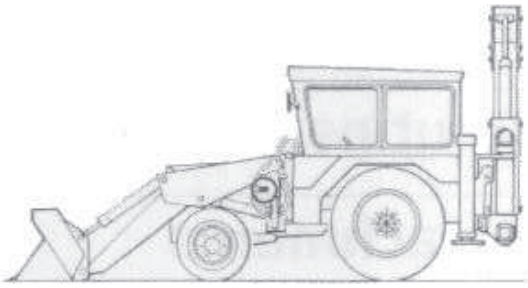
JCB

EXCAVATOR LOADER



WORKSHOP MANUAL

Models: MK 2 and MK 3 Range

2D – 2DS – 3 – 3C – 3CS – 3D – 700

Manual Gearbox & Torque Converter
UK – USA – Austrian – German –

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SERVICE MANUAL

Preface

This volume is published mainly for the benefit of JCB Distributor Service Engineers, but copies are available from JCB Distributors to individual machine users.

The manual is compiled in sections, the first three are numbered and contain Care and Safety aspects of workshop procedure, Technical Data and Routine Maintenance. The remaining sections are alphabetically coded and deal with Dismantling, Overhaul etc., of specific components.

For Example:-

B = Body and Framework
E = Hydraulics

All sections are listed on the front cover. Each individual section also has it's own Contents Page.

Removal, Replacement, Dismantling and Assembly procedures should be carried out in accordance with the sequences shown on the illustrations, paying particular attention to items noted in the text.

Where more detailed information is necessary, this is given in the text in the form of step by step instructions.

Left Hand and Right Hand where used, are as viewed from the rear of the machine.

*Torque Settings in this Publication are given as "mean" figures and may vary by 3% higher or lower.

1 Care and Safety 1

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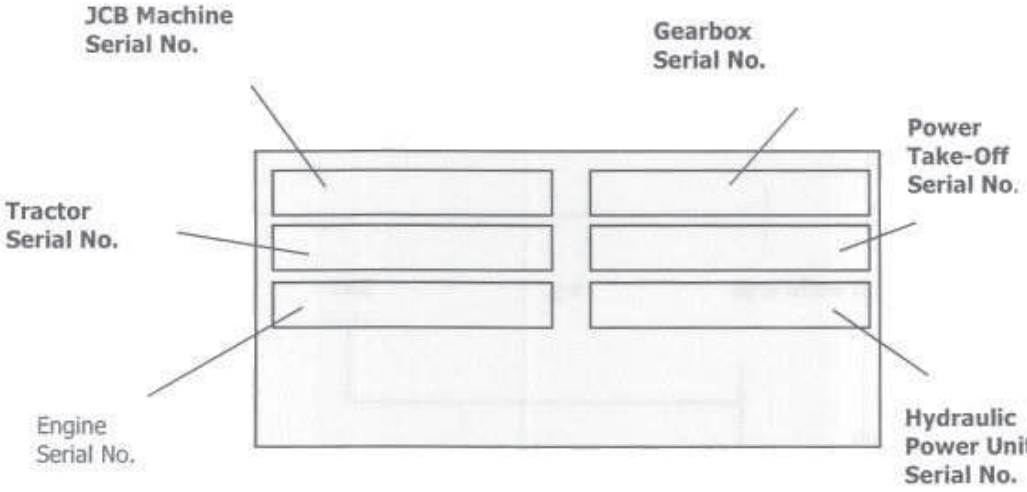
MACHINE IDENTIFICATION 1-1

The following information explains the various serial numbers to be found on the data plate attached to the machine.

It is essential that the serial numbers are used to ensure the correct supply of parts and to locate the correct service information.

SKIDDED TRANSMISSION MACHINES – Manual and /3 build



JCB Machine Serial Number **e.g.** **3D3** **129564** **/ 3**

MACHINE TYPE AND MARK

SEQUENTIAL SERIAL NO
55000-68150 MK2 range
100001-124999 and loaders
125001-199999 MK3 range

BUILD IDENTIFICATION

Blank-Manual Transmission

/3 –Torque converter

MACHINE IDENTIFICATION 1-2

Tractor Serial Number **e.g.** **384B / 7 / 237580**

TRANSMISSION TYPE
384B-10 speed, manual or torque converter.
272B-9 speed, manual only

BUILD TYPE
1-Manual, standard
2-Torque converter, standard
7-Manual, German
8-Torque converter, German
9-P.T.O. with hydraulics
10-P.T.O. less hydraulics

SEQUENTIAL SERIAL NO.

Tractor Serial No – JCB Build skid **e.g.** **SKI / 002676**

BUILD TYPE
SK1 – Standard
SK2 – German / Austrian

SEQUENTIAL SERIAL NO

Engine Serial No **e.g.** **498NT / 1897 / 61294**

ENGINE TYPE

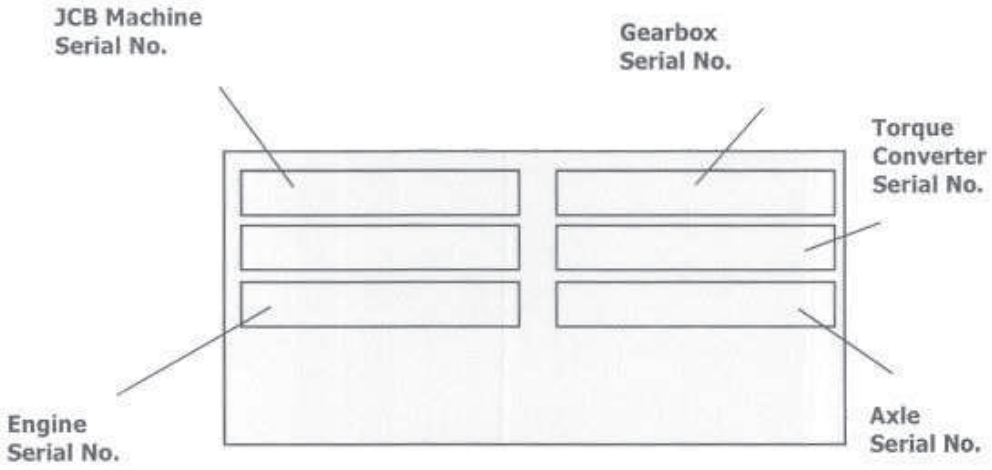
4– Number of cylinders
98– Bore in millimetres

ENGINE BUILD LIST NO.

SEQUENTIAL SERIAL NO

MACHINE IDENTIFICATION 1-3

POWERTRAIN -/5 build



JCB Machine Serial Number **e.g.** **3D3** **129564** **/ 5**

MACHINE TYPE AND MARK

SEQUENTIAL SERIAL NO
125001-199999 MK3 range

BUILD IDENTIFICATION
/5 –Torque converter

Engine Serial Number **e.g.** **498NT** **/** **2058** **/ 64878**

ENGINE TYPE
4– Number of cylinders
98– Bore in millimetres

ENGINE BUILD LIST NO

SEQUENTIAL SERIAL NO

Gearbox Serial Number **e.g.** **12731** **/** **1078** **/ 1**

BUILD LIST NO

BUILD DATE
Month and Year

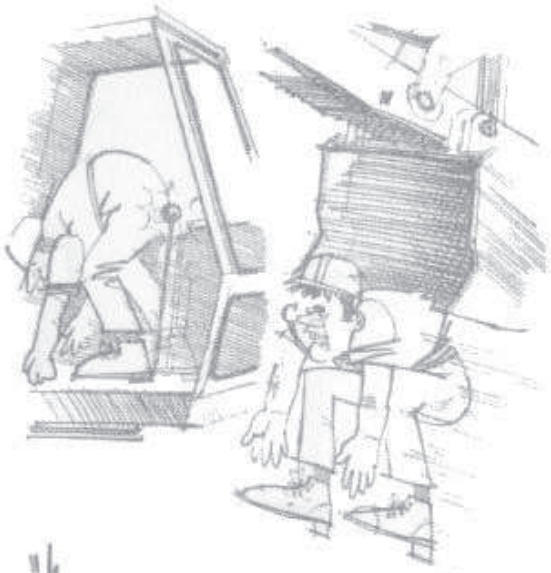
SEQUENTIAL SERIAL NO
Over yearly period

2-1

COMPONENT REMOVAL

Secure all moving parts of the machine to prevent inadvertent actions by other personnel causing dangerous movement and possible injury.

For example: Always set buckets and shovels on the ground or on adequate supports before work is commenced.



SAFETY FIRST!

Never work beneath a machine unless it is standing on hard ground, preferably concrete or tarmacadam. If a machine is lifted to improve accessibility, always place substantial supports under the main frame or track frame before work is commenced.

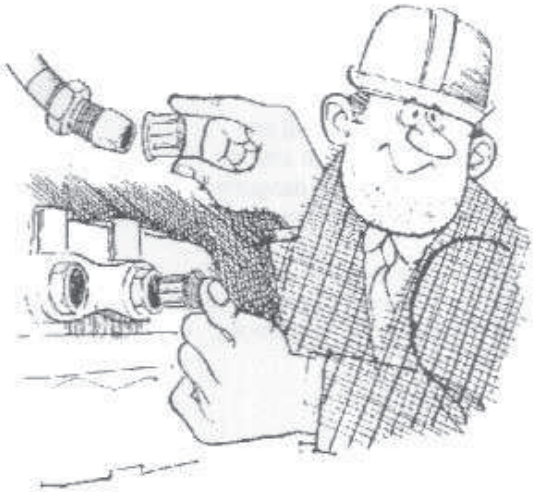
NEVER TAKE RISKS

Always check lifting equipment, slings, chains etc, before components are hoisted. Always use equipment which is adequate for the job in hand.

3-1

HOSES AND PIPES

Always fit blanking plugs whenever hoses or pipes are disconnected. Serious damage can occur if dirt or abrasive material enters the hydraulic system.



DIRT....THE ENEMY

Rest the digging equipment on the ground, stop the engine and operate all control levers to vent any residual pressure from the hydraulic circuit before hoses or pipes are disconnected. This minimises the chance of injury from spurting oil when a connection is loosened.

HOT OIL BURNS

Test the temperature of adjacent pipework and components with the hand prior to disconnecting a hose or pipe. If the oil is considered too hot for safety, allow sufficient time for it to cool before a connection is loosened.

3-2

Renew hoses if any of the following faults are found.

1 End Fitting Damaged or Leaking

If the hose elbows are dented or crushed, oil flow is restricted and the speed at which the service operates will be reduced. Badly crushed elbows can completely block the oil flow and prevent the service from operating.

2 Outer covering chafed or cut and wire reinforcing exposed.

If a hose remains in service in this condition water will seep into the internal wire reinforcing and cause concealed corrosion and consequent weakening of the hose structure. This may not be apparent until the hose subsequently fails.

3 Outer Covering Ballooning Locally

This is caused by failure of the hose structure which allows hydraulic oil to leak internally. The oil eventually forces it's way into the outer layers of the hose's construction and ultimately causes the hose to burst.

4 Evidence of kinking or crushing on flexible part of hose.

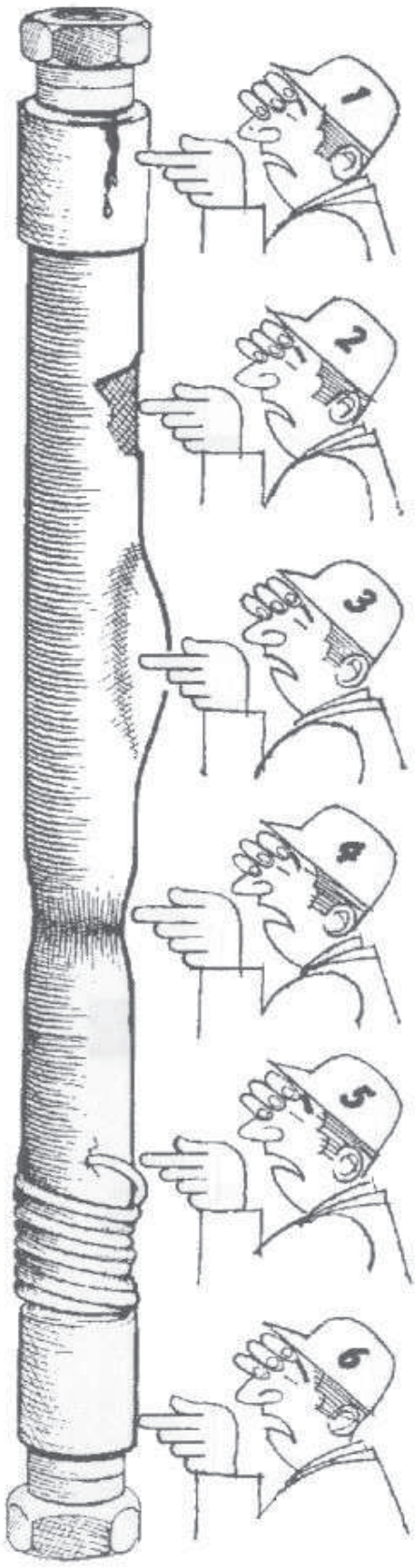
If a hose is deformed past it's design limits, damage to the internal structure is caused. This can result in restriction of oil flow or local weakening of the hose.

5 Armouring embedded in outer cover.

If armouring is deformed, internal damage similar to that caused by crushing or kinking will almost certainly have occurred.

6 End Fittings Displaced.

If the swaged sleeve of an end fitting appears to have moved from it's original position, there is a possibility that partial failure has occurred in the area where the sleeve grips the flexible part of the hose. Ultimately the end fitting will pull off.



3-3

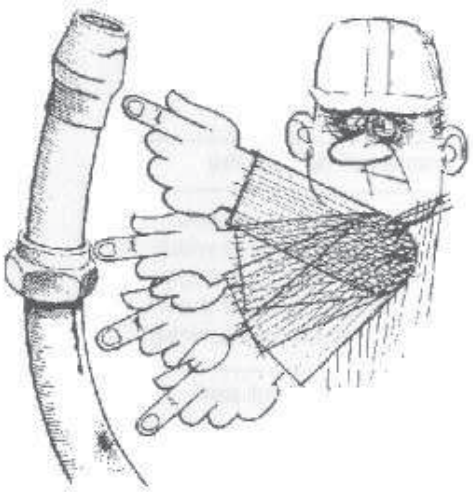
Renew pipes if any of the following faults are found.

1 Cone damage or distorted

2 Thread damaged.

3 End fittings damaged or leaking.

4 Outer surfaces damaged or severely corroded.



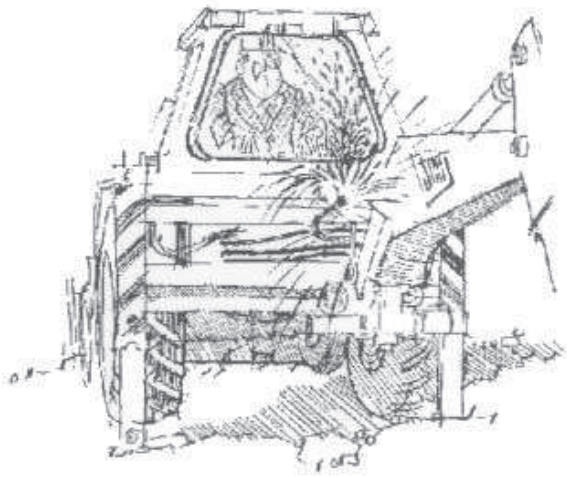
CHECK CAREFULLY !

Unsupported hoses or pipes must not touch each other or adjacent components or chafing will be caused

GOOD FITTING PAYS !

Loosely connect each end, settle the hose or pipe into position and tighten connections. Clamps should be tightened sufficiently to retain the hose or pipe without causing crushing.

If a hose is connected to moving components, the components should be moved over the full extent of their travel to check that the hose does not foul as it is bent.



CARE

Hoses must never be twisted when fitting.

4-1

DISMANTLING & ASSEMBLY

Thoroughly clean the exterior of all components before dismantling. If dismantling is commenced without removing a component from the machine, cleanliness is doubly important since the service life of a component is drastically reduced if dirt or abrasive matter is not excluded at all times.

CLEAN IT FIRST !

Sometimes components are dismantled in adverse conditions without workshop facilities being available. If this is necessary, suitable precautions must be taken to prevent dust and dirt settling on internal parts, particularly on oiled surfaces where it will be retained and contaminate any new oil with which a component is filled.

CLEAN WITH CARE !

Select cleaning agents and solvents with care. The following are recommended: Petrol, alcohol, methylated spirits and carbon tetrachloride. All these solvents evaporate at room temperature and do not leave residue.

WARNING: Solvent type cleaners are dangerous when used in a confined area. Avoid inhalation of the vapour or contact with the skin. Do not use near a naked flame.

Trichlorethylene or paint thinners must not be used in the presence of seals and 'O' rings because they can severely damage certain types of rubber.

CARE !

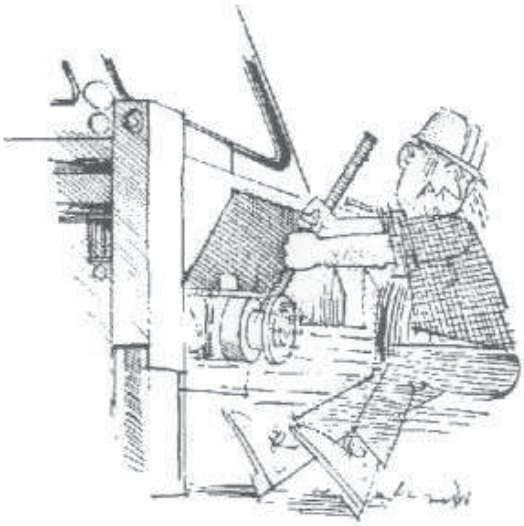
Renew 'O' rings, seals and gaskets regardless of condition, whenever they are disturbed, unless instructed otherwise.

Lightly coat 'O' rings and gaskets with hydraulic oil before fitting, unless instructed otherwise.

GOOD SEALING PAYS !

Coat gaskets with a suitable jointing solution before fitting, unless instructed otherwise. Proprietary solutions which are compatible with the various oils used by JCB are given and are referred to where appropriate

BEARINGS



REMOVAL

Do not remove bearings unless they are to be renewed (see inspection) or unless unavoidable in a dismantling sequence.

Whenever possible, use a suitable puller or extractor to minimise risk of damage to both the bearing and adjacent parts. Keep bearings with loose rings, balls or rollers as matched assemblies; they are selectively assembled and parts do not interchange from one bearing to another.

CHECK CAREFULLY!

INSPECTION

Check that the bearing has had ample lubrication and that the lubricant has not been contaminated.

Check for discoloration and signs of overheating.

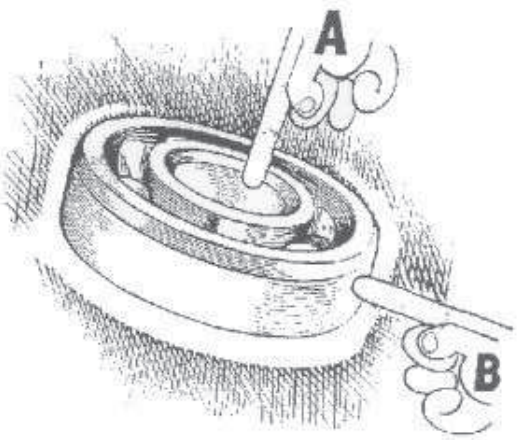
Check the bearing for excessive clearance and the cage for wear, cracks and scuffing. If in doubt regarding the clearance, compare this with an identical new bearing.

NOTE. Journal bearings are graded by the internal clearance when new, this is indicated by one, two or three feint circles marked on one ring. Ensure that both bearings are of the same grade when comparing new with old.

5-2

Check the finish of the locating surfaces A & B They may have been lightly marked on assembly but should not be polished. Polishing indicates that the ring has been turning relative to it's seating – this is confirmed if the seating is also polished.

If the bearing rings have been turning, the mating parts must be either renewed or built up and machined to their original sizes.



CHECK THOROUGHLY

Renew the needle roller bearings if:-

1. Rollers, cages or rings are damaged.

2. Rollers fall from cage.

3. Rollers can be moved noticeably out of alignment.

4. The shaft is damaged or worn. If this has occurred, shaft particles will have entered the bearing and subsequent early failure is almost inevitable.

IF IN DOUBT RENEW!

If bearing is judged to be fit for further service, it should be washed in clean solvent and immersed in clean oil for temporary storage.

FITTING

Bearings are normally a press fit on rotating parts and a sliding fit on static components such as housings. Whenever possible fit the bearing to the rotating part first.

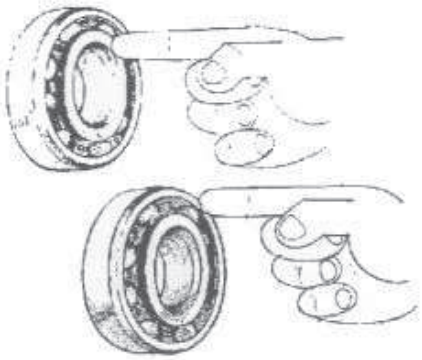
GOOD FITTING PAYS!

Use a tubular drift or press tool but ensure that it does not contact the ring lip since damage may be caused.

Bearing on shaft – Exert effort against the inner ring.

Bearing in housing – Exert effort against the outer ring.

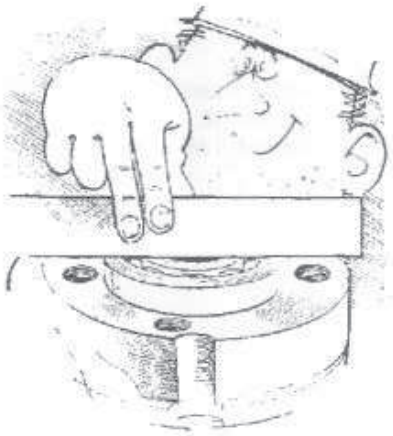
If a press is not available when fitting large bearings, it is preferable to either heat the bearing in hot oil or to heat the housing rather than use a large hammer and drift.



CARE!

Check that the bearing abuts squarely against the locating face.

Any peculiarities regarding the fitting of specific bearings are covered in the appropriate assembly sequence.



PRESSURE TESTING

Ensure that there are no leaks from hoses or pipework before pressure testing is carried out.

Readings should be taken using a gauge of adequate pressure range for the test, either liquid filled or fitted with a restrictor or damper.

Before adjusting a valve, unscrew the adjusting screw two or three turns to release any trapped dirt.

SUCTION STRAINERS

Thoroughly wash suction strainers in petrol or carbon tetrachloride, using a soft brush and air blasting if necessary

Remove all traces of gummy deposit. It should be possible to see light through the mesh.

TRAINING

Training courses suitable for all grades of personnel are held at regular intervals. Details are readily available from JCB Service

Contents

ATTACHMENTS

JCB Roadbreaker			
Pump Flow Rate at 2000 rev/min and zero pressure	45 litres /min	10 UK Gal/min	12 US Gal/min
Relief Valve Settings			
-System Relief Valve (Hamworthy)	138 bar	141 kgf/cm2	2000 lbf/in2
-System Relief Valve with combined Dipper Mounted Attachments	127 bar	130 kgf/cm2	1845 lbf/in2
-Component Relief Valve (L.H.&R.H.)	103 bar	105 kgf/cm2	1500 lbf/in2
JCB Extending Dipper JCB Jaw and Powerbreaker			
Pump Flow Rate at 2000 rev/min and	45 litres/min	10 UK Gal/min	12 US Gal/min
Relief Valve Settings. (Parker Hannifin)	127 bar	130 kgf/cm2	1845 lbf/in2
Hydraulic Power Take-off			
Gearbox Ratio	3:1		
Output Shaft Diameter	35mm	1.375in.	
	6 splines to BS1495/SAE J718d		
Flow to motor at 1800 engine rev/min. to give P.T.O. speed of 530-550 rev/	100 litres/min	22 UK Gal/min	26.5 US Gal/min

BRAKES

Type	Multiplate disc unit, mounted inboard on each
Diameter to m/c no. 129502	165mm. X 89mm. (6.5in. X 3.5in.)
From m/c no. 129503	
-dry	178mm. X 102mm. (7in. X 4in.)
-oil immersed (from m/c no. 138622/5)	Nominal 200mm. (8in.) dia.
Operation-Manual and/3 build	By foot or hand via mechanical linkage.
-/5 build	By foot via hydraulics
Parking Brake -/5 build only	
Type	Disc unit mounted on gearbox out put shaft
Diameter	279mm. (11in.)
Operation	Lever and cable

1-2

CAPACITIES

	Litres	UK Gal	US Gal
ENGINE OIL – Manual and /3 build			
Balanced Engines			
Steel Sump	9.6	2.1	2.5
Alloy Sump	11.0	2.4	2.8
Non Balanced Engines			
Steel Sump	11.0	2.4	2.8
Alloy Sump	11.5	2.5	3.0
ENGINE OIL -/5 build	9.1	2.0	2.4
COOLING SYSTEM	13.6	3.0	3.6
TORQUE CONVERTER			
-/3 build	20.4	4.5	5.4
-/5 build	11.0	2.4	2.9
GEARBOX			
– 10 speed	50.0	11.0	13.2
- 9 speed	56.8	12.5	15.0
-/5 build	2.55	0.56	0.67
- with hydraulic lift	57.0	12.5	15.0
DRIVE AXLE			
-/5 build with Dry Brakes	25.0	5.5	6.6
-/5 build with Oil Immersed Brakes	29.5	6.5	7.8
FUEL TANK	68.0	15.0	18.0
SLEW ACTUATOR	4.5	1.0	1.2
HYDRAULIC SYSTEM			
-2D,3	173.0	38.0	45.6
-2DS, 3CS	159.0	35.0	42.0
-3C	195.0	43.0	51.6
-3D	205.0	45.0	54.0
-700	177.0	39.0	46.8

Note The following original equipment engines were fitted with balancer units on production:
38TD engines from serial no **44287** **All 4/98NT engines**

Balancers may have been fitted in service to other engines.
Steel and alloy sumps have been fitted intermittently

1-3

ELECTRICAL SYSTEM

Type	12 volt negative earth	
Battery	12 volt	128 amp/h
Alternator		
To Engine No. 4/98NT 2724	Lucas 18ACR	
From Engine No. 4/98NT 2725	AC Delco DN460	
Sealed	CAV AC5HER	
Dynamo To Machine No. 61767	Lucas C40	
Starter Motor	Lucas M50	
Light Bulbs	Headlights	36/36W
	Working Lights	48W
	Side Lights	6W
	Rear Lights	6/21W
	Indicators	21W
	Instruments	2.2W
	Interior	18W

ENGINE

Make	BLMC 4 Cylinder diesel	
Type	38TD	Identifiable by serial
Superseded by	4/98	Number prefix
Swept Volume	3.77 litres	230 in³
Bore 38TD	100 to 100.2mm	3.937 to 3.9738in.
Bore 4/98	98 to 98.2mm	3.8583 to 3.859in.
Stroke 38TD	120mm	4.7in.
Stroke 4/98	125mm	4.921in.
Compression Ratio 38TD	17.5:1	
Compression Ratio 4/98	16.8:1	
Firing Order	1,3,4,2	
Valve Clearance (hot or cold)	0.33mm	0.013in.
Injection Timing 38TD	20° B.T.D.C.	
Injection Timing 4/98 Simms Minimec	16° B.T.D.C.	
Injection Timing CAV D.P.A.	14° B.T.D.C.	
Engine Speed		
Idling	700 – 720 rev/min	
Maximum Revs	2000 rev/min	
Maximum no load Revs	2200 – 2220 rev/min	

Note :
For full details, refer to Engine Service Manual

1-4

HYDRAULICS

Pump flow rates at 2000 rev/min and maximum pressure

Machine	M/c No.	Pump Type	Litres/min	UK Gal/min	US Gal/min
2D,2DS,3	To 100611	Plessey Gear	102	22.5	27
	From 100612	Hamworthy Gear	93	20.5	24.6
3C,3CS,3D,700		Hamworthy Gear	126.1	27.75	33.3

Note: 2D,2DS and 3 machines fitted with JCB Roadbreaker or Hydraulic Power Take-off use the 3C type main pump.

Relief Valve Operating Pressures

	Bar	Kgf/cm²	Lbf/in²
Main Relief Valve (M.R.V.)	138	141	2000
Auxiliary Relief Valves (A.R.V.)			
Hamworthy (Shovel and Excavator)	186	191	2700
Slew Cylinders 127mm (5in) only	152	155	2200
Cessna Shovel Tip	207	210	3000
Cessna Shovel Clam	190	193	2750

STEERING

System Type	Fully Hydrostatic		
Pump	Plessey Gear Type		
Control Unit	Plessey Vane Type		
	Danfoss Orbitrol		
Max flow to Control Unit			
-Manual Clutch machines	18 litres/min	4 UK gal/min	4.8 US gal/min
-/3 build to m/c 131319	36-38 litres/min	8-8.5 UK gal/min	9.6-10.2 US gal/min
-/3 build from m/c 131320	16.3-19.1 litres/min	3.5-4.2 UK gal/min	4.3-5 US gal/min
Relief Valve Operating Pressure			
To m/c no. 131319	121 bar	123 kgf/cm²	1750 lbf/in²
From m/c no. 131320	117-124 bar	120-127 kgf/cm²	1700-1800 lbf/in²
Camber Angle	5º		
Castor Angle	2º		
Toe-in	1.6mm. (1/16in.)		

1-5

TRANSMISSION

Manual Clutch Machines

Clutch	Single dry plate	330mm.	(13in.) dia
Gear Ratios			
To m/c no. 1301301	10 Forward – 2 Reverse		
From m/c no. 1301302	9 Forward – 3 Reverse (Synchromesh)		

Torque Converter Machines-/3build

Gear Ratios	4 Forward – 4 Reverse		
Direction Control	Forward/Reverse Clutch Pack		
Charging Pump	Plessey Gear Type		
Flow at 2000 eng.rev/min			
Up to m/c 131319	36-38 litres/min	8-8.5 UK gal/min	9.6-10.2 US gal/min
From m/c 131320	22.6 litres/min	5 UK gal/min	
Oil Temperature			
-Normal	90-100°C		
-Max. Intermittent	120°C		
Converter Out Pressure	0.7-1.7 bar	0.7-1.8 kgf/cm²	10-25 lbf/in²
Clutch Oil Pressure	8.2-11.0 bar	8.4-11.2 kgf/cm²	120-160 lbf/in²
Stall Test Speed	1780 engine rev/min		

Torque Converter Machines -/5 build

TORQUE CONVERTER

Diameter	279mm. (11in.)		
Stall Torque ratio	2.2:1		
Torque Absorption at stall	210 Nm (155 lbf ft) at 1700 rev/min		
Converter Pressure	Bar	kgf/cm²	Lbf/in²
IN			
1000 rev/min	0.7-2.1	0.7-2.1	10-30
2000 rev/min	4.1-6.2	4.2-6.3	60-90
OUT			
1000 rev/min	0-1.3	0-1.4	0-20
2000 rev/min	0.7-2.1	0.7-2.1	10-30

TRANSMISSION Continued

SHUTTLE TRANSMISSION

Direction Control	Forward/Reverse Clutch Packs		
Ratios	1.0: 1 Forward	1.1: 1 Reverse	
Pressures	**Bar**	**Kgf/cm²**	**Lbf/in²**
Main Line-			
1000 rev/min	6.9-8.9	7.0-9.1	100-130
2000 rev/min	8.6-10.7	8.8-10.9	125-155
Forward Clutch			
1000 rev/min	6.2-7.9	6.3-8.1	90-115
2000 rev/min	7.6-10.0	7.7-10.1	110-145
Reverse Clutch			
1000 rev/min	6.9-8.9	7.0-9.1	100-130
2000 rev/min	8.3-10.3	8.4-10.5	120-150
Flow Rates	**l/min**	**UK gal/min**	**US gal/min**
Cooler at 50°C			
800 rev/min	4.9-6.4	1.08-1.4	1.3-1.7
1000 rev/min	8.6-9.1	1.9-2.0	2.3-2.4
2000 rev/min	16.3-17.0	3.6-3.75	4.3-4.5
Cooler at 100°C			
800 rev/min	6.4-6.8	1.4-1.5	1.7-1.8
1000 rev/min	7.5-8.3	1.66-1.83	2.0-2.2
2000 rev/min	19.5-20.4	4.3-4.5	5.2-5.4
Pump-			
1000 rev/min	11.7	2.58	3.1
2000 rev/min	29.1	6.4	7.7

GEARBOX

Ratios-	
First	5.55:1
Second	2.84:1
Third	1.64:1
Forth	1.00:1

DRIVE AXLE

Ratio-	18.3:1

1-7

TYRES	SIZE		PRESSURE	
2D,2DS		**bar**	**Kgf/cm²**	**lbf/in²**
Standard Front	7.50x16x10	4.00	4.08	58
Standard Rear	14.9/13x28x8	1.79	1.82	26
Optional Front – Vredestein	9.00x16x10	3.93	4.00	57
Optional Front – Other Makes	9.00x16x10	3.44	3.51	50
	10.5/80x18x10	4.62	4.71	67
Optional Rear	16.9/14x28x8	1.65	1.68	24
3,3C,3CS		**bar**	**Kgf/cm²**	**lbf/in²**
Standard Front – Vredestein	9.00x16x10	3.93	4.00	57
- Other Makes	9.00x16x10	3.44	3.51	50
Standard Rear	16/14x28x8	1.65	1.68	24
Optional Front	10.50x16x12	4.41	4.50	64
	10.50/80x18x10	4.62	4.71	67
	12.00x18x10	2.76	2.80	40
	12.00x18x12	3.93	4.00	57
	13.0/65x18x12	3.59	3.67	52
Optional Rear	16.9/14x28x10	2.07	2.10	30
	18.4/15x26x8	1.38	1.40	20
	18.4/15x26x12	2.14	2.18	31
3D		**bar**	**Kgf/cm²**	**lbf/in²**
Standard Front	12.00x18x10	2.76	2.80	40
OR	12.0/75x18x12	2.90	2.95	42
Standard Rear	18.4/15x26x8	1.38	1.40	20
Optional Front	13.0/65x18x12	3.59	3.67	52
	16.0x19.5x10	2.07	2.10	30
Optional Rear	18.4/15x26x12	2.14	2.18	31
700		**bar**	**Kgf/cm²**	**lbf/in²**
Standard Front	12.00x18x12	2.76	2.81	40
OR	12.00x18x12	3.93	4.00	57
Standard Rear	18.40x26x12	2.14	2.18	31
Optional Front	13.0/65x18x12	3.59	3.67	52

SPECIFIC TYRES FOR MACHINE OPTIONS

Machine	Option		Tyres
3C	JCB Powerbreaker		Front: As available for standard machine Rear: 18.4/15 x 26 x12
	JCB Extending Dipper		
	JCB Jaw		
3	JCB Jaw		
2D	JCB 6 in 1 Clamshovel	Front:	9.00x16x10
		Rear:	16.9/14x28x8

2-1

TORQUE SETTINGS

Use only where no torque setting is specified in the text. Values are for DRY threads and may be reduced within three percent of the figures stated. For lubricated threads the values should be REDUCED by one third.

UNF Grade 'S' Bolts

Bolt Size		Hexagon (A/	Torque Settings		
in.	(mm.)	in.	Nm.	kgf m	lbf ft
1/4	6.3	7/16	14	1.4	10
5/16	7.9	1/2	28	2.8	20
3/8	9.5	9/16	49	5.0	36
7/16	11.1	5/8	78	8.0	58
1/2	12.7	3/4	117	12.0	87
9/16	14.3	13/16	170	17.3	125
5/8	15.9	15/16	238	24.3	175
3/4	19.0	1.1/8	407	41.5	300
7/8	22.2	1.5/16	650	66.3	480
1	25.4	1.1/2	970	99.0	715
1.1/4	31.7	1.7/8	1940	198.0	1430
1.1/2	38.1	2.1/4	3390	345.0	2500

Metric Grade 8.8 Bolts

Bolt Size		Hexagon (A/	Torque Settings		
in.	(mm.)	in.	Nm.	kgf m	lbf ft
M5	5	8	7	0.7	5
M6	6	10	12	1.2	9
M8	8	13	28	3.0	21
M10	10	17	56	5.7	42
M12	12	19	98	10	72
M16	16	24	244	25	180
M20	20	30	476	48	352
M24	24	36	822	84	607
M30	30	46	1633	166	1205
M36	36	55	2854	291	2105

2-2

TORQUE SETTINGS

Rams

NOTE: Alltorque figures are 'mean' settings and may be varied by 3% higher or lower.

2D,2DS,3,3C,3CS,3D,700
Split pin Retained Piston Heads

Piston	Rod dia	Cylinder	Bore	Piston Head Nut			Cylinder End Bolts		
mm.	in.	mm.	in.	Nm	kgf m	lbf ft	Nm	kgf m	lbf ft
25.4	1.0	-	-	136	13.8	100	-	-	-
38.1	1.5	-	-	420	42.9	310	-	-	-
50.8	2.0	-	-	408	41.5	300	-	-	-
64.0	2.5	102	4.0	522	53.2	385	-	-	-
64.0	2.5	114	4.5	780	79.5	575	-	-	-
76.0	3.0	127	5.0	1051	107.2	775	342	34.9	252

Loctite Retained Piston Heads

Piston	Rod dia	Cylinder	Bore	Piston Head Nut			Cylinder End Bolts		
mm.	in.	mm.	in.	Nm	kgf m	lbf ft	Nm	kgf m	lbf ft
63.5	2.5	127	5.0	408	41	300	-	-	-

Slew Actuator

Piston Head Nuts	420Nm	42.9 kgf m	310 lbf ft
Cylinder Bolts	373Nm	38.0 kgf m	275 lbf ft

3 ROUTINE MAINTENANCE 3

CONTENTS

1-1

LUBRICANTS

	Below – 1 deg C (30 deg F)	-1 to 27 deg C (30 to 81 deg F)	Above 27 deg C (81 deg F)
ENGINE	Mobil Delvac	JCB Super X	Delvac
INJECTION PUMP (in line)	1310	Universal (20W20) Or Mobil Delvac 1320	1330

TORQUE CONVERTER/SHUTTLE		Mobil Delvac 1310
GEAR BOX/FINAL DRIVE		
	10 Speed	Mobilube HD90
	4 Speed (/3 build)	Mobilube HD90
	9 Speed (synchro)	JCB Super X Universal (20W20) or Mobil Delvac 1320
GEARBOX	4 Speed (/5 build)	JCB Super X Universal (20W20) or Mobil Delvac 1320
DRIVE AXLE (/5 build)		
To machine no. 138621/5 (Dry Brakes)		JCB Super X Universal (20W20) or Mobil Delvac 1320
From machine no. 138622/5 Oil Immersed		JCB Special Gear Oil
BRAKE SYSTEM (/5 build) -		
To machine no. 138621/5 Dry Brakes		Mobil Hydraulic Brake Fluid 550
From machine no. 138622/5 Oil immersed		Below –20 deg C (-4 deg F) Mobil DTE 11

CAUTION: USE OF INCORRECT BRAKE FLUID WILL CAUSE SERIOUS DAMAGE

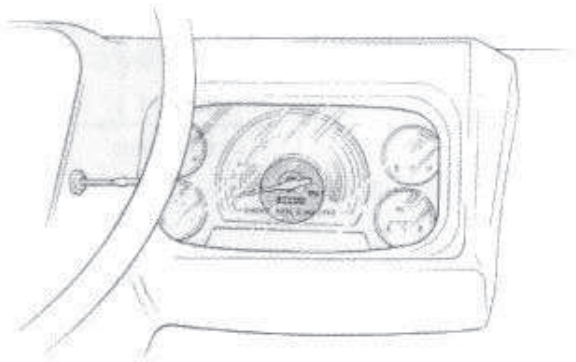
SLEWING ACTUATOR	Mobilube HD90
HYDRAULIC SYSTEM	JCB 'Special' Hydraulic Fluid
GREASE POINTS	JCB 'Special' MPL Grease or Mobilgrease Super
H.P.T.O. GEARBOX	JCB Super X Universal (20W20) or Mobil Delvac 1320
EXTENDING DIPPER	Mobiltac E

CAUTION:

Mobiltac E contains 1.53% lead. Contaminated materials, eg rags, containers, etc; should only be disposed of in accordance with local regulations covering

HOURMETER
Manual and /3 build machines

The hourmeter is to be used to determine the correct service intervals



HOURMETER
/5 build machines

SERVICE SCHEDULE	DAILY	Every 50 Hours	Every 100 Hours	Every 200 Hours	Every 400 Hours	Every 800 Hours	Every 1600 Hours
Action							
Before Starting Engine							
Check / Adjust							
Tightness wheel nuts	R	R	D R	R	D R	R	R
Tyre Pressures	R	R	D R	R	D R	R	R
Wheel alignment					D R	R	R
Front axle adjustment			D		R	R	R
Brake adjustment		R	D R	R	D R	R	R
Clutch adjustment		R	D R	R	D R	R	R
Fan belt adjustment		R	D R	R	D R	R	R
Air cleaner hose security			D R	R	D R	R	R
Starter motor, dynamo/alternator							R
Torque Converter oil cooler		R	D R	R	D R	R	R
Clean							
Drain fuel sediment trap and fuel		R	D R	R	D R	R	R
Fuel lift pump			D		R	R	R
Injectors and test			D		D R	R	R
Air filter vacuator valve				R	R	R	R
Battery terminals			D R	R	D R	R	R
Change / Adjust							
Fuel filter element			D		D R	R	R
Air cleaner elements			D		D R	R	R
Valve clearances			D		D R	R	R
Injector pump oil				R	R	R	R

D 1st 100/400 hr Dealer Service

R Routine Service

SERVICE SCHEDULE	DAILY	Every 50 Hours	Every 100 Hours	Every 200 Hours	Every 400 Hours	Every 800 Hours	Every 1600 Hours
Action							
Before Starting Engine							
Grease							
Axle pivot	R	R	D R	R	D R	R	R
Pump drive		R	D R	R	D R	R	R
Kingpins	R	R	D R	R	D R	R	R
All pivot pins	R	R	D R	R	D R	R	R
Kingpost	R	R	D R	R	D R	R	R
Brake cross shaft	R	R	D R	R	D R	R	R
Clutch bearing	R	R	D R	R	D R	R	R
Coolant pump					R	R	R
Control lever ball joints			D R	R	D R	R	R
Oil all linkages			D R	R	D R	R	R
Propshaft /5build		R	D R	R	D R	R	R
Front hubs with grease nipples	R	R	D R	R	D R	R	R
Check Levels and							
Slewing actuator oil		R	D R	R	D R	R	R
Engine oil	R	R	R				
Injector pump oil in-line pump		R	D R				
Engine coolant anti-freeze	R	R	D R	R	D R	R	R
Gearbox oil manual and 3/build		R	D R	R	D R		
Hydraulic fluid	R	R	D R	R	D R	R	
Battery electrolyte		R	D R	R	D R	R	R
Fuel system			D		D R	R	R
Gearbox oil /5build		R	D R	R	D R		
Drive axle oil /5build		R	D R	R	D R		
Brake fluid /5build	R	R	D R	R	D R	R	R

D 1st 100/400 hr Dealer Service

R Routine Service

SERVICE SCHEDULE	DAILY	Every 50 Hours	Every 100 Hours	Every 200 Hours	Every 400 Hours	Every 800 Hours	Every 1600 Hours
Action							
After Starting Engine							
Check							
Operation of electrical equipment	R	R	D R	R	D R	R	R
Instrument readings	R	R	D R	R	D R	R	R
Exhaust excessive smoke	R	R	D R	R	D R	R	R
Idling speed			D		D R	R	R
Torque converter oil level 3/build	R	R	D R	R	D R		
Main relief valve pressure					D R	R	R
Auxiliary relief valve pressure					D R	R	R
Steering relief valve pressure					D R	R	R
Operation of all services							
Excavator	R	R	D R	R	D R	R	R
Shovel	R	R	D R	R	D R	R	R
Transmission	R	R	D R	R	D R	R	R
Brakes	R	R	D R	R	D R	R	R
Steering	R	R	D R	R	D R	R	R
Rams for leaks and rod damage			D		D R	R	R
Engine power			D		D		
Max governed engine speed			D		D R	R	R
Engine pulled down speed			D		D R	R	R

D 1st 100/400 hr Dealer Service

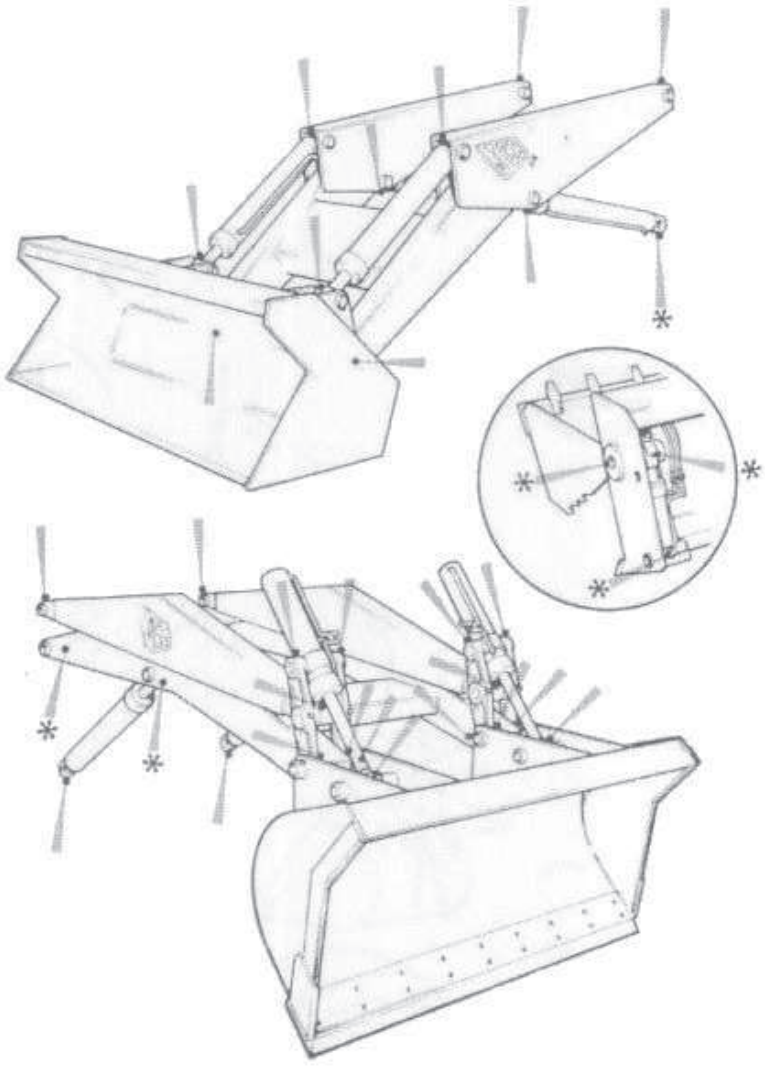
R Routine Service

SERVICE SCHEDULE	DAILY	Every 50 Hours	Every 100 Hours	Every 200 Hours	Every 400 Hours	Every 800 Hours	Every 1600 Hours
Action							
After Stopping Engine							
Change/Adjust							
Engine oil			D	R	D R	R	R
Engine oil filter element			D	R	D R	R	R
Hydraulic fluid & clean suction			T D		T D		R
Hydraulic fluid filter change			D		D R	R	R
Torque converter oil						R	R
Torque converter oil element					D R	R	R
Gearbox oil						R	R
Axle oil /5build						R	R
Check							
Hose and pipework			D R				
Tightness of ram end caps			D R				
Engine compression							
Torque converter oil level /5build	R	R	D R				

D	1st 100/400 hr Dealer Service
R	Routine Service
T	Steering Pump Strainer only

LOADER

GREASE ALL
PIVOT PINS 10 Hours



* Applies to both L.H. and R.H. pivots

EXCAVATOR

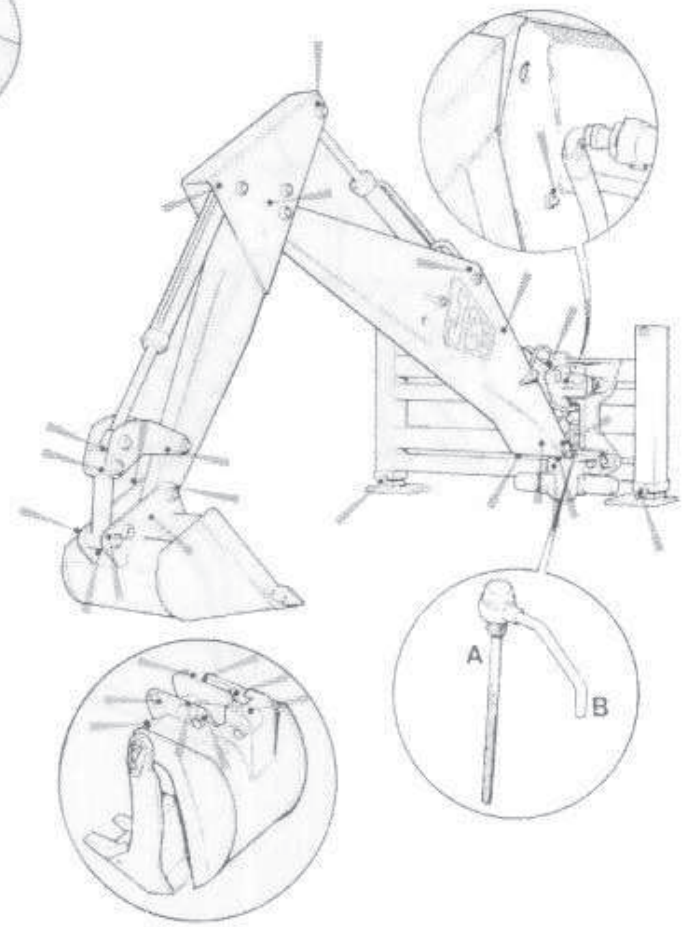
GREASE ALL
PIVOT PINS 10 Hours

CHECK ACTUATOR
LEVEL 50 Hours

A Filler and dipstick

B Bleed-off pipe. Leakage may indicate a seal failure

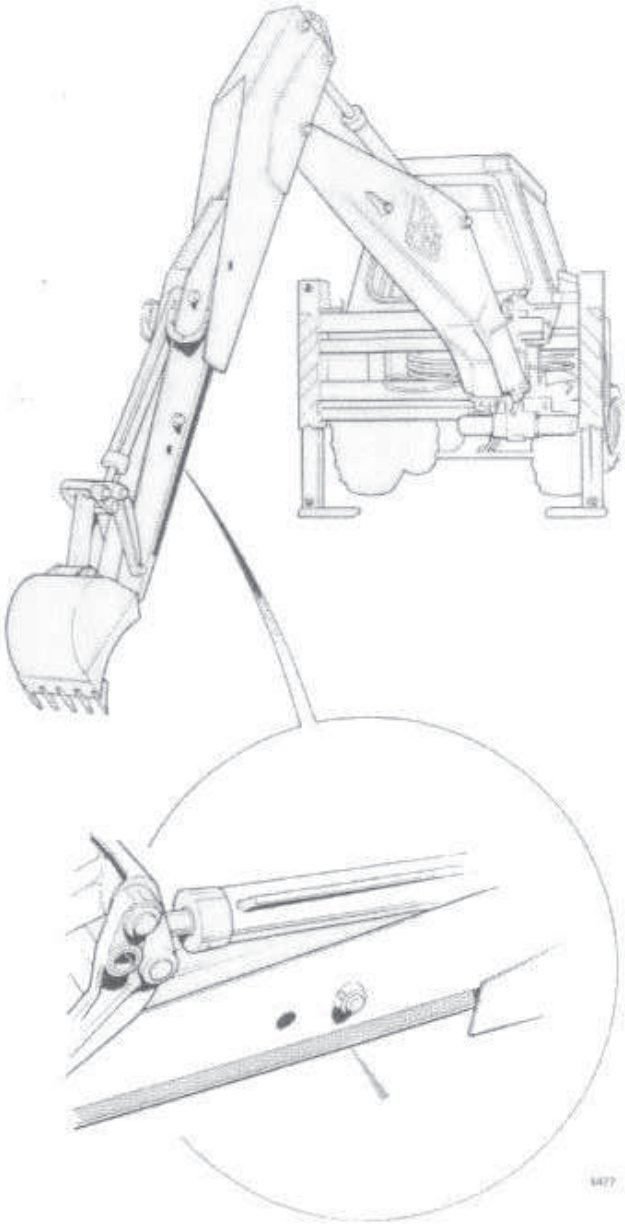
Note: Do not grease cross rails



EXTENDING DIPPER

GREASE SLIDING FACES 50 Hours

50



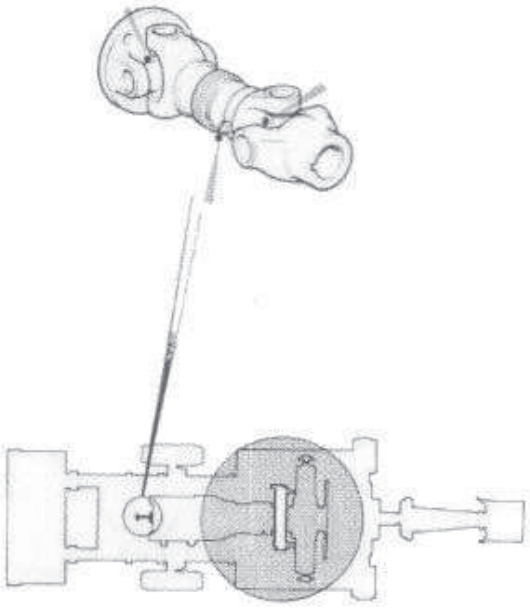
PUMP DRIVE

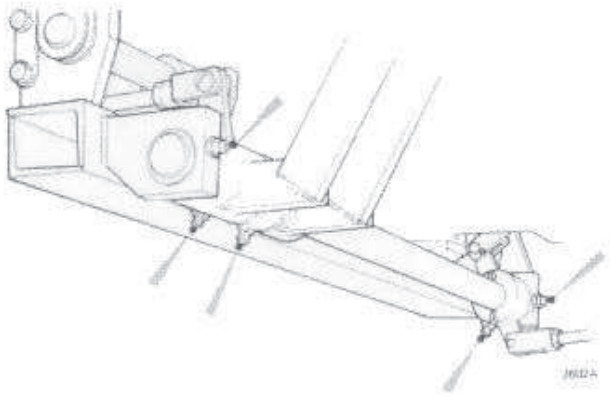
GREASE UNIVERSAL JOINTS
Every 50 Hours

CROSS SHAFT

GREASE ALL PIVOTS

Every 10 Hours





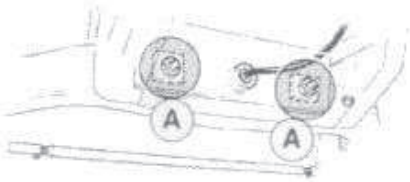
FRONT AXLE

ADJUSTMENT (to m/c 68150)
Every 400 Hours

1. Slacken locknuts A

2 Fully tighten bolts, then slacken one half turn.

3 Tighten locknuts

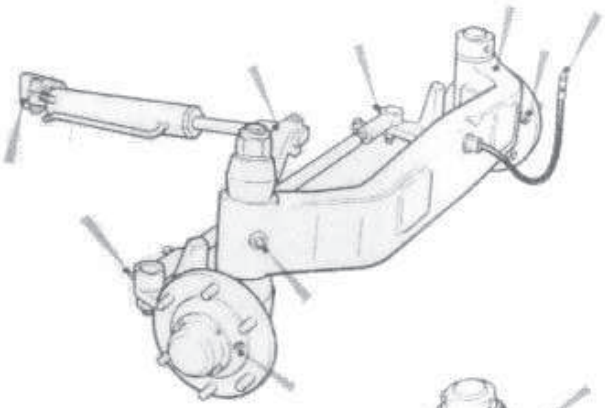


GREASE ALL NIPPLES 10 Hours

NOTE: When greasing axle, raise front wheels and turn from lock to lock to ensure full penetration.

Axle B – To m/c 68150

Axle C – From m/c 100000



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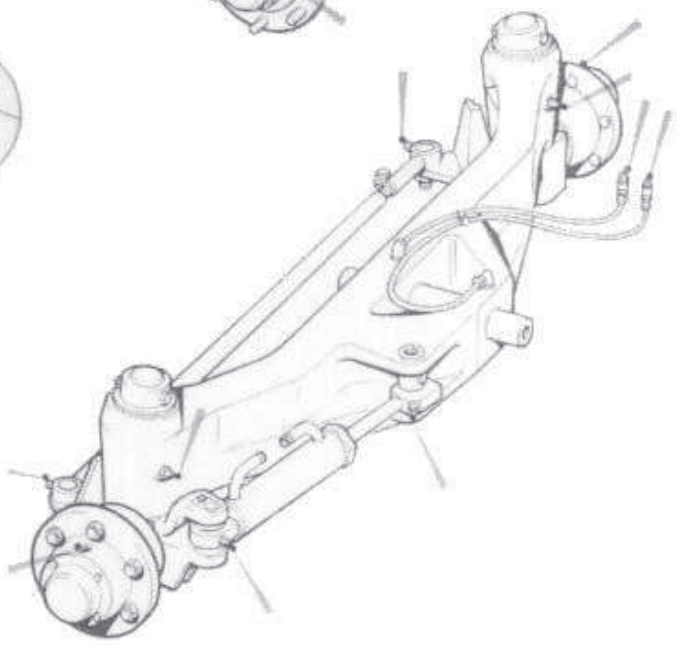
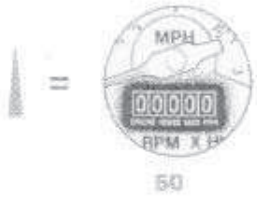
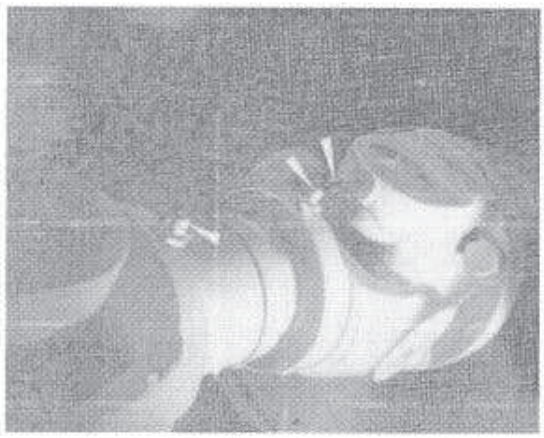


PROPSHAFT

GREASE 50 Hours





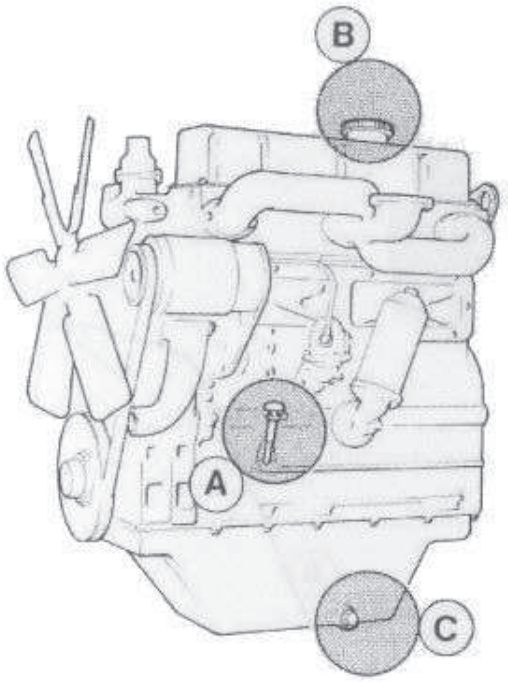
4-1

ENGINE OIL

CHECK LEVEL 10 Hours

DRAIN & REFILL
200 Hours

A



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4-2

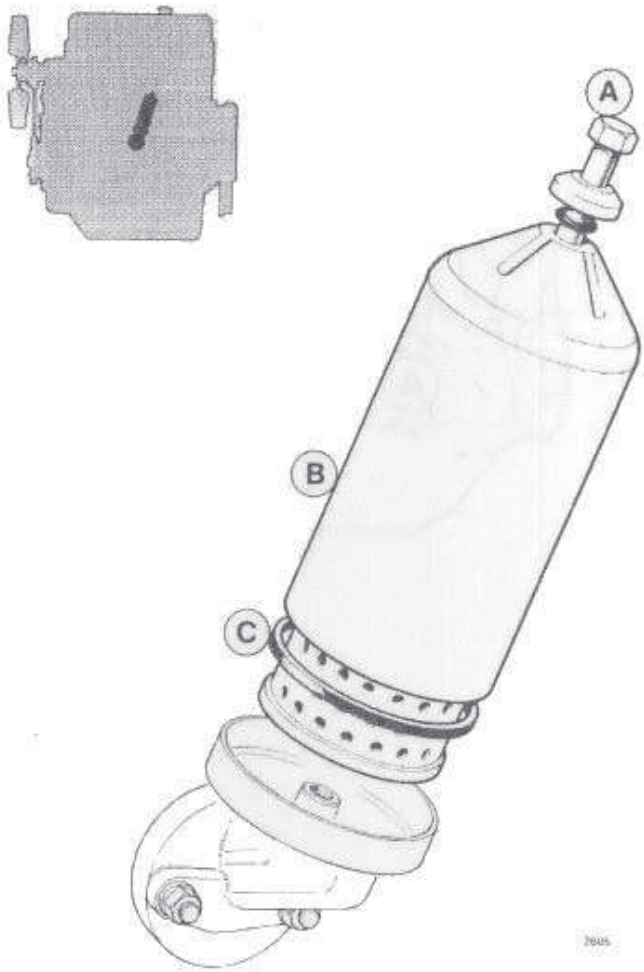
ENGINE OIL FILTER

RENEW
ELEMENT 200 Hours

1 Unscrew bolt A remove body and element B

2 Clean all metal parts

3 Re-assemble with new element and seal C
Smear new seal with oil before assembly



ENGINE Fuel System

Bleeding

If engine fails to start or misfires, or if any part of the fuel system has been disconnected, bleed system as follows:

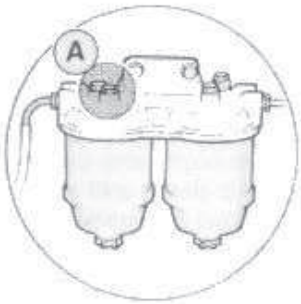
1 Slacken screw A

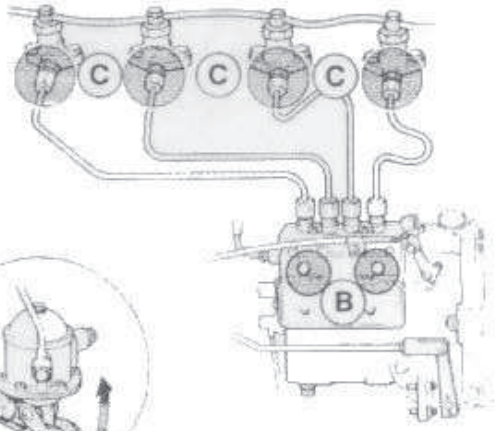
2 Operate lift pump priming lever until air free fuel flows from the screw, then re-tighten.

Note:
If the lift pump priming lever cannot be operated, turn engine until lever can be moved.

3 Slacken screws B operate lift pump lever until air free fuel flows from screws then re-tighten.

4 Slacken unions C open throttle, push in engine stop control, operate starter until air free fuel flows from unions then re-tighten.





Bleeding

If engine fails to start or misfires, or if any part of the fuel system has been disconnected, bleed system as follows:

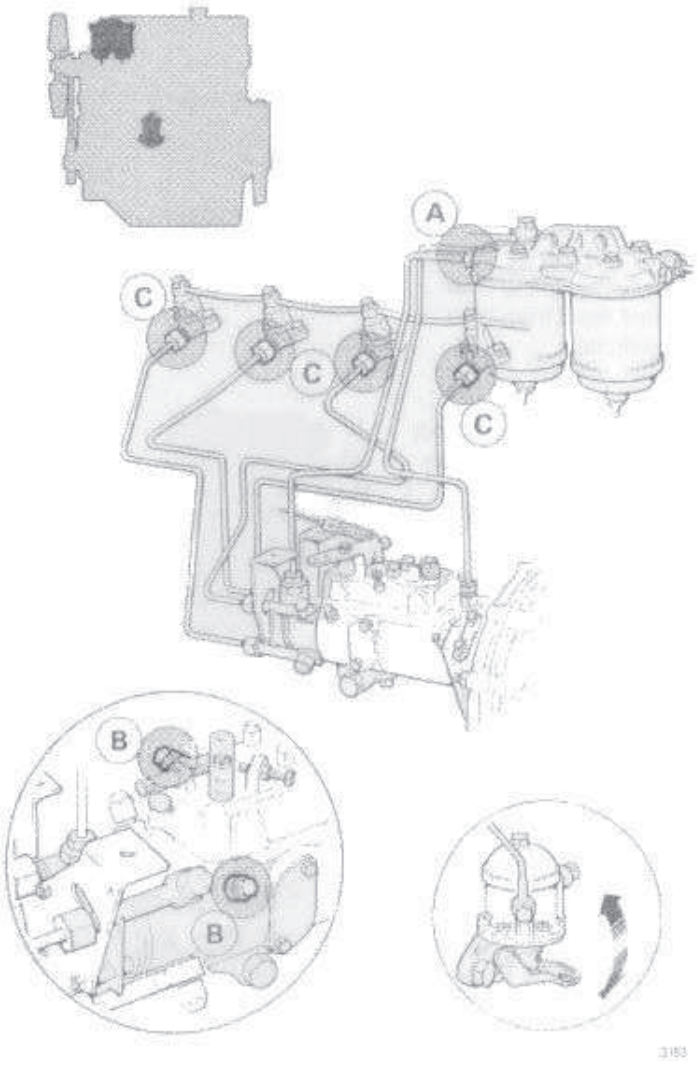
1 Slacken screw A

2 Operate lift pump priming lever until air free fuel flows from the screw, then retighten.

Note:
If the lift pump priming lever cannot be operated, turn engine until lever can be moved.

3 Slacken screws B operate lift pump lever until air free fuel flows from screws then retighten.

4 Slacken unions C open throttle, push in engine stop control, operate starter until air free fuel flows from unions then re-tighten.



ENGINE FUEL SYSTEM
From Engine No 35217

Bleeding

If engine fails to start or misfires, or if any part of the fuel system has been disconnected, bleed system as follows:

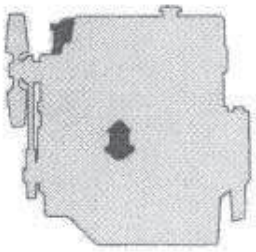
1 Slacken screw A

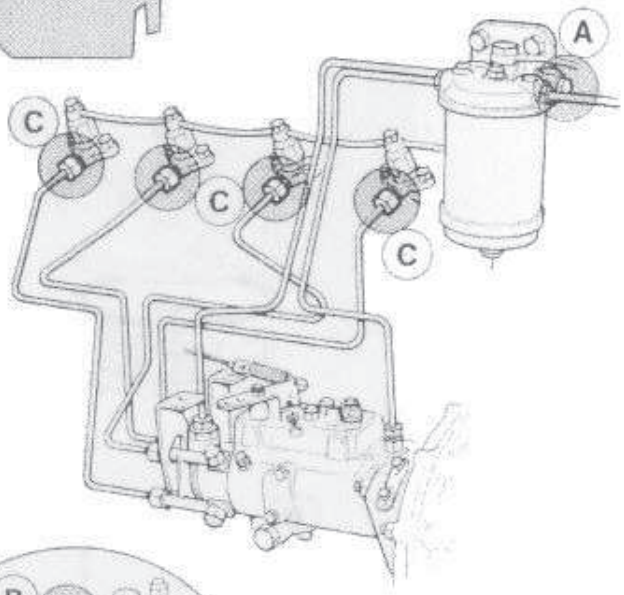
2 Operate lift pump priming lever until air free fuel flows from the screw, then re-tighten.

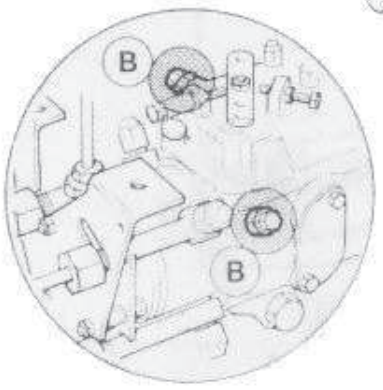
Note:
If the lift pump priming lever cannot be operated, turn engine until lever can be moved.

3 Slacken screws B operate lift pump lever until air free fuel flows from screws then re-tighten.

4 Slacken unions C open throttle, push in engine stop control, operate starter until air free fuel flows from unions then re-tighten.







ENGINE FUEL Filter

DRAIN 50 Hours

Drain off any water in glass bowl by turning tap A

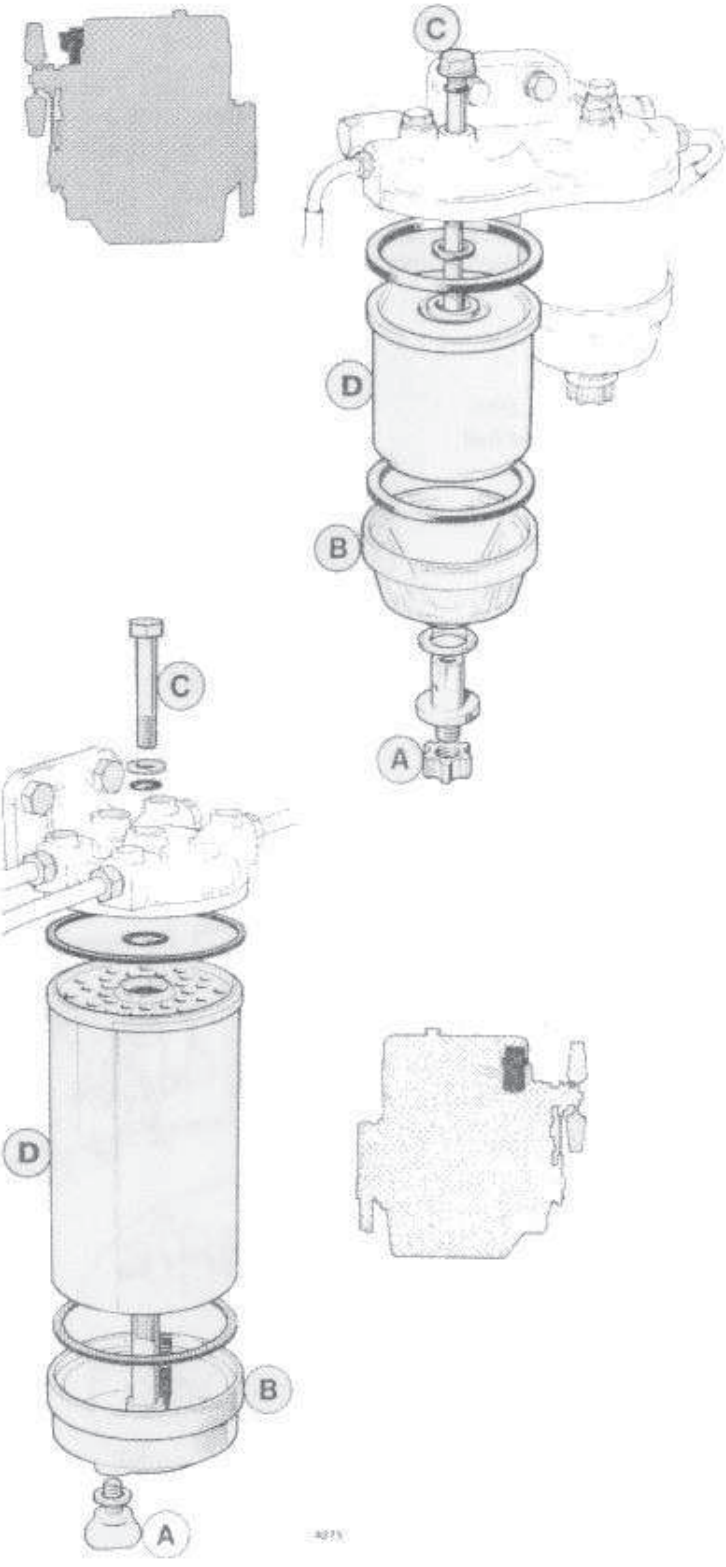
RENEW ELEMENTS 400 Hours

1 Support bowl B while unscrewing bolt C

2 Remove bowl and element D using a twisting motion

3 Re-assemble using new element and sealing rings

4 Bleed the fuel system



ENGINE FUEL SEDIMENT BOWL

DRAIN 50 Hours

Drain off any water in glass bowl by turning tap A

CLEAN
Periodically dismantle

1 Clamp inlet fuel lines to prevent loss of fuel

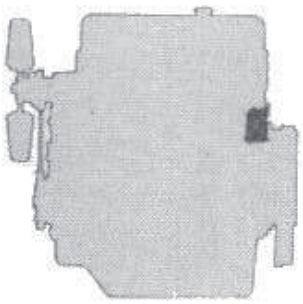
2 Support bowl B and unscrew bolt C

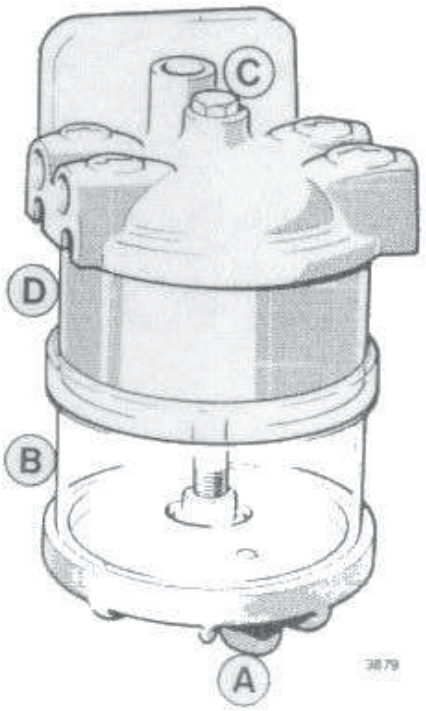
3 Wash element D in clean fuel

4 Reassemble in reverse order ensuring gaskets are in position and bolt is not overtightened

5 Remove fuel line clamp

6 Bleed the fuel system





ENGINE FUEL LIFT PUMP

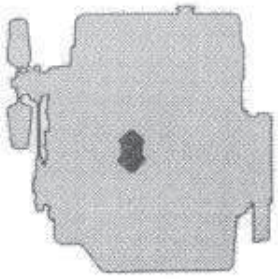
CLEAN GAUZE 400 Hours

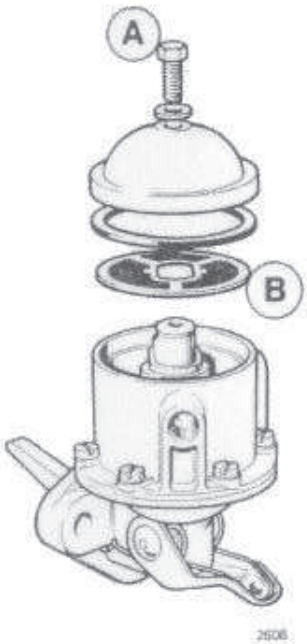
1 Unscrew bolt A remove cover and gauze B

2 Wash gauze with petrol and a soft brush

3 Re-assemble, tightening bolt just sufficiently to make a seal

4 Bleed the fuel system





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4-9

ENGINE FUEL INJECTION PUMP

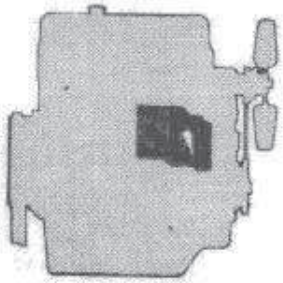
CHECK OIL LEVEL 50 Hours

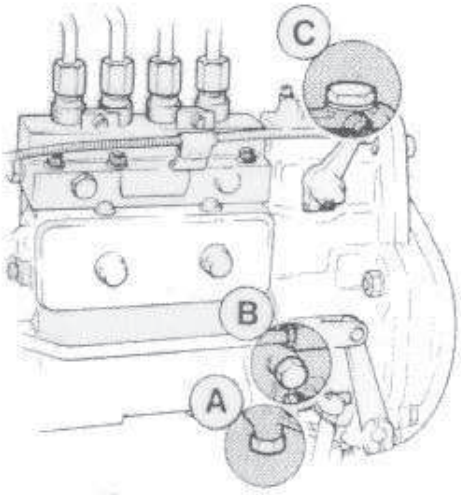
DRAIN & REFILL 200 Hours

A Drain Plug

B Level Plug

C Filler Plug





ENGINE FUEL INJECTORS

CLEAN & SERVICE 400 Hours

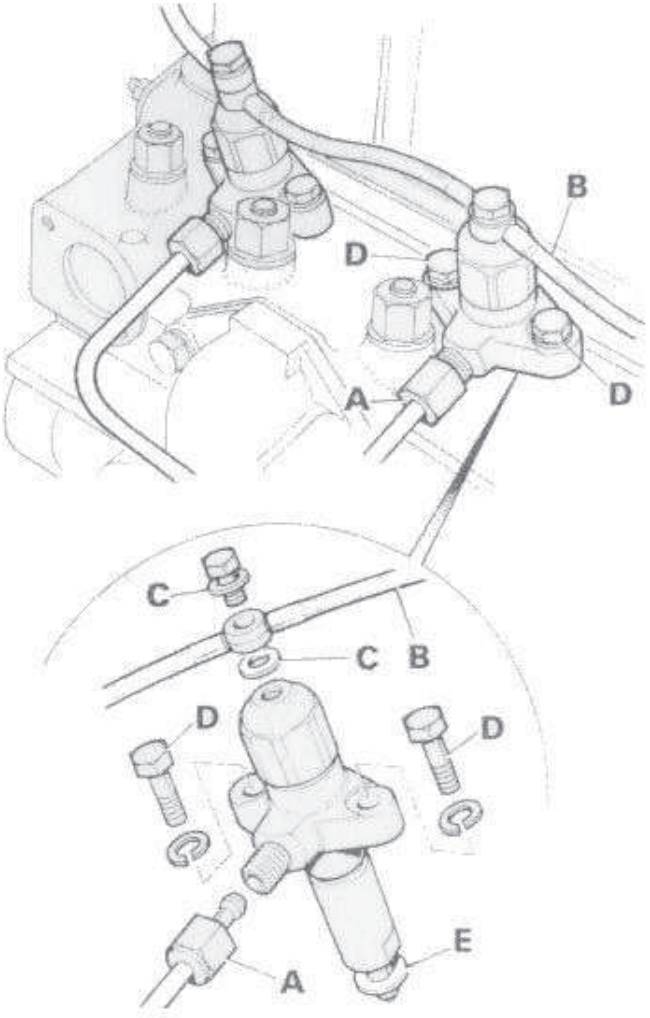
1 Disconnect feed pipe A and spill rail B Note the sealing washer C each side of the spill rail banjo.

2 Remove the injector securing bolts D and the injector.

3 Clean and test injectors (see engine manual 9803/1200)

4 Renew sealing washer E when replacing injectors

5 Torque tighten securing bolts D (see Technical data)



ENGINE
COOLING SYSTEM

CHECK LEVEL 10 Hours

A Radiator Filling Cap

B Radiator Drain Tap

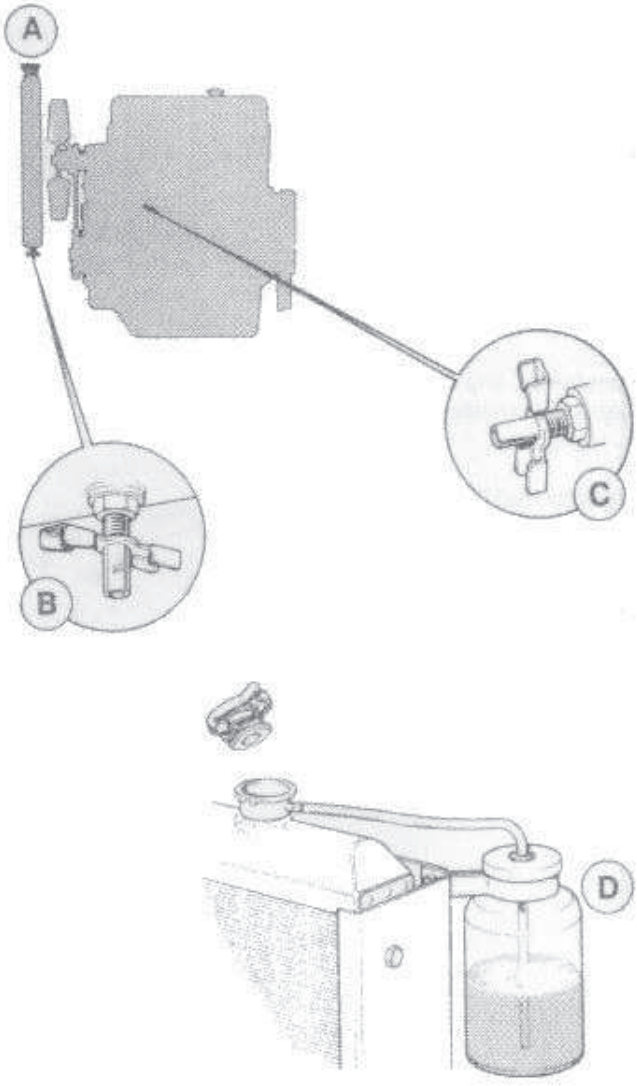
C Cylinder Block Drain Tap

D Expansion Bottle

Warning:
Do not remove radiator cap when system is over-heated.

Keep expansion bottle half full

Top up with appropriate solution of anti-freeze and water



ANTI-FREEZE

Add 0.15 litres (1/4 pint) to coolant in expansion tank Add to radiator (see below)

25% Anti-freeze - 3.5 litres - 6 UK pints – 7.2 US pints starts to freeze at –12°C (10°F)

57% Anti-freeze - 8 litres - 13.5 UK pints – 16.2 US pints starts to freeze at –30°C (22°F)

ENGINE
FAN BELT

ADJUSTMENT 50 Hours

1 For easier access to alternator, unscrew bolts at A to remove fan guard B.

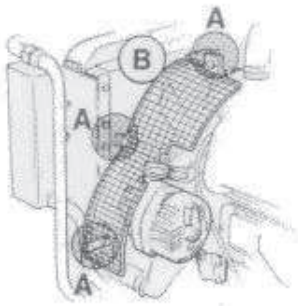
2 Slacken bolts C and D.

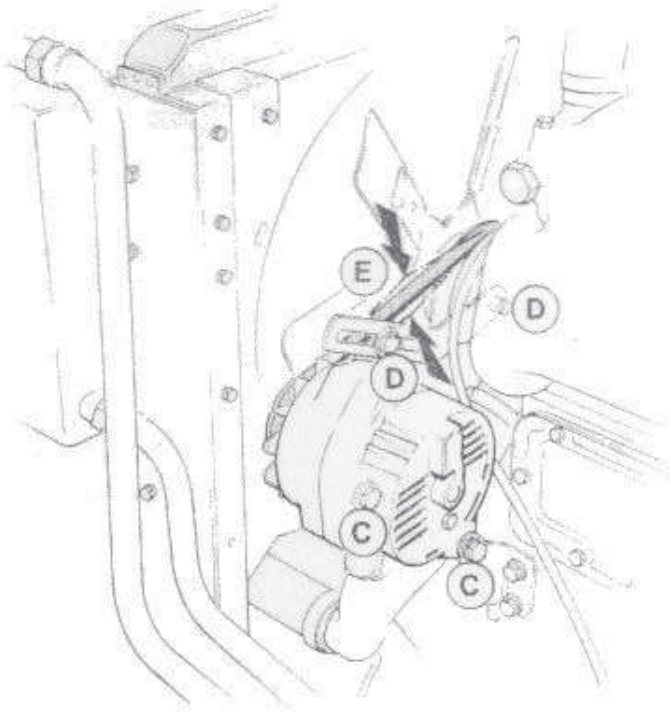
3 Move alternator away from engine until there is 13mm. (0.5in) slack at E.

4 Retighten bolts C and D tightening bolt C at rear of alternator last.

CAUTION:
Any leverage required to position alternator must be applied at the drive end bracket only, using a wooden lever.

5 Refit fan guard and secure.





ENGINE FAN BELT

ADJUSTMENT
Note: Ensure Engine is not running

1 For easier access to alternator, unscrew bolts at A to remove fan guard B.

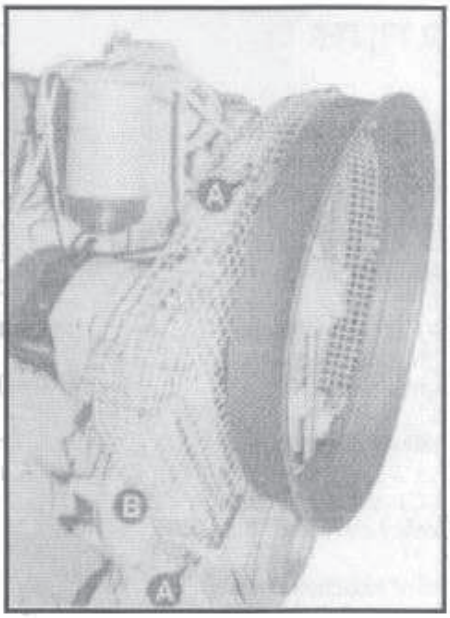
2 Slacken bolts C and D.

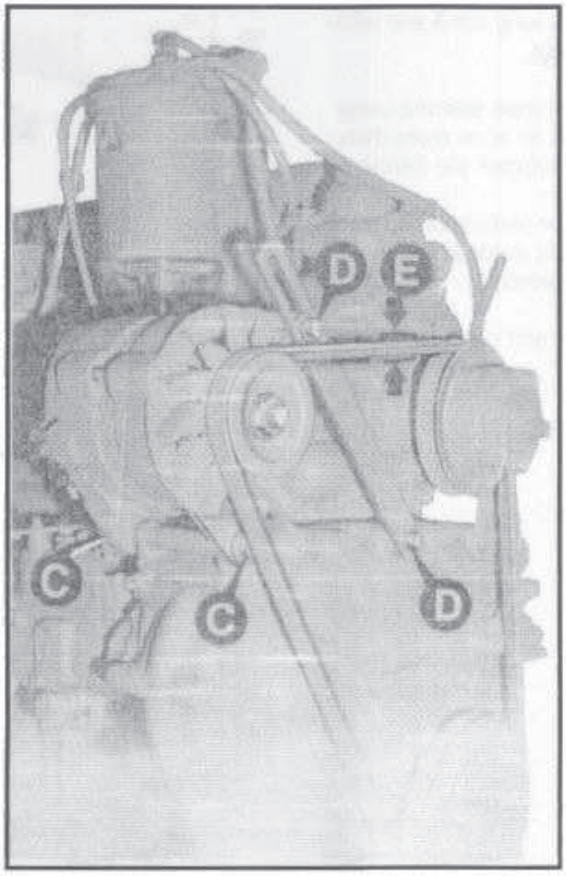
3 Move alternator away from engine until there is 13mm. (0.5in) slack at E.

4 Retighten bolts C and D tightening bolt C at rear of alternator last.

5 Refit fan guard and secure

CAUTION:
Any leverage required to position alternator must be applied at the drive end bracket only, using a wooden lever.





ENGINE AIR FILTER

To Machine N0. 129342

CLEAN VACUATOR VALVE 50 hours

RENEW ELEMENT 800 hours

DO NOT disturb filter elements between service intervals unless the filter warning light shows red.

DO NOT tap or knock element

ENSURE seal at C is smeared with grease and is seated correctly

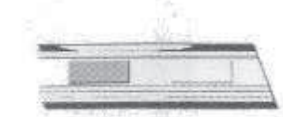
CHECK tightness of induction hose clips at regular intervals.

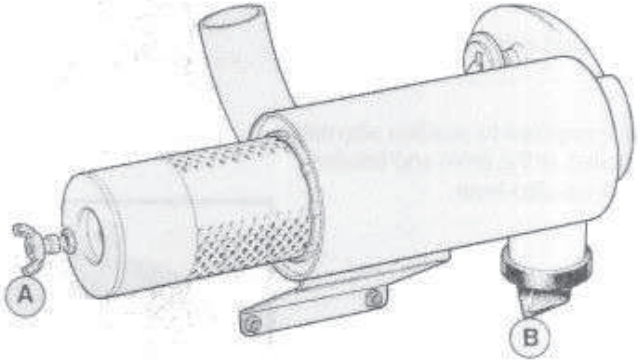
1 Unscrew wing nut A and withdraw element.

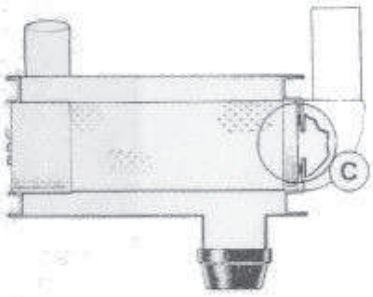
2 Blow dirt from element using compressed air at no more than 6.9 bar (7kgf/cm² 100 lbf/in²)

3 Check for perforation by placing a strong light inside element. Renew if perforated.

4 Remove and clean vacuator valve B







ENGINE AIR FILTER

From Machine N0. 129343

CLEAN VACUATOR VALVE 50 hours

RENEW Main ELEMENT 800 hours

RENEW SAFETY ELEMENT 1600 hours

DO NOT disturb filter elements between service intervals unless the filter warning light shows red.

DO NOT tap or knock element

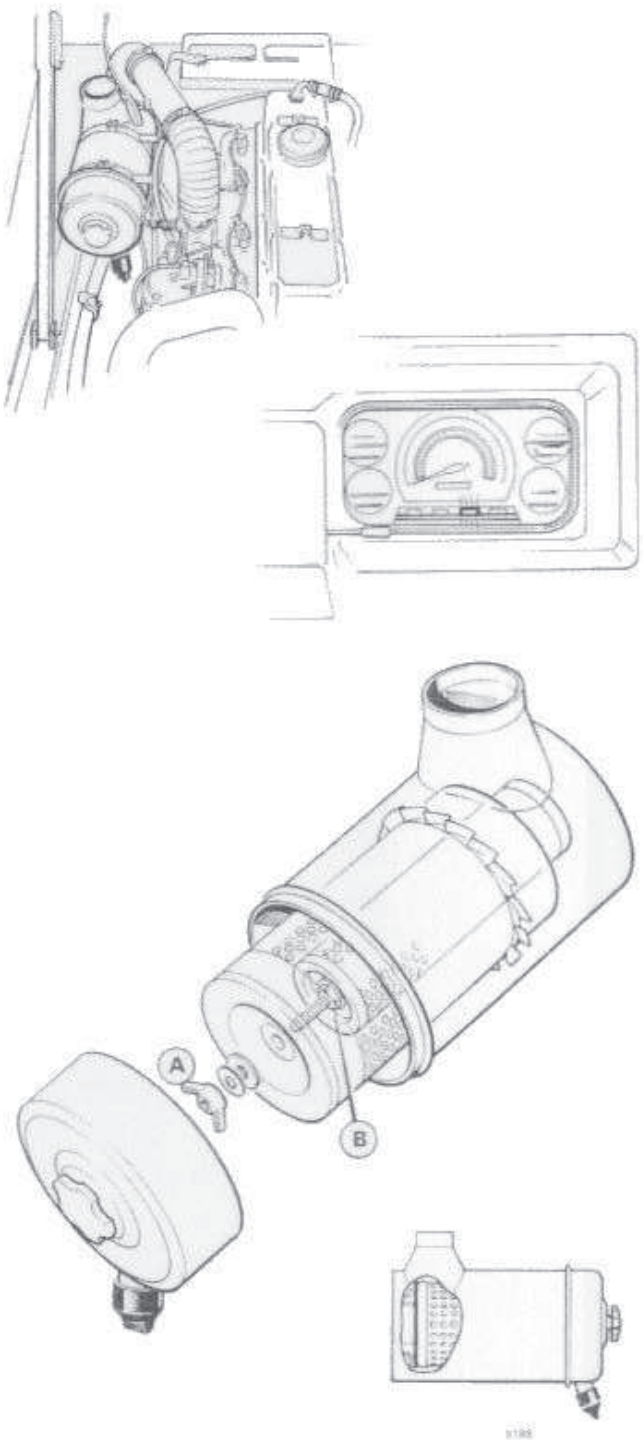
Note: The safety element should only be removed at 1600 hours or if the main element has been holed.

CAUTION: Before removing the safety element disconnect the air cleaner from the engine.

1 Unscrew wing nut A and withdraw element.

2 Blow dirt from element using compressed air at no more than 6.9 bar (7kgf/cm² 100 lbf/in²)

3 Check for perforation by placing a strong light inside element. Renew if perforated.



GEARBOX OIL

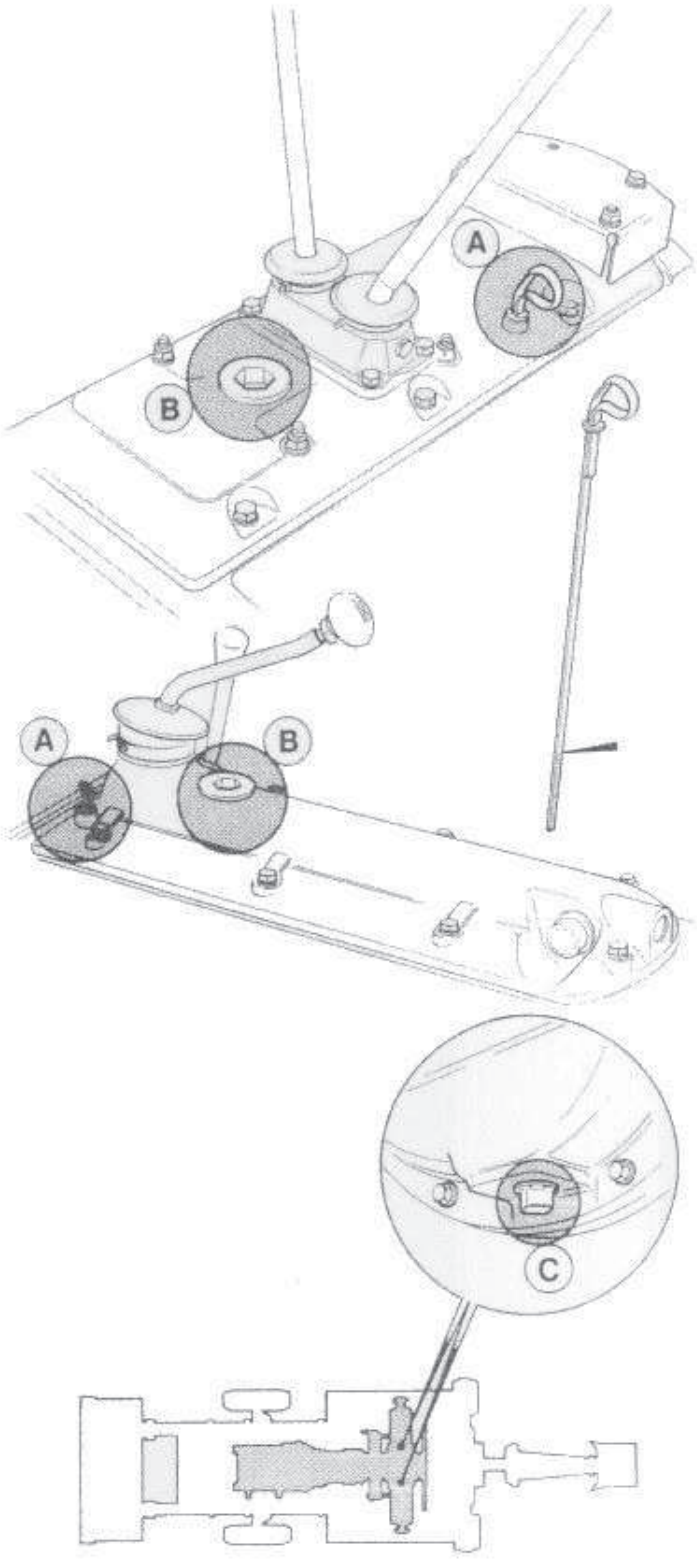
CHECK LEVEL 50 hours

DRAIN AND REFILL 800 hours

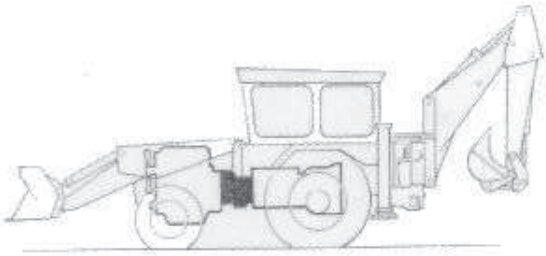
A Dipstick

B Filler plug

C Drain plug (one each side)



TORQUE CONVERTER OIL LEVEL



CHECK LEVEL 10 hours

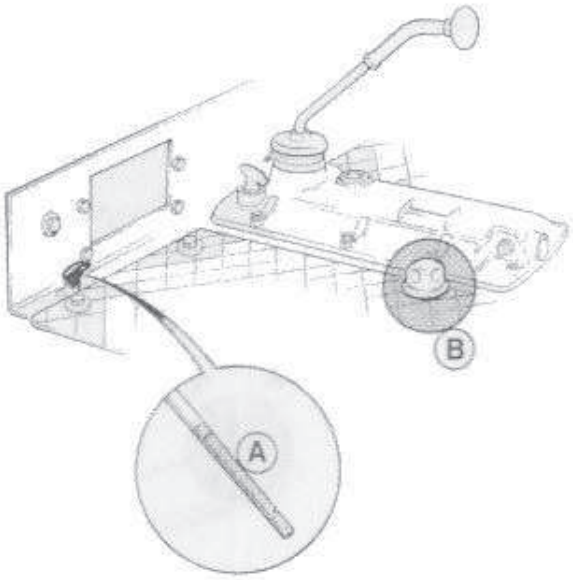
Run engine for two minutes then with engine idling check oil level (Dipstick A)

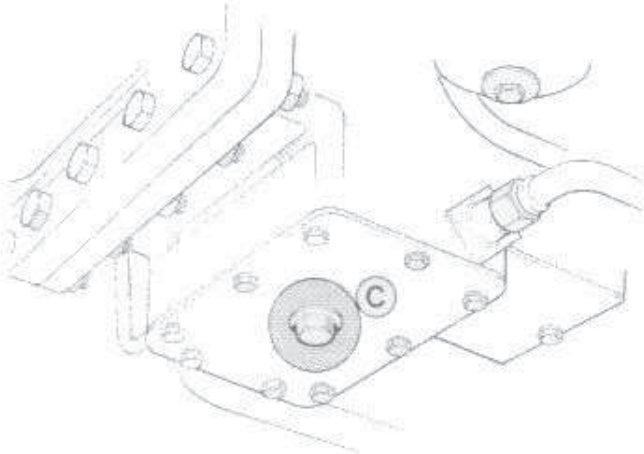
DRAIN AND REFILL 800 hours

Drain (Drain plug C) whilst transmission oil is hot.

Top up or fill (Filler cap B) with transmission fluid (see Lubrication Chart)

Caution:
DO NOT OVERFILL





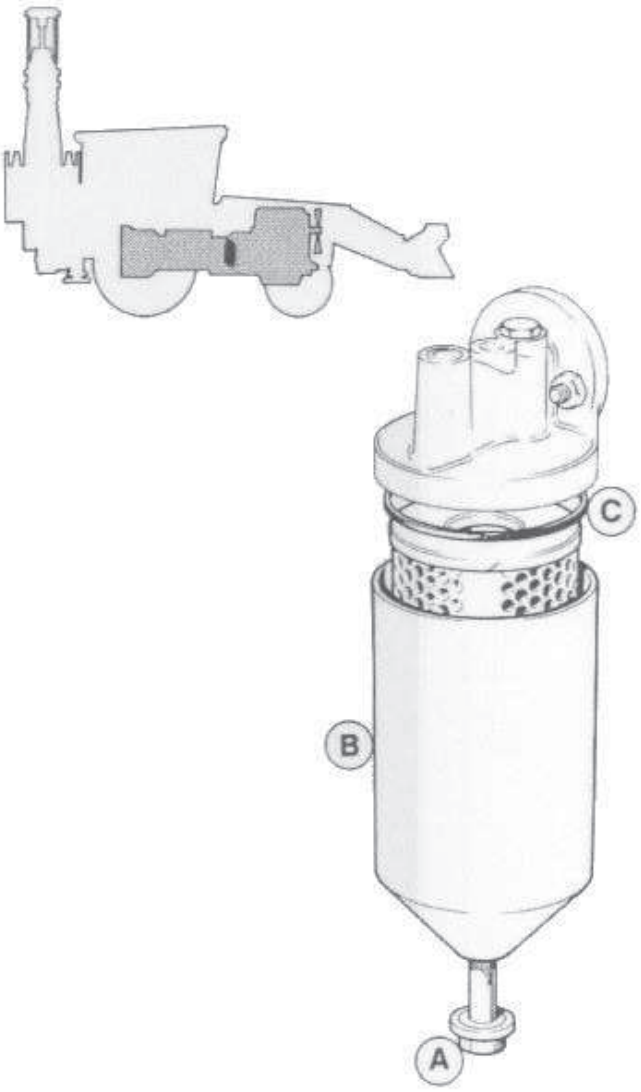
TORQUE CONVERTER OIL FILTER

RENEW ELEMENT 400 hours

1 Unscrew bolt A remove body and element B

2 Clean all metal parts

3 Re-assemble with new element and seal C



GEARBOX OIL LEVEL

CHECK LEVEL 50 hours

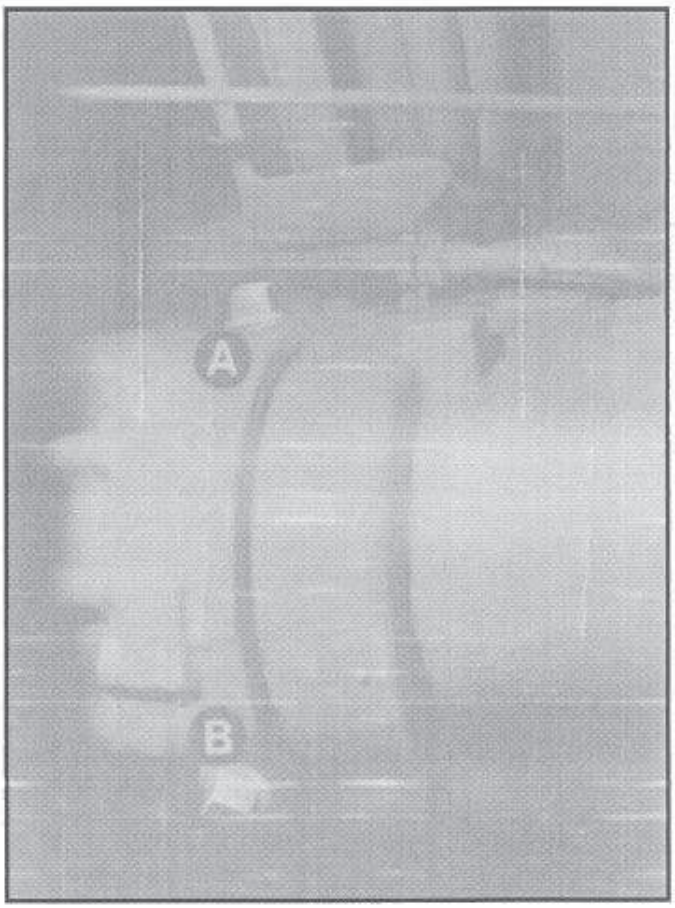
When checking oil level park machine on level ground. Remove fill/level plug **A**

Drain and Refill 800 hours

1 Remove fill/level plug A and drain plug **B**

2 Refit drain plug **B**

3 Refill at **A**



TORQUE CONVERTER OIL LEVEL

CHECK LEVEL DAILY

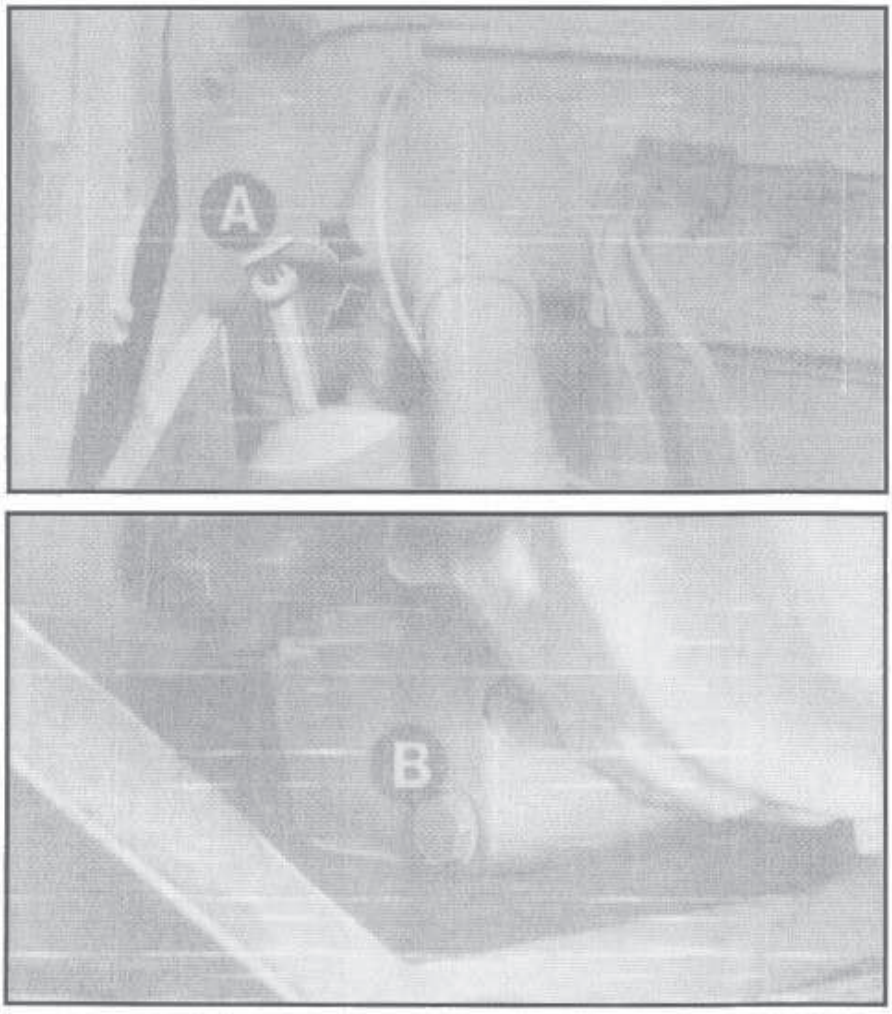
DRAIN & REFILL 800 hours

A Dipstick / Filler

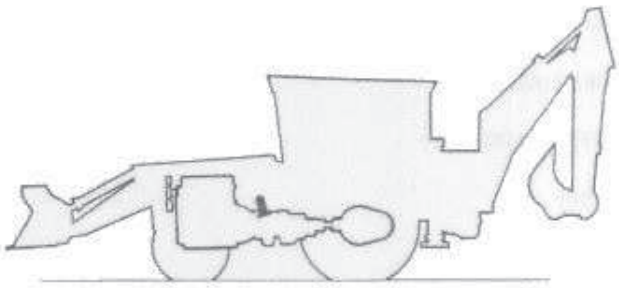
B Drain plug

Note:
Twist dipstick to remove

Check oil level immediately after stopping engine



TORQUE CONVERTER OIL FILTER

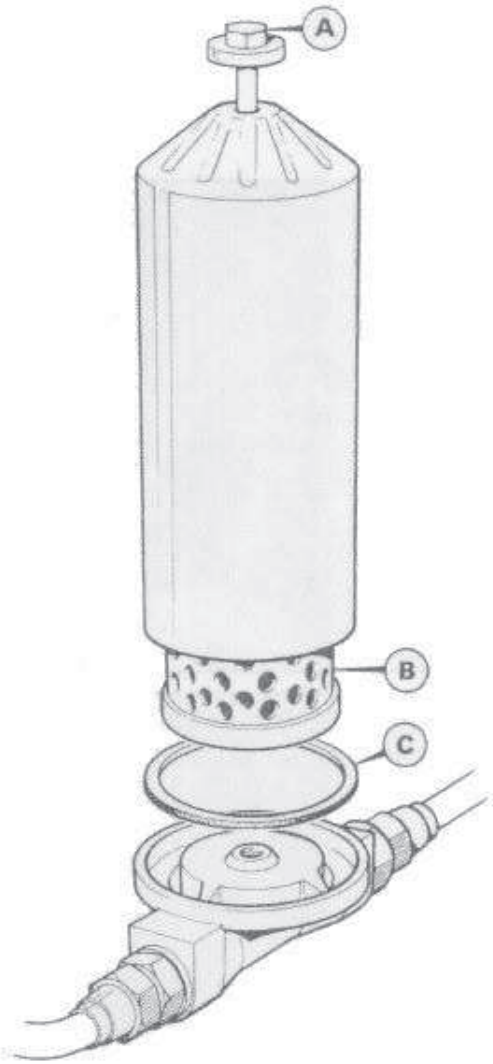


RENEW ELEMENT 400 hours

1 Unscrew bolt A remove body and element B

2 Clean all metal parts

3 Re-assemble with new element and seal C



5-7

REAR AXLE OIL LEVEL

CHECK LEVEL 50 hours

When checking park machine on level ground, remove Fill / Level Plug A Oil should run from hole. Top up if necessary

DRAIN and REFILL 800 hours

To drain and refill park machine on level ground.

1 Remove Fill Level Plug A and Drain Plug (Magnetic) B

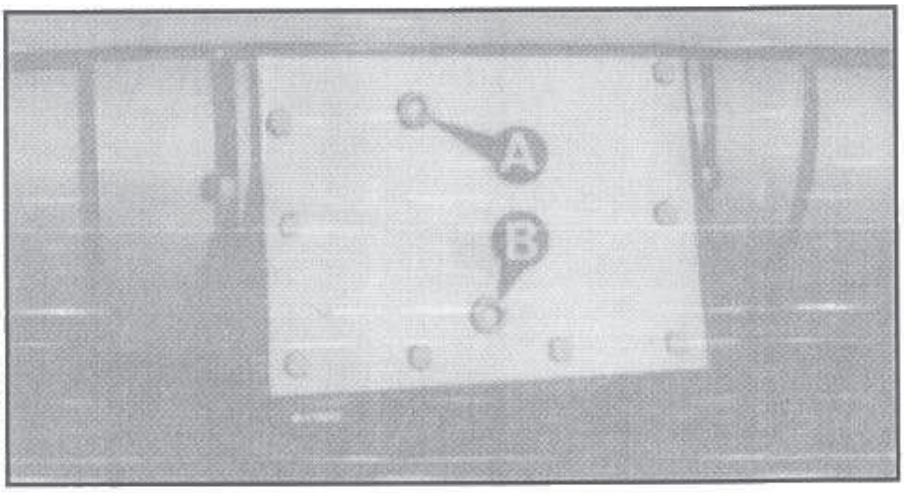
NOTE: Wipe drain plug clean before refitting.

2 Refit drain plug B

3 Refill at A

(See Lubrication Chart)

Note:
When filling the axle allow time for the oil to drain past the axle shaft bearings into the axle arm before rechecking the level otherwise a



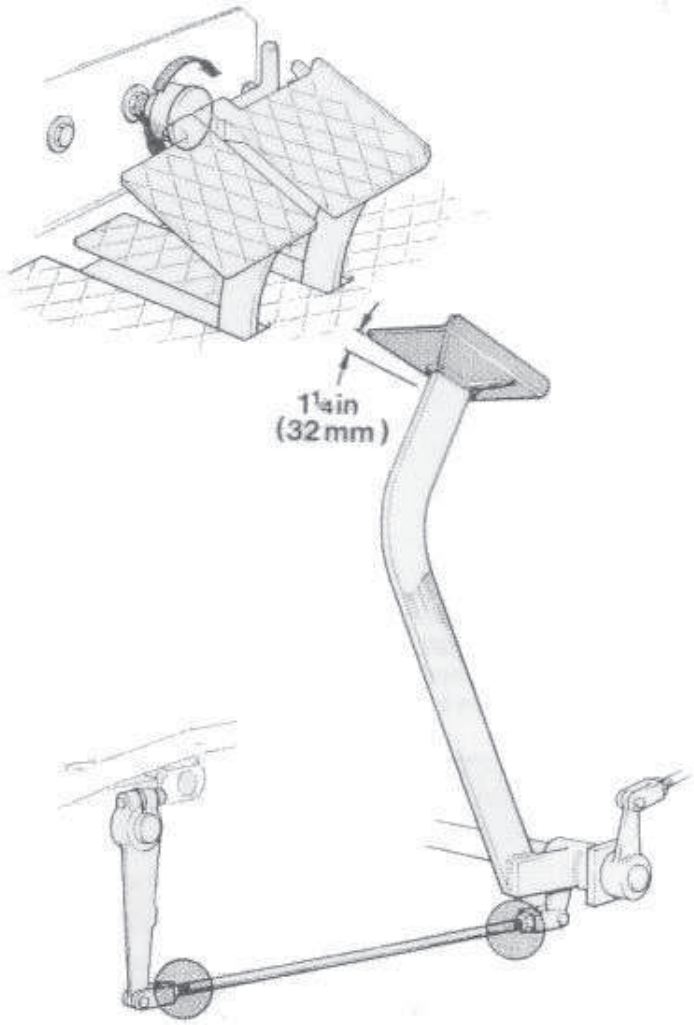
CLUTCH ADJUSTMENT

CLUTCH GREASER
10 hours (Half a turn)

Keep clutch greaser filled with grease (See Lubrication Chart)

CHECK FREE MOVEMENT
Every 50 hours

Adjust length of rod to obtain 1¼ (32mm) free movement at clutch pedal.



FOOTBRAKE

To Machine No 129502

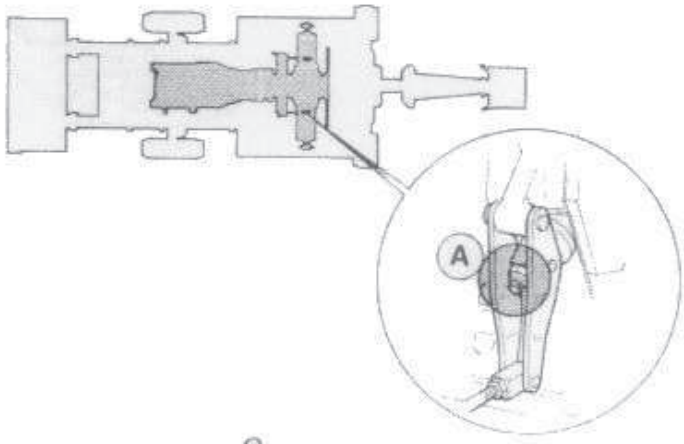
CHECK ADJUSTMENT
50 hours

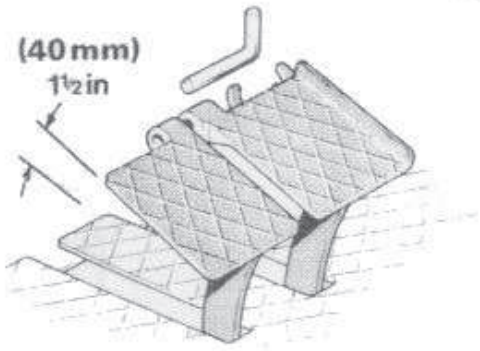
LEFT FOOT BRAKE
Screw up nut A to obtain 40mm (1½in) free movement on L.H. pedal.

RIGHT FOOT BRAKE
Adjust until R.H. pedal lines up with L.H. pedal when free movement is taken up.

Machine should brake in a straight line when brake pedals are latched together. If machine pulls to one side slightly increase free movement on pedal operating that side.

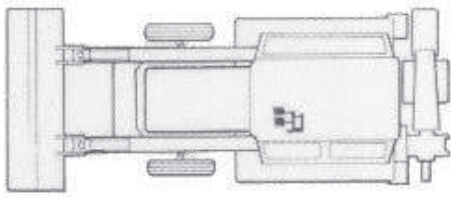
For handbrake adjustment see page 3 7-2





HANDBRAKE

To Machine No 129502



CHECK ADJUSTMENT

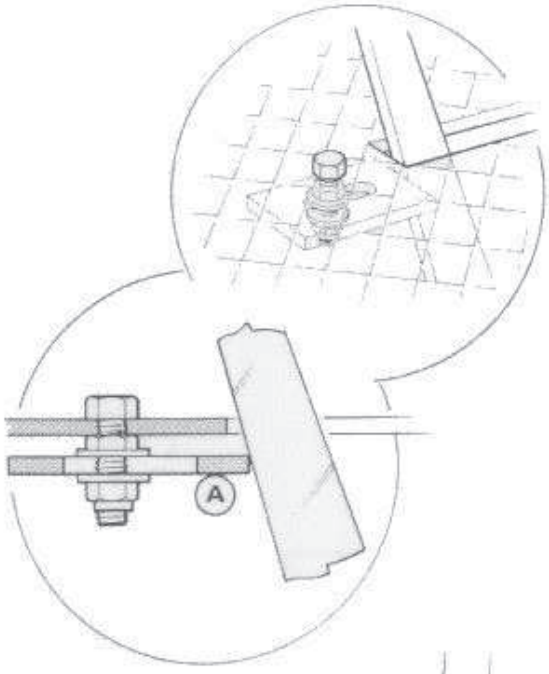
50 hours

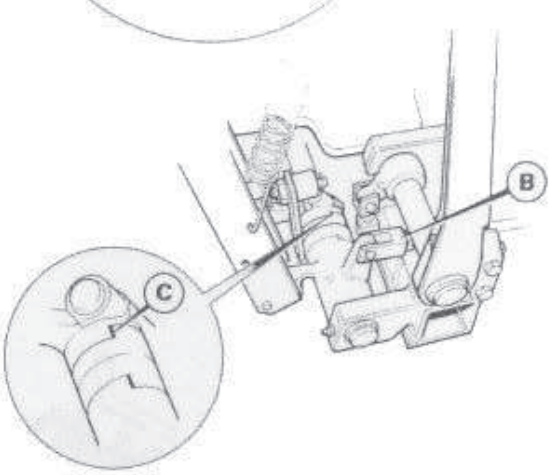
NOTE:
The handbrake adjustment must always be checked after adjusting footbrakes.

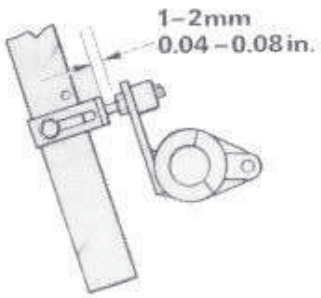
Set handbrake lever on first notch of ratchet and adjust stop A.

Adjust clevis B to remove free play C.

Set angle bracket to give switch clearance.







BRAKES

From Machine No 129503
(skid builds only)

CHECK ADJUSTMENT

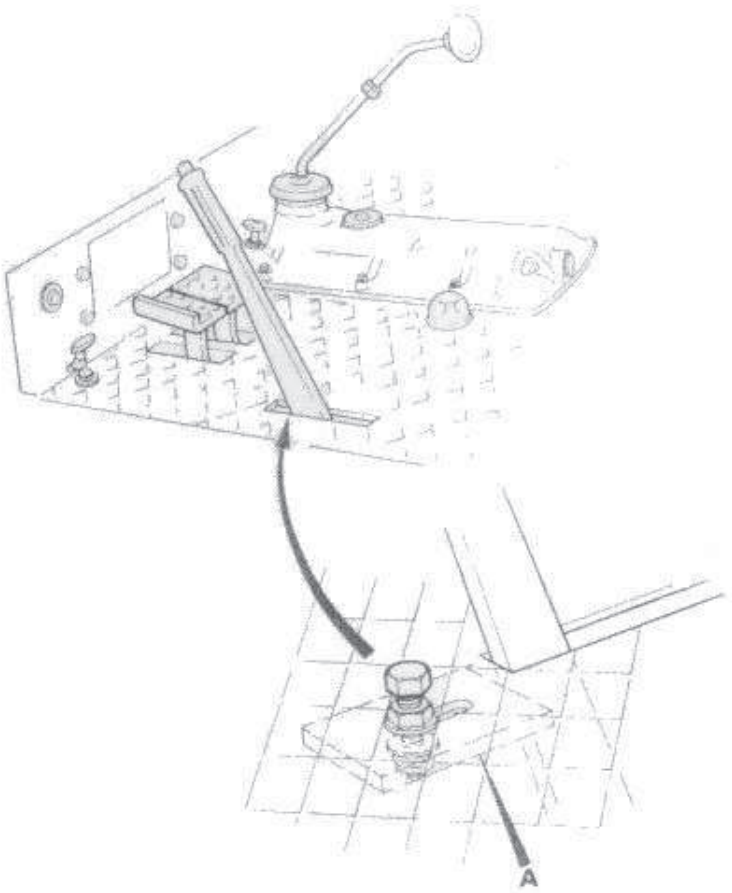
50 hours

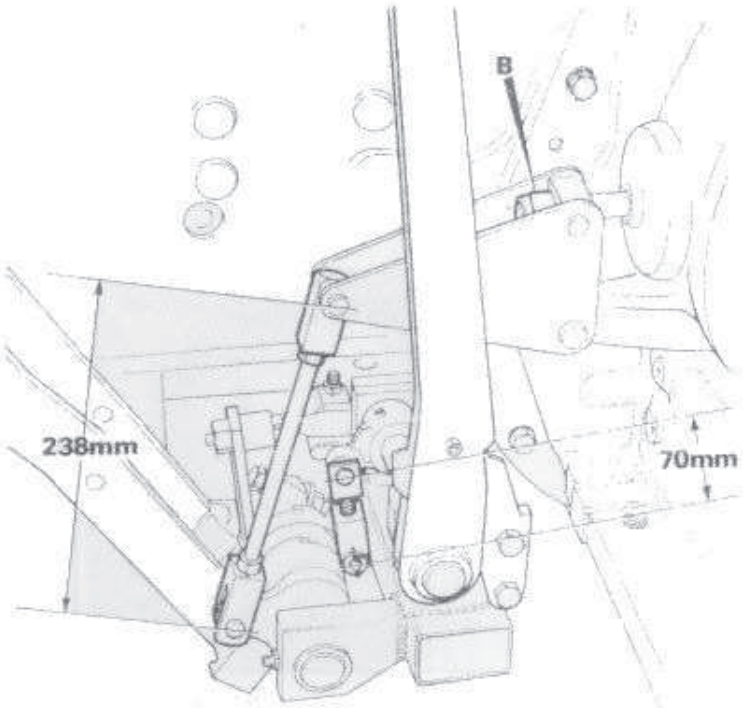
Adjust brake linkage to the dimensions given between the clevis pin centres.

Set handbrake stop A to limit forward travel of handbrake lever at 2nd notch of rack.

Jack rear wheel off ground and tighten each adjusting nut B until wheel just locks and then back off nut10 flats.

Road test to check brake balance backing off appropriate nut, if required, to adjust balance.





SERVICE BRAKES

Check level Daily

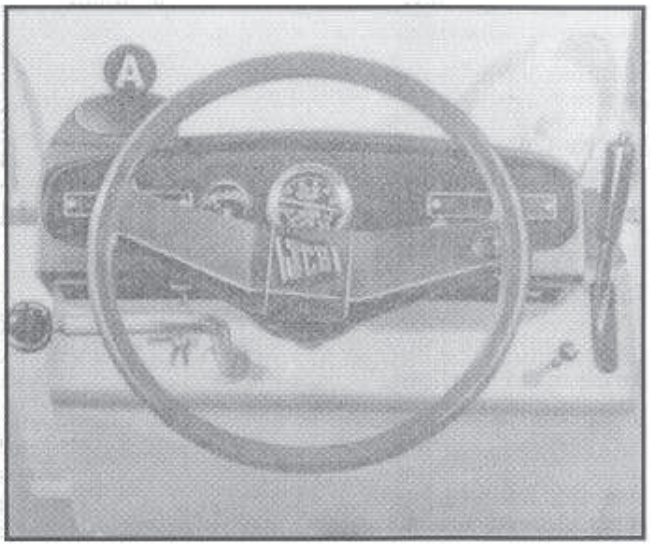
CHECK ADJUSTMENT
DRY BRAKES ONLY
50 hours

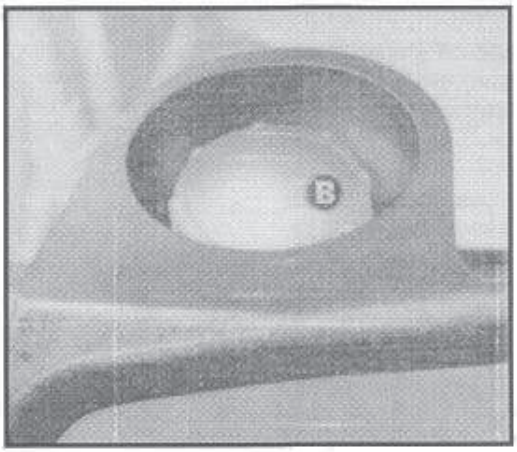
Remove cover **A** unscrew cap **B** and top up if necessary to correct level mark. **DO NOT** allow fluid to fall below **DANGER** mark.

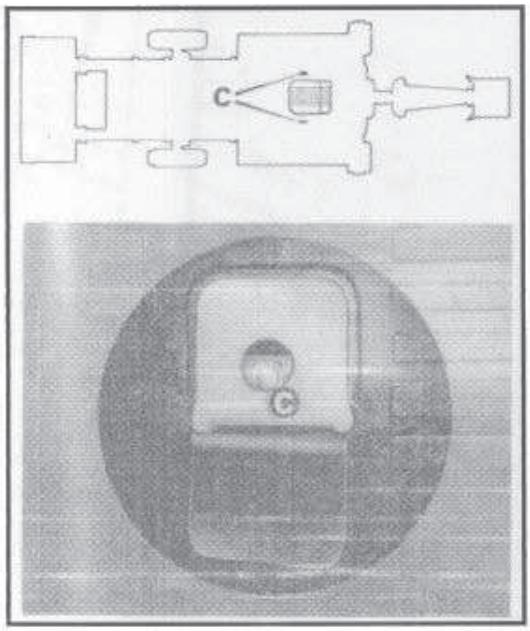
See lubrication chart for correct fluid.

WARNING
USE OF INCORRECT BRAKE FLUID WILL CAUSE SERIOUS DAMAGE.

Jack rear wheels off ground. Tighten each adjusting nut C until wheel just locks and then slacken off 1½ turns. Road test to check brake balance. To adjust balance, back off appropriate nut and re-test machine.







PARKING BRAKE

ADJUSTMENT

Pads should just touch the discs as A Adjust at nut B if required.

Take up any cable slack at C

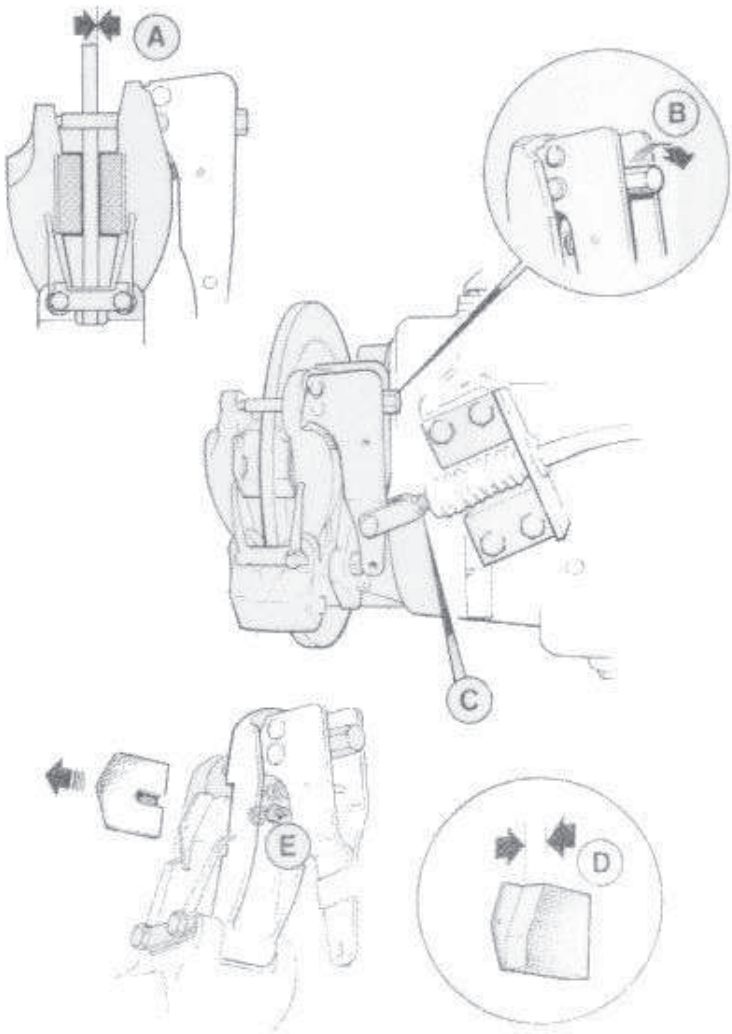
PAD RENEWAL

Renew pads when thickness D of friction material is 3mm (0.125in)

Back off all adjustment, slacken nut E and withdraw pads.

Install new pads and adjust.

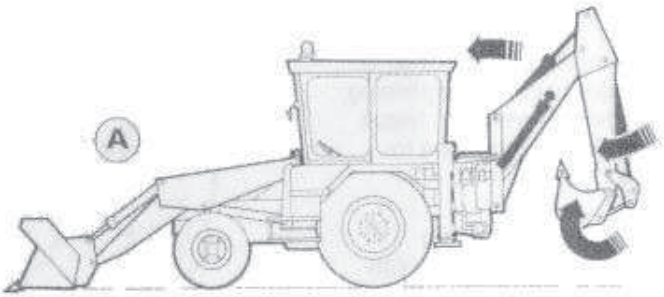
Caution:
The parking brake must NOT be used to slow the machine from travelling speed, otherwise pad wear will be excessive. In the case of an emergency stop, the brake pads should be checked and if nec-



HYDRAULIC FLUID LEVEL

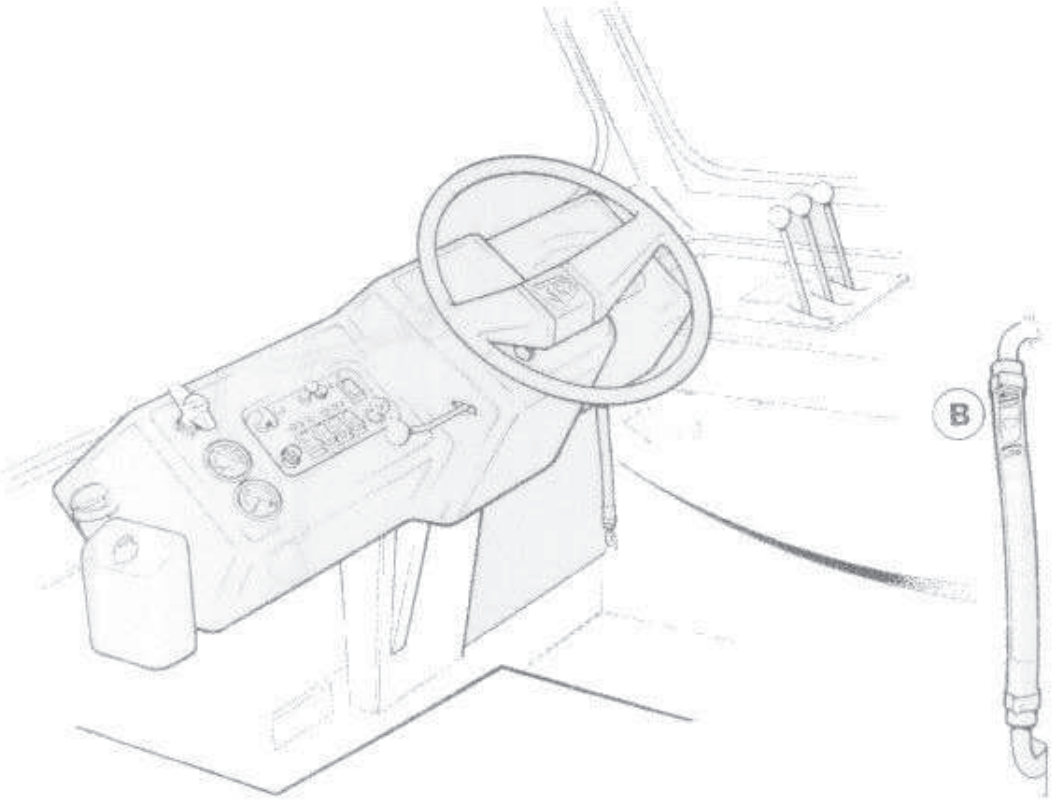
CHECK LEVEL 10 Hours

Drain & refill 1600 Hours

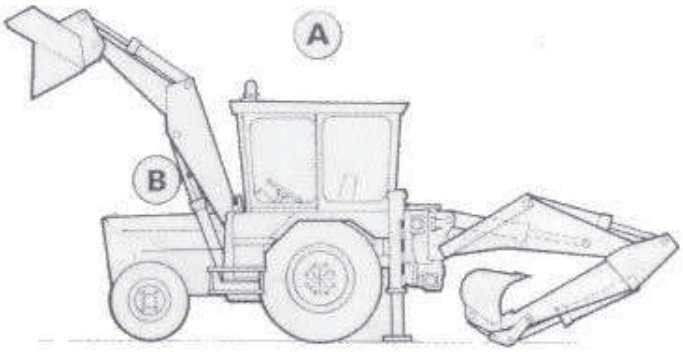


FLUID LEVEL
Position machine as shown at A with front shovel resting on ground, boom ram closed and dipper and bucket rams open. The correct level is then two thirds up the level indicator tube (early machines) or between the two indicator marks as shown at B (later machines)

CAUTION
DO NOT run engine with filler cap E (page 3 8-2 removed.



HYDRAULIC FILTER



RENEW ELEMENT 400 Hours

1 Position machine as at A with all rams extended to prevent syphoning when filter body is removed. Install ram prop B before attempting to change filter element.

2 Remove U-bolt C, unscrew through bolt D until filter body can be withdrawn approximately 25mm (1 in)

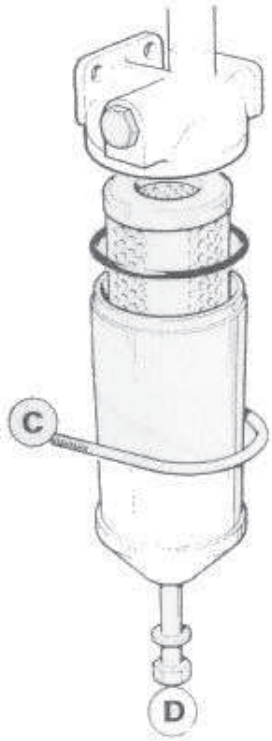
NOTE:
More than 5 litres (1 UK Gal) will flow from filter at this stage.

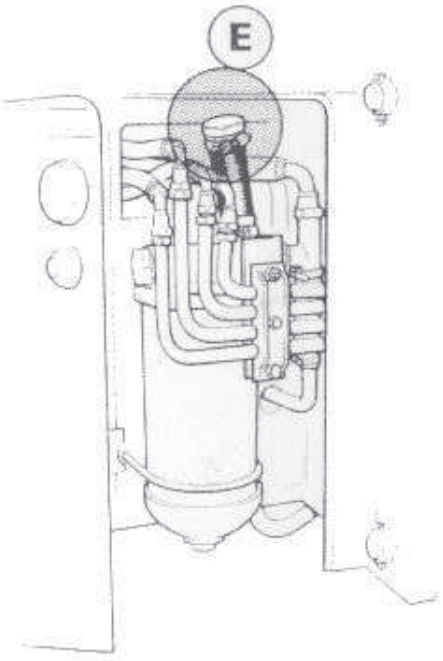
3 Remove bolt D and filter body, discard element and seals.

4 Wash allmetal parts in clean JCB Special Hydraulic Fluid.

5 reassemble using new element and seals.

6 Top up hydraulic system at E





MAIN SUCTION STRAINER

CLEAN 1600 Hours

1 Remove plug **A** to drain hydraulic tank.

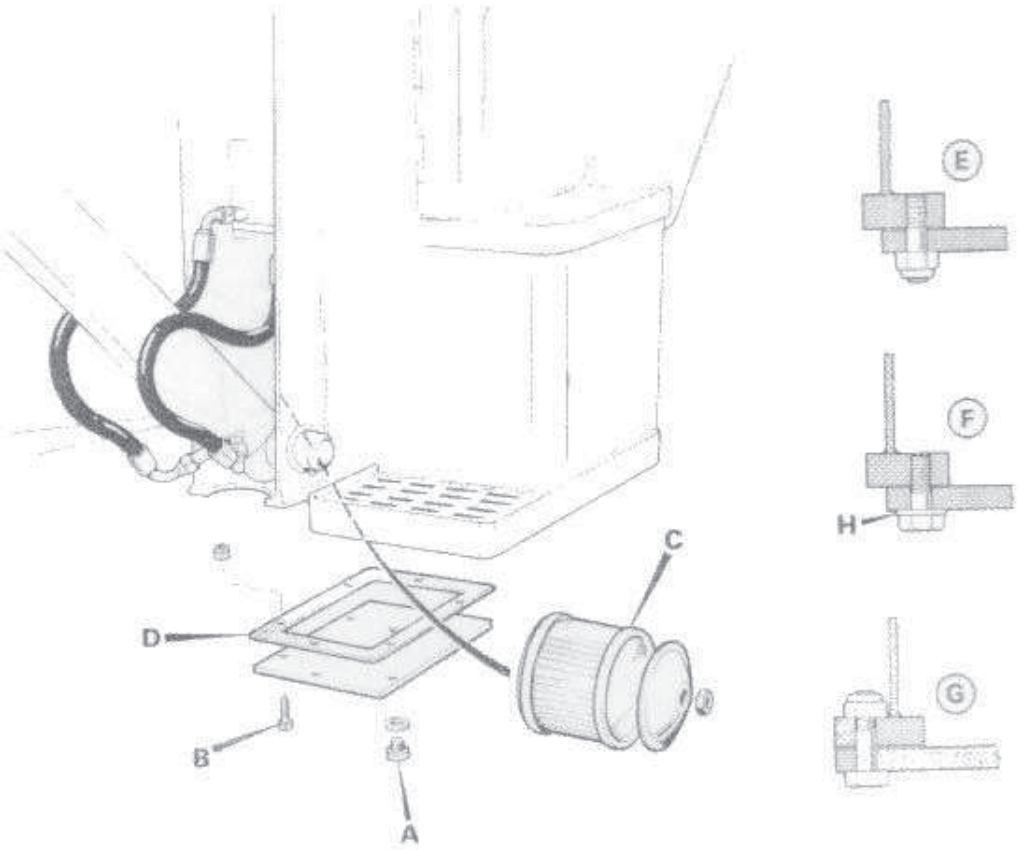
2 Unscrew bolts **B** and remove access plate.

3 Remove strainer C and wash in petrol or carbon tetrachloride

NOTE:
If a new strainer is fitted, it should be similarly washed to remove the protective coating.

4 Reassemble using new gasket **D**

NOTE:
Three alternative methods of access plate attachment are shown at **E, F** and **G** If F is used, renew sealing washer **H**



STEERING PUMP STRAINER

CLEAN ELEMENT 1600 Hours

1 Disconnect and blank hose A and connection B

2 If hydraulic fluid is not drained, unscrew complete strainer assembly C and blank stub pipe D to avoid excessive fluid loss.

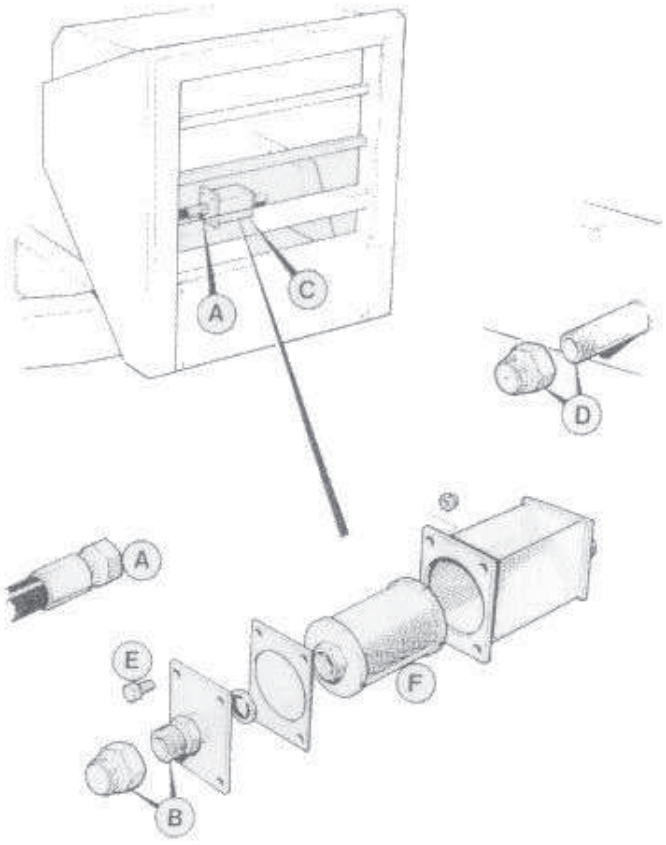
3 Unscrew bolts E and remove element F.

4 Wash element in petrol or carbon tetrachloride.

NOTE:
If a new strainer is fitted, it should be similarly washed to remove the protective coating.

5 Reassemble using new seal and gasket.

CAUTION:
Tighten bolts E to a torque setting of 15-20 lbf ft (2.1-2.8 kgf m). Overtightening will cause distortion of the end plate and subsequent fluid leakage.



9-1

ELECTRICS

Control Box
Up to m/c No 61767

A Fuses
B Flasher Unit
C Voltage Regulator

From m/c No 61768

D Fuses
E Flasher Unit

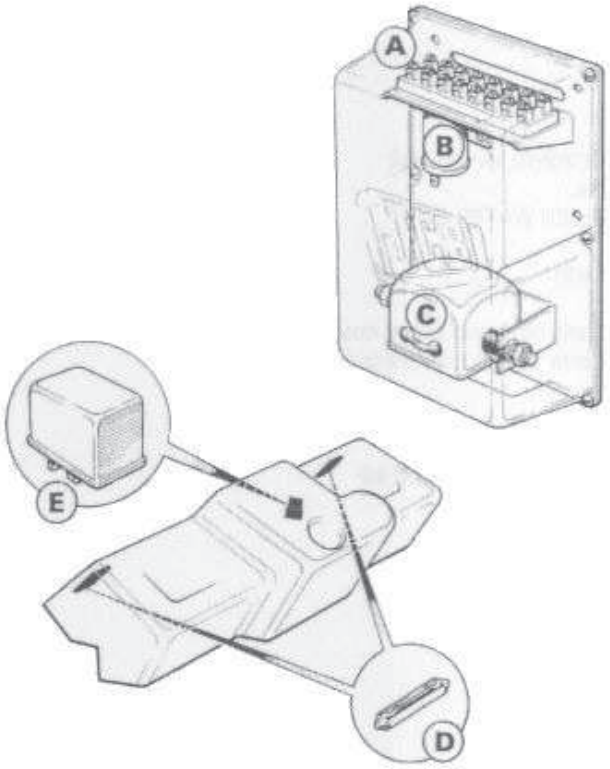
NOTE:
Voltage regulator not required with alternator.

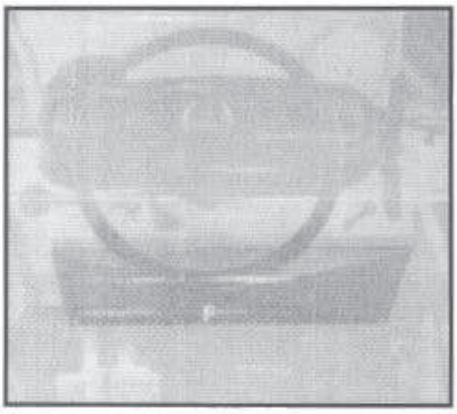
/5 Build

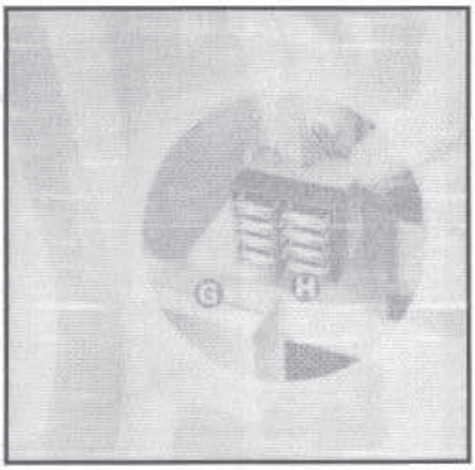
1 Remove Panel **F**

2 Pull off cover **G**

3 Fuses are shown at **H**







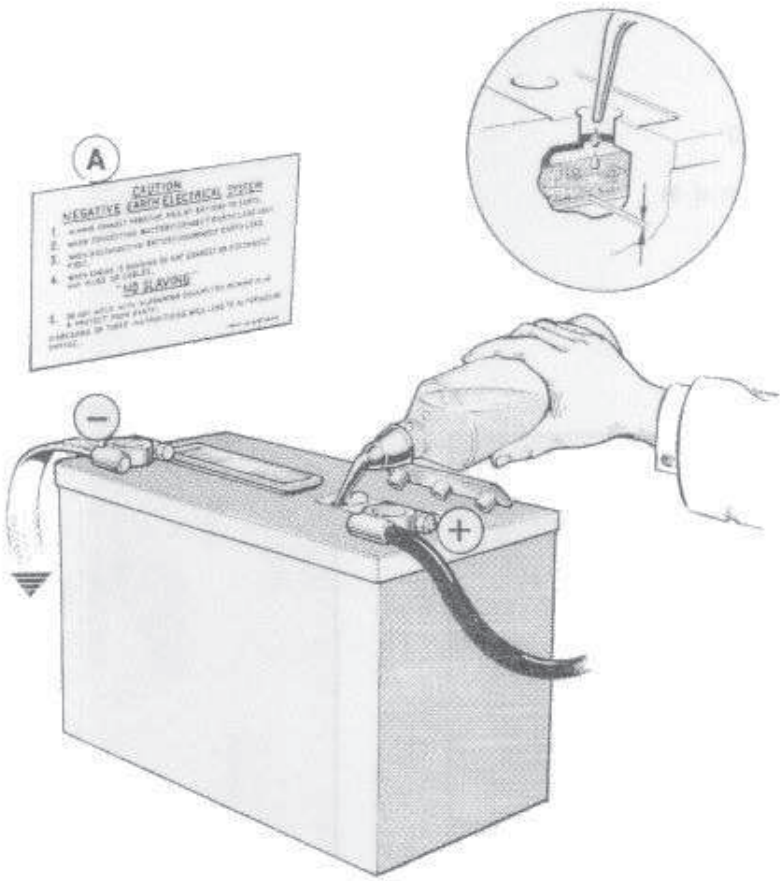
BATTERY

CHECK electrolyte level is just above plates.
ADD DISTILLED WATER ONLY

Negative Earth

Keep terminals tight and clean, coat with petroleum jelly to prevent corrosion.

Caution:
Affixed instructions A must be adhered to at all times.



ELECTRICAL PRECAUTIONS

NEGATIVE EARTH ELECTRICAL SYSTEM

1 Always connect negative pole of battery to EARTH

2 When connecting battery connect earth lead LAST

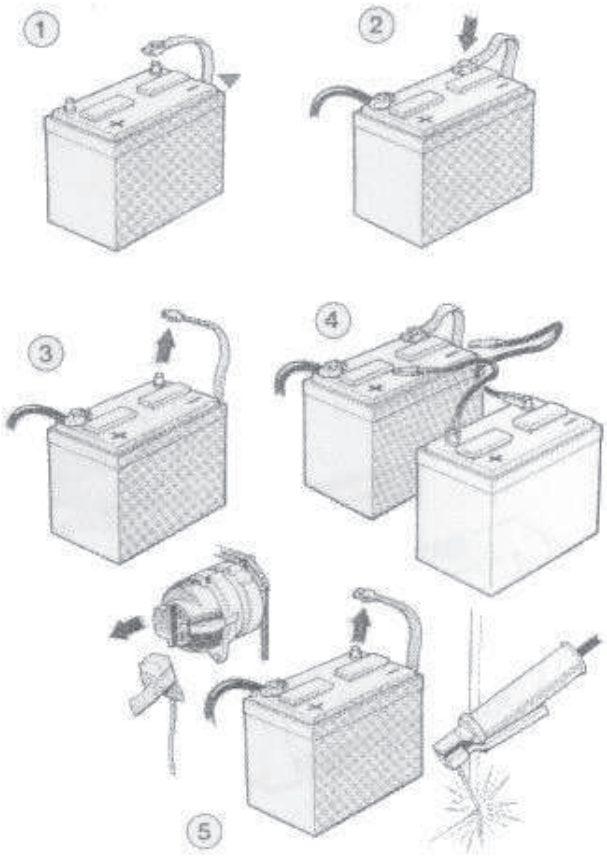
3 When disconnecting battery Disconnect earth lead FIRST

4 If slaving is necessary ensure that the batteries are wired in parallel

Do not connect or disconnect any plugs or cables when engine is running

5 Do not weld with alternator connected, remove plug and protect from earth. Disconnect battery earth lead.

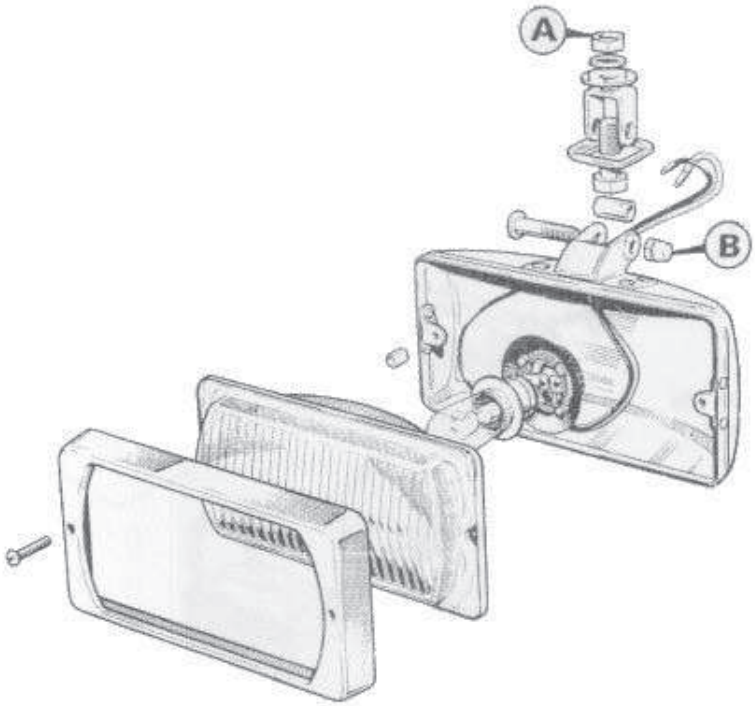
DISREGARD OF THESE INSTRUCTIONS WILL LEAD TO ALTERNATOR DAMAGE.

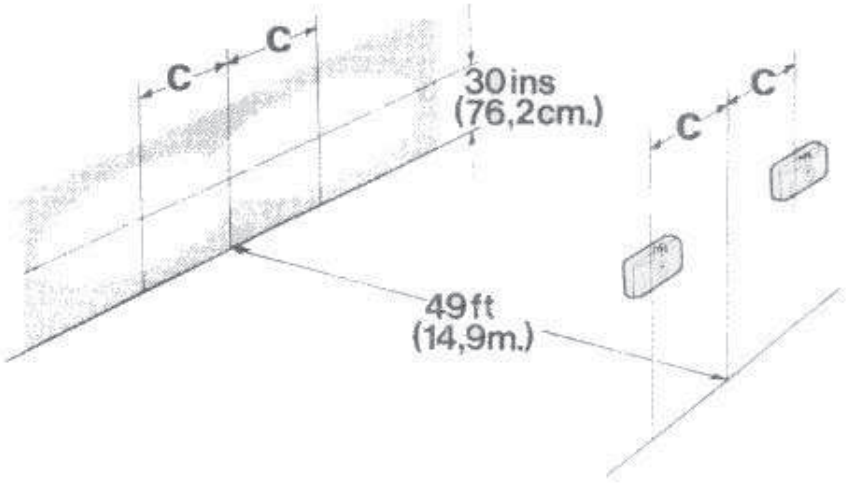


HEADLAMPS

With lamps on main beam, light pattern should fall as shown.

To adjust, slacken nuts A or B and reposition lamp body as required





POWERBREAKER

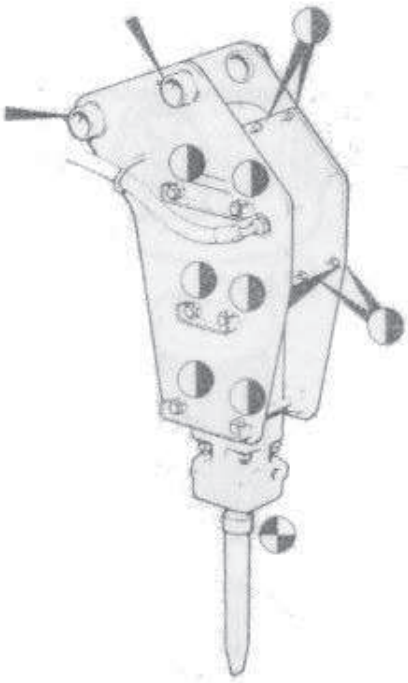
GREASE STEELS 3 hours

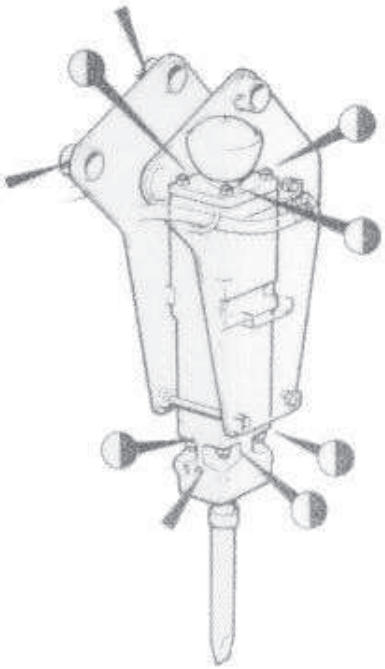
GREASE ALL PIVOT PINS 10 hours

CHECK TORQUE SETTING 50 hours

Tighten carrier bolts in sequence shown

Clean and grease chuck and steel when changing steel.





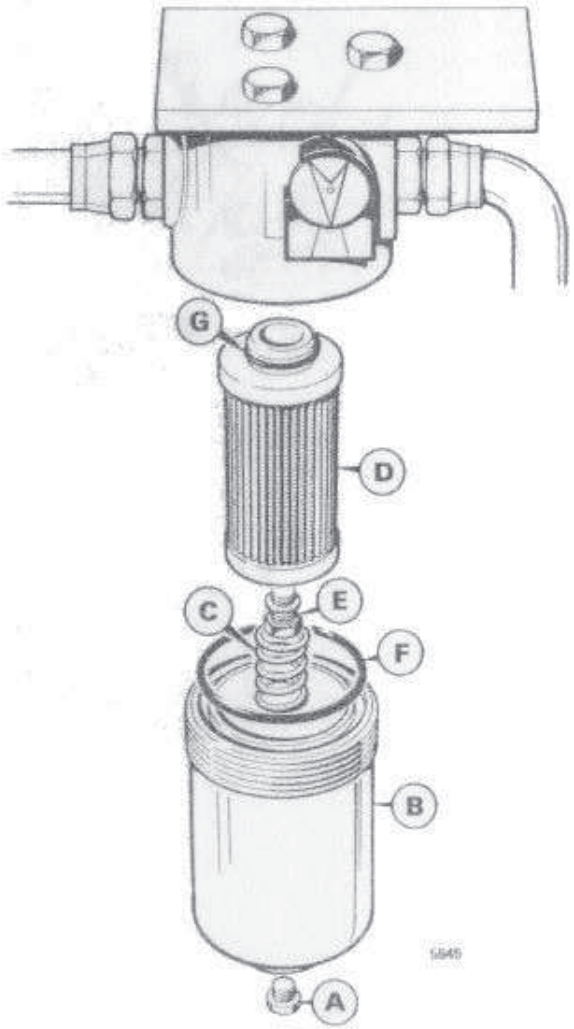
POWERBREAKER FILTER

With engine running at 1700 rev/ min check position of pointer. Change element when pointer is in position shown.

1 Drain filter by removing plug A

2 Remove filter bowl B spring C and element D

3 When re-assembling fir bolt E to new element and fit new seals F and G. Smear new seals with oil before assembling.



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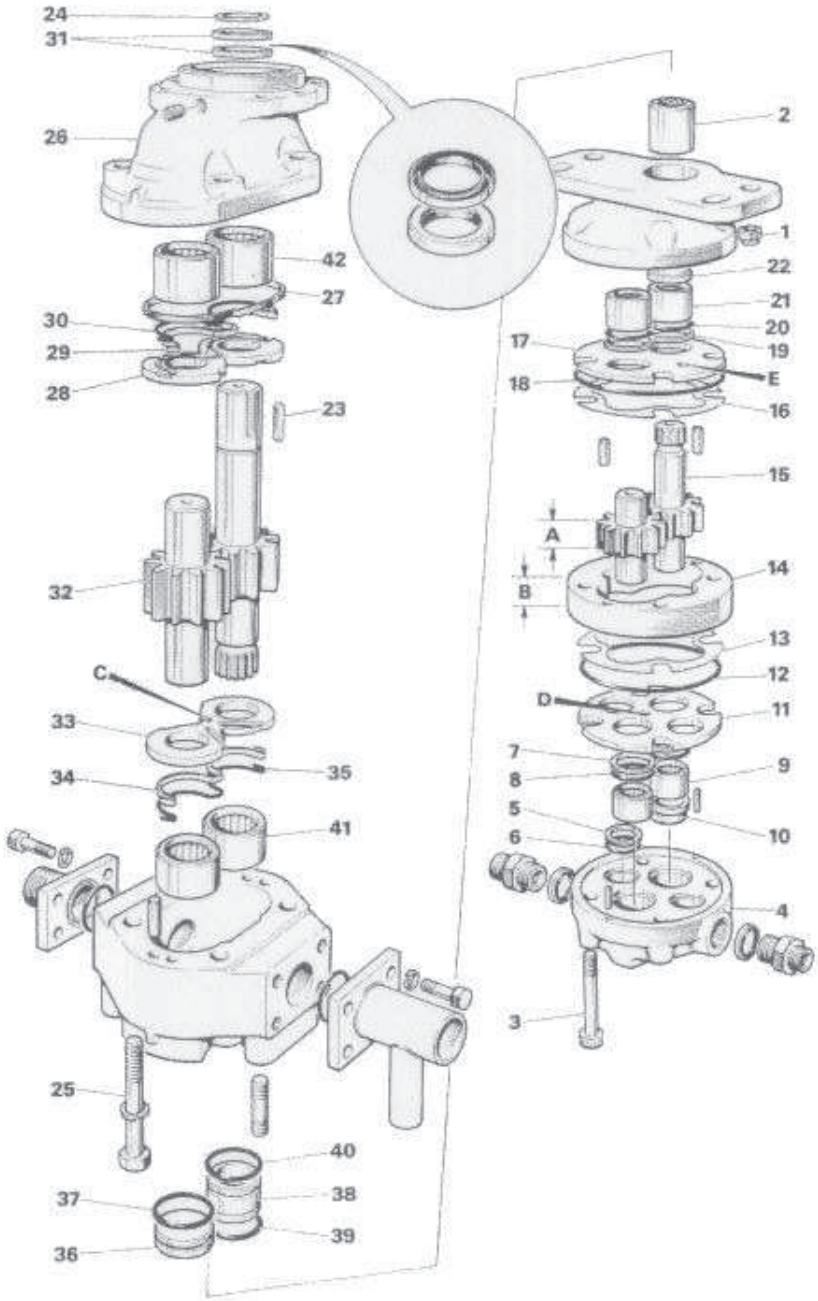
ATTACHMENTS

CONTENTS



DOUBLE PUMP – HAMWORTHY
To Machine No **114049**

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed.

When Dismantling

Remove sharp edges and burrs from shafts to avoid seal damage.

Mark housings and covers to ensure correct replacement. Do not damage machined faces by prising these apart use a soft faced hammer.

Mark adjacent gear teeth to ensure correct replacement using indelible ink or paint. Do not use a centre punch or similar tool.

Remove bearings only if requiring replacement using service tool part no BT2464. For removal of bearings 9 and **21**, actuator pin 28253 and collet 33862 will also be required.

NOTE:
In addition to replacement due to wear, bearings should be renewed when new gears are fitted.

When Assembling

Renew all seals and O rings lubricating all internal parts using JCB Special hydraulic fluid.

Renew gears **15** if dimension **A** is less than dimension **B** by more than 0.076mm (0.003in)

Renew either pair of gears if:

A) Journal area of shaft is pitted or worn in excess of 0.025mm (0.001in)

B) Keyway, splines or gears are badly worn or cracked.

Install bearings in the following positions:-

Item	Depth below face of housing
41 & 42	Flush to 0.05mm (0.002in)
9 & 21	0.18 to 0.23mm (0.007 to 0.009in)

Renew wear plates if scored or eroded. Trim to size seals **30** and **35** and supports **29** and **34** using grease to retain them firmly in the wear plates.

Fit wear plates **28** and **33** with single slots **C** facing the gears on the pressure side of the pump. Ensure the seals and supports are not trapped between plate and bore, also that wear plate **33** is fully home in the bore and free to move.

Renew seal bushes **10** and **22** if scored or damaged, or if their bores exceed 22.26mm (0.8765in) diameter

Fit wear plates **11** and **17** with recesses D 12.7 x 1.6mm (0.5 x 0.0625in) deep facing the gears on the pressure side of the pump. Hole E 6.3mm (0.25in) dia; in wear plate **17** will then be on suction side.

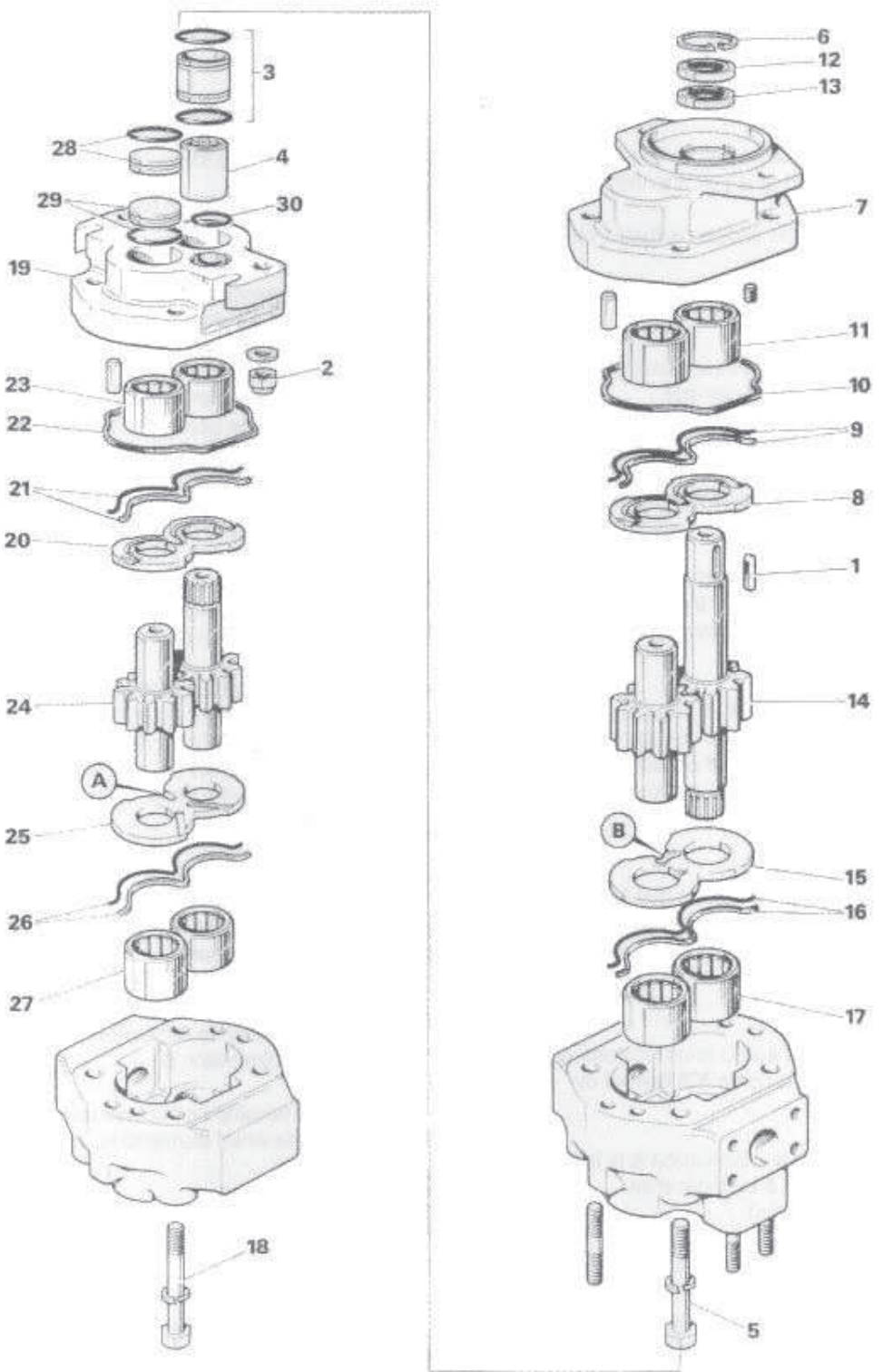
The running clearance of gears **15** is 0.064 to 0.1mm (0.0025 to 0.004in) This is achieved by addition of shims **13** and **16** distributed equally on each side of the housing **14**. The total thickness of shims required is found by adding the running clearance to dimension **A** then subtracting dimension **B**

Align gear housing and covers using marks made when dismantling.

Torque Settings

Item	Nm	kgf m	lbf ft
1	43	4.3	31
3	108	11	80
25	163	16.6	120

1-3



DOUBLE PUMP – HAMWORTHY

From Machine No **129804**

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed.

When Dismantling

Remove sharp edges and burrs from shafts to avoid seal damage.

Mark housings and covers to ensure correct replacement. Do not damage machined faces by prising these apart use a soft faced hammer.

Mark adjacent gear teeth to ensure correct replacement using indelible ink or paint. Do not use a centre punch or similar tool.

Remove bearings only if requiring replacement using service tool part no BT2464.

NOTE:
In addition to replacement due to wear, bearings should be renewed when new gears are fitted.

When Assembling

Renew all seals and O rings lubricating all internal parts using JCB Special hydraulic fluid.

Renew either pairs of gears if:

A) Journal area of shaft is pitted or worn in excess of 0.025mm (0.001in)

B) Keyway, splines or gears are badly worn or cracked

Bearings must fit flush with or up to 0.05mm (0.002in) below the housing face.

Renew wear plates if scored or eroded. Trim to size seals and supports **9 16 21** and **26** using grease to retain them firmly in the wear plate.

Fit wear plates **8 15 20** and **25** with single slat **A** or kidney shaped cut out **B** facing the gears on the pressure side of the pump.

NOTE:
Either style of wear plate may be fitted.

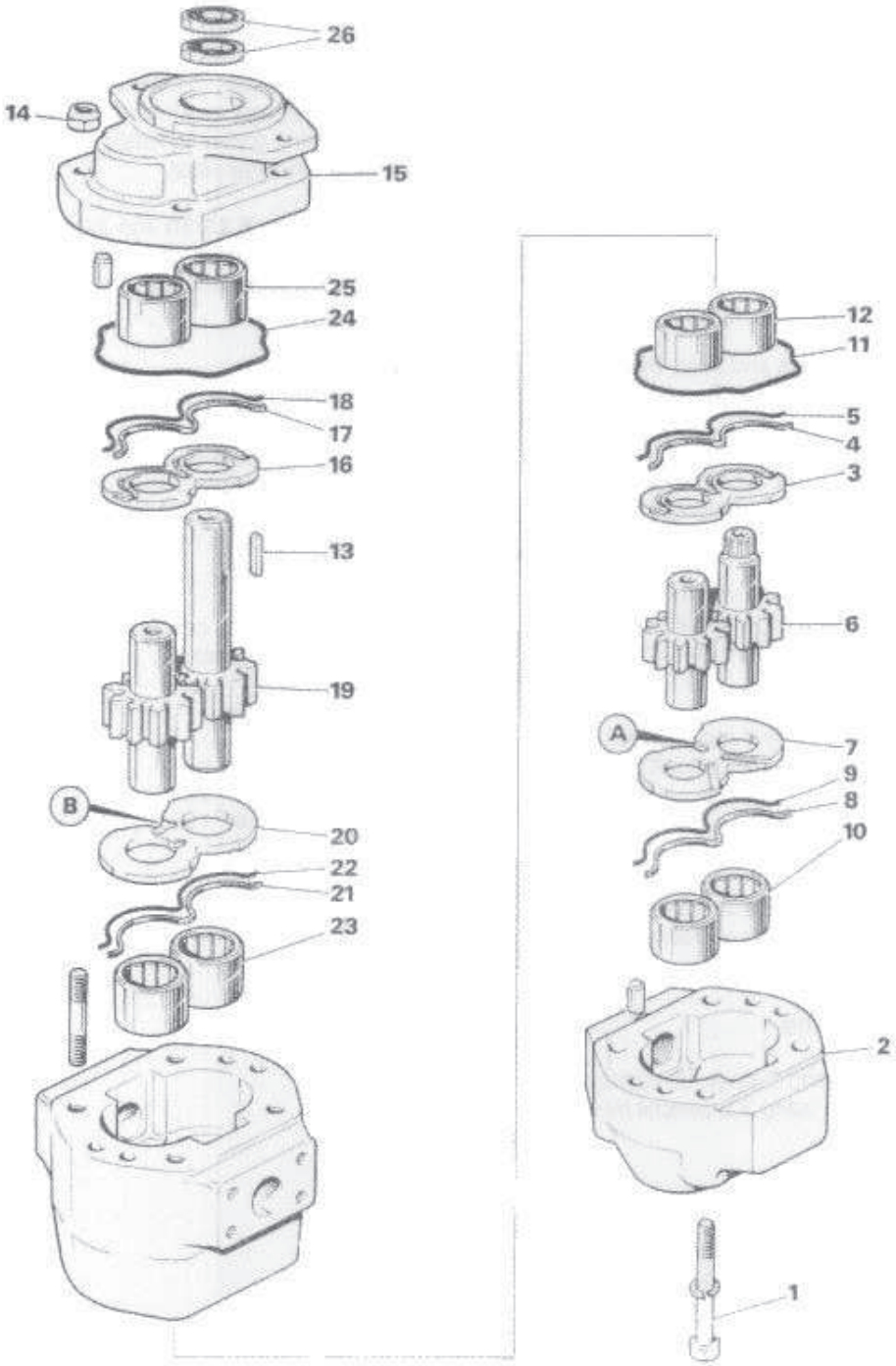
Ensure that seals and supports are not trapped between plate and bore, also that wear plates **15** and **25** are fully home in their bores and are free to move.

Align housings and covers using marks made when dismantling

Torque Settings

Item	Nm	kgf m	lbf ft
1	163	16.6	120
18	163	16.6	120

1-5



DOUBLE PUMP – HAMWORTHY

From Machine No **131516**

Dismantling and Assembly

When Dismantling

Remove bearings only if requiring replacement using service tool part no BT2464.

NOTE:
In addition to replacement due to wear, bearings should be renewed when new gears are fitted.

When Assembling

Renew either pairs of gears if:

A) Journal area of shaft is pitted or worn in excess of 0.025mm (0.001in)

B) Keyway, splines or gears are badly worn or cracked

Bearings must fit flush with or up to 0.05mm (0.002in) below the housing face.

Renew wear plates if scored or eroded. Trim to size seals **5 9 18** and **22** and supports **4 8 17** and **21** using grease to retain them firmly in the wear plate.

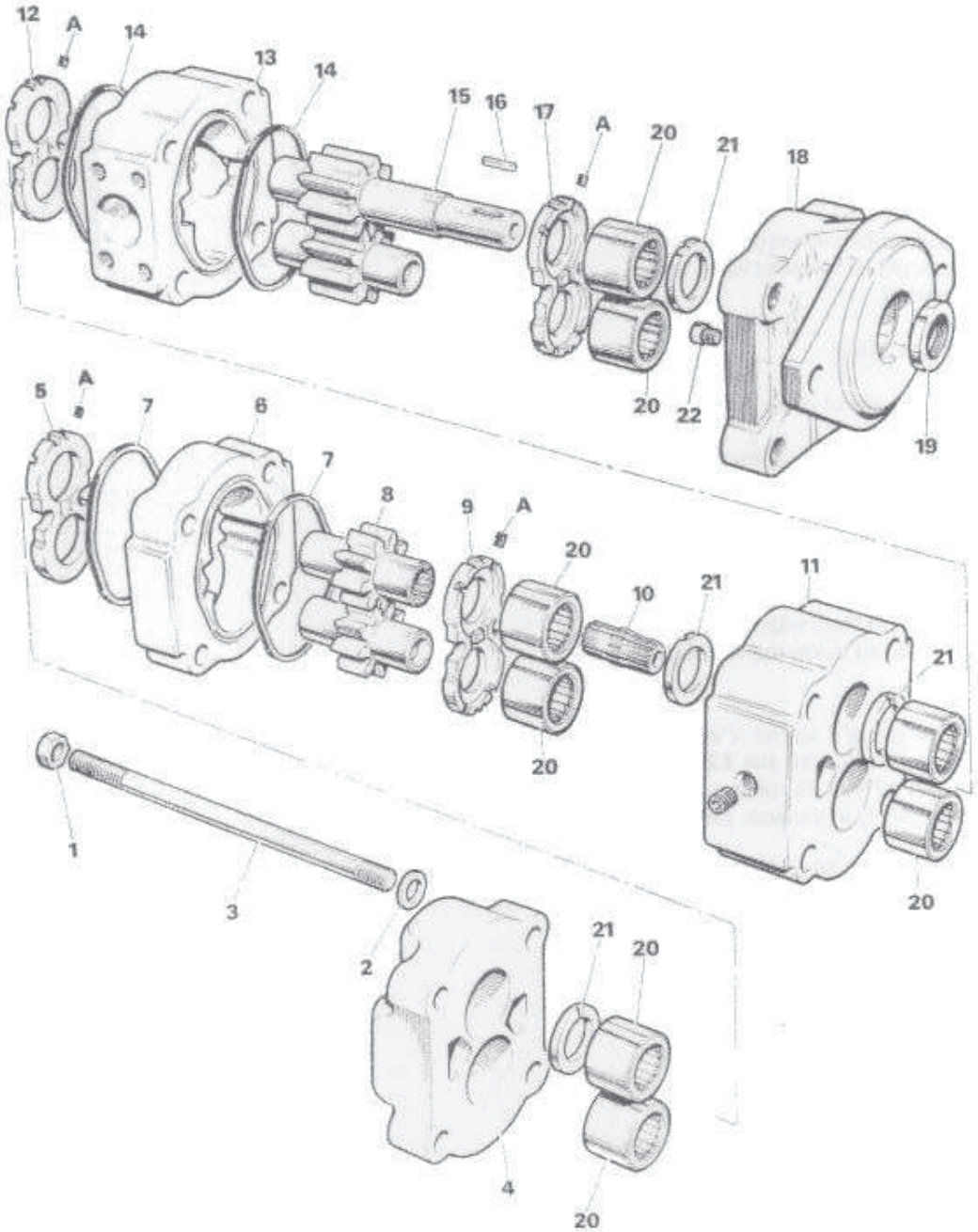
Fit wear plates **3 7 16** and **20** with single slot **A** or kidney shaped cut out **B** facing the gears on the pressure side of the pump.

NOTE: Either style of wear plate may be fitted.

Ensure that seals and supports are not trapped between plate and bore, also that wear plates **7** and **20** are fully home in their bores and are free to move.

Torque Settings

Item	Nm	kgf m	lbf ft
1	163	16.6	120



DOUBLE PUMP – COMMERCIAL

To Machine No **129803**

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed.

When Dismantling

Mark housings and end covers to ensure correct assembly. Retain gears in pairs as removed.

Take care not to distort thrust plates **5 9 12** and **17**

Note position of plug **22** if removed.

Use extractor MD956 (Service Tools) to remove bearings **20**.

Check all components for wear, see Section **A 2-4**

When Assembling

Renew ring seals **21** and face seals **14** and **7** grease before fittingEnsure that ring seals are pressed fully into bearing housings with grooved faces towards bearings.

Renew pocket seals **A** see Section A page 2-3

Install gears tight against thrust plates before fitting housings.

Tighten nuts **1** evenly in a diagonal sequence.

Torque Settings

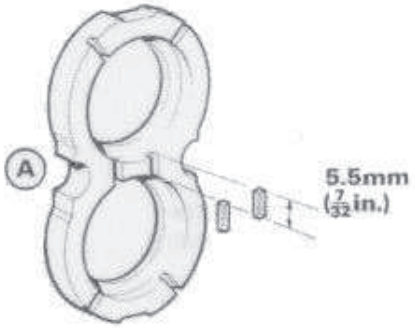
Item	Nm	kgf m	lbf ft
1	163	16.6	120

DOUBLE PUMP – COMMERCIAL

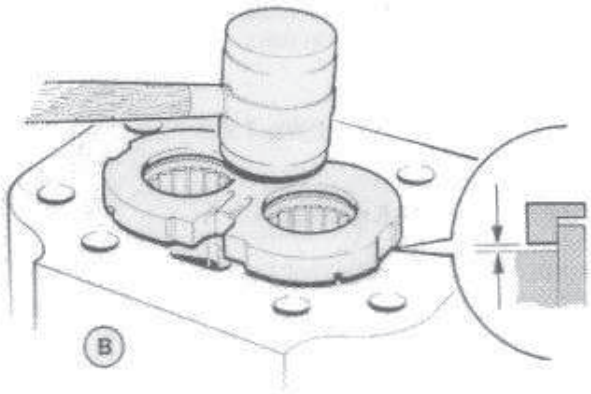
Pocket Seal Fitting

The following instructions apply when fitting seals to all thrust plates.

Cut two centre seals from the seal strip to the length of the seal recess, as shown at **A**. Smear with grease before installing.

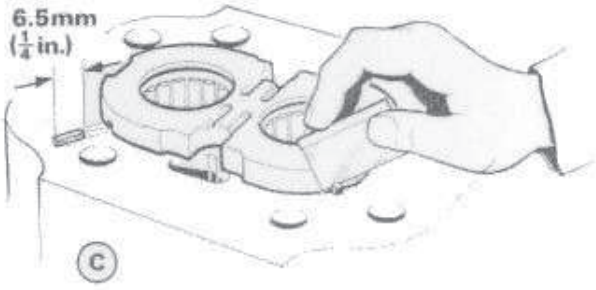


Place thrust plate, seals face downwards, over the bearings (as at **B**) and tap lightly down until clearance between thrust plate and housing face is approximately 0.8mm (0.030in)



Cut four seals about 13mm (0.5in) long and slide them into the radial slots in the thrust plate (as at **C**), until they touch the bearing.

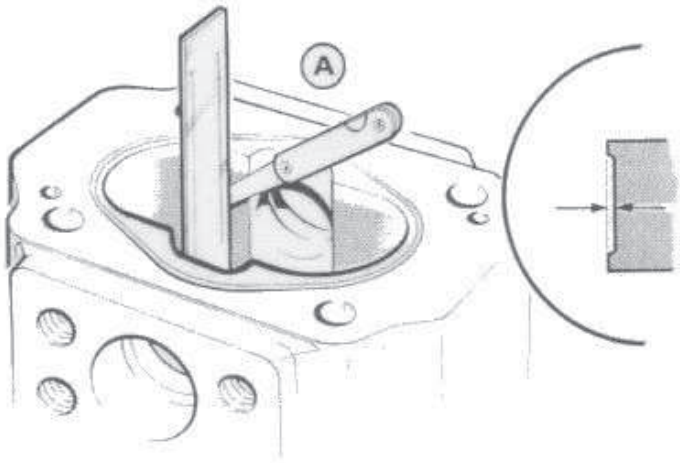
Continue to tap down the thrust plate until it is firmly against the housing. Trim off the excess seal length square and level with the thrust plate.



DOUBLE PUMP – COMMERCIAL

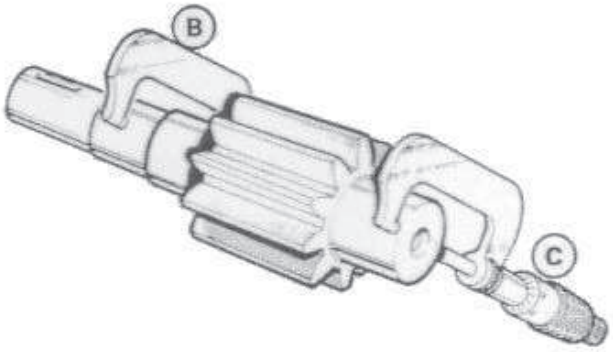
Inspection

Check housings for wear as shown at **A** If depression is greater than 0.12mm (0.005in) the housing should be re-newed.

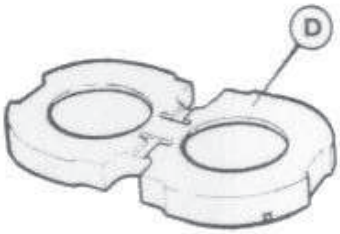


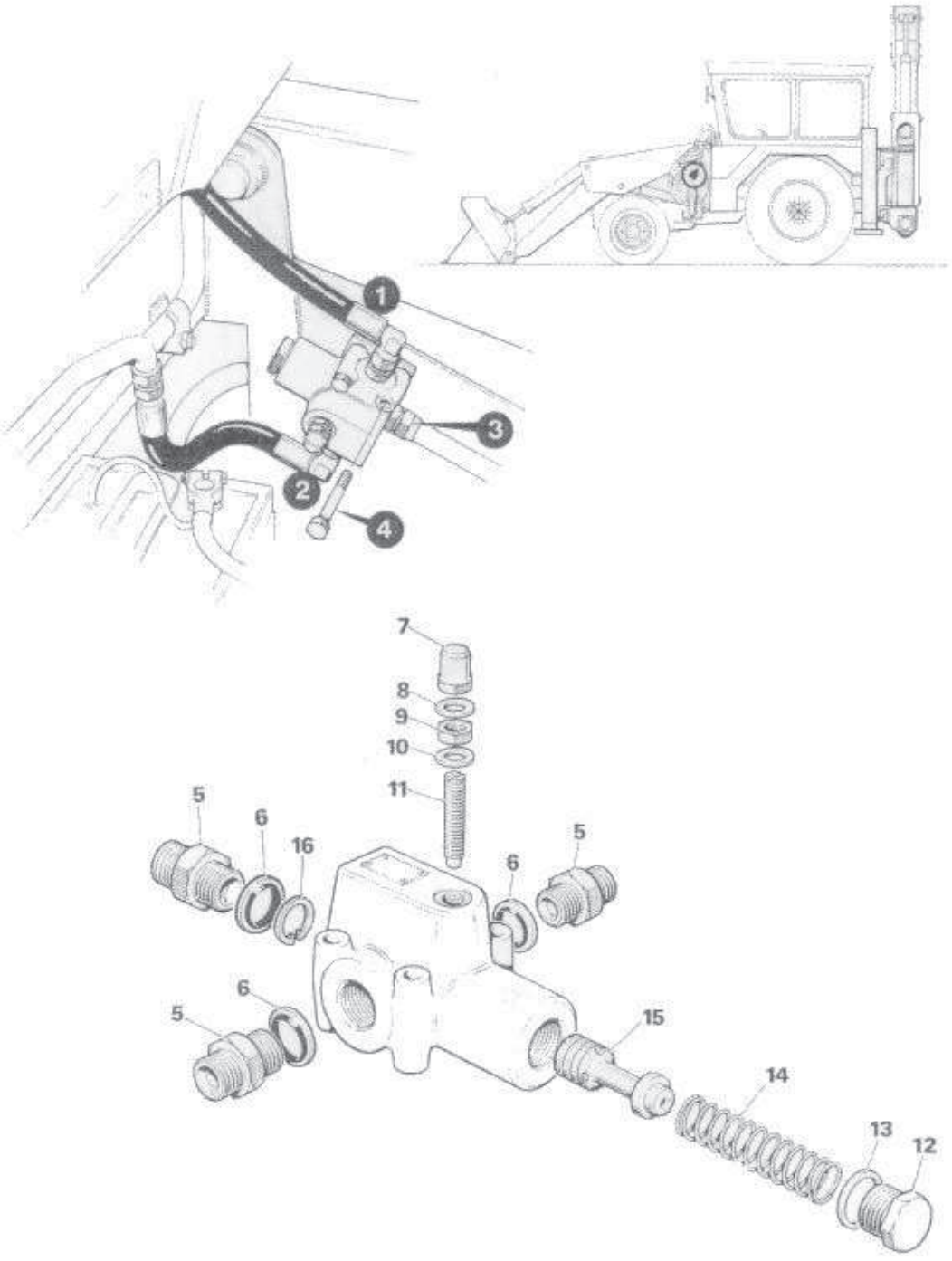
Renew gears if wear (detectable by touch) is more than 0.05mm (0.002in) on di-mensions **B** or **C**
Gears should also be renewed if scoring or pitting is evident or if the gear teeth are chipped

Always renew gears as matched pairs. Renew bearings if gears are renewed.



Thrust platesare subject to wear on surface **D**. Note that it is possible for the grey outer layer to wear through to the bronze during the early life of the thrust plate. This condition is not detrimental, but wear in excess of 0.05mm (o.002in) will necessitate renewal of the thrust plate. Renewal is also necessary if the plates are pit-ted or scored.





HAMWORTHY FLOW DIVIDER
(JCB Roadbreaker)

The numerical sequence shown on the illustration is intended as a guide to removal and dismantling.

For assembly and replacement, the sequence should be reversed.

When Removing

Blank hose and pipe connections to prevent entry of dirt and loss of hydraulic fluid.

When Assembling

Using a fine stone, remove minor nicks and burrs from plunger 15 and it's housing. If either of these components is badly worn, the complete flow divider must be renewed.

Renew washers **6** and **13**

Connections:

1 To left hand roadbreaker

2 To right hand roadbreaker

3 Feed from pump

After replacement

Adjust flow divider to balance breaker speeds (see page A7-1)

3-3

KONTAK FLOW DIVIDER
(JCB Roadbreaker)

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement, the sequence should be reversed.

When Removing

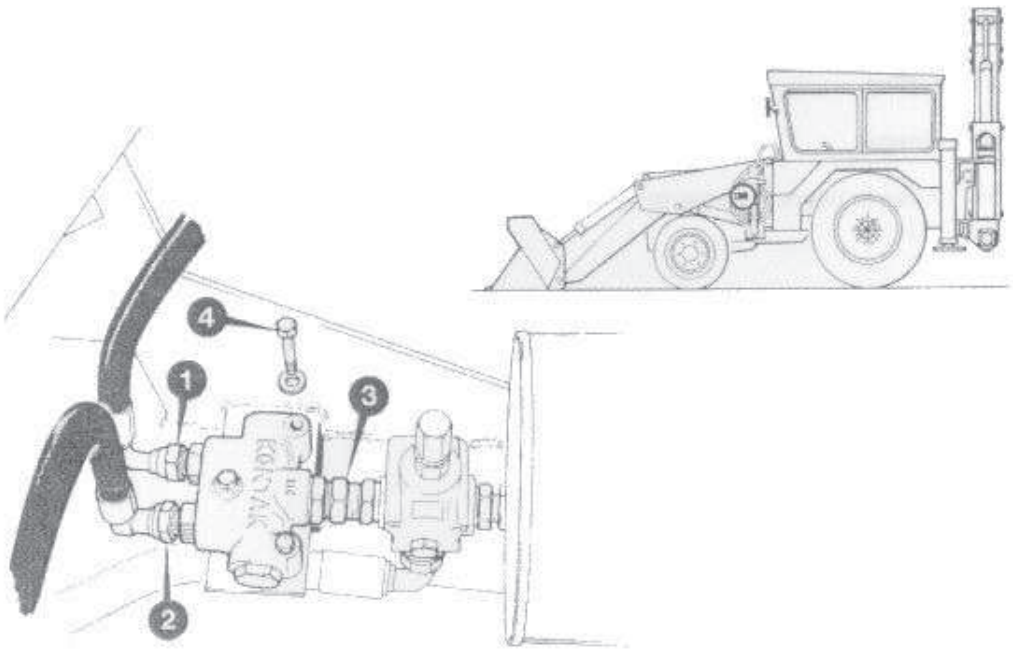
Blank hose connections to prevent entry of dirt, and loss of hydraulic fluid.

Connections:

1 To left hand roadbreaker

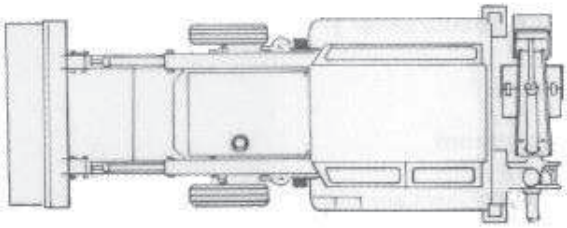
2 To right hand roadbreaker

3 From system relief valve



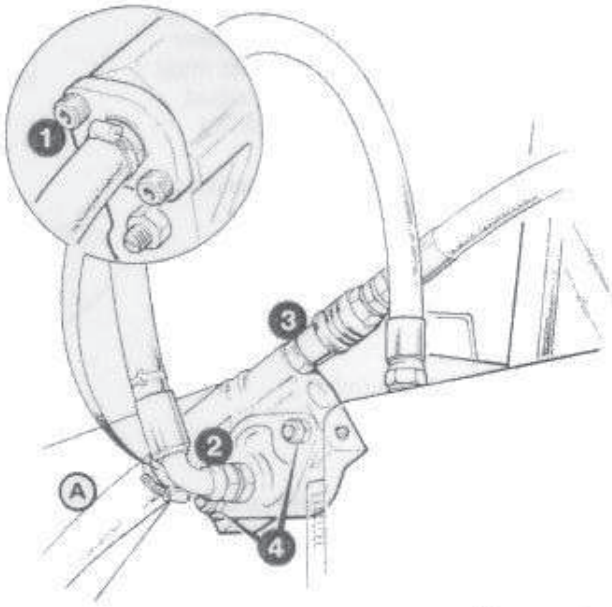
4-1

COMPONENT RELIEF VALVE (JCB Roadbreaker)



The numerical sequence shown on the illustration is intended as a guide to removal.

For assembly and replacement, the sequence should be reversed.



When Removing

Disconnect hose A by removing screws **1** do not remove hose clip.

Blank hoses to prevent entry of dirt and loss of hydraulic fluid.

When Dismantling

Screw in adjuster 10 to force out spool body 6

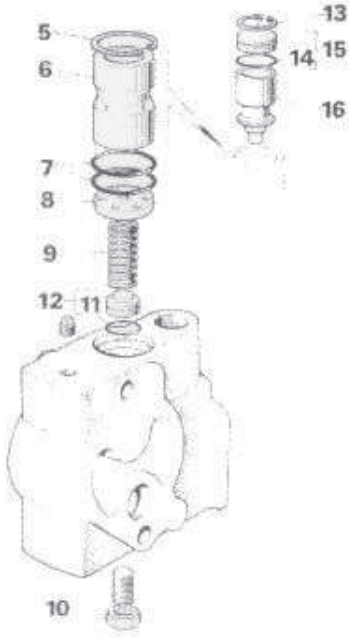
When Assembling

Renew O rings

Apply Loctite 241 (Nut Lock) to threads of capscrews **1**

After Replacement

Reset relief valve pressure
(see page A4-2)



4-2

COMPONENT RELIEF VALVE
(JCB Roadbreaker)

Adjustment

If two breakers are fitted, this operation should be carried out on each relief valve A. On machines fitted with the Hamworthy flow divider, first balance the roadbreaker speeds (see page A7-1) On machines fitted with the Kontak flow devider, first adjust the system relief valve (see page A5-3)

Remove 1/8in B.S.P. plug B and connect gauge (Service tools).

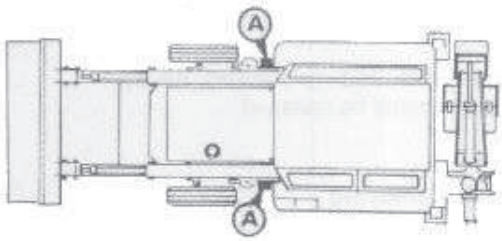
Run engine at the normal breaker operating speed according to type of flow divider fitted:

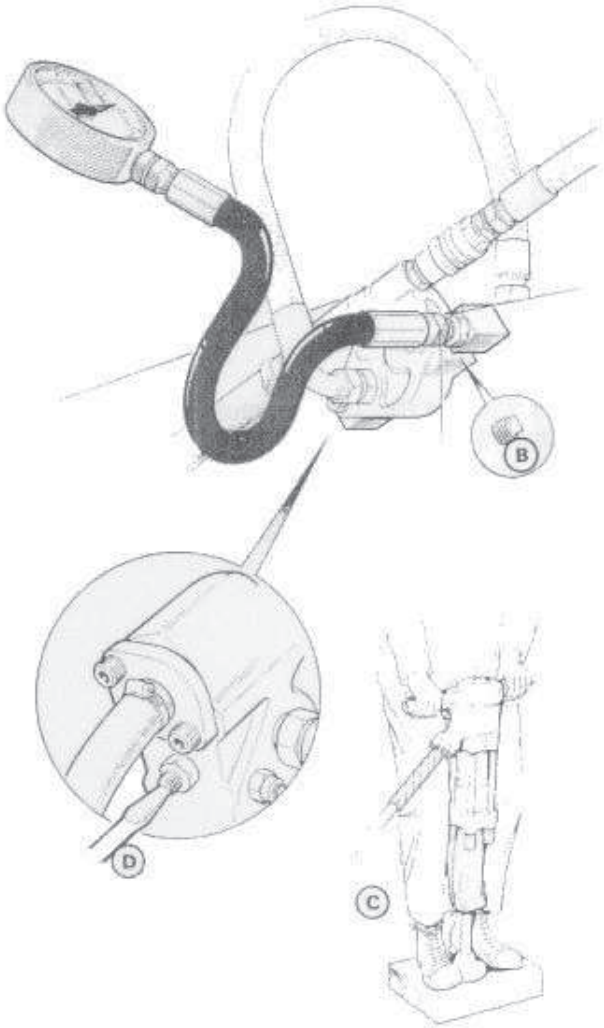
Hamworthy – 1800 rev/min.

Kontak – 1500 rev/min.

Operate roadbreaker fitted with rammer pad as at **C** and check gauge reading.

Adjust **D** until the gauge reading corresponds to the correct relief valve setting (see technical Data)





5-1

SYSTEM RELIEF VALVE
(JCB Roadbreaker)

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal.

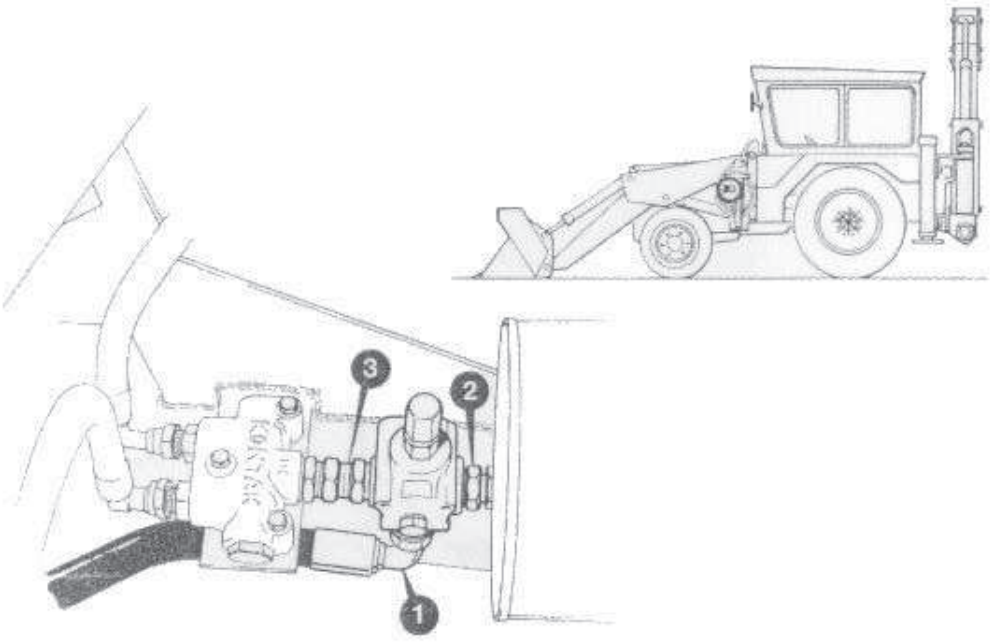
For assembly and replacement, the sequence should be reversed.

When Removing

Blank hoses to prevent entry of dirt and loss of hydraulic fluid.

After Replacement

Adjust pressure setting
(see page A5-3)



5-2

SYSTEM RELIEF VALVE
(JCB Roadbreaker)

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to removal.

For assembly the sequence should be reversed.

When Dismantling

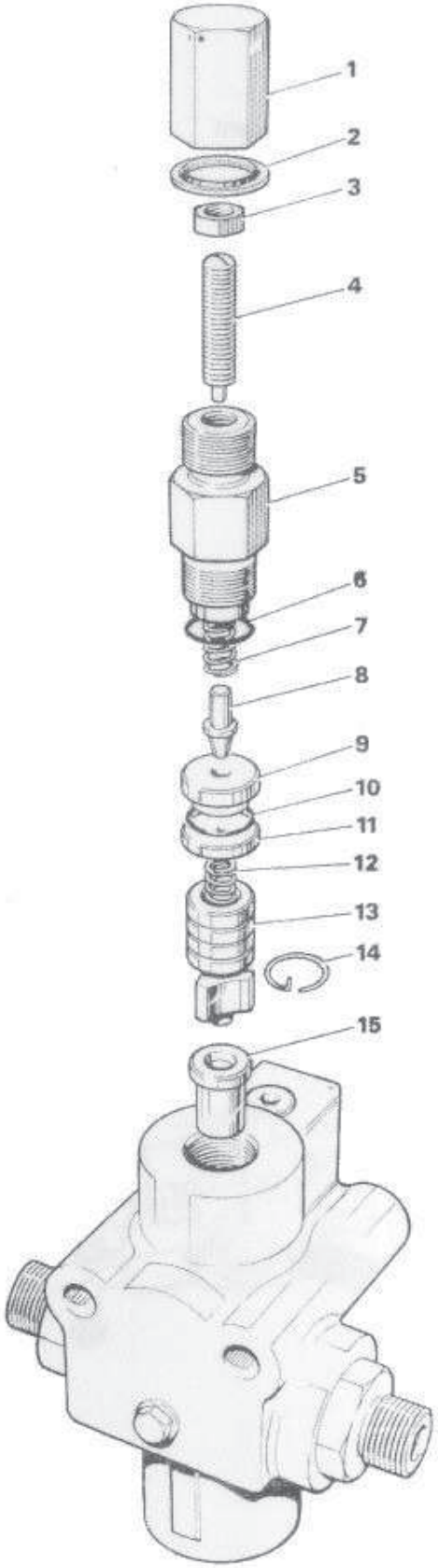
To remove plunger 13 pass a soft metal rod through seat 15.

To remove seat, use a piloted soft drift.

After Assembling

Renew all seals an O rings

Do not lap or grind seating faces, but where these are worn renew both mating parts.



SYSTEM RELIEF VALVE
(JCB Roadbreaker)

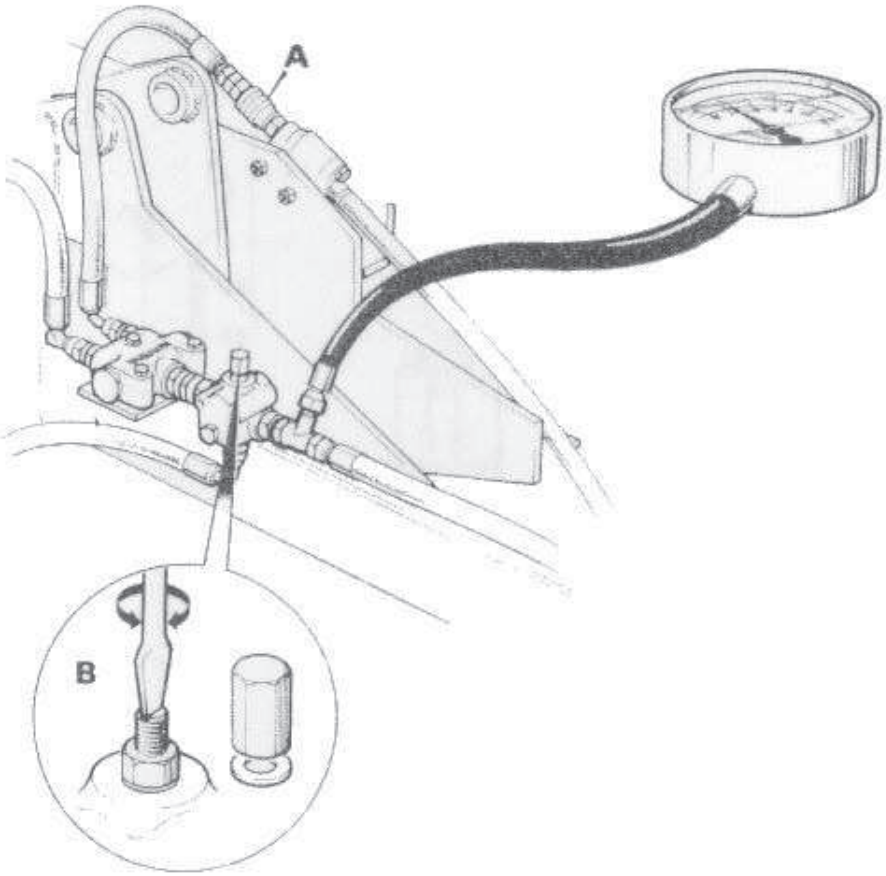
Adjustment

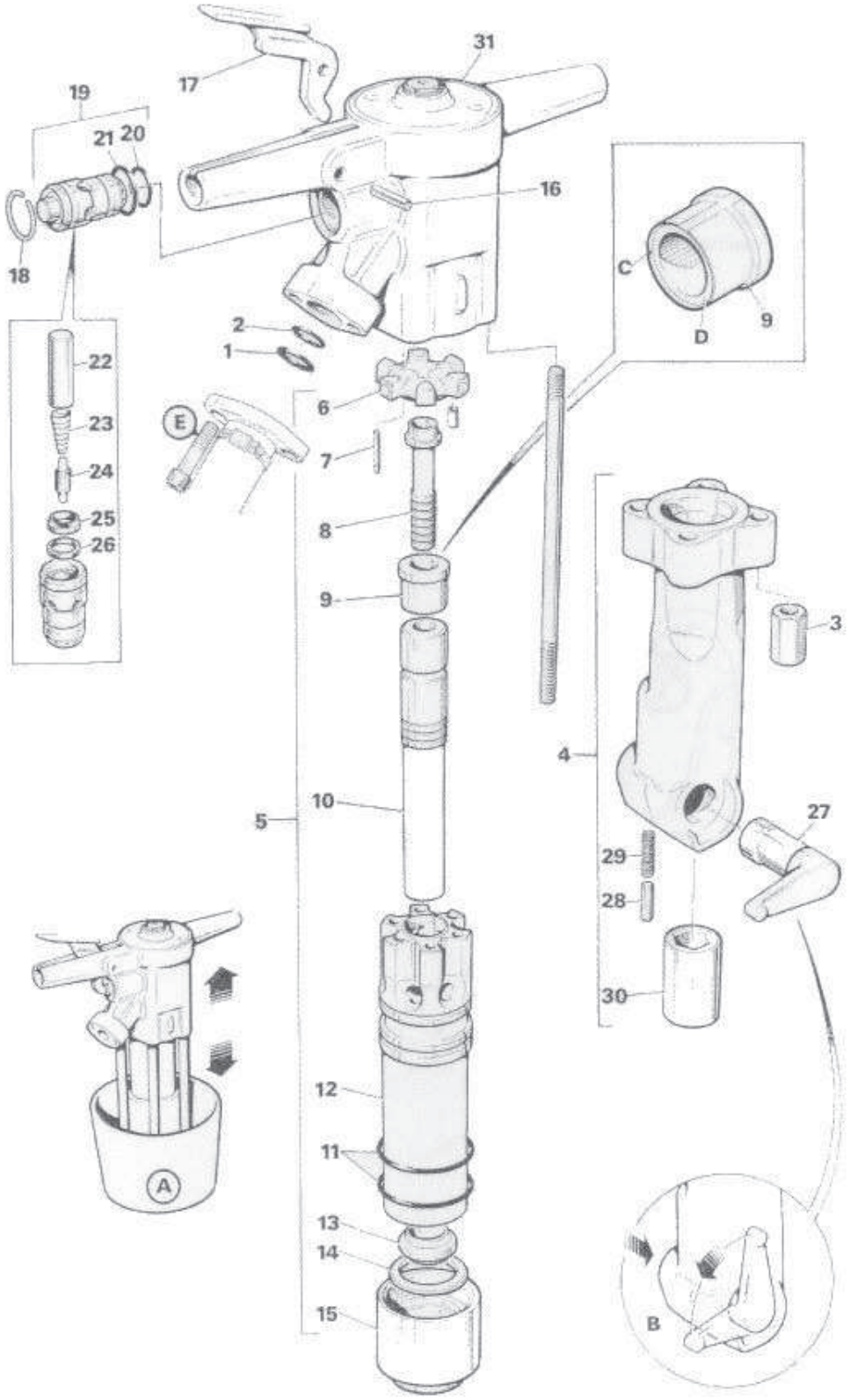
Connect tee piece and pressure gauge as shown (see Service Tools)

Disconnect self-sealing couplings **A** (on both sides of the machine if two road-breakers are fitted).

Run engine at 2000 rev/min. and check gauge reading.

Adjust as at **B** until the gauge reading corresponds to the correct relief valve setting
(see Technical Data)





JCB ROADBREAKER

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed.

When Dismantling

After removal of the front head assembly **4** separate the cylinder assembly **5** from the handle **31** as follows:

Place the roadbreaker in a plastic container as at A and allow to drop on to the studs from a hight of about 30mm (1.25in) Hydraulic fluid will drain into the container.

Ensure that the cylinder assembly is kept vertical to prevent loss of dowels **7**

Turn cam **27** through 90° before drifting out as **B**

CAUTION:
Do not dismantle handle **31** as it contains a nitrogen accumulator requiring specialised inflation equipment.

When Assembling

Inspect the lower thin edge of valve **9** if any nicks are present in addition to the calibration notch C the valve should be renewed.

NOTE:
Valve **9** is a match to fit the cylinder **12** and is identified by one, two or three punch marks in the lower face D which must correspond to one, two or three punch marks on the side of the cylinder.

Renew all O rings and seals.

Lubricate all moving parts and o rings with hydraulic fluid before assembly.

Apply Loctite 242 to capscrew threads **E** when refitting hose connection flange.

Tighten nuts **3** progressively in a diagonal sequence.

Retorque nuts **3** after first days used.

Torque Settings

Item	Nm	kgf m	lbf ft
3	127	13	94

7-1

JCB ROADBREAKER

To Balance Breaker Speeds

NOTE:
This operation is only applicable to machines fitted with the Hamworthy flow divider **A** The Kontak flow divider fitted to later machines is non-adjustable.

Ensure that the hydraulic fluid is at working temperature by the operation of services.

Connect flow meter as at **B** and check that the pump output is correct at 2000 rev/min. (see Technical Date).

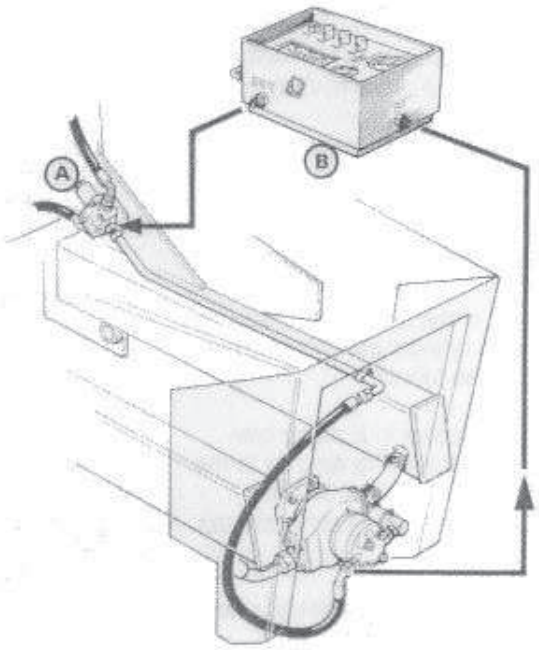
Connect flow meter as at **C** and adjust flow divider as at **D** until the flow rate is equal to half the actual pump output. (Screw out to increase flow).

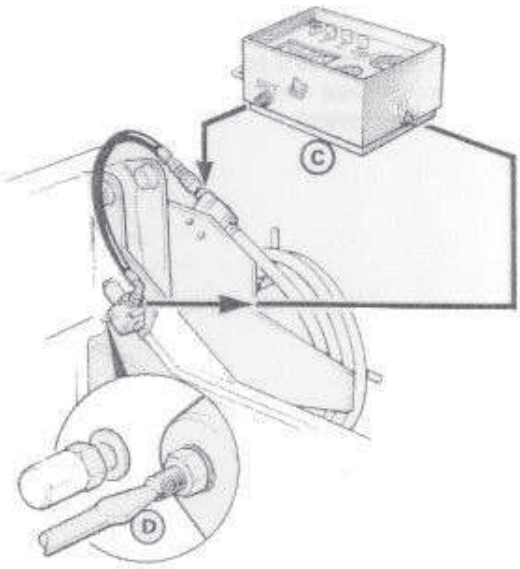
Operate both roadbreakers simultaneously and adjust flow divider until the right hand unit operates slightly faster than the left hand.

Adjust component relief valve pressures (see page A4-2)

Operate roadbreakers both together and separately to ensure that a satisfactory result has been achieved.

NOTE:
It may be necessary to make further adjustments to the flow divider until individual breaker performance is acceptable.





7-2

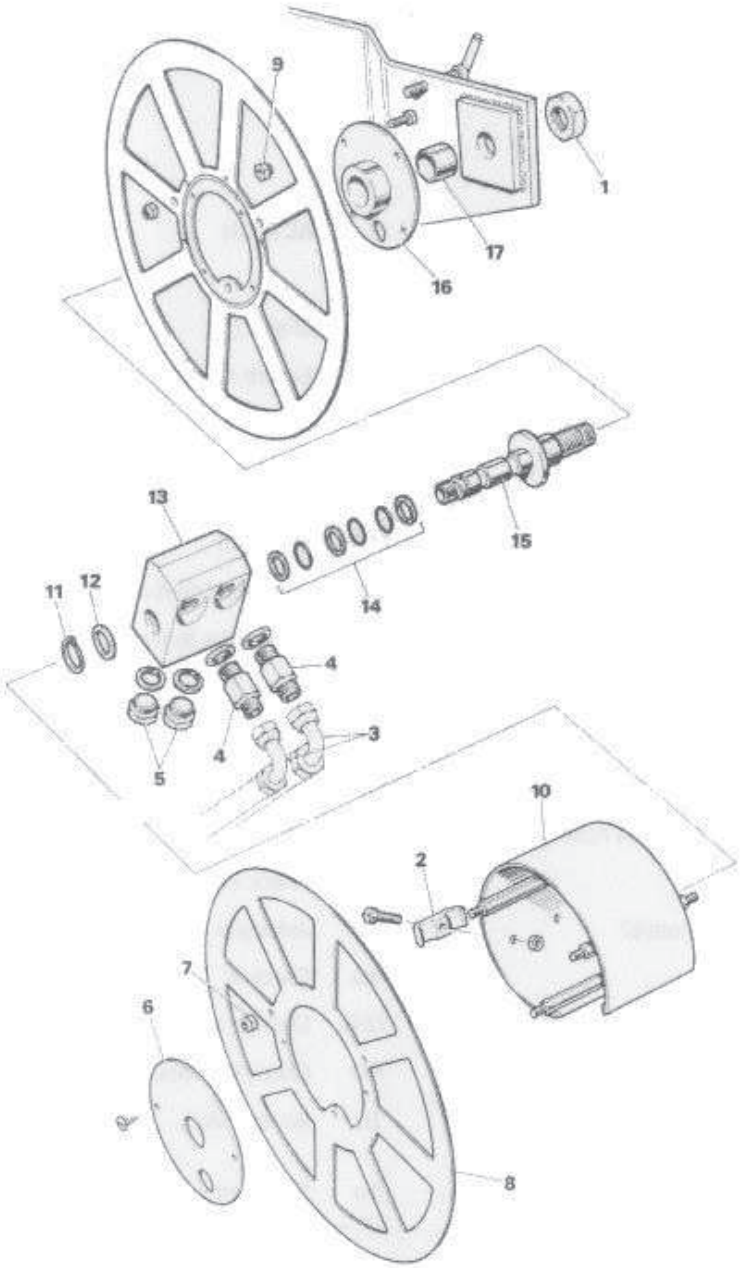
FAULT FINDING – JCB Roadbreaker

A If breaker fails to operate with pressure available, start at check 1.

B If breaker is slow to operate, start at check 4.

C If there are oil leaks, check 9.

	CHECK		ACTION
1	Are couplings secure?	YES	Check 2
		NO	Secure coupling
2	Is the distributor valve stuck?	YES	Raise breaker 300mm (12in) hold con-
		NO	Check 3
3	Are the tie rod nuts loose?	YES	Retorque
		NO	Overhaul breaker
4	Is the hydraulic oil cold?	YES	Allow time to warm
		No	Check 5
5	Is the plunger sticking?	YES	Overhaul breaker
		NO	Check 6
6	Is there a restriction in hose?	YES	Remove restriction or renew hose
		NO	Check 7
7	Are the tie rods loose?	YES	Retorque
		NO	Check 8
8	Is the muffling collar displaced on steel?	YES	Change to new steel
		NO	Check flow and pressure of system
9	Where are the leaks showing	In	Renew seals
		On	Overhaul breaker and renew gland



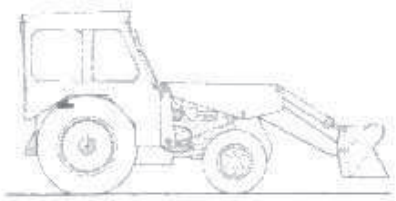
ROADBREAKER HOSE REEL

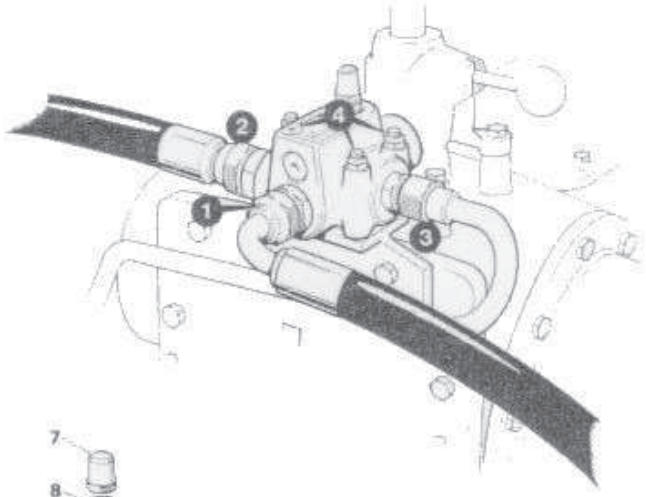
Dismantling and Assembly

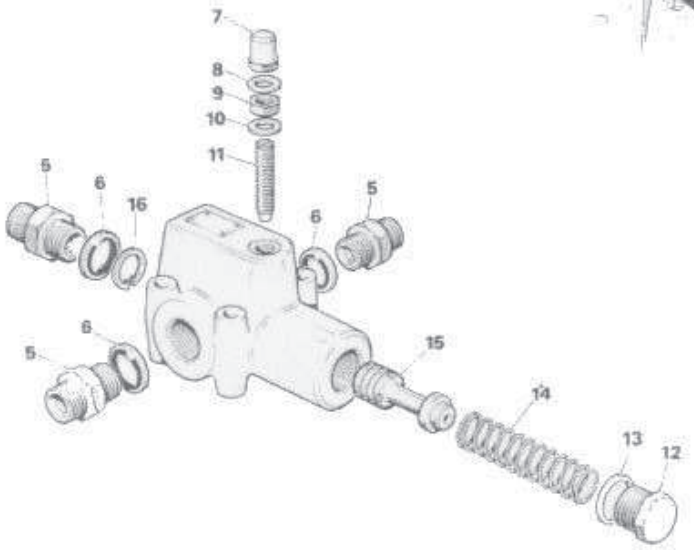
When Assembling

Apply Anti-seize paste to inner and outer surfaces of bearing **17**.

Apply hydraulic oil to spindle O rings and block, items **13** **14** and **15**







9-2

FLOW DIVIDER

(Hydraulic Power Take-Off)

The numerical sequence shown on the illustration is intended as a guide to removal and dismantling.

For assembly and replacement the sequence is reversed.

When Removing

Blank hose and pipe connections to prevent entry of dirt and loss of hydraulic fluid.

When Assembling

Using a fine stone, remove minor nicks and burrs from plunger **15** and it's housing. If either of these components is badly worn, the complete flow divider must be renewed.

Renew washers **6** and **13**

Connections

1 Feed from loader circuit

2 To motor

3 To control valve

After Replacement

Adjust flow divider to achieve correct shaft speed (see page A 12-1)

10-1

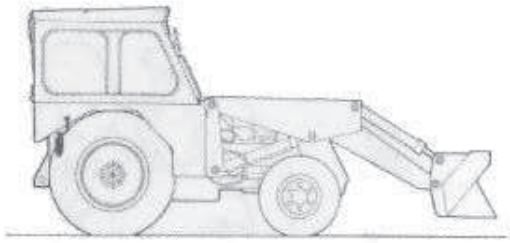
CONTROL VALVE

(Hydraulic Power Take-Off)

Removal and Replacement

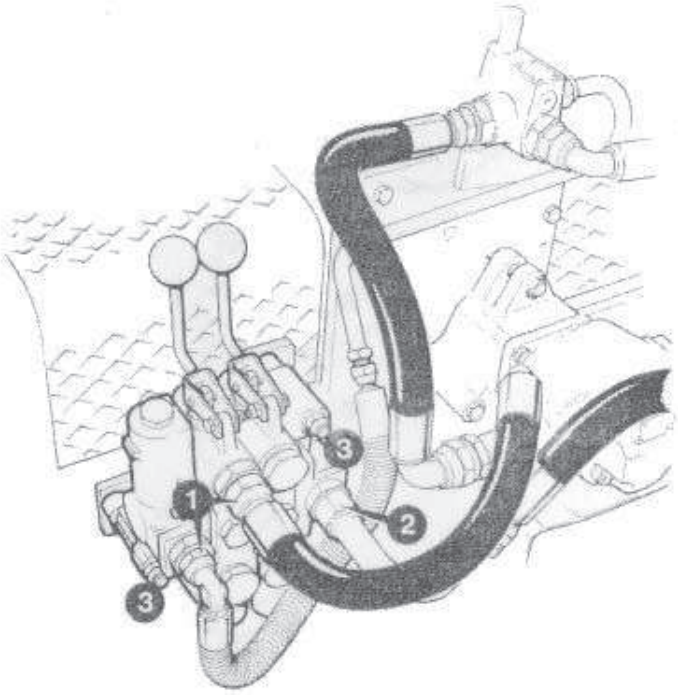
The numerical sequence shown on the illustration is intended as a guide to removal and dismantling.

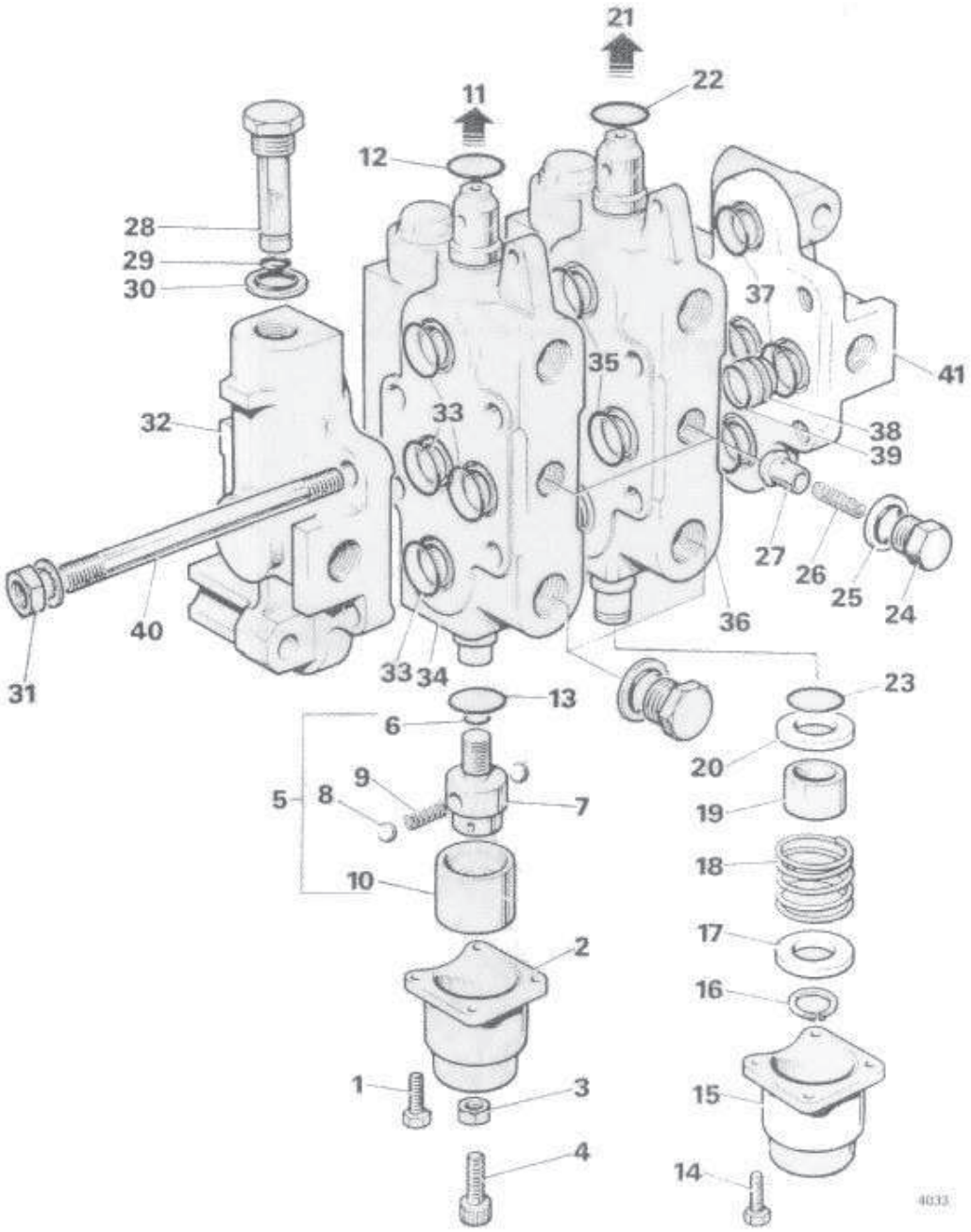
For assembly and replacement the sequence is reversed.



When Removing

Blank hose and pipe connections to prevent entry of dirt and loss of hydraulic fluid.





10-3

CONTROL VALVE

(Hydraulic Power Take-Off)

Dissmantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to removal and dismantling.

For assembly and replacement the sequence is reversed.

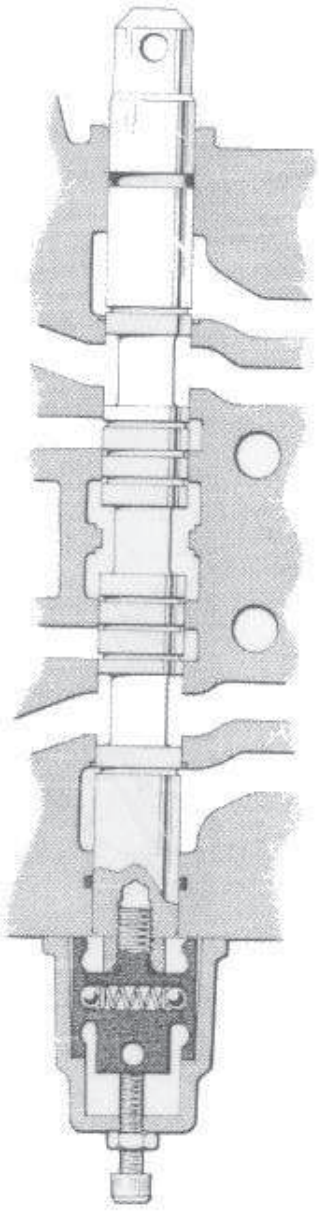
When Dismantling

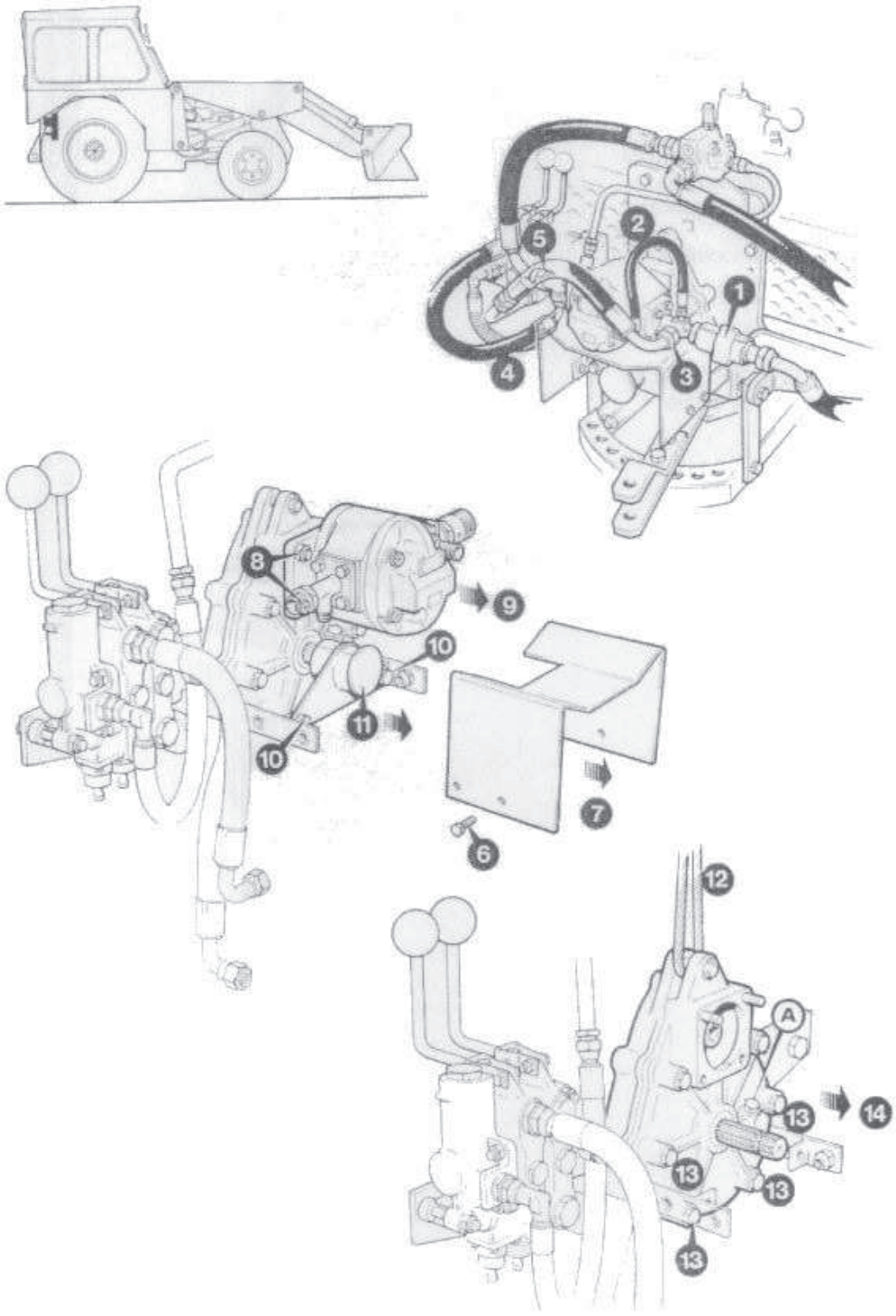
If removed label spools 11 and 21 to ensure replacement in their original bores.

When Assembling

Renew all O rings and seals.

Adjust screw 4 so that spool 11 cannot be moved downwards from the neutral position.





11-2

GEARBOX AND MOTOR

(Hydraulic Power Take-Off)

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal and dismantling.

For assembly and replacement the sequence is reversed.

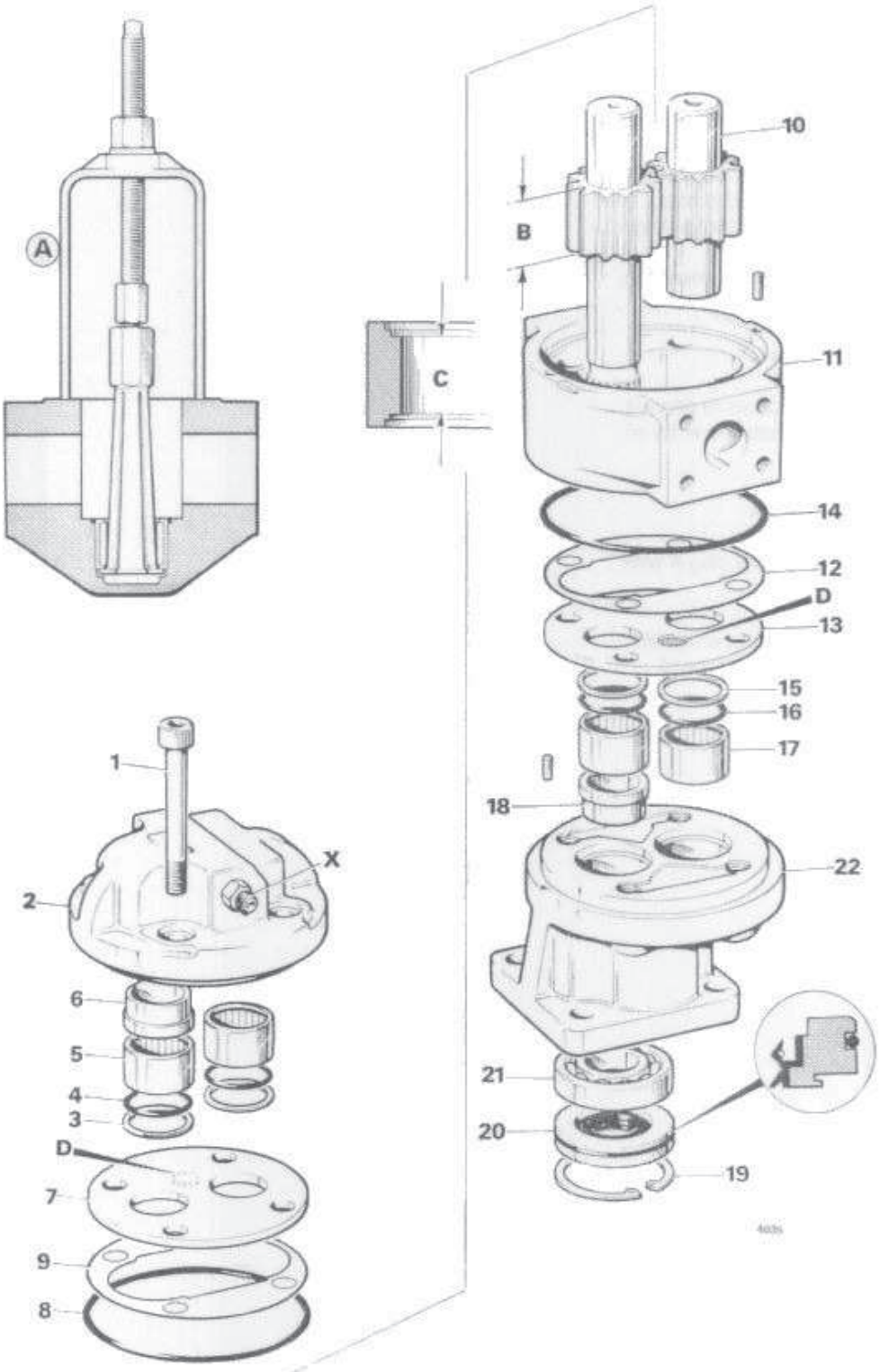
When Removing

Blank hose connections to prevent loss of hydraulic fluid and entry of dirt.

After Replacement

Refill gearbox via level plug A with Mobil Delvac 1320 oil.

If the motor has been overhauled or renewed, check shaft speed (see page A 12-1)



MOTOR
(Hydraulic Power Take-Off)

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed.

When Dismantling

Remove sharp edges and burrs from shaft to avoid seal damage.

Mark end covers **2** and **22** and housing **11** to ensure correct replacement. Do not damage machine faces by prising these apart– use a soft faced hammer.

Use service tool **A** part no. BT2464 to remove bearings **5** and **17**

Mark adjacent teeth of gears **10** to ensure correct replacement using indelible ink. Do not use a center punch or similar tool.

When Assembling

Renew all seals and O rings, lubricating all internal parts with JCB Special hydraulic fluid.

Renew seal bushes **6** and **18** if sealing faces are damaged or bores are scored or worn larger than a diameter of 1.2515in (31.788mm)

Using service tool part no 892/00065 install bearings **5** and **17** to a depth of 0.007 to 0.009in (0.18 to 0.23mm) below machined surface of end cover. New bearings should be fitted if gears are renewed.

Renew gears in pairs if:

A) Journal area of shaft is pitted, or worn in excess of 0.001in (0.025mm).

B) Gears are badly worn or cracked.

C) Gear width **B** is less than housing width **C** by 0.003in (0.076mm) or more

Renew wear plates **7** and **13** if scored or eroded. Ensure that recesses D are diagonally opposite and facing the gears.

Running clearance between gears and wear plates is 0.0045 to 0.006in (o.11 to 0.15mm) this is achieved by addition of shims **9** and **12** 0.0015in (0.038mm) thick, distributed each side of housing **11**. The total thickness of shims required is found by adding the running clearance to dimension B then subtracting dimension **C**

Ensure that drain adapter **X** in end cover **2** is free from obstruction.

Align gears, housings and covers using marks made on dismantling

Torque Settings

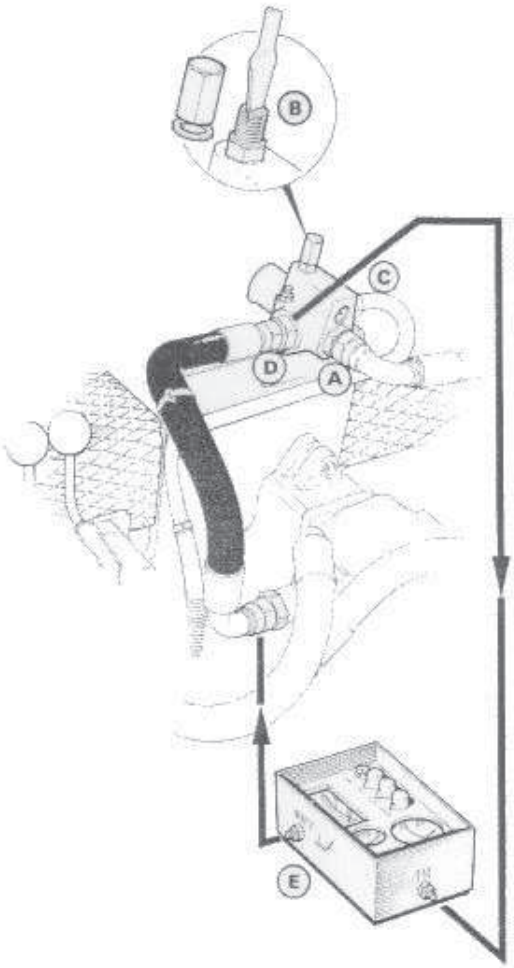
Item	kgf m	lbf ft
1	13.8	100

HYDRAULIC POWER TAKE-OFF

Output Shaft Speed

Fluid from the pump enters the flow divider at port **A**.
A constant quantity, controlled by adjustment **B** is fed to the attachment spool via port **C**. Pump output in excess of this quantity is fed to the power take-off motor via port **D**.

The power take-off is designed to operate at a shaft speed of 530-550 rev/min at an engine speed of 1800 rev/min. This requires a flow to the motor of 22 UK gal/min (100 litres/min). With a pump output of 29 UK gal/min (132 litres/min) The resultant flow to the attachment spool will be 7 UK gal/min (32 litres/min.)

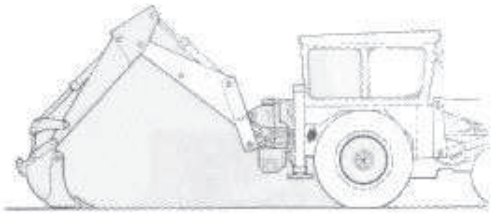


Adjustment

Connect flow meter **E** as shown and adjust the flow divider to give the specified motor flow (screw in to increase)

NOTE:
If the pump output is below standard, then the required flow to the motor may be achieved only at the expense of flow to the attachment spool.

CONTROL VALVE – HAMWORTHY



Removal and Replacement

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed.

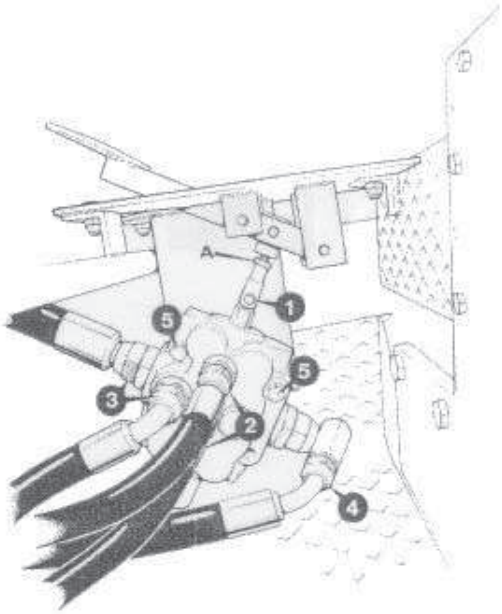
When Removing

Prior to disconnecting hoses, operate control levers to vent pressure and label hoses to ensure correct replacement.

Blank all hoses and pipes to prevent entry of dirt and loss of hydraulic fluid.

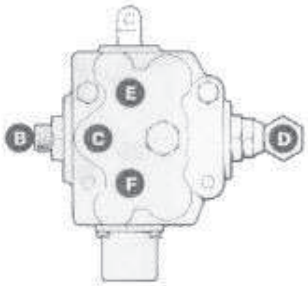
When Replacing

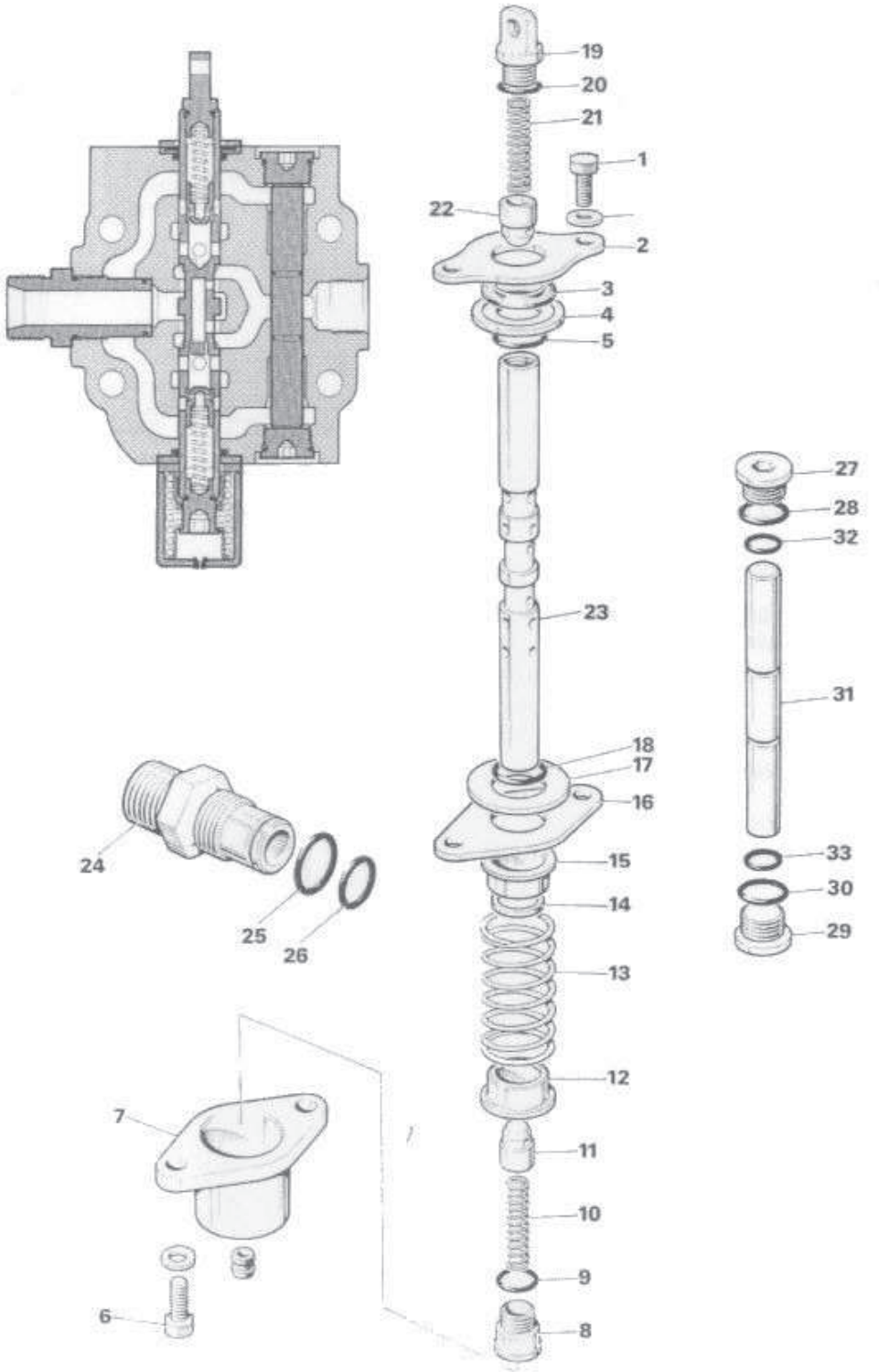
Adjust length of link **A** so that pedal pads are level when spool is in the neutral position.



Connections

B To Excavator Valve
C To Tank
D From Shovel Valve
E Jaw Ram Rod End
F Jaw Ram Head End





14-3

CONTROL VALVE – HAMWORTHY

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed.

When Dismantling

To prevent spool rotating when removing items 8 and 19 use barrel clamp part no 992/02100 with the spool protruding from the block. Alternatively items 8 to 23 may be removed as an assembly and mounted in a vice for dismantling. Use soft jaws if the barrel clamp is not available.

If removed label spool 23 to ensure replacement the correct way up.

When Assembling

Renew all O rings and seals lubricating all internal parts with JCB Special hydraulic fluid.

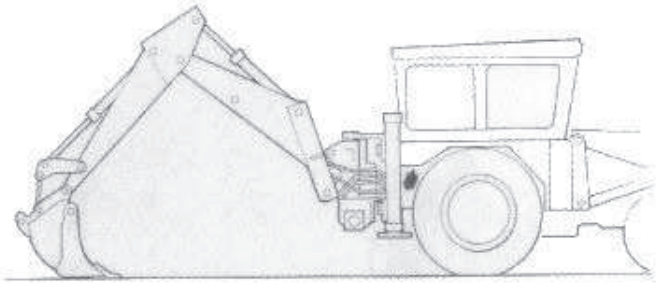
14-4

CONTROL VALVE PARKER HANFIN

Removal and Replacement

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed.



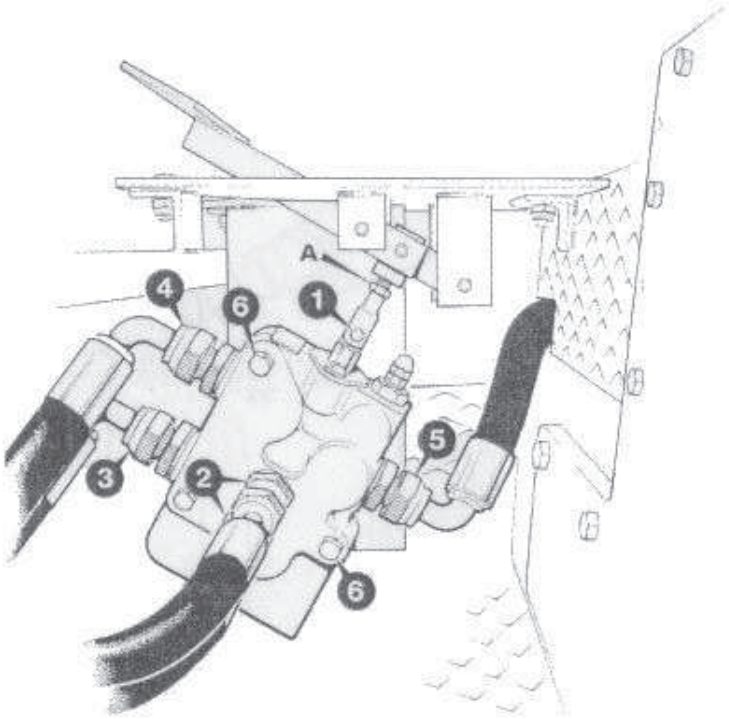
When Removing

With the engine off, operate all controls to vent residual pressure before disconnecting hoses.

Blank all hoses and pipes to prevent entry of dirt and loss of hydraulic fluid.

When Replacing

Adjust length of link A so that pedal pads are level when spool is in the neutral position.



Conections

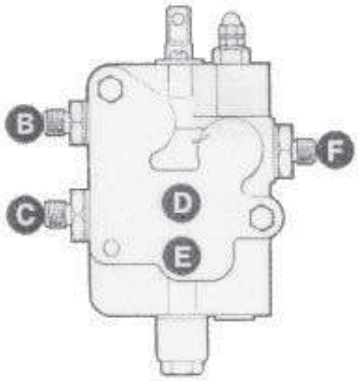
B To Roadbreaker Flow Divider

C To Tank via Excavator Valve Exhaust Line.

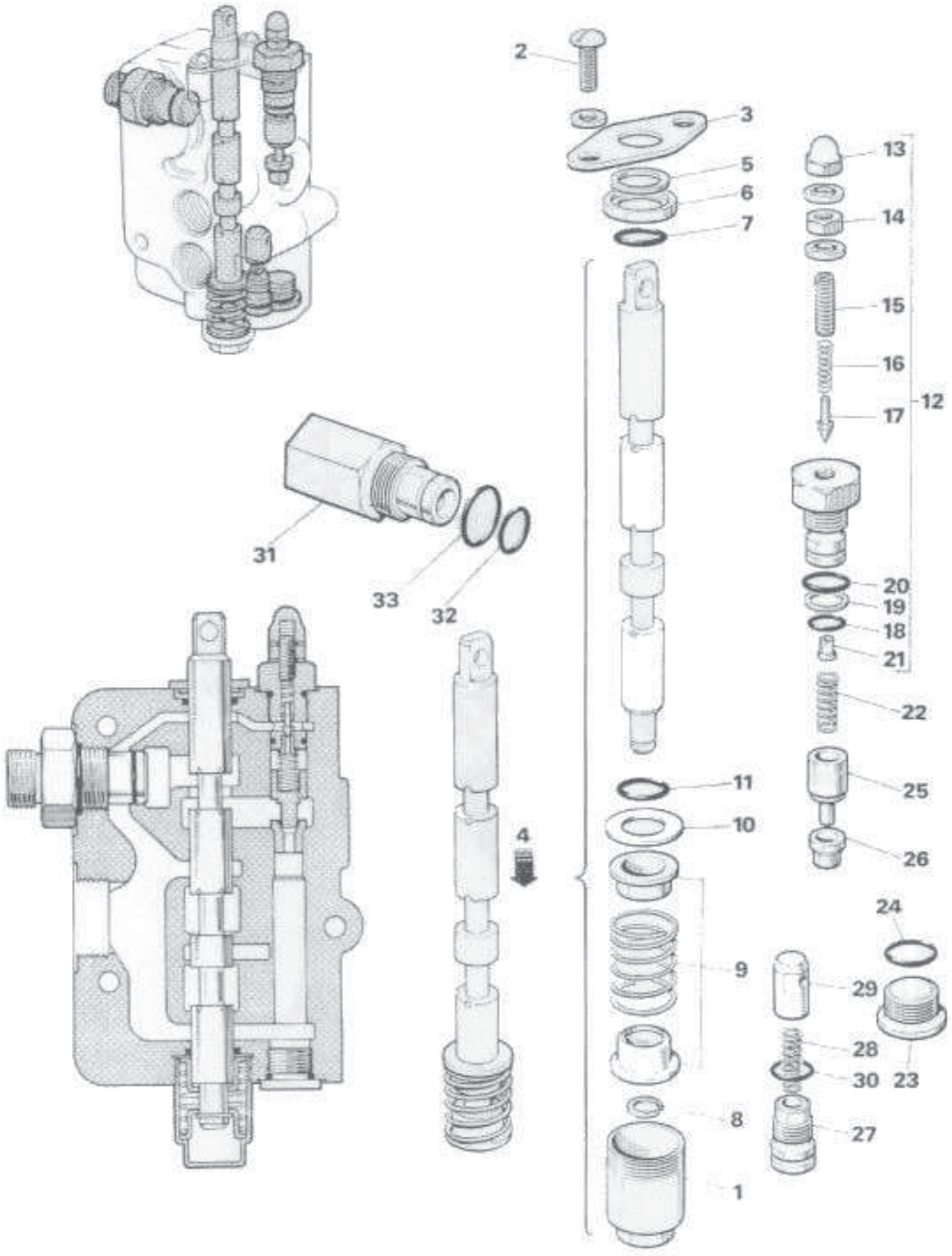
D To Attachment (Jaw Ram Head Side/Extending Dipper Ram Head Side)

E To Attachment (Jaw Ram Rod Side/Extending Dipper Ram Rod Side)

F From Pump



NOTE:
Hose **B** is only fitted when a roadbreaker is used with dipper mounted attachments.



14-6

CONTROL VALVE PARKER HANIFIN

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed.

When Dismantling

To remove plunger **25** pass a soft metal rod through seat **26**

To remove seat **26** use a piloted soft drift

When Assembling

Remove minor nicks and burrs. Excessive wear on spools or bore must be remedied by renewal of complete valve.

Do not lap or grind seating faces, but where these are worn renew both mating parts.

Renew all seals and O rings.

After Assembly

Reset relief valve pressure see page A 14-7

14-7

CONTROL VALVE
PARKER HANIFIN

Relief Valve

Pressure Testing

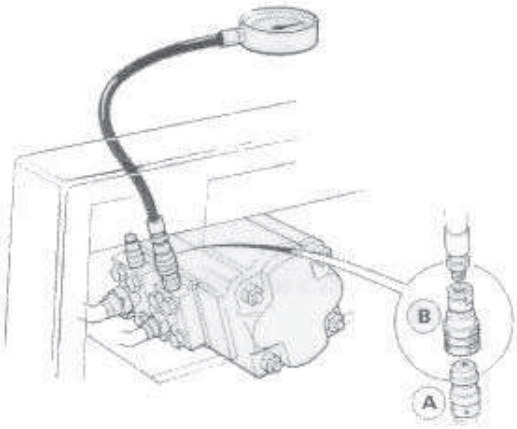
If a powerbreaker is fitted disconnect both pipes **C** and fit plugs 816/00197 (Service Tools)

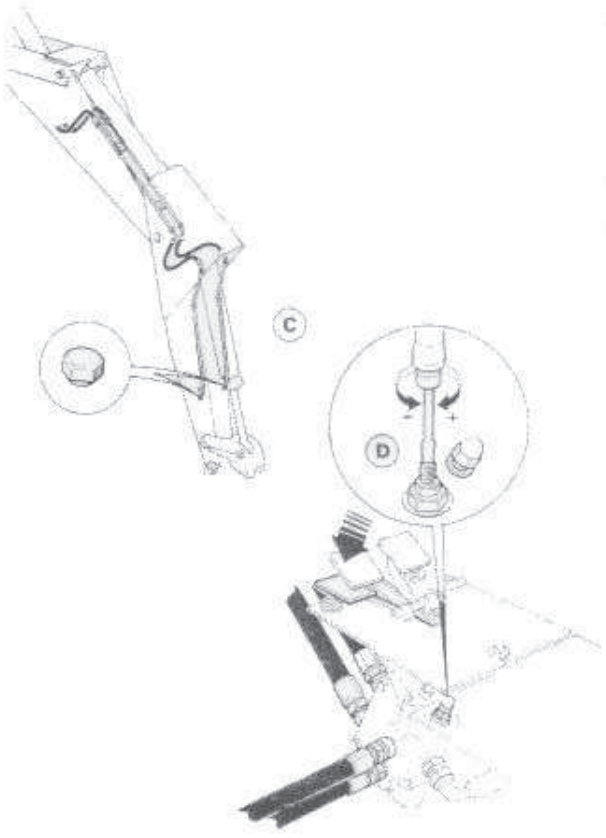
Connect a pressure gauge to test adapter **A** using snap connector **B** 892/00099 (Service Tools)

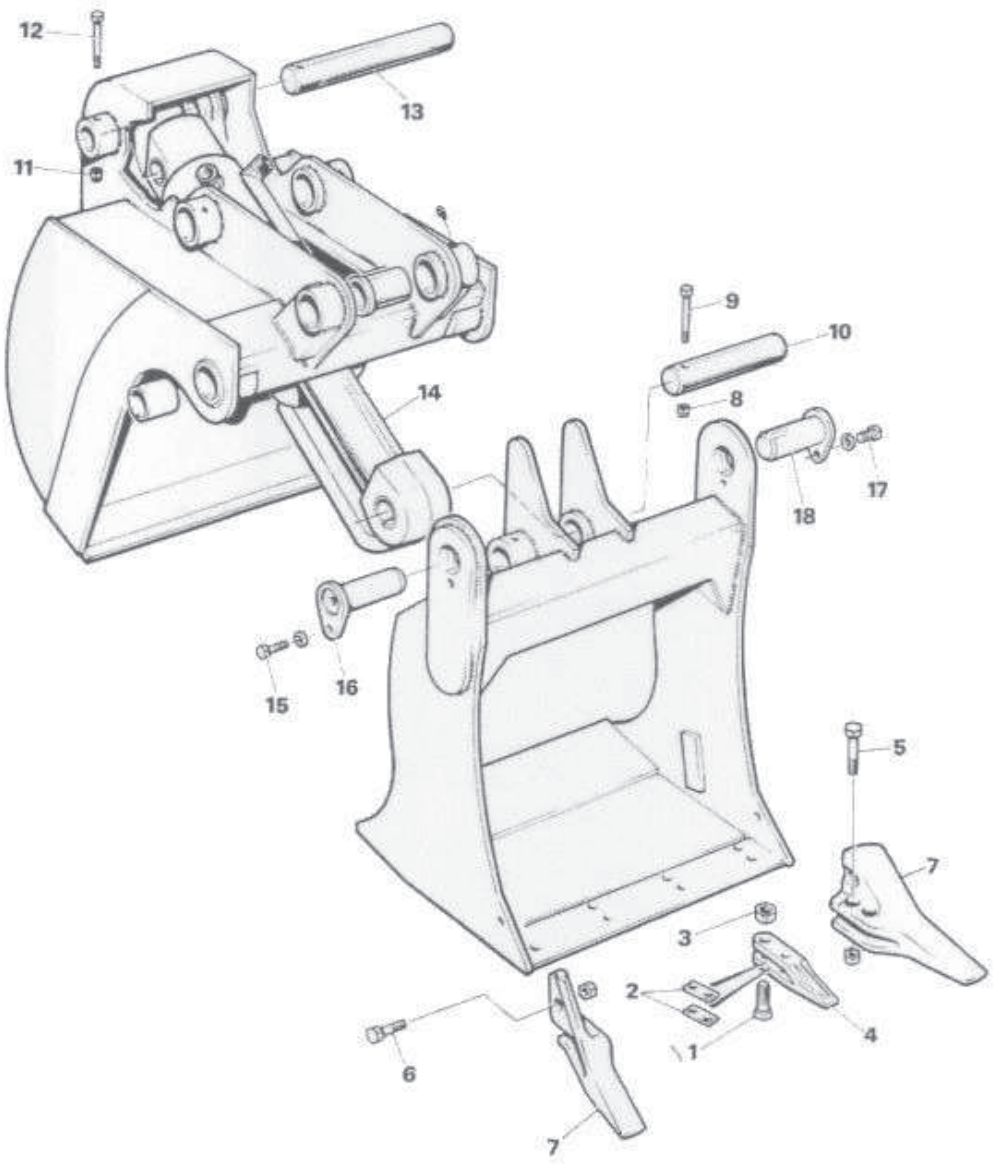
Run the engine at 2000 rev/min and depress control valve pedal to obtain maximum gauge reading.

When an attachment is fitted other than a powerbreaker the service will have to reach full travel before the maximum reading is attained.

If the reading does not correspond to that given in the Technical Data section adjust as shown **D**







15-2

JAW BUCKET

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed.

When Dismantling

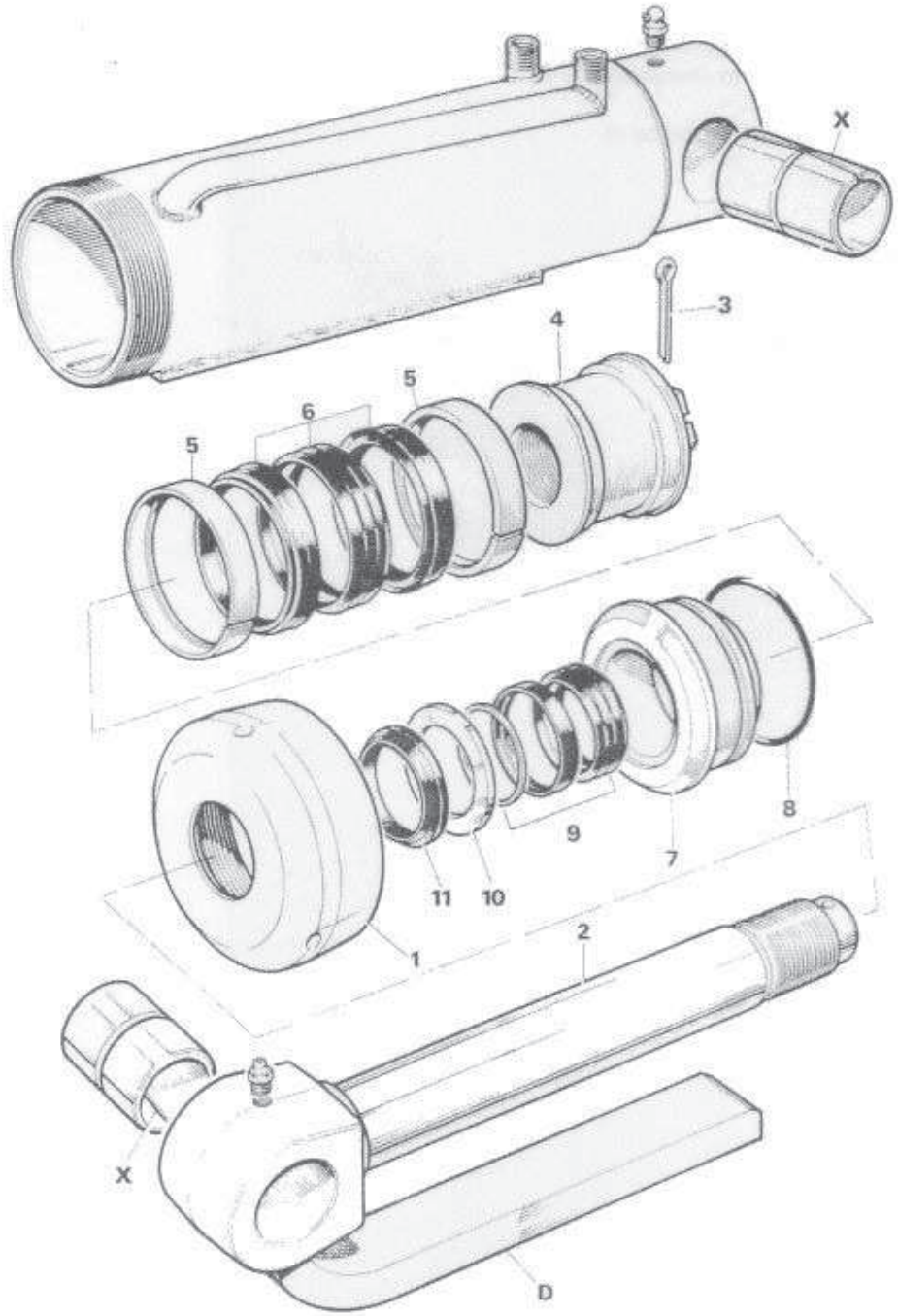
Ensure that bucket jaw is adequately supported before removal of ram **14** or pivot pins **16** and **18**

When Assembling

Fit shims **2** in sufficent quantity to take up clearance between tooth and toeplate

Torque Settings

Item	lbf ft	kgf m
1	300	41.5



RAM
One Piece Piston Head
(Typical)

Dismantling and Assembly
The numerical sequence on the illustration is intended as a guide to dismantling a typical ram.
Components of specific rams may vary in shape and quantity, for details refer to Parts Catalogue.

NOTE:
Protection bar **A** is fitted to JCB Jaw only.

For assembly the sequence should be reversed.
When Dismantling

It may be necessary to use hydraulic pressure or compressed air to drive out the piston assembly.

WARNING:
Ensure that the end cap **1** is securely in position during the operation as severe injury can be caused by a suddenly released piston rod.

When Assembling
Renew all seals and O rings, lubricating all internal parts with JCB Special hydraulic fluid.

Use sleeve **A** part no 892/0024 to fit seal **11** onto 64mm (2,5in) dia rod.

Install one piece seal **C** centrally on the piston head using expander sleeve **B** part nos:
892/00012 – 92mm (3,625in)
892/00013 – 102mm (4in)

Position one split seal and one wear ring on each side of seal **C**

End cap item 1 is to be fitted to cylinder with 4 drops of Loctite 241 (Service Tools) on bottom 3 or 4 threads.

If replacing eye end bushes position the splits **X** as shown

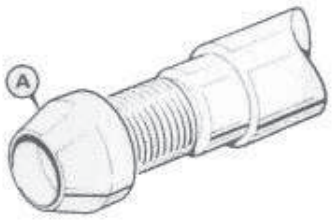
Renew end cap lockwire and secure to feed pipe.

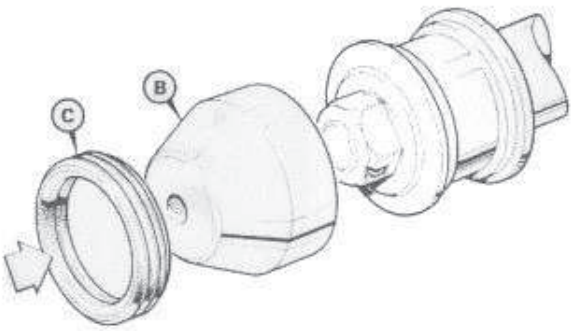
Piston Head Torque Settings

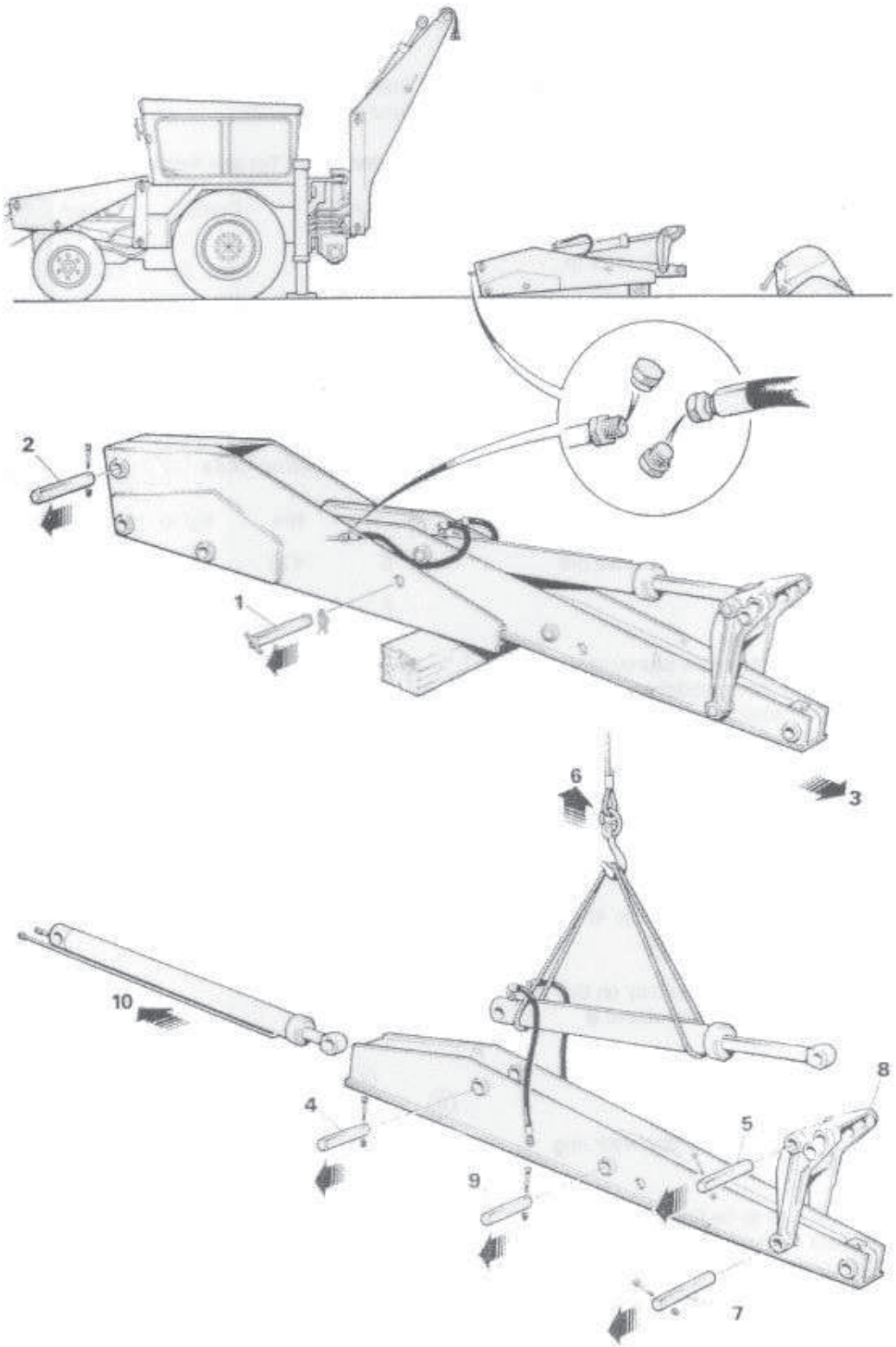
Piston Rod		Cylinder		Torque
mm	In.	mm	In.	Code
38	1,5	70	2,75	E
51	2,0	92	3,625	F
64	2,5	102	4,0	G

Torque Setting Code

	Nm	kgf m	lbf ft
E	420	42.9	310
F	408	41.5	300
G	522	53	385







EXTENDING DIPPER

Removal and Replacement

Prior to disconnecting hoses fit locking pin **1** stop engine and operate control lever to vent pressure.

Label hoses to ensure correct replacement.

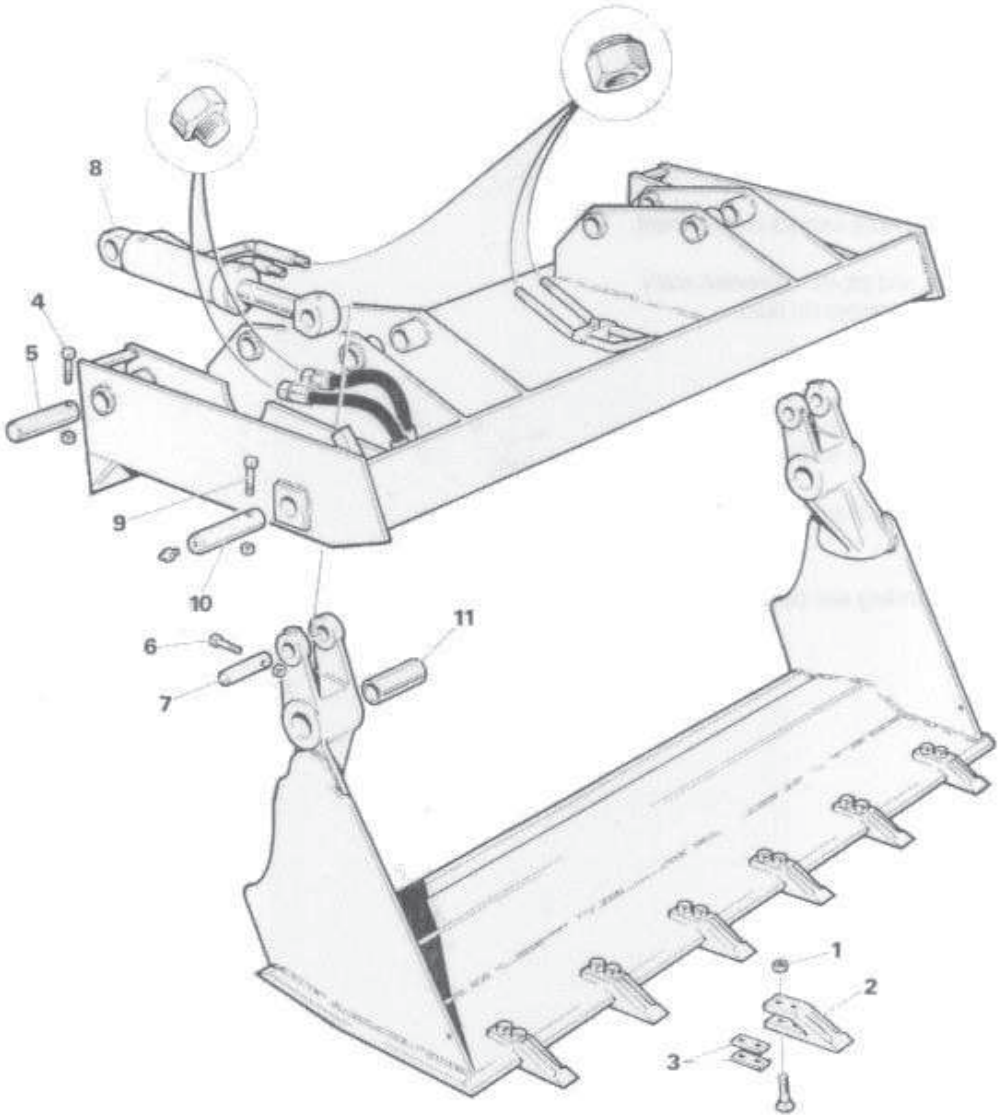
Blank all hoses and pipes to prevent entry of dirt and loss of hydraulic fluid.

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to Dismantling.

For Assembly the sequence should be reversed.

For Ram Dismantling see page A 16-1



18-2

POWERBREAKER

Dismantling and Assembly

When Dismantling

The accumulator items **2** to **7** contains pressurised Nitrogen. Dismantle only if requiring attention.

Remove screw **4** slowly to release Nitrogen pressure.

Remove item **6** using tool 825/99836

When Dismantling

Ensure seals are fitted as shown

Renew studs **24** if the rubber buffers ore loose or damaged.

Fit seal **35** using tool 992/07500

Replace chuck **27** if bore diameter for tool exceeds 67mm (2.637in)

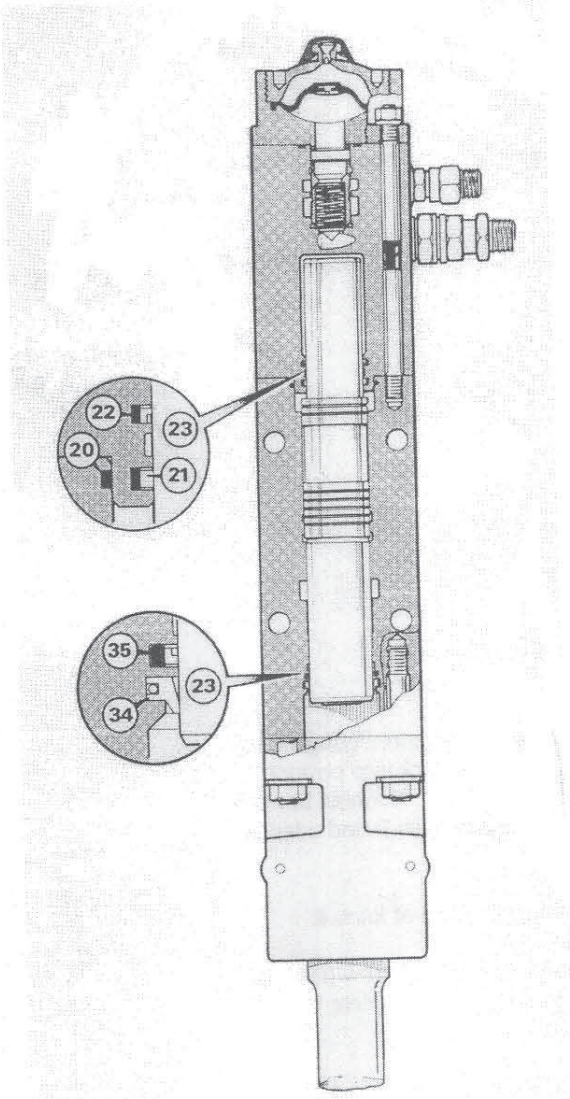
Coat diaphragm flange with petroleum jelly and fit into body **2** ensuring it is correctly seated.

Using tool 825/99835 fully tighten item **6** by hand. Scribe a line across items **6** and **2** hammer tight until lines are 6 to 8mm (0.236 to 0.314in) apart.

For Nitrogen filling see page **18-3**

Torque Settings

Item	Nm	kgf m	lbf ft
1	170	15	110
26	650	66	480



18-3

POWERBREAKER

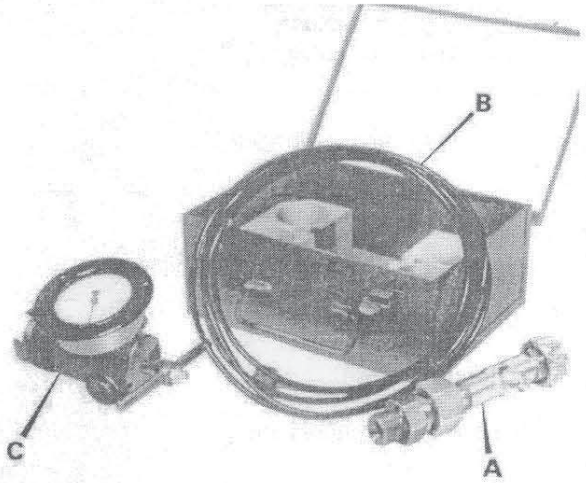
Nitrogen Filling

Nitrogen filling kit 992/06600
Comprising

A Nitrogen bottle adapter and valve

B Connector hose

C Accumulator adapter and pressure gauge



Fit adapter and pressure gauge **C** to accumulator and lock into position with knurled ring **D**. Connect to nitrogen bottle using hose **B** and adapter **A**.

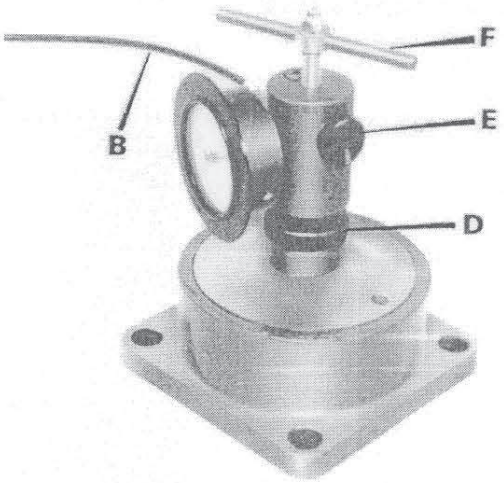
Close adapter valve at knob **E**

Release accumulator screw (item **4** on page 18-1) two complete turns using handle F

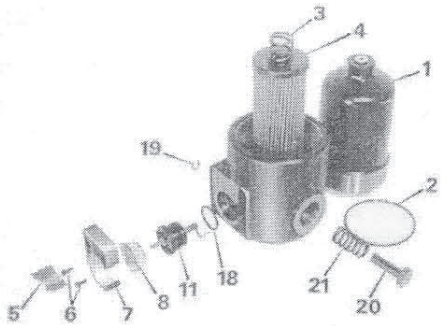
Open nitrogen bottle valve **A**

Open valve **E** and allow pressure to build up to 50 bar (51 kgf/cm² 725 lbf/in²)

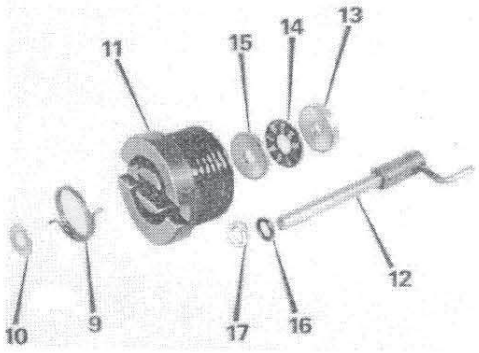
Close valve **E** nitrogen bottle valve **A** and tighten accumulator screw at handle **F**.



TELL TALE FILTER
Dismantling and Assembly



1. Filter components

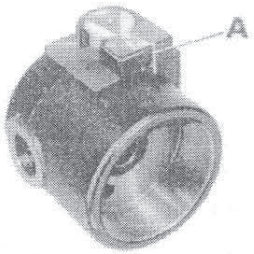


2. Details of collar 11 components

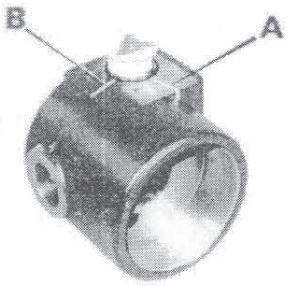
When Dismantling

All numbered items in the following instructions refer to the above photographs which show the dismantling sequence.

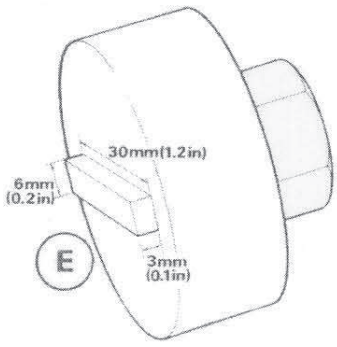
Dismantle up to item **4** then proceed as follows.



3. Extend line A down on to filter housing to show start of by-pass section

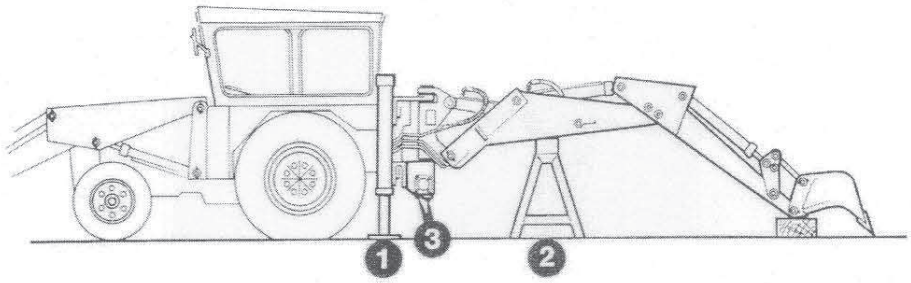


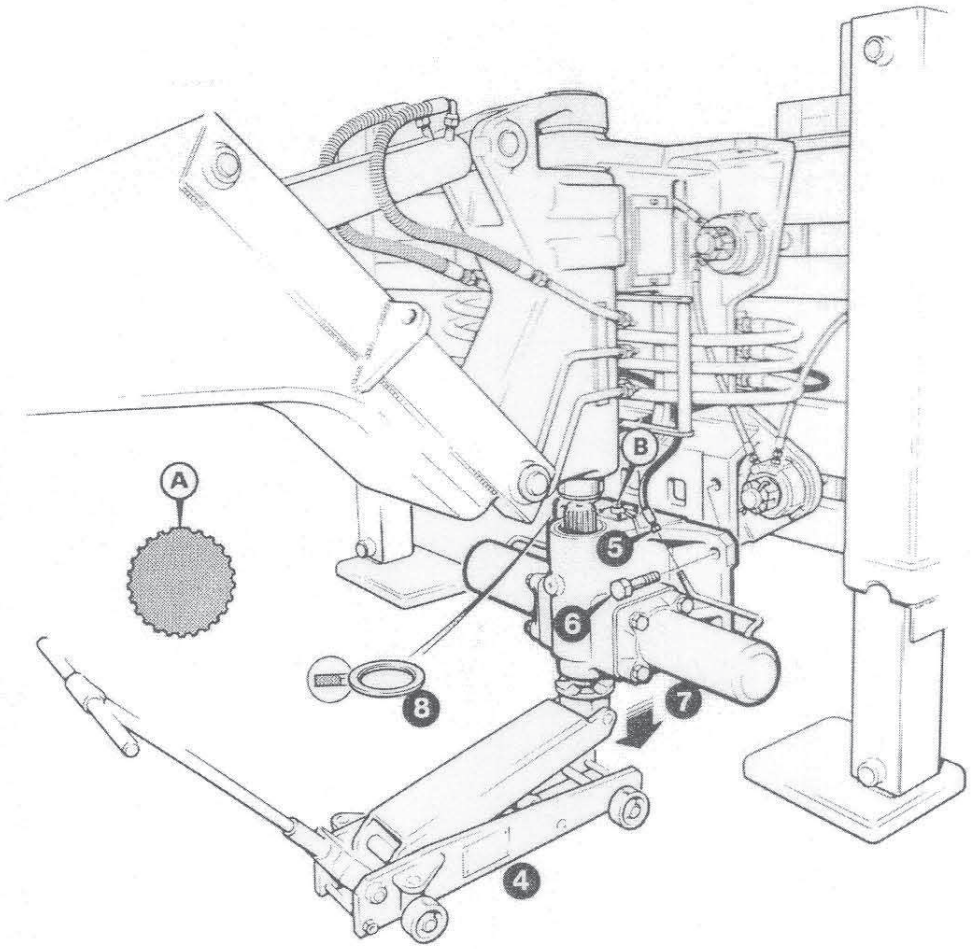
4. Remove items **5** to **7** Extend line **A** towards centre of indicator spindle. Slacken indicator locking screw. Spring **9** will turn indicator to new position **B** mark position with a line. Remove indicator **8**. De-burr spindle **12** to avoid damage to seals then remove all components up to item **17**. Removal of collar **11** may require the use of a tool similar to that illustrated at **E**



B BODY AND FRAMEWORK B

CONTENTS





2-2

SLEW ACTUATOR

Removal and Replacement

The numerical sequence on the illustration is intended as a guide to dismantling

For replacement the sequence should be reversed.

When Removing

Position and support boom and dipper as shown

Drain oil via both plugs ar **3**

Label and blank hoses **5** to ensure correct replacement and prevent entry of dirt.

When Replacing

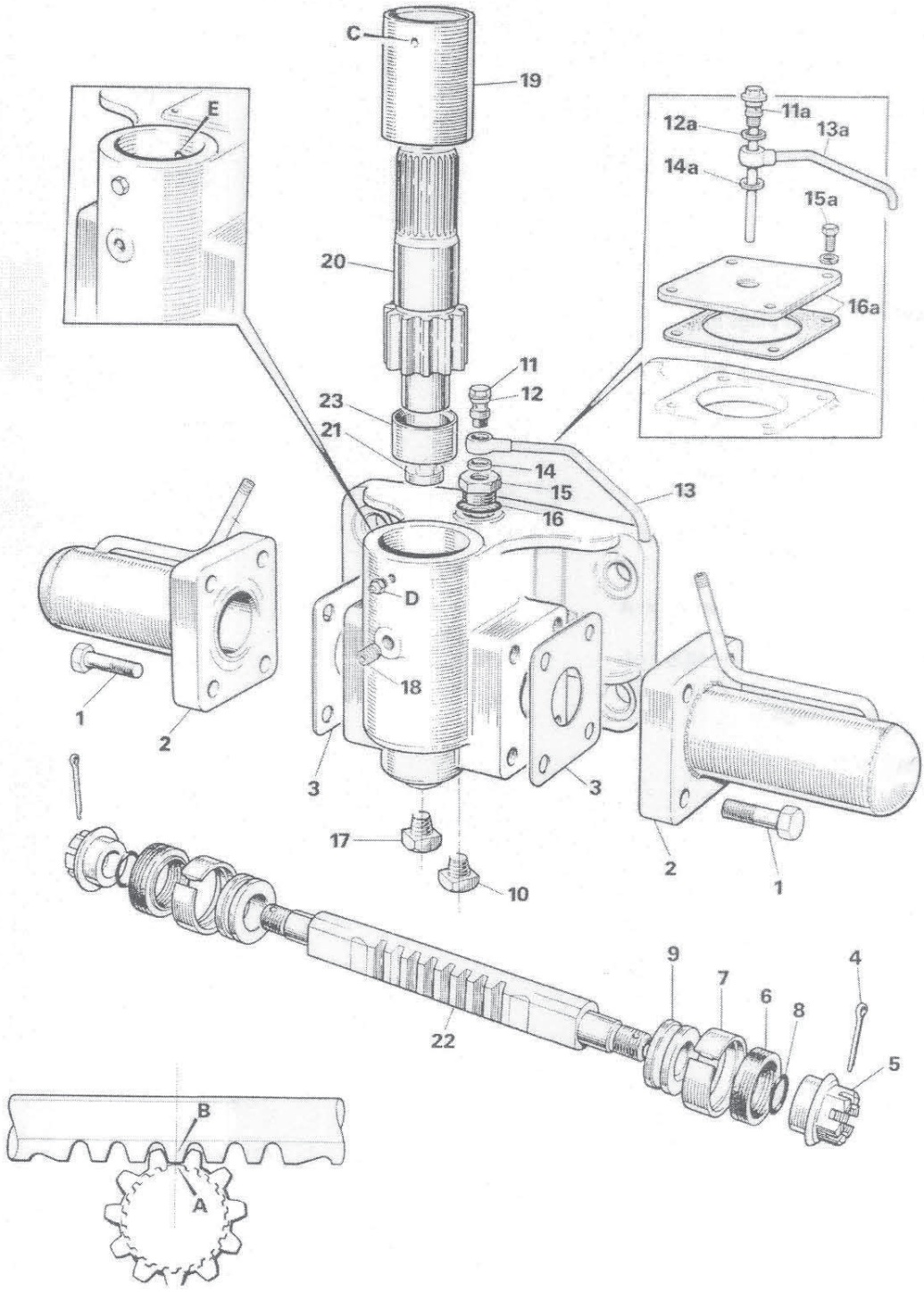
Renew thrust washer **8** with the chamfer facing towards the kingpost.

Take care to align master spline **A**

Refill at **B** with Mobilube HD90 oil.

Torque Settings

Item	lbf ft	kgf m
6	600	83



2-4

SLEW ACTUATOR

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed.

When Dismantling

To remove items **19** **20** and **21** enter press-tool, through hole for plug **17**.

NOTE:
Items **11a** to **16a** are fitted on later machines in place of items **11** to **16**

When Assembling

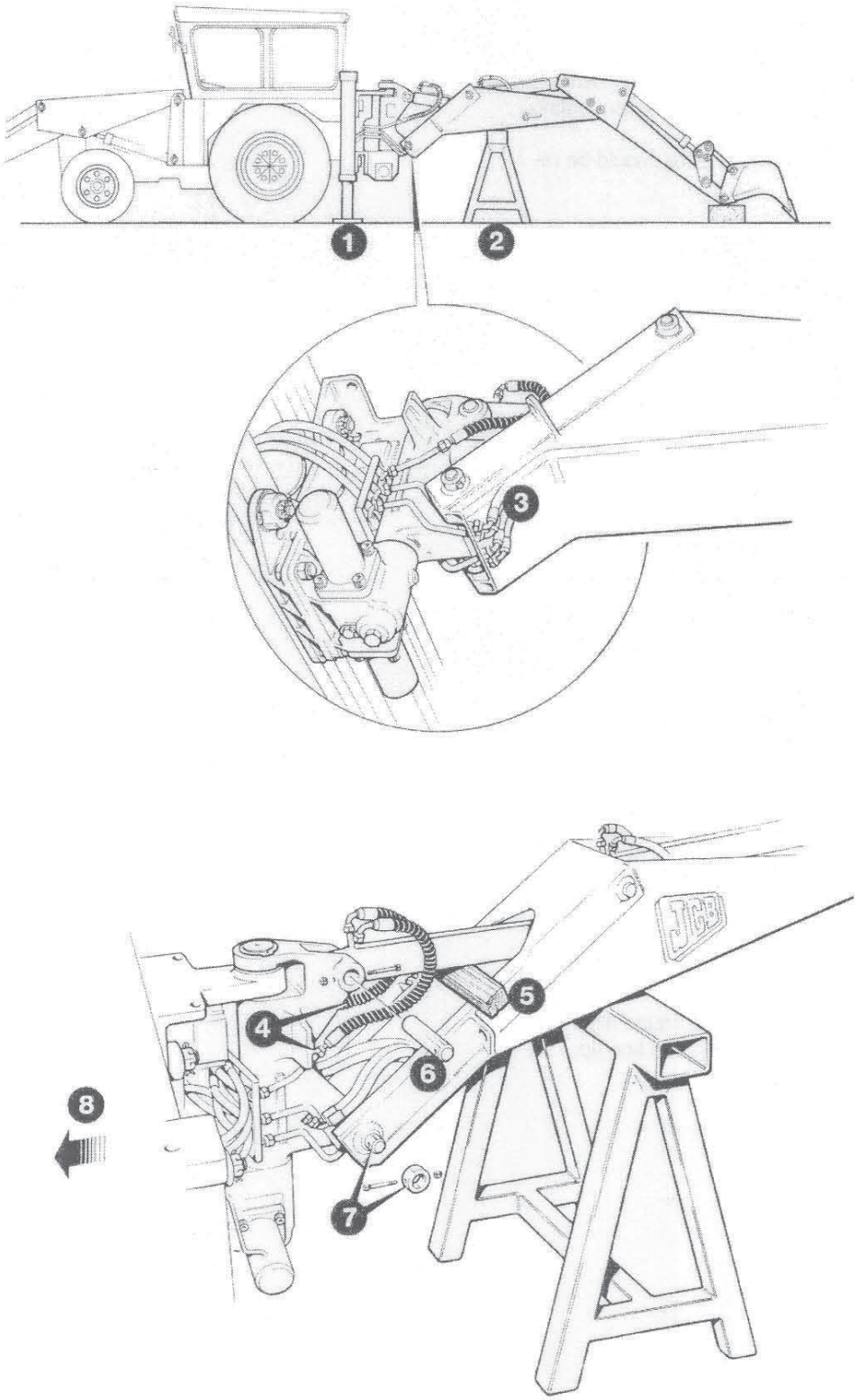
Position master spline **A** directly above centre tooth **B** of rack **22**

Align hole **C** in bush **19** with grease nipple **D** (if fitted) On later machines, align hole **C** with hole **E** in actuator body.

Torque Settings

Item	Nm	kgf m	lbf ft
1	372	38	275
5	420	42.8	310
10	95	9.7	70
17	95	9.7	70

NOTE: Item 5 may be torqued higher to allow holes for split pin 4 to line up.



3-2

BOOM AND DIPPER

Removal and Replacement

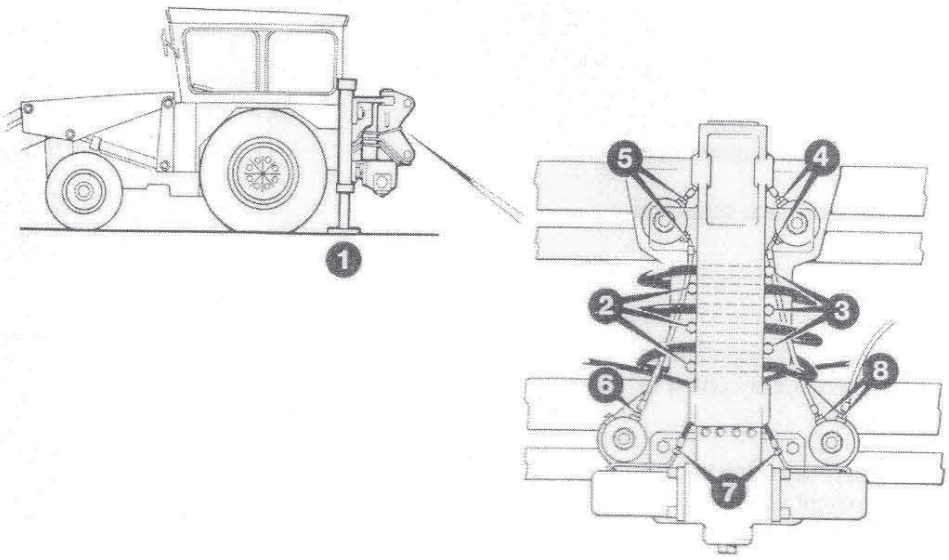
The numerical sequence on the illustration is intended as a guide to dismantling

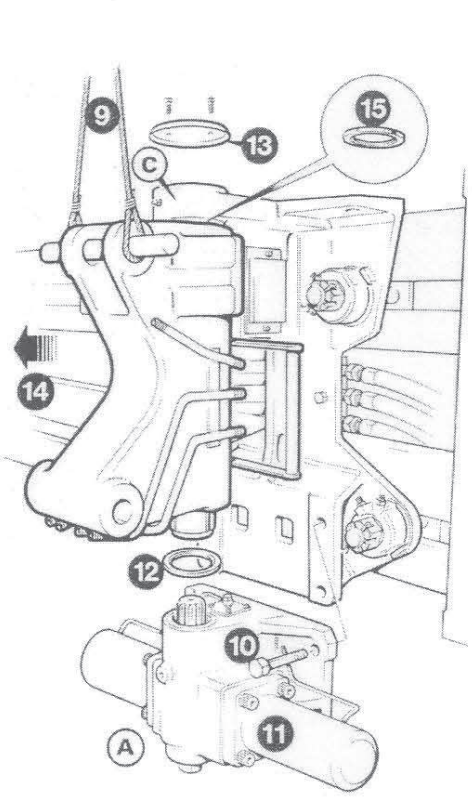
For replacement the sequence should be reversed.

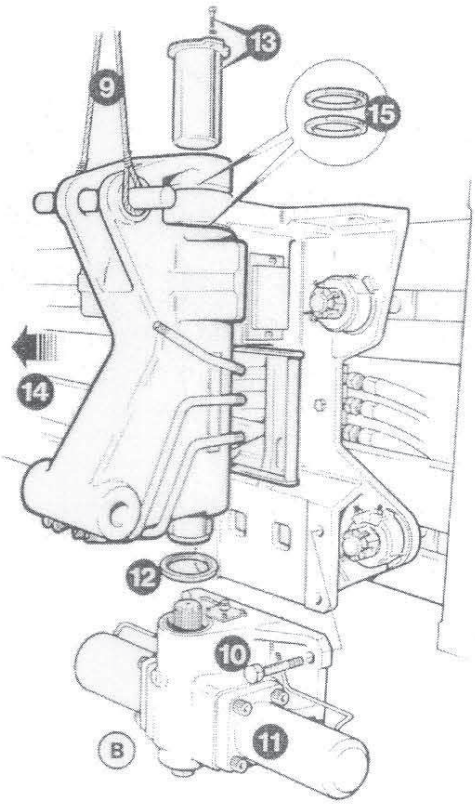
When Removing

After positioning support **2** stop engine and operate boom and dipper control to vent residual pressure.

Label and blank hoses to ensure correct replacement and prevent entry of dirt.







4-2

KINGPOST
KINGPOST CARRIAGE

Torque Settings

Item	lbf ft	kgf m
10	**600**	**83**

Removal and Replacement

The numerical sequence on the illustration is intended as a guide to dismantling

For replacement the sequence should be reversed.

A – JCB 2D, 3 and 3C

B – JCB 3D

When Removing

First remove boom and dipper (see page B 3-1)

Label and blank hoses to ensure correct replacement and prevent entry of dirt.

To remove pivot pin 13 use a 1in UNF bolt in the tapped hole provided.

NOTE:
On JCB 2D, 3 and 3C machines, before swinging the kingpost rearwards, lower the hoist so that the top pivot boss clears housing C

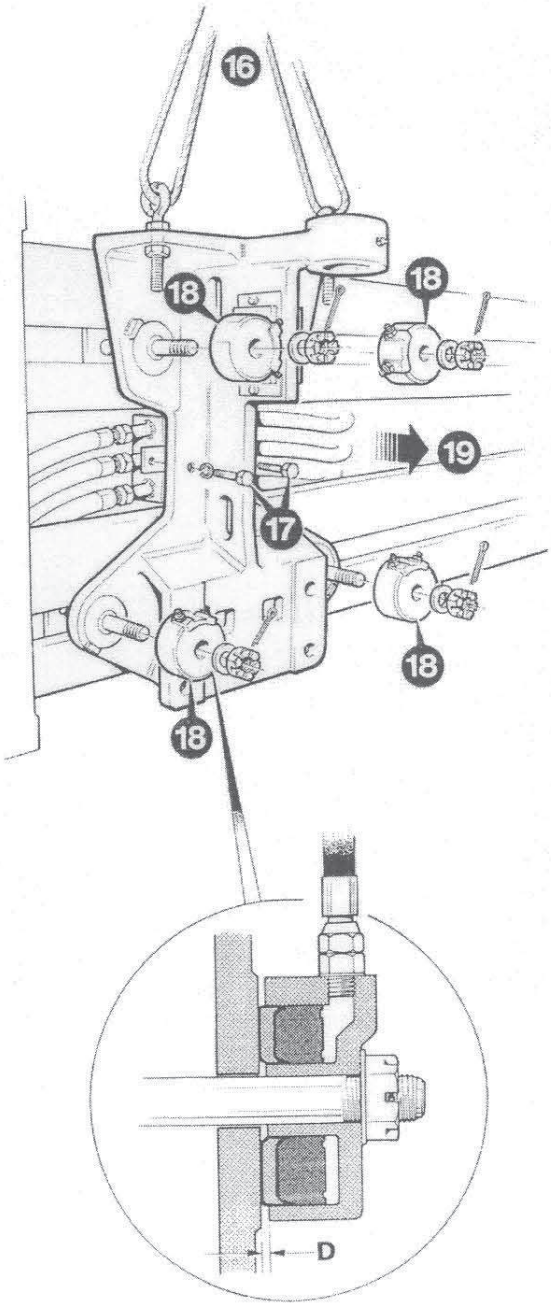
When Replacing

Ensure that when hydraclamps are pressurized, clearance D is 1/8 to 3/16in (3 to 5 mm)

Renew thrust washers 12 and 15 with chamfers facing towards the kingpost.

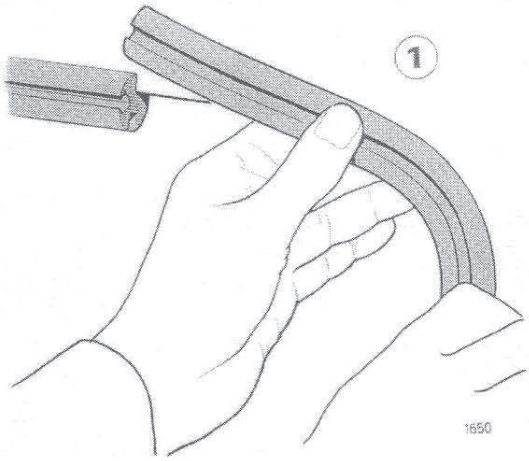
If a new kingpost is fitted, apply a liberal coating of grease around the actuator splines to prevent machining particles from entering the actuator.

Tale care to align master spline.

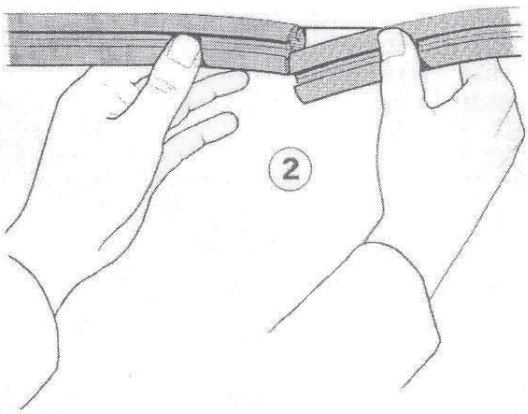


Glazing

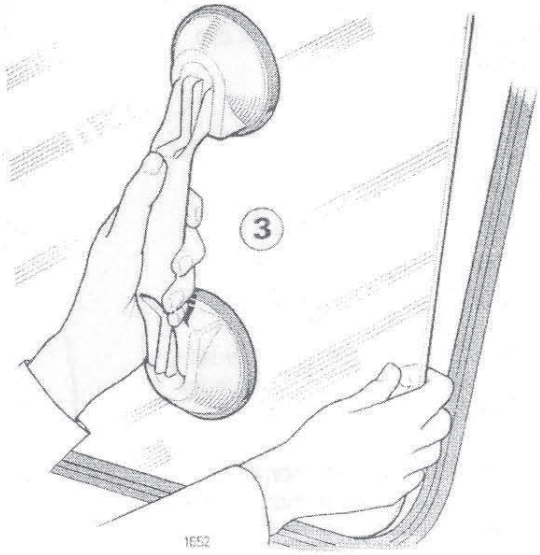
When fitting glazing rubber to panel edge, allow for small overlap before cutting



Press both ends together, then push back on to the panel ensuring correct location

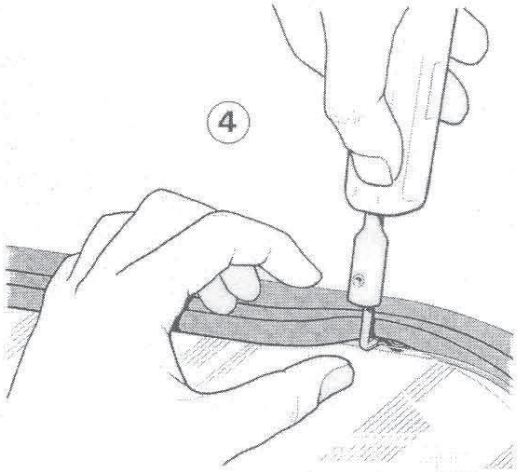


Commencing at lower corner, carefully fit the glass. The use of glazing suction cups will simplify this operation, particularly when handling larger size windows

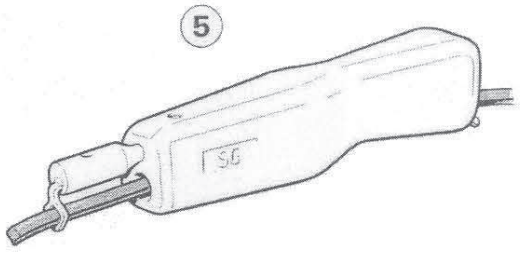


Glazing

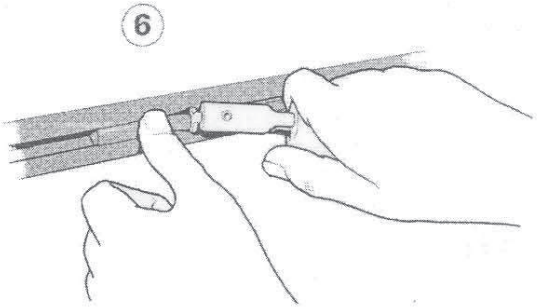
Complete glass installation using a glazing tool (Service Tools)
DO NOT USE FORCE



Remove the hook from the glazing tool and fit the correct size eye for the filler strip which is then threaded through the eye and handle.

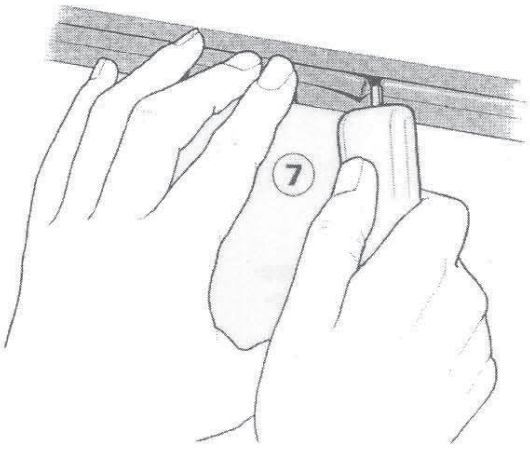


Start at a point away from the glazing rubber joint. Insert tool eye in the filler strip channel and hold the end of the filler strip in place. Commence drawing the tool eye round the channel



When cutting filler strip, allow sufficient overlap to place joint under pressure.

Use spur tool to press home the joint and any small sections of filler strip not correctly locating.

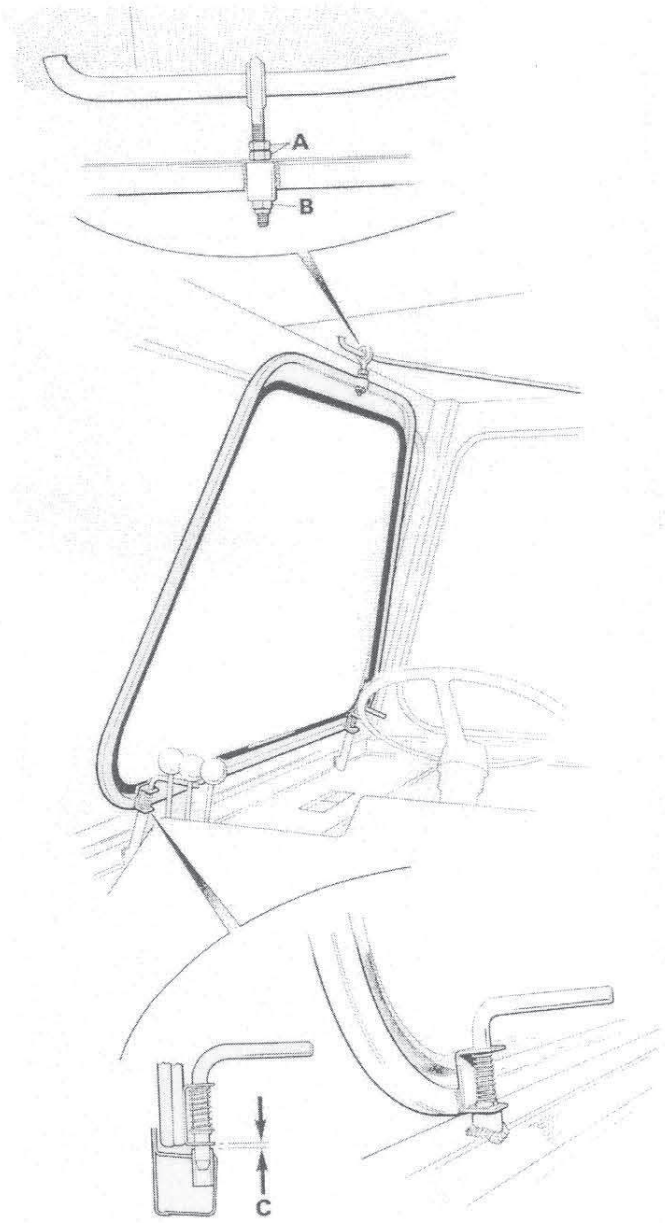


REAR WINDOW

Setting

With the door in the side stow position adjust nuts **A** and **B** to give minimum clearance at **C**

Tighten self locking nut **B** to allow door to rotate with minimum of vertical movement



ELECTRICS

CONTENTS

BATTERIES

General Maintenance

The primary function of the battery is to provide the 400 – 800 amperes required to start the engine. A well maintained battery has an adequate power reserve but this will diminish rapidly if the battery is allowed to deteriorate.

Attention to the following points will appreciably extend the useful life of the battery

Keep the battery and terminals clean and dry. Spilled water or electrolyte causes corrosion of metal parts and also encourages 'tracking' of current between the terminals. This can partially discharge the battery over a prolonged period. Use only distilled water for 'topping up'.

Maintain the battery in a 'charged' condition. Stored batteries (except 'dry charged') should be given a trickle charge every three to four weeks. Check electrolyte level and specific gravity on hour after the charging period.

When charging a battery 'in situ' the earthing cable should be disconnected to avoid possible damage to the alternator.

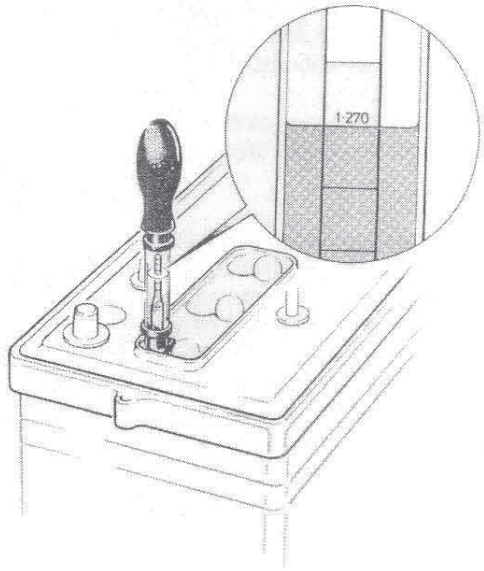
If removing the battery from the machine, disconnect the earthed terminal first (and reconnect last) This will prevent 'flash over' if the spanner touches the machine bodywork.

Terminal connections should have bright metal to metal contact and should be kept tight. Smear the terminals with petroleum jelly to reduce the possibility of corrosion.

BATTERIES

Testing – Specific Gravity

The specific gravity of the electrolyte gives an indication of the state of charge of the battery. Readings should be taken using a hydrometer, when the electrolyte temperature is 15° C (60°F) If the battery has recently been on charge, wait approximately one hour (or slightly discharge the battery) to dissipate the 'surface charge' before testing.



Readings should be as tabulated and should not vary between cells by more than 0.04 A greater variation indicates an internal fault on that particular cell.

If the electrolyte temperature is other than 15°C (60°F) a 'correction factor' must be applied to the reading obtained. Add 0.007 per 10°C (18°F) if the temperature is higher than 15°C (60°F) and subtract the same if the temperature is lower. Note that batteries for use in high ambient temperature areas have a lower specific gravity electrolyte (see table)

Specific Gravity at 15°C (60°F)	Fully Charged	Half Discharged	Fully Discharged
Ambient Temperature up to 27°C (80°F)	1.270-1.290	1.190-1.210	1.110-1.130
Ambient Temperature above 27°C (80°F)	1.240-1.260	1.170-1.190	1.090-1.110

BATTERIES

High Rate Discharge Test

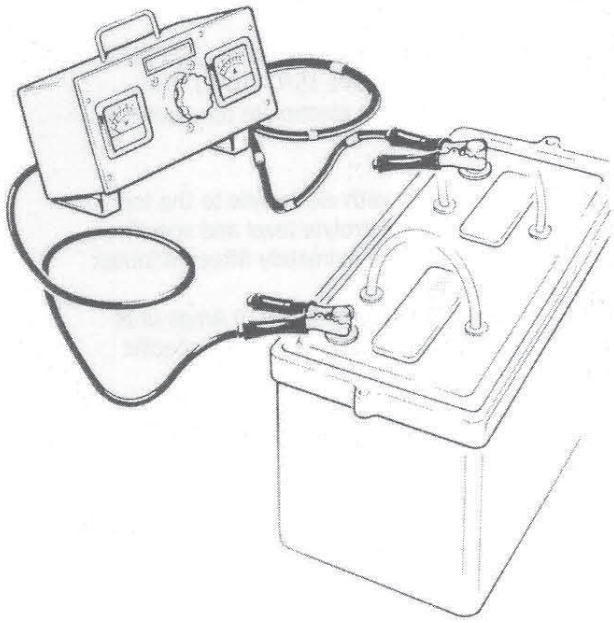
The test is used to determine the electrical condition of the battery and to give an indication of the remaining useful 'life'.

Before testing ensure that the battery is at least 75% charged (see Specific Gravity testing).

Adjust the discharge tester (Service tools WIL/18) to 3x Amp hour rating of the battery (approximately 380 amperes) and connect one clip to each battery terminal, observing polarity.

Note the voltmeter reading. The battery should be capable of maintaining at least 9 volts for 10 seconds. A rapidly falling voltage indicates a fault in one or more cells.

Do not leave the discharge tester in circuit for longer than is necessary to complete the test.



BATTERIES

Dry Charged – Preparation for Service.

Obtain electrolyte of specific gravity 1.016 (Arctic and temperate climates) or 1.23 (Tropical climates) or mix one part by volume of Sulphuric Acid 1.840 to the quantity of distilled water shown in the table.

WARNING:
Always add Acid to water. If water is poured into Concentrated acid an explosion may result.

Allow mixture to cool to ambient temperature before checking specific gravity.

Add a 'correction factor' of 0.007 per 10°C (18°F) if electrolyte temperature is above 15°C (60°F). Similarly, subtract the same if the electrolyte temperature is below 15°C (60°F).

Unseal the battery and fill with electrolyte to the top of the plates. Check the electrolyte level and specific gravity of each cell after approximately fifteen minutes

Charge the battery at approximately 8-10 Amps until all cells are gassing freely and have uniform specific gravity.

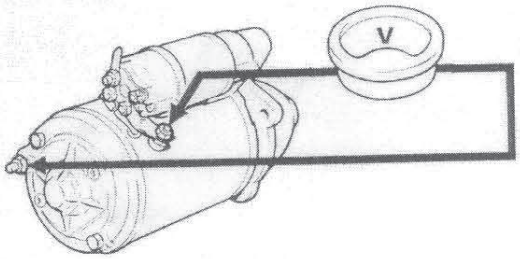
Electrolyte Mixture Table (Parts by Volume)

	Sulphuric Acid	Distilled Water	Final Specific Gravity at
Ambient Temperature up to 27°C (80°F)	1	3.1	1.260
Ambient Temperature above 27°C (80°F)	1	3.7	1.230

STARTER MOTOR

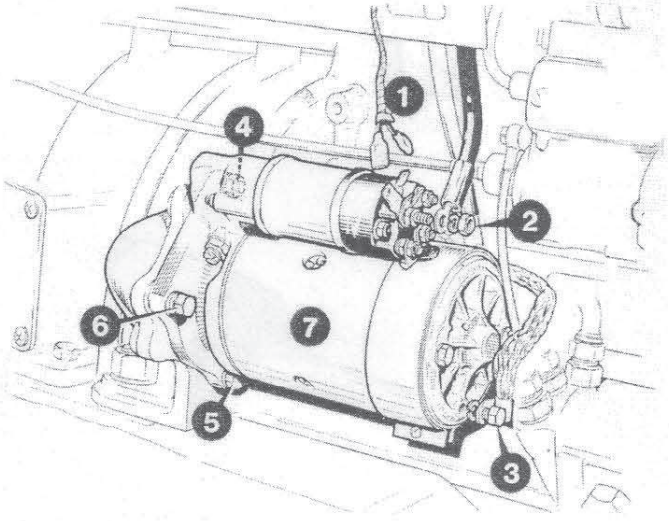
Testing

Check that all battery and starter connections are clean. Tight and making good metal to metal contact. Also ensure that the battery is well charged and that Neutral gear is engaged.



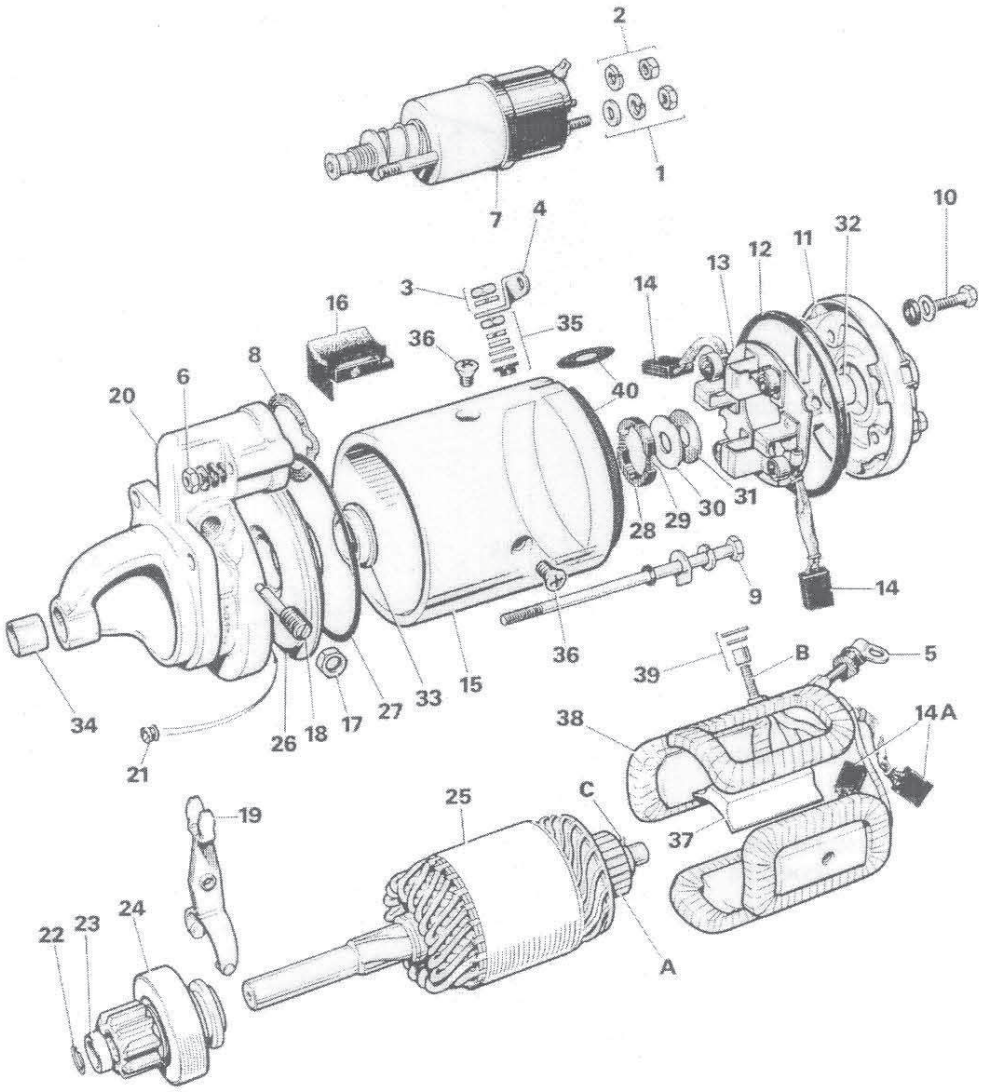
If the starter fails to turn the engin connect a voltmeter across the battery terminals and operate the starter switch. A falling voltage reading (to approximately half system voltage) indicates that the starter is drawing current but is probably mechanically faulty. If the voltmeter reading remains steady at system voltage, reconnect it (as shown) between the starter main input terminal and a good 'earth' and again operate the start switch.

Should the meter now show a steady reading at system voltage, the solenoid and starter switch are in good order but the starter motor has an internal 'open circit'. If the meter reading is zero the start switch, solenoid and interconnecting cables should be checked for continuity.



Removal

Before removing the starter motor, disconnect the battery negative terminal and then follow the numerical sequence shown on the illustration.



STARTER MOTOR – LUCAS M50

Dismantling

Follow the numerical sequence shown on the illustration.

NOTE:
Dismantle only to item **34** unless the field windings **38** are to be renewed. Test the windings electrically before removing them from the motor yoke **15**.

Use a slotted steel tube to displace ring **23** to allow withdrawal of ring **22**.

Allow brake shoes **28** to remain in the end plate **11** unless the shoes require renewal.

Servicing and Assembly

Renew bushes **14** and **14A** if their length is less than 8mm (0.3in).

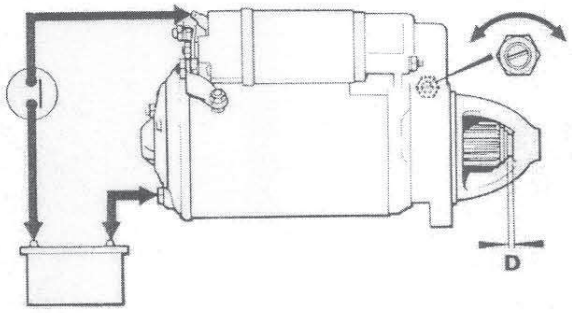
Clean the commutator A with petrol or carbon tetrachloride (see care and safety section for precautions). If individual copper bars are burnt or eroded the armature has broken windings and must be renewed. Otherwise polish with fine grade glass paper (not emery). Renew armature if the commutator diameter is 38mm (1.5in) or less.

Check the field winding for open circuits by connecting an Ohnneter (0 to 100 ohms) between the stud terminal **B** and each positive brush **14A** in turn. A high or 'infinity' reading indicates an open circuit. Similarly, connect the neter between brushes **14A** and the motor yoke **15**. Any reading other than infinity indicates a short circuit between the coils and the yoke. Renew the coils as necessary, use Pole Shoe screwdriver C50 (Service Tools) to remove screws 36

Check bronze bushes **32** and **34** for wear. Soak new bushes in clean, warm engine oil for 2 hours before fitting.

Align crosspin **C** with the notches in the brake shoes **28** before assembling brush carrier and back plate to motor yoke. Make sure that brushes **14A** are installed in the insulated brush boxes.

Set the movement of drive pinion **24** as follows:
Connect a 6v battery and switch as shown. Operate switch and check simension **D**.
Adjust to 0.38 – 0.63mm (0.015-0.025in)
By slackening locknut **17**, rotating eccentric pin **18** as necessary and retightening locknut.



STARTER MOTOR

Dismantling and Assembly

Follow the numerical sequence shown on the illustration it is a guide to dismantling.
For assembly reverse the sequence.

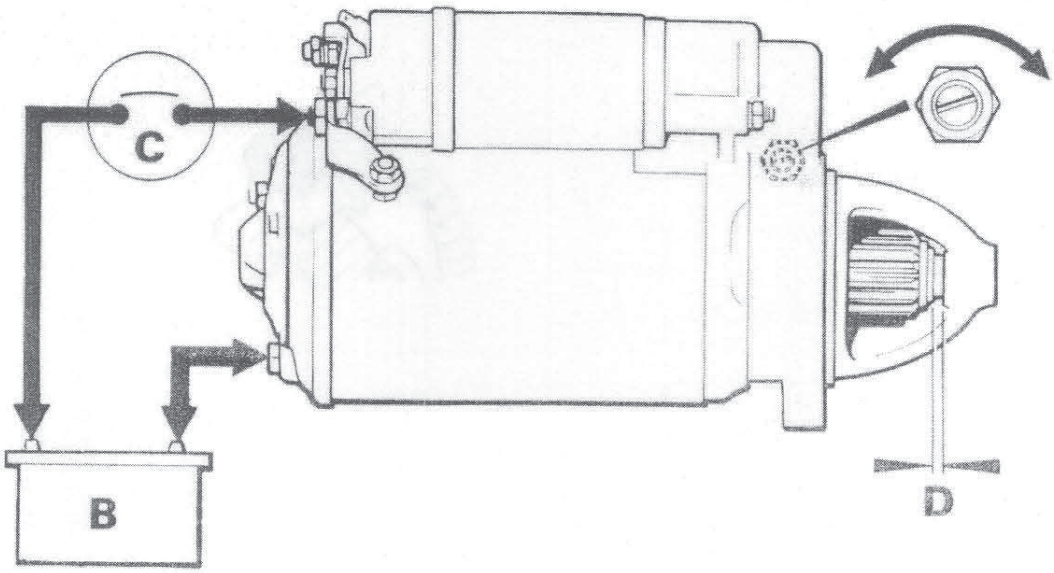
When Dismantling

Remove only items **1** to **34** inclusive, unless renewing the field coils.
NOTE:
For armature and brushgear reconditioning, refer to the following page.

When Assembling

Solder brushes **13A** to new field coils **38** after installation in yoke **15**

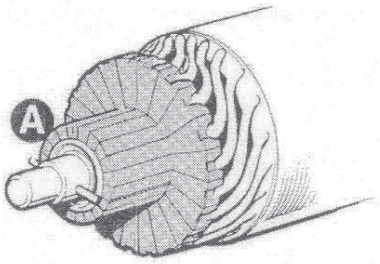
Set the movement of drive pinion **24** as follows:
Connect a 6v battery **B** and switch **C** as shown. Operate switch and check dimension **D**
Adjusr to 0.015–0.025in (0.38-0.63mm)
By slackening locknut **17** rotating eccentric pin **18** as necessary and retightening locknut.



STARTER MOTOR

Reconditioning – Armature

Burnt commutator segments A may indicate an open circuit winding.



Unless the commutator is heavily burred or pitted, clean with a petrol, moistened cloth or fine glass paper. Otherwise, skim the commutator on a lathe to a minimum diameter of 1.5in (38.1mm).

CAUTION:
Do not undercut insulators. Do not machine the core or attempt to straighten a distorted shaft.

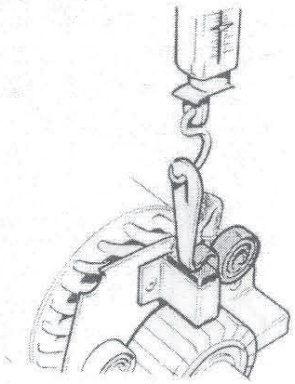
Reconditioning – Brushgear

1 Remove all traces of brush deposit.

2 If the brush length is less than 0.312in (8.0mm) renew by unsoldering connectors and soldering new connectors in place.

3 Ensure that brushes move freely in boxes by lightly polishing the sides if necessary.

4 Using a spring balance check the brush spring tension as shown and renew if less than 25oz (708g)



ALTERNATORS

General Description

The alternator is a three phase generator having a rotating field winding and static power windings. When the start switch is turned on, current from the battery flows by way of the 'No Charge' warning lights, to the field winding. This creates a magnetic field which supplements the residual magnetism in the rotor poles. As the engine is started, the fanbelt drives the rotor and alternating current is generated in the power windings as they are 'cut' by the rotating magnetic field. A built in diode bank rectifies the current for supply to the battery. A small proportion of the rectified current is fed back to the rotor to maintain the magnetic field.

Output is controlled by a solid state regulator which varies the field current in accordance with electrical demand. Servicing is restricted to periodic inspection of slip ring brushes. Bearings are 'sealed for life' ball races

Service Precautions

1. Use Negative Earth systems only.

2. Ensure that battery Negative terminal is connected to earthing cable.

3. Never make or break connections to the battery or alternator or any part of the charging circuit whilst the engine is running.

4. Main output cables are 'live' even when engine is not running. Take care not to earth connectors in moulded plug if removed from alternator.

5. During arc welding on a machine, protect the alternator by removing the moulded plug.

6. If slave starting is necessary, connect the second battery in parallel without disconnecting the vehicle battery from the charging circuit. The slave battery may then be safely removed after a start has been obtained. Take care to connect batteries positive to positive, negative to negative, See also Note: 3

CHARGING CIRCUIT CHECK

Ensure that all battery and alternator connections are in place, secure and making good metal to metal contact, especially 'earth' connections to chassis and engine.

Adjust alternator drive belt tension if necessary and make sure that the battery is well charged,

Turn start switch to the on position.

'Oil pressure' and 'No charge' warning lights should glow.

If any light fails, proceed to **Check 1.**

Start engine, all warning lights should extinguish rapidly.

If NO charge warning remains ON proceed to **Check 2.**

If oil pressure warning remains ON **STOP ENGINE IMMEDIATELY** And investigate engine lubrication system.

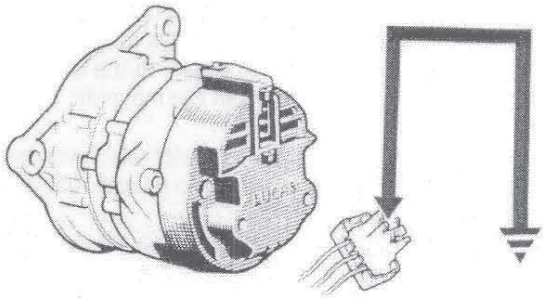
Check 1

With start switch ON try heater motor and screen wiper.

If items operate normally, check warning light bulb (s) for blown filament.

Simultaneous failure of all items indicates a fault at the start switch. Check for cable disconnection before condemning the switch itself.

If the NO charge warning bulb is in good order, withdraw the triple plug from the back of the alternator. Make a temporary connection between the SMALL terminal in the plug and earth as shown. If the no charge warning bulb still fails to light check the Brown/Black cable for continuity. If the bulb now lights check the alternator for defective regulator.
(See Alternator Testing)



CHARGING CIRCUIT CHECK

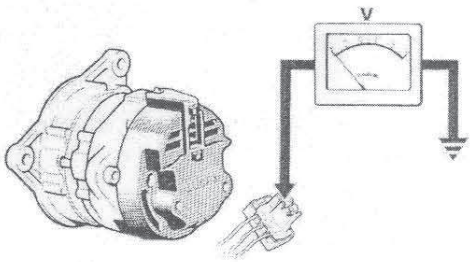
Check 2

Stop engine and turn start switch OFF

Withdraw the alternator plug and, using the voltmeter section of a suitable test meter (Service Tools) check for battery voltage between the large terminals and 'earth'. If the reading is zero check the brown cable for continuity, particularly at the starter terminals.

If the voltage is correct check the alternator output as follows.

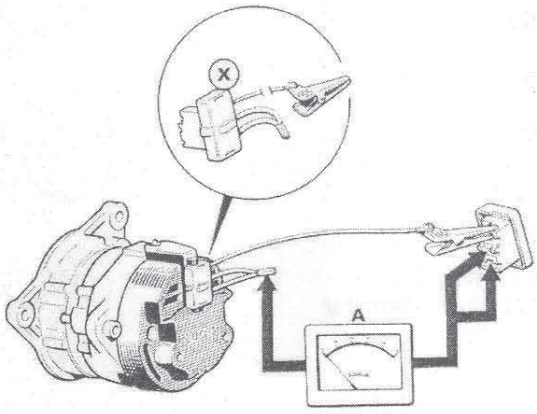
Using a dummy connector X connect the ammeter section of the test meter between the alternator and the alternator plug as shown (positive meter lead to alternator) Note: that connections are similar for both Lucas and AC Delco alternators.



Connect the voltmeter section of the test meter across the battery (observe polarity).

Start the engine and run at 2000 rev/min.

As the engine starts, the voltmeter reading should rise rapidly to charging voltage (14 to 15 volts).



Switch on all lights and auxiliaries and check the ammeter reading. This should be approximately 40 amperes. If the ammeter reading is low check that all charging cables and connectors are cool. A hot connection is 'resistive' and should be cut back and remade.

If the meter reading is low but everything else is satisfactory stop the engine and carry out further tests as indicated under Alternator Testing.

ALTERNATOR 18ACR

Testing

Before testing alternator, carry out charging circuit checks 1 and 2.

Failure of the alternator to charge the battery may be caused by one of the following conditions. These in the approximate order of probability.

1 Defective regulator

2 Dirty slip rings or worn slip ring brushes

3. Defective Rectifier

4 Defective surge protection diode

5 Open or short circuited field (rotor) winding

6 Open or short circuited power (stator) winding

Regulator Check

Remove alternator end cover and temporarily connect the regulator field to earth as at X or Y according to the type of Regulator fitted.

14TR Regulator (X)
Regulator case to alternator

8TR Regulator (Y)
Green wire to alternator frame.

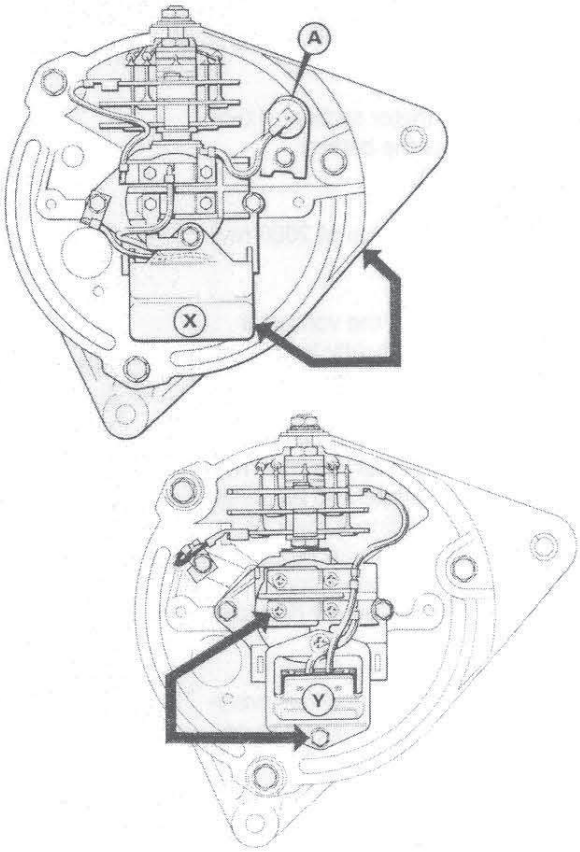
Connect test meter (Service Tool) in circuit, using a dummy alernator connector as shown in charging circuit Check 2.

Run engine at 2000 rev/min switch on all lights and auxiliaries and check the ammeter reading.

If the ammeter now indicates a high rate of charge, (approximately) 40 amps the alternator is in good order but the regulator is defective.

If the ammeter continues to show a low reading, disconnect the surge protection diode A and repeat the test.

If the ammeter reading is now satisfactory, the diode is defective. Otherwise, remove the alternator for further testing.



ALTERNATOR DN460

Testing

Defects in the charging system will manifest as one or more of the following three conditions.

1 Faulty indicator lamp

2 Under charged battery

3. Over charged battery

Faulty Indicator Lamp Operation

Test Lamp for Normal Operation

Start

OFF	OFF	Stopped
ON	ON	Stopped
ON	OFF	Stopped

If lamp does not operate normal check as follows:

Switch Off and Lamp On
This condition will cause an under charged battery. If switch functions correctly renew the rectifier bridge.

Switch On, Lamp Off and Engine Stopped.
This condition will cause an under-charged battery.

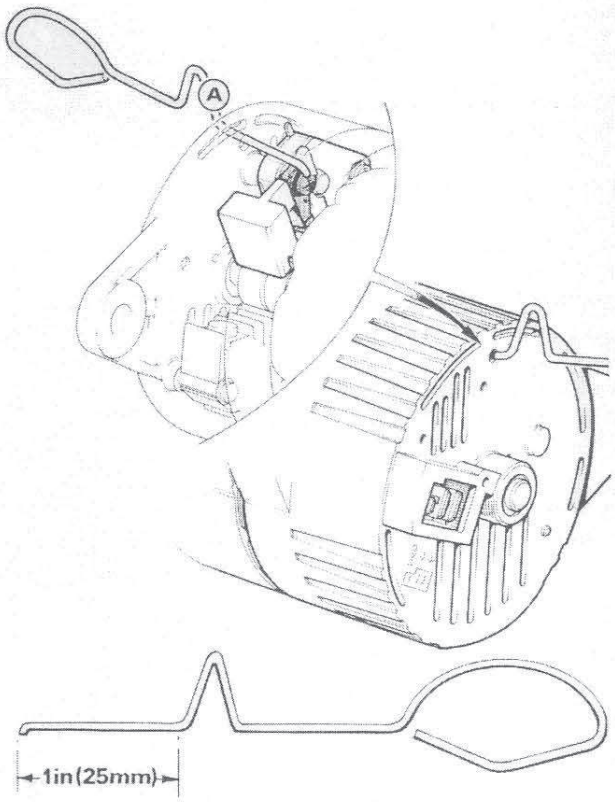
With the switch On disconnect lead from IND terminal and earth it. If lamp fails to light, check lamp, switch and leads.

Make Earthing tool A to the dimensions shown. If the lamp lights, replace IND terminal lead and insert the tool into the test hole to earth the field windings as shown.

If the lamp does not light, check the brushes, slip-rings and rotor windings for open circuit.

If lamp lights, renew the regulator and check the rotor windings.

Switch On, Lamp On and Engine Running at Charging Speed.
Check for undercharged battery condition. (See Page C 3-6)
Defective Alternator.



UNDERCHARGED BATTERY (Indicator Lamp operating normally)

Check that the condition has not been caused by:-

1 Accessories left on for an extended period

2 Slipping drive belt

3. Faulty wiring or connections

Withdraw the alternator plug and check for system voltage at the large terminals as shown at B If there is no reading an open circuit exists between the connector and battery.

If the voltage is correct check the alternator output as follows:-

Using a dummy connector as shown at C connect the ammeter between the alternator and the alternator plug (positive meter lead to alternator)

Connect the voltmeter across the battery observing polarity

Start the engine and run at maximum revs.

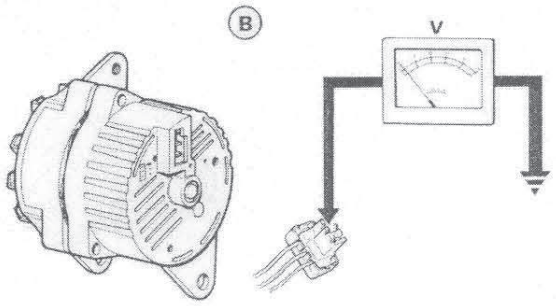
As the engine starts the voltmeter reading should rise rapidly to a charging voltage of 14 to 14.5 volts.

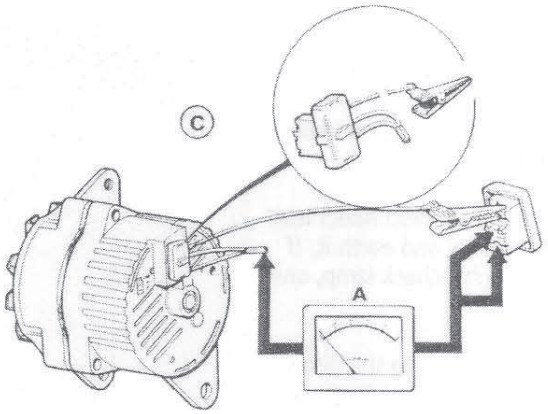
Switch on lights and auxiliaries and check the ammeter reading is approx 40 amps.

If the reading is low check for alternator faults.

OVERCHARGED BATTERY (Battery in good condition but using excessive water)

Check for short circuit in the field winding, defective or missing insulation sleeve from the brush lead clip, or defective regulator.





3-7

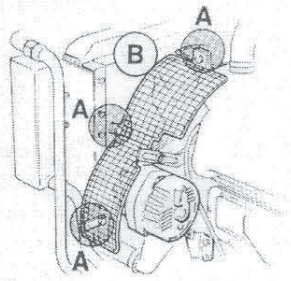
ALTERNATOR

Removal and Replacement (Typical)

For easier access to alternator unscrew bolts **A** to remove fan guard **B**

The numerical sequence on the illustration is intended as guide to removal.

For replacement, reverse the sequence.



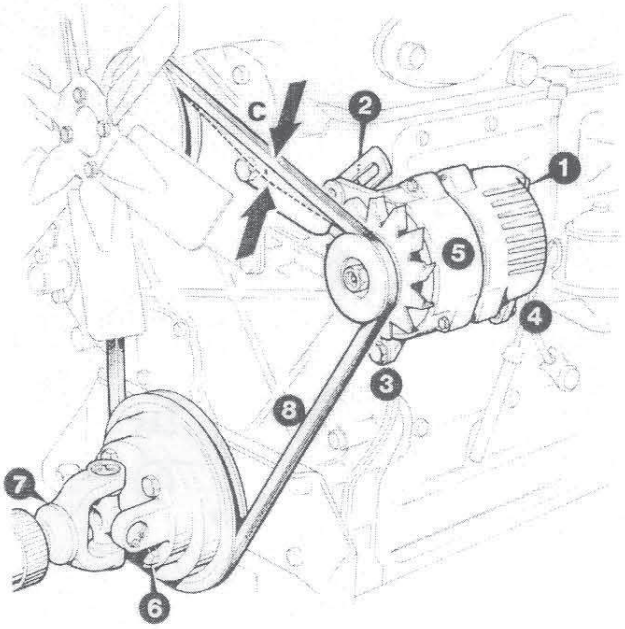
When Removing

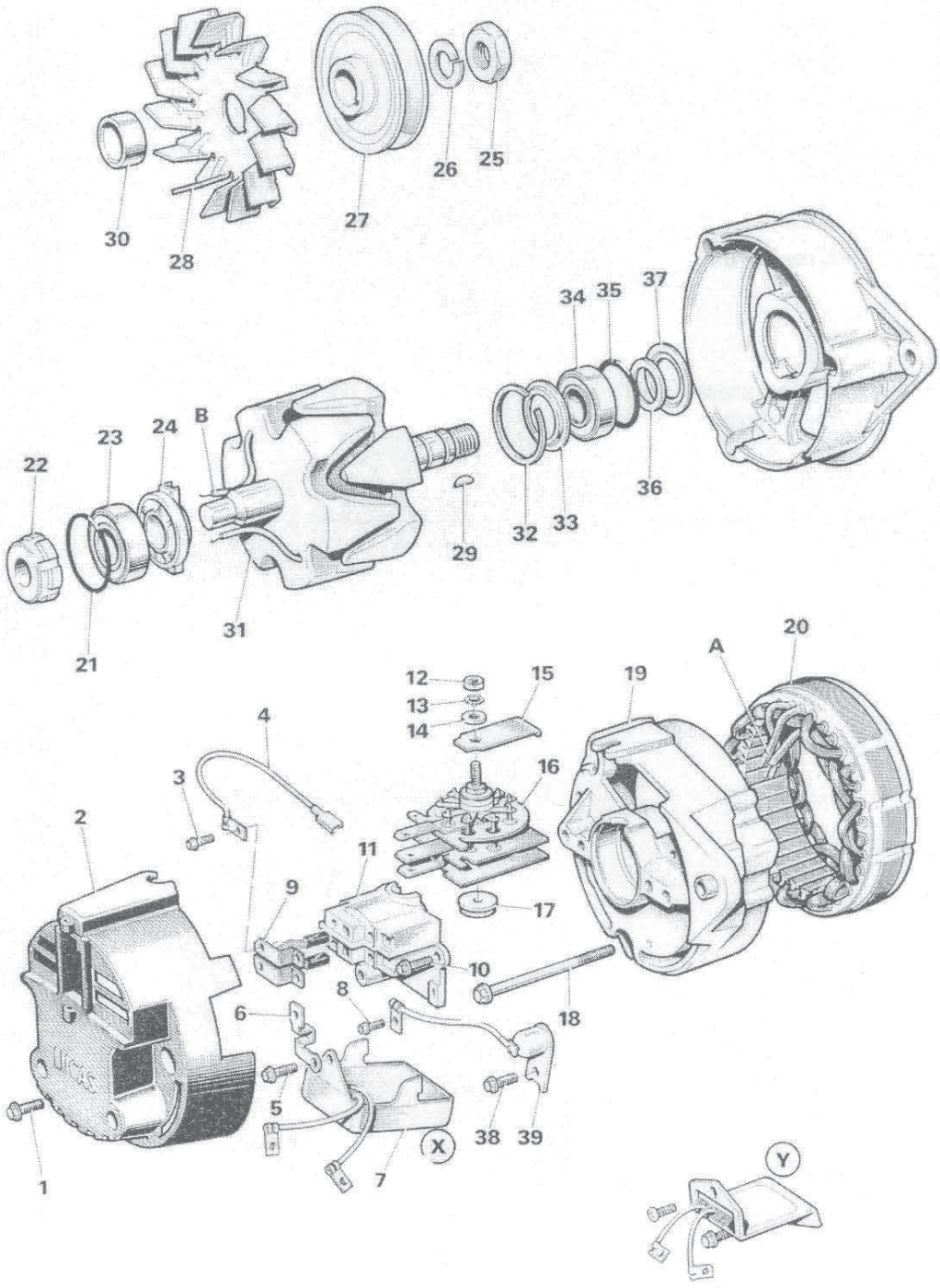
If drive belt **8** requires renewal, disconnect shaft **7** by removing bolts **6**

When Replacing

Adjust position of alternator to give 13mm (0.5in) deflection of the drive belt as at **C**

CAUTION:
Any leverage required to position the alternator must be applied at the drive-end bracket only, using a lever of soft material, e,g, wood.





3-9

ALTERNATOR 18ACR

Dismantling and Assembly

Use the numerical sequence as a guide to dismantling

For assembly, reverse the sequence.

When Dismantling

Leads A and B must be unsoldered when separating items 16 and 20 and items 22 and 31

Use Service Tool 892/00044 to drive out rotor 31 and it's bearings from the end brackets.

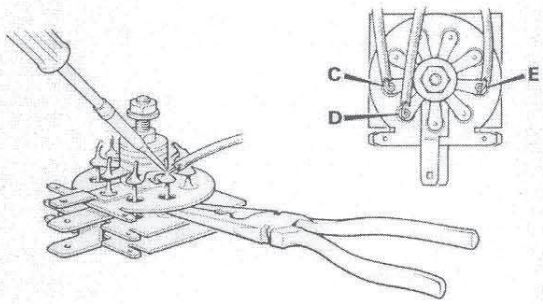
CAUTION:
When unsoldering or soldering cables to rectifier 16 it is essential to avoid overheating the diodes or bending the diode pins. Carry out soldering as quickly as possible whilst gripping the pins with long nosed pliers to conduct away excess heat. Ensure that leads are soldered to the correct positions: C,D and E.

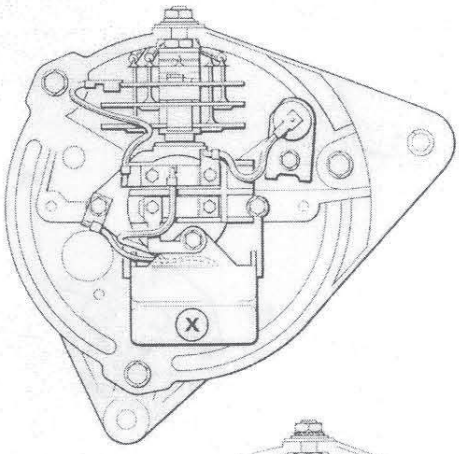
Clean faces of slip ring 22 with petrol moistened cloth, or very fine glass paper if burning is evident. Do not use emery cloth.

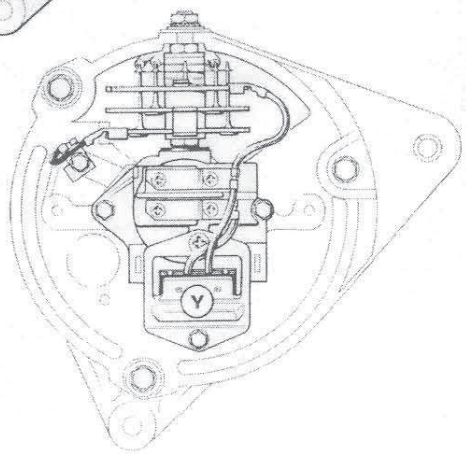
Renew brushes 9 if their length is less than 8mm (0.3in) or if the spring pressure is less than 198 to 283g (7 to 10oz) with brush pressed flush with the housing.

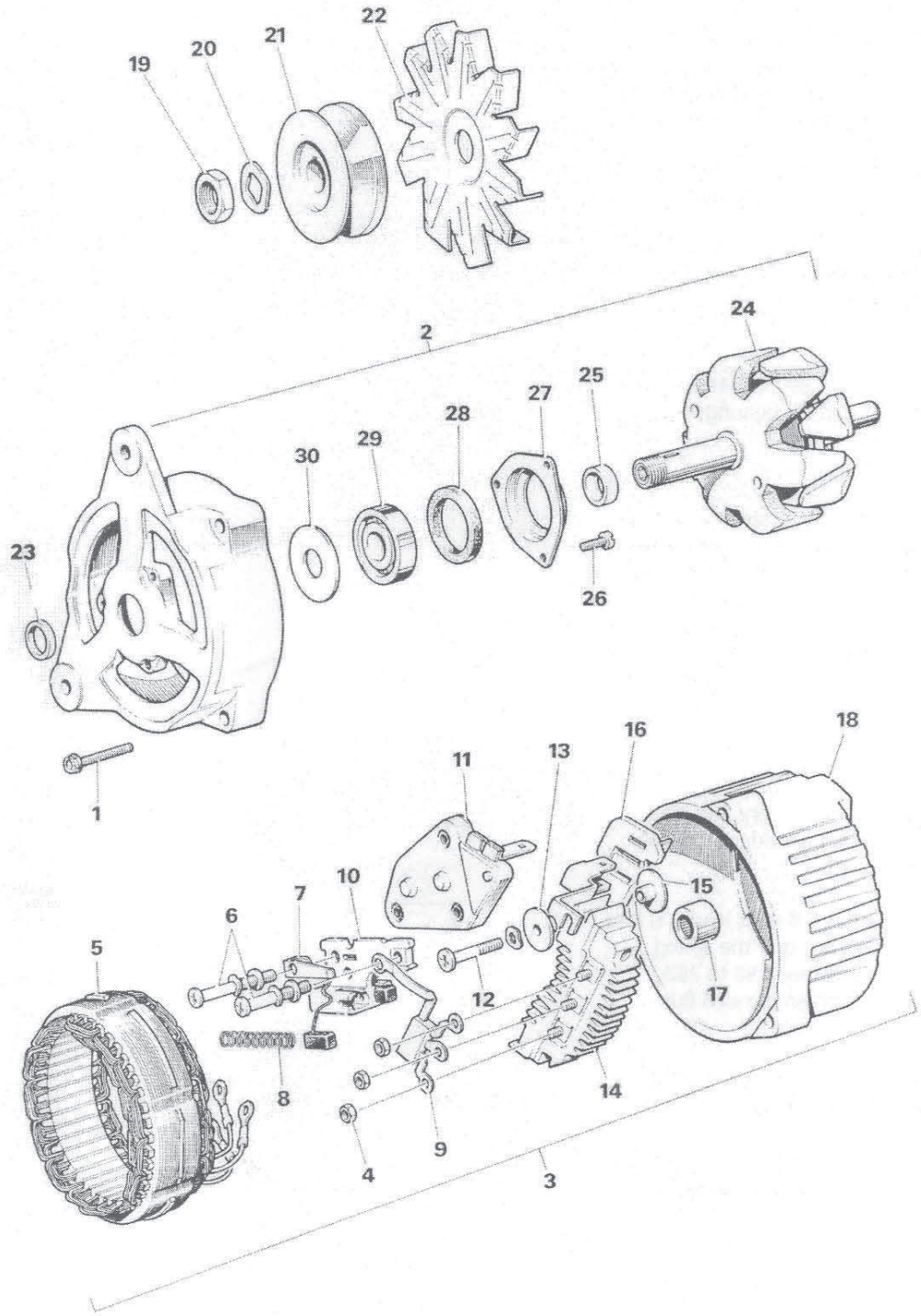
To ensure free movement of brushes, lightly polish side faces.

Regulators X (14TR) and Y (8TR) are alternatives. If interchanged follow instructions supplied with new unit.









ALTERNATOR DN460

Dismantling and Assembly

Use the numerical sequence as a guide to dismantling

For assembly, reverse the sequence.

When Dismantling

Mark all parts as they are removed to ensure correct re-assembly.

Separate the drive end bracket and rotor assembly **2** from the stator and housing **3**

Remove nuts **4** to release the leads before separating the stator winding from the slip ring end bracket **18**.

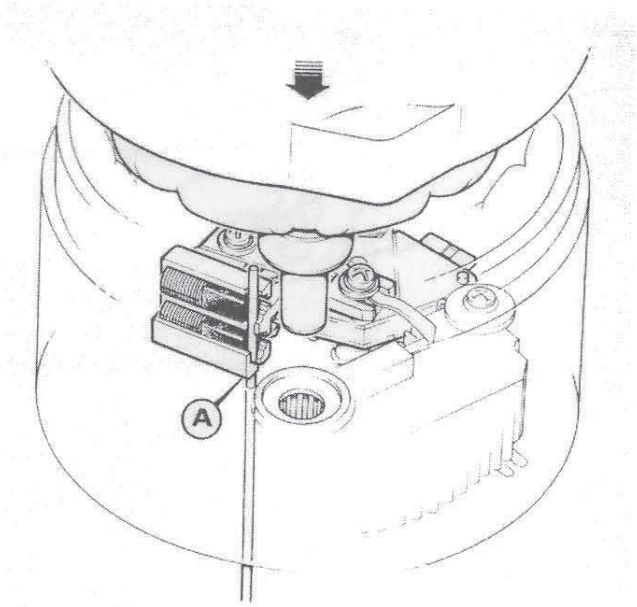
Tape over bearing **17** and the slip ring end of the shaft to ensure cleanliness. Use pressure sensitive tape, as sticky tape would leave a deposit on the shaft.

When removing the pully, secure rotor **24** in a vice to slacken nut **19**. Do not overtighten vice as the rotor is easily distorted.

When Assembling

Ensure that shaft and bearing **17** are perfectly clean after removal of protective tape.

To retain the brushes in place when entering the rotor into position, insert a screwdriver or rod as shown at **A**



Torque Settings

Item	Nm	kgf m	lbf ft
19	68	7.0	50

4-1

DYNAMO

Testing

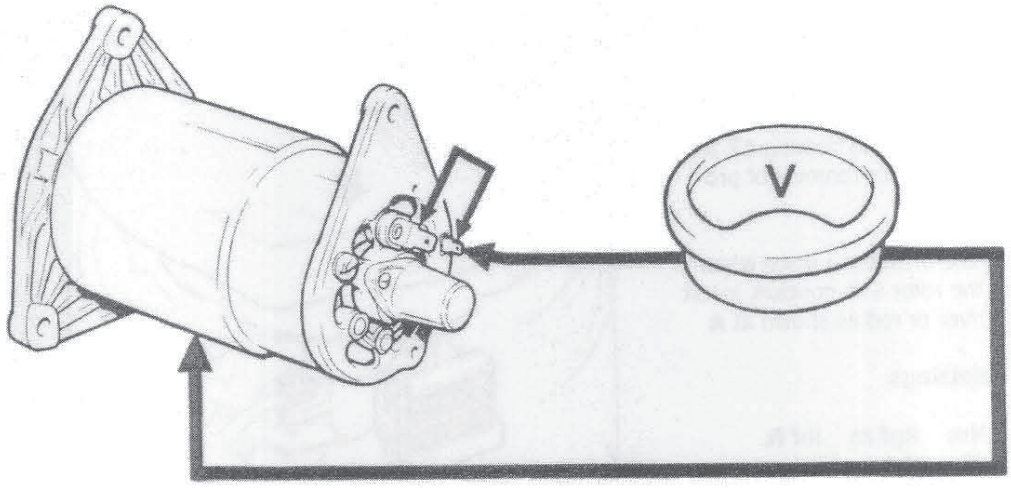
Disconnect cables from dynamo terminals and bridge the terminals with auxiliary cable.

Run engine at idling speed and connect voltmeter V between terminals and earth as shown

Gradually increase engine speed and observe voltmeter reading which should rise in proportion to engine speed and without fluctuation.

CAUTION:
Do not allow reading to exceed 15 volts, or serious damage to the dynamo may be caused.

If reading does not reach 12 volts, the dynamo is defective.



DYNAMO

Removal and Replacement

The numerical sequence on the illustration is intended as guide to removal.

For replacement, reverse the sequence.

When Removing

Disconnect shaft **7** by removing bolts **6** only if drive belt **8** requires renewal

When Replacing

Adjust position of dynamo to give 0.5in (13mm) deflection of the drive belt as at **A**

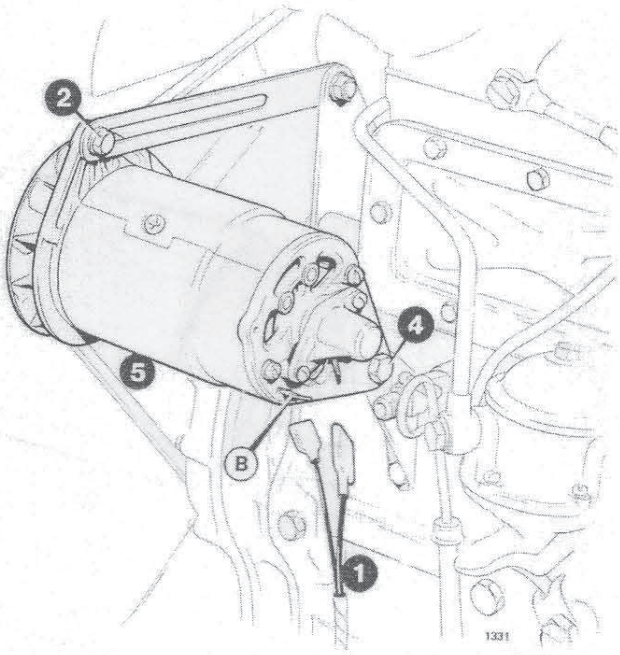
If a replacement dynamo is being fitted, polarise as follows to suit the machine's electrical system:

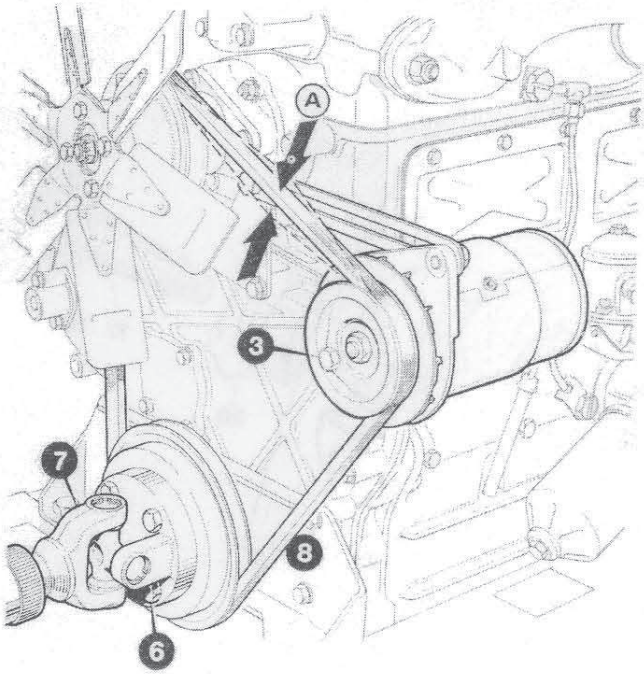
1 Fit the dynamo to the machine, but do not connect cables **1**

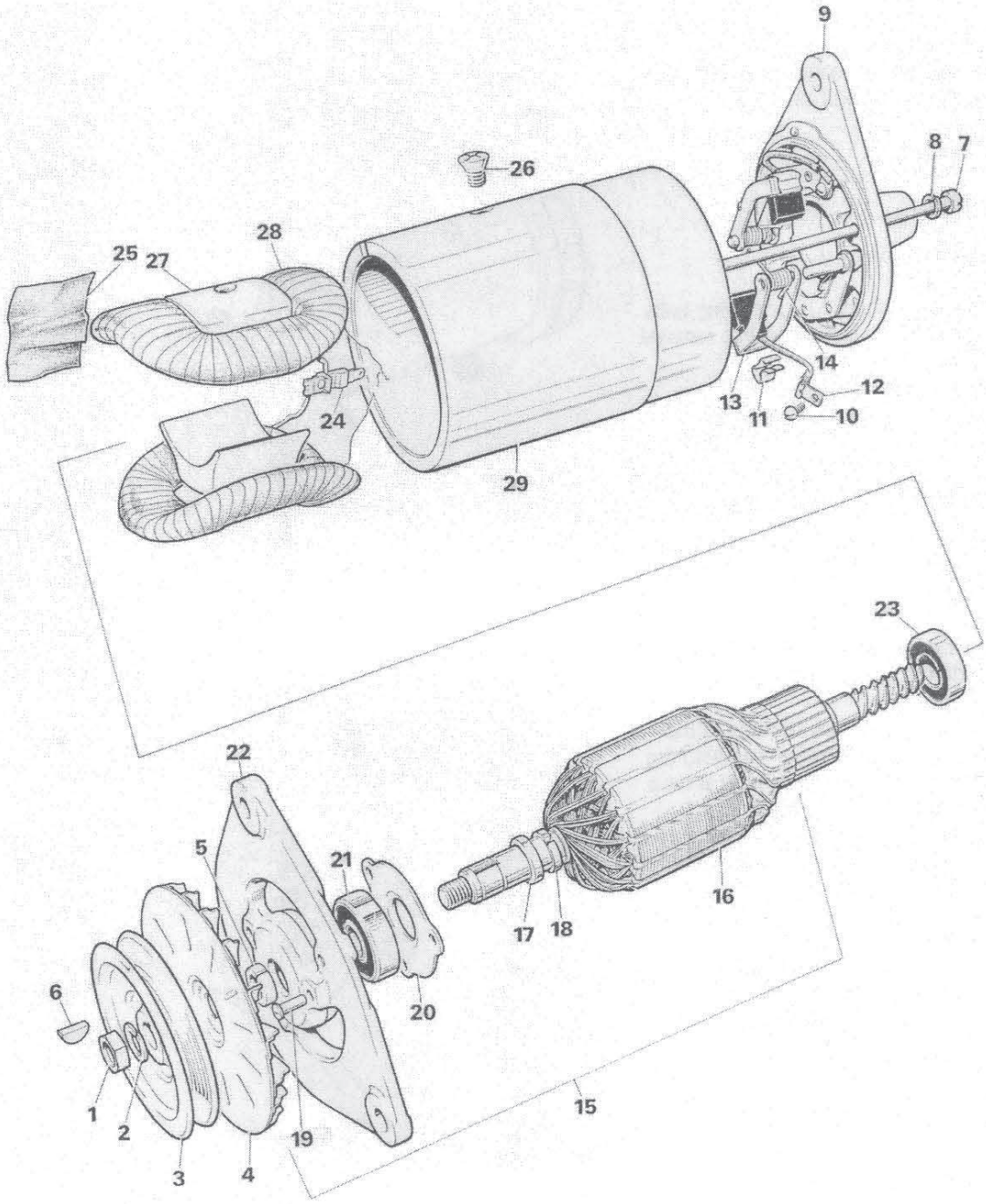
2 Connect a length of cable to the positive battery terminal and hold the other end to dynamo terminal **B** for a few seconds.

3 Remove cable from battery and connect cables **1**

NOTE:
From machine no 55500, a negative earth system is used.







DYNAMO

Dismantling and Assembly

Use the numerical sequence as a guide to dismantling

For assembly, reverse the sequence.

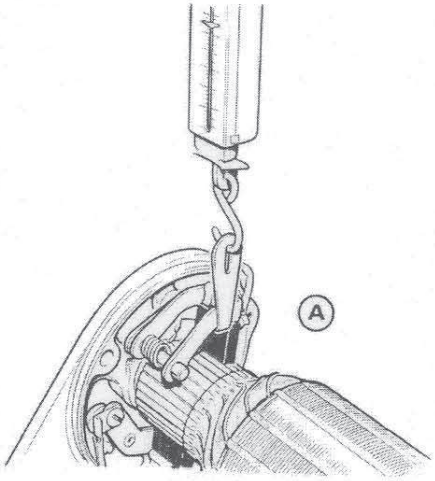
When Dismantling

Remove only items 1 to 23 inclusive, unless renewing field coils.

Inspection and Repair

Renew brushes 12 if chipped or cracked, or if worn to a length of less than 0.5in (12.7mm)

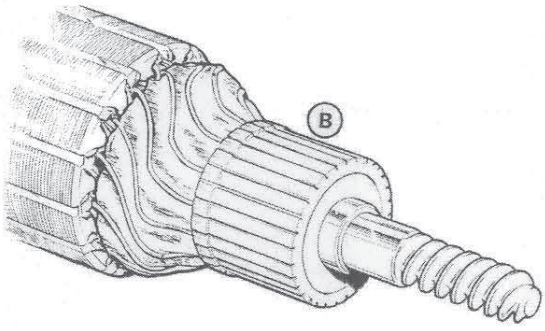
Renew springs 14 if tension, measured as at A is less than 18oz (510g)



Check commutator segments B for burning, which may indicate an open circuited winding.

Unless the commutator is heavily burred or pitted, clean with a petrol moistened cloth or fine glass paper. Otherwise skim the commutator on a lathe to a minimum diameter of 1.45in (35.8mm) Polish with fine glass paper. Do not use emery cloth.

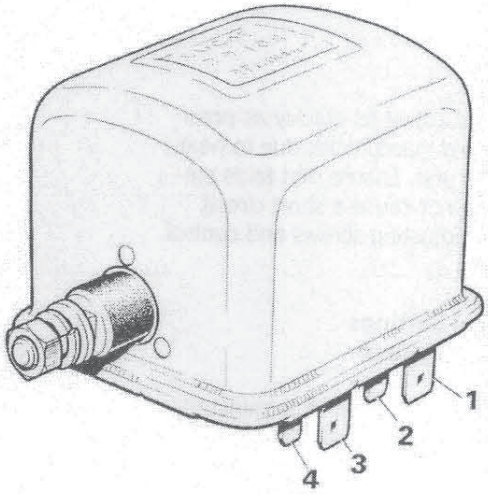
Clean out slots between segments but do not undercut.

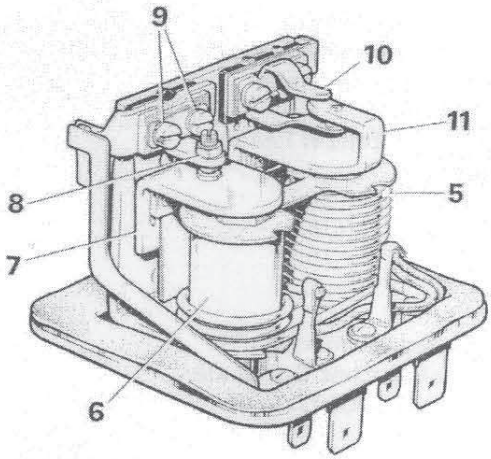


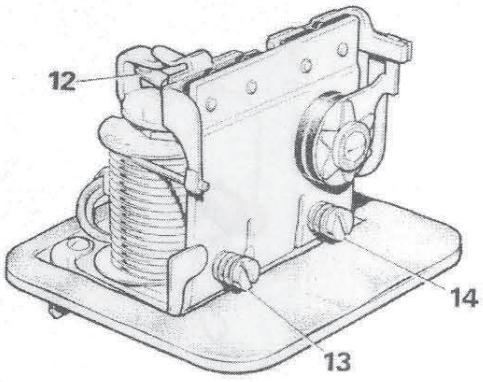
CONTROL BOX

Component Key

1	D Terminal
2	E Terminal
3	A Terminal
4	F Terminal
5	Cut-out core and winding
6	Voltage Regulator core and
7	Voltage Regulator armature
8	Voltage Regulator adjustable
9	Adjustable contact arm secur-
10	Cut-out stop arm
11	Cut-out armature
12	Cut-out fixed contact
13	Cut-out adjusting screw
14	Voltage Regulator adjusting







CONTROL BOX

Testing and Adjustment

CAUTION:

Check and adjust as quickly as possible to avoid inaccuracies due to heating of the unit. Ensure that tools employed do not cause a short circuit between adjusting screws and control box cover.

Electrical Settings
Voltage Regulator

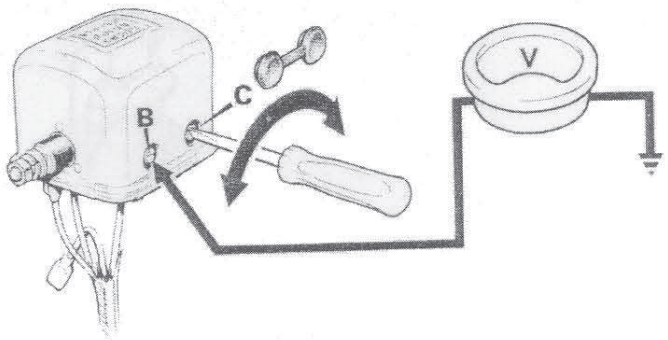
Disconnect cable from **A** terminal remove linked plugs and connect voltmeter **V** between the cut-out adjusting screw **B** and a good earth.

With engine running at approx 1800 re/min the voltmeter reading should be between the following limits.

Ambient Temperature	Voltmeter Reading
10°C – 50°F	16.1 – 16.7
20°C – 68°F	16.0 – 16.6
30°C – 86°F	15.9 – 16.5
40°C – 104°F	15.8 – 16.4

Adjust as necessary by turning the regulator adjusting screw **C** clockwise to increase or anti-clockwise to decrease the voltage.

Stop engine and reconnect cable to **A** terminal



CONTROL BOX

Electrical Settings – Cut-out

Cut-in Voltage

Connect voltmeter between the D terminal and a good earth.

Switch on working lights, start engine and increase speed slowly. On reaching 12.7 to 13.3 volts, the voltmeter needle should drop slightly, indicating closure of contacts (cut-in voltage).

If reading is incorrect, reduce engine speed and adjust by turning the cut-out adjusting screw **B** clockwise to decrease the cut-in voltage.

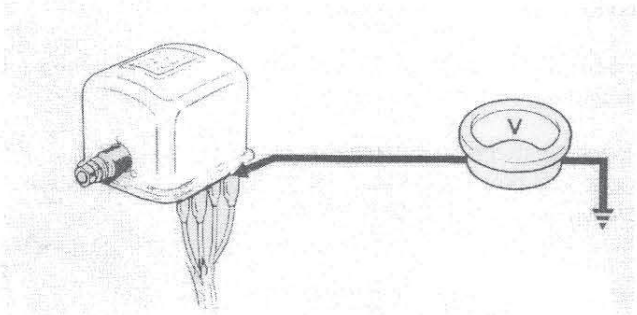
Slowly open the throttle to recheck setting as above.

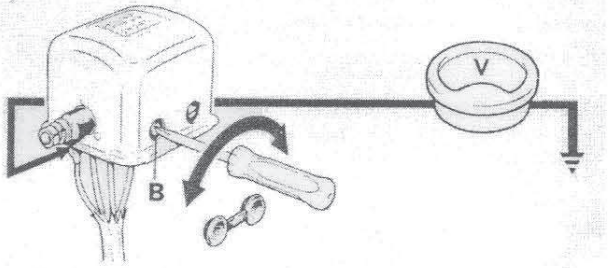
Drop-off Voltage

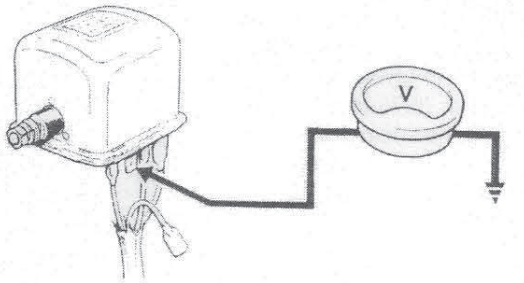
Disconnect cable from the **A** terminal and connect volymeter between this terminal and a good earth.

Run engine at approx 1000 rev/min then slowly decelerate. Voltmeter needle should fall to zero on reaching 11.0 to 8.5 volts, indicating opening of contacts (drop-off voltage)

NOTE:
Drop-off voltage cannot be adjusted externally. If the voltage reading is incorrect, either adjust as described under Mechanical Settings (Page C 5-4) or fit a replacement control box.



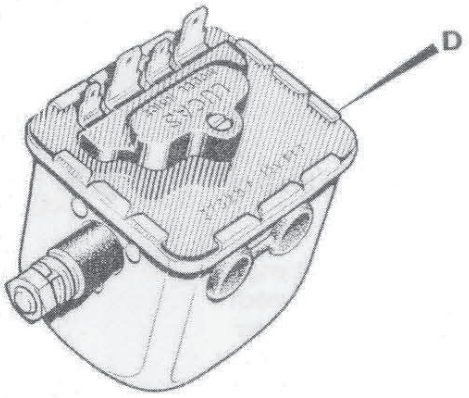




CONTROL BOX

Mechanical Settings
Voltage Regulator

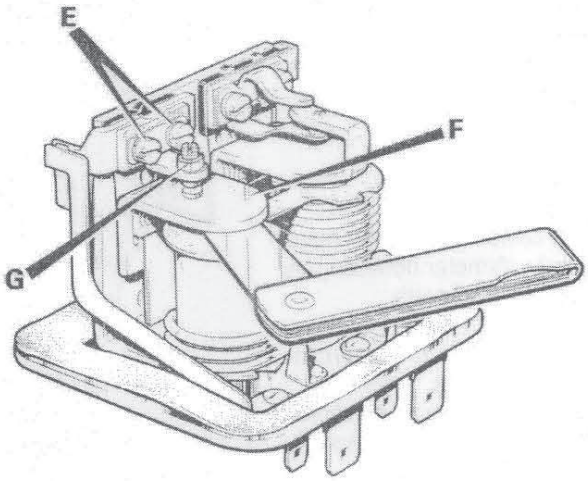
Disconnect battery earth cable, remove control box from machine and carefully prise up tags D to remove cover.



Slacken securing screws E and insert 0.021in (0.53mm) feeler gauge between armature F and core face as shown.

With armature pressed squarely against the gauge, retighten screws.

With gauge still in position slacken locknut G adjust fixed contact and retighten locknut.

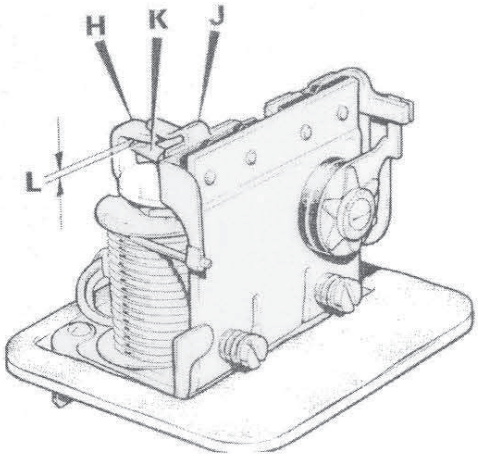


Reassemble control box onto machine and check electrical setting (see page C 5-2)

Mechanical Settings – Cut-out

Disconnect battery earth cable remove control box from machine and carefully prise up tags D to remove cover.

Press armature H onto core face; gap between armature tongue and stop arm J should be 0.025 to 0.040in (0.63 to 1.02mm). Adjust gap by carefully bending stop arm. Release armature and carefully bend fixed contact blade K to give a gap of 0.010 to 0.020in (0.25 to 0.51mm) At L. Check that blade deflects slightly as armature is pressed against core face.



NOTE:
Increase or decrease gap L to raise or lower drop-off voltage respectively.

Reassemble control box onto machine and check electrical setting (see page C 5-3)

FAULT FINDING - STARTING SYS-

FAULT	DIAGNOSIS
1. Starter inoperative	A Battery discharged B Poor cable connection C Defective cables D Brushes worn or sticking E Commutator worn or dirty F Pinion jammed G Faulty switch, solenoid or relay H Faulty windings
2. Starter operates but does not crank	A Check 1a, b, c, d, e. B Faulty drive assembly Engine fault
3 Starter cranks engine slowly	A Check 1a, b, c, d, e. B Faulty switch

FAULT FINDING CHARGING SYSTEM

Fault	Diagnosis
Battery low in charge (low hydrometer reading)	A Check 1a, b, c. B Dynamo or alternator drive belts broken or slipping C Faulty battery D Dynamo or alternator output insufficent E Control box or voltage control incorrectly set or faulty

FAULT FINDING - CHARGING SYSTEM Continued

FAULT	DIAGNOSIS
5. No output or low intermittent output from dynamo or alternator.	A Check 1b, c, and 4b B Brushes worn or sticking C Alternator slip rings worn or dirty D Faulty windings
6. Excessive high output from dynamo or alternator	A Check 4e.

FAULT FINDING LIGHTING SYSTEM

Fault	Diagnosis
7. All lights inoperative	A Check 1a, b, c. B Fuse blown C Faulty ammeter (if fitted)
8. Individual lights inoperative	A Check 1 b, c. B Bulb burned out

COMPONENT KEY

1 Alternator
6 Battery
7 Flasher Unit
8 Heater
9 Horn
10 Horn Button
11 Panel Light
12 Starter Motor
13 Voltage Stabiliser
14 Terminal Connector
15 Temperature Gauge Engine
*16 Temperature Gauge Transmisson
17 Temperature Transmitter Engine
*18 Temperature Transmitter Transmission
19 Wiper Motor
20 Regulator
23 Fuse Box
24 Dynamo
25 Battery Indicator
26 Power Point (3D only)
27 Lamp Socket
28 Fuel Tank Unit
29 Fuel Gauge
30 Cigarette Lighter (3D only)

LAMPS

38 Beacon
39 Dipper
40 Interior (3C & 3D Only)

LAMPS – LEFT HAND

42 Working – Front
43 Working – Rear
45 Head
47 Flasher – Front
48 Flasher – Rear
51 Stop/Tail
52 Side

*** Torque Converter Machines Only**

LAMPS – RIGHT HAND

62 Working – Front
63 Working – Rear
65 Head
67 Flasher – Front
68 Flasher – Rear
70 Number Plate
71 Stop/Tail
72 Side

WARNING LIGHTS

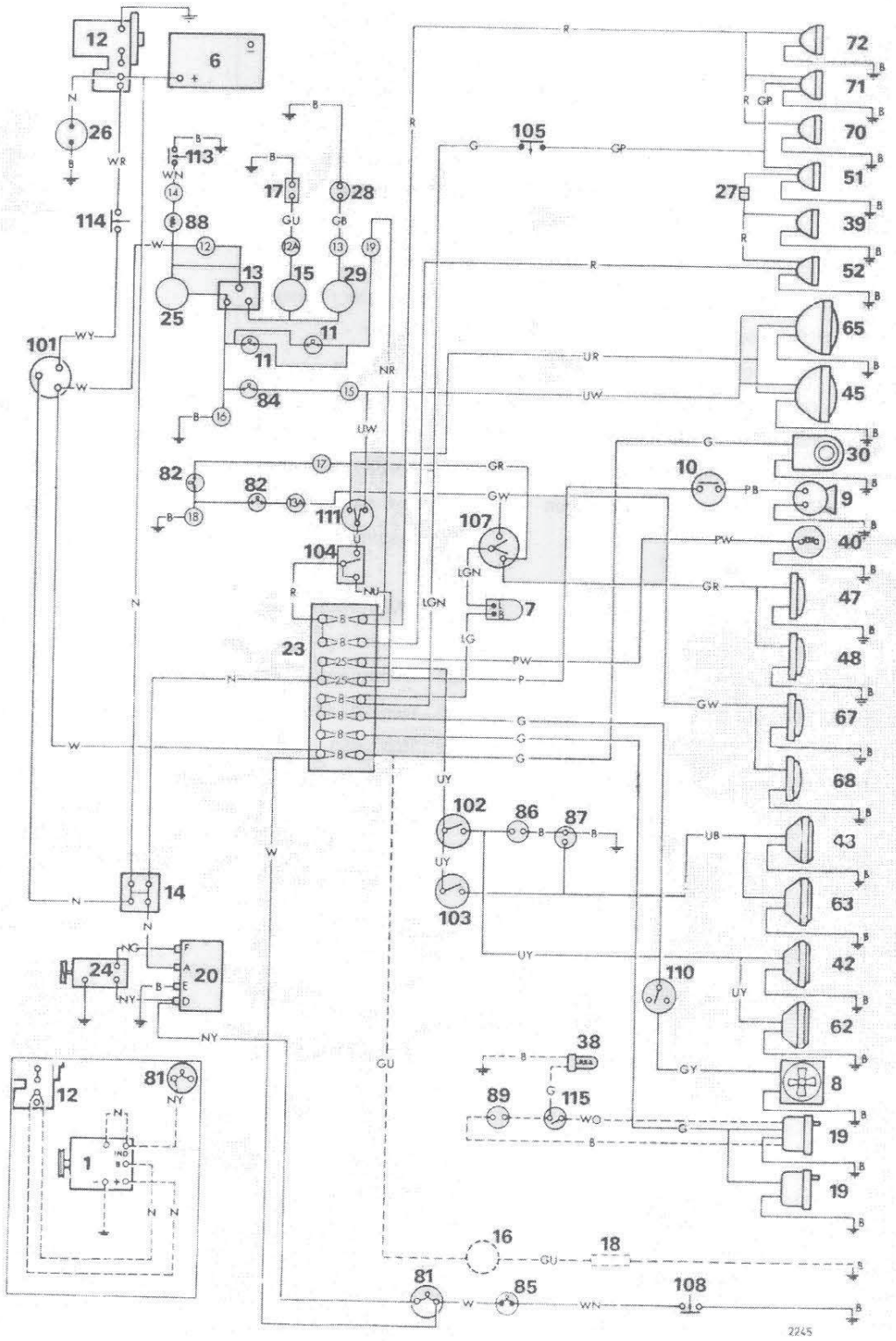
81 Alternator / Dynamo
82 Flasher
84 Main Beam
85 Oil Pressure
86 Working Light – Front
87 Working Light – Rear
88 Air Cleaner
89 Beacon Light

SWITCHES

101 Starter
102 Working Lamp – Front
103 Working Lamp – Rear
104 Headlamp
105 Stop Lamp
107 Flasher
108 Oil Pressure
110 Heater
111 Dip
113 Air Cleaner
114 Neutral Start
115 Beacon Light

WIRE COLOUR CODE

B Black
G Green
LG Light Green
N Brown
O Orange
P Purple
R Red
U Blue
W White
Y Yellow



COMPONENT KEY

1 Alternator
6 Battery
7 Flasher Unit
8 Heater
9 Horn
10 Horn Button
11 Panel Light
12 Starter Motor
13 Voltage Stabiliser
14 Terminal Connector
15 Temperature Gauge Engine
*16 Temperature Gauge Transmisson
17 Temperature Transmitter Engine
*18 Temperature Transmitter Transmission
19 Wiper Motor
20 Regulator
23 Fuse Box
24 Dynamo
25 Battery Indicator
26 Power Point (3D only)
27 Lamp Socket
28 Fuel Tank Unit
29 Fuel Gauge
30 Cigarette Lighter (3D only)
33 Diode
34 Lighting Relay
35 Horn Relay

LAMPS

38 Beacon
39 Dipper
40 Interior (3C & 3D Only)

LAMPS – LEFT HAND

42 Working – Front
43 Working – Rear
47 Flasher – Front
53 Stop/Tail/Flasher
52 Head/Side

*** Torque Converter Machines Only**

LAMPS – RIGHT HAND

62 Working – Front
63 Working – Rear
67 Flasher – Front
73 Stop/Tail/Flasher
72 Head/Side

WARNING LIGHTS

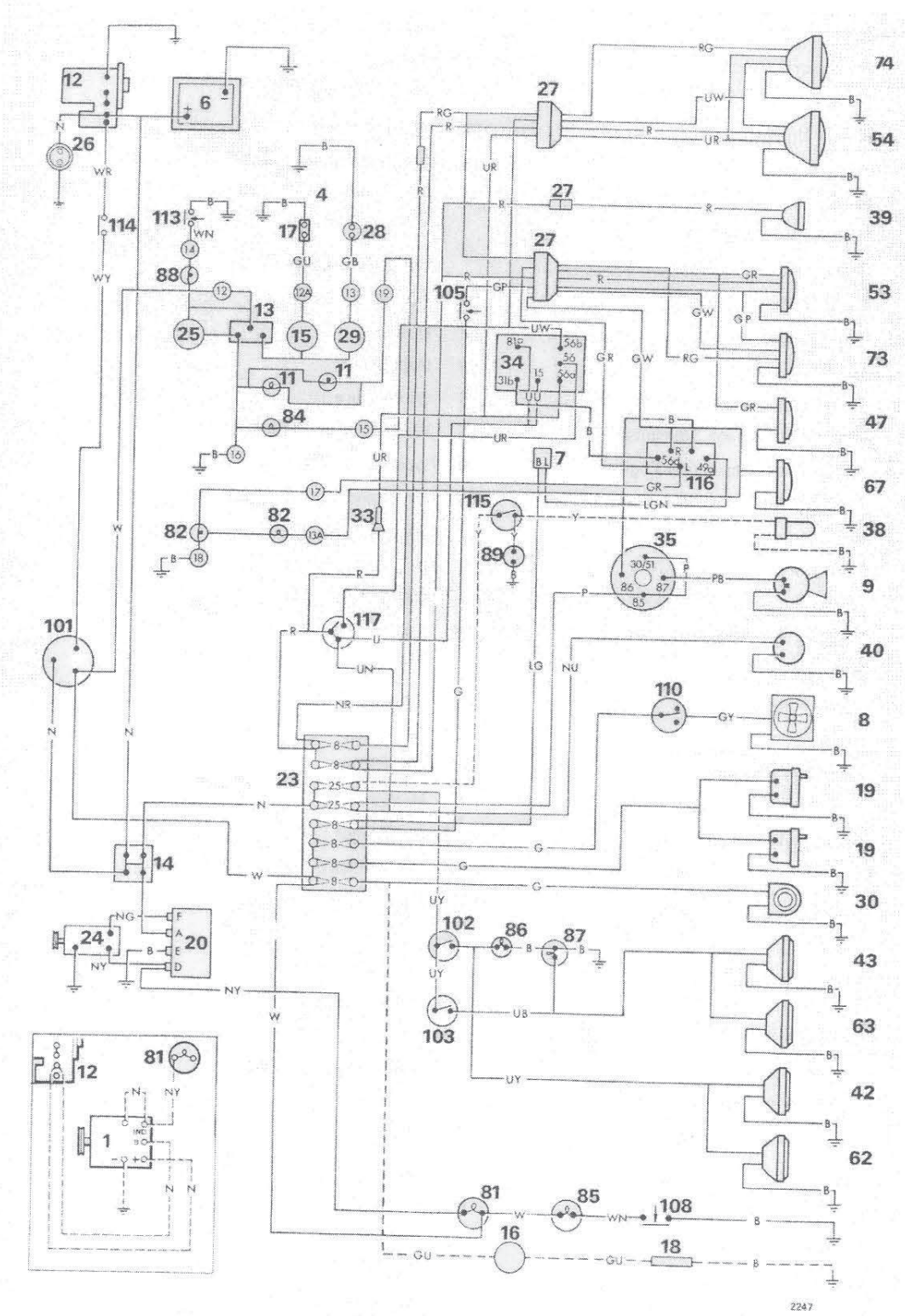
81 Alternator / Dynamo
82 Flasher
84 Main Beam
85 Oil Pressure
86 Working Light – Front
87 Working Light – Rear
88 Air Cleaner
89 Beacon Light

SWITCHES

101 Starter
102 Working Lamp – Front
103 Working Lamp – Rear
105 Stop Lamp
108 Oil Pressure
110 Heater
113 Air Cleaner
114 Neutral Start
115 Beacon Light
116 Multi-Purpose
117 Head/Sidelight

WIRE COLOUR CODE

B Black
G Green
LG Light Green
N Brown
O Orange
P Purple
R Red
U Blue
W White
Y Yellow



COMPONENT KEY

1	Alternator
6	Battery
7	Flasher Unit
8	Heater
9	Horn
10	Horn Button
11	Panel Light
12	Starter Motor
13	Voltage Stabiliser
14	Terminal Connector
15	Temperature Gauge Engine
*16	Temperature Gauge Transmisson
17	Temperature Transmitter Engine
*18	Temperature Transmitter Transmission
19	Wiper Motor
20	Regulator
23	Fuse Box
24	Dynamo
25	Battery Indicator
26	Power Point (3D only)
27	Lamp Socket
28	Fuel Tank Unit
29	Fuel Gauge
30	Cigarette Lighter (3D only)

LAMPS

38	Beacon
39	Dipper
40	Interior (3C & 3D Only)

LAMPS – LEFT HAND

42	Working – Front
43	Working – Rear
47	Flasher – Front
53	Stop/Tail/Flasher
52	Head/Side

*** Torque Converter Machines Only**

LAMPS – RIGHT HAND

62	Working – Front
63	Working – Rear
67	Flasher – Front
73	Stop/Tail/Flasher
72	Head/Side

WARNING LIGHTS

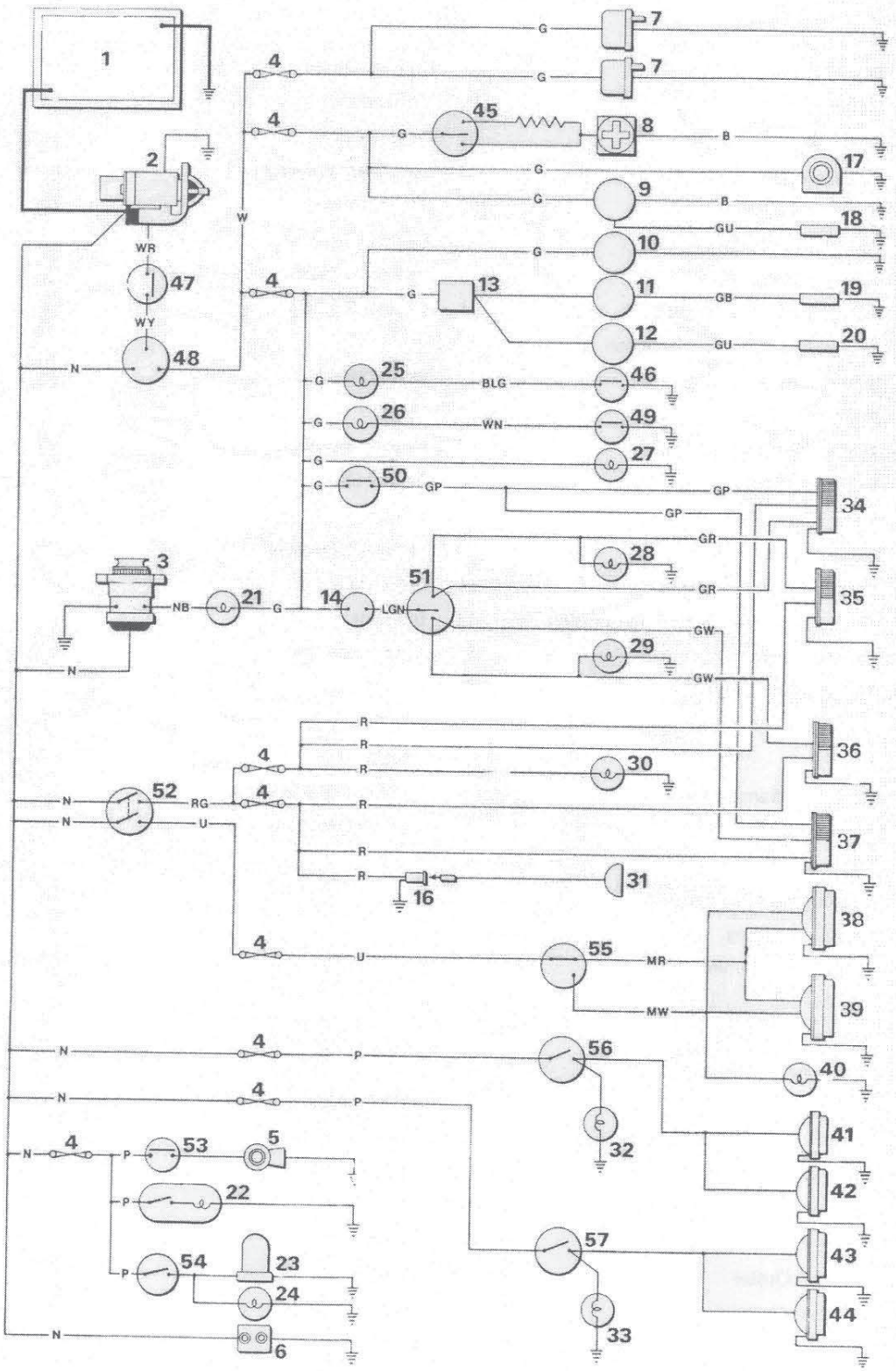
81	Alternator / Dynamo
82	Flasher
84	Main Beam
85	Oil Pressure
86	Working Light – Front
87	Working Light – Rear
88	Air Cleaner
89	Beacon Light

SWITCHES

101	Starter
102	Working Lamp – Front
103	Working Lamp – Rear
105	Stop Lamp
108	Oil Pressure
110	Heater
113	Air Cleaner
114	Neutral Start
115	Beacon Light
116	Multi-Purpose
117	Head/Sidelight
118	Hazard Warning

WIRE COLOUR CODE

B	Black
G	Green
LG	Light Green
N	Brown
O	Orange
P	Purple
R	Red
U	Blue
W	White
Y	Yellow



COMPONENT KEY

1 Battery
2 Starter Motor
3 Alternator
4 Fuses (8 amp)
5 Horn
6 Power Point (Optional)
7 Wiper Motor
8 Heater
9 Temperature Gauge Transmisson
10 Battery Indicator
11 Fuel Gauge
12 Temperature Gauge Engine
13 Voltage Stabiliser
14 Flasher Unit
16 Lamp Socket
17 Cigarette Lighter (Optional)
*18 Temperature Transmitter Transmission
19 Fuel Tank Unit
20 Temperature Transmitter Engine

LAMPS

21 Alternator Warning
22 Interior
23 Beacon (Optional)
24 Beacon (Warning)
25 Air Filter Warning
26 Oil Pressure Warning
27 Panel Lights
28 LH Flasher Indicator
29 RH Flasher Indicator
30 Number Plate
31 Dipper
32 Front Working Light Warning
33 Rear Working Light Warning
34 LH Rear Clusted
35 LH Front Cluster
36 RH Front Cluster
37 RH Rear Cluster
38 LH Headlamp
39 RH Headlamp
40 Main Beam Warning
41 LH Front Working
42 RH Front Working
43 LH Rear Working
44 RH Rear Working

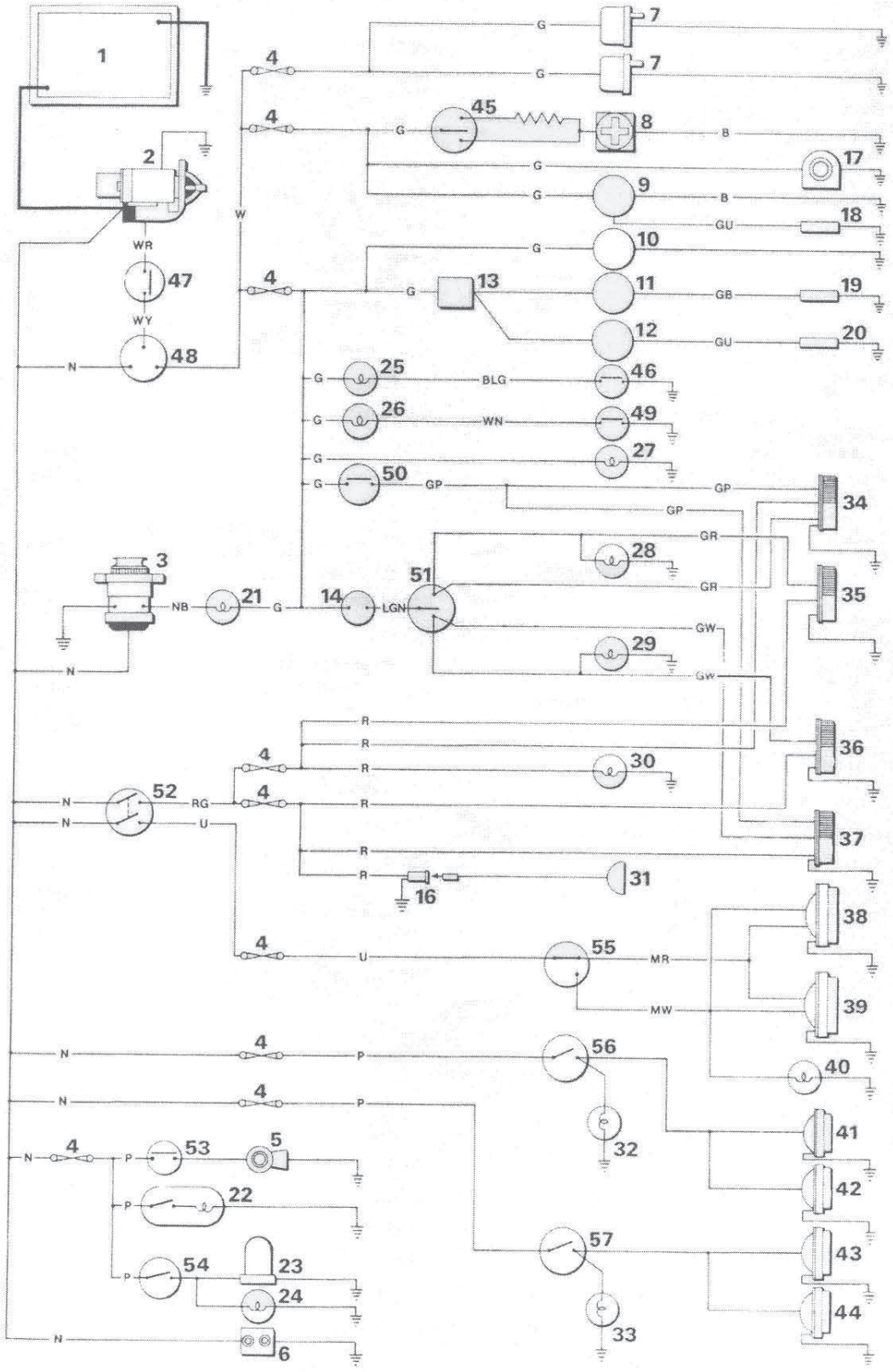
SWITCHES

45 Heater
46 Air Filter Warning
47 Neutral Start
48 Starter
49 Engine Oil Pressure
50 Brake Light
51 Indicator
52 **Side / Headlamp**
53 Horn
54 Beacon Lamps (Optional)
55 Headlamps – Dip
56 Front Working Lamp
57 Rear Working Lamp

*** Torque Converter Machines Only**

WIRE COLOUR CODE

B Black
G Green
LG Light Green
N Brown
O Orange
P Purple
R Red
U Blue
W White
Y Yellow



COMPONENT KEY

1 Battery
2 Starter Motor
3 Alternator
4 Fuse – 8 amp
4a Fuse – 16 amp (for Coffee Maker)
5 Horn
6 Wiper Motor – Front
6a Wiper Motor – Rear
7 Thermostart
8 Heater Motor
9 Heater Resister
10 Voltage Stabilizer
11 Battery Condition Gauge
12 Fuel Gauge
13 Temperature Gauge – Engine
*14 Temperature Gauge – Transmission
15 Fuel Tank Unit
16 Temperature Transmitter – Engine
*17 Temperature Transmitter – Transmission
18 Cigar Lighter
19 Flasher Unit
20 Hazard Flasher Unit
21 Kettle Socket

LAMPS

22 LH Rear Flasher
23 LH Front Flasher
24 RH Front Flasher
25 RH Rear Flasher
26 LH and RH Stop
27 Dipped Beam
28 Main Beam
29 Number Plate
30 Dipper
31 LH Tail
32 LH Side
33 RH Side
34 RH Tail
35 Front Working (Option USA)

*** Torque Converter Machines Only**

36 Rear Working (Option USA)
37 Beacon
38 Interior
39 Instrument
40 Torque Converter Instrument

WARNING LIGHTS

41 Left Turn
42 Right Turn
43 Hazard
44 Oil Pressure
45 Alternator Rear
46 Alternator Front
47 Main Beam
48 Rear Working
49 Front Working
50 Beacon
51 Air Filter

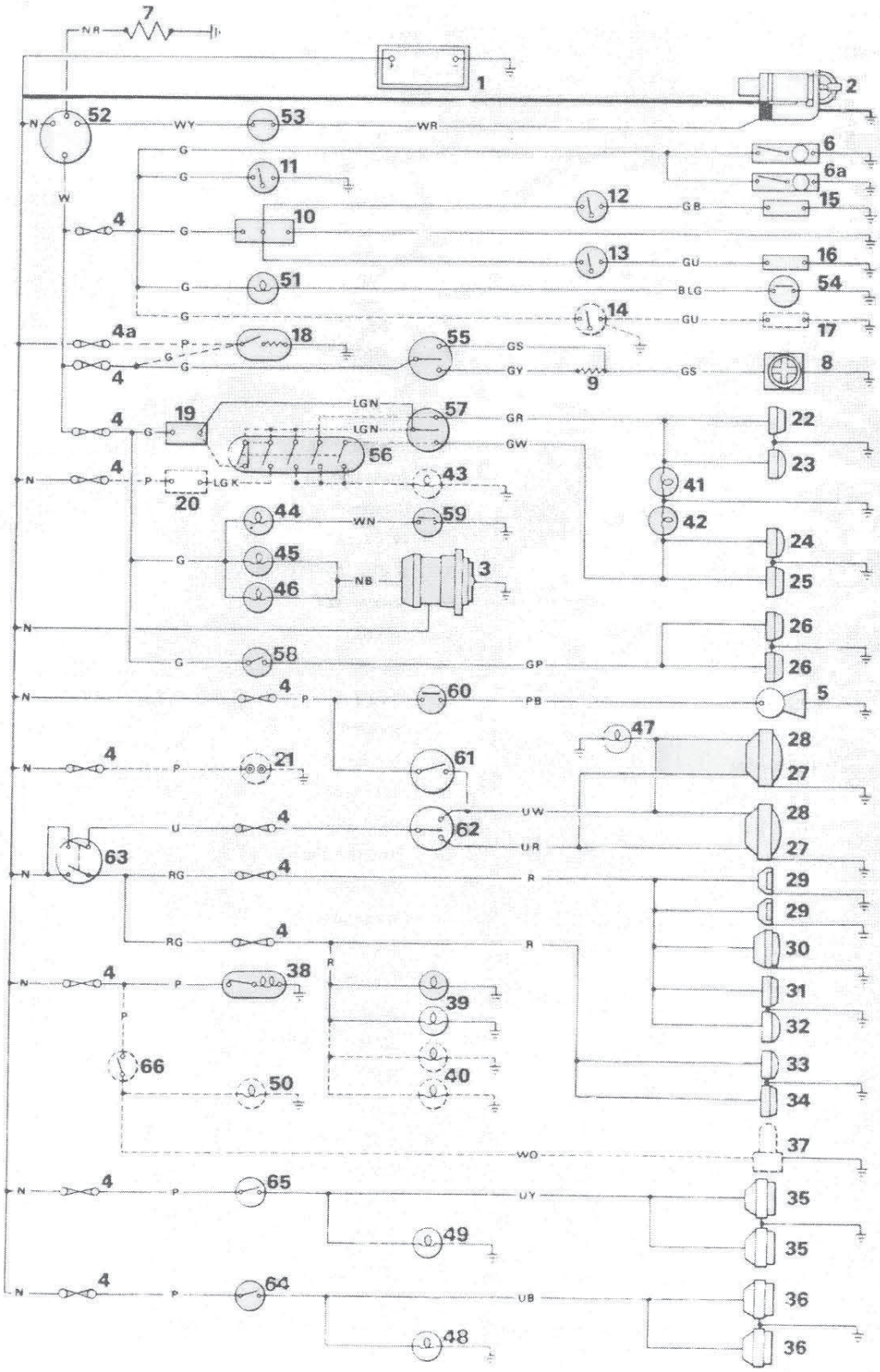
SWITCHES

52 Starter
53 Neutral Start
54 Air Filter
55 Heater
56 Hazard
57 Indicator
58 Stop Lamp
59 Oil Pressure
60 Horn
61 Headlamp Flasher
62 Dip
63 Road Light
64 Rear Working
65 Front Working
66 Beacon

WIRE COLOUR CODE

B Black
G Green
LG Light Green
N Brown
O Orange
P Purple
R Red
U Blue
W White
Y Yellow

1. When hazard warning is fitted, the LGN wire between the flasher unit and the indicator switch is omitted.
2. The 16 amp fuse 4a is used only when a coffee maker is to be fed from the cigar lighter. The G wire feeding the cigar lighter is then disconnected.



COMPONENT KEY

1 Battery
2 Starter Motor
3 Alternator
4 Fuse
5 Horn
6 Wiper Motor – Front
6a Wiper Motor – Rear
7 Thermostart
8 Heater Motor
9 Heater Resister
10 Voltage Stabilizer
11 Battery Condition Gauge
12 Fuel Gauge
13 Temperature Gauge – Engine
*14 Temperature Gauge – Transmission
15 Fuel Tank Unit
16 Temperature Transmitter – Engine
*17 Temperature Transmitter – Transmission
18 Cigar Lighter
19 Flasher Unit
20 Hazard Flasher Unit
21 Kettle Socket

LAMPS

22 LH Side Repeater
23 LH Rear Flasher
24 LH Front Flasher
25 RH Front Flasher
26 RH Rear Flasher
27 RH Side REpeater
28 LH and RH Stop
29 Dip Beam
30 Number Plate
31 Dipper
32 LH Tail
33 LH Side
34 RH Side
35 RH Tail

*** Torque Converter Machines Only**

36 Front Working
37 Rear Working
38 Beacon
39 Interior
40 Instrument
41 Torque Converter Instrument

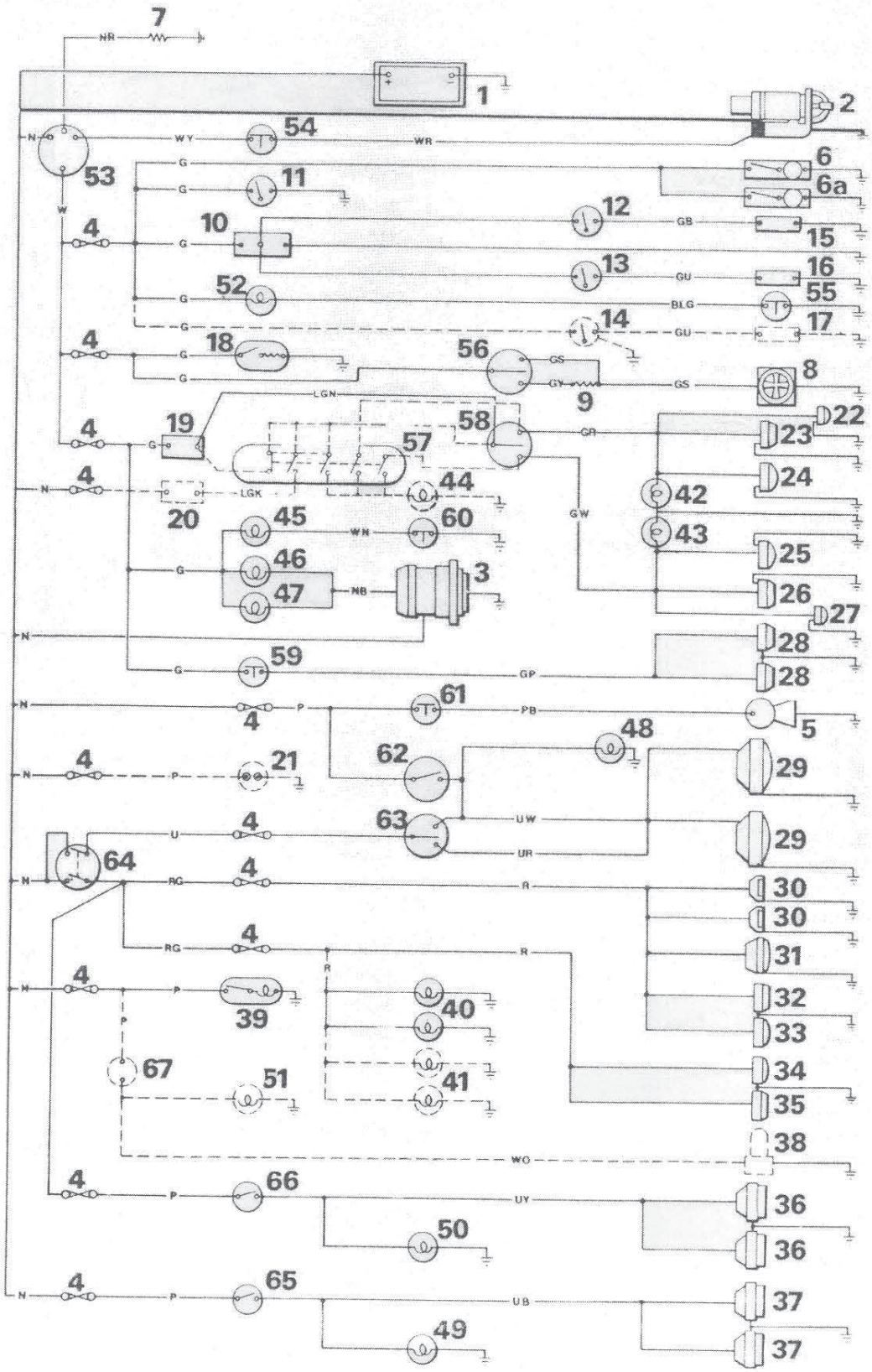
WARNING LIGHTS

42 Hazard
43 Right Turn
44 Hazard
45 Oil Pressure
46 Alternator – Rear
47 Alternator – Front
48 Dip Beam
49 Rear Working
50 Front Working
51 Beacon
52 Air Filter
53 Starter **SWITCHES**
54 Neutral Start
55 Air Filter
56 Heater
57 Hazard
58 Direction Indicator
59 Stop Lamp
60 Oil Pressure
61 Horn
62 Dip Beam Flash
63 Dip Switch
64 Road Lamp
65 Rear Working
66 Front Working
67 Beacon

WIRE COLOUR CODE

B Black
G Green
LG Light Green
N Brown
O Orange
P Purple
R Red
U Blue
W White
Y Yellow

Note: When hazard warning is fitted, the LGN wire between the flasher unit and the indicator switch is omitted.



7-13

COMPONENT KEY

1 Battery
2 Starter Motor
3 Alternator
4 Fuse
5 Horn
6 Wiper Motor – Front
6a Wiper Motor – Rear
7 Thermostart
8 Heater Motor
9 Heater Resister
10 Voltage Stabilizer
11 Battery Condition Gauge
12 Fuel Gauge
13 Temperature Gauge – Engine
*14 Temperature Gauge – Transmission
15 Fuel Tank Unit
16 Temperature Transmitter – Engine
*17 Temperature Transmitter – Transmission
18 Cigar Lighter
19 Flasher Unit
20 Kettle Socket

LAMPS

21 LH Side Repeater
22 LH Rear Flasher
23 LH Front Flasher
24 RH Front Flasher
25 RH Rear Flasher
26 RH Side REpeater
27 LH and RH Stop
28 Dip Beam
29 Number Plate
30 Dipper
31 LH Tail
32 LH Side
33 RH Side
34 RH Tail
35 Front Working

*** Torque Converter Machines Only**

R Red
W White

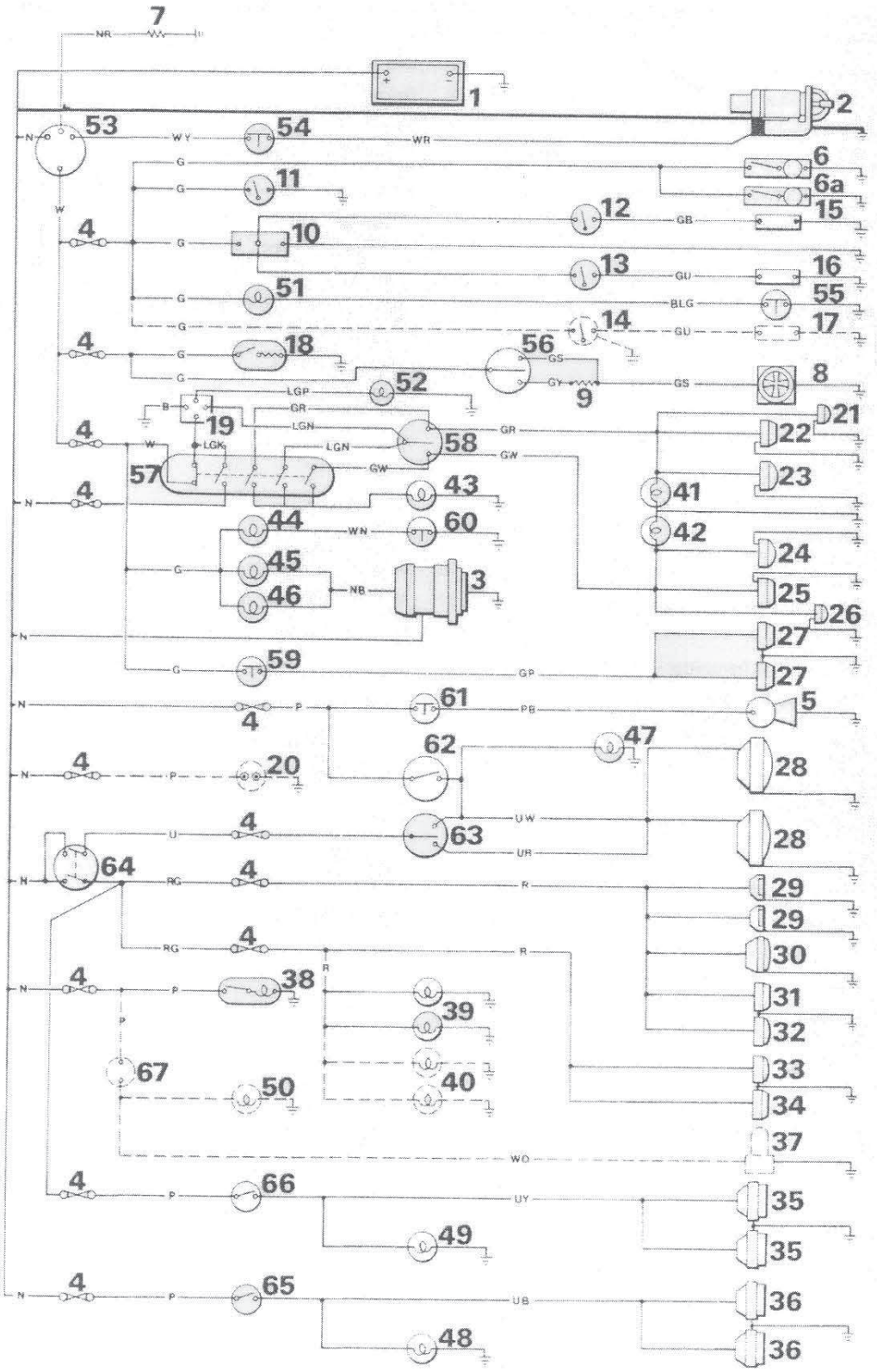
36 Rear Working
37 Beacon
38 Interior
39 Instrument
40 Torque Converter Instrument

WARNING LIGHTS

41 Left Turn
42 Right Turn
43 Hazard
44 Oil Pressure
45 Alternator – Rear
46 Alternator – Front
47 Dip Beam
48 Rear Working
49 Front Working
50 Beacon
51 Air Filter
52 Flasher Failure Warning
53 Starter **SWITCHES**
54 Neutral Start
55 Air Filter
56 Heater
57 Hazard
58 Direction Indicator
59 Stop Lamp
60 Oil Pressure
61 Horn
62 Dip Beam Flash
63 Dip Switch
64 Road Lamp
65 Rear Working
66 Front Working
67 Beacon

WIRE COLOUR CODE

B Black
G Green
LG Light Green
N Brown
O Orange
P Purple
U Blue
Y Yellow



COMPONENT KEY

1 Battery
2 Starter Motor
3 Alternator
4 Fuse – 8 amp
5 Fuse – 16 amp (for Coffee Maker)
6 Horn – Front
7 Horn Rear
8 Wiper Motor – Front
8a Wiper Motor – Rear
9 Thermostart
10 Rear Window Demister
11 Heater Motor
12 Heater Resister
13 Voltage Stabilizer
14 Battery Condition Gauge
15 Fuel Gauge
16 Temperature Gauge – Engine
17 Temperature Gauge – Transmission
18 Fuel Tank Unit
19 Temperature Transmitter – Engine
20 Temperature Transmitter – Transmission
21 Cigar Lighter
22 Flasher Unit
23 Hazard Flasher Unit

LAMPS

24 LH Rear Flasher
25 LH Front Flasher
26 RH Front Flasher
27 RH Rear Flasher
28 LH and RH Stop
29 Main Beam
30 Dipped Beam
31 Number Plate
32 Dipper
33 LH Tail
34 LH Side
35 RH Side
36 RH Tail
37 Front Working
38 Rear Working
39 Beacon
40 Interior
41 Engine Compartment
42 Instruments
43 Torque Converter Instruments

WARNING LIGHTS

44 Left Turn
45 Right Turn
46 Hazard
47 Oil Pressure
48 Alternator Rear
49 Alternator Front
50 Main Beam
51 Front Working
52 Rear Working
53 Beacon
54 Air Filter

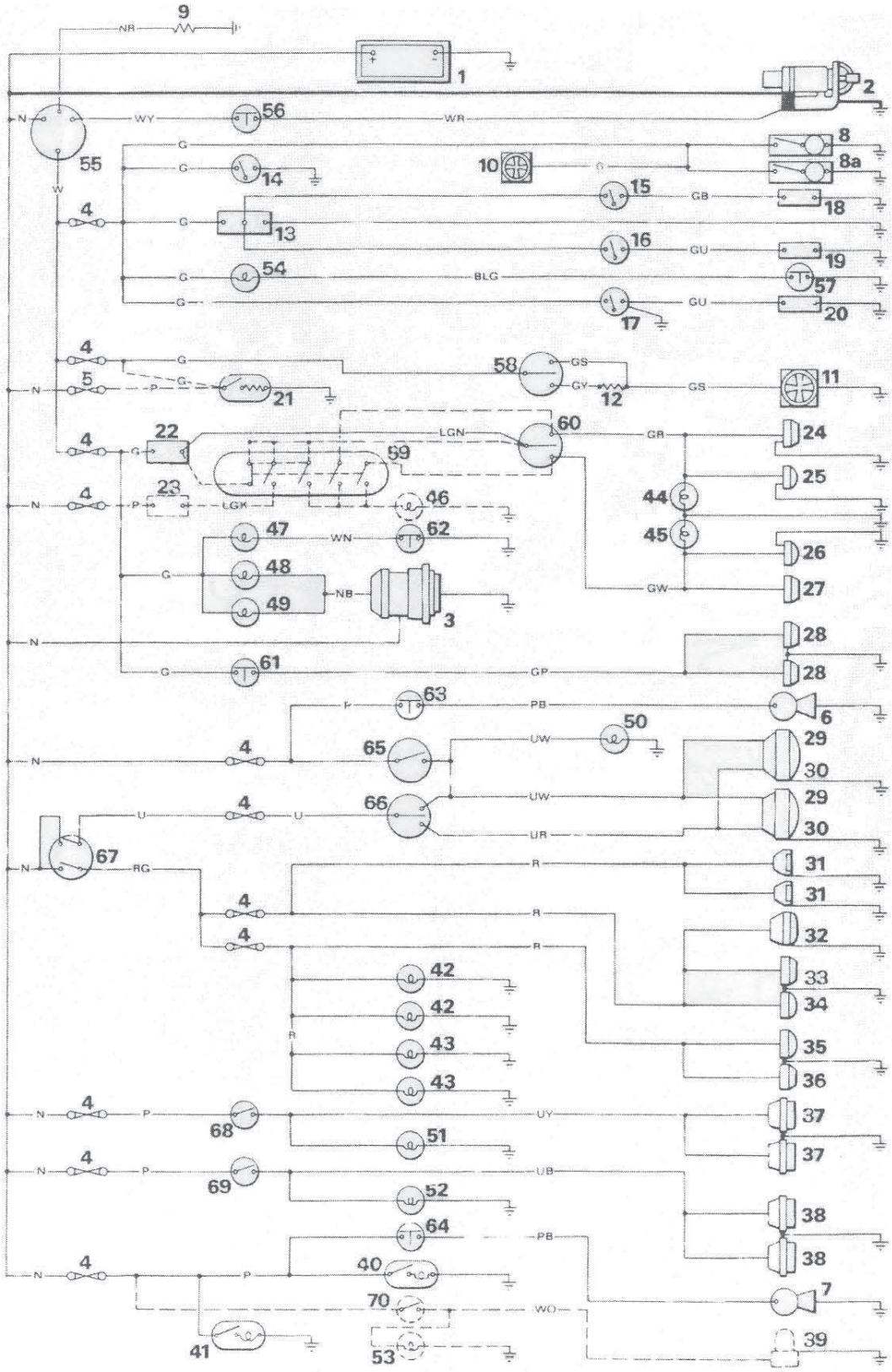
SWITCHES

55 Starter
56 Neutral Start
57 Air Filter
58 Heater
59 Hazard
60 Indicator
61 Stop Lamp
62 Oil Pressure
63 Horn Front
64 Horn Rear
65 Headlamp Flasher
66 Dip
67 Road Light
68 Front Working
69 Rear Working
70 Beacon

WIRE COLOUR CODE

B Black
G Green
LG Light Green
N Brown
O Orange
P Purple
U Blue
Y Yellow
R Red
W White

1. When hazard warning is fitted, the LGN wire between the flasher unit and the indicator switch is omitted.
2. The 16 amp fuse 5 is used only when a coffee maker is to be fed from the cigar lighter. The G wire feeding the cigar lighter is then disconnected.



CONTROLS

CONTENTS

CAB LAYOUT

1 Throttle Lever

2 Seat Adjustment (Reach)

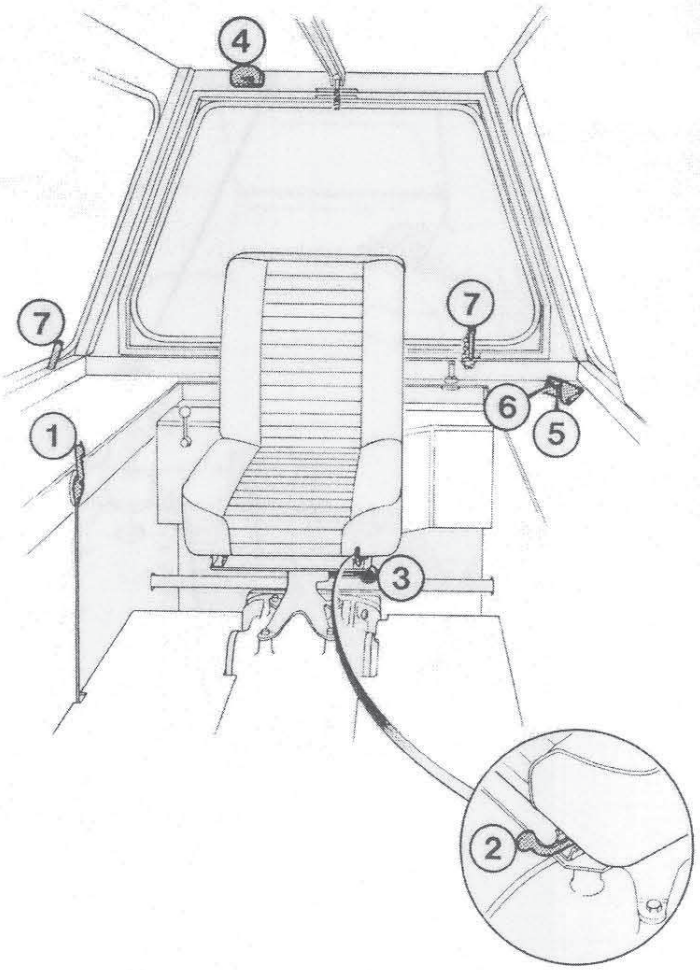
3 Seat Adjustment (Height)

4 Windscreen Wiper

5 Generator Warning Light (Red)

6 Oil Pressure Warning (Green)

7 Rear Window Stowage Pins and Tubes



DRIVING CONTROLS

MANUAL GEARBOX

1 Clutch Pedal

2 Gear Lever

3 High/Low Ratior Lever

4 L.H. Brake Pedal

5 R.H. Brake Pedal

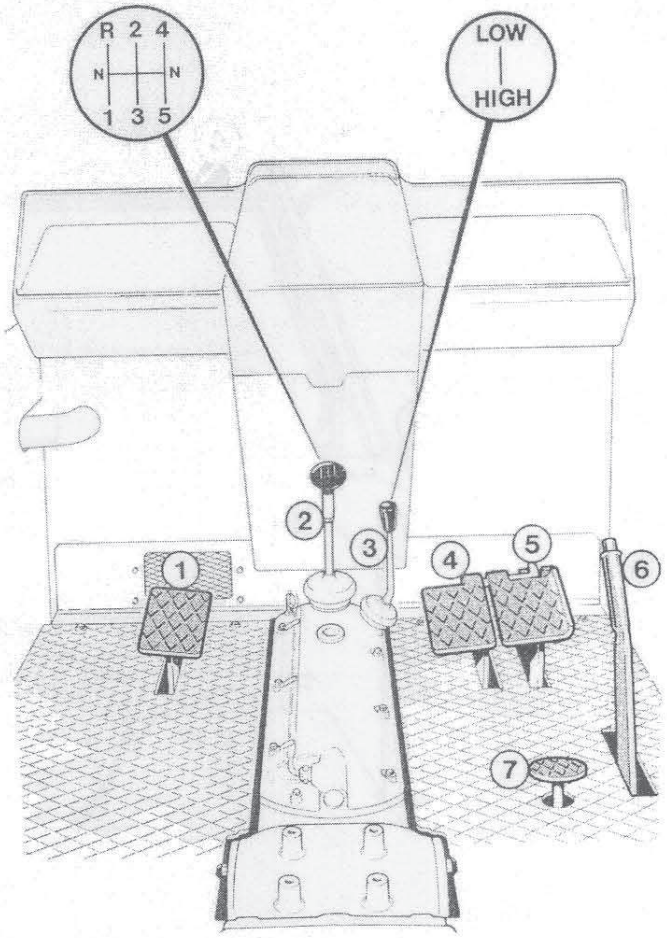
6 Handbrake Lever

7 Throttle Pedal

Brake pedals MUST be latched together when travelling on public roads.

Do not change gear when machine is moving.

Do not use clutch pedal as a foot rest



DRIVING CONTROLS

TORQUE CONVERTER

1 Gear Lever

2 Forward/Reverse Selector

3 Handbrake Lever

4 L.H. Brake Pedal

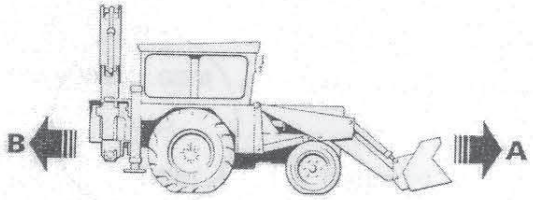
5 R.H. Brake Pedal

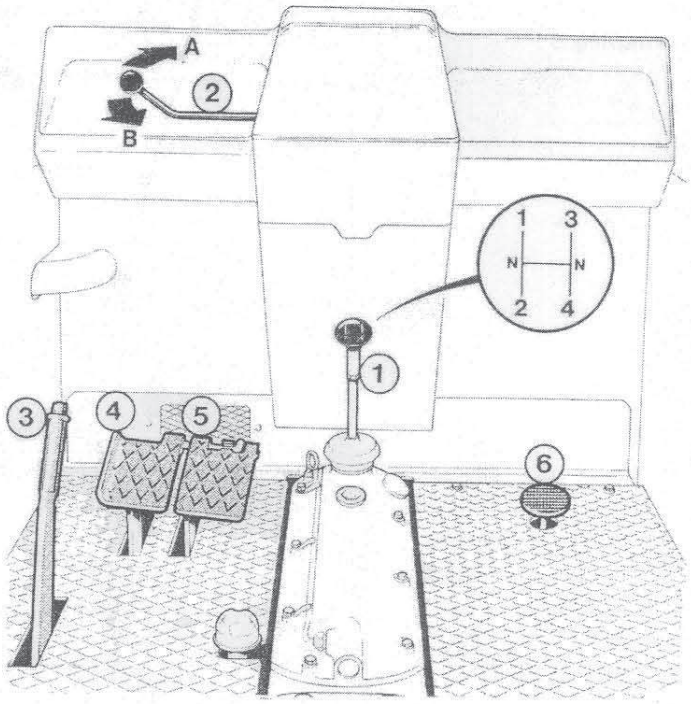
6 Throttle Pedal

Brake pedals MUST be latched together when travelling on public roads.

Do not change gear when machine is moving.

Do not use clutch pedal as a foot rest





DRIVING CONTROLS
From Machine
No 130302

MANUAL GEARBOX

1 Clutch Pedal

2 Gear Lever

3 High/Medium/Low Ratio Lever

4 L.H. Brake Pedal

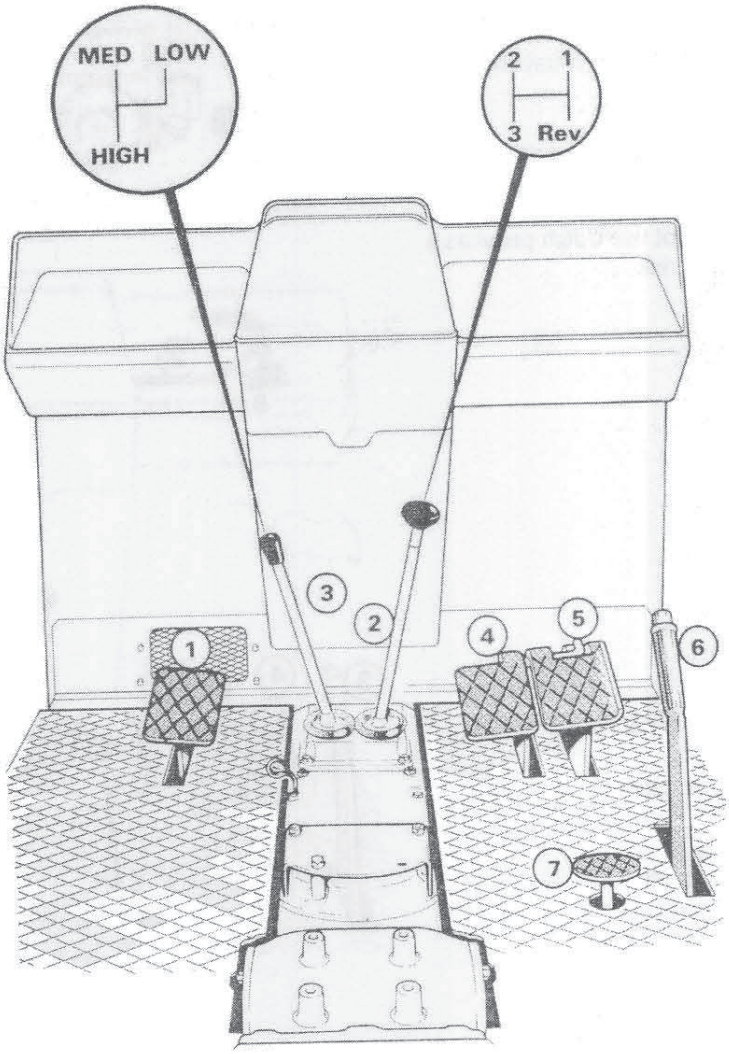
5 R.H. Brake Pedal

6 Handbrake Lever

7 Throttle Pedal

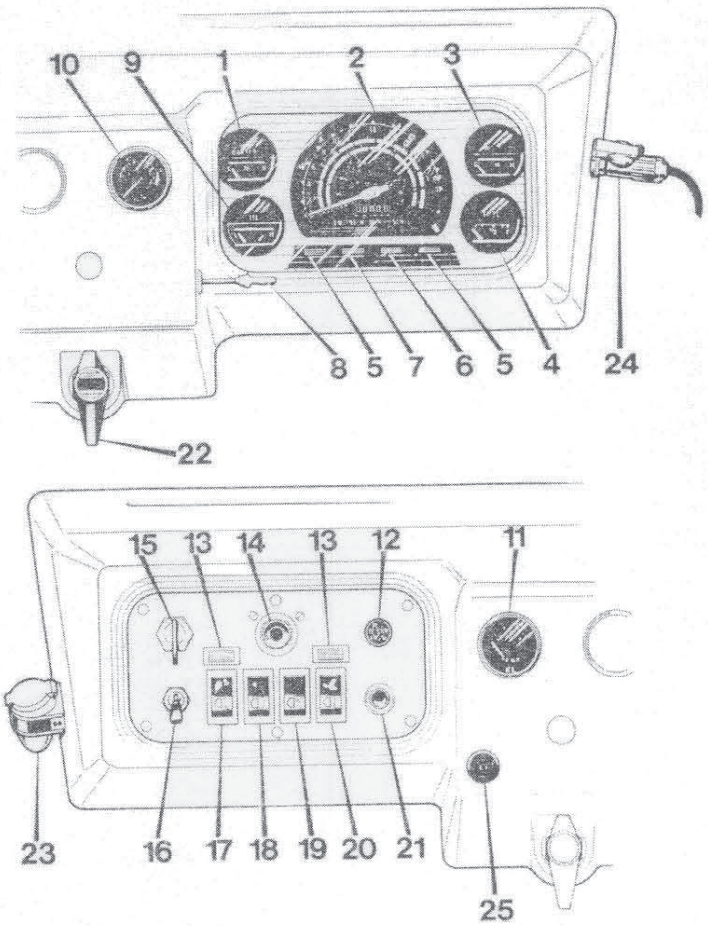
Brake pedals MUST be latched together when travelling on public roads.

Do not change gear when machine is moving.



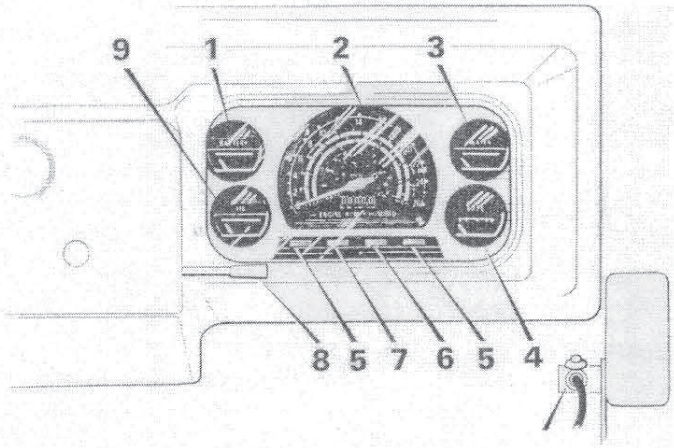
INSTRUMENT PANEL

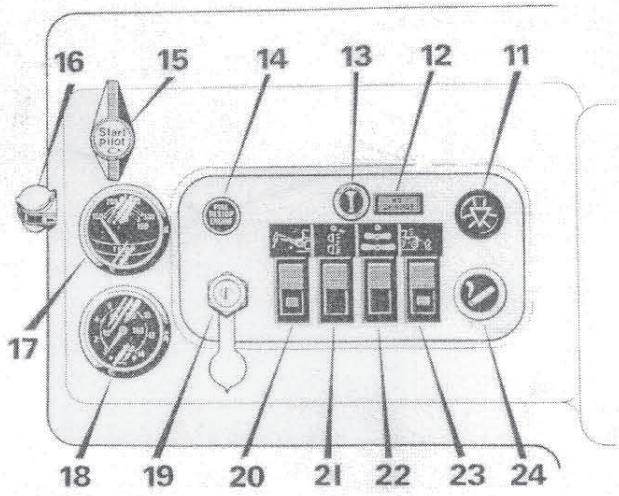
1 Battery Condition Indicator
2 Proof Meter
3 Water Temperature
4 Fuel
5 Indicator Warning Light
6 Air Cleaner Warning Light
7 Headlight Warning Light
8 Direction Indicator Switch
9 Oil Pressure
10 Torque Converter Oil Pressure
11 Torque Converter Oil Temperature
12 Engine Stop Control
13 Working Light Indicator
14 Cigarette Lighter
15 Starter Switch
16 Heater Switch (2 speeds)
17 Rear Working Light Switch
18 Side/Headlight Switch
19 Dipswitch
20 Front Working Light Switch
21 Horn
22 Cold Start Plunger
23 Cold Start Reservoir
24 Power Point

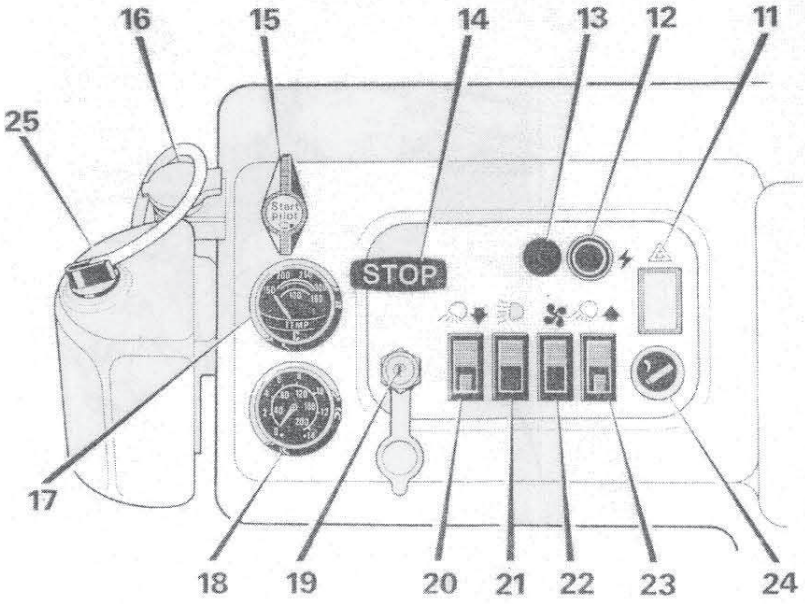


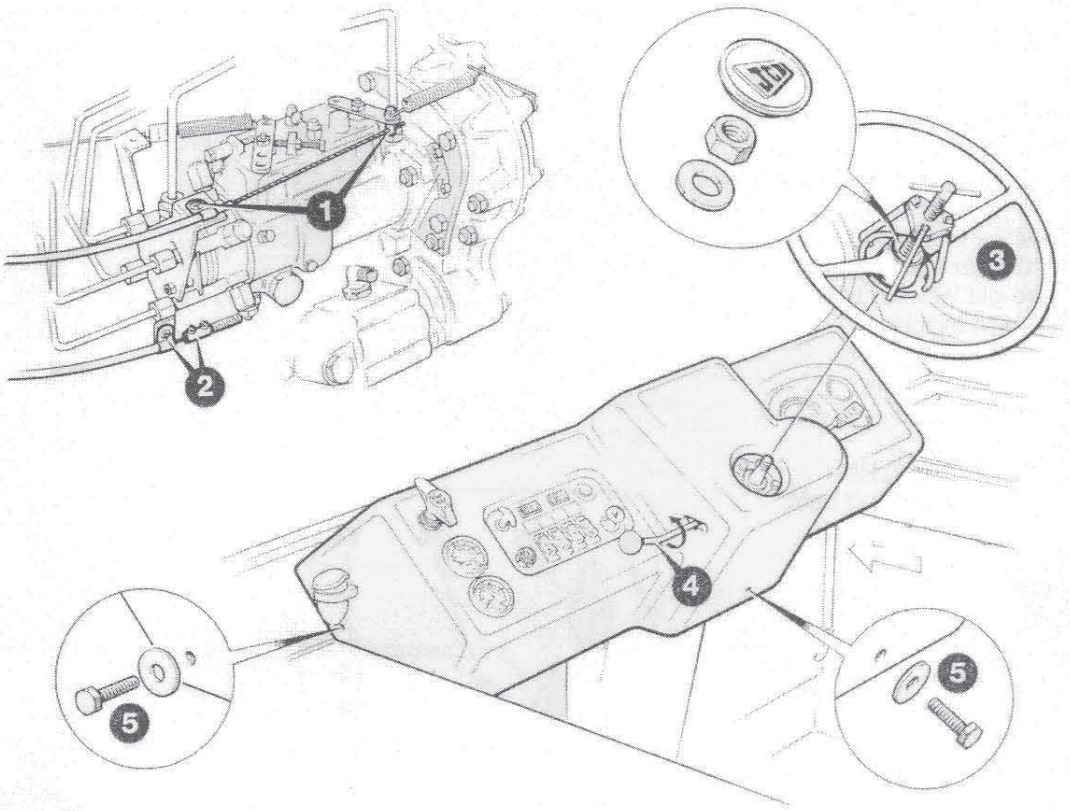
INSTRUMENT PANEL

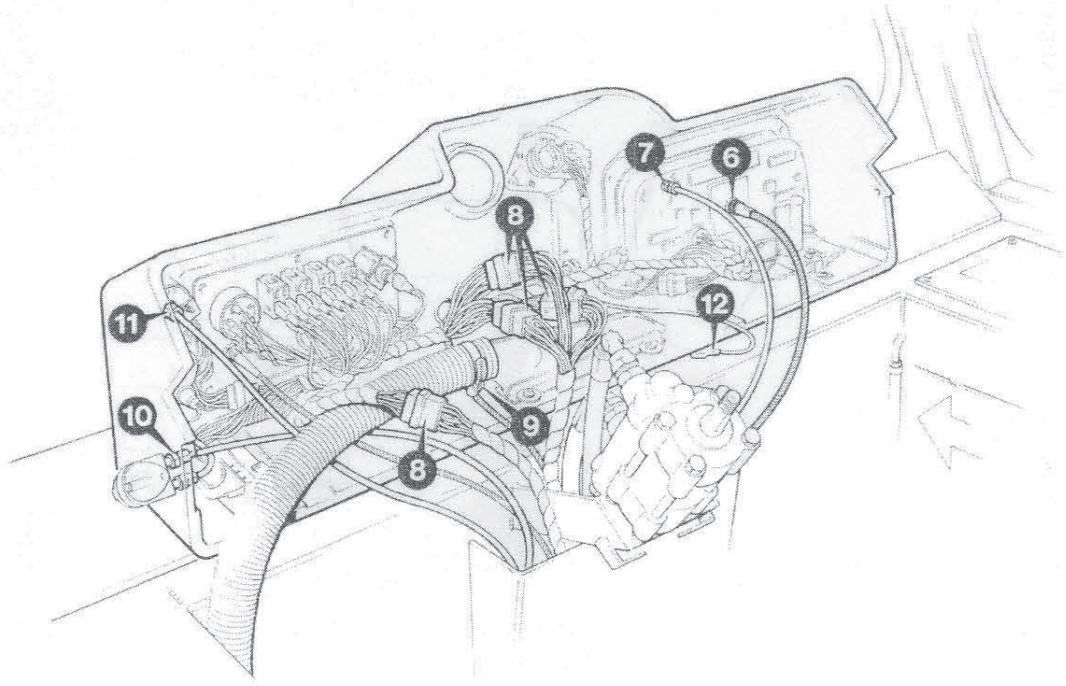
1 Battery Condition Indicator
2 Proof Meter
3 Water Temperature
4 Fuel
5 Indicator Warning Light
6 Air Cleaner Warning Light
7 Headlight Warning Light
8 Direction Indicator
Headlamp flasher / Horn
9 Engine Oil Pressure
10 Power Point
Oil Pressure
11 Hazard Warning Light
12 No Charge Warning Light
13 Windscreen washer
14 Engine Stop Control
15 Cold Start Plunger
16 Cold Start Reservoir
17 Torque Converter
Oil Temperature
18 Torque Converter
Oil Pressure
19 Starter Switch
20 Rear Working Light Switch
21 Side/Headlight Switch
22 Heater Switch (2 speed)
23 Front Working
Light Switch
24 Cigarette Lighter
25 Washer Reservoir











INSTRUMENT PANEL

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement the sequence should be reversed.

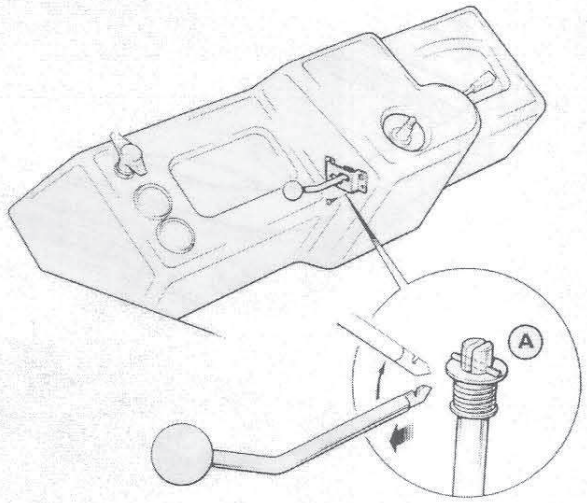
When Removing

Disconnect engine stop cable **1** and cold start cable **2** at injection pump

Disconnect battery negative lead.

Use puller ring 892/00069 (service tools) in conjunction with a standard hub puller to remove steering wheel **3**

On torque converter machines only, remove direction control lever **4** (Inset view **A** shows alternative arrangement fitted on some European build machines)



After removing holding screws **5** disconnect tach cable **6** and tilt the complete panel forwards to gain access to electrical connections and gauge lines.

Remove fuel tank sender unit **12**

When Replacing

Ensure that oil gauge connections are oil tight.

Do not use excessive force when refitting the steering wheel. Shock loading may cause damage to the steering valve.

Apply Loctite 241 (service tools) to the thread of item **4**

INSTRUMENT CLUSTER

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement the sequence should be reversed.

When Dismantling

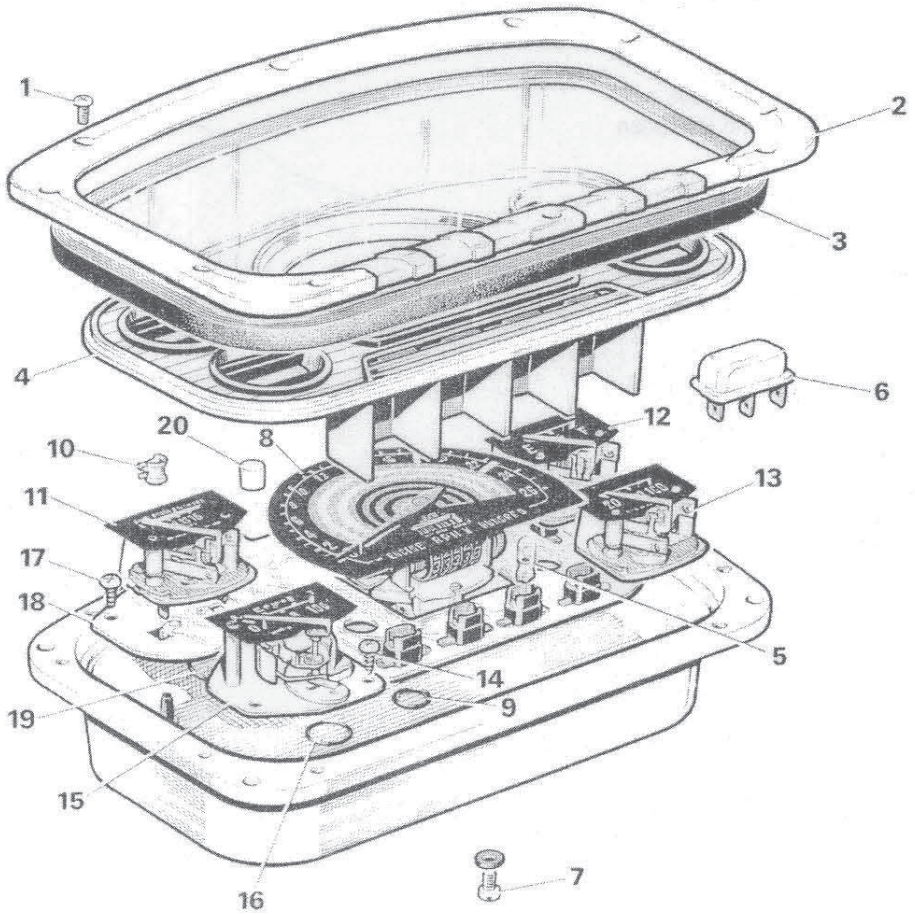
Take care not to damage the instrument pointers and avoid losing O rings **9**, **16** and **19**

Remove dessicator **20** heat for 1 hour at approx 230°C (450°F) to drive out moisture.

When Assembling

Renew bulbs **5** voltage stabiliser **6** or other items as required.

Reassemble panel within 20 minutes of removing dessicators from heat source



CROSS SHAFT

Removal and Replacement

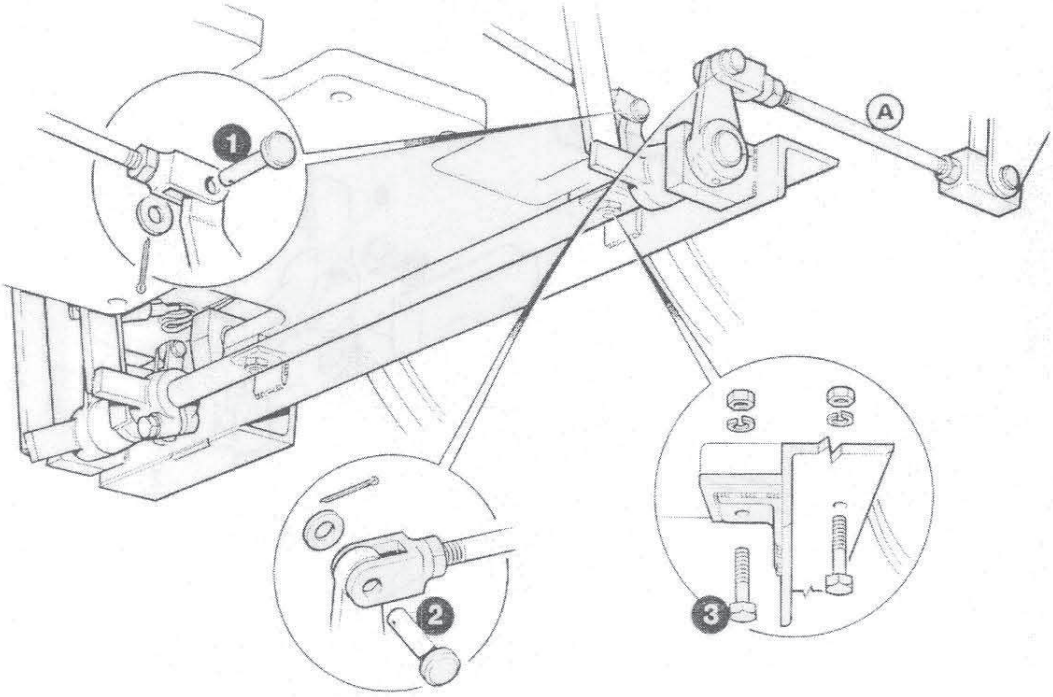
The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement the sequence should be reversed.

When Replacing

If footbrake links A are dismantled or replaced they should be reset with a distance between clevis pin centres of 238mm (9.375in)

See section 3 pages 7-1 and 2 for footbrake and handbrake adjustment.

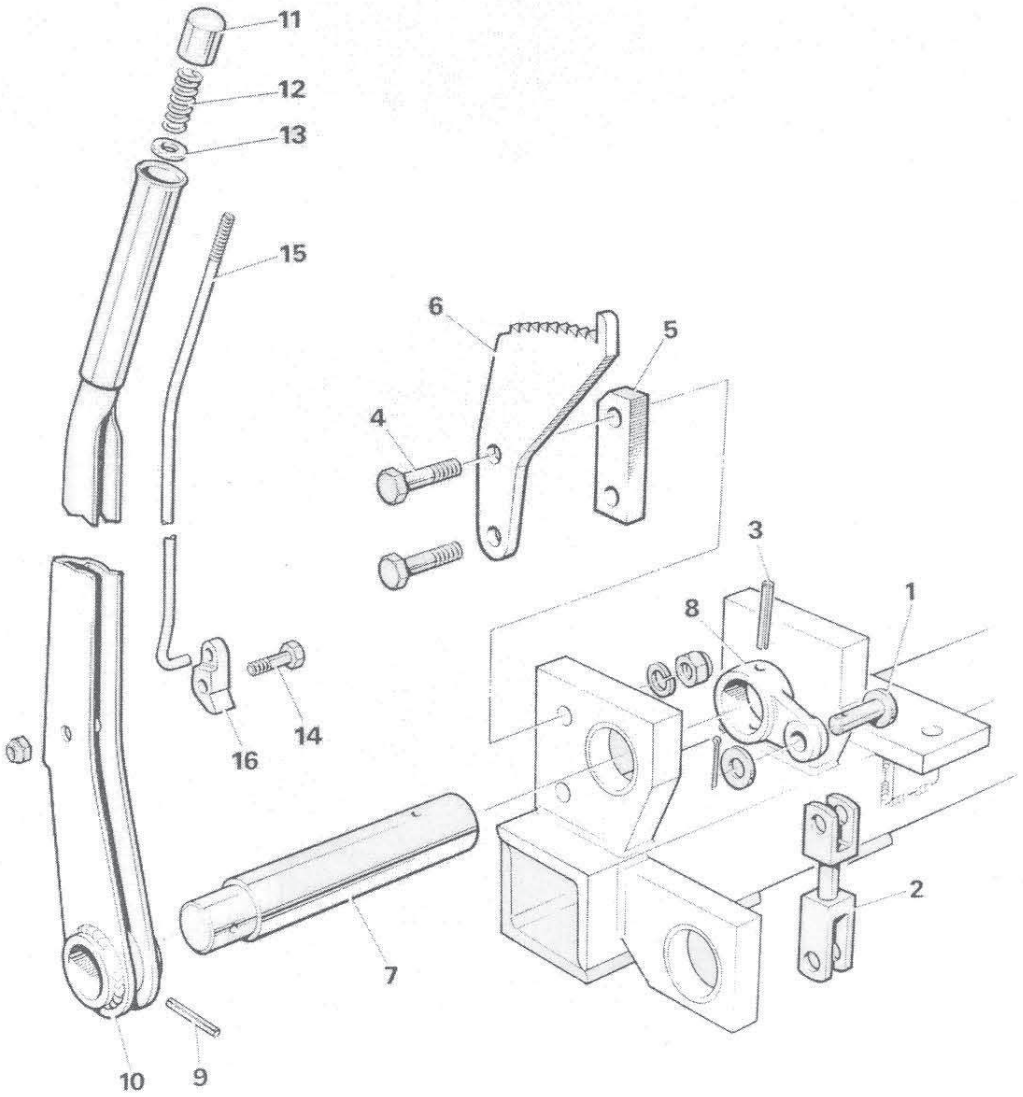


HANDBRAKE

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement the sequence should be reversed.



8-1

HANDBRAKE AND CLUTCH PEDALS

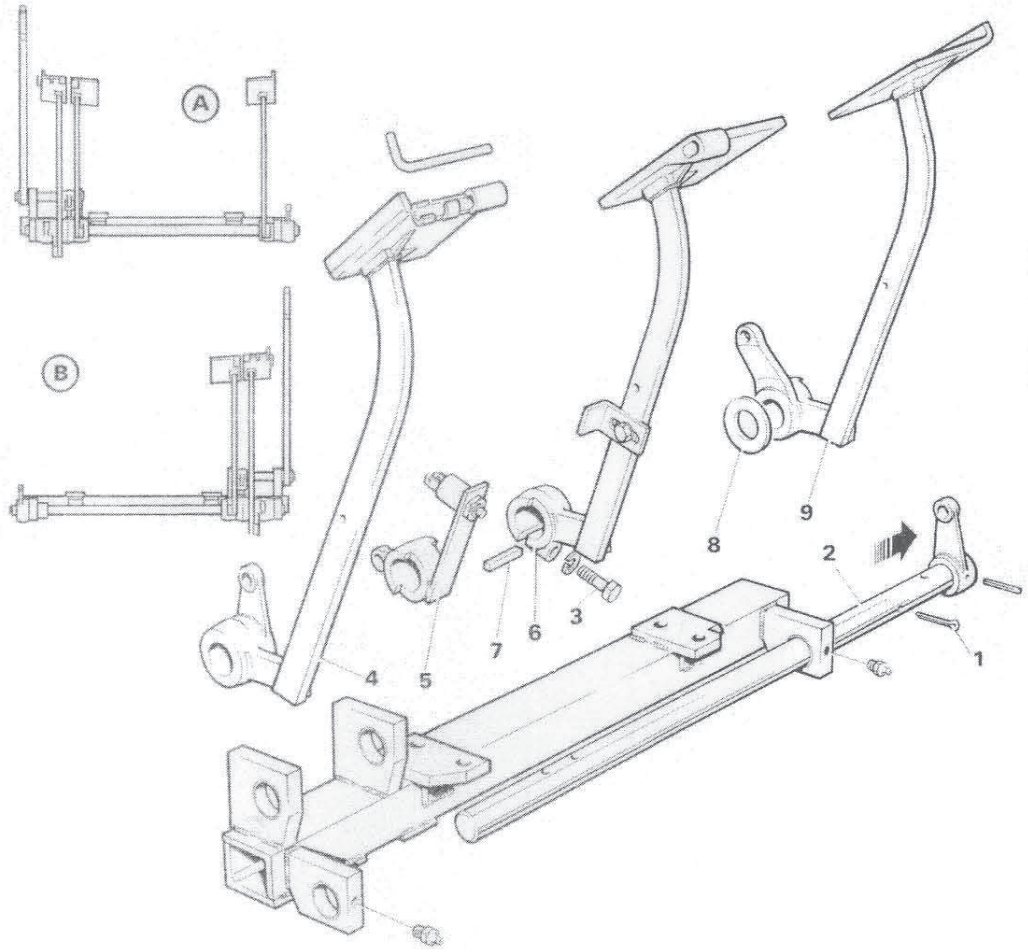
Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement the sequence should be reversed.

A Manual Clutch Machines

B Torque Converter Machines



E HYDRAULICS E

CONTENTS

SUCTION STRAINER

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement the sequence should be reversed.

When Removing

First drain hydraulic fluid at plug **A**

When Replacing

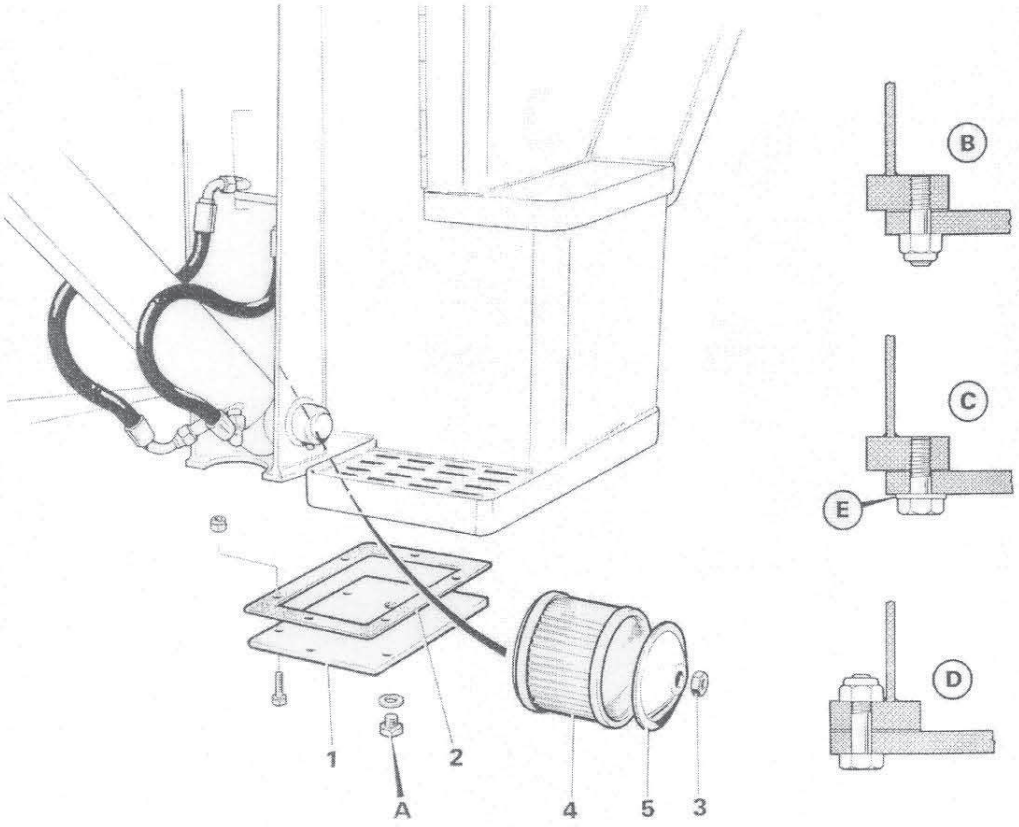
If the original strainer is re-used, clean thoroughly as described in Section **1** page 6-1

If a new strainer is fitted, remove the protective coating by washing in petrol, carbon tetrachloride or paraffin.

Note the three methods of plate attachment:

B To m/c no. 68150
C M/c no. 68151 to 105056
D From m/c no. 105057

If method **C** is employed renew sealing washers **E**



PUMP

Removal and Replacement (Typical)

The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement the sequence should be reversed.

When Removing

Raise lift arms to gain access. If hydraulic pressure is not available select 'lift arms raise' on control lever whilst lifting arms with a suitable hoist.

WARNING: Before working beneath shovel, fit ram prop 2 part no:

102/11600 – 2D
106/08100 – 3,3C,3D,700

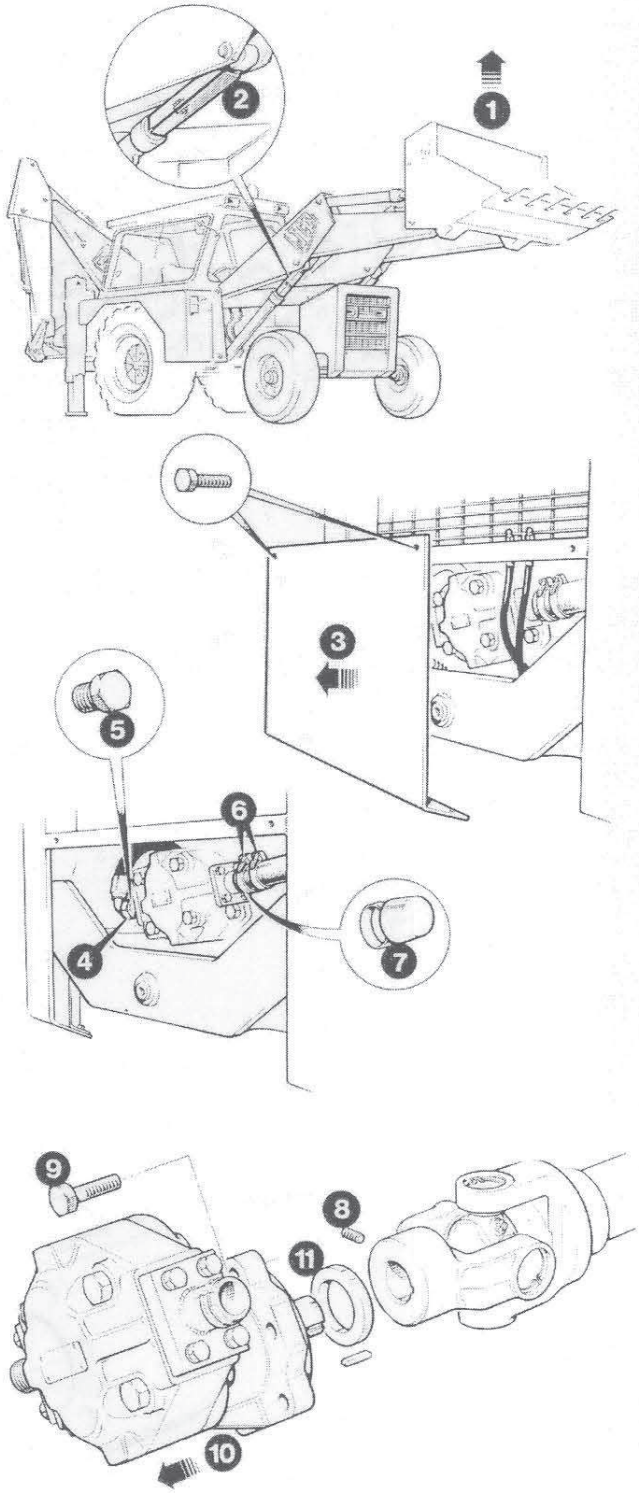
To prevent excessive fluid loss, either lift the front of the machine so that the pump is higher than the fluid level, or drain the hydraulic system.

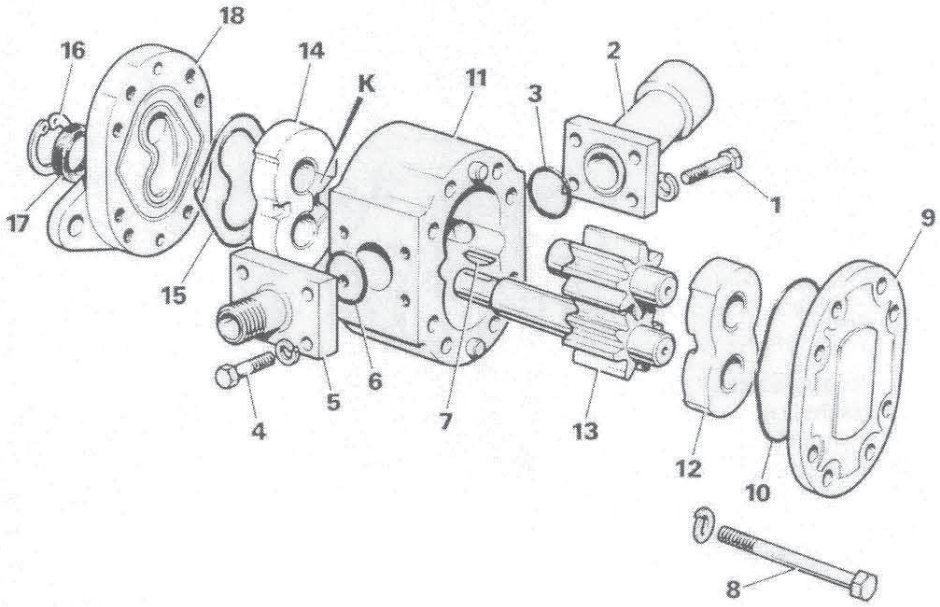
If the system is not drained, quickly fit plug **7** (part no 892/00052) to retain the fluid.

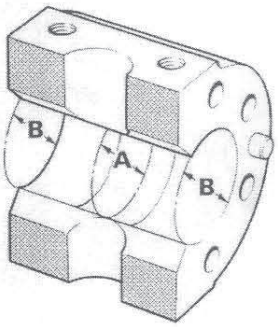
NOTE: Space **11** is fitted to certain machines only – see Parts Catalogue

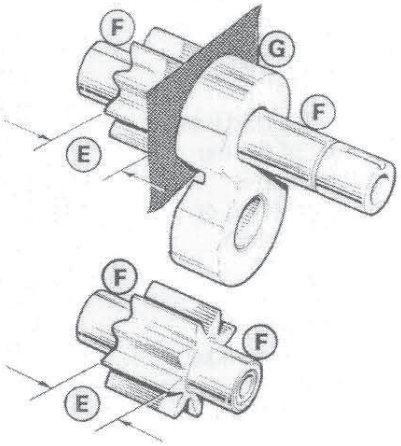
When Replacing

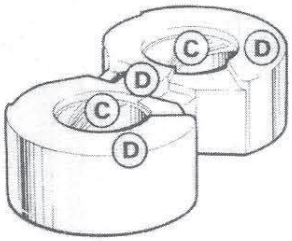
Before fitting guard **3,** check fluid level and M.R.V. operating pressure. Check for leaks whilst operating a service

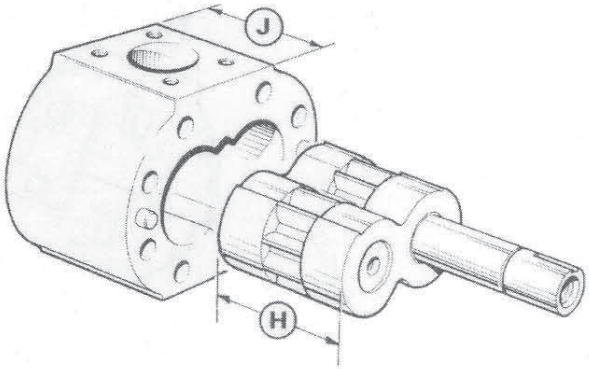












PUMP

2D 3 To m/c no. 100611

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

When Dismantling

Remove sharp edges and burrs from shaft to avoid seal damage.

Mark covers **9** and **11** and housing **18** to ensure correct replacement. Do not damage machined faces by prising these apart – use a soft-faced hammer.

Inspection

Check housing bore dimensions **A** and **B** If gear track **A** is worn greater than **B** by more than 0.004in (0.1mm) or heavy scoring is present, the complete pump must be renewed. Light scoring may be removed with very fine emery cloth.

Ensure that bearing blocks are free from scoring or damage, especially in bores **C** and on faces **D**. Use fine emery cloth to remove scoring and to ensure free movement in the pump body.

Renew gears if widths **E** vary by more than 0.0002in (0.005mm) or journal diameters F vary by more than 0.0005in (0.013mm) Polish out light scoring on side faces using a very fine emery cloth and a scrap bearing block as shown at **G**.

Ensure that dimension H is 0.003 to 0.007in (0.076 to 0.178mm) less than dimension **J**

When Assembling

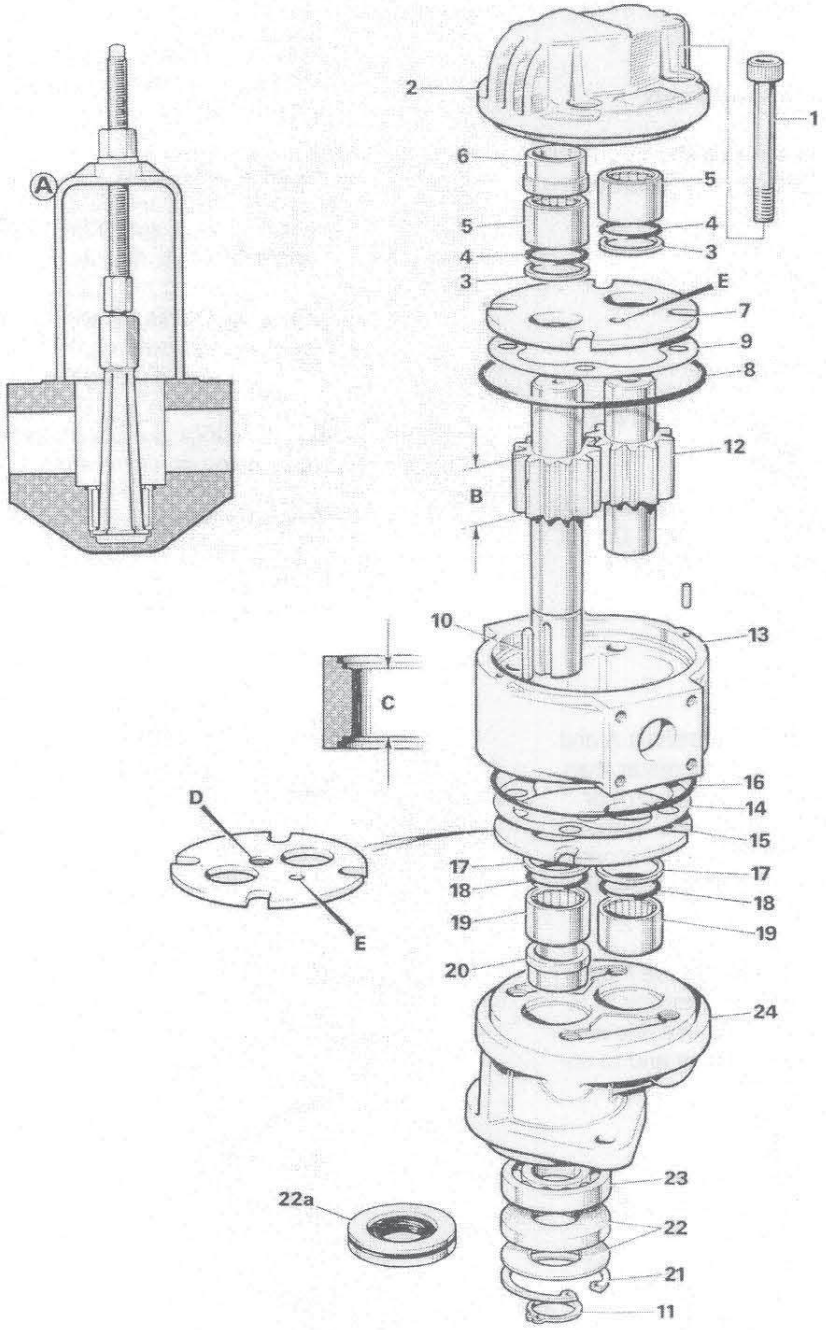
Renew all seals and O rings using JCB Special hydraulic fluid as a lubricant.

Fit bearing blocks **12** and **14** with recesses **K** positioned on the inlet side of the pump and facing the gears.

Align housings and covers using the marks made on dismantling

Torque Settings

Item	lbf ft	kgf m
8	90-95	12.4-13.1



PUMP

3C, 3D, 700 To m/c no. 56670

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

When Dismantling

Remove sharp edges and burrs from shaft to avoid seal damage.

Mark end covers **2** and **24** and housing **13** to ensure correct replacement. Do not damage machined faces by prising these apart – use a soft-faced hammer.

Mark adjacent gear teeth to ensure correct replacement using indelible ink or paint. Do not use a centre punch or similar tool.

Remove bearings **5** and **19** if requiring replacement, or to drift out bearing **23**. Use Service Tool part no BT2464 as at **A**.

NOTE: In addition to replacement due to wear, bearings should be renewed when new gears are fitted.

When Assembling

Renew all seals and O rings, lubricating all internal parts with JCB Special hydraulic fluid. Seals **22** and **22a** are alternatives.

Renew seal bushes **6** and **20** if sealing faces are damaged or if bores are scored or worn to a greater diameter than 31.788mm (1.2515in)

Install bearings **5** and **19** 0.18 to 0.23mm (0.007 to 0.009in) below end cover machined surface. Use service tool 892/00065.

Renew gears in pairs if:

A) Journal area of shaft is pitted or worn in excess of 0.025mm (0.001in)

B) Keyway or gears are badly worn or cracked.

C) Gear width **B** is less than housing width C by 0.076mm (0.003in)

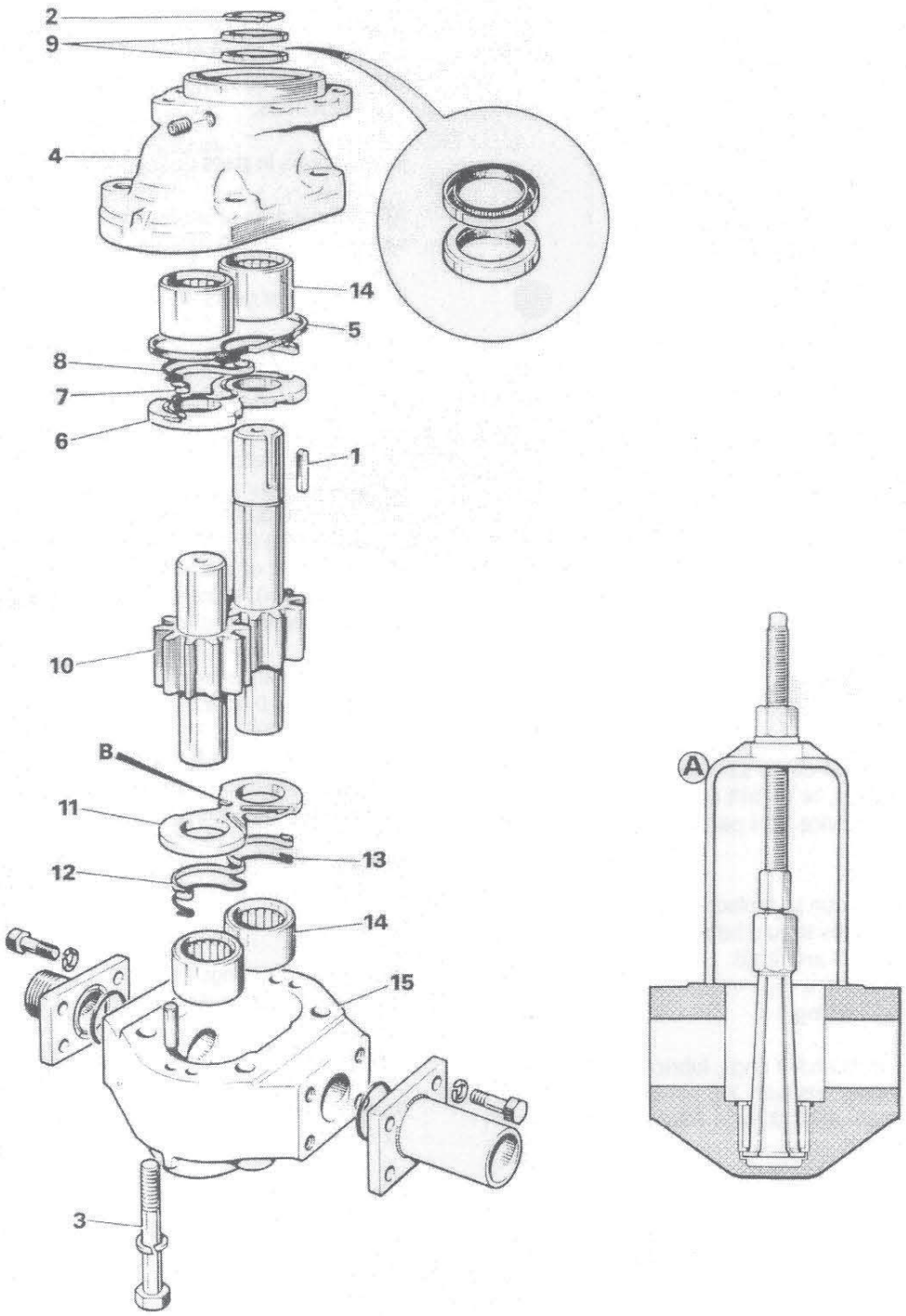
Renew wear plates **7** and **15** if scored or eroded. Ensure that recesses **D** 12.7mm diameter x 1.6mm deep (0.5x0.0625in) face the gears on the discharge side of the pump. Holes **E** 6.3mm (0.25in) diameter will then align with drain holes in end covers.

Running clearance between gears and wear plates is 0.11 to 0.15mm (0.0045 to 0.006in). This is achieved by addition of shims **9** and **14**, 0.038mm (0.0015in) thick, distributed each side of the housing **13**. The total thickness of shims required is found by adding the running clearance to dimension **B** then subtracting dimension **C**.

Align gears, housings and covers using marks made on dismantling.

Torque Settings

Item	Nm	kgf m	lbf ft
1	136	13.8	100



PUMP

2D, 3 From m/c no. 56670
3C, 3D, 700 From m/c no. 56671

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

When Dismantling

Remove sharp edges and burrs from shaft to avoid seal damage.

Mark covers **4** and housing **15** to ensure correct replacement. Do not damage machined faces by prising these apart – use a soft-faced hammer.

Mark adjacent gear teeth to ensure correct replacement using indelible ink or paint. Do not use a centre punch or similar tool.

Remove bearings **14** only if requiring replacement. Use Service Tool part no BT2464 as at **A**.

NOTE: In addition to replacement due to wear, bearings should be renewed when new gears are fitted.

When Assembling

Renew all seals , lubricating all internal parts with JCB Special hydraulic fluid.

Renew gears in pairs if:

A) Journal area of shaft is pitted or worn in excess of 0.001mm (0.025in)

B) Keyway or gears are badly worn or cracked.

Install bearings **14** into housing and end cover flush to 0.002in (0.05mm) maximum below face of bearing bore.

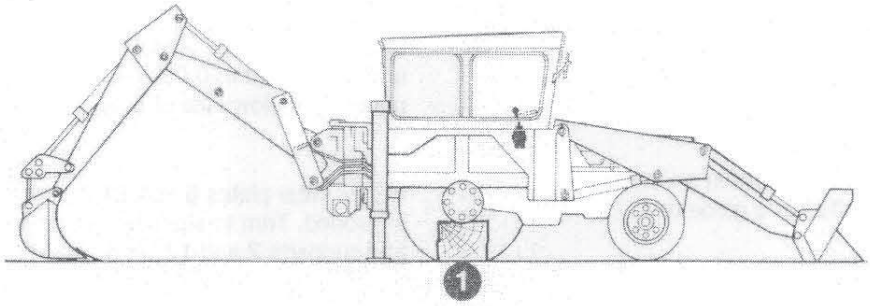
Renew wear plates **6** and **11** if scored or eroded. Trim to size seals **8** and **13** and supports **7** and **12**, using grease to retain them firmly in the wear plates.

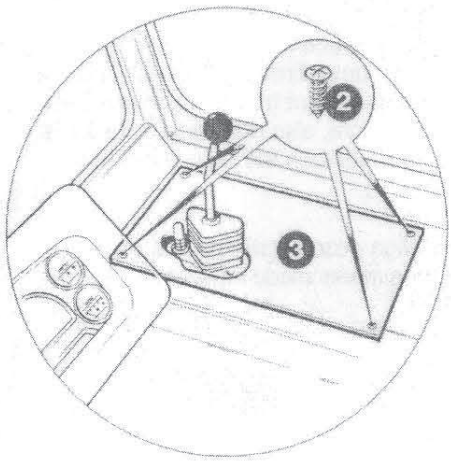
Fit wear plates with single slots **B** facing the gears on the pressure side of the pump. Ensure that seals and supports are not trapped between plate and bore, also that wear plate **11** is fully home in the bore and free to move.

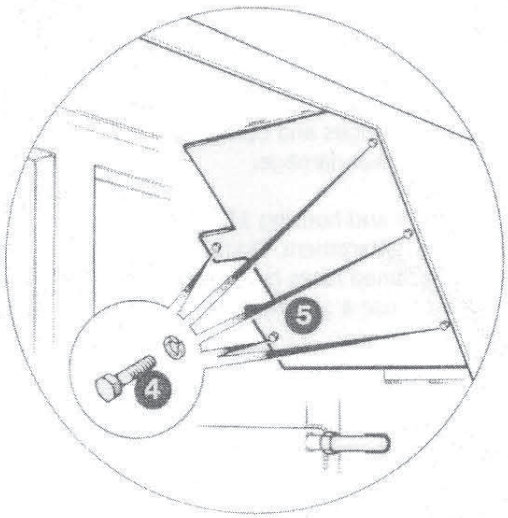
Align gears, housings and covers using marks made on dismantling.

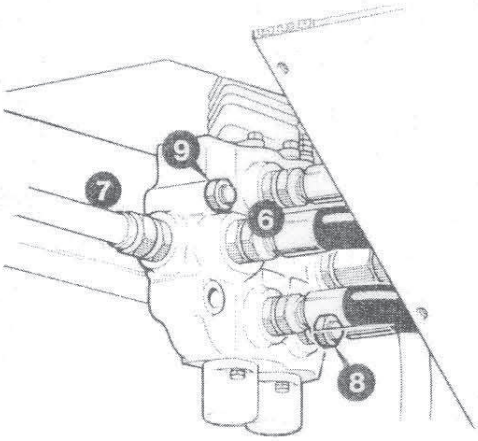
Torque Settings

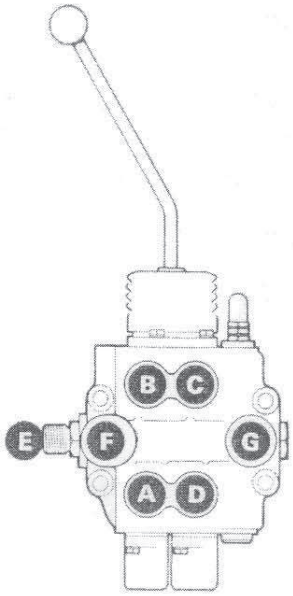
Item	lbf ft	kgf m
3	120	16.6











LOADER VALVE (Hamworthy)

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement the sequence should be reversed.

When Removing

Prior to disconnecting hoses and pipes, operate control levers to vent pressure and label hoses to ensure correct replacement.

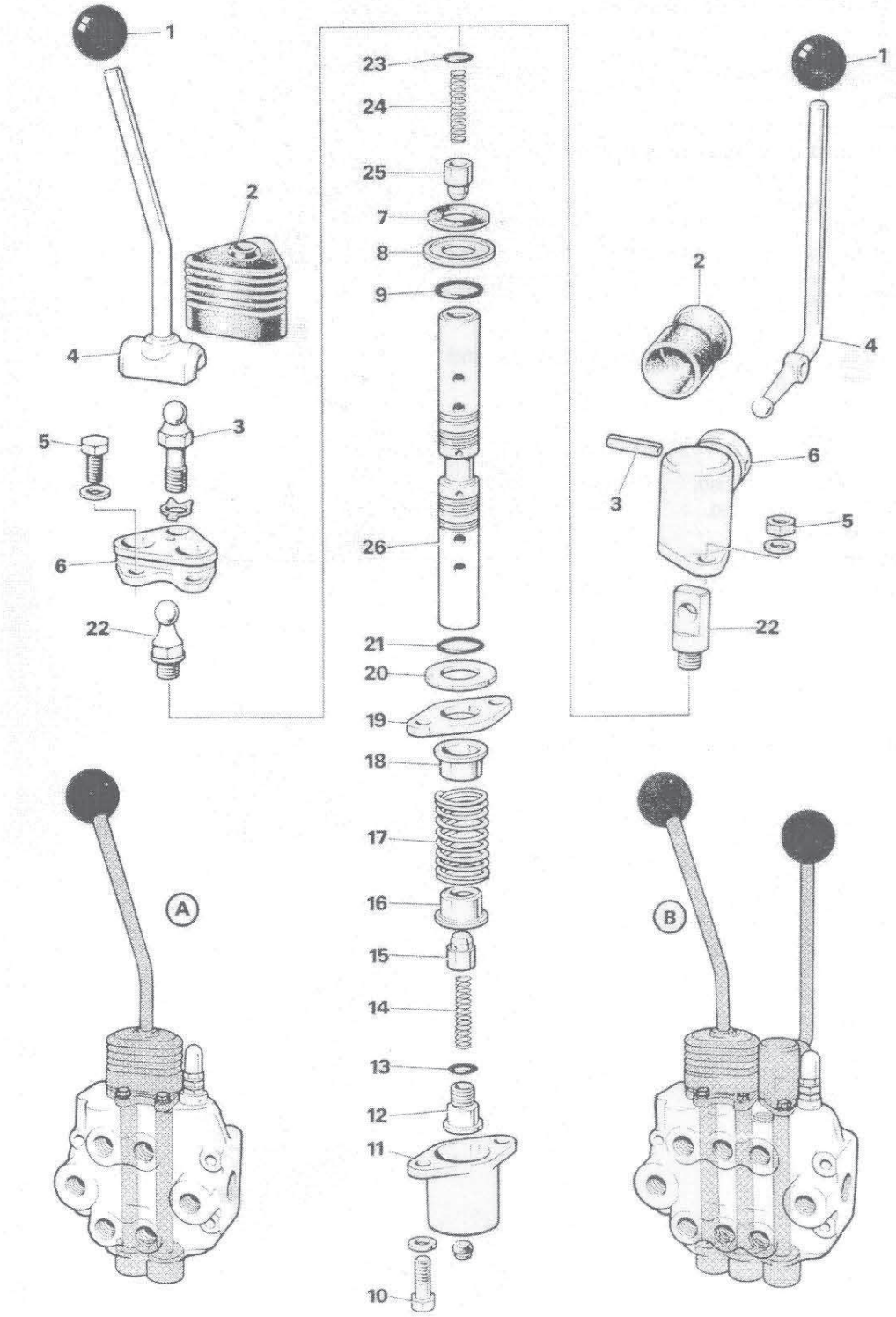
Blank all hoses and pipes to prevent entry of dirt and loss of hydraulic fluid.

Connections

A Shovel Ram, Head End.
B Shovel Ram, Rod End.
C Lift Ram, Rod End.
D Lift Ram, Head End.
E Excavator Valve, High Pressure Carry-over.
F Exhaust.
G Feed.

After Replacement.

Adjust main relief valve (see page E4-10)



LOADER VALVE (Hamworthy)

Dismantling and Assembly Spools

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

When Dismantling

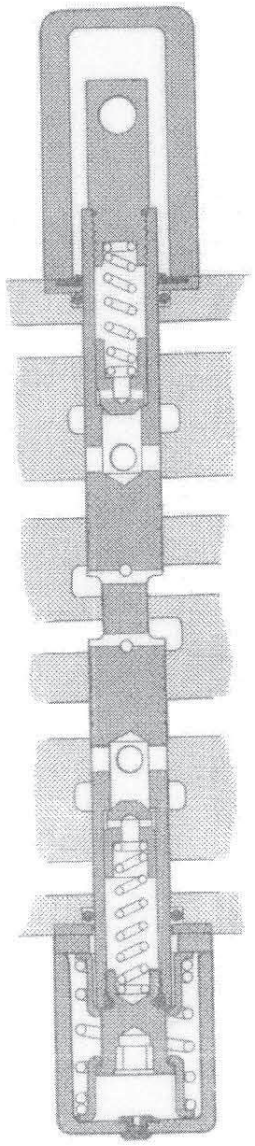
To prevent spool rotating when removing items **12** and **22** use barrel clamp part no. 992/02100 with the spool protruding from the block. Alternatively items **12** to **26** may be removed as an assembly and mounted in a vice for dismantling. Use a soft jaws if the barrel clamp is not available.

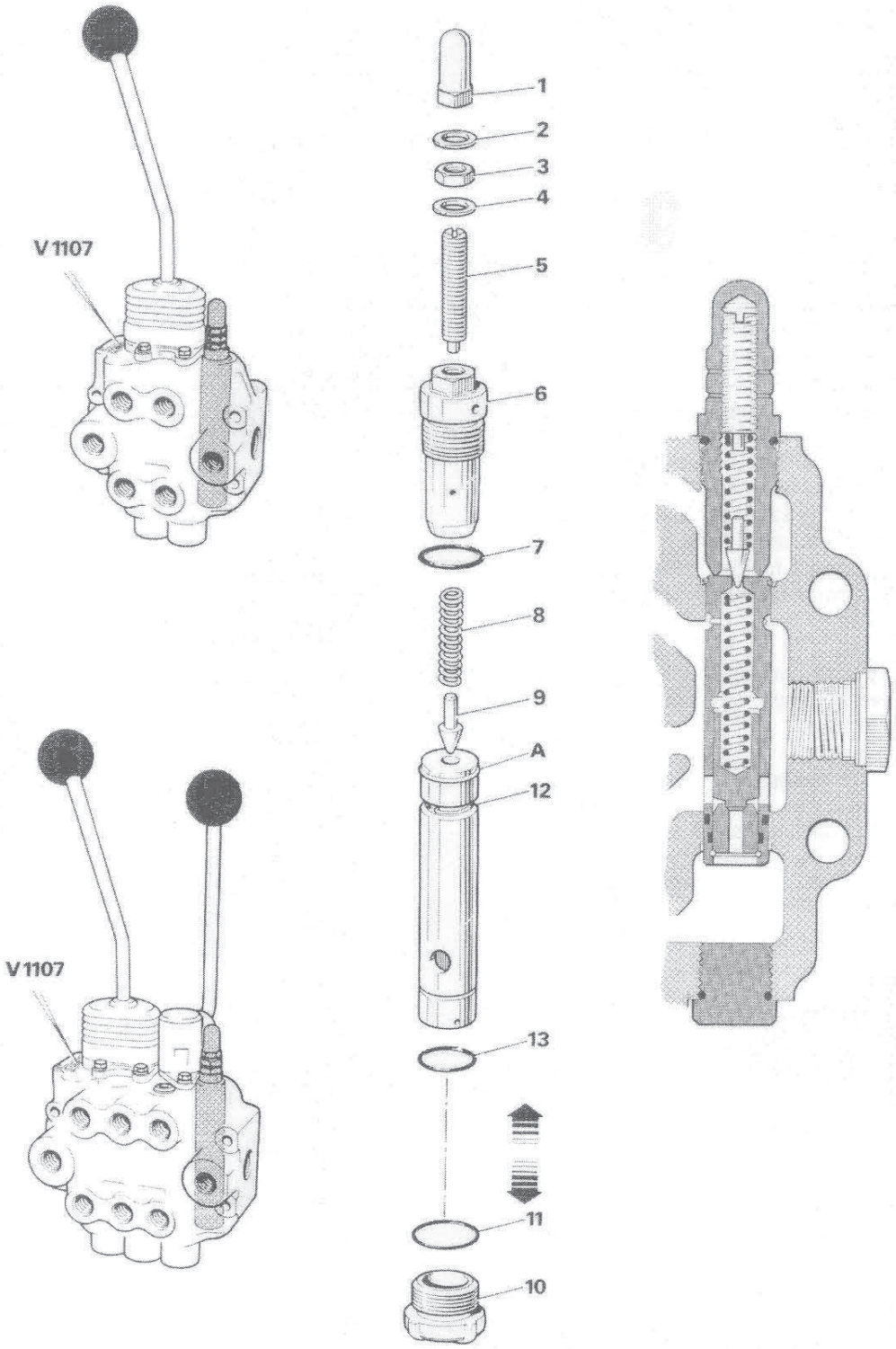
Lable any spool removed to ensure replacement the right way round in the correct bore.

When Assembling

Renew all O rings and seals.

Lubricate all internal parts with JCB Special Hydraulic fluid.





LOADER VALVE (Hamworthy)

Dismantling and Assembly Main Relief Valve (M.R.V.)

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

NOTE: The M.R.V. type shown is fitted only to valve blocks with the serial number prefixed 'V1107'

When Dismantling

Drive out cartridge **12** in an upwards direction, using a brass or bronze drift.

Label any spool removed to ensure replacement the right way round in the correct bore.

When Assembling

Renew all O rings and seals.

If any wearing part requires renewal, the mating part should also be renewed.

Lubricate all internal parts with JCB Special Hydraulic fluid.

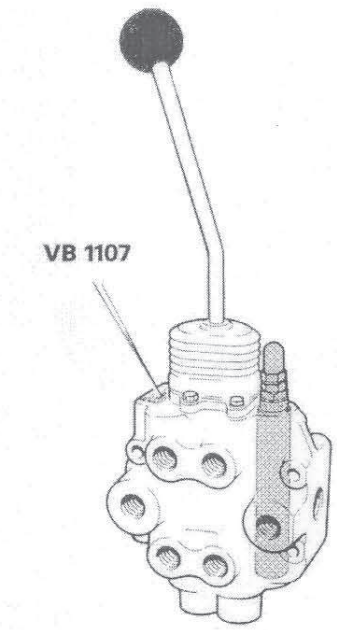
Drive in the cartridge until the snap ring A locates in the housing recess.

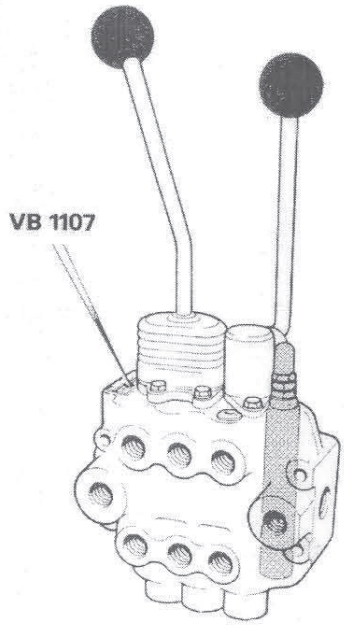
Lightly grease items **8** and **9** to retain in position.

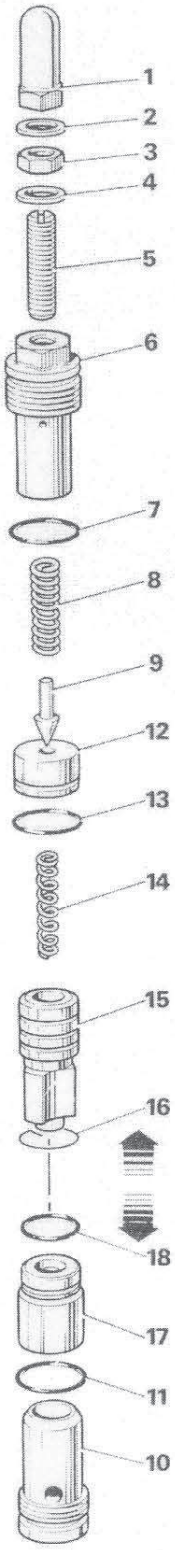
Torque Settings

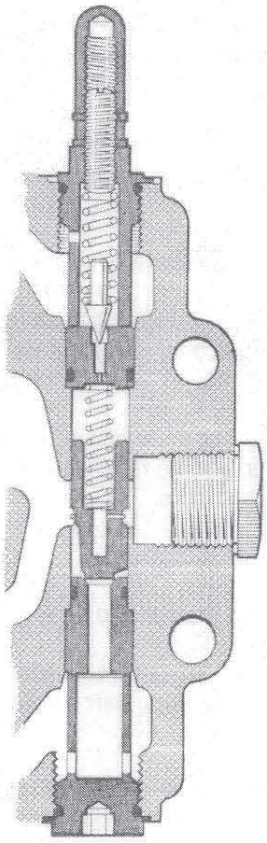
Item	lbf ft	kgf m
6	30	4.1

NOTE: After assembly the pressure setting must be adjusted see page E4-10









LOADER VALVE (Hamworthy)

Dismantling and Assembly Main Relief Valve (M.R.V.)

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

NOTE: The M.R.V. type shown is fitted only to valve blocks with the serial number prefixed 'V1107'

When Dismantling

Tap out items 12 to 16 using a mild steel rod 0.25in (6mm) dia; passed through valve seat 17

Use a brass or bronzed rod 0.625in (15.8mm) dis to drive out the valve seat in the opposite direction.

When Assembling

Renew all O rings and seals.

Do not grind or lap plunger 15 to its seat as the components have a ground finish.

If any wearing part requires renewal, the mating part should also be renewed.

Lubricate all internal parts with JCB Special Hydraulic fluid.

Lightly grease items **8** and **9** to retain in position.

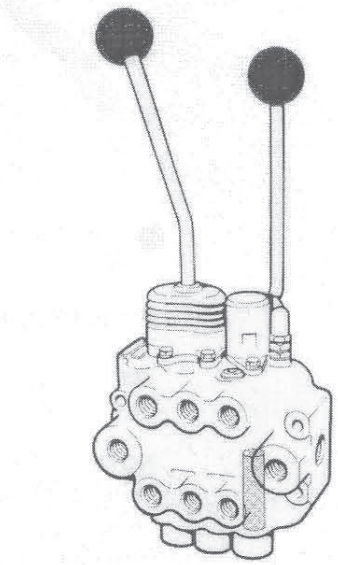
Torque Settings

Item	lbf ft	kgf m
6	30	4.1

NOTE: After assembly the pressure setting must be adjusted see page E4-10

LOADER VALVE (Hamworthy)

Dismantling and Assembly Auxiliary Relief Valve (A.R.V.)



The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

When Dismantling

Hold cartridge body **4** in a barrel clamp part no 892/00039

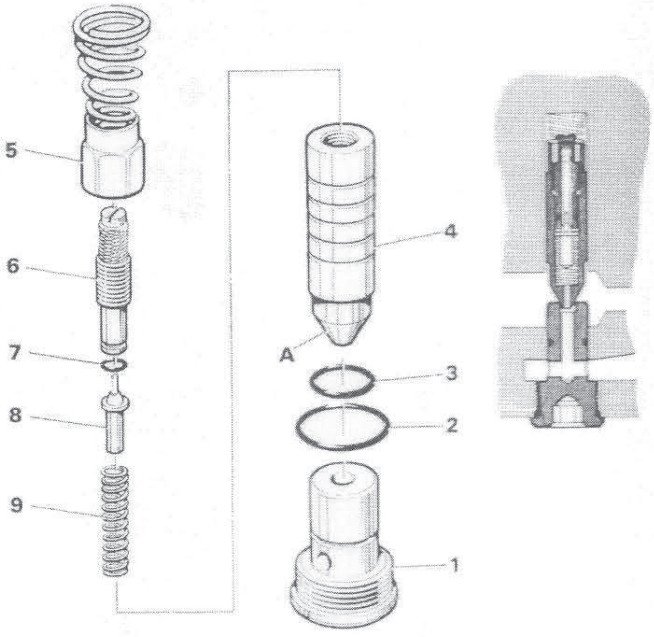
When Assembling

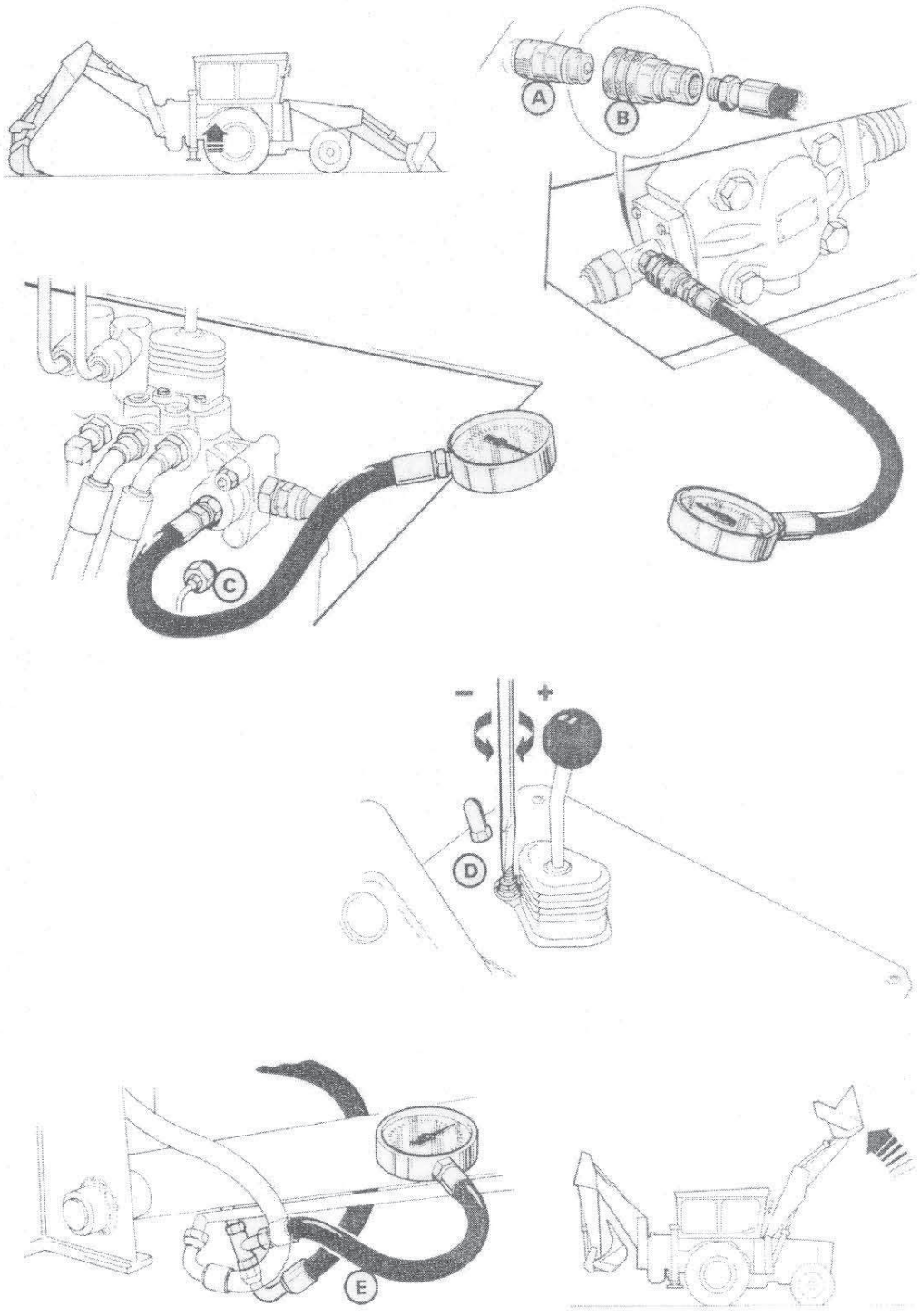
If seating face **A** of valve is worn, renew both valve and seat **1**

Renew O rings

Thoroughly clean all components and lubricate with JCB Special hydraculic fluid.

If dismantled beyond item **5** it is essential to reset the A.R.V. pilot setting (see page E 6-7)





LOADER VALVE (Hamworthy)

Main Relief Valve (M.R.V.) Pressure Testing

1. With shovel and bucket on the ground and engine stopped, operate all control levers to vent residual pressure.

2. Connect a 0-6000 lbf/in² (420 kgf/cm²) pressure gauge fitted with a snubber (see service tools catalogue) to test adapter A using service tool B part no 892/00099. If adapter A is not fitted, remove plug or connection C and connect gauge into excavator valve.

NOTE: On loading shovel machines, begin the test at operation 6.

3. With engine running at maximum rev/min, fully retract a stabiliser ram and note maximum gauge reading, which should equal the pressure specified in Technical Data.

4. Repeat the check by operating other excavator services, when a similar gauge reading should be obtained in each case. A low reading on any one service would indicate a fault with that service, e,g. fluid leakage, defective ram seals or defective auxiliary relief valve (A.R.V.)

NOTE: There are no A.R.V. 's in the stabiliser services.

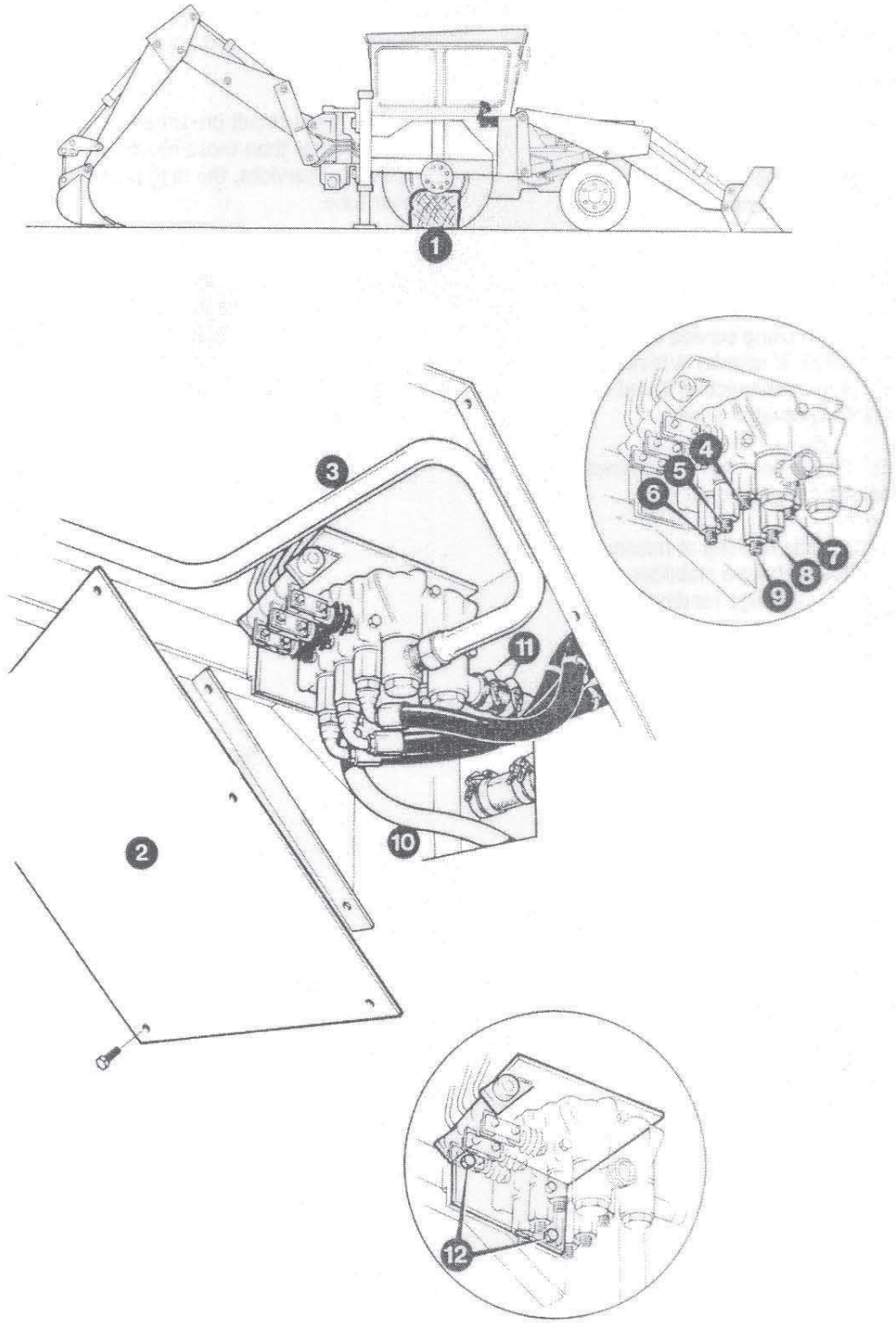
5. If a consistently high reading is obtained on all excavator services, adjust the M.R.V. setting as shown at D. If a consistently low reading is obtained, proceed to the shovel circuit as follows:

6. With a gauge connecected at A run engine at Maximum rev/min, fully extend the lift rams, and note the maximum gauge reading. Repeat the check with the shovel rams.

If adapter A is not fitted, connect a tee-piece into the lift ram, feed as at E. Run the engine at maximum rev/min, extend the lift rams to full travel and note the maximum gauge reading.

If the shovel circuit pressures are consistently higher than those recorded on the excavator services, the high pressure carry-over tube.

7. If all the gauge readings are approximately equal, but differ from the specified M.R/V. settin, adjust the M.R.V. as shown at D. Before setting the pressure, unscrew the adjusting screw two or three turns to release any trapped dirt.



LOADER VALVE (Cessna)
To M/c No. 104066

Removal and Replacement

Stage 1.

The numerical sequence shown on the illustration is intended as a guide to removal.

For assembly the sequence should be reversed.

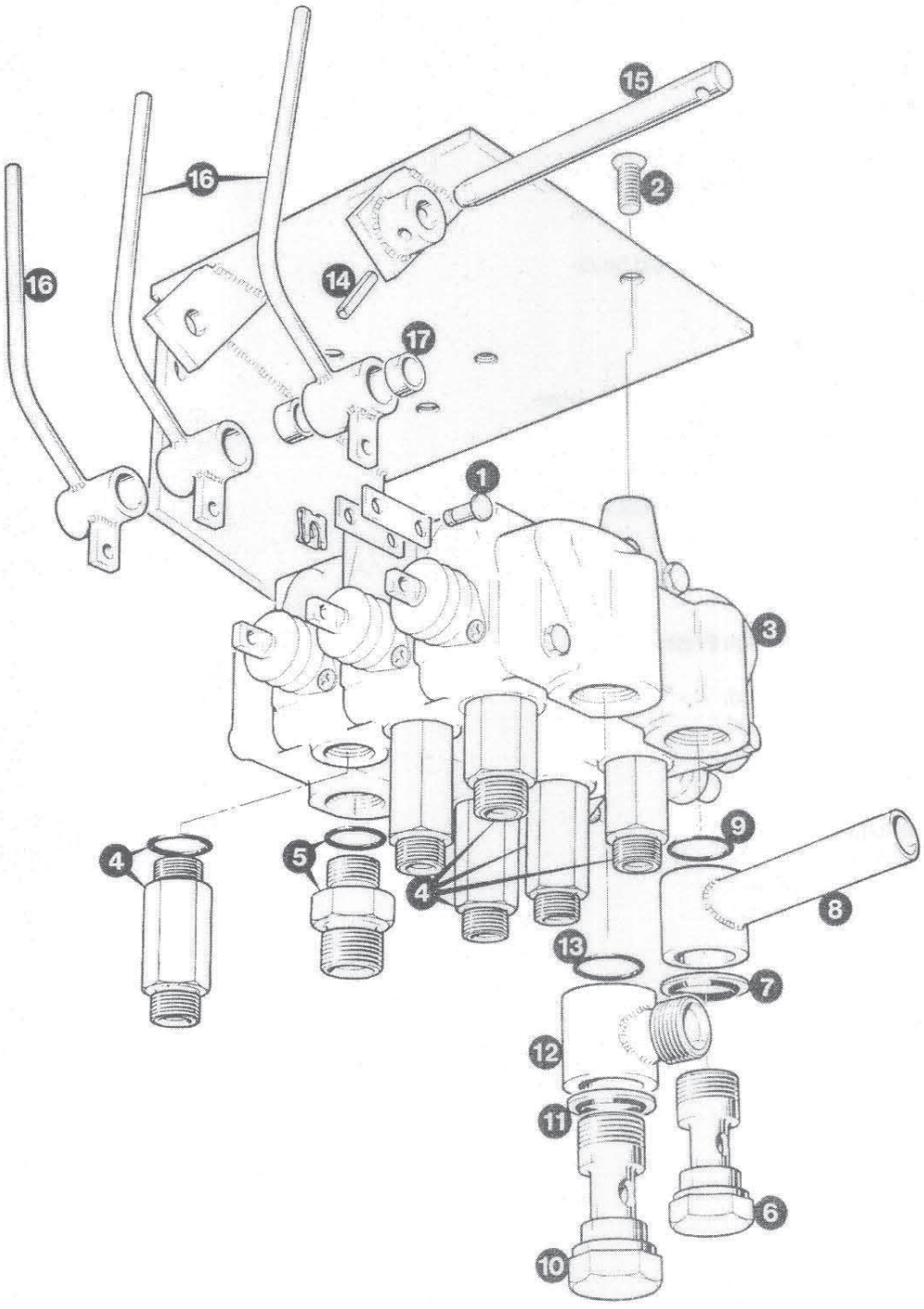
When Removing

Prior to disconnecting hoses and pipes, operate control levers to vent pressure and label hoses **4** to **9** to ensure correct replacement.

Blank all hoses and pipes to prevent entry of dirt and loss of hydraulic fluid.

Connections

3. Excavator Valve High Pressure Carry-over.
4. Clam Ram Head End.
5. Shovel Ram Rod End.
6. Lift Ram Head End.
7. Clam Ram Rod End.
8. Shovel Ram Head End.
9. Lift Ram Rod End.
10. Feed.
11. Exhaust.



LOADER VALVE (Cessna)
To M/c No. 104066

Removal and Replacement

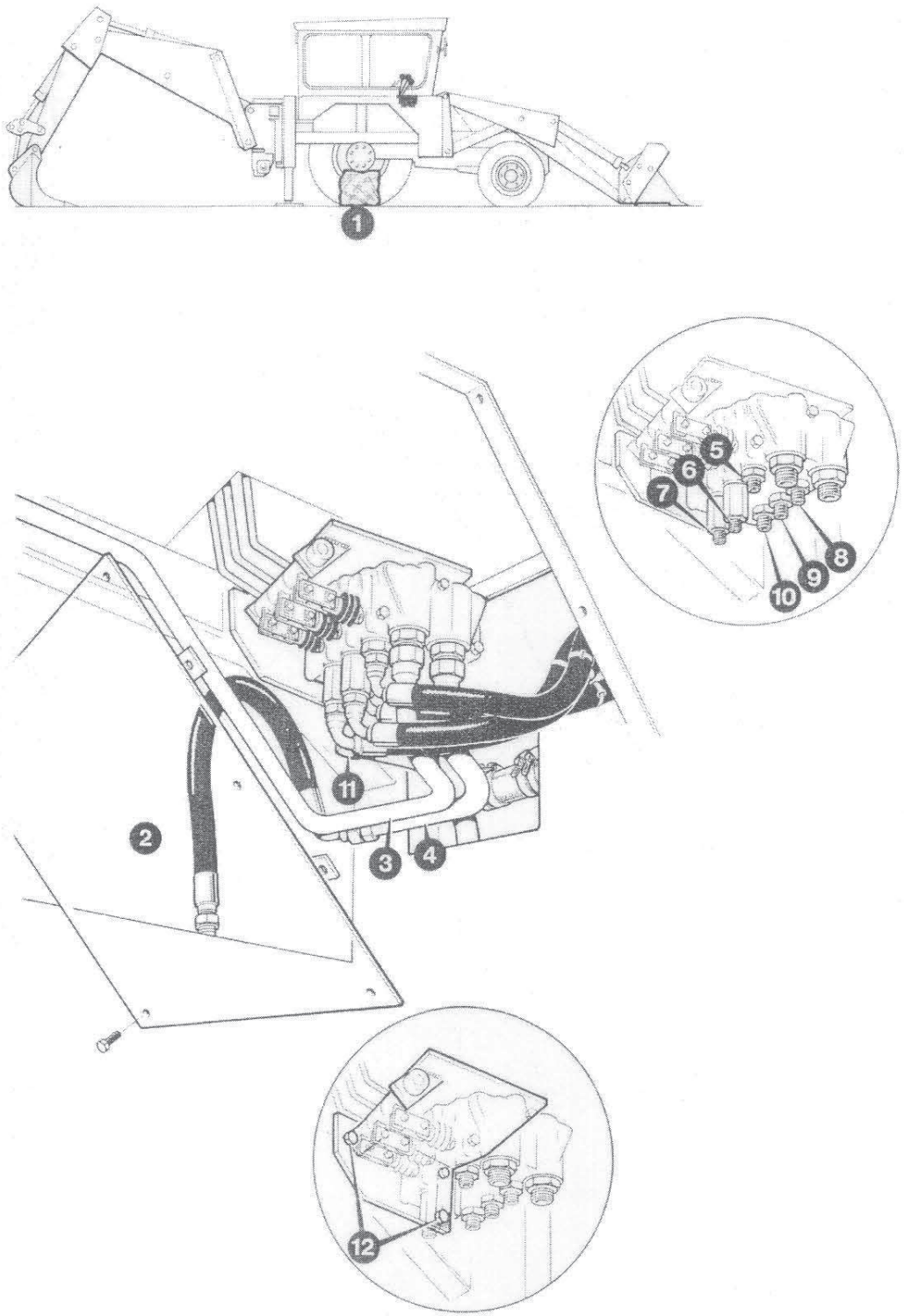
Stage 2.

The numerical sequence shown on the illustration is intended as a guide to removal.

For assembly the sequence should be reversed.

When Replacing

Renew all O rings and bonded washers.



LOADER VALVE (Cessna)
From M/c No. 104067

Removal and Replacement

Stage 1.

The numerical sequence shown on the illustration is intended as a guide to removal.

For assembly the sequence should be reversed.

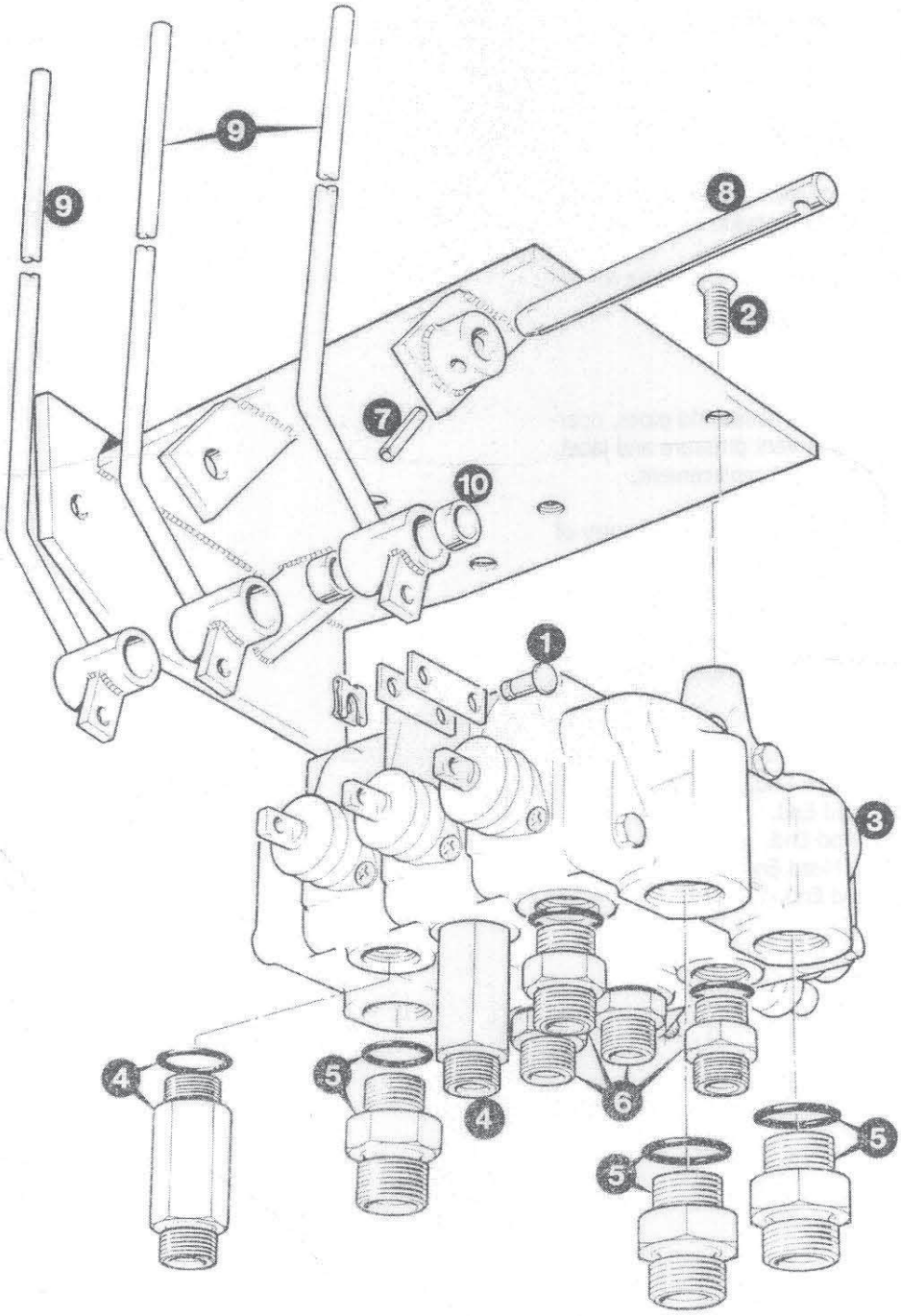
When Removing

Prior to disconnecting hoses and pipes, operate control levers to vent pressure and label hoses to ensure correct replacement.

Blank all hoses and pipes to prevent entry of dirt and loss of hydraulic fluid.

Connections

3. Excavator Valve High Pressure Carry-over.
4. Exhaust.
5. Clam Ram Head End.
6. Shovel Ram Rod End.
7. Lift Ram Head End.
8. Clam Ram Rod End.
9. Shovel Ram Head End.
10. Lift Ram Rod End.
11. Feed.



LOADER VALVE (Cessna)
From M/c No. 104067

Removal and Replacement

Stage 2.

The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement the sequence should be reversed.

When Replacing

Renew all O rings

LOADER VALVE (Cessna)

Dismantling and Assembly

The control valve comprises three control sections, as listed below, plus two end covers. These are held together by tie bolts and the interconnecting galleries are sealed by O rings.

1. Lift Ram Section (ZB)
2. Shovel Tilt Section (WW)
3. Shovel Clam or Attachment Service Section (CC)

The sections may be separated by removing the through bolts or dismantled in situ as described on their respective pages.

When Dismantling

Mark each section to ensure correct reassembly.

When Assembling

Renew O rings and lubricate with Mobilplex 47 or similar mineral-based grease.

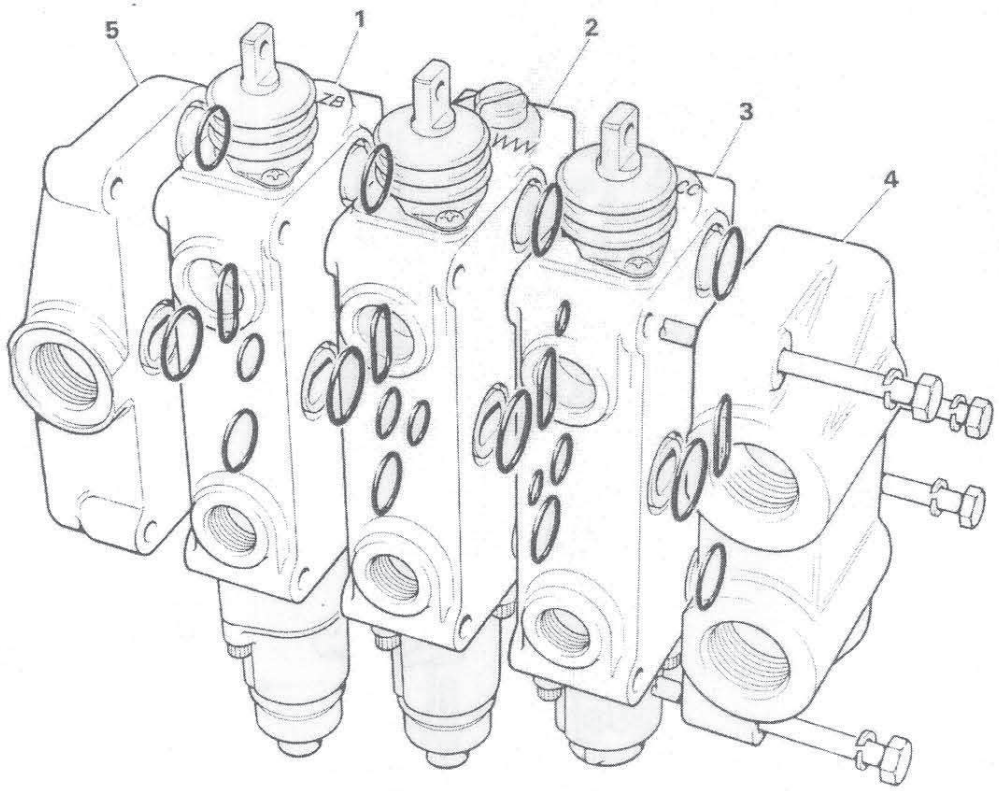
Ensure correct alignment of sections as follows:

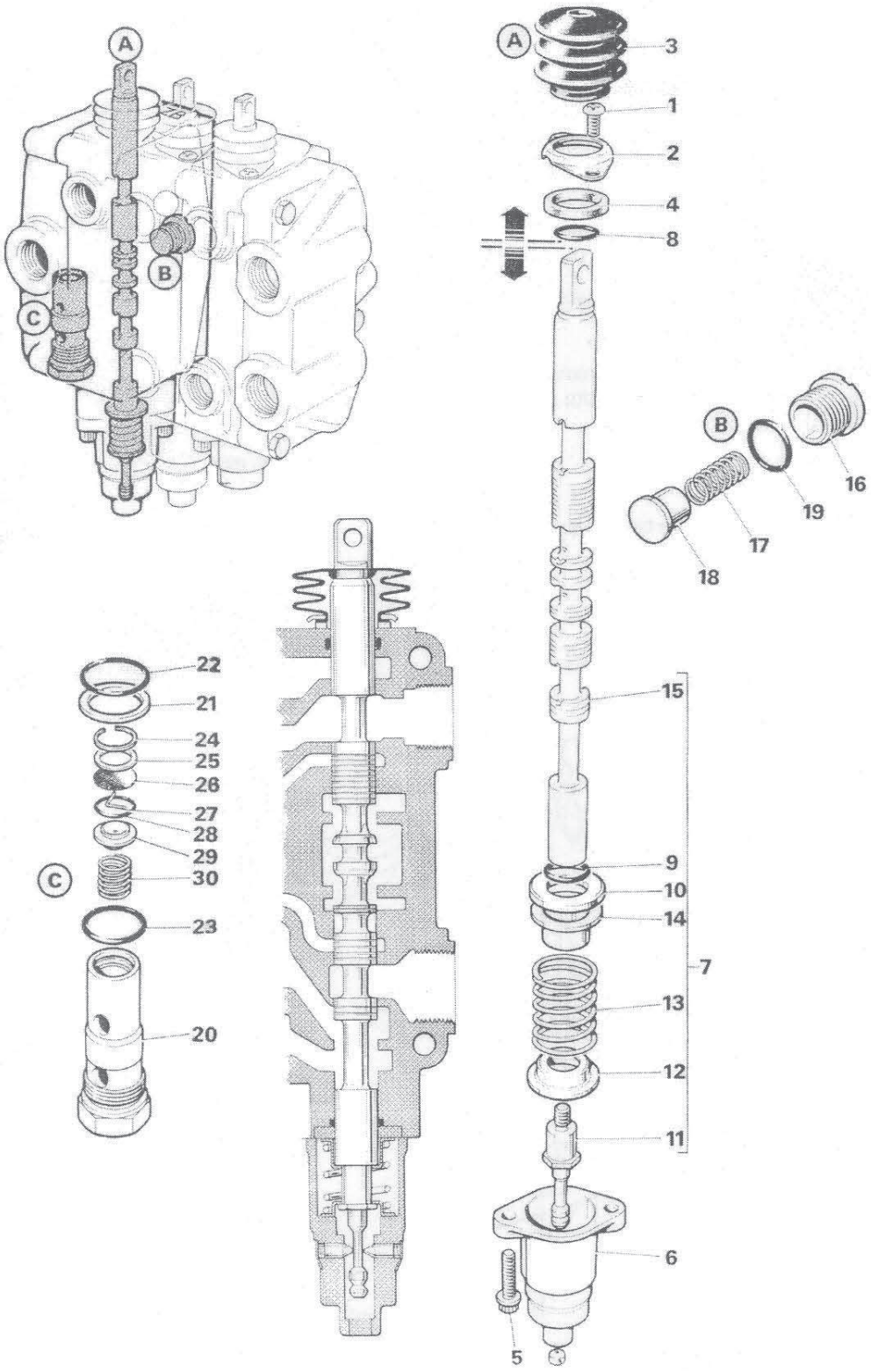
1. Install bolts through end plate **4**.

2. Lay end plate on bench, bolts pointing upwards.

3. Stack control sections and end plate 5 on to the bolts, ensuring that O rings are correctly positioned.

4. Tighten bolts evenly to 25-40 lbf ft (3.5-5.5 kgf m).





LOADER VALVE (Cessna) -ZB Section

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling.

For assembly the sequence is reversed.

A – LIFT RAM SPOOL

When Dismantling

Do not remove screw **11** unless spring **13** is broken.

When Assembling

Remove minor nicks and burrs. Excessive wear on spool **15** or in its bore, must be remedied by renewal of the complete control section.

If screw **11** has been removed re-assemble using Loctite 241

Renew O rings **8** and **9**.

Torque Settings

Item	lbf ft	kgf m
5	10-13	1.4-1.8
11	5-8	0.7-1.1

B– NON RETURN VALVE

When Assembling

Renew O ring 19

C-MAIN RELIEF VALVE

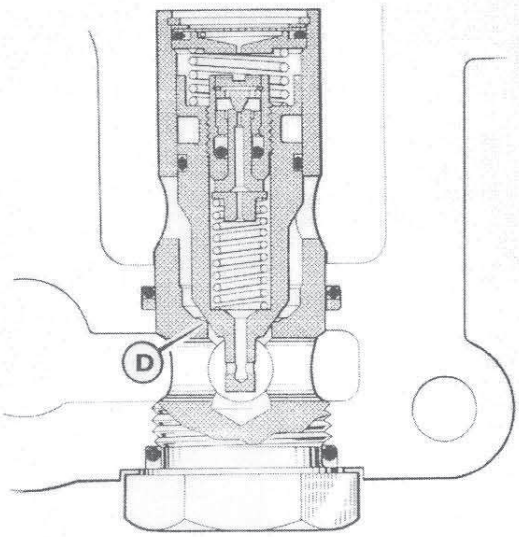
When Dismantling

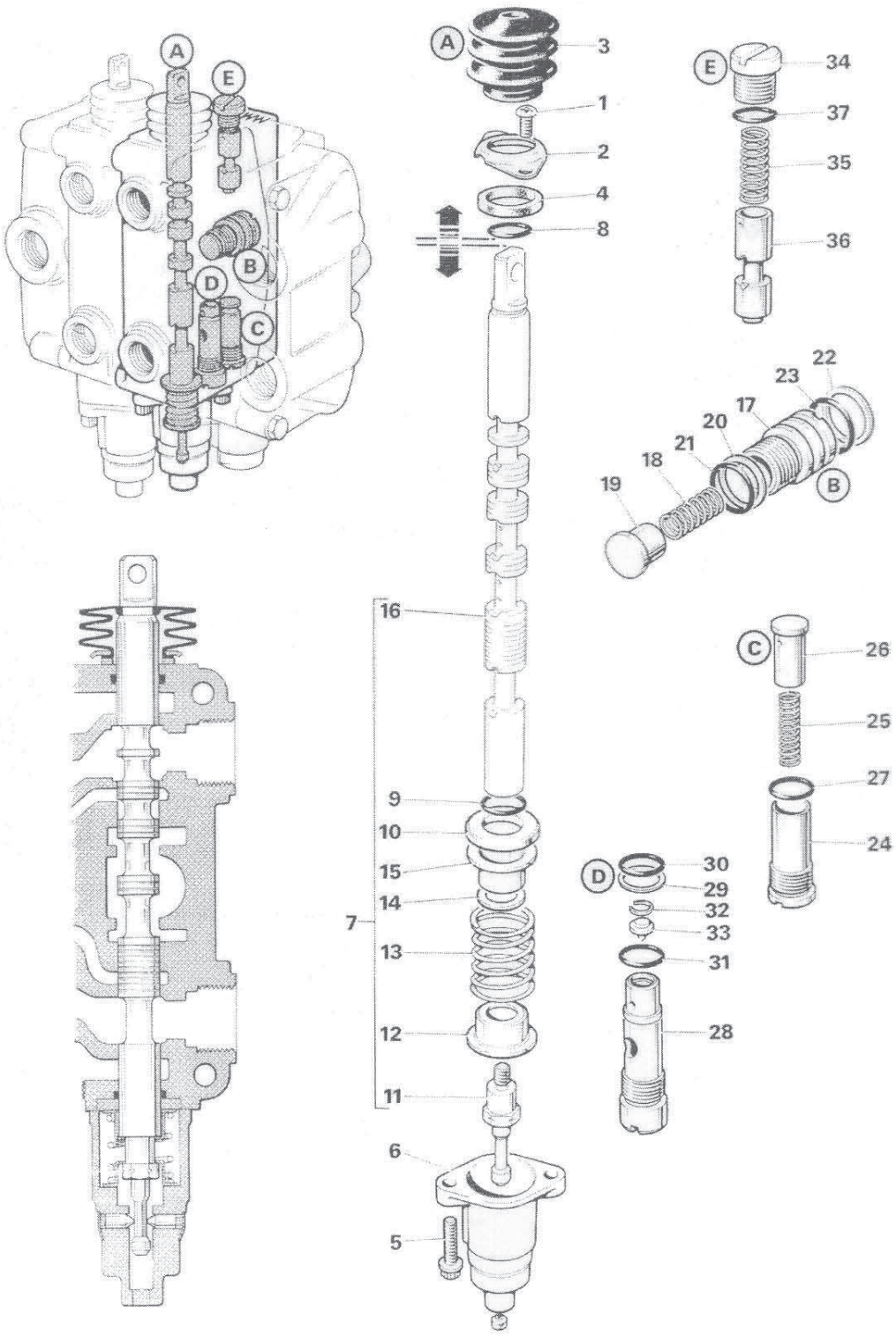
Components remaining inside item **20** cannot be renewed separately and should not be disturbed unless it is necessary to remove dirt trapped beneath seat D.

When Assembling

Ensure that the orifice in the centre of plate **29** is clear. Do not probe with wire.

Renew washer **21** and O rings **22**, **23** and **28**





LOADER VALVE (Cessna) -WW Section

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling.

For assembly the sequence is reversed.

A – SHOVEL TILT RAM SPOOL

When Dismantling

Do not remove screw **11** unless spring **13** is broken.

When Assembling

Remove minor nicks and burrs. Excessive wear on spool **15** or in its bore, must be remedied by renewal of the complete control section.

If screw **11** has been removed re-assemble using Loctite 241

Renew O rings **8** and **9**.

Torque Settings

Item	lbf ft	kgf m
5	10-13	1.4-1.8
11	5-8	0.7-1.1

B & C-NON RETURN VALVES

When Assembling

Renew O rings **21**, **23** and **27**, also back-up washers **20** and **22**

D– AUXILIARY RELIEF VALVE

When Dismantling

Components remaining inside item **28** cannot be renewed separately and should not be disturbed.

When Assembling

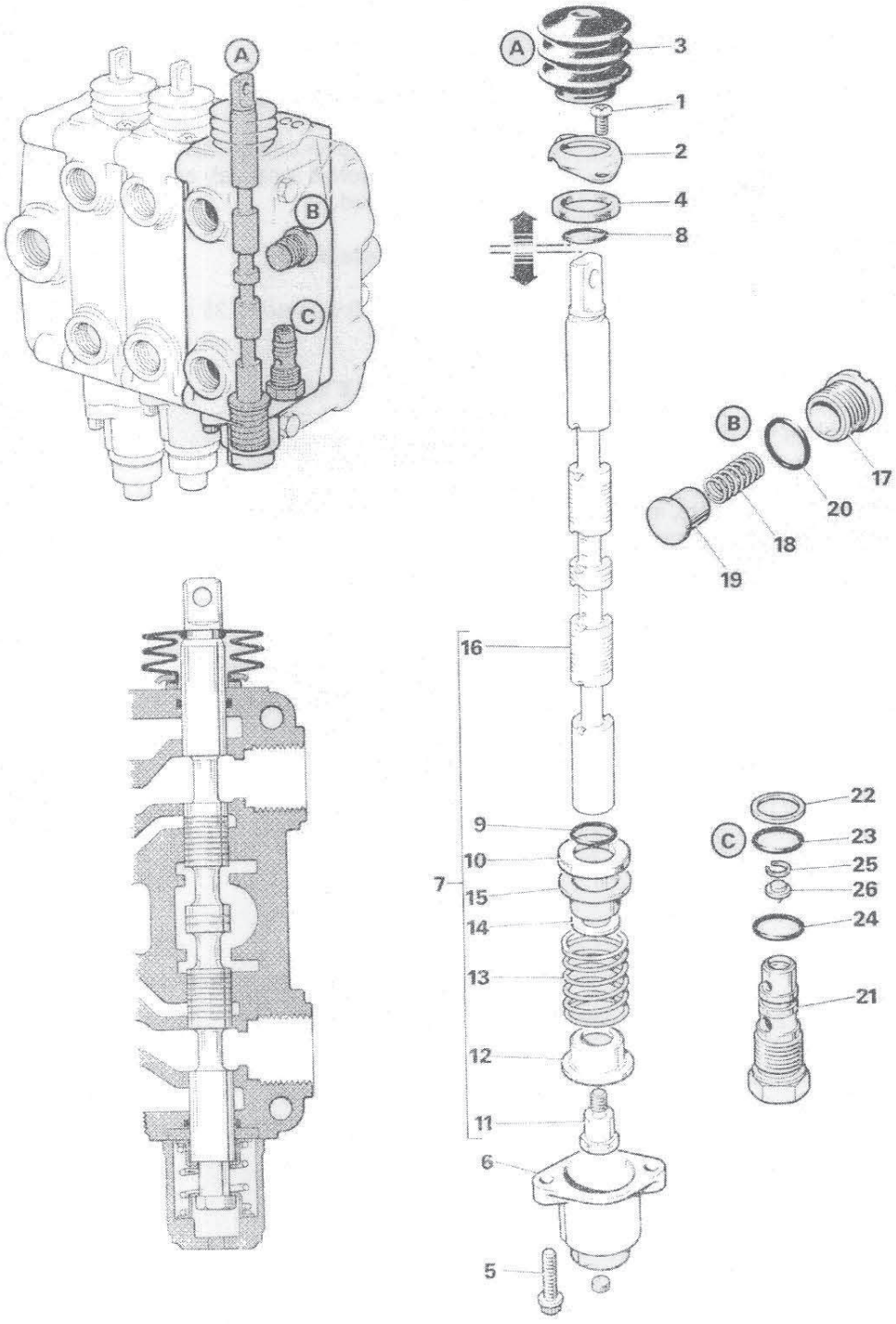
Renew back-up washer **29** and O rings **30** and **31**

E-SHUTTLE VALVE

When Assembling

Ensure that piston **36** slides freely in its bore.

Renew O ring **37**



LOADER VALVE (Cessna) -CC Section

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling.

For assembly the sequence is reversed.

A – SHOVEL CLAM OR ATTACHMENT SERVICE SPOOL

When Dismantling

Do not remove screw **11** unless spring **13** is broken.

When Assembling

Remove minor nicks and burrs. Excessive wear on spool **16** or in its bore, must be remedied by renewal of the complete control section.

If screw **11** has been removed re-assemble using Loctite 241

Renew O rings **8** and **9**.

Torque Settings

Item	lbf ft	kgf m
5	10-13	1.4-1.8
11	5-8	0.7-1.1

B– NON RETURN VALVE

When Assembling

Renew O ring **20**

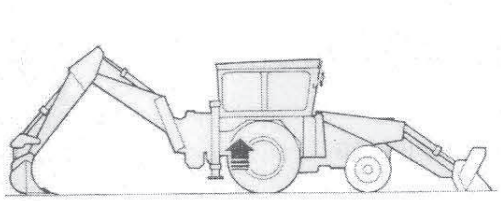
C-AUXILIARY RELIEF VALVE

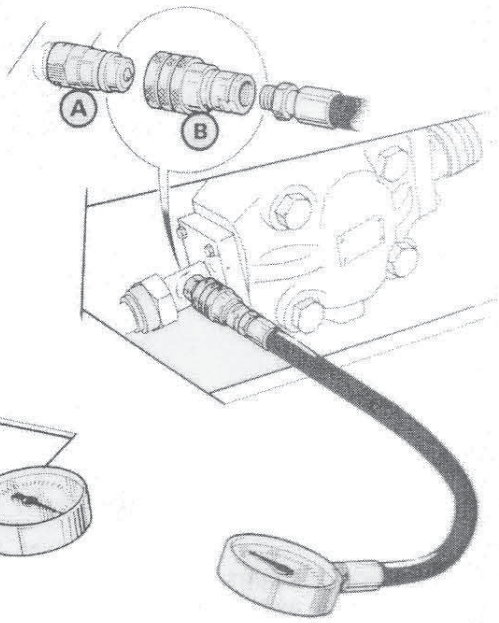
When Dismantling

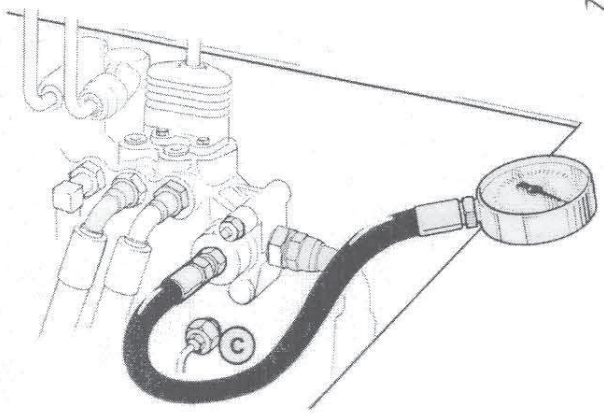
Components remaining inside item **21** cannot be renewed separately and should not be disturbed.

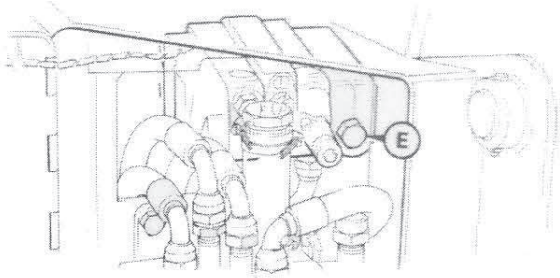
When Assembling

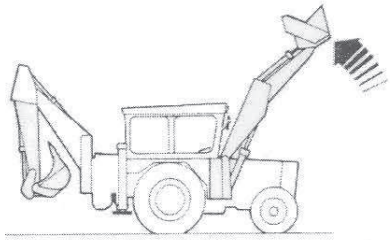
Renew back-up washer **22** and O rings **23** and **24**

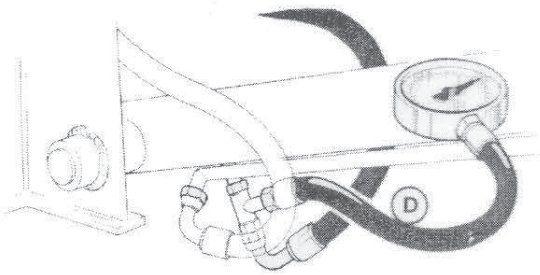












LOADER VALVE (CESSNA)

Main Relief Valve (M.R.V.) Pressure Testing

1. With shovel and bucket on the ground and engine stopped, operate all control levers to vent residual pressure.

2. Connect a 0-6000 lbf/in² (420 kgf/cm²) pressure gauge fitted with a snubber (see service tools catalogue) to test adapter **A** using service tool **B** part no 892/00099. If adapter **A** is not fitted, remove plug or connection **C** and connect gauge into excavator valve.

NOTE: On loading shovel machines, begin the test at operation **6**.

3. With engine running at maximum rev/min, fully retract a stabiliser ram and note maximum gauge reading, which should equal the pressure specified in Technical Data.

4. Repeat the check by operating other excavator services, when a similar gauge reading should be obtained in each case. A low reading on any one service would indicate a fault with that service, e,g. fluid leakage, defective ram seals or defective auxiliary relief valve (A.R.V.)

NOTE: There are no A.R.V. 's in the stabiliser services.

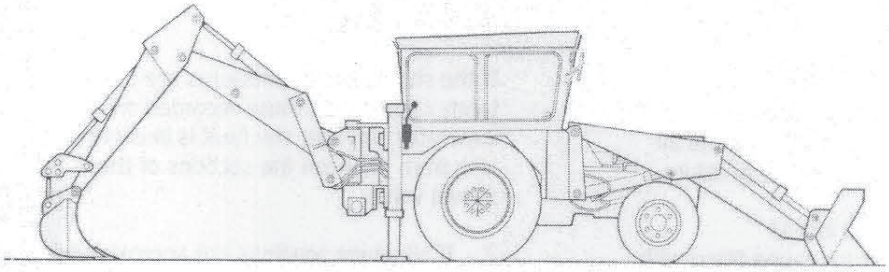
5. If an incorrect reading is obtained on all excavator services, proceed to the shovel circuit as follows:

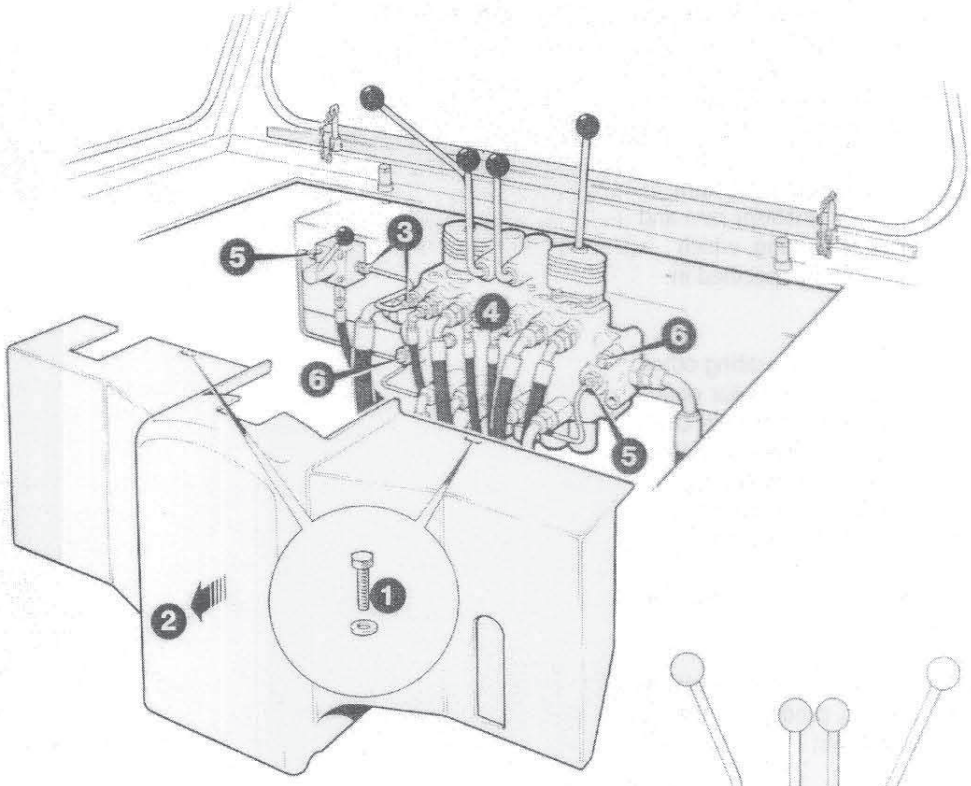
6. With a gauge connected at **A** run engine at Maximum rev/min, fully extend the lift rams, and note the maximum gauge reading. Repeat the check with the shovel rams.

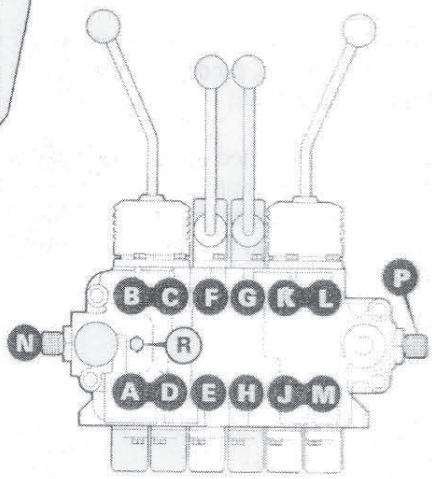
If adapter **A** is not fitted, connect a tee-piece into the lift ram, feed as at **D**. Run the engine at maximum rev/min, extend the lift rams to full travel and note the maximum gauge reading.

If the shovel circuit pressures are consistently higher than those recorded on the excavator services, the fault is likely to be a leak from between the sections of the shovel valve.

7. If all gauge readings are approximately equal, but differ from the specified M.R.V. setting, the M.R.V. E, which is none adjustable, must be removed and either cleaned or renewed.







EXCAVATOR VALVE

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal.

For assembly the sequence should be reversed.

When Removing

Prior to disconnecting hoses and pipes, operate control levers to vent pressure and label hoses **4** to **9** to ensure correct replacement.

Blank all hoses and pipes to prevent entry of dirt and loss of hydraulic fluid.

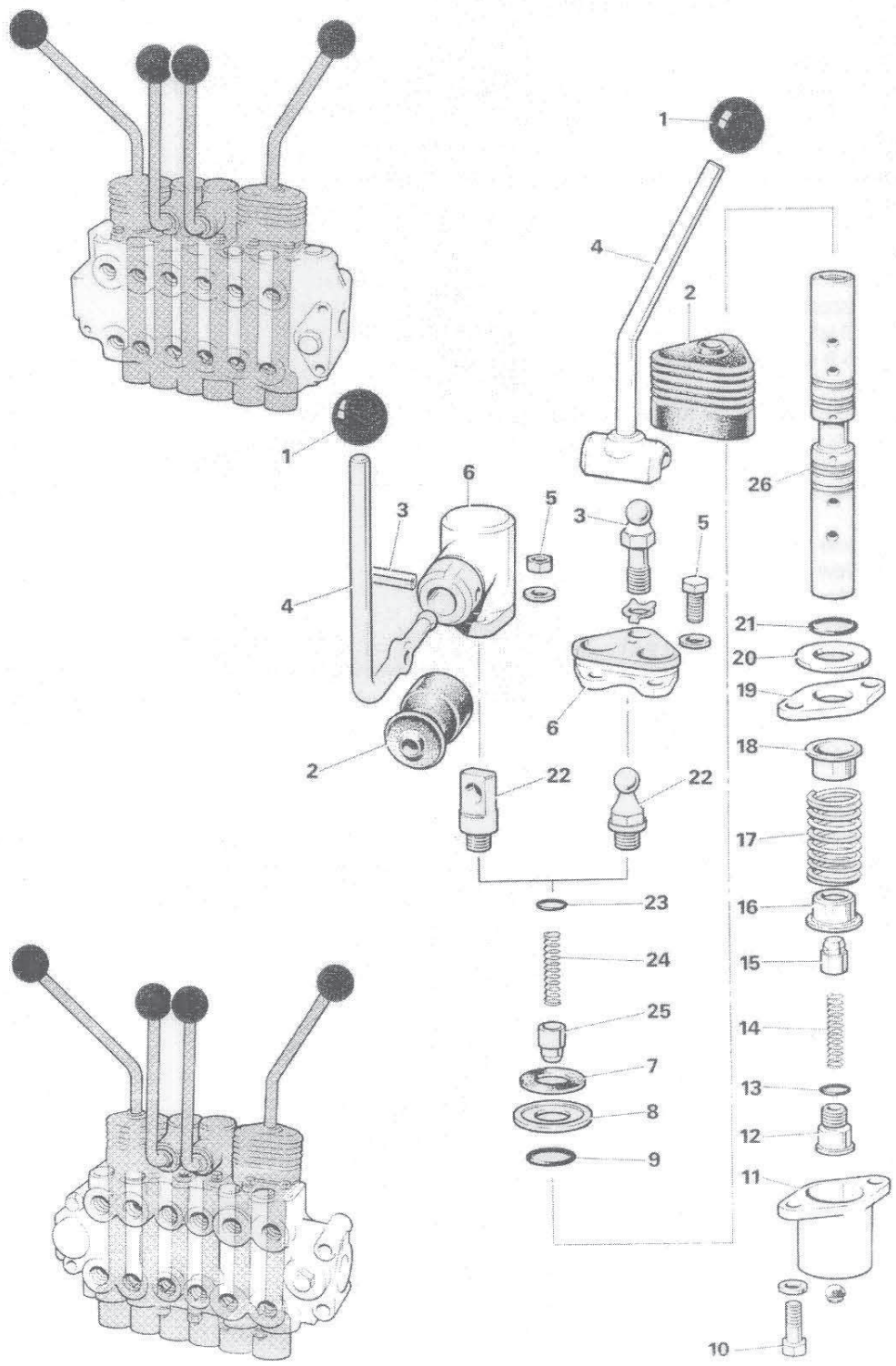
Connections

A L.H. Slew Cylinder
B R.H. Slew Cylinder
C Boom Ram, Head End
D Boom Ram, Rod End
E R.H. Stabiliser Ram, Head End
F R.H. Stabiliser Ram, Rod End
G L.H. Stabiliser Ram, Rod End
H L.H. Stabiliser Ram, Head End
J Bucket Ram, Rod End
K Bucket Ram, Head End
L Dipper Ram, Head End
M Dipper Ram, Rod End
N Exhaust to Tank
P Feed from Shovel Valve

NOTE: L.H. and R.H. indicate left hand and right hand when viewed from the rear of the machine.

After Replacement

If slew override is excessive, this may be due to air trapped in the A.R.V. cavity. Slacken plug **R** and gently operate the slew service until air is expelled. Re-tighten plug.



EXCAVATOR VALVE

Dismantling and Assembly Spools

The numerical sequence shown on the illustration is intended as a guide to dismantling.

For assembly the sequence should be reversed.

When Dismantling

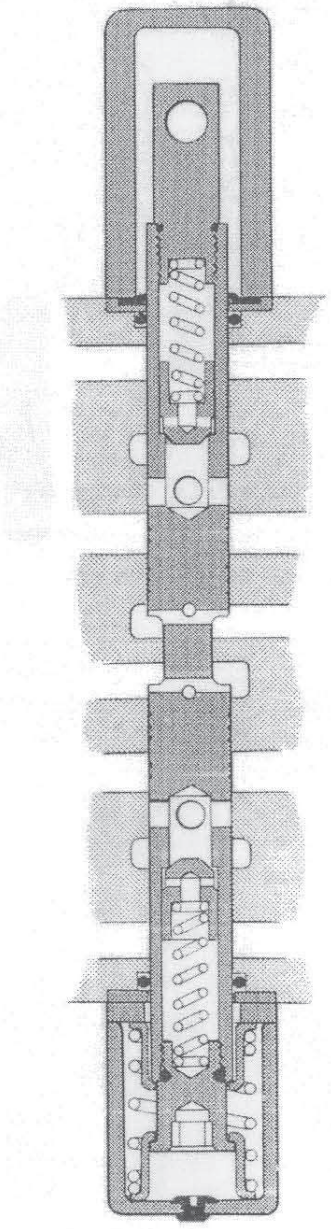
To prevent spool rotating when removing items **12** and **22** use barrel clamp part no. 992/02100 with the spool protruding from the block. Alternatively items **12** to **26** may be removed as an assembly and mounted in a vice for dismantling. Use a soft jaws if the barrel clamp is not available.

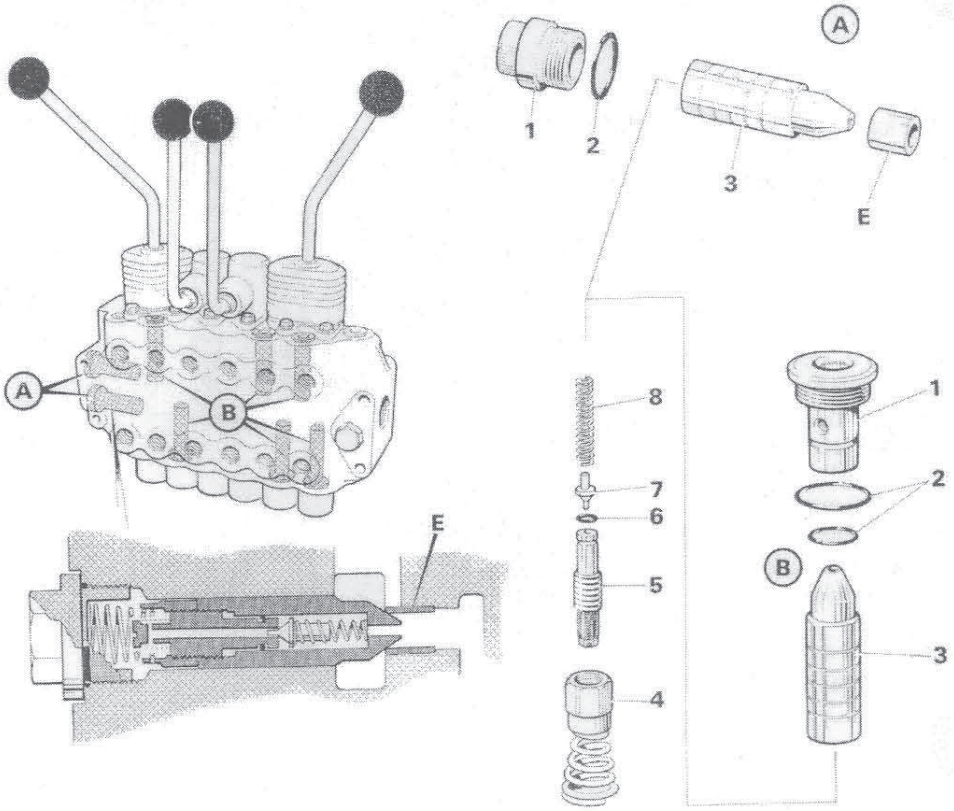
Label any spool removed to ensure replacement the right way round in the correct bore.

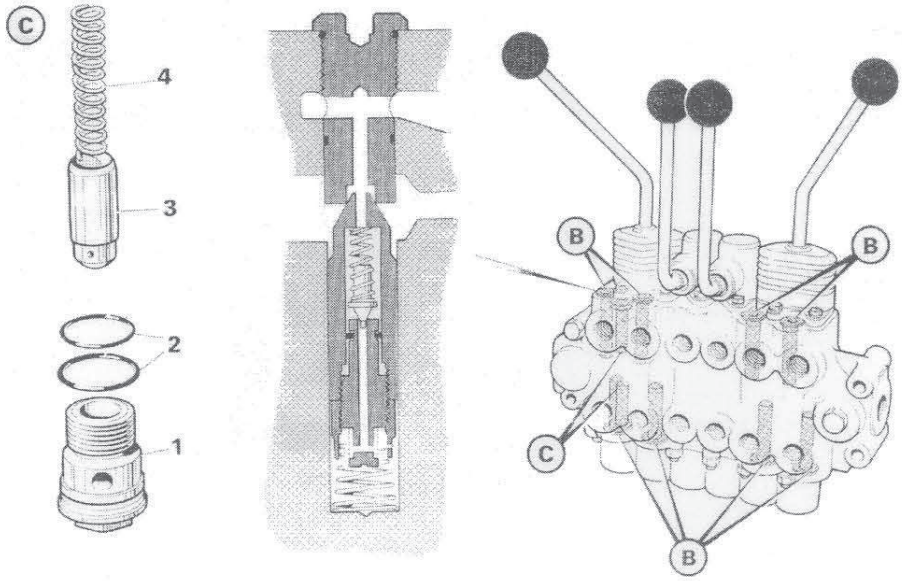
When Assembling

Renew all O rings and seals.

Lubricate all internal parts with JCB Special Hydraulic fluid.



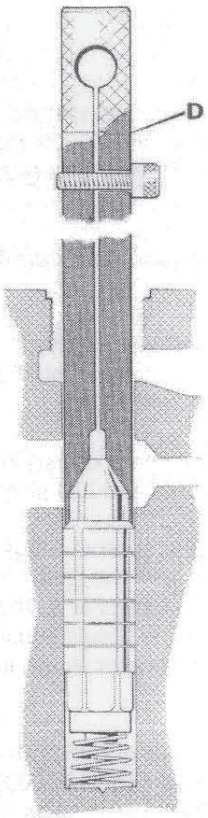




EXCAVATOR VALVE

Dismantling and Assembly
Spools

A- Auxiliary Relief Valve (A.R.V.)
(To machine No 58449 only)
B- Auxiliary Relief Valve (A.R.V.)
(All Machines)
C- Anti-cavitation Valve
(From machine No 58450)



The numerical sequence shown on the illustration is intended as a guide to dismantling.

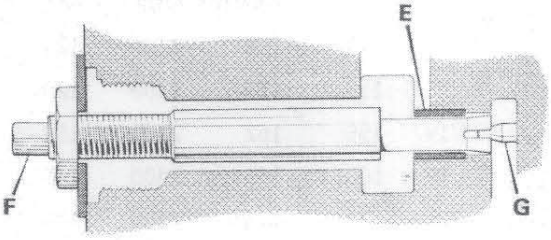
For assembly the sequence should be reversed.

NOTE: To remove relief valves B from valve block, use extractor D part no 992/02800

When Dismantling

Hold cartridge body of valve A or B in a barrel clamp part no. 892/00039

If it is necessary to remove seat use extractor F, part no 992/02900. Insert tapered plug G into end of spigot and push spigot through valve seat until plug contacts gallery wall as shown. Strike end of extractor to expand spigot and then extract seat by tightening nut.



When Assembling

If seating face of valve is worn renew both valve and seat.

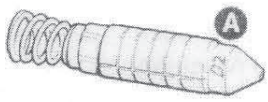
Renew all O rings.

Thoroughly clean all components and lubricate all internal parts with JCB Special Hydraulic fluid.

If A.R.V.'s A or B have been dismantled beyond item 4, it is essential to reset the pilot setting (see page 6-7)

AUXILIARY RELIEF VALVE
(Hamworthy Pilot Operated)

Pressure Testing

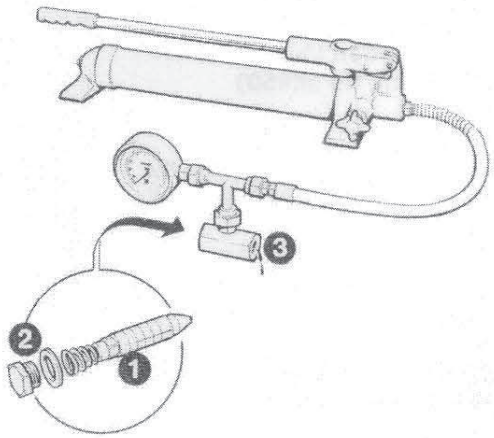


Connect a 0-6000 lbf/in² (420 kgf/cm²) pressure gauge, part no. 892/00001 to test fixture 992/01000 and hand pump P365 (see Service tools catalogue)

CAUTION: Do not connect the fixture to a motor driven pump.

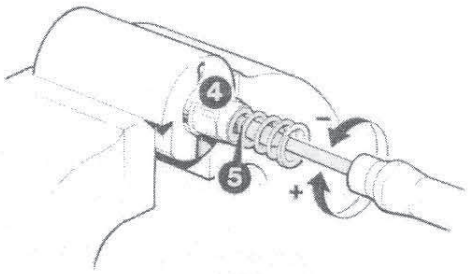
By reference to the table below, check that the correct code is engraved on the cartridge at A (See Technical Data)

Insert the cartridge 1 (cone end first) into the fixture and fit bonded seal and plug 2



Operate hand pump and observe gauge reading which will rise until the pilot valve operates and oil escapes at 3. The highest obtainable reading should equal the appropriate pilot setting as shown in the table.

To adjust the pilot setting, grip the cartridge in barrel clamp part no 892/00039, slacken locknut 4 and turn screw 5 as required. Recheck setting after tightening locknut.



Code		Operating Pressure			Pilot Setting		
Old	New	bar	kgf/cm²	lbf/in²	bar	kgf/cm²	lbf/in²
C1	21/197	145	148	2100	121	124	1760
C2	22/197	152	155	2200	128	131	1860
C3	23/197	156	162	2300	134	136	1940
C4	24/197	166	169	2400	140	143	2030
C5	25/197	172	176	2500	146	149	2120
C6	26/197	179	183	2600	152	155	2210
C7	27/197	186	190	2700	159	161	2300
C8	28/197	193	197	2800	164	167	2380
C9	29/197	200	204	2900	170	173	2470
D0	30/197	207	211	3000	177	180	2560

HYDRACLAMP SELECTOR VALVE AND CHECK VALVE

To Machine No. 129624

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement the sequence should be reversed.

When Removing

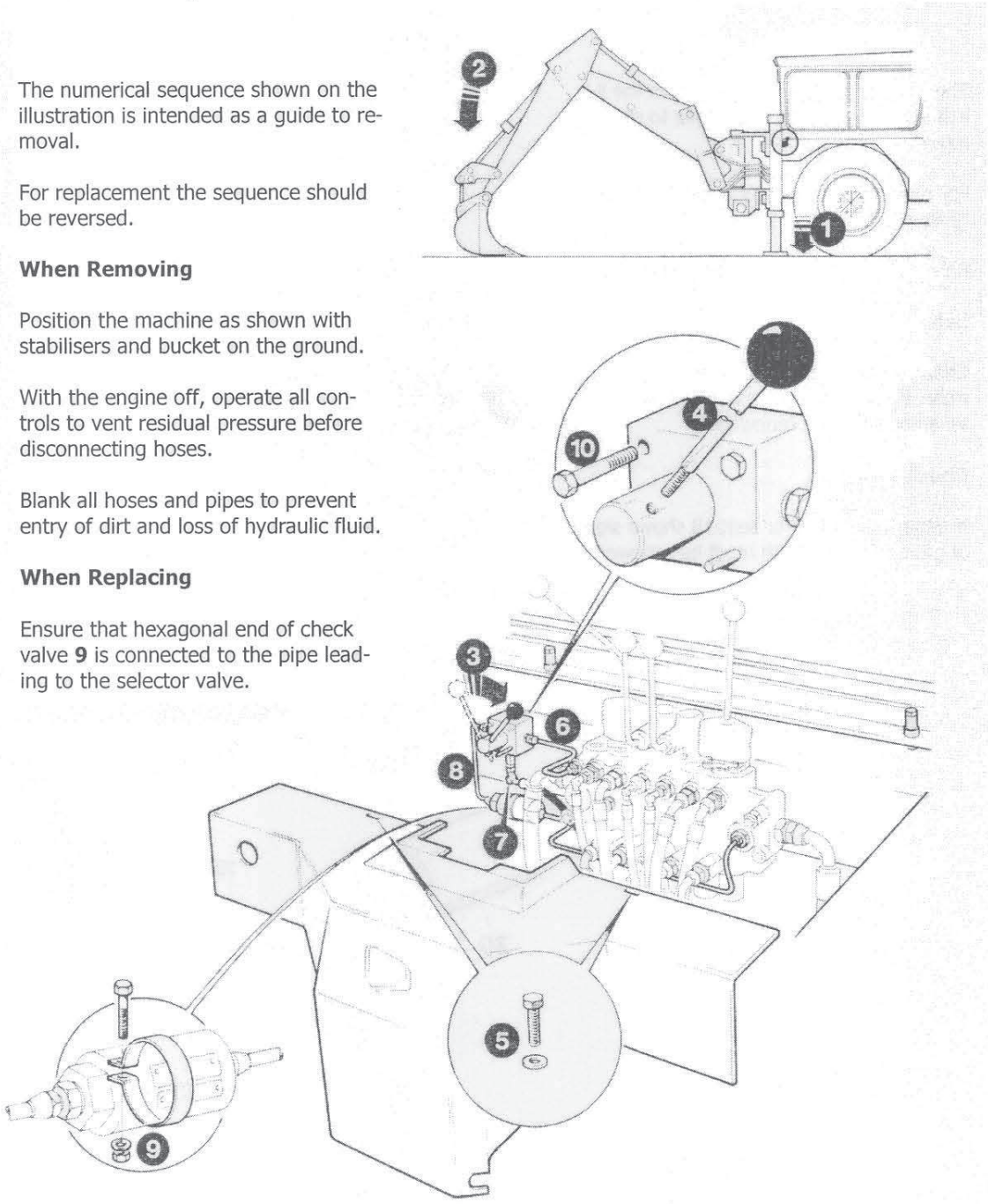
Position the machine as shown with stabilisers and bucket on the ground.

With the engine off, operate all controls to vent residual pressure before disconnecting hoses.

Blank all hoses and pipes to prevent entry of dirt and loss of hydraulic fluid.

When Replacing

Ensure that hexagonal end of check valve **9** is connected to the pipe leading to the selector valve.



HYDRACLAMP SELECTOR VALVE AND CHECK VALVE

To Machine No. 129624

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement the sequence should be reversed.

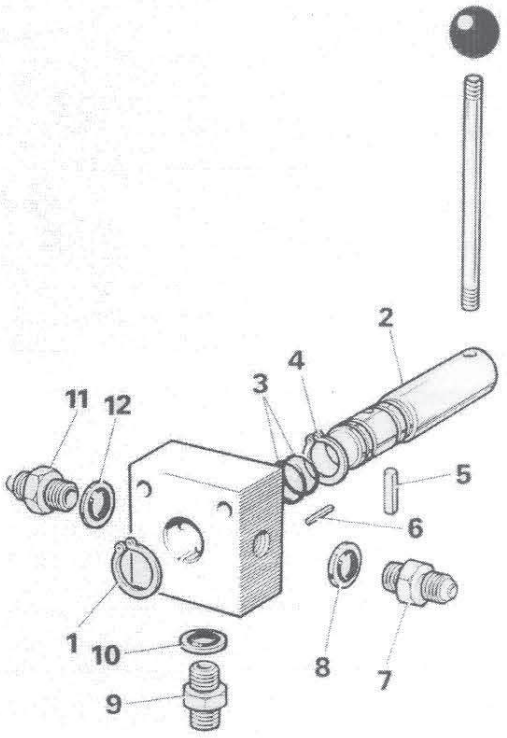
Renew all O rings and bonded washers.

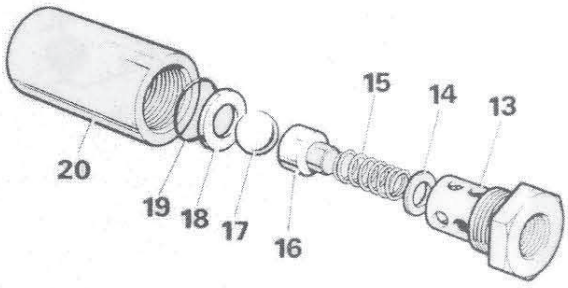
Selector Valves

Check spool 2 and body for scoring or wear. If either are unserviceable the valve assembly must be renewed.

Check Valve

If either the ball 17 or seat 18 shows signs of pitting or wear both must be renewed.





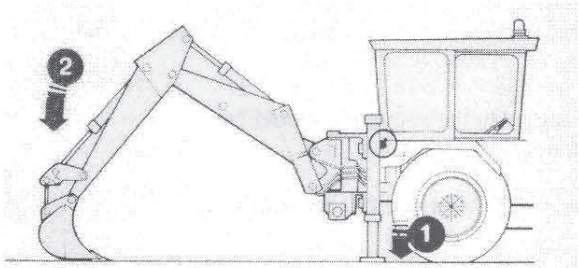
HYDRACLAMP SELECTOR VALVE AND CHECK VALVE

From Machine No. 129625

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement the sequence should be reversed.

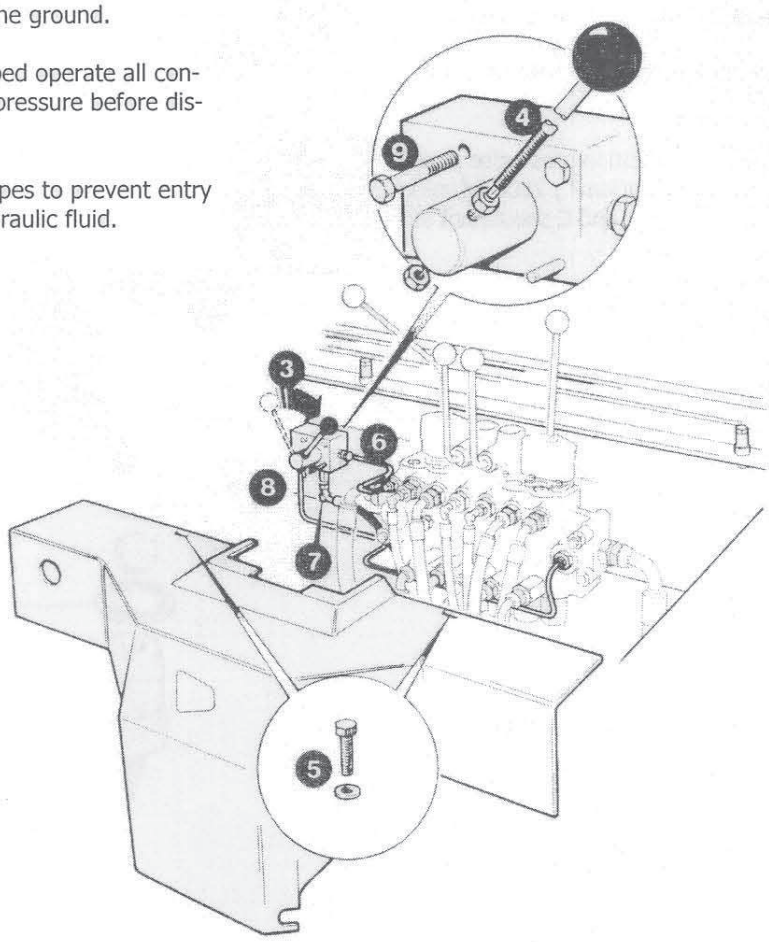


When Removing

Position the machine as shown with stabilisers and bucket on the ground.

With the engine stopped operate all controls to vent residual pressure before disconnecting hoses.

Blank all hoses and pipes to prevent entry of dirt and loss of hydraulic fluid.



HYDRACLAMP SELECTOR VALVE AND CHECK VALVE

From Machine No. 129625

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling

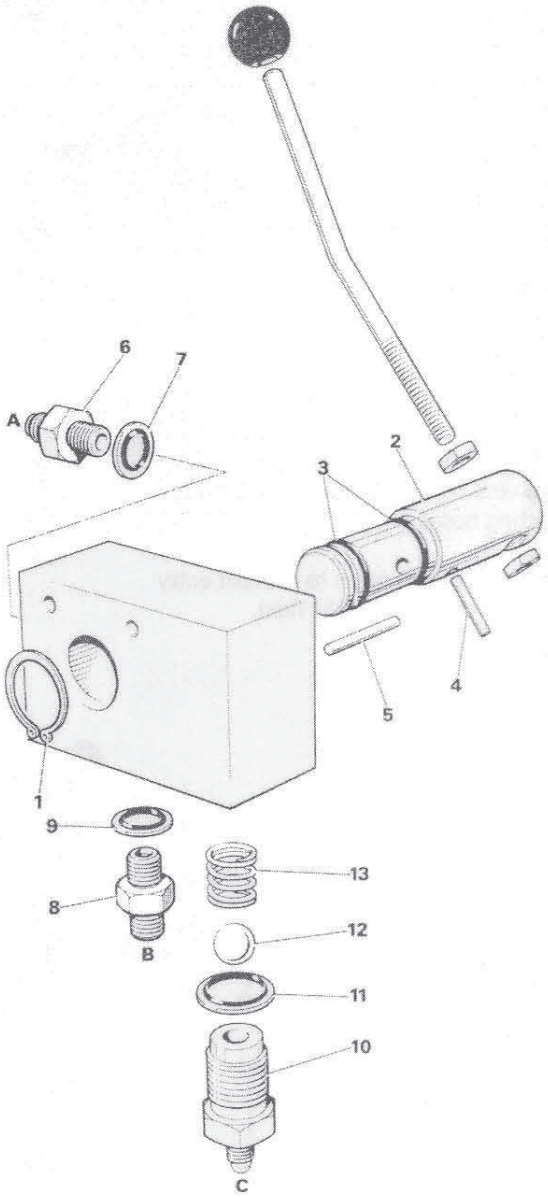
For assembly the sequence should be reversed.

Renew all O rings and bonded washers.

Check spool 2 and body and valve seat for scoring or wear. If either are unserviceable the valve assembly must be renewed.

Complete assembly to be checked as follows:

With lever in ON position pressurise port B to 138 bar (140.6 kgf/cm² ; 2000 lbf/in²) leakage from ports A and C should not exceed 3cc/min



RAM

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal of all rams except the stabiliser rams.

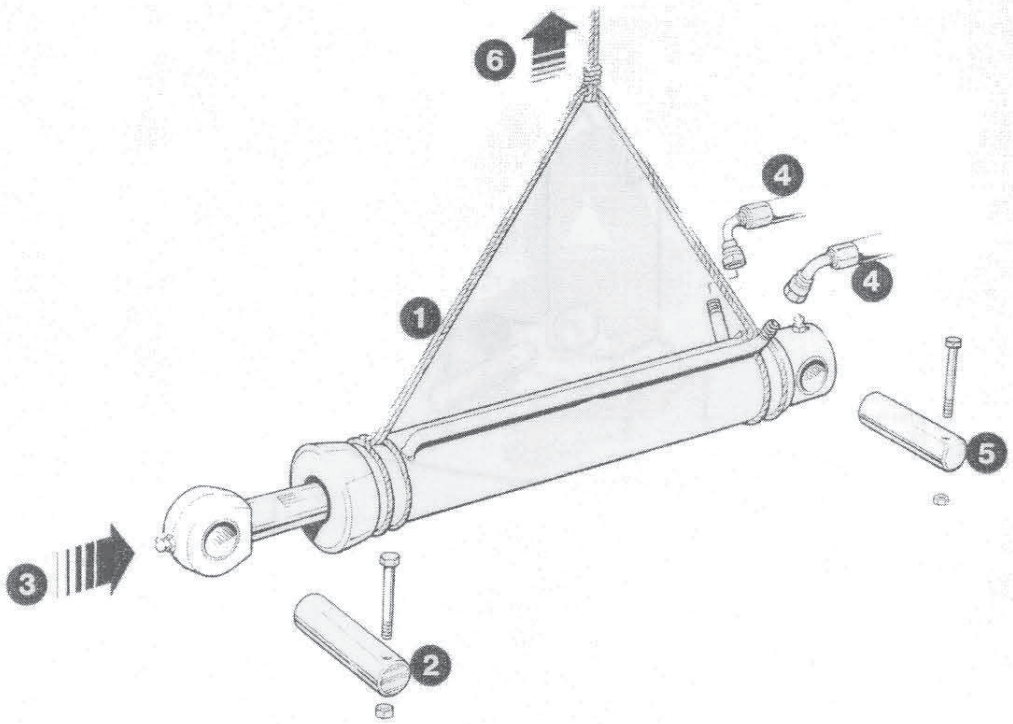
For replacement the sequence should be reversed.

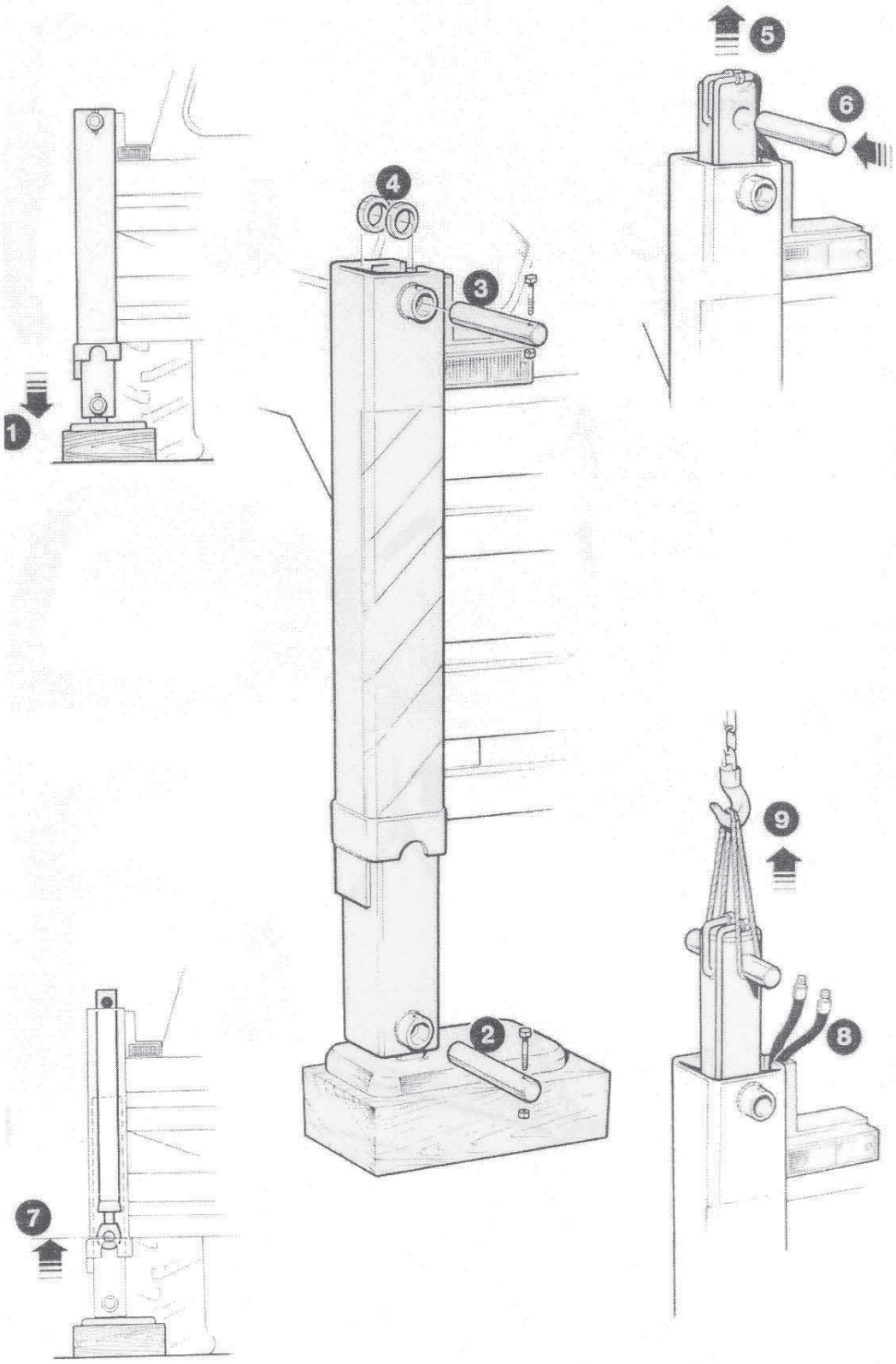
When Removing

Before removing pin 2 ensure that boom, dipper, loader arms or bucket are adequately supported to prevent collapse.

After retracting piston rod 3, stop engine and vent residual pressure by operating control levers.

Label and blank hoses to ensure correct replacement and prevent entry of dirt.





STABILISER RAM

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal.

For replacement the sequence should be reversed.

When Removing

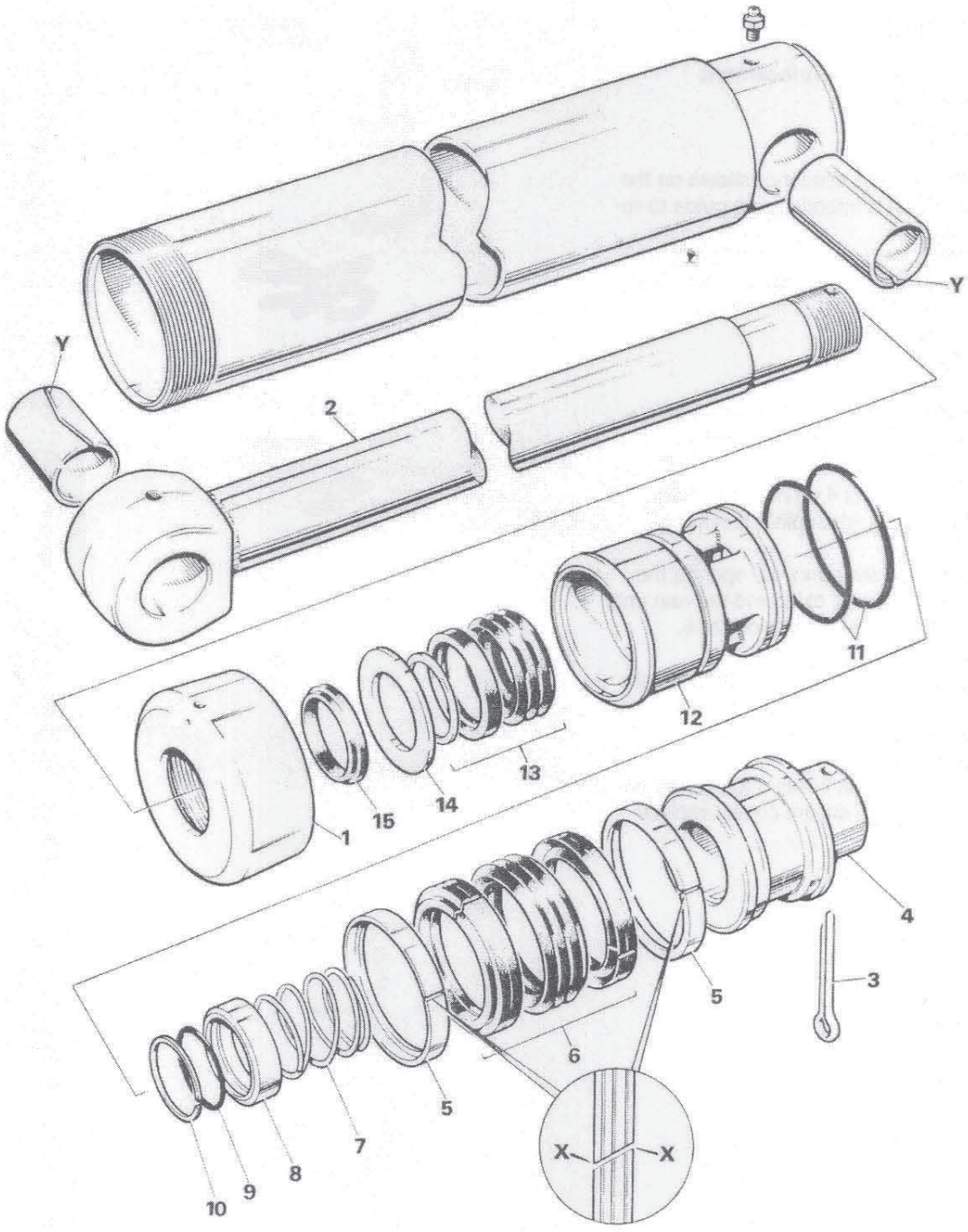
Place a large block of wood under the stabiliser to limit the ram travel.

Ensure spacers 4 do not drop inside the stabiliser leg when pin 3 is removed.

With both pins removed, operate the stabiliser service to extend the ram until the top pin can be replaced at 6.

Retract the ram as at 7 to reduce both the content of fluid and the lifting hight required.

Label and blank hoses 8 to prevent entry of dirt and ensure correct replacement.



RAM
One Piece Piston Head (Typical)

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling a typical ram. Components of specific rams may vary in shape and quantity, for detail refer to parts catalogue.

Loader arms and shovel rams should be replaced in pairs.

NOTE: Items **7** to **10** are fitted to dipper and bucket rams only.

For assembly the sequence should be reversed.

When Dismantling

It may be necessary to use compressed air to drive our the piston assembly.

WARNING: Ensure that the end cap **1** is securely in position during this operation as severe injury can be caused by a suddenly released piston rod.

When Assembling

Renew all seals and O rings, lubricating all internal parts with JCB Special Hydraulic fluid.

For seal fitting see page E 7-10

Position one split seal and one wear ring on each side of seal B Before fitting aluminium bronze type wear rings (rams larger than 102mm (4in) bore only), ensure that sharp corners **X** are removed, leaving a radius of 0.5mm (0.020in)

If replacing eye end bushes position the splits **Y** as shown.

End cap, item **1** is to be fitted to cylinder with 4 drops of Loctite 242 (Service Tools) on bottom 3 or 4 threads.

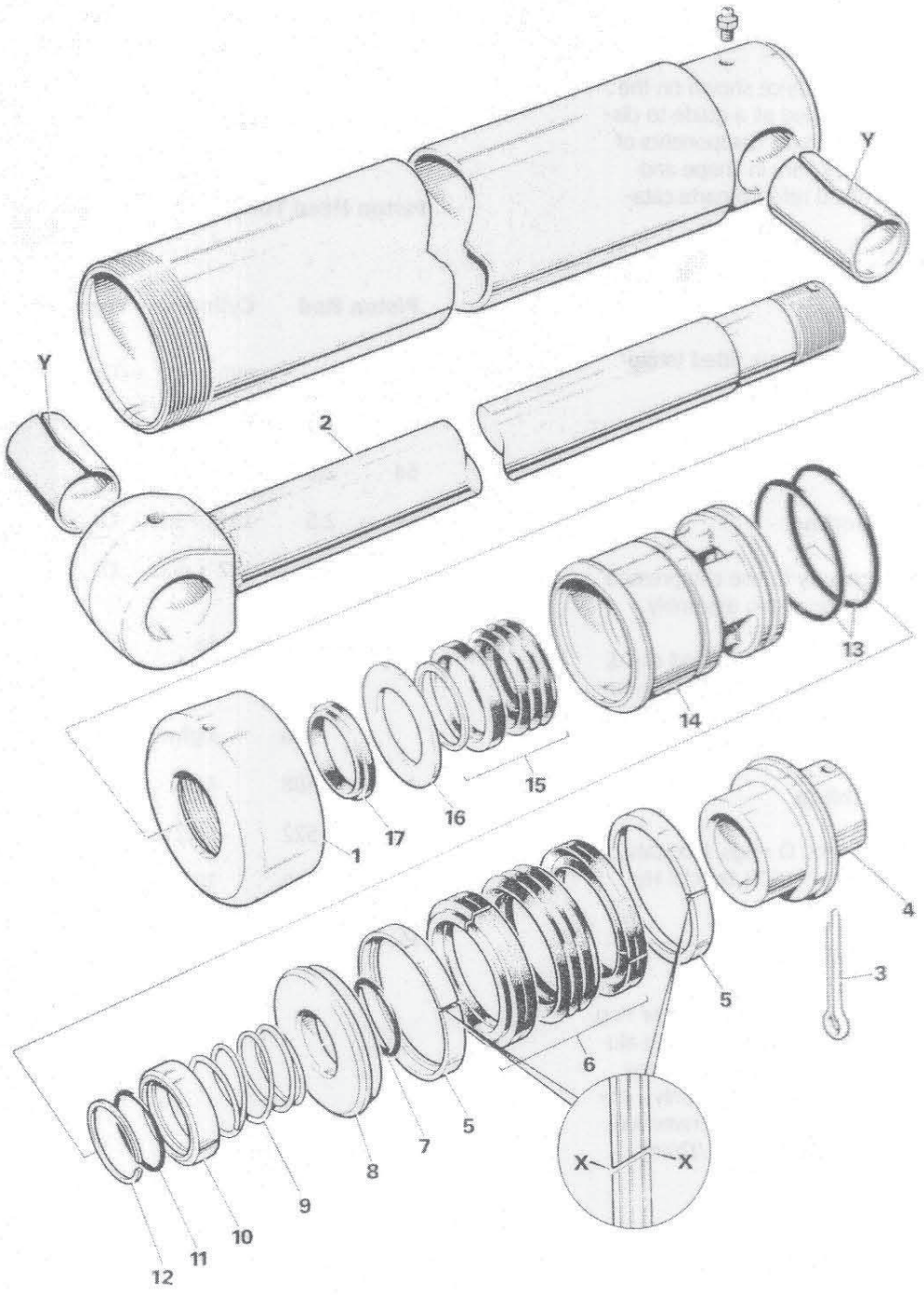
Renew end cap lockwire and secure to feed pipe.

Piston Head Torque Settings

Piston Rod		Cylinder		Torque
mm	in	mm	in	Code
51	2.0	-	-	A
64	2.5	102	4.0	B
64	2.5	114	4.5	C
64	2.5	127	5.0	D

Torque Setting Code

	Nm	kgf m	lbf ft
A	408	41.5	300
B	522	53.2	385
C	780	79.5	575
D	1051	107.2	775



RAM
Two Piece Piston Head (Typical)

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling a typical ram. Components of specific rams may vary in shape and quantity, for detail refer to parts catalogue.

Loader arms and shovel rams should be replaced in pairs.

NOTE: Items **9** to **12** are fitted to dipper and bucket rams only.

For assembly the sequence should be reversed.

When Dismantling

It may be necessary to use compressed air to drive our the piston assembly.

WARNING: Ensure that the end cap **1** is securely in position during this operation as severe injury can be caused by a suddenly released piston rod.

When Assembling

Renew all seals and O rings, lubricating all internal parts with JCB Special Hydraulic fluid.

For seal fitting see page E 7-10

Before fitting aluminium bronze type wear rings (rams larger than 102mm (4in) bore only), ensure that sharp corners **X** are removed, leaving a radius of 0.5mm (0.020in)

If replacing eye end bushes position the splits **Y** as shown.

End cap, item **1** is to be fitted to cylinder with 4 drops of Loctite 242 (Service Tools) on bottom 3 or 4 threads.

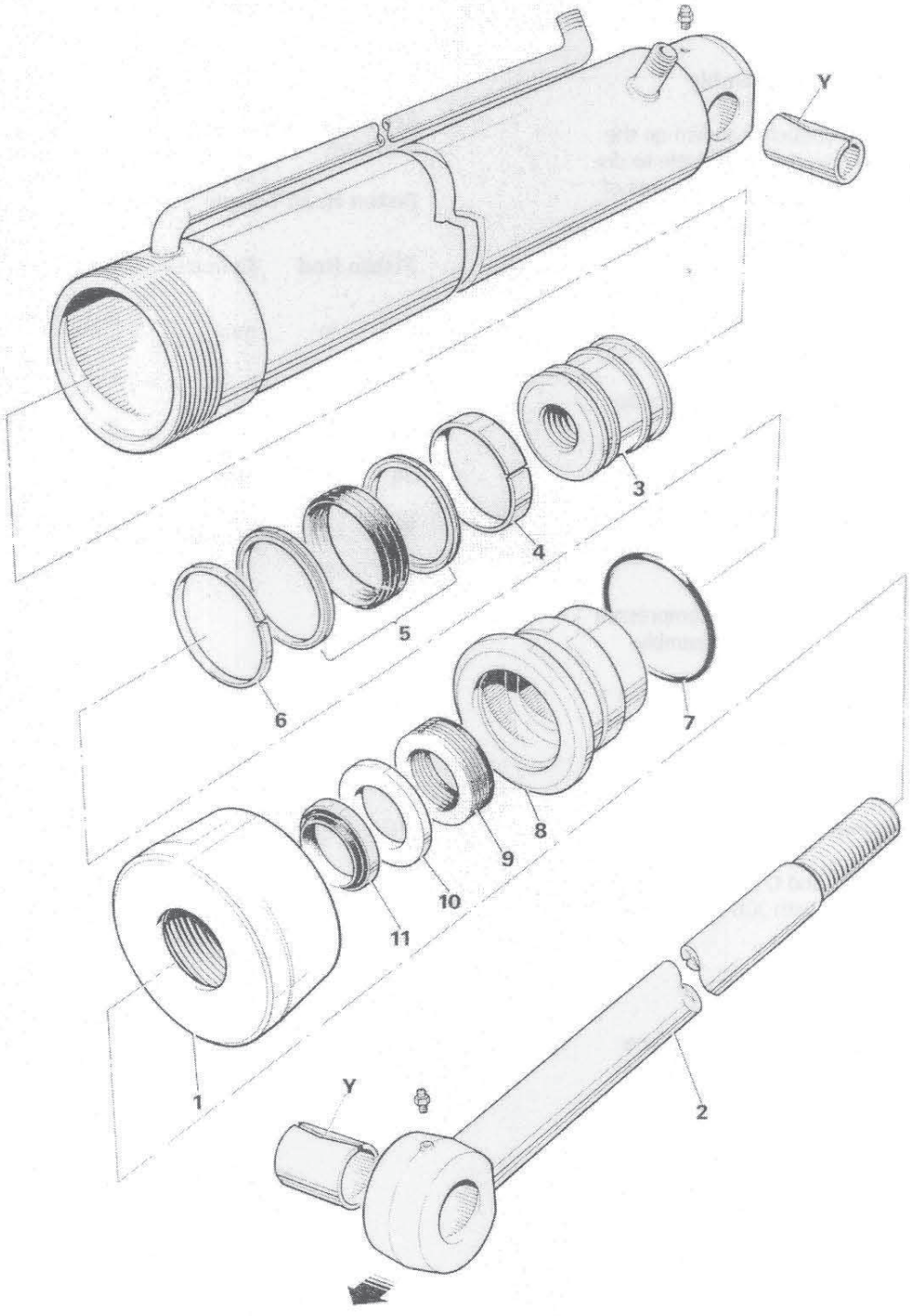
Renew end cap lockwire and secure to feed pipe.

Piston Head Torque Settings

Piston Rod		Cylinder		Torque
mm	in	mm	in	Code
38	1.5	-	-	A
51	2.0	-	-	B
64	2.5	102	4.0	C
64	2.5	114	4.5	D
76	3.0	127	5.0	E

Torque Setting Code

	Nm	kgf m	lbf ft
A	420	42.9	310
B	408	41.5	300
C	522	53.2	385
D	780	79.5	575
E	1051	107.2	775



RAM
Loctite Retained Head (Typical)

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling a typical ram. Components of specific rams may vary in shape and quantity, for detail refer to parts catalogue.

For assembly the sequence should be reversed.

When Dismantling

It may be necessary to use compressed air to drive our the piston assembly.

WARNING: Ensure that the end cap **1** is securely in position during this operation as severe injury can be caused by a suddenly released piston rod.

Note that it is necessary to use heat (180°C-365°F) to break the Loctite bond between the piston rod and head.

When Assembling

Renew all seals and O rings, lubricating all internal parts with JCB Special Hydraulic fluid.

For seal fitting see page E 7-10

If replacing eye end bushes position the splits **Y** as shown.

End cap, item **1** is to be fitted to cylinder with 4 drops of Loctite 242 (Service Tools) on bottom 3 or 4 threads.

Renew end cap lockwire and secure to feed pipe.

Piston Head Torque Settings

Piston Rod		Cylinder		Torque
mm	in	mm	in	Code
64	2.5	127	5	A

Torque Settings Code.

	Nm	kgf m	lbf ft
A	408	41.5	300

RAM SEAL FITMENT

The following service tools should be used to assist the fitment of ram seals.

Lubticate seals with JCB Special hydraulic fluid before fitting.

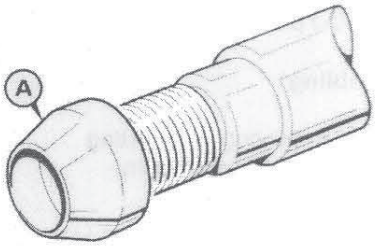
It is important that the seals do not turn inside out.

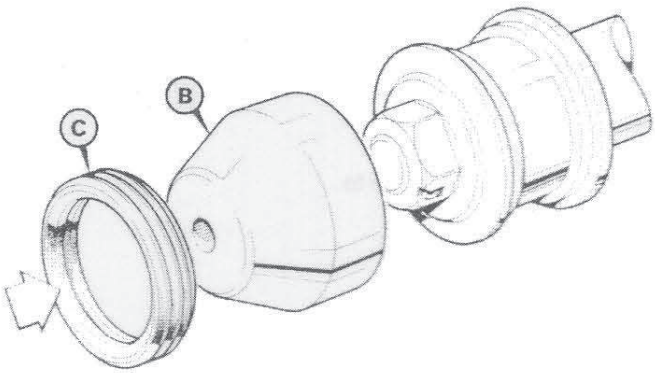
Wiper Seal Fitting Tool – A

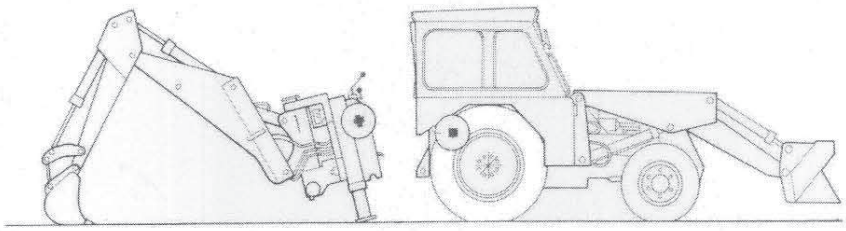
64mm (2.5in) dia, rod 892/00024

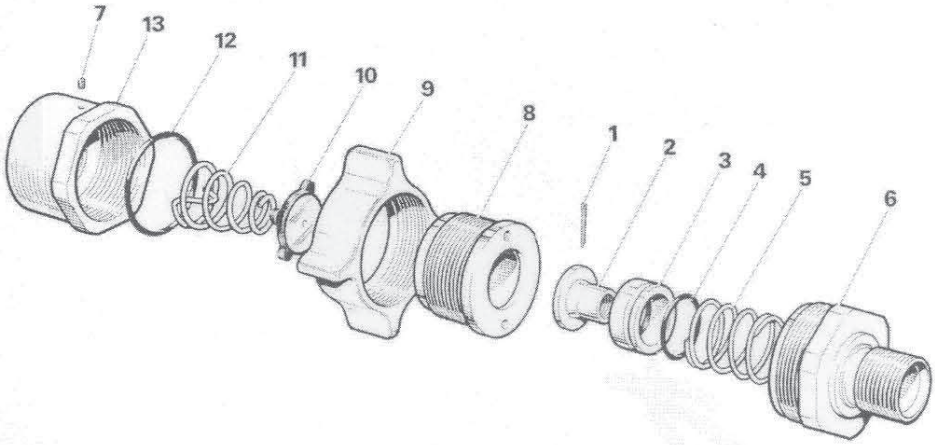
Seal Expander Sleeve –B
Fitting Selemaster seals

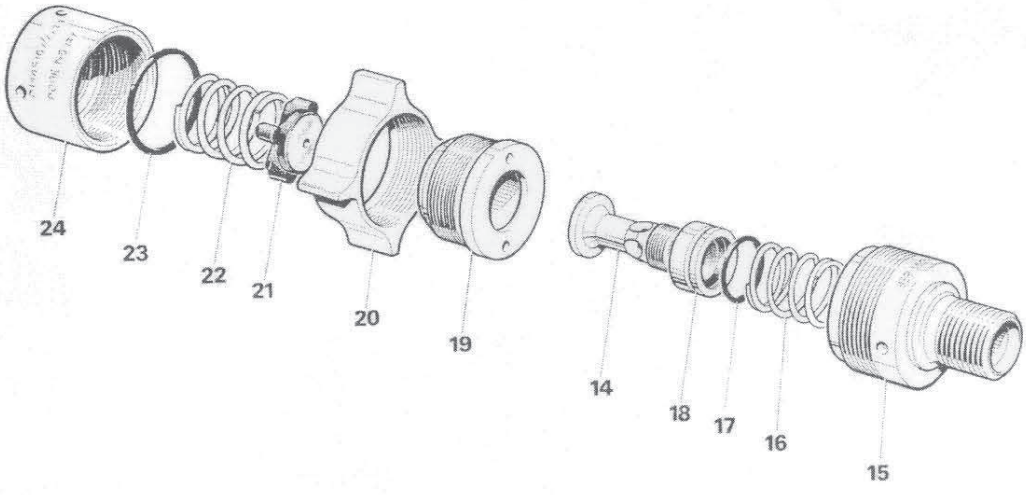
92mm (3.625in bore 892/00012
101mm (4in) bore 892/00013
114mm (4.5in) bore 892/00031
127mm (5in) bore 892/00102











SELF SEALING COUPLING

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling.
For assembly the sequence should be reversed.

For assembly the sequence should be reversed.

Note that on machines with two couplings fitted, detaching the excavator unit will leave the female half **A** of one half coupling and the male half **B** of the other attached to the excavator unit.

Upper illustration shows Dowty type coupling, lower illustration shows Locheed type.

When Dismantling

Use service tool 892/00067 to compress valve seat **3** against its spring to allow split pin **1** to be withdrawn. On Lockheed units, grip the projecting end of valve **14** in a vice (use soft jaw clamps) and unscrew body **15** anticlockwise.

Use service tool 892/00066 to turn sleeve **8** and **19**

When Assembling

Check all parts for wear or damage.

Renew O rings and (on Dowty units) split pin 1

FAULT FINDING

FAULT	DIAGNOSIS
1. Hydraulics – Not Functioning	
	A. Oil Level Low
	B. Incorrect Oil
	C. Drive Coupling Broken
	D. Pump Defective
	E. Drive Shaft Broken
	F. M.R.V. Defective
	G. M.R.V. Incorrectly Adjusted
	H. Suction Hose Adrift
	I. Main Feed Hose Adrift
2. Hydraulics	
	A. Oil Level Low
	B. Incorrect Oil
	C. Cleaner Blocked
	D. Engine Defective
	E. Pump – Excess Slippage
	F. Pump O Ring Leaking
	G. M.R.V. Defective
	H. M.R.V Incorrectly Adjusted
	I. Suction Pipe Leaking
	J. Feed Pipe/ Hose Leak

FAULT FINDING

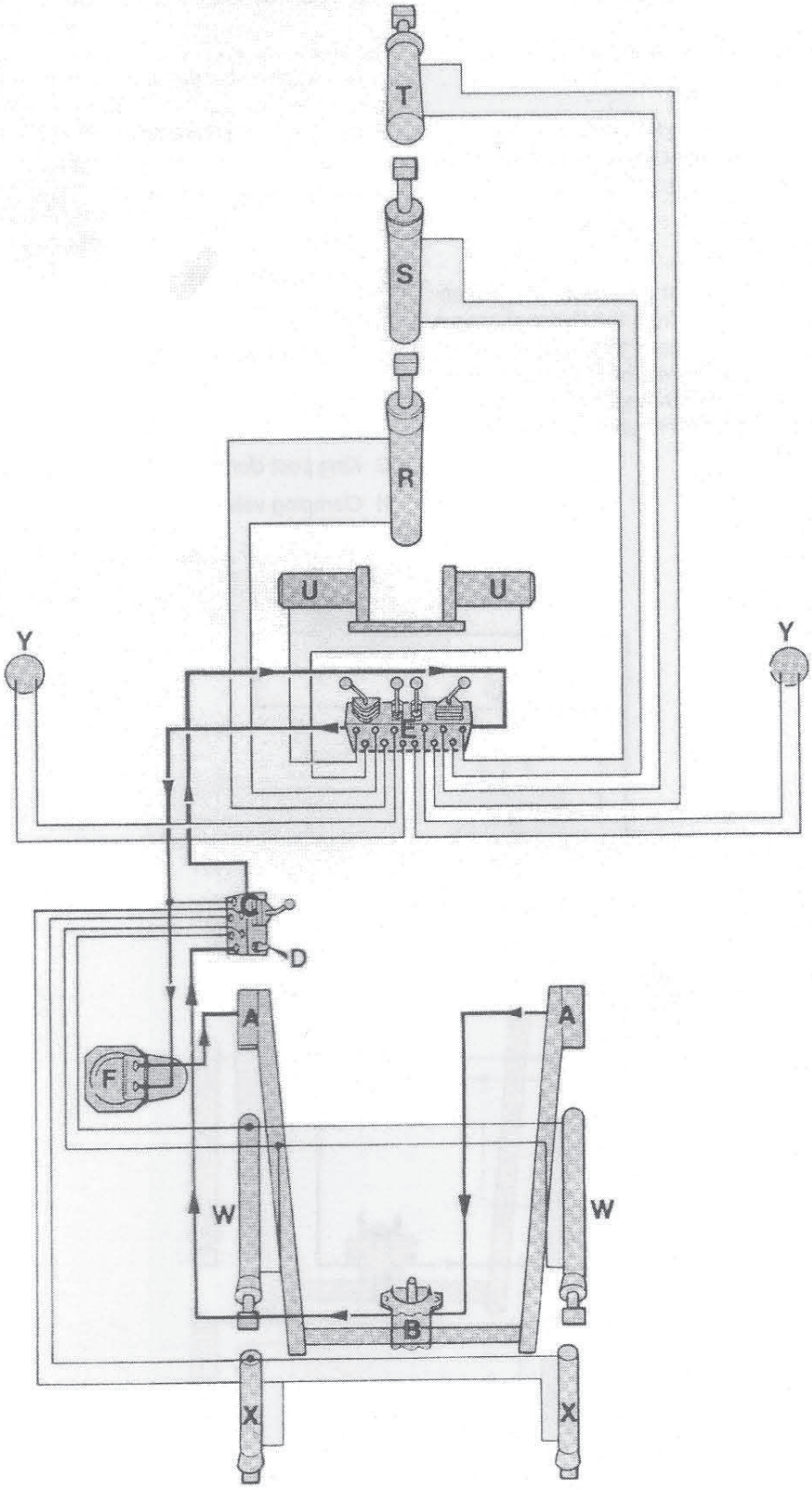
FAULT	DIAGNOSIS
3. Loader Valve Block – Not Functioning	
	A. Refer to 1
4. Loader Valve Block – Not Functioning **Functions Slowly – Lacks Power -**	
	A. All Rams Failed
	B. One Lift Ram One Tip Ram Faulty
	C. O Ring/Seal Leak
	D. Valve Block Cracked Internally
5 One Service on Valve Block **- Not Functioning** **- Functions Slowly – Lacks Power**	
	A. Ram Seals Defective
	B. Ram O Rings Defective
	C. O Ring On A.R.V. Seat Defective
	D. A.R.V. Defective
	E. Valve Block O Ring Defective
	F. Ram Hose/Pipework Leaking

FAULT FINDING

FAULT	DIAGNOSIS
6. Excavator Valve Block – Not Functioning	A. Refer to 1
7. Excavator Valve Block – Not Functioning **Functions Slowly – Lacks Power -**	A. Carry Over Tube Defective B. Excavator Valve Feed Pipe Damaged Or C. Valve Block Cracked Internally
8. Slew Over-Ride Excessive	A. Air Trapped In A.R.V. Cavity B. Dirt Trapped On A.R.V. Seat C. Dirt Trapped On Anti-cavitation Valve Seat D. A.R.V. Defective E. Anti-cavitation Valve Defective F. Ram Seals Defective G. Slew Gearbox Worn

FAULT FINDING

FAULT	DIAGNOSIS
9. Clamps – Not Functioning	
	A. Pressure In Main Circuit Low
	B. Pipework Leaking
	C. Clamps Seized
	D. Maloperation Of Control
	E. Air In System
10. Clamps – Not Releasing	
	A. Insufficient Clearance
	B. Clamps Seized
11. Slew Over-Ride Excessive	
	A. Air In System
	B. Incorrect Oil In Main System
	C. None Return Valve Faulty



CIRCUIT DIAGRAM JCB 3D

The illustration on the right shows the circuit with the Hamworthy Shovel Valve.

The illustration below shows the optional shovel circuit with the Cessna Shovel Valve Fitted from Machine No 100000

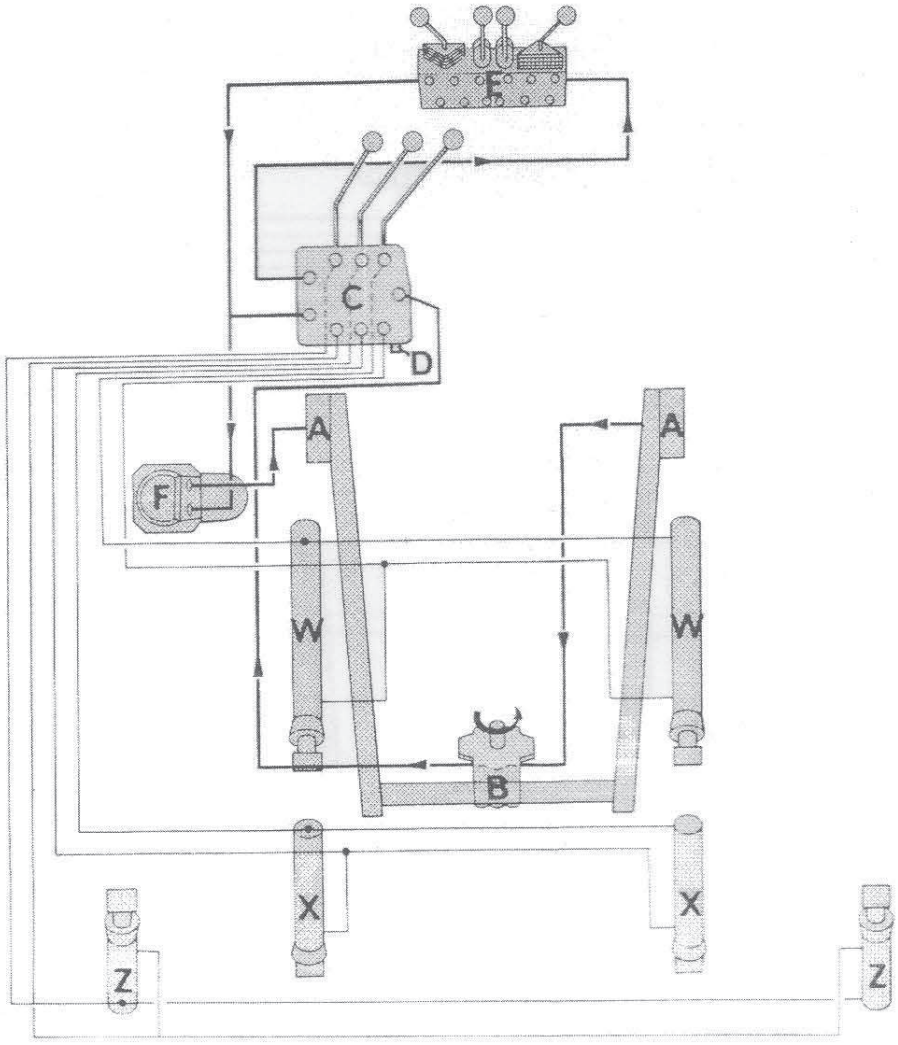
Neutral Circuit

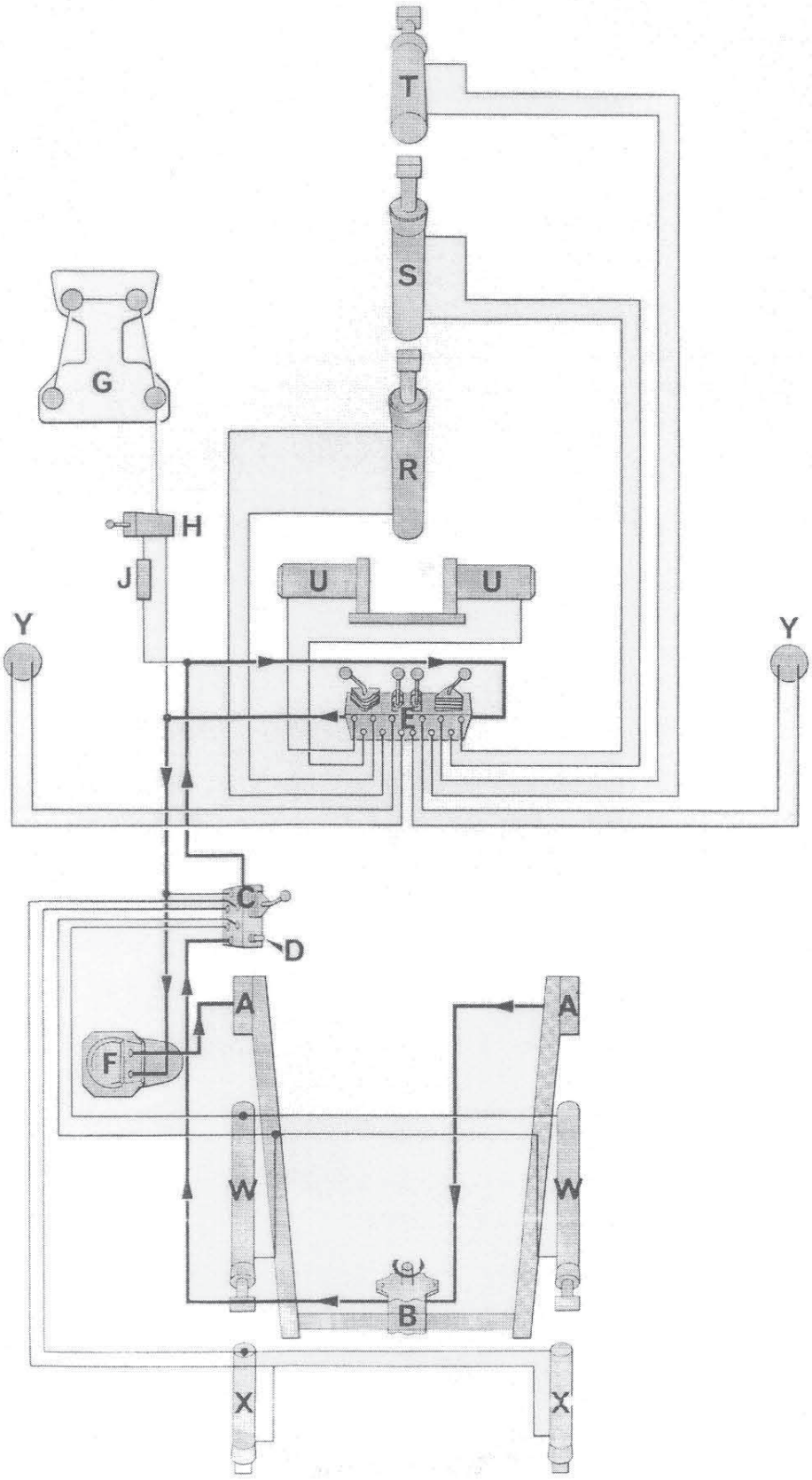
Oil in the neutral circuit (shown in bold line on the illustration) flows from the Hydra-chassis **A** to the pump **B** and passes through the centre of the Shovel Valve **C** via the Main Relief Valve **D**. The oil then flows through the centre of the Excavator Valve **E** and returns to the hydra-chassis via the Filter **F**

Excavator or Shovel Operated

The neutral circuit is blocked by the selected spool and oil is diverted under pressure to the ram. Oil exhausted from the ram is returned by the other end of the spool to the filter and

A Hydra-chassis
B Pump
C Shovel valve block
D Main relief valve
E Excavator valve
F Filter
G King post clamps
H Clamping valve
R Boom ram
S Dipper Ram
T Bucket ram
U Slewing ram
W Shovel arm ram
X Shovel ram
Y Stabiliser ram
Z Clamp ram





F TRANSMISSION F

CONTENTS

CONTENTS POWERTRAIN

DESCRIPTION

The torque converter unit attaches to the rear of the engine and replaces the clutch unit, reverse gear and high/low ratios of the manual transmission. This allows selection of forward and reverse direction without disengagement of the manual gearbox.

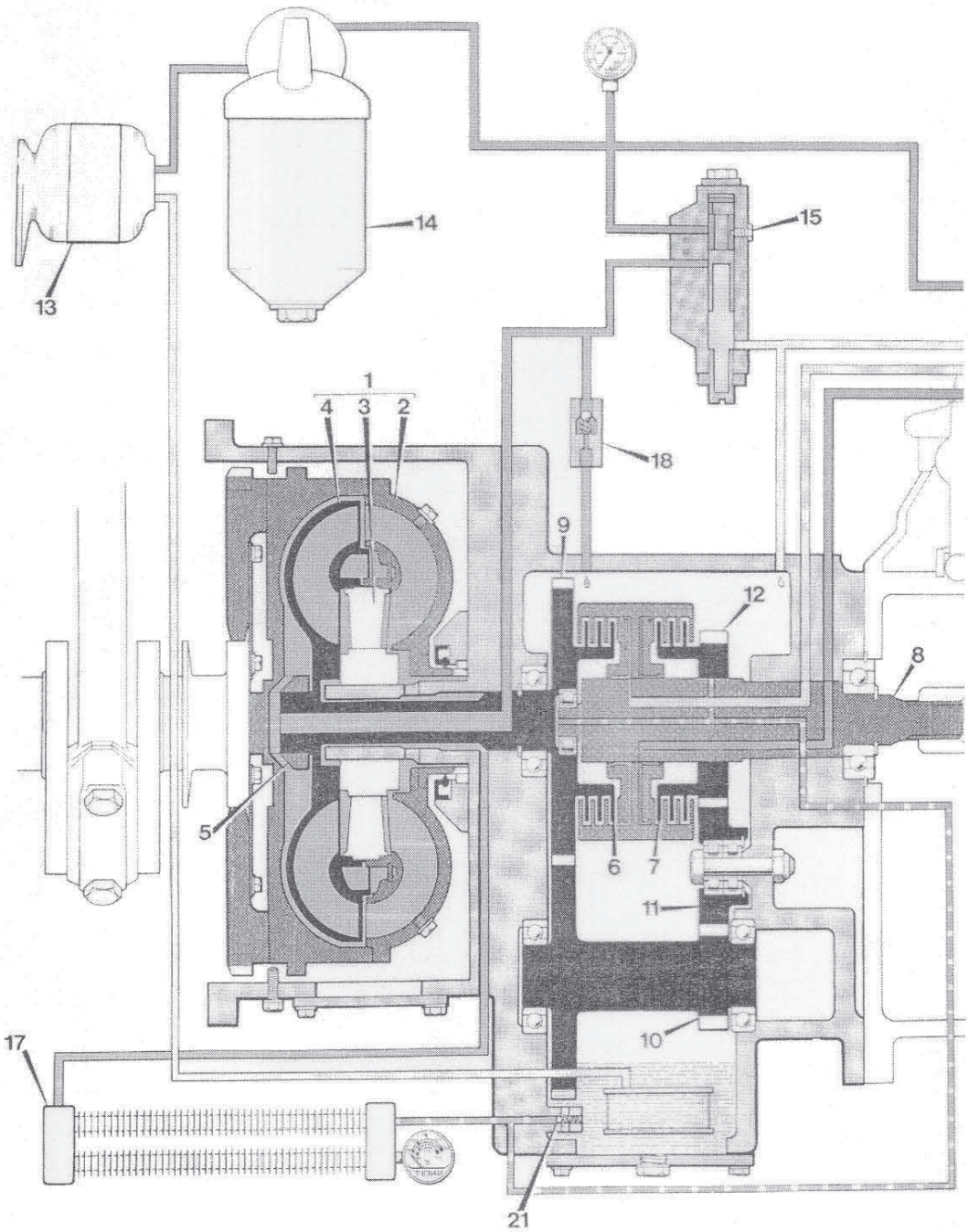
The engine flywheel is mechanically coupled to the torque converter impeller **2**. Oil at moderate pressure is introduced into the torque converter and directed by the impeller into the blades of the turbine **4** thus causing the turbine to rotate. Reaction member **3** which at low speeds is stationary, directs the oil back into the centre of the impeller. This circulation utilises the momentum of the oil to impart additional turning effort to the turbine.

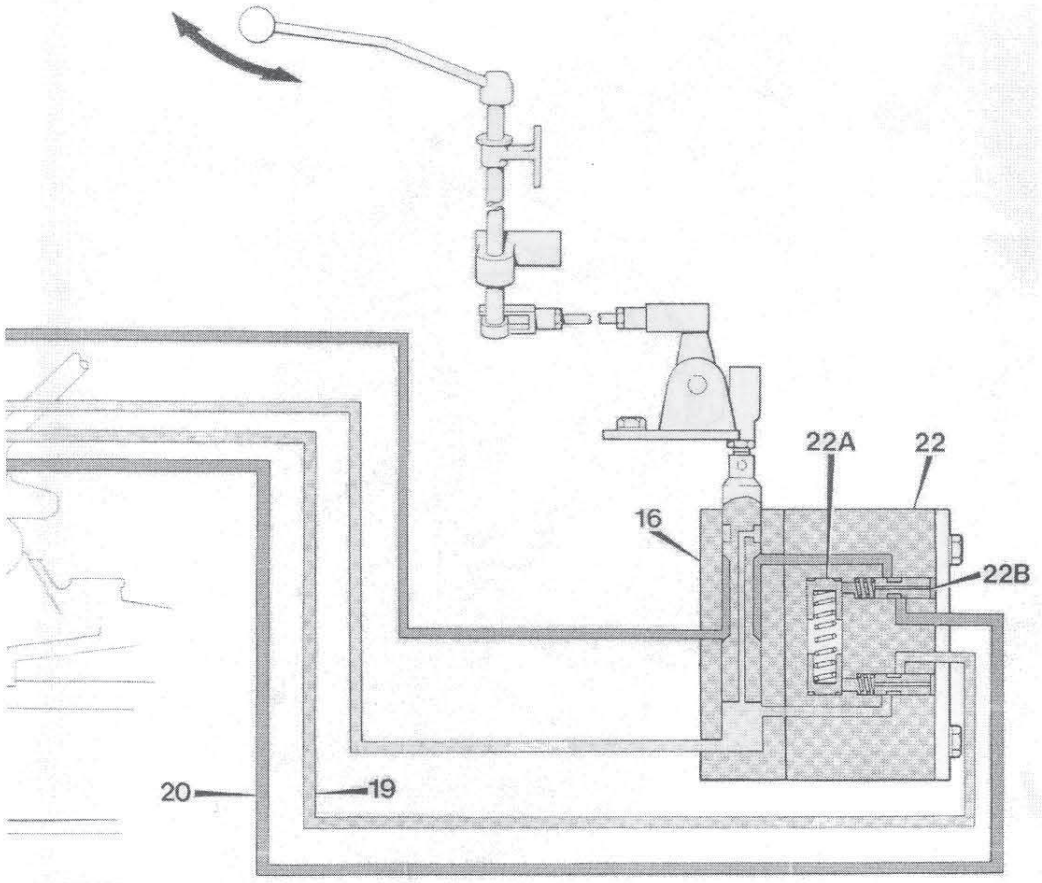
Under light load, high speed conditions, impeller and turbine turn at the same speed and the reaction member rotates freely in the same direction, thus giving a direct drive, without torque multiplication.

Converter output is transmitted to the gearbox by way of hydraulically actuated forward/reverse clutches **6** and **7**.

Hydraulic oil flow is initiated by the pump **13** which supplies oil to the torque converter by way of pressure valve **15** and to the clutches by way of direction valve **16** and modulating valve **22**. A full flow filter **14** is incorporated into the pressure line. The modulating valve ensures smooth clutch engagement by allowing a gradually increasing amount of oil to flow from the direction valve to the clutch. Whenever the direction valve is operated, oil passes to the base of shuttle valve **22B**. The pressure difference across the valve, created by a restrictor drilling, causes the valve to shut-off pressure to the clutch line. Oil 'bleeds' through the restrictor drilling moving the accumulator piston (**22A**) against the spring until pressure is balanced across the shuttle valve. At this stage the shuttle valve is opened to the clutch line by it's own actuating spring.

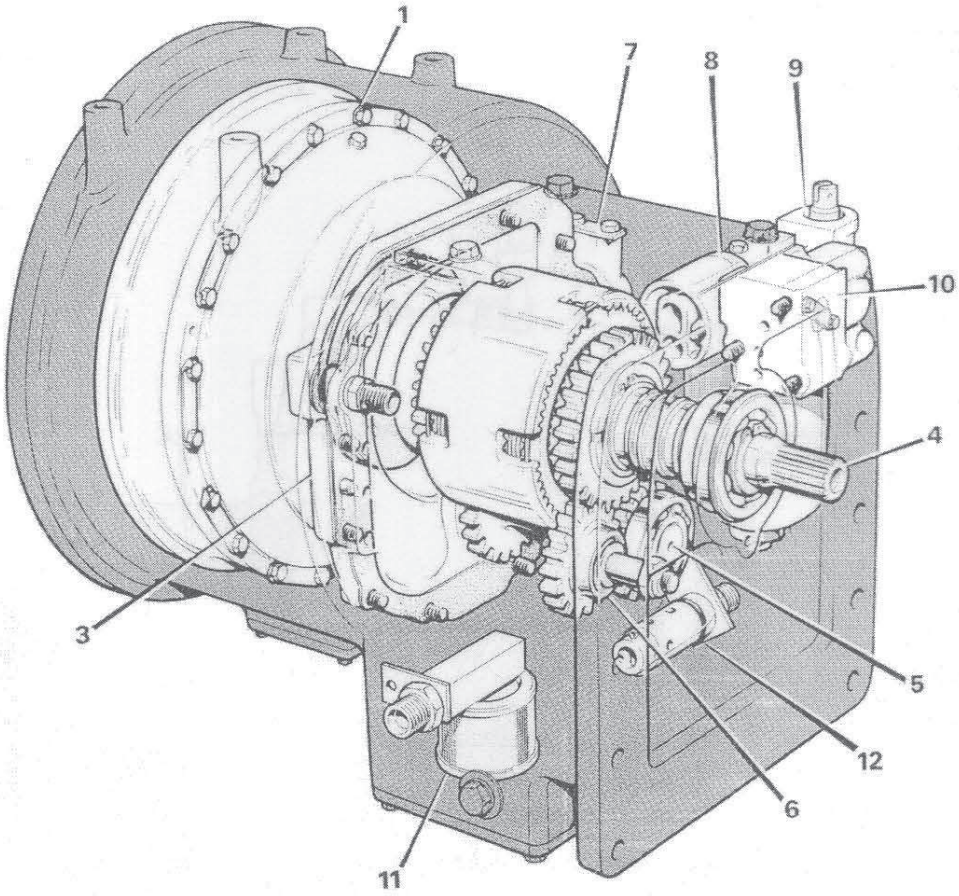
Lubrication valve **21** ensures that the torque converter always remains filled with oil. A low pressure feed for clutch lubrication is also taken from this point.





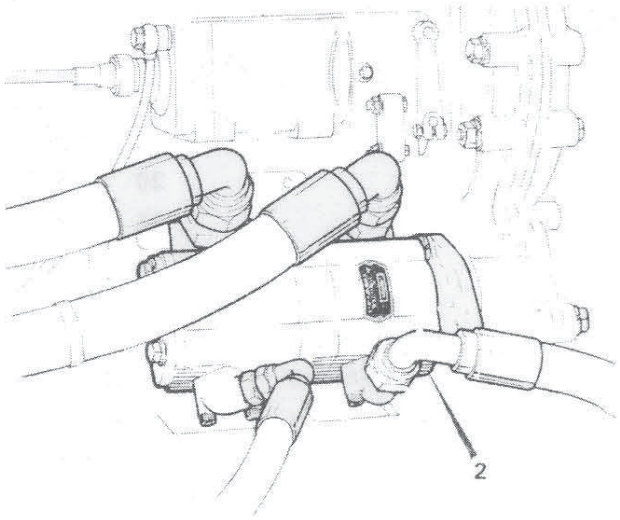
1	Torque Converter	**11**	Reverse Idler
2	Impeller	**12**	Reverse Gear
3	Reaction Member	**13**	Pump
4	Turbine	**14**	Filter
5	Turbine Shaft	**15**	Pressure Valve
6	Forward Clutch	**16**	Direction Valve
7	Reverse Clutch	**17**	Cooler
8	Output Shaft	**18**	Relief Valve
9	Turbine Shaft Gear	**19**	Gallery to Forward Clutch
10	Layshaft	**20**	Gallery to Reverse Clutch
		21	Lubrication Valve
		22	Modulating Valve

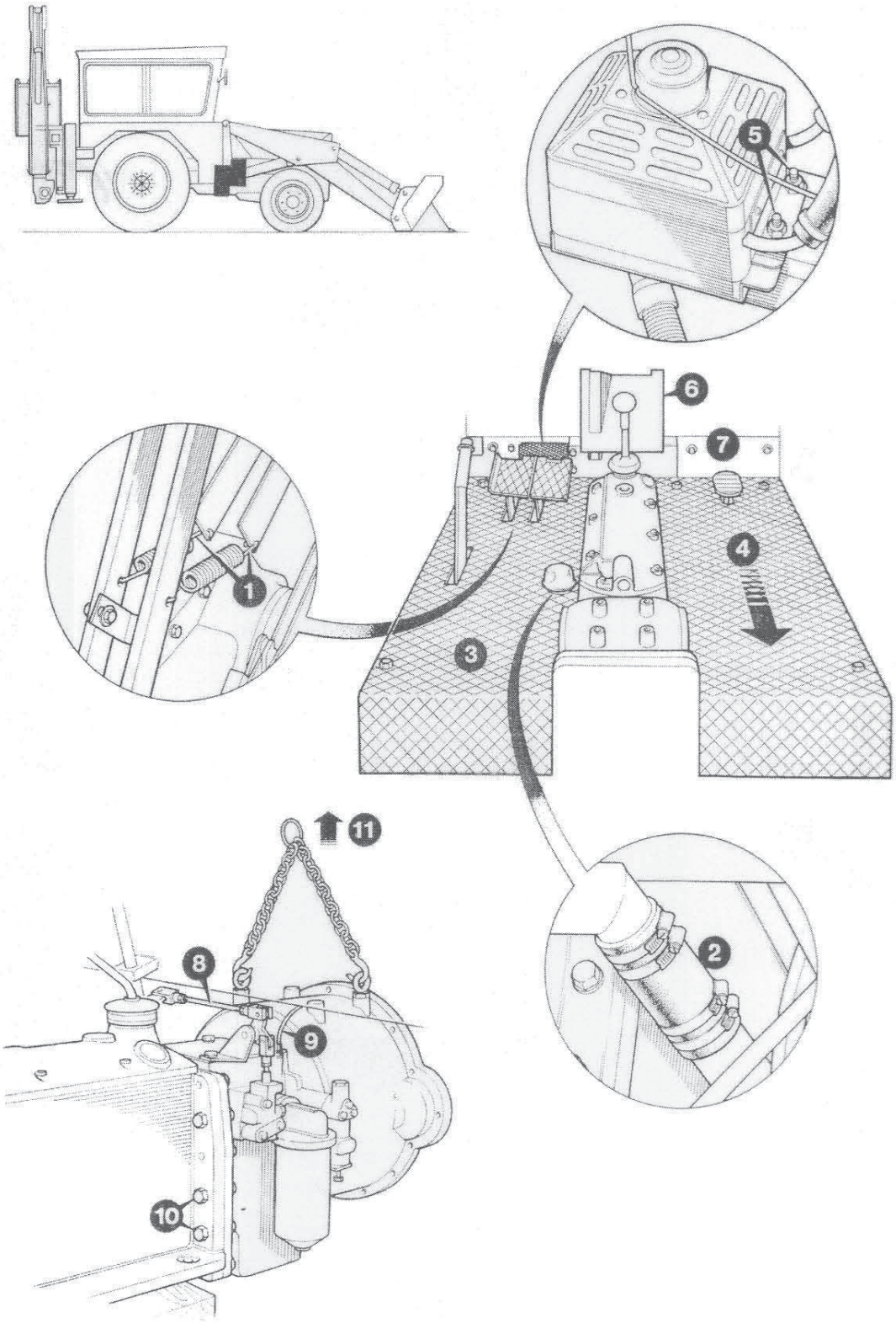
Pressure Circuit.(Engaged)
Pressure Circuit.(Disengaged)
Torque Converter Circuit.
Low Pressure Returns
Lubrication Circuit.



KEY

1 Driving shell assembly
2 Pump (engine driven)
3 Reaction plate assembly
4 Output shaft and clutches
5 Layshaft assembly
6 Reverse idler gear
7 Pressure valve
8 Filter
9 Directional valve
10 Modulating valve
11 Strainer
12 Lubrication valve





TORQUE CONVERTER

Removal and Replacement

Before the torque converter can be removed it will be necessary to take out the engine, see Section **K**.

The numerical sequence shown on the illustration is intended as a guide to Removal.

For replacement the sequence should be reversed

When Removing

Drain Torque Converter oil (see section 3 page 5-2)

Disconnect pedal return springs **1** and transmission oil filler hose **2** (accessible from underneath the machine)

Work inside the machine will be made easier if the driving seat is taken out.

Withdraw dipstick, unbolt floor plates **3** and **4** and move them clear of the working area.

Remove heater **5** (if fitted) accessible from underneath the machine.

Remove steering hose cover **6** and toeplate **7**

Disconnect control rod clevis 8 and oil pressure gauge line 9

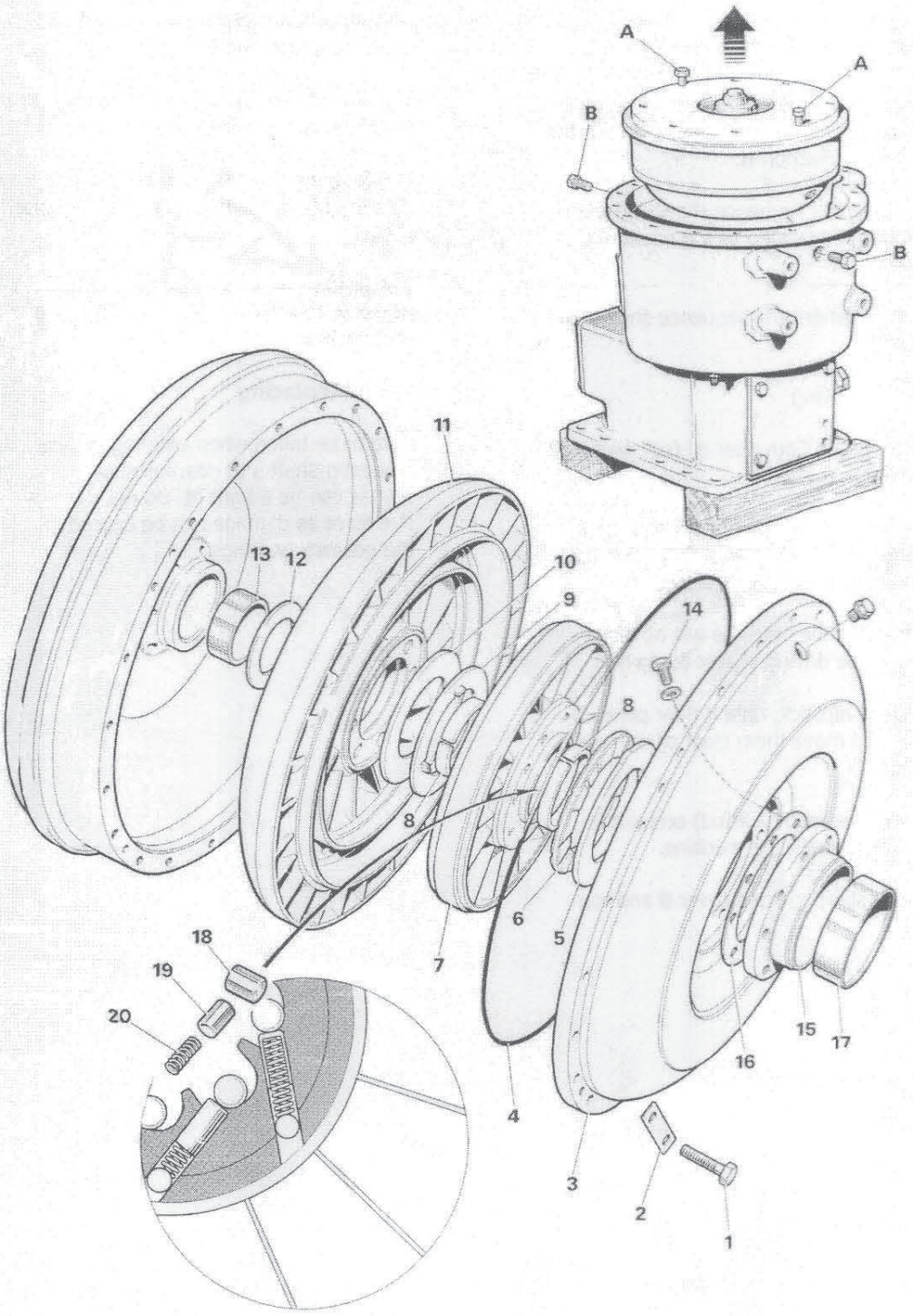
Disconnect bonnet stay and tie back bonnet in vertical position.

Fit lifting eyes to threaded bosses (battery tray mountings) and attach hoist slings.

Unbolt the torque converter from the gearbox, remove torque converter from the machine.

When Replacing

Care to be taken when entering torque converter shaft into gearbox shaft as splines can be a tight fit. Do not use undue force as damage can be caused to the gearbox bearings.



TORQUE CONVERTER
Driving Shell
(Up to Converter No 24110/4167

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to Dismantling

For Assembly the sequence should be reversed

When Dismantling

Install lifting bolts **A** into driving shell, remove holding bolts **B**.

When Assembling

Renew bushes **8**,**13**, and **17**, and gasket **16**.

Locate tabs **X** on thrust washer 9 into holes **Y** in reaction member **7**

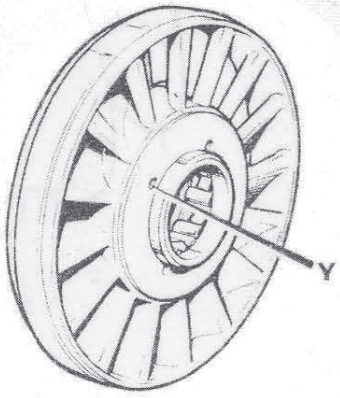
Renew O ring **4**, lubricate with transmission oil before fitting. (Take care not to damage O ring when bringing together driving shell and impeller)

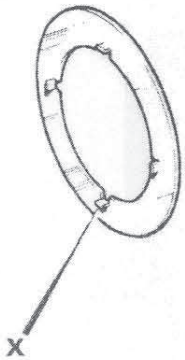
Install new tab plates **2**, torque tighten bolts evenly to specified value, turn down corners of tab plates.

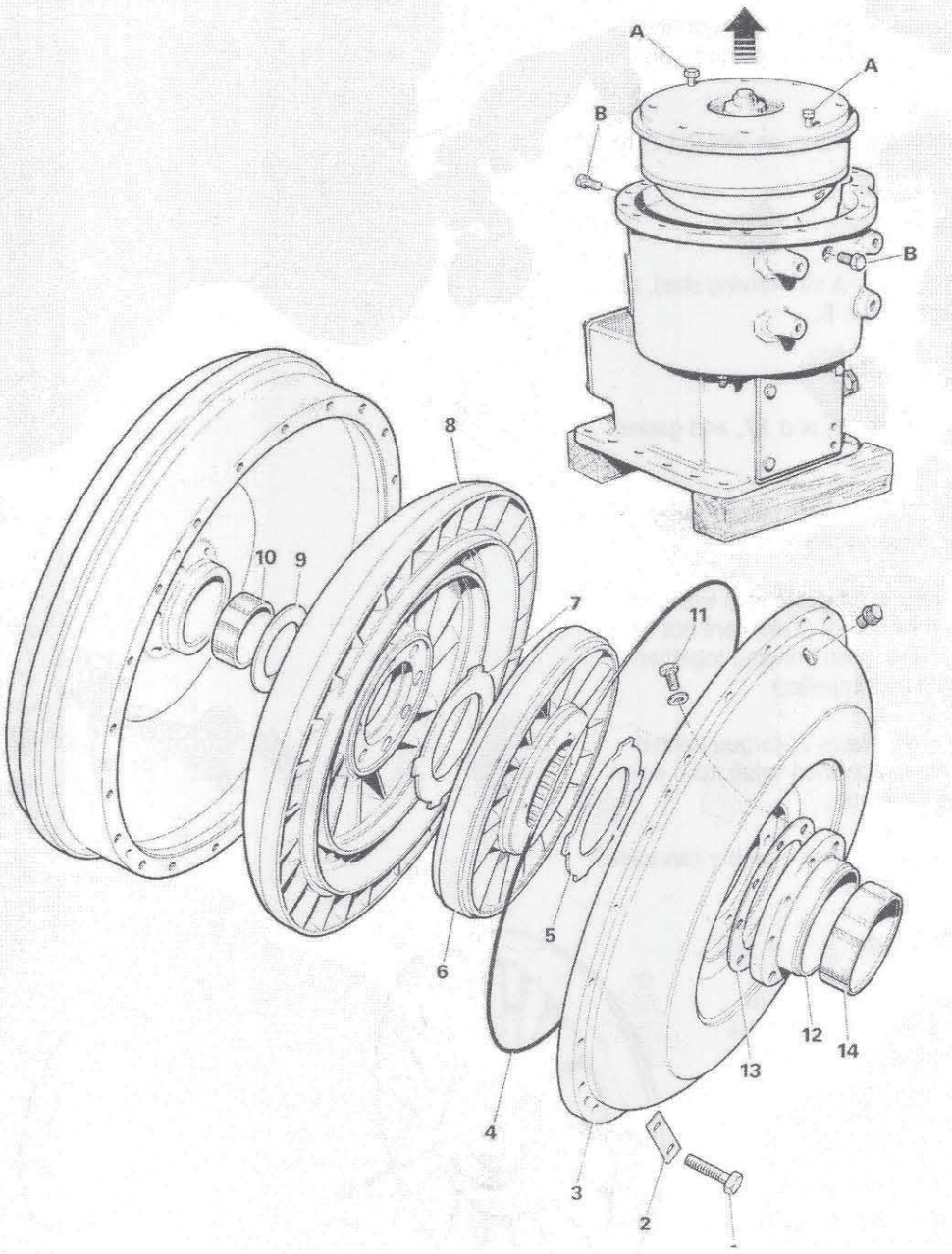
Check that the reaction member can turn freely.

Torque Settings

Item	lbf ft	kgf m
1	10-12	1.3-1.6
14	6-8	0.8-1.1







TORQUE CONVERTER
Driving Shell
(From Converter No 24111/4168

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to Dismantling

For Assembly the sequence should be reversed

When Dismantling

Install lifting bolts **A** into driving shell, remove holding bolts **B.**

When Assembling

Renew thrust washers **5** and **7** ensuring that their grey sides face the reaction member **6**

Renew O ring **4**, lubricate with transmission oil before fitting. (Take care not to damage O ring when bringing together driving shell and impeller)

Renew tab plates **2**, torque tighten bolts evenly to specified value, turn down corners of tab plates.

Check that the reaction member can turn freely.

Torque Settings

Item	lbf ft	kgf m
1	10-12	1.3-1.6
11	6-8	0.8-1.1

TORQUE CONVERTER
Reaction Plate

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to Dismantling

For Assembly the sequence should be reversed

When Dismantling

Use extractor bolts at A to remove plate.

NOTE: that item 8 is precision fitted

When Assembling

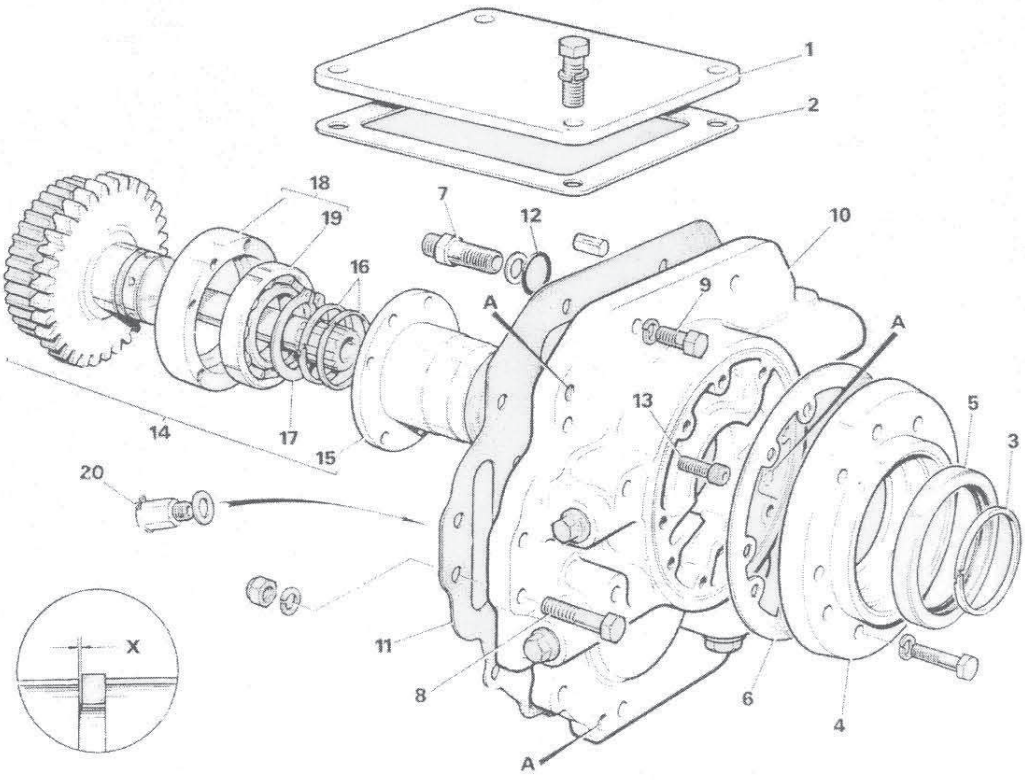
Renew gaskets 2, 6, and 11 and O ring 12

Renew oil seal 5

Renew bearings 19 and piston rings 16 if worn or damaged. Ensure that piston rings are correctly seated in their grooves with 0.076mm (0.003in) maximum end float, as shown

Torque Settings

Item	lbf ft	kgf m
9	35-40	4.8-5.5
13	22-25	3.0-3.5



TORQUE CONVERTER
Output/Clutch shafts

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to Dismantling

For Assembly the sequence should be reversed

When Dismantling

Blow out the oil ways using compressed air.

Withdraw items 6 and 7 simultaneously

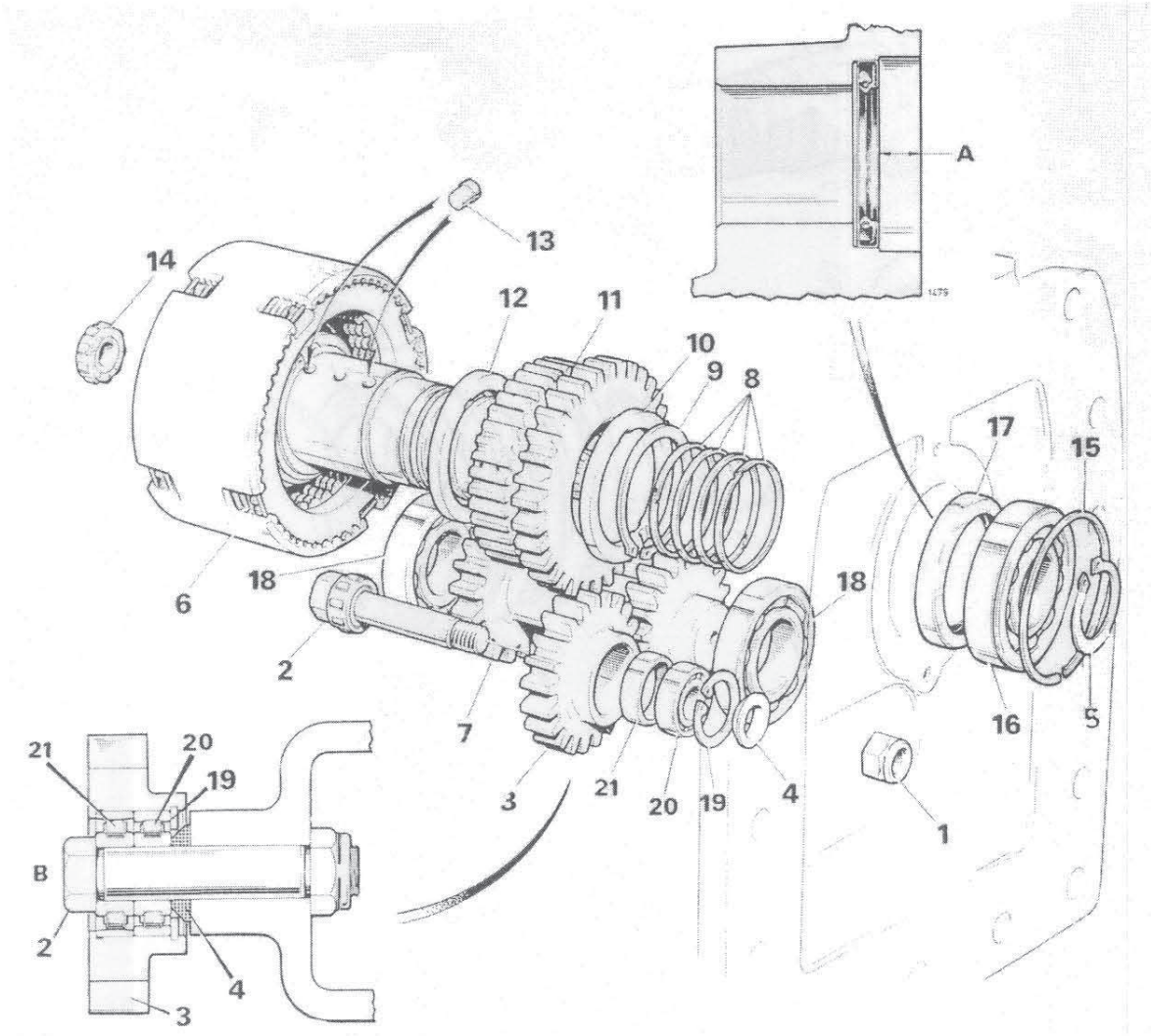
When Assembling

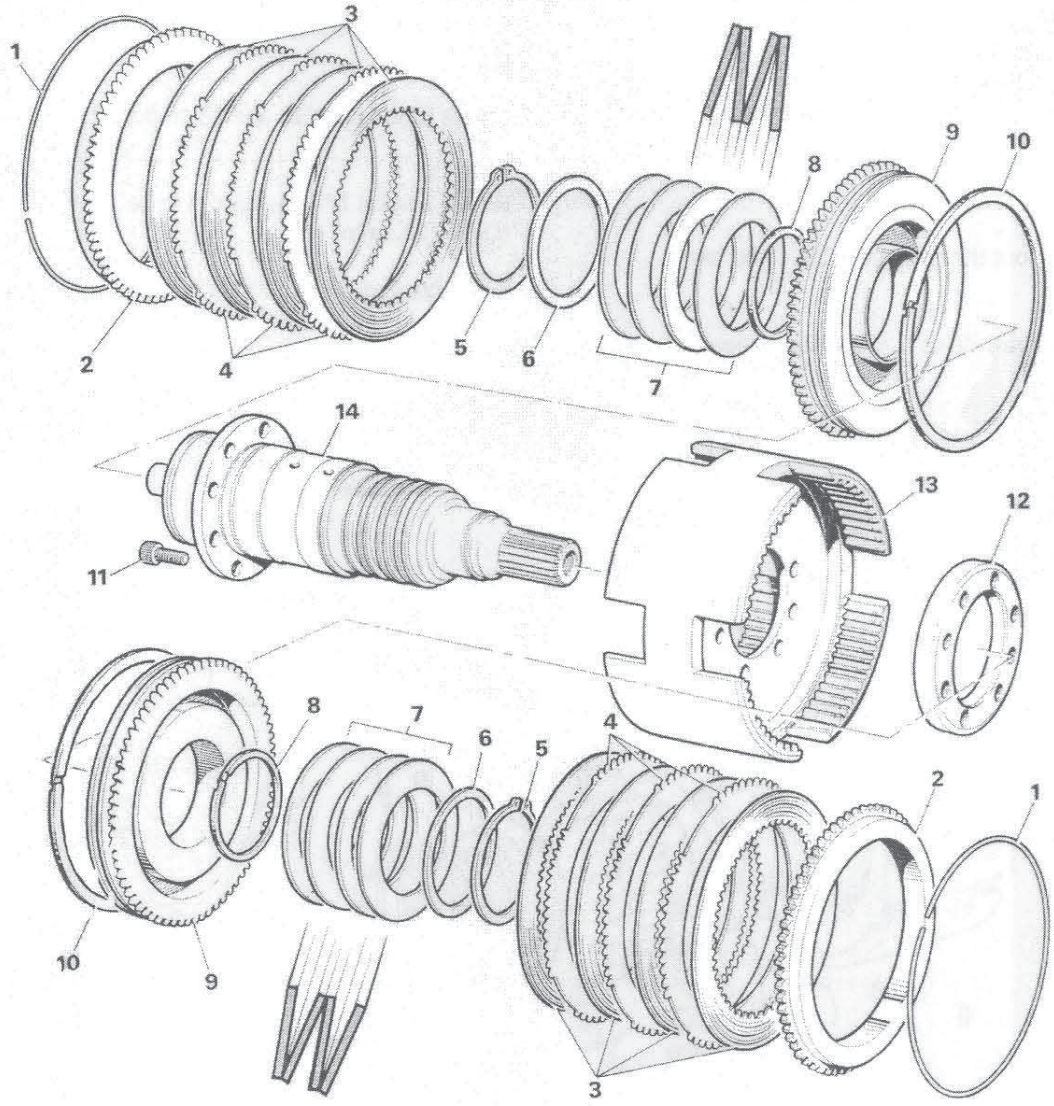
Renew bearings 14, 16, 18, 20 and 21 if worn or damaged. Assemble idler gear as shown at B

Locate thrust rings 10 and 12 on pegs 13

Renew oil seal 17 dimension A to be 0.80in (20.3mm)

Assemble items 6 and 7 simultaneously





HYDRAULIC CLUTCH

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to Dismantling

For Assembly the sequence should be reversed

When Dismantling

Compress clutch pack to allow snap ring 1 to be removed.

When Assembling

Renew piston rings **8** and **10** if broken or worn. End clearance between ring and grove must not exceed 0.076mm (0.003in) as at **A**.

Renew clutch plates **3** and **4** if scored, distorted, showing signs of over heating or if worn down to the minimum thickness given in the table.

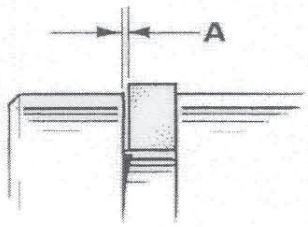
Soak new plates in warm transmission oil for 30 minutes before fitting.

CAUTION: Later type graphite sintered plates (grey colour) must not be mixed with earlier type bronze plates in the same clutch pack.

Align tooth gaps in steel plates with cut-outs in clutch housing.

Torque Settings

Item	Nm	kgf m	lbf ft
11	64.4	6.6	47.5



Clutch Plates.

	New Thickness		Minimum Thickness	
	mm	in.	mm	in.
Steel	1.39-1.52	0.055-0.060	1.27	0.050
Sintered	2.31-2.39	0.091-0.094	2.1	0.085

DIRECTION CONTROL VALVE

Dismantling and Assembly

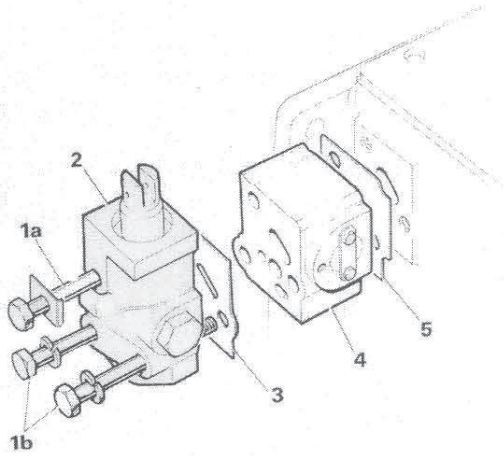
The numerical sequence shown on the illustration is intended as a guide to Dismantling

For Assembly the sequence should be reversed

When Assembling

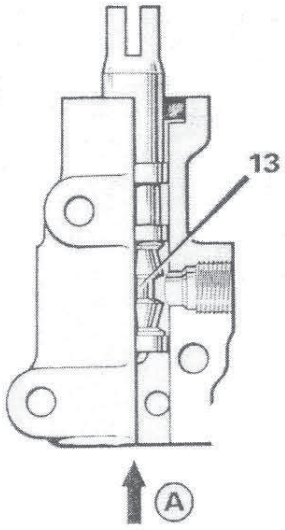
Renew gaskets **3**, **5**, and **12** and seal **14**.

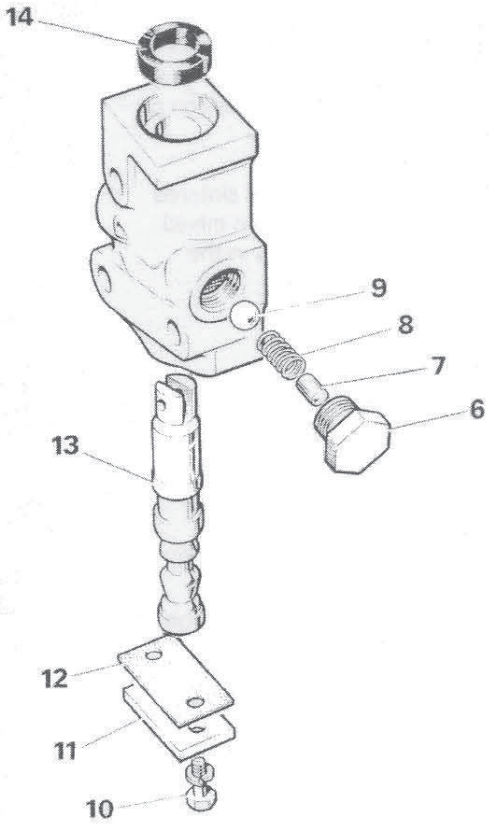
Install spool **13** in direction of arrow **A** Insure that the detent is positioned in line with the detent drilling before fitting items **6** to **9**.



Torque Setting

Item	lbf ft	kgf m
1a	18-20	2.5-2.8
1b	30-35	4.2-4.8





MODULATING VALVE

Dismantling and Assembly

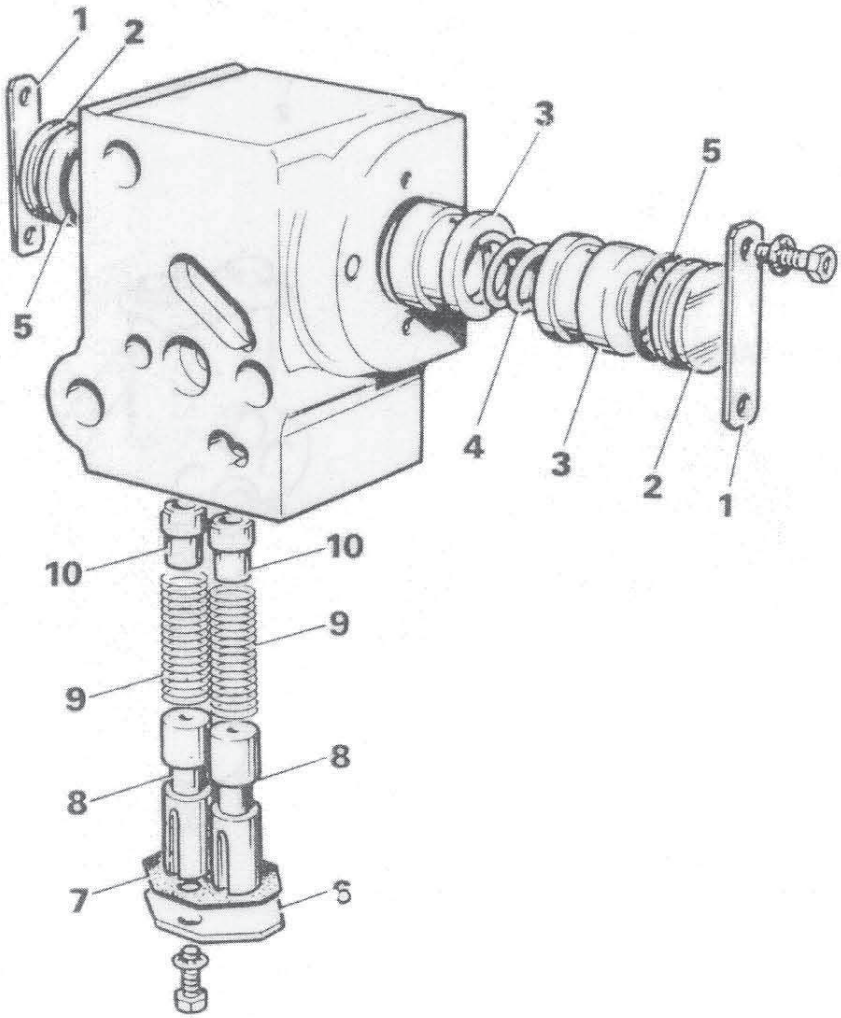
The numerical sequence shown on the illustration is intended as a guide to Dismantling

For Assembly the sequence should be reversed

When Assembling

Renew O ring 5 and gasket 7

Ensure that shuttle valve spools 8 are fitted with fluted ends downwards.



LUBRICATION VALVE

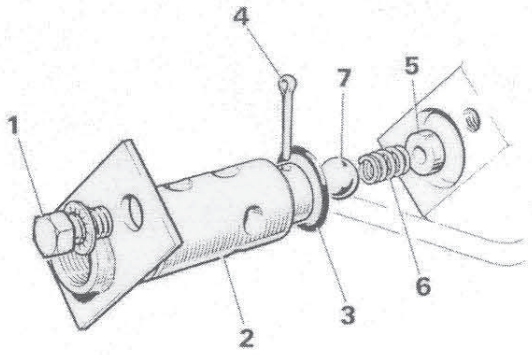
Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to Dismantling

For Assembly the sequence should be reversed

When Assembling

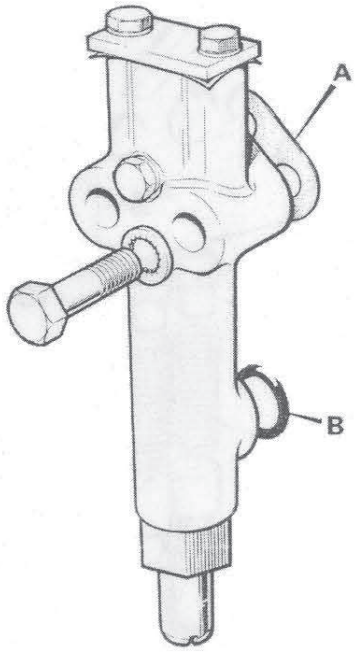
Renew O ring **3**.



PRESSURE VALVE

The pressure valve is preset to operate at 9.1-10.5 kgf/cm² (130-150 lbf/in²) And should not be adjusted or dismantled. Renew valve as a complete assembly if failure occurs.

Renew gasket **A** and O ring **B** when refitting valve.



FAULT DIAGNOSIS – Torque Converter

NOTE:
Before attempting to diagnose any suspected malfunction, ensure that the condition is not created by low oil level, oil not at normal working temperature, or oil in poor or dirty condition. Check that there is no leakage in the external circuit. Also make sure that valves and control linkages are operating correctly.

Fault		Possible Cause	
1.	**Fluctuating Oil Pressure**	A	Partially blocked suction strainer
		B	Air leaks in suction pipe
		C	Partially blocked pressure filter
		D	Worn direction control valve spool
		E	Mechanical defect
		F	Pressure gauge faulty
2.	**Low Oil Pressure**	A	Partially blocked suction strainer
		B	Air leaks in suction pipe
		C	Pressure maintaining valve defective
		D	Worn pump
3	**Zero Oil Pressure**	A	Pressure gauge faulty
		B	Pressure gauge line disconnected or broken
		C	Seized pump
		D	Direction control valve spool broken
4.	**High Oil Pressure**	A	Pressure maintaining valve sticking
5.	**High Oil Temperature**	A	Excessive load (causing converter to stall)
		B	Incorrect operating technique, too high
		C	Dirty or blocked oil cooler
		D	Relief valve sticking open
		E	Worn pump
		F	Seized reaction member

Fault			Possible Cause
6.	**High engine speed with machine**	A	Torque converter oil flow reduced (see also
		B	Clutch piston rings worn or damaged
		C	Clutch plates worn
		D	Clutch oil galleries restricted
		E	Torque converter damaged or worn
		F	Relief valve sticking open
7.	**Low engine speed with machine**	A	Engine requires servicing
		B	Torque converter reaction member incor-
		C	Direction control valve worn or seized
8.	**Difficulty in selecting Forward, Re-**	A	Direction control valve worn or seized
		B	Modulating valve worn or damaged
		C	Clutch oil galleries blocked
9.	**Machine will not move with gear en-**	A	Modulating valve worn or damaged
		B	Clutch plates seized
		C	Clutch oil gallery blocked
10.	**Transmission squeals under load**	A	Clutch piston rings worn or damaged
		B	Turbine thrust bearing worn or damaged
11.	**Machine road speed erratic**	A	See (Fluctuating Oil Pressure) and high and

PRESSURE/FLOW TESTING

Flow Rate

Before commencing test ensure that the oil is at the correct level and at working temperature (80°-100°C, 176°-212°F)

Check that clutch pressure is between 120 and 150lbf/in² (8.4-9.8 kgf/cm²)

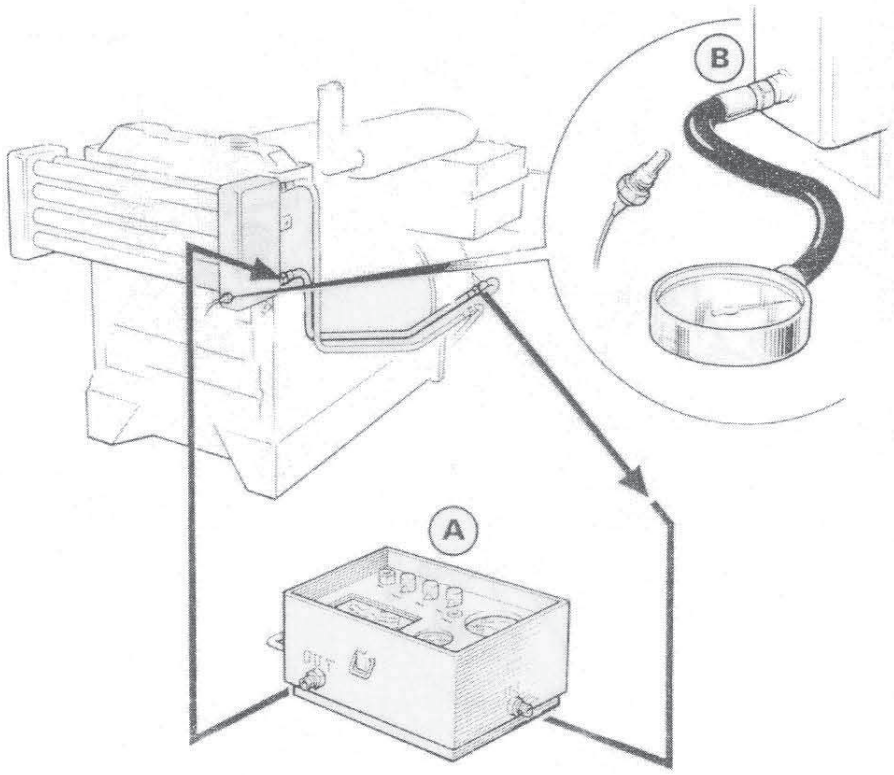
Connect flow meter HT100 (Service Tools) into oil cooler line from torque converter (as at **A**). Make sure that the flow meter loading valve is **OFF**.

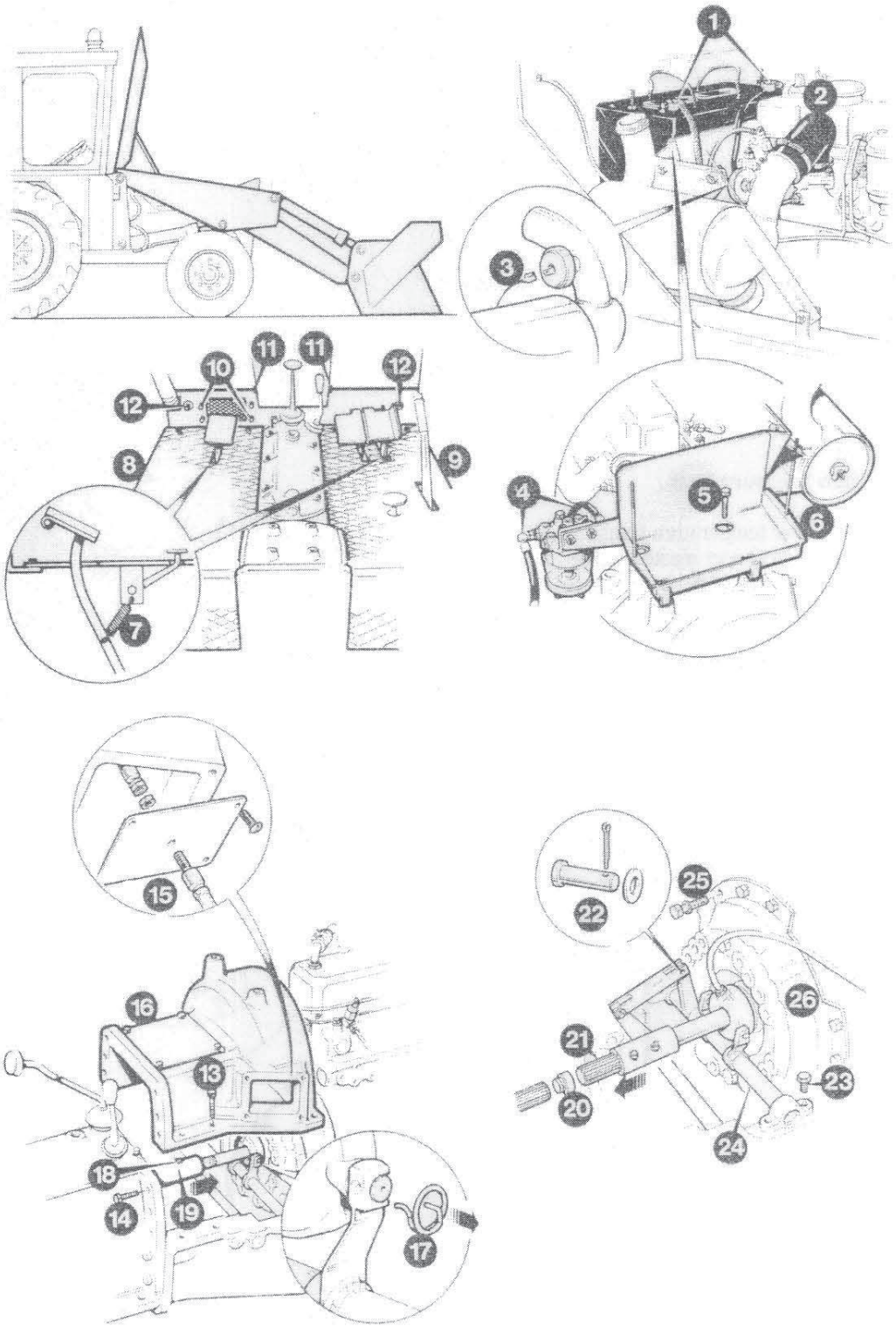
Run engine at maximum speed, flow meter reading should be between 8 and 8.5 UK gal/min (36-38 litres).

Lubrication Pressure Test

Remove oil cooler temperature transmitter (as at **B**) and connect master gauge 892/00003 (Service Tools)

Run engine at maximum spees, pressure gauge reading should be between 10 and 25 lbf/in² (0.7-1.7 kgf/cm²)





CLUTCH

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal

For Replacement the sequence should be reversed

When Removing

The battery tray, air cleaner and sedimenter assembly 6 should be removed as one unit.

NOTE: The sedimenter was not fitted prior to m/c no. 110552

If a cab heater is fitted, this must be removed by taking out bolts **10**. Cover plates **11** and **12** should then be removed to give clearance for the removal of the clutch housing **16**

Take out the retaining pins **18** and slide forward sleeve **19**

Remove plug **20** and slide transmission shaft **21** rearwards.

Clutch assembly **26** is removed together with transmission shaft **21** and thrust bearing.

When Replacing

Fit the driven plate with its long centre boss facing away from the flywheel.

Use the transmission shaft to centralise the driven plate.

Adjust clutch pedal (see page 3 6-1)

Torque Settings

Item	Nm	kgf m	lbf ft
13	57	5.8	42
14	130	13.3	96

CLUTCH

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed

When Dismantling

Mark pressure plate and clutch cover to ensure correct assembly.

Compress clutch using tools 18G99A and 18G99C

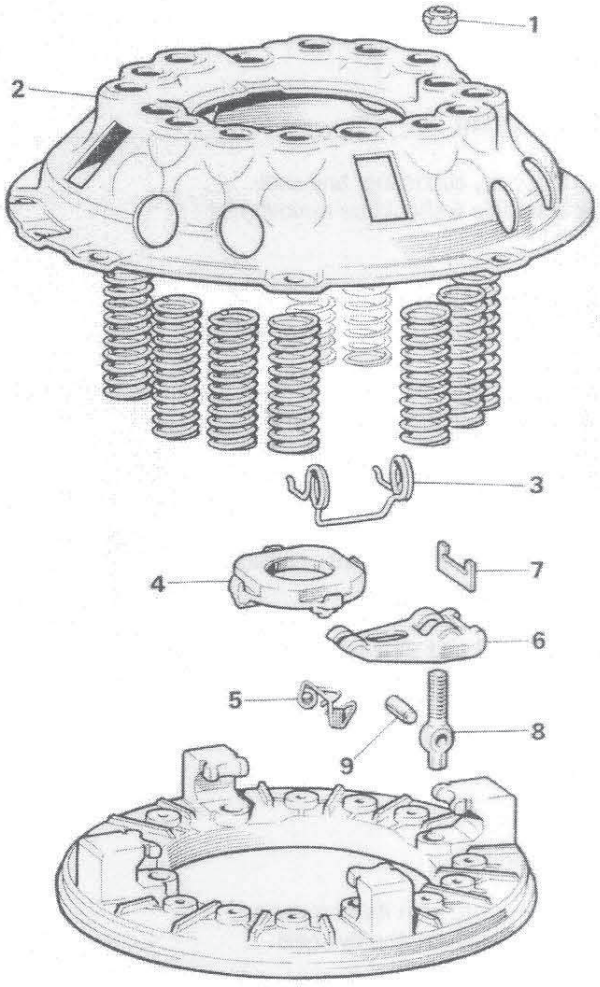
Eyebolt adjusting nuts **1** are peened over for security

When Assembling

Renew pressure springs as a set

Set release lever hight using tools 18G99A and 18G99C

Peen over adjusting nuts **1** to lock in position



MANUAL GEARBOX

Description

The gearbox casing contains the main gearbox and the high-low gearbox at the front and the differential gears at the rear. The gearbox top cover contains the selector mechanism for both parts of the gearbox.

Power from the clutch is transmitted from the primary shaft 3 through either the high or low ratio gears 4 or 5 to the layshaft 6.

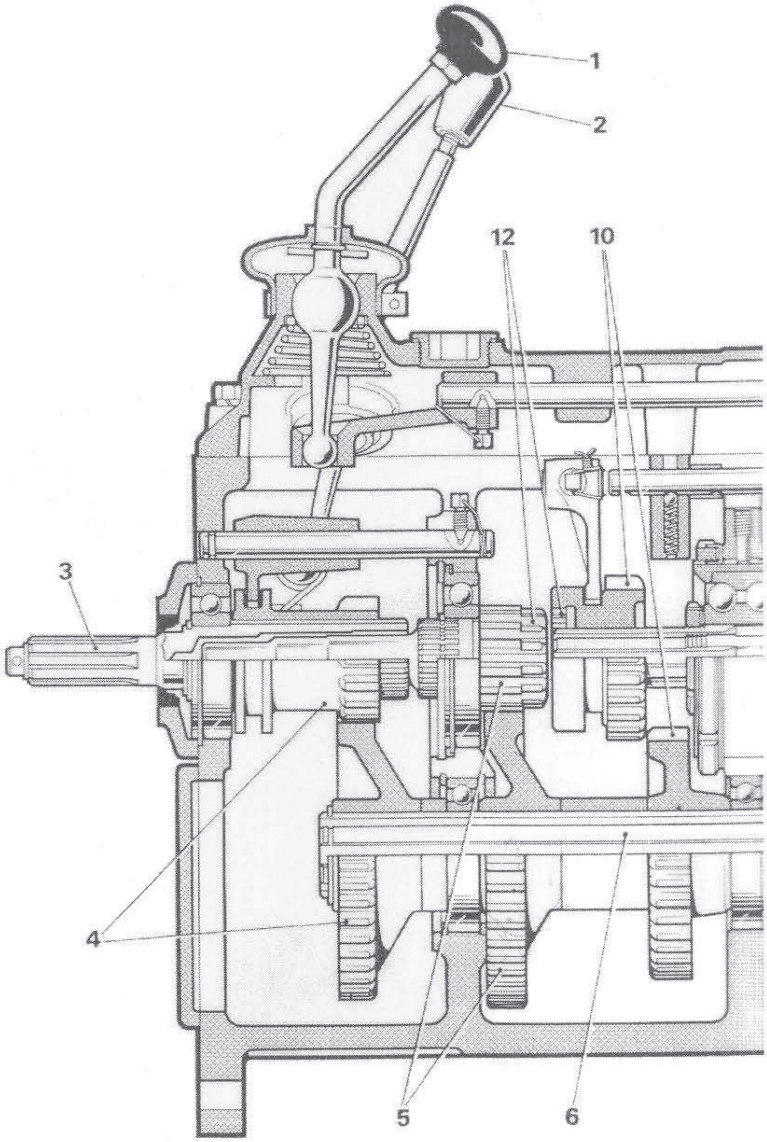
When gears 1st to 4th are selected the power from the layshaft is transmitted through the selected gear to the main shaft 11.

When 5th gear is selected the power is transmitted direct from the high-low ratio to the main shaft.

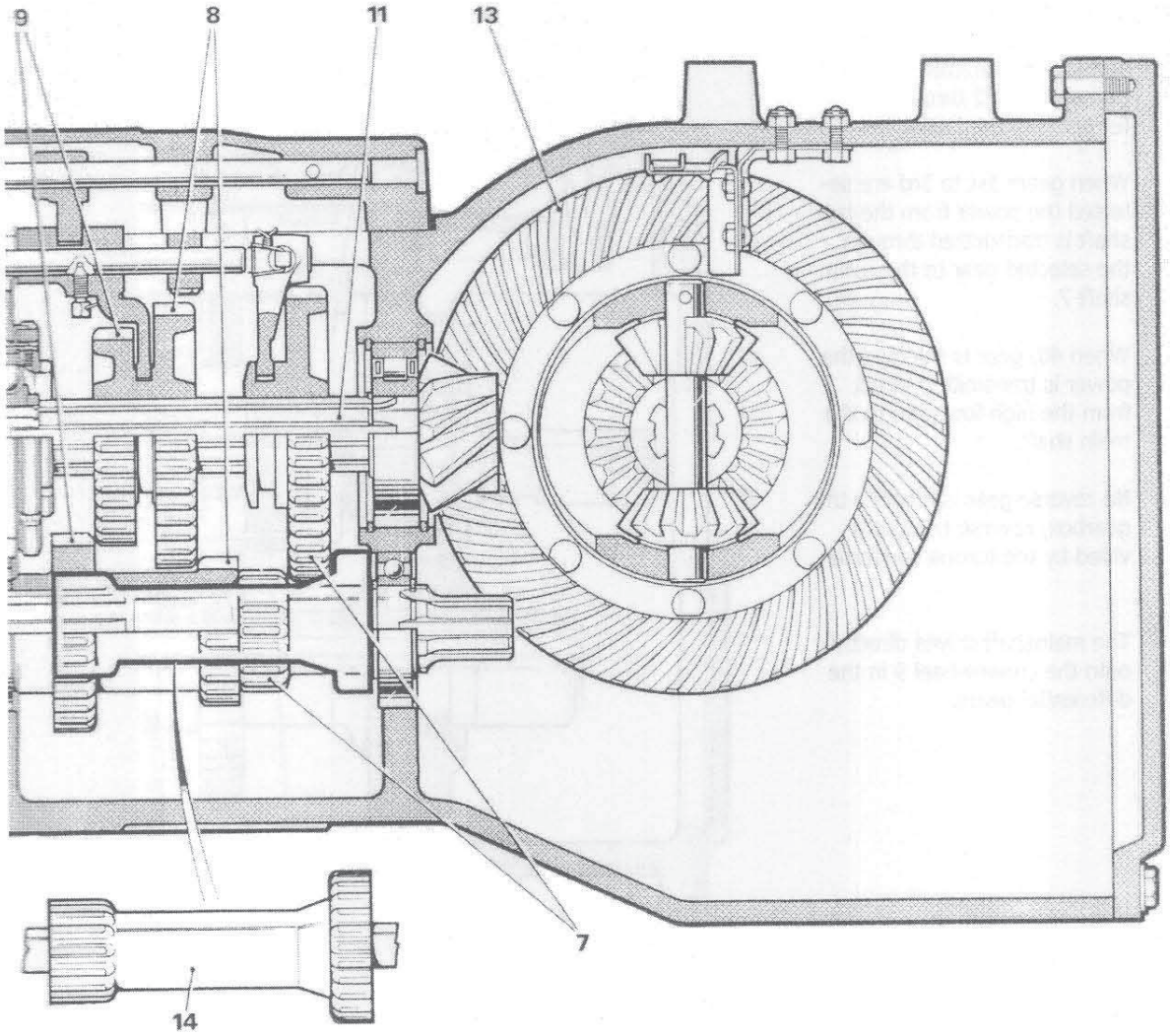
The reverse gear shaft 14 is mounted at the side of the layshaft towards the rear of the gearbox.

Selection of reverse gear slides the main shaft first gear 7 rearwards to engage with the reverse gear. Power is then transmitted from layshaft third gear 9 to the reverse gear shaft, then to the mainshaft through the first gear.

The mainshaft drives directly onto the crownwheel 13 in the differential gears.



1 Ratio Lever
2 Range Lever
3 Primary Shaft
4 High Ratio Gear
5 Low Ratio Gear
6 Layshaft
7 1st Gear
8 2nd Gear
9 3rd Gear
10 4th Gear
11 Mainshaft / Pinion
12 5th Gear
13 Crown Wheel
14 Reverse Gear



TORQUE CONVERTER GEARBOX

Description

The gearbox casing contains the main gearbox and the high-low gearbox at the front and the differential gears at the rear. The gearbox top cover contains the selector mechanism for both parts of the gearbox.

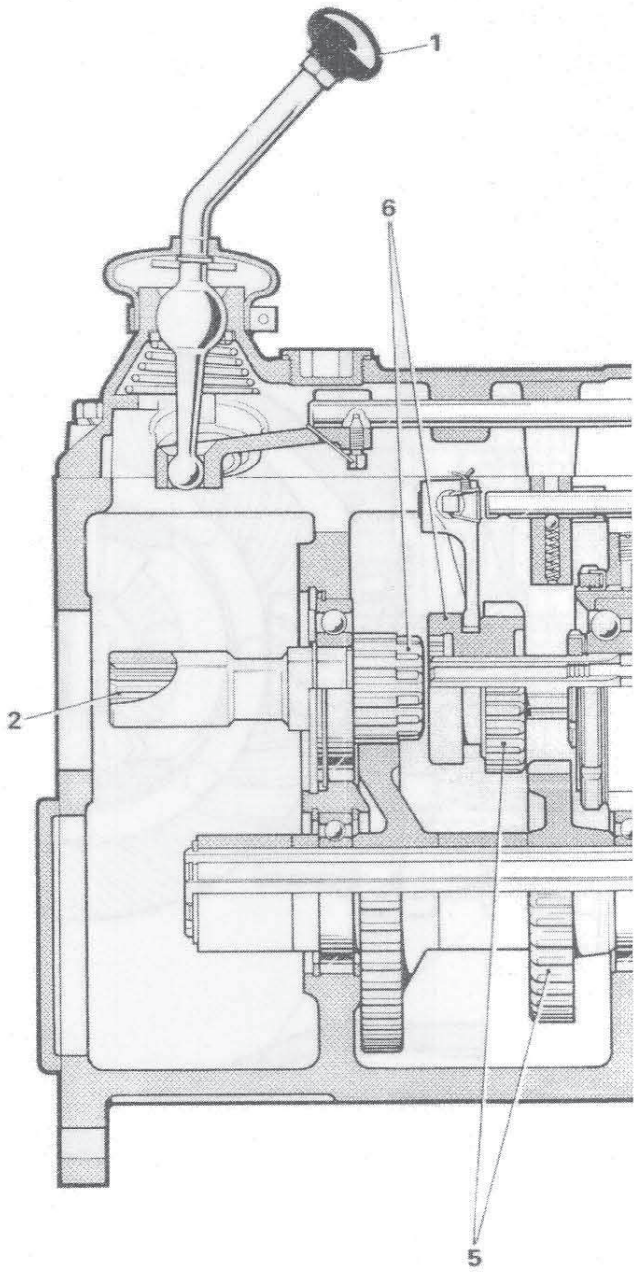
Power from the torque converter is transmitted from the primary shaft 2 through transfer gears to the layshaft 8

When gears 1st to 3rd are selected the power from the layshaft is transmitted through the selected gear to the main shaft 7.

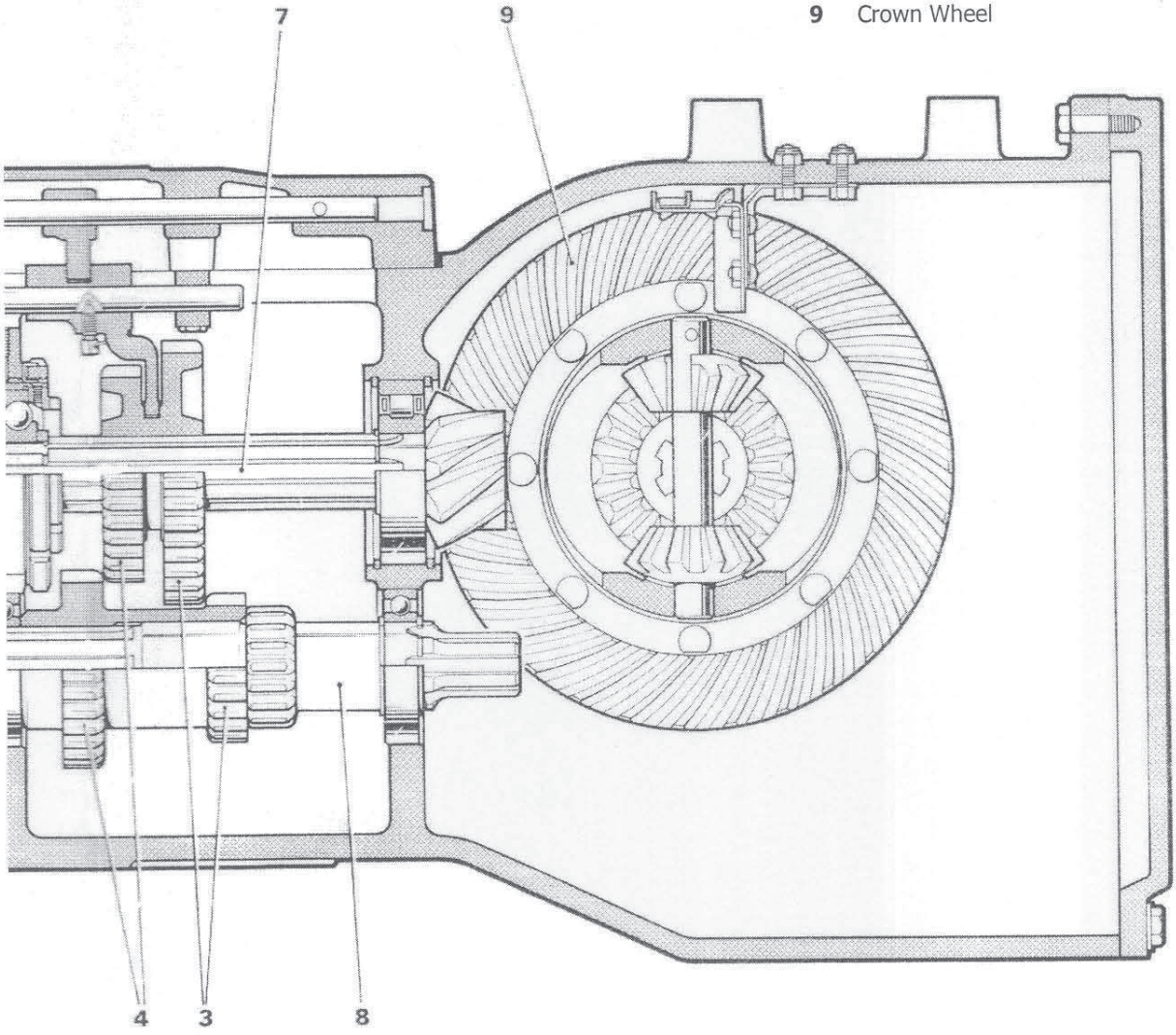
When 4th gear is selected the power is transmitted direct from the high-low ratio to the main shaft.

No reverse gear is fitted to the gearbox, reverse being provided by the torque converter.

The mainshaft drives directly onto the crownwheel 9 in the differential gears.



1 Ratio Lever
2 Primary Shaft
3 1st Gear
4 2nd Gear
5 3rd Gear
6 4th Gear
7 Mainshaft / Pinion
8 Layshaft
9 Crown Wheel



TORQUE CONVERTER GEARBOX
Suffix R Build

Description

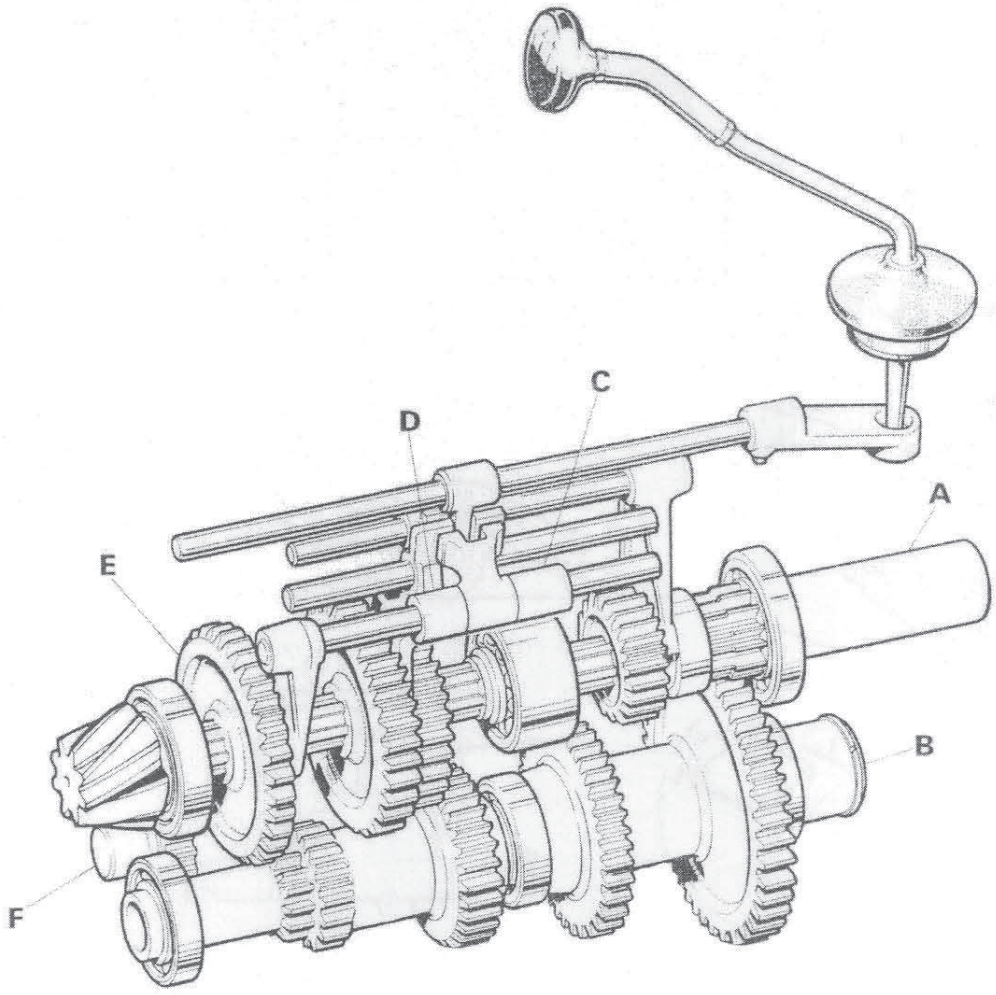
Torque converter machines have been built using modified 10 speed manual gearboxes.

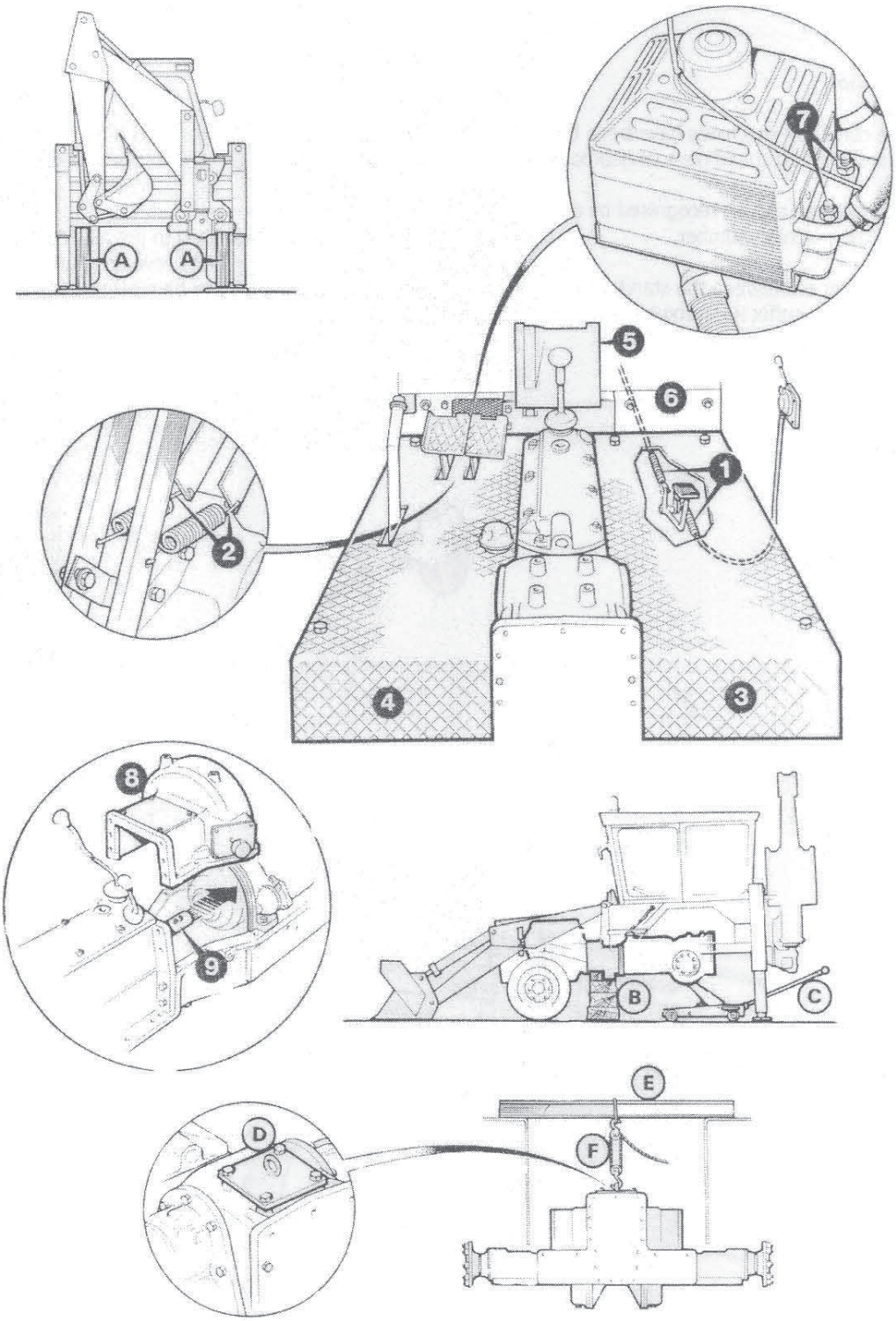
These machines can be recognised by a suffix R in the machine number.

The differences between the standard 10 speed and the suffix R gearboxes is as follows:

1. Primary shaft A is changed and the high ratio gear and oil flinger on the layshaft are replaced by spacer B

2. Spacers C and D are fitted to prevent engagement of first gear E and reverse gear F. These spacers must always be replaced when servicing the gearbox.





GEARBOX FINAL DRIVE

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal

For Replacement the sequence should be reversed

When Removing

Raise machine on stabiliser legs ans support as A

Drain transmission oil and remove rear road wheels.

Remove the battery tray, air cleaner and sedimenter assembly (see page K 1-1)

Remove the seat assembly from the transmission.

Items 8 and 9 apply to manual machines only.

Support engine under clutch or torque converter housing B.

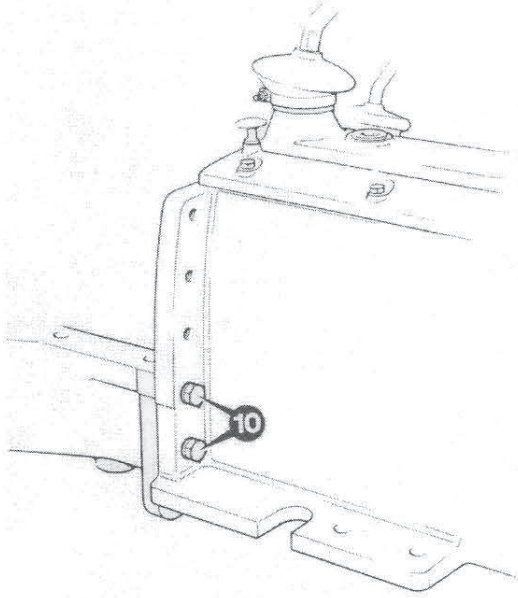
Support transmission assembly with trolly jack C or as follows. Make up lifting plate D to fit seat mounting on transmission. Place lifting bar E across inner fenders and fit pully block F to lifting bar and plate.

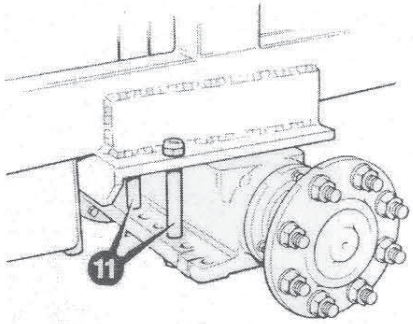
Remove remaining bolts 10 from transmission / clutch housing or all bolts from transmission / torque converter.

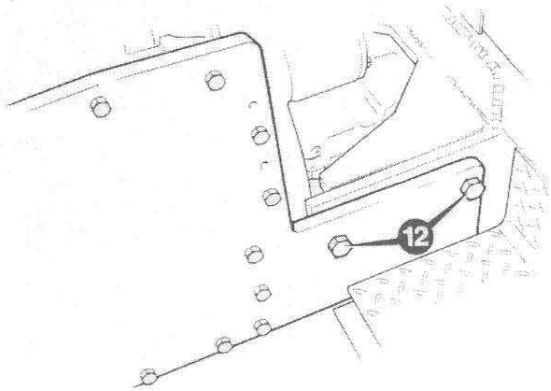
When Replacing

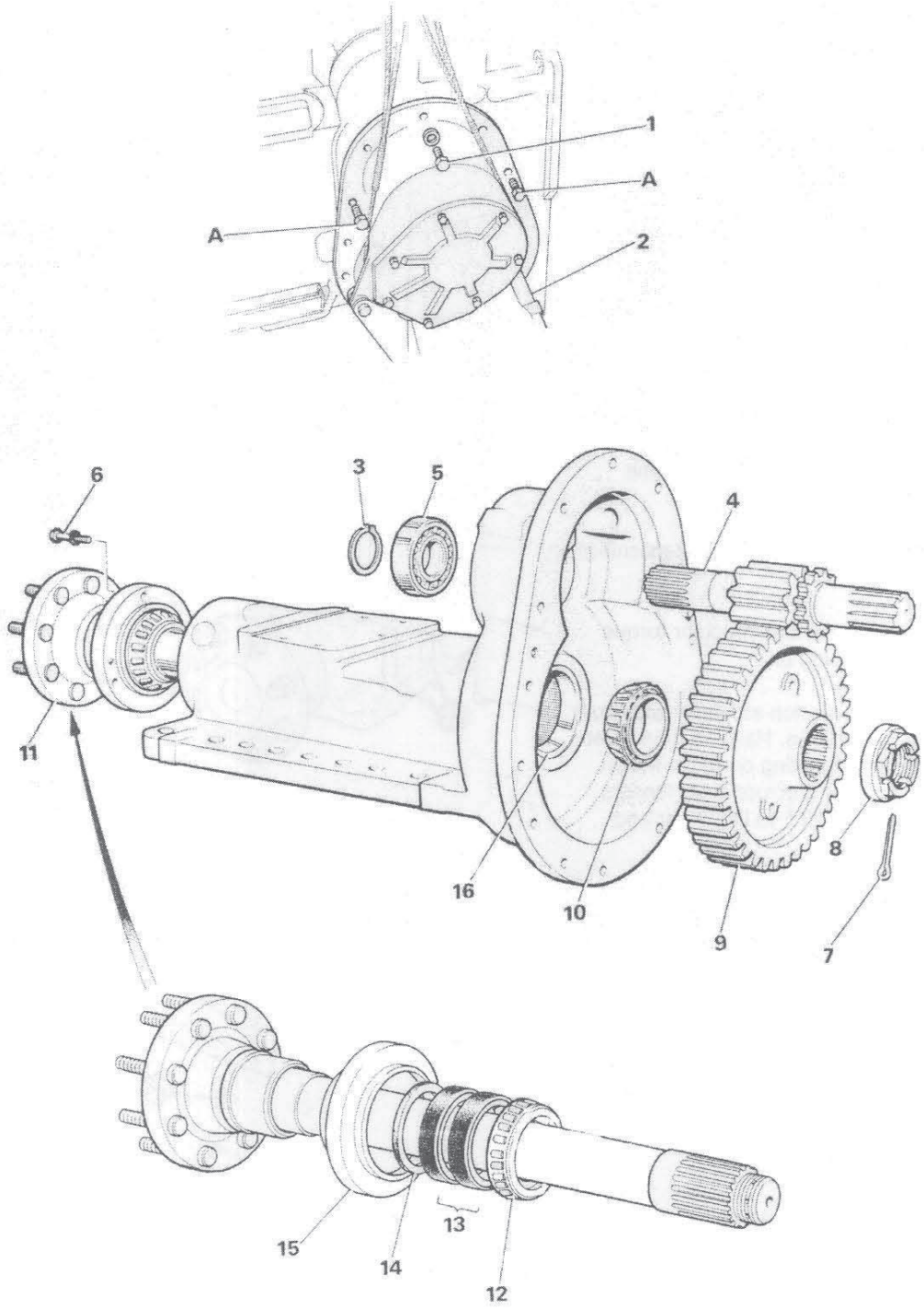
Care to be taken when entering torque converter shaft into gearbox shaft as splines can be a tight fit. Do not use undue force as damage can be caused to gearbox bearings.

Refill transmission with oil.









FINAL DRIVE AND REDUCTION GEARS

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed

When Dismantling

Screw two housing bolts 1 into tapped holes A and tighten equally to release the drive pinion from its splines.

Remove the brakes and housings as section G page 1-1.

Remove bearing 12 using tools 18G47C and 18G47AF.

When Assembling

Inspect bearings for wear and renew if necessary.

Replace oil seals 13 and felt washer 14

Set bearing pre-load by tightening nut 8

Check pre-load as follows:

1. Attch a length of cord to a wheel stud and wrap around the stud 3-4 times.

2. Attach a spring balance to the free end of the cord.

3. Pull on the spring balance and note the reading whilst the shaft is rotating.

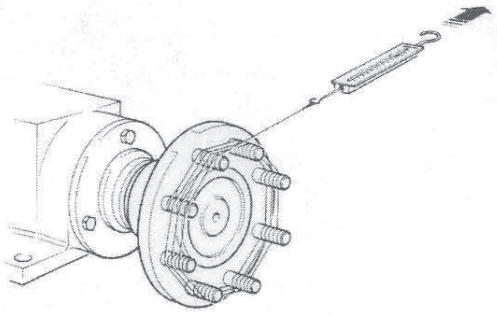
Bearing Pre-load

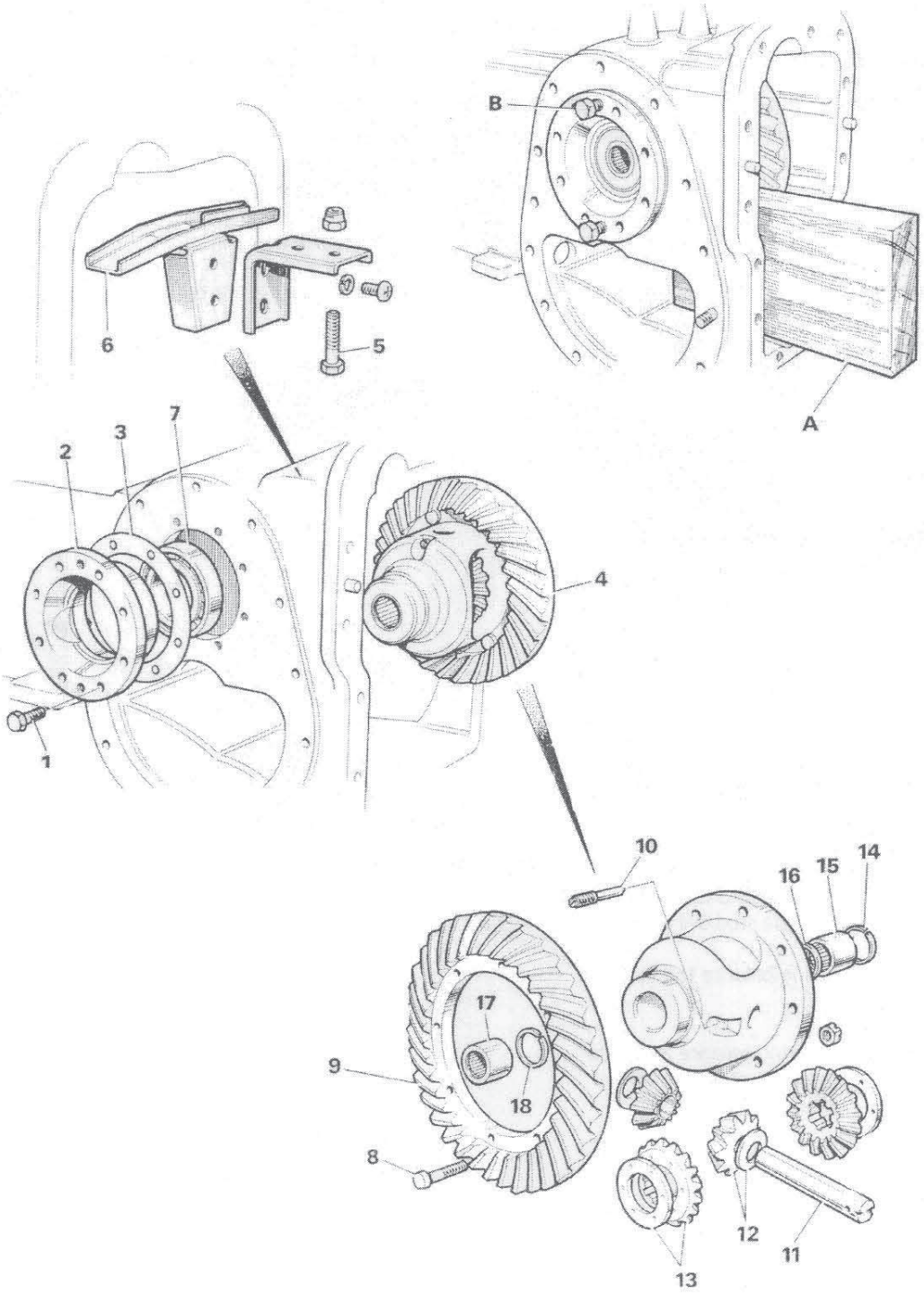
With old bearings:
0.05mm (0.002in)
With new bearings:
0.175mm (0.007in)

Spring Balance Reading

0 to 1.3kg (0 to 3lb) is equal to 0.05mm. Pre-load.

5.5 to 8.2kg (12 to 18lb) is equal to 0.175.. Pre-load.





DIFFERENTIAL

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed

When Dismantling

Support differential assembly as at A

Use two bplts to remove item 2 as at B

When Assembling

Set bearing pre-load as follows:

Fit differential assembly into transmission case.

Assemble bearings 7 into housings 2 and fit to transmission case without shims. Secure with four equally spaced bolts, finger tight.

Tighten left hand bolts and rotate differential to check that bearings are fitted correctly.

Fully slacken right hand bolts and measure the gap between the housing and casing in four positions. Remove housing and fit shims 0.076mm (0.003in) less than the measured gap. Refit housing and fully tighten bolts.

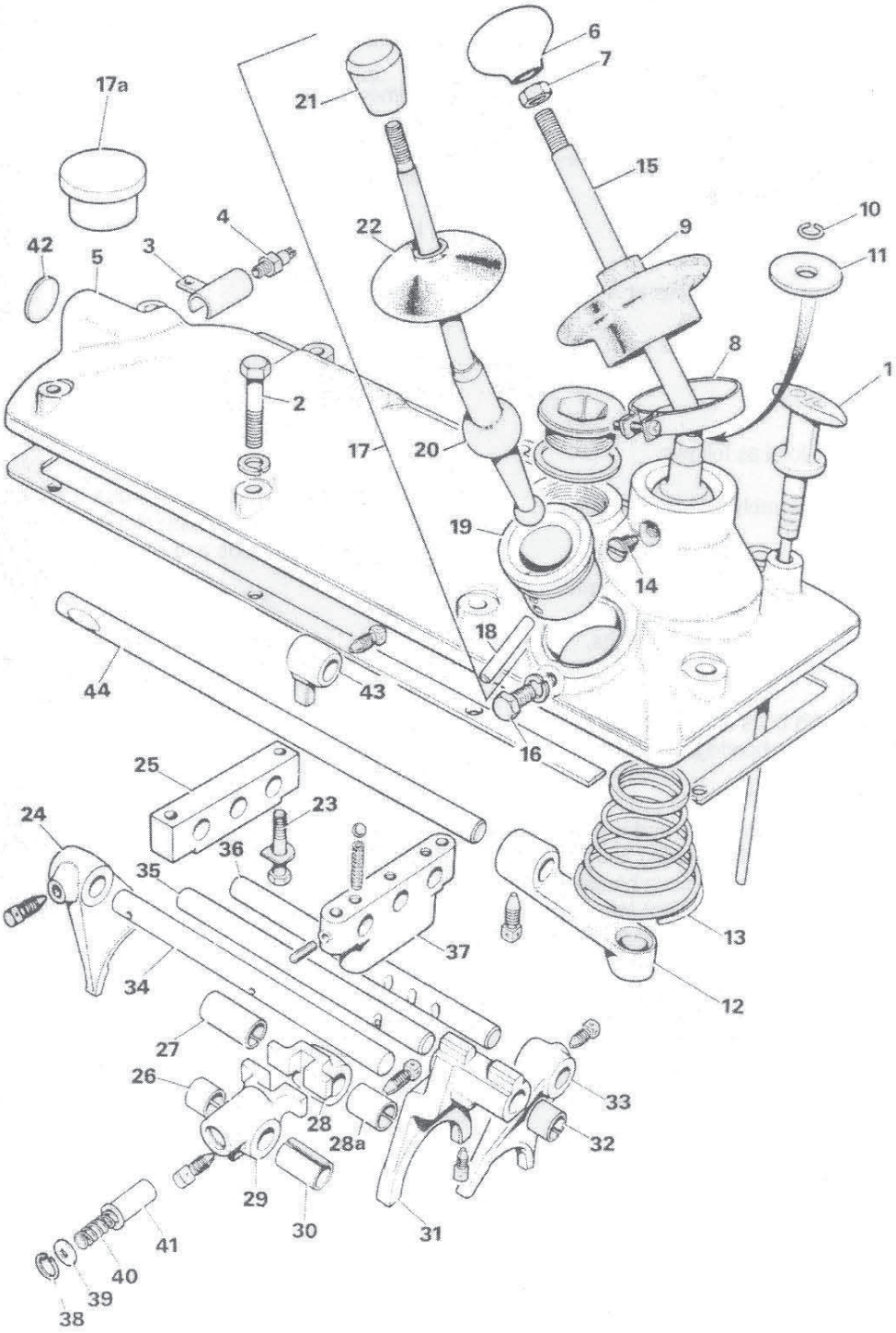
Check crown wheel backlash as follows:

Remove gearbox top cover and lock up gears to prevent transmission turning. Take three equally spaced crown wheel backlash readings.

NOTE: If any reading is in excess of 0.7mm (0.028in) reset the mainshaft as page F 10-10.

From the average backlash reading subtract 0.33mm (0.013in) devide by 3 and multiply by 5. The answer will give the number of shims to be removed from the right hand housing and fitted to the left.

Adjust oil catcher trough 6 to give 0.05 to 0.07mm (0.002 to 0.003in) clearance between the rear scoop and crown wheel.



GEARBOX
Manual and Suffix R Gearbox

Cover and Selectors

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed

NOTE: On Suffix R boxes spacer 28a is additional and item 17 is replaced by 17a

When Dismantling

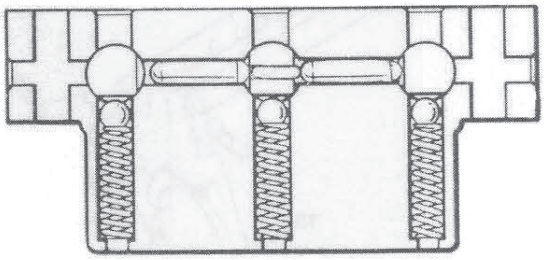
Care to be taken when removing rods from 37 not to lose detent balls and springs and interlock pins.

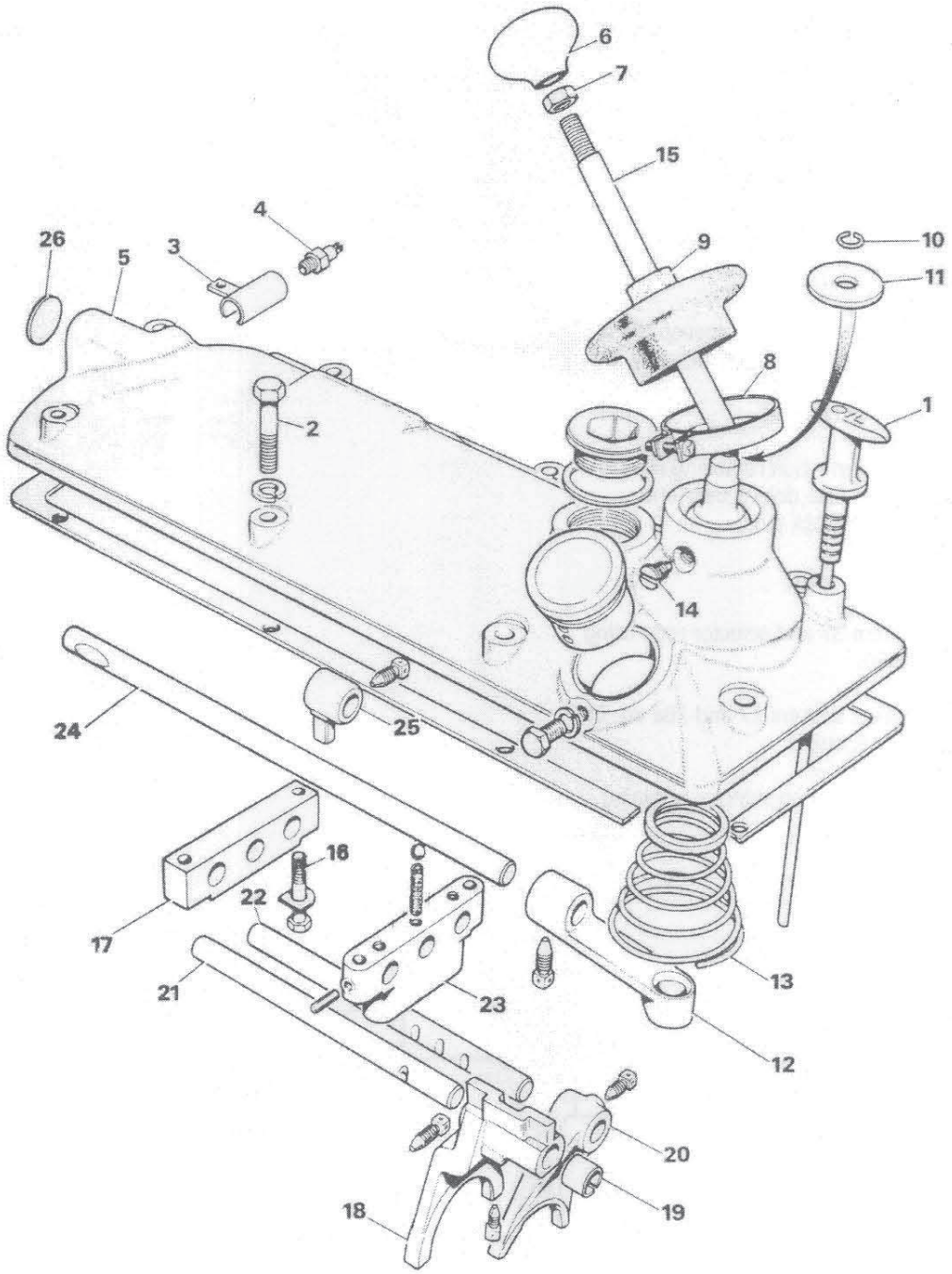
When Assembling

Assemble item 37 and selector rods using tool 18G1020.

Ensure correct spacers 27 and 28a are fitted to Suffix R builds.

Renew all lockwire on selector retaining screws.





GEARBOX – Stage 1
Torque Converter Machines

Cover and Selectors

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed

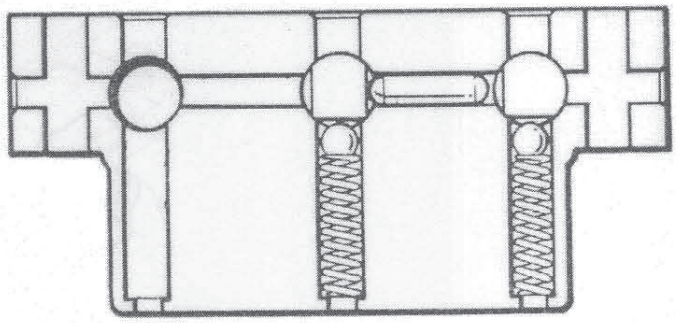
When Dismantling

Care to be taken when removing rods from interlock housing 23 not to lose detent balls and springs and interlock pins.

When Assembling

Assemble item 23 and selector rods using tool 18G1020.

Renew all lockwire on selector retaining screws.



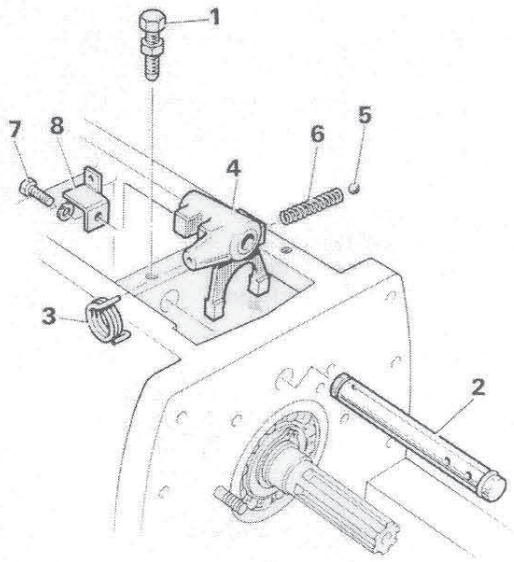
GEARBOX – Stage 2
Manual Gearbox only

High/Low Selectors

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed

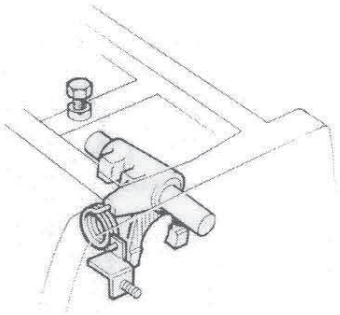


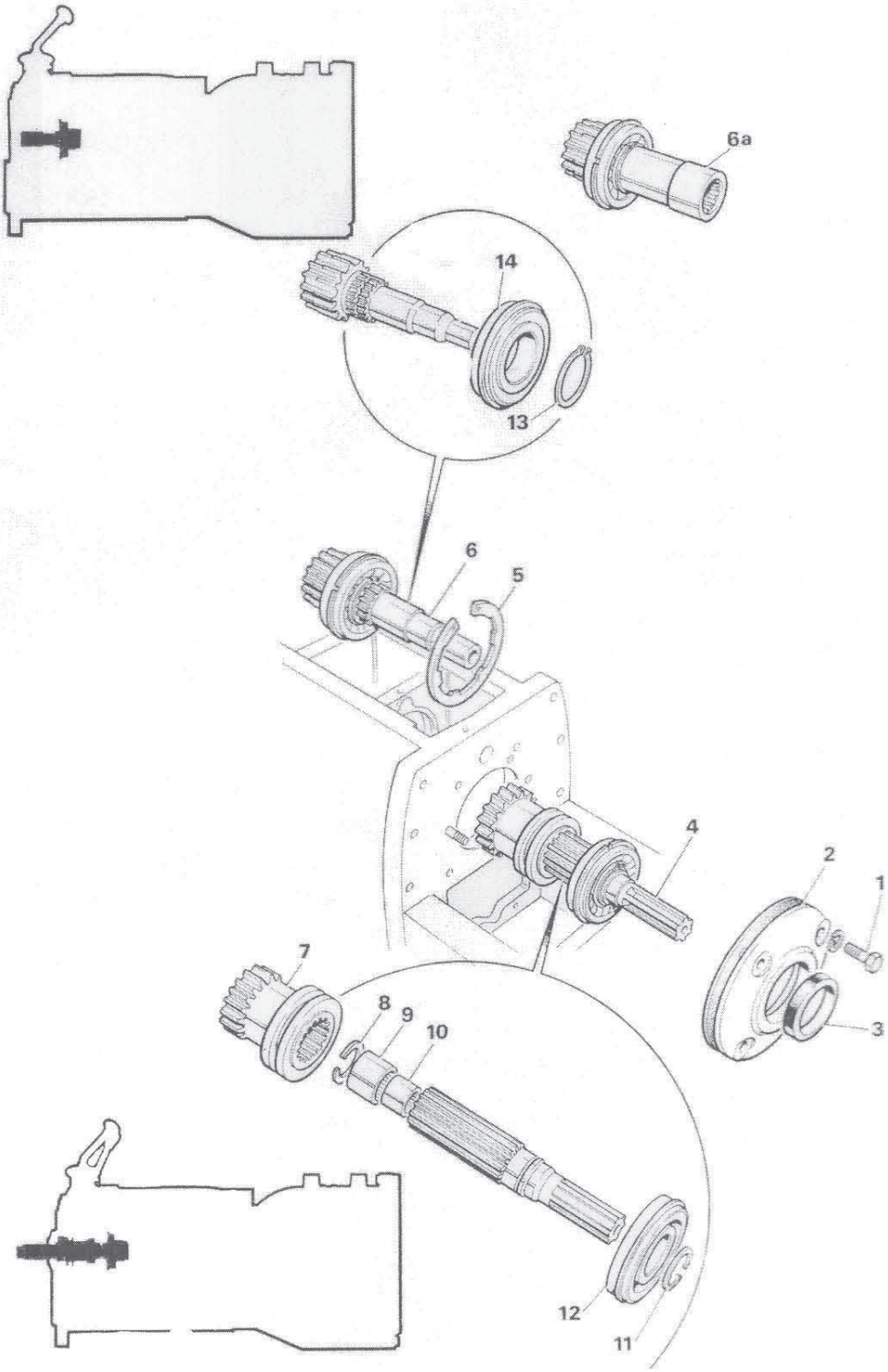
When Dismantling

Care to be taken not to lose items 5 and 6

When Assembling

Renew lockwire on item 1





GEARBOX

Primary Shaft

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal

For replacement the sequence should be reversed.

NOTE: The illustration shows a manual gearbox. The following changes should be noted for a torque converter and Suffix R boxes.

Items 1 to 4 and 7 to 11 are deleted and item 6 is replaced by item 6a

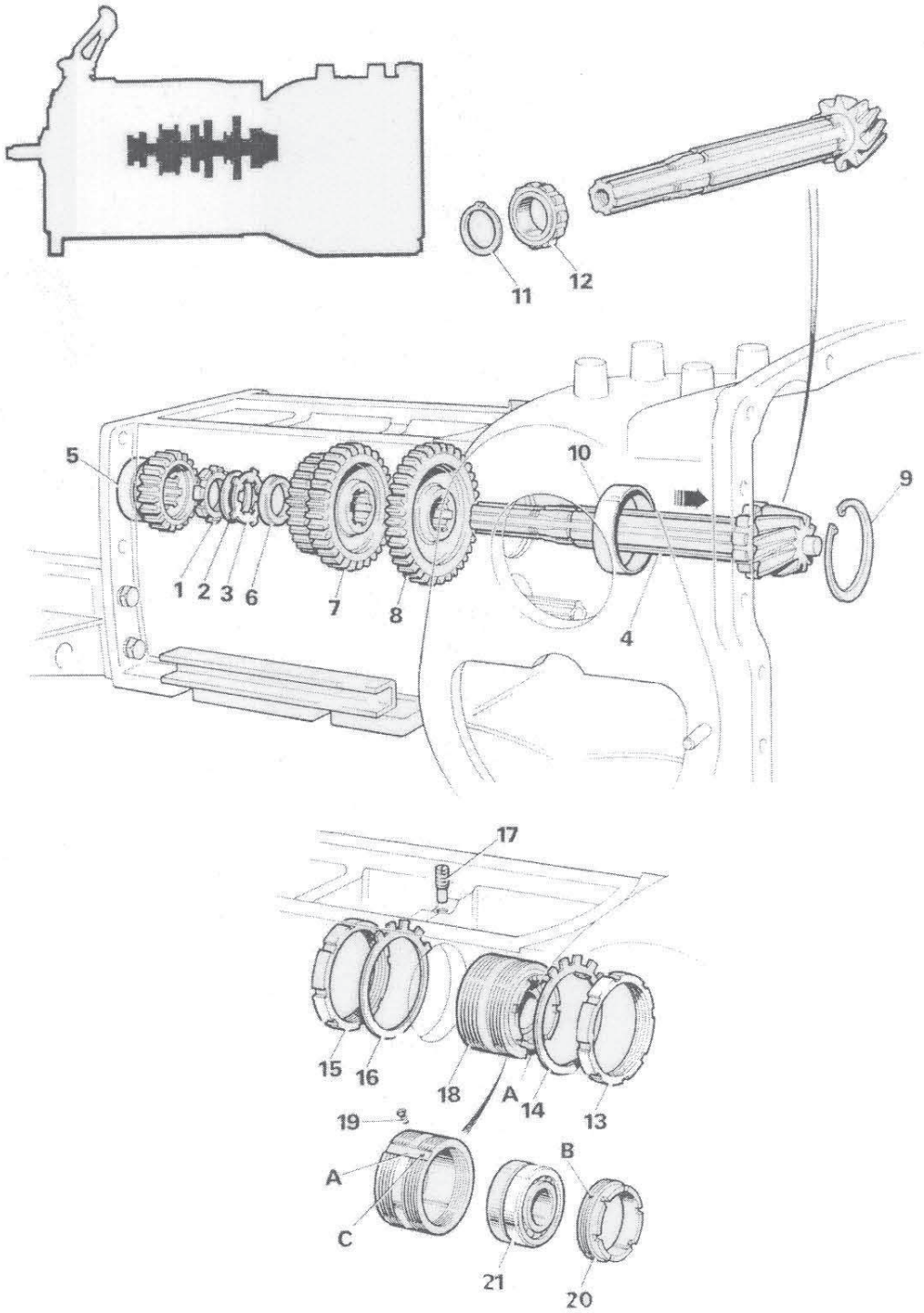
When Removing

To remove item 4 use the sliding gear as an impulse hammer.

When Replacing

Inspect bearings for wear and renew if necessary. Grease roller bearings before assembly.

Remove sharp edges and burrs from splines, shafts and gears using a fine abrasive stone.



GEARBOX

Main Shaft and Centre Bearing

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal

For replacement the sequence should be reversed.

NOTE: Gear 8 is only fitted to manual gearbox.

Before removing mainshaft 4 remove differential assembly (see page F9-4)

When Removing

Remove mainshaft nut 1 using tool 18G1139.

Drive out shaft 4 using a soft drift, removing items 2, 3 and 5 to 8 as the shaft is withdrawn.

To remove bearing assembly 18, unlock both locknuts and slacken anti-rotation pin 17 half a turn.

Unscrew the rear bearing locknut 13 whilst pushing the bearing assembly forwards.

Remove anti-rotation pin 17. Rotate bearing housing 18 to line its location slot with uppermost tooth of layshaft third gear (second gear on torque converter boxes)

Unscrew the front bearing locknut 15 whilst pushing the bearing assembly rearwards and then remove bearing assembly.

When Replacing

Inspect bearings for wear and renew if necessary.

Remove sharp edges and burrs from splines, shafts and gears using a fine abrasive stone.

When assembling centre bearing if tapped hole B and screw hole C do not align redrill item 20 3.9mm dia, and tap 2 BA.

Reset main shaft as page F10-10

Torque Settings

Item	Nm	kgf m	lbf ft
1	244	24.9	180

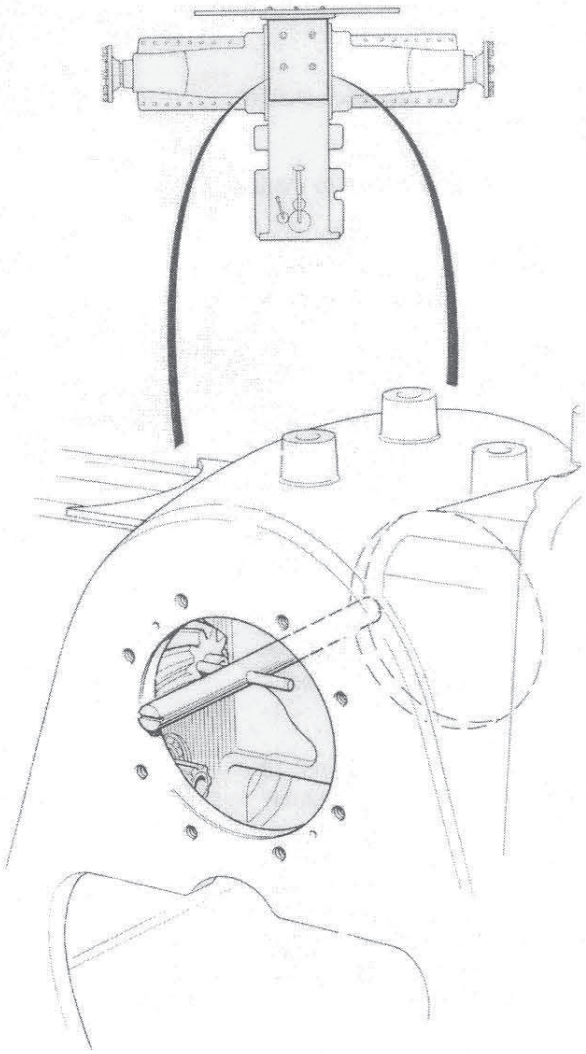
GEARBOX – Stage 5

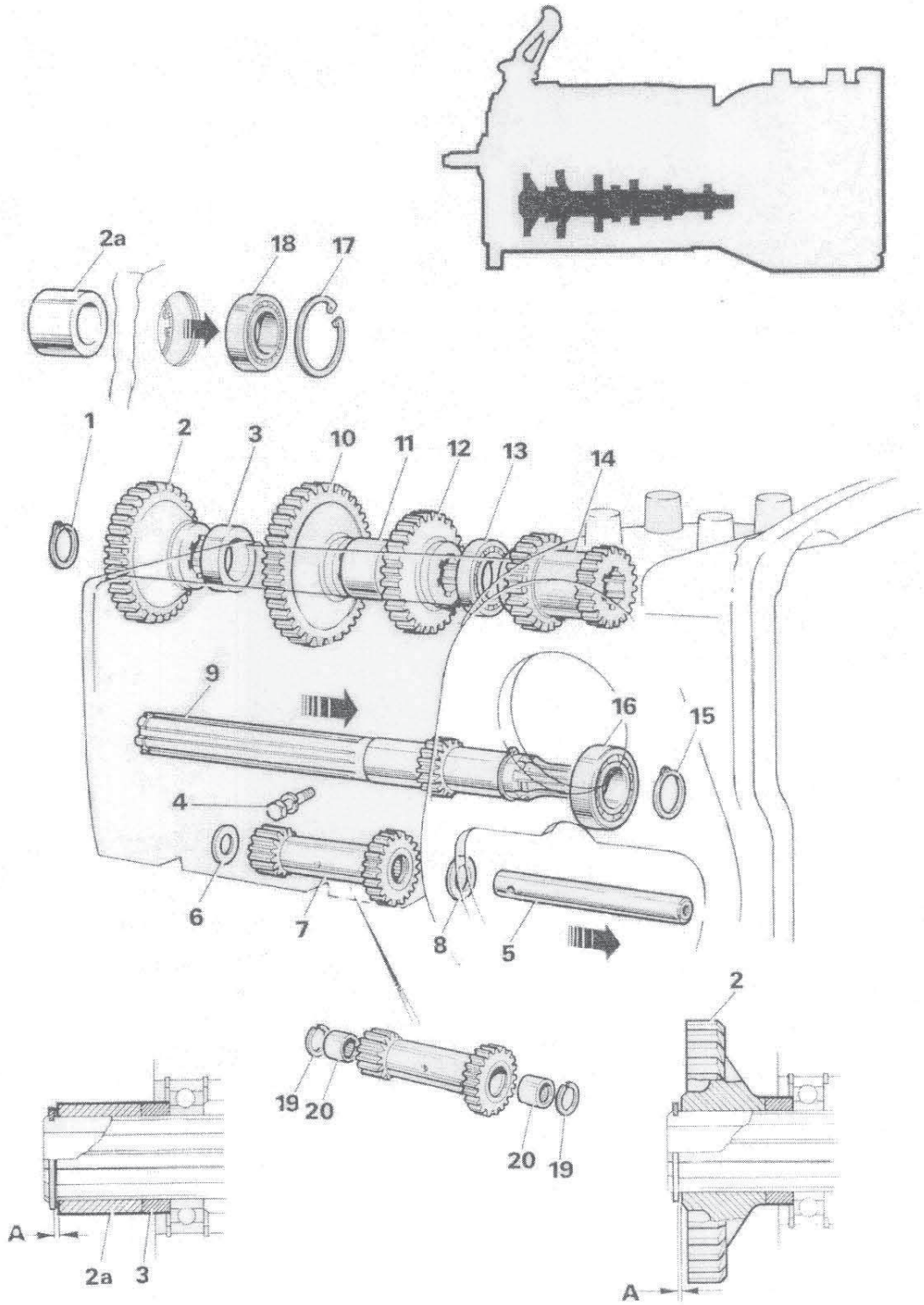
Mainshaft Resetting

Position tool 18G477 against the inner face of the housing bores, as shown, with the 30.16mm (1.1875in) long side of the peg towards the mainshaft.

Slacken the anti-rotation pin and using tool 18G474 adjust the centre bearing locknuts until the ground face of the pinion just touches the gauge peg with both locknuts fully tightened.

When the setting is correct tighten the anti-rotation pin.





GEARBOX

Layshaft and Reverse Gear

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal

For replacement the sequence should be reversed.

NOTE: The illustration shows a manual box. The following changes should be noted.

Suffix R Gearboxes. Item 2 deleted and replaced with item 2a.

Torque Converter Gearboxes. Item 2 Deleted and replaced with item 2a and items 4 to 8 and 19 to 20 deleted.

When Removing

Remove shaft 5 by fitting bolt 4 into the tapped end.

Drive out shaft 9 using a soft drift, removing items 10 to 14 as shaft is withdrawn.

When Replacing

Inspect bearings for wear and renew if necessary.

Remove sharp edges and burrs from splines using a fine abrasive stone.

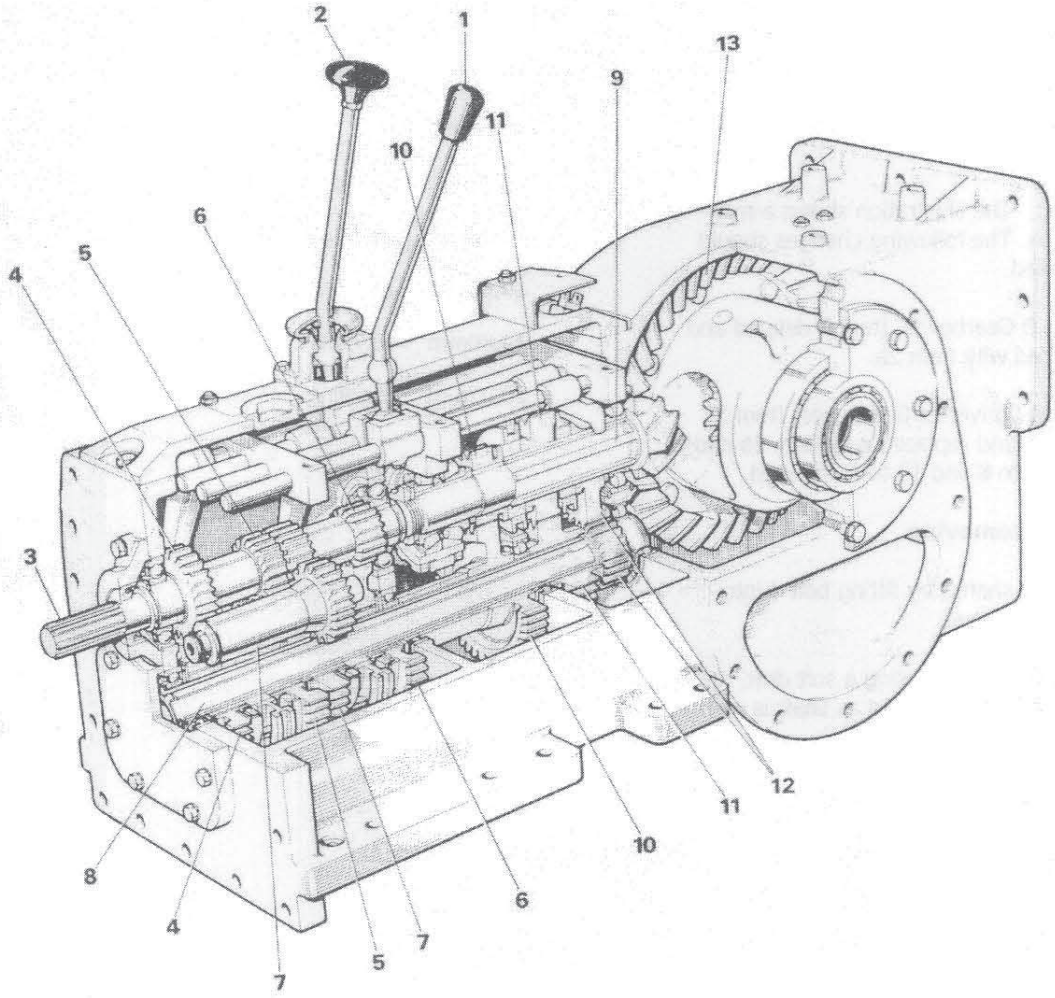
Reset end float as follows:

Assemble layshaft 9 with all gears, bearings and spacers on the bench, using the smallest spacer 3.

Measure gap A if it exceeds 0.38mm (0.015in) fit larger spacer to bring below this figure.

Spacer Sizes

19.05mm	(0.75in)
19.30mm	(0.76in)
19.56mm	(0.77in)
19.80mm	(0.78in)
20.07mm	(0.79in)



GEARBOX (SYNCHRO)

Manual Clutch Machines

Description

The one piece casing contains the ratio gearbox at the front, the range gearbox in the centre and the differential gears at the rear. The gearbox top cover contains the selector mechanism for both parts of the gearbox.

All gears are constant mesh, the ratio gears have sliding dog engagement with synchromesh and the range gears sliding dog engagement only.

Power from the clutch is transmitted by the primary shaft 3 through the selected ration gear 4, 5 or 6 to the layshaft 8. From the layshaft the power is transmitted through the range gears 10, 11 or 12 to the mainshaft 9 and pinion.

Reverse gear 7 is mounted at the front of the gearbox, by the side of the primary shaft, running in constant mesh with 2nd gear on the primary shaft.

When reverse is selected power passes from the primary shaft, through reverse gear shaft to reverse gear on the layshaft. From the layshaft the power is transmitted through the range gears 10, 11 or 12 to the main sahft and pinion.

1 Range Lever
2 Ratio Lever
3 Primary Shaft
4 3rd Ratio Gear
5 2nd Ratio Gear
6 1st Ratio Gear
7 Reverse Gear
8 Layshaft
9 Mainshaft/Pinion
10 High Range Gear
11 Medium Range Gear
12 Low Range Gear
13 Crown Wheel

GEARBOX (SYNCHRO)

Synchromesh

Description

The gearbox is fitted with 'Blocking Pin' synchromesh on forward and reverse gears, comprising the following parts.

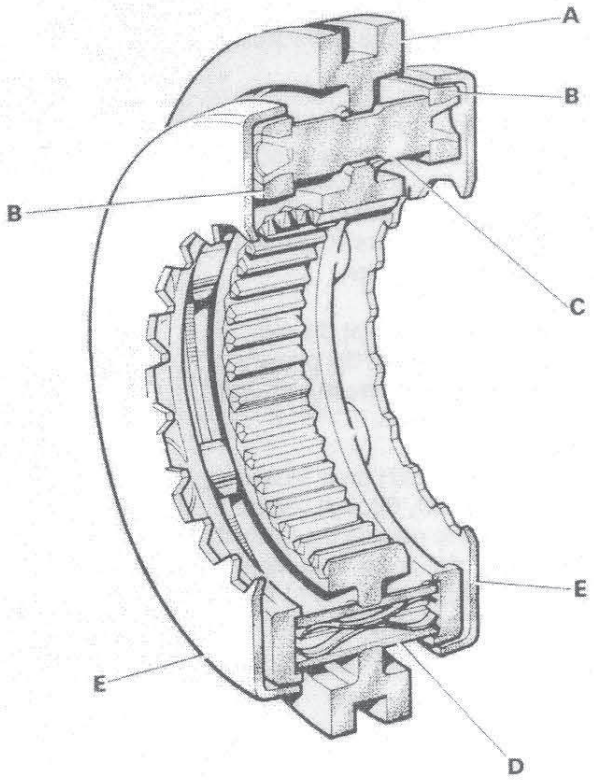
SYNCHRO HUB (A) controls the operation of the synchromesh unit and gear selection, the selector fork fitting into the outer groove. Internally are dog teeth which link the selected gear to the drive shaft. Through the syncro hub centre are two sets of holes for the Blocker Pins (C) and the Split Energiser Pins (D), spaced alternately.

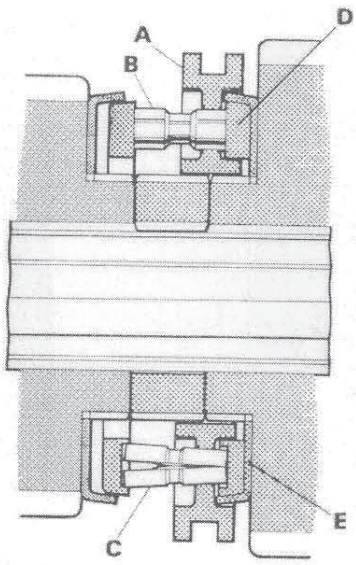
SYNCHRO RINGS (B) are rigidly joined by the blocker pins, with the split energiser pins held, in counterbores, between the two synchro rings.

BLOCKER PINS (C) have a narrow neck in the centre against which the sunchro hub transmits radial drive during gear changes. The edges of the blocker pin neck and their mating synchro hub hole are designed so that, as the radial loads are reduced, the synchro hub can slide over the shoulder of the blocker pin.

SPLIT ENERGISER PINS (D) take the initial axial load of the synchro hub on the shoulder of the split energiser pin neck. As the axial load reaches approx. 400 N (40.8 kg 90 lb) the internal springs allow the split energiser pin to collapse and the synchro hub to move axially.

SYNCHRO HUBS (E) take the frictional drive from the synchro ring on their inner faces. The synchro hubs are splined to drive their respective gears whilst sychronisation is taking place.





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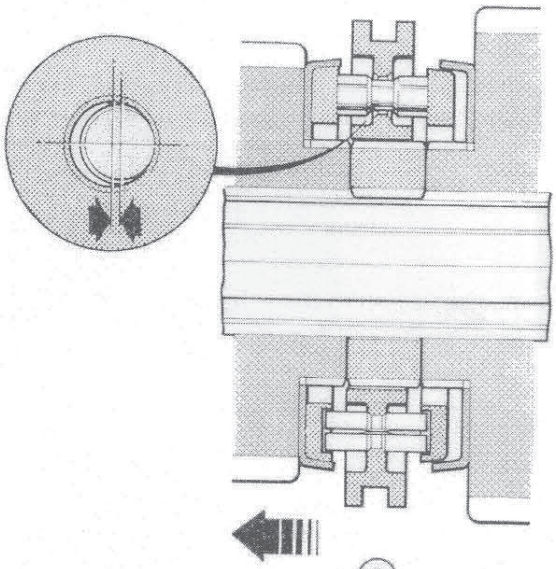

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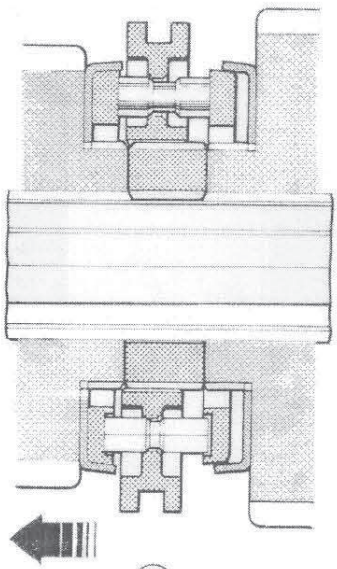

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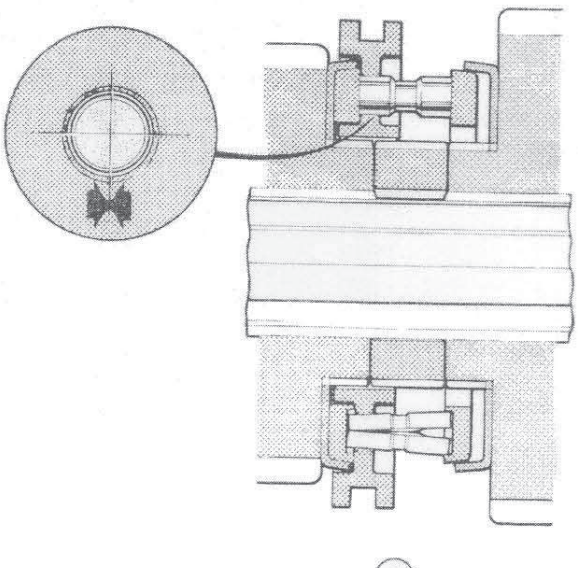


J

GEARBOX (SYNCHRO)

Synchromesh – Operation

Diagram F shows the gearbox with second gear engaged. Synchro ring D is in contact with synchro cup E and the synchro hub dog teeth are linking second gear to the shaft gear. In this position the split energiser pins C are collapsed.

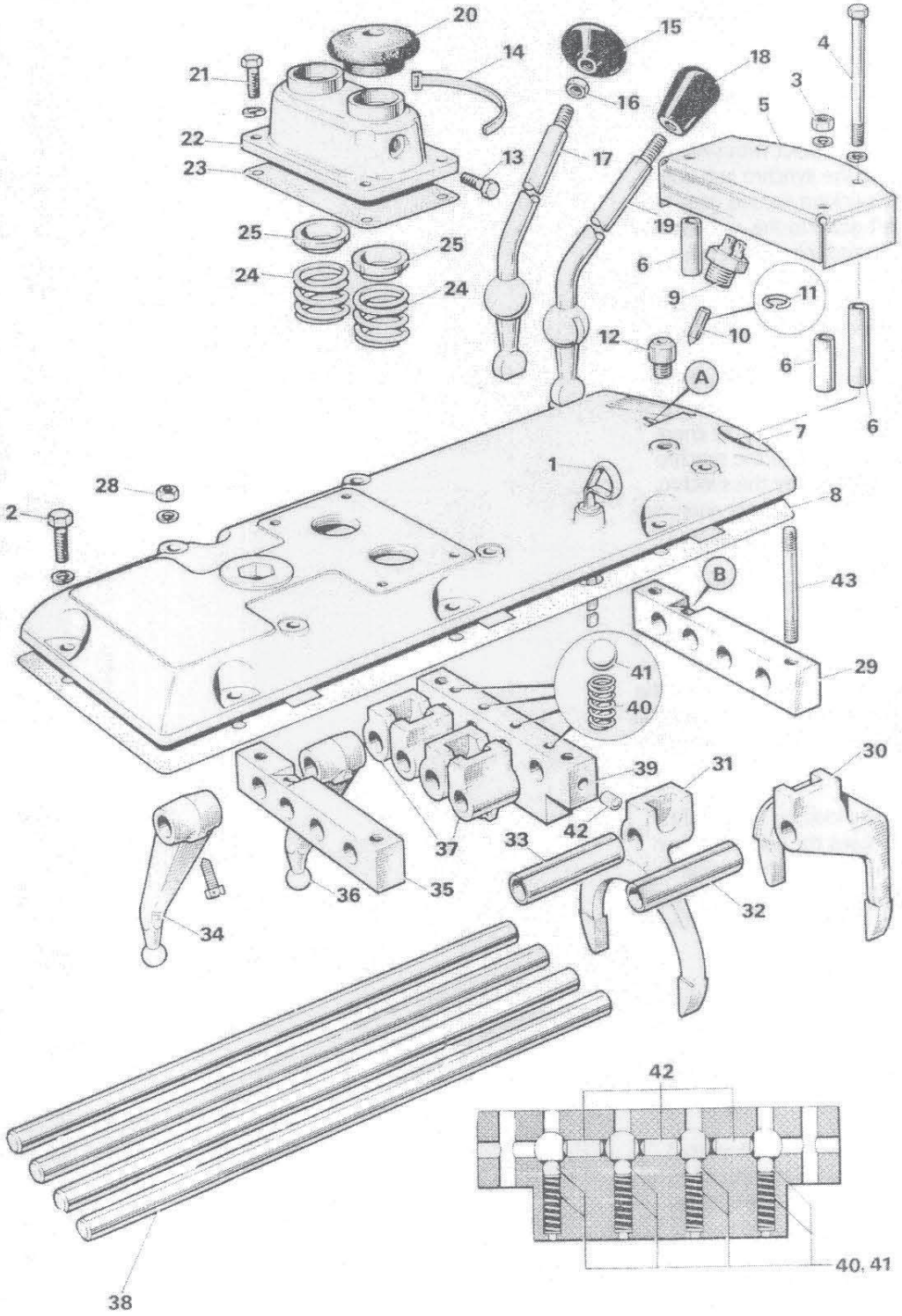
When selecting third gear the synchro hub A slides along the split energiser pins until the pin recess and the synchro hub flange are in line. At this point the split energiser pins open and the synchro rings are moved by the synchro hub pushing on the split energiser pin shoulder.

Initial contact between the synchro ring and the synchro cup starts to synchronise the speed of the shaft and 3rd gear. The rotational force of the synchro ring is taken by the neck of the blocker pin against the edge of the synchro hub hole, as at G.

As the axial load on the synchro hub increases the split energiser pin 'collapses' and the conical faces of the blocking pin and synchro hub hole come into contact, as at H.

Further increases in the axial loads increase the frictional grip of the synchro ring and synchro hub causing the shaft and gear speeds to become closer.

As the speeds are synchronised the radial load on the blocker pin and the synchro hub is reduced. This allows the synchro hub to slide freely along the blocker pin and to engage its dog teeth with 3rd gear, see diagram J



GEARBOX (SYNCHRO)

Manual Clutch Machine

Covers and Selectors

Dismantling and Assembly

The numerical sequence shown on the illustration is intended as a guide to dismantling

For assembly the sequence should be reversed.

When Dismantling

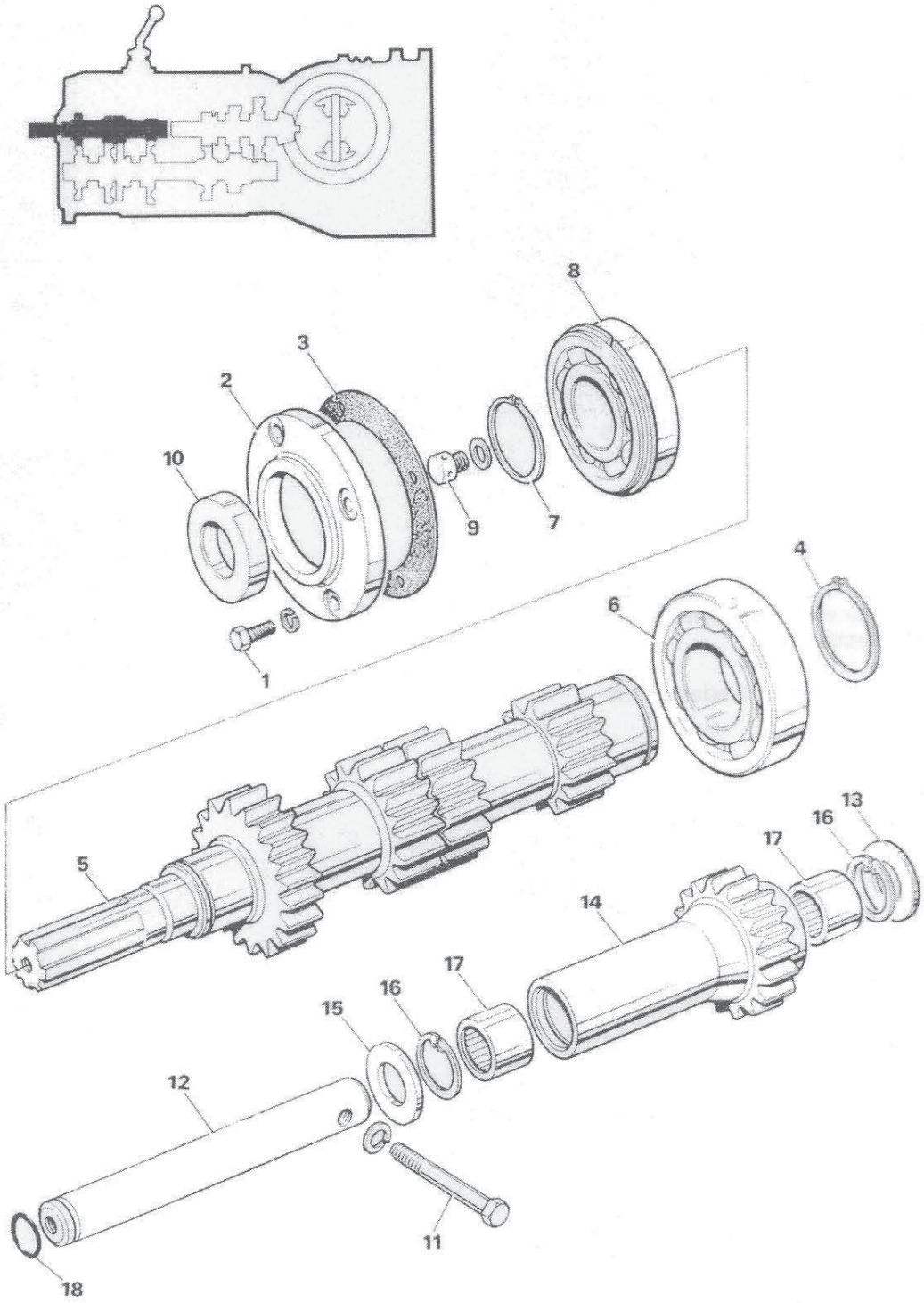
Care should be taken when removing selector rods from interlock housing 39 not to lose detent balls 41 springs 40 and interlocl pins 42.

When Assembling

Assemble items 30 to 43 together and fit to gearbox ensuring all selectors are correcrly positioned.

Assemble item 39 and selector rods 38 using tool 18G 1020.

Fit cover 7 to gearbox after fitting selector assembly. Inset 150mm (6in) length of 8mm (5/16in) dia rod through hole A to align slot B when replacing cover.



GEARBOX (SYNCHRO)

Manual Clutch Machine

Primary and Reverse Shafts

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal

For replacement the sequence should be reversed.

When Removing

Engage third and reverse before removing Primary Shaft

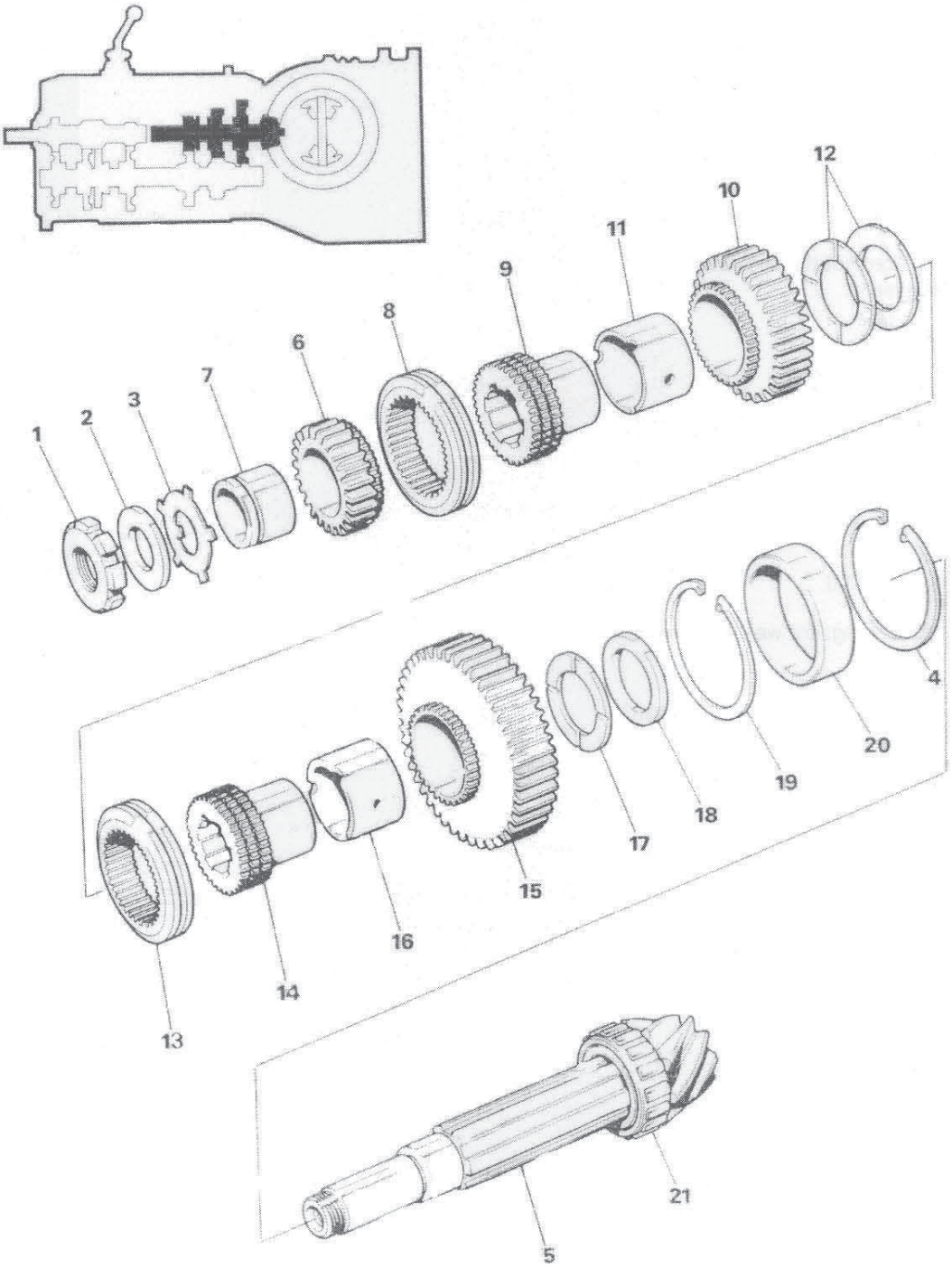
Fit bolt 11 into the tapped end of shaft 12 to aid removal.

When Replacing

Inspect bearings for wear and renew if necessary.

Remove sharp edges and burrs from splines, shafts and gears using a fine abrasive stone.

Renew O ring 18 on reverse shaft.



GEARBOX (SYNCHRO)

Manual Clutch Machine

Main Shaft

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal

For replacement the sequence should be reversed.

When Removing

Lock mainshaft, by selecting high and low, remove nut 1 using tool LC279. Drive mainshaft out rearwards using tool LC280

When Replacing

Inspect bearings for wear and renew if necessary.

Remove sharp edges and burrs from splines, shafts and gears using a fine abrasive stone.

Item 12 to be fitted with thrust faces outwards and item 17 with thrust face towards low gear.

Use tool LC281 to replace bushes 11 and 16 ensuring holes in bushes and gears are in line.

If the mainshaft, or any parts, have been renewed the end float must be checked as follows.

Assemble mainshaft components as shown, using smallest spacer 18 and sleeve from centre bearing A item 7 page F 12-7

Tighten locknut 1 to secure assembly and check end float in gears.

Select spacer to give correct end float as below.

Remove components and assemble mainshaft into gearbox.

Apply Loctite 222 to locknut 1, torque tighten with tool LC279. See tool for torque setting.

Reset mainshaft as page F 10-10

Mainshaft gear end float

0.127 to 0.254mm
(0.005 to 0.10in)

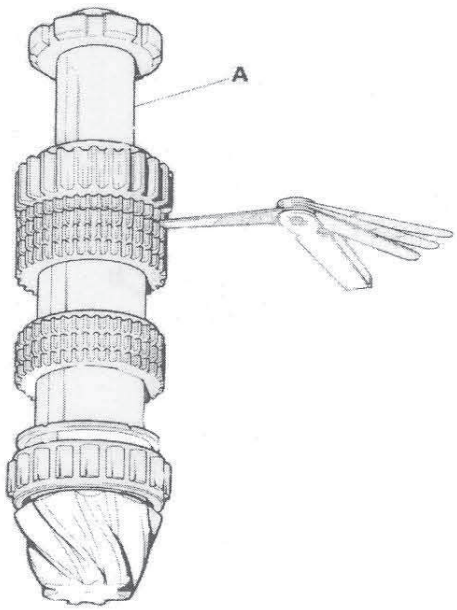
Mainshaft gear spacer sizes

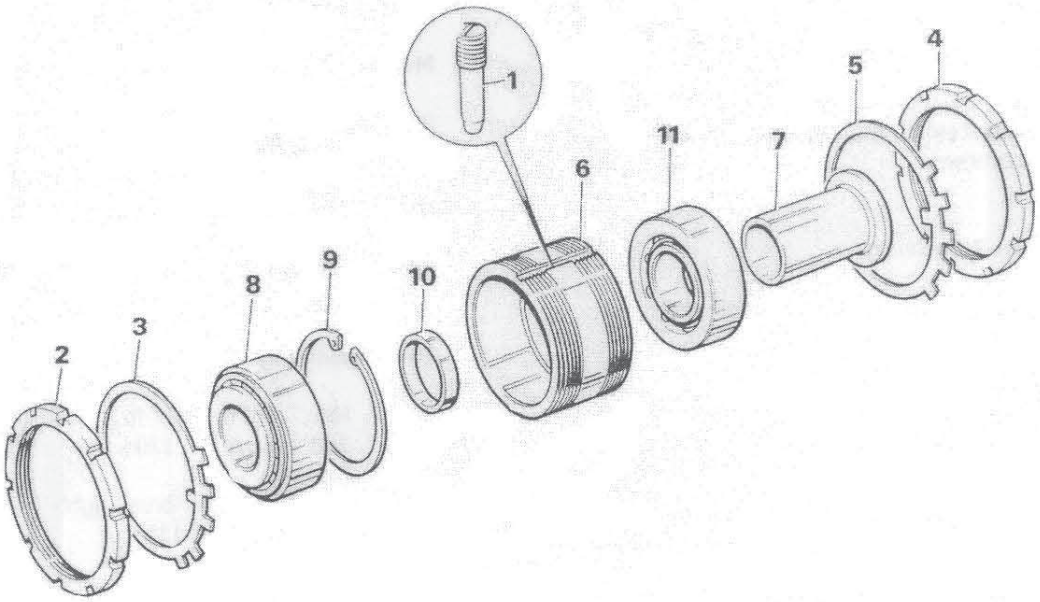
3.55 to 5.58mm (0.140 to 0.22in) in steps of 0.127mm (0.005in)

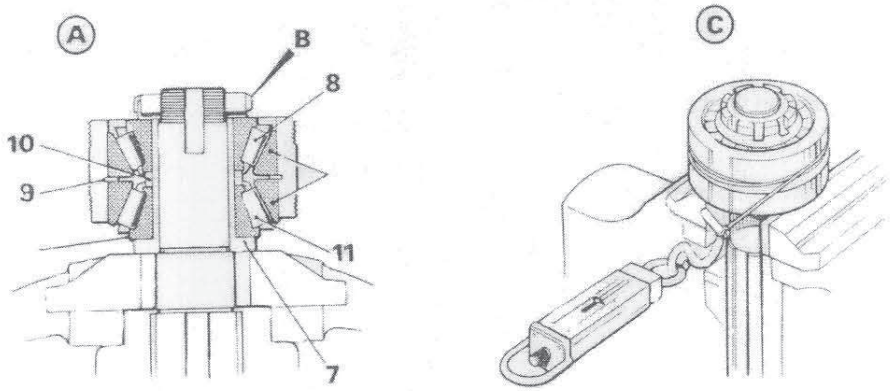
Torque Setting

Item	Nm	kgf m	lbf ft
1	163	16.6	120

Refer to page F 13-1 for brush tightness test (items 16 and 11)







GEARBOX (SYNCHRO)

Manual Clutch Machine

Centre Bearing

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal

For replacement the sequence should be reversed.

When Removing

Slacken pin 1 half turn and unscrew item 2 using tool 18G474A

When Replacing

Inspect bearings for wear and renew if necessary.

Reset centre bearing preload as follows

Assemble components onto mainshaft using original spacer 10 as A and tighten nut B to correct torque, see page.

Wind a length of cord around the bearing assembly and attach to a spring balance, as at C.

Pull on the spring balance and note the reading whilst the bearing is turning, if it is incorrect (refer to data opposite), dismantle, change spacer 10 and recheck preload.

Before assembling centre bearing into gearbox, lightly grease bearing races 8 and 11.

Remove the assembly from the mainshaft and assemble into gearbox. Do not tighten items 2 and 4 until the mainshaft is set see page F 12-6

Torque Setting.

Item	Nm	kgf m	lbf ft
2&4	163	16.6	120

NOTE: Set torque wrench to the figure stamped on tool 18G474A

Centre Bearing Torque

With new bearings
1.35 to 2.81 N (13.8 to 28.7 kgf cm; 12 to 15 lbf in)

With original bearings
0.67 to 1.41 N (6.9 to 14.3 kgf cm; 6 to 12.5 lbf in)

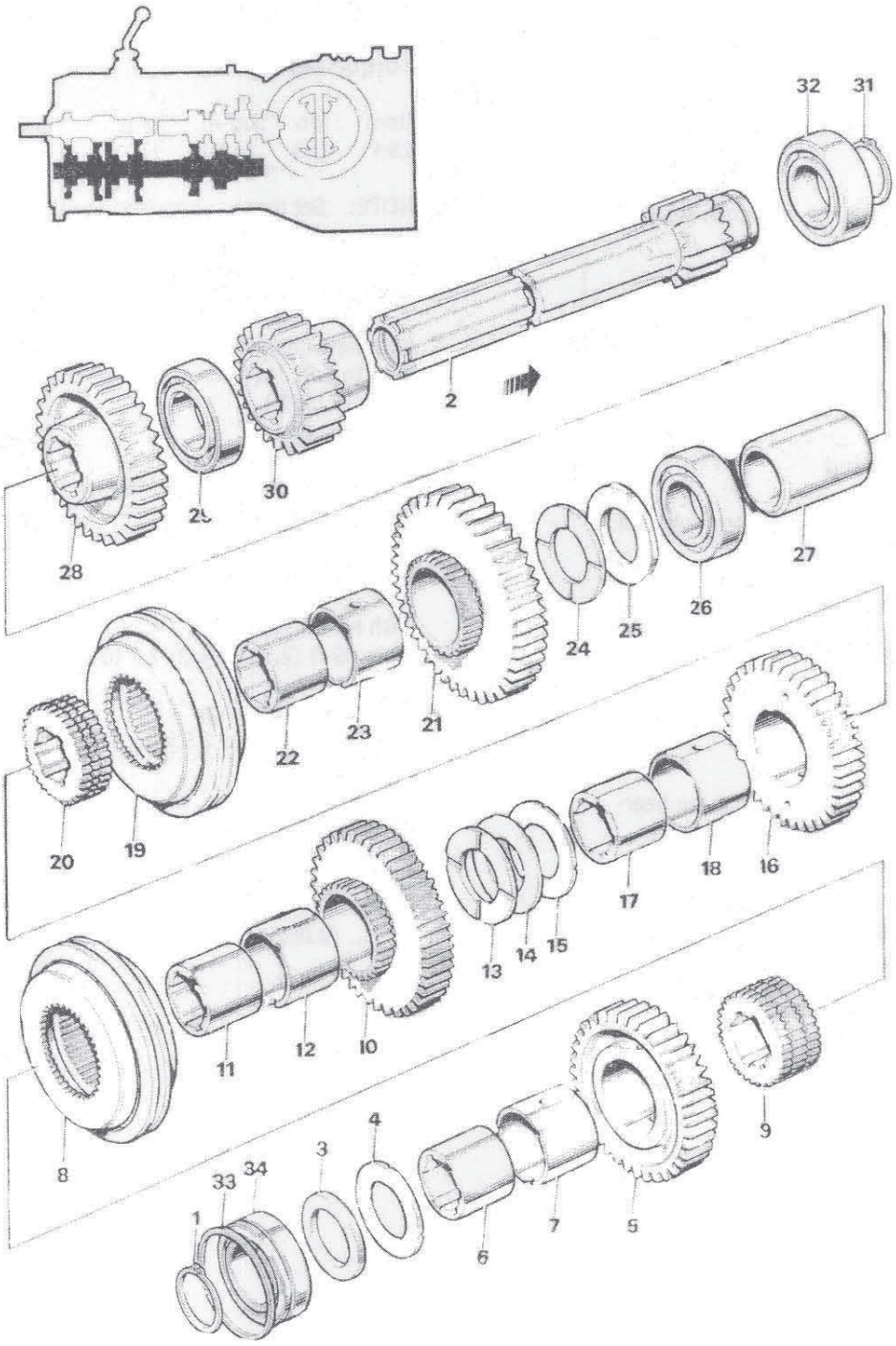
Spring Balance Reading

With new bearings
24 to 49 N (2.5 to 5 kgf; 2.7 to 5.4 lb)

With original bearings
12 to 24 N (1.25 to 2.5 kgf; 2.7 to 5.4lb)

Spacers

7.772 to 8.179mm
(0.306 to 0.322in) in steps of:
0.051,, (0.002in)



GEARBOX (SYNCHRO)

Manual Clutch Machine

Layshaft

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal

For replacement the sequence should be reversed.

When Removing

Drive layshaft out rearwards using tool LC280

When Replacing

Use tool LC281 to replace bushes 23, 18, 12 and 7. Ensuring oil holes in bushes and gears are inline.

If the layshaft or any component has been replaced the end float must be checked (see page F 12-11).

Items 4, 13, 15 and 24 to be fitted with thrust faces towards the gears.

Fit bearings 26 and 34 into the gearbox casing, ensure bearing 26 is flush with the rear face of casing wall.

Remove components and assemble layshaft into gearbox.

Refer to pages F 13-1 for bush tightness check (items 23, 18, 12 and 7)

GEARBOX (SYNCHRO)

Manual Clutch Machine

Layshaft

End Float

Build up layshaft with items 24, 25, 26, 28, 29, 30 shortest spacer 27 and gauge tube (tool no LC282) as at A

Fit circlip 1 and check the clearance between the tool and the circlip.

Select spacer to give the correct end float A as below.

Remove gauge tube and continue building up the layshaft using components as at B. Use smallest spacer 3.

Fit circlip 1 and check the clearance between the circlip and the bearing.

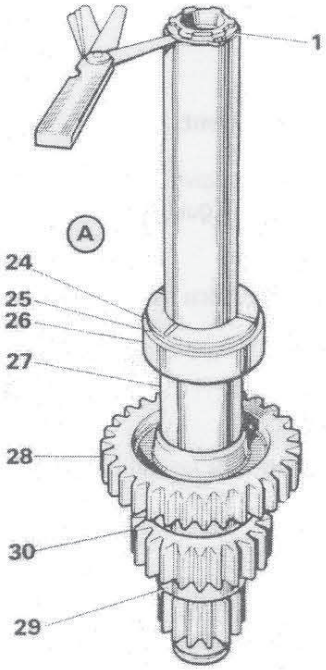
Select spacer 3 to give the correct end float as below

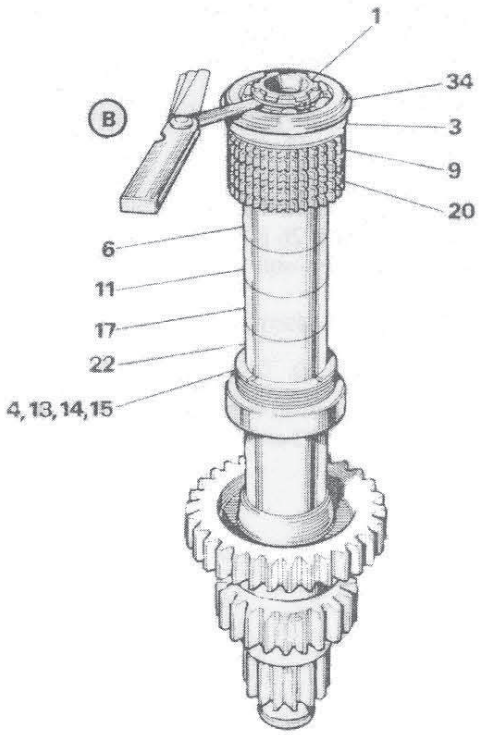
End Float A

0.245mm (0.010in) max.
Available spacers 82.80 to 84.83mm (3.26/3.34in)

End Float B

0.245mm (0.010in) max.
Available spacers 2.29 to 3.81mm (0.090 to 0.150in)





GEARBOX (SYNCHRO)

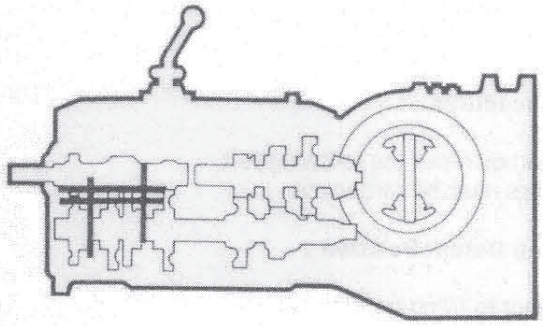
Manual Clutch Machine

Ratio Selectors

Removal and Replacement

The numerical sequence shown on the illustration is intended as a guide to removal

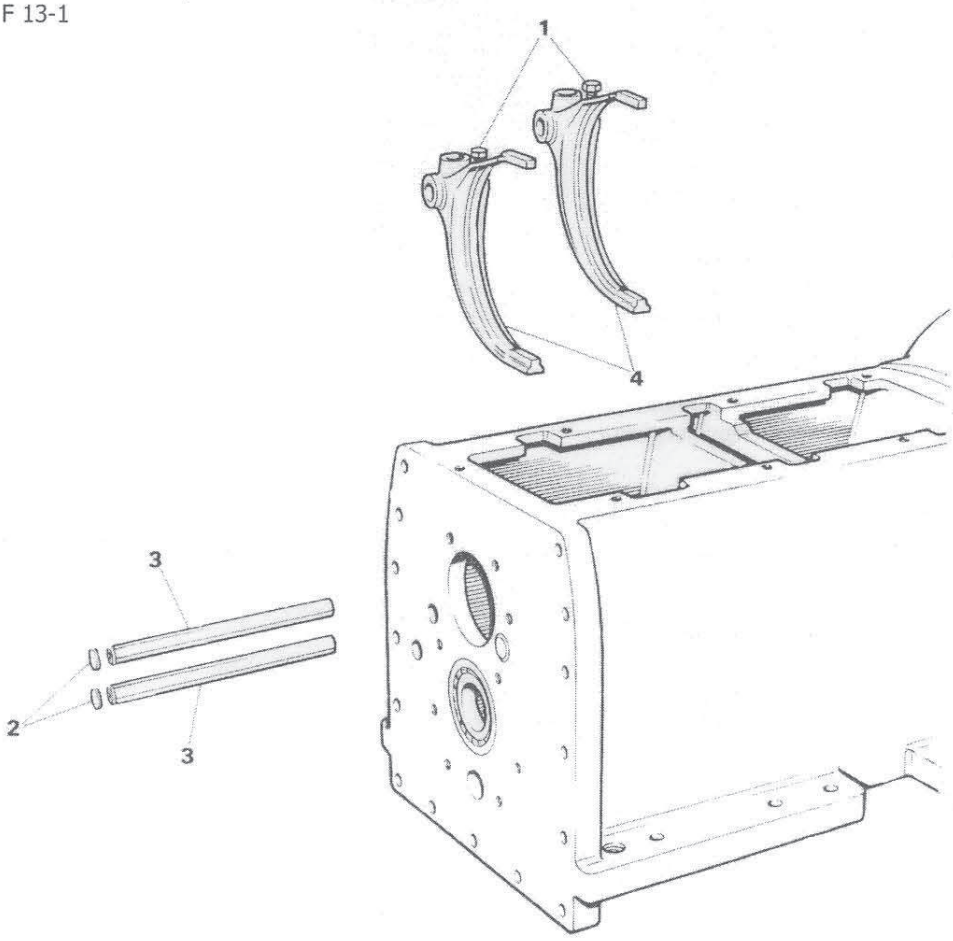
For replacement the sequence should be reversed.



When Replacing

Lockwire selector securing screws.

Check Selector detent position see page F 13-1



GEARBOX (SYNCHRO)

Manual Clutch Machine

Test Procedures

After gearbox repair the following test procedures must be carried out.

Checking Detent Position

Check prior to filling transmission with oil and engine stopped.

Engage first gear, move lever slowly into neutral and continue into reverse.

Detent should be heard operating when the lever is passing through neutral. If it is biased towards either gear the selecter arm must be reset centrally on rod.

Repeat the above procedures with second and third gears.

Checking for Tight Bushes

Layshaft Bushes (Ratio Gears)

After filling transmission with oil, start engine and release brakes.

Ensure gear change lever is in neutral, engage low range and increase engine speed to 1000 rev/min

If the bushes are free the machine will remain stationary with the engine speed steady.

If the bush is partially seized the machine will creep.

If the bush is totally seized the machine will move at a speed relative to the seized gear ratio.

Main Shaft Bushes (Range Gears)

Repeat the procedures as for the ratio gears, with the range change lever in neutral and reverse gear selected.

Checking Operation

Select first or second gear and with the machine travelling check for noise when reverse gear is selected.

Finally road test the machine checking all gears.

GEARBOX (SYNCHRO)

Fault Finding

Before carrying out the checks listed, if possible, the machine should be operated to determine the fault area and bring the systems to their normal working temperatures.
The gearbox should also be checked to ensure the correct grade of oil is used and is at the correct level and that there are no obvious leaks.

A If the gearbox is noisy, start at check 1

B If the gearbox is jumping out of gear, start at check 11

C If the gearbox is hard, start at check 18

D If the gearbox is sticking in gear, start at check 21

E If the gearbox is 'crash changing', start at check 23

	CHECK		ACTION
1.	Is the noise a growl, hum or grinding?	**YES**	Check gearbox for damage or
		NO	Check 2
2.	Is the noise a hiss, thump or bumping?	**YES**	Check bearings for damage or
		NO	Check 3
3.	Is the noise a squeal?	**YES**	Check free running gears for sei-
		NO	Check 4
4.	Is the noise in neutral or when in gear?	**YES**	Check 5
		NO	Check 9
5.	Is the flywheel pilot worn?	**YES**	Renew
		NO	Check 6
6.	Is the layshaft or its bearing worn or damaged?	**YES**	Renew
		NO	Check 7
7.	Is their excessive backlash in the gears?	**YES**	Adjust
		NO	Check 8
8.	Is the centre bearing worn?	**YES**	Renew
		NO	Check gear teeth for scuffing
9.	Is the mainshaft rear bearing worn?	**YES**	Renew
		NO	Check 10
10.	Are the sliding gear teeth worn or damaged?	**YES**	Renew gears
		NO	Check mainshaft end float

	CHECK		ACTION
11.	Are the selector forks loose?	YES	Tighten wire locked screws.
		NO	Check 12
12.	Are the selector forks or grooves in gears worn?	YES	Renew worn parts.
		NO	Check 13
13.	Are the dog gear teeth worn?	YES	Renew
		NO	Check 14
14.	Are the selector rod poppet springs broken?	YES	Renew
		NO	Check 15.
15.	Are the selector rods worn or damaged?	YES	Renew
		NO	Check 16.
16.	Are the selector forks out of position.	YES	Reposition or renew
		NO	Check 17.
17.	Is there excessive end float in gears or shafts?	YES	Adjust.
		NO	Check thrust washers and faces.
18.	Is the synchroniser bronze worn?	YES	Renew
		NO	Check 19
19.	Are steel chips embedded in the bronze?	YES	Continue using, chips will either embed below bronze or be re-
		NO	Check 20
20.	Are the synchroniser components damaged?	YES	Renew.
		NO	Check free running gears for sei-
21.	Are the sliding gears tight on the splines?	YES:	Free or Renew.
		NO:	Check 22.
22.	Are chips wedged between splines of shaft and	YES:	Remove chips.
		NO:	Check that gears are not locking
23.	Are steel chips embedded in the bronze?	YES:	Continue using, chips will either embed below bronze or be re-
		NO:	Check 24.
24.	Are the synchroniser spring pins damaged?	YES:	Renew synchro.
		NO:	Check 25.
25.	Is the synchroniser bronze worn?	YES:	Renew synchro.
		NO:	Check blocker pins.

SERVICE TOOLS

Powertrain

Gearbox

Tool Number	Description
992/07608	Mainshaft rear bearing cone remover
992/07609	Mainshaft rear bearing cone replacer
992/07610	Mainshaft front bearing cone remover
992/07611	Press adapter ring
992/07612	Mainshaft/layshaft end float gauge
992/07613	Speedo housing oil seal replacer

Bull Gear Axle

Tool Number	Description
992/07601	Half shaft nut wrench
992/07602	Pinion bearing cone remover/replacer
992/07603	Pinion bearing cup replacer
992/07604	Crown wheel bearing cone replacer
992/07605	Bull pinion bearing cone remover/replacer (dry brakes)
992/07606	Pinion bearing measuring cup
992/07607	Pinion bearing pre-load gauge
992/07614	Bull pinion bearing cone remover/replacer (Oil immersed brakes)

The above service tools, for the gearbox and bull gear axle, are all contained in one kit

In addition the following tools are required.

18G47AF	Half shaft bearing remover
992/04800	Piston flange and spanner
18G134 and 992/06400	Pinion bearing cone remover
892/00098	Arm seal replacer shorten by 15mm (0.6in)
992/06700	Bearing cup replacer
MS47	Hand press

TORQUE CONVERTER

Removal and Replacement

When Replacing

Attach torque converter to drive plate A, tighten bolts finger tight only.

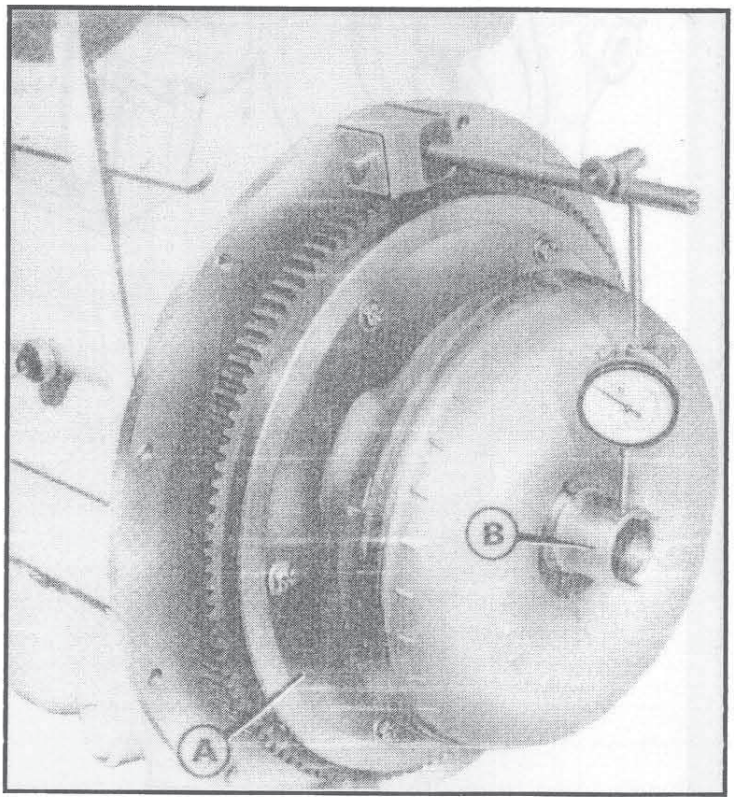
Bolt drive plate to flywheel and check run out of pump drive shaft B maximum 0.254mm (0.010in)

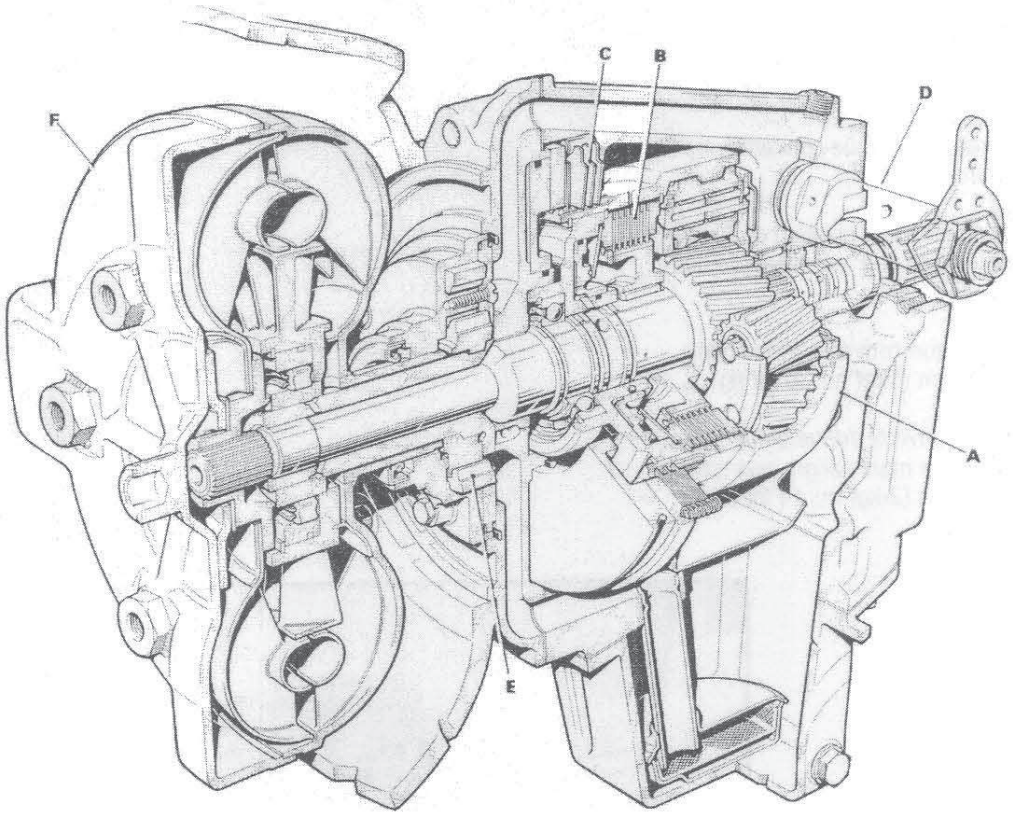
If incorrect tap torque converter, by hand to reposition.

When correct mark position of flywheel and drive plate and remove driveplate from the flywheel/

Tighten torque converter/drive plate bolts to 40Nm (5kgf m; 30 lbf ft)

Fit torque converter/drive plate to flywheel, ensure marks align, and torque bolts to 19Nm (2 kgf m; 14 lbf ft)





SHUTTLE TRANSMISSION FORWARD CLUTCH AND DRIVE GEAR

Dismantling and Assembly

When Assembling

Assemble items 22 to 24 onto shaft 8.

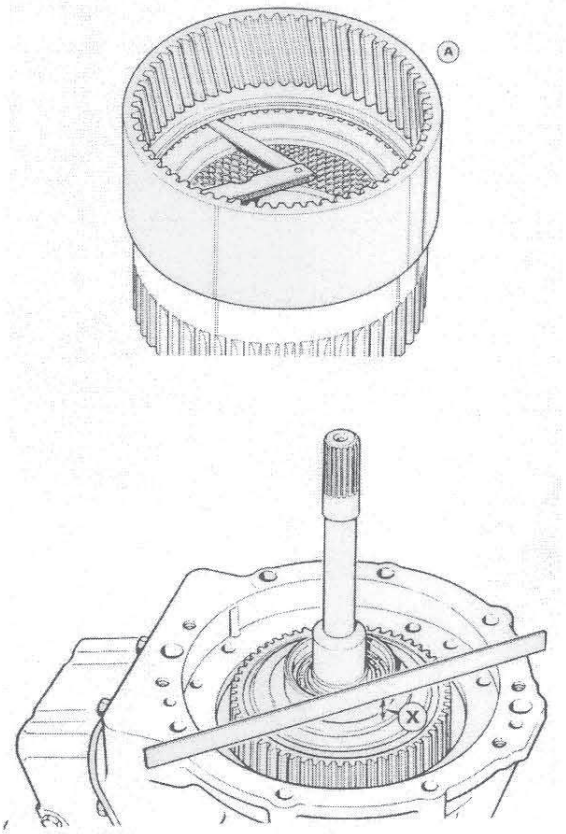
When assembling items 9 to 11 and 13 to 20 into drum 1 ensure the following:

1. Flat faces of items 18 and 20 are towards clutch plates.

2. Snap ring 17 is positioned against the end of the internal splines.

3. Clutch spring 16 id fitted concave side down.

Turn assembly over and check clutch pack clearance by pressing down on pressure plate 20 with a force of 4.5kg (10lb). Measure clearance between pressure plate and ring gear web as at A.



Select snap ring 21 to reduce the clearance to 0.3 to 1.2mm (0.011 to 0.046in).

Fit drive shaft 8 into clutch drum 1 before fitting items 3, 4, 6, 7 and 12.

Fit thrust washer 2 and clutch assembly into casing and check dimension X selecting spacer 5 as follows.

If X is under 12.7mm (0.501in) use spacer

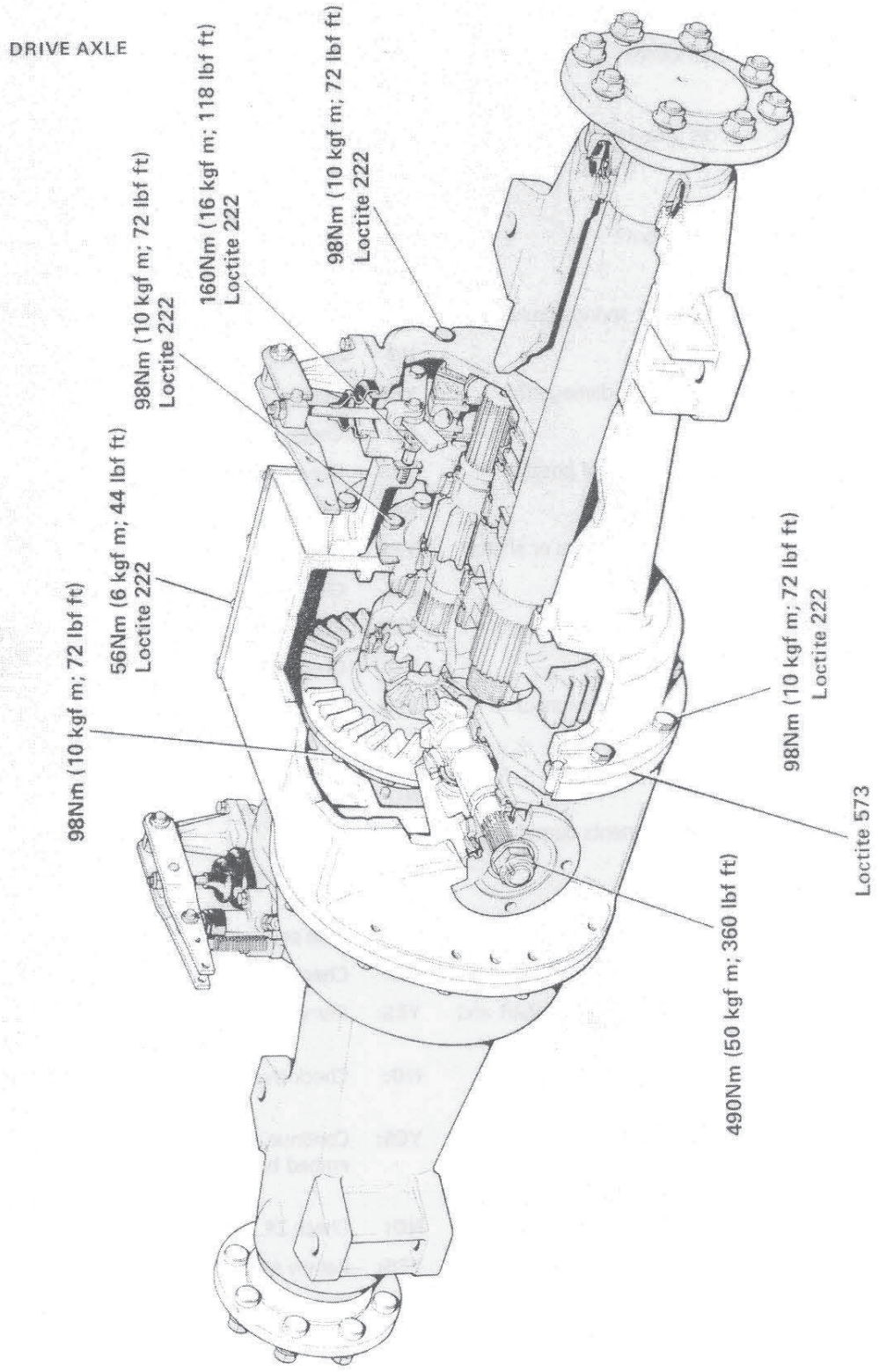
Snap Ring Identification

Item	Thickness		Free Diameter	
	mm	in	mm	in
9	1.9-2.0	0.074-0.079	149	5.7/8
17	2.3-2.4	0.090-0.093	142.1	5.19/32
21				
Green	1.27-1.37	0.050-0.054	145.5	5.11/16
Pink	1.57-1.68	0.062-0.066	145.5	5.11/16
Orange	1.88-1.98	0.074-0.078	145.5	5.11/16
Blue	2.13-2.24	0.084-0.088	145.5	5.11/16
White	2.44-2.54	0.096-0.100	145.5	5.11/16

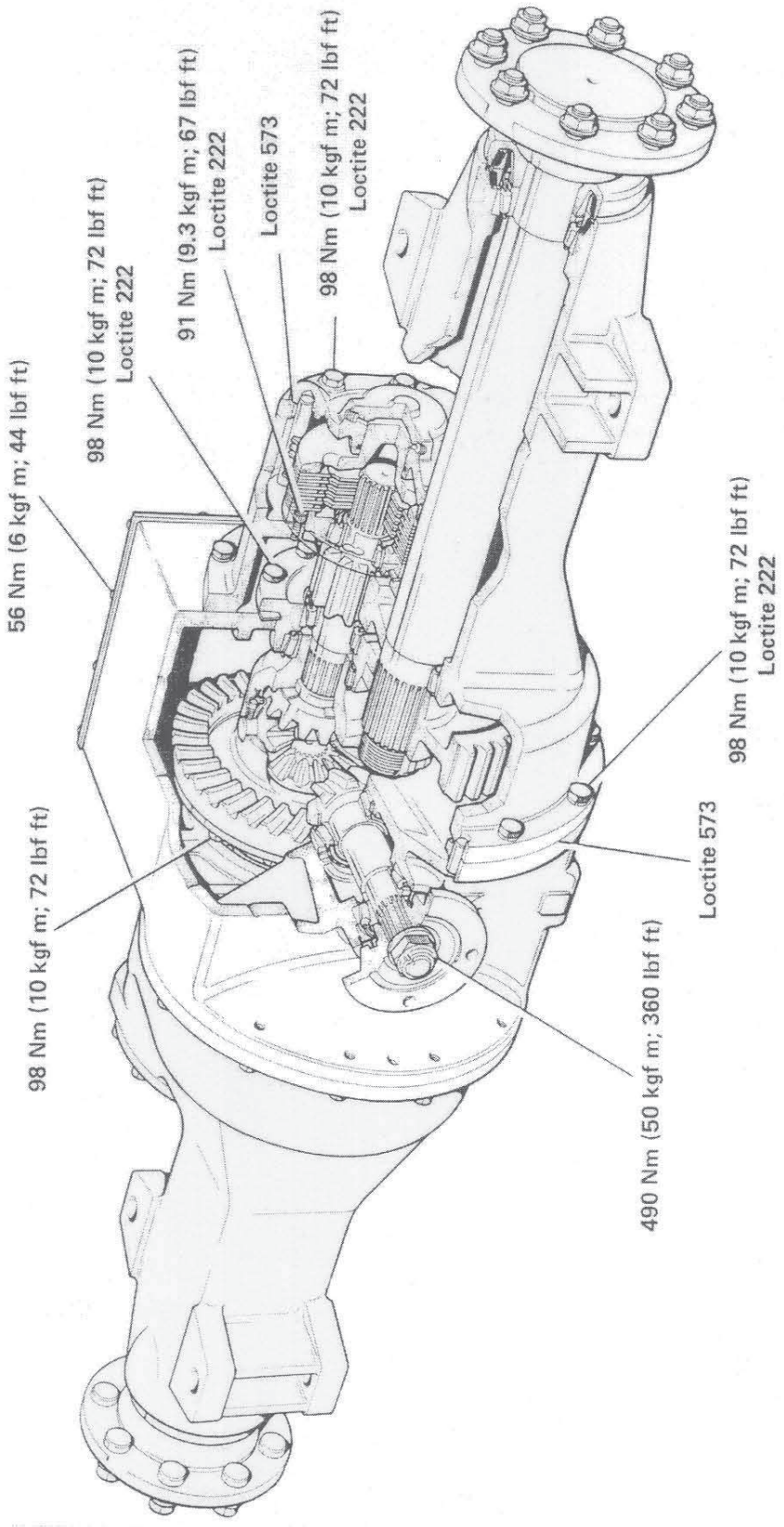
18-18

Fault Finding
Gearbox

	CHECK		ACTION
1.	Are the selector forks loose?	**YES**	Tighten screws.
		NO	Check 12
2.	Are the selector forks pads or grooves in gears	**YES**	Renew worn parts.
		NO	Check 13
3.	Are the dog gear teeth worn?	**YES**	Renew
		NO	Check 14
4.	Are the selector rod poppet springs broken?	**YES**	Renew
		NO	Check 15.
5.	Are the selector rods worn or damaged?	**YES**	Renew
		NO	Check 16.
6.	Are the selector forks pads out of position.	**YES**	Reposition or renew
		NO	Check 17.
7.	Is there excessive end float in gears or shafts?	**YES**	Adjust.
		NO	Check thrust washers and faces.
8.	Is the synchroniser bronze worn?	**YES**	Renew synchro pack
		NO	Check 19
9.	Are steel chips embedded in the bronze?	**YES**	Continue using, chips will either embed below bronze or be re-
		NO	Check 20
10.	Are the synchroniser components damaged?	**YES**	Renew.
		NO	Check free running gears for sei-
11.	Are the sliding gears tight on the splines?	**YES:**	Free or Renew.
		NO:	Check 22.
12.	Are chips wedged between splines of shaft and	**YES:**	Remove chips.
		NO:	Check that gears are not locking
13.	Are steel chips embedded in the bronze?	**YES:**	Continue using, chips will either embed below bronze or be re-
		NO:	Check 24.
14.	Are the synchroniser spring pins damaged?	**YES:**	Renew synchro.
		NO:	Check 25.
15.	Is the synchroniser bronze worn?	**YES:**	Renew synchro.
		NO:	Check blocker pins.



DRIVE AXLE



DRIVE AXLE DIFFERENTIAL BEARING

Preload Setting

Fit differential assembly into casing and support on piece of 25mm (1in) timber.

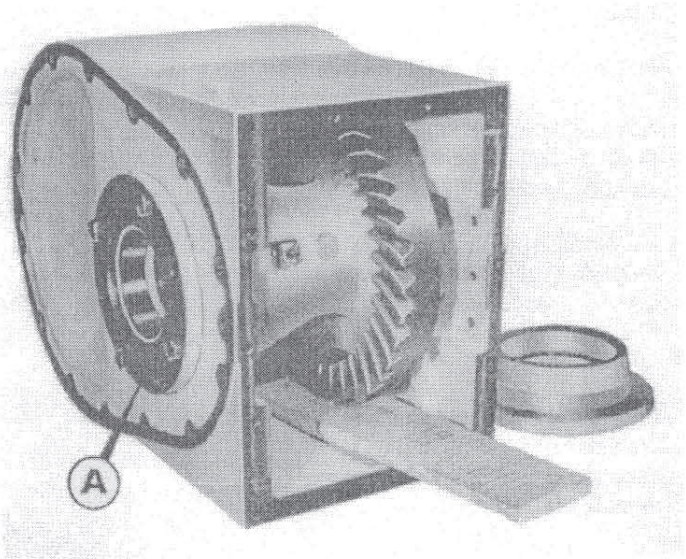
Fit left hand housing A with four bolts tightened to 98Nm (10 kgf m; 72 lbf ft) and right hand housing with four bolts left loose.

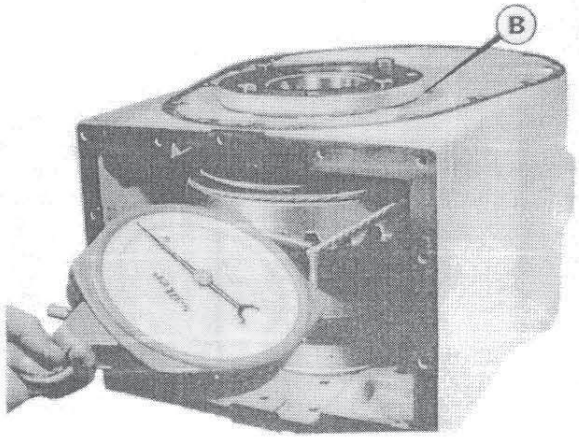
Turn casing on its left hand side, remove timber support and wrap a cord around the differential carrier.

Tighten the four housing bolts evenly and in turn until a moving pull of 36-40N (8.9lb) is recorded.

Select shims to fit gap B reassemble housing with shims and tighten bolts to 98Nm (10 kgf m; 72 lbf ft)

If pull is incorrect adjust by adding or subtracting shims. Keep final shims together for backlash setting (see page 19-5)



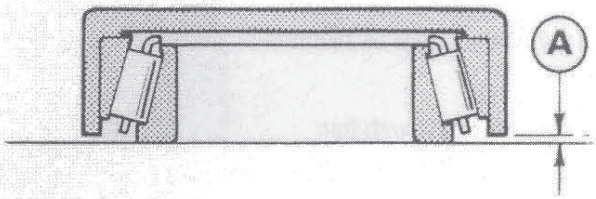


DRIVE AXLE
DIFFERENTIAL PINION

Depth Setting

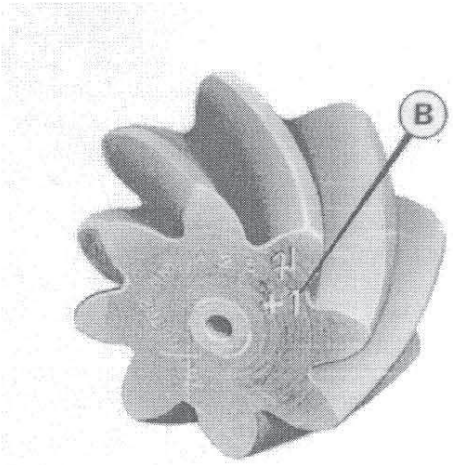
All dimensions are in millimetres

Remove inner bearing from the pinion using tool no 992/07612 and press part no 47.



Measure gap A, using tool no 992/07606 on a flat surface, and add 36.4mm to give bearing depth The total should be 36.512-36.712mm.

Note the mounting distance B etched on the pinion and C stamped on the casing. These are in units of 0.01mm.

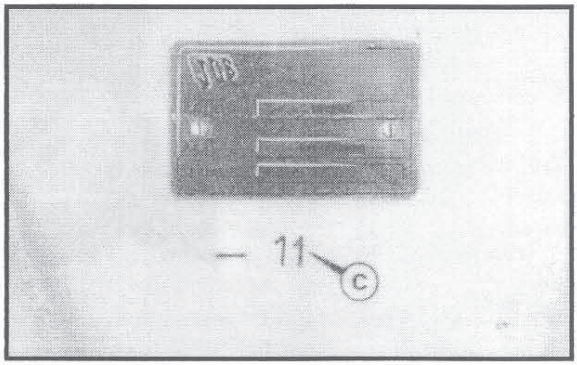


If dimension B is positive ADD to bearing depth, if negative SUB-TRACT from bearing depth.

If dimension C is positive SUB-TRACT from total, if negative ADD to total.

The result should be subtracted from 37.44mm to give the shim thickness.

Dimension A	0.302
Add tool depth	36.400
	36.702
Add dimension B if positive (Subtract if	0.010
	36.712
Add dimension C if negative (Subtract if	0.110
	36.822
Standard value	37.440
Less total above	36.822
SHIM THICKNESS	0.618



DRIVE AXLE
DIFFERENTIAL PINION

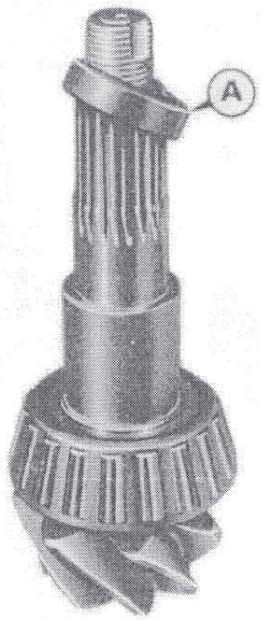
Bearing preload setting

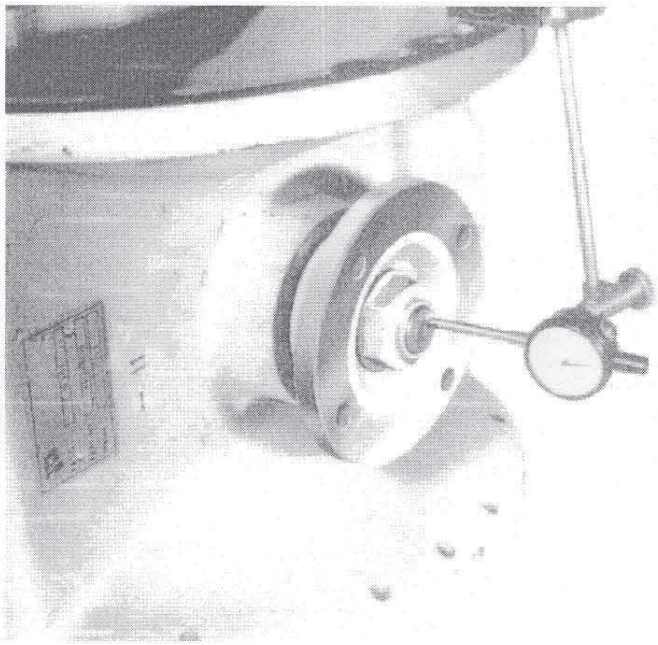
Fit tool A No 922/07607 to pinion, assemble into casing without oil seal and torque pinion nut to 488Nm (50 kgf m; 360 lbf ft)

Measure pinion end float and add 0.10mm (0.004in) pre load. Subtract answer from 11.5mm (0.453in) and fit spacer to this thickness. Reassemble without oil seal, and re rorque nut.

Wrap a cord around the pinion flange and a moving pull of 20-33N (4.5-7.5 lbs) should be recorded. Correct by changing spacer.

When reading is correct remove flange, fit oil seal, re torque complete assembly and stake pinion nut.





DRIVE AXLE
CROWN WHEEL

Backlash

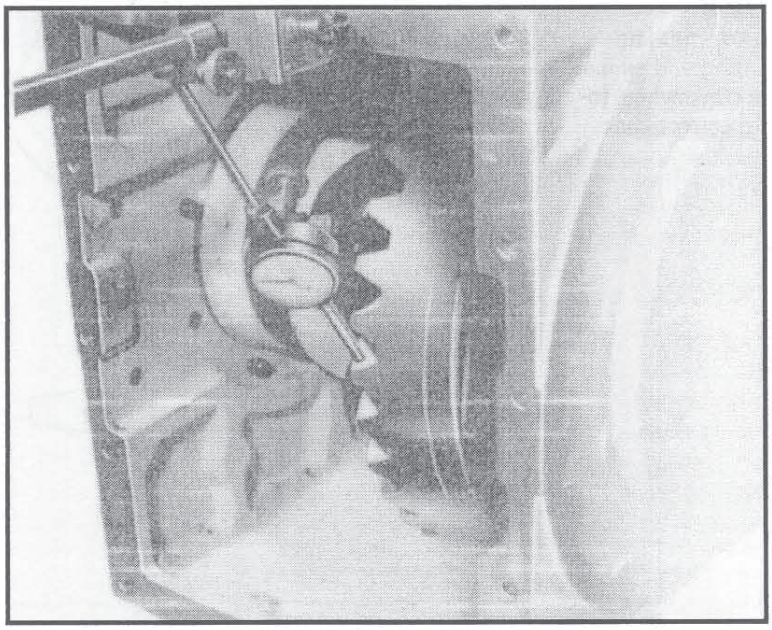
Fit left hand carrier without shims and right hand with shim pack as determined on page 19-2
Torque carrier bolts to 98Nm (10 kgf m; 72 lbf ft)

Check backlash at four equal points on the crown wheel and calculate the average
NOTE: If backlash readings vary by more than 0.1mm (0.004in) check crown wheel/diff carrier for run-out.

Subtract .033mm (0.013in) from the average, devide by 3 and multiply by 5.

The result is the thickness of shims to be removed from the right hand carrier and fitted to the left hand carrier.

After fitting shims check backlash reading is 0.25-0.33mm (0.010-0.013in)

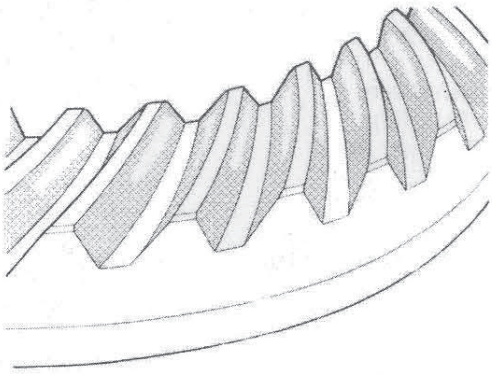


AXLES (JCB POWERTRAIN)

Crownwheel and pinion adjustment

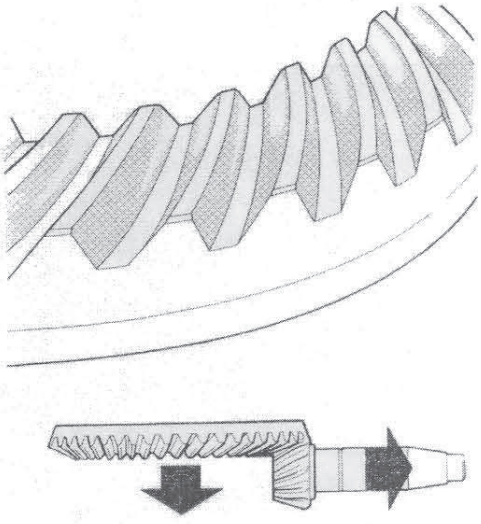
Meshing of the gears should be checked by marking three pinion teeth with oiled red lead or engineers marking compound and rotating the pinion. The marking will then be transferred to the crownwheel teeth.

Correct tooth bearing



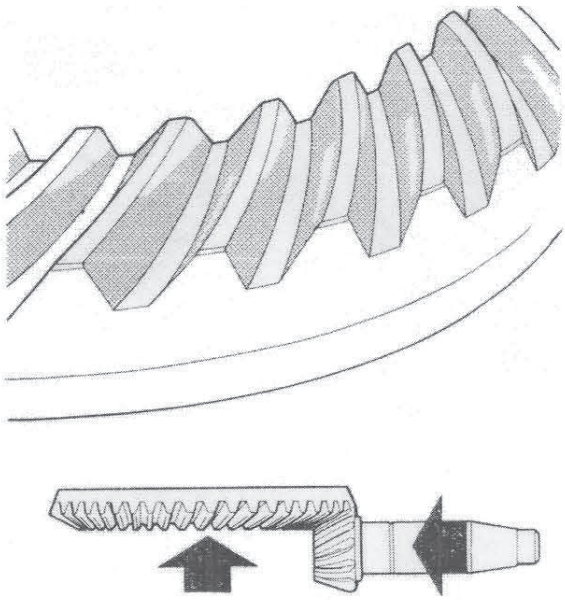
Pinion too deeply in mesh

Increase the shim thickness between the bevel casing and pinion housing. Move the crownwheel towards the pinion to correct backlash.



Pinion too far out of mesh

Decrease the shim thickness between the bevel casing and pinion housing. Move the crownwheel away from the pinion to correct backlash.



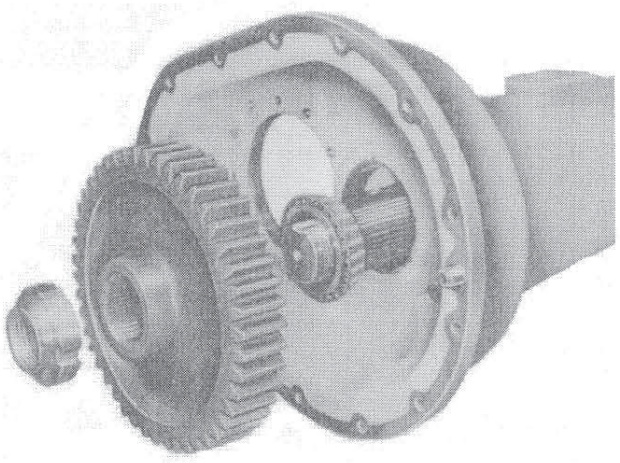
DRIVE AXLE ARM

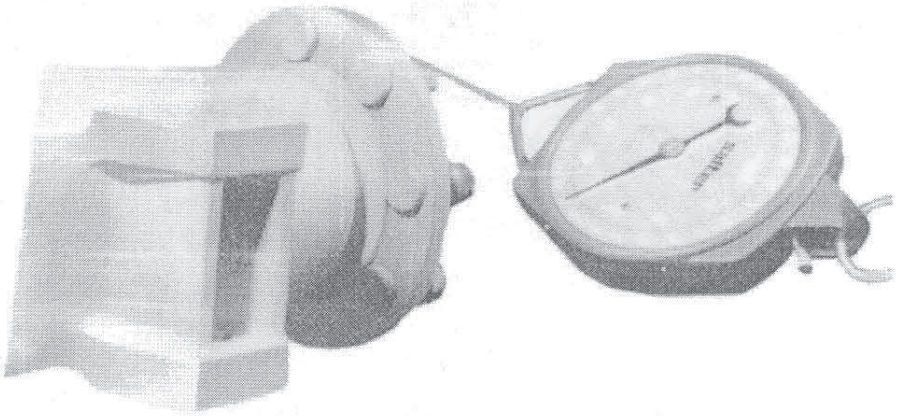
Bearing pre load

Assemble axle arm and tighten nut to 6.9-8.8 Nm (0.7-0.9 kgfm; 5.0-6.5 lbf ft) using tool No 992/07601. Rotate shaft at intervals to seat bearing.

Attach a length of cord to a wheel stud and wrap around the studs three or four times. The spring balance reading, whilst shaft is rotating should be 80-97.5 N (18-22 lb)

When correct reading is achieved stake nut.



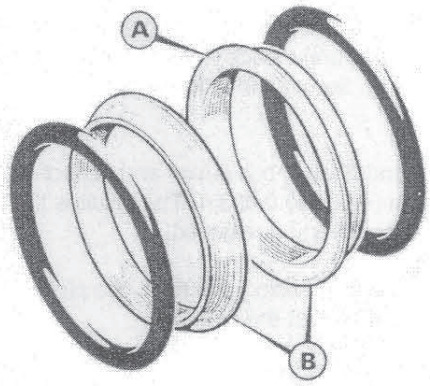


METALLIC FACE SEALS

Removal

Caution: Avoid skin contact with surface A as corrosion may be caused.

Retain seals in pairs when they are removed. Fit as a matched pair if suitable for further use.



Inspection

If contact surface A is undamaged, estimate remaining life as follows.

New seals. Contact area is a narrow band at outer edge.

Partly worn seals. Contact area is wider but does not extend full width.

Scrap seals. Contact area is worn to full width.

Renew pair of seals if contact surface is scratched, pitted or corroded.

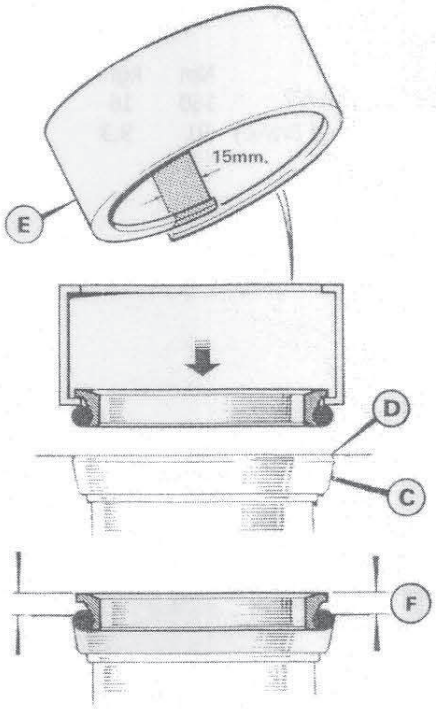
Examine outer edges B housing ramp C and lip D. Carefully polish away light damage or corrosion.

Thoroughly clean and dry seals, O rings and housings before fitting seals as follows:

NOTE: Do not allow oil to come into contact with the O rings or housings until assembly is complete.

Fit new O rings on to the seals, check that they seat evenly and are not twisted.

Modify tool E (Part No 892/00098) by removing 15mm as shown. Fit the modified tool to each seal assembly. Press O ring past lip D. Check that dimension F is constant round circumference of seal.



Immediately before final assembly clean dust etc: from surface A and lightly coat with clean oil of the appropriate grade.

DRIVE AXLE BULL PINION

End Float

Select shims 1mm (0.04in) thicker than previously used and fit brake back plate (without O ring on dry brake). Secure with allen screws.

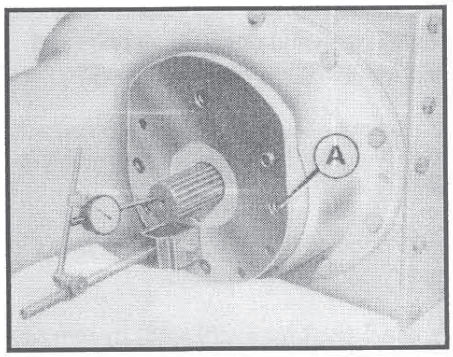
Check end float of bull pinion and deduct 0.03 to 0.08mm (0.001 to 0.003in) The result is the thickness of shims to be removed.

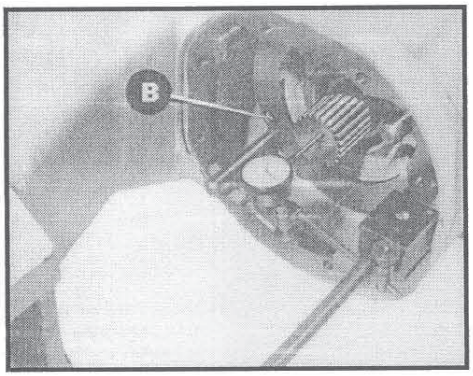
Note: When checking end float, the pinion must be rotated to seat the bearings.

Apply Loctite 222 to allen screws and tighten to the specified torque setting. Check that end float is 0.03 to 0.08mm (0.001 to 0.003in)

Torque Setting

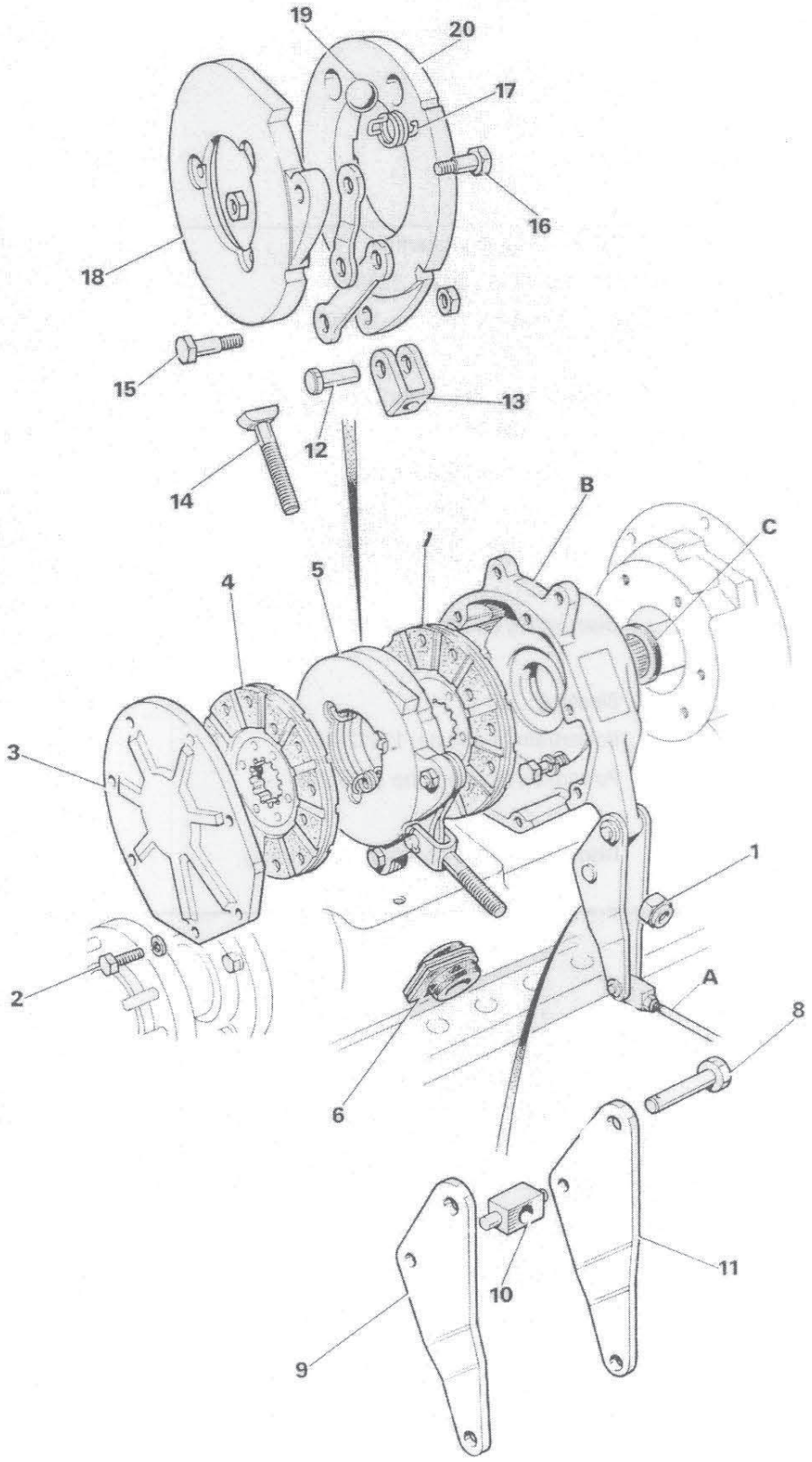
Item	Nm	kgf m	lbf ft
A (Dry Brake)	160	16	118
B (Oil-immersed Brake)	91	9.3	67





G BRAKES G

CONTENTS



TRANSMISSION BRAKES

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling.

For assembly, the sequence is reversed.

When Dismantling

Remove floor plates for access and disconnect linkage at **A**.

Mark the actuator plates **18** and **20** to ensure correct assembly.

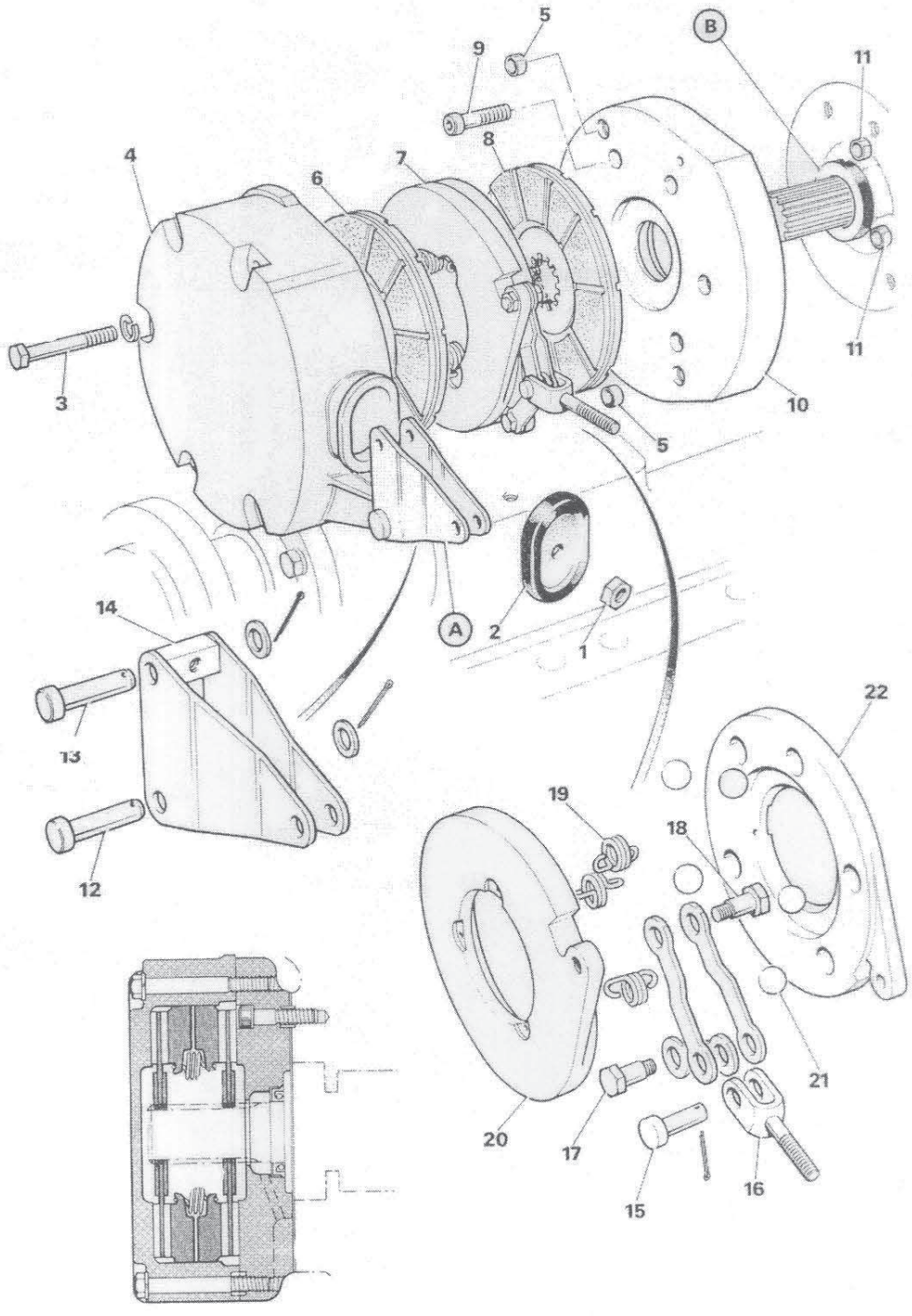
If removing brake drum **B** use tool 18G1036 to protect oil seal **C**.

When Assembling

Renew linings and oil seal if worn or damaged.

Fit brake drum using tool 18G1036

Adjust brakes as pages 3 7-1 and 3 7-2



TRANSMISSION BRAKES

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling.

For assembly, the sequence is reversed.

When Dismantling

Remove floor plates for access and disconnect linkage at **A**.

Mark the actuator plates **20** and **22** to ensure correct assembly.

If removing backplate **10** use tool 18G1036 to protect oil seal **B**.

When Assembling

Renew linings and oil seal if worn or damaged.

Fit backplate **10** using tool 18G1036 to protect oil seal **B**

Ensure that locating spacers **5** and **11** are fitted correctly.

Apply Loctite 275 to the mating faces of backplate **10** and the axle casing, and brake housing **4**

Apply Loctite 242 to bolts **9**

Adjust brakes as pages 3 7-1

Torque Settings

Item	Nm	kgf m	lbf ft
3	78	8	58
9	115	11.7	85

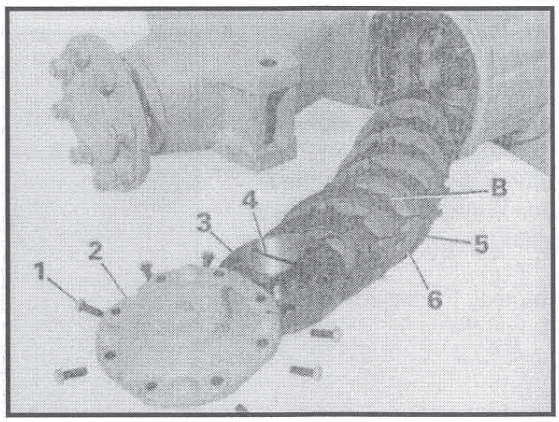
TRANSMISSION BRAKES

From m/c no 138622/5

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling.

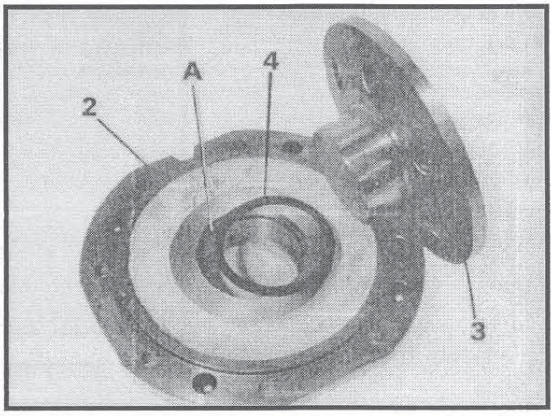
For assembly, the sequence is reversed.



When Assembling

Use only JCB Special Hydraulic Fluid or Mobil DTE11 for cleaning and lubrication of hydraulic components **2, 3** and **4. DO NOT USE NORMAL BRAKE FLUID.**

Fit seal **4** into groove **A**

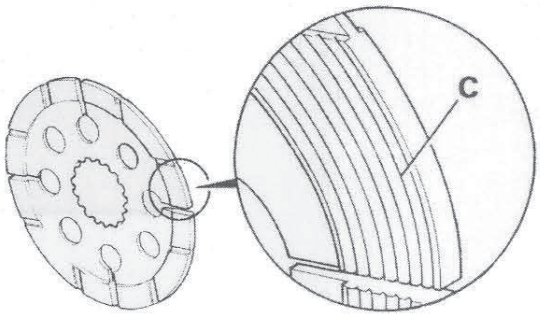


Wear limit of friction plates 6 is to depth of circumferential grooves C or when plate thickness is 4.4mm (0.175in)

Renew friction plates and counter plates **5** together in complete sets. Soak friction plates in JCB Special Gear Oil before assembly. Fit friction and counter plates alternately, ensuring that there is a counter plate at each end of the pack and that holes B are aligned to allow free oil flow.

Apply Loctite 573 to joint face of cover **2**. Ensure that bleed screw faces upwards and pressure port faces axle arm.

Apply Loctite 222 to bolts **1**



Torque Settings

Item	Nm	kgf m	lbf ft
1	98	10	72

COMPENSATING MASTER CYLINDER

To m/c no 138621/5

Dismantling and Assembly

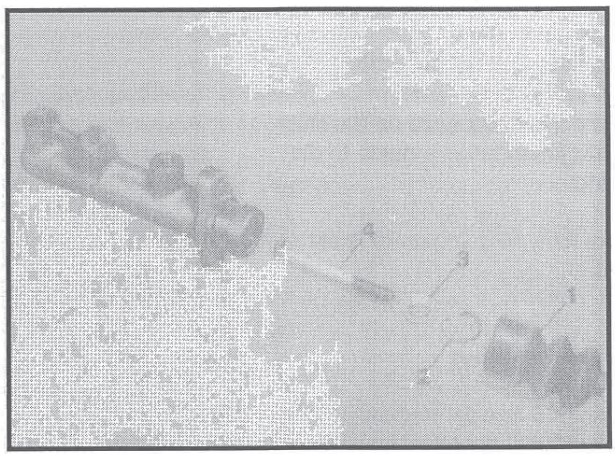
The numerical sequence on the illustration is intended as a guide to dismantling.

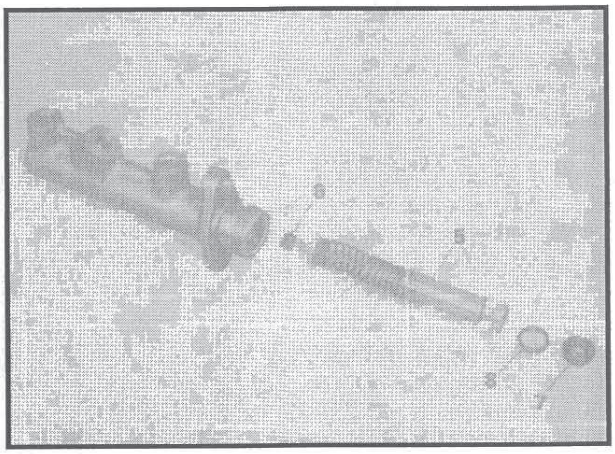
For assembly, the sequence is reversed.

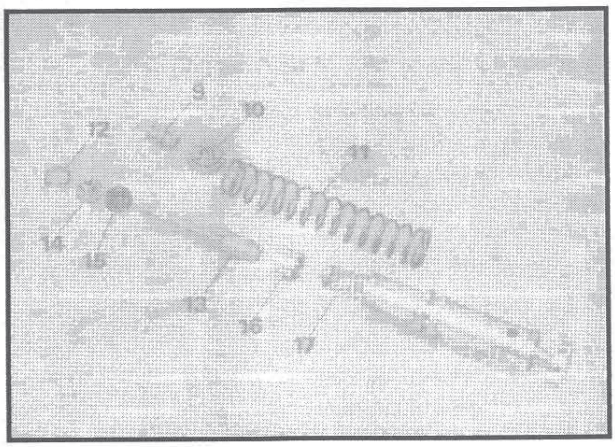
When Dismantling

Compress collar 10 against spring 11 to allow retaining pin inend cap 9 to be removed.

Use correct brake fluid for cleaning and lubrication (see lubricants, Section 3.)







MASTER CYLINDER

From m/c no 138622/5

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling.

For assembly, the sequence is reversed.

When Dismantling

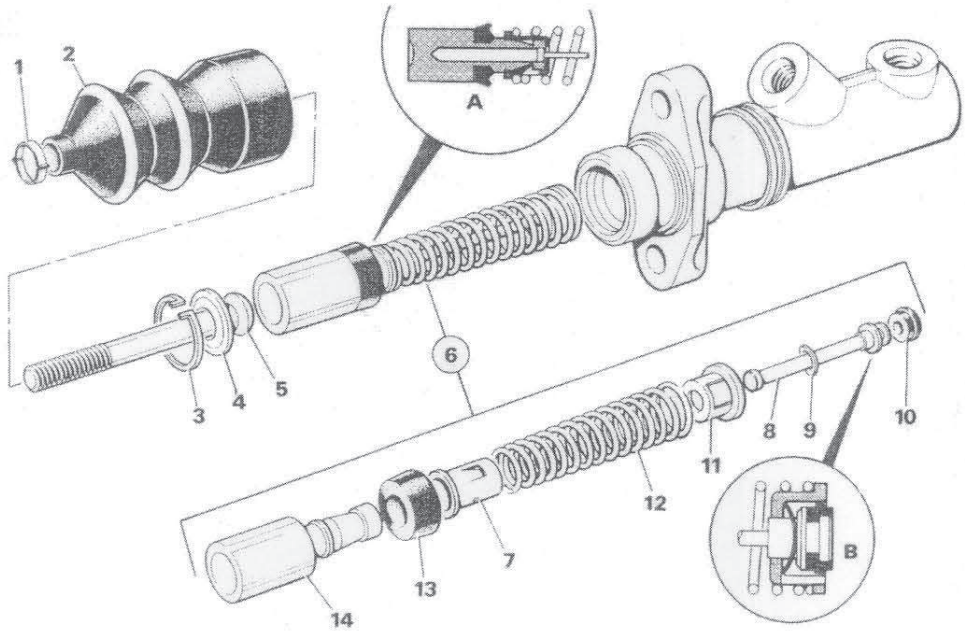
Lift leaf of thimble **7** to release it from piston **14**

When Assembling

Use only JCB Special Hydraulic Fluid or Mobil DTE 11 for cleaning and lubrication. DO NOT USE NORMAL BRAKE FLUID.

Ensure that seal **13** and thimble **7** are fitted as **A**.

Ensure that seal **10** and washer **9** are fitted as at **B.**



SLAVE CYLINDER

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling.

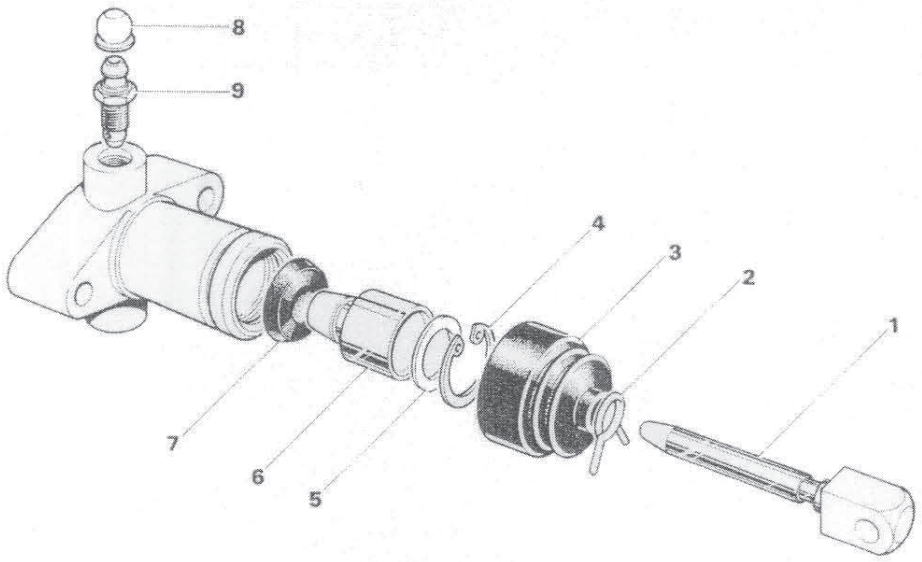
For assembly, the sequence is reversed.

When Assembling

Fit seal 7 with the flat back against the shoulder of piston 6.

Smear dust cover sealing areas with grease (supplied with service kit).

Fill dust cap with remaining grease.



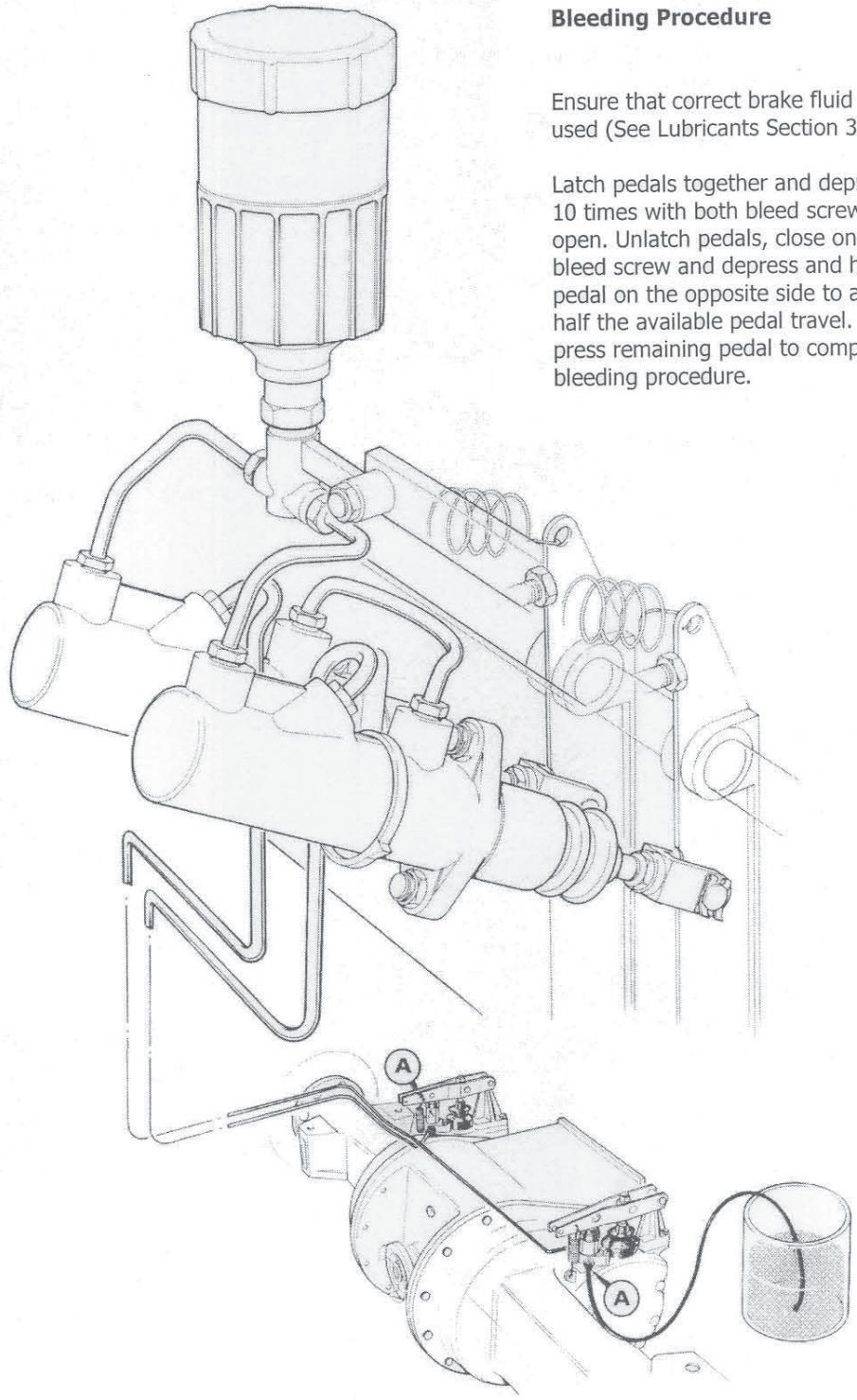
HYDRAULIC CIRCUIT

To m/c no 138621/5

Bleeding Procedure

Ensure that correct brake fluid is used (See Lubricants Section 3)

Latch pedals together and depress 10 times with both bleed screws A open. Unlatch pedals, close one bleed screw and depress and hold pedal on the opposite side to approx half the available pedal travel. Depress remaining pedal to complete bleeding procedure.



HYDRAULIC CIRCUIT

From m/c no 138622/5

Bleeding Procedure

Fill reservoir with correct fluid (see lubricants section 3.)

CAUTION: USE OF INCORRECT FLUID WILL CAUSE SERIOUS DAMAGE.

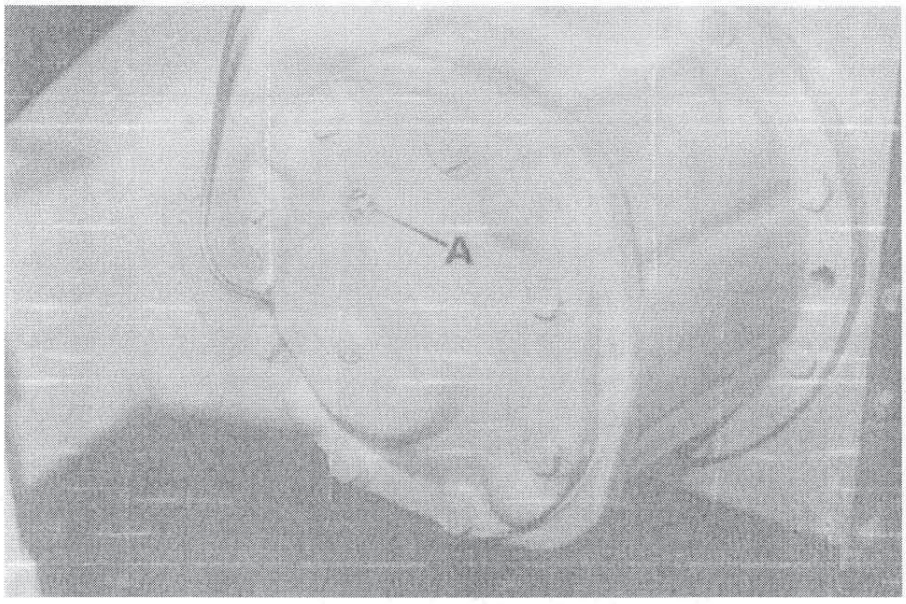
Unlatch pedals and bleed each brake separately as follows:

Attach tube to bleed screw A ensuring that free end of tube is immersed in fluid contained in a suitable jar.

Open bleed screw and apply one rapid full stroke of the appropriate brake pedal followed by three rapid short strokes from the half way pedal position. After the third short stroke, allow the pedal to return quickly to its stop by removing the foot from the pedal.

Continue bleeding normaly until all air is dispelled, closing the bleed screw with the pedal fully depressed.

Repeat the procedure for the second brake.



PARKING BRAKE

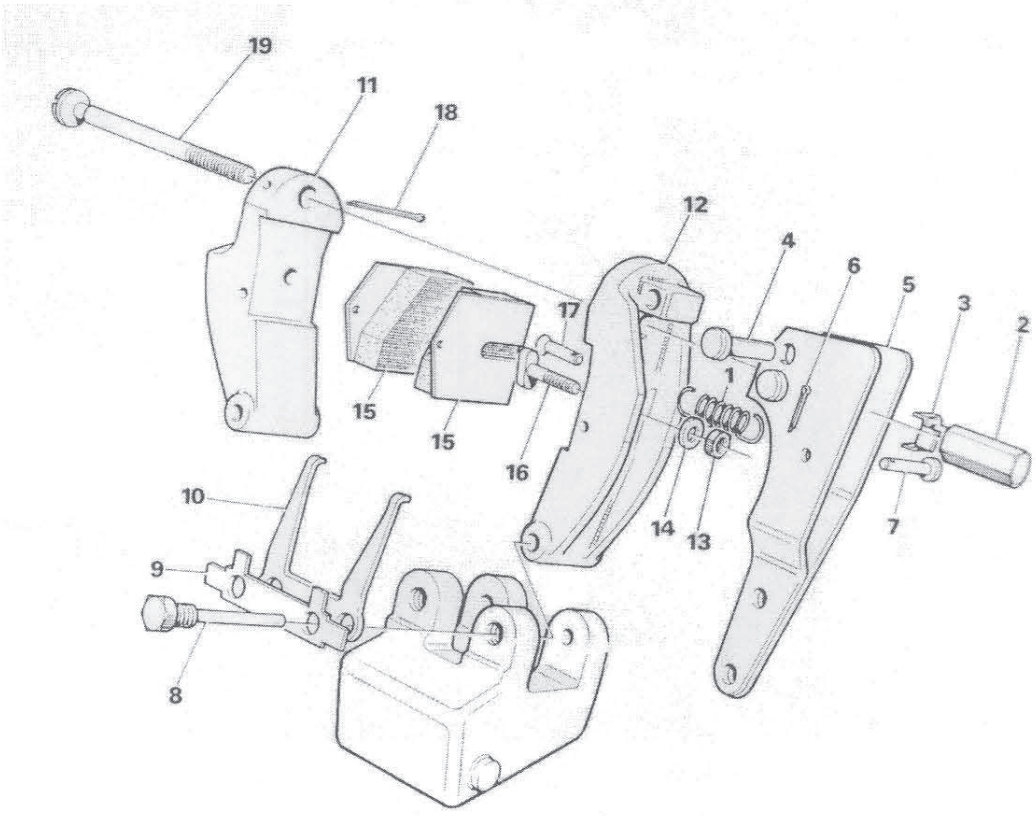
Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling.

For assembly, the sequence is reversed.

When Assembling

Renew pads if friction material thickness is less than 6mm (0.25in)



H STEERING H

CONTENTS

PUMP

Removal and Replacement

The numerical sequence on the illustration is intended as a guide to removal.

For replacement, reverse the sequence.

When Removing

Raise and support lift arms.

Blank hose and pipes to avoid loss of hydraulic fluid.

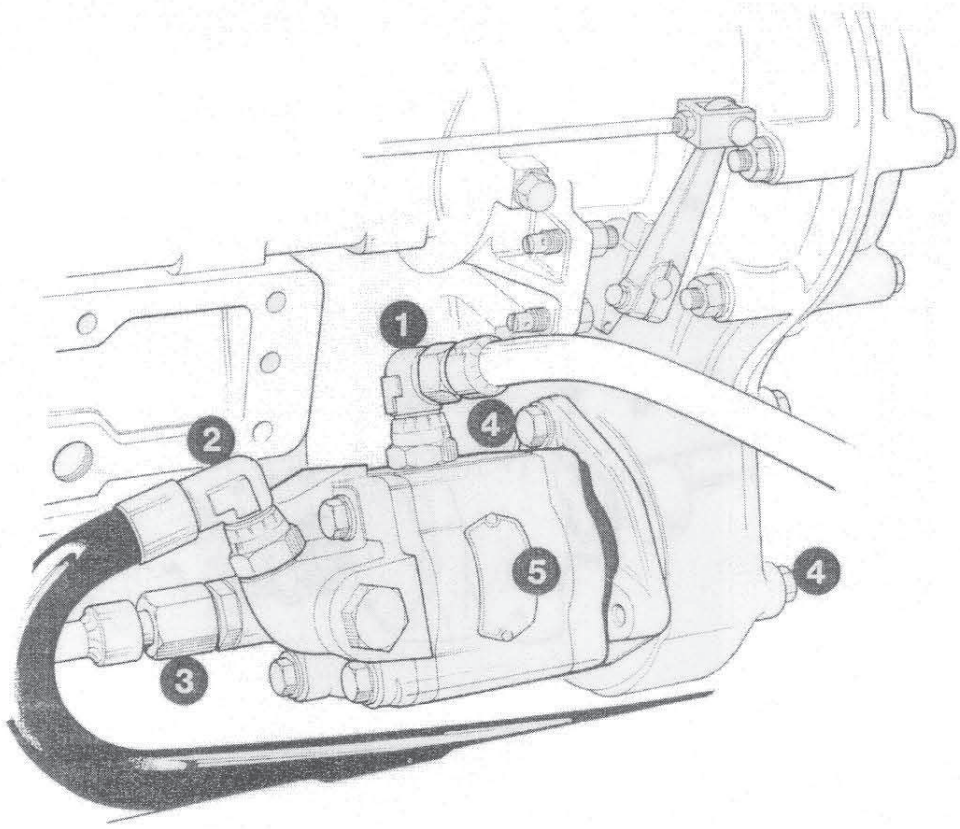
After Replacement

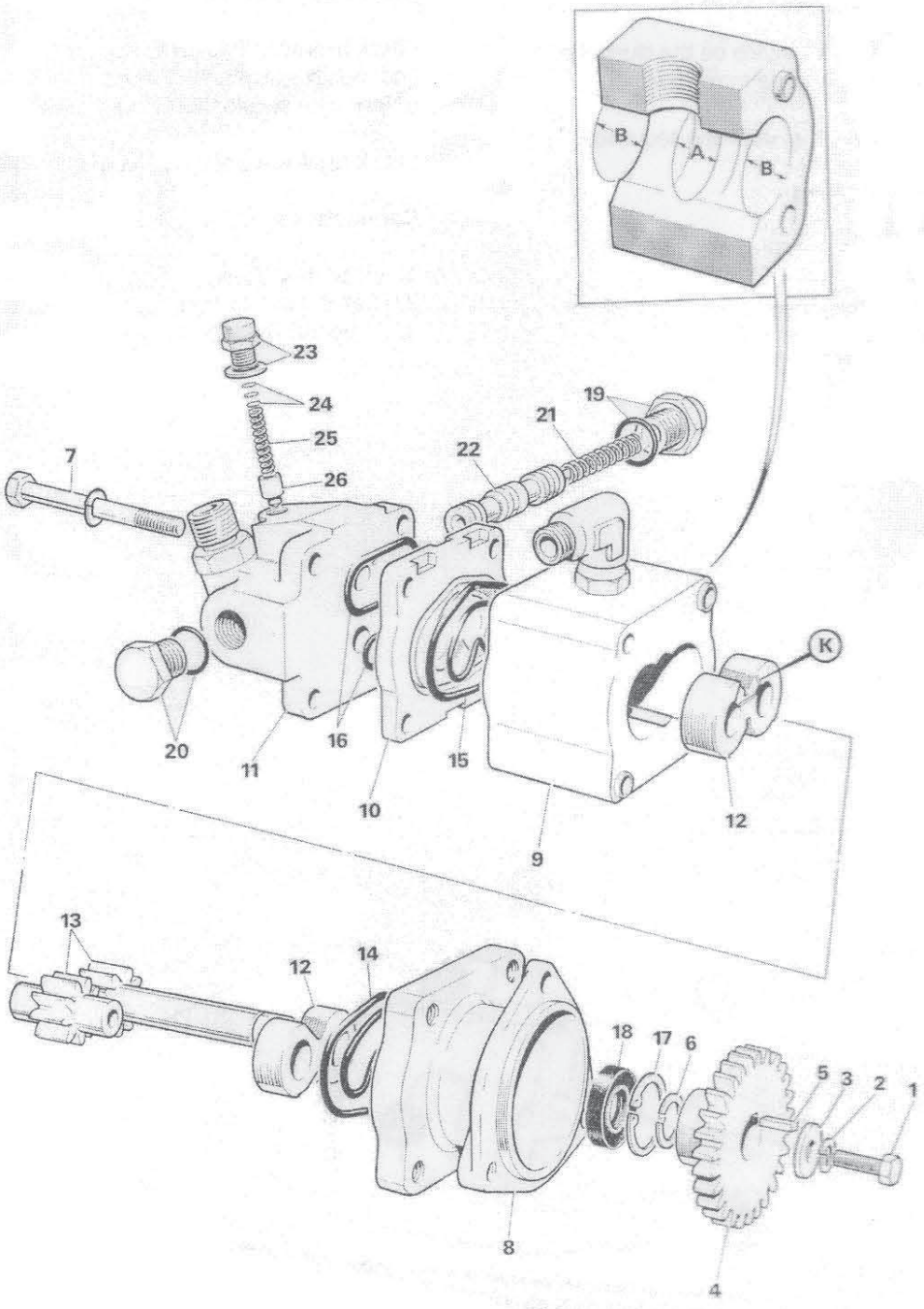
Check hydraulic fluid level, start engine and rapidly spin steering wheel from lock to lock until steering becomes positive.

Check relief valve setting (see page H 6-1)

Connections

1. Feed from Tank
2. Relief Valve to Tank
3. Pressure Feed to Steering Unit





PUMP

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling.

For assembly, reverse the sequence.

When Dismantling

Mark housings and covers to ensure correct assembly.

Remove sharp edges and burrs from shaft to avoid seal damage.

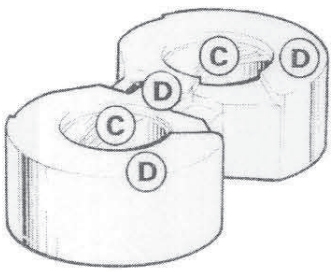
Inspection

Check housing bore diameters at **A** and **B.** If **A** exceeds **B** by more than 0.004in (0.1mm) or heavy scoring is present, the complete pump must be renewed. Light scoring may be removed with very fine emery cloth.

Ensure that bearing blocks are free from scoring or damage especially in bores **C** and on faces **D**. Use fine emery cloth to remove scoring and to ensure free movement in the pump body.

Renew gears if widths **E** vary by more than 0.0002in (0.005mm) or journal diameters F vary by more than 0.0005in (0.013mm) polish out light scoring on side faces using very fine emery cloth and a scrap bearing block as shown at **G**.

Ensure that dimension **H** is 0.004 to 0.008in (0.012 to 0.203mm) less than dimension **J**.



When Assembling

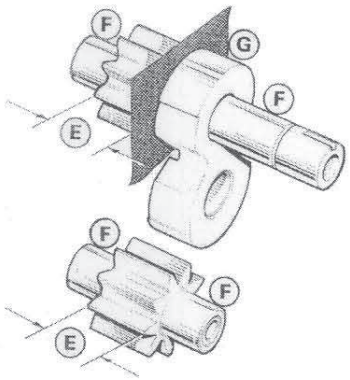
Renew all seals and O rings using JCB Special Hydraulic fluid as a lubricant.

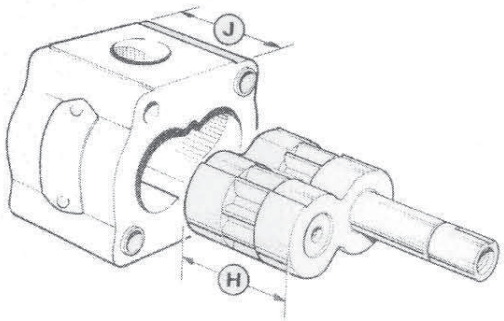
Fit bearing blocks **12** with recess **K** positioned on the inlet side of the pump and facing the gears.

Align housings and covers using marks made on dismantling.

Torque Settings

Item	lbf ft	kgf m
7	25-30	3.5-4.1





PUMP

Removal and Replacement

The numerical sequence on the illustration is intended as a guide to removal.

For replacement, reverse the sequence.

When Removing

Raise and support lift arms.

Blank hose and pipes to avoid loss of hydraulic fluid.

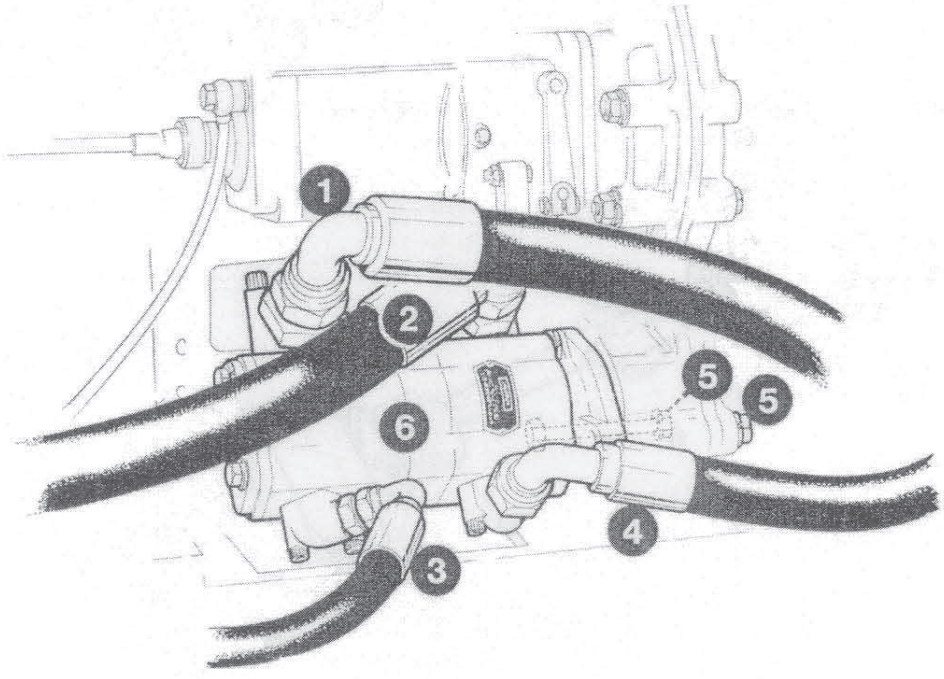
After Replacement

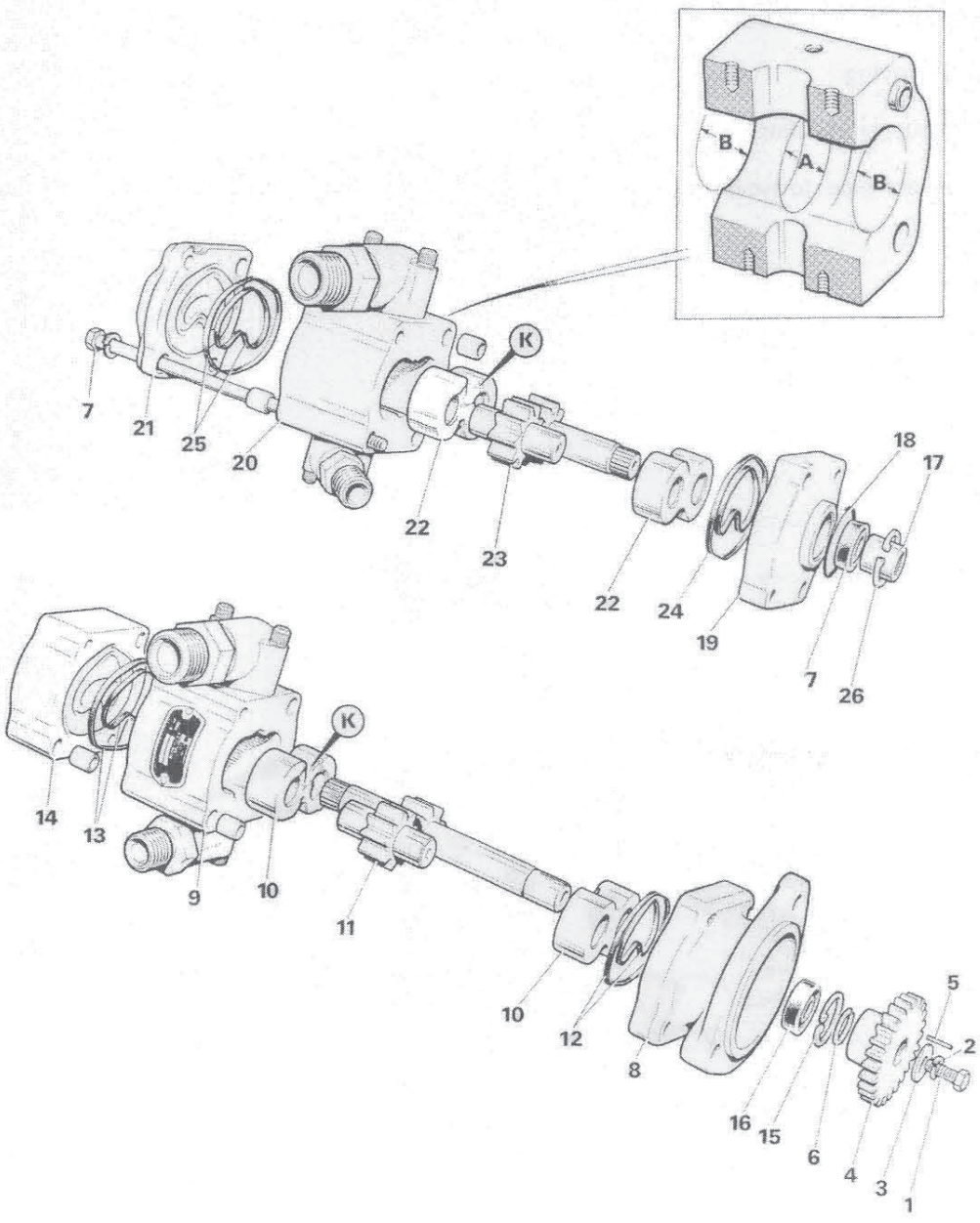
Check hydraulic fluid level, start engine and rapidly spin steering wheel from lock to lock until steering becomes positive.

Check relief valve setting (see page H 6-2)

Connections

1. Feed from Tank
2. Torque Converter Suction
3. Feed to Steering Relief Valve
4. Pressure Feed to Torque Converter





PUMP

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling.

For assembly, reverse the sequence.

When Dismantling

Mark housings and covers to ensure correct assembly.

Remove sharp edges and burrs from shaft to avoid seal damage.

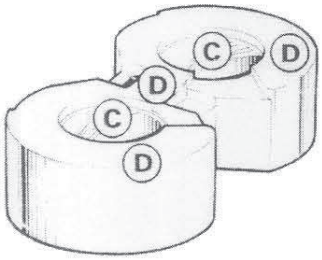
Inspection

Check housing bore diameters at **A** and **B.** If **A** exceeds **B** by more than 0.004in (0.1mm) or heavy scoring is present, the complete pump must be renewed. Light scoring may be removed with very fine emery cloth.

Ensure that bearing blocks are free from scoring or damage especially in bores **C** and on faces **D**. Use fine emery cloth to remove scoring and to ensure free movement in the pump body.

Renew gears if widths **E** vary by more than 0.0002in (0.005mm) or journal diameters F vary by more than 0.0005in (0.013mm) polish out light scoring on side faces using very fine emery cloth and a scrap bearing block as shown at **G**.

Ensure that dimension **H** is 0.004 to 0.008in (0.012 to 0.203mm) less than dimension **J**.



When Assembling

Renew all seals and O rings using JCB Special Hydraulic fluid as a lubricant.

Fit bearing blocks **10** and **22** with recess **K** positioned on the inlet side of the pump and facing the gears.

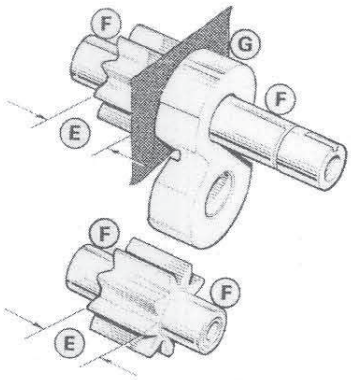
NOTE: The inlet side has the larger diameter ports

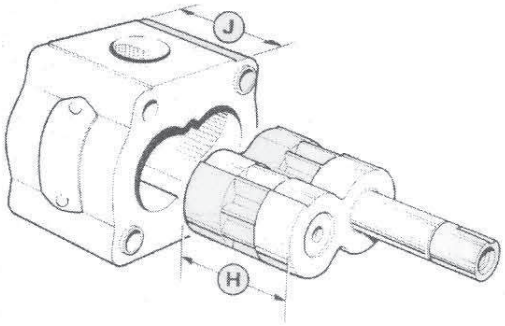
Renew all O rings

Align housings and covers using marks made on dismantling.

Torque Settings

Item	lbf ft	kgf m
7	25-30	3.5-4.1





RELIEF VALVE
(Torque Converter m/c's Only)

Removal and Replacement

The numerical sequence on the illustration is intended as a guide to removal.

For replacement, reverse the sequence.

When Removing

Blank hose and pipes to avoid loss of hydraulic fluid.

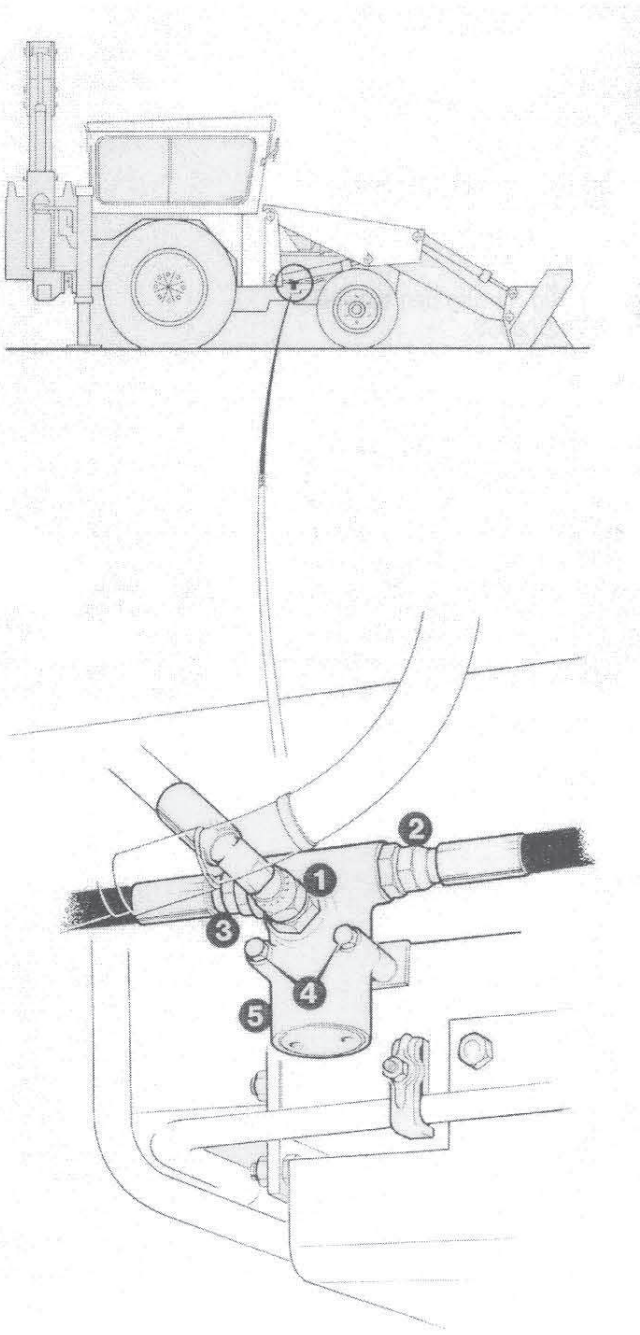
After Replacement

Start engine and rapidly spin steering wheel from lock to lock until steering becomes positive.

Check pressure setting (see page H 6-2)

Connections

1. To Tank
2. From Pump
3. To Steering Unit



RELIEF VALVE
(Torque Converter m/c's Only)

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly, reverse the sequence.

When Dismantling

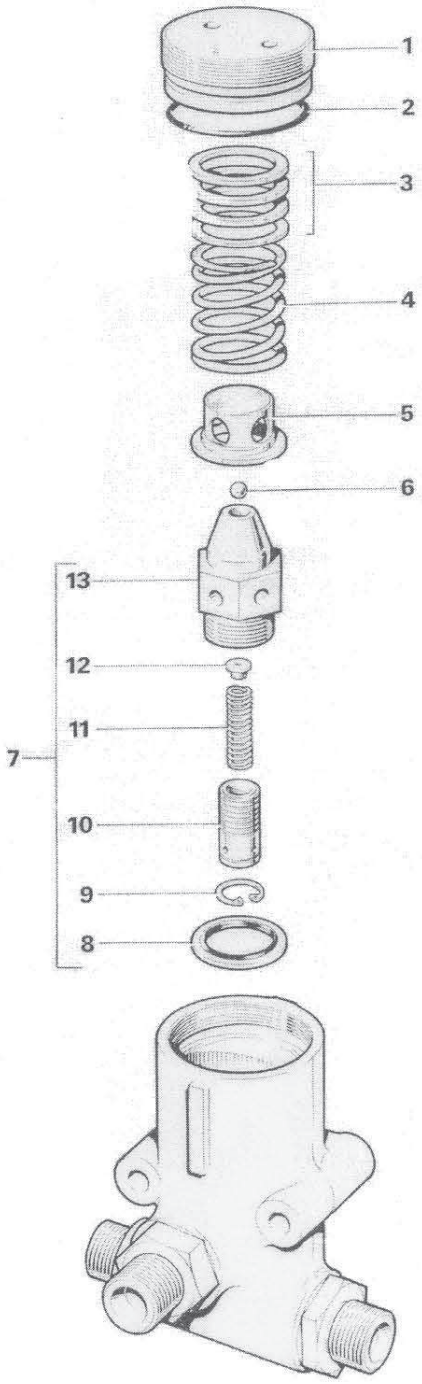
Remove plug **1** using peg spanner part no 892/00068.

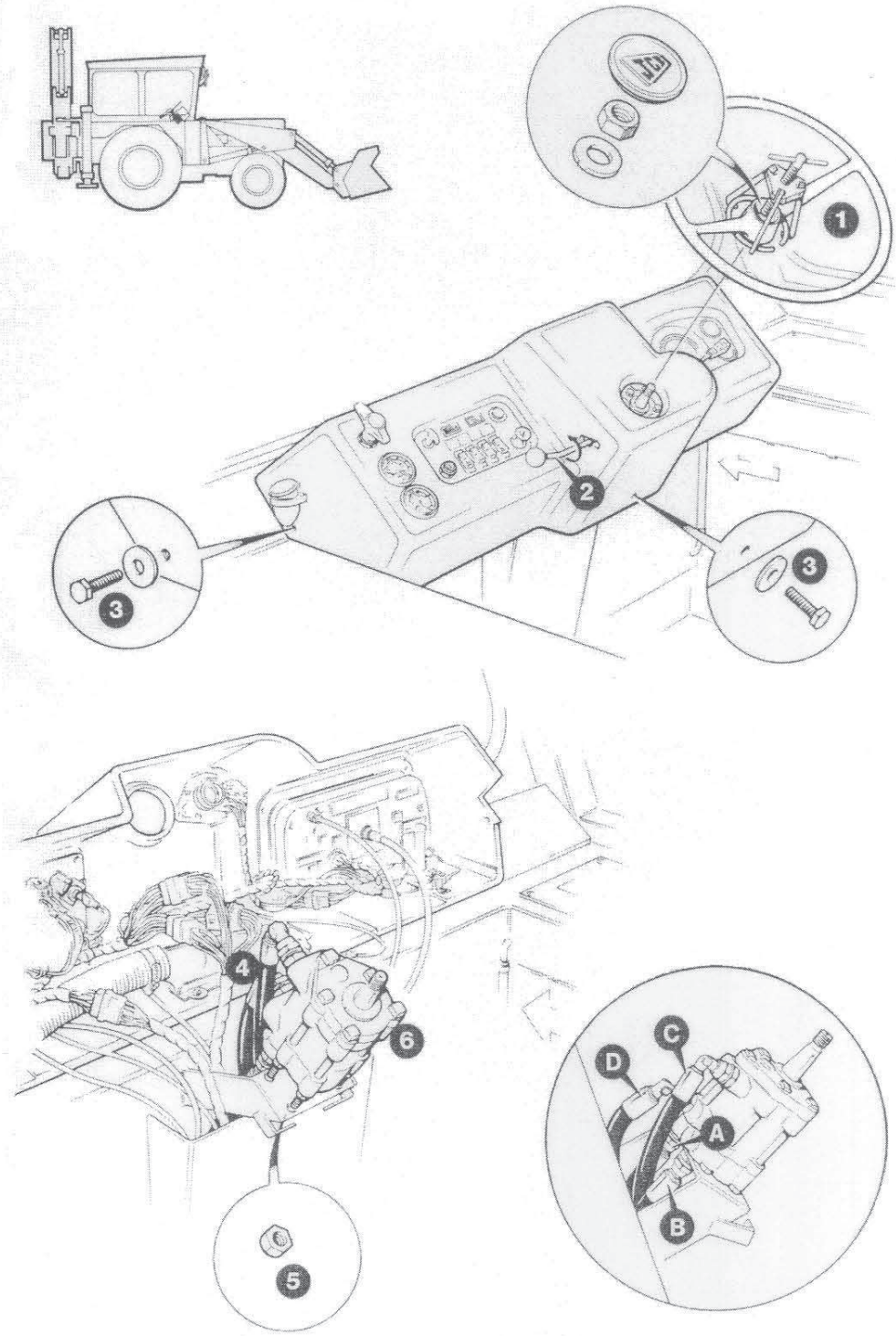
Inspection

Ensure that there is a good sliding fit between the valve spool **10** and its housing **13**. Slight stiction may be removed using metal polish but any serious damage must be remedied by the replacement of the valve assembly 7 as a unit.

When Assembling

Renew seals **2** and **8**





HYDRAULIC STEERING UNIT (PLESSEY)

Removal and Replacement

The numerical sequence on the illustration is intended as a guide to removal.

For replacement, reverse the sequence.

When Removing

Do not hammer the end of the steering shaft to release wheel from taper. Use puller ring part no 892/00069 (see service tools in conjunction with a general purpose puller.

Identify hoses to ensure correct replacement, plug ends to prevent ingress of dirt.

When Replacing

Fit three only of nut **5** to prevent distortion of the unit.

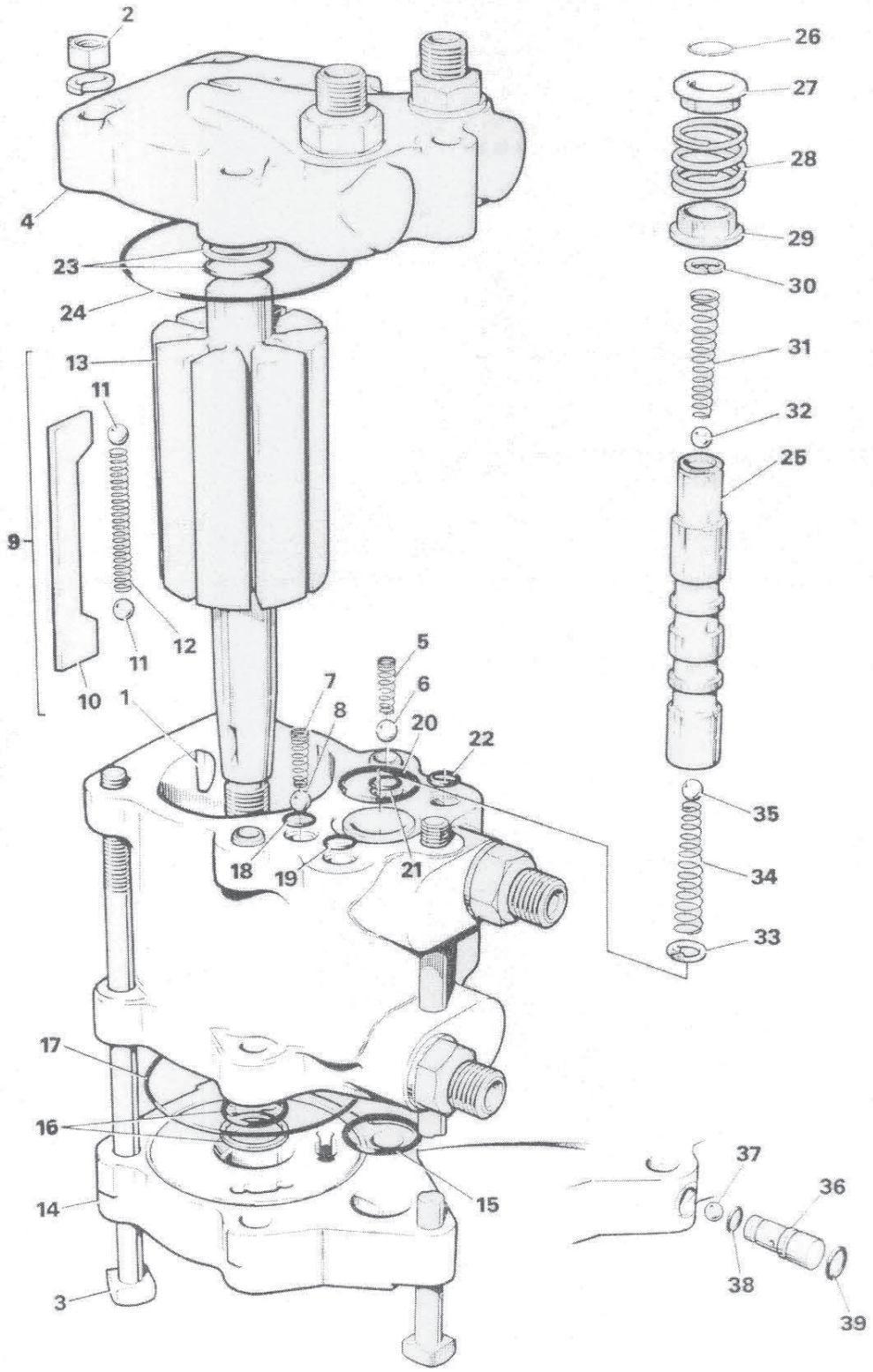
Do not hammer steering wheel onto shaft or the valve may be internally damaged.

Connections

A. From Steering Pump
B. Return to Tank
C. To Ram Head Side
D. To Ram Rod Side

Torque Settings

Item	Nm	kgf m	lbft ft
5	27.1	2.8	20



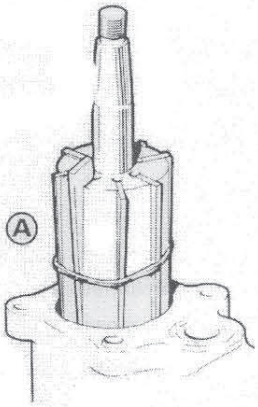
HYDRAULIC STEERING UNIT PLESSEY

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly, reverse the sequence.

Before dismantling ensure that exposed portion of the shaft is free from paint, rust or burrs, otherwise damage will be caused to bearing surfaces.

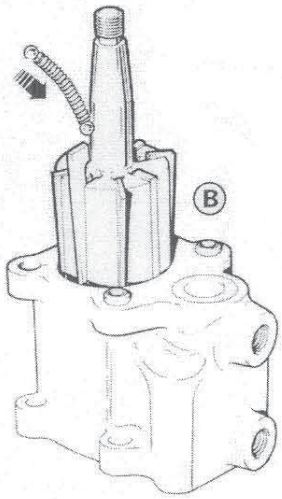


When Dismantling

Do not use screwdrivers or wedges to remove end covers. To remove **4**, gently tap end of shaft with soft hammer.

Items **10**, **11** and **12** should be retained with string or a rubber band **A**

To remove **14** use a wooden drift passed through the bore.

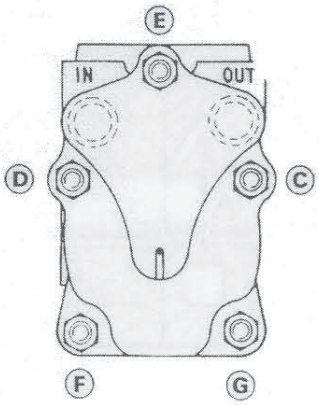


When Assembling

Fit balls and springs as shown **B**

When renewing seals **15** and **20** discard any back up rings previously fitted.

Tighten nuts **2** in sequence **C, D, E, F, G.**



Torque Settings

Item	Nm	kgf m	lbf ft
1	54	5.5	40

HYDRAULIC STEERING UNIT PLESSEY

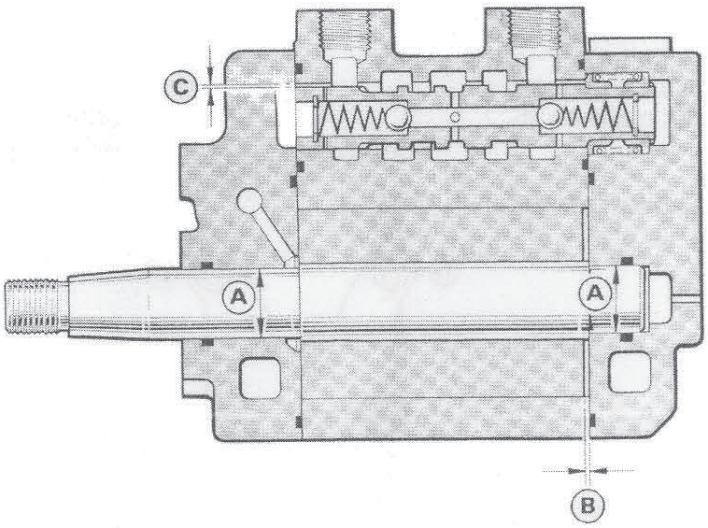
Inspection and Repair

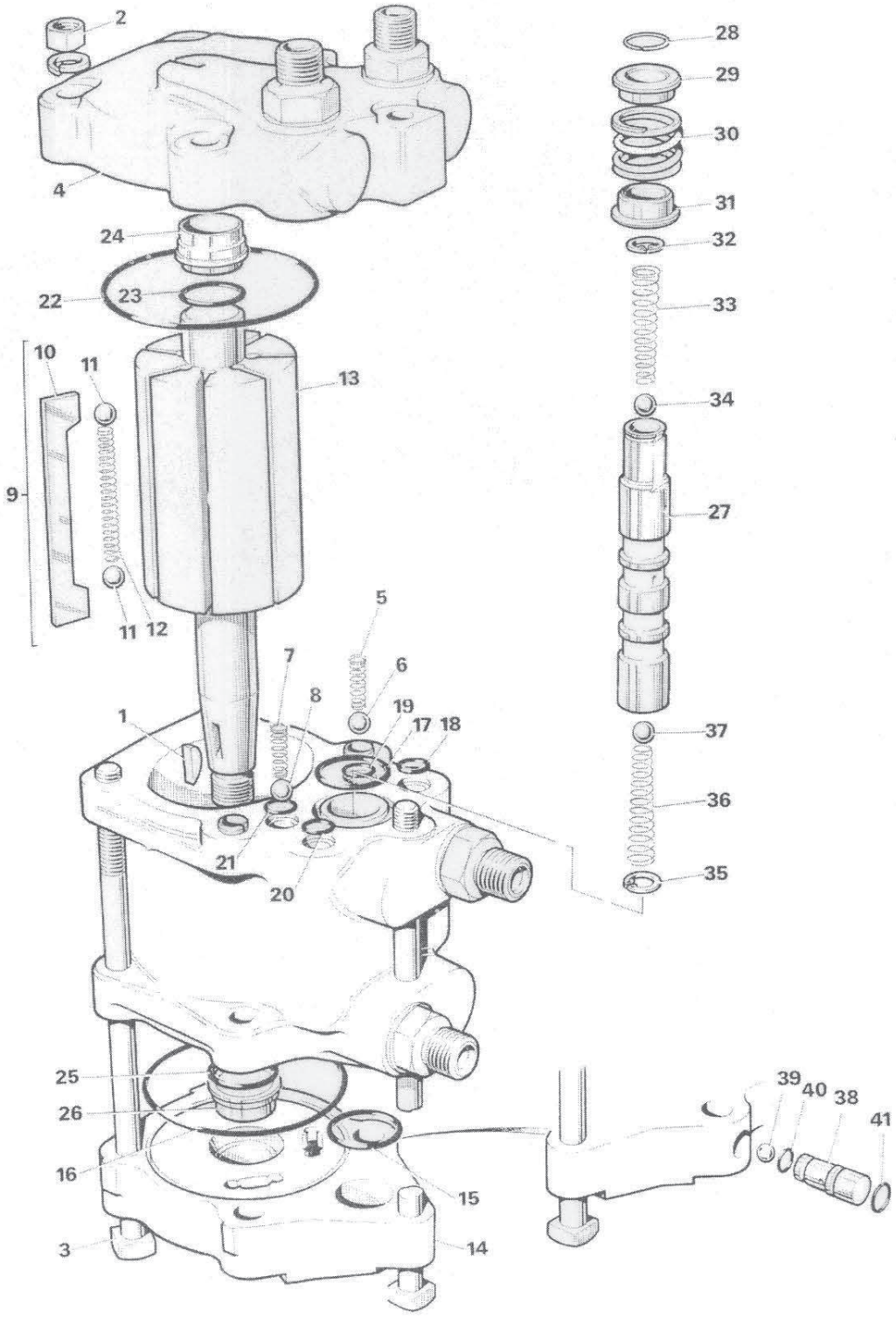
Remove burrs and light scoring from components using fine emery cloth

Ensure that vanes **10** move freely in their slots.

Wear Limits

	Millimetres	Inches
Wear at **A**	0.013	0.0005
Clearance **B**	0.061	0.0024
	to	to
	0.076	0.0030
Clearance **C**	0.010	0.0004
	to	to
	0.013	0.0005





HYDRAULIC STEERING UNIT PLESSEY

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to dismantling

For assembly, reverse the sequence.

Before dismantling ensure that exposed portion of the shaft is free from paint, rust or burrs, otherwise damage will be caused to bearing surfaces.

When Dismantling

Do not use screwdrivers or wedges to remove end covers. To remove **4**, gently tap end of shaft with soft hammer.

Items **10**, **11** and **12** should be retained with string or a rubber band **A**

To remove **14** use a wooden drift passed through the bore.

Do not disturb O rings 23 and 25 or bearings 24 and 26 unless fluid is leaking along the shaft.

When Assembling

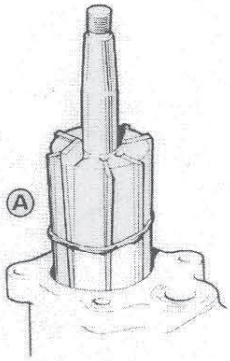
Fit balls and springs as shown **B**

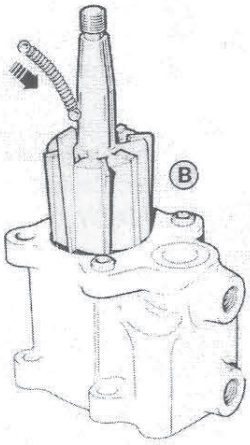
If new bearings 24 or 26 are fitted, it is essential to use the special tool as described on page H 4-7

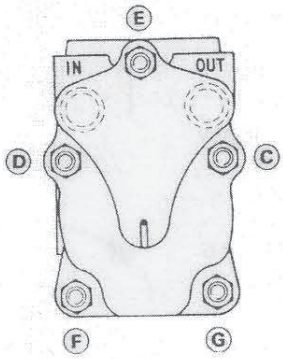
Tighten nuts **2** in sequence **C, D, E, F, G.**

Torque Settings

Item	Nm	kgf m	lbf ft
1	54	5.5	40







HYDRAULIC STEERING UNIT PLESSEY

Bearing Replacement

This operation requires special tool part no 992/01300 consisting of:
A. Guide Block
B. Mandrel
C. Tommy Bar
Each end of the mandrel must be used for its specified function:
1. Fitting
2. Sizing

Bolt guide block to control valve end cover D ensuring that dowels are correctly located.

Fit new bearing E onto the mandrel, with the smallest diameter of the bearing seated firmly in recess F.

Enter the mandrel into the guide block and mount the assembly in a vice as shown. Tighten the vice until a resistance is felt, indicating that the bearing is fully home in the end cover.

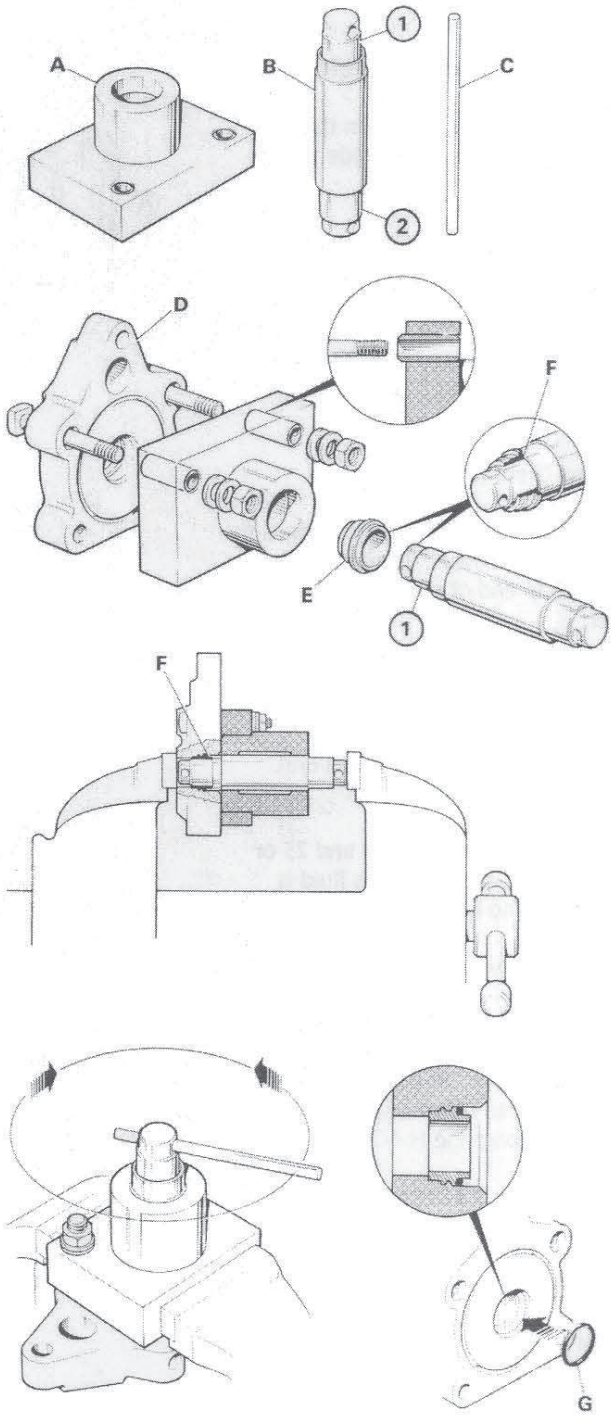
Position the assembly vertically in the vice and reverse the mandrel so that the sizing end 2 enters the bearing.

NOTE: It may be necessary to lightly tap the mandrel with a soft faced mallet to engage it in the bearing.

Rotate the mandrel through at least 6 turns in each direction to size the bearing.

Remove the tool from the end cover and thoroughly clean out all loose bearing material from the bores.

Fit O ring G as shown.



HYDRAULIC STEERING UNIT PLESSEY

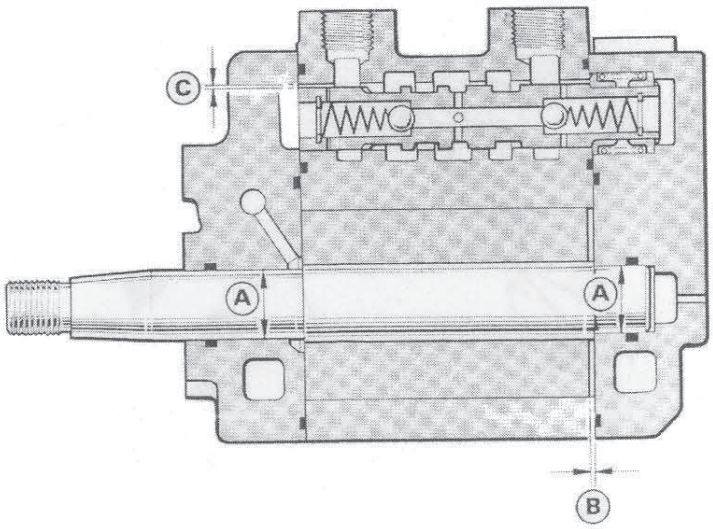
Inspection and Repair

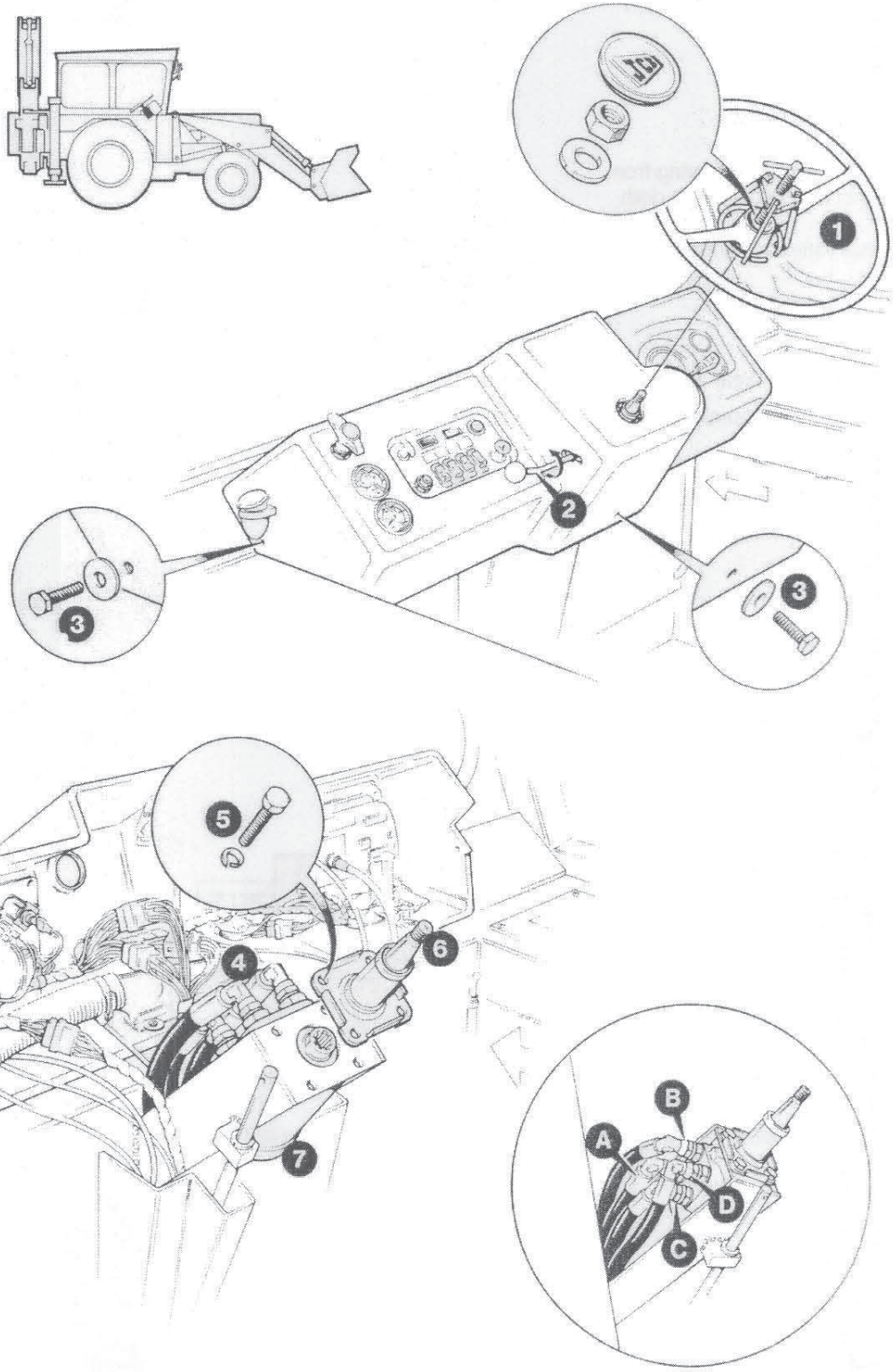
Remove burrs and light scoring from components using fine emery cloth

Ensure that vanes **10** move freely in their slots.

Wear Limits

	Millimetres	Inches
Wear at **A**	0.013	0.0005
Clearance **B**	0.061	0.0024
	to	to
	0.076	0.0030
Clearance **C**	0.010	0.0004
	to	to
	0.013	0.0005





HYDRAULIC STEERING UNIT (DANFOSS)

Removal and Replacement

The numerical sequence on the illustration is intended as a guide to removal.

For replacement, reverse the sequence.

When Removing

Do not hammer the end of the steering shaft to release wheel from taper. Use puller ring part no 892/00069 (see service tools in conjunction with a general purpose puller.

On later machines the puller ring will require modification to fit the later type steering wheel.

Identify hoses to ensure correct replacement, plug ends to prevent ingress of dirt.

When Replacing

Do not hammer steering wheel onto shaft or the valve may be internally damaged.

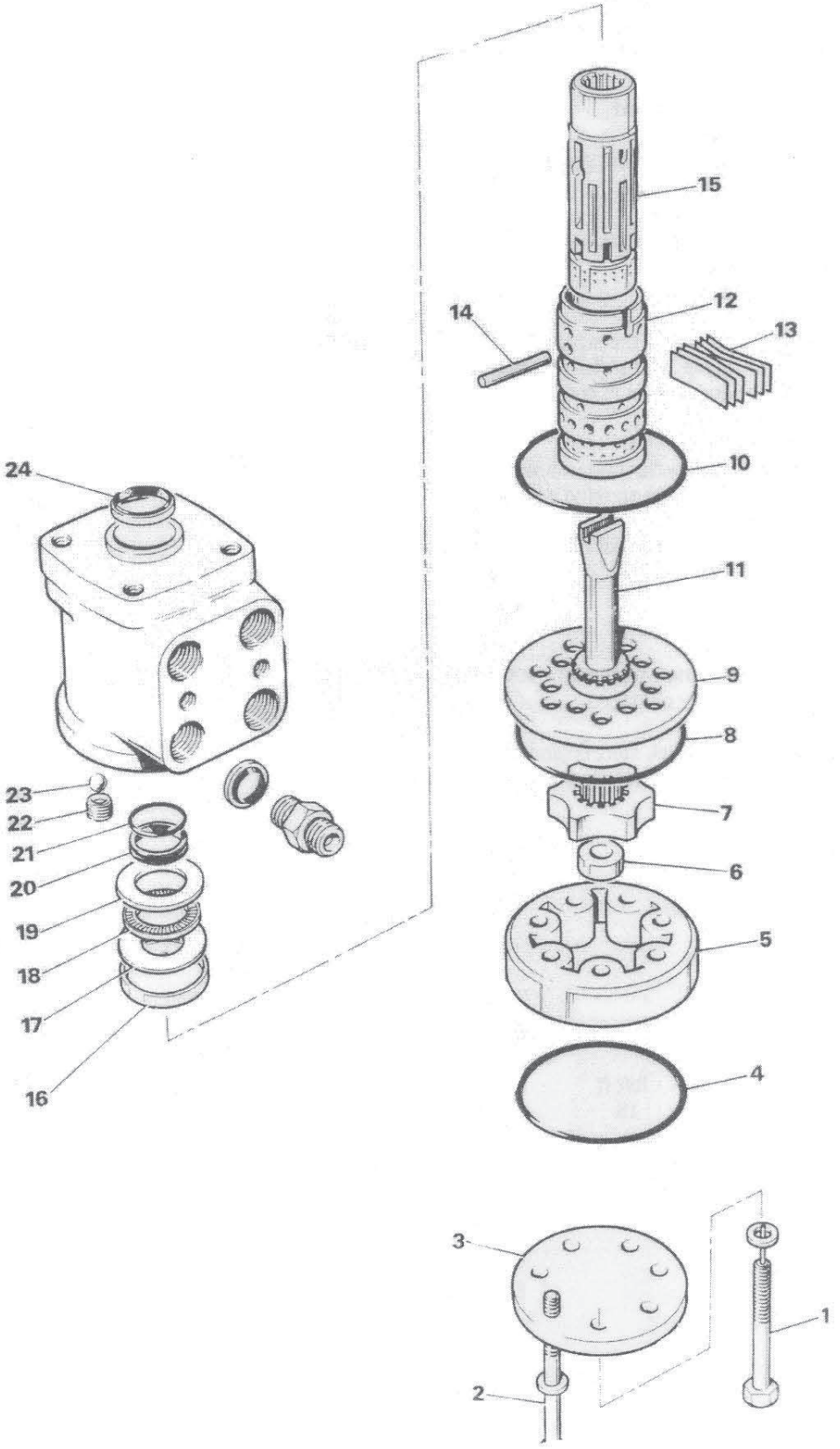
Check hydraulic fluid level, start engine and turn the steering wheel from lock to lock until the steering becomes positive.

Connections

A. From Steering Pump
B. Return to Tank
C. To Ram Head Side
D. To Ram Rod Side

Torque Settings

Item	Nm	kgf m	lbft ft
5	20.3	2.1	15



HYDRAULIC STEERING UNIT (DANFOSS)

Dismantling and Assembly

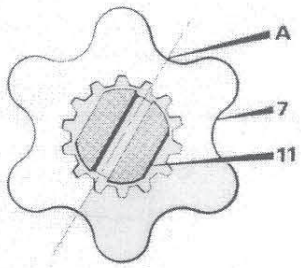
The numerical sequence on the illustration is intended as a guide to removal.

For assembly, reverse the sequence.

When Assembling

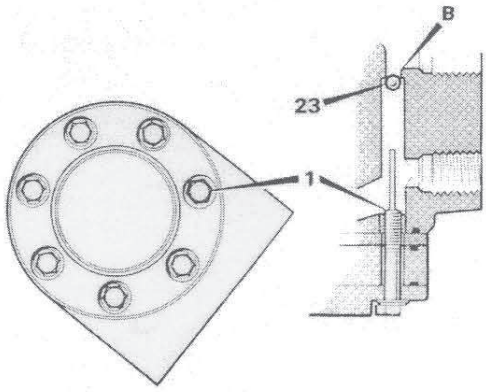
Renew all O rings and seals

Ensure that the slot in the drive shaft 11 is aligned with the hollows of the rotor as at A.



Fit O ring 21 and back up ring 20 using tool MS62A

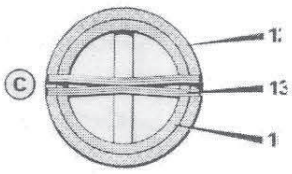
Ball 23 is to rest against seat B before bolt 1 is fitted.

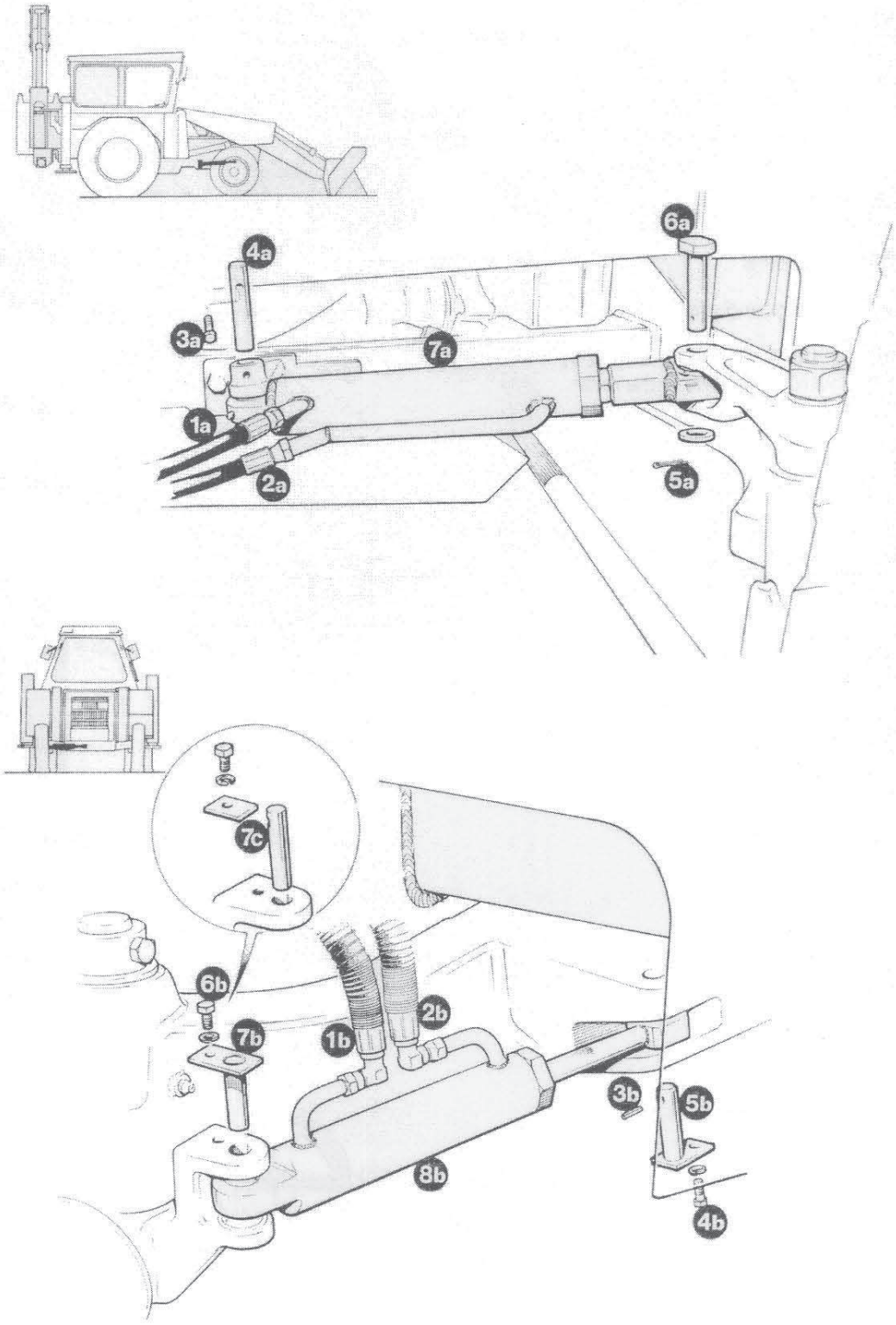


Springs 13 must be located as at C

Torque Settings

Item	Nm	kgf m	lbft ft
1&2	29	3.0	21.7





RAM

Removal and Replacement

The numerical sequence on the illustration is intended as a guide to dismantling.

For assembly, reverse the sequence.

NOTE:
Items 1a to 7a To m/c no. 68150
Items 1b to 8b From m/c no 100000
Pin and plate 7c are alternative to pin 7b

When Removing

Blank hoses to prevent loss of hydraulic fluid and entry of dirt.

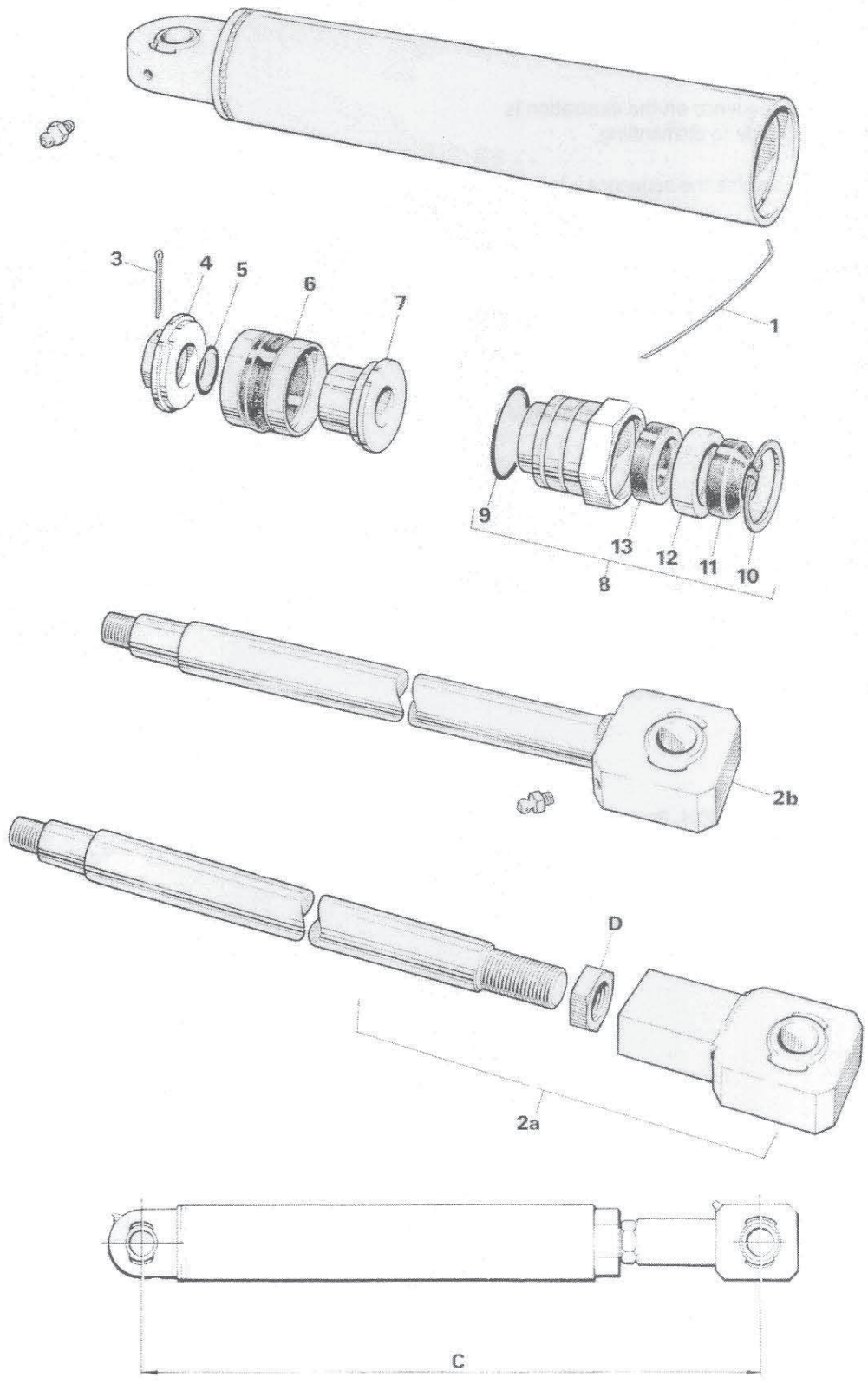
When Replacing

Apply anti-seize paste, part no 4003/0211 to pivot pin 5b to facilitate subsequent removal.

After connecting hoses, prime the system with engine running by turning the steering wheel rapidly from lock to lock until steering becomes positive.

Connections

1a, 1b. Steering Unit R.H. Port.
2a, 2b. Steering Unit L.H. Port



RAM

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to removal.

For assembly, reverse the sequence.

NOTE:
The two types of piston rod shown are not interchangeable.
2a To m/c no. 68150
2b From m/c no 100000

When Dismantling

Eject retaining wire **1** by turning the gland bearing as at **A**. On very early rams, it may be necessary to pull out the wire.

When Assembling

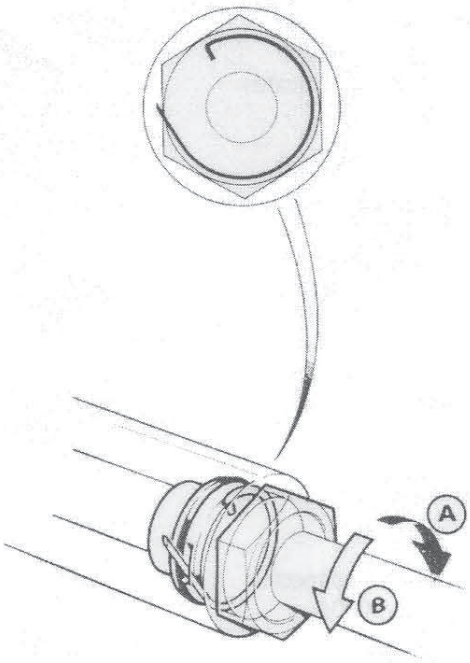
Renew all seals and O rings.

Coat all internal parts with JCB Special hydraulic fluid.

Fit wiper seal **11** with its lip facing circlip **10**.

Fir new retaining wire as at B.

Apply Loctite 221 (see service tools) to adjustment threads of piston rod 2a and set dimension C to 21.29 – 21.39in (541-543mm) with ram fully closed.



Torque Settings

Item	Nm	kgf m
D	150	20.7
4	100	13.8

PRESSURE TESTING

Pump and Relief Valve

Disconnect and blank pipe A and connect gauge B part no 892/00001.

With engine running at 1700 rev/min, the maximum gauge reading will indicate the setting of the relief valve (see technical date)

If the setting is incorrect adjust as described on page H 6-3.

When the gauge reading is correct at 1700 rev/min a drop of more than 200 lbf/in² (14 kgf/cm²) with engine idling, indicates a defective pump.

Steering Unit and Ram Internal Leakage Check

NOTE: In cases of inefficient steering, this test will determine which component is defective, assuming that there are no external leaks and that the pump and relief valve are functioning correctly.

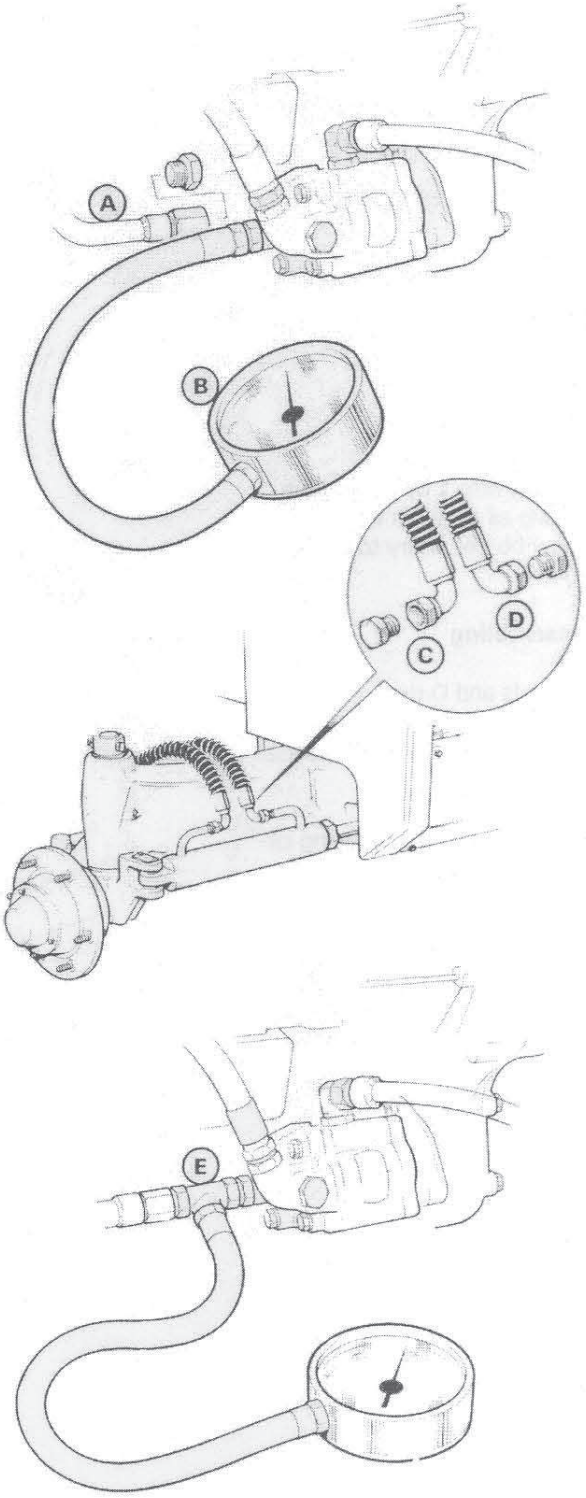
Disconnect and blank hoses C and D.

Insert tee piece E and connect gauge part no. 892/00001.

With engine running at 1700 rev/min, check maximum gauge reading when steering wheel is turned.

If the reading is equal to the relief valve setting, suspect a defective ram.

If the reading is appreciably lower than the relief valve setting, suspect a defective steering unit.



PRESSURE TESTING

System Pressure

Snap on Pressure Test Points

Connect pressure gauge (see service tools catalogue) to test point A using snap connector part no 892/00099.

Run engine at 1700 rev/min, and turn steering wheel from lock to lock. The maximum gauge readings at full lock should equal the correct relief valve pressure (see technical data)

If the readings are both incorrect, check the pump and the relief valve pressure. If one reading only is incorrect, check the steering unit and ram for internal linkage.

Pump and Relief Valve Pressure

With gauge connected to point A, disconnect and blank pipe B as shown.

With engine running at 1700 rev/min, the maximum gauge reading should equal the correct relief valve pressure. If incorrect adjust the relief valve (see page H 6-3)

NOTE: When the gauge reading is correct at 1700 rev/min, a drop of more than 200 lbf/in² with engine idling, indicates a defective pump.

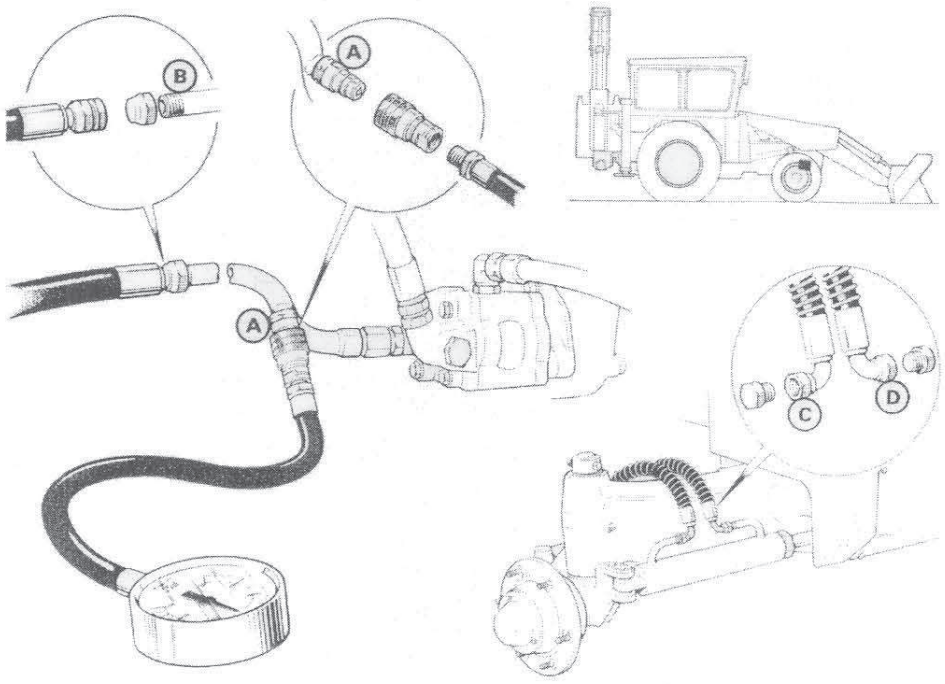
Steering Unit and Ram Internal Leakage Check

First check the pump and the relief valve pressure.

With gauge connected to point A and pipe B reconnected, disconnect and blank hoses C and D.

Run engine at 1700 rev/min and check maximum gauge reading when steering wheel is turned in each direction.

If the reading is equal to the relief valve setting, suspect a defective ram. If the reading is appreciably lower than the relief valve setting, suspect a defective steering unit.



PRESSURE TESTING

Pump and Relief Valve

Disconnect and blank pipe A and connect gauge B part no 892/00001.

With engine running at 1700 rev/min, the maximum gauge reading will indicate the setting of the relief valve (see technical date)

If the setting is incorrect adjust as described on page H 6-3.

When the gauge reading is correct at 1700 rev/min a drop of more than 200 lbf/in² (14 kgf/cm²) with engine idling, indicates a defective pump.

Steering Unit and Ram Internal Leakage Check

NOTE: In cases of inefficient steering, this test will determine which component is defective, assuming that there are no external leaks and that the pump and relief valve are functioning correctly.

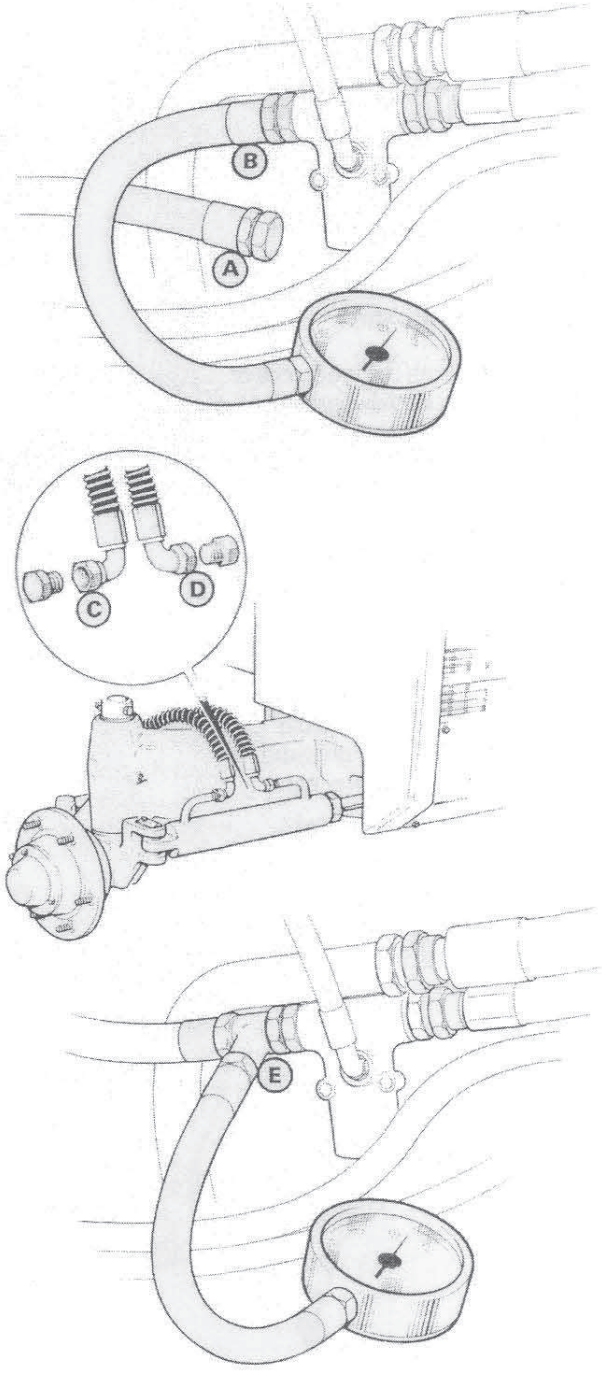
Disconnect and blank hoses C and D.

Insert tee piece E and connect gauge part no. 892/00001.

With engine running at 1700 rev/min, check maximum gauge reading when steering wheel is turned.

If the reading is equal to the relief valve setting, suspect a defective ram.

If the reading is appreciably lower than the relief valve setting, suspect a defective steering unit.

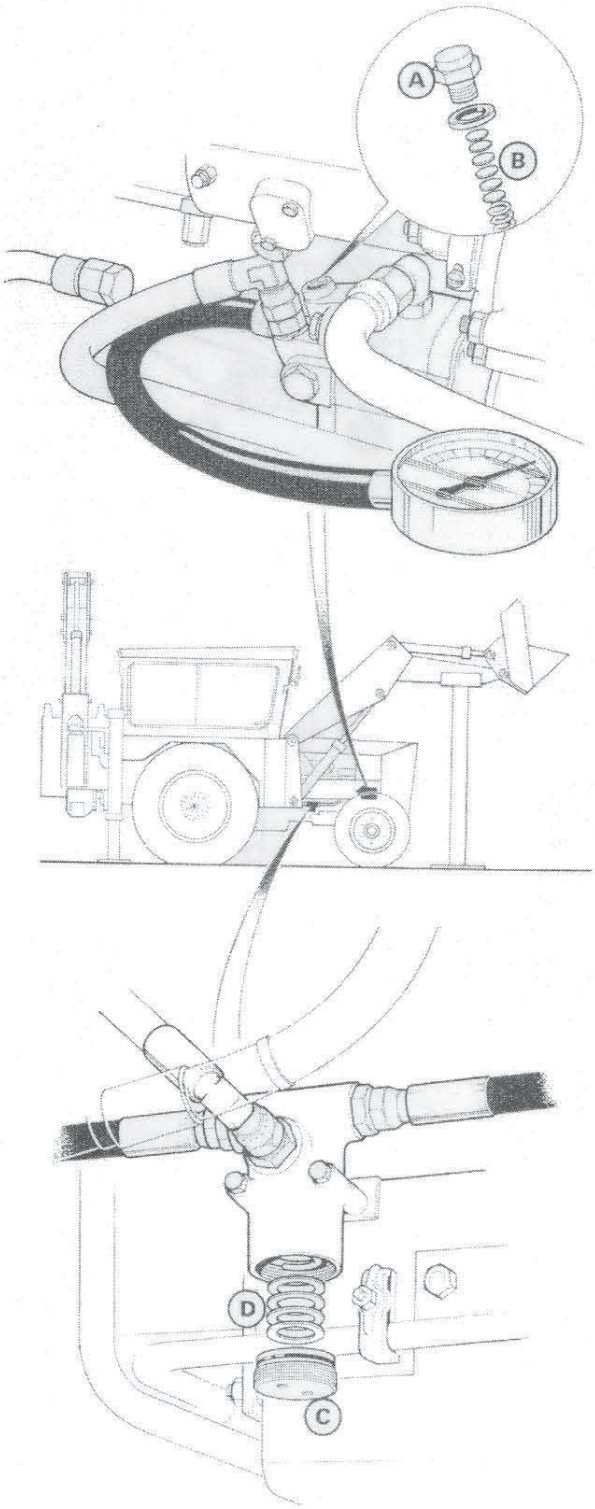


RELIEF VALVE
(Manual Clutch m/c's)

Adjustment

Remove cap A and add or subtract shims B as required.

One 0.007in (o.178mm) shim raises or lowers the pressure by approximately 100 lbf/in² (7 kgf/cm²)



RELIEF VALVE
(Torque Converter m/c's)

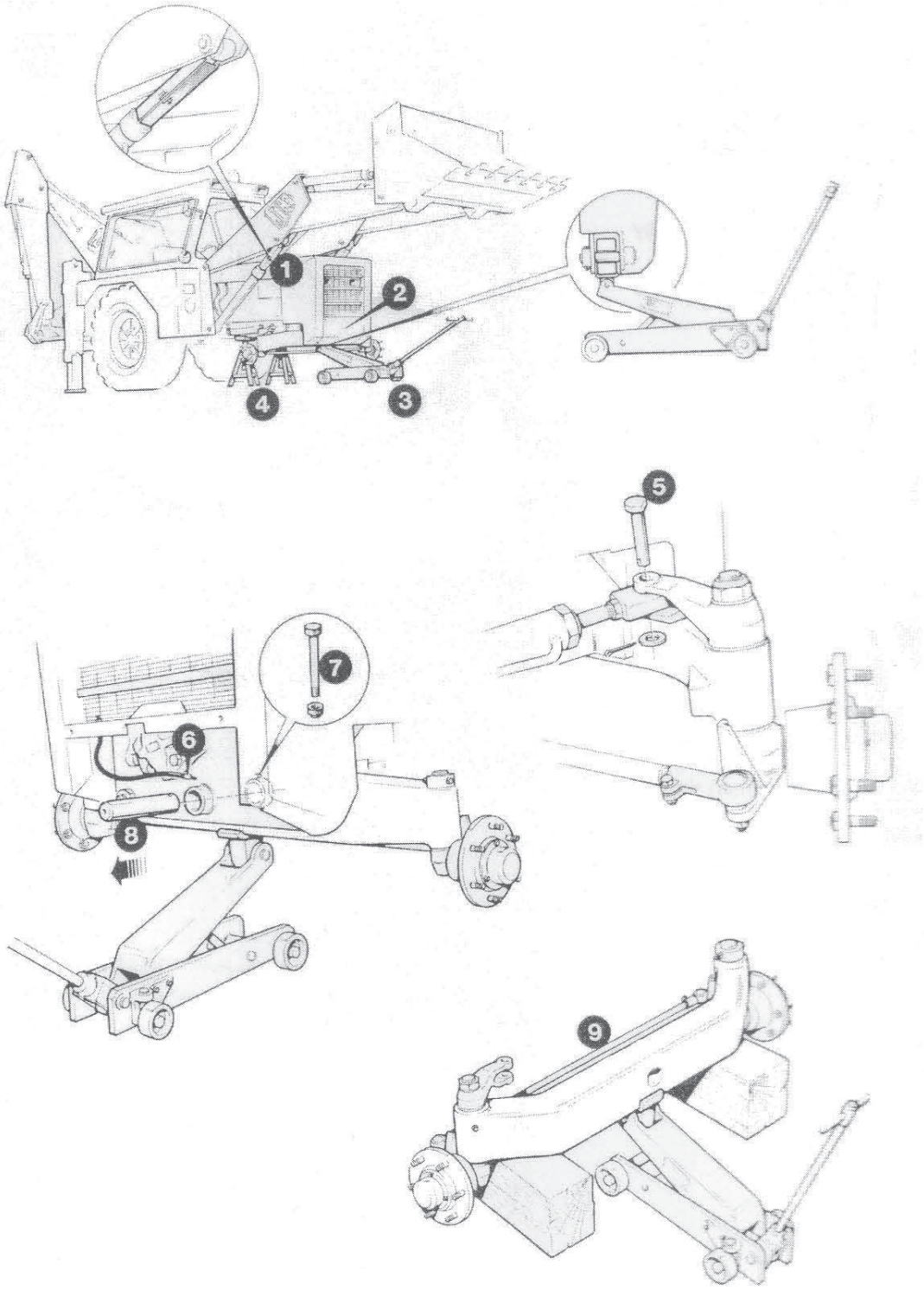
Adjustment

Remove plug C using peg spanner part no 892/00068, and add or subtract shims D as required.

One 0.020in (0.508mm) shim raises or lowers the pressure by approximately 100 lbf/in² (7kgf/cm²)

H STEERING

7-1



FRONT AXLE

Removal and Replacement

The numerical sequence on the illustration is intended as a guide to removal.

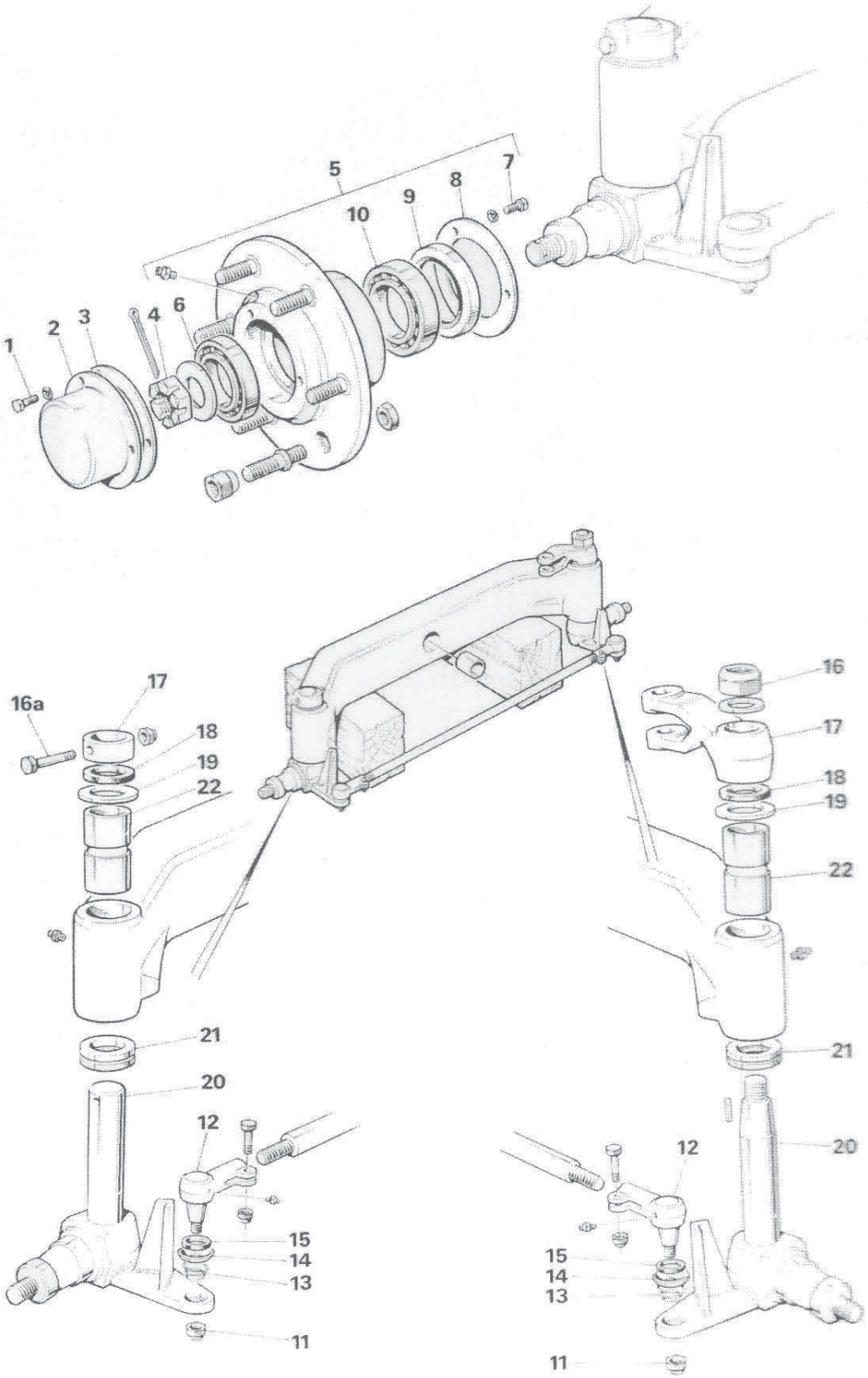
For assembly, reverse the sequence.

WARNING: Before working beneath shovel, fit ram prop **1** part no:
102/11600 **2D 2DS**
106/08100 **3, 3C, 3CS, 3D, 700**

When Replacing

Lubricate pivot pin **8** with Mobilgrease Super or equivalent.

After fitting road wheels torque tighten wheel nuts to 3000 lbf ft (41.5 kgf m)



FRONT AXLE

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to removal.

For assembly, reverse the sequence.

When Assembling

Renew gasket **3** seals **9** and **15** and felt washer **18**. Felt washer to be soaked in oil before fitting.

Add spacers **19** as required to achieve minimum end float on swivel pins **20**.

Secure nut **16** using Loctite 270, which must be kept clear of taper anf keyway on swivel pin.

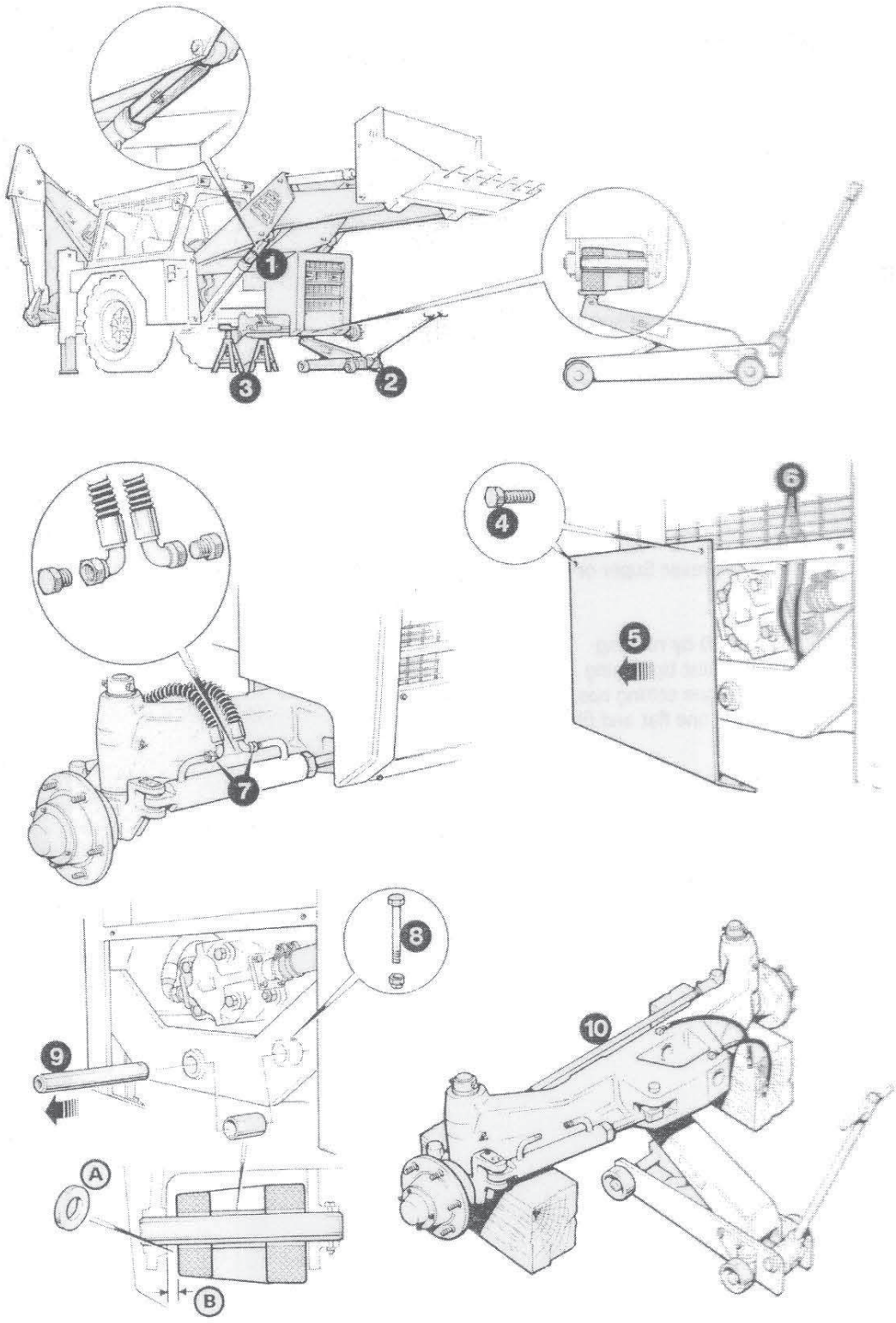
Pack hubs **5** with Mobilgrease Super or equivalent.

Bed in bearings **6** and **10** by rotating hub in each direction whilst tightening nut **4**. When correct torque setting has been achieved, back off one flat and fit split pin.

After fitting road wheels torque tighten wheel nuts to 3000 lbf ft (41.5 kgf m)

Torque Settings

Item	Nm	kgf m	lbf ft
4	407	41.5	300
11	156	16	115



FRONT AXLE

Removal and Replacement

The numerical sequence on the illustration is intended as a guide to removal.

For assembly, reverse the sequence.

WARNING: Before working beneath shovel, fit ram prop **1**
part no:
102/11600 **2D 2DS**
106/08100 **3, 3C, 3CS, 3D, 700**

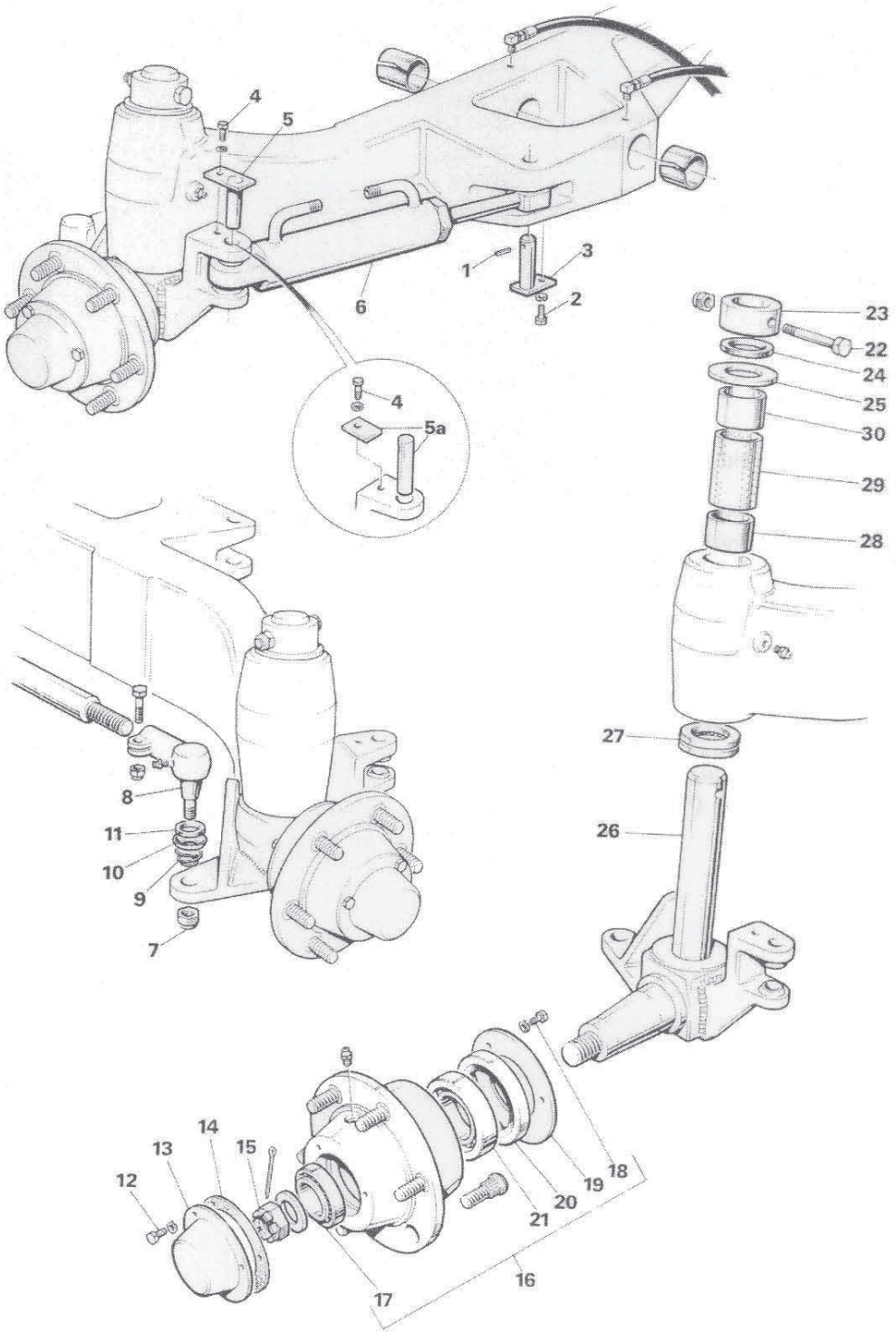
When Replacing

Lubricate pivot pin **9** with Mobilgrease Super or equivalent.

Add washer(s) A as required to reduce end float B to a maximum of 0.125in (3.2mm)

After connecting hoses 7, prime the system with engine running, by turning the steering wheel rapidly from lock to lock, until steering becomes positive.

After fitting road wheels torque tighten wheel nuts to 3000 lbf ft (41.5 kgf m)



FRONT AXLE

Dismantling and Assembly

The numerical sequence on the illustration is intended as a guide to removal.

For assembly, reverse the sequence.

NOTE: Pin and plate **5a** are alternative to pin **5**

When Assembling

Renew felt washer **24** and soak in oil.

Renew seals **11** and **20** and gasket **14**.

Add spacers **25** as required to achieve minimum end float on swivel pins **26**.

Pack hubs **16** with Mobilgrease Super or equivalent.

Bed in bearings **17** and **21** by rotating hub in each direction whilst tightening nut **15**. When correct torque setting has been achieved, back off one flat and fit split pin.

Apply anti-seize paste, part no 4003/0211 to pivot pin 3 to facilitate subsequent removal.

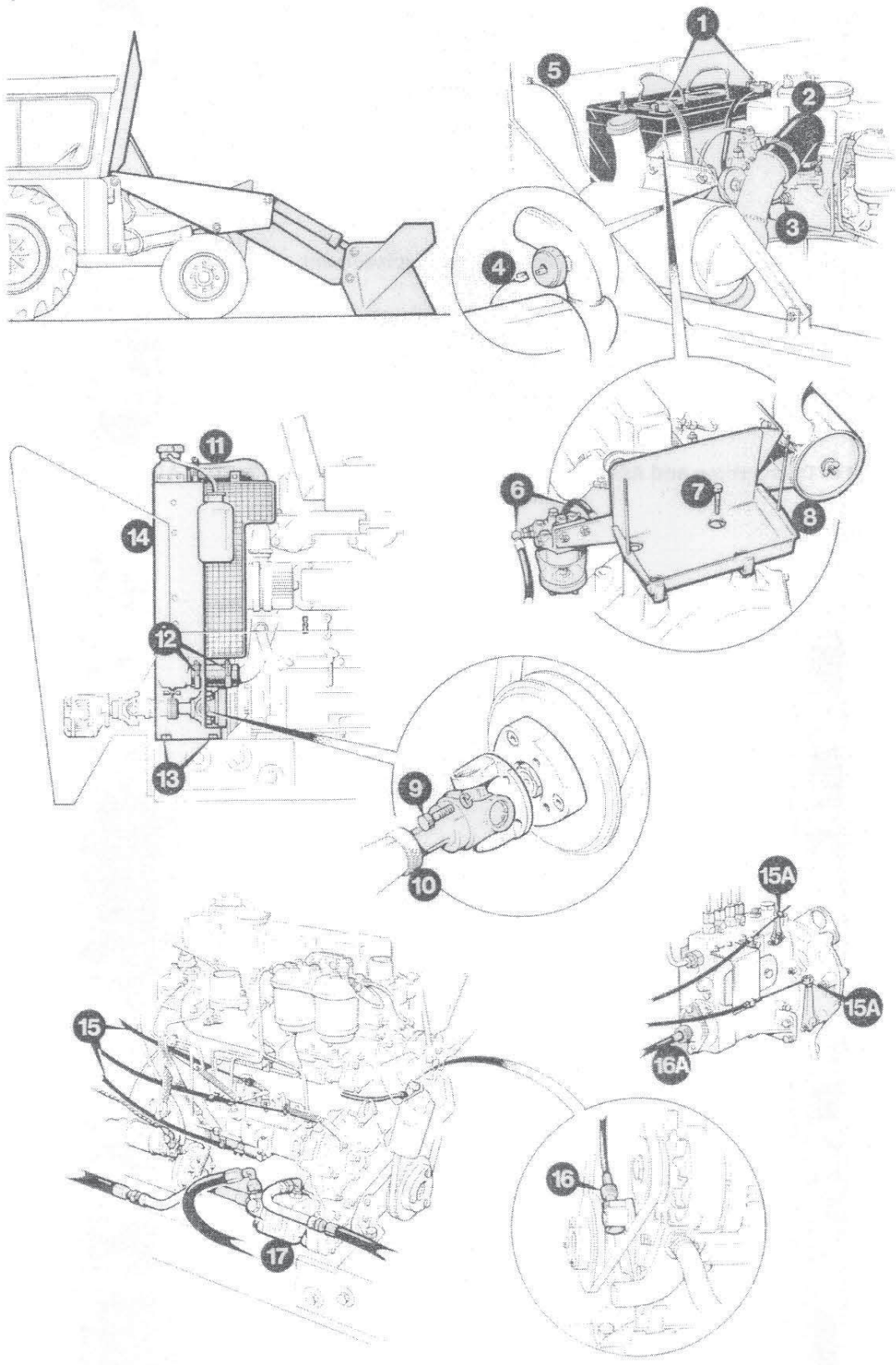
After fitting road wheels torque tighten wheel nuts to 3000 lbf ft (41.5 kgf m)

Torque Settings

Item	Nm	kgf m
7	140-150	19.4-20.7
15	300	41.5

CONTENTS

For Dismantling and Assembly Procedures refer to Leyland 38TD & 4/98 NT Engine Service Manual



ENGINE
(Manual Clutch Machines)

Removal and Replacement

The numerical sequence illustrated is intended as a guide to removal.

Fir replacement, the sequence should be reversed.

When Removing

The battery tray, air cleaner and sedimenter assembly **8** should be removed as one unit.

NOTE: The sedimenter was not fitted prior to machine no. 110552.

After draining the coolant and removing bolts **9**, unscrew sleeve **10**. The pump drive shaft will then divide when the radiator and mounting **14** are removed.

NOTE: The respective control cables and tachometer drive connections for the two types of fuel pump are shown thus:

C.A.V. D.P.A. Pump – **15** and **16**.
Simms 'Mini-mec' Pump – **15A** and **16A**

Unbolt the steering pump **17** from the timing cover. The hose connections need not be removed if the pump is adequately supported.

After removing clamp **19** and slackening clamp **20**, raise the pipes above the lower edge of the bodywork and secure with string.

Brake and clutch pedal return springs **27** must be removed before unbolting and lifting clear the floor plates **28** and **29**. It may also ne necessary to disconnect the cable from the accelerator pedal.

If a cab heater is fitted, this must be removed by taking out bolts **30**. Cover plates **31** and **32** should then be removed to give clearance for the removal of clutch housing **36**

Take out the retaining pins **37** and slide forward sleeve **38**.

When retaining clips **39** have been removed the clutch withdrawal race will be free to be lifted out of the engine, after removal of the four mounting bolts **40**

When commencing to lift the engine ensure that slings are securely attached and all parts are disconnected and freely separating.

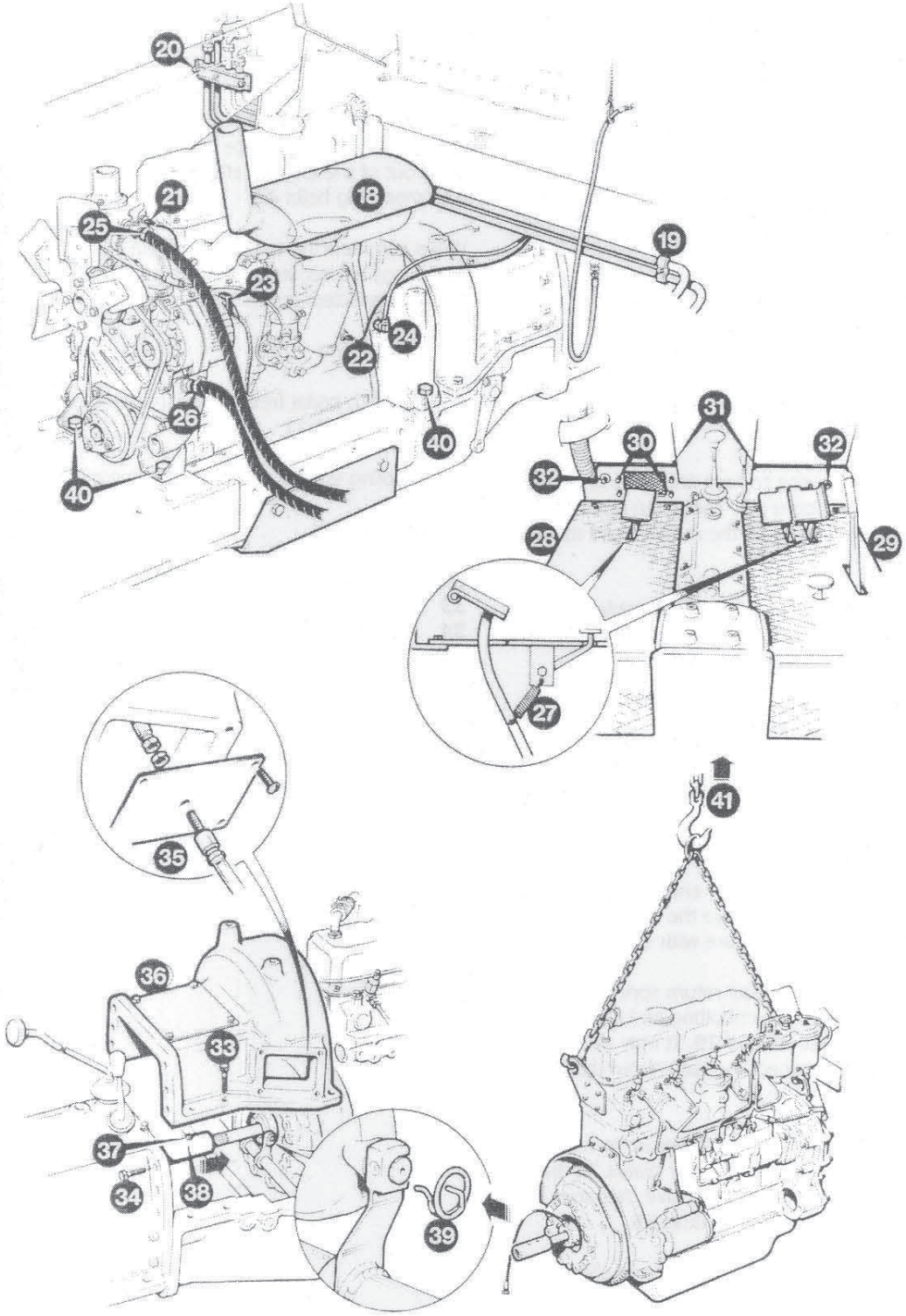
When Replacing

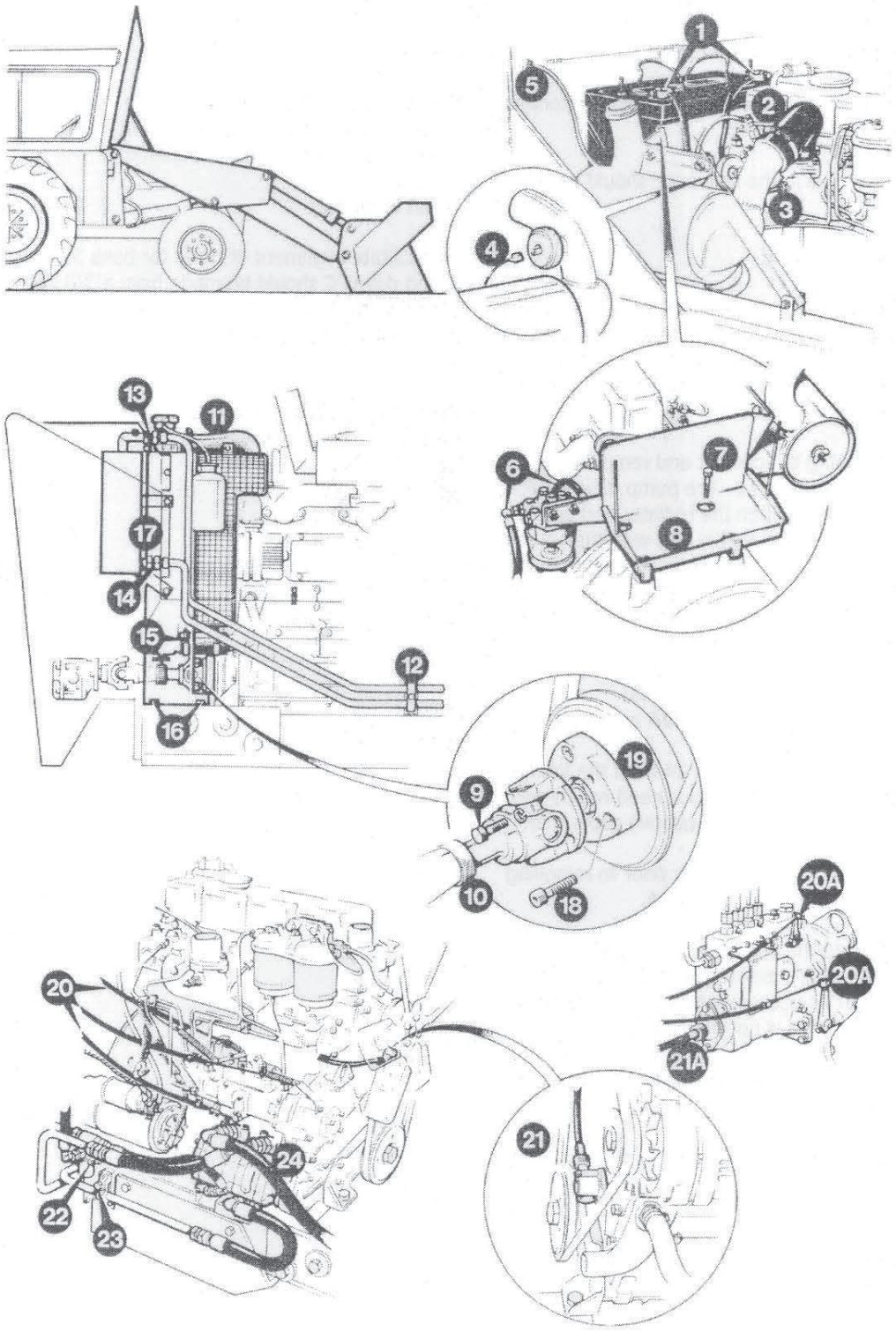
Adjust clutch pedal free travel if required (see section 3 page 6-1)

Refill cooling system and check engine oil level.

Torque Setting

Item	Nm	kgf m	lbf ft
33	57	5.8	42
34	130	13.3	96
40	130	13.3	96





ENGINE
(Torque Converter Machines)

Removal and Replacement

The numerical sequence illustrated is intended as a guide to removal.

Fir replacement, the sequence should be reversed.

When Removing

The battery tray, air cleaner and sedimenter assembly **8** should be removed as one unit.

NOTE: The sedimenter was not fitted prior to machine no. 110552.

After draining the coolant and removing bolts **9**, unscrew sleeve **10**. The pump drive shaft will then divide when the radiator and oil cooler **17** are removed in unit with their cradle

NOTE: The respective control cables and tachometer drive connections for the two types of fuel pump are shown thus:

C.A.V. D.P.A. Pump – **20** and **21**.
Simms 'Mini-mec' Pump – **20A** and **21A**

Unbolt the steering pump **24** from the timing cover. The hose connections need not be removed if the pump is adequately supported.

Support the engine securely prior to removing engine bearer bolts **33** and **34**.

To separate the engine from the torque converter impeller, remove plug **36** and rotate the crankshaft as necessary to permit removal of bolts **37**. If this is not possible (due to engine siezure for example) remove bolts A and withdraw the engine with the torque converter **B** attached.

NOTE: To avoid excessive oil loss, keep the torque converter upright after its removal from the engine.

To permit the use of a socket to rotate the crankshaft, remove adapter **19**.

When commencing to lift the engine ensure that slings are securely attached and all parts are disconnected and freely separating.

When Replacing

To facilitate alignment of holes for bolts 37 locating dowel C should be made from a 3/8 in. UNF bolt (part no 1305/3212) by removing the head and providing a taper and a screwdriver slot.

Refill cooling system and check engine and torque converter oil levels.