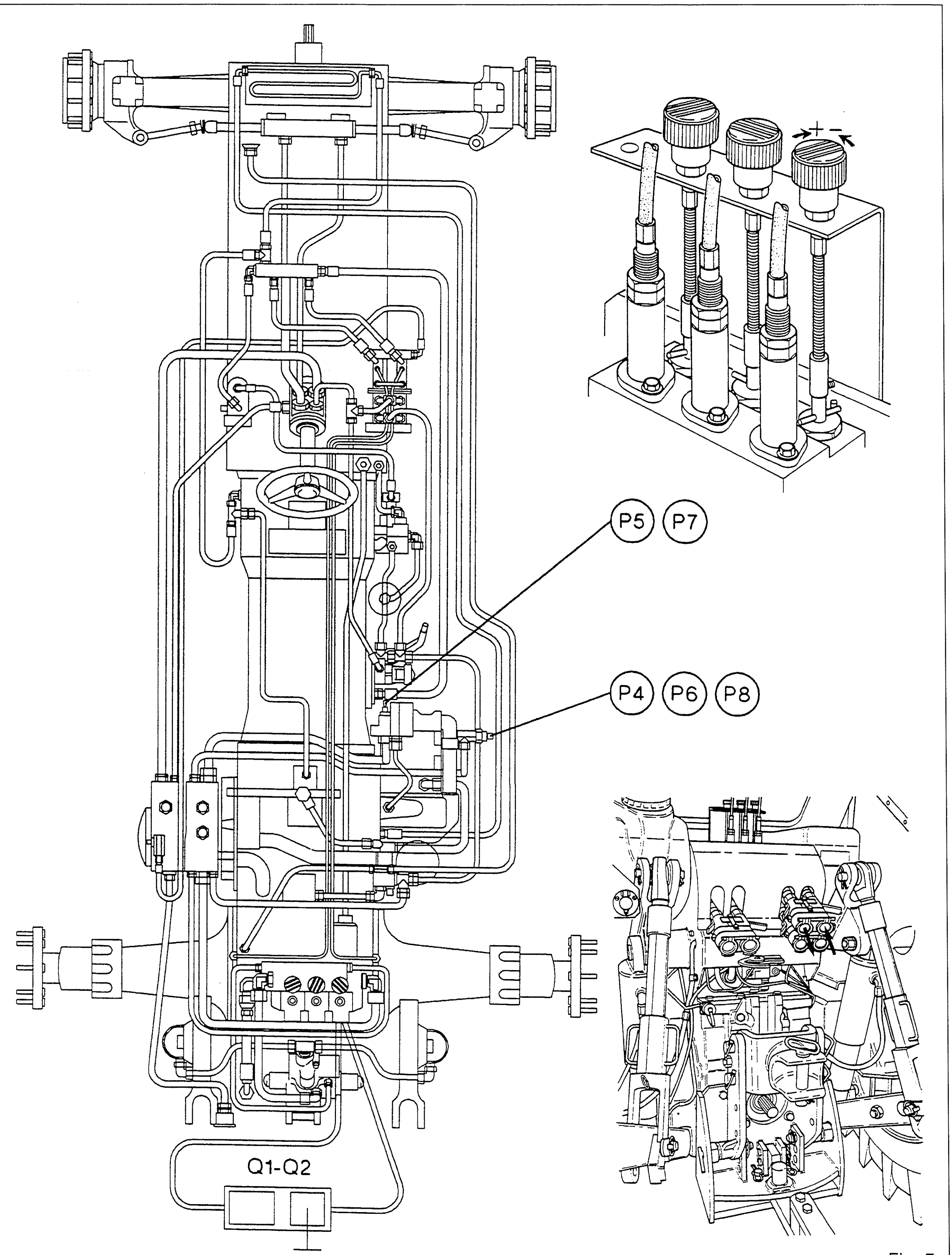


Fig. 5

5. Auxiliary spool valve with automatic return to neutral

- Connect a flowmeter to the valve concerned.
- Make sure that the levers of the auxiliary couplers are in the open position (towards the rear).
- Connect a pressure gauge under the main pump (Fig. 6) to read: XLS pressure = **P8**.
- Run the engine at 1,000 rpm. Set the valve to the automatic return position, release the lever and gradually close the flowmeter valve until the lever returns to the neutral point. Read the triggering pressure:

  P8 = 155 to 175 bar.

  If the triggering pressure is not correct, see Section 9 C01 for adjustment.

  Note: Check that the valve is in the automatic return position and not in the floating position.

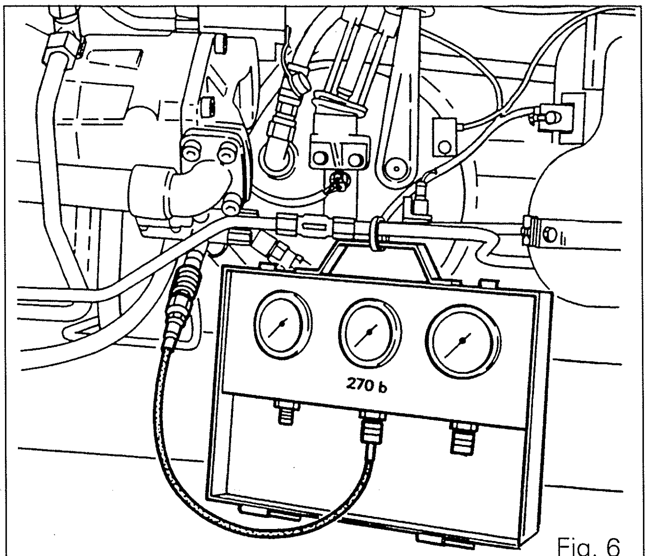


Fig. 6

6. Lifting

Maximum pressure

- Connect a pressure gauge to each diagnostic connector (Fig. 7) located:
  . under the main pump: XLS pressure = **P9**,
  . under the outlet unit: pump pressure = **P10**.
- Run the engine at 1,000 rpm.
- Use the external lift control buttons to engage the maximum high position:

  P9 = P10 = 190 to 200 bar

Shock valve

- With the engine stopped, connect a hand-operated calibrating pump to the lift rams (with the rams linked together).
- Apply pressure with the calibrating pump.

  P11 = 200 to 219 bar

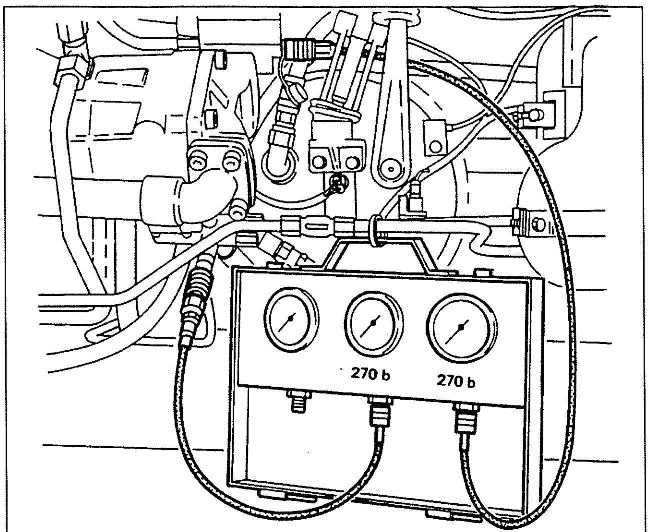


Fig. 7

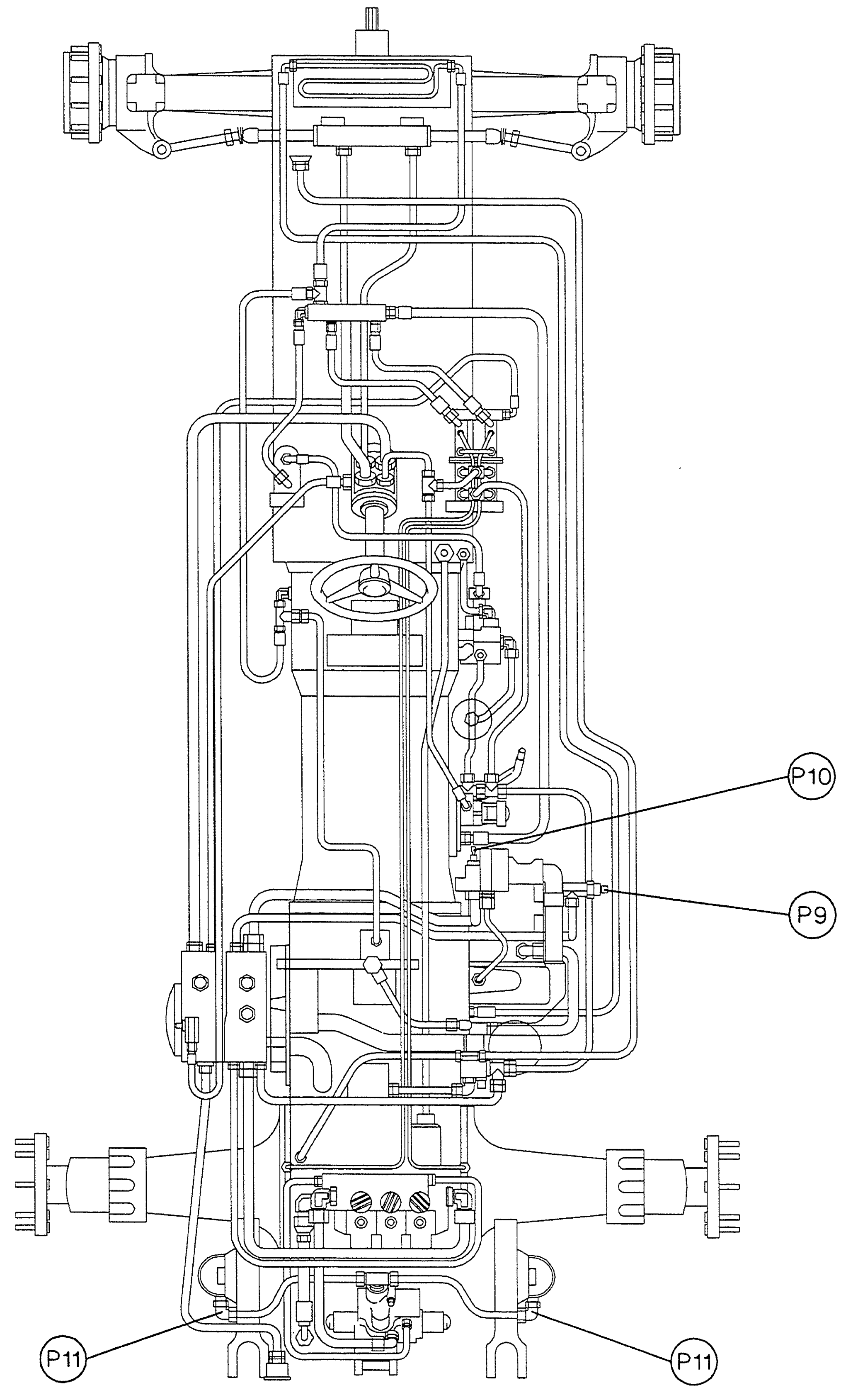


Fig. 8

7. Steering

Maximum pressure

- Connect a pressure gauge to each diagnostic connector and run the engine as described in paragraph 6.
- Slowly turn the steering wheel and check that **P12** and **P13** gradually increase.

  P12 = 140 to 142 bar
  P13 = 155 to 160 bar

Shock valve

- With the engine stopped, connect a hand-operated calibrating pump under one of the two steering ram supply points.
- Apply pressure with the calibrating pump.

  P14 = 225 to 245 bar
- Carry out the same procedure for the second steering ram supply point.

Checking the steering circuit for leaks

- Run the engine at 1,000 rpm.
- Apply full steering lock and apply a torque of 4 Nm on the steering wheel. It must not turn at more than 2 revolutions per minute. If the steering wheel turns at more than 2 rpm, disconnect the lines supplying the rams and block the two openings.
- Apply the same torque on the steering wheel. If it turns at less than 2 rpm, there is a leak from the ram.

8. Trailer brake (if fitted)

Maximum pressure

- Connect a pressure gauge to the quick coupler on the brake system (Fig. 14) to read **P15**.
- Run the engine at 2,200 rpm.
- With the brake pedals coupled together, gradually apply force.
- The pressure reading must gradually increase to reach:

  P15 = 130 to 150 bar max.
- If the pressure does not increase gradually, bleed the brake circuit.

Flowrate

- Connect a flowmeter to the quick coupler on the trailer brake system. Connect the return to the filling port and read **Q3**.

Engine speed rpm	**Q3** (l/mn) min.
1,000	25

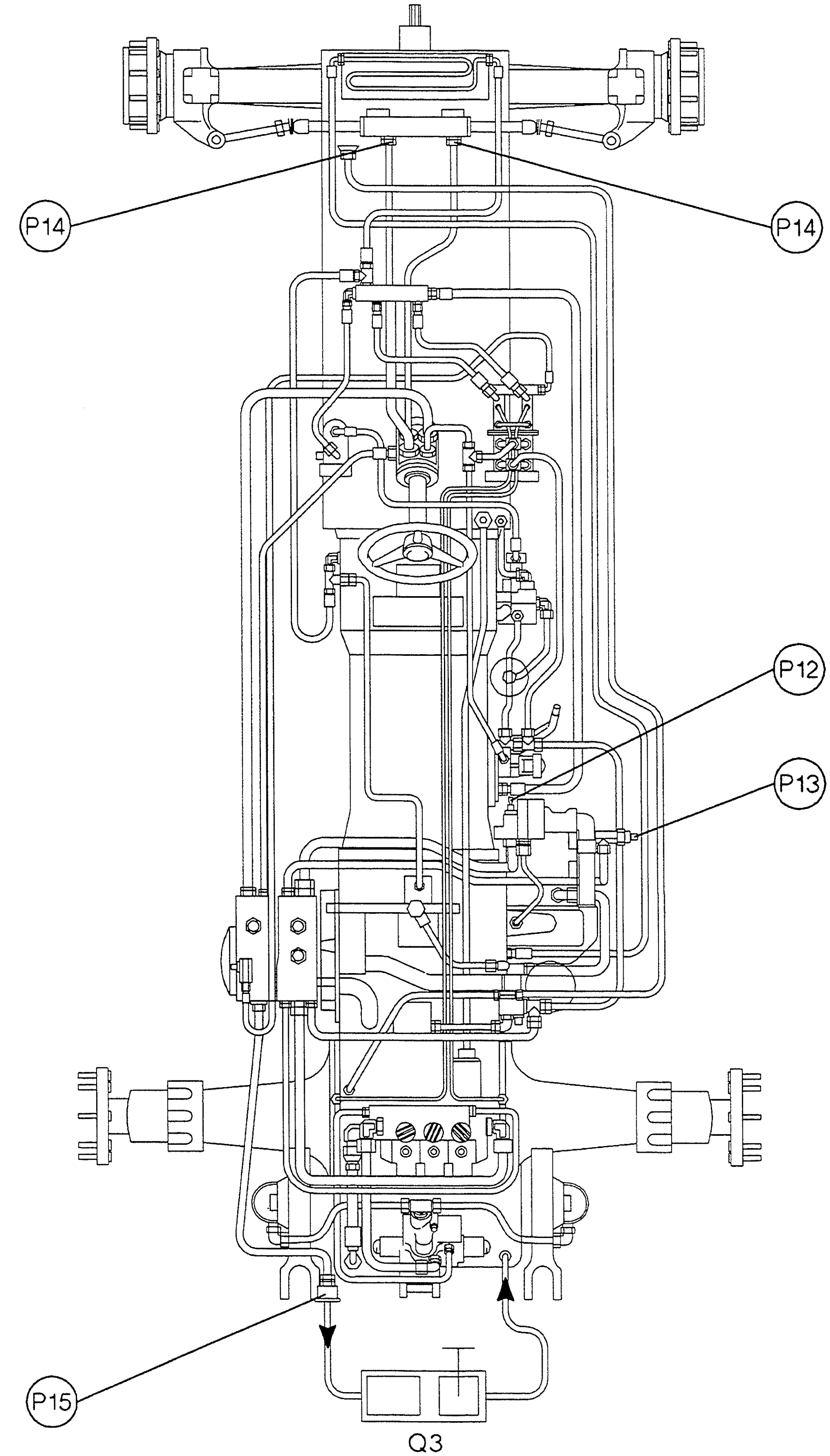


Fig. 9

B. Low-pressure circuit

The 17-bar low-pressure circuit supplies the following systems:
- Dynashift or Speedshift,
- wet clutch,
- rear power take-off clutch,
- front take-off clutch (if fitted),
- 4WD clutch,
- front and rear differential lock,
- Hare/Tortoise range,
- Braking assistance (if fitted).

1. 17-bar circuit

- Connect a pressure gauge to the diagnostic connector (Fig. 10) located to the rear of the right-hand hydraulic cover to check **P16**.
- Run the engine at 1,000 rpm.
- Declutch and deactivate all the low-pressure components.
  The front axle must be engaged with the pressure used only for declutching.
  Place the range lever in the Tortoise position and the Dynashift lever in position D.
- **Engage each system. The pressure must not drop below 14 bar** and must return to its initial level when each system is engaged.
  P16 = 17 ± 1 bar

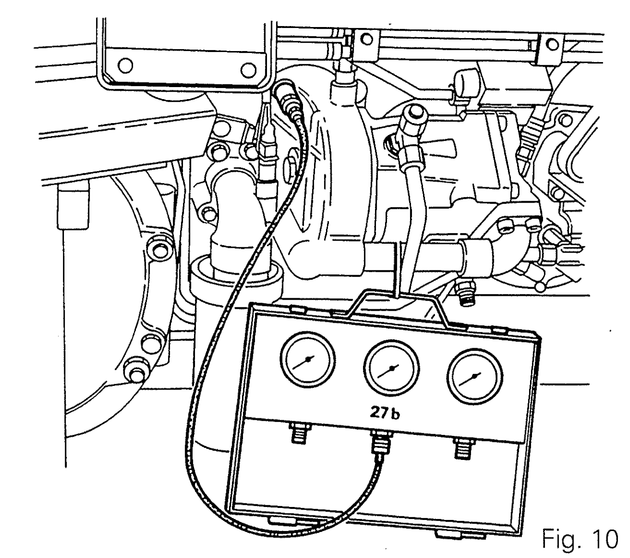


Fig. 10

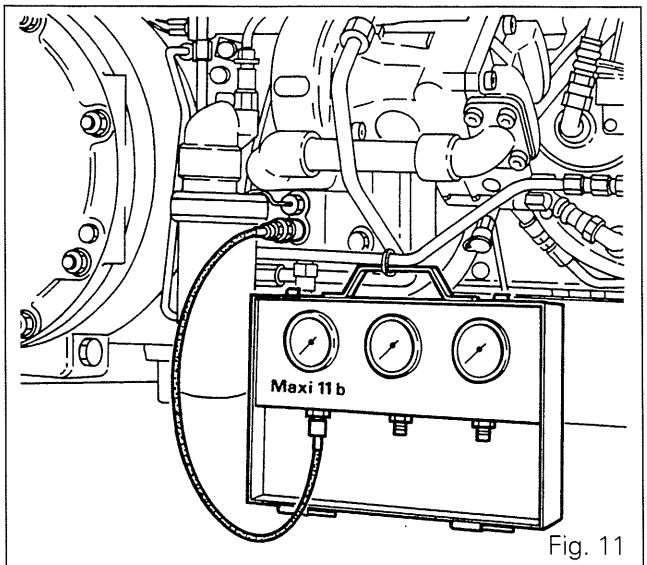


Fig. 11

2. Charge circuit and cooling safety

- Connect a pressure gauge to the diagnostic connector located on the lower section of the right-hand hydraulic cover (Fig. 11) to check **P17**.

Engine speed (rpm)	**P17** (bar)
1,000 2,200	4.8 5.5

3. Oil cooler (optional)

- As shown in Figure 14, connect a pressure gauge to the cooler inlet to check **P18** and onto the cooler outlet to test **P19**.

Engine speed (rpm)	**P18** (bar)	**P19** (bar)
1,000 2,200	1.4 3.1	1.3 2.8

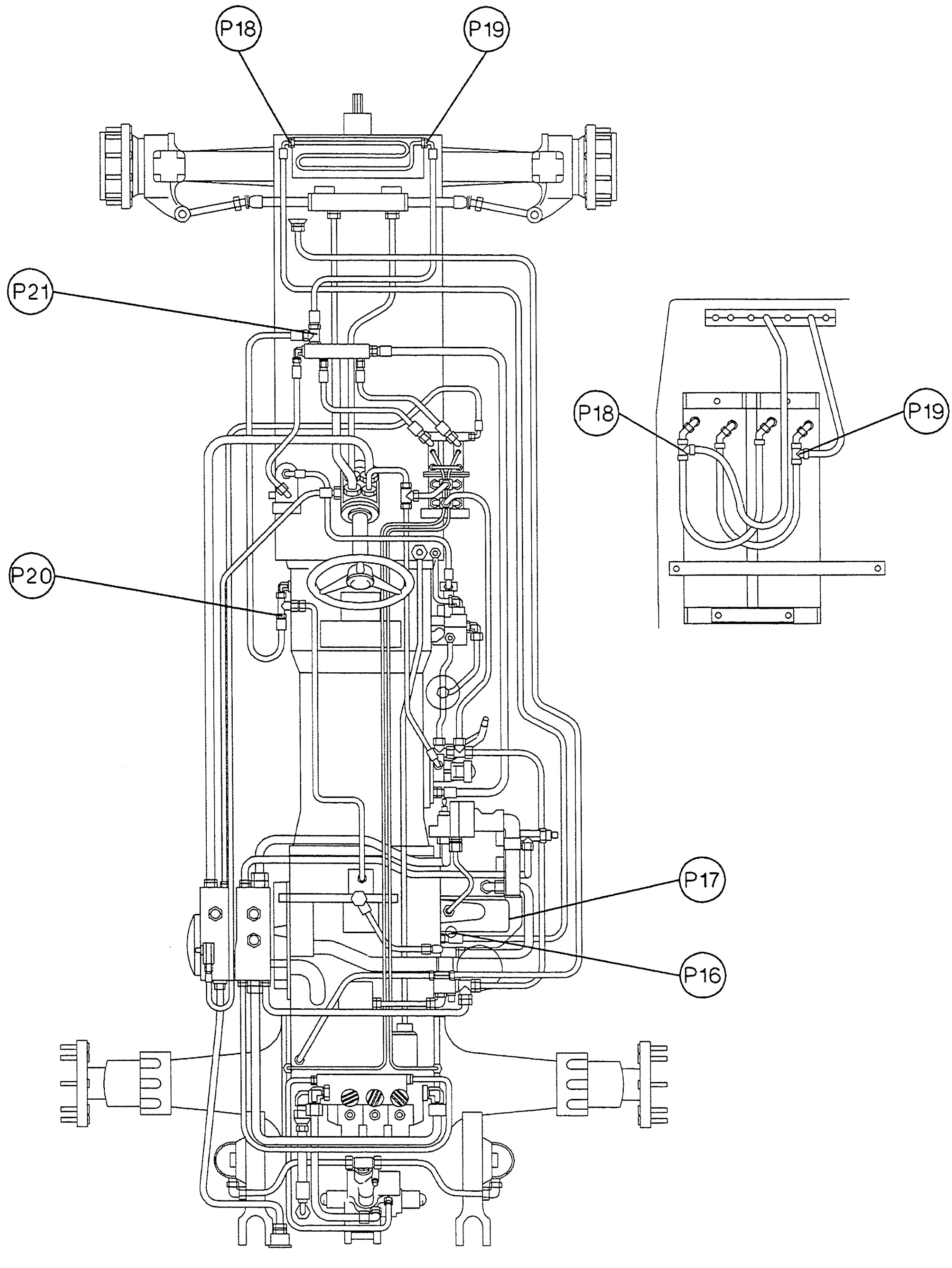


Fig. 12

4. Transmission lubricating circuit

a) Pressure test

- Tractor without additional tank
  Connect a pressure gauge to the connector on the front left-hand side of the gearbox to check **P20**.
  At 1,000 rpm, **P20 = 1.9 bars**
- Tractor with additional tank
  Connect a pressure gauge to the connector located under the manifold bar to check **P21**.
  At 1,000 rpm, **P21 = 2.4 bars**.
  Important: If an auxiliary spool valve is engaged (in which case a flowmeter or a slave device must be connected to it), the pressure must not drop below:
  1 bar for P20,
  1.5 bars for P21.

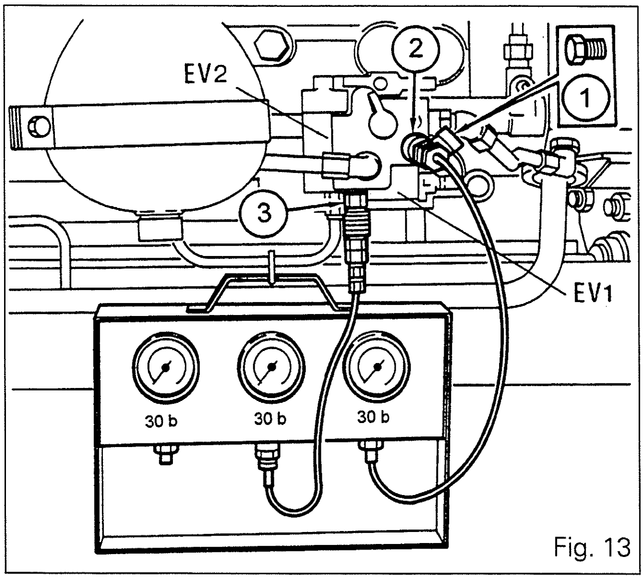


Fig. 13

b) Flowrate test

- Connect a flowmeter to the lubricating circuit between the manifold bar and the gearbox to read **Q4**.
  Important: The flowmeter valve must, mandatorily, be in the maximum open position until the end of the test.

Engine speed (rpm)	**Q4** (l/mn) min.
1,000	15

If an auxiliary spool valve is engaged (in which case a flowmeter or a slave device must be connected to it), the flowrate must not drop by more than 2 l/mn.

5. Pressure of servo systems

a) Dynashift

- Remove the guard preventing access to the connectors (30 km/h tractors).
- Remove the plugs **(1)** from the distribution unit.
- Screw on two male connectors **(2)** and **(3)**, ref. 3384387M1, and connect them to diagnostic connectors fitted on pressure gauges with a capacity of approximately 30 bars (Fig. 13).
- Start the engine.
- Operate the lever under the steering wheel to select each ratio (A, B, C and D).
- Check whether the pressures are correct compared with the table:

Ratio	Front piston connector **(2)** **P22** (bar)	Rear piston connector **(3)** **P23** (bar)	EV1 (V)	EV2 (V)
A	17	17	12	0
B	17	0	12	12
C	0	17	0	12
D	0	0	0	0

- If the pressures are not correct, check the movement of the spools of the solenoid valves (EV1, EV2) or see the documentation on electrical tests.
- Fit the guard and seal the attaching bolt with lead.

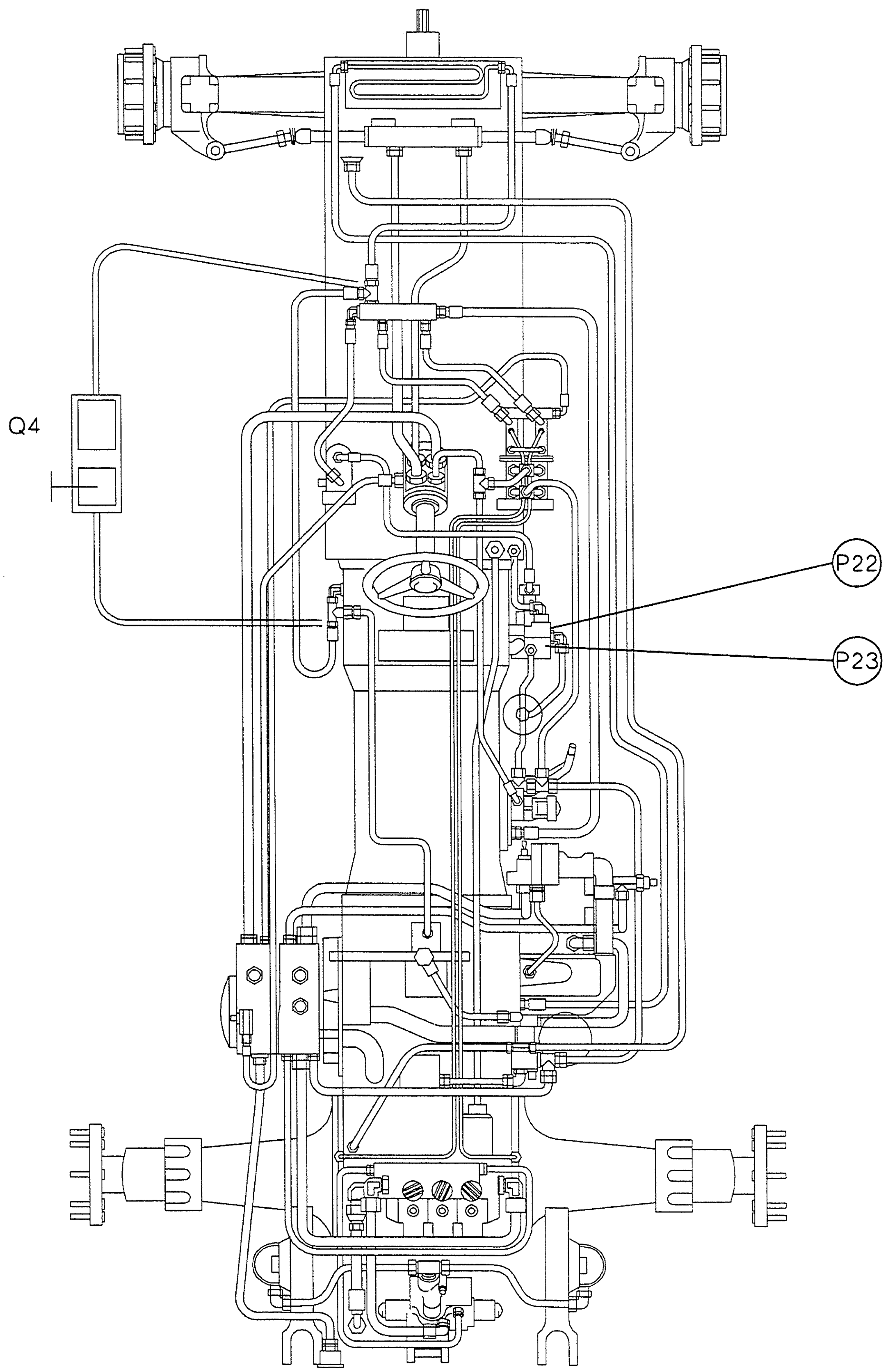


Fig. 14

b) Wet clutch
Control circuit

- Connect a pressure gauge to the diagnostic connector of the wet clutch valve located on the right-hand side of the gearbox (Fig. 15) to check **P24**.
- Operate the pedal to engage or disengage the clutch.

Engine speed (rpm)	**P24** (bar) disengaged	**P24** (bar) engaged
1,000	0	17
2,200	0	17

Modulation pressure

- The wet clutch valve modulates between 11 bars and 0 bar. This modulation corresponds to a pedal travel extending 32 ± 1 mm from the high stop position and 25 ± 1 mm before the pedal low stop position (the total travel being 150 mm).
  . If the modulation travel is offset with respect to the pedal travel, the control system must be bled using the bleeder **(1)** located at the end of the valve.
  . If the modulation travel is too low, check the adjustment of the wet clutch valve.

Lubricating circuit

- Connect a pressure gauge to the diagnostic connector located on the left-hand side of the gearbox (Fig. 16) to check **P25**.
- Operate the pedal to disengage or engage the clutch.

Engine speed (rpm)	**P25** (bar) disengaged	**P25** (bar) engaged
1,000	2	0.4
2,200	3	1.2

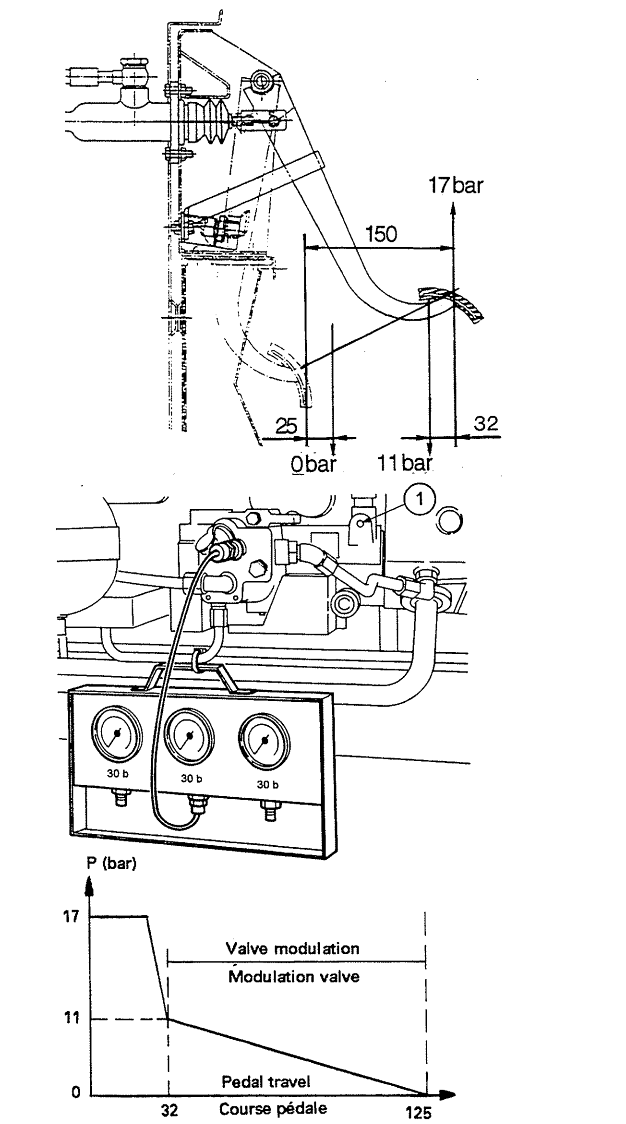


Fig. 15

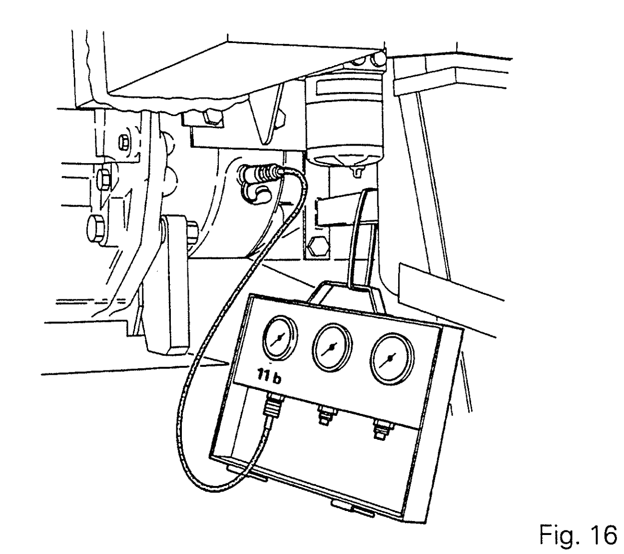


Fig. 16

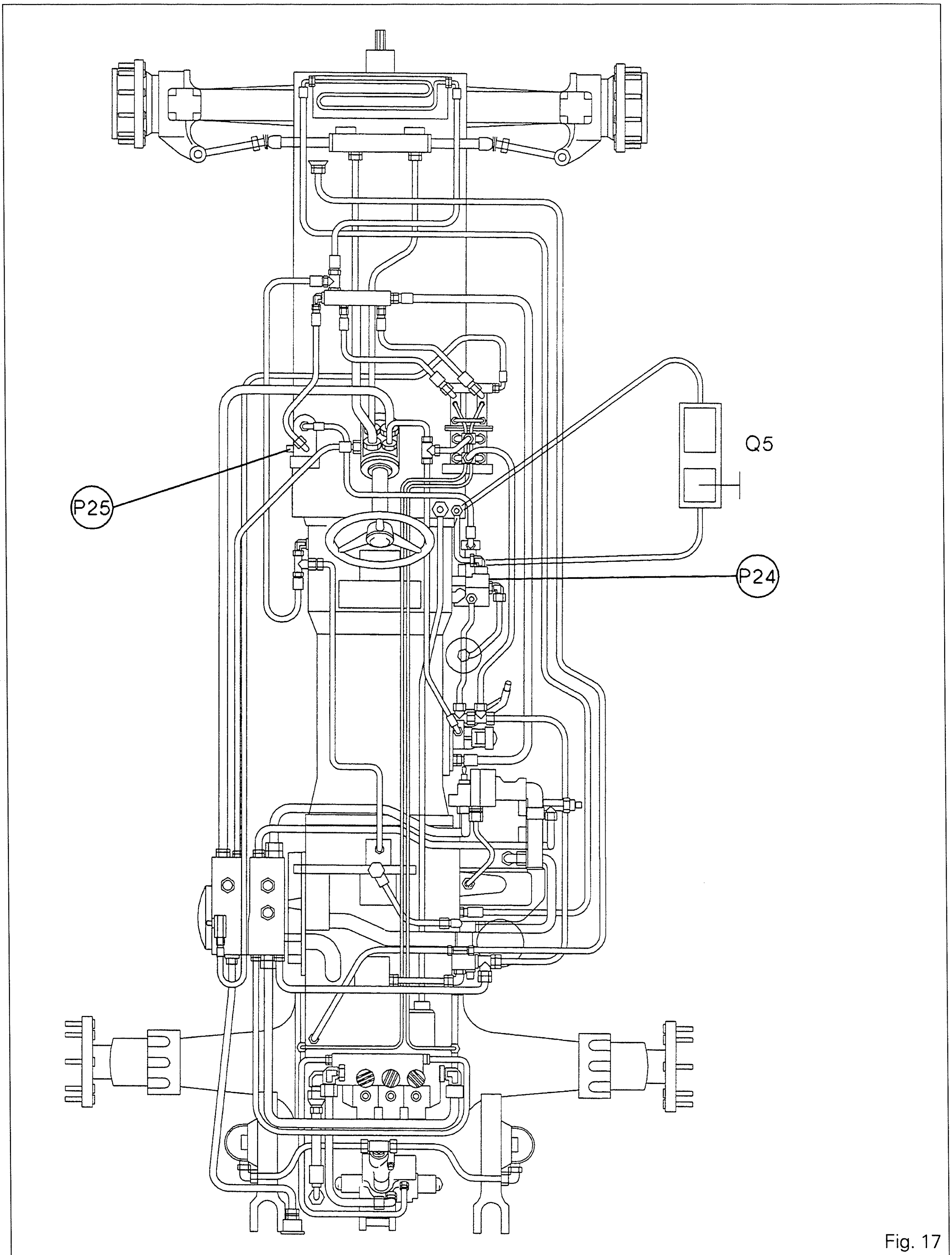


Fig. 17

Checking the permissible leakage

- Connect a flowmeter between the valve and the wet clutch supply point (Fig. 18) and read **Q5**.

Engine speed (rpm)	**Q5** (l/mn) disengaged	**Q5** (l/mn) engaged
1,000	0	3 max.

c) Front power take-off (if fitted)
Checking the constant level in housing

- Using a probe, measure the outlet flowrate **Q5** and the inlet flowrate **Q6** after the restrictor (Fig. 19).

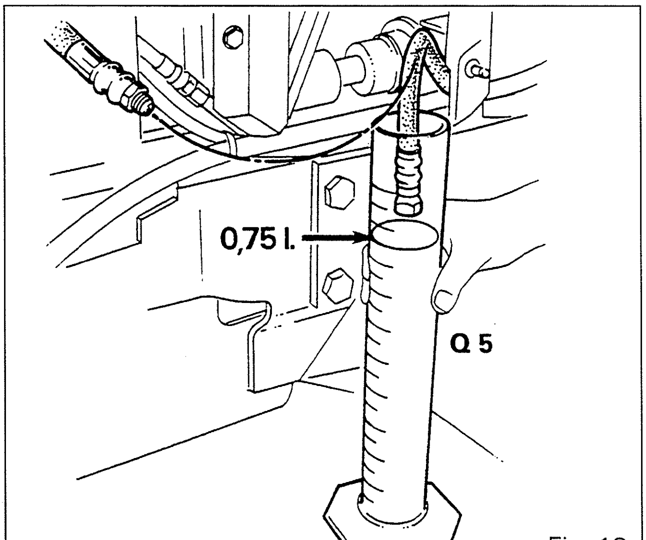


Fig. 18

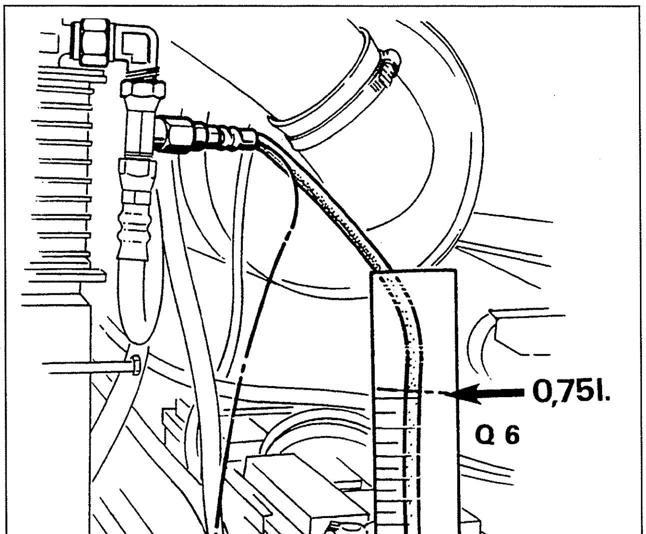


Fig. 19

CONTENTS

9 L01 Description of circuit

CONTENTS

General

8100 series tractors can be equipped, depending on models, with an open centre hydraulic system supplied by a two-part pump with a constant capacity.

A . Description

A geared, two-part pump is installed inside the right-hand hydraulic cover (see section 9 R01). The pump sucks transmission oil from the common fuel tank formed by the central housing and the gearbox through the 20-micrometre filter that is also fitted on the right-hand cover.
This pump is driven by the teeth on the PTO clutch unit.
It supplies two separate circuits:
- the high-flow, high pressure circuit with a nominal flowrate of 53 l/mn - 180 bar,
- the low-flow, low pressure circuit with a nominal flowrate of 21 l/mn - 17 bar.

High-flow circuit

The high-flow element (20.5 cc) supplies the following functions in series in this order :
- the hydrostatic steering,
- the trailer brake valve,
- the auxiliary spool valves,
- the lift control valve.

Low-flow circuit

The low-flow element (8 cc) provides supply in parallel to the various transmission functions via a 17-bar pressure control valve. Some of these functions are controlled by solenoid valves which are sometimes connected to the Autotronic system (4WD, PTO, etc.). None of these are priority functions and they can be actuated simultaneously.
The functions supplied by the low-pressure circuit are as follows:
- the Dynashift,
- the main clutch,
- the 4WD clutch,
- the rear PTO clutch,
- the front and rear differential lock,
- the Hare/Tortoise (Hi/Lo) range,
- the servo brake,
- the front PTO clutch (if fitted).

The excess flow in the two circuits is directed to a flow combination valve installed in the left-hand side cover (see section 9 R02).

Part of the flow is sent to the oil cooler and, from there, to the following circuits:
- gearbox lubrication,
- brake master cylinder topping up,
- clutch master cylinder topping up,
- return to housing.

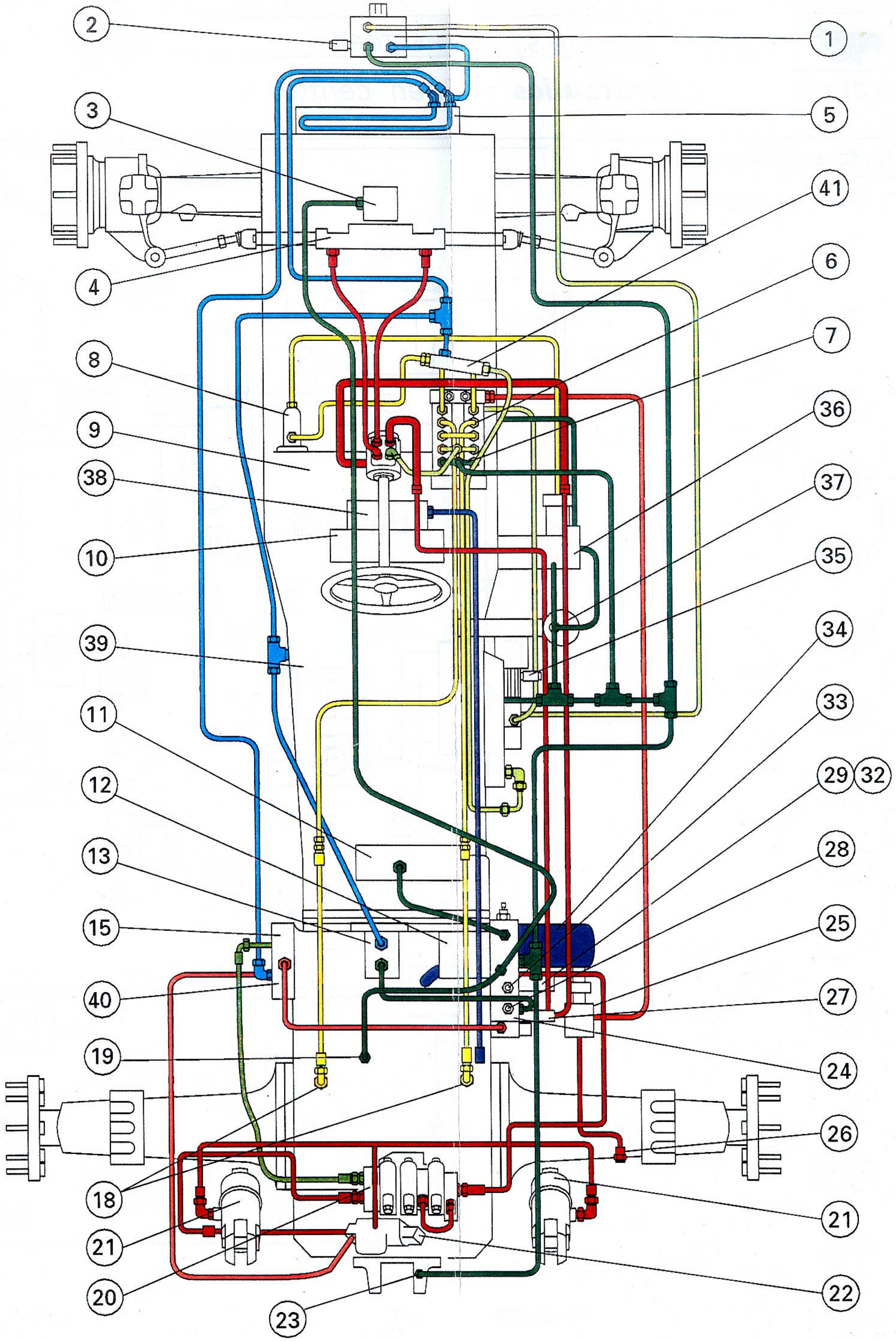
As the pressure of the oil directed to the cooler is limited by a 4.5-bar valve, the excess flow is directed to the pump inlet without passing via the suction filter.

B . Layout of parts

List of parts

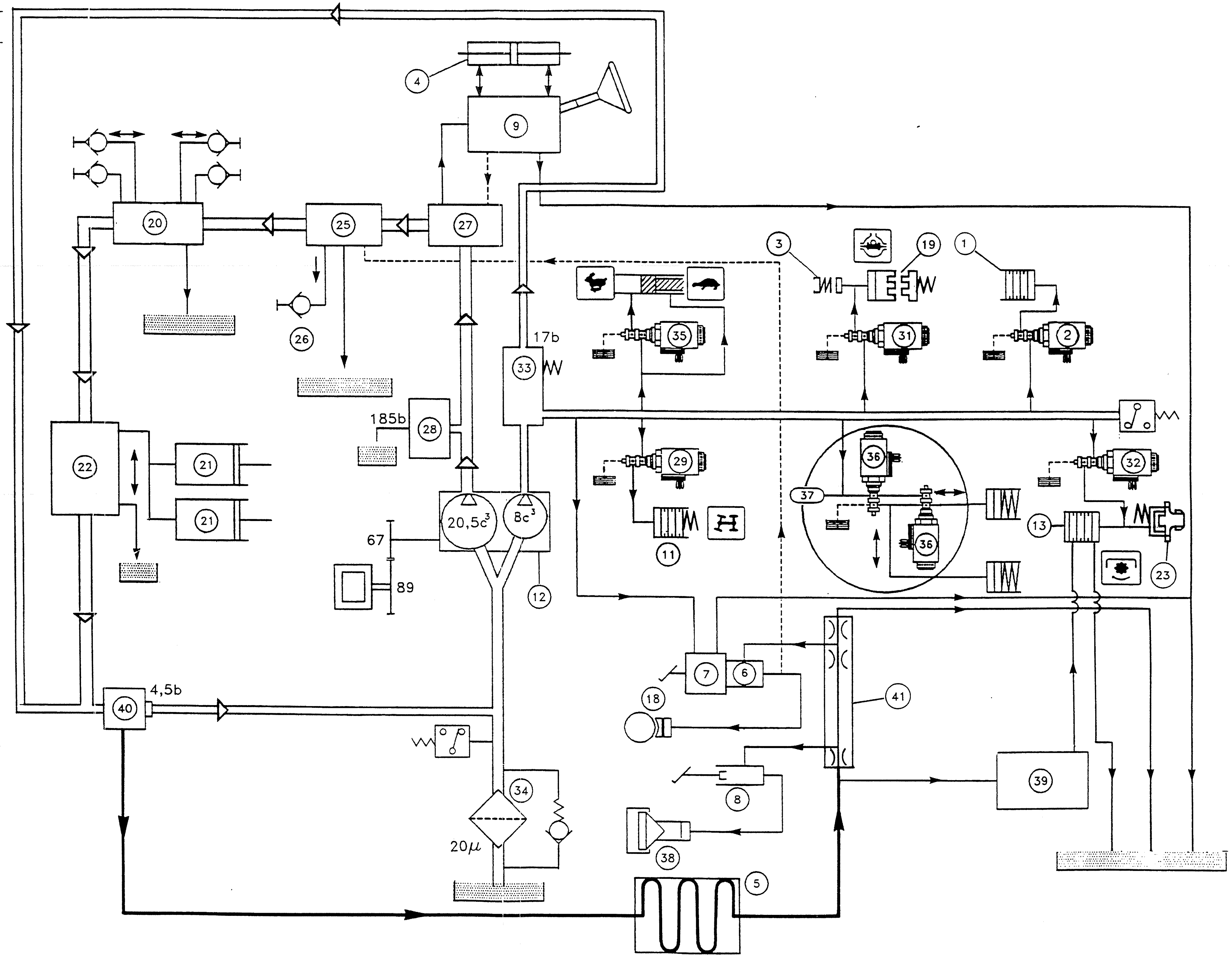
(1) Front PTO (if fitted)
(2) Front PTO solenoid valve (if fitted)
(3) Front differential lock
(4) Steering ram
(5) Oil cooler
(6) Brake master cylinders
(7) Servo brake
(8) Clutch master cylinder
(9) Hydrostatic steering unit (Orbitrol)
(10) Dynashift unit
(11) 4WD clutch
(12) Hydraulic pump
(13) PTO clutch
(15) Left-hand hydraulic cover
(18) Right-hand and left-hand brake
(19) Rear differential lock
(20) Auxiliary spool valves
(21) Lift rams
(22) Lift valve
(23) PTO brake (if fitted)
(24) Right-hand hydraulic cover
(25) Trailer brake valve
(26) Trailer brake connector
(27) Steering override valve
(28) Right-hand HP safety valve, 185 bar
(29) 4WD solenoid valve
(31) Differential lock solenoid valve
(32) PTO solenoid valve
(33) Pressure control valve, 17 bar
(34) Right-hand pump filter, 20 micrometres
(35) Hare/Tortoise solenoid valve
(36) Dynashift solenoid valves
(37) Dynashift accumulator
(38) Main clutch
(39) Gearbox
(40) Valve, 4.5 bar
(41) Manifold

High pressure
Low pressure
Lubrication
Suction
Return
Excess flow
Brakes - Clutch
Pilot flow

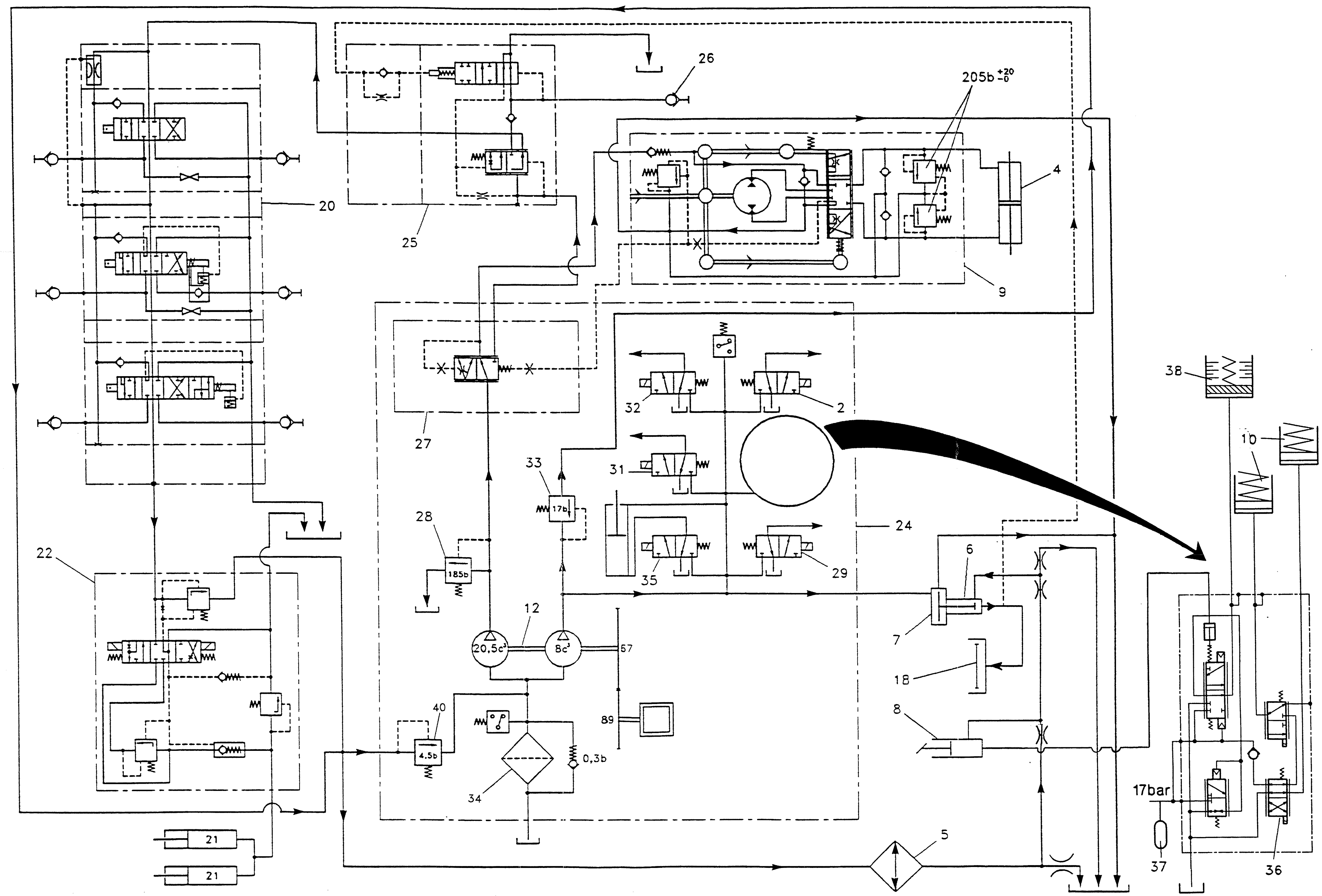


C . Circuit diagrams

1. Simplified diagram



2. ISO diagram



9 M01 Trailer brake

CONTENTS

Hydraulics - Open centre

General

8100 series tractors can be equipped with a trailer braking system consisting of:

- a valve assembly (spool valve) fitted on the right-hand hydraulic cover,
- a pipe linking the spool valve to a connector located at the rear of the tractor,
- a pipe connected to the master cylinders and linked to the pilot flow housing of the valve.

The valve receives priority supply from the high-pressure circuit. The oil not used for trailer braking is sent to the auxiliary spool valves.

The valve controls the flow and pressure towards the trailer brakes. It is actuated by the pressure of the tractor braking circuit so as to obtain gradual tractor/trailer braking that is proportional to the effort applied on the pedal. The trailer brake only works if both pedals are coupled.

Description of the trailer braking valve (Fig. 1)

Flow control valve (1)
This valve controls flow Qx and regulates the hydraulic flow transmitting the pressure to the trailer brakes (see pages 3 and 5).

Control spool assembly (2)
This actuates the flow control valve and regulates the trailer braking pressure.

Non-return valve (3)
This valve stops oil flowing back from brake line **B** to port **N** (see pages 3 and 5).

Pressure relief valve (4)
With loaded springs **(8)**
This limits the brake pressure.

Pilot flow housing (5)
With piston **(6)** and bleed screw **(7)**.
This controls the trailer brake valve via a sensing line from the tractor braking system.

Designation of ports (see page 5)

B Supply to the trailer brake connection
N Continuation to the auxiliary spool valve
P Pressure
R Return to housing
Y Supply from the tractor braking system

A. Operation, trailer brakes released and partial trailer braking

Trailer brakes released (Fig. 2)

There is no pressure in sensing line **Y** (no effort applied on pedals).

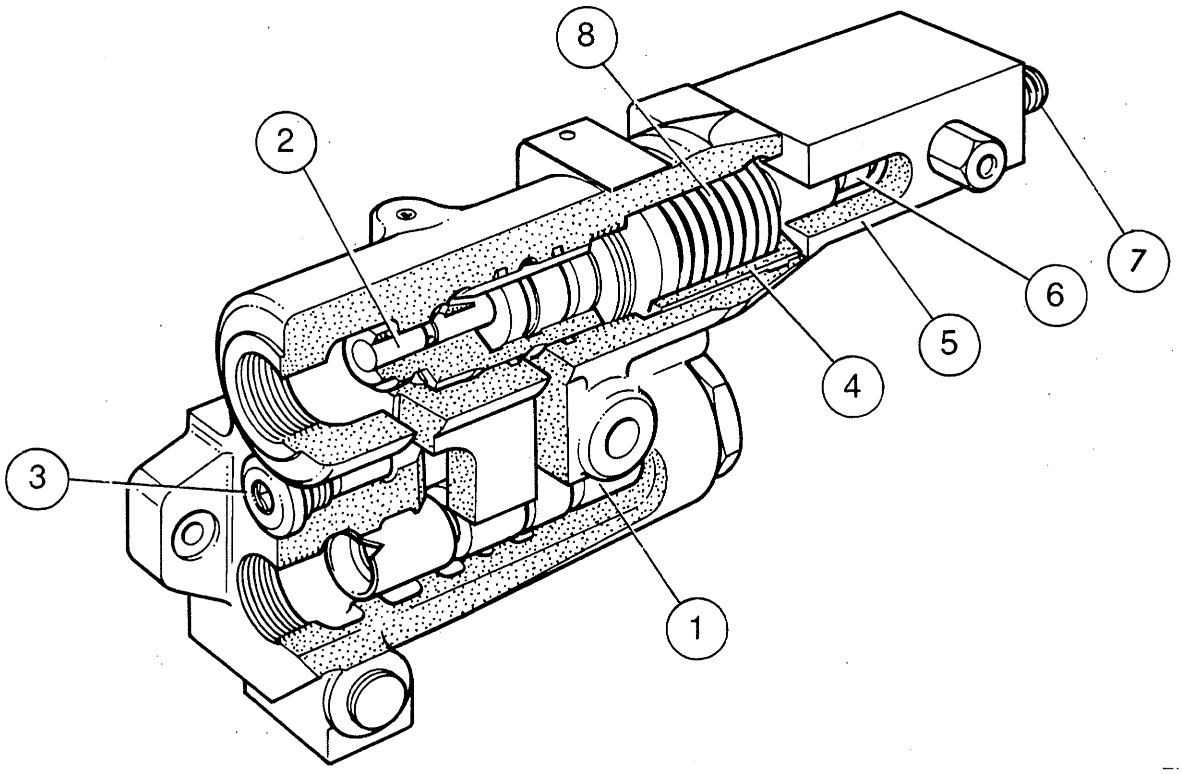


Fig. 1

Port **B** (supply to the trailer brake connection) communicates with return line **R** via channel **f** of the control spool **(2)**.
Flow QP from the pump passes through port **P** in the flow control valve **(1)**.
A flow QP - QX is sent to port **N** (continuation to the auxiliary spool valves).
A partial flow QX (approximately 0.6 l/mn) from port **P** towards the diaphragm **(11)**, the restrictor **(9)**, the channel **(10)** and the control spool **(2)** reaches line **R**.
Consequently, the pressure drop caused by the restrictor **(9)** holds the flow control valve **(1)** in the open position **a**, where it has no regulating function.

Partial trailer braking

Start of braking operation (Fig. 3)

The piston **(6)** of the pilot flow housing **(5)** is supplied under pressure by the tractor braking system (effort applied on the brake pedals).
The pressure is applied via port **Y**. The control spool **(2)** is then pushed to the left, obstructing channel **f** and shutting off the communication between port **B** (to the trailer brake connection) and return line **R**, and thus the connection with channel **(10)**.

The control spool **(2)** moves from position **c** to position **e**. Control flow QX is cut off and the flow control valve **(1)** moves to position **b** (regulating position).
A constant flow QK runs from port **P** to port **B** (towards the trailer brake connection) via the diaphragm **(11)**, channel **(12)**, line **(13)** and non-return valve **(3)**. The surface area of the diaphragm **(11)** is calculated in accordance with constant flow QK.
Residual flow QR passes through the flow control valve **(1)** and then to port **N** (continuation to the auxiliary spool valve).
The line from port **B** (to the trailer brake connection) is placed under pressure and acts on the surface **(14)** of the control spool **(2)** against the pressure exerted on the piston **(6)** by the tractor braking system.

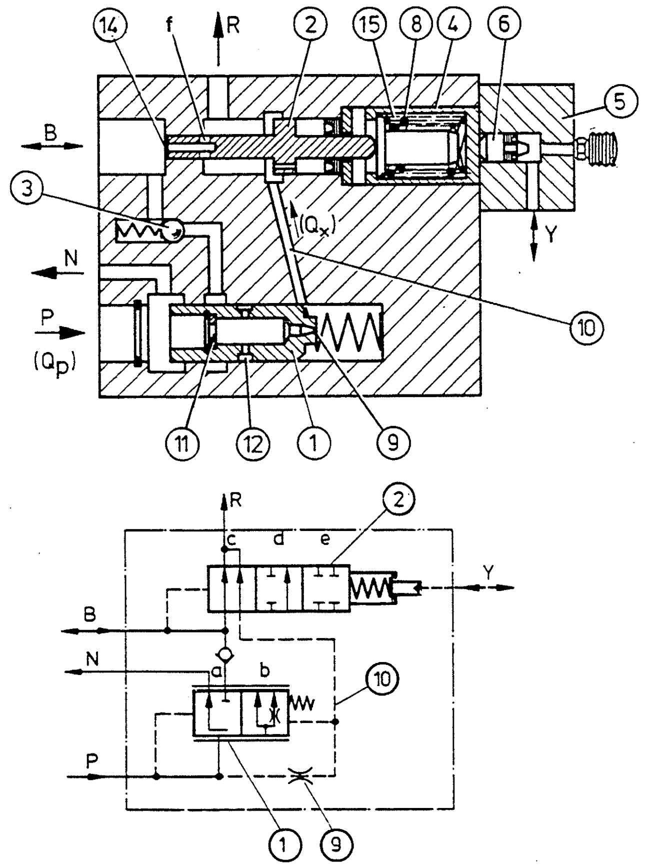


Fig. 2 - Trailer brakes released

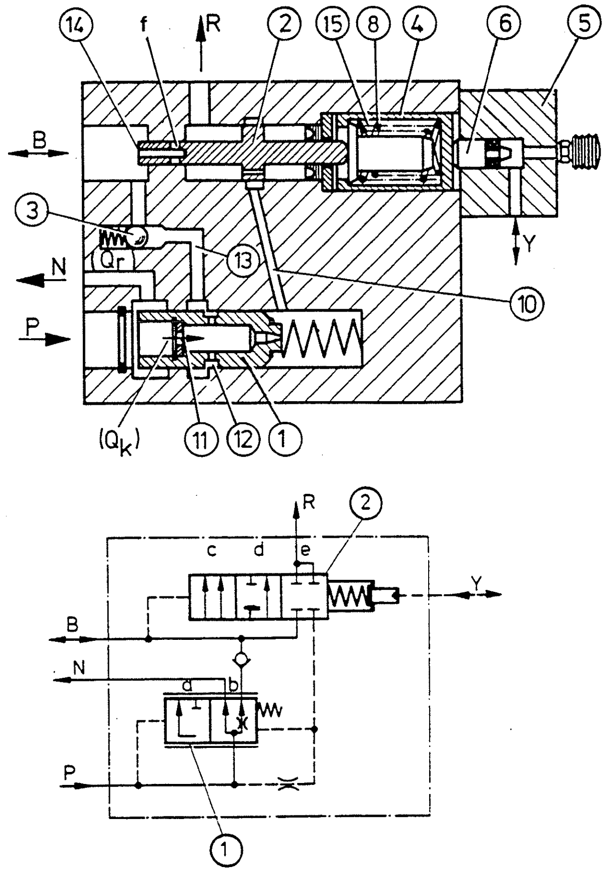


Fig. 3 - Partial trailer braking, start of braking operation

B. Partial and maximum trailer braking

Partial trailer braking (Fig. 5)

Pressure Pb in the trailer brake line (pressure acting on the active surface **(14)** of the control spool **(2)**) is equal to pressure Py (from the tractor braking system) acting on the piston **(6)** of the pilot flow housing **(5)**.

The line from port **(B)** to the trailer brake connection remains cut off from return port **R**. The oil is thus trapped inside the trailer braking system. When the pressures are equalised, the control spool **(2)** is in position **d**.

The flow control valve **(1)** then moves to position **a**, where it has no regulating function.

As in the case where the trailer brakes are released, flow Qp - Qx is directed to port **N** (continuation to the auxiliary spool valve) and control flow Qx is directed to return line **R** by the control spool **(2)**.

Maximum trailer braking (Fig. 6)

Limited braking pressure

The flow control valve **(1)** and the control spool **(2)** are in the same positions (**a** and **d**) as for partial braking.

Flows Qp and Qx are the same as for partial braking. The maximum permissible braking pressure for the trailer is reached (Pb = 150 bar). There can be no increase in trailer braking pressure even if the tractor braking pressure continues to increase.

The pressure relief valve **(4)** is then pushed to the left.

Springs **(8)** and **(15)**, preloaded to the maximum permissible braking pressure for the trailer (Pb = 150 bar), are compressed.

Due to external influences, the trailer braking pressure Pb increases, the control spool **(2)** momentarily opens channel **f** between port **B** (supply towards the trailer braking connection) and return line **R**.

In all the trailer braking valve operating positions, the auxiliary spool valves and the lift control valve can be freely adjusted via the port **N** on the cover (Fig. 4) without causing any major effect on the trailer braking system. This system takes priority over the high-flow hydraulic circuit.

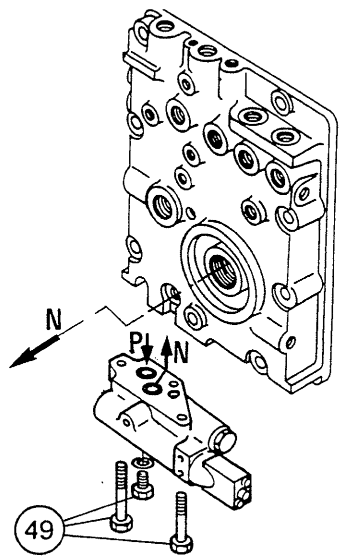


Fig. 4

CONTENTS

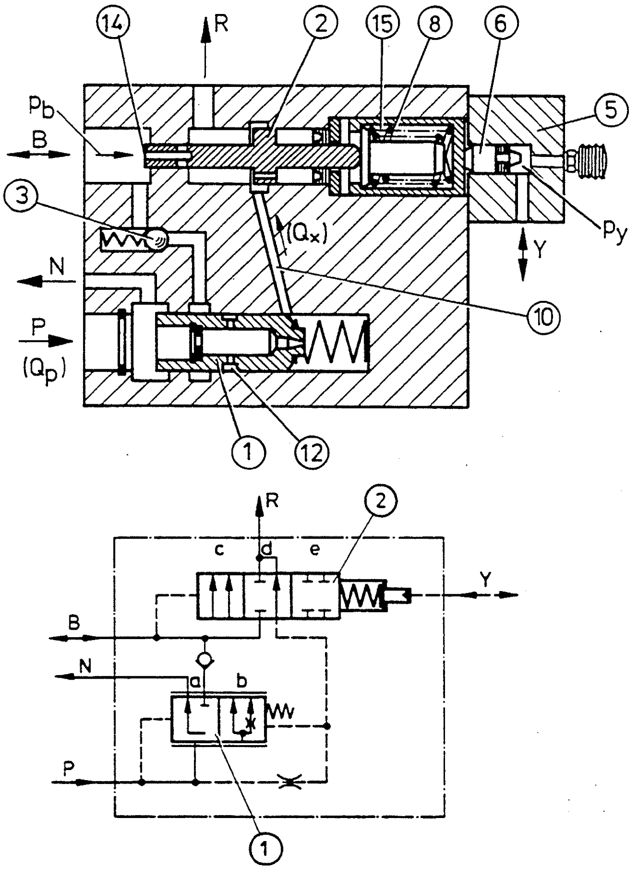


Fig. 5 - Partial trailer braking

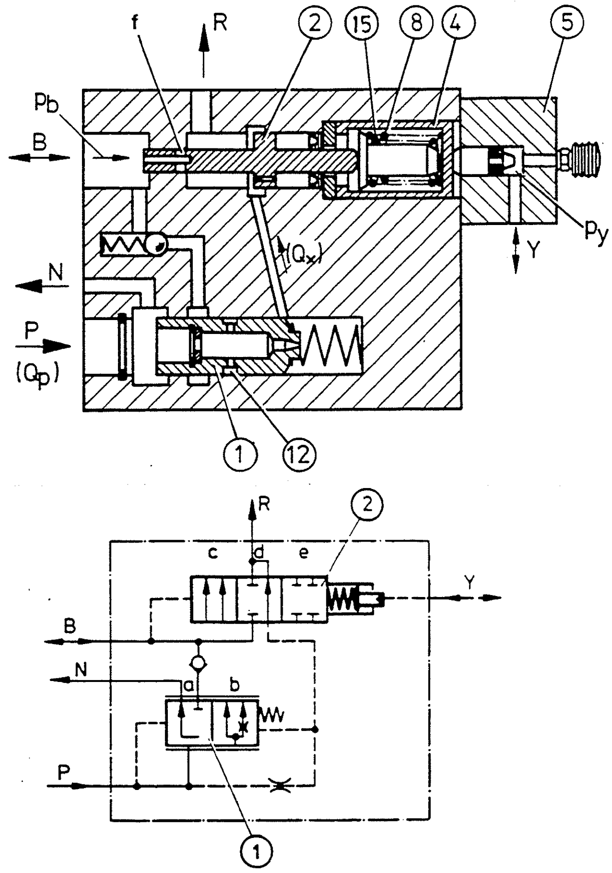
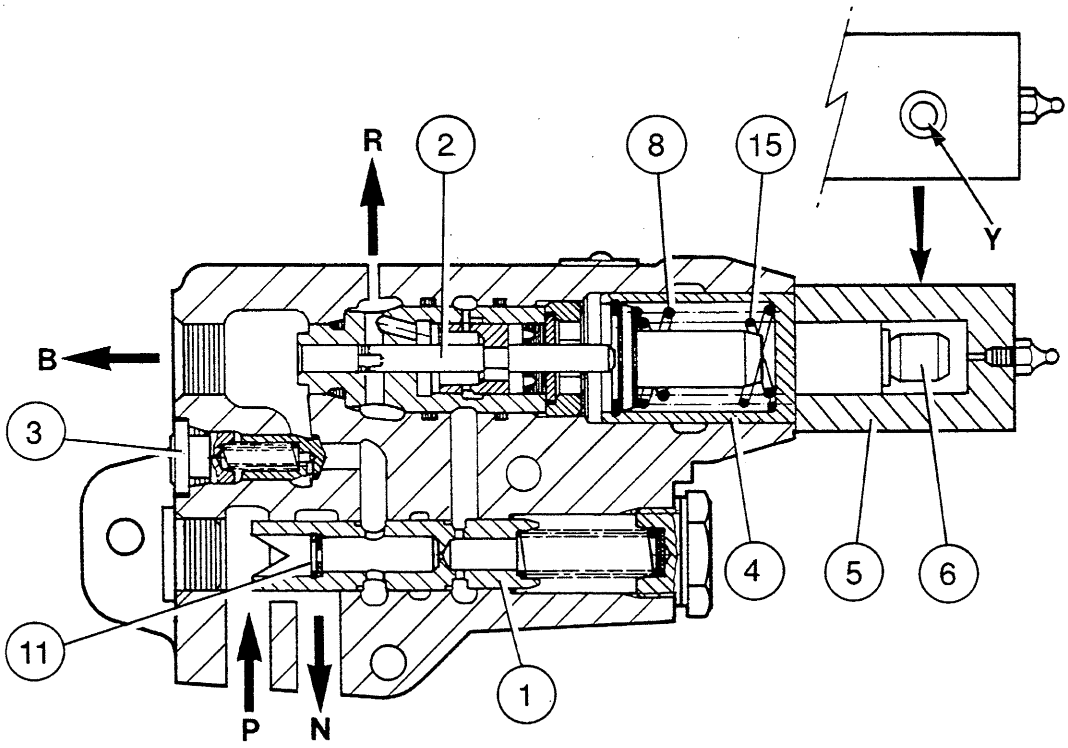


Fig. 6 - Maximum trailer braking, limited braking pressure



C. Removing and refitting the brake valve

Removal

1. **Disconnect and block**:
   - the hose from the pilot flow housing,
   - the line from the trailer brake connection.
2. Remove the screw **(49)** (Fig. 4) and remove the valve.

Refitting

3. Clean the mating faces between the hydraulic cover and the valve.
4. Replace the O-rings **(1)** and **(2)** (Fig. 7).
5. Refit the valve, and fit and tighten the bolts **(49)** (Fig. 4) to a torque of between 25 and 35 Nm.
6. **Reconnect**: the line on the trailer brake connection and the hose on the pilot flow housing.
7. Bleed the main brake and the trailer brake, and check pressure. Carry out the operations in section 9 G01 and in part D.

D. Bleeding the trailer braking system

Note: It is essential to bleed the main braking system before the trailer braking system.

8. Connect a transparent hose (inside diameter of 4 mm) to the bleed screw on the pilot flow housing of the trailer brake valve.
9. Plunge the end of the hose into a receptacle partially filled with transmission oil.
10. Run the engine at about 1,200 rpm. Using a clamp with suitable protection, block the return hose **(1)** to the gearbox selector cover (Fig. 8).
11. Open the bleed screw, and check for leaks between the hose and the bleed screw.
12. **Gently** press the coupled pedals. Repeat this operation several times until the oil flowing out contains no air bubbles.
13. Close the bleed screw and remove the clamp from the return line.
14. Connect a pressure gauge to the trailer brake connection (Fig. 9).
15. Run the engine at 2,000 rpm.
16. **Gradually** press on the coupled brake pedals.
17. The pressure obtained must be between 120 and 150 bar maximum.

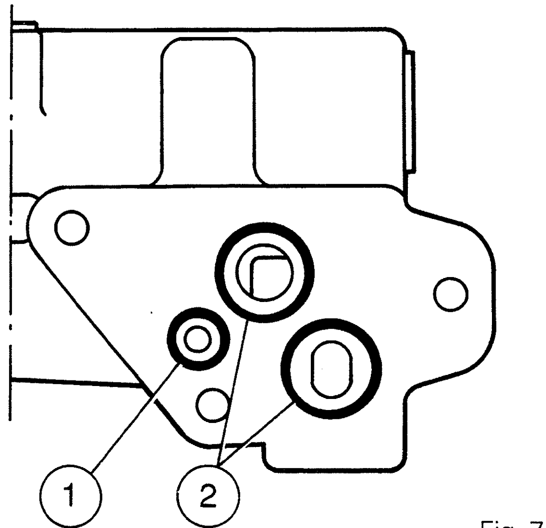


Fig. 7

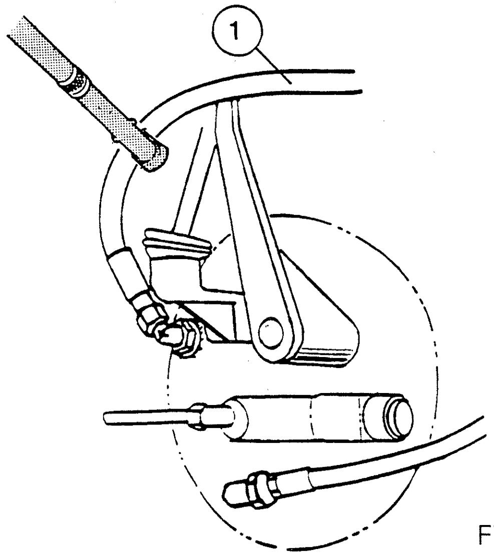


Fig. 8

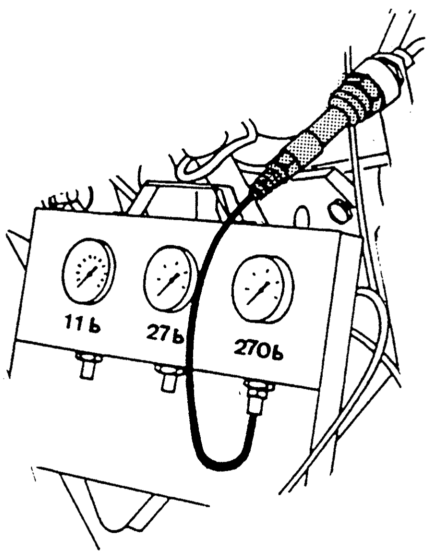


Fig. 9

9 N01 Auxiliary spool valves

CONTENTS

General

The auxiliary spool valves are fitted on the high-pressure circuit. They are fed by the oil coming from the trailer brake valve or from the cover plate (depending on the option).

In the neutral position, the oil not used by the spool valves is available for the lift valve fitted downstream.

The auxiliary spool valves are fixed on a support which in turn is mounted on the rear of the lift cover. The quick couplings are mounted directly on the body of the spool. To obtain an adequate distance between the couplings, the spool valves contain blocks which serve as distance pieces. These blocks also permit the oil to continue to the next spool.

Characteristics

Each spool valve is activated by a lever in the cab, and has three phases:
- 35% slow flow
- 45% progressive increase in flow and pressure
- 20% full flow

The progressive increase in flow and pressure enables uniform control of implements.
This characteristic also enables two spool valves to be activated simultaneously, the overall flow being shared. The flow to each quick coupler is proportional to the position of the control lever.

Different types of spool valves

- 3 positions, convertible to single or double acting.
- 3 positions, convertible to single or double acting with kickout return to neutral.
- 3 positions, convertible to single or double acting with nonreturn valve and kickout return to neutral.
- 4 positions, double acting with kickout return and floating position.
- 3 positions with shock valves.

Assembly procedure (Fig. 1 and 2)

1. For correct assembly of the plates **(2)** and seals each spool valve must be disassembled and reassembled vertically with the end plate **(11)** at the bottom.
2. Screw on the nuts **(12)** until they touch the intake block **(1)**.
3. Place the spool valve assembly with the fastening surfaces "F" supported on a flat surface, ensuring that it is lying perfectly flat.
4. Tighten the nuts **(12)** to a torque of 18 - 22 Nm.
5. Fit the connectors **(13)** and the pipe **(3)**, then tighten them to a torque of 50 Nm.

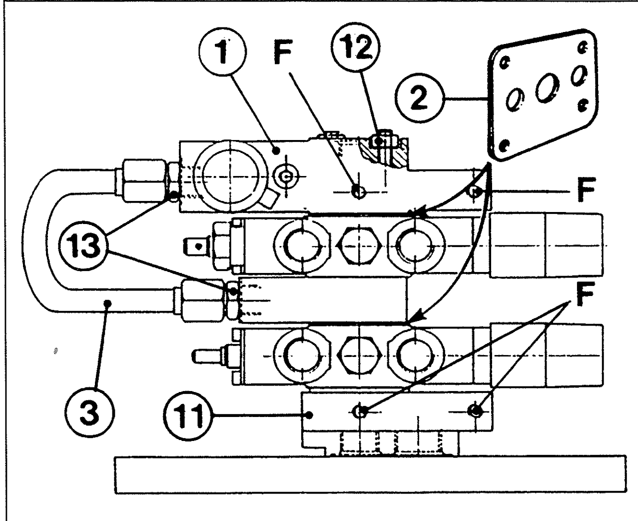


Fig. 1

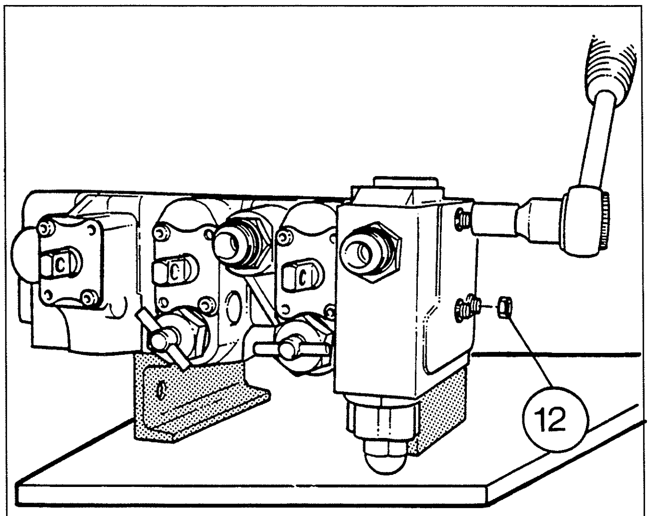
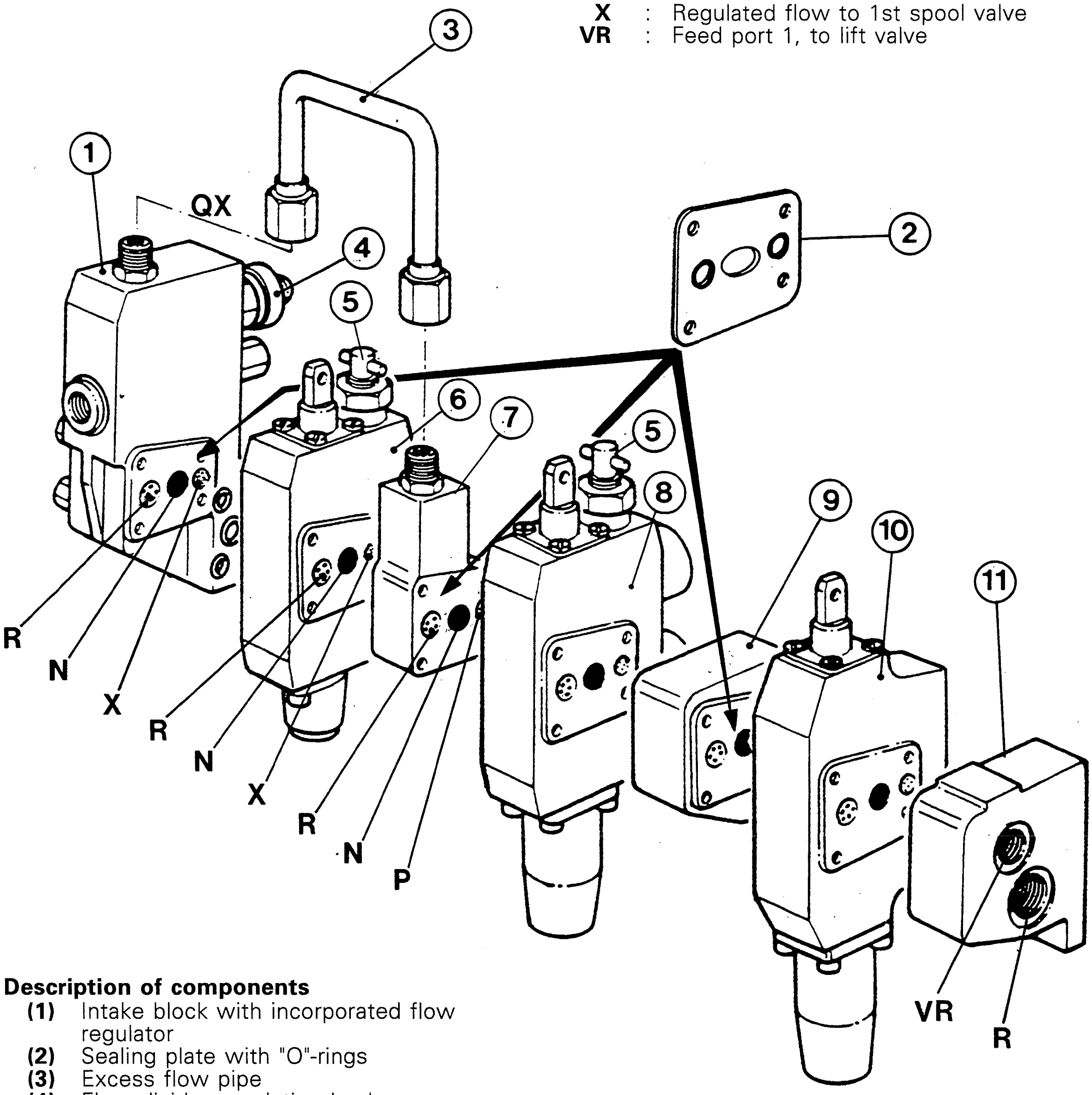


Fig. 2

Designation of ports

N	:	Continuity (to lift valve)
P	:	Pressure
QX	:	Excess flow
R	:	Return
X	:	Regulated flow to 1st spool valve
VR	:	Feed port 1, to lift valve



Description of components

- **(1)** Intake block with incorporated flow regulator
- **(2)** Sealing plate with "O"-rings
- **(3)** Excess flow pipe
- **(4)** Flow divider regulating knob
- **(5)** Single/double change-over screw
- **(6)** 3-position spool valve, convertible single/double acting, return to neutral by spring
- **(7)** Intermediate block receiving excess flow
- **(8)** 3-position spool valve, convertible single/double acting with kickout return to neutral
- **(9)** Intermediate block
- **(10)** 4-position spool valve with kickout return to neutral
- **(11)** End-plate enabling continuity to lift and return to sump

Fig. 3

A. Flow divider

For work requiring a regulated flow, the divider enables a variable flow to be obtained, by adjusting the knob **(4)** between the minimum and maximum positions (Fig. 4).

The divider is situated at the intake of the auxiliary spool valve assembly. It is fed by the oil from the high-pressure circuit passing through the brake valve or the cover plate (depending on the option).

Operation (Fig. 5)

The oil coming from port **N** is sent to port **X** and feeds the first spool valve. The flow is regulated according to the position of the knob **(4)**.
At the same time, the pressure existing in channel **N** enables the oil to pass through hole "**a**" and restrictor "**b**".
The piston **(7)** is then moved upwards, sending the oil through the port **QX** and the intermediate block, which receives the excess flow through the pipe **(3)**.

Adjustment (Fig. 6)

1. Remove the stop screw **(6)**, the lock nut **(1)** and the washer **(2)**.
2. Unscrew and remove the knob **(4)**.
3. Without forcing it, tighten the screw **(3)** so that the valve **(8)** is in contact with its seat.
4. Screw in the knob so that it is in contact with the cap **(5)**.
5. Unscrew the knob by two turns.
6. Screw in and tighten the stop screw **(6)** to a torque of 20 Nm.
7. Place the knob in the closed position (Fig. 4).
8. Fit the washer **(2)** and tighten the locknut **(1)** to a torque of 30-40 Nm.

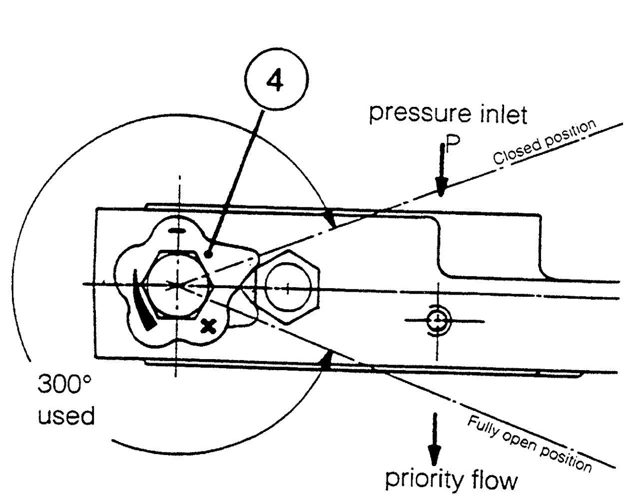


Fig. 4

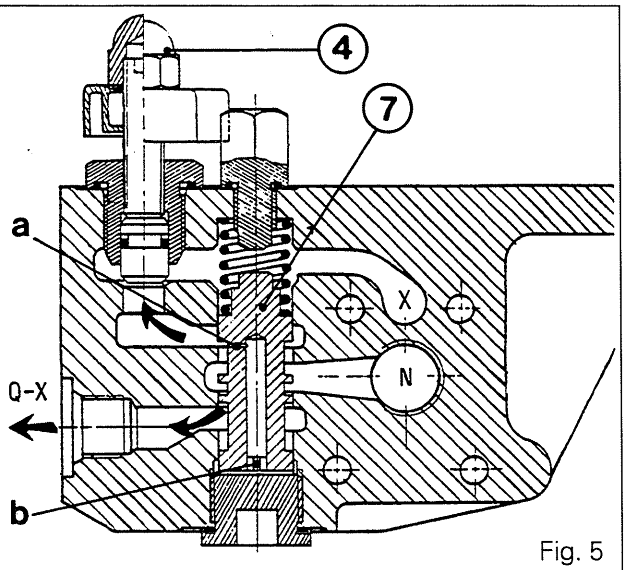


Fig. 5

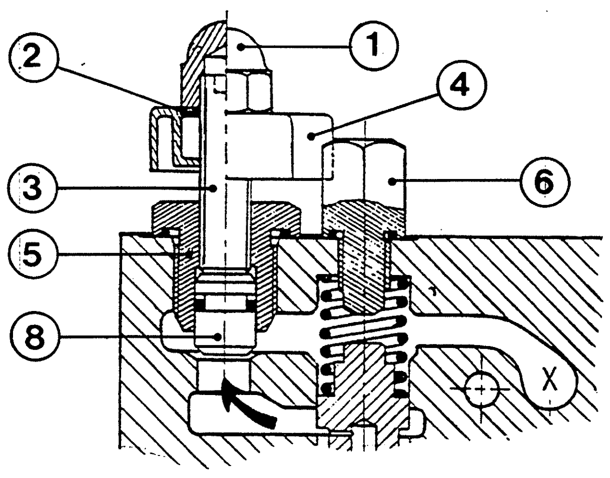


Fig. 6

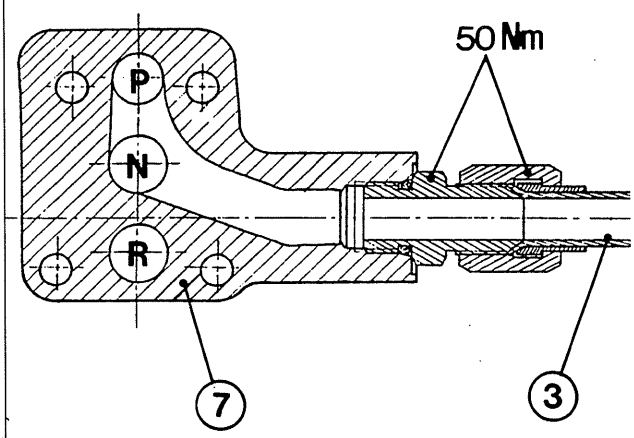


Fig. 7

CONTENTS

B. 3-position spool valve, single/ double acting

Operation (Fig. 8)

According to version (see general) the oil from the high-pressure circuit passes through the brake valve (if fitted) or the cover plate fixed on the right hydraulic cover and feeds the various spool valves via the continuity channel **N**.

Neutral position

The oil is not available at outputs **S1** or **S2**. It is sent via the continuity line towards the lift valve and passes directly to the intake manifold of the pump when the lift is in the neutral position.

Channels **N** and **P** are connected in the intermediate block **7** (Fig. 7) to feed the following spool valves.

Intake - Discharge phase

When the spool **(2)** is moved to right or left, the pressure increases and lifts the valve **(1)**. The oil is sent to channel D or G, depending on the direction of movement of the spool, to feed the outputs **S1** or **S2** via grooves **g1** or **g2**. At the same time, the returning oil is sent from the ram to output S1 or S2, depending on the position of the spool, and comes back to the return channel **R**.

Change-over single/double acting

For the single acting position, unscrew the valve **(4)**. Output **S1** is now connected to channel **R**. Output **S2** feeds the ram.

For the double acting position, screw in the valve **(4)**.

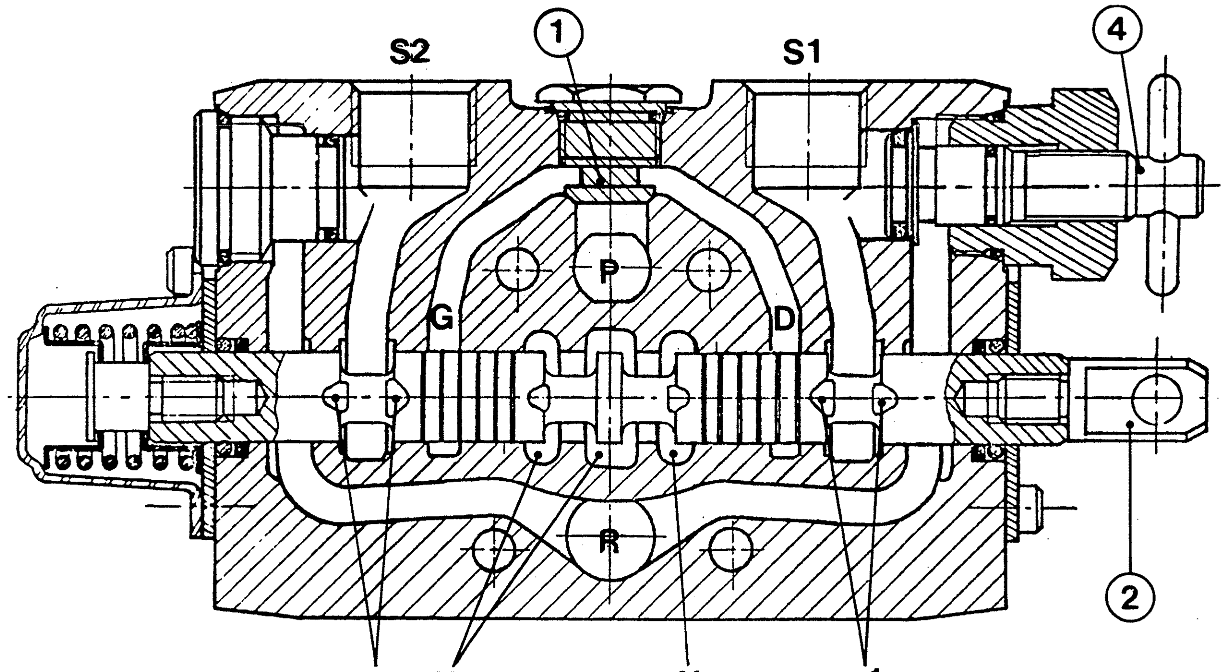


Fig. 8

C. 3-position spool valve, single/ double acting with kickout return to neutral

Operation

Neutral position

The operating principle of the 3-position spool valve, single and double acting with kickout return to neutral, is the same as that of the previous spool valve.

Intake - discharge phase (Fig. 10)

Operation identical to the previous 3-position spool valve, plus the special characteristic that it automatically returns to the neutral point.

The system in the housing **(3)** locks when the spool **(2)** is actuated.

The spool automatically returns at a pressure of 140-160 bar.

The pressure passes through the holes **a** and **b**, releases the system, and enables automatic return of the spool to the neutral position.

The housing **(3)** is in communication with channel **R**.

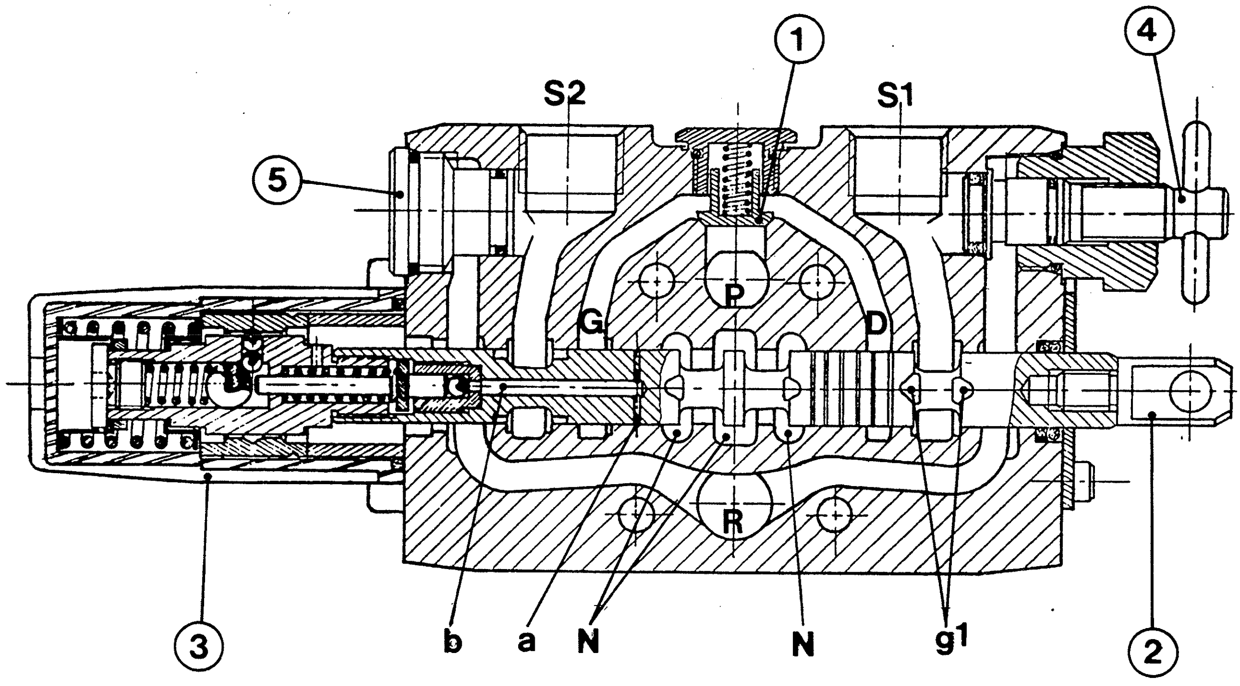


Fig. 9

D. 3-position spool valve, single/ double acting, with nonreturn valve and kickout return

This spool valve operates in the same way as the previous ones.

Operation of check valve (Fig. 11)

When the spool **(2)** is moved to the right, the oil coming from channel **N** is sent to the output **S2**, lifting the check valve **(6)** to feed the service side.

In the neutral position, the check valve seals the circuit.

When the spool **(2)** is moved to the left, the oil coming from channels **N** and **P** lifts the valve **(1)** and is sent to channel **D** to feed the service side via grooves **g1** and output **S1**.

In its movement, the spool moves the needle **(5)** which lifts the ball and causes the pressure to drop on the service side, enabling the valve **(6)** to lift from its seat and oil to flow towards channel **R**.

Note: When dismantling the spool, it is essential to dismantle the checkvalve (6) and the needle (5) first.
If it is mandatory to replace the spool (2) change also the spool valve body.

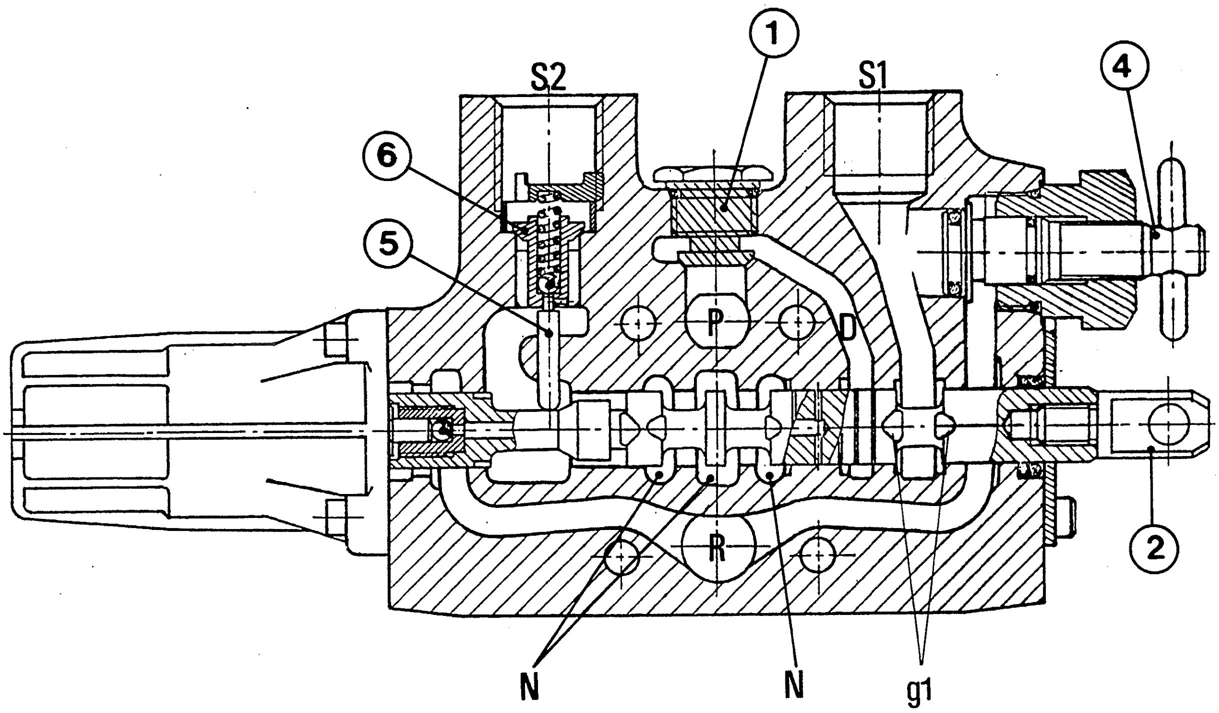


Fig. 10

E. 4-position spool valve, double acting with kickout return to neutral and floating position

Operation (Fig. 12)

When the spool **(2)** is moved to right or left, the same positions are obtained as with the previous spool valves.

The special characteristic of this spool valve is that it has a floating position **F**, when the spool is withdrawn as far as possible, beyond the kickout return to neutral position.

In this **F** position, the channels of outputs **S1** and **S2** are connected with the return channel **R**. Therefore the oil can circulate freely.

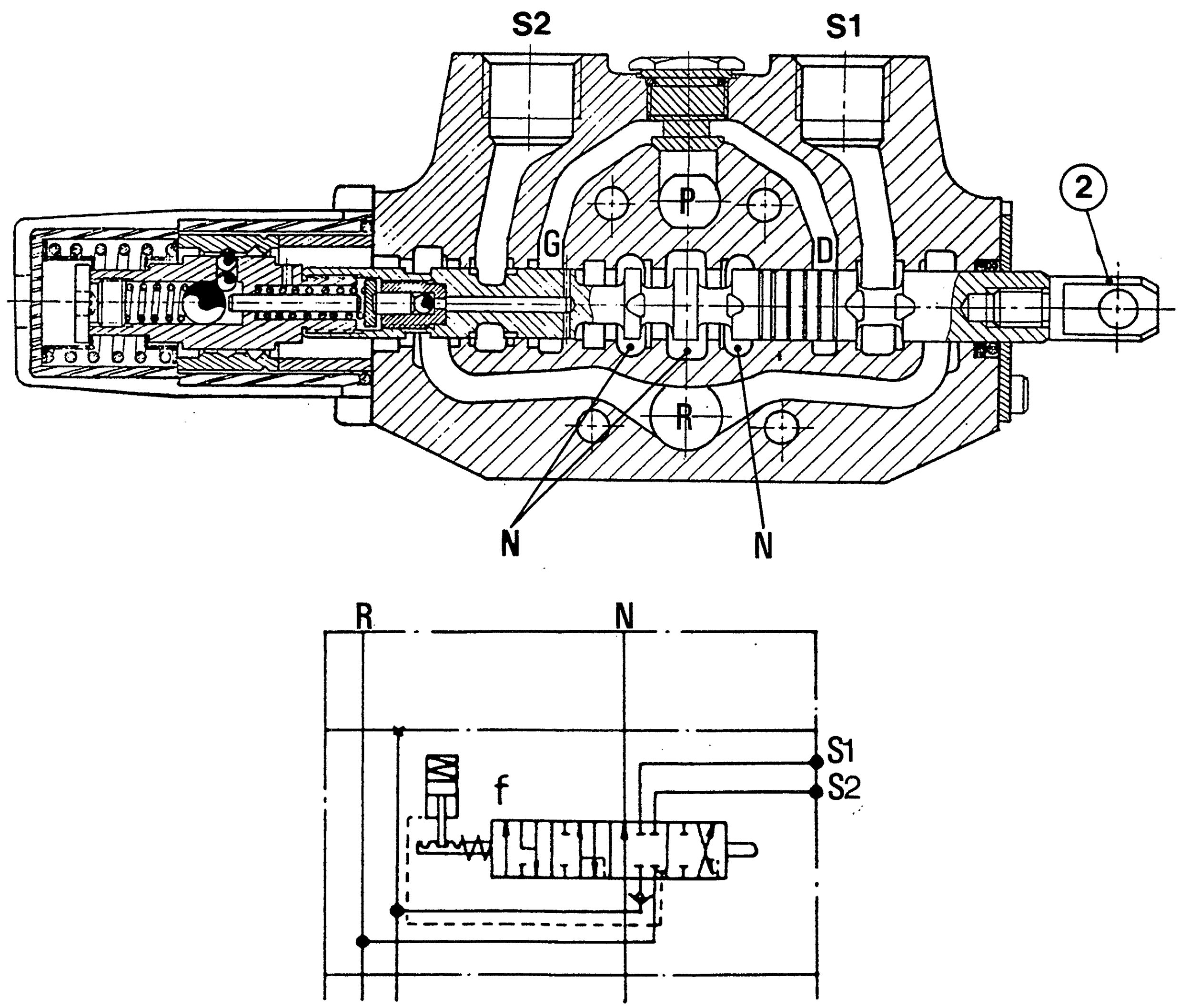


Fig. 11

G . Diagrams

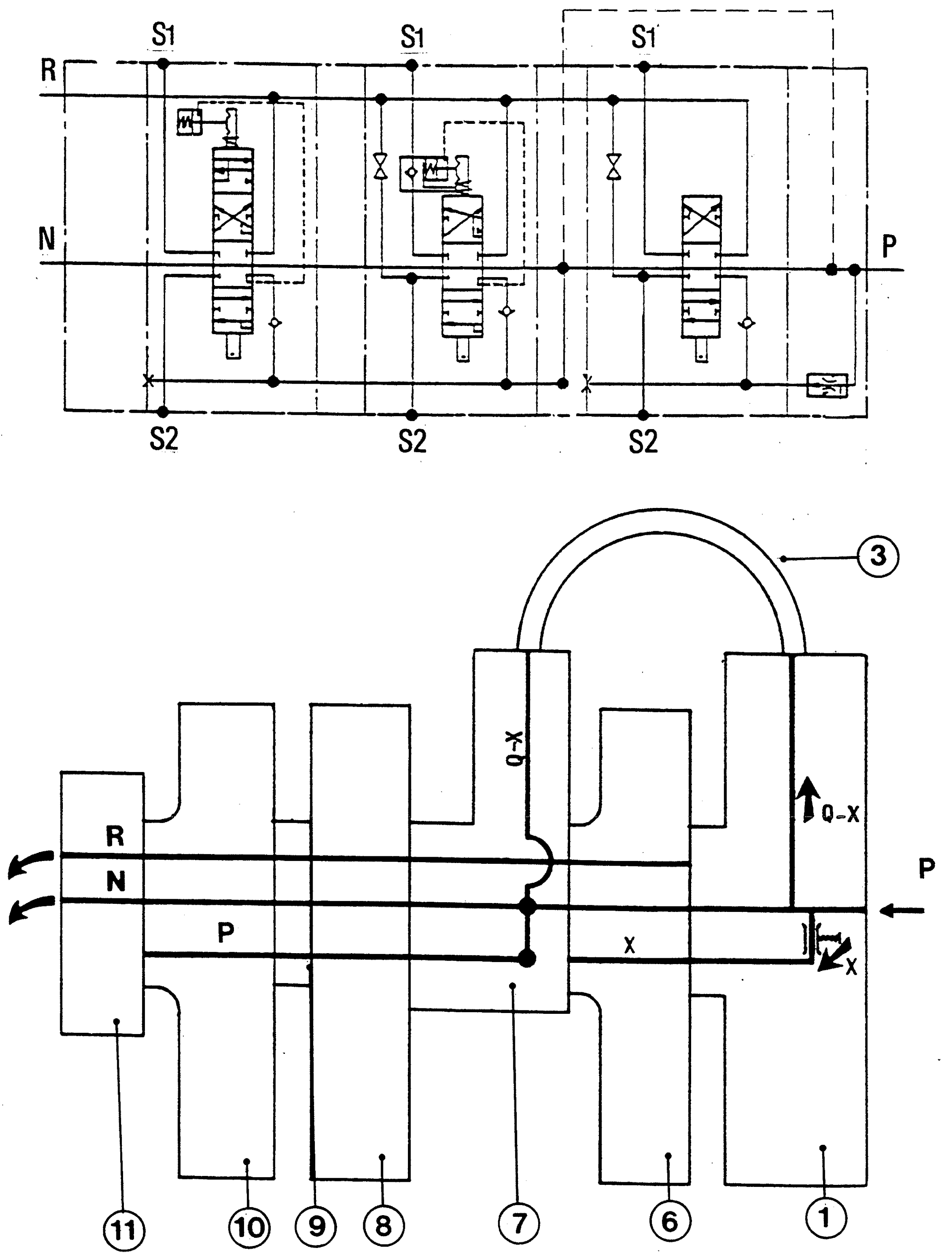


Fig. 12

9 P01 Lift control valve

CONTENTS

General

The lift control valve is attached onto the auxiliary spool valve support mounted to the rear of the lift cover. Its function is to regulate the flow of hydraulic fluid to and from the lift rams according to the signals transmitted to it by the computer of the electronic control system. The lift control valve is made up of a series of spools and valves, most of which are not reparable as separate parts.

A. Removing and refitting the lift control valve (Fig. 1)

Removal

1. Place the lift arms in the lowered position. Remove the protective cover from the lift control valve (spool valve). Mark and disconnect the harnesses from the lifting **(8)** and lowering **(7)** solenoid valves.
2. Disconnect the lines **(3)**, **(4)** and **(5)** from the valve.
3. Remove the bolts **(6)**. Remove the valve.

Refitting

4. Clean the mating faces on the support and the valve.
5. Change the seal **(1)** (Fig. 2) and refit the valve.
6. Fit the bolts **(6)** after smearing them with Loctite 542 and tighten them to a torque of 25 to 35 Nm.
7. Reconnect the lines.
8. Reconnect the lifting **(8)** and lowering **(7)** solenoid valves (yellow connector).
9. Use a clip to attach the harness onto the valve supply line.
10. Start the engine.
11. Check the operation of the lift system and check for leaks on the seals and hydraulic connectors.

Description (Fig. 3 to 5)

The BOSCH hydraulic valve controlling supply to the lift rams is made up of two sections:

Hydraulic section (valve) comprising the following parts:

- **(1)** Non-return valve, keeping fluid in the rams
- **(2)** Servo piston used in the lowering phase
- **(3)** Non-return valve used in the lowering phase
- **(4)** Control spool valve
- **(5)** Flow regulating spool valve
- **(6)** Shock valve calibrated at 200 bar
- **(9)** Flow regulating spool valve spring
- **(10)** Control spool valve spring
- **(11)** Control spool valve spring
- **(12)** Non-return valve ball
- **(13)** Restrictor

Electrical section (solenoid valves) comprising two electromagnetic coils:

- **(7)** Lowering solenoid valve
- **(8)** Lifting solenoid valve

Designation of ports:

N: Communicating port to the flow combination valve, the transfer line and pump intake
P: Pressure
R: Return to housing
V: Supply and return to rams

Note: To distinguish between a hydraulic fault and an electrical fault, simply operate the push-buttons at the ends of the solenoid valves in order to deactivate the electronic lift system.

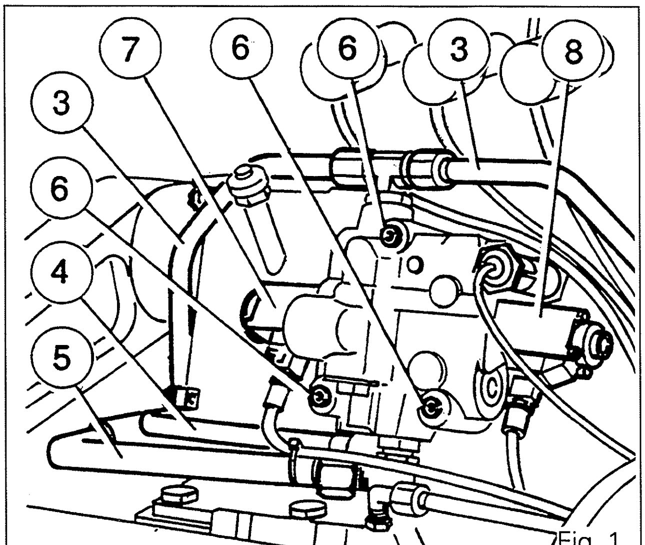


Fig. 1

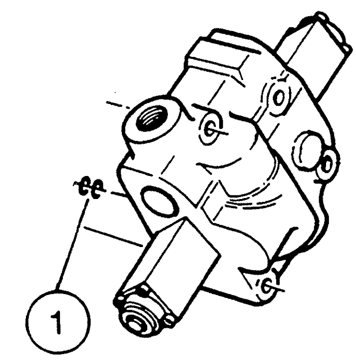


Fig. 2

CONTENTS

B. Neutral position

When the engine is stopped, the lift control valve is in the neutral position. Spool valve **(4)** is held in position by springs **(10)** and **(11)**.
The flow regulating spool valve **(5)** is pushed to the left by spring **(9)**.
When the engine is running, the hydraulic pump supplies the lift control valve via the brake valve (if fitted) and the auxiliary spool valves, with pressure being applied via port **P**. The hydraulic fluid flows initially through hole **«a»** and via port **b**. As port **b** is smaller than hole **«a»**, there is a pressure drop on the spring **(9)** side.

This action causes a control flow to be established, directed to spool valve **(4)** and then to the housing return port **R**. Once the control flow has been established, spool valve **(5)** moves to the right to a position which maintains the control flow and allows the fluid to be directed to the communicating port **N**, the flow combination valve on the left-hand cover and the transfer line.
When, the lift control valve is returned from the lowering position to the neutral position, a channel from the rear of the piston **(2)** to the return line **C** is always open.

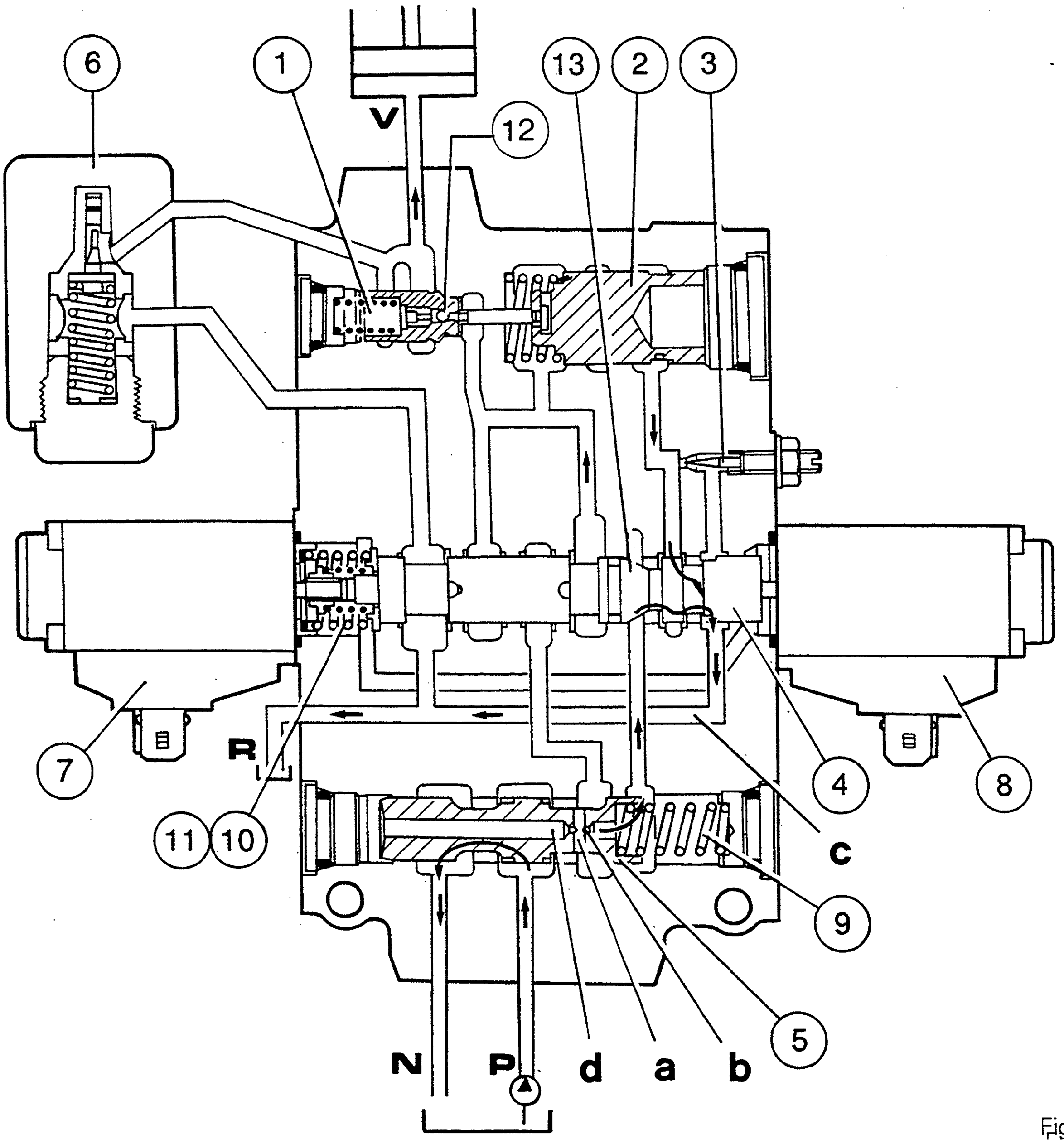


Fig. 3

C. Lifting position

The lifting solenoid valve **(8)** is actuated to raise the tractor hitch system.
The control spool valve **(4)** moves to the left and stops the control flow by placing the chamber of spring **(9)** under pressure and pushing spool valve **(5)** to the left.
The movement is damped by the volume of hydraulic fluid flowing through port **d**.

When spool valve **(5)** has been moved to the left, this allows the main flow to be directed to spool valve **(4)** and to non-return valve **(1)**.
As soon as the pressure on the non-return valve exceeds the pressure in the channels of the rams, the non-return valve opens and the hitch system is raised.

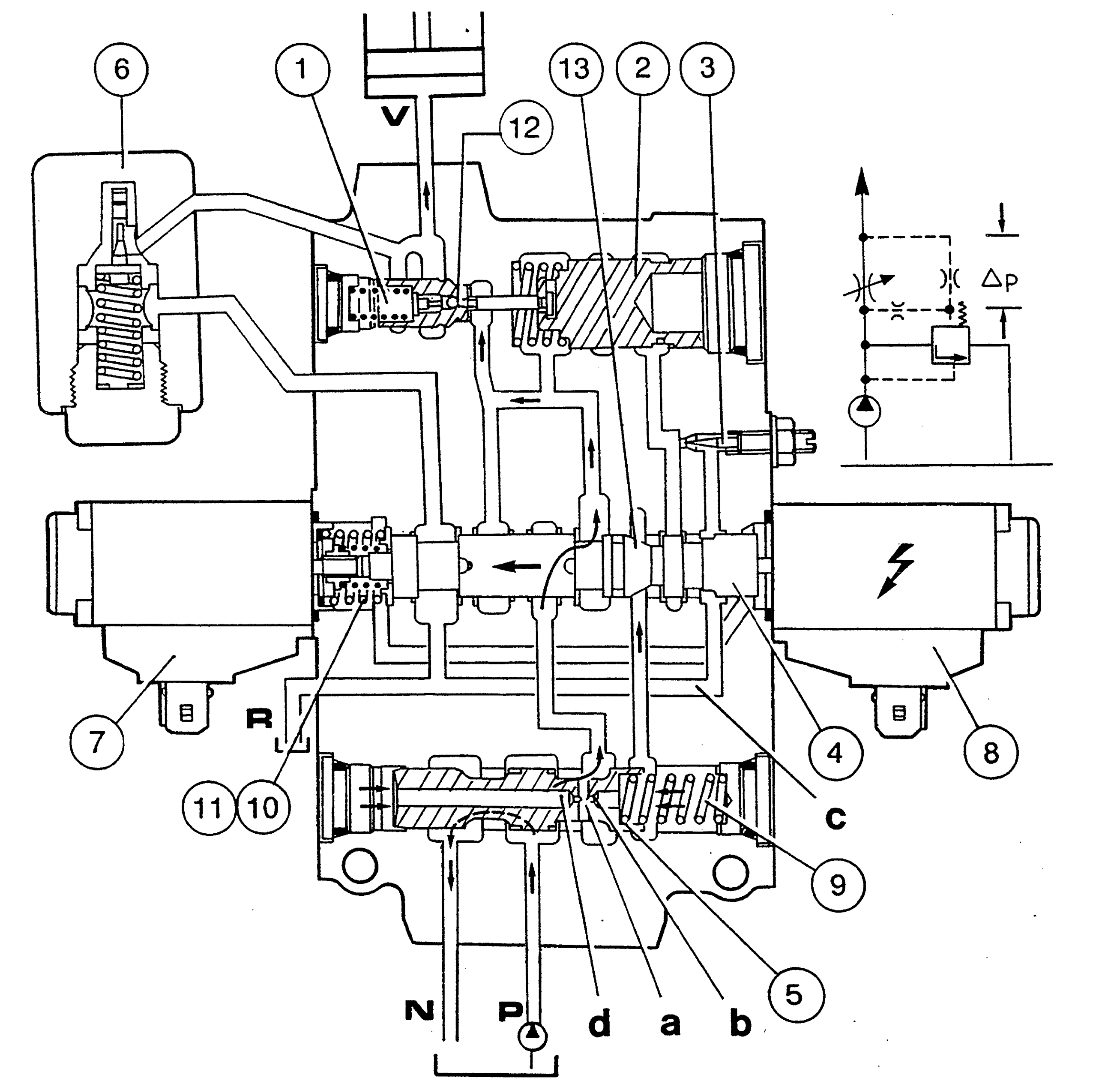


Fig. 4

D. Lowering position

The lowering solenoid valve **(7)** is actuated to lower the tractor hitch system. Control spool valve **(4)** moves to the right. The control flow is stopped and the return channel from piston **(2)** is closed. Hydraulic fluid under pressure is then directed through hole **a**, port **b** and the restrictor **(13)** towards the piston **(2)** which is moved to the left.
The rod at the end of the piston **(2)** lifts the ball **(12)** of the non-return valve **(1)** from its seat. This first causes a pressure drop in the ram circuit. The next step is that the piston **(2)** opens the non-return valve **(1)** enabling the fluid returning from the rams to be directed towards the housing return port **R**.
As the movement of the piston **(2)** is limited, the control flow is re-established and is directed towards non-return valve **(3)**, the return line **c** and the housing return port **R**. The lowering phase has no effect on spool valve **(5)** which is in a floating position. This allows the minimum flow required for control purposes and ensures that the main flow is channelled from the lift valve to the pump intake via the communicating port **N**. The flow is then directed towards the combination valve and the transfer line.

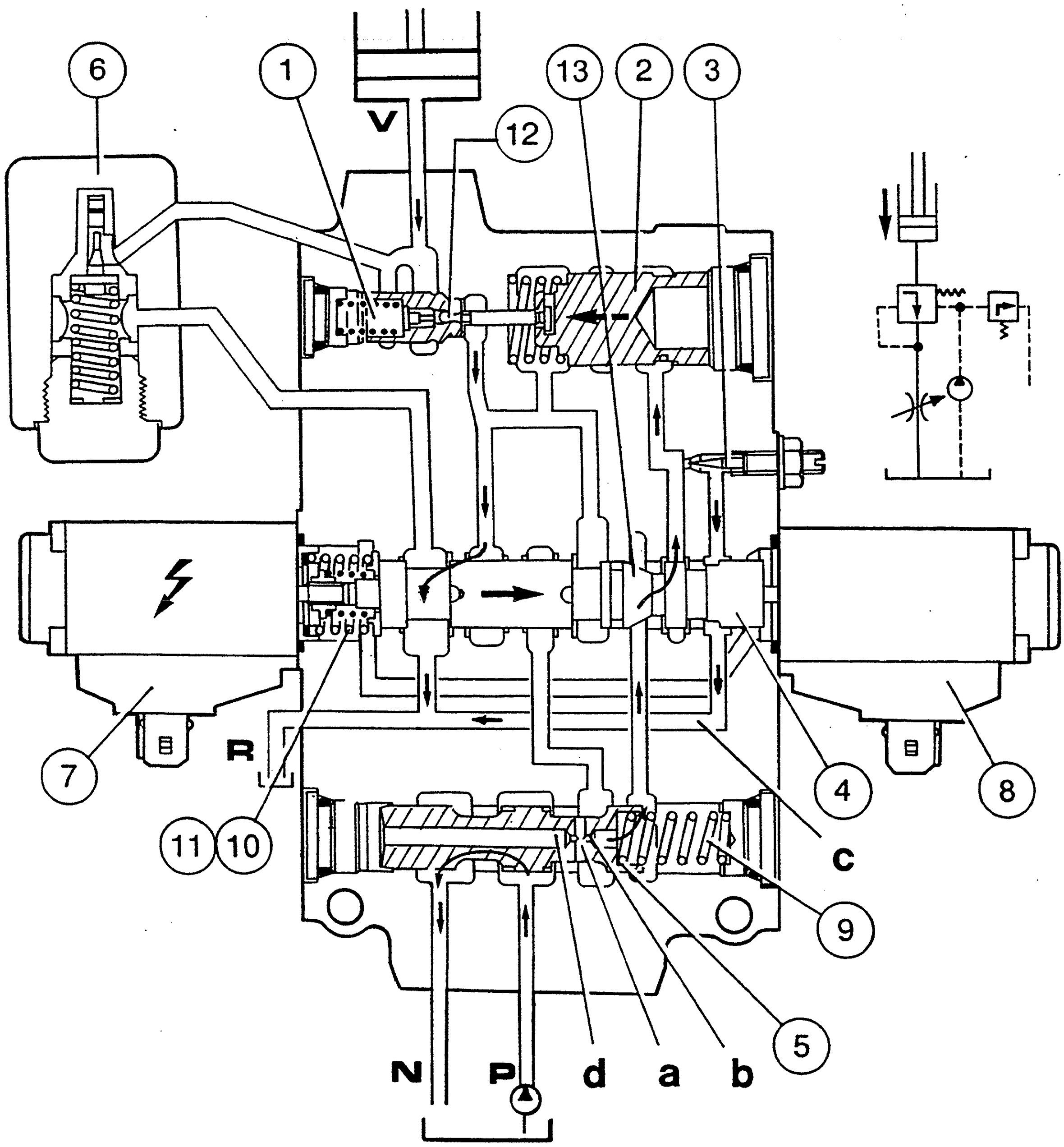


Fig. 5

E . Replacing the solenoid valves

General

In order to avoid changing the complete lift control valve when a solenoid valve is damaged, it is possible to replace it using kit P/N 3900390 M91.
Important :
When replacing a solenoid valve, to avoid any problem of mal-functioning and/or damage, it is IMPERATIVE to check the compatibility of adjustment between the lift control valve and the new solenoid valve.

Fitting (Fig. 7)

1. Disconnect the harness **(E)** or **(E1)** from the solenoid valve.
2. Unscrew the four bolts **(F)** or **(F1)** and remove the solenoid valve **(A)** or **(A1)**.
3. Remove the O-ring **(B)** or **(B1)**.
4. Lubricate and fit the new O-ring in the lift control valve casing.
5. Fit the new solenoid valve and tighten the four bolts to a torque of 2.6 to 3.5 Nm.
6. Reconnect the harness.

F . Adjustment principle (Fig. 6)

Lowering

With a current of 1.2 A through the lower solenoid valve, the flow between the ports **V** (cylinder ram supply/return) and **R** (return to sump) must be between 2 and 4 l/mn.

Raising

With a current of 1.2 A through the lift solenoid valve, the flow between the ports **P** (pressure) and **V** (cylinder ram supply/return) must be between 1.8 and 3.5 l/mn.

G . Checking method (Fig. 8 and 9)

Raising/Lowering with 1.2 A

On the tractor, the first lighting of the E.L.C. panel lift or lower indicator lights **(G)** and **(H)** corresponds to a current of 1.2 A on the lift or lower solenoid valve.

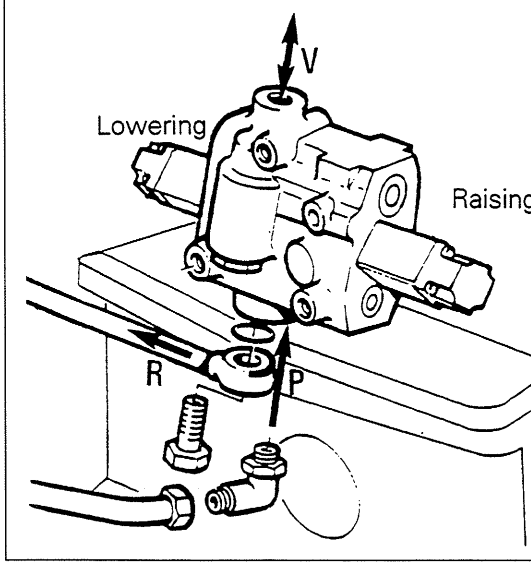


Fig.6

Flow

The flow is checked by noting the time for lowering or lifting and noting the cylinder ram stroke. It is calculated according to the following formula :

$$\mathbf{Q = \frac{3\pi D^2 C}{100000\,t}}$$

i.e. : Q = Flow in l/mn
D = Cylinder ram diameter in mm
C = Cylinder ram stroke in mm
t = Lowering or lifting time in seconds

Example :
D = 89 mm
C = 250 mm
t = 58 s

$$Q = \frac{3\pi \times 89^2 \times 250}{100000 \times 58} = 3.21 \text{ mm}$$

Conditions

- Engine speed = 1000 Rpm
- Transmission oil temperature = 30° C mini
- Checking done under load = weight of 500 Kg mini on linkage

Operations

Important : On the new E.L.C. panel, the quick soil engagement button (J) must not be used during the checking operations.

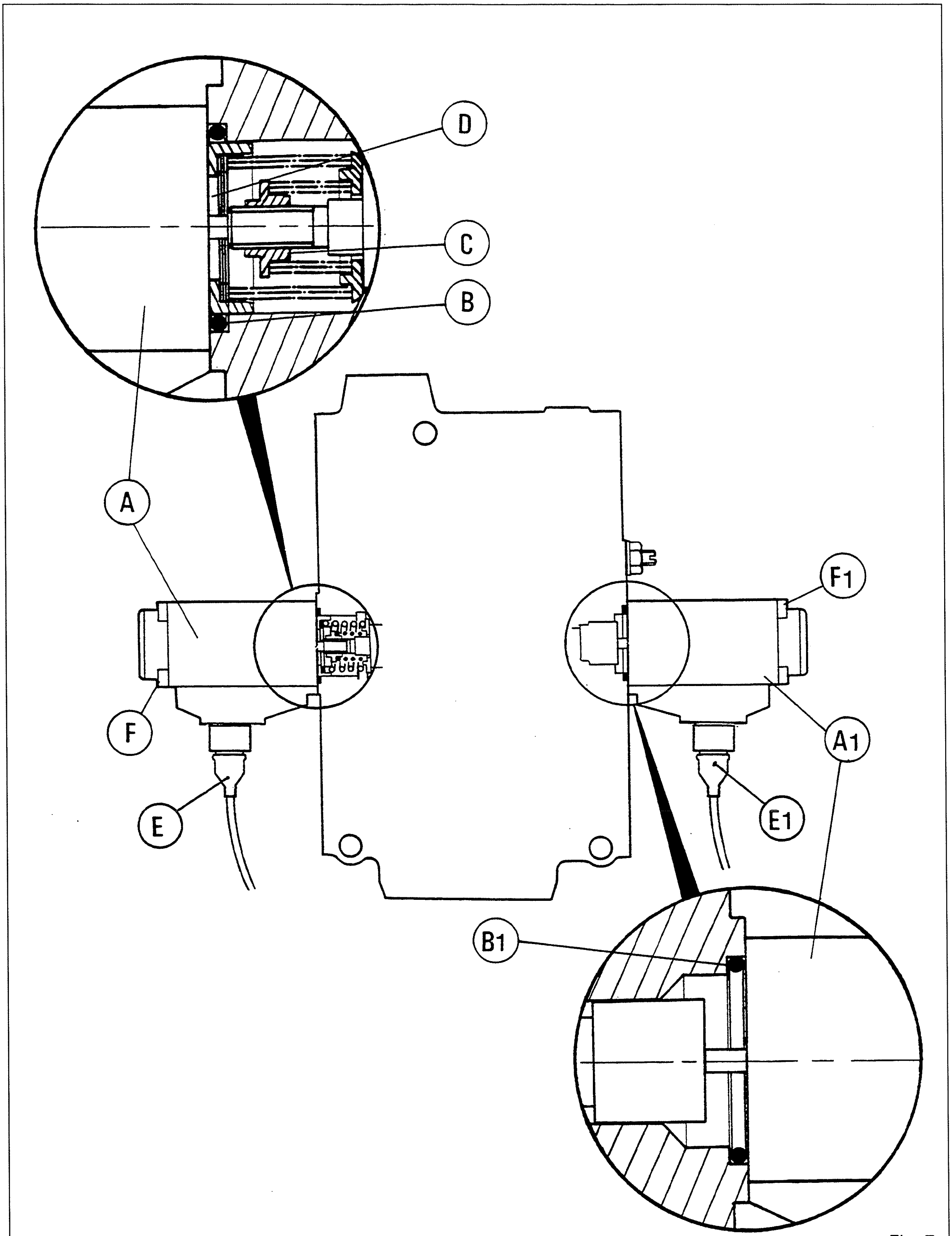


Fig. 7

Lowering (Fig. 8)

7. Set the lift arms to the maxi high position.
8. Adjust the potentiometers and the switch on the E.L.C. panel as follows :
   - rate of drop control and transport lock **(D)** on lock position.
   - maximum height control **(C)** slightly below maxi position.
   - function selector control **(B)** on position 6, draft control only.
   - depth/height control **(A)** on position 10.
   - lift/lower switch **(E)** on lower position.
9. Lightly turn the potentiometer **(D)** until the lower indicator light **(H)** comes on.
10. Stop the lift arms when they reach a low position slightly above the maxi low position by moving the lift/lower switch **(E)** to the neutral position.
11. Note the lowering time, from when the indicator light comes on to when the lift arm stop. Note also the cylinder ram stroke.
12. Calculate the flow. If the result obtained is :
    - **between 2 and 4 l/mn** : the solenoid valve is compatible, no adjustment is necessary.
    - **below 2 l/mn or above 4 l/mn** : it is necessary to adjust the shimming of the lower slide valve spring on the lift control valve to make the solenoid valve compatible (see § H).

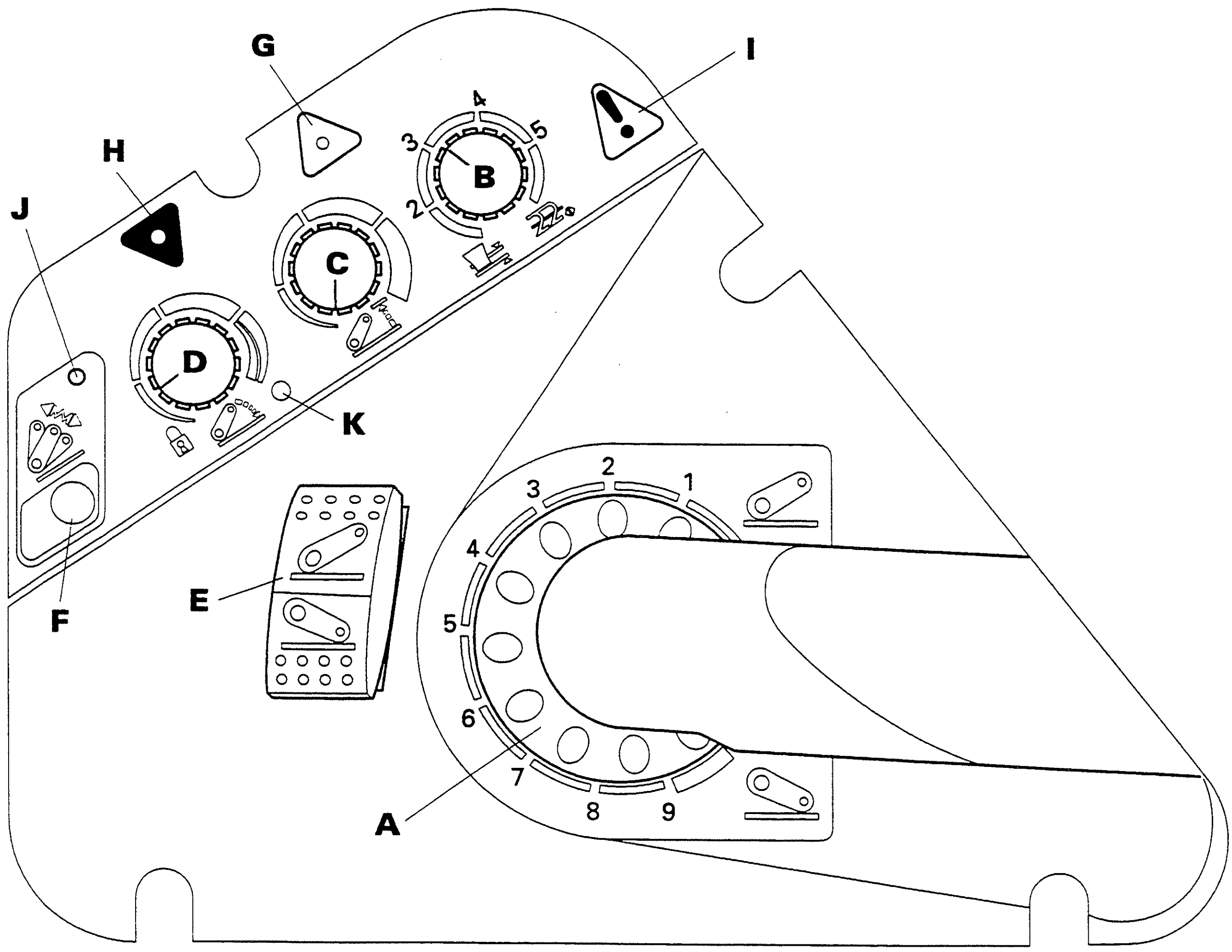


Fig. 8

Raising (see Fig. 9)

13. Set the lift arms to the maxi low position.
14. Stop the engine.
15. Disconnect the tractor position sensor and connect instead an independent position sensor (to cancel the depth signal).
16. Start again the engine.
17. Adjust the potentiometers on the E.L.C. panel as follows :
    - maximum height control **(C)** slightly above mini position.
    - rate of drop control and transport lock **(D)** on lock position.
    - function selector control **(B)** on position 1, position control only.
    - depth/height control **(A)** on position 10.
18. To reactivate the E.L.C. panel, move the lift/lower switch **(E)** to the lift position, then to the lower position, keep it in this position.
19. Lightly turn the potentiometer **(A)** until the lift indicator light **(G)** comes on.
20. Stop the lift arms when they reach a high position slightly below the maxi high position by moving lift/ lower switch **(E)** to the neutral position.
21. Note the lifting, from when the indicator light comes on to when the lift arm stop. Note also the cylinder ram stroke.
22. Calculate the flow. If the result obtained is :
    - **between 1.8 and 3.5 l/mn** : the solenoid valve is compatible, no adjustment is necessary. The tractor position sensor can be reconnected.
    - **below 1.8 l/mn or above 3.5 l/mn** : it is necessary to adjust the shimming of the lift slide valve spring on the lift control valve to make the solenoid valve compatible (see § H).

Note : Some tests on replacement of the solenoid valves, in lift as well as in lower, have shown that all the solenoid valves give flows between mini and maxi. In short, it appears that it will not be necessary to adjust the shimming in most cases.

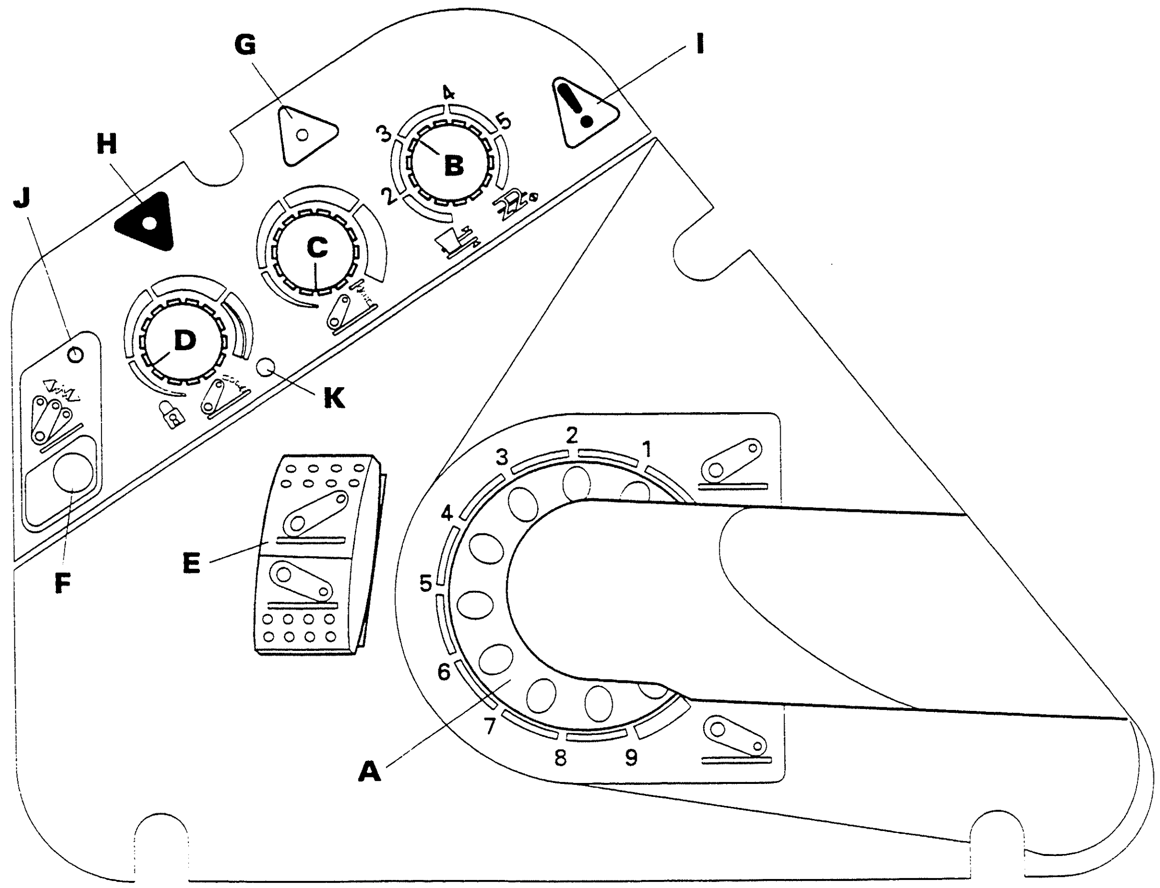


Fig.9

H . Shimming of the spools springs (Fig. 10)

Adjustment

a) The shimming of the lower spring **(A)** is done by adjusting nut **(C)** :
- reduce the dimension **(X)** by loosening the nut to increase the flow.
- increase the dimension **(X)** by tightening the nut to decrease the flow.

b) The shimming of the lift spring **(E)** is done by using the shims **(D)** (available shims = 0.05 mm - 0.1 mm - 0.5 mm) :
- reduce the thickness **(Y)** of the shims to increase the flow.
- increase the thickness **(Y)** to the shims to decrease the flow.

c) The adjustment must be done 0.1 mm at a time (value defined according to tests) until the correct flow is obtained.

Operations

Lowering

23. Remove the lower solenoid valve, the O-ring **(B)**, the spring seat **(F)**, the shims **(D)** and the spring **(E)**.
24. Partially pull out the slide valve **(G)** from the lift control valve casing.
25. Note the original shimming dimension **(X)**.
26. Loosen the original nut **(C)**, crimped on the slide valve thread, using an open ended flat 12 mm spanner and clamping the slide valve with a protected adjustable spanner centred on the diameter "Dia". **This operation must be done carefully to avoid damage to the slide valve edges.**
27. Screw the new nut according to the original shimming dimension **(X)**.
28. Adjust the shimming according to the flow obtained with the new solenoid valve :
    - flow below 2 l/mn, reduce the dimension **(X)** by 0.1 mm loosening the nut **C** 1/4 turn.
    - flow above 4 l/mn, increase the dimension **(X)** by 0.1 mm tightening the nut **C** 1/4 turn.
29. Without crimping the nut, put back the slide valve **(G)**, refit the spring **(E)**, the shims **(D)**, the spring seat **(F)**, the O-ring **(B)** and the solenoid valve.
30. Check again the flow (see § G).

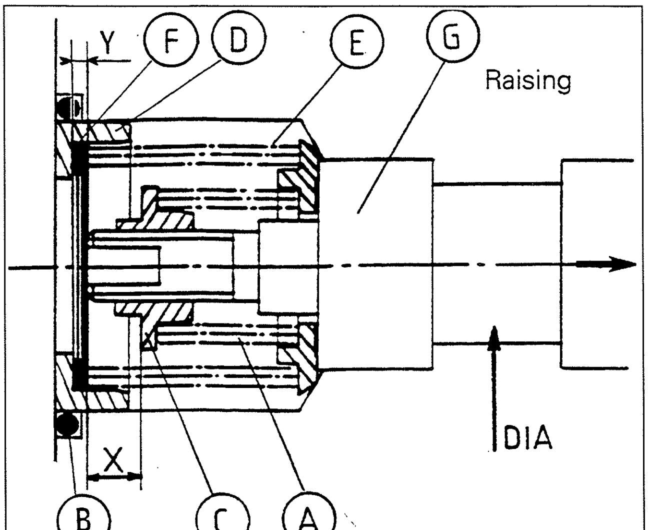


Fig.10

31. Repeat the adjustment and checking operations if necessary.
32. When the flow is correct, crimp the nut on the thread and finally refit the spring, shims, spring seat, O-ring and solenoid valve.

Raising

33. Remove the lower solenoid valve, the O-ring **(B)**, the spring seat **(F)** and the shims **(D)**.
34. Note the original shim thickness **(Y)**.
35. Adjust the shimming according to the flow obtained with the new solenoid valve :
    - flow below 1.8 l/mn, reduce the thickness **(Y)** by 0.1 mm removing one or more shims.
    - flow above 3 l/mn, reduce the thickness **(Y)** by 0.1 mm adding one or more shims.
36. Refit the shims **(D)**, the spring seat **(F)**, the O-ring **(B)** and the solenoid valve.
37. Check again the flow (see § G).
38. Repeat the adjustment and checking operations if necessary.
39. When the flow is correct, reconnect the tractor position sensor.

9 Q01 Hydrostatic steering

CONTENTS

General

The steering system used on 8100 series tractors with open centre is of the hydrostatic type with no mechanical linkage between the steering wheel and the steering ram cylinder.

Its control is based on the principle of «Load Sensing».
The main components of the system are:
- a pressurised oil feed supplied by the high-pressure stage of the hydraulic pump,
- a flow divider valve (priority valve) installed in series on the high-flow circuit,
- a steering distribution valve (unit, Orbitrol LS) with closed centre, installed in parallel,
- a double-acting steering cylinder fitted on the 4WD front axle or the 2WD axle.

The Orbitrol unit is supplied by the high-flow circuit via the divider valve. When the steering wheel is turned, the required oil flow is sent to the relevant side of the steering cylinder. The excess flow not required by the cylinder is then directed via return ports to the selector cover installed on the gearbox, forming a reservoir with the rear axle housing.
In the case of failure of the engine or the hydraulic pump, the Orbitrol unit acts as a hand-operated pump so that the steering can be controlled.

Description of the distribution valve (Orbitrol)

The Orbitrol unit consists of a selector spool valve, a supply sleeve which is centred by springs and a drive shaft connected to the steering column. The Orbitrol unit has five ports, as follows:
- a pressure port,
- a port for return to the selector cover,
- two supply ports for the steering cylinder,
- a Load Sensing port.

The circuit is protected by a safety valve and two shock valves as well as two suction valves.

A. Principle of «Load Sensing»

Steering unit

Unlike the classic unit, the LS steering unit is equipped with a fifth LS port (Fig. 8).
This port is either connected to the Orbitrol closed circuit when the steering is in the neutral position or connected with the supply pressure line when the steering wheel is turned.

Divider valve (Fig. 1 and Fig. 8)

The divider valve fitted in a cartridge on the right-hand lateral cover is equipped with four ports:
- **P** connection with the pump,
- **DC** connection with port **DC** on the steering unit,
- **DE** connection with the trailer brake supply,
- **LS** control of connection with the **LS** port of the steering unit.

Operation of «Load Sensing»

The divider valve (Fig. 1) comprises a slide which is balanced under the effect of:
- the **LS** control pressure + a spring (equivalent to a pressure of 10 bar),
- **DC** supply pressure from the steering unit acting on the opposite side of the slide valve from the spring.

The divider valve, as its name indicates, divides the flow from the pump into two directions: one directed to port **DC** of the steering unit and the other (**DE**) directed to the trailer brake and the auxiliary distribution valves, according to the position of the slide valve.

This division is governed only by the operation of the steering and the **LS** control signal.

When the steering system is not being used (steering in the neutral position), the oil from the **DC** channel joins the Orbitrol closed centre circuit, with no pressure towards port **LS**. The action of the spring, equivalent to 10 bar, is applied on one side of the slide valve. The pressure in channel **DC** and in the axial hole in the slide valve forces it to move against the spring (Fig. 1).

If there is no pressure in line **DE**, the slide valve is positioned so as to slightly close the passage to **DE** and create a 10-bar decrease in pressure from **P** to **DE**.

If, however, there is pressure in line **DE**, such as when the auxiliary distribution valves are used, for example, the slide valve is moved to the right, fully opening the passage towards the trailer brake.

Neutral position

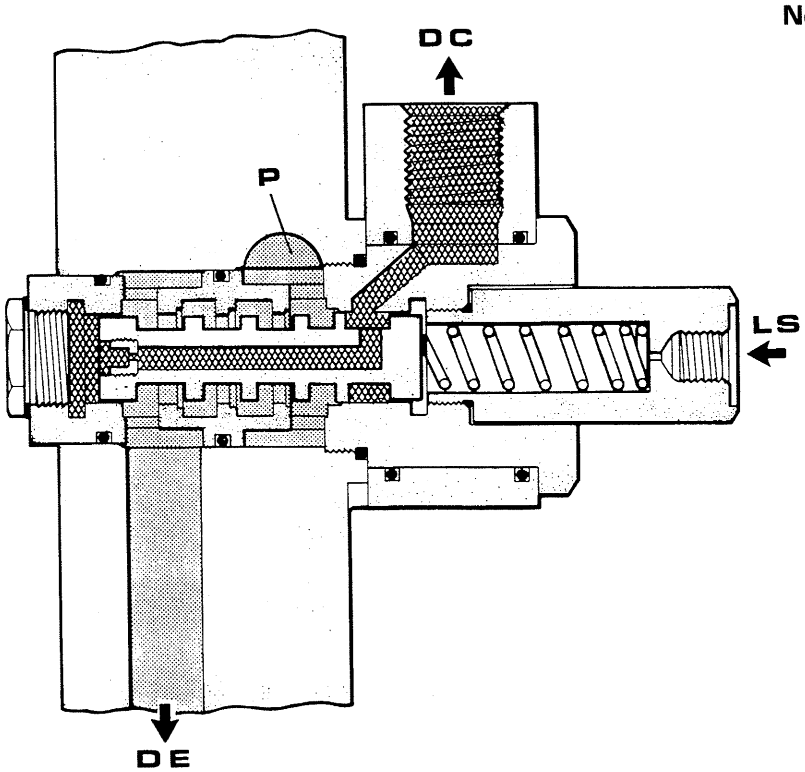


Fig. 1

It has been shown that, when the steering is operated, line **LS** is connected with line **DC** supplying the steering unit. This connection is not, however, direct but is achieved through ports which are opened to varying degrees according to how quickly the steering wheel is turned.
The angular offset between the sleeve **(27)** and the spool valve **(25)** of the rotary distribution valve, and thereby the opening of the ports, depends on the speed with which the steering wheel is turned.
The **LS** control signal is thus modulated according to the steering wheel turning speed. The slide of the divider valve is actuated more or less towards the left to allow through a variable flow according to the requirements of the steering system (Fig. 2).
The position of the slide corresponds to the balance between the input pressure from the steering system and pressure **LS** + spring.
In fact, the slide of the divider valve acts as the pressure balance of a flow controller and allows a constant pressure difference (**P** spring) to be maintained between pressure **DC** and pressure **LS**.
When the steering wheel is operated at the same time as the auxiliary distribution valves, the slide of the divider valve is positioned so as to allow the **flow** that is strictly necessary **to the steering system AS PRIORITY**. The **remaining flow** is **directed to the trailer brake and the auxiliary distribution valves**.
When the steering ram reaches its end of travel, the relief valve installed on line **LS** (in the steering unit) is opened and the pressure in line **LS** drops and does not exceed 160 bar. The slide then moves to the right and directs all the flow towards the trailer brake.

List of parts

(1) Bolt
(2) Bolt
(3) Seal
(4) Cover plate
(5) O-ring
(6) Stator
(7) Pin
(8) O-ring
(9) Rotor
(10) Spacer
(11) Link shaft
(12) Washer
(13) Centring springs
(14) Needle-roller bearing
(15) Bush
(16) Washer
(17) O-ring
(18) Relief valve
(19) Seal
(20) Shock valve
(21) Orbitrol distribution valves
(22) Non-return valve
(23) Suction valves
(24) Ring
(25) Spool valve
(26) Check valve
(27) Sleeve
(28) O-ring
(29) Distributor plate

Steering wheel turned

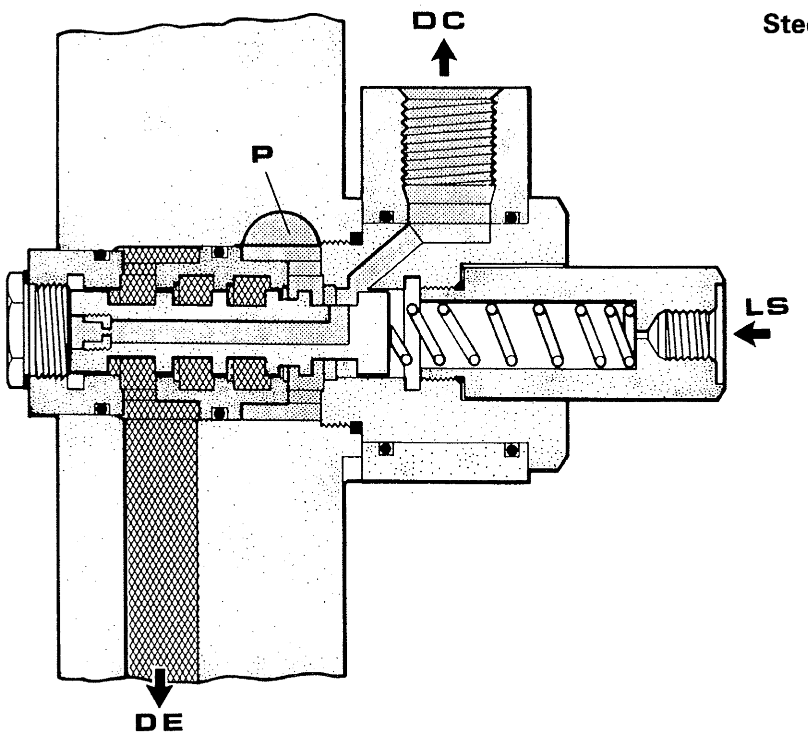


Fig. 2

CONTENTS

Overall view

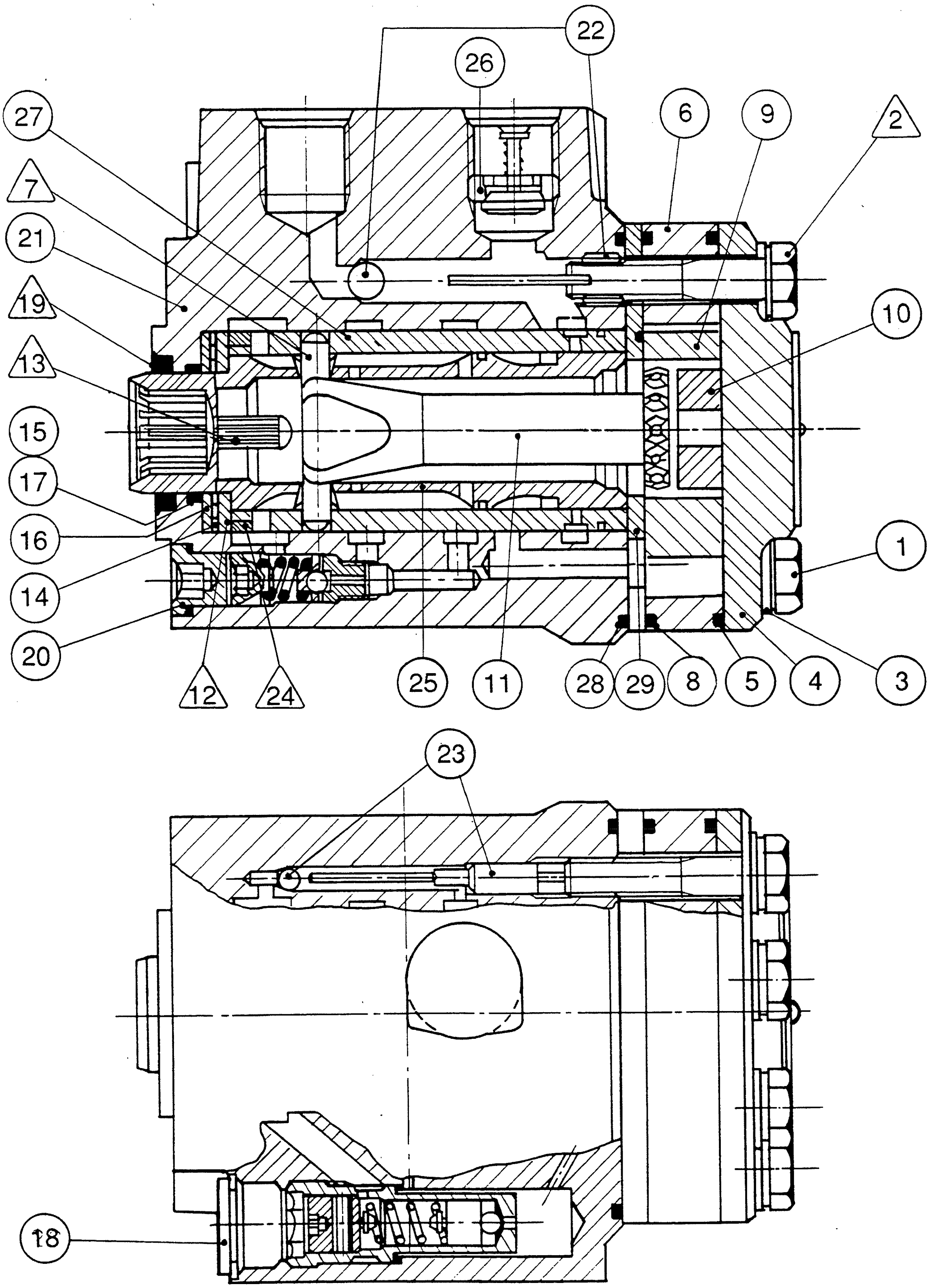
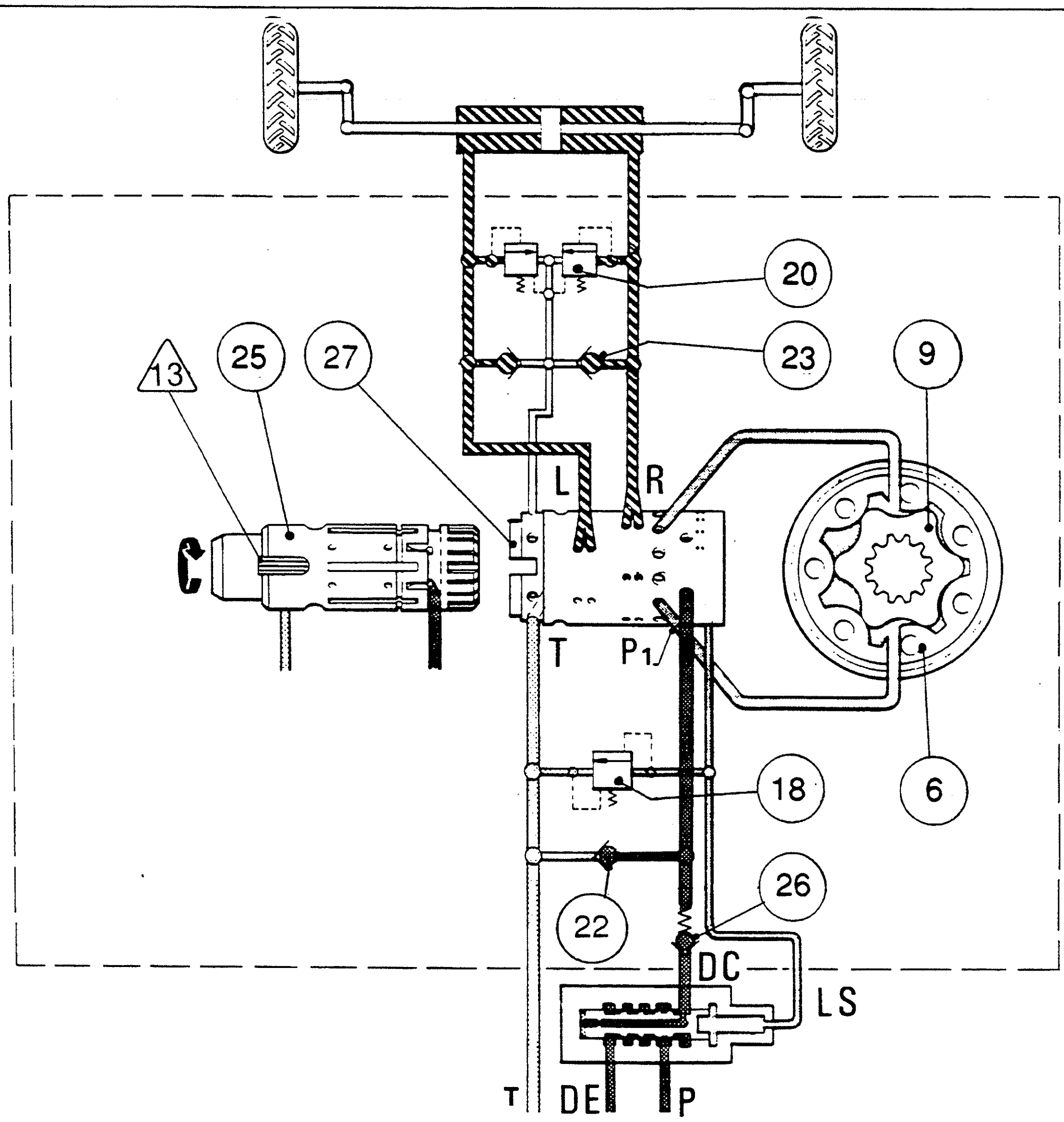


Fig. 3

B. Neutral position (engine running)

In this position, the spool valve **(25)** is centred with respect to the sleeve **(27)** by means of springs **/13**. There is no supply to channels **P1-L-R**. The oil coming from the pump via port **P** is routed through the divider valve and enters the Orbitrol closed circuit. As the pressure increases in channel **DC**, the slide of the divider valve is moved, compressing the spring and thus allowing the oil to flow from **P** to **DE** (trailer brake). The circuit is closed.

Two shock valves **(20)** and two suction valves **(23)** are placed in ports **L** and **R** of this distribution valve.
The shock valves **(20)** protect the circuit between the steering cylinder and the distribution valve from any impact on the wheels.
The suction valves **(23)** allow the oil released by the shock valves **(20)** to flow from the right-hand channel to the left-hand channel or vice versa, depending on the displacement of the piston in the steering cylinder.



DC	Supply to steering
DE	Supply to trailer brake
L	Supply to left-hand side of steering cylinder
LS	Control
P	High-flow supply from hydraulic pump
P_1	Supply to metering device (stator **(6)** and rotor **(9)**)
R	Supply to right-hand steering valve
T	Return to housing

Fig. 4

C. Steering wheel turning (engine running)

Action on the steering wheel (movement to the right or left) causes an angular shift of the spool valve **(25)** with respect to the sleeve **(27)** and opening of the Orbitrol closed circuit. The priority flow from the divider valve, controlled by the pressure reigning in channel **LS**, is directed towards the metering device (stator **(6)** and rotor **(9)**).
The rotor **(9)** is driven in rotation and supplies the cylinder with a quantity of oil that is proportional to the angle of rotation. The rotation of the rotor **(9)** is equal to that of the steering wheel.
Example:
Let us suppose that the steering wheel is turned through an angle of 5°. This causes an angular shift of 5° of the spool valve **(25)** with respect to the sleeve **(27)**.
The rotor **(9)** is driven in rotation as long as it is supplied. It drives, with it, the link shaft **(11)** and the sleeve **(27)**. When these have turned through 5°, the spool valve **(25)** and sleeve **(27)** are again centred by the springs **/13**. The rotor is no longer supplied and stops rotating.
This reasoning can be extended to greater angles. The quantity of oil delivered by the steering unit to the cylinder is, thus, proportional to the angle of rotation of the steering wheel. Depending on whether the steering wheel is turned to the left or to the right, the spool valve **(25)** directs the oil delivered by the metering device (stator **(6)** and rotor **(9)**) to port **L** or **R**.
During the rotation, the sleeve **(27)** ensures that the cavities in the metering device are set into synchronous communication with the circuit from the pump, on the one hand, and the circuit to the cylinder, on the other hand.
A check valve **(26)** is screwed into the distribution valve supply port. This is a one-way valve which prevents excess pressures exerted on the wheels from being transmitted to the pump when the wheels are turned. If the pressure in the steering system is too high, the relief valve **(18)**, located in the distribution valve, is actuated and the excess pressure is routed to channel **T**.

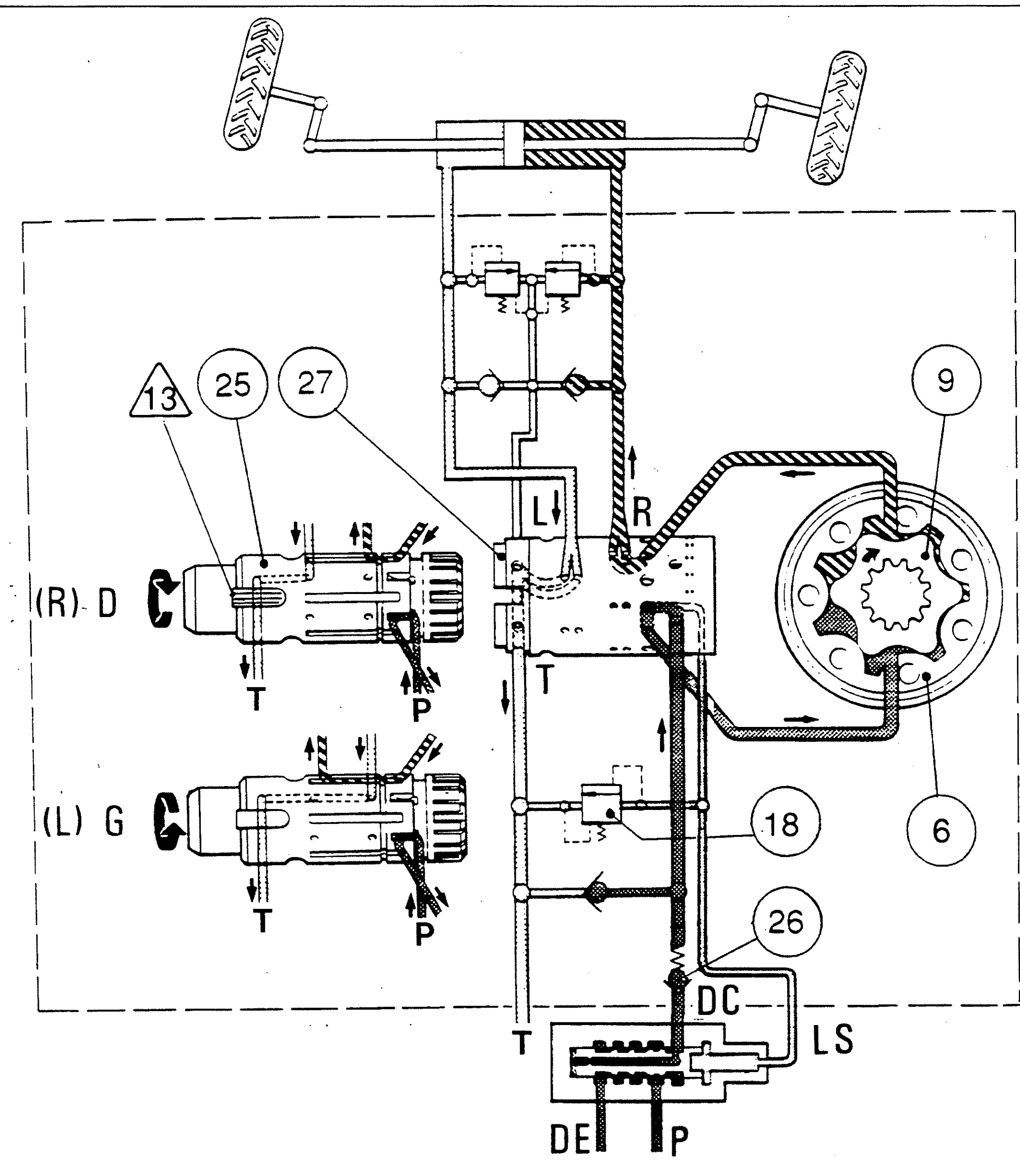


Fig. 5

D. Manual steering (engine stopped)

When there is no more flow from the pump or when the available pressure is too low, the rotor **(9)** is no longer driven hydraulically. Power assistance is no longer provided.
In this case, action on the steering wheel compresses the centring springs **/13**. The angular play between the pin **/7** and the sleeve **(27)** is taken up and the metering device (stator **(6)** and rotor **(9)**) is driven mechanically. The distribution valve then functions like a hand-operated pump.

The oil returning from the cylinder passes via the non-return valve **(22)** and supplies the metering device.

The pressure generated is proportional to the torque applied on the steering wheel. In this case, considerable force is required on the steering wheel.

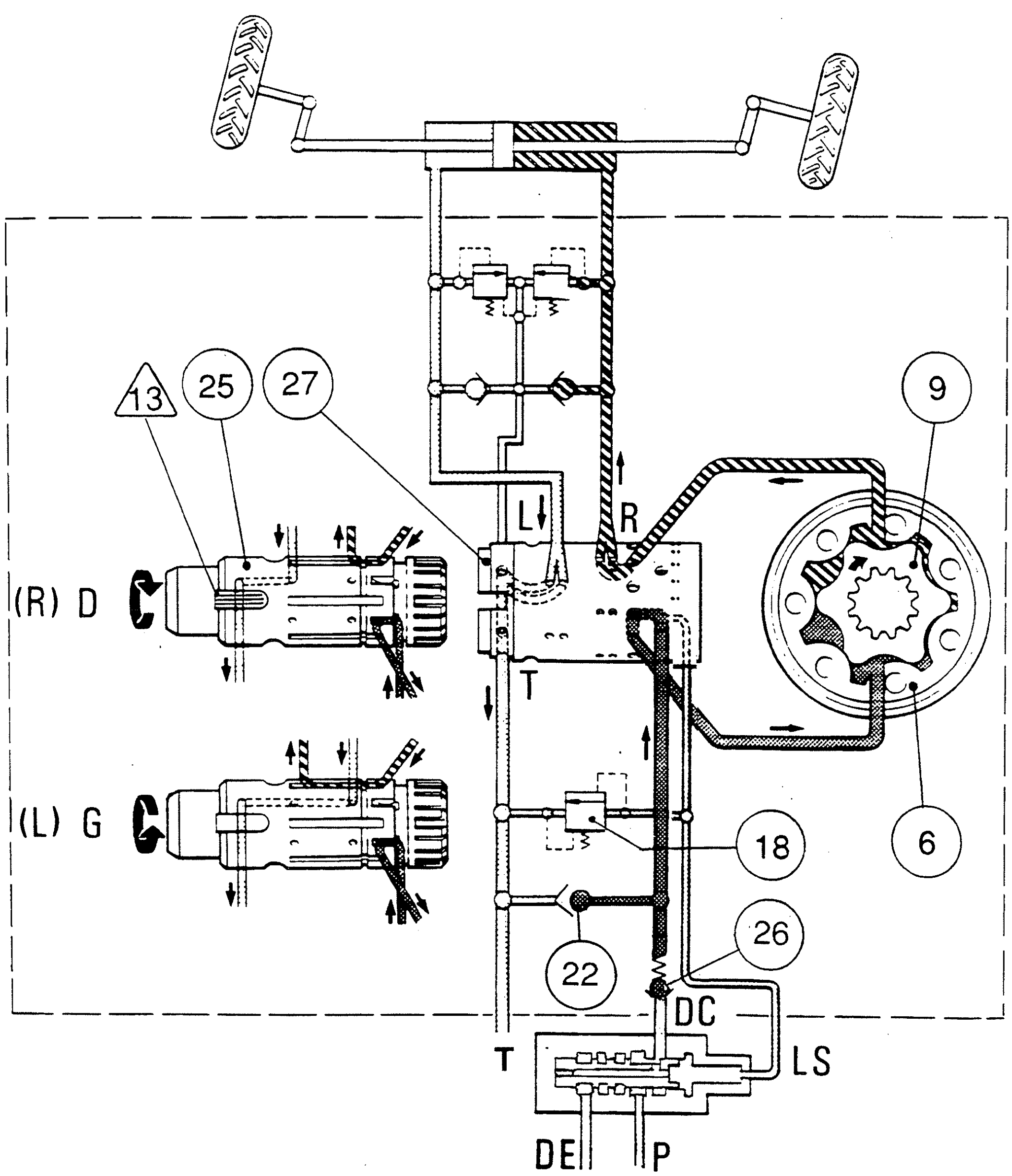


Fig. 6

CONTENTS

Hydraulics - *Open centre*

Exploded view

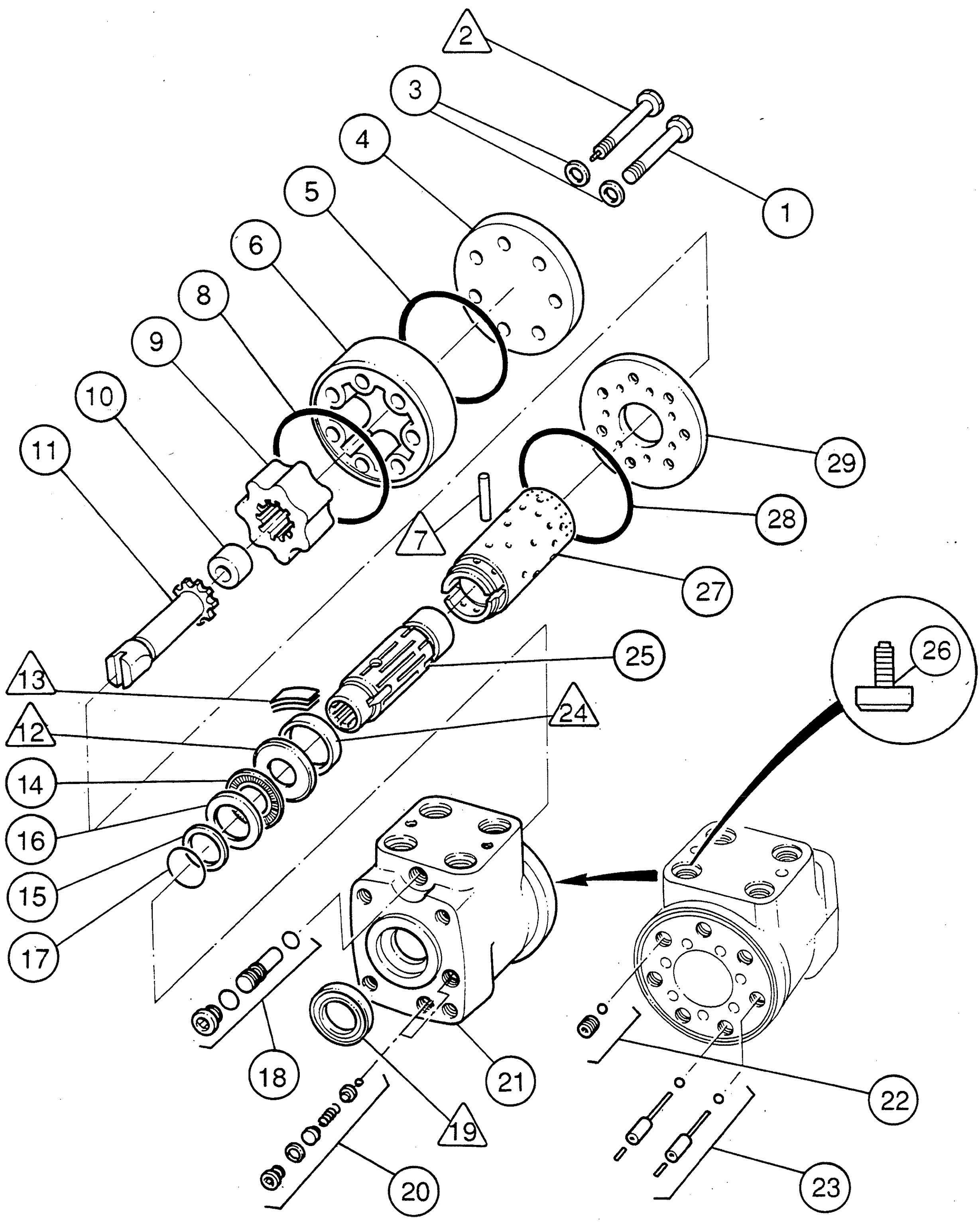
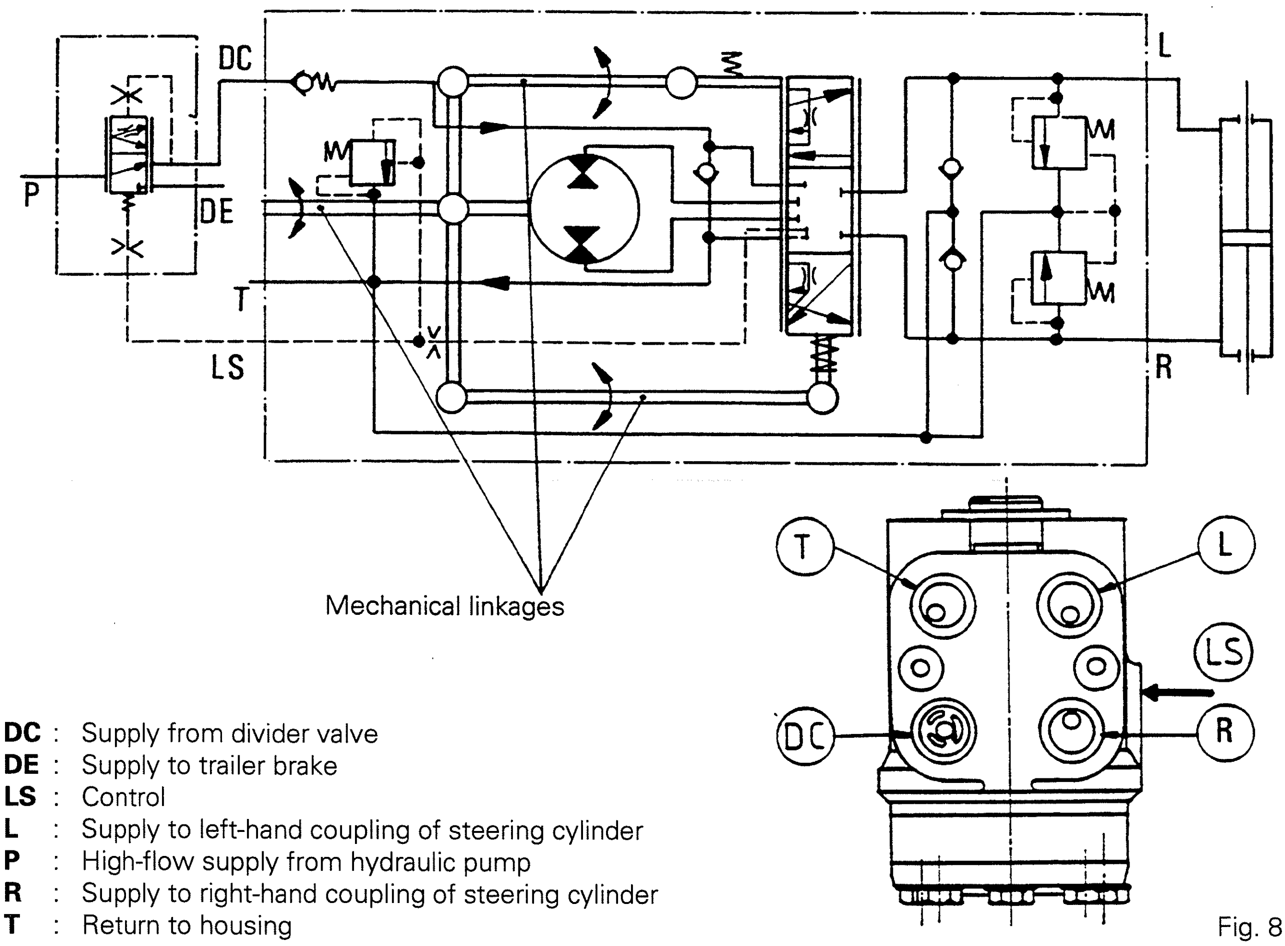


Fig. 7

CONTENTS



DC : Supply from divider valve
DE : Supply to trailer brake
LS : Control
L : Supply to left-hand coupling of steering cylinder
P : High-flow supply from hydraulic pump
R : Supply to right-hand coupling of steering cylinder
T : Return to housing

Fig. 8

E. Disassembling and reassembling the distribution valve (Orbitrol) (Fig. 3)

Disassembly

1. Remove the distribution valve from the tractor.
2. Place the distribution valve in a vice fitted with plastic jaws.
3. Remove bolts **(1)**. Mark the position of bolt **/2** and remove it.
4. Remove the cover plate **(4)**, O-ring **(5)**, the stator **(6)** and O-ring **(8)**.
5. Remove the spacer **(10)**, rotor **(9)**, distributor plate **(29)** and O-ring **(28)**.
6. Withdraw the splined link shaft **(11)**.
7. Unscrew the threaded bush and recover the ball from the non-return valve **(22)**.
8. Withdraw the two pins and the two balls from the suction valves **(23)** of the distribution valve.
9. Extract the sleeve **(27)** and spool valve **(25)** assembly by pushing it, making sure that the pin **/7** is horizontal.
10. Remove the washers **/12** and **(16)**, the needle-roller bearing **(14)** and the ring **/24** from the sleeve/spool valve assembly.
    Remove the pin **/7** and the centring springs **/13** by pressing on one of their ends. Separate the sleeve **(27)** from the spool valve **(25)**.
11. Unscrew the cap of the relief valve **(18)**. Using an 8 mm Allen key, remove the threaded bush and take out the seal, the spring and the valve. (The crimped seat is not removable).
12. Unscrew the two caps from the shock valves **(20)**, and remove the seals.
    Using a 6 mm Allen key, remove the threaded bushes and take out the springs, the balls and their seats. (The crimped seats are not removable).
13. Extract the seal **/19**, the bush **(15)** and O-ring **(17)**.
14. Remove the check valve **(26)**.

Reassembly

15. Check and clean the parts, and replace any that are faulty. Lubricate parts with clean transmission oil before reassembling.
16. Refit the check valve **(26)**.
17. Fit seal **/19**, O-ring **(19)** and bush **(15)**.
18. Place the balls and springs in the recesses for the shock valves **(20)**. Screw in the threaded bush, position the seals and tighten the caps.
19. Place the valve and spring in the recess for the relief valve **(18)** and screw in the threaded bush. Position the seal and tighten the cap to a torque of 40 to 60 Nm.
20. Insert the spool valve **(25)** in the sleeve **(27)**. Position the centring springs **/13** as shown in Figure 9 and fit the pin **/7**.
21. Position the ring **/24** on the sleeve and spool valve assembly so that the chamfer facilitates assembly in the distribution valve.
22. Fit washers **/12** and **(16)** with the chamfer on washer **/12** directed towards the centring springs **/13** and with the needle-roller bearing **(14)** positioned between them.
23. Fit the sleeve and spool valve assembly in the distribution valve, applying a slight oscillating movement. Check that the pin **/7** is held horizontally.
24. Place the two balls and the two pins in the recesses for the suction valves **(23)**.
25. Place the ball in the recess for the non-return valve **(22)** and screw in the threaded bush.
26. Position the splined link shaft **(11)**.
27. Fit O-ring **(28)** and the distributor plate **(29)**.
28. Fit the rotor **(9)** so that the two hollows **«C»** are in line with the slot in the splined shaft **(11)** (Fig. 10). Refit the spacer **(10)**.
29. Place O-rings **(5)** and **(8)** on the stator **(6)**.
30. Taking care not to move the rotor **(9)**, fit the stator **(6)**. Then move the stator so that its attachment holes coincide with those of the distribution valve. ***Note: The rotor (9) and pin /7\\ must be in the position shown in Figure 11.***
31. Refit the cover plate **(4)**.
32. Refit bolt **/2** (in the position marked during disassembly) and bolts **(1)** fitted with their seals **(3)**. Tighten them alternately to a torque of 30 to 35 Nm.
33. Using a test bench or a suitable fixture, check the adjustment and operation of the distribution valve.
34. Refit the distribution valve on the tractor.
35. Check the couplings for leaks.

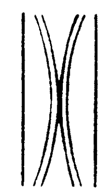


Fig. 9

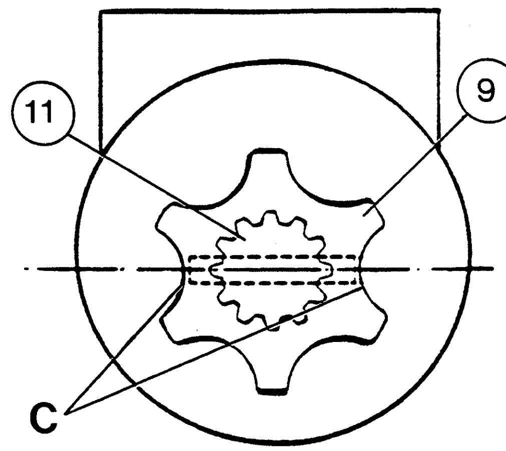


Fig. 10

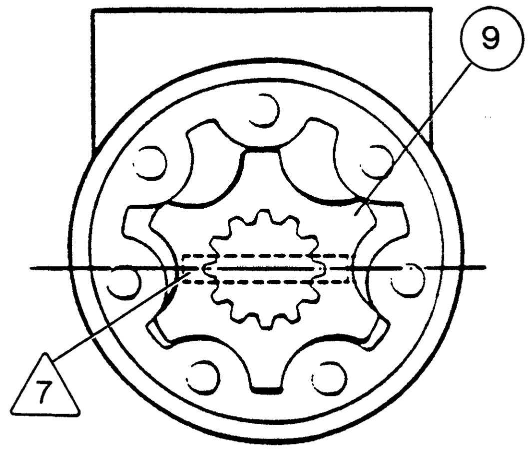


Fig. 11

9 R01 Right-hand hydraulic cover

CONTENTS

General

The right-hand cover fitted on the rear axle housing has the following two main functions :
- It serves as a support for many components of the hydraulic system.
- It comprises various intake and delivery channels of the high and low flow (high and low pressure) circuits.

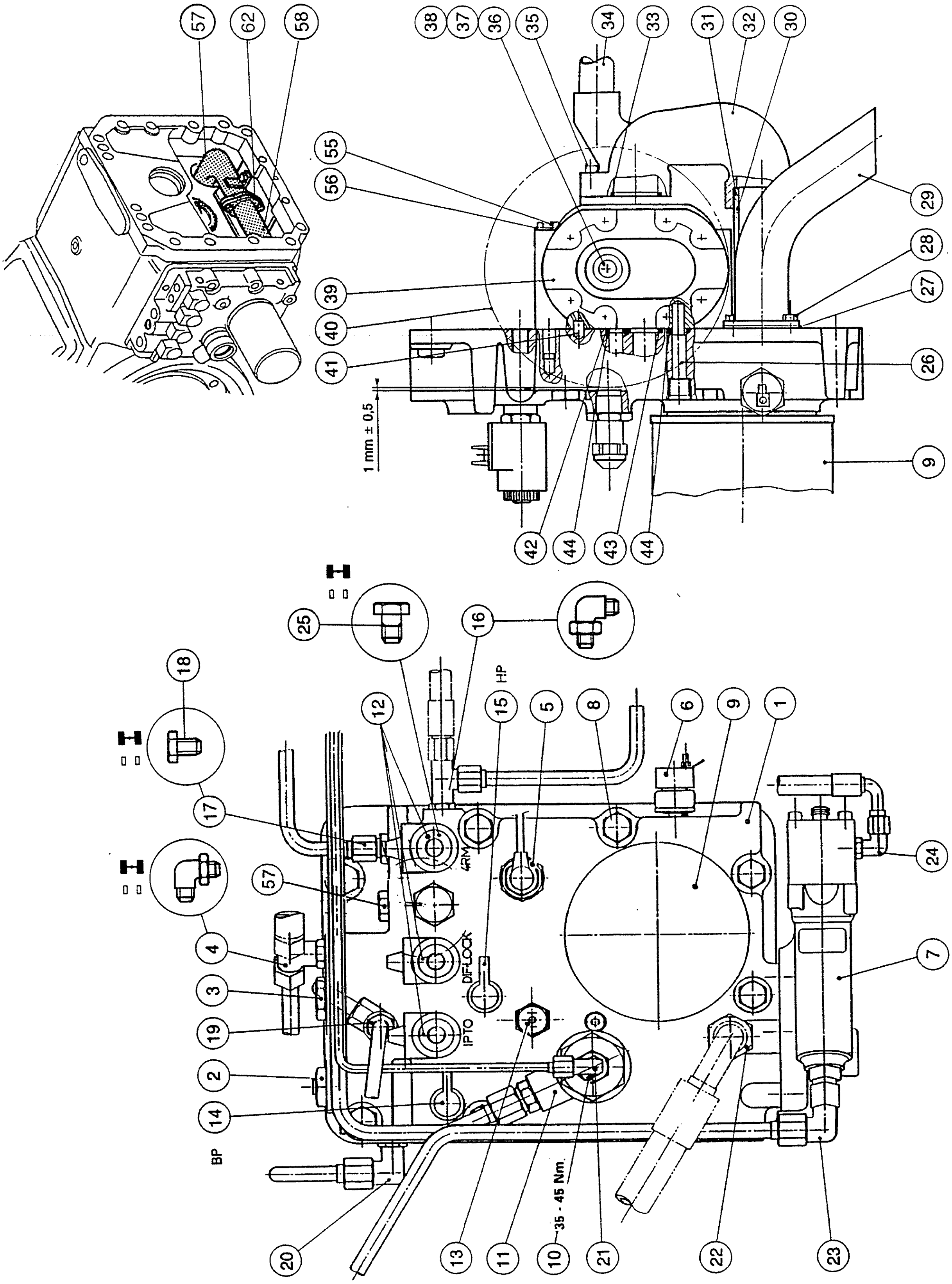
The internal face of the cover accommodates :
- the dual-element hydraulic pump and its driving gear,
- the suction pipe or pipes (according to serial number),
- the intake manifold,
- the transfer pipe from the left-hand cover.

On its external faces, it is fitted with :
- the solenoid valves controlling the low-pressure functions : PTO, Diff-Lock and 4 WD.
- the safety valves for the high and low-pressure circuits,
- the steering override valve,
- the trailer brake valve (if fitted) or a cover plate,
- the "diagnostic" connectors,
- the oil filter,
- the low oil pressure switch,
- the filter switch,
- the engine speed sensor.

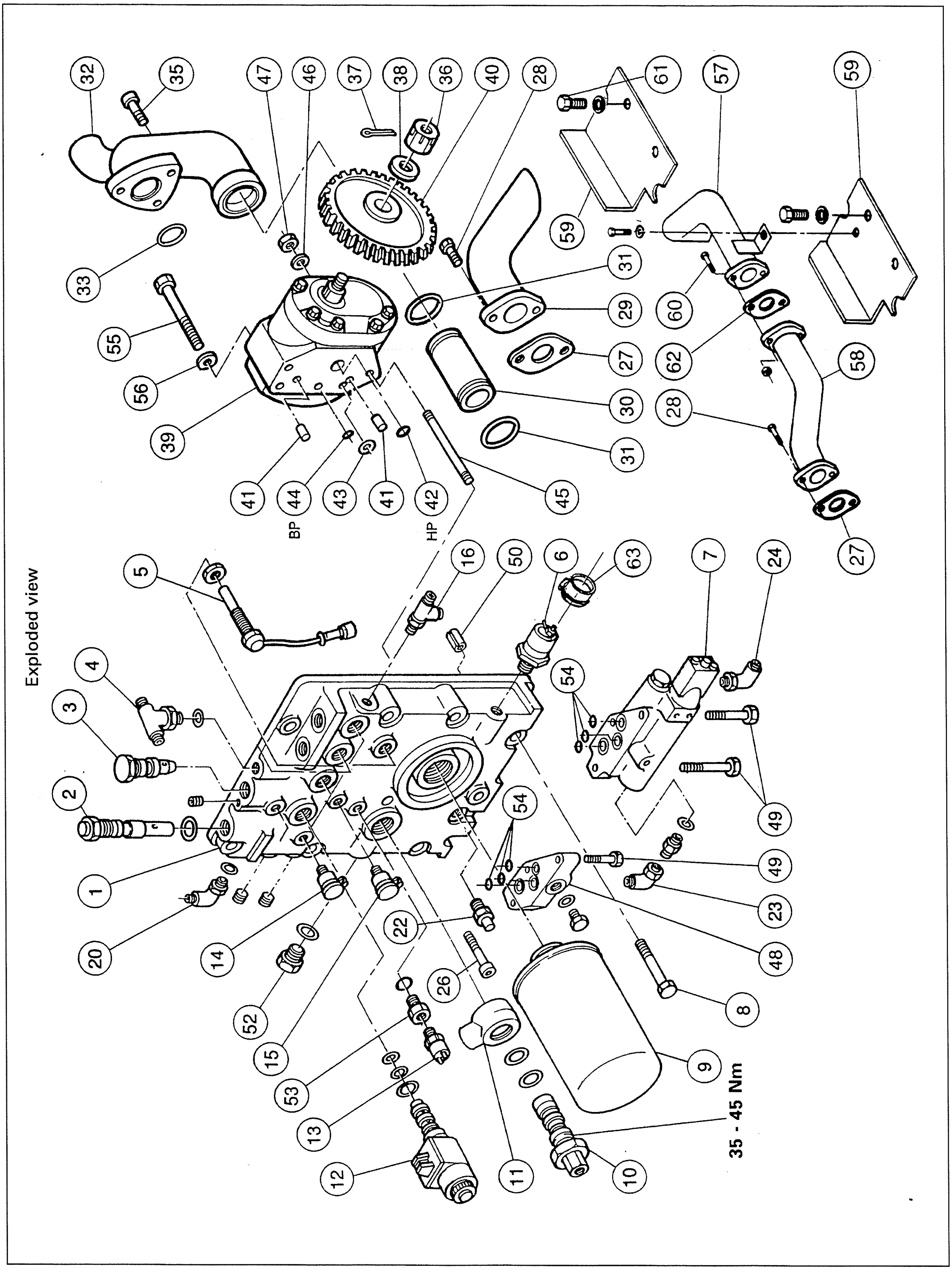
List of parts

(1) Cover
(2) LP valve
(3) HP valve
(4) Union (2 or 4WD differential lock)
(5) Engine speed sensor
(6) Filter switch
(7) Trailer brake valve
(8) Bolt
(9) Filter
(10) Steering override valve
(11) Banjo union (supply to Orbitrol)
(12) Solenoid valves
(13) LP switch
(14) LP diagnostic connector
(15) HP diagnostic switch
(16) 17 bar union (with or without braking power assistance)
(17) Straight fitting (4WD supply)
(18) Plug (2WD)
(19) Straight fitting (PTO supply)
(20) Elbow fitting (LP excess flow)
(21) Elbow fitting to "Orbitrol" distributor)
(22) Straight fitting (pump outlet)
(23) Elbow fitting (to trailer brake connector)
(24) Elbow fitting (from brake master cylinders)
(25) Plug (2WD)
(26) Bolt
(27) Seal
(28) Bolt
(29) Suction pipe
(30) Link pipe
(31) O-ring
(32) Manifold
(33) O-ring
(34) Transfer pipe
(35) Bolt
(36) Nut
(37) Cotter pin
(38) Washer
(39) Pump
(40) Gear
(41) Locating pins
(42) O-ring
(43) O-ring
(44) O-ring
(45) Stud
(46) Washer
(47) Nut
(48) Cover plate (version without trailer brake)
(49) Bolt
(50) Locating dowels
(52) Plug
(53) Reducer
(54) O-rings
(55) Bolt
(56) Washer
(57) Primary suction pipe
(58) Secondary suction pipe
(59) Plate
(60) Bolt
(61) Bolt
(62) Seal
(63) Cap

Overall view



Hydraulics Open centre



A . Removing and refitting the cover

Note: On tractors from serial number E261025 onwards, it is necessary to remove the rear wheels, drain the centre housing and remove the right and left hand covers in order to gain access to the new suction pipes (57) and (58). (See Section 9F02).
The method of removing and refitting the right-hand cover is the same as before the modification.

Removal

Tractors before modification

1. Immobilise the tractor. Fit wedge blocks under the left-hand rear wheel. Apply the handbrake. Fit chock between the frame and front axle.
2. Drain the oil from the rear axle only.
3. Use a trolley jack to raise the relevant side of the tractor. Position an axle stand and remove the wheel.
4. For easier access to the upper union on the cover, dismantle the front and rear right-hand attaching points of the cab. Tilt the cab slightly to the left-hand side. Check the space between the hood and the windshield. Wedge the cab in place.
5. Remove the filter **(9)**.
6. Disconnect the outlet pipe to the trailer brake connector (if fitted). Remove the bolts **(49)**. Remove the valves without disconnecting the hose from the elbow fitting **(24)** on the pilot head in order to avoid having to bleed the trailer brake circuit.
7. Disconnect and block the following pipes or hoses:
   - differential lock (2 and 4WD),
   - PTO clutch and brake (if fitted),
   - 4WD clutch (if fitted),
   - "Orbitrol" distributor supply,
   - piloting on the steering override valve,
   - LP excess return,
   - Pump outlet to auxiliary distributors,
   - Hare/Tortoise range and power-assisted system (if fitted).
8. Disconnect :
   - the solenoid valves (and mark their connections),
   - the engine speed sensor,
   - the LP switch **(13)** and filter switch **(6)**.
9. Remove the bolts **(8)**. Detach and remove the cover.
10. Remove the transfer pipe **(34)**.

Refitting

Note: For tractors from serial number E261025 onwards:
- ***Refit the right-hand cover. Fit the primary suction pipe (57).***
- ***Position the flange of seal (62). Tighten bolts (60) to a torque of 11 to 155 Nm and bolt (61).***
- ***Refit the left-hand cover (see Section 9R02).***

Tractors before modification

11. Clean the mating faces on the housing and cover.
12. Check that the two locating dowels **(50)** are present on the cover **(1)**.
13. Screw two guide studs in diametrically opposite positions on the central housing.
14. Check that the O-rings on the transfer pipe **(34)** are not damaged. Position the transfert pipe on the left-hand cover or on the right-hand cover (according to the serial number).
15. Smear the mating face on the cover with a sealing compound (Loctite 510 or equivalent).
16. Refit the cover in contact with the housing. Fit and tighten the bolts **(8)** to a torque of 105 to 117 Nm.
17. Reconnect and attach the electrical harnesses. Reinstall the pipes and hoses. Carry out procedures 7 and 8 in the reverse order.
18. Replace the O-rings **(54)**. Refit the valve **(7)**. Tighten the bolts to a torque of 25 to 35 Nm. Reconnect the outlet pipe towards the trailer brake connector.
19. Grease the seal for the filter **(9)**. Fit and tighten the filter by a quarter of a turn after contact with the cover.
20. Position the cab. Tighten the bolts on the front support to a torque of 200 to 270 Nm and tighten the nuts and locknuts on the rear support to the following torques:
    - nut : 27 - 35 Nm
    - locknut : 13 - 20 Nm (Loctite 270)
21. Raise the tractor. Refit the wheel. Remove the axle stand and tighten the wheel nuts to a torque of 400 to 450 Nm.
22. Top up the oil in the housing.
23. Check the operation of the LP switch **(13)**, the solenoid valves and the filter switch **(6)**.
24. Check for leaks on the cover mating face and the hydraulic unions.

B . Disassembling and reassembling the cover

Disassembly

25. Remove the cover and carry out procedures 1 to 10. Clamp the cover in a vice fitted with soft jaws.
26. Remove the solenoid valves **(12)** and the plug **(25)** (2WD version).
27. Remove the switches **(6)** and **(13)**, the reducer **(53)**, the steering override valve **(10)** and the banjo union **(11)**.
28. Remove the fittings and plugs **(4)**, **(16)** to **(22)**, **(51)** and **(57)**.
29. Remove the bolts **(49)** and the cover plate **(48)** (version without trailer brake). Remove the O-rings **(54)**.
30. Unscrew the engine speed sensor **(5)**.
31. Remove the diagnostic connectors **(14)** and **(15)**.
32. Remove the HP and LP valves. See parts C and D.
33. Remove the hydraulic pump. See part E.
34. Remove the suction pipe **(29)** or **(58)** according to the serial number. Discard the seal **(27)**.
35. If necessary, remove the locating dowels **(50)**, the screw plugs from the hydraulic lines and plug **(52)**. Extract the stud **(45)**.

Reassembly

36. Clean and check the parts. Replace any that are faulty. Check that none of the channels in the cover are free of obstructions.
37. Refit the hydraulic pump. See part E.
38. Replace the seal **(27)**. Reinstall the suction pipe **(29)**. Tighten the bolts **(28)** to a torque of 11 to 15 Nm.
39. Fit the locating dowels **(50)**, if they were removed. Fit the screw plugs after applying Loctite 542 and the plug **(52)**. Apply Loctite 542 on the stud **(45)** and tighten it to a torque of 40 to 50 Nm.
40. Refit the HP and LP valves. See parts C and D.
41. Fit and tighten the diagnostic connectors **(14)** and **(15)**.
42. Fit the sensor **(5)** after coating it with Loctite 577 Sensor Sealing compound or equivalent. Screw the sensor without forcing, in contact with the gear **(40)**. Unscrew the sensor by three-quarters of a turn in order to obtain a clearance of approximately 1 mm between the sensor and the gear. Tighten the nut to a torque of 18 to 20 Nm.
43. Position the O-rings **(54)** in their respective locations on the cover plate **(48)** (version without trailer braking). Fit and tighten the bolts **(49)** to a torque of 25 to 35 Nm.
44. Refit the fittings and plugs **(4)**,**(16)** to **(22)**, **(51)** and **(57)**. Reinstall the reducer **(53)** fitted with its seal and switches **(13)** and **(6)** after lightly coating them with Loctite 221.
    Reinstall the banjo union **(11)** and the steering override valve **(10)** fitted with their seals and tighten to a torque of 35 to 45 Nm.
45. Screw the solenoid valves onto the cover.
    Tighten to the following torques:
    - solenoid valves: 18 - 20 Nm,
    - knurled nuts: 5 - 8 Nm.

    On the 2WD version, fit the plug **(25)** equipped with its seal.
46. Refit the cover. See part A.
47. Carry out the hydraulic tests. See Section 9 T01.
48. Check for leaks on the cover mating face and on the hydraulic unions.

C . Disassembling and reassembling the HP valve

Operation

If pressure **P** exceeds 185 bar, the spring **(4)** is compressed, and the valve **(7)** moves allowing oil to flow to the housing via port **C**.

Disassembly (Fig. 1)

49. For easier access to the HP valve **(3)**, dismantle the front and rear right-hand attaching points of the cab. Tilt the cab slightly to the left-hand side. Check the space between the hood and the windshield. Wedge the cab in place.
50. Unscrew the plug **(1)**. Recover the shims **[2]**. Take out the spring **(4)**. Remove the O-ring **(5)**. Withdraw the body **(6)** with the valve **(7)** and washer **(8)** from the cover.
    Note: The ball (9) is crimped in the valve body.

Reassembly (Fig. 1)

51. Clean and check the parts. Replace any that are faulty.
52. Check that the valve **(7)** slides freely in the valve body. Position the washer **(8)**, fit the body **(6)** with the valve **(7)** in the cover. Position the O-ring **(5)**.
53. Fit the spring **(4)**, the adjusting shims **[2]** and tighten the plug **(1)** to a torque of 50 to 60 Nm.
54. Check the pressure in the circuit. Carry out the hydraulic test (see Section 9 T01).
55. Position the cab. Carry out procedure 20.

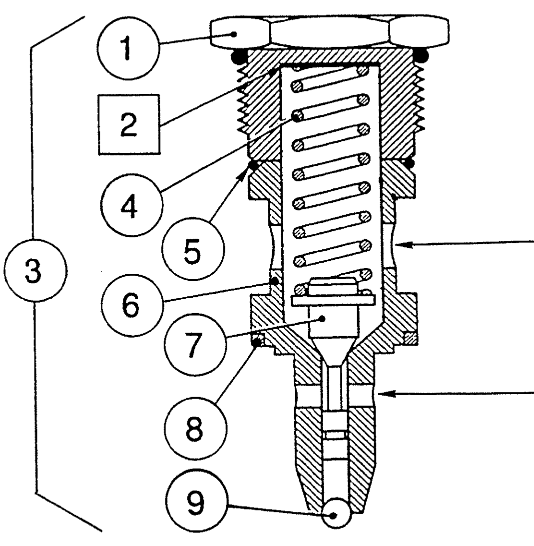


Fig. 1

D . Removing and refitting the LP valve

Operation (Fig. 2)

As soon as the engine is started up, oil delivered from the pump via channel **A** enters ducts **P** which are linked to the solenoid valves **(12)** and supply the low flow circuit comprising the following functions:
- the Dynashift,
- the Hare/Tortoise shift and power-assisted braking (if fitted),
- the 4WD clutch (if fitted),
- the rear and front differential lock (if fitted),
- the PTO clutch,
- the front PTO (if fitted).

A back-pressure is established in the circuit forcing the ball **(20)** to be lifted from its seat, thus compressing the spring **(21)**. The oil passes behind the slide valve **(19)** creating a pressure which gradually moves it by compressing the spring **(17)** bearing against the adjusting shims **[18].**
The slide valves **(19)** allows the oil to flow towards port **B** and the excess flow control valve installed on the left-hand cover to cater for the master cylinders' lubrication and topping up requirements.
When one of the low-pressure functions is actuated, the momentary pressure drop causes the ball **(20)** to be pushed back onto its seat under the effect of the spring **(21)** and the slide valve **(19)** starts to move under the effect of spring **(17)**. The oil contained in the end cham-ber escapes via hole **V** allowing the slide valve to gradu-ally return. The leaks return to the housing via port **R**.

Identification of ports

A	Supply from the pump
B	Excess outlet to the left-hand cover
P	17 bar ducts
R	Return of leaks
V	Bleed port
12	Solenoid valves
13	LP switch
14	LP diagnostic connector
16	17 bar outlet controlling Hare/Tortoise and power-assisted braking (if fitted).

Removal

56. For easier access to the LP valve **(2)**, dismantle the front and rear right-hand attaching points of the cabin. Tilt the cabin slightly to the left-hand side. Check the space between the hood and the windshield. Wedge the cabin in place.
57. Remove the valve.

Refitting

58. Clean and check the parts, and replace any that are faulty.
59. Refit the valve and tighten it to a torque of 14 to 19 Nm.

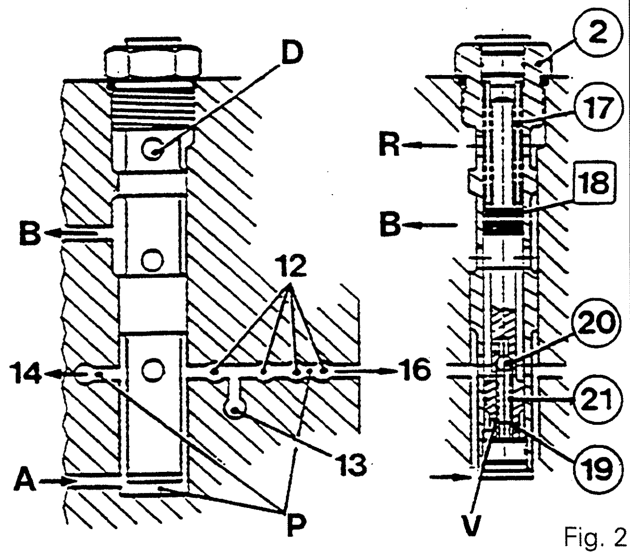


Fig. 2

60. Check the pressure in the circuit. Carry out the hydraulic test. See Section 9 T01.
61. Position the cab. Carry out procedure 20.

E . Removing and refitting the pump and the gear

Note: It is not necessary to remove the pump in order to dismantle the gear (40).

Removal

62. Remove the right-hand hydraulic cover. See part A.
63. Remove the bolts **(35)**. Remove the manifold **(32)** and the link tube **(30)** equipped with its seals. Recover the O-ring **(38)**.
64. Remove the bolts **(55)** and **(26)**, the washers **(56)** and **(46)** and the nut **(47)**.
65. Detach and remove the pump. If necessary, extract the locating pins **(41)** from the cover. Remove the O-rings **(42)** to **(44)**.
66. Remove the cotter pin **(37)**, nut **(36)** and washer **(38)**. Remove the gear **(40)** with an extractor. Recover the key.

Refitting

67. Clean and check the parts and replace any that are faulty.
68. Position the key in the groove on the shaft. Install the gear, washer and nut **(36)**, and tighten to a torque of 45 to 68 Nm. Lock the nut with a new cotter pin **(37)**. Check the rotation of the gear by hand.

69. Fit the locating pins **(41)**, if they were removed. Position new O-rings **(42)** to **(44)**. Refit the pump in contact with the cover **(1)**. Position the washers **(56)** and **(46)**. Fit and tighten the bolts **(55)** and **(26)** and nut **(47)** to a torque of 45 to 68 Nm.
70. Check that the O-rings **(31)** are not damaged. Position the link tube **(30)** and the manifold **(32)** equipped with a new O-ring **(33)**. Tighten the bolts **(35)** to a torque of 11 to 15 Nm.
71. Reinstall the hydraulic cover. See part A.
72. Carry out the hydraulic tests. See Section 9 T01.
73. Check for leaks on the cover mating face and the hydraulic unions.

F . Disassembling and reassembling the pump

Preliminary operations

74. Remove the right-hand hydraulic cover. See part A.
75. Remove the hydraulic pump and the gear **(40)**. Carry out procedures 63 to 66.

Disassembly (Fig. 3)

High-pressure element (185 bar) (gears with wide tooth face)

76. Position the pump with the LP cover clamped in a vice equipped with soft jaws. Mark the cover **(12)** and the pump body **(2)** with two marks one opposite the other.
77. Remove the bolts **(15)**. Detach and remove the cover. Remove the seals **(7)** to **/9**, the friction plate **/10**. Recover the spring **(14)** and the ball **(13)**.
78. If necessary, extract the locating pins **(11)**.
79. Remove the driving and driven gears **(4)** and **(5)**. Remove the friction plate **/3**. Extract the sealing bush **(16)**.

Low-pressure element (17 bar)

80. Turn the pump over. Tighten the vice moderately. Mark the cover **(28)** and the pump body **(2)** with two marks one opposite the other.
81. Remove the bolts **(29)**. Detach and remove the cover. Remove the seals **(23)** to **(25)** and the friction plate **/26**.
82. If necessary, extract the locating pins **(27)**.
83. Remove the gear train (driving, driven) **(17)** and **(20)**.

Reassembly (Fig. 3)

High-pressure element

84. Clean and check the parts, and replace any that are faulty. Check that the ports in the body **(2)** and the cover **(12)** are free of obstructions.
85. Refit the friction plate **/3**, with the recess **E** of the oilway directed towards the inlet port **A** (Fig. 3) and the wear face in contact with the gears.
86. Install gear **(5)** in the pump body.
87. Fit the bush **(16)** on the cover **(12)** using a suitable fixture. Immobilise the bush in the pump body by striking with a punch. Grease the bush. Fit the locating pins **(11)**, if they were removed.
88. **Replace the seals.**
    Fit the following components in the cover **(12)**: moulded seal **/9**, protective seal **(8)** and seal **(7)**. Position the ball **(13)** and spring **(14)** in the bore, facing the inlet port **A**. Position the friction plate **/10**, with the wear face directed towards the gears. Fit the gear **(4)**.
89. Refit the cover assembly **(12)** in accordance with the markings made during disassembly. Fit the bolts **(15)** without tightening them.
    Note: The long bolts are installed in the tapped holes T (Fig. 3).

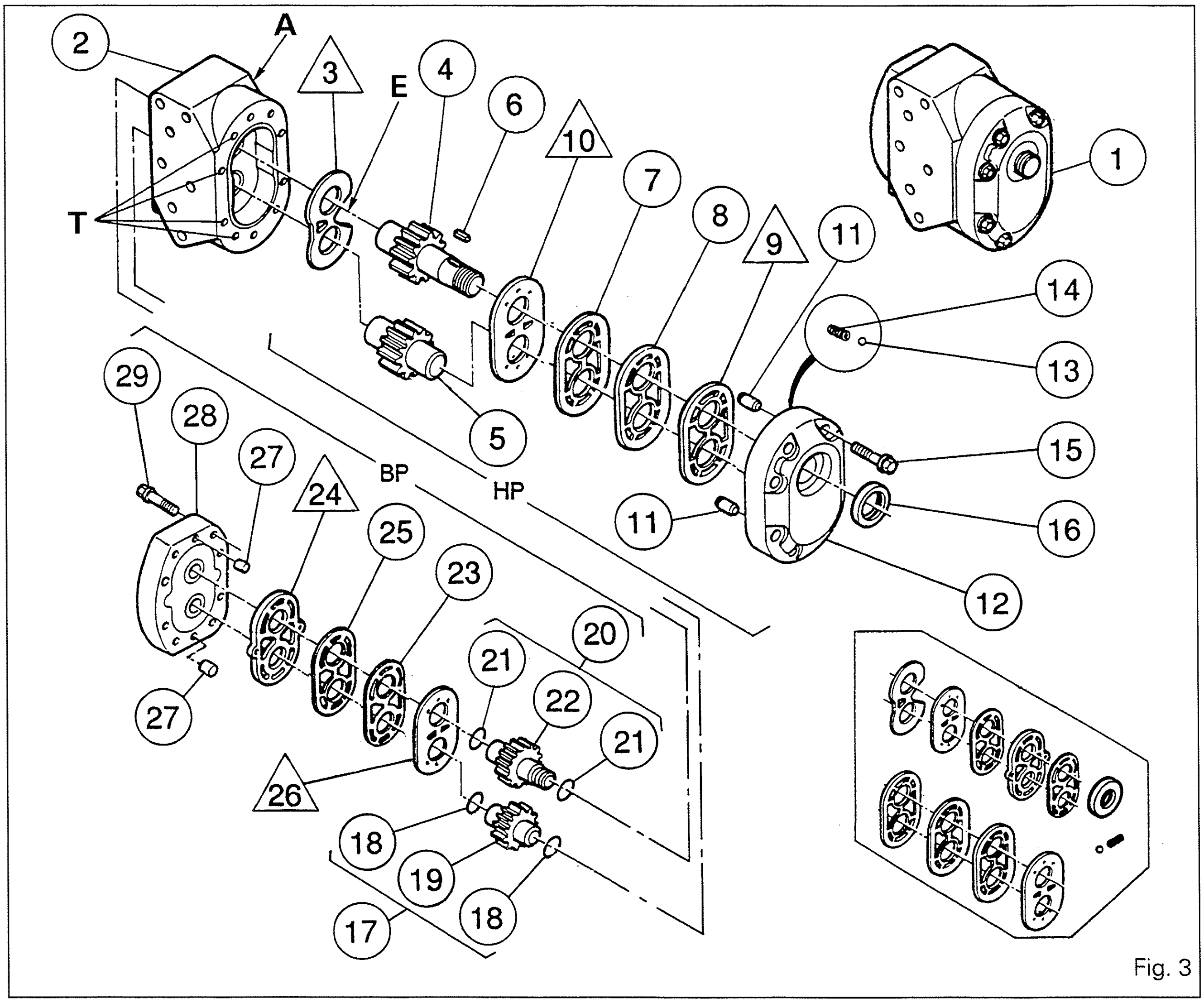


Fig. 3

Low-pressure element

90. Clean and check the parts, and replace any that are faulty. Check that the hydraulic ports in the pump body **(2)** and cover **(28)** are free of obstructions.
91. Refit the gear train (driving, driven) **(17)** and **(20)**.
92. **Replace the seals.**
    Fit the following components in the cover **(28)**: moulded seal **/24**, protective seal **(25)**, seal **(23)**.
93. Place the friction plate **/26** with its wear face directed towards the gears.
94. Fit the locating pins **(27)**, if they were removed.
95. Refit the cover **(28)** in accordance with the markings made during disassembly. Fit the bolts **(29)**.
96. Tighten the bolts **(15)** and **(29)** to a torque of 31 to 35 Nm.
97. Check the rotation of the pump by hand.

Final operations

98. Refit the gear **(40)** and washer **(38)**. Tighten the nut **(36)** to a torque of 45 to 68 Nm and lock it with a new cotter pin **(37)**.
99. Refit the hydraulic pump and the right-hand cover. Carry out procedures 69 to 70 and see part A.
100. Carry out the hydraulic tests. See Section 9 T01.
101. Check for leaks on the cover mating face and the hydraulic unions.

9 R02 Left-hand cover

CONTENTS

Hydraulics - Open centre

General

The left-hand cover is installed on the centre housing. The function of the cover is to collect the excess flow from the low-pressure (low flowrate) and high-pressure (high flowrate) pumps by means of a control valve which incorporate a 4.5 bar safety valve protecting the oil cooler.
The cover is equipped with ports which are connected to the following systems:
- LP excess flow,
- oil cooling system,
- HP excess flow,
- return.

List of parts

(1) Cover
(2) Transfer pipe
[3] Control valve
(4) Valve plunger
(5) Flow control valve body
(6) Elbow fitting (LP excess flow)
(7) Straight fitting (to cooling system)
(8) Elbow fitting (HP excess flow)
(9) Straight fitting (return to housing)
(10) Bolt

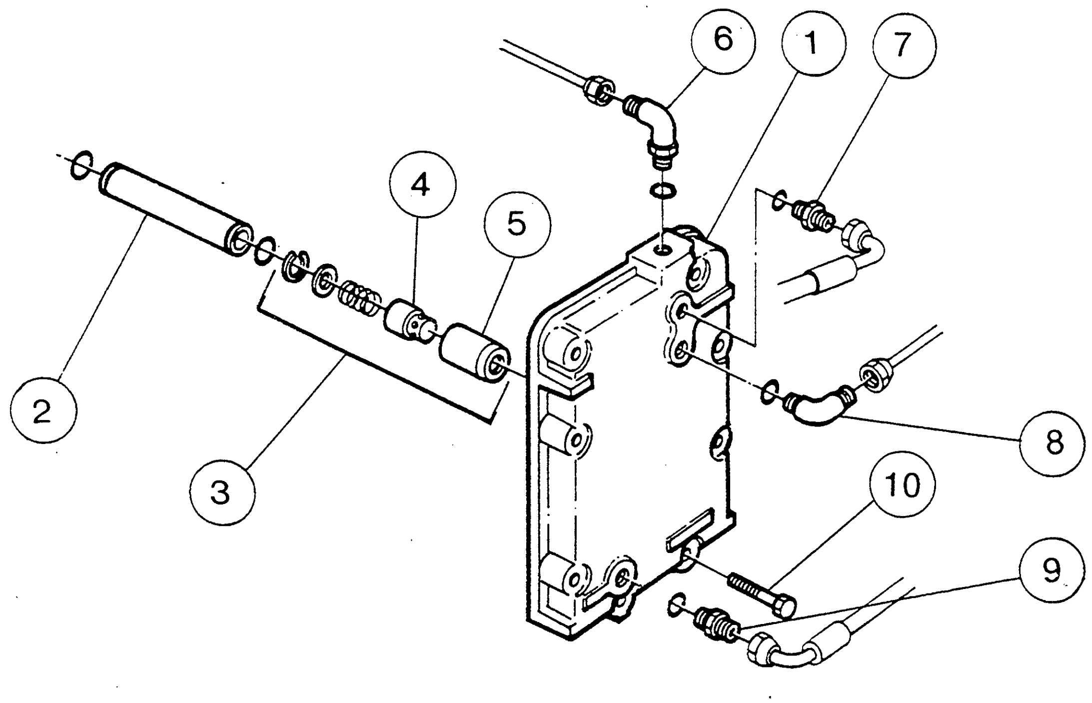


Fig. 1

A. Removing and refitting the cover

Removal

1. For easier access to the upper coupling on the cover, dismantle the front and rear left-hand attaching points of the cab. Tilt the cab slightly to the right-hand side.
   Check the space between the hood and the windshield. Wedge the cab in place.
2. Disconnect the pipes and hoses. Drain the rear axle housing. Remove the cover.

Refitting

3. Carry out operations 1 and 2 in reverse order.
   Check for leaks on the cover mating face and the hydraulic unions.
   Tightening torques :
   - Bolt **(10)** : 105 - 117 Nm
   - Cab front support bolt : 200 - 270 Nm
   - Cab rear support nuts and locknuts :
     . nut : 27 - 35 Nm
     . Locknut : 13 - 20 Nm (Loctite 270)
     - Wheel nuts : 400 - 450 Nm

   Note : The mating face of the housing and of the cover must be cleaned and coated with loctite 510 or equivalent.

B. Disassembling and reassembling the cover and flow control valve

Disassembly

4. Remove the cover (see part A), the unions and the flow control valve.

Reassembly

5. Carry out operation 4 in reverse order.
   Note : Apply Loctite 542 on the flow control valve body (5).

   See section 9 R01 for the operation and adjustment of the HP valve.
   Check that the valve plunger **(4)** slides freely in the valve body **(5)**.
   If servicing action is required on the flow control valve, conduct hydraulic tests (see section 9 T01).

9 S01 Decontaminating the hydraulic circuit

CONTENTS

A. General

The level of contamination of the hydraulic and lubricating fluid is one of the main factors affecting the performance and service life of the hydraulic system. When a major servicing operation has been carried out on the gearbox-axle assembly (such as repair of the transmission, brakes, etc.), it is clear that the level of contamination is too high.
It is then imperative to proceed with decontamination on completing the repair in order to avoid a series of failures due to the circulation of contaminants in the circuit (e.g. clogging of solenoid valves and spool valves, damage to the hydraulic pump, etc.).
This decontamination procedure ensures that:
- the degree of cleanliness in the circuit is higher than that required for service. It should be noted that each particle causes the formation of other particles.
- Particles are eliminated as quickly as possible in order to avoid failures do to the circulation of contaminants in the circuit.

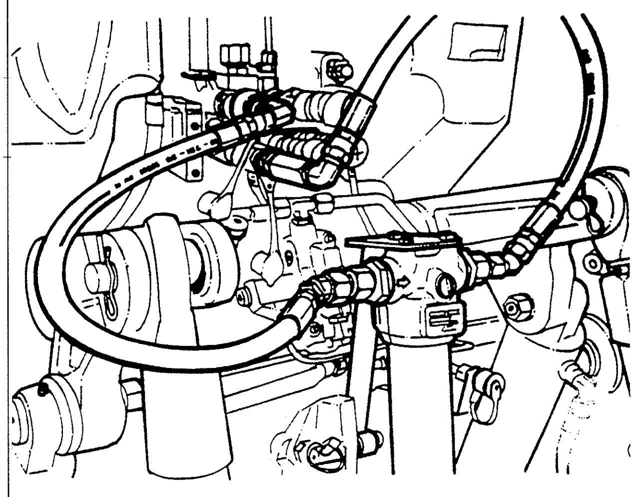


Fig. 1

B. Description of kit

Decontamination is performed using kit 3376882 M91.
This kit comprises:
- a filter with a visual clogging indicator calibrated at: 2.5 bar with bypass calibrated at 3.5 bar,
- an interchangeable filter element with a capacity of 15 micrometres. This element can be ordered as a spare part from the Parts Service under the reference 3615949 M1.
- a beam for attachment onto the tractor's third link,
- two hoses with male couplers for connection to the tractor,
- a non-return valve preventing any reverse flow due to a handling error.

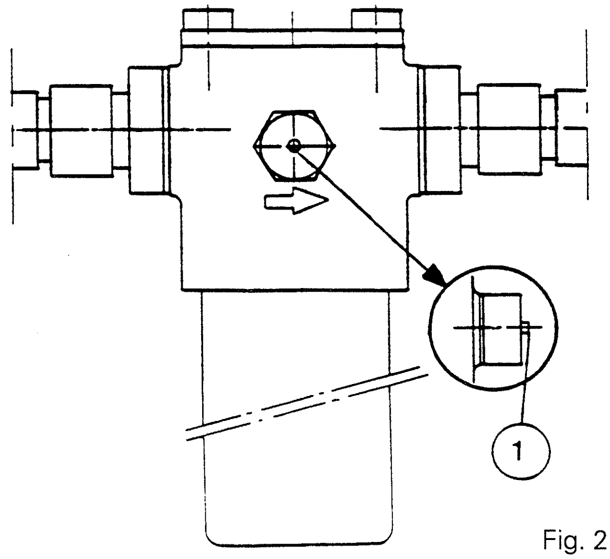


Fig. 2

C. Procedure

Decontamination must be carried out immediately after repair work. Install the beam in the kit on the tractor's third link as shown in Fig. 1. Connect the two couplers onto one of the auxiliary spool valves.
The decontamination procedure is made up of two phases:
- **static phase** to quickly trap particles in suspension in the fluid:
  . run the engine at 1,200 rpm,
  . duration: 15 mn,
- **dynamic phase** to filter the fluid rinsing all the circuits and the whole transmission:
  . use the tractor on road,
  . actuate all the hydraulic functions: lifting, braking, front axle, auxiliary spool valve, PTO, etc.,
  . minimum duration: 15 mn.

Before starting the decontamination procedure, install new filter elements on the kit and on the filtering system fitted on the tractor.

During the decontamination process, the operator must keep a check on the clogging indicator on the filter. When the filter element is clogged, the nipple **(1)** is extended (Fig. 2).
In the event of clogging, install a new element before continuing the operation (this is possible on tractors with highly contaminated circuits). It is also imperative to keep a check on the filter fitted on the tractor which must not be clogged.

Conclusion

It should be emphatically stated that this deconta-mination procedure is extremely important for tractors in service.
Purifying the fluid after repair guards against practically any risk of further failures on the hydraulic circuit however serious the initial failure.

9 T01 Hydraulic tests

CONTENTS

Preparation

Before beginning the tests, the engine should be run to bring the oil temperature up to a minimum of 60°C (140°F).
The following equipment is recommended for the tests described in this section. This equipment is available through the MF network:
- MF 3001: Pressure gauge kit
- MF 3002: Hoses and unions kit
- MF 3003: Flowmeter assembly
- 3582045 M1: Hydraulic coupler

Otherwise, use suitable equivalent equipment.

In all cases, make sure of the direction of flow of the oil to avoid damaging the flowmeter. Choose pressure gauges, hoses and unions of sufficient capacity and strength.

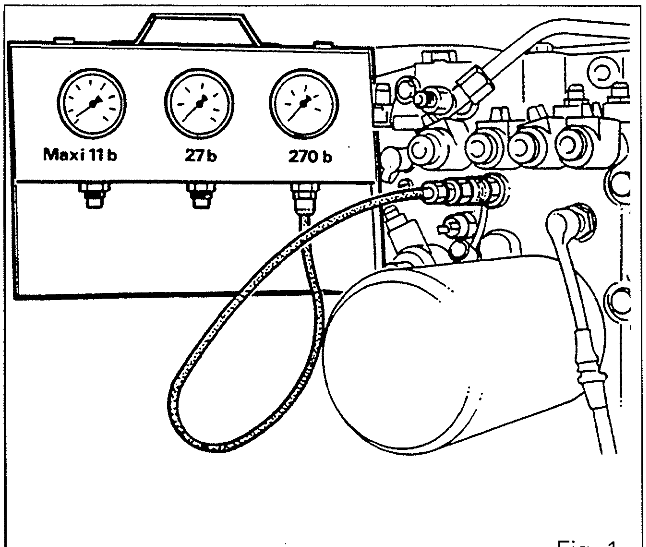


Fig. 1

A. Tests on high-flow circuit

A two-part pump installed inside the right-hand hydraulic cover supplies the following functions in series in this order:
- power-assisted steering system,
- the trailer brake system,
- the auxiliary spool valves,
- the lift function.

1. High-pressure safety valve

- Fit a pressure gauge with a coupler 3582045 M1 (Fig. 1) on the diagnostic point located on the right-hand hydraulic cover.
- Run the engine at 2,200 rpm. Operate an auxiliary spool valve. Read: **P1 = 188 ± 12 bars**.

At 1,000 rpm, the pressure should not drop. If necessary, adjust the valve with shims (see section 8 R01).

2. Pump output

Two-way auxiliary spool valve
- Connect the flowmeter inlet to a quick coupler on auxiliary spool valve No. 2 (Fig. 2) and connect the return directly to the housing via the transmission filler port.
- Check that the flowmeter valve is fully open and connect a suitable pressure gauge to the flowmeter diagnostic point.

Check that the following minimum values are obtained.
Engine speed: 2,200 rpm.

Q1: l/mn	P2: bars
51	100

High-flow circuit

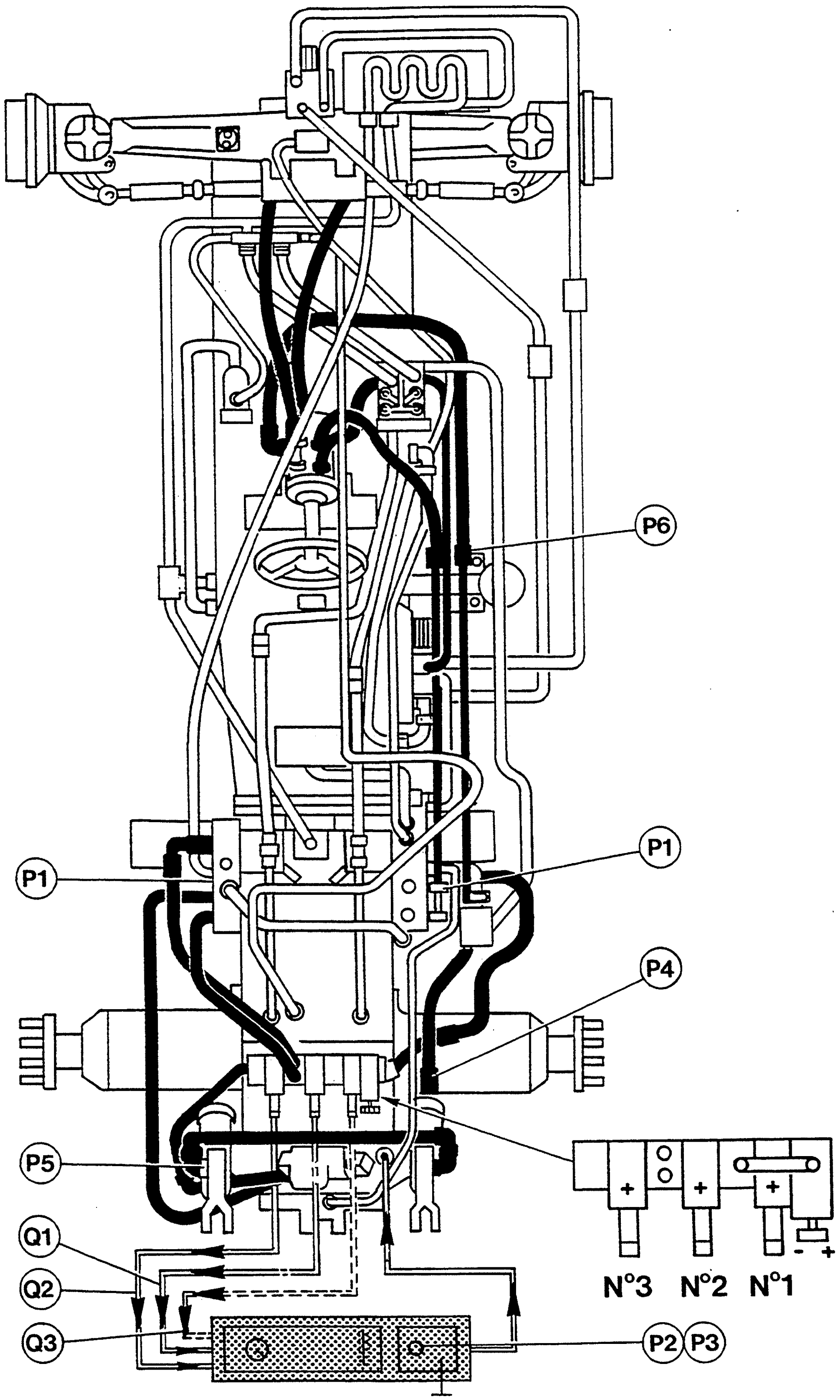


Fig. 2

3. Flow divider (if fitted)

- Connect up the flowmeter as described in part A.2 but on spool valve No. 1 (Fig. 2).
- Operate the spool valve and control the flow through the flow divider by operating the regulating valve (Fig. 3).

Engine speed 2,200 rpm		P2: 0 bar
Q3 l/mn	max.	40

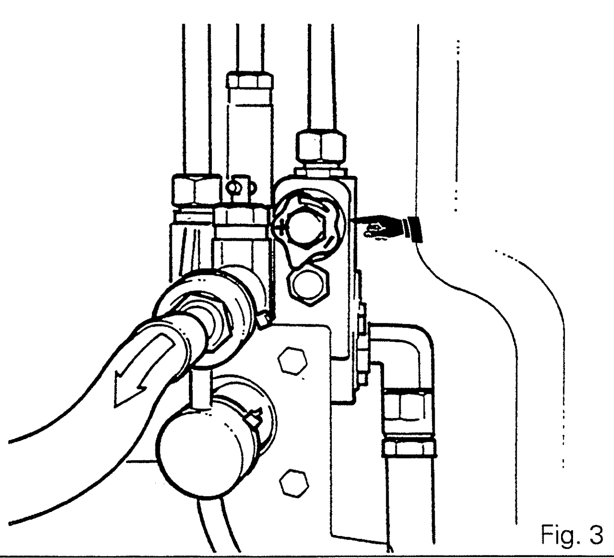


Fig. 3

4. Auxiliary spool valve with automatic return to neutral point

- Connect the flowmeter onto the corresponding spool valve as described in para A.2.
- Run the engine at 2,200 rpm and operate the spool valve. Release the lever and gradually close the flowmeter valve until the lever returns to the neutral point.
- The triggering pressure must be:
  P3 = 135 - 160 bars

5. Trailer brake

- Connect a pressure gauge to the quick coupler.
- Run the engine at 2,200 rpm.
- With the brake pedals coupled together, gradually apply force. The pressure reading must gradually increase to reach:
  P4 = 120 - 150 bars max.

6. Lift shock valve

- Use a hand-operated calibrating pump to perform this test.
- With the engine stopped and the lift control valve in the neutral position, apply pressure in the ram circuit. Note the opening pressure:
  P5 = 200 -0+8 bars

7. Orbitrol safety valve

- Connect a suitable pressure gauge with a tee on the union between the hose and the pipe supplying the override valve (load sensing).
- With the engine running at 2,200 rpm, apply full steering lock and hold the steering wheel in that position.
- Check that **P6 = 155 - 160 bars**.

8. Checking the steering circuit for leaks

- Run the engine at 1,000 rpm.
- Apply full steering lock and apply a torque of 4 Nm on the steering wheel. It must not turn at more than 2 revolutions per minute.
- If the steering wheel turns at more than 2 rpm, disconnect the lines supplying the rams and block the two openings.
- Apply the same torque on the steering wheel. If it turns at less than 2 rpm, there is a leak from the ram.

Low-flow circuit

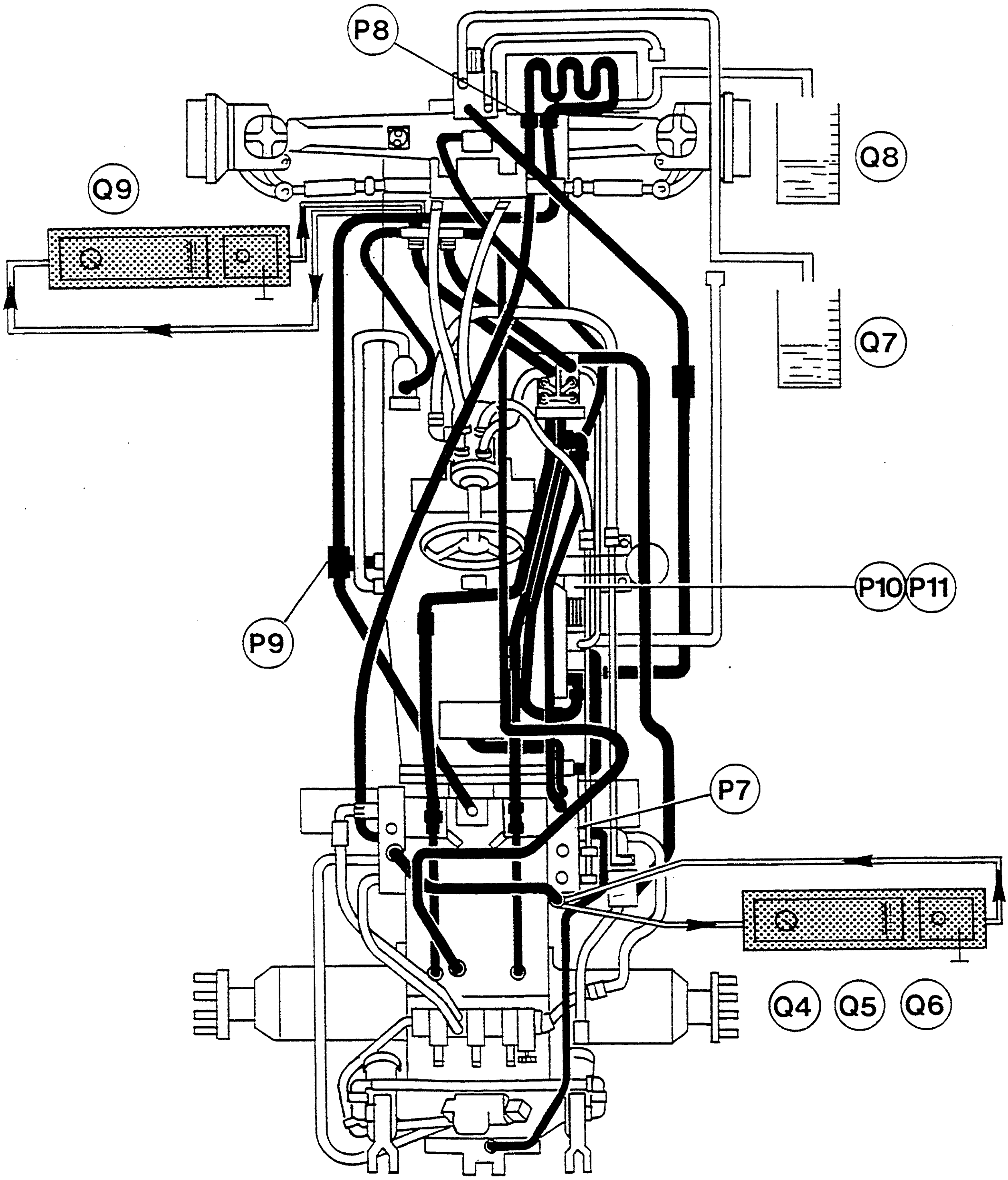


Fig. 4

B. Tests on low-flow circuit

Caution: During the tests, the rear axle must not be placed on blocks with the front axle engaged.

1. Test on 17-bar circuit

- Connect a pressure gauge with a coupler 3582045 M1 on the diagnostic point on the right-hand hydraulic cover (Fig. 5).
- Check that none of the solenoid valves are power supplied.

Note: Press the clutch pedal fully down (tractors fitted with wet clutch). Place the gear range lever in the Tortoise position and the Dynashift lever (if fitted) in position D.
The front axle must be engaged, with the pressure used only for disengagement.

Engine speed rpm	**P7** bar
1,000	16.4 - 19
2,200	

- Operate each function one after the other. The pressure must drop momentarily and quickly rise again.
- A constant pressure drop indicates an excessive leak on this function.
- For the specific Dynashift test, see Section 9 H01-5.

2. Pump output

- Connect the flowmeter in series on the excess flow return (Fig. 6).
- Check the direction of flow.
- ***Make sure that the flowmeter calibrating valve is fully open.***
- Release all the low-pressure functions.
- Check the minimum flow.

Engine speed rpm	**Q4** l/mn
2,200	19

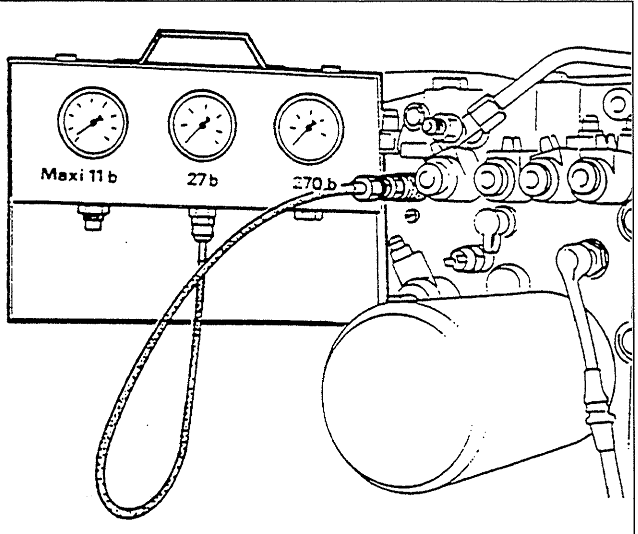


Fig. 5

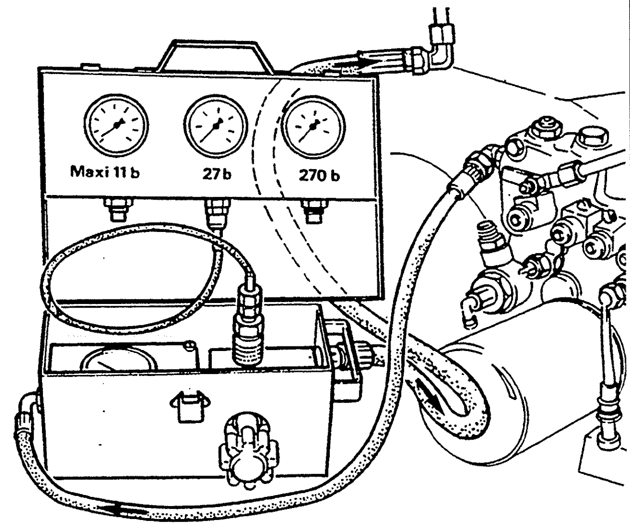


Fig. 6

3. Checking for leaks on clutches and receiving components

- To obtain the reference flow Q5, the front axle must be engaged (no flow to clutch, warning light on). The range lever must be in the Tortoise position and the Dynashift lever (if fitted) must be in position D. On tractors equipped with a wet clutch, the clutch pedal must be pressed fully down (no flow to clutch).
- Remain connected as in B2. Check the reference flow Q5 at 1,000 rpm.
- Operate each function separately and note flow Q6. The difference between Q5 and Q6 represents the leak observed which must not exceed the values shown in the guide table.

Example: PTO clutch
Q5 = 13 l/mn Q6 = 11.5 l/mn leak = 1.5 l/mn, OK
Q5 = 13 l/mn Q6 = 10.8 l/mn leak = 2.2 l/mn, higher than permissible value

Note: Before checking the next function and to avoid falsifying flow rate Q6, the clutch pedal must be pressed fully down. Return the control lever for the component under test to the neutral point or to the range position specified above.
When all the clutches and receiving components are operated, pressure P7 must stay at 16.4 / 19 bar.

	PTO clutch and brake	Diff. lock	Front PTO	Dyna A/B/C/D	Hare range	Front axle Clutch		Wet clutch	
Reference flow Q5							*		◊
Flow reading Q6							*		◊
Leak observed Q5 - Q6 l/mn									
Permissible leak l/mn	1.5	2	3	0	0.5	2		3.5	
Pressure P7 (bar)				16.4 - 19					

* Q5 = Front axle **engaged** (no flow to clutch)
* Q6 = Front axle **disengaged** (flow to clutch)

◊ Q5 = Pedal pressed **fully down** (no flow to clutch)
◊ Q6 = Pedal **released** (flow to clutch)

- To disengage the front axle, with the tractor stopped, the solenoid valve must be supplied directly from the battery.
- Leaks from single-piston systems can be detected using the values stated above. For dual-piston functions (power take-off and differential lock) further testing is required:
  . disconnect one of the pistons and block off its supply. Check whether the leak disappears.

4. Cooling system

- Install a diagnostic point on the oil cooler inlet (Fig. 7).
- Run the engine at 2,200 rpm and read the pressure at which the safety valve opens:
  P8 = 4.5 bar max.

5. Lubricating system

- Install a diagnostic point on the lubricating system at the gearbox inlet (Fig. 8).
- Run the engine at 1,000 rpm and read:
  P9 = . 1.5 bar, version 1 cooler
  . 1.5 bar, version 2 coolers installed in parallel
  . 1 bar, version 2 coolers installed in series
- Connect up a turbine type flowmeter between the manifold and the lubricating hose (Fig. 4).
- Check that the flowmeter calibrating valve is fully open.
- Check the flow rate.

Engine speed rpm	**Q9** l/mn
1,000	
2,200	16

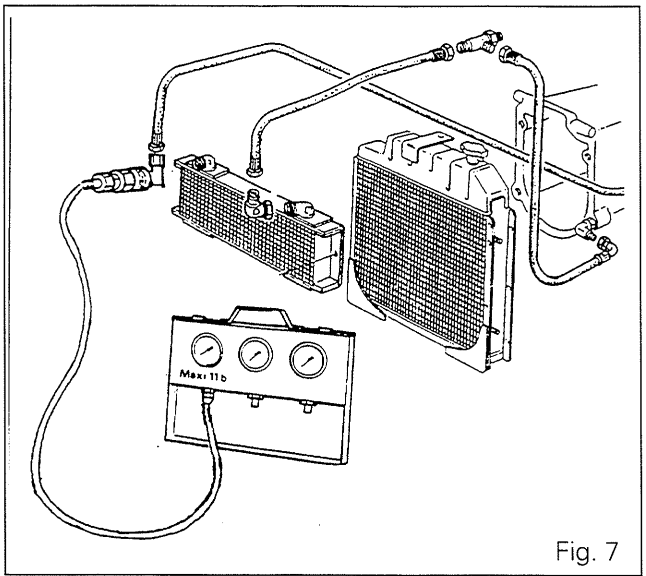


Fig. 7

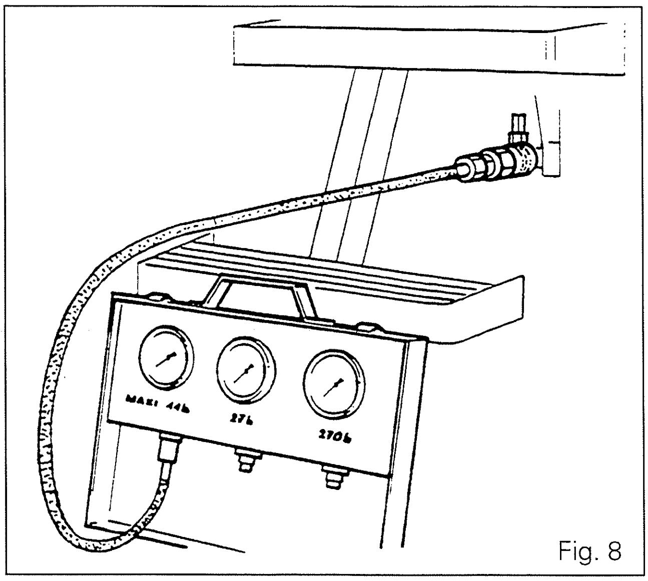


Fig. 8

CONTENTS

6. Front power take-off (if fitted)

Checking constant level in housing

- Using a measuring column, check the output flow **Q7** (Fig. 9) and the inlet flow **(Q8)** after the restrictor (Fig. 10).

Engine speed rpm	**Q7** l/mn	**Q8** l/mn
2,200	0.75	0.75

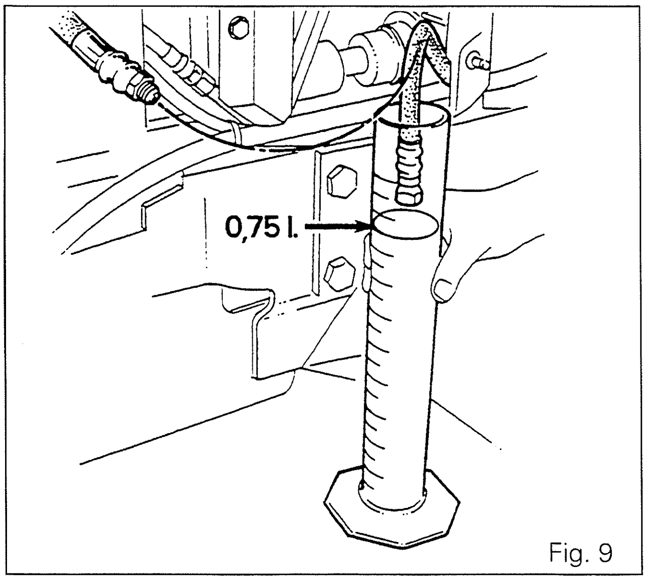


Fig. 9

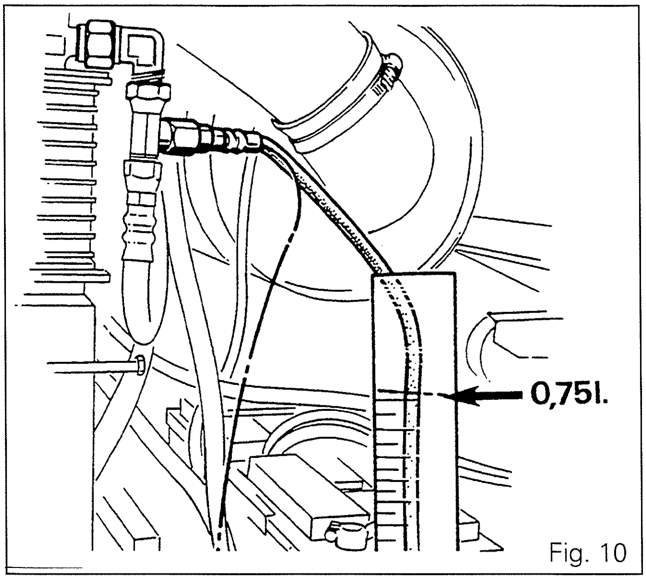


Fig. 10

10 . ELECTRICAL EQUIPMENT

Contents

10 A01 Electrical system

CONTENTS

A. General

MF 8100 tractors are equipped with a 12-volt electrical system with negative earth, charged by a 70-ampere alternator.
The alternator has an integrated rectifier and charging regulator. An additional terminal is provided to supply power to the electronic engine tachometer. The alternator is fitted on the right-hand side of the engine and is driven by a twin belt from the crankshaft pulley.
The starter motor, mounted on the right-hand side of the engine, is of the pre-engaged type.
A starting safety switch, located under the clutch pedal, cuts off the power supply to the starter motor when the clutch is not pressed.

Specifications

Battery

8110 to 8140

Quantity	2
Make	CEAC
Type	Maintenance-free
Model	FCS 066431
Cold start performance	420 A (-18°C)
Reserve capacity at 25 A	120 mn
Voltage	12 V
Acid capacity	4.3 l

8150 - 8160

Quantity	2
Make	CEAC
Type	Maintenance-free
Model	FCS 105556
Cold start performance	505 A (-18°C)
Reserve capacity at 25 A	180 mn
Voltage	12 V
Acid capacity	8.2 l

Alternator

Make	Valeo
Type	NG
Max. output	70 A
Regulator	Integrated
Regulator voltage	14.2 V

Starter motor

Make	Magnetti-Marelli
Model	M127 (2.8 kW)
Voltage	12 V
Type	Pre-engaged

Identification of connectors

Item	Colour	Ways
C1	Black (circular)	9
C2	Black (circular) Red band	9
C3	Black	6
C4	Black	6
C5	White	5
C7	White	13
C8	Black	2
C9	Black (circular)	3
C10	Black	1
C11	Black	1
C12	Red	2
C13	Black	1
C14	White	5
C16	White	4
C17	Black	3
C18	Black	6
C19	Black	2
C20	Black	1
C21	Black	2
C22	Black	2
C23	Black	1
C24	Black	8
C25	Black	1
C26	Black	1
C27	Black	1
C28	Black	3
C30	White	13
C31	White	11
C33	Black	2
C34	Black	2
C60	Black	6

Identification of harnesses

Item	Description of harnesses
(a)	Instrument panel harness
(b)	Engine harness
(c)	Engine harness extension
(d)	Console harness
(e)	Starting assistance wire
(f)	Internal power socket supply harness
(g)	Roof harness
(h)	Battery main switch harness
(i)	Rear wiper harness
(j)	Wire (for power supply to radio, clock and interior light) (for battery main switch)
(k)	Additional tank harness
(l)	Interior light door switch harness
(m)	Instrument panel electronic harness
(o)	Battery harness
(t)	Instrument panel/roof harness (lower section)
(u)	Instrument panel/roof harness (upper section)
(w)	Front and rear lighting harness
(ae)	25 A internal power socket harness
(af)	Cigar lighter harness

B. Engine and equipment wiring

1. Cab equipment and accessories

Key to diagram

1. Starter switch
2. Pressure switch
3. Air-conditioning compressor
4. Cab relay
5. Brake oil pressure warning light
6. Alternator warning light
7. Radio (NA)
8. Radio (except NA)
9. Digital clock
10. Interior light
11. Door switch
12. Water circulating pump (optional)
13. Switch (optional)
14. Blower switch
15. Blower motor
16. Compressed air thermostart
17. Starter motor
18. Battery
19. Battery main switch (optional)
20. Windscreen wiper motor
21. Interior power socket
22. Overhead panel illumination
23. Windscreen washer pump
24. Parking brake switch
25. Rear wiper switch
26. Cigar lighter
27. Timing relay
28. Parking brake warning light
29. Rear wiper motor
30. Wiper selector switch

Colour code

A = Aluminium
B = White
BL = Blue
G = Grey
I = Ivory
J = Yellow
M = Brown
N = Black
O = Orange
R = Red
RO = Pink
V = Green
VI = Violet
C = Light
F = Dark

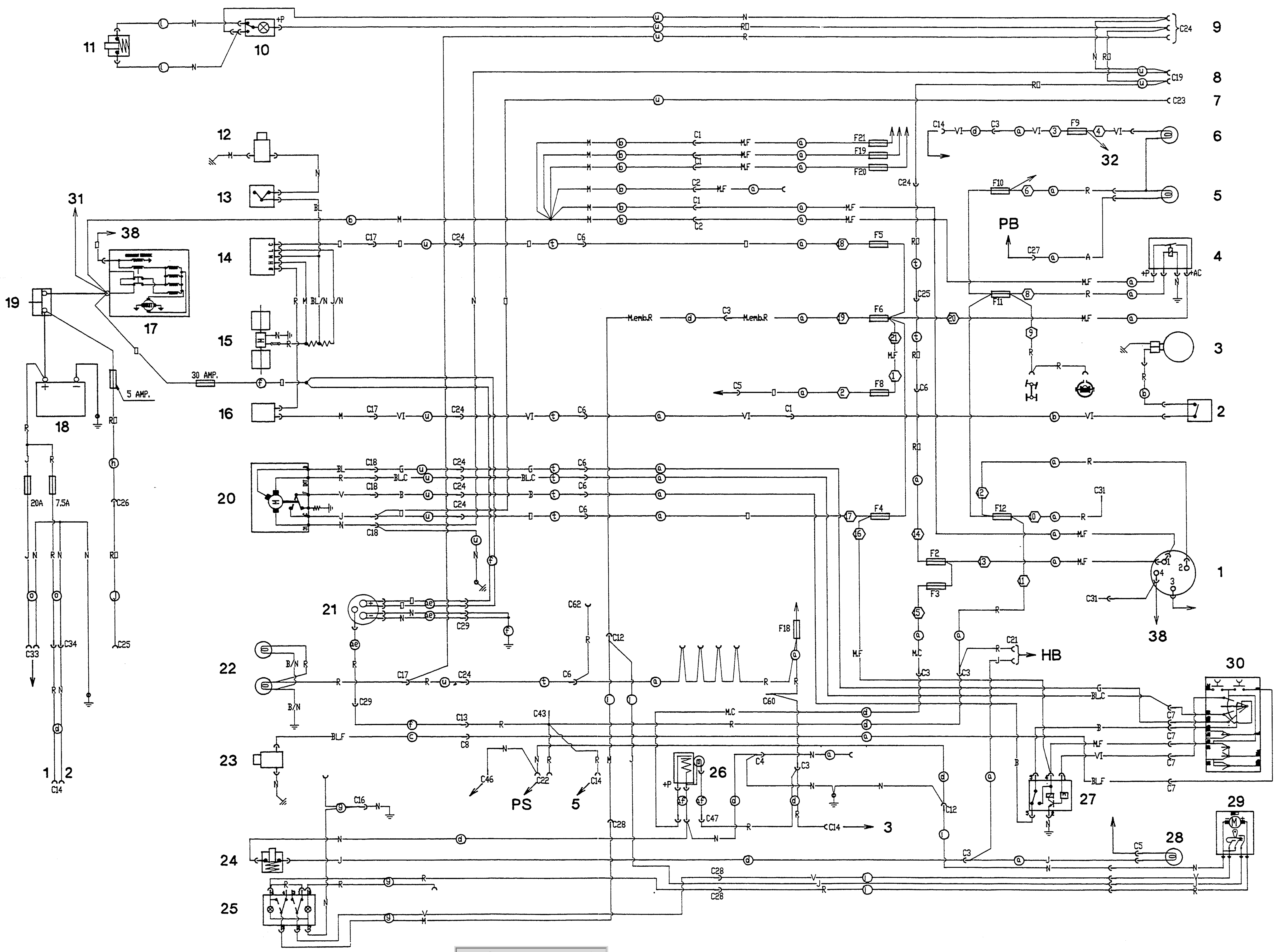
Abbreviations, symbols

HB: Handbrake buzzer (if fitted)
PB: Pneumatic brake (if fitted)
PS: Pneumatic seat (if fitted)

emb: end fitting
+ P = + permanently live
+ AC = + live when ignition is on

Note: If the alternator warning light (6) does not come on when the starter switch is in position 2, check that the bulb has not blown. If it has blown, the alternator will not be energised and will not charge, which renders the lift function inoperative.

Electrical equipment - *System*



2. Engine equipment

Key to diagram

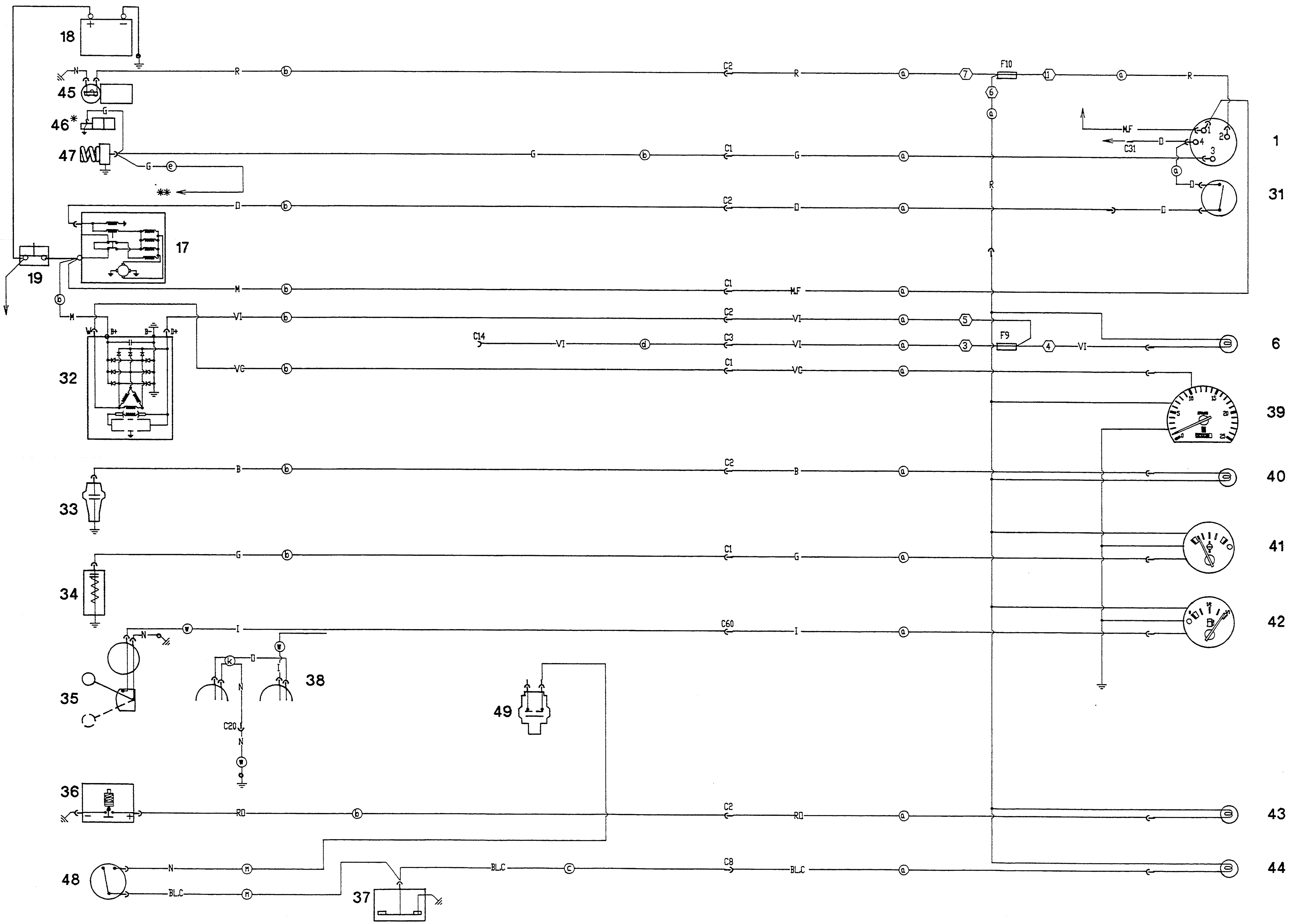
1. Starter switch
6. Alternator warning light
17. Starter
18. Battery
19. Battery main switch (optional)
31. Safety switch
32. Alternator
33. Engine oil pressure switch
34. Temperature gauge
35. Fuel gauge
36. Air filter vacuum gauge
37. Hydraulic filter vacuum switch
38. Gauges with additional fuel tank
39. Rev. counter / totaliser
40. Engine oil pressure warning light
41. Water temperature gauge
42. Fuel gauge indicator
43. Air filter clogging warning light
44. Hydraulic filter clogging warning light
45. Injection pump control solenoid
46. Thermostart solenoid valve *
47. Thermostart
48. Hydraulic filter, clogging indicator
49. 17 bar oil pressure switch

* Tractors 8150 - 8160
** Tractors with Valmet 634 DS engine

Colour code

A = Aluminium
B = White
BL = Blue
G = Grey
I = Ivory
J = Yellow
M = Brown
N = Black
O = Orange
R = Red
RO = Pink
V = Green
VI = Violet
C = Light
F = Dark

Electrical equipment - *System*



CONTENTS

C. Lighting system wiring - all types except USA

Key to diagram

1. Starter switch
2. Stop switches
3. Rear RH direction indicator
4. Rear RH brake light
5. Rear RH work lamp
6. Number-plate lights
7. Power socket
8. Rear LH work lamp
9. Rear LH brake light
10. Rear LH direction indicator
11. Front LH direction indicator
12. Front LH sidelight
13. Front LH work lamp
14. Front LH headlight
15. Horn
16. Front RH headlight
17. Front RH work lamp
18. Front RH sidelight
19. Front RH direction indicator
20. Flashing beacon
21. Flashing beacon switch
22. Flasher unit
23. Lighting selector switches
24. Hazard warning light switch
25. Instrument panel assembly illumination
26. LH direction indicator warning light
27. RH direction indicator warning light
28. Front headlight main beam warning light
29. 1st trailer warning light
30. 2nd trailer warning light
31. Rear work lamps switch
32. Front work lamps switch
33. Rear work lamp relays
34. Front work lamp relays
35. Front and rear work lamp relays
36. Fuel gauge

Colour code

A = Aluminium
B = White
BL = Blue
G = Grey
I = Ivory
J = Yellow
M = Brown
N = Black
R = Red
RO = Pink
V = Green
VI = Violet
F = Dark

Abbreviations, symbols

+ P = + permanently live
+ AC = + live when ignition is on

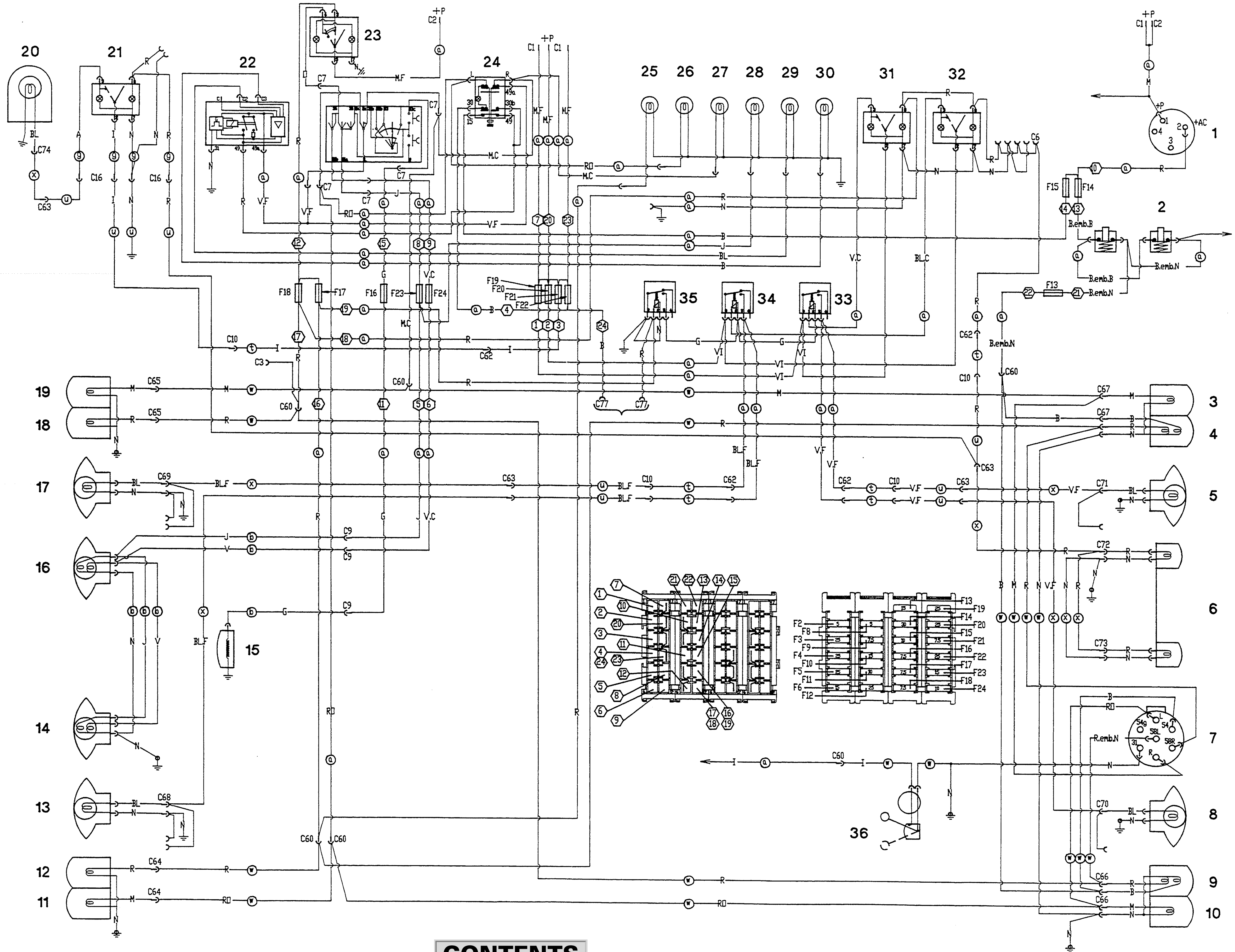
Identification of connectors

Item	Colour	Ways
C7	White	13
C9	Black	3
C10	White	6
C16	White	4
C60	White	6
C62	White	6
C63	Black	6
C64	White	2
C65	White	2
C66	Black	4
C67	Black	4
C68	Black	2
C69	Black	2
C70	Black	1
C71	Black	1
C72	Black	2
C73	Black	2
C74		1 Tubular connection
C75	Black	6
C76	Black	6
C77	Black	2

Identification of harnesses

Item	Description of harnesses
(a)	Instrument panel harness
(b)	Engine harness
(g)	Roof harness
(t)	Instrument panel / roof harness (lower section)
(u)	Instrument panel / roof harness (upper section)
(v)	Front work lamps harness (accessories)
(w)	Front and rear lighting harness
(x)	Roof lighting harness
(y)	Number-plate illumination harness
(ag)	Instrument panel / roof illumination harness
(ah)	Roof lights harness

Electrical equipment - *System*



CONTENTS

D. Lighting system wiring - USA type

Key to diagram

1. Starter switch
2. Stop switches
3. Rear RH direction indicator
4. Rear RH brake light
5. Rear RH work lamp
6. Number-plate lights
8. Rear LH work lamp
9. Rear LH brake light
10. Rear LH direction indicator
11. Front LH direction indicator
13. Front LH work lamp
14. Front LH headlight
15. Horn
16. Front RH headlight
17. Front RH work lamp
19. Front RH direction indicator
22. Flasher unit
23. Lighting selector switches
24. Hazard warning light switch
25. Instrument panel assembly illumination
26. LH direction indicator warning light
27. RH direction indicator warning light
28. Front headlight main beam warning light
29. 1st trailer warning light
30. 2nd trailer warning light
31. Rear work lamps switch
32. Front work lamps switch
33. Rear work lamp relays
34. Front work lamp relays
36. Fuel gauge

Colour code

A = Aluminium
B = White
BL = Blue
G = Grey
I = Ivory
J = Yellow
M = Brown
N = Black
R = Red
RO = Pink
V = Green
VI = Violet
F = Dark

Abbreviations, symbols

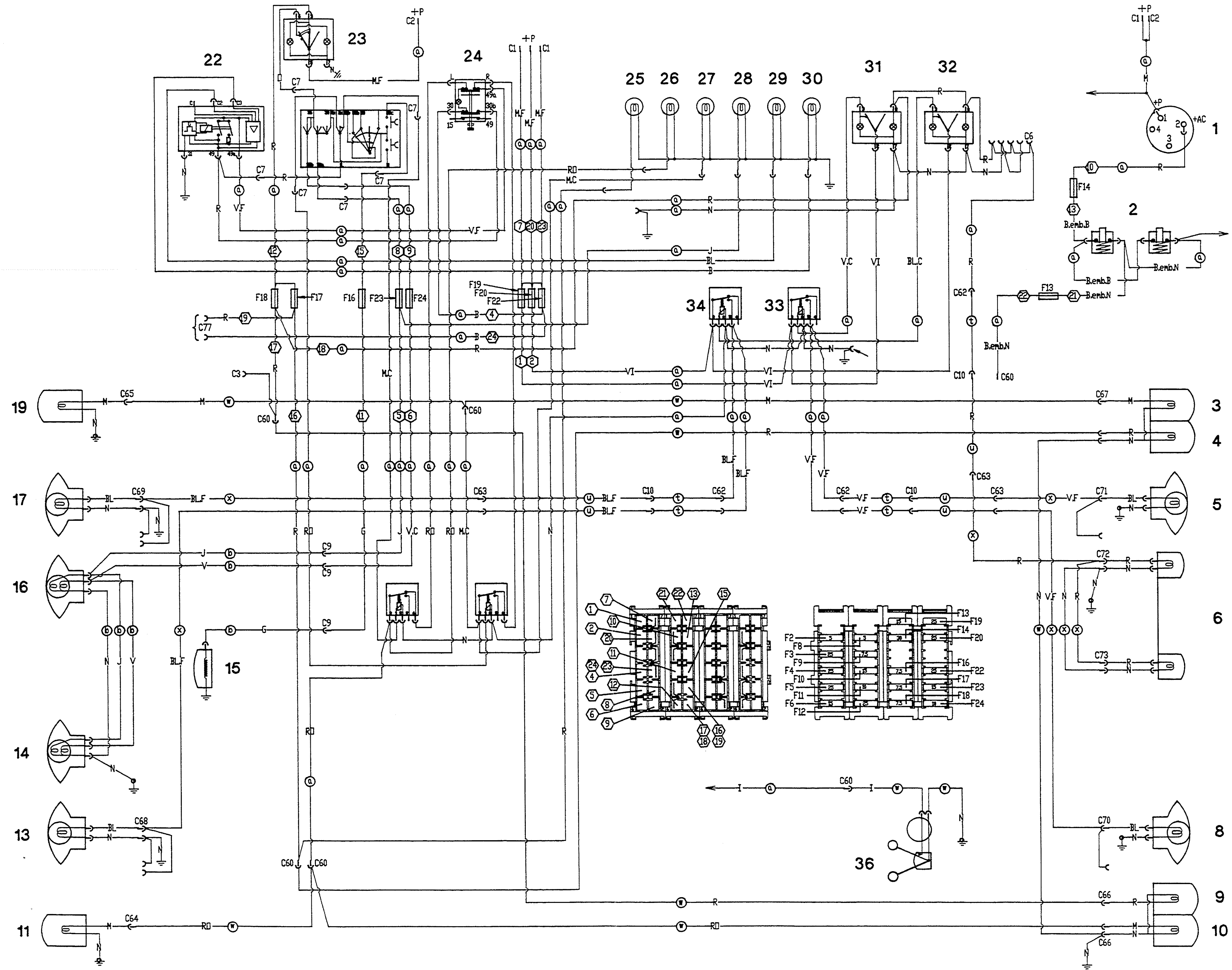
+ P = + permanently live
+ AC = + live when ignition is on

Identification of connectors

Item	Colour	Ways
C7	White	13
C9	Black	3
C10	White	1
C16	White	4
C60	White	6
C62	White	6
C63	Black	6
C64	White	2
C65	White	2
C66	Black	3
C67	Black	3
C68	Black	2
C69	Black	2
C70	Black	1
C71	Black	1
C72	Black	2
C73	Black	2
C74		1 Tubular connection
C75	Black	6
C76	Black	6
C77	Black	2

Identification of harnesses

Item	Description of harnesses
(a)	Instrument panel harness
(b)	Engine harness
(g)	Roof harness
(t)	Instrument panel / roof harness (lower section)
(u)	Instrument panel / roof harness (upper section)
(v)	Front work lamps harness (accessories)
(w)	Front and rear lighting harness
(x)	Roof lighting harness
(y)	Number-plate illumination harness
(ag)	Instrument panel / roof illumination harness
(ah)	Roof lights harness


1
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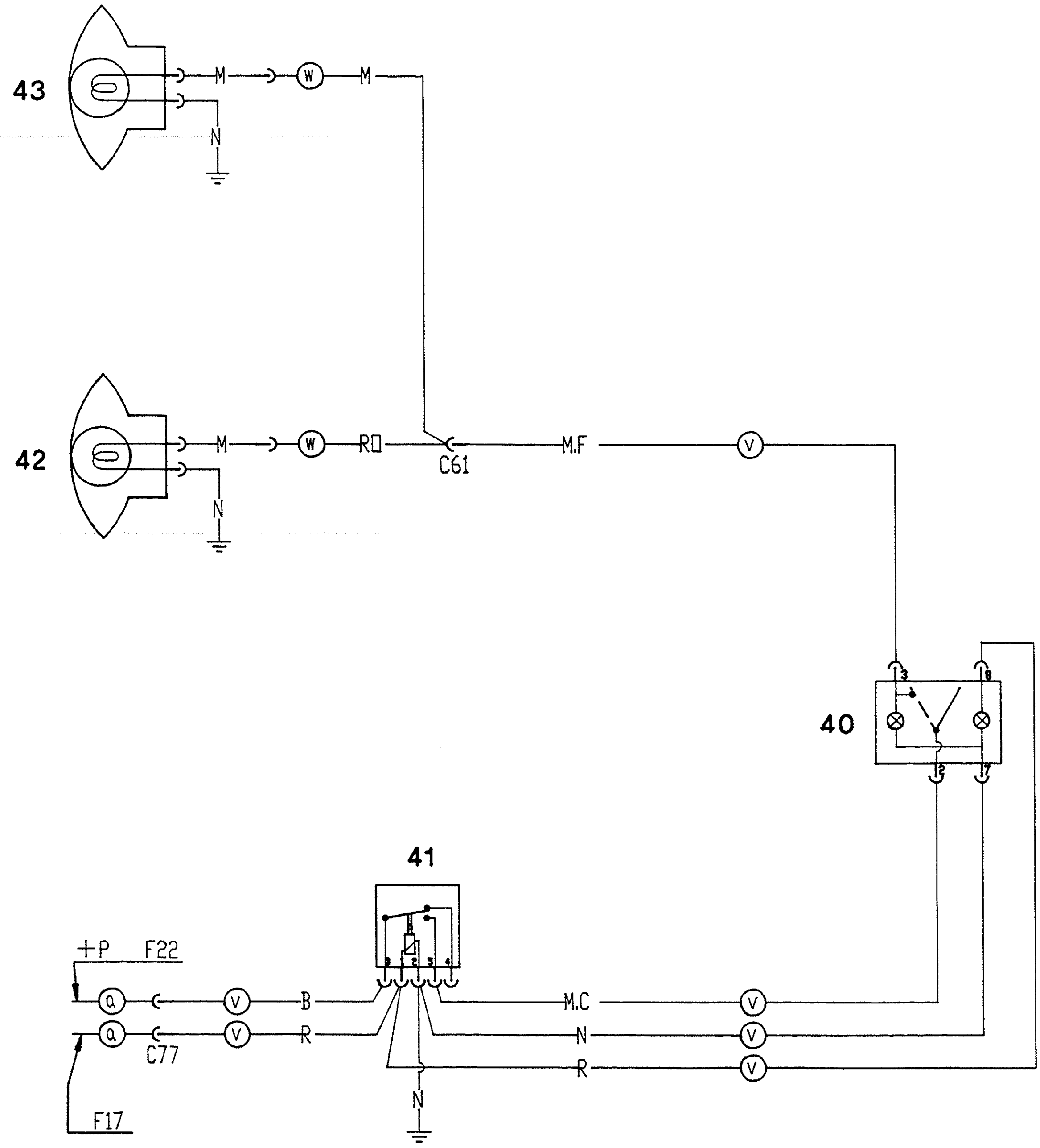
34
36

E. Wiring for additional front work lamps (optional)

Key to diagram

40. Switch
41. Relay
42. Front LH work lamp
43. Front RH work lamp



F. Fuses

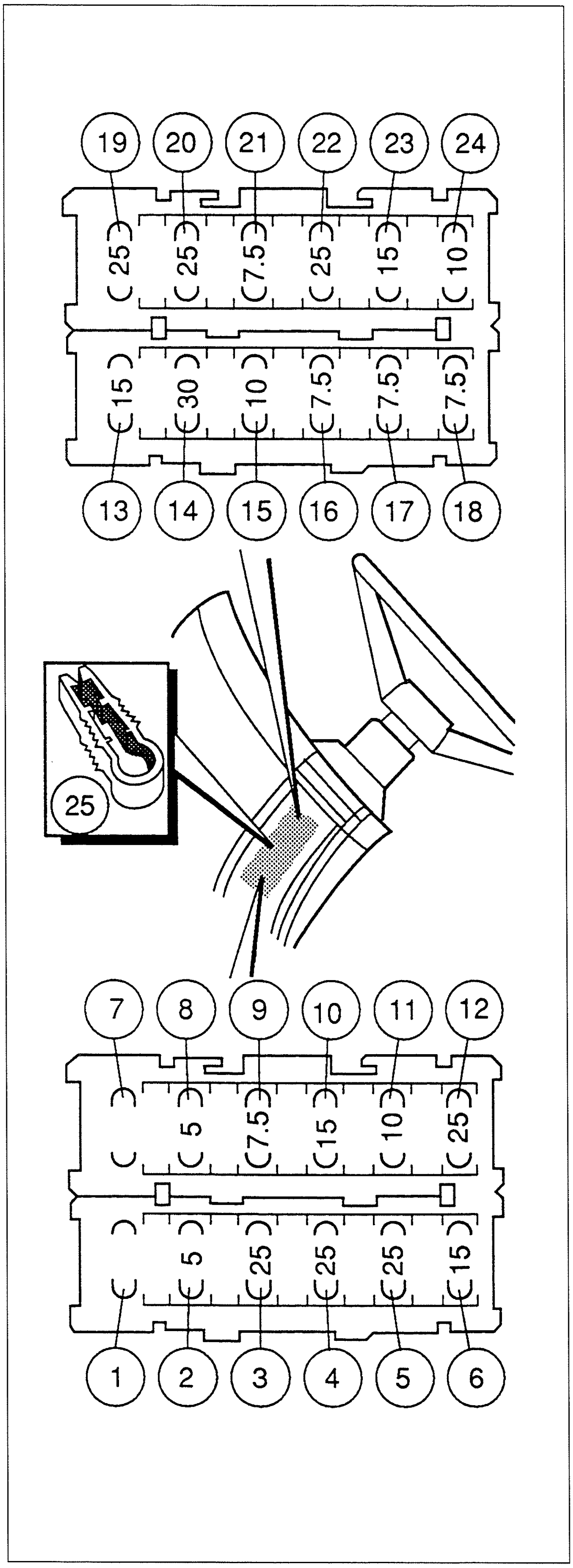
Fuses are housed in a box located to the left of the instrument panel. The box is divided into two sections. The upper section contains the fuses for the lighting system and the lower part contains the fuses protecting the engine and electronic functions.
A special tool **(25)** located in the box allows fuses to be replaced easily.

Note: The fuse box should always be kept clean. Fuses with a higher rating than the specified rating must never be used. The origin of the failure should always be traced before replacing a blown fuse.

In addition to those fitted in the fuse box, the system is also equipped with other fuses, as follows:
- four fuses fitted at the front:
. 7.5 A fuse (brown) protecting the electronic lift unit,
. 15 A fuse (red) protecting the Autotronic unit,
. 5 A fuse (yellow) protecting the front PTO (if fitted);
. 30 A fuse protecting the interior power supply socket.

ITEM No.	AMP.		APPLICATION
1-7		Not used	
2	5	(+P)	- Radio, clock and interior light pre-equipment
3	25	(+P)	- Cigar lighter
4	25	(+AC)	- Front windscreen wiper and washer
5	25	(+AC)	- Cab blower
6	15	(+AC)	- Rear wiper
8	5	(+AC)	- Dynashift control
9	7.5	(+AC)	- Electronic lift
			Alternator warning light
10	15	(+AC)	- Instrument panel assembly
			Injection pump
11	10	(+AC)	- 4WD and differential lock switch
			Cabin relay
12	25	(+AC)	- On-board computer
			Parking brake buzzer
			Pneumatic suspension seat
			Creeper gears
			Interior power socket
			Hare/Tortoise
			Lift
			PTO switch
			Autotronic
13	15	(+AC)	- In series with F14
			Stop switch and brake lights
14	30	(+AC)	- TCU braking information
15	10	(+AC)	- RH and LH indicators
16	7.5	(+AC)	- Horn
17	7.5		Lighting relay control
			Lighting, front LH sidelights
			RH rear red light
			Illumination of instrument panel assembly
18	7.5		Illumination of clock, differential lock
			Front RH sidelight
			LH red light
			Illumination of switches/buttons
			Illumination of number-plate
19	25	(+P)	- Rear work lamp
20	25	(+P)	- Front work lamp
21	7.5	(+P)	- Flashing beacon switch
22	25	(+P)	- Hazard warning lights
			Additional work lamps (if fitted)
23	15		Headlights (main beam) and indicator light
24	10		Headlights (dipped beam)

(+P) = + permanently live (+AC) = + live when ignition is on



11 . ELECTRONICS

Contents

CONTENTS

11 A01 Tester-programmer

CONTENTS

Tester-programmer - Description

A. General - Description

Note : These sections concern the use of the tester-programmer on all tractors in series 6100 and 8100.

The following testers should be used according to the local language and speed limits:

-	3376941	30 km/h	French
-	3376942	40 km/h	French
-	3376943	30 km/h	English
-	3376944	40 km/h	English
-	3376945	30 km/h	German
-	3376946	40 km/h	German
-	3376947	30 km/h	Spanish
-	3376948	40 km/h	Spanish

The tester-programmer allows you to:

- display the operation of the main electronic components and detect failures of the following systems:
  . Autotronic,
  . Electronic lift control,
  . Datatronic.
- set the parameters of the various electronic components according to the characteristics of the tractor concerned.

Autotronic

It is possible to:
- Load a new program into the AUTOTRONIC 2 electronic transmission control unit (ETCU) in order to update its programming.
- Set the parameters on a replacement AUTOTRONIC 2 unit before installing it on a tractor.
- Test the AUTOTRONIC 2 system.

Electronic lift control

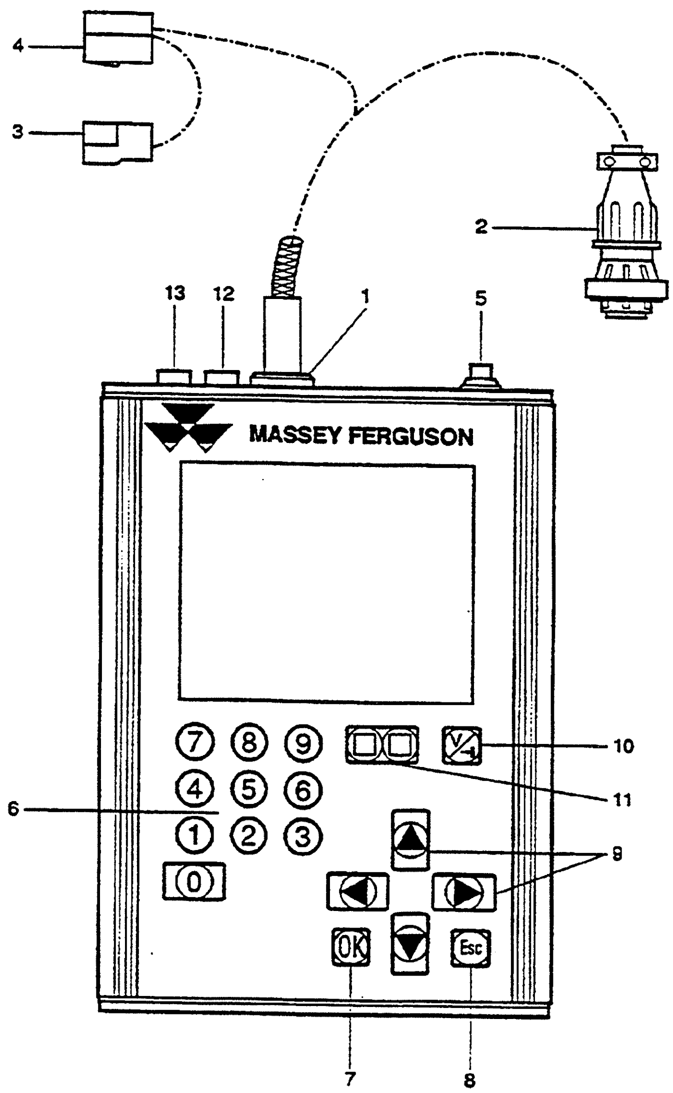
It is possible to:
- Display the operation of the system and detect failures.
- Check the setting of the position sensor.

Datatronic

It is possible to:
- Configure the Datatronic system according to the specifications of the tractor it is installed on (in the same way as for the Autotronic system).
- Check the various values calculated by the Datatronic system.
- Display the menu in the desired language.

List of parts

1 - Cable harness/tester connector
2 - Connector for Autotronic unit (CAN)
3 and 4 - Power supply and earth terminals
5 - On/Off switch
6 to 10 - Keypad
11 - Screen display contrast adjustment
12 - Input for earth continuity test
13 - Input for testing of voltmeter and frequency-meter



B. Composition of kit

The basic kit includes:
- a tester box,
- a wiring harness to be connected to the tester,
- an adapter cable harness 3714779 M1,
- a needle type test lead,
- a carrying case.

The tester does not include any battery and must be connected to the tractor harness to be powered.

The following additional cable harnesses can be supplied on request.
- 3712344 M1 - PC/tester link harness:
  Used to update or reprogram the tester from a PC.
- 3712723 M1 - 4 LED harness:
  Used to program or parameterise the "Auto 2" unit when not on the tractor (installed on a table).
- 3714780 M1 - Connecting harness for tractors with Datatronic:
  This is connected to the round 16-way connector in the cabin.
  Used to test all electronic systems.
- 3715767 M1 - Connecting harness for tractors without Datatronic:
  This is connected to the C35 connector on the cabin console.

Please read the following instructions carefully before switching on the tester.

C. Using the tester

The tester is switched ON and OFF by pressing the switch **(5)**.

When the tester is switched on, the various tester software issues are shown on the screen. The various menus are accessed using the keys as indicated at the bottom of the screen.

The keypad includes:
- the numeric keypad **(6)** used to enter codes,
- the OK key **(7)** used to validate choices,
- the ESCAPE key **(8)** used to go back to the previous menu,
- the four arrow keys **(9)** used to move the cursor on the display,
- key V/→+ **(10)** used to obtain direct access to the multimeter function from anywhere in the program,
- two keys **(11)** used to adjust the display contrast.

D. Connecting the tester

There are four different possibilities:

Connections	On tractor	On table	Functions tested: Autotronic II	Lift control	Datatronic II	Harness used
1	•		•			3714779 M1
2		•	•			3712723 M1
(a) **3**	•		•	•	• (b)	3715767 M1
4	•		•	•	•	3714780 M1

(a) This connection can only be used to parameterise or program the "Auto 2" unit.

(b): See section 11 D02.

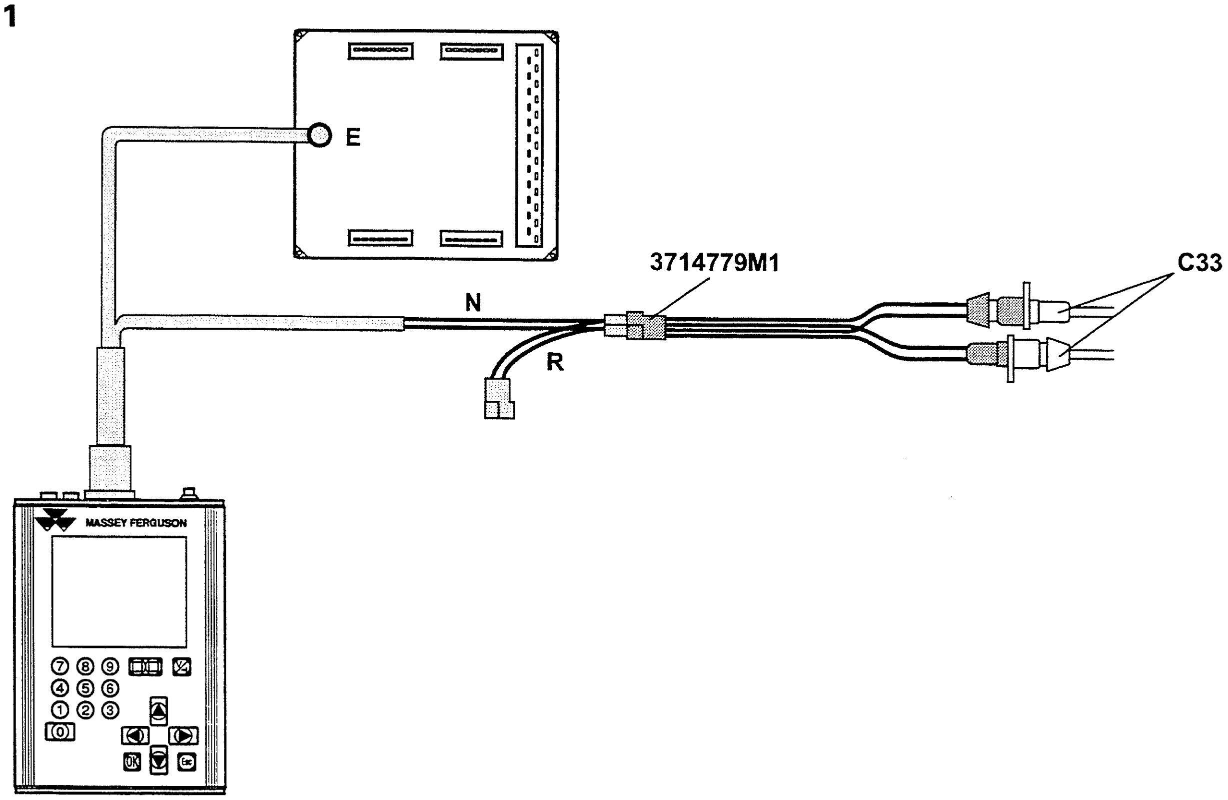
- Connect the tester harness to plug **(1)**.
- Disconnect connector **C33** of the tractor harness. This connector is the direct power supply and earth for the Autotronic system. It is a two-way connector (yellow and black wires) located below the Autotronic ETCU.
- Connect the tester connectors **(3)** and **(4)** to the ends of connector **C33**. In this way, the ETCU power supply is not interrupted.
- Connect connector **(2)** (black) to connector **"E"** of the ETCU after removing the plug.
- Switch on the tester using the On/Off switch **(5)**.

Fault:
If the tester screen does not light up, check the tractor cable harness.
- Yellow wire: direct supply from the battery protected by a 15 A fuse fitted in the battery compartment.
- Black wire: connected to the earth on the gearbox selection cover.
- Check for MINIMUM VOLTAGE of 9 volts on connector **C33**.

11A01.4

Tester-programmer - Description

1



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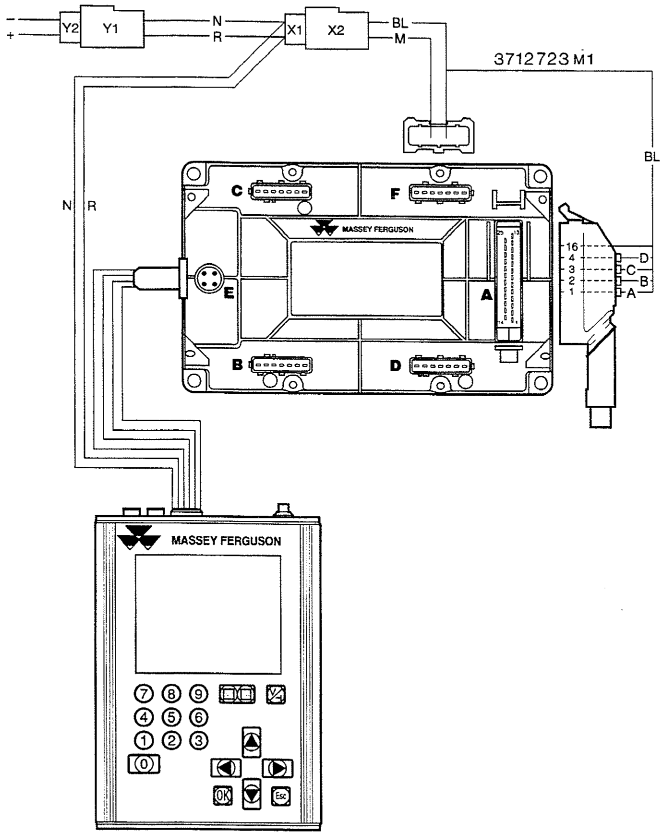
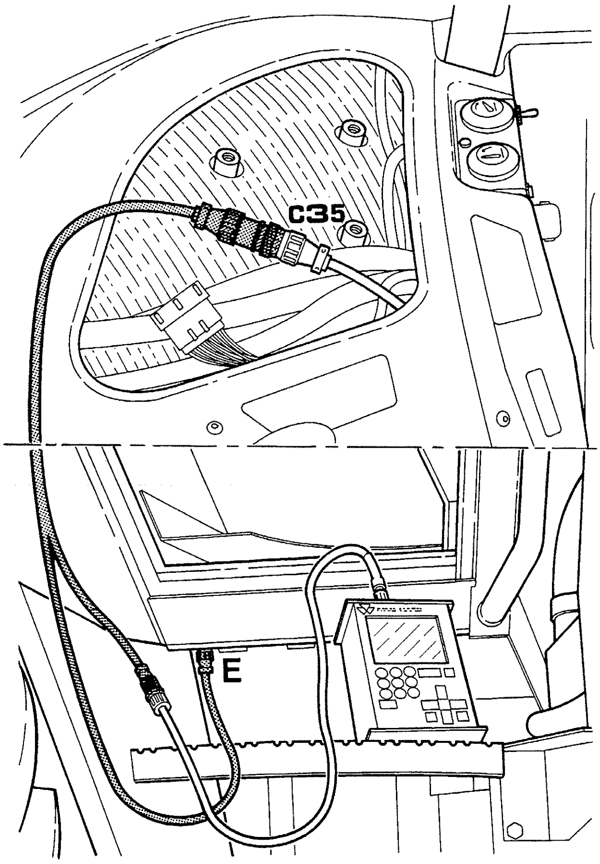


Wire colours

BL:	Blue
M:	Brown
N:	Black
R:	Red

CONTENTS

3



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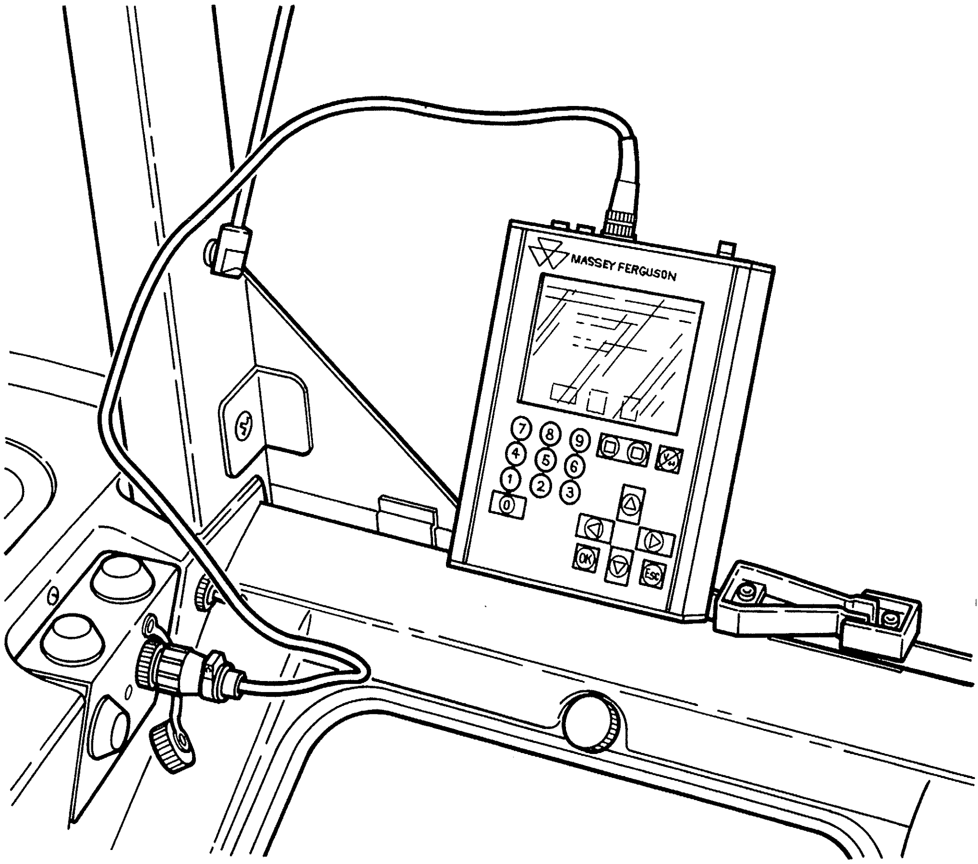


E. Screen displays

Issue of operating software present on the tester-programmer.

I: Identification of tester (see 11A02, § C)

MASSEY FERGUSON
(C) COPYRIGHT
1993

PROM: A93121
FLASH: A931210
SERIAL: 30101

I xxxx

PRESS OK ■

Select the circuit to be tested using arrows and then press OK.

AUTOTRONIC

DATATRONIC

LIFT CONTROL

OK ▲ ▼

The tester indicates the ETCU operating software issue present in the tester (e.g. issue Y).
Press the clutch to activate the ETCU.
The tester indicates the issue of the operating software of the tractor ETCU.
If the ETCU operating software issue is Y, press OK to go to the main menu.

OPER. SOFT. ISSUES

TESTER: Y

AUTOTRONIC: ?

PRESS CLUTCH PEDAL

TCU OFF

Case 1 - When the tester detects an ETCU software issue earlier than its own:

The message «Program is necessary» is displayed on the screen.
Press OK to continue.

OPER. SOFT. ISSUES

TESTER : Y

AUTOTRONIC : Y-1

PROGRAM IS NECESSARY

PRESS OK ■

Start the engine to provide a power supply of more than 13.6 volts. This is required in order to clear the ETCU memory. Otherwise, a message is displayed on the screen.
Press OK.

> **PROGRAM TCU**
>
> **START ENGINE**
>
> **PRESS OK ■**

Disconnect the Autotronic black connector, **F**, to reset the ETCU.
Press OK.

> **PROGRAM TCU**
>
> **DISCONNECT CONNECTOR F**
>
> **PRESS OK ■**

Reconnect the Autotronic black connector, **F**.
Press OK.

> **PROGRAM TCU**
>
> **CONNECT CONNECTOR F**
>
> **PRESS OK ■**

Press the clutch pedal to activate the ETCU.
Press OK.

> **PROGRAM TCU**
>
> **PRESS CLUTCH PEDAL**
>
> **PRESS OK ■**

Tester-programmer - *Description*

It takes two minutes to clear the ETCU memory.
Wait, without taking any action during this period (no indicator light on).
If you make a mistake, disconnect connector **F** and then reconnect it. Then repeat the programming procedure.

PROGRAM TCU

WAIT

The tester reprograms the ETCU to obtain issue Y (indicator lights **B** and **C** or Speedshift Hi come on).
Wait until the programming is completed (about five minutes).
The value displayed on the screen switches from 32716 to 0.
Then, lights **A, B, C, D** (or Speedshift Hi and Lo) come on.

PROGRAM TCU

WAIT PROGRAMMING
32716

The transfer has been completed.
The program was correctly transferred but the ETCU has not yet been initialised.
Disconnect connector **F** on the ETCU to reset.
Press OK.
If a problem occurs during programming, only light **A** or **B** comes on. In this case, check the power supply and the connectors.
Disconnect the ETCU and start again.

PROGRAM TCU

WAIT PROGRAMMING
0
PROGRAM OK
DISCONNECT CONNECTOR F

PRESS OK ■

Reconnect connector **F** on the ETCU.
Press OK.

PROGRAM TCU

WAIT PROGRAMMING
0
PROGRAM OK
DISCONNECT CONNECTOR F
RECONNECT CONNECTOR F

PRESS OK ■

Case 2:

The issues of the tester operating software and the ETCU are identical.
No reprogramming is required.
Press OK.

OPER. SOFT. ISSUES

TESTER : Y
AUTOTRONIC : Y

PRESS OK ■

The tester indicates the three possible functions:
- **Test** : to test the tractor circuit,
- **Parameter** : to read or enter new parameters,
- **Program** : to update the operating software issue.

Select by moving the black line with the arrow keys.
Press OK.
TCU: XX indicates the mode in which the ETCU is working (see section F). If the ETCU is switched off, press the clutch again.

TEST
PARAMETER
PROGRAM

TCU: XX OK ▲ ▼ ESC

Parameter setting must be performed for each switch between issue **Y-1** and issue **Y** and when a new ETCU is installed.
Press OK.

TEST
PARAMETER
PROGRAM

OK ▲ ▼ ESC

OPER. SOFT. ISSUES

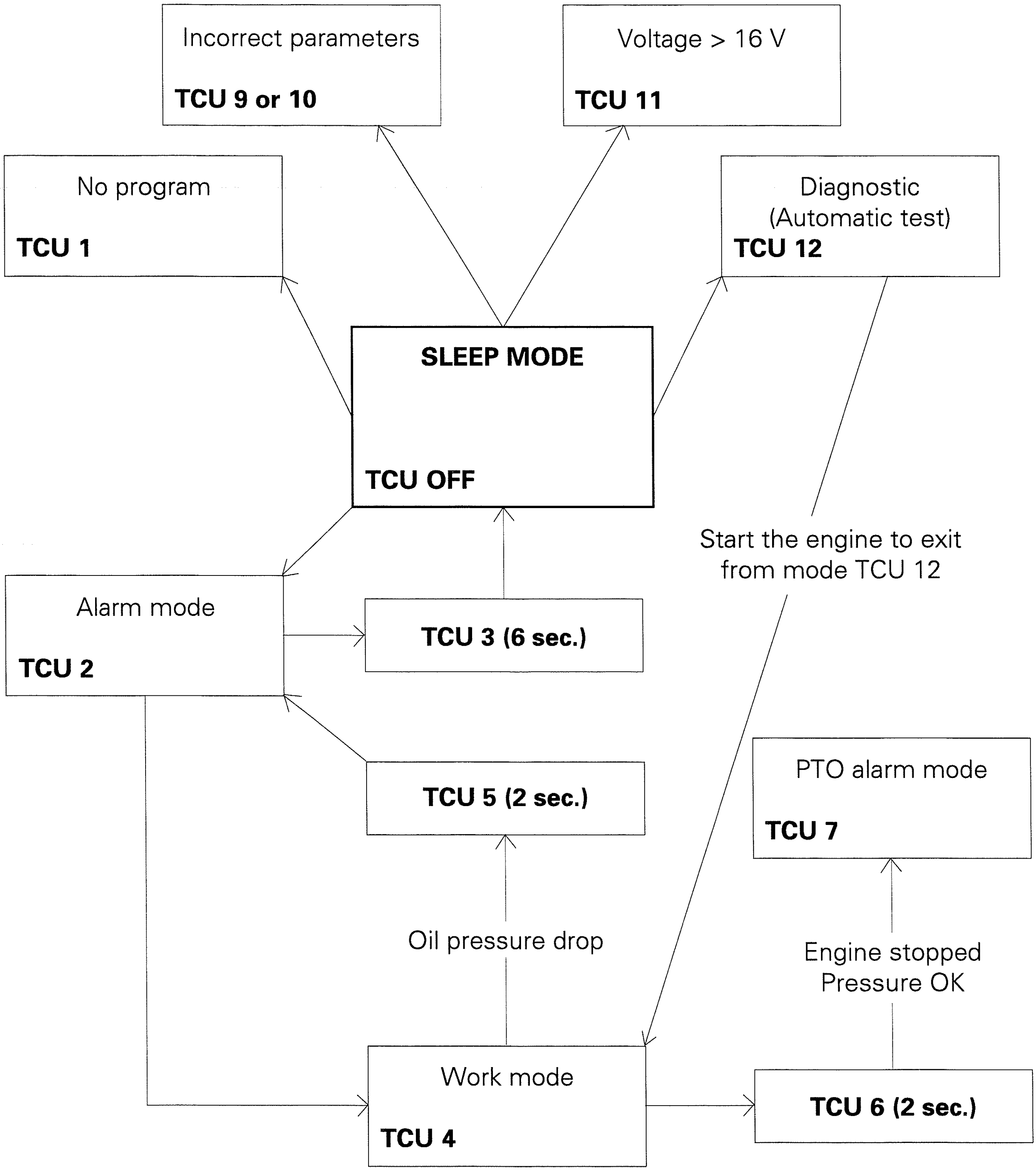
TESTER : Y
AUTOTRONIC : Y

PRESS OK ■

F. ETCU modes

The tester indicates the status of the Autotronic ETCU. This status, referred to as its mode, is identified by means of a code (TCU off, 1, 2, etc.) which is automatically displayed in the bottom left-hand corner of the screen.

In case of failure, it is important to note which mode the Autotronic ETCU is in.



G. Error messages

The tester can give the following error messages:

Symbol ⚠ E100

E:1 Program error. Switch off and then on again.

E:2 Parameter code too long. Check code on label in fuse box.

E:3 No-existent reference parameters. Check code on label in fuse box.

E:4 Non-existent 4WD parameters. Check code on label in fuse box.

E:5 Non-existent Hi/Lo (Hare/Tortoise) parameters. Check code on label in fuse box.

E:6 Non-existent gearbox parameters. Check codes on label in fuse box.

E:7 Non-existent speed limit parameters. Check code on label in fuse box.

E:8 Non-existent Speedshift parameters. Check code on label in fuse box.

E:9 Non-existent Dynashift parameters. Check code on label in fuse box.

E:10 Incorrect parameters (last 4 digits). Check code on label in fuse box.

E:100 Voltage too low. Start engine. Check alternator. Min. 13 volts.

E:101 Problem erasing TCU software. Check connections and try again.

E:102 Problem locating new software in TCU. Check connections and try again.

H. Multimeter function

Whatever point you are at in the program, this function allows the following operations to be performed with **a single test lead**:
- measure a positive voltage using the tractor chassis as earth,
- measure earth continuity on the tractor,
- measure the frequency of speed sensor signals.

To access multimeter mode:
- Press key V/→+ (10).
- Connect the test lead to plug 12 **(black)** to check earth continuity, or to plug 13 **(red)** to check voltage or frequency.

To exit from multimeter mode, press the ESCAPE key (8). The display on the tester screen returns to the state it was in before the multimeter function was selected.

⚠ **Do not use the tester to perform any measurements other than those specified.**

Resistance

The earth reference is on connector **C33**.
(R = 0 Ω)

The screen display can be:
R = -1 Ω (when measuring the battery negative terminal for a low resistance on the line)
R = 0 Ω (when measuring earth continuity with connector **C33**)
R = +1 or 0L for infinity or more than 30 Ω
R = 1 to 30 Ω for resistance between 1 and 30 Ω

Frequency

Value in hertz = 0 to 4,000 Hz

11A02 Reprogramming of the tester

CONTENTS

11A02.2 **Tester-programmer** - *Reprogramming*

Note : To perform procedures C, D and E basis knowledges of the DOS system are necessary.

A . Equipment required

- 1 tester.
- 1 PC/tester connecting cable, ref. 3712344 M1.
- 1 mains power unit, 220 V - 12 V at 1 A (12.6 V min at 0.3 A).
- 1 PC IBM 386 or 286 Turbo compatible, serial port No 1 equipped with a 9-pin socket.
- 1 diskette containing the following files :
  Disc B:\ or A:\ (depending on the PC)

TRADUCT	EXE	../../95
FRANCAIS		../../95
BASE	TXT	../../95
TRADUCT	TXT	../../95
NAMETEST	TXT	../../95
TCU	HEX	../../95
TRANSFER	EXE	../../95
TRANSFER	TXT	../../95
TESTEUR	HEX	../../95
GERMAN		../../95
SPANISH		../../95
NAMETEST	EXE	../../95

B . Connecting the tester

- Using cable 3712344 M1, connect the tester to the 12 V power supply (standard 3.5 mm jack plug).
- Switch on the tester. If it does not work, check the power supply or reverse the 12 V supply "+" and "-" leads.
- Switch off the tester.
- Connect the serial connector to port COM1 on the PC (9-pin socket).
- Switch on the tester and the PC.

C . Tester identification

This procedure consists in replacing the message "SEGRE ELECTRONIQUE" displayed on the tester when it is switched on by the identification desired by the user.

- Start program NAMETEST.EXE on the PC in typing NAMETEST and then, press the "ENTER" key.
  Type you ID (20 characters maxi) ex : "SA.TRAC.OISE".
  Switch off the tester and then switch it back on.
  Your message is displayed instead of "SEGRE ELECTRONIQUE".

Note : File NAMETEST.EXE is the program used to change the tester identification.
File NAMETEST.TXT is the file containing the messages for the NAMETEST program.

D . Updating the tester

This operation consists in replacing the whole tester program if you want to :
- enter a new version of the tester program,
- enter a new version of the TCU program in the tester,
- change the tester language.

Procedure

- Connect the tester to the power supply and to the PC as specified in part B.
- Switch on the tester and the PC.
- Type the following message and then press the "ENTER" key
  - to transfer English, type TRANSFER
  - to transfer French, type TRANSFER FRANCAIS
  - to transfer German, type TRANSFER GERMAN
  - to transfer Spanish, type TRANSFER SPANISH

  Caution : This program will transfer the following to the tester :
  - the tester program (file TESTEUR.HEX)
  - the TCU program (file TCU.HEX)
  - the tester language FRENCH or GERMAN or SPANISH or other (see E).

  The transfer takes about 8 minutes.

- When the operation has been completed, switch off the tester and then switch it on again.

Error messages

The messages are listed in "**ERREUR.TXT**". Use the DOS function "TYPE" to read them.
ERROR 1 : problem on serie port of PC (COM1).
ERROR 2 to 7 : dialog problem
ERROR 8 : loading problem (PC microprocessor speed)
ERROR 9 : dialog problem
ERROR 10 : no answer from tester (reboot tester)
ERROR 11 and 12 : dialog problem
ERROR 13 and 14 : problem on files to transfer (check disc)
ERROR 15 : dialog problem
ERROR 16 and 17 : problem of tester identification
ERROR 18 and 19 : too low tester supply
ERROR 20 : supplier test problem

If an error message appears, check connections, supply stability, PC compatibility.
Switch the tester OFF, then ON to reboot and start again : TRANFER.
If the problem appears again, contact Beauvais Service.

E . Translating

This procedure consists in creating a new file containing the messages displayed on the tester
The new messages can be displayed in another language.

• Start the TRADUCT program on the PC, for example :
To translate into another language (ex : ITALIAN)
Type "TRADUCT ITALIAN"
A file "ITALIAN" will be created to store the italian translation you will enter.
If the file "ITALIAN" already exists, you will be asked if you want to modify it.
Then, a temporary file TEMP.XXX will be created.
The english text appears on the screen. Type the translation line per line using 20 characters maxi for each of them.

It is necessary to type the blanks to centralise the text and to cover the existing letters.
In case of a mistake, finish the translation to exit. Re-enter the same file with TRADUCT.EXE.
Use "RETURN" to go down to the faulty line. Press any key to erase it. Type the correct text.
Use "RETURN" to go to the end and exit.

• The new language file (Italian) is ready to be introduced in the tester. Use the procedure updating the tester (part D) by typing TRANSFER ITALIAN.

Tester language to translate (English version)	**New language to introduce**
" AUTOTRONIC "	
" TEST "	
" PARAMETER "	
" PROGRAM "	
" CODE "	
" CODE OK ? "	
" PROGRAM TCU "	
" PUT AUTOTRONIC OFF "	
" PRESS CLUTCH PEDAL «	
" WAIT "	
" WAIT PROGRAMMING "	
" PROGRAM OK ! "	
" DISCONNECT "	
" CONNECT "	
" POWER CONNECTOR F "	
" OPER.SOFT ISSUES "	
" TESTER "	
" PROGRAM IS NECESSARY"	
" PROGRAM TCU "	
" OPER.SOFT ISSUE OK "	
" NOT NECESSARY "	
" CONFIRM PROGRAM ? "	
" OPER.SOFT "	
" NOT "	
" COMPATIBLE "	
" START ENGINE "	
" MONITORING "	
" TESTING "	
" DATATRONIC "	
" "	
" "	
" "	
" "	
" "	
"ENGINE RPM"	
"PTO 540 "	

Tester language to translate (English version)	New language to introduce
"PTO 1000 "	
"FWD SPEED "	
"WHEEL SLIP "	
"SLIP LIMIT "	
"AREA/HOUR "	
"FUEL/HOUR "	
"FUEL/AREA "	
"COST/AREA "	
"FUEL USED "	
"AREAWORKED"	
"DISTANCE "	
"HRS WORKED"	
"COUNTER "	
"COMP.MODE"	
"EXT.TEMP. "	
"TIME "	
"DATE "	
"SERVICE "	
"FUEL/COST "	
"COST/HOUR"	
"METRIC/IMP"	
" "	
" "	
" "	
" "	
" "	
" "	
"METRIC "	
"US IMPER. "	
"UK IMPER. "	
" "	
" "	
" "	
" "	
" "	
"WORKING WIDTH :"	
"AREA WORKED :"	
"DISTANCE :"	
"FUEL USED :"	
"HOURS WORKED :"	
"COUNTER :"	
" "	
" "	
" "	

11 B01 Description of electronic lift control

CONTENTS

A. Description

The electronic lift control system (Fig. 1) is made up of the following components:

- a control panel **(1)**,
- a digital computer **(2)**,
- a position sensor **(3)**,
- two draft sensors **(4)**,
- an electrical harness **(5)**,
- a proportional control electrohydraulic control valve **(6)**,
- four or six external control switches (according to option) **(7)**.

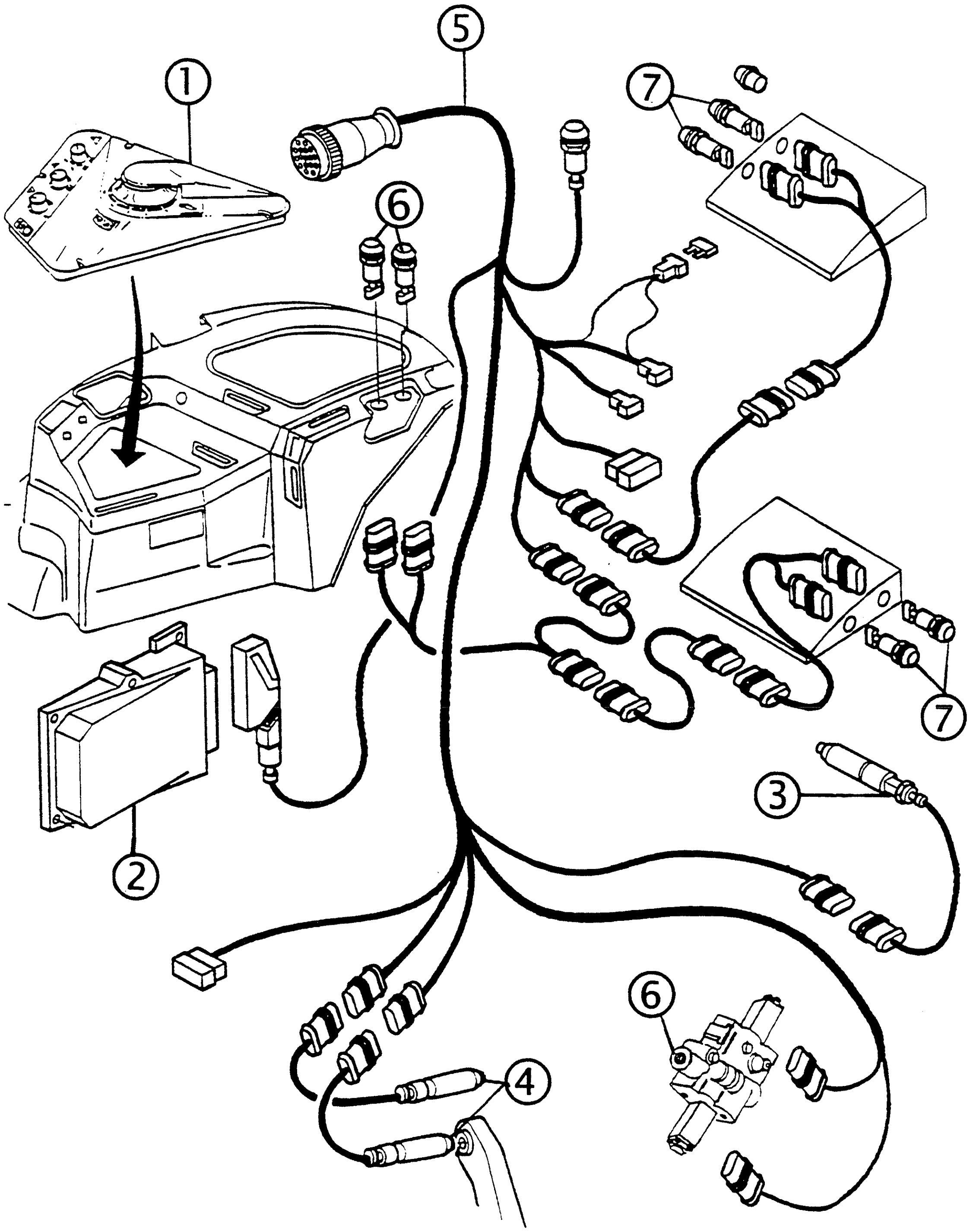


Fig. 1

(1) Control panel
Located on the right-hand side in the cab, the control panel comprises:
- four potentiometers,
- a switch,
- a push-button,
- five warning lights.

(2) Electronic computer
This is installed on the right-hand side in the cab, under the lift control panel.
The computer records the signals sent out from the various controls on the control panel and compares them with the signals transmitted by the sensors. If these two types of signal have different values, the computer transmits its own signals to the lift control valve solenoids. This signal causes the lift arms to be raised or lowered until the values set on the control panel are equal to those received from the sensors.
When the tractor is working, these corrections are made continuously to ensure optimum work quality.
Safety:
The system is equipped with a safety device that prevents the electronic system from being active when the engine is stopped.
When the ignition is switched on, the computer is supplied with 12-volt power from the starter contactor. This lights up the three warning lights, **I**, **J** and **K**.
Lights **K** and **J** come on for 0.5 second.
Light **I** remains eliminated until the «engine running» signal is received from the alternator and the raising/lowering switch is set to position 1, then lowering position 2.
Warning: Set position monitoring by positioning knob B to 1.

(3) Position sensor
The position sensor is installed on the auxiliary spool valve support to the rear of the tractor. It is positioned in contact with a cam on the arm lift actuating shaft. The sensor registers the angular position of the lift actuating shaft and sends the data to the lift control computer.

(4) Draft sensors
These two sensors are fitted on the hitch links at their articulation with the lower support.
They convert the loads exerted on the hitch links during work operations into electrical signals.
Those signals are transmitted to the lift control computer.

(5) Electric harness linking the various components

(6) Electrohydraulic control valve
This is fitted on the auxiliary spool valve support to the rear of the tractor.
Its function is to regulate the oil flow so that the lift arms are raised or lowered in accordance with the signals transmitted by the computer and received by the two solenoids. The control valve is installed on the high-pressure (high-flow) hydraulic system.

(7) External control switches
These are located on the fenders or in the cab, according to the relevant specifications. They are designed to simplify the coupling of certain implements by allowing the operator to control the height of the implement.
The switches can be used if the control panel is activated and the raising/neutral/lowering switch is set to the neutral or lowering position.
For safety reasons, the lift controls in the cab are automatically switched off when the external control switches are used.
To return control of lifting operations to the control panel in the cab, switch **E** must be moved to the raising position.

Electronics - Lift control

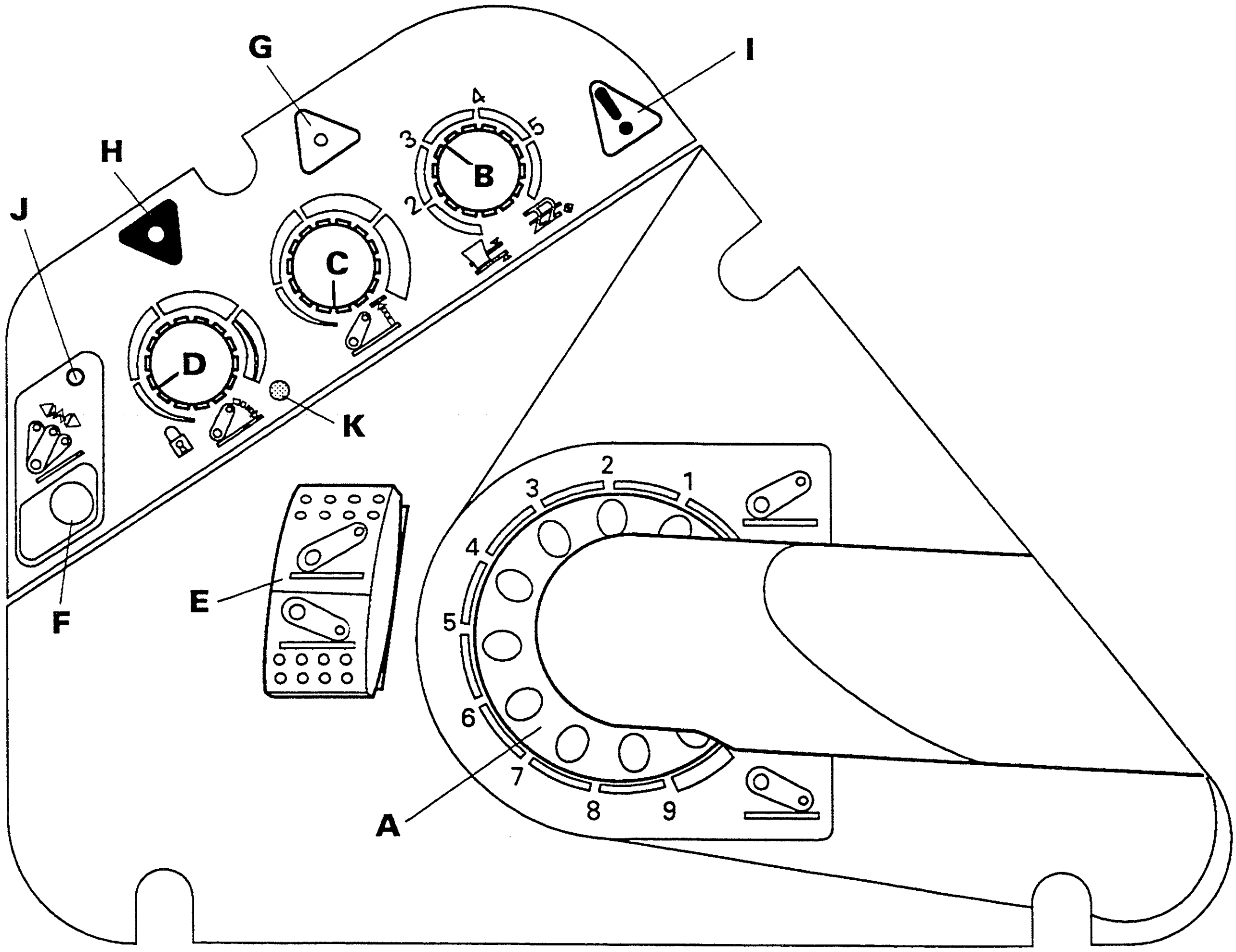


Fig. 2

B. Control panel

Designation of controls

A. Height/depth setting
B. Function selector (draft, mixing, position)
C. Maximum lift limiter (setting of high position)
D. Setting of manual or automatic lowering speed and locking position (padlock) or automatic control
E. Raising/neutral/lowering
   - Raising or transport: the high position is defined by adjusting knob C.
   - Neutral or stop: no movement of the lift arms is possible in this position.
   - Lowering or work position: the low position obtained is defined by the settings of selectors A and B.
F. Transport control selector push-button
G. Arm lifting warning light
H. Arm lowering warning light
I. Control panel locking warning light and self-diagnosis of operating failures
J. Transport control selector warning light
K. Lowering speed automatic control warning light

Electronics - *Lift control*

Description of controls

A. Height/depth setting potentiometer

This potentiometer **A** must be adjusted to set the depth (or height) of the instrument once the function selector **B** has been selected.
In position control mode, the potentiometer travel is maximum.
The maximum high position is slightly higher when it is obtained using external controls than when using the potentiometer **A**.
The floating position can be obtained by setting the potentiometer **A** to 9. In this case, the lowering warning light remains on.

B. Function selector potentiometer (draft/intermix/position)

This potentiometer must be set according to the work to be done:

- Position control: to be used for carried implements.
- Draft control: to be used for implements entering the soil (rarely used in 100% control).
- Intermix: to be used with implements entering the soil in order to control the maximum draft while maintaining even depth (position most commonly used for ploughing, subsoil work, etc.).

C. High position potentiometer

This potentiometer is used to set the maximum height of the lift arms.
When the switch, **E**, is in the raising position, the lift arms are raised until they reach the adjustment value selected by the high position potentiometer, **C**.

D. Lowering speed potentiometer

This potentiometer is used to adjust the implement lowering speed when lowering is selected on switch **E**.
The potentiometer operates in the following three modes:

- Locked position: when the potentiometer is in the maximum anticlockwise position, the lift control cannot be lowered (transport safety device).
- Automatic speed position: when the potentiometer is in the maximum clockwise position, the speed is automatically adjusted according to the weight of the implement (measured by the draft sensors in the high position) and the tractor speed (measured by the tractor speed sensor connected to the Autotronic system). When this automatic speed mode is selected, warning light **K** is illuminated.

E. Raising/neutral/lowering switch

This switch allows work in the following three modes:

- Raising or transport position: the implement is raised until the maximum position selected by potentiometer **C** is reached.
- Neutral position: the implement is locked in its current position. This setting must not be used during the work phase.
- Lowering or work position: the instrument is lowered until it reaches the position selected on the depth potentiometer **A** and the function selector potentiometer **B**.

Note: When restarting or after using the external controls, switch E must be set to the lifting position in order to activate the system.

F. Transport control selector push-button

This push-button must be pressed once in order to be activated when switch **E** is in the transport position. In this case, each time that switch **E** is set to the transport position, the electronic computer energises the lift valve solenoids in order to keep the implement stable whatever the tractor speed.
The system is automatically disengaged when switch **E** is in the work position.
Warning light **J** is illuminated when the system is active in the transport position.
To deactivate this function, the lift control must be set to the transport position and push-button **F** must be pressed twice.

G - H. Arm raising and lowering warning lights

The warning lights come on at exactly the same time that the solenoids are energised. They indicate that the system is operating correctly.
Their status changes continually when the lift control is used in draft control mode or in slip control mode.

I - J - K. Warning lights indicating corresponding functions

11 B02 Lift control electrical system

CONTENTS

A. Description

The electrical system is made up of the following components:

1. Start switch
2. Lift control panel lighting
3. Alternator
4. Battery
5. Autotronic unit
6. Radar
7. Tractor computer (Datatronic)
8. Engine speed sensor (Autotronic 2 speed output)
9. Forward speed sensor (Autotronic 2 speed output)
10. Lift control valve
11. Left-hand draft sensor
12. Right-hand draft sensor
13. Position sensor

14-15. External control buttons

16. Third set of external or internal controls for automatic hook
17. Lift control computer

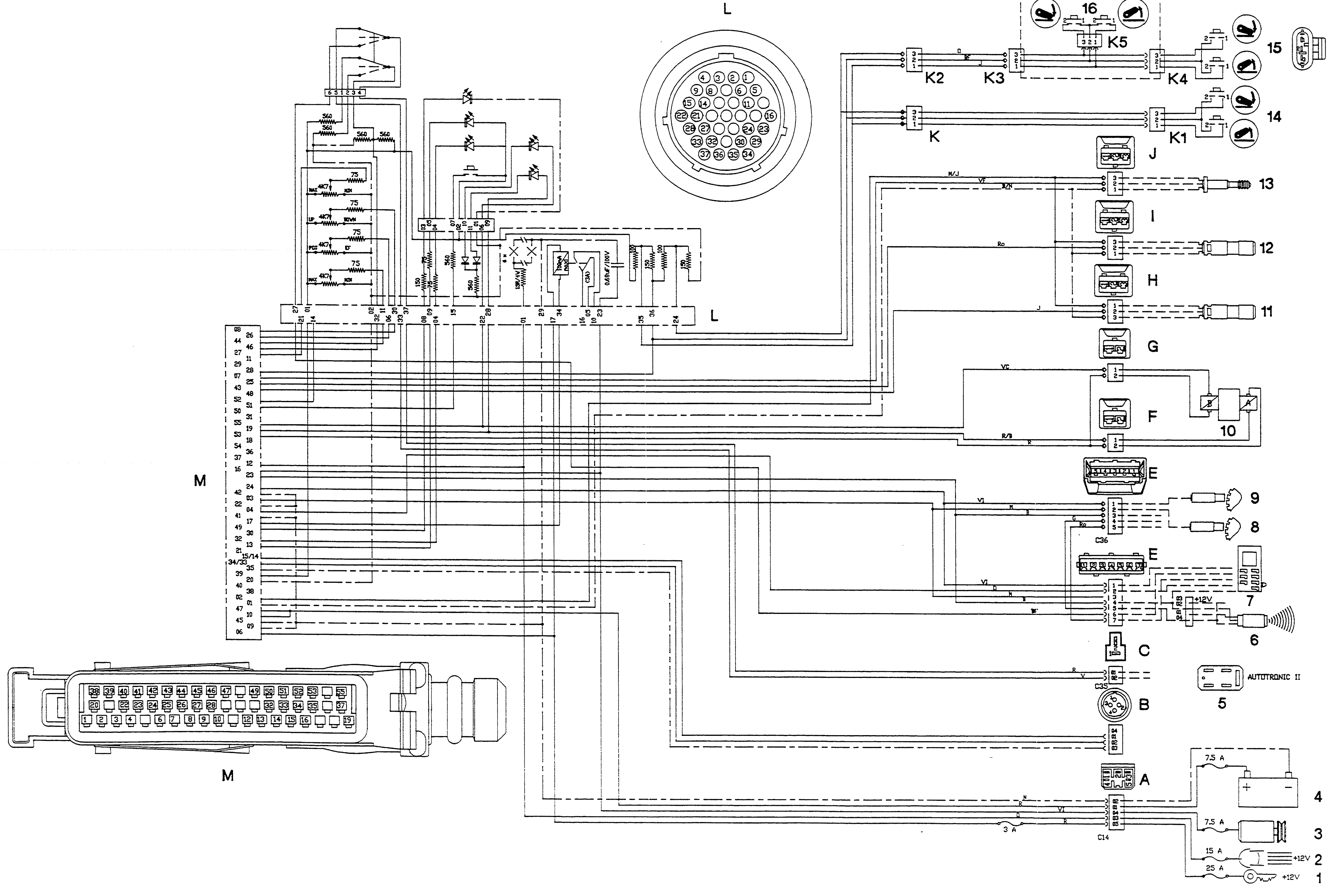
Identification of connections

Item	Colour	Ways	Description
A	White	5	General power supply - connector C14
B	Black	4	«CAN» network
C	White	2	«Autotronic» high position signal connector C35
D	Black	7	Datatronic speed signals
E	Black	5	Forward speed and engine speed signals - connector C36
F	Yellow	2	Lowering solenoid valve
G	Black	2	Raising solenoid valve
H	Grey	3	Left-hand draft sensor
I	Grey	3	Right-hand draft sensor
J	Black	3	Position sensor
K	Black	3	External controls
K1	Black	3	External controls
K2	Black	3	External controls
K3	Black	3	External controls
K4	Black	3	External controls
K5	Black	3	External controls
L	Round	37	Lift control panel connection
M	Black	55	Computer connection

Identification of terminals on lift control computer connector M

1. Earth for sensors
2. 9.5 V power supply for sensors
3. Engine speed signal
4. Slip control signal
5. Not used
6. +12 V after contact
7. Position sensor signal
8. Depth potentiometer signal
9. Battery earth
10. Battery +12 V
11. Not used
12. Lighting +12 V
13. Automatic lowering warning light
14. CAN H. (connected to 15)
15. CAN H.
16. Alternator engine running signal (D+)
17. Not used
18. Not used
19. Lowering solenoid
20. Lift control panel earth
21. Not used
22. Earth
23. Ground speed signal
24. Forward speed signal
25. Right-hand draft signal
26. Intermix
27. Lowering speed
28. External controls, raising/lowering
29. Not used
30. Not used
31. Not used
32. Transport control warning light
33. CAN L. (connected to 34)
34. CAN L.
35. «CAN» network earth
36. Not used
37. Not used
38. Not used
39. Control panel 9.5 V power supply
40. Not used
41. Earth
42. Earth
43. Left-hand draft signal
44. High position signal
45. Battery earth
46. Raising/neutral/lowering switch
47. Battery +12 V
48. Not used
49. Diagnostic warning light
50. Not used
51. Transport control switch
52. Not used
53. Power supply to solenoids
54. Not used
55. Raising solenoid

CONTENTS


L
16
K5
15
K2
K3
K4
14
K
K1
J
13
I
12
H
11
G
10
F
E
9
8
C36
E
7
6
C
C35
AUTOTRONIC II
5
B
A
4
3
2
1
C14
7.5 A
7.5 A
15 A
25 A
3 A
+12V
M
M

Electronics - *Lift control electrical system*

The lift control panel is equipped with a 37-way round connector and a printed circuit soldered onto the potentiometers and other components (resistors). Two connectors are located under the control panel: the raising/neutral/lowering switch harness and the warning lights harness.
The main output signals are signals from the potentiometers (depth, intermix, maximum height, lowering speed), the signal from the raising/neutral/lowering switch (via resistors: earth = lower, voltage = raise), the signal from the transport control button and the signal from the computer external controls.

External controls
Three sets of external controls can be fitted. They are connected to a set of resistors installed on the printed circuit. There is a single line to the computer for the raising and lowering signal.

The electronic lift control computer is equipped with a 55-way connector (see page 2).
Certain connections are not used in the standard application.
The computer is supplied with power by the battery. It is protected by a 7.5 A fuse located under the air filter, a 25 A fuse located in the fuse box and a 3 A fuse located under the lift control panel.
The computer is earthed by means of a wire on the gearbox selector cover.
To prevent the lift control system being active when the engine is running, a safety system is installed, managed by the computer (see Section 11B01, Part B).
The computer supplies the sensors (position and draft) and the lift control panel (potentiometers and switches) with 9.5-volt power.
It receives signals from:
- the position sensor,
- the draft sensors,
- the sensors for engine speed and theoretical forward speed via the Autotronic system (the forward speed being necessary for management of the lowering speed),
- the radar,
- the Datatronic system (slip control).

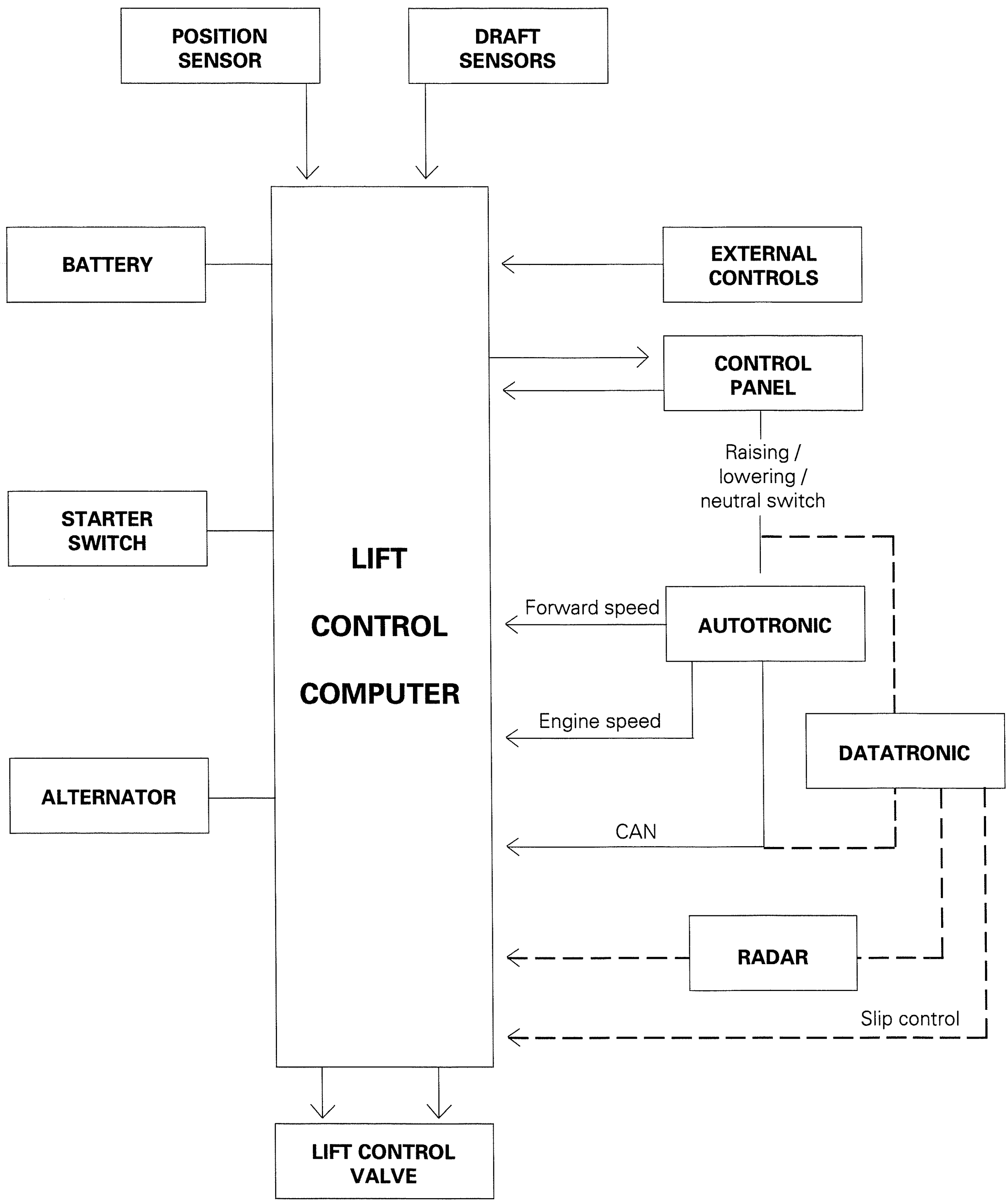
Note: The raising/neutral/lowering switch on the control panel is connected to the Autotronic unit and to the Datatronic unit (so that the Datatronic system can count the hours and area worked).

Terminals of lift control panel connector

No.	Description
1.	+12 volts - Lighting
2.	Earth for potentiometers and switches
3.	9.5-volt power supply
4.	Power supply to transport control warning light
5.	Not used
6.	Intermix potentiometer signal
7.	Not used
8.	Power supply to diagnostic warning light
9.	Power supply to automatic lowering speed warning light
10.	Not used
11.	High position potentiometer signal
12.	Not used
13.	Not used
14.	Not used
15.	Transport control selector push-button signal
16.	Not used
17.	Not used
18.	Not used
19.	Not used
20.	Not used
21.	Lowering speed potentiometer signal
22.	Power supply to raising indicator light
23.	Power supply + engine running
24.	Power supply to lowering external controls
25.	Not used
26.	Not used
27.	Work position signal for Datatronic (from raising/neutral/lowering switch)
28.	Power supply to lowering warning light
29.	Earth for warning lights, lamps and capacitor
30.	Depth potentiometer signal
31.	Not used
32.	Signal from raising/neutral/lowering switch
33.	Transport position signal for Autotronic (from raising/neutral/lowering switch)
34.	Not used
35.	Power supply to raising external controls
36.	Signal for external control
37.	+12 volts after contact for Autotronic signal

CONTENTS

Block Diagram of data received and supplied by lift control computer



11B03 Auto-diagnostic

COTENTS

Electronic lift control - Auto-diagnostic

A . Operation

The electronic lift control calculator is able to detect some faults on the harness or the components.
When a fault has been detected, the driver will be informed by the flashing of the warning light **I** on the ELC control panel.

The first number of the flashing sequence indicated the importance level of the failure (1 = important, 2 = average, 3 = minor)

Code	Fault	System reaction	Action
1 - 1	One solenoid unplugged	Supply of solenoids interrupted No movement permitted	Interrupt supply. Repair fault. Reconnect supply to reset.
1 - 2	Short on lift solenoid	Idem	Idem
1 - 3	Short on lowering solenoid	Idem	Idem
1 - 5	Problem on external controls	Idem	Idem
1 - 6	Supply : more than 18 V	Idem	Idem
1 - 7	Short on 9.5 V line	Idem	Idem
1 - 8	Problem on lift/Lowering switch	Idem	Idem
2 - 2	Problem on position sensor	Console locked. Non control active.	Repair fault. Reset by putting Lift/ Lowering switch on lift.
2 - 3	Problem on depth potentiometer	Idem	Idem
2 - 4	Problem on maxi height potentiometer	Idem	Idem
2 - 7	Supply : less than 10 V	Idem	Idem
3 - 1	Problem on R.h.s. draft sensor	System working but diagnostic light flashing.	Idem
3 - 2	Problem on L.h.s. draft sensor	Idem	Idem
3 - 4	Problem on drop speed potentiometer	System working but diagnostic light falshing. Automatic drop speed selected.	Idem
3 - 6	Problem on intermix potentiometer	System working but diagnostic light flashing.	Idem

11 B04 Checking with tester

CONTENTS

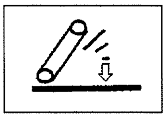
Electronics - Electronic lift control

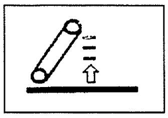
A. General

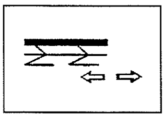
The tester is used to trace failures in the event of faulty operation of the lift linkage whether it is recognised by the diagnostic indicator light or not.
To carry out the test: START THE ENGINE.
The **monitoring** and **position sensor adjustment** functions are then accessible.

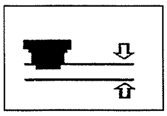
B . Symbols (icons)

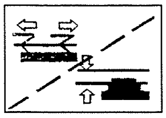
As in the case of the Autotronic unit, the ELC functions are identified by the following icons:

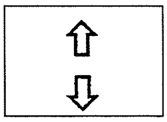

Lowering speed

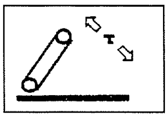

High position


Draft

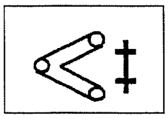

Position

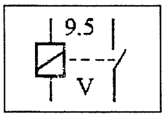

Intermix


Lifting Lowering

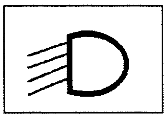

Damper

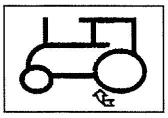

Fault

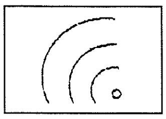

Depth



Relay


Lighting


Wheel slip


Radar

C . Connection (see 11 A01)

- Use connection No. 3 for tractors not equipped with Datatronic.
- Use connection No. 4 for tractors equipped with Datatronic.

D . Procedure

- Tracing a fault code

If more than one failure occurs at the same time, it may be difficult to visually decode the auto-diagnostic indicator light **I** on the console.
In these conditions, the «MONITORING» function can be used to identify the code or codes generated by the indicator light. The code is displayed in clear mode under the symbol corresponding to the auto-diagnostic indicator light.
Example:
Code 22 - Fault on position sensor


22

- Precise tracing of a fault

The code generated by the auto-diagnostic system has been translated and you want to carry out a precision check on a component, such as a potentiometer. The first monitoring screen allows you to view all the components of the console along with the corresponding values of the feedback signals.
The second screen is used to monitor all the analogue inputs: battery voltage, signals from effort and position sensors, state of the internal safety relay.
The third screen is dedicated to external controls and the fourth to frequency inputs, i.e.: engine speed, forward speed (radar), theoretical forward speed (sensor) and MAX wheel slip value.

- Adjusting the position sensor

If, during servicing, it is necessary to check the adjustment of the position sensor or to fit a replacement sensor, the tester proposes the following section: position sensor adjustment. When this function is called, the tester indicates whether the position sensor is correctly adjusted or not and, if it is incorrectly adjusted, it indicates whether the adjustment value is to be decreased or increased.
In all cases, the message «OK» is displayed on the screen as soon as the sensor is correctly adjusted.

This screen is used to select the circuit to be tested.

Use the cursor arrow keys to position the grey bar on ELECTRONIC LINKAGE.

Press OK.

AUTOTRONIC

DATATRONIC

ELECTRONIC LINKAGE

OK ▲ ▼

If the ignition is on but the engine is not running, the screen only appears if AUTO II is activated. Press the clutch pedal: the tester displays its operating software issue number and that of the lift control computer.

Press OK.

OPER. SOFT. ISSUES

TESTER	:	2.1
LINKAGE	:	1.0

OK ESC

E . Monitoring

The tester offers the following choice: Monitoring, Sensor adjustment.

Select «MONITORING».

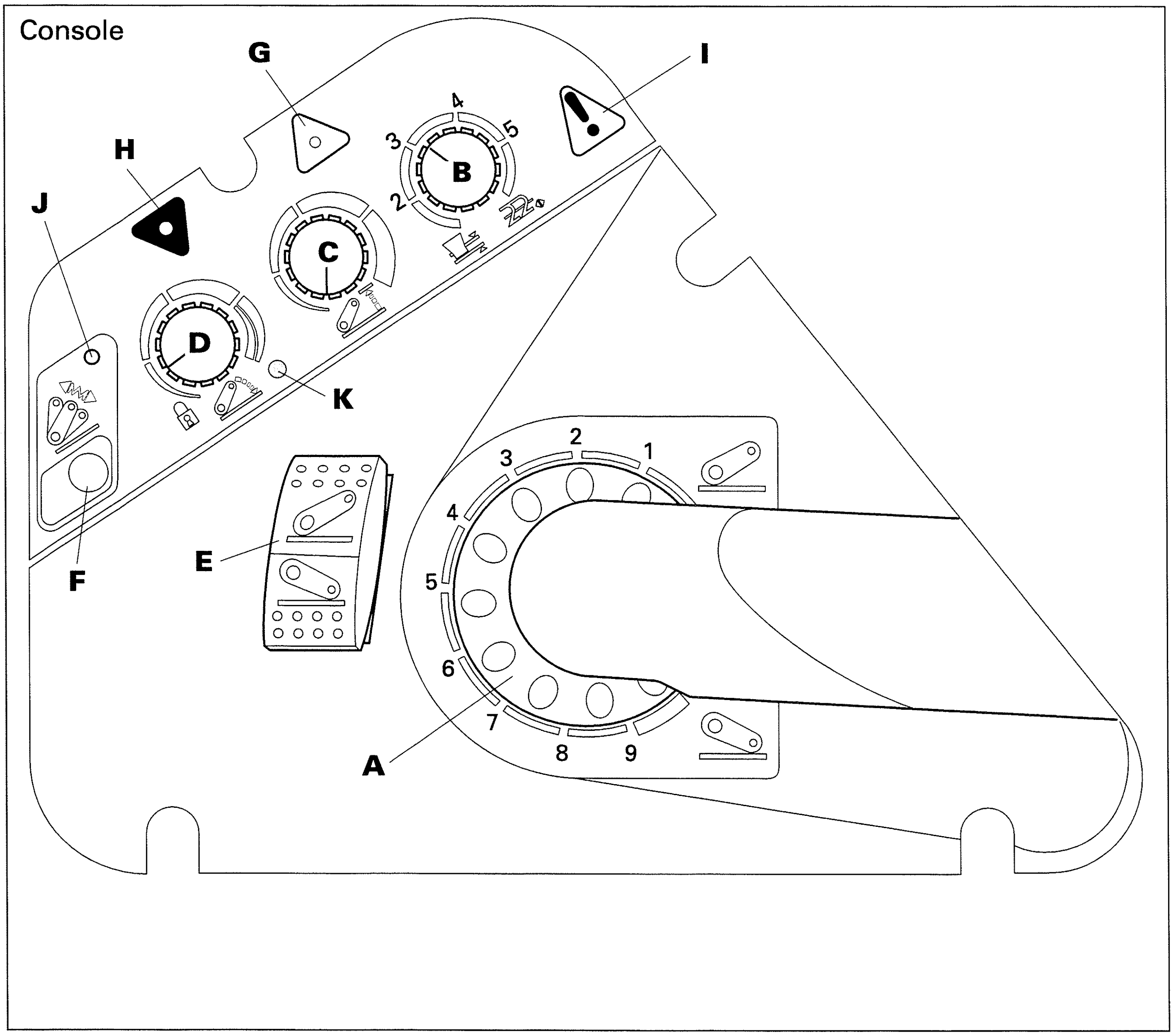
Press OK.

MONITORING

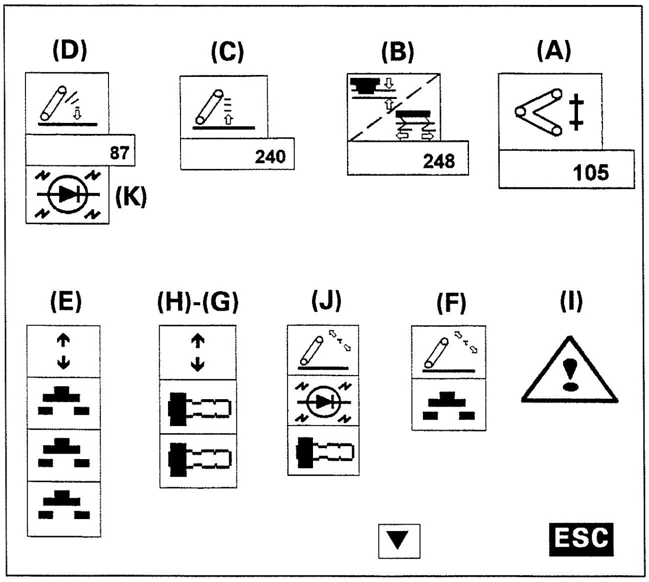
SENSOR ADJUSTMENT

OK ▲ ▼ ESC

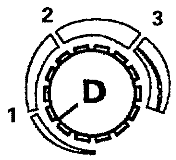
Electronics - Electronic lift control



- **(D)** Lowering speed potentiometer
- **(K)** Automatic lowering LED
- **(C)** High position potentiometer
- **(B)** Intermix potentiometer
- **(A)** Depth potentiometer
- **(E)** Lifting / Neutral / Lowering switch
- (**H** and **G**) Lifting and Lowering indicator lights
- **(J)** Transport impact damper indicator light
- **(F)** Impact damper control button
- **(I)** Auto-diagnostic indicator light

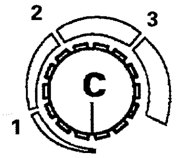


1 . Lowering speed potentiometer (D) (between 1 and 248, fault at 254) with an LED signalling the automatic earthing function (K).



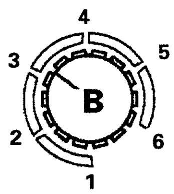
Graduation	Approximate value
1	50
2	130
3	200

2. High potentiometer (C) (between 79 and 240, fault at 255). The high position potentiometer cannot give a lower value than that on the position sensor. To test the whole range of values, set the lift control to the MAX. LOW position.



Graduation	Approximate value
1	119
2	169
3	216

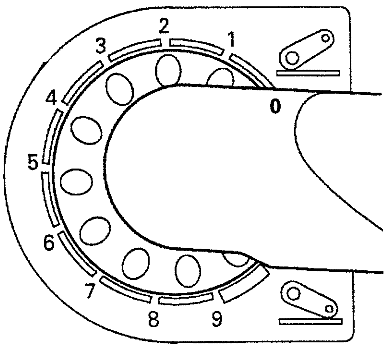
3 . Intermix potentiometer (B) (pure effort at 1, pure position at 248 and fault at 254).



Graduation	Approximate value
1	248
2	211
3	158
4	100
5	42
6	1

4 . Depth potentiometer (A) (between 11 and 249, fault at 255).

Graduation	Approximate value
0	249
1	226
2	202
3	178
4	156
5	130
6	104
7	80
8	55
9	29



5 . Lifting / neutral / lowering switch (E). The three contactors shown under the icon correspond to the three positions of the switch. According to the switch position, the icons change to reverse video (change of state) one after the other.

6 . Lifting / lowering solenoid valve. Start the engine and operate switch **E**. The solenoid valve indicator lights **H - G** on the tester change to reverse video (change of state) as soon as the lift control is activated either in lifting or lowering mode.

The corresponding indicator lights are illuminated on the console as soon as the switch is placed to the lifting or lowering position.

7 . Transport damper indicator light (J). This changes to reverse video on the screen when the damper button is pressed and the Lifting / Lowering switch is in the high position.

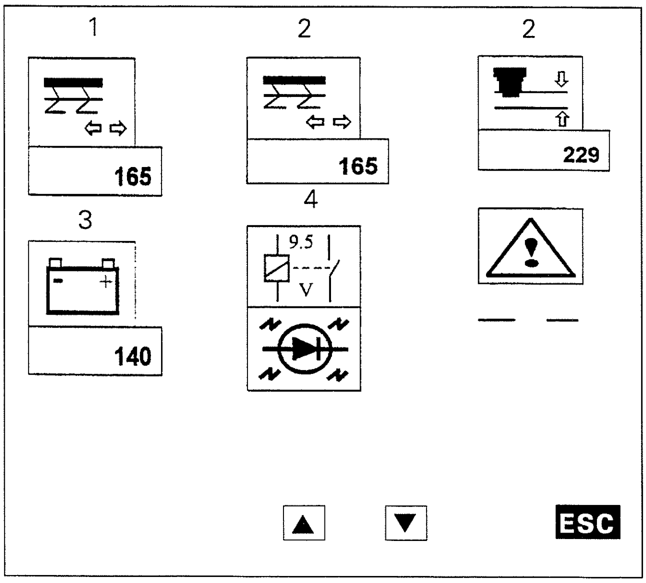
8 . Damper control button (F). This changes to reverse video when the button is pressed.

9 . AUTO DIAGNOSTIC indicator light (I). The fault code detected by the auto-diagnostic system is shown under this icon.

Electronics - Electronic lift control

Analog inputs

From the console elements monitoring screen, press ▼ to go to the «Analog inputs» screen.



1 . Value of right and **left draft sensor**
166 when sensor not fitted, fault 255.

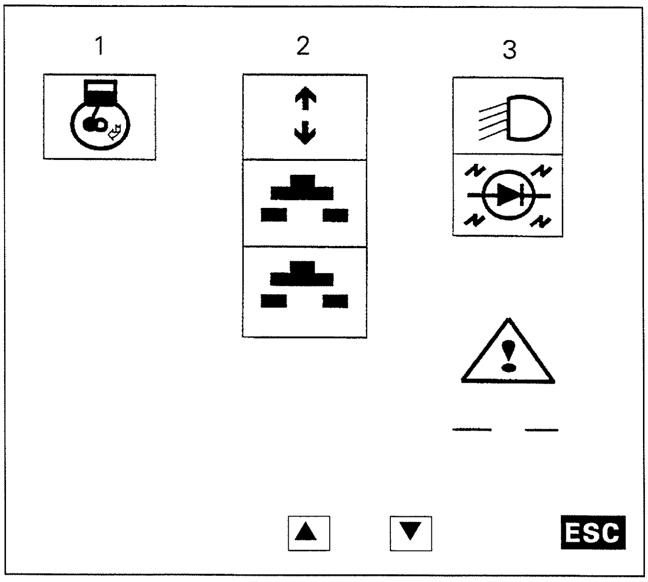
2 . Value of position sensor
235 in high position.

3 . Value of battery voltage
ERR displayed for abnormal voltage.

4 . State of internal safety relay
This controls the 9.5 V voltage for the analog inputs. If no 9.5 V is present (icon displayed in normal video mode), all the analog input values (sensors, potentiometers and states of control buttons) are cleared as they no longer have any significant meaning and the power stages (outputs to solenoid valves) can no longer be operated.

External controls

From the analog input monitoring screen, press ▼ to display the «External controls» screen.



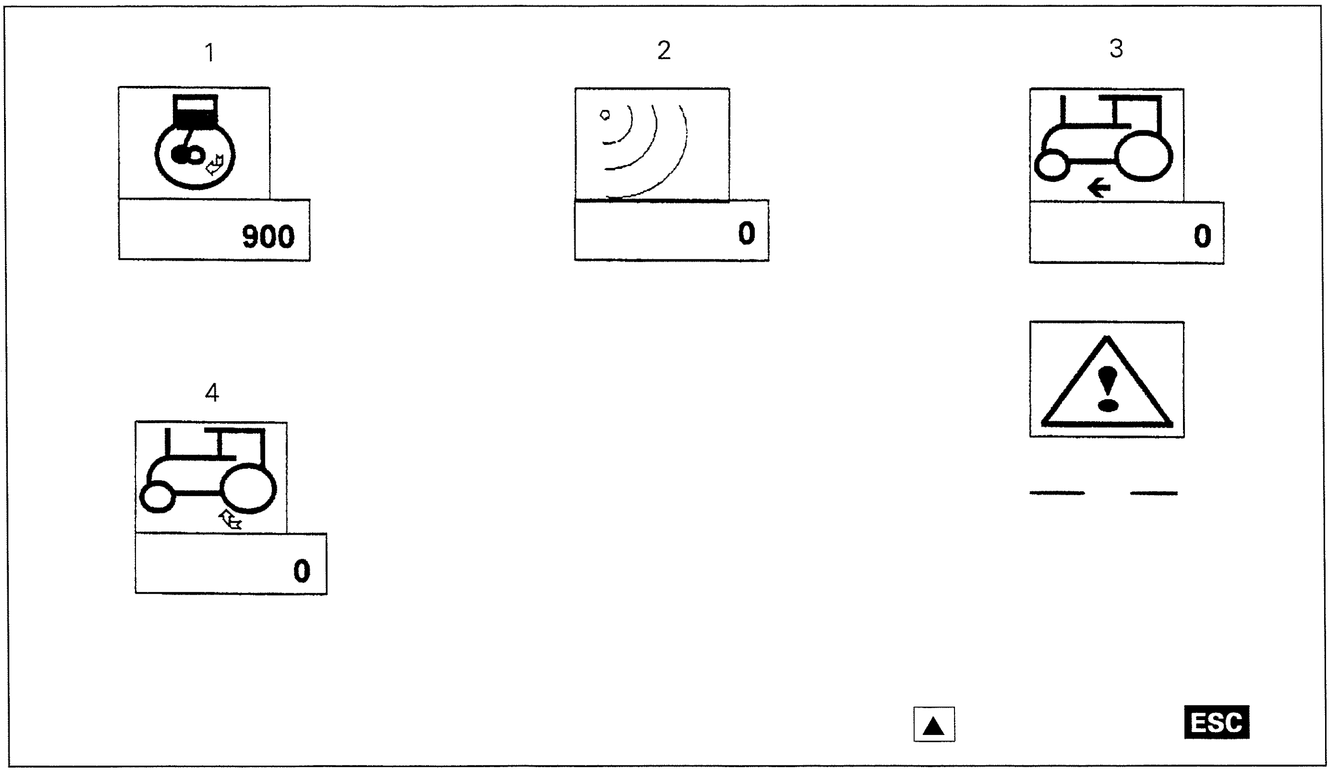
1 . Information + Engine running
Icon in reverse video if + engine running present.

2 . State of lifting and lowering external controls
The corresponding icon changes to reverse video when the button is pressed.

3 . Presence + Lighting
Changes to reverse video mode when the parking lights are on.

Frequency inputs

From the external controls monitoring screen, press ▼ to display the «Frequency inputs» screen.



1 . Engine speed (rpm)

2 . Actual forward speed (radar) (in km/h)

3 . Theoretical forward speed (sensor) (in km/h)

4 . Wheel slip control information
When Datatronic is installed, the tester displays the MAX WHEEL SLIP set point if the Datatronic is in active wheel slip control mode (otherwise the set point remains at zero).
If the frequency transmitted is abnormally low (connection problem or problem on Datatronic), the tester then displays a failure symbol next to the wheel slip icon.

A . To return to one of the previous screens, press ▲

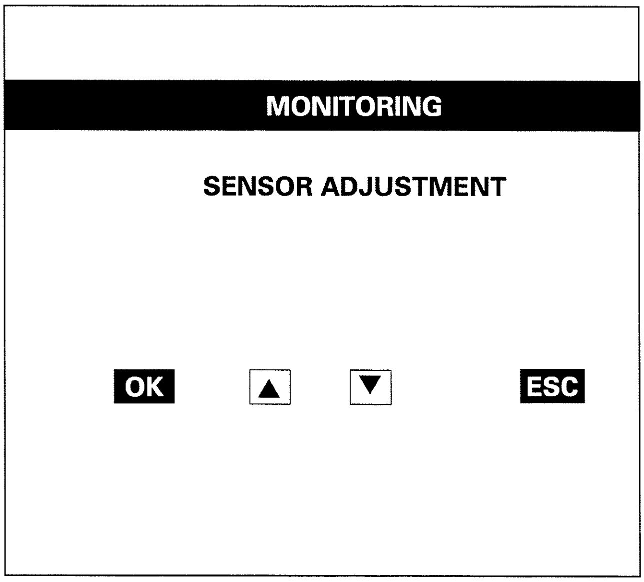
B . To quit «Monitoring» and return to the function selection screen, press ESC

F . Position sensor adjustment

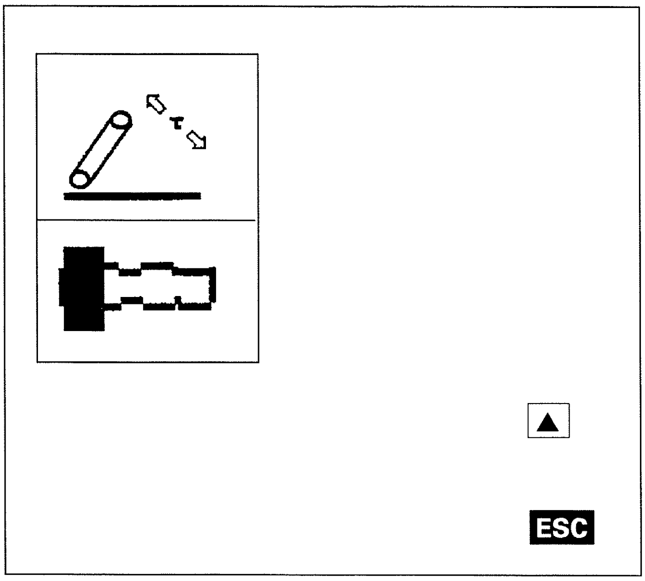
The tester offers the following choice: Monitoring, Sensor adjustment.

Select «Sensor adjustment».

Press OK.



This function was selected when the impact damper was engaged.
The icon is displayed to remind you that the position sensor cannot be adjusted when this function is engaged.
Press the damper button.
The icon should disappear.



Adjustment procedure

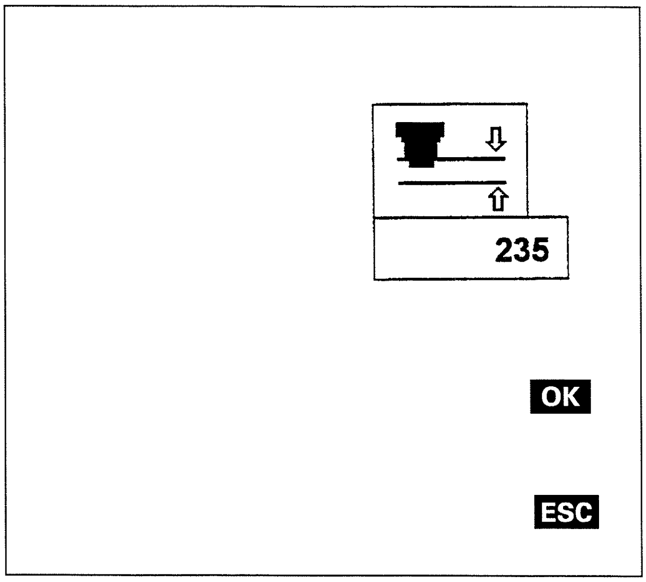
- Place the lift control in the high stop position with the external controls.
- Position the sensor in contact with the cam.
- Lower the lift linkage by 3 to 5 cm.
- Adjust the sensor in order to obtain a value of 235 + 1 on the screen.

If the value is incorrect, the tester indicates the direction it should be adjusted:

▲ Tighten

▼ Loosen

OK ADJUSTMENT IS CORRECT



11 C01 Description

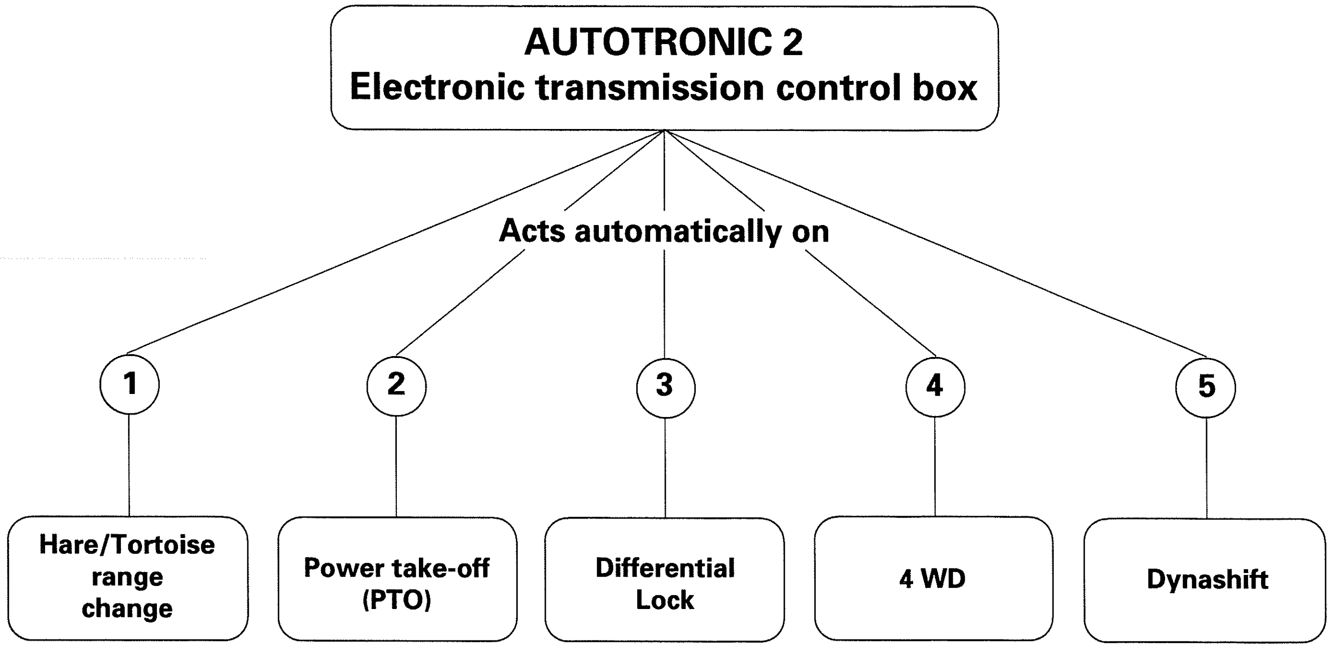
CONTENTS

Autotronic 2 - Description

A . Description

General

The following information and procedure apply to the **Autotronic 2** system featuring the new ETCU box 3618318M5 fitted on 8100 tractors.



Hydraulic protection of functions 1 - 2 - 3 - 4 - 5

If hydraulic pressure becomes too low (17 bar nominal). The red pressure warning light comes ON and the Autotronic system comes to an Alarm Mode.

In this mode :
1. The Hare/Tortoise shifting is prevented.
2. The PTO is disengaged automatically.
3. The Diff.lock is disengaged automatically.
4. The 4WD is engaged automatically.
5. The Dynashift shifts automatically to D range.

HARE/TORTOISE RANGE CHANGE

1

Tortoise/Hare or Hare/Tortoise change impossible

- If ground speed higher than :
  . 10 Kph : Tortoise to Hare
  . 5 Kph : Hare to Tortoise for the 8110 to 8140
  . 6 Kph : Hare to Tortoise for the 8150 and 8160
- If hydraulic pressure too low.

Hare range prevented

- If the Hare range is shifted with the creeper gear engaged, the Hare warning light illuminates to indicate the driver to shift the Tortoise range.

POWER TAKE-OFF

2

Controlled gradual engagement

- by supplying pulsed current to the solenoid until full engagement is achieved.

Disengaged if PTO clutch slips

- If pressure drops (17 bar nominal), or if clutch slips, oil supply to PTO clutch is cut-off (warning light flashes)

Does not re-engage when engine started

- If engine is stopped with PTO engaged, or if PTO is reengaged before starting the engine, Autotronic prevents PTO engagement when engine is started (warning light flashes).
- Dynashift tractor : For this function, it is necessary to stop the engine during a while to allow the hydraulic pressure in the accumulator to drop.

Does not engage if implement is blocked

- If implement is blocked engagement is cut-off before stalling (warning light flashes).

Autotronic 2 - *Description*

DIFFERENTIAL LOCK

3

Disengaged when brakes are applied

- Diff.lock is disengaged when either brake pedal is depressed.
- Re-engages when brake pedals are released.

Disengaged when 3-point linkage is raised

- Diff.lock is disengaged when lift-lower switch is moved to lift position.
- Re-engages when switch is returned to lower position (warning light goes out then comes back on).

4 WD engaged when diff.lock switch is operated

- Warning light comes on.

Disengaged if ground speed exceeds 14 Kph

- Does not re-engage when speed reduced to below 14 Kph (warning light goes out).

Disengaged if hydraulic pressure drops (17 bar nominal)

FOUR WHEEL DRIVE

4

Engaged when starting the tractor

- To disengage 4 WD after starting the engine, press and release brake pedal then push on 4 WD button (warning light goes out).

- 4 WD is still engaged until tractor starts moving (solenoid then energized).

Disengaged is speed exceeds 14 Kph

- If tractor speed is below 14 Kph and the 4 WD button is pressed once : 4 WD will be disengaged when ground speed exceeds 14 Kph, but will be reengaged as soon as ground speed drops below 14 kph.

- If tractor is being driven at more than 14 Kph and 4 WD has been disen-gaged, it can be re-engaged by pressing the 4 WD control button once.

Engaged whatever tractor speed is

- Button pressed for more than 2 s when ground speed is below 14 kph.
- When ground speed is over 14 Kph, press the 4 WD button once

Engaged when braking if speed higher than 5 Kph

- When braking Autotronic automatically engages 4 WD if ground speed is higher than 5 Kph (warning light does come on i this case).

Engaged when diff.lock is engaged

Engaged if hydraulic pressure drops

DYNASHIFT

5

Progressivity

- Automatic shifting of intermediate ranges when lever is moved directly from A to D.

Low hydraulic pressure

- Automatic shifting to D range in case of low hydraulic pressure.

Maximum engine speed

- No shifting down when engine speed is over 2400 rev/min (light flashing).

Engine speed drop

- No shifting up if the engine speed drops for more than 12 % between two ranges (light flashing).

30 Kph speed limit (for certains markets)

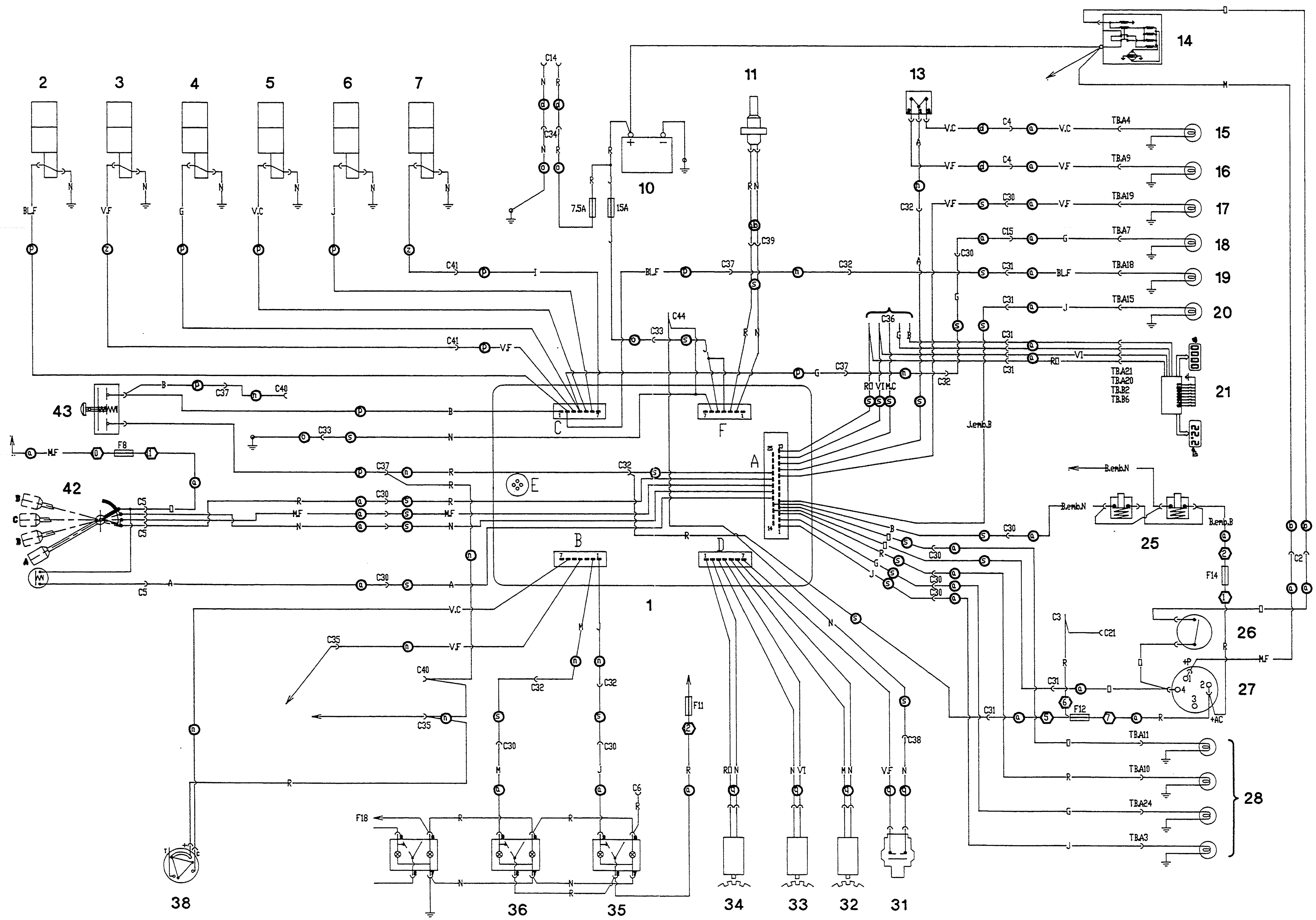
- Automatic shifting to C then B if forward speed is higher than 30 km/hr. D light then four lights flashing. To select D range again, move lever to C or B then back to D.

Low temperature

- No shifting while hydraulic oil temperature is below 0° C. The system is blocked in D range, A and D lights flashing. When the temperature is correct, the lights flash A B to C D. Put the lever on D to allow shifting.

B . Diagram

1 - Electronic Transmission Control unit
2 - Differential lock soneloid
3 - Dynashift soneloid EV2 (3x2)
4 - Hare/Tortoise solenoid
5 - Rear PTO soneloid
6 - 4WD soneloid
7 - Dynashift soneloid EV1 (4x2)
10 - Battery
11 - Temperature sensor
13 - PTO switch 500/1000 Rev/min
14 - Starter motor
15 - PTO warning light 540 Rev/min
16 - PTO warning light 1000 Rev/min
17 - Hydraulic pressure warning light
18 - Hare warning light
19 - Differential lock warning light
20 - 4WD warning light
21 - Digital display PTO and forward speed
25 - Brake switch
26 - Safety switch - clutch
27 - Ignition and starter switch
28 - Dynashift warning lights
31 - Hydraulic pressure switch (17 bar)
32 - Engine speed sensor
33 - Forward speed sensor
34 - Rear PTO sensor
35 - 4WD switch
36 - Differential lock switch
38 - Rear PTO switch
42 - Dynashift control lever
43 - Hare/Tortoise switch



11 C02 Checking without tester

CONTENTS

11C02.2 **Autotronic 2** - Checking without tester

A. Testing procedure

This procedure is for checking correct operation of the electronic transmission control unit Autotronic 2 as well as for solving very simple breakdown problems.

1 . Power supply

Engine stopped, ignition off, all warning lights OFF.
Declutch : The following warning lights should illuminate almost immediately :
- hydraulic pressure,

then
- A, B, C, D lights,

at the end
- hydraulic pressure,
- 4 WD,
- Hare/Tortoise,
- D range

Re-engage : The warning lights should extinguish after a few seconds.

This shows that :
- there is power supply to the Autotronic system,
- processor is operating,
- hydraulic pressure warning light, 4 WD light, Hare/ Tortoise, A, B, C, D range lights are correctly wired,
- clutch switch is correct.

Note : To confirm power supply is correct, check battery voltage and lines resistance.

2 . Hydraulic pressure switch / Engine speed sensor

a) Engine stopped, ignition off

Declutch
The warning lights illuminate as per test 1.
Start the engine, idling.
The red pressure warning light should extinguish after a few seconds.

This shows that :
- the engine speed sensor is wired and operates correctly.
- the hydraulic pressure switch circuit closes.

b) If 2a correct :

Stop the engine.
After a few seconds the red pressure warning light, the D range light, the 4 WD one, the Hare one if the Hare range is engaged should re-illuminate before all warning lights extinguish.

Note : It may be necessary to wait 4 or 5 minutes for the warning light to re-illuminate if a hydraulic accumulator is fitted (Dynashift or super-creeper fitment).

This shows that :
- the hydraulic pressure switch is wired and operates correctly (re-opening).

3 . Differential lock

Engine idling

4 WD light illuminated.
- Press differential lock button.
  Differential lock light illuminates.
- Press differential lock button again.
  Differential lock warning light extinguishes.
- Whilst moving along at 4 Kph, engage the differential lock. The 4 WD will engage as well.
- Make a tight turn. You should see the rear tires skid when the differential lock is engaged and feel a jerk as you engage and disengage.
- The differential lock disengage itself above 14 Kph.
- The differential lock disengage itself in braking.
- Raise and lower the lift. The differential lock warning light should illuminate and extinguish.

This shows that :
- supply to switches seems correct,
- differential lock button is correct,
- differentail lock warning light is correct.
- the solenoid is wired and operating.
- the differential lock is operating.

4 . Brake switch

Engine idling

4 WD light illuminated.
Press differential lock button again.
Differential lock light illuminates.
Unlatch brake pedals. Apply light pressure to each brake pedal in turn. The differential lock warning light should go out as soon as each pedal has left the return stop.

This shows that :
- the two brake switches are correct and well adjusted.
- the supply to the brake switches is correct.

5 . 4 WD

Engine idling

4 WD light illuminated.

- Press once the brake pedals.
- Press the 4 WD button.
  The 4 WD warning light should go out.
- Press differential lock button : 4 WD and diff. lock warning lights come on.
- Press both buttons, both lights should extinguish.
- Drive the tractor forward at approx 4 kph. Make a tight turn. Engage and disengage the 4 WD alternately several times. When 4 WD is engaged you should see the front wheels skid and feel a jerk as you engage and disengage.
- 4 WD disengaged : drive over 5 Kph.
  The 4 WD engaged itself in braking.
- Drive the tractor below 14 Kph. Press more the 2 seconds on the 4 WD button. The 4 WD will be engaged whatever the speed is.
- Drive the tractor below 14 Kph. Press the 4 WD button less than 2 second, the 4 WD will be engaged under 14 Kph and disengaged above 14 Kph.
- Drive the tractor above 14 Kph. Press less than 2 seconds on the button, the 4 WD will be engaged whatever the speed is.

This shows that :

the front axle solenoid is wired and operates.

- the front axle clutch is operating.
- 4 WD button correct.
- the 4 WD clutch is operating.
- the forward speed sensor and the ETCU is operating.

6 . Lift raising / lowering switch

Engine idling

- Lift switch in down position. Press the differential lock button. The differential lock and 4 WD warning lights come on.
- Then put it to up position ; the differential lock warning light should go out. Move the switch to down position, the differential lock warning light should re-illuminate (the 4 WD light stays on).

This shows that :

- the lift raising : lowering switch is working properly.

7 . Hare/Tortoise range change

Engine idling. Tractor stationary.

- Operate the Hare/Tortoise change using the lever. On each movement the Hare/Tortoise warning lights should illuminate alternately.
- Drive the tractor forward and change the range several times, checking that the forward speed changes. Also check that the range warning light corresponds to the range actually engaged.
- Check that :
  . above 10 Kph, it is not permitted to shift the Hare range from Tortoise.
  . above 5 Kph for the 8110 to 8140 and aboce 6 Kph for the 8150 and 8160, it is not permitted to shift the Tortoise from Hare range.

This shows that :

- the Hare/Tortoise is correctly wired.
- the range warning lights are correctly wired.
- the Hare/Tortoise solenoid is operating.
- the forward speed sensor is operating.

8 . P.T.O.

Engine idling

- Move the PTO switch to 1000 rev/min
  Engage the PTO 1000 rev/min
  The 1000 rev/min PTO light come on and the shaft start to rotate.
- Move the PTO switch to 540 (or 750) rev/min
  Engage the 540 (or 750) rev/min PTO
  The 540 (or 750) rev/min PTO warning light come on.
- If the engine is stopped with the PTO engaged, the PTO warning light is flashing in starting the engine and the PTO is off.

This shows that :

- the PTO switches are correctly wired.
- the PTO warning lights are correctly wired.
- the PTO solenoid is correctly wired.

Disengage the P.T.O.

Autotronic 2 - Checking without tester

9 . Checking the P.T.O. speed sensor

Engage the P.T.O. with engine idling.

- Disconnect the P.T.O. sensor (near the lifting rams). The P.T.O. should stop after 5/6 seconds and the P.T.O. warning light should begin to flash.
- Stop the engine, PTO sensor disconnected and start it again. The PTO is engaged but without progressivity.

10 . Checking the forward speed sensor

Start moving

- Above 10 Kph, it is not permitted to shift the Hare range from Tortoise.
- Above 5 Kph for the 8110 to 8140 and 6 Kph for the 8150 and 8160, it is not permitted to shift the Tortoise range from Hare.
- Differential lock engaged : the differential lock disengaged itself over 14 Kph.
- 4 WD engaged : 4 WD disengaged itself over 14 Kph.

The shows that :
- the forward speed sensor is operating.

Note :
These tests indicate that the sensors are present, electrically connected and operating. These tests do not prove that they have been correctly adjusted. The only way to ensure correct adjustment is by carrying it out again :
- screw down the sensor fully against the pinion teeth, without forcing it.
- slacken off the sensor by half to three quarter turn.
- lock the securing nut moderately - maximum 20 Nm.

11 . Dynashift

Engine idling - Tractor stationary - Temperature higher than 0° C.

- Move the Dynashift lever from A to D.
- Check that the 4 Dynashift lights are illuminating accordingly for each lever position.

Tractor moving

Select each Dynashift range one by one and check that the forward speed increases accordingly.

This shows that :
- the lever is correctly wired and its supply is correct.
- the warning lights are correctly wired.
- the temperature sensor is wired.
- the solenoids are correctly wired and the electronic box reacts correctly.

If only D range can be selected, check lever supply.

Temperature sensor

Test done at a temperature higher than 0° C.

Tests 11 correct : stop the engine.
- wait for the Autotronic to go back to sleep mode (all warning lights extinguished).
- disconnect the temperature sensor fitted on the gearbox selection cover.
- start the engine.
- the Dynashift A and D lights flash.

This shows that :
- there is no short on the temperature sensor lines.

Test done at a temperature below 0° C.

- If the temperature is below 0° C, the ETCU shift the Dynashift in D and the A and D lights are flashing together in starting the engine.
- When the temperature is above 0° C, the lights AB and CD are flashing two by two.
- Then move the lever in D to use the Dynashift.

B . Analysis of the possible defects

The aim of this section is to analyse the cause of a failure without tester.
VERY IMPORTANT : The first thing to do, is to check if that the power to the ETCU and that the hydraulic pressure are correct. In every case, you have to do the tests described in the items "Power supply" and "Hydraulic pressure".

The tests have to be done on the connectors of the harnesses.

After every step, you have to plug back the connector which has been used before going on in the tests.

Items	Igni-tion on	Engine run-ning	Checking method	Results	Notes
Power supply (1)	No	No	Disconnect the connector **F** (black)	Between **F4** and **F6**, U = 9 VDC mini Between **F5** and **F6**, U = 9 VDC mini	
			Plug on light of 55 W between	**F4** and the earth, light is on **F5** and the earth, light is on	If the light is not on, check the fuse 15A (battery)
	No	No	Disconnect the connector **A** (black)	**A22** and earth, U = 0 VDC	
	Yes	No		**A22** and earth, U = 12 VDC	
Hydraulic pressure (2)	No No	No Yes	Disconnect the connector **A** (brown)	**D7** and earth, R = ∞ **D7** and earth, R = 0 Ω	
Differential Lock (3) • Light	No	No	Disconnect the connector **C** (green)	**C2** and + battery, diff.lock light on	
• Switch	Yes	No	Disconnect the connector **B** (grey)	**B2** and earth, U = 0 V, swith off **B2** and earth, U = 12 V, switch on	Check the fuse **F11**, if the values are incorrect
• Solenoid	Yes	Yes	Disconnect the solenoid and measure voltage between its two connector lines	U = 0 V, diff.lock switch off U = 12 V, diff.lock switch on	
Brake switches (4)	Yes	Non	Uncouple the two pedals. Disconnect the connector **A** (black)	**A17** and earth, U = 0 V, brake pedal(s) released **A17** and earth, U = 12 V, brake pedal(s) depressed	If the values are incorrect, check the fuse **F14**

Autotronic - Checking without tester

Items	Ignition on	Engine running	Checking method	Results	Notes
4 WD (5)					
• Light	No	No	Disconnect the connector **A** (black)	**A5** and + battery, 4 WD light is on	
• Switch	Yes	No	Disconnect the connector **C** (grey)	**B1** and earth, U = 12 V, switch on **B1** and earth, U = 0 V, switch off	
• Solenoid	Yes	Yes	Disconnect the solenoid. Connect a light of 55 W to its connector. Press on the brake pedal(s) and then drive the tractor.	Tractor stopped = 4 WD : the light is off Tractor moving = 2 WD : the light is on	
Lift switch (6)	No	No	Disconnect the connector **B** (grey)	**B4** and earth, U = 12 V, switch on transport position **B4** and earth, U = 0 V, switch on work position	
Hare/ Tortoise (7)					
• Light	No	No	Disconnect the connector **C** (green)	**C4** and + battery, the Hare light is on	
• Switch	Yes	No	Disconnect the connector **C** (green)	**C1** and earth, U = 12 V, lever in its position to change the range **C1** and earth, U = 0 V, lever released	If the values are incorrect, check the fuse **F11**
• Solenoid	Yes	Yes	Disconnect the solenoid and measure between its two connector lines	Hare, U = 12 V, Hare light on Tortoise, U = 0 V, Hare light off	
PTO light (8)					
• Light	No	No	Disconnect the connector **A** (black)	**A10** and + battery : 540 PTO light is on if the PTO switch is on 540 rev/min **A10** and + battery : 1000 PTO light is on if the PTO switch is on 1000 rev/min	
• Switch	Yes	No	Disconnect the connector **B** (grey)	**B6** and earth, U = 0 V, PTO released **B6** and earth, U = 12 V, PTO engaged	If the values are incorrect, check the fuse **F12**
• Solenoid	Yes	Yes	Disconnect the solenoid and measure voltage between its two connector lines	U = 0 V, PTO disengaged U = 12 V, PTO engaged	

Autotronic - *Checking without tester*

<table>
<tr><th>Items</th><th>Igni-tion on</th><th>Engine run-ning</th><th>Checking method</th><th>Results</th><th>Notes</th></tr>
<tr><td>Speed sensor (9)
• PTO speed sensor</td><td>No</td><td>No</td><td>Disconnect the connector D (brown)</td><td>Between D1 and D2, R = 450 Ω</td><td></td></tr>
<tr><td>• Forward speed sensor</td><td>No</td><td>No</td><td>Disconnect the connector D (brown)</td><td>Between D3 and D4, R = 450 Ω</td><td></td></tr>
<tr><td>• Engine speed sensor</td><td>No</td><td>No</td><td>Disconnect the connector D (brown)</td><td>Between D5 and D6, R = 450 Ω</td><td></td></tr>
<tr><td>Dynashift (10)
• Light</td><td>No</td><td>No</td><td>Disconnect the connector A (black)</td><td>A1 and + battery : A light is on
A2 and + battery : B light is on
A3 and + battery : C light is on
A4 and + battery : D light is on</td><td></td></tr>
<tr><td>• Lever</td><td>Yes</td><td>No</td><td>Disconnect the connector A (black)
Change the position of the lever for each range and check the voltage between A19, A20, A21 and earth</td><td><table><tr><th></th><th>A19</th><th>A20</th><th>A21</th></tr><tr><td>A</td><td>0 V</td><td>0 V</td><td>0 V</td></tr><tr><td>B</td><td>12 V</td><td>0 V</td><td>0 V</td></tr><tr><td>C</td><td>12 V</td><td>12 V</td><td>0 V</td></tr><tr><td>D</td><td>12 V</td><td>12 V</td><td>12 V</td></tr></table></td><td>If the voltage is 0 V in all positions, check the power supply of the lever (fuse F8 and orange line)</td></tr>
<tr><td>• Solenoid</td><td>Yes</td><td>Yes</td><td>Disconnect the solenoids EV1 and EV2 and measure the voltage between its two connector lines</td><td><table><tr><th></th><th>EV1</th><th>EV2</th></tr><tr><td>A</td><td>12 V</td><td>0 V</td></tr><tr><td>B</td><td>12 V</td><td>12 V</td></tr><tr><td>C</td><td>0 V</td><td>12 V</td></tr><tr><td>D</td><td>0 V</td><td>0 V</td></tr></table></td><td>EV1 : vertical solenoid (ivory line)
EV2 : horizontal solenoid (green line)</td></tr>
<tr><td>• Tempera-ture sensor</td><td>No</td><td>No</td><td>Disconnect the connector F (black)</td><td>Between F2 and F3
- R < 10 k Ω if temperature > 0° C
- R > 10 k Ω if temperature < 0° C</td><td></td></tr>
</table>

CONTENTS

11C03 Checking with tester

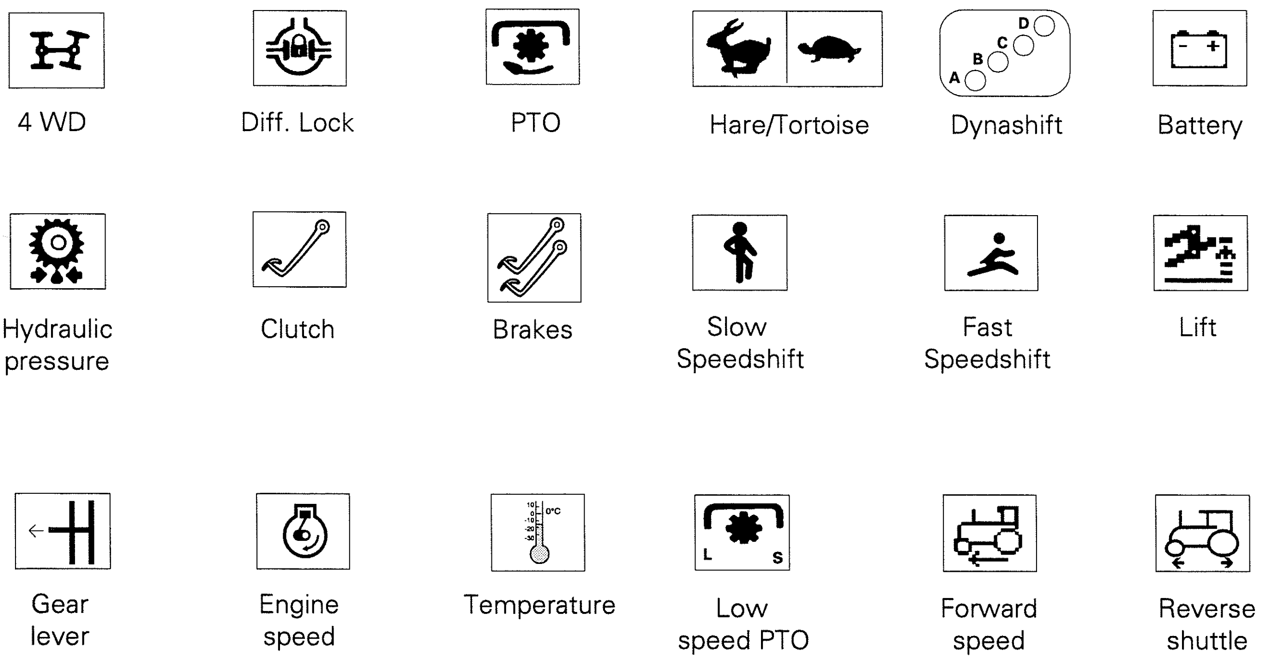
CONTENTS

Autotronic 2 - *Checking with tester*

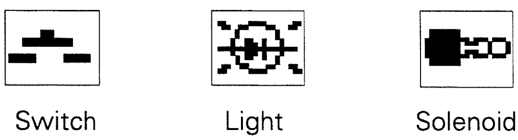
A. Symbols (Icons)

Each function and the various components of the Autotronic 2 system are identified by symbols, as follows:

Functions



Components



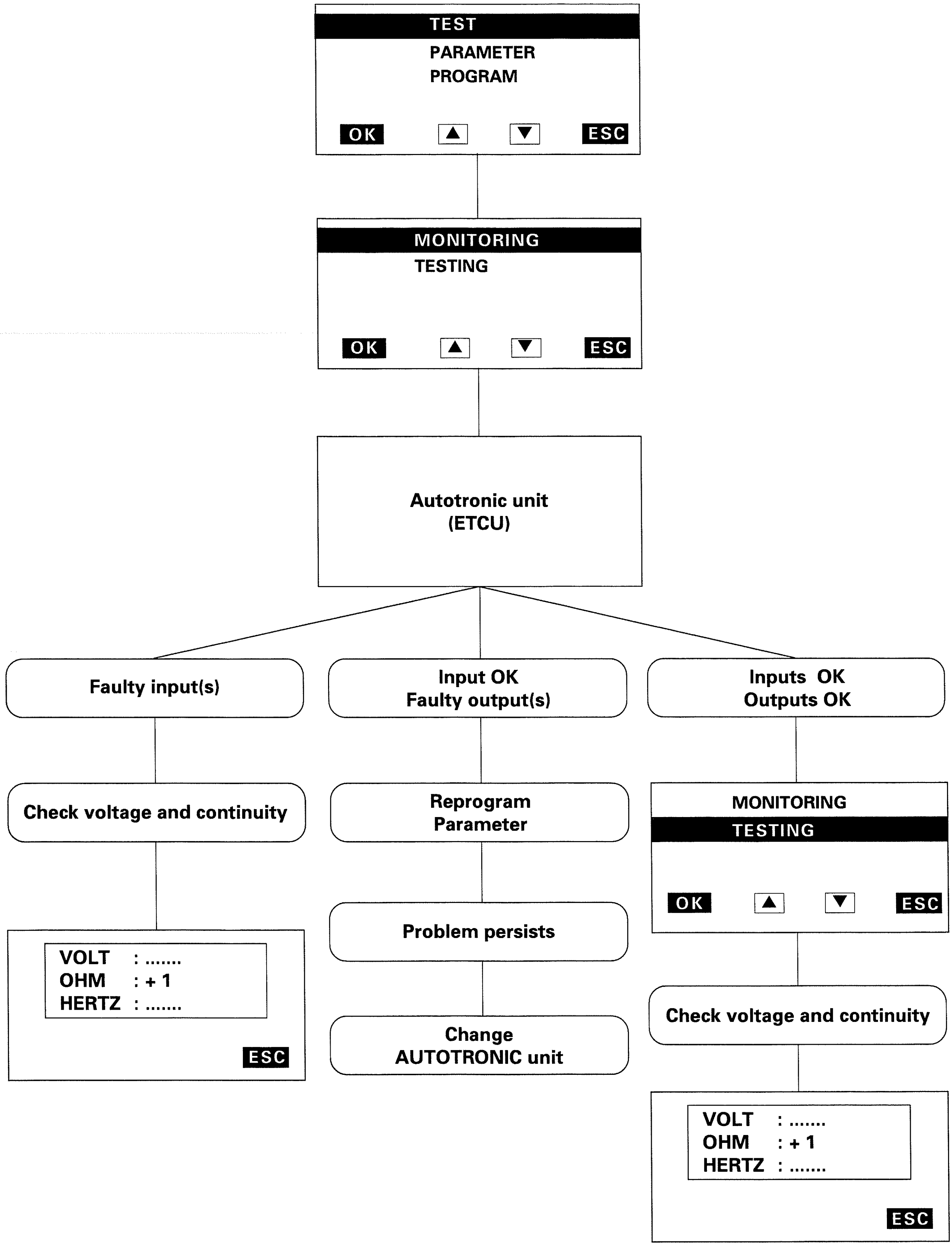
B. Connecting the tester

Carry out connection 1, 2 or 4. See section 11 A01.3.

C. Operating procedure in case of failure

In case of failure, use the following procedure.

Autotronic 2 - Checking with tester



Autotronic 2 - Checking with tester

D . Using the «Test» function

The main «test» function should be used for trouble-shooting. It is made up of two secondary functions:
- monitoring,
- testing.

Monitoring

1. Access conditions
- With the engine running and the hydraulic pressure light out, operate all the Autotronic functions one by one.
- Drive the tractor to check the safety systems concerning forward speed.

2. Principle
Each screen display shows the status of the input and output signals read or transmitted by the TCU.
The symbol for a switch is black when contact is closed.
The symbol for an indicator light or solenoid is black when that component is supplied with 12 V by the TCU.
Sensors for engine speed, forward speed and PTO speed indicate the values measured by the TCU:
- engine speed in rpm,
- forward speed in 0.1 kph,
- PTO speed in rpm (behind the clutch, not the speed of the implement).

Apart from power supply problems, there are three types of operating fault, as follows:

1. Faulty input: The TCU does not receive the input signal and, therefore, the outputs remain unchanged.

2. Faulty output: The TCU transmits a correct output signal but the corresponding component of the tractor (indicator light or solenoid) does not react. Carry out testing on the outputs.

3. Faulty TCU: The TCU reads the right inputs but does not supply power to the right outputs.
It is also possible that an internal connection may be broken (resulting in correct output on the tester but absence of current on the TCU output terminal).

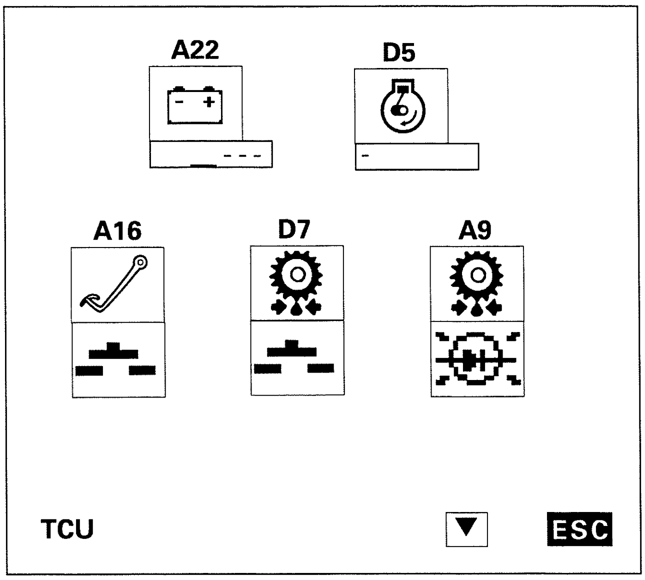
Testing

See paragraph F, page 24.

CONTENTS

E . "Monitoring" function

This function monitors Autotronic's internal working.
Use the keyboard to access to the monitoring function.
The tester screen shows the symbols (icons) corresponding to the various components whose functions are being tested, and these change colour whenever an input or output is activated.



Meaning of symbols
Example : A16
A = connector A on ETCU
16 = pin 16

Power supply and warning lights

Symbol	Description
A22	Supply voltage
D5	Engine speed
A16	Clutch switch
D7	Hydraulic pressure switch
A9	Hydraulic pressure light

This initial screen shows all the input signals required for the ETCU to switch to «WORK» mode. If these signals are incorrect, there is no point in continuing the test procedure.

INSTRUCTION	ON TESTER	ON TRACTOR
Start up engine and keep clutch pedal pressed down	Clutch switch **A16 on** Pressure switch **D7 on** Engine speed sensor **operating** Pressure light **A9 off** Mode TCU 4	4WD light **on** Pressure light **off** Hare light **on** and speed range solenoid **powered**
Release clutch pedal	Clutch switch **A16 off** Pressure switch **D7 on** Engine speed sensor **operating** Pressure light **A9 off** Mode TCU 4	4WD light **on** Pressure light **off** Hare light **on** and speed range solenoid **operating**

Autotronic 2 - Checking with tester

In case of operating fault "ON TESTER", see below.
In case of operating fault "ON TRACTOR", see Testing.

Operating faults

1. **Battery:** The tester does not check the Autotronic power supply. This operation must be carried out separately before connecting the tester. The screen shows the voltage supplied from the alternator (ignition switched on) and read by the ETCU on terminal **A22** of the harness.

2. **Clutch switch :** Measure the resistance between terminal **A16** of the tractor harness and the earth terminal :
   Correct value R = 0 to 1.5 Ω : pedal pressed down, switch closed
   Operating fault
   If R = infinity : pedal released, switch open. Check line continuity and connection on the starter motor.

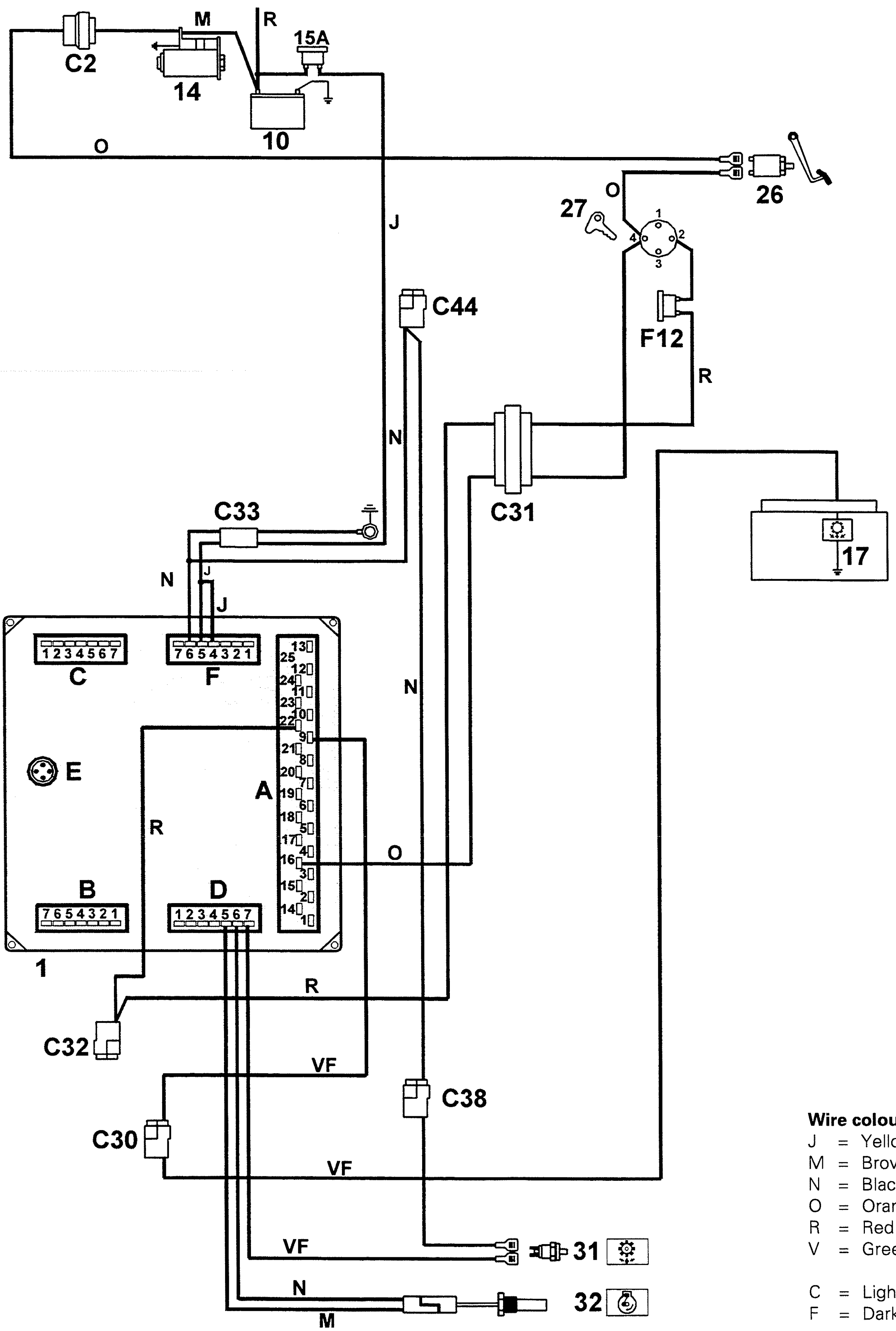
3. **Low hydraulic pressure switch :** Measure the resistance between terminal **D7** of the tractor harness and the earth terminal:
   Correct value R = 0 Ω : switch is closed (engine running, pressure OK)
   Operating fault
   If R = infinity : switch is open (engine stopped, accumulator discharged, no pressure)
   Check switch directly. Check resistance of green wire and earth connection (black wire).

4. **Engine speed sensor signal :** Measure the resistance between **D5** and **D6** of the tractor harness :
   Correct value R = 450 Ω ± 10 Ω
   If R = correct, adjust the sensor and use the frequency measurement to check that the sensor is working. See 9I01.14 (6100) and 9F01.9 or 9R01.6 (8100).
   If R = 0 or infinity, check the continuity of lines **D5** and **D6**.

5. **TCU mode :** The TCU switches from mode TCU 4 to TCU 6 and then 7 if there is a problem with engine speed, and from mode TCU 5 to 2 if there is a switch problem.

TCU 1	:	problem with software
TCU 5 - 2	:	low pressure problem, see switch, earth wire
TCU 6 - 7	:	engine signal problem, see engine speed sensor, adjustment, wires
TCU 9 or 10	:	incorrect parameters or no parameters
TCU 11	:	battery voltage too high
TCU 12	:	TCU is in testing mode. Engine signal is required to exit from this mode.

Autotronic 2 - Checking with tester



Wire colour

J = Yellow
M = Brown
N = Black
O = Orange
R = Red
V = Green

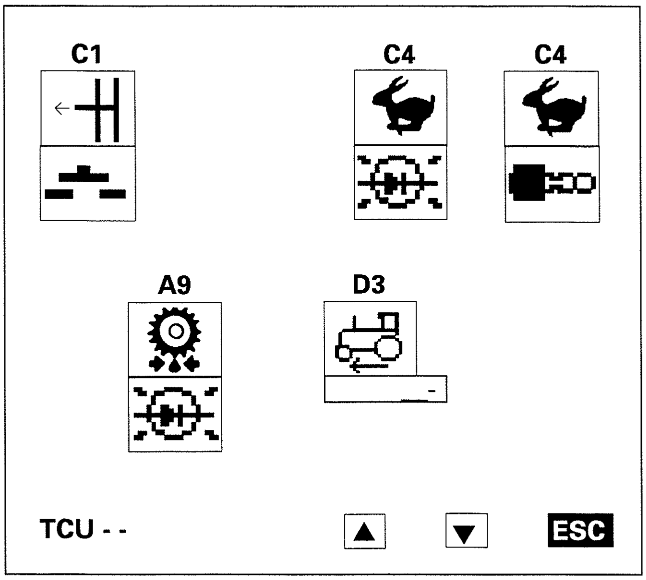
C = Light
F = Dark

CONTENTS

Autotronic 2 - Checking with tester

Hare/Tortoise range

Symbol	Description
C1	Switch
C4	Solenoid - Light
A9	Hydraulic pressure light
D3	Forward speed



INSTRUCTION	ON TESTER	ON TRACTOR
Select range change by moving the lever Check that the range changes after each action on the lever	Speed in kph = 0 Range switch **C1 on** while holding lever in position **Hare** Hare light **C4 on** Range solenoid **C4 on** **Tortoise** Hare light **C4 off** Range solenoid **C4 off** Pressure light **A9 off**	**Hare** Hare light **on** Range solenoid **powered** **Tortoise** Hare light **on** Range solenoid **non powered**
Drive the tractor at more than 10 kph Select a range change Check that the range remains unchanged	Speed = + 10 kph The range switch **C1 comes on** but the range does not change	No change

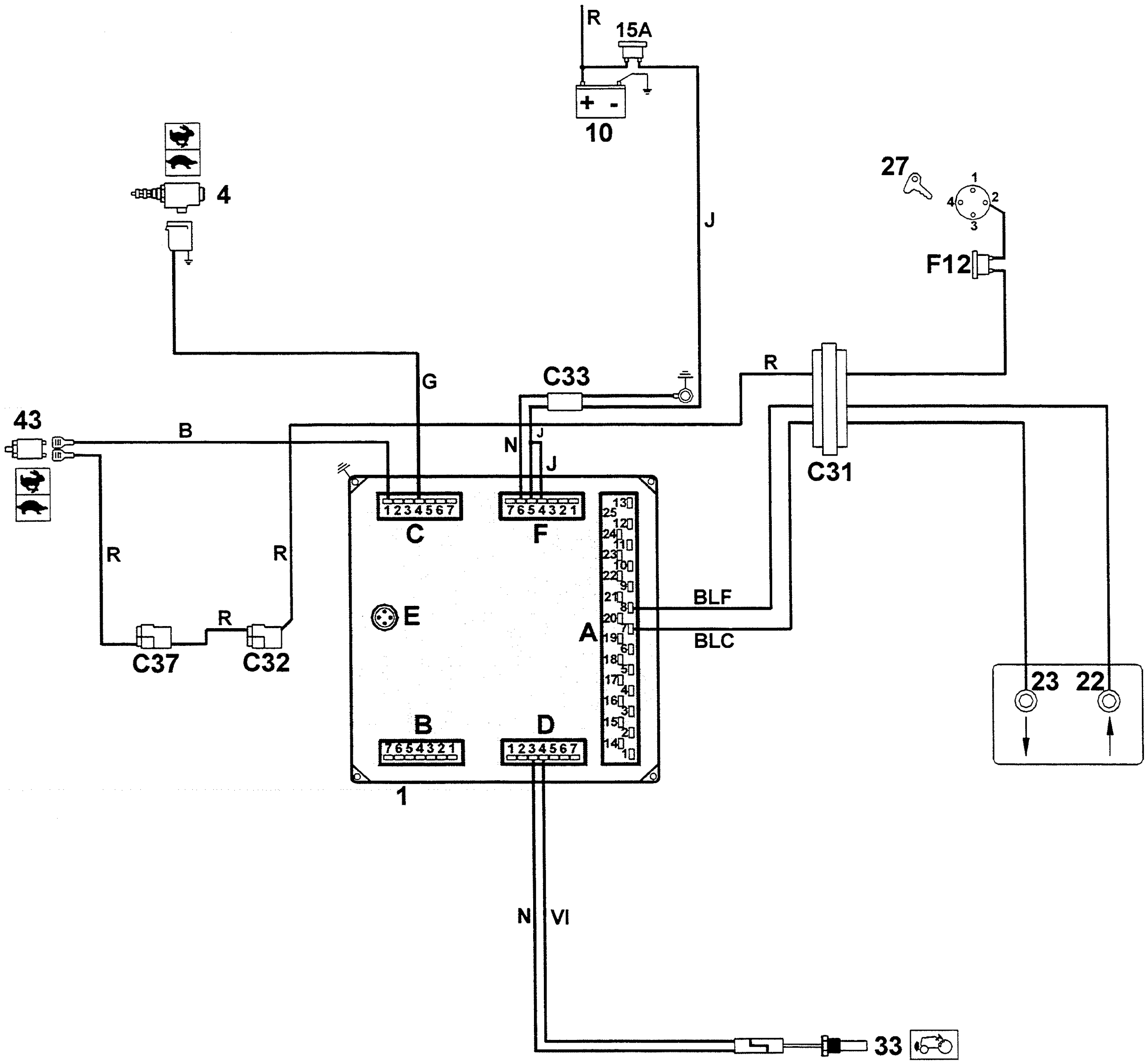
Operating faults

1. Range switch : Check the voltage on terminal **C1** of the tractor harness
V = 12 volts when the switch is closed (pressed)
V = 0 volt when the switch is open (released)
If not, check the switch power supply (fuse, etc.), the switch and line continuity.

2. Forward speed signal : Using an ohmmeter, measure the resistance between **D3** and **D4** of the tractor harness:
Correct value R = 450 Ω. If R = correct ensure that the sensor is operating by measuring the frequency and checking its setting, see § 6B01.9 (6100) or 6E01.7 (8100).
If R = 0 or infinity, check the continuity of lines **D3** and **D4**.

3. Range lights and solenoid : Perform testing.

Autotronic 2 - Checking with tester



Wire colour
B = White
BL = Blue
G = Grey
J = Yellow
N = Black
R = Red
VI = Violet

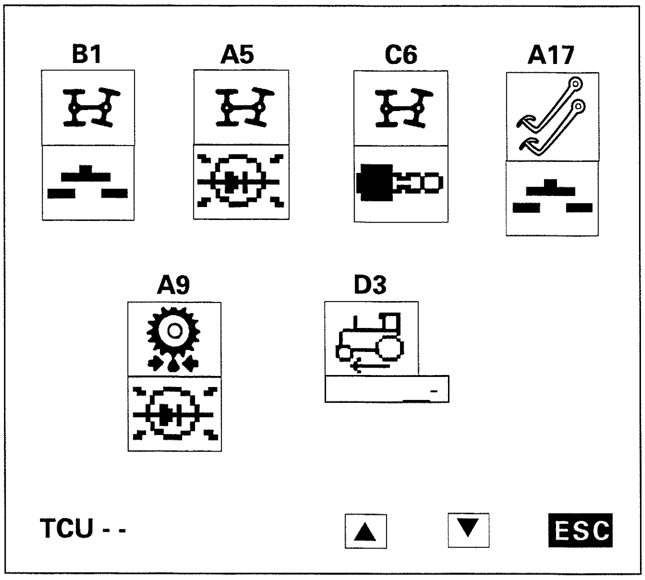
C = Light
F = Dark

11C03.10

Autotronic 2 - Checking with tester

4WD

Symbol	Description
B1	4WD switch
A5	4WD warning light
C6	Solenoid
A17	Brake switches
A9	Hydraulic pressure light
D3	Forward speed



INSTRUCTION	ON TESTER	ON TRACTOR
Press the 4 WD button on instrument panel, press the brake pedals in turn	Brake switch **A17 on** while pressing pedals V = 0 kph Pressure light **A9 off**	4WD light **stays on** 4WD solenoid **not power-supplied** Pressure light **off**
Press the 4WD button once.	4WD switch **B1 on** while pressing button 4WD light **A5 goes out** V = 0 kph Pressure light **A9 off**	4WD light **goes out** 4WD solenoid **not power-supplied** Pressure light **off**
Drive the tractor and check that the 4WD transmission is disengaged	A signal **is transmitted** by the forward speed sensor The 4WD solenoid **C6 comes on** V = more than 0 kph	4WD light **stays out** 4WD solenoid is **power-supplied** (front axle disengaged)

Operating faults

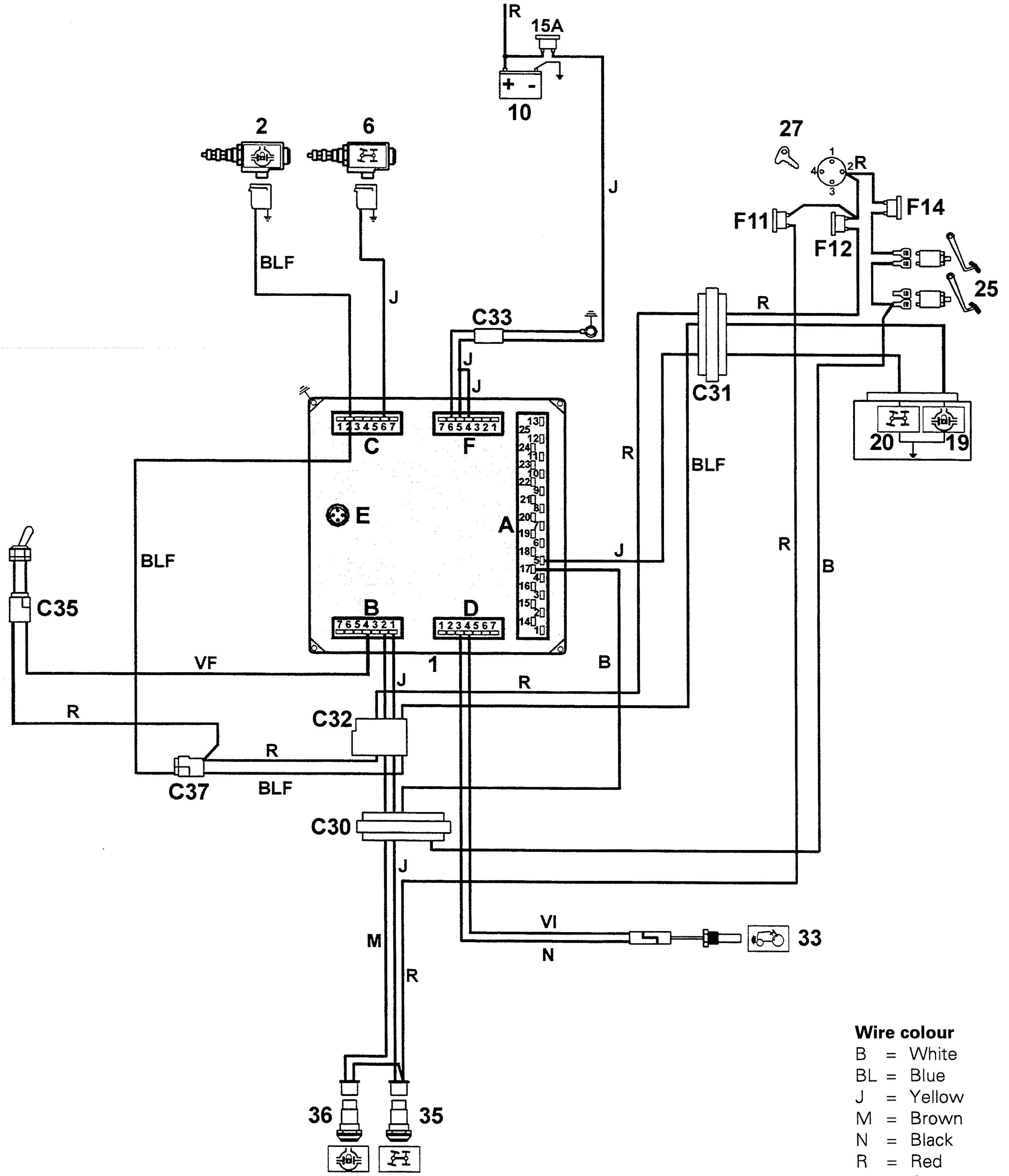
1. 4WD switch : Check the voltage on terminal **B1** of the tractor harness
V = 12 volts when the switch is closed (pressed)
V = 0 volt when the switch is open (released)
If not, check the switch power supply (fuse, etc.), the switch and line continuity.

2. Brake switches : Check the voltage on terminal **A17** of the tractor harness
V = 12 volts when the pedal is pressed and the switch is closed
V = 0 volt when the pedal is released and the switch is open
If not, check the power supply to the brake switches (fuse, etc.), the switches and line continuity.
Note : If the brake switches are open, it is impossible to disengage the 4WD transmission.

3. Forward speed signal : Measure the resistance between **D3** and **D4** on the tractor harness :
See fault 2, page 8.

4. 4WD light and solenoid : Perform testing.

Autotronic 2 - Checking with tester



Wire colour
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M = Brown
N = Black
R = Red
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C = Light
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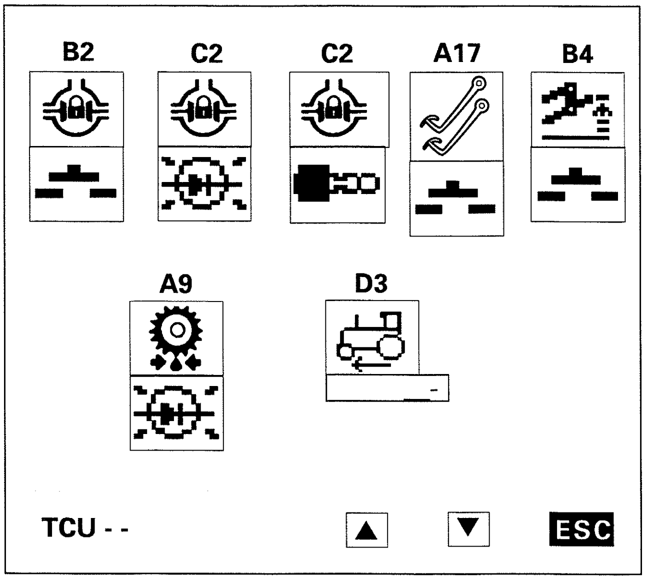
Autotronic 2 - Checking with tester

Differential lock

Symbol	Description
B2	Switch
C2	Warning light and solenoid
A17	Brake switch
B4	Lift switch
A9	Hydraulic pressure light
D3	Forward speed

- The 4WD light comes on automatically when starting the engine.

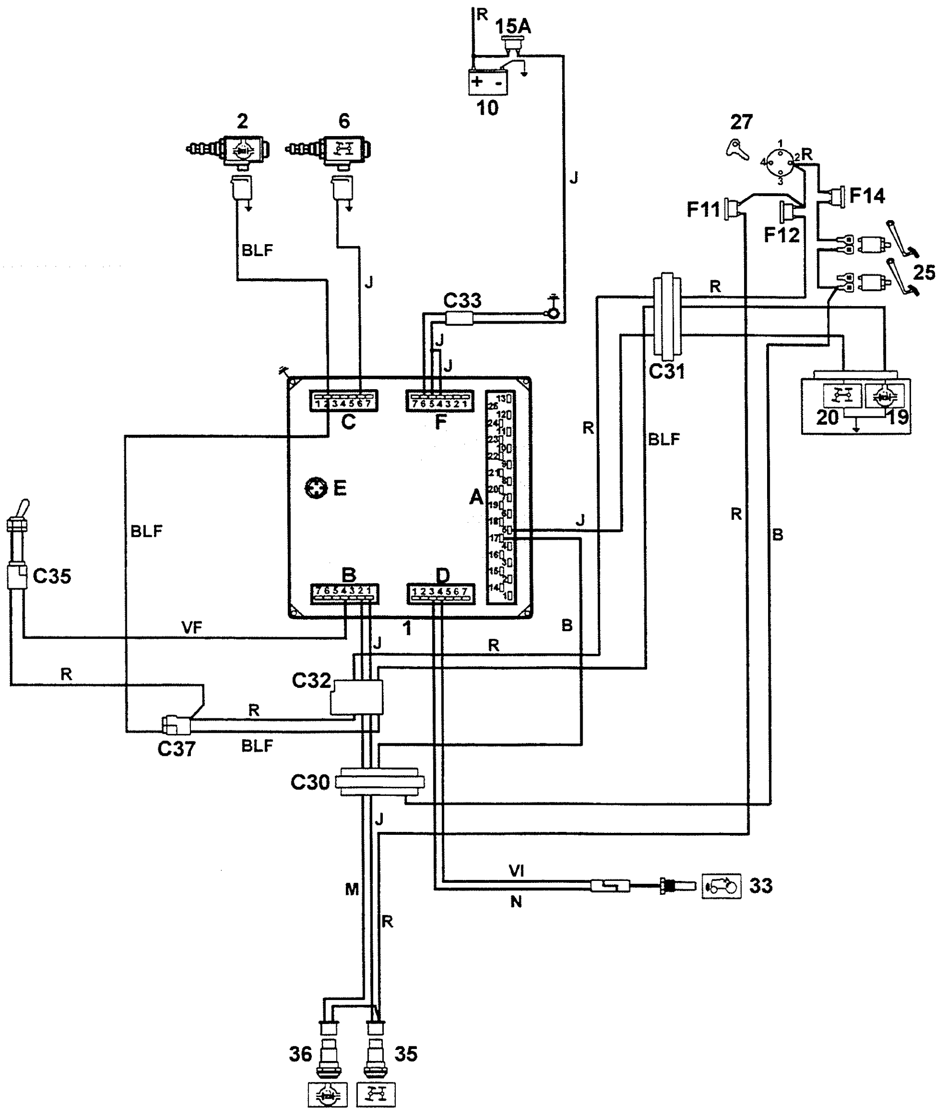


INSTRUCTION	ON TESTER	ON TRACTOR
Press the Diff.Lock once. Lift switch on the down position	Diff.Lock switch **B2 on** while pressing the button Diff.Lock light **C2 comes on** Diff.Lock solenoid **C2 comes on** Pressure light **A9 off** V = 0 kph	Diff.Lock light **comes on** Diff.Lock solenoid **is power-supplied** Pressure light **off**
Press the brake pedals in turn	Brake switch **A17 comes on** Diff.Lock light **C2 goes out** Diff.Lock solenoid **C2 goes out** V = 0 kph Pressure light **A9 off**	Diff.Lock light **goes out** Diff.Lock solenoid **is no longer power-supplied** Pressure light **off**
Release the brake pedals	Brake switch **A17 comes off** Diff.Lock light **C2 comes on** Diff.Lock solenoid **C2 comes on** Pressure light **A9 off** V = 0 kph	Diff.Lock light **comes on** Diff.Lock solenoid **is power-supplied** Pressure light **off**
Set the lift switch to the up position (transport)	Lift switch **B4 comes on** Diff.Lock light **C2 goes out** Diff.Lock solenoid **C2 goes out** V = 0 kph	Diff.Lock light **goes out** Diff.Lock solenoid **is no longer power-supplied**
Set the lift switch to the down position	Lift switch **B4 goes out** Diff.Lock light **C2 comes on** Diff.Lock solenoid **C2 goes out** V = 0 kph	Diff.Lock light **comes on** Diff.Lock solenoid **is power-supplied**
Drive the tractor along at more than 14 kph	Forward speed signal is **OK** Diff.Lock light **C2 goes out** Diff.Lock solenoid **C2 goes out** V = 0 kph	Diff.Lock light **goes out** Diff.Lock solenoid **is no longer power-supplied**

Autotronic 2 - *Checking with tester*

Operating faults

1. **Diff.Lock switch :** Check the voltage on terminal **B2** of the tractor harness
   V = 12 volts when the switch is closed (pressed)
   V = 0 volt when the switch is open (released)
   If not, check the switch power supply (fuse, etc.), the switch and line continuity.
2. **Brake switches :** Check the voltage on terminal **A17** of the tractor harness
   V = 12 volts when the pedal is pressed and the switch closed
   V = 0 volt when the pedal is released and the switch open
   If not, check the power supply to the brake switches (fuse, etc.), the switch and the continuity of switches and lines.
   Note: If the brake switches are open, it is impossible to disengage the 4WD transmission.
3. **Lift switch :** Check the voltage on terminal **B4** of the tractor harness
   V = 12 volts when the switch is closed (lift in up position)
   V = 0 volt when the switch is open (lift in down or neutral position)
   If not, check the switch power supply (fuse, etc.), the switch and line continuity.
4. **Diff.Lock light and solenoid :** Perform testing.
5. **Forward speed signal :** Measure the resistance between **D3** and **D4** of the tractor harness
   If R = 450 Ω, the correct value, adjust the sensor and use the frequency measurement to check that the sensor is working.
   If R = 0 or infinity, check the continuity of lines **D3** and **D4**.



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N = Black
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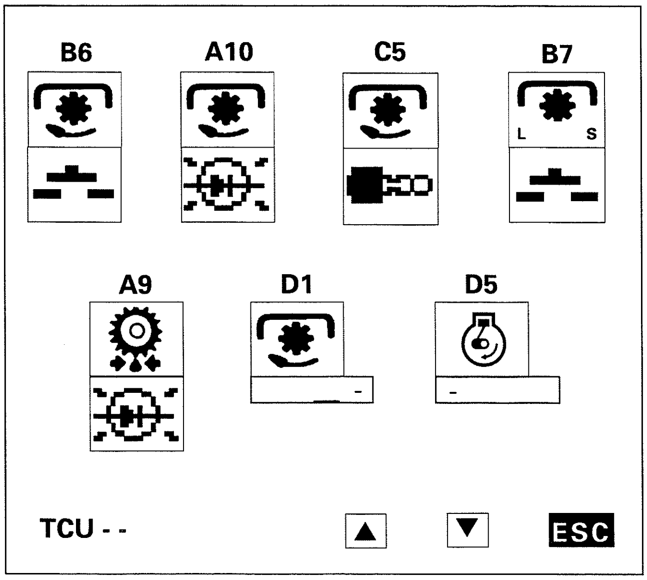
C = Light
F = Dark

Autotronic 2 - Checking with tester

PTO

Symbol	Description
B6	PTO switch
A10	PTO warning light
C5	Solenoid
B7	PTO low speed switch
A9	Hydraulic pressure light
D1	PTO speed
D5	Engine speed



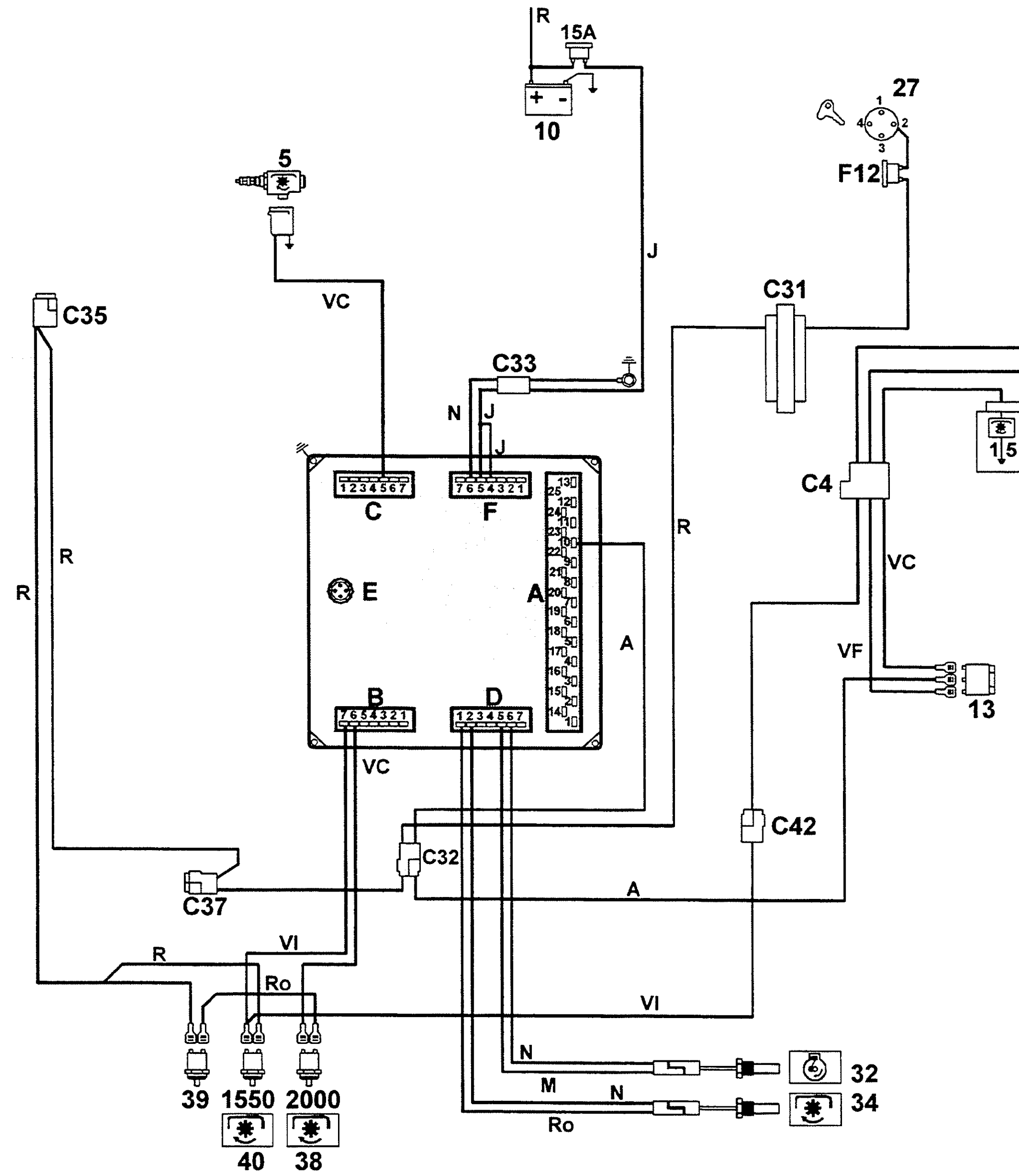
INSTRUCTION	ON TESTER	ON TRACTOR
Engage the PTO	PTO switch **B6 comes on** PTO light **A10 comes on** PTO solenoid **C5 comes on** PTO speed sensor **operating** PTO speed **is displayed** PTO speed = engine speed * Low speed PTO **B7** switch **is off**	PTO light **comes on** PTO solenoid is **power-supplied**
Disconnect the PTO speed sensor After 5 seconds, the PTO should stop rotating	PTO switch **B6 stays on** PTO light **A10 flashes** PTO solenoid **C5 goes out** Engine speed **is displayed** PTO speed = 0 immediately Low speed PTO switch **B7 is off**	PTO light **flashes** PTO solenoid **is no longer power-supplied** PTO **stops** rotating
Disengage the PTO Reconnect the PTO speed sensor		
On 6100 series only : Select low speed PTO and engage the PTO	PTO switch **B6 comes on** PTO light **A10 comes on** PTO solenoid **C5 comes on** Engine speed **is OK** PTO speed = engine speed * Low speed PTO switch **B7 comes on**	Low speed PTO light **comes on** PTO light **comes on** PTO solenoid **is power-supplied**
Increase the engine speed to over 2,000 rpm The PTO should stop rotating	PTO switch **B6 stays on** PTO light **A10flashes** PTO solenoid **C5 goes out** PTO speed = 0 Engine speed **is OK** Low speed PTO switch **B7 goes out**	Low speed PTO light is **on** PTO light **flashes** PTO solenoid **is no longer power-supplied** PTO **stops** rotating

The PTO speed read on the tester is not the speed on the output shaft but the speed calculated on output from the PTO clutch.

Autotronic 2 - *Checking with tester*

Operating faults

1. **PTO switch** : Check the voltage on terminal **B6** of the tractor harness
   V = 12 volts when the switch is closed (PTO engaged)
   V = 0 volt when the switch is open (PTO stopped)
   If not, check the switch power supply (fuses, etc.), the switch and line continuity.
2. **Low speed PTO switch** : Check the voltage on terminal **B7** of the tractor harness
   V = 12 volts when the PTO is engaged and the switch is closed
   V = 0 volt when the PTO is stopped and the switch is open
   If not, check the switch power supply (fuses, etc.), the switch and line continuity.
3. **Engine speed signal** : Measure the resistance between **D5** and **D6** of the tractor harness
   See fault 4 p. 6.
4. **PTO speed sensor signal** : Measure the resistance between **D1** and **D2** of the tractor harness.
   Correct value R = 450 Ω
   If R = correct ensure that the sensor is operating by measuring the frequency and checking its setting (see 11B04p8).
   If R = 0 or infinity, check the continuity of lines **D1** and **D2**.
   If the engine speed and PTO speed are different, this indicates a bad parameter or clutch slippage.
5. **PTO light and solenoid** : Perform testing.



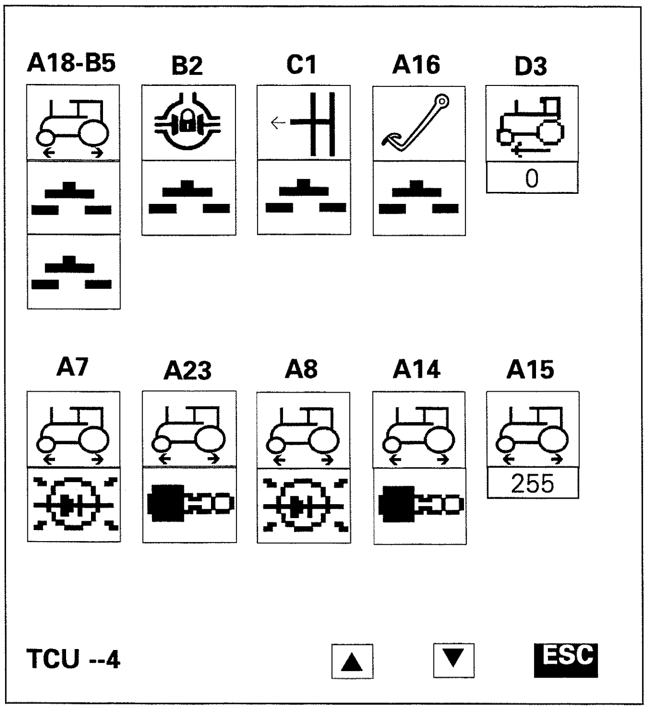
Wire colour
A = Aluminium
J = Yellow
M = Brown
N = Black
R = Red
Ro = Pink
V = Green
VI = Violet

C = Light
F = Dark

Autotronic 2 - *Checking with tester*

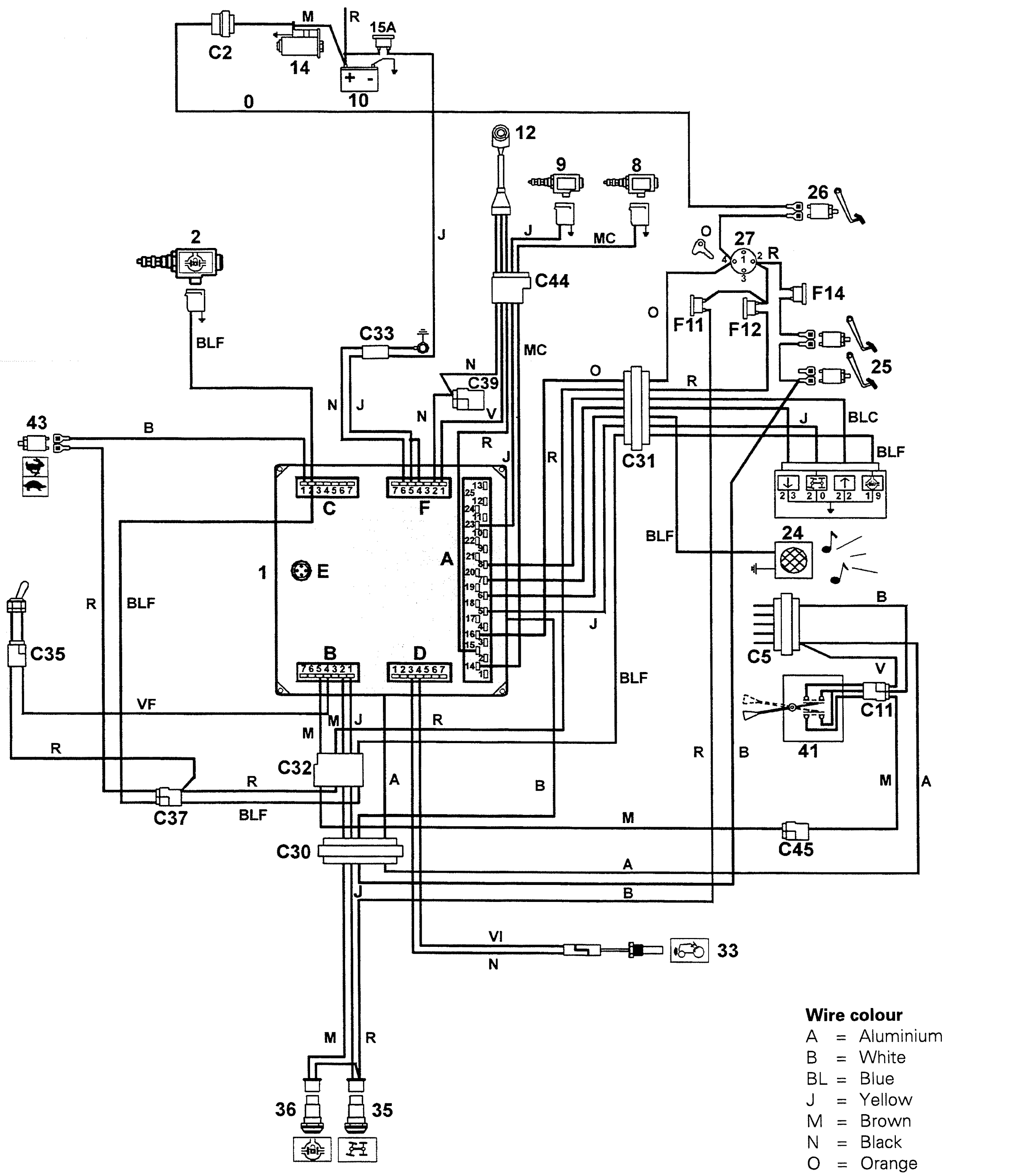
Hydro-electrical reverse shuttle (6100)

Symbol	Description
A18	Forward reverse shuttle switch
B2	Diff.Lock switch
C1	Hare/Tortoise switch
A16	Clutch switch
D3	Forward speed sensor
A7	Reverse shuttle warning light (forward)
A14	Reverse shuttle solenoid (reverse)
A8	Reverse shuttle warning light (reverse)
A23	Reverse shuttle solenoid (forward)
A15	Sensor - Reverse shuttle piston



INSTRUCTION	ON TESTER	ON TRACTOR
Pre-select the forward speed with the lever	**A18 on** (during moving of the lever) **A7 flashes** **A8 on** **A14** and **A23 off** **A15** gives the fork position	Reverse shuttle light - Reverse **on** Reverse shuttle light - Forward **flashes** Buzzer rings
Disengage the clutch	**A16 on** (when declutching) **A7 on** **A8 off** **A23 on during 2 s** **A15** gives new position of the fork	Reverse shuttle light - Reverse **on** Reverse shuttle light - Forward **off** Forward solenoid powered about 2 s Buzzer off
Pre-select the reverse speed with the lever	**A18 on** (during moving of the lever) **A7 on** **A8 flashes** **A14** and **A23 off** **A15** gives the fork position	Reverse shuttle light - Reverse **flashes** Reverse shuttle light - Forward **on** Buzzer rings
Disengage the clutch	**A16 on** (when declutching) **A7 off** **A8 on** **A14 on during about 2 s** **A15** gives new position of the fork	Reverse shuttle light - Reverse **on** Reverse shuttle light - Forward **off** Reverse solenoid powered about 2 s Buzzer off

Autotronic 2 - *Checking with tester*



Wire colour

A = Aluminium
B = White
BL = Blue
J = Yellow
M = Brown
N = Black
O = Orange
R = Red
V = Green
VI = Violet

C = Light
F = Dark

Autotronic 2 - *Checking with tester*

Operating faults

1. **Reverse shuttle lever (swith) :** Ignition on, check the voltage on pins of the 3 way-connector **C11** located at the rear of the instrument panel.

White wire :	forward = 12 V	
	reverse = 12 V	
Brown wire :	forward = 12 V	
	reverse = 0 V	
Green wire :	forward = 0 V	
	reverse = 12 V	

   If these values are not obtained, check the switch power supply (fuse, etc...) the switch and the line continuity.

2. **Diff.Lock switch**
   See p. 13
3. **Hare/Tortoise switch**
   See p. 8
4. **Clutch switch**
   See p. 6
5. **Forward speed sensor**
   See p. 8
6. **Reverse shuttle piston sensor**
   If the value **A15** displayed on the tester = 0 in reverse or forward check :
   - voltage on green wire F1, about 10 volts

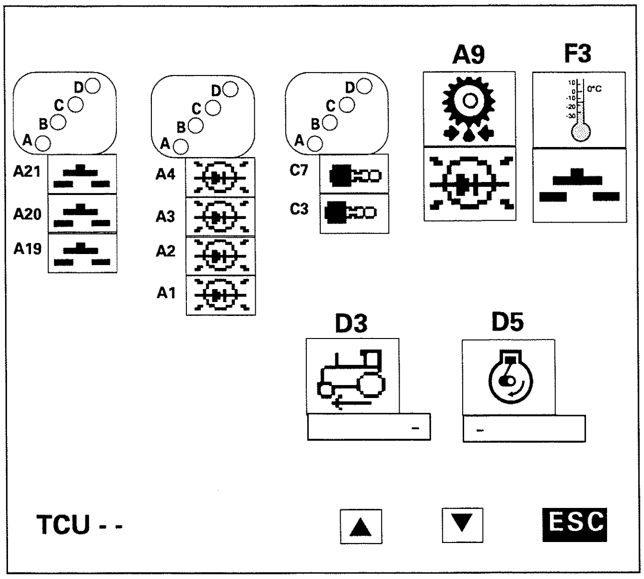
   If value of A15 does not change check :
   - voltage on red wire varies

   If not, check the sensor power supply, the sensor and the line continuity.

Autotronic 2 - Checking with tester

Dynashift

Symbol	Description
A19	Dynashift lever input
A20	Dynashift lever input
A21	Dynashift lever input
A1	Range A light
A2	Range B light
A3	Range C light
A4	Range D light
C3	Solenoid EV2
C7	Solenoid EV1
A9	Hydraulic pressure light
F3	Temperature sensor
D3	Forward speed
D5	Engine speed



INSTRUCTION	ON TESTER	ON TRACTOR
	Engine speed sensor operating Temperature sensor is operating and remains black for the following tests:	
Select ratio A	Switch **A19 off** Switch **A20 off** Switch **A21 off** Light **A1 on** Solenoid **C7 on** Solenoid **C3 off**	Light **A on** Solenoid 1 **power-supplied** Solenoid 2 **not power-supplied**
Select ratio B	Switch **A19 on** Switch **A20 off** Switch **A21 off** Light **A2 on** Solenoid **C7 on** Solenoid **C3 on**	Light **B on** Solenoid 1 **power-supplied** Solenoid 2 **power-supplied**
Select ratio C	Switch **A19 on** Switch **A20 on** Switch **A21 off** Light **A3 on** Solenoid **C7 off** Solenoid **C3 on**	Light **C on** Solenoid 1 **not power-supplied** Solenoid 2 **power-supplied**
Select ratio D	Switch **A19 on** Switch **A20 on** Switch **A21 on** Light **A4 on** Solenoid **C7 off** Solenoid **C3 off**	Light **D on** Solenoid 1 **not power-supplied** Solenoid 2 **not power-supplied**
Drive the tractor	Forward speed sensor **D3 operating**	
Disconnect temperature sensor	Temperature sensor **F3 off**	

Autotronic 2 - Checking with tester

Operating faults

1. Dynashift switch

Check the voltage on terminals **A19**, **A20** and **A21**

	A19	A20	A21
Ratio A	0	0	0
Ratio B	12 V	0	0
Ratio C	12 V	12 V	0
Ratio D	12 V	12 V	12 V

IF NOT : Check the power supply to the lever switch **C5** (orange wire from relay: 12 V with engine running) and check lever output lines.

	Black	Brown	Red
Ratio A	0	0	0
Ratio B	12 V	0	0
Ratio C	12 V	12 V	0
Ratio D	12 V	12 V	12 V

2. Clutch switch : Measure the resistance between terminal **A16** of the tractor harness and the earth

R = 0 to 1.5 Ω when the pedal is pressed and the switch is closed

R = infinity when the pedal is released and the switch closed. Check line continuity and connection to the starter motor.

3. Engine speed sensor signal: Measure the resistance between **D5** and **D6** of the tractor harness :

See page 6

4. Forward speed signal : Measure the resistance between **D3** and **D4** of the tractor harness :

See page 8

5. Temperature sensor

If lights **A** and **D** are flashing, this indicates LOW temperature or open circuit.

Check the resistance between **F2** and **F3** of the harness:

R = infinity = lines broken

R less than 10 kΩ = correct if temperature higher than 0°C

R more than 10 kΩ and temperature higher than 0°C,

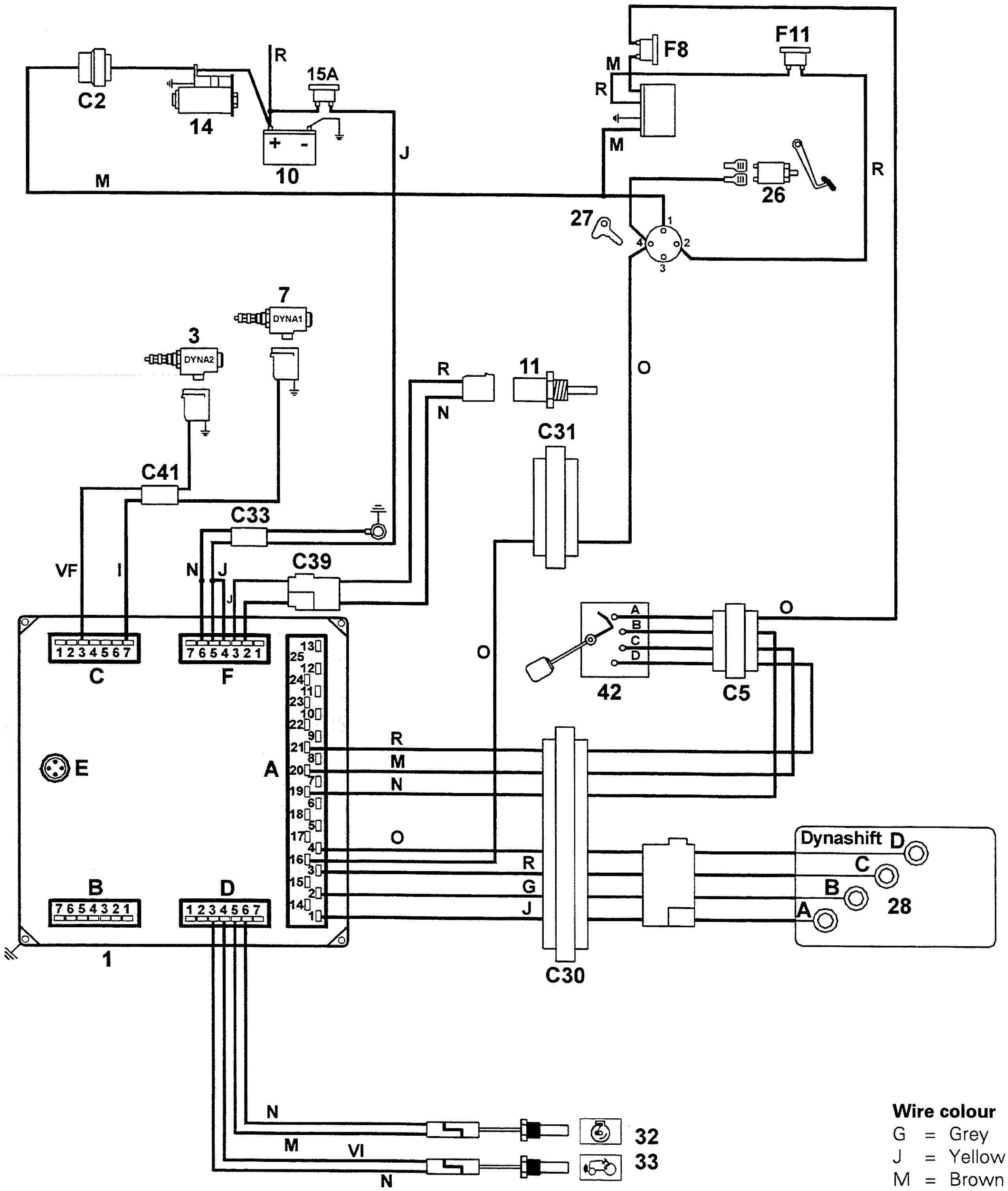
check resistance of lines

change sensor

R = 0 = short-circuit

6. DYNASHIFT lights and solenoids : Perform testing.

Autotronic 2 - Checking with tester



Wire colour

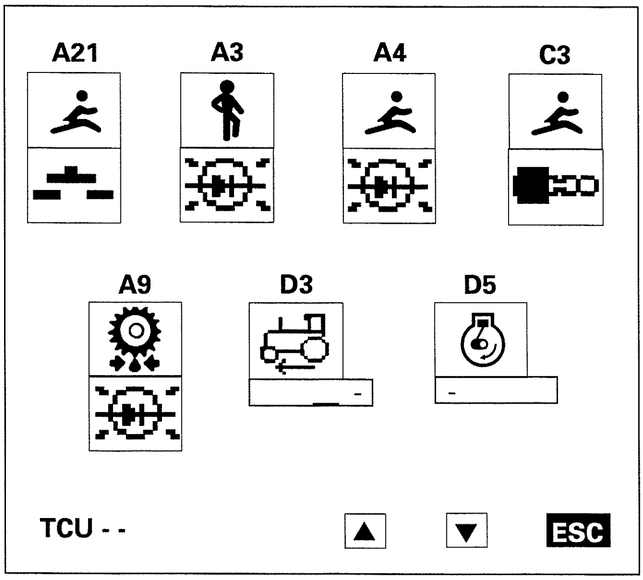
G = Grey
J = Yellow
M = Brown
N = Black
O = Orange
R = Red
V = Green
VI = Violet

C = Light
F = Dark

Autotronic 2 - Checking with tester

Speedshift

Symbol	Description
A21	Switch
A3	Low range light
A4	High range light
C3	Solenoid
A9	Hydraulic pressure light
D3	Forward speed
D5	Engine speed



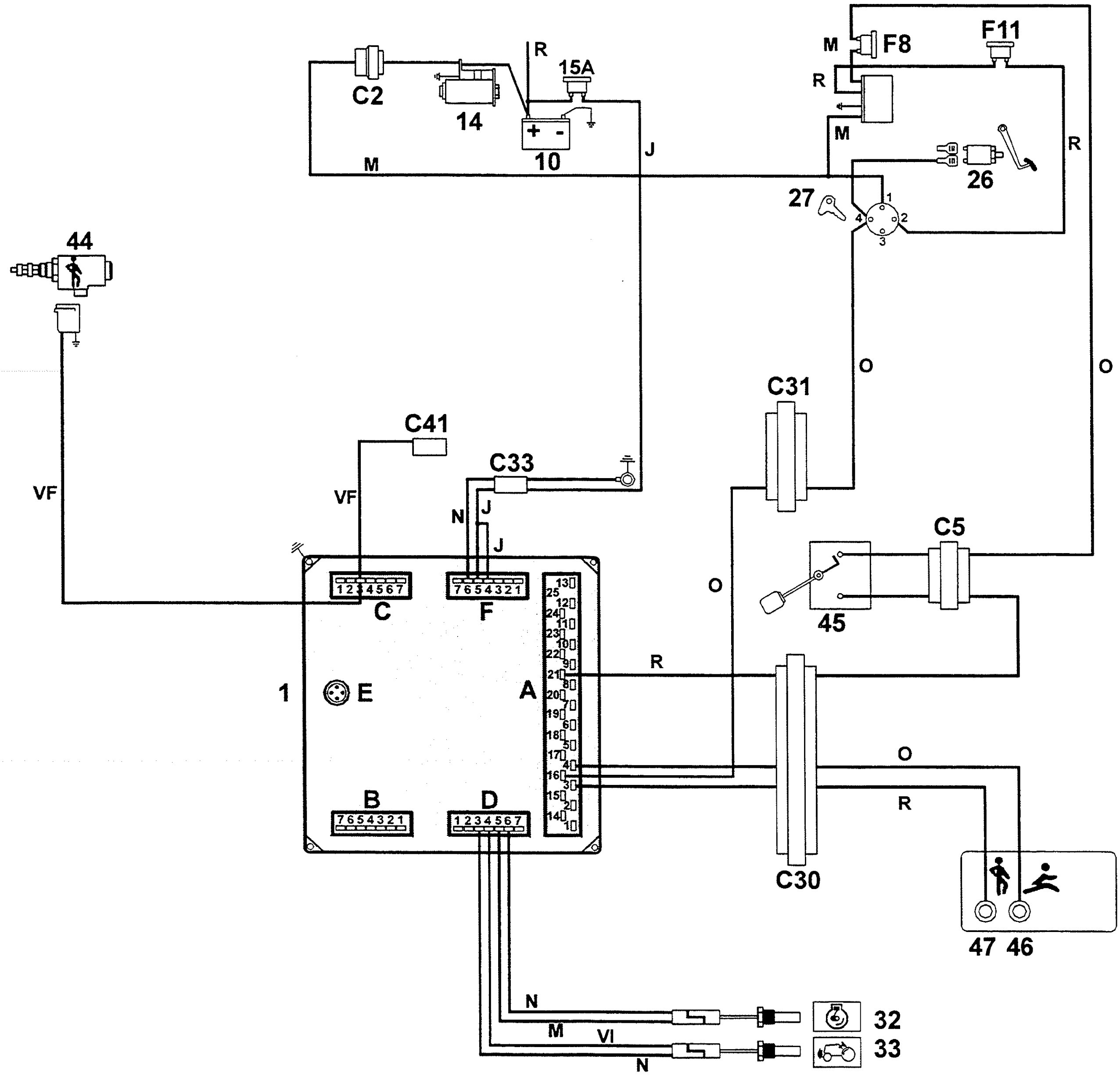
INSTRUCTION	ON TESTER	ON TRACTOR
Press Speedshift button	V = 0 kph Speedshift switch **A21 on** when button pressed	
Check that the Speedshift changes from high range to low range and back again	**Speedshift 30 kph** Hi light **A4 on** with Speedshift solenoid **C3 on** Lo light **A3 on** with Speedshift solenoid **C3 off** **Speedshift 40 kph** Hi light **A4 on** with Speedshift solenoid **C3 off** Lo light **A3 on** with Speedshift solenoid **C3 on**	**Speedshift 30 kph** Hi light **on** with Speedshift solenoid **power-supplied** Lo light **on** with Speedshift solenoid **not power-supplied** **Speedshift 40 kph** Hi light **on** with Speedshift solenoid **not power-supplied** Lo light **on** with Speedshift solenoid **power-supplied**

Operating faults

1. **Speedshift switch**
   Check the voltage at terminal **A21**
   V = 12 V when the switch is closed
   V = 0 V when the switch is open
   If not, check the switch power supply, the switch and the resistance of the line connected to the ETCU

2. **Speedshift light and solenoid** : Perform testing.

Autotronic 2 - Checking with tester



Wire colour

J = Yellow
M = Brown
N = Black
O = Orange
R = Red
V = Green
VI = Violet

C = Light
F = Dark

CONTENTS

Autotronic 2 - Checking with tester

F . "Testing" function

1. Access conditions

With the engine stopped, hydraulic pressure light on, and ignition switched on.

Press the clutch pedal to hold the TCU in alarm mode.

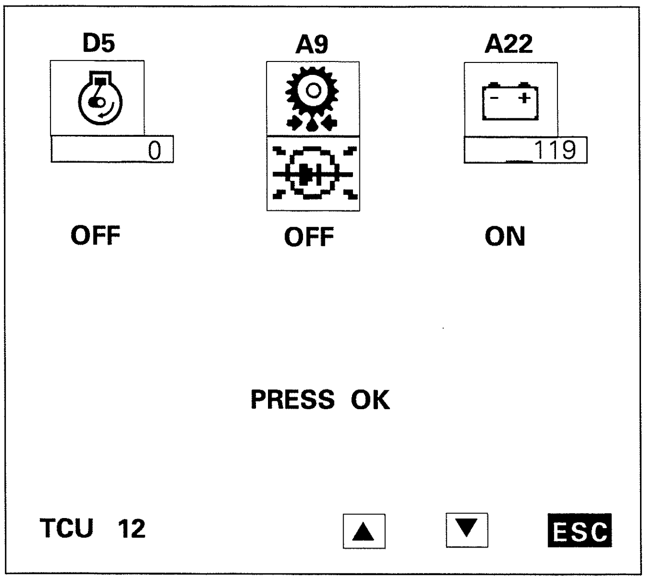
- "OFF" is displayed under symbol **D5** indicating that the engine is stopped.
- "OFF" is displayed under symbol **A9** indicating that there is no hydraulic pressure.
- "ON" is displayed under symbol **A22** indicating that the ignition is switched on. The supply voltage (11.9 V) is also displayed.

2. Principle

The tester forces operation of all Autotronic outputs one by one. It analyses the current draw to detect unconnected or short-circuited components. The component symbol (solenoid or light) on the tester goes black when the output is power-supplied. As soon as an anomaly is detected, "ERR" is displayed under the symbol for the faulty output.

Important : The tester cannot be used to check :
- LEDs owing to their low current draw,
- PTO and 4 WD solenoids for purely electronic reasons. Question marks are displayed indicating that the voltage must be checked directly on the solenoid.

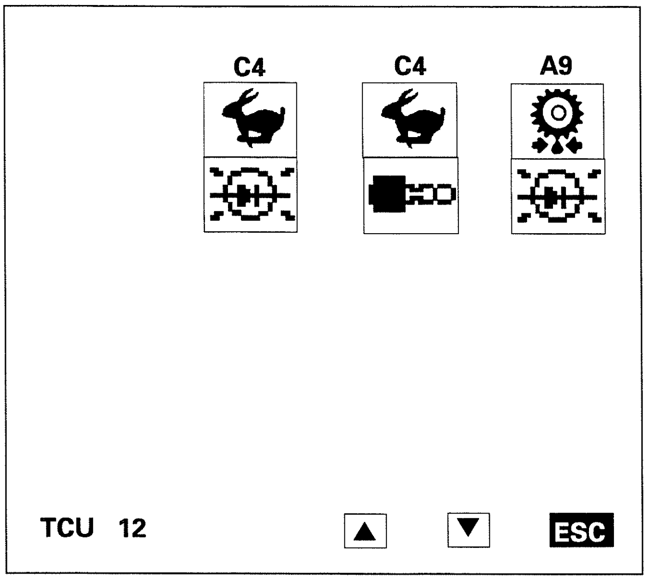
Access to the function "Testing" using the keyboard.



If these values are correct, the TCU switches to "Diagnostic" mode (TCU 12). Press OK to go on to the test procedure. Use the arrows to go on to the next screen.

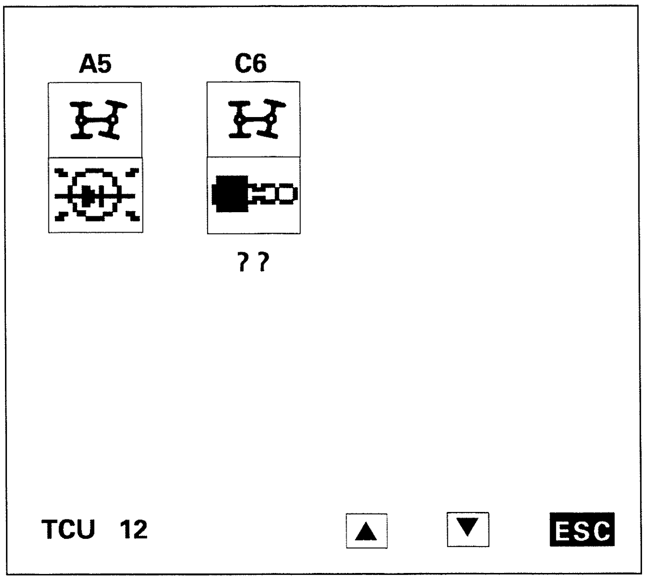
Screen 2: Hare/Tortoise

On tester	On tractor
Hare light changes status	Hare light is illuminated on instrument panel
Solenoid changes status	Solenoid is energised
Hydraulic pressure light changes status	Hydraulic pressure light is illuminated
Solenoid changes status but "ERR" is displayed	Measure resistance between earth and output C4 Correct value = 10 Ω ± 2
The hare light changes status but is not illuminated on control panel	Check light line and faulty light



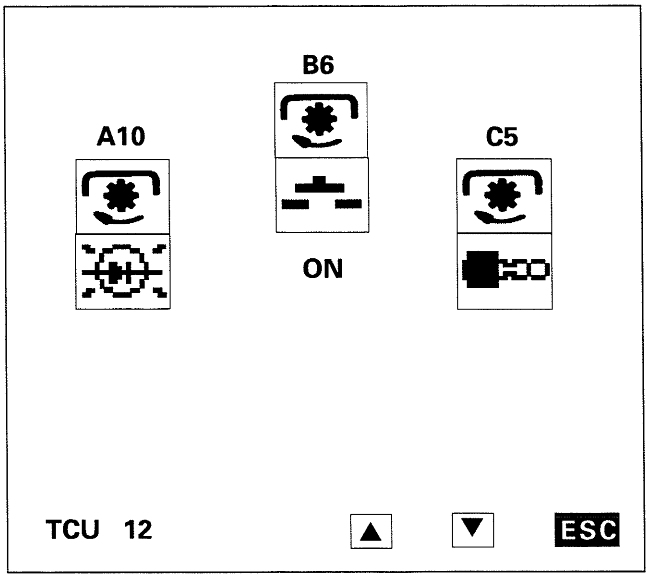
Screen 3 : 4WD

On tester	On tractor
4WD light changes status	4WD light is illuminated on instrument panel
Solenoid changes status and two question marks are displayed	Solenoid is normally energised
Light changes status but «ERR» is displayed	Check light line and light
Solenoid changes status with two question marks	Measure resistance between earth and output C6 Normal value = 10 Ω ± 2



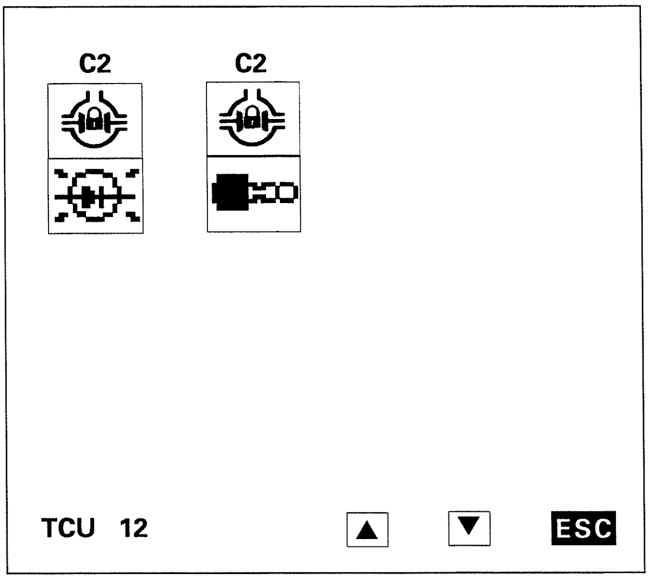
Screen 4 : PTO

On tester	On tractor
PTO switch changes status	Engage PTO lever in cab
PTO light changes status	PTO light changes status on instrument panel
Solenoid changes status	Solenoid is energised
Switch status does not change	Check switch input
Light changes status but is not illuminated on instru-ment panel	Check light line and light
Solenoid changes status but "ERR" is displayed	Measure resistance between earth and output C5 Normal value = 10 Ω ± 2



Screen 5 : Differential lock

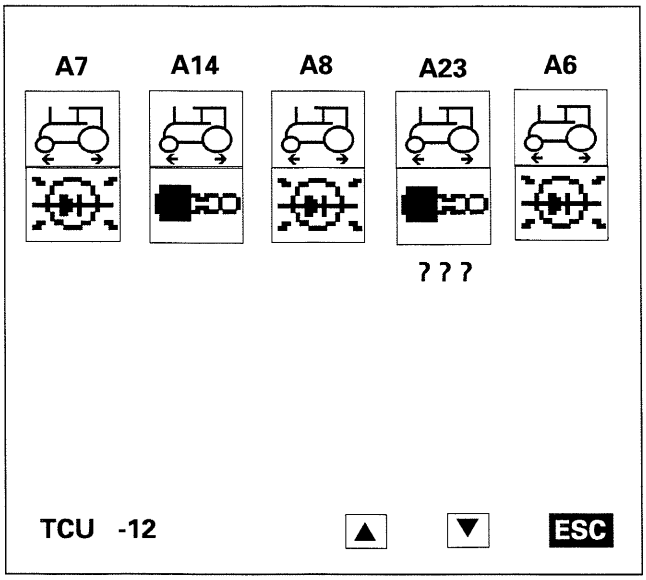
On tester	On tractor
Diff.Lock light and solenoid change status	Diff.Lock light changes status on instrument panel and solenoid is energised
Light and solenoid change status but «ERR» is displayed	Measure resistance between earth and output C2 Correct value = 5.9 Ω as the light and solenoid are connected in parallel
If C32 is disconnected and «ERR» is displayed, there is a problem on light	To differentiate between problem on light or solenoid, disconnect C32



Autotronic 2 - *Checking with tester*

Screen 6 : Hydro-electrical reverse shuttle

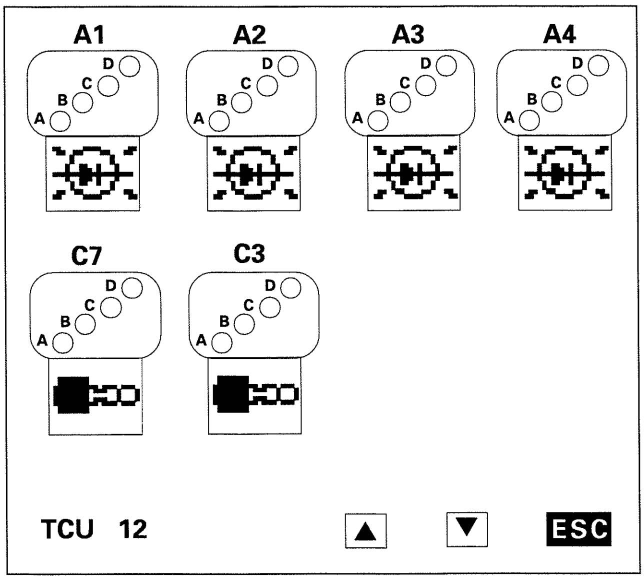
on tester	on tractor
Forward light **A7** changes status	The green forward light comes on on the instrument panel
The forward solenoid **A23** changes status. Three question marks are displayed under the icon to mean that the tester is unable to test it	The forward solenoid is energised
The reverse shuttle light **A8** changes status	The red reverse shuttle light comes on on the instrument panel
The reverse shuttle sole-noid **A14** changes status	The reverse shuttle sole-noid is energised
The buzzer **A6** changes status	The buzzer rings



Nota : Like the PTO and 4 WD solenoids the tester cannot check the forward solenoid.

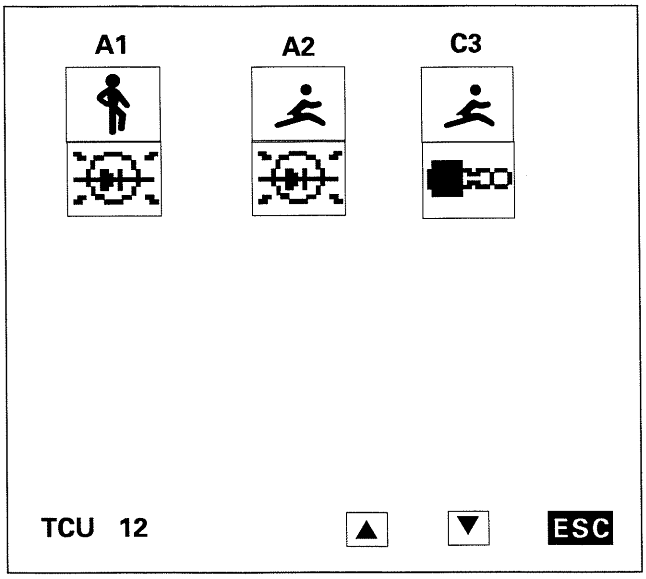
Screen 7 : Dynashift

On tester	On tractor
Light **A1** changes status	Light A is illuminated on instrument panel
Light **A2** changes status	Light B is illuminated on instrument panel
Light **A3** changes status	Light C is illuminated on instrument panel
Light **A4** changes status	Light D is illuminated on instrument panel
Solenoid EV1 **C7** changes status	Solenoid is energised
Solenoid EV2 **C3** changes status	Solenoid is energised
One of the lights changes status but is not illuminated on instrument panel	Check light lines and lights
Solenoid EV1 changes status but "ERR" is displayed	Measure resistance between earth and output C7 Normal value = 10 Ω ± 2
Solenoid EV2 changes status but "ERR" is displayed	Measure resistance between earth and output C3 Normal value = 10 Ω ± 2



Screen 8 : Speedshift

On tester	On tractor
Low range light changes status	Low range light is illuminated on instrument panel
High range light changes status	High range light is illuminated on instrument panel
Solenoid changes status to high range except 6180 **Warning for MF 6180**, solenoid is only energised in low range	Solenoid is energised
One of the two lights changes status but is not illuminated on instrument panel	Check light lines and lights
Solenoid status does not change	Measure resistance between earth and output C3 Normal value = 10 Ω ± 2



11 C04 Parameters

CONTENTS

When setting parameters on the electronic transmission control unit (ETCU), always ensure that you comply with the local road speed limit.

Autotronic 2 - Parameters

A. Screens

Select PARAMETER.
Press the clutch pedal to activate the electronic transmission control unit (ETCU). The tester checks that the ETCU is at issue Y. If it is, the parameter screen is displayed.
The ETCU will then be locked in this mode. Indicator lights will remain in the same state (on or off) as when the tester started this procedure.

OPER. SOFT. ISSUE

TESTER : Y
AUTOTRONIC : ?

PRESS CLUTCH PEDAL

TCU OFF

OLD: current parameters of the ETCU
NEW: parameters to be entered

TYPE NEW CODE THEN PRESS OK.

CODE

OLD : 022111010000
NEW : _

OK ◀ ESC

The tester checks whether the code is known.
If it is known, the line «CODE OK?» is displayed.
Press OK to send the code to the ETCU.

CODE

OLD :022111010000
NEW : 022112010000

OK ◀ ESC

Once the parameters have been recorded by the ETCU, it is automatically reset with the new parameters.
IF THE CODE IS UNKNOWN TO THE TESTER: the message «ERR» is displayed. The cursor flashes on the erroneous figure.
Press OK.
Type another code.
Press OK.

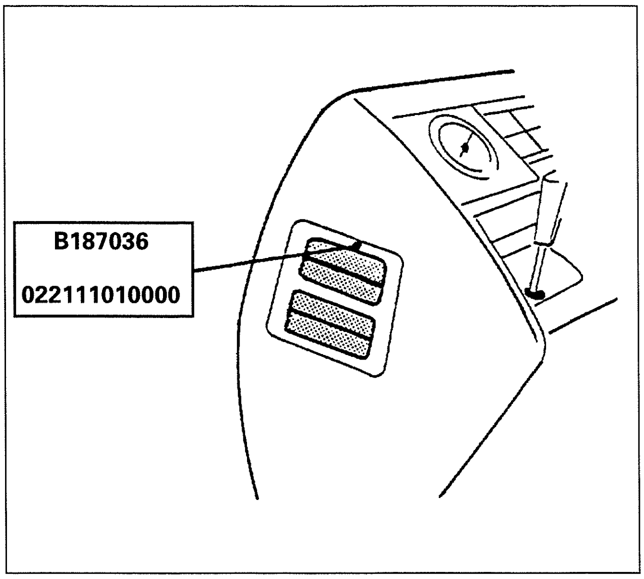
CODE

OLD : 022111010000
ERR : 020112020000
NEW : 032112.............

0,9 OK ◀ ESC

B. Key to parameters

B187036 = Tractor serial number
022111010000 = Parameter code (see below)



Parameter code	A	A	B	C	D	E	F	G	H	I	J	K
Parameter exemple	0	2	2	1	1	1	0	1	0	0	0	0

Code AA = 02 = MF 6150 with not modified flow hydraulic pump
Code B = 2 = with 4 WD
Code C = 1 = with Hare/Tortoise synchro
Code D = 1 = 4 x 2 gearbox (without A/B range)
Code E = 1 = speed limit 40 km/h
Code F = 0 = without Speedshift
Code G = 1 = Dynashift with control by lever
Code H = 0 = mechanical reverse
Code I = 0 = not used
Code J = 0 = not used
Code K = 0 = not used

Autotronic 2 - Paramètres

Code AA : Modèle tracteur

MODELE	CODE AA Pompe hydraulique à débit non modifié jusqu'à N° D125026	Pompe hydraulique à débit augmenté à partir du n° D125027	6100 Load Sensing
6110 - 6120 - 6130 - 6140	00	19	25
6150 - 6160 - 6170	02	20	26
6180	03	21	27
6190	04	22	28
	PDF 540 / 1000	**PDF 750 / 1000**	
8110 - 8120 Normal Duty	05	12	
8110 - 8120 Heavy Duty	06	13	
8130 Normal Duty	07	14	
8130 Heavy Duty	08	15	
8140 - 8150 Heavy Duty	09	16	
8150 Reduction double	10	17	
8160 Reduction double	11	18	
8160 Transmission Heavy Duty renforcée	23	24	

Autotronic 2 - Paramètres

Code B Pont avant	Code C Lièvre / Tortue	Code D Type boîte de vitesses	Code E Vitesse maxi
1 = 2 RM 2 = 4 RM 3 = 4 RM "à mémoire" à partir de F167026 (c)	0 = Non synchronisé 1 = Synchronisé	1 = 4 x 2 (sans AB) 2 = 4 x 4 (avec AB) (a)	1 = 30 km/h 2 = 40 km/h 3 = 33 km/h (Japon) 4 = 40 km/h pour transmission Heavy Duty renforcée

Code F : Speedshift	Code G : Dynashift	Code H : Inverseur de marche
0 = Sans Speedshift 1 = Commande par bouton sur levier de vitesses 2 = Commande par levier au volant	0 = Sans Dynashift 1 = Commande par levier au volant 2 = Commande par bouton sur levier de vitesses 3 = pour AGCO Allis ou White	0 = Mécanique 1 = Pré-sélection • avec bouton • avec capteur MCB 2 = Pré-sélection • avec levier • avec capteur MCB 3 = Pré-sélection • avec levier • avec capteur Bosch 4 = Pré-sélection • avec bouton • avec capteur Bosch

Code I : Usine	Code J : Non utilisé	Code K : PDF 6100
0 = AGCO MF	0 =	0 = Ancienne progressivité 1 = Nouvelle progressivité

(a) pour série 3000/3100
(b) pour série 6100 seulement

(c) applicable sur tous les tracteurs avec Autotronic 2 en version M.

11C05 Reprogramming the Autotronic 2

CONTENTS

Autotronic 2 - Reprogramming

A. Programming on the tractor

This operation takes about 7 minutes and is not normally necessary, except for updating.
Example: Switching from issue Y-1 to Y.

Select PROGRAM.
If the ETCU program is at issue Y, no reprogramming is required.
If you wish to perform reprogramming, press OK. Otherwise press ESC.
Note: If the ETCU issue is more recent than that of the tester, a message is displayed on the screen informing you that the operating software is not compatible.
Press ESC.
Contact Beauvais to update the tester.

PROGRAM TCU

OPER. SOFT. ISSUE OK

PROGRAM
NOT NECESSARY

CONFIRM PROGRAM?

OK ESC

Start the engine to provide an electric power supply of more than 13 V. If the voltage is lower than 13 V, an error message is displayed on the screen.
Disconnect the connector **F** to reset the program, press OK and then reconnect.
Press OK.

PROGRAM TCU

START ENGINE
PRESS OK
DISCONNECT CONNECTOR F
PRESS OK
RECONNECT CONNECTOR F
PRESS OK

OK ESC

Press the clutch to reset the Autotronic electronic transmission control unit.
The program is loaded automatically.
The ETCU program is, first of all, erased (no indicator light on) for about 2 minutes.

PROGRAM TCU

PRESS CLUTCH PEDAL
PRESS OK

WAIT

OK ESC

The tester then reprograms the ETCU at issue Y (indicator lights **B** and **C** or Speedshift in Hi range are illuminated).
Wait for programming to be completed (about 5 minutes).

PROGRAM TCU

WAIT PROGRAMMING

32766

OK ESC

The displayed value switches from 32766 to 0. Once reprogramming has been completed, the indicator lights **A, B, C** and **D** (or Speedshift Hi and Lo) come on.
If a problem occurs during reprogramming, the tester indicates that problem and only indicator light **A** or **B** comes on.
Check the power supply and connectors.
Disconnect the ETCU and start again.
The program is now loaded in the ETCU.
Disconnect connector F of the ETCU to reset.
Press OK. Reconnect. Press OK.

Do not forget to reconnect and then check the parameters (see Parameter).

PROGRAM TCU
WAIT PROGRAMMING
0
PROGRAM OK

DISCONNECT CONNECTOR F
PRESS OK
CONNECT CONNECTOR F
PRESS OK

OK ESC

Autotronic: Operating software issue

TRW TRANSPORTATION ELECTRONICS	***TRW***
TRW N°:	02100-00 Issue F
OP-SOFTWARE N°:	02795-00 Issue Y
BOOTROM SOFTWARE N°:	02912-00 Issue B
MASSEY FERGUSON N°:	3618318M05A
Serial N°:	9502 xxxx
Transmission Control Unit	
Tested:________________	
Made in UK	
CASE MUST BE EARTHED	

OP-SOFTWARE = TCU operating software

For information :
- Issue B : first configuration
- Issue C : same characteristics as Autotronic 1
- Issue D : speed limit on 3100 Speedshift is 30 kph
- Issue E : dialog with tester
- Issue F : electro-hydraulical reverse shuttle and Hilo synchro
- Issue G : modification of the reverse shuttle
- Issue H : security mode introduction
- Issue H : security mode modification

BOOTROM SOFTWARE = Software including non-reprogrammable read-only memory.
Issue B only

Autotronic 2 - Reprogramming

B. Programming off the tractor

It is also possible to load the operating software or change the Autotronic parameters without being connected to the tractor.

- Connect harness number 3712723M1 (Fig. 1) to connectors **A** and **F**. Connector **A** has four Dynashift indicator lights (A, B, C and D) and a clutch contactor earth connection, input line **A16**.

- Connect the tester to connector **E** and connect power supply **X1** to connector **X2** of harness 3712723M1.

- Connect power supply **Y1** to a generator **Y2**: **12 volts - 1 A for parameter-setting; 13 volts minimum for programming).**
  Brown wire on red wire: + 12 volts
  Blue wire on black wire: Earth

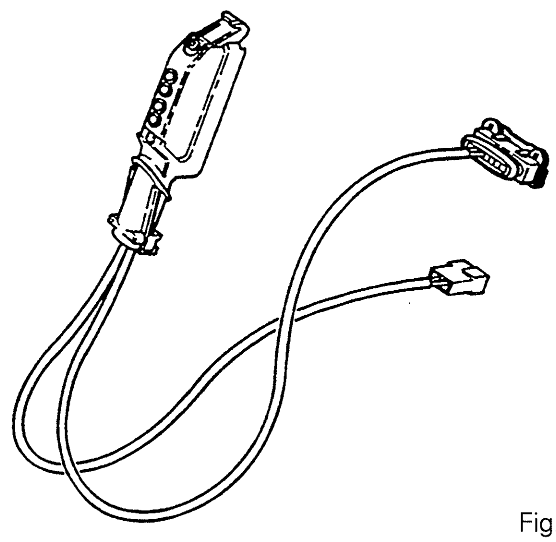
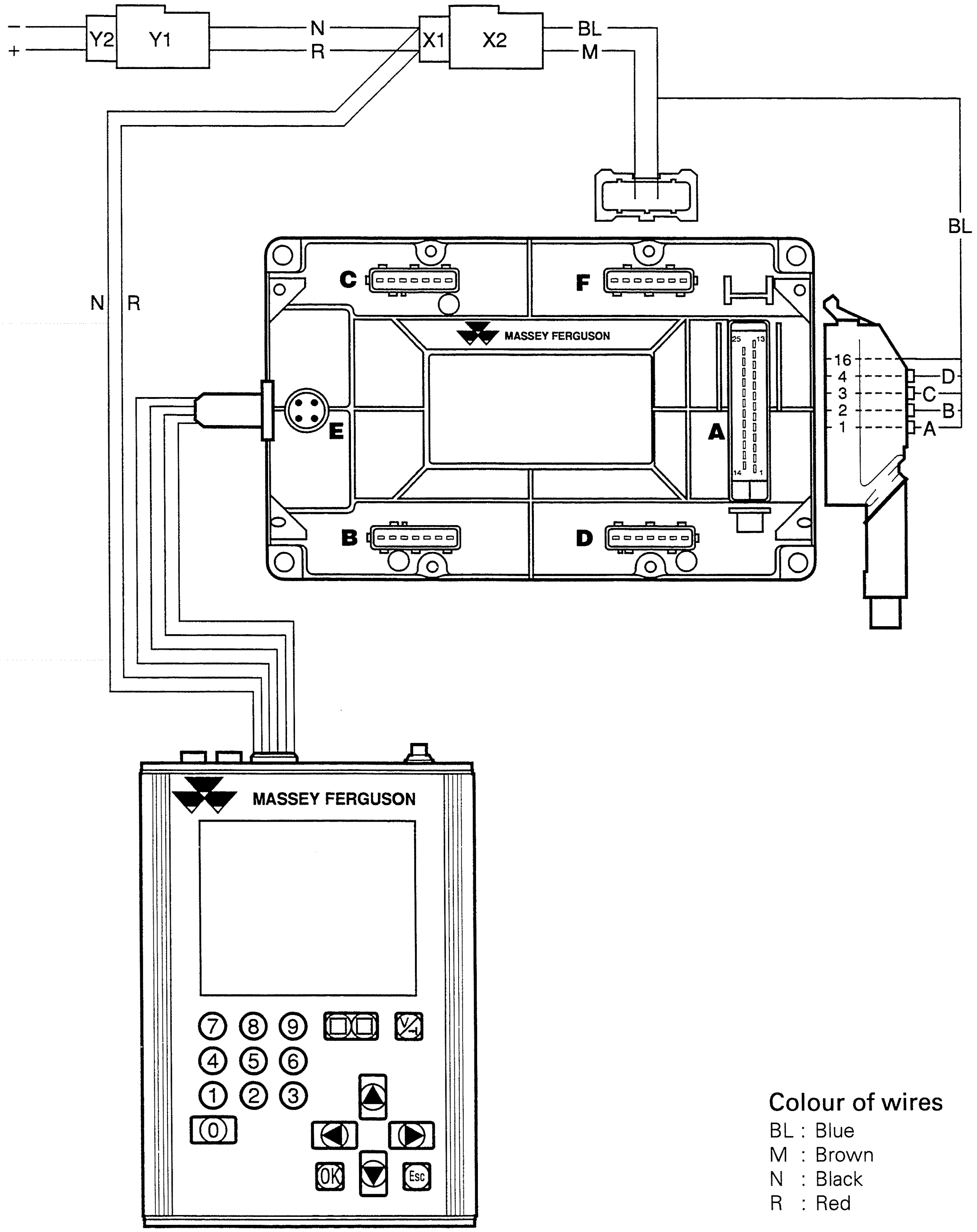


Fig. 1

Note: The electronic unit is now in alarm mode with a permanent earth for the clutch signal. There is, therefore, no need to press the clutch to activate the TCU.
The TCU modes are monitored by four indicator lights:
- no program = A, B, C, D lit up,
- incorrect parameter = flashing from AC to BC,
- during programming:
  erasing = indicator lights out
  loading = BC
  completed = A, B, C, D,
  error = A or B,
- normal alarm mode:
  D = Dynashift
  A or B = Speedshift

Autotronic 2 - Reprogramming



Colour of wires

BL : Blue
M : Brown
N : Black
R : Red

CONTENTS

11D01 Description

CONTENTS

Datatronic - Description

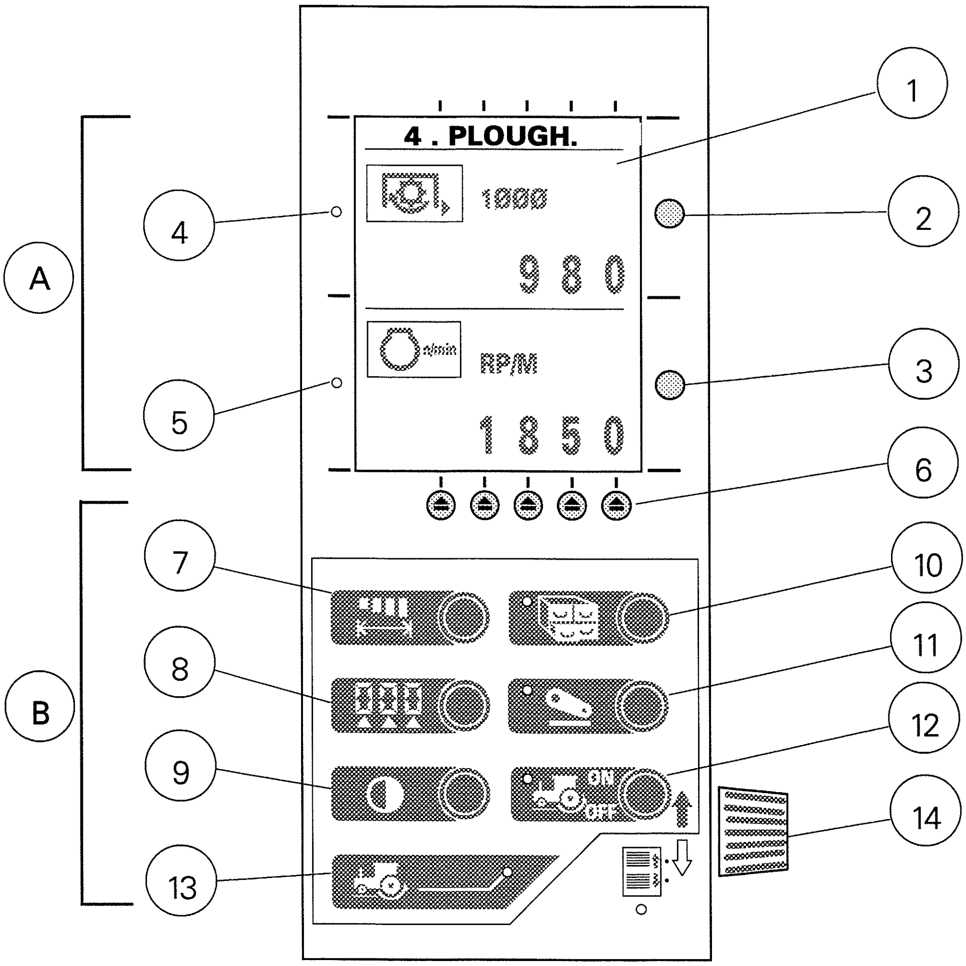


Fig. 1

A . General

The tractor performance monitor is a measuring system providing information that helps to make optimum use of the tractor. The unit is fitted on the right-hand side pillar of the cab.
The Datatronic system is offered as an optional equipment.
It can be factory fitted or dealer fitted.

The purpose of this equipment is :
1. To give to the driver a wide range of information to enable him to choose the best adjustments of the couple tractor / implement.
2. To allow the driver to keep some of these information in a memory and to print them by means of a cab-fitted printer (see "printing of the memory").
3. To control the tractor wheel slip in order to optimize the workrate, to reduce tyre wear and to limit the soil compaction.

B . Description of the screen

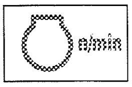
Data display

1 - Screen divided into two parts.
2-3 - Selection keys for upper and lower display.
4-5 - Red led indicating the display selected.

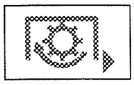
Selection of functions

6 - Keys used to change stored data
7 - Working width
8 - Reset
9 - Screen contrast
10 - Memory on/off
11 - Working position
12 - Wheel slip control
13 - Slip control indicator
14 - Selection of the 22 functions of the menu or changing of the characters after selection of one of the keys 2 or 3.

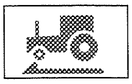
C. Symbols



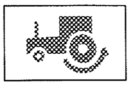
Engine speed : Instantanous engine speed in RPM.



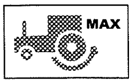
PTO 540/1000 rpm : PTO speed in rpm



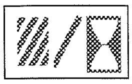
Forward speed : This is the real forward speed of the tractor in relation to the ground in KPH.



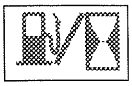
Wheel slip : This is the real rate of wheel slip as a percentage.



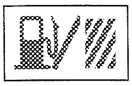
Wheel slip limit : Maximum value accepted by operator or maximum limit. Over this limit, the wheel slip control comes into action. This percentage varies unit by unit.



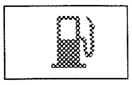
Area per hour : Area worked per hour.



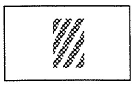
Fuel per hour : Instantaneous consumption per hour (liter, gallon).



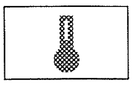
Fuel per area : Consumption per hectare or acre worked.



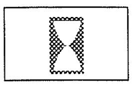
Fuel used : Total fuel used



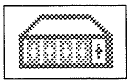
Area worked : This is the total area in acres or hectare worked but only when the implement is working.



Temperature : Digital reading of the external temperature.

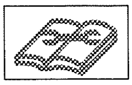


Time spent : The time accumulated when engine is running.

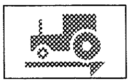


Counter : Can be used to count and memorize any unit desired (for example number of baces).

Cost per hect : In stantaneous cost per area unit worked (in local currency).



Service : Display the number of hours before the next service.



Distance : Total distance covered (meter, mile).

Clock : See additional functions section.

Date : See additional section.

Local cost : Information about the local fuel cost (must be stored).

Cost per hect : Cost per hectare is the sum of the fuel cost and the cost per hour multiplied by the work rate (hours per hectare). Must be stored.

Units : Must be selected from:
- Metric : liters, meters, kilometers, hectares, degrees celsius,
- USA : US gallons, yards, miles, acres, degrees fahrenheit,
- UK : Imperial gallons, yards, miles, acres, degrees fahrenheit.

D . Use of the screen

Active mode

Active mode

When the starter switch key is in ON position, the last data stored appears (fig. 2).

1 - Press the key 2 or 3 to access the available functions (fig. 3).

2 - Turn the knob 14 to select the function wanted.

3 - Press key 2 or 3 again to display the selection on the lower or upper part of the screen: e.g.:

Upper display : PTO speed

Lower display : Engine speed, 2 different functions can be displayed at the same time.

Note: *If the units of data displayed (french franc, US dollar, pound) do not correspond, return to the menu, select* UNITS *and press key 2 or 3.*

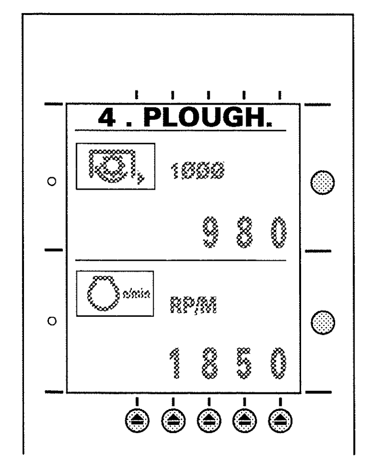


Fig. 2

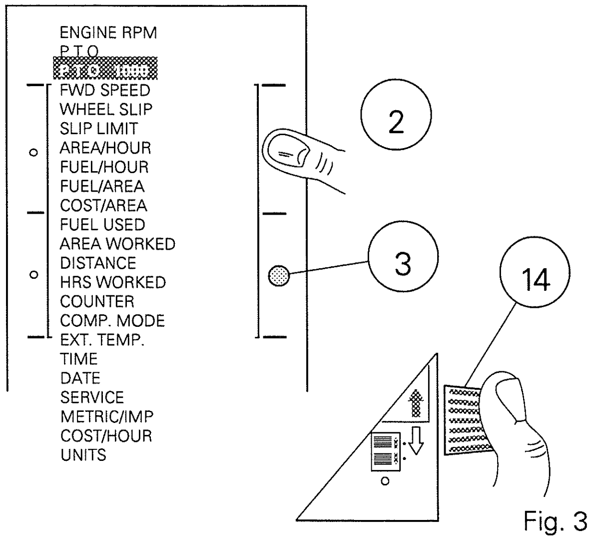


Fig. 3

MEMORY MODE (fig. 4)

The Datatronic features 4 independent memories identified by a number (1 to 4) and a name which can be introduced by the operator. It is possible to record the total work done with 4 different implements or to record the work done by four different drivers "1 SEEDER".

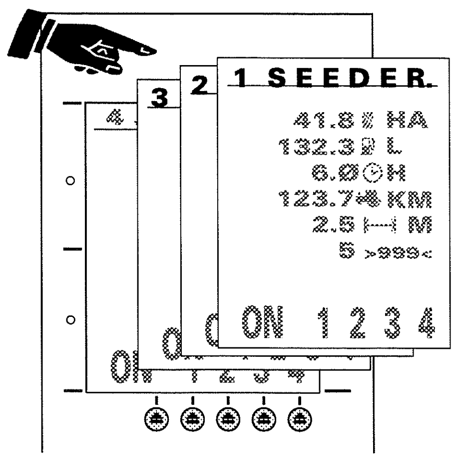


Fig. 4

CONTENTS

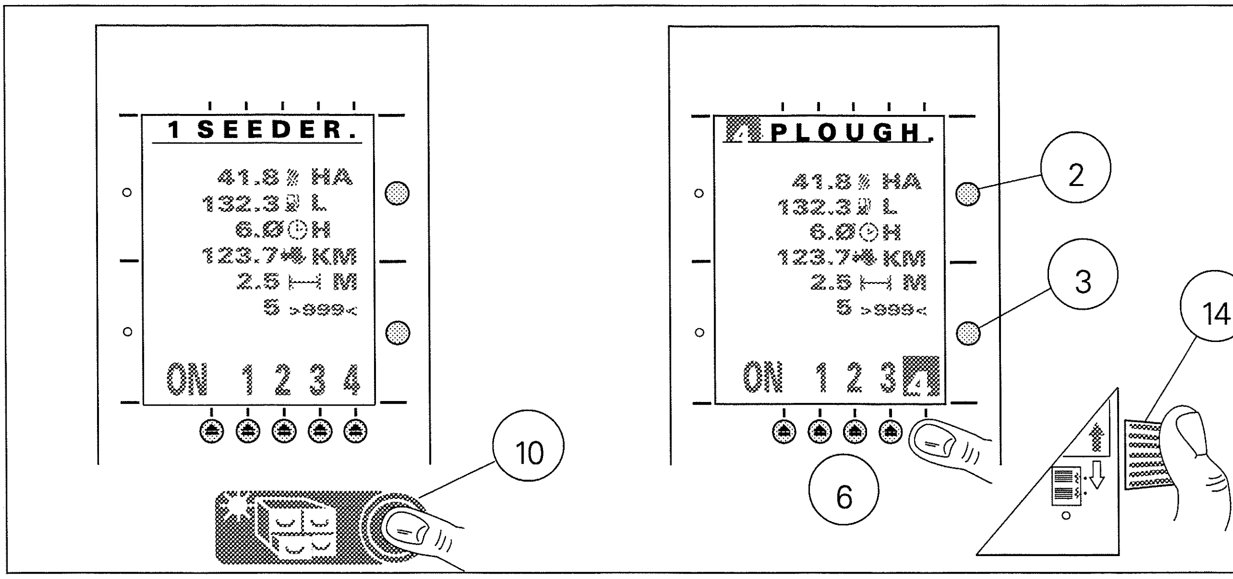


Fig. 5

Use of the memory (fig. 5 - 6)

Select the memory mode by pressing the key 10.
To change the name of this memory, press the upper selection key 2, the first character of the screen becomes dark, e.g.4plough.
Turn the knob 14 to obtain the correct figure press key 2 again, to validate the first character and select the second one.
Same method for the second, third characters.
To move the selection from right to left, press key 3.
To reset the area selected, press one of the key 6.
To reset the stored value other than the test display, press key 8.

ON/OFF Position: If you do not want to record the next work, press key C to go to the "OFF" position, the top of the screen displays "MEMORY OFF".
To return automatically to the "ON" position, press the memory key 10.

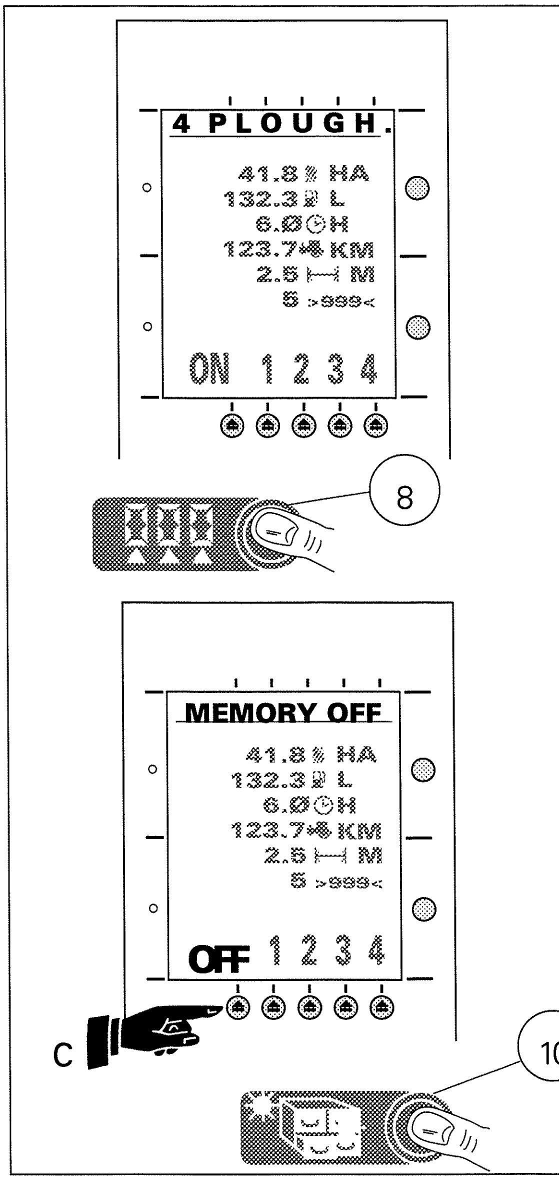


Fig. 6

Datatronic - Description

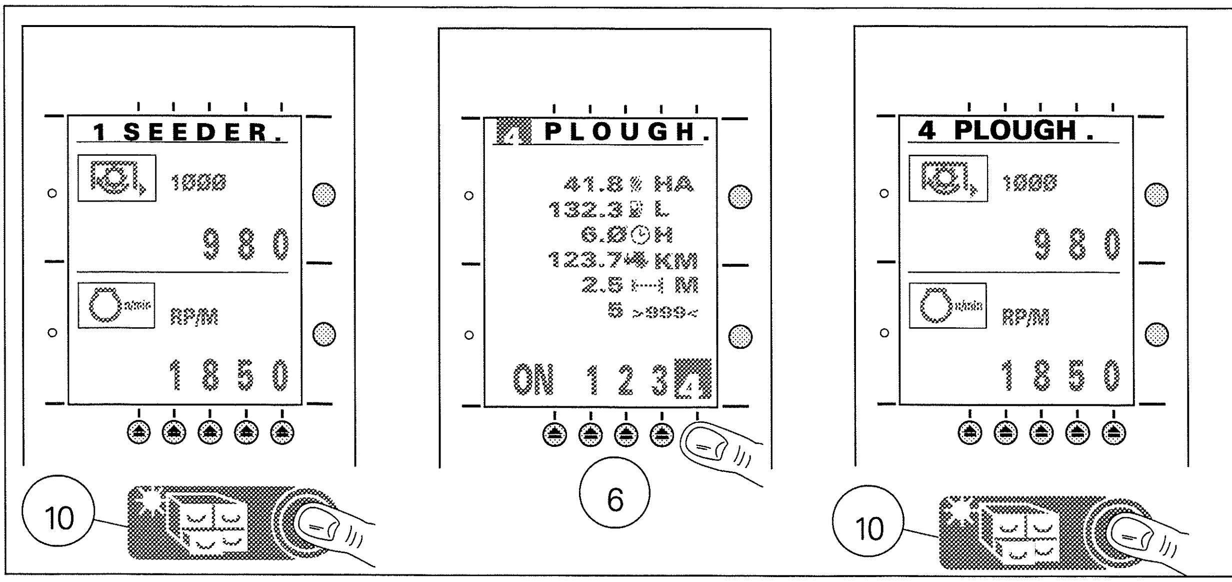


Fig. 7

Use when working

Before starting your work, select the memory that you want (1 to 4); refer to the "MEMORY MODE" section, page 4.
Press the memory key 10 (fig. 7), then press the key 6 corresponding to the memory that you want to use for your work; *the selection appears in grey.*
Press key 10 again: the pre-recorded data (name, implement, etc.) is displayed at the top of the screen.
The half-screens display the last selections stored when quitting, before selecting "MEMORY MODE".

Working position

This operating mode takes three parameters into account:
1. The PTO speed in ON/OFF position,
2. The elevation (low position) ON/OFF,
3. The coupled implement (through the auxiliary socket located in the cab).

Application:
Select the working width of the implement used by pressing key 7 (fig. 8); modify the figures by pressing the corresponding keys 6, then turn knob 14 to display new values. Press key 7 again to return to the previous screen.
***Note**: The display of the work function has priority whenever the key is pressed.*
Select the work function 11. The display appears, the work can start.

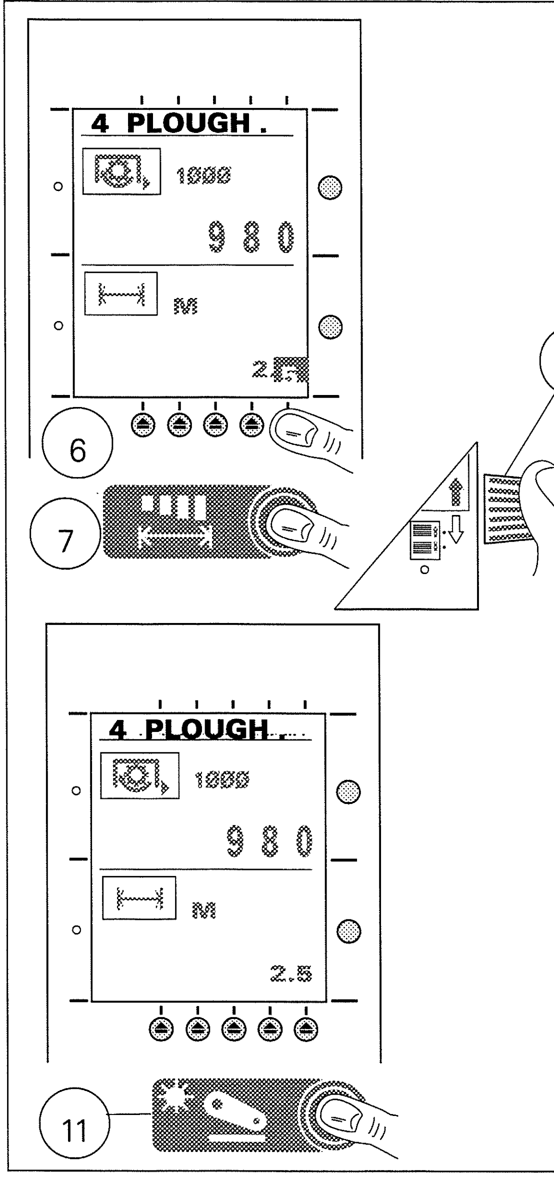


Fig. 8

CONTENTS

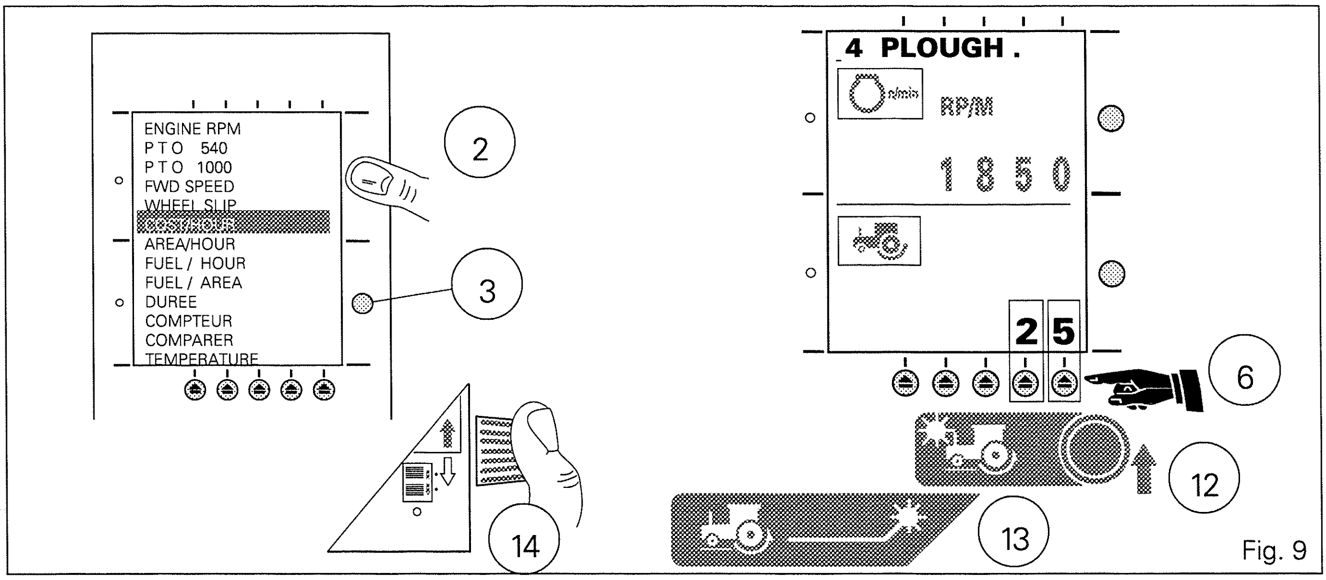


Fig. 9

Wheel slip control (fig.9)

Setting the maximum slip limit

Select SLIP LIMIT in the function menu. Press keys 6 to enter the value.

When the wheelslip control 12 is on, the system continuously compares the real wheelslip rate with the limit set by the driver.

As long as the wheelslip is less than the set limit everything happens normally. When the rate becomes greater than the pre-set threshold, the system raises the implement during the time necessary to return to a normal situation complying with the set limit, and the control on LED flashes. The system reacts in the same manner when the driver changes the height/depth setting on the elevation panel.

Comparative mode (fig. 10)

Select COMPARE in the function menu: a second menu appears.

Turn the knob 14 to select, for example, the ENGINE RPM line, and press key 2 or 3. The Datatronic displays the same function on both half-screens. The upper part displays the stored data, the lower part displays the real working data, and the LED flashes.

When the required working conditions are entered, press the memory key 10; the new data is stored in the upper window.

You can store other data (engine speed, forward speed, etc.) by carrying out the same operations.

The value is stored in memory until a new value is recorded.

To quit the comparative mode, press key 2 or 3 to return to the menu.

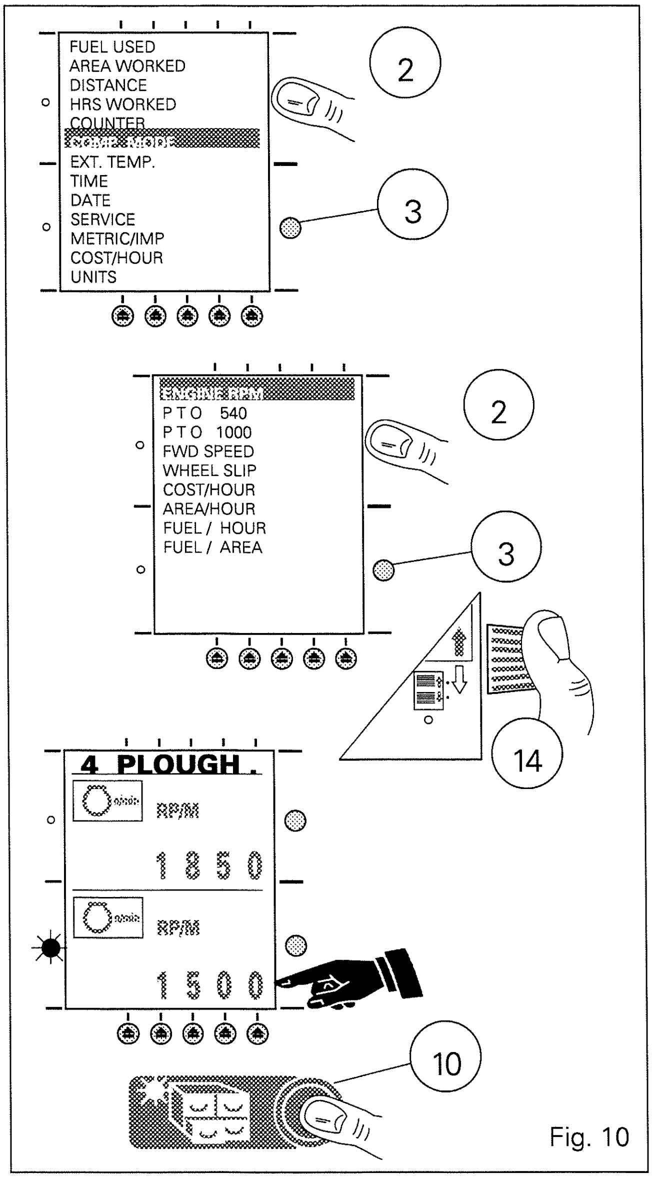


Fig. 10

Select END by turning knob 14 (fig. 11). Press 2 or 3 again, the active mode data is displayed.

E . Auxiliary functions

Clock setting (hours, minutes, seconds) (fig. 13):
Press key 2 or 3: the list of functions is displayed.
Select TIME then press 2 or 3 again; the display appears in the selected window and LED 4 or 5 is lit.
Press one of the keys 6 corresponding to the figures to modify, then turn the knob 14 to modify these figures one by one.
Proceed in the same way to update the parameters Date, Month and Year.

Screen contrast (fig. 13)
You can modify the screen contrast at any time by proceeding as follows:
Press key 9 until both LEDs 4 and 5 come on; turn knob 14 to lighten or darken the screen.
Press key 9 again or any other key to return to normal operation.

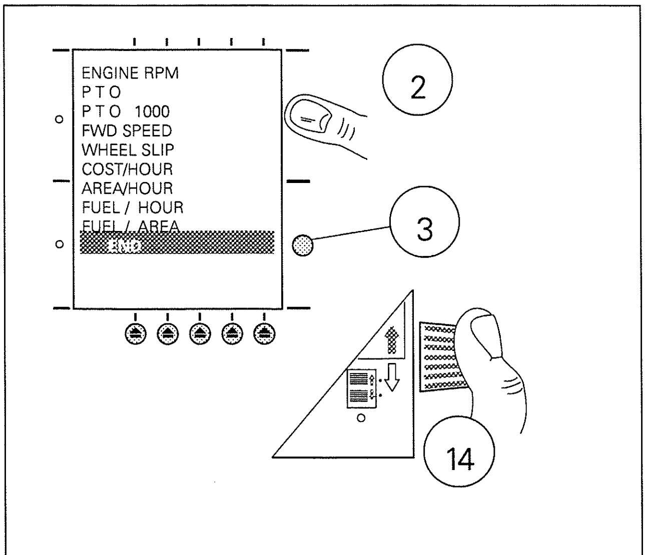


Fig. 11

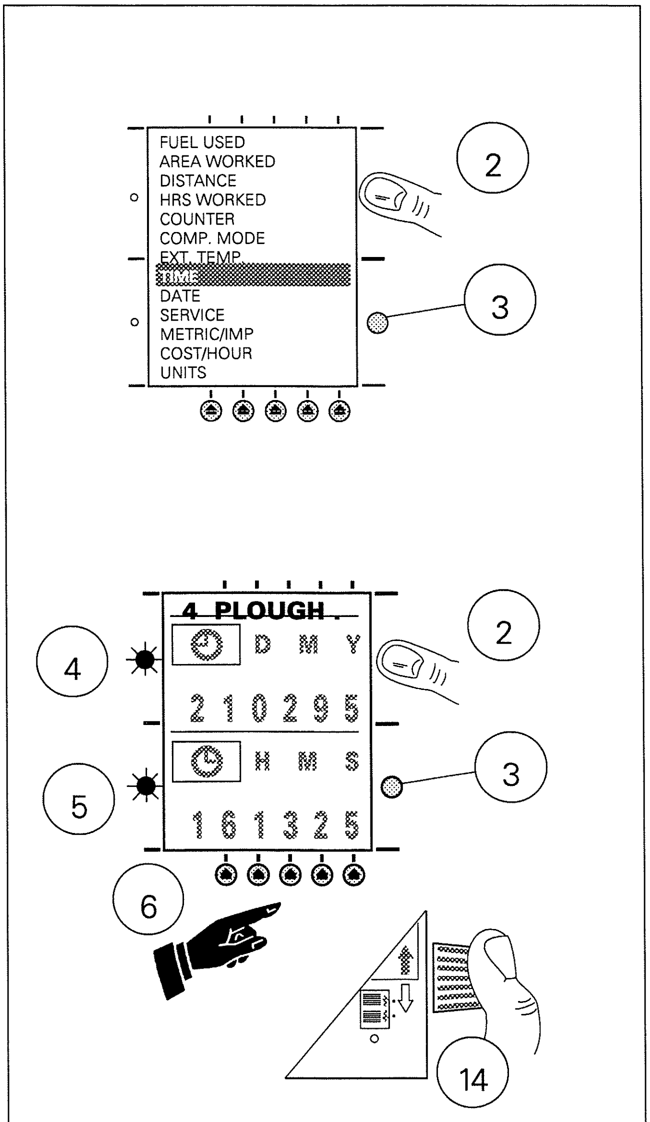


Fig. 12

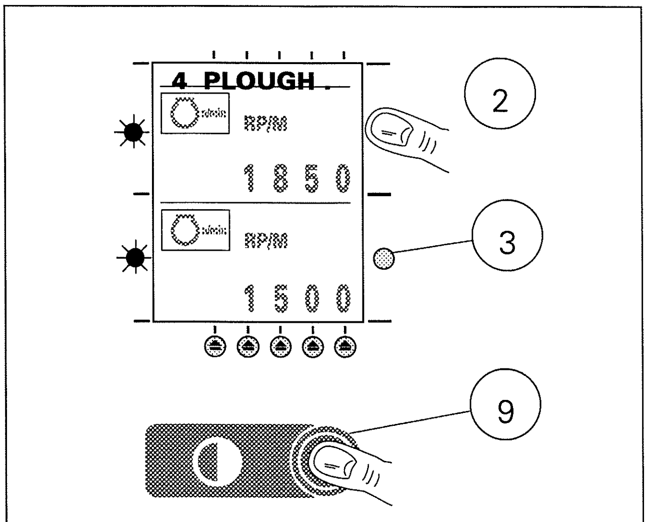


Fig. 13

Printing of the memory content (Fig. 14 - 15)

Select a HEWLETT PACKARD 82240 B compatible printer.

Fit the printer holder supplied as a kit (available from your dealer).

Remove the plastic cover under the Datatronic and install the printer, so that the infra-red readers are facing each other. Select the stored data by pressing the memory key 10, then press twice the key 6 corresponding to the memory that you want to print. The screen gradually colors; the LEDs (5 and memory 10) flash during the operation.

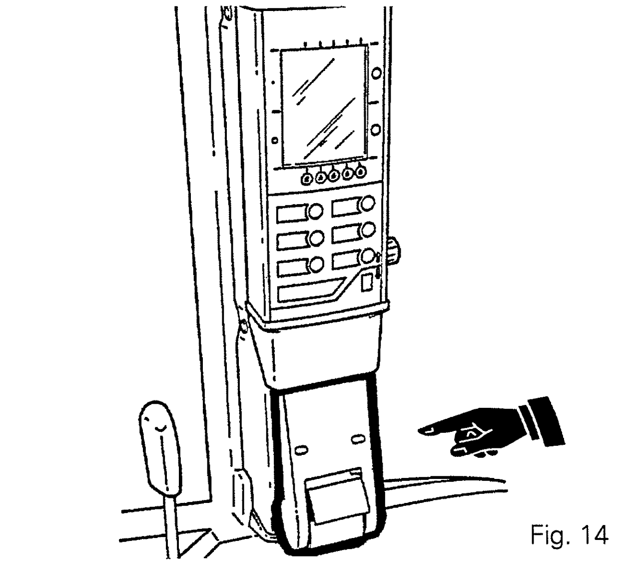


Fig. 14

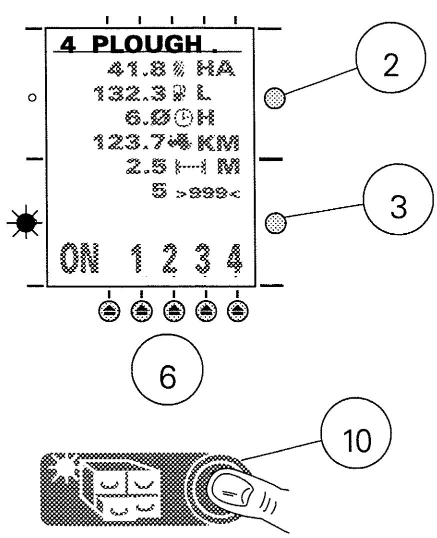


Fig. 15

11 D02 Using the tester

SOMMAIRE

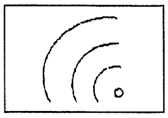
Datatronic - Using the tester

A . General

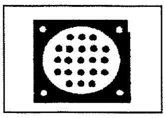
As in the case of the Autotronic unit, the Datatronic must be configured according to the specifications of the tractor it is installed on.
The tester can be used to check the various values calculated by the Datatronic system and, also, to display the menu in the tester language.

B . Symbols (icons)

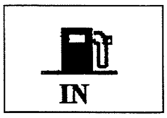
The specific Datatronic functions or components are identified by the following symbols:



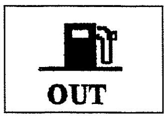
Radar



Connector



Flowmeter



Flowmeter

C . Connections

Use connection No. 4 (section 11 A01). If harness 3714780M1 is not available, use the connection shown in Fig. 1.

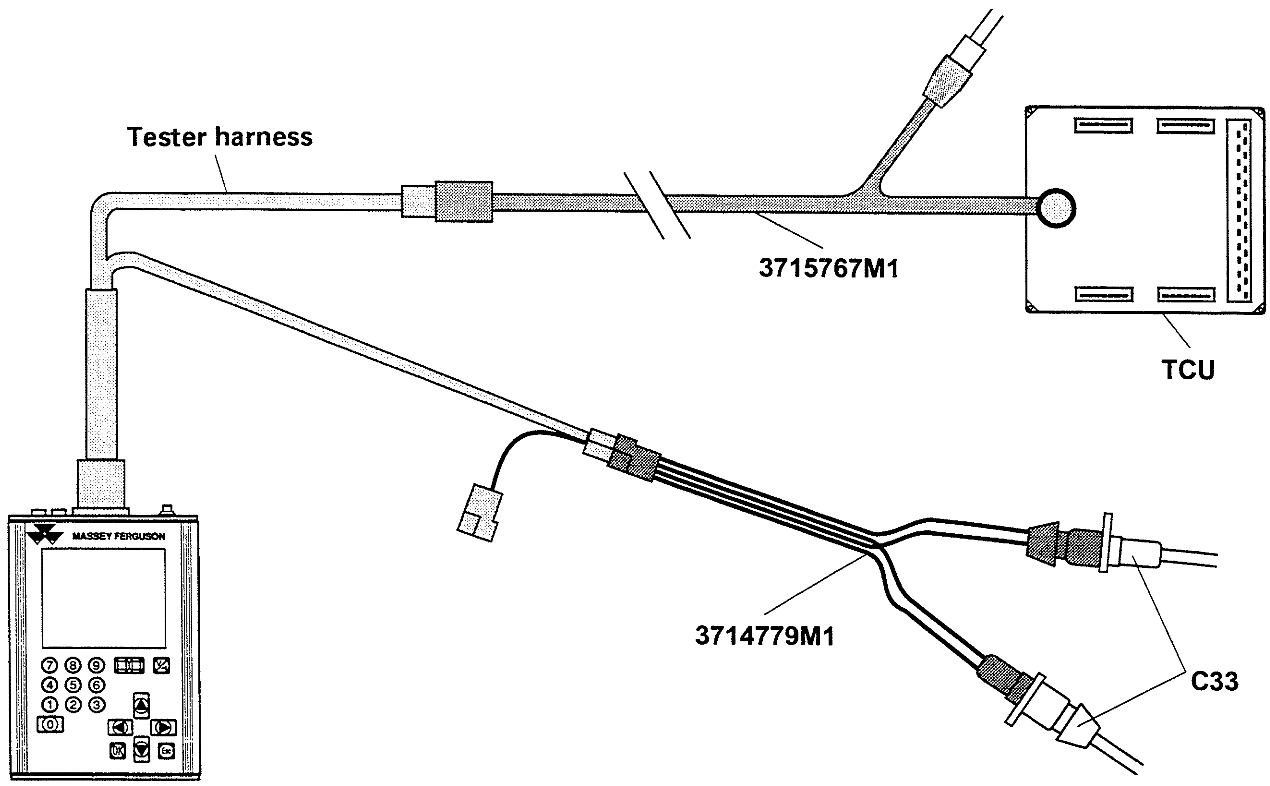


Fig. 1

Datatronic - *Using the tester*

D . Functions

Parameter

In order to supply correct data, the Datatronic unit must be parameterised with all the specifications of the tractor it is installed on.
The parameters (three-figure codes) can only be transmitted via the tester.

Frequencies

With the Datatronic option, a «communication link» can be established between an implement and the tractor by means of the 16-way connector located in the cab. As the applications are variable and numerous, a wide signal range is provided for on this connector's output:

- Engine frequency
- Radar frequency
- PTO frequency
- Forward speed sensor frequency (theoretical speed)

These signals are generated by two outputs on the Datatronic unit:

- Pin 1 (connection No. 1): Engine frequency or Radar frequency
- PPin 2 (connection No. 2): PTO frequency or Forward speed sensor frequency.

The tester allows the two outputs, Pin 1 and Pin 2, to be configured by selecting the desired frequencies and adjusting the value of the signals according to the requirements of the implement.

Test

This allows the values calculated by the Datatronic to be checked for the actual speed and instantaneous fuel consumption. For this purpose, the values of radar and theoretical forward speeds and the outward and return fuel flow rates.

Translation

This allows the menu on the tractor computer to be displayed in the tester language.

Datatronic - Using the tester

E . Operating procedure

Switch on for connection No. 4.
For the connection with harnesses 3714779M1 and 33715767M1, power supply is direct.

This screen allows the selection of the circuit to be tested. Use the cursor arrow keys to position the grey bar on Datatronic.
Press OK.

AUTOTRONIC

DATATRONIC

ELECTRONIC LINKAGE

OK ▲ ▼

The tester indicates the operating software issues stored in the tester and the Datatronic unit.
Press OK.

OPER. SOFT. ISSUE

TESTER	:	D950700
DATATRONIC	:	D950202

OK ESC

Parameter

The tester offers the following choice: parameter, test, translation.
Select «Parameter».
Press OK.

PARAMETER

TEST

TRANSLATION

OK ▲ ▼ ESC

Datatronic - *Using the tester*

This screen is used to select either parameterisation or output frequencies.
Select «Parameter».
Press OK.

PARAMETER

OUTPUT FREQUENCIES

OK ▲ ▼ **ESC**

The tester reads the code installed in the Datatronic unit and displays «OLD».
Enter the three-figure code of the tractor the Datatronic unit is installed on.
The code is displayed opposite the word «NEW».
See the parameterisation table.
Press OK.

CODE

OLD : 210

NEW : _

0 - 9 **OK** ◀ **ESC**

When the code has been entered, the tester checks its structure.
If the code is not correct, the tester displays an error message (see Section 11 A01).
If the structure is correct, the tester asks for confirmation of the code and the message «Code correct» is displayed.
Press OK.

CODE

OLD : 210

NEW : 210

CODE CORRECT

0 - 9 **OK** ◀ **ESC**

The function selection screen is redisplayed.

PARAMETER

TEST

TRANSLATION

OK ▲ ▼ **ESC**

Switch off and then switch on again to validate and return to the first menu (reboot).

Datatronic - Using the tester

Parameter coding

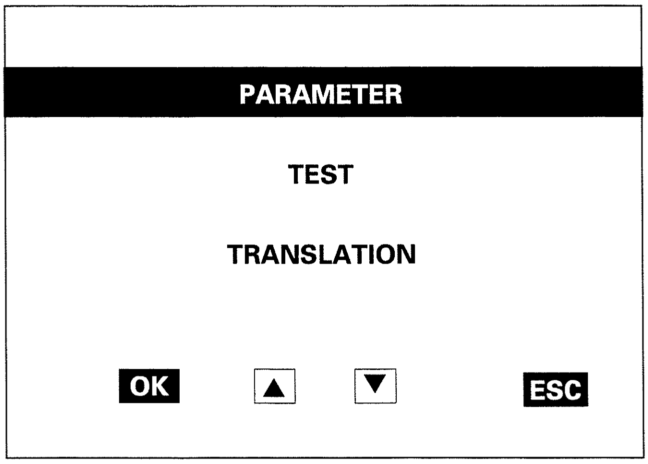
The parameter code is made up of three figures. The first two figures indicate the tractor model and are identical to those for Autotronic II parameters. The latter can easily be identified by means of the label bonded onto the fuse box. The list of parameters corresponding to the tractor model (code AA) is also included in section 11 C04. **Take care to check the serial number.**
The third figure corresponds to the Dual Control option which is now managed by Datatronic, so it is necessary to specify whether this option is installed or not.
If the Dual Control option is installed, enter 1.
If the Dual Control option is not installed, enter 0.
For information, the table below specifies the programmed values for a rated engine speed of 2,200 rpm.

Code	Nbr signals / engine rev.	Nbr signals / 10 km/h	Radar signals / 10 km/h	PTO 540/750 rpm	PTO 1,000 rpm	Outward fuel	Return fuel
00	73	108	273	103	56	1	1
01	73	111	273				
02	73	106	273	103	56	1	1
03	73	115	273	103	56	1	1
04	73	114	273	103	56	1	1
05	89	125	273	107	61	1	1
06	89	142	273	107	61	1	1
07	89	125	273	107	61	1	1
08	89	138	273	107	61	1	1
09	89	136	273	107	61	5	5
10	89	146	273	107	61	5	5
11	89	146	273	107	61	5	5
12	89	125	273	99	78	1	1
13	89	142	273	99	78	1	1
14	89	125	273	99	78	1	1
15	89	138	273	99	78	1	1
16	89	136	273	99	78	5	5
17	89	146	273	99	78	5	5
18	89	146	273	99	78	5	5
19	77	108	273	103	56	1	1
20	77	106	273	103	56	1	1
21	77	115	273	103	56	1	1
22	77	114	273	103	56	1	1
23	89	146	273	107	61	5	5
24	89	146	273	99	78	5	5

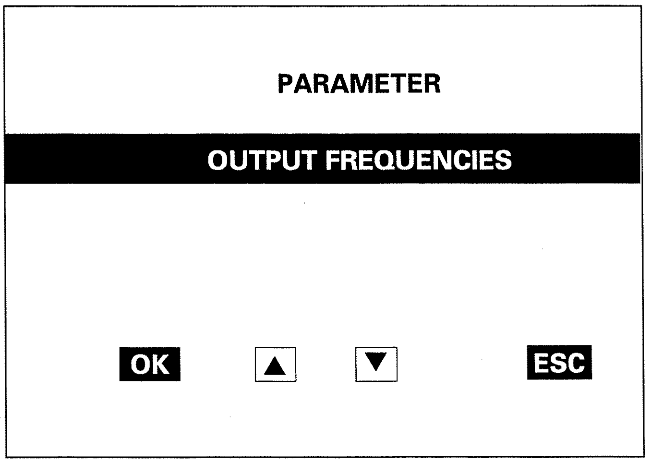
Output frequencies

Use the keyboard to return to the «Parameter screen».

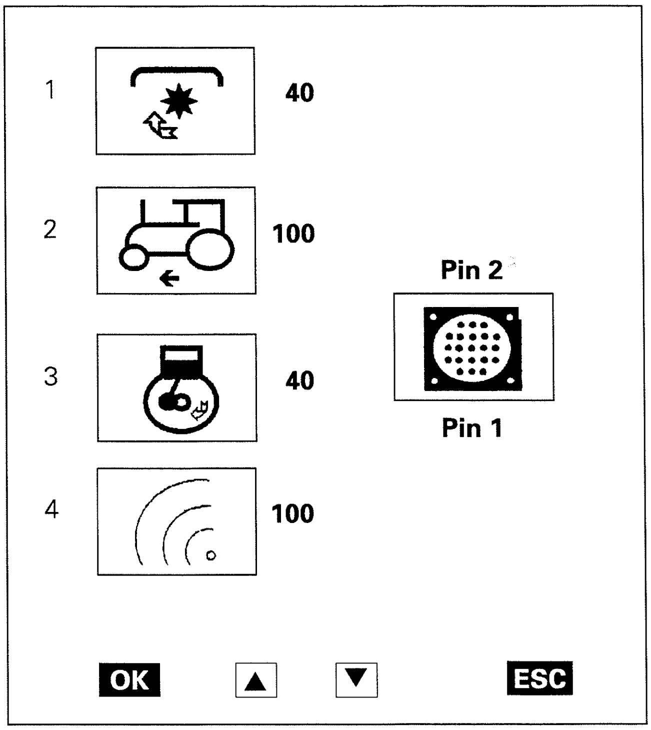
This screen is used to select either parameterisation or output frequencies.
Choose «Parameter».
Press OK.



This screen is used to select either parameterisation or output frequencies.
Choose «Output frequencies».
Press OK.



1 - PTO frequency
2 - Theoretical forward speed frequency
3 - Engine frequency
4 - Radar frequency



Datatronic - Using the tester

Using the keys

▲ ▼ To move the arrow opposite one of the four icons.

OK To validate the selection of an icon. The selection is defined by the position of the arrow. When validated with the OK key, the icon indicated by the position of the arrow changes state and the value displayed opposite it is cleared. The tester is then ready to receive new data.

Modifying the value of frequencies

The figure indicated opposite each icon actually corresponds to a multiplying coefficient used by the Datatronic unit to generate an output frequency on the basis of a reference frequency originating from a tractor component.

For engine speed and PTO frequencies:

$$\mathbf{F = \frac{N}{60} \times Y}$$

F = frequency (Hz)
N = rpm
Y = Hz/rpm = revolution coefficient.

Coefficient **Y** for revolution speed must be between 40 and 60.

For radar and forward speed frequencies:

$$\mathbf{F = \frac{V}{10} \times Z}$$

F = frequency (Hz)
V = km/h
Z = Hz/km.h = linear coefficient

Coefficient **Z** for linear speed must be between 100 and 400.

Example: If a PTO speed is selected with a revolution coefficient **Y** of 40, an output frequency of 400 Hz is obtained for a speed of 600 rpm.

$$\mathbf{F} = \frac{600 \text{ rpm}}{60} \times 40 = 400 \text{ Hz}$$

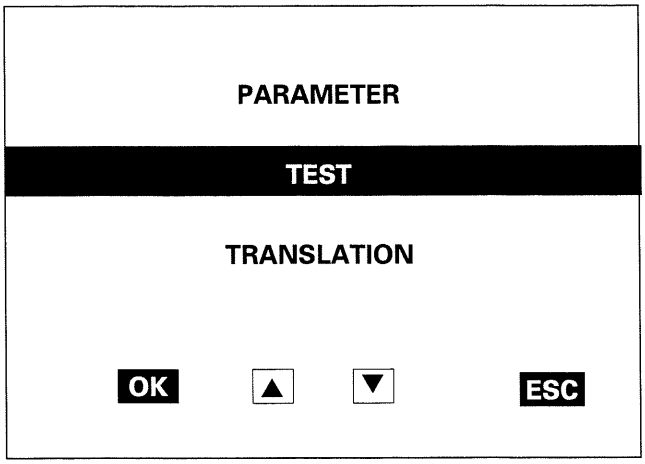
Caution:
If one of the frequencies has been selected but the specified value of the coefficient is not correct, the ⚠ icon is displayed to indicate that the value cannot be accepted.

Clear the incorrect value by pressing OK.
Enter the correct value and press OK.
To quit: press ESC.

Datatronic - *Using the tester*

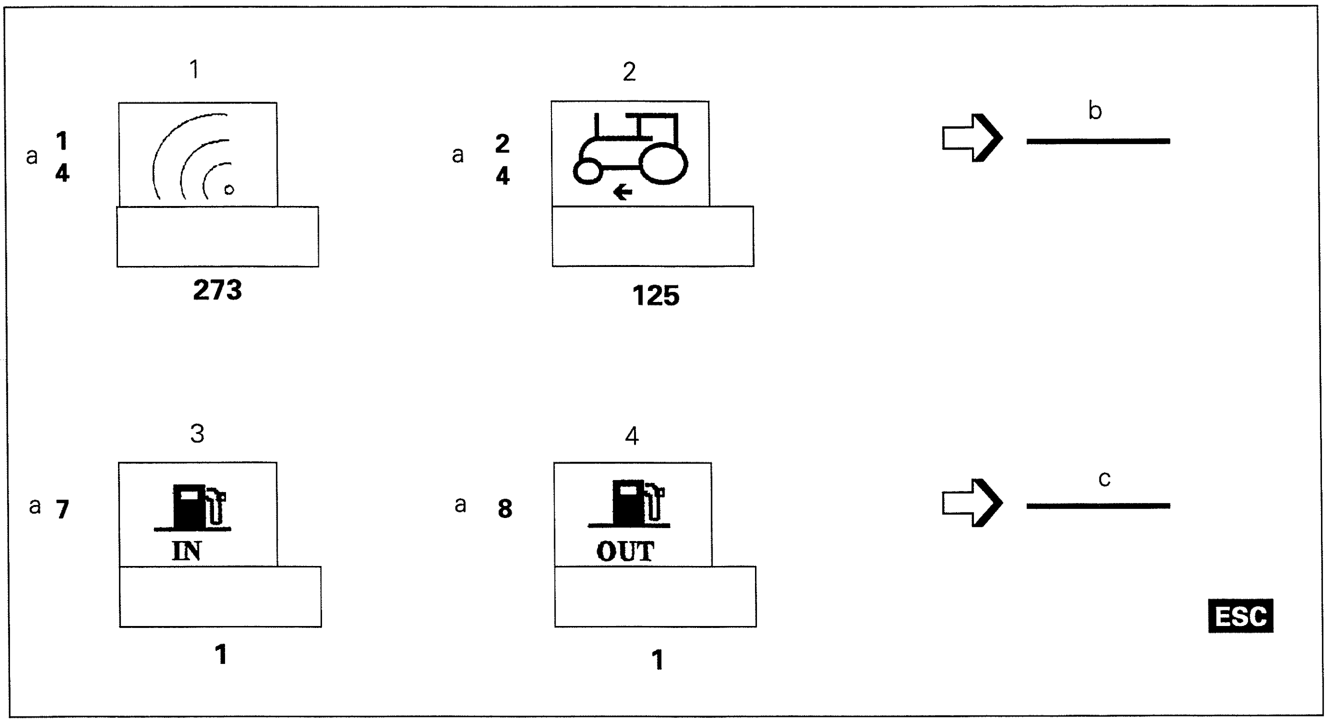
Monitoring the calculated values

The tester offers the following choice: parameterisation, test or translation.
Select «Test».
Press OK.



1. Radar frequency
2. Theoretical forward speed frequency
3. Flowmeter frequency: input flow rate
4. Flowmeter frequency: return flow rate

a. Pin No. on 29-way connector
b. Speed displayed on tractor computer
c. Fuel consumption per hour displayed on the tractor computer



Display

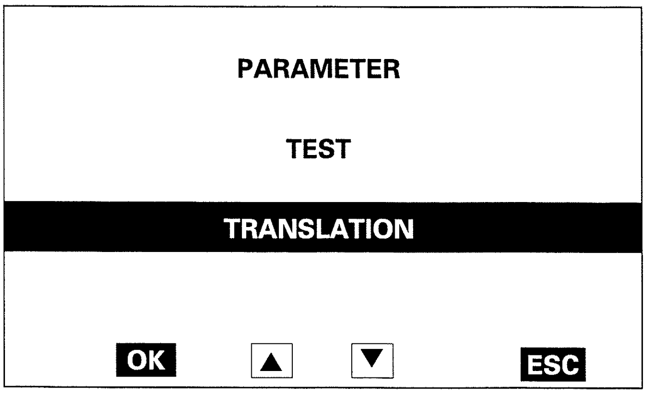
When the tractor is travelling at less than 1 km/h, the actual speed is zero (radar precision) and only the theoretical speed is displayed.
When the tractor is travelling at more than 1 km/h, the actual speed is displayed with allowance for effective wheel slip.
If both speeds are greater than 20 km/h and there is a difference of 10% between them, it is the theoretical speed that is displayed directly (incorrect wheel diameter or driving in puddle).

The display of flow rates varies according to the effective consumption of the engine (position of accelerator, load applied, etc.). Display **c** on the extreme right-hand side is equal to the difference between the input and the output.
This must remain true in all cases. Otherwise, it means that there is a problem either on the flowmeter (internal fouling, fault on electrical connections) or the parameterisation is wrong.

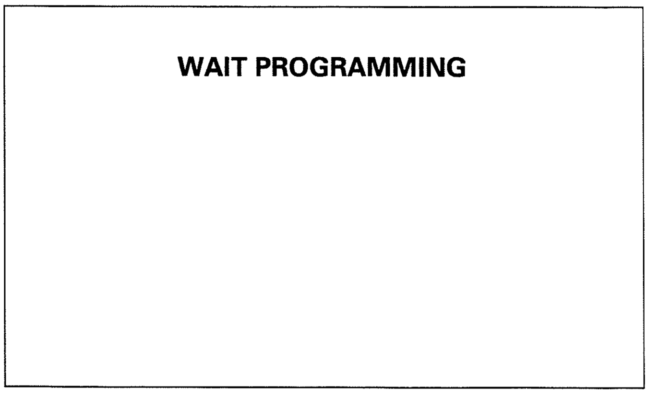
Datatronic - Using the tester

Translation

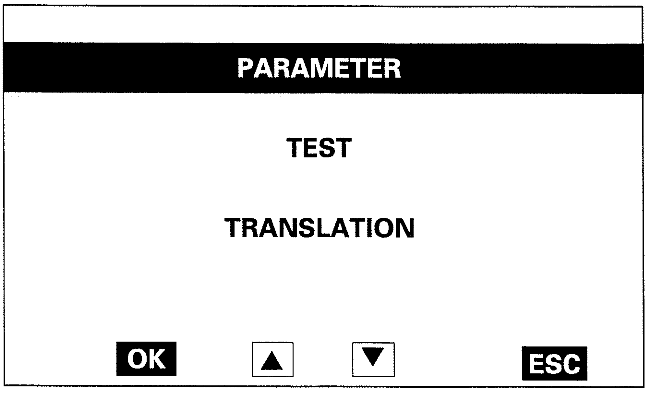
The tester offers the following choice: parameterisation, test or translation.
Select «translation».
Press OK.



The translation of the whole text displayed on the Datatronic screen is being transferred from the tester to the Datatronic unit.
The language used is the same as that used by the tester.



The transfer has been completed.
Automatic return to the function selection screen.



Switch off in order to validate the transfer.

12 . CAB AND EQUIPMENT

Contents

12 A01 Instrument panel

CONTENTS

Cab - *Instrument panel*

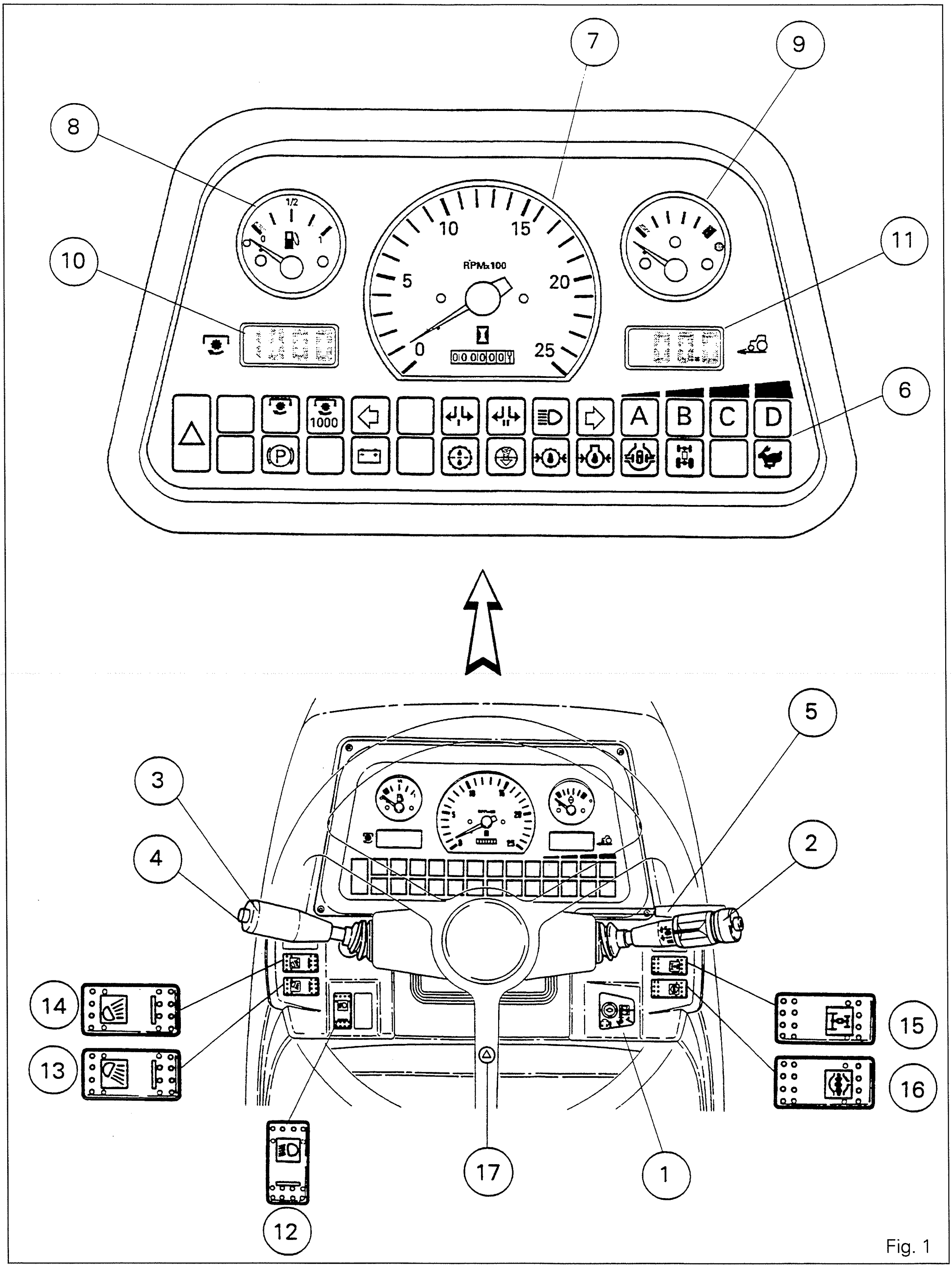


Fig. 1

Cab - *Instrument panel*

A . Description (Fig. 1)

1. **Starter switch - 4 positions**
   1 - Stop
   2 - On normal position for running the engine, but which also allows for the electrical equipment to be used when the engine is not running.
   3 - Heat
   4 - Start
2. **Direction indicator, light, horn, wiper and washer switch**
3. **Dynashift control lever**
4. **Not used**
5. **Steering wheel adjustment**
6. **Warning lights panel (see detail Fig. 2)**
   All the warning lights are coming on during a few seconds when the ignition is put on. This allows to check they all work correctly.
7. **Tachometer/hourmeter**
   The tachometer shows the engine speed in hundreds of revolutions per minute.The hourmeter shows the total number of working hours.
8. **Fuel gauge**
9. **Temperature gauge**
   The green zone shows the limits for the normal operating temperature. Stop the engine if the needle moves into the red zone.
10. **Digital display of PTO speed**
11. **Digital display of forward speed**
12. **Side rear lights and dipped beam switch**
13. **Rear work lamps switch** (after switching on side lights)
14. **Front work lamps switch** (after switching on side lights)
15. **Four-wheel-drive control switch**
16. **Differential lock control switch**
17. **Hazard warning light control button**

B . Warning lights panel (Fig. 2)

1. Failure warning light (red)

This light comes on at the same time as the (red) warning lights. If it comes on, stop the tractor immediately and look for the causes of the failure.

2. Not used

3. Handbrake warning light (red)

4. Not used

5. Alternator charge warning light (red)

This charge warning light comes on when the starter switch key is in the "On" position but with the engine not started. The light should extinguish when the engine starts and the starter switch key is returned to the "On" position. If the warning light comes on when the engine is running, identify the cause of the failure (see section 10 A01).

6. Not used

7. Transmission oil filter warning light and lubricating pressure warning light (red).

If this light remains on after starting the engine, check the lubricating filter and circuit. If the problem persists after changing the filter, identify the cause of the failure :
- Hydraulic (see section 9)
- Electric (see section 10 A01)

8. Air cleaner warning light (red).

9. Transmission oil low pressure warning light (red).

If this warning light illuminates during operation,identify the cause of the failure :
- Hydraulic (see section 9)
- Electric (see section 10 A01)

10. Engine oil pressure warning light (red)

This warning light illuminates when the key is in the "On" position, but it should extinguish when the engine starts. If the warning light stays on when the engine is running, investigate the reason for the loss of pressure.

11. Differential lock warning light (yellow)

12. Four-Wheel-Drive engaged warning light (green)

13. Not used

14. Hare warning light (green)

15. Ratio speed warning light Dynashift : A to D (green)

16. Tractor direction indicator warning light (green)

17. Main beam warning light (blue)

18. Direction indicator warning light for the second trailer (green)

19. Direction indicator warning light for the first trailer (green)

20. Not used

21. 1000 RPM P.T.O warning light (yellow)

22. 540 or 750 RPM P.T.O warning light (yellow) (according to option)

23. Not used

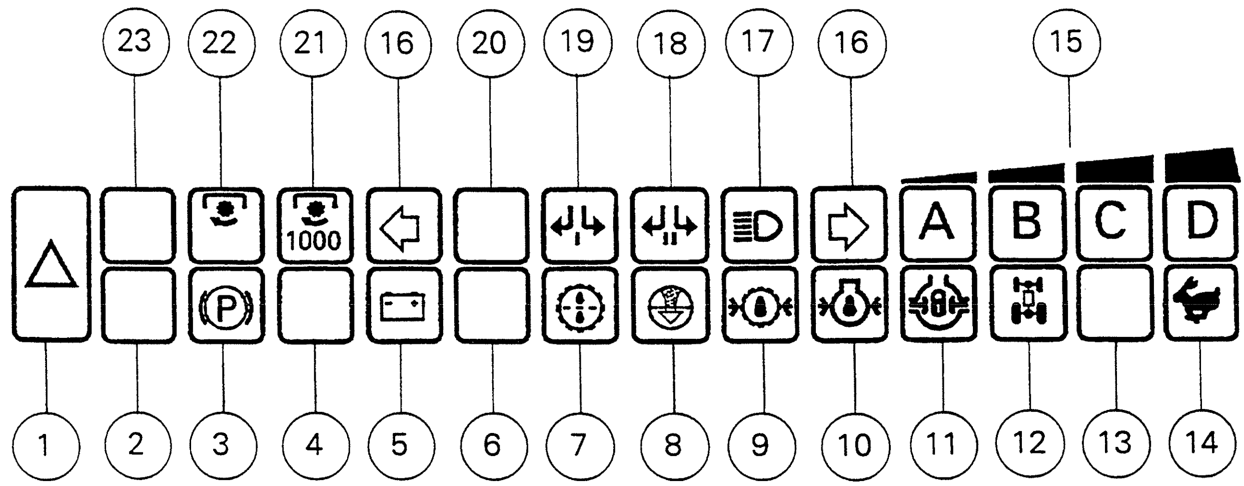


Fig. 1

C . Digital display of PTO speed and forward speed

The digital display depends on the programming of the dashboard electronic calculator.

1. PTO speed

The digital display shows the speed of the PTO selected (540 or 750 or 1000 RPM) measured by the PTO sensor when the small in-cab switch (Fig. 3) is on the position related to the PTO used and when the corresponding warning light is on.
The calculator is programmed to the tractor PTO specifications

2. Forward speed

The digital display shows the travel speed measured by the forward speed sensor or the speed measured by the radar (when fitted).
The calculator is programmed according to the average rolling circumference of the wheels per model for a standard tyre combination.

3. Programming

The calculator is programmed by means of eight micro-swithces numbered from 1 to 8 and located on the electronic card inside the dashboard, they are accessible from the back of the latter (Fig. 4).
The micro-switches can be :
- open (off = 0 (number way))
- closed to earth (on = 1)

The micro-switches No 1 to 5 correspond to the model and are used for the forward speed programming (see chart § 5, column (1)).
Note : When the tyre combination is not standard, it is possible to modify the standard programming to reduce the margin between the theoritical travel speed shown and the real travel speed (see § 4 and 5).
The micro-switches No 6 and 7 correspond to the PTO :
- 01 = PTO 540 - 1000 RPM
- 10 = PTO 750 - 1000 RPM

The micro-switch No 8 correspond to the choice between miles or kilometers :
- 0 = Mph
- 1 = Kph

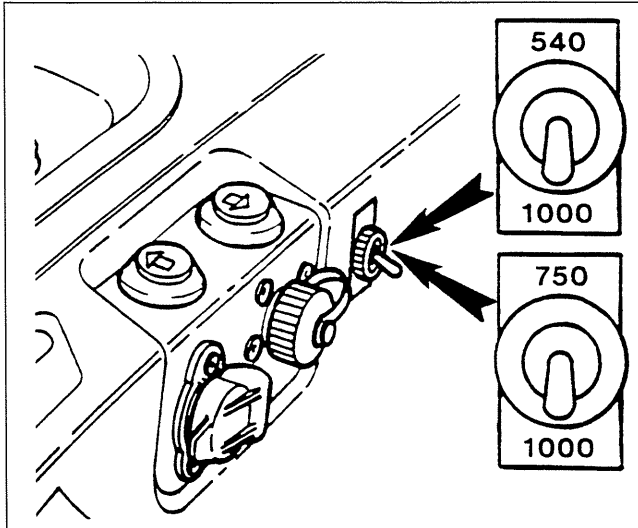


Fig. 3

4. Modification of the forward speed programming

- Remove the upper and lower dashboard trim panels.
- Disconnect the three harness connectors and remove the dashboard.
- Remove the black plug from the back of the dashboard to have access to the micro-switches.
- Using a screwdriver, position the micro-switches No 1 to 5 following the programming codes defined in chart § 5 :
  . column (2) for a tyre combination with smaller rolling circumferences.
  . column (3) for a tyre combination with larger rolling circumferences.
- Refit the black plug.
- Connect the harness connectors (Fig. 4).
- Refit the dashboard and its trim panels.

Cab - Instrument panel

5. Programming chart for the forward speed shown by the dashboard digital display.

Models	(1) Standard tyre programming						(2) To increase the speed shown						(3) To decrease the speed shown					
	1	2	3	4	5	N	1	2	3	4	5	N	1	2	3	4	5	N
8110-8120-8130 ND	0	1	0	1	0	126.6	1	0	0	1	0	121	1	1	0	1	0	132.6
8110-8120 HD	1	0	1	1	0	145.3	0	0	1	1	0	138.8	0	1	1	1	0	152.2
8130-8140 HD	0	0	1	1	0	138.8	1	1	0	1	0	132.6	1	0	1	1	0	145.3
8150-8160 DR	1	0	1	1	0	145.3	0	0	1	1	0	138.8	0	1	1	1	0	152.2

N = Number of pulses/sec. from the sensor (in Hertz) for 10 Kph (6.24 Mph)
Final reductions : ND = Normal Duty - HD = Heavy Duty - DR = Double reductions

Connection of the dashboard harness :
A = 25 way black connector
B = 7 way black connector
C= 7 way grey connector

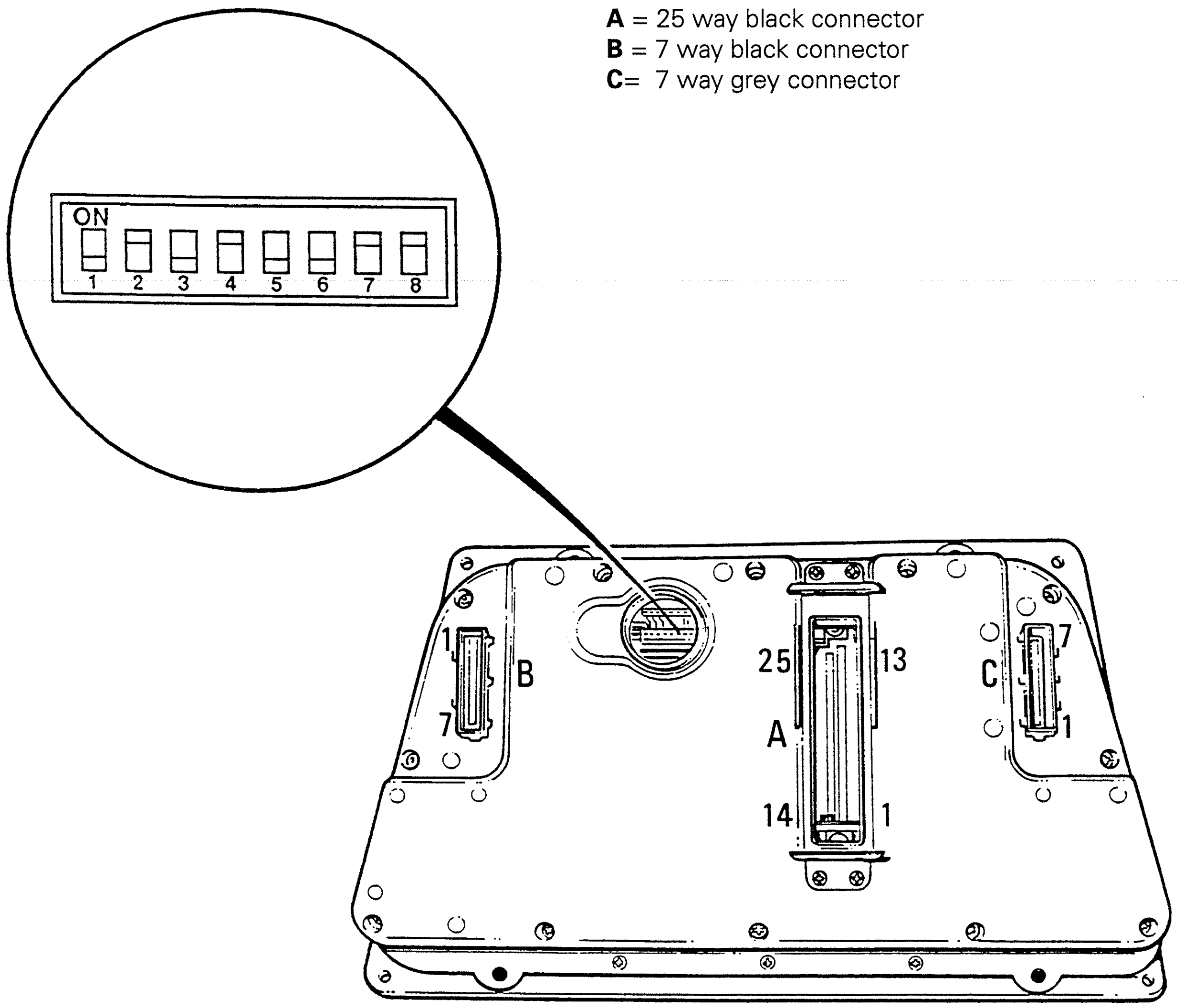


Fig. 4

12 B01 Air conditioning

CONTENTS

A. General

Suitable control of the internal environment of the cab of an agricultural implement requires:
- that the temperature and humidity in the cab should be within a range that is compatible with human comfort,
- the supply of fresh filtered air to keep the cab under pressure and to prevent the ingress of impurities,
- the de-icing of windows to ensure visibility in all directions.

Moreover, the distribution of air should be such that no difference in temperature can be detected within the cab, especially over the body surface of the driver.

In addition, the air conditioning system must be designed to withstand mechanical stresses caused by the numerous impacts and vibrating stresses associated with applications in the context of agricultural work.

Finally, it is of critical importance that the system should operate satisfactorily in the muddy and dusty conditions associated with agricultural work. The equipment must also be capable of operating in positions corresponding to an angle of tilt that may reach 16° from the horizontal.

The cooling principle

There is no known method of producing cold: only the absorption of heat is possible. Air conditioning is a process by which heat is taken out of the air. Temperature is measured by the quantity of heat in a given substance. Like water, which always runs from a high point to a low point, heat always «runs» from a hot body to a cold body. Consequently, in order to condition the air or absorb heat from the air in a cab, the warm air must be placed in contact with a cold surface.

It is a physical property of liquids that they boil or evaporate at a specific temperature when at a given pressure.

In the vaporising process which takes place at a constant temperature, the liquid absorbs a considerable amount of heat. One example is that, at normal atmospheric pressure, water boils or vaporises at 100°C (212°F). A considerable quantity of heat can be absorbed by the water but its temperature will not rise. The same principle applies if heat is removed: steam returns to the liquid state or liquids become solid. When pressure is controlled in a closed circuit, a liquid can be maintained at low pressure and with a low boiling point. During vaporisation, the liquid absorbs heat from its environment.

The cooling cycle

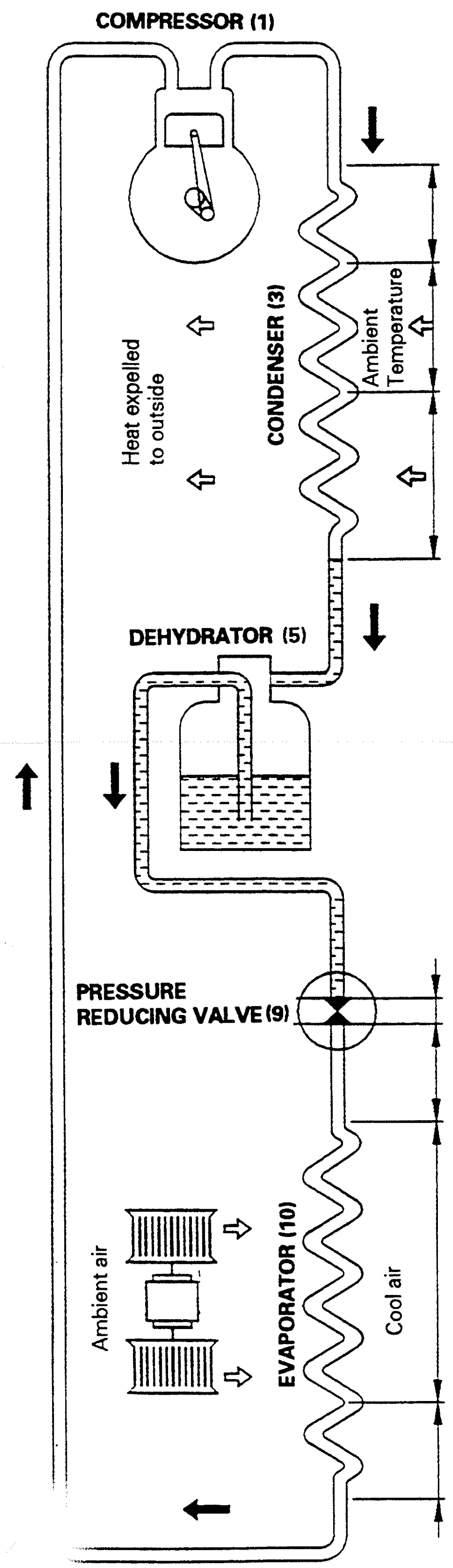
Air conditioning in the cab is provided by means of a ventilation system. During cold weather, the cab is supplied with filtered air that has been heated by pipes containing hot water from the engine. When the ambient temperature is too high and makes it uncomfortable to drive the tractor (in the summer), a compressor-based cooling system allows the temperature in the cab to be reduced by several degrees. In an air conditioning unit, a refrigerant circulates in a closed circuit under pressure. This refrigerant is the R134a (HFC). At specific points in the circuit, the gas is subjected to pressure and temperature modifications.

A compressor, which is belt-driven by the engine, sucks in vapour to maintain a low pressure on the upstream side in the evaporator and compresses the resulting gaseous refrigerant by directing it to a cooling unit known as the condenser. The passage of air across the condenser located in front of the engine water radiator cools and condenses the gaseous refrigerant. The refrigerant which has become liquid is filtered. Humidity and impurities are removed by a filter which also has the function of acting as a temporary reservoir. This filter is known as the receiver-drier.

The liquid R134a refrigerant under high pressure is directed to the expansion valve which governs the liquid's flowrate. The pressure is relieved, bringing about a considerable drop in temperature and pressure. The liquid under low pressure starts boiling and evaporating in a heat exchanger or evaporator. The warm, humid air in the cab is pulsed through the evaporator by turbine fans, cools on contact and is driven into the cab. The humidity in the air condenses in the evaporator and is discharged outside the cab through pipes. The cycle is completed when the gas is returned to the compressor.

According to the desired temperature in the cab, a thermostat with an «off» position causes the compressor to be automatically engaged and disengaged by means of an electromagnetic clutch.

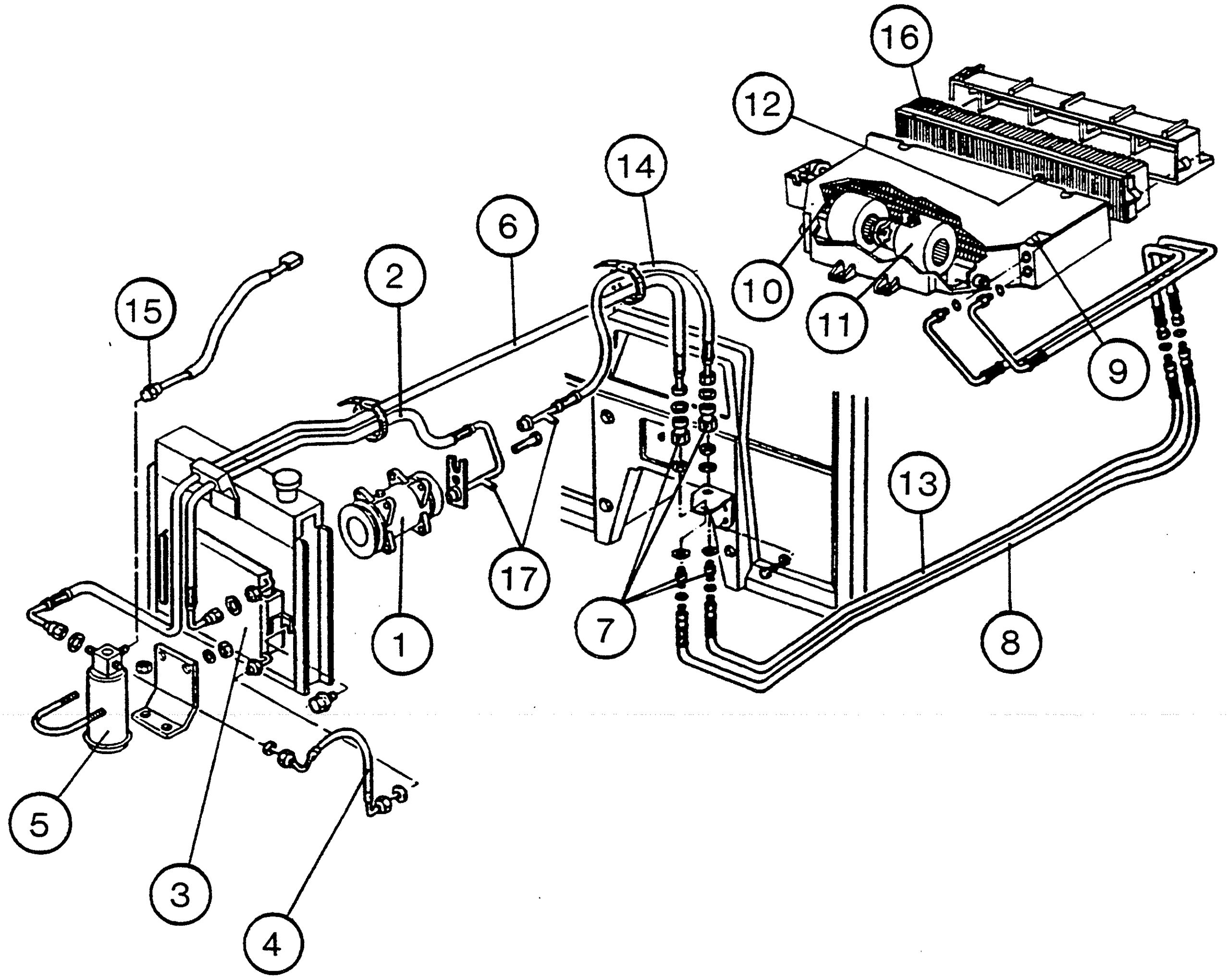
B. Schematic diagram



Points on circuit	State of fluid	Pressure	Tempe-rature	Remarks
Compressor	vapour	Switches from low to high	Switches from low to high	This procedures vapour at high pressure and high temperature
Compressor outlet condenser inlet	vapour	High	High	-
Condenser	vapour + liquid	High	Switches from high to medium	Under the action of outside air, the vapour is liquefied and heat is expelled to the outside. This exchange is assisted by motor-driven fans.
Condenser outlet Receiver-drier Expansion Valve inlet	liquid	High	Medium	Allows the removal of humidity from the circuit and the evaluation of circuit filling level.
Expansion valve	liquid + vapour (≥ 20%)	Switches from high to low	Switches from medium to low	Reduction of the fluid's pressure causes a drop in pressure and temperature, resulting in vaporisation of some of the liquid (≥ 20 %)
Expansion Valve outlet Evaporator inlet	liquid + vapour	Low	Low	-
Evaporator	liquid + vapour	Low	Low	The liquid changes to the vapour state by absorption of the heat contained in the cab air. This has a cooling effect which is assisted by the blower system
Evaporator outlet Compressor inlet	vapour	Low	Low	

Cab - *Air conditioning*

Fig. 1



List of parts

(1) Compressor with electromagnetic clutch
(2) High-pressure pipe (compressor to condenser)
(3) Condenser
(4) High pressure pipe (condenser to receiver-drier)
(5) Receiver-drier
(6) High pressure pipe (receiver-drier to quick coupler)
(7) Quick couplers
(8) High pressure pipe (quick coupler to expansion valve)
(9) Expansion valve
(10) Evaporator (integrated in heating system)
(11) Motor fan
(12) Thermostat
(13) Low pressure pipe (evaporator outlet to quick coupler)
(14) Low pressure pipe (quick coupler to compressor)
(15) High / Low pressure switch
(16) Cab filter
(17) Service ports

C . Technical characteristics

1. General

Compressor

- Make	Sanden
- Type	SD-7H15
- No of cylinders	7
- Oil capacity	190 cc (6.69 fl oz)
- Drive belt	
Tension	108 - 122 Nm (80 - 90 lbf ft)
Deflection	12 - 15 mm (1/2 - 5/8)
- Weight	7.5 kg (16.5 lb)

Electro magnetic clutch

- Voltage	12 V
- Current	3.6 - 4.2 amps
- Air gap	0.4 - 0.8 mm (0.016 - 0.031 in)

Torque specifications

- Clutch retaining nut	30 Nm (22 lbf ft)
- Cylinder head cap screws	34 Nm (25 lbf ft)
- Service port with O-ring	15 Nm (11 lbf ft)

Air conditioning system

- Refrigerant type	R-134a
- Capacity	1.7 kg (3.75 lb)
- Operating pressure and temperatures	
Ambient temperature at 30 - 40 ° C (86 - 104 ° F) at sea level	
- Low side pressure	0.3 - 0.65 bar (4.3 - 9.4 lbd in^2)
- High pressure side	12 - 18.5 bar (174 - 268 lbf in^2)

Combined hig/low pressure switch

- Descending cut-out pressure	2 bar (29 lbf in^2)
- Ascending cut-out pressure	27 bar (392 lbf in^2)

Temperature control

- Range	1 - 20° C (34 - 68 ° F)
- Differential	4° C (7° F)

2. Components

Compressor and electromagnetic clutch

Compressor

The compressor, its clutch and the pulley constitute a removable assembly.
This assembly compresses the low-pressure gaseous refrigerant to high pressure and ensures circulation of the refrigerant through the system.

Electromagnetic clutch

This allows the compressor to be engaged and disengaged according to the evaporator temperature.
The coupling consists of two main components: the stationary induction coil (permanent induction field) and the rotor.
The induction coil is fitted directly on the compressor.
The grooved pulley is fitted on the tapered end of the crankshaft.
The current transmitted by the temperature control switch generates a magnetic field and the rotor disk is magnetically attracted against the pulley. The compressor runs. When the current is switched off, the rotor is demagnetized and the mechanical coupling is thus disengaged.
If parts are replaced : evaporator, condenser, receiver-drier, compressor or expansion valve, the circuit must be drained, taking the precautions specified in the next section and performing the operations in the correct order.

Condenser

The condenser receives the gaseous refrigerant under high pressure and at high temperature from the compressor and transforms it into pre-cooled liquid in the high-pressure state. It is designed to withstand variations in the temperature of the hot, gaseous refrigerant and cold outside air. When the refrigerant is cooled, the gas becomes liquid. This cooling is obtained by passing a stream of cool air (according to the vehicle's speed and the capacity of the motor fan). The temperatures of the refrigerant in the condenser vary between 49°C and 77°C for pressures of between 10.5 kg/cm^2 and 21 kg/cm^2.

If the condenser has to be replaced:

- Avoid damaging the cooling fins in order to ensure the appliance's maximum efficiency.

Receiver-drier

The receiver-drier is an important component of the air conditioning system. It is supplied with liquid refrigerant from the condenser and removes any humidity and foreign bodies which may have entered the system.
The receptacle is used for temporary storage of the refrigerant, according to the requirements of the expansion valve.

The circulation of refrigerant in the circuit can be checked on the warning light located above this reservoir.
This part also acts as a filter (similar to an engine oil filter) and **must be replaced at least every 1,000 hours or every three years, or when any servicing action requires recharging the circuit.**

When installing or replacing the receiver-drier :

- Check the correct connection on pipes on the IN side to the condenser.
- Remove the rubber protective covers from the couplings at the last moment in order to avoid the entry of any dampness.
- All the seals must be replaced after disassembly and the new seals must be lubricated when fitted. These are special seals.

Expansion valve

This valve, located on the evaporator inlet, controls the quantity of refrigerant entering the evaporator and reduces the pressure of the refrigerant. It automatically governs the flow of refrigerant to the evaporator according to the amount of heat.
It reacts according to the temperature of its sensitive element and to the pressure of the liquid.
In order to avoid any excessive pressure drop in the evaporator, the valve is equipped with a compensating system with a bulb which takes into account the temperature of the gas on outlet from the evaporator. This bulb is also connected to the valve diaphragm.

If the valve is replaced:

- Always lightly lubricate the couplings with oil for refrigerant.
- Check that the needle operates correctly before fitting by spraying liquid refrigerant onto the bulb and checking the movement of the needle.
- Check that the valve is correctly connected.
- Handle the capillary tubes with care.
- When fixing the heat-sensitive element (the bulb) onto the pipe, clean the pipe to ensure good contact. Secure the bulb onto the pipe with the clip provided and insulate with insulating fabric.

Cab - *Air conditioning*

Evaporator
The purpose of the evaporator, located behind the turbine fans, is to cool and dehumidify the ambient air.
In the evaporator, the liquid refrigerant which is at low pressure and low temperature after passing through the expansion valve, boils and starts evaporating immediately.
This process absorbs the heat from the air sucked in from the cab.

Motor fan
A permanent magnet type motor drives two turbine fans each of which is protected by an air nozzle unit. The assembly is fitted on an insulated support bracket. A resister system connected to the main switch allows the motor to run at three speeds.

Thermostat
The thermostat controls the operation of the compressor by means of its electromagnetic clutch.
This is a capillary type thermostat which controls an electrical switch.
It has an adjustable range so that a preset temperature in the cab to be selected.
The capillary tube measures the temperature in the evaporator and controls the operation of the switch by the expansion of its gas.

If the thermostat has to be replaced:
- Handle the capillary tube with care.
- The capillary tube must be in contact with the evaporator pipe and the pressure-reducing valve side.

High/Low pressure switch
The pressure switch,located on the high pressure circuit, is fitted on the receiver-drier and is wired in serie with the compressor clutch circuit.
It provides protection to the system by cutting out the clutch circuit when an excessive pressure drop or increase occurs in the high pressure circuit.

Switch working pressure	
Interlock	Cut-out
2.1 bar	2 bar 27 bar

Quick couplers
The quick couplers are installed on the high and low pressure circuits, on the L.h.s. of the tractor in front of the cab, to enable the tractor to be split without having to discharge the system. They facilitate separation between the engine and transmission and cab removal.
During these operations, seal the couplers using the plug kit 3376935M91 (see § H).

Service ports
The service ports located on the high and low pressure pipes on the back of the compressor are of quick male coupler type.

High and low pressure pipes
The hoses are in nylon lined nitrile.
To avoid damage to the hose nylon insert, do not attempt to bend the hoses beyond the radius given in the chart below :

Hose external diameter	Curvature radius min
18 mm	86 mm
21 mm	105 mm
26 mm	130 mm

D. Safety instructions

It is very important to work in a clean environment in order to prevent the ingress of any dirt into the system. Carefully clean couplings and, then, lightly lubricate them with compressor oil before making the connections.
Do not blow compressed air into the pipes to remove any particles which might be there: use only refrigerant for that purpose.
Do not remove pipe protective coverings until the last moment. Cut hoses using a knife: never use a saw.
Carefully plug pipes when they are stored.
The oil contained in the air conditioning circuit is a refrigerating oil. It is miscible with refrigerant.

Precautions to be taken

An air conditioning unit can be a dangerous piece of equipment which may be compared to a high-pressure steam boiler. The pressure of the refrigerant is always greater than at its normal boiling point. If a rupture occurs on a pipe, the refrigerant will evaporate or boil extremely quickly.
The forces generated by expansion can be very dangerous. A refrigeration technician must always work with care to prevent any uncontrolled escape of refrigerant. R134a refrigerant is non-flammable, non-toxic (except when in contact with an open flame) and non-corrosive (except in contact with water).
Great care must be taken when handling R134a refrigerant. It can freeze the skin or the eyes on direct contact.
In contact with an open flame or at high temperature, it decomposes to produce phosgene gas which is deadly poisonous.
Never handle refrigerant without wearing safety goggles and gloves.
Never attempt to drain a system by loosening a coupling. Slow draining without any danger can only be carried out using an evacuating/charging station dedicated to R134a refrigerant (see section 12C01).
Never drain the system in a room where there is a flame. The same precautions must be taken when checking for leaks.
When it is necessary to retighten a coupling, use two wrenches so as to avoid deformations which may cause leaks.
Never weld or clean with steam near a filled system as this may result in excess pressure and result in leaks.

Do not store R134a refrigerant in direct sunlight or near a source of heat or in a wet place. Always reinstall the bottle safety devices when not in use. Avoid subjecting the bottle to impacts. Do not carry the bottle in the passenger compartment of a vehicle.

In case of accident with R134a

If R134a refrigerant comes into contact with the eyes, wash them immediately with cold water. Call a doctor immediately.
Note: Frostbite caused by the liquid refrigerant can be treated by gradually warming the injured area with cold water and then applying a cream for dry skin. Call a doctor immediately.

E . General maintenance

Very important: Before switching on the air conditioning system, check that windows and doors are properly closed. The interior of the cab must be kept as clean as possible. If, for any reason, the cab cannot be fully closed, the air recycling system must be switched off. If these recommendations are not complied with, the evaporator may be clogged and this will stop the air conditioning system and may damage the compressor.

To ensure that the system operates correctly, the filter located at the back of the cab, the condenser, the fans and the evaporator must be periodically checked. Any clogging results in increased high and low pressure and reduces the cooling efficiency. The tension of the driving belt and its alignment must be checked.
Check the condition of the pipes carrying condensation water from the evaporator. Any accumulation of water in the tray may cause the evaporator to ice up and stop the refrigerant circulating, so reducing the system's efficiency.
To keep the system in good condition, it is advisable to run the system for a few minutes each week in order to lubricate all the components, as the oil in the compressor is miscible with refrigerant.

Electrical system

For the purposes of electrical checks, it must be ensured that the fuse or pressure switch located on the receiver-drier are in good condition. A failed fuse will have been overheated and will be deformed so that it will not allow power supply to the compressor.
To check that the electromagnetic clutch is actuated, set the fan switch to the low or high speed position and then position the air conditioning switch on the maximum cold position: a click should be heard.
After a few minutes in operation, you should notice the successive switching on and off of the electromagnetic clutch.
The connecting wires must be in good condition.

Caution:

When restarting the compressor, especially if it has not been operated for some time, proceed in the following manner to ensure correct lubrication as soon as the compressor starts running:

a) switch on the electromagnetic clutch.
b) crank over the tractor engine for a few seconds with the fuel supply cut off.
c) disconnect the electric stop button and allow the engine to idle for a few minutes.

Visually check the quantity of refrigerant (without bubbles) and its colour through the sight glass in the receiver-drier reservoir, while operating the engine at maximum revs (with the fan and the thermostat set to the maximum cold position).

Note: On starting and stopping, the presence of bubbles is normal. If a brown or bluish colouring can be seen through the sight glass: drain the system, change the lubricating oil in the compressor and the receiver-drier, and if necessary change the expansion valve, in that order.

F. Checking and preventive maintenance

1. Carry out the checks and maintenance operations described in preceding paragraphs.
2. Visually check the evaporator, pipes, condenser, receiver-drier, compressor, couplers and belt, and the flow of condensation water on the evaporator.
3. Carry out an "internal" check with low-pressure gauge (blue), high-pressure gauge (red), engine at 1500 rpm, thermostat on maximum cold position and fan on high speed.
4. Check temperature of components.
   The output from the expansion valve (on the evaporator side), the evaporator, the low-pressure pipes and the «inlet valve» on the compressor must be cold to the touch.
   The condenser, the receiver-drier, the inlet to the expansion valve, the compressor and «delivery valve», and the high-pressure pipes must be hot to the touch.
5. **The receiver-drier filter and oil should be changed at least every 1000 hours or every three years, or when any servicing action requires recharging the circuit.**
6. If the circuit is overfilled (more than 2 kg of R134a refrigerant), there is a danger of blockage at the receiver-drier and expansion valve.
7. If the high and low pressure are equal when the air conditioning unit is operating, this means the compressor is faulty.
8. If there is water in the circuit, the expansion valve (needle valve) will be blocked by a drop of water which will freeze to form ice, so decreasing the low and high pressure values.

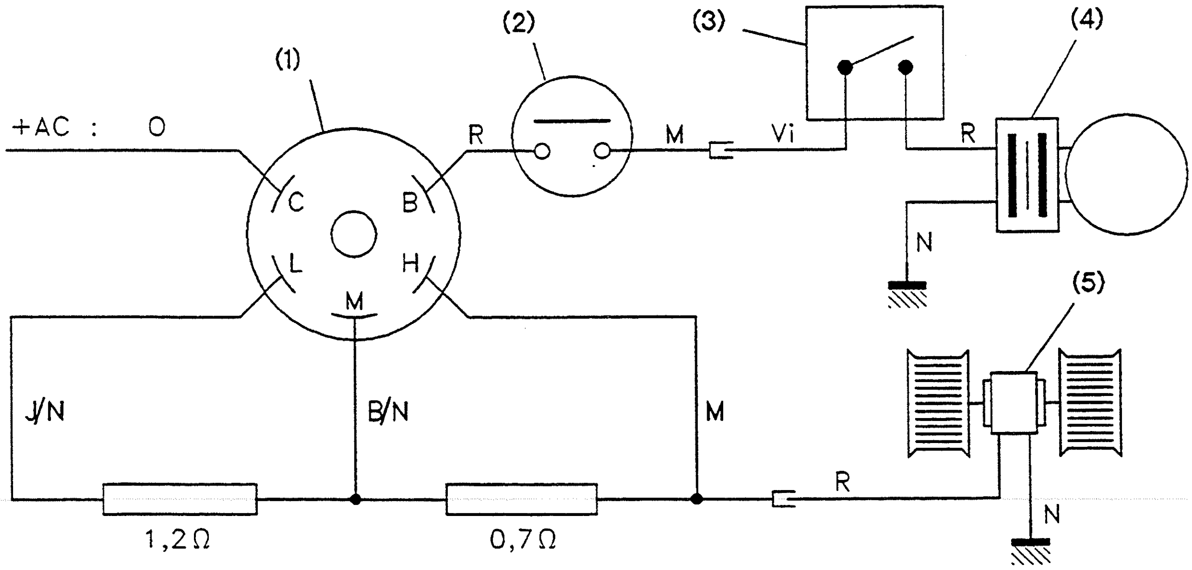
G . Wiring diagram

List of parts

(1) 4-way fan switch
(2) Air conditioning thermostat
(3) Pressure switch on HP circuit protecting the system by cutting out power supply to the clutch when high pressure is too low or too high (2 bar or 27 bar).
(4) Electromagnetic clutch
(5) Motor fan

Colour of wires

B/N : Blue and black
J/N : Yellow and black
M : Brown
N : Black
O : Orange
R : Red
Vi : Violet



H . Service tool

(3376935M91 - Plug kit for quick couplers on high and low pressure circuits

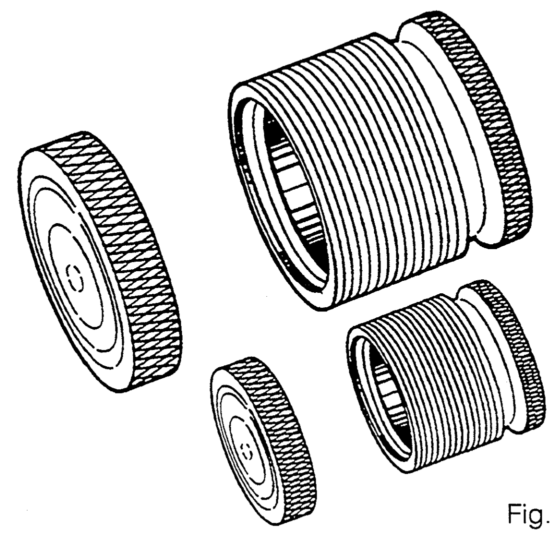


Fig. 2

12 C01 Recharging the system

CONTENTS

Recommendation

All the operations described in this section must be carried out using imperatively a service equipment (evacuatin/charging station, refrigerant recovery station, refrigerant leak detector,...) dedicated for R134a refrigerant (see § H).

A. Discharging the system and checking for leaks

Discharging the system

This operation must be carried out in well-ventilated premises.

Avoid any open flame. Smoking must be prohibited.

Prepare the system for discharging by running the engine for a few minutes at 1,000 rpm with the air conditioning unit set to the maximum cooling position.

Stop the engine and switch off the air conditioning unit.

Connect the manifold equipment to the service ports on the back of the compressor (Fig. 1) :
- red hose on high pressure
- blue hose on low pressure

Slowly open the manifold **low pressure** valve.

Warning: If the system is discharged too quickly, compressor oil will be carried out with the refrigerant.

After a few minutes, when the pressure has dropped by 1.5 to 2 bar (22 to 29 PSI), **slowly** open the manifold high pressure valve to allow all the refrigerant to escape.

Checking for leaks

When the system is empty, replace any faulty parts and then flush the system with R134a refrigerant by sealing with gas under a pressure of 2 to 3 bar (29 to 44 PSI). To do this, connect the middle hose between the pressure gauges to the upper connector on the charging cylinder (Fig. 4). Slightly loosen the middle by-pass hose connector to bleed the air from the hose and then retighten it.

Open the taps on the high and low pressure gauges and allow the R134a refrigerant gas to build up a pressure of between 2.5 and 3 bar (36 to 44 PSI) in the system. Shut off the taps and leave the system charged at this pressure for between 15 to 20 minutes before checking for leaks.

Note: Make sure that all the taps are closed before handling the hoses in order to avoid accidents.

Use an electronic leak detector (Fig. 2), and run the end of its hose over:

a) the compressor valve connectors,

b) all the compressor seals: shaft rotary seal, oil reservoir plug seal.

Repeat discharging of system

Discharge the system again by allowing the gas to escape through the high and low pressure taps, leaving a residual pressure of between 0.2 and 0.3 bar (3 to 4.4 PSI).

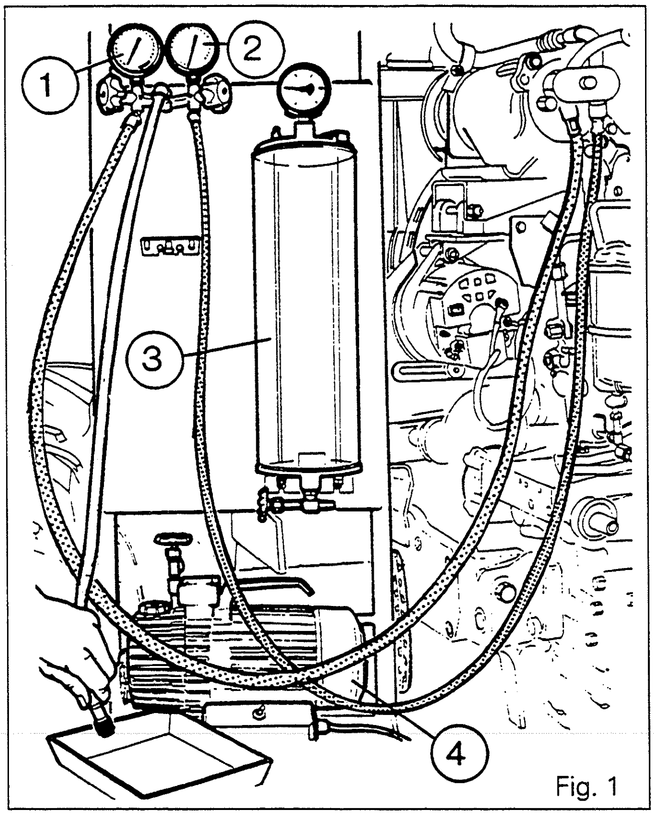


Fig. 1

(1) Low pressure gauge
(2) High pressure gauge
(3) Charging cylinder
(4) Vacuum pump

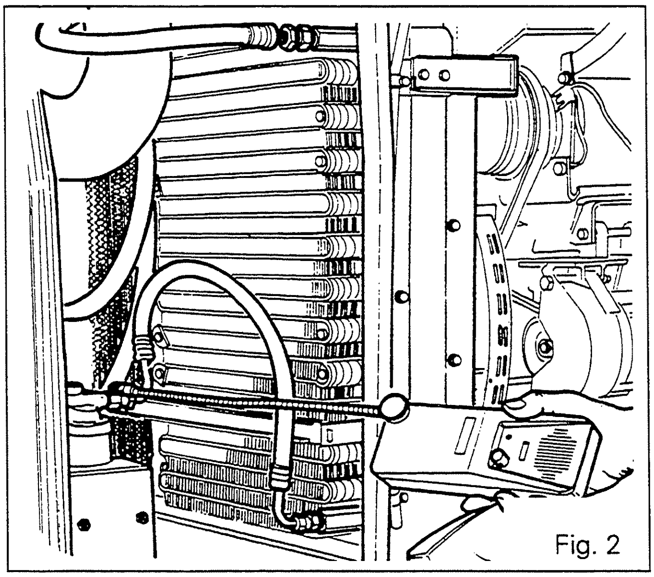


Fig. 2

B. Evacuating and flushing the system

Evacuating the system (Fig. 3)

When the system is no longer under pressure, connect the middle hose to the vacuum pump. Open the high pressure tap (with the low pressure tap already open). Open the tap on the vacuum pump and start up the pump.

Note: At ambient temperatures above 20°C (68°F), a sufficient vacuum is generally obtained in 30 minutes, in two 15-minute periods. If the ambient temperature is lower than 20°C (68°F), it will take at least 60 minutes, especially if the relative humidity is high. At the end of the evacuating period, the low pressure gauge should indicate a partial vacuum of 635 to 711 mm (25 to 28 inches) of mercury.

Close the high and low pressure taps and the vacuum pump tap, and switch off the pump.

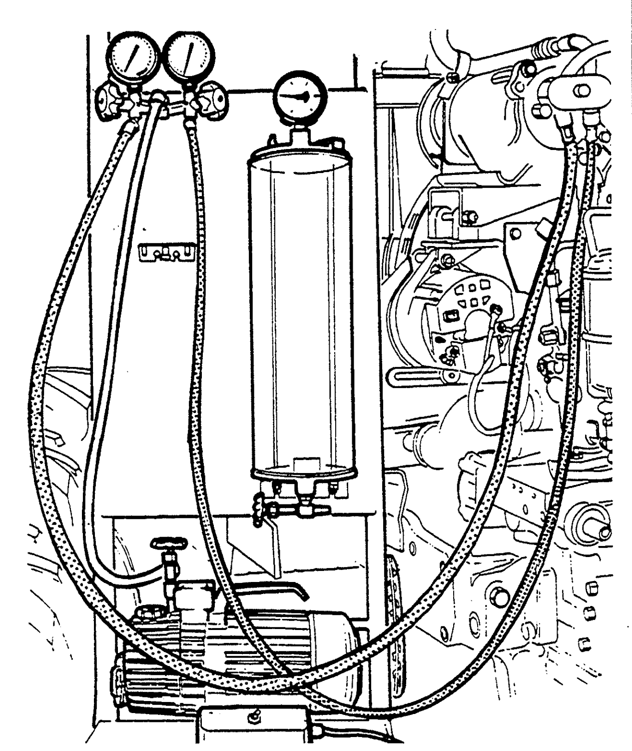


Fig. 3

Flushing the system (Fig. 4)

Disconnect the middle by-pass hose from the vacuum pump and connect it to the top of the charging cylinder. Open the top tap on the charging cylinder, slightly loosen the middle by-pass hose in order to bleed any air from the hose and retighten the connector when R134a refrigerant starts to escape from the hose.

Open the high and low pressure by-pass taps to obtain an R134a gas pressure of between 2.5 and 3 bar (36 to 44 PSI).

Close the taps and leave the charged system for 20 minutes.

Using the leak detector, check the system for leaks again (Fig. 2).

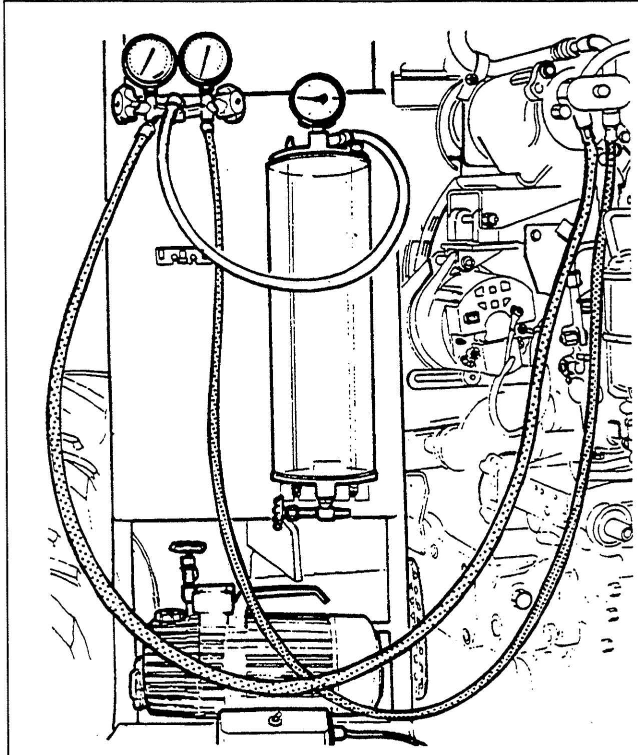


Fig. 4

Discharging and evacuating the system (Fig. 3)

Purge the system by slightly opening the low pressure by-pass tap and allowing R134a refrigerant to escape. Close the tap when a residual pressure of between 0.1 and 0.2 bar (1.4 to 3 PSI) is obtained on both pressure sides.

Connect the middle hose to the vacuum pump.

Open the high and low pressure taps and let the vacuum pump run for 20 minutes.

Close the high and low pressure taps after ensuring that the low pressure gauge indicates a partial vacuum of between 634 and 711 mm (25 to 28 inches) of mercury.

When all these operations have been carried out, the system is ready for recharging with R134a refrigerant.

Note: The air must be bled from the hoses each time they are connected to the pressure gauges and charging cylinder.

C. Recharging the system (engine stopped)

The quantity of refrigerant required to charge the system correctly is 1.7 Kg (3.7 lbs).

1. Instructions for filling the charging cylinder from the refrigerant gas bottle (Fig. 5)

Connect the refrigerant bottle to the bottom of the charging cylinder and tip the bottle upside down. Open the taps. When the pressures are equal in the bottle and in the charging cylinder, bleed gas from the charging cylinder through the top tap until the quantity of refrigerant required for the system is obtained.

2. Connecting the charging system (Fig. 6)

Connect the bottom of the charging cylinder to the middle connector between the pressure gauges.
- Bleed air from the hoses.
- Mark the level of refrigerant on the charging cylinder.
- Slowly open the low and high pressure taps on the pressure gauges in order to charge the system.

Note: To ensure complete charging with liquid, the pressure in the charging cylinder must be between 6 and 7 bar (87 and 101 PSI).

When a system is correctly charged and when the pressures are equal, the pressure on both the low and high pressure sides should be between 4 and 5 bar (58 to 73 PSI).

When the charging cylinder is not equipped with a heating element, the system must be partially charged with liquid and then topped up with gas.

Partial recharging with liquid and topping up with gas (engine stopped, then running)

When the pressures in the charging cylinder and the system are equal, close the high and low pressure taps as well as the tap on the bottom of the charging cylinder. To top up with gas, connect the middle hose between the pressure gauges to the top of the charging cylinder, and then purge the hose (by unscrewing the hose slightly and allowing gas to escape for a few seconds). (Fig. 7). For this operation, open **only the low pressure tap**. Run the engine at between about 1,000 and 1,200 rpm with the air conditioning set to maximum cooling and the fan on maximum speed.
The system is correctly charged when the required level is obtained on the charging cylinder.
At that moment, close the taps on the charging cylinder and on the low pressure gauge.

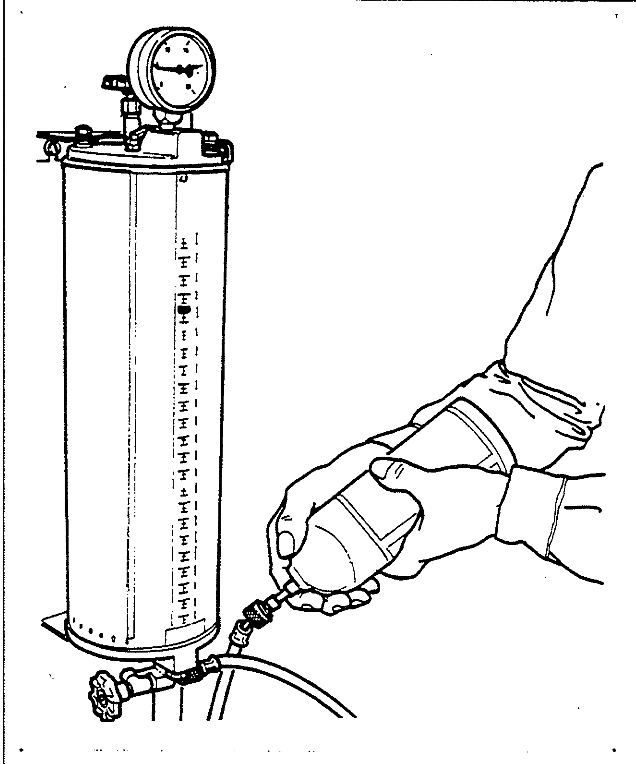


Fig. 5

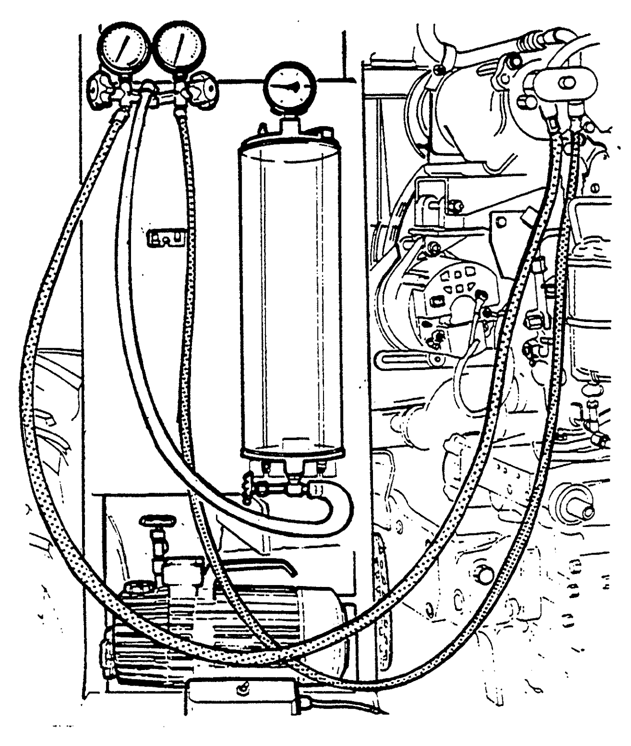


Fig. 6

D. Checking the pressures

Once charging has been completed, the air conditioning system should be checked for correct operation.
With the pressure gauges connected to the compressor (Fig. 8), run the engine and set the thermostat control to maximum cooling and the fan to maximum speed.
After a few moments' operation, **the high pressure hose should feel hot and the low pressure hose should feel cold**.
No bubbles should be visible in the dehydrator sight glass.
Check the compressor cycles. The compressor operating time should be approximately equal to its shutdown time once the temperature in the cab has stabilized, according to the thermostat setting.
When the air conditioning is switched off, the pressures on the low and high pressure sides should be equal and between 4 and 5 bar (58 and 73 PSI) if the system is correctly charged. **These values vary, however, according to the outside temperature**.
When the air conditioning system is running, the low pressure should be between 0.3 and 0.65 bar (4.3 and 9.4 PSI) and the high pressure between 12 and 18.5 bar (174 and 268 PSI).
All these values depend on the outside temperature.
The system should cycle on and off in all cases.
Note:
- **Fan on maximum speed and thermostat on coldest setting.**
- **Engine running at 1800 to 2000 rpm.**

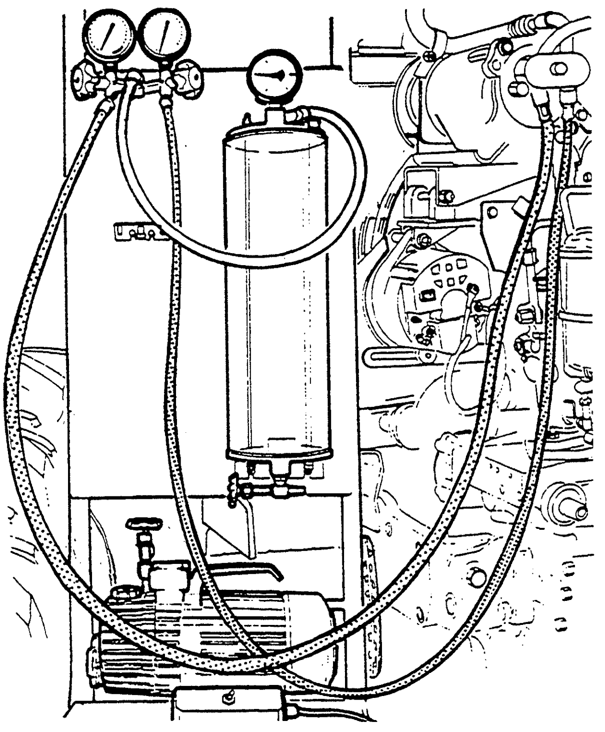


Fig. 7

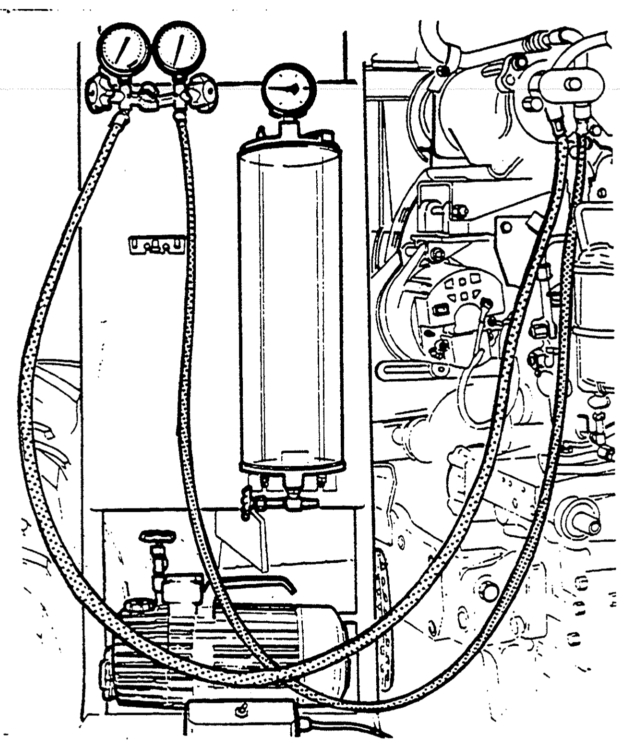


Fig. 8

E . Service tools

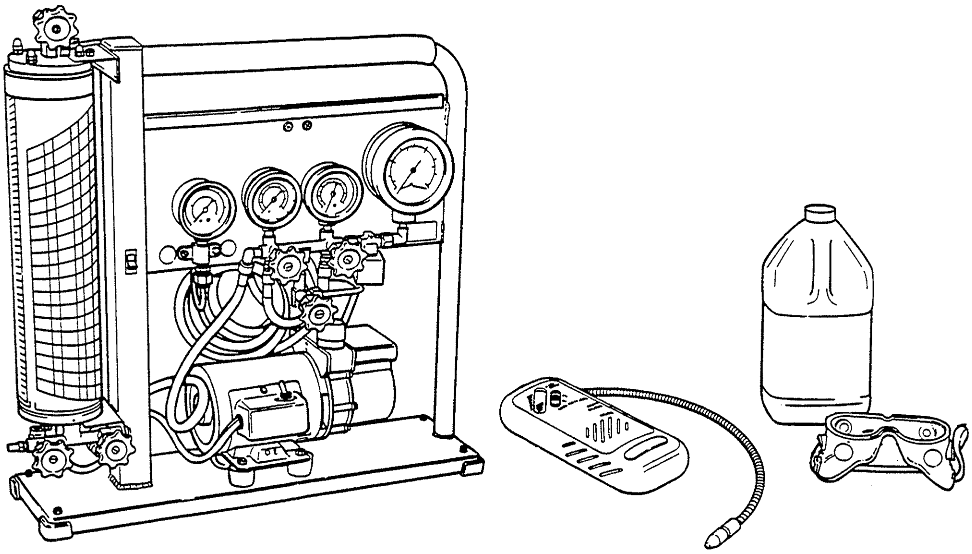


Fig. 9

Description	Specification	Part number
Portable evacuatin/charging station	• Vacuum pump : 1 cfm 2 stage with anti-oil migration • Charging cylinder of 2200 g (5 lb) capacity • Hoses 1.8 m (72 in) with R134a couplers • Supply : 220/240 V 50 Hz	311DAB8QC01 (a) 311CAP8QC01 (b)
	Options : • Compressor oil injection	311DAB8QC01S (a) 311CAP8QC01S (b)
	• Absolute (TORR) vacuum gauge (a) Metric scales (b) Imperial scales	311DAB8QCB1 (a) 311DAB8QCB1S 311CAP8QCB1 (b) 311CAP8QCB1S
Portable refrigerant recovery station (not shown Fig. 9)	• Float switch for automatic shut-off when the tank is 80 % full • 13.6 Kg (30 lb) nominal capacity tank • Without tank	17621 / PAG 17621ENF / PAG
	Options : • Oil separator : removes oil, acid and particulate matter from refrigerant • Receiver-drier : removes moisture before refrigerant enters the tank	 17651 / PAG
Refrigerant leak detector	• Switchable between : R134a and R12	16500
Vacuum pump oil	• Can of 4.5 litres (1 gal.)	13204
Eye protection goggles	• Should ALWAYS be worn when working with refrigerant	12008

12 D01 Air conditioning system failures - Compressor

CONTENTS

Cab - Failures - Compressor

A . Diagnosis and failure analysis

Diagnosis

In general, pressure readings are directly related to atmospheric conditions (pressure and temperature). At ambient temperatures between 30° C and 40° C (86° F and 104°F) at sea level, low pressure readings will vary between 0.3 and 0.65 bar (4.3 and 9.4 PSI) and high pressure readings will vary between 12 and 18.5 bar (174 and 268 PSI). To locate failures, the manifold pressure gauges must be connected to the service ports on the back of the compressor.

Failure analysis

Leaks in the system will lead to inadequate cooling, and low and high pressures will be too low.
If the system is under-charged, bubbles will always be visible in the dehydrator sight glass, in addition to the symptoms already mentioned.
If the evaporator is dirty or the expansion valve clogged or frozen up, there will be a partial vacuum on the low pressure side and insufficient pressure on the high pressure side.
If the system is over-charged, the expansion valve stuck in the open position or the condenser fouled, the pressure will be too high on the low pressure side.
If the condenser is fouled or the system over charged, the pressure will be excessive on the high pressure side.

Over-charging problems

In a correctly charged system, the R134a refrigerant discharged from the compressor in the form of gas loses its excess heat resulting from compression in the first coil of the condenser and condenses into a liquid in the subsequent coils. The resulting liquid is held in the last condenser coil before flowing to the receiver-drier.
If the system is over-charged, the liquid level rises in the condenser, leaving fewer coils available to condense gas. Both the temperature and pressure then build up causing hoses to burst in some cases.

Causes of failure with engine running

Over-charging
Worn hoses
Chafed hoses
Hoses cut by sharp edges on sheet metal
Bends too tight
Hoses too close to battery (acid)

Causes of failure with engine stopped

These are the same as when the engine is running, plus the following:
- shutdown of engine compartment ventilation,
- "temperature surge" caused by the engine immediately after it has been stopped.

The temperature increase when the engine is stopped causes both the temperature and pressure in the air conditioning system hoses to rise.
If a hose is only just holding, it is more liable to burst due to this effect.
This is particularly prevalent in systems that are over-charged with R134a refrigerant and when hoses are worn or badly positioned (in hot spots).

B . Failure of air conditioning unit

The manifold pressure gauges must be connected to the service ports on the back of the compressor.

High pressure reading too high

1. Refrigerant over-charge.
   Purge the system.
   Avoid leaving the system under-charged.
2. Air in system, in spite of correct low pressure reading.
   Purge the system.
   After purging, recharge the system.
3. Space between condenser fins clogged with insects.
   Clean the condenser.
4. Refrigerant remains in liquid state in suction pipe at evaporator outlet. This causes the formation of moisture or frost on the hose or on the compressor inlet valve.
   Check that the expansion valve sensing bulb is properly secured in contact with the suction pipe.
5. Plug left in a pipe during assembly. This is indicated by a difference in temperature upstream and downstream of the point where the plug is located.
6. If high pressure reading is higher than the reading obtained during normal operation with correct low pressure reading and correct charge but presence of bubbles in the receiver-drier, then the receiver-drier hose connections have been reversed and fluid is flowing in the wrong direction.
7. If high pressure reading is very high and low pressure reading is normal, with bubbles in the receiver-drier and frosting of the receiver-drier, there is a restriction at the receiver-drier inlet, causing the receiver-drier to act as an expansion valve.

Cab - *Failures - Compressor*

High pressure reading too low

1. Incorrect charge. A lack of refrigerant is shown by bubbles which appear in the sight glass of the receiver-drier.
2. Compressor gasket cracked or compressor valves leaking.

Low pressure reading too low, together with insufficient cooling

1. Restriction in a hose or in the receiver-drier. This problem can be detected by a difference in temperature upstream and downstream of the restriction or by cooling of the receiver-drier when the system is running.
2. Insufficient charge in the expansion valve sensing bulb.
   Warm up the end of the temperature-sensing bulb in the hand. The intake pressure should quickly rise to at least 1.45 bar (21 PSI) with the engine idling. If it does not, the expansion valve must be replaced.
3. Expansion valve capillary tube broken or leaking.
   The expansion valve stays closed causing the system to operate at very low pressure.
4. Formation of frost in expansion valve or jet.
   The expansion valve or jet may be frosted even though the pipes are hardly frosted at all.
5. Expansion valve stuck. Rust residue in system.
   Heating the end of the bulb has no effect on the low pressure reading.
   The expansion valve may open after a period at rest and then stick again after some time in operation.
6. Check that the evaporator air inlet is not obstructed.
7. Low refrigerant charge.
   Check whether bubbles can be seen in the sight glass when the system is operating with the fans switched on.

Low pressure reading too high

1. Compressor belt too slack.
2. Expansion valve sensing bulb incorrectly installed.
3. Expansion valve needle stuck in the open position.
   Refrigerant flows too freely through the coils and cools or freezes the inlet pipe.
4. Compressor inlet valve filter blocked.
5. Leakage from compressor inlet and outlet valves.
6. If the high pressure reading is low, the low pressure reading is high and the charge is correct, there is leakage from the compressor gasket or valves are faulty.

Noisy expansion valve (persistent whistling)

1. Low refrigerant charge, indicated by the presence of bubbles in the sight glass.

Insufficient cooling

1. Incorrect operation of compressor.
2. Incorrect operation of expansion valve.
3. High and low pressure readings are low, tending to cause partial vacuum with correct charge. Temperature too low at evaporator outlet, causing expansion valve to close and poor synchronization between thermostat cycling and opening of expansion valve.

Formation of frost on evaporator fins

1. Check thermostat electrical contacts.
2. Check that the sensing bulb is in contact with the evaporator fins.

Intermittent operation of compressor (irregular cycling)

Check belt tension.
Check clutch drive plate clearance.
Check clutch coil voltage and current.
Check compressor.

Abnormal compressor noise

In engaged position:
Check installation of compressor.
Check clutch and that there is no slipping.
Check R134a refrigerant charge.
Check clutch and compressor bearings.
Check quantity of refrigerant oil (190 cm^3)
Check compressor inlet and outlet valves.

In disengaged position:
Check clutch drive plate clearance.

C. Compressor

Setting the clutch drive plate clearance

Check the clearance with feeler gauges. The clearance should be 0.4 to 0.8 mm (Fig. 1).
If the clearance is not the same all the way round, lift slightly and tap gently where the difference is greatest.
Note: The correct clearance is obtained using shims. When reinstalling the clutch or fitting a new one, try fitting the original shims first.
When fitting a new clutch on a compressor, use the following shim sizes: 1.02 mm (0.04016 in) - 0.05 mm (0.00197 in) - 0.12 mm (0.00472 in). Tighten the nut to a torque of 30 Nm (22 lbf/ft).

Precautions to be taken when removing and refitting the compressor :

1. Run the air conditionning system for 5 or 10 minutes and discharge the R134a refrigerant (see § A, section 12C01) before removing the compressor.
2. Align the valve plate locating pins to the pin holes in the block and position the plate, the top valve plate gasket and the cylinder head (Fig. 2). The cylinder head low pressure (S) and high pressure (D) connections must be facing upwards and in line with the compressor oil filler hole (Fig. 3).
3. Tighten the 6 cylinder head bolts to a torque of 34 Nm (25 lbf/ft) using the star configuration as shown Fig. 3.

Filling with oil

Imperative : Use only synthetic Polyalkylene-Glycol (PAG) oil when filling or topping up the compressor.
Recommended oil : SANDEN SP20 PAG
Compressor capacity : 190 cc
Whenever work is carried out on the system and whenever a component has to be replaced (pipes, receiver-drier, condenser), it is advisable to drain the oil from the compressor and refill with the recommended quantity of clean oil instead of topping up.
1. Dischange the R134a refrigerant (see § A, section 12C01).
2. Remove the filler plug.
3. Fill or top up the compressor
4. Refit the filler plug.
   Check the condition of the O-ring.
   Check that the O-ring and its seat are clean.
5. Tighten the plug to a torque of 15 Nm (11 lbf/ft). If there is any leak, do not tighten the plug any further but remove it and fit a new O-ring.
6. Recharge the installation with R134a refrigerant (see part C, section 12C01).
7. Run the system and check if it operates normally.

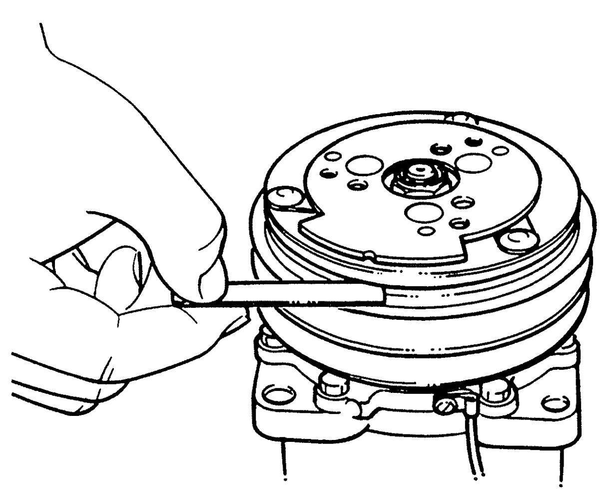


Fig. 1

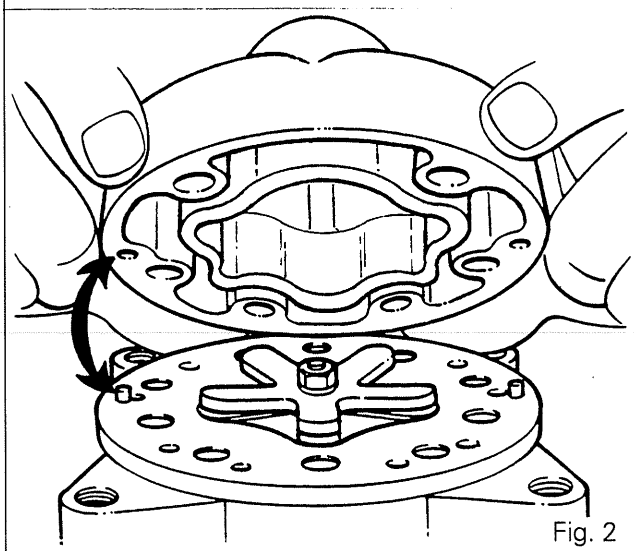


Fig. 2

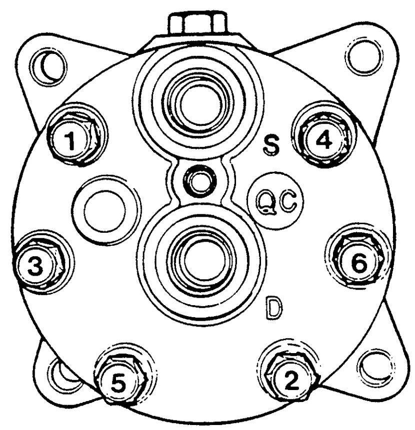


Fig. 3

CONTENTS