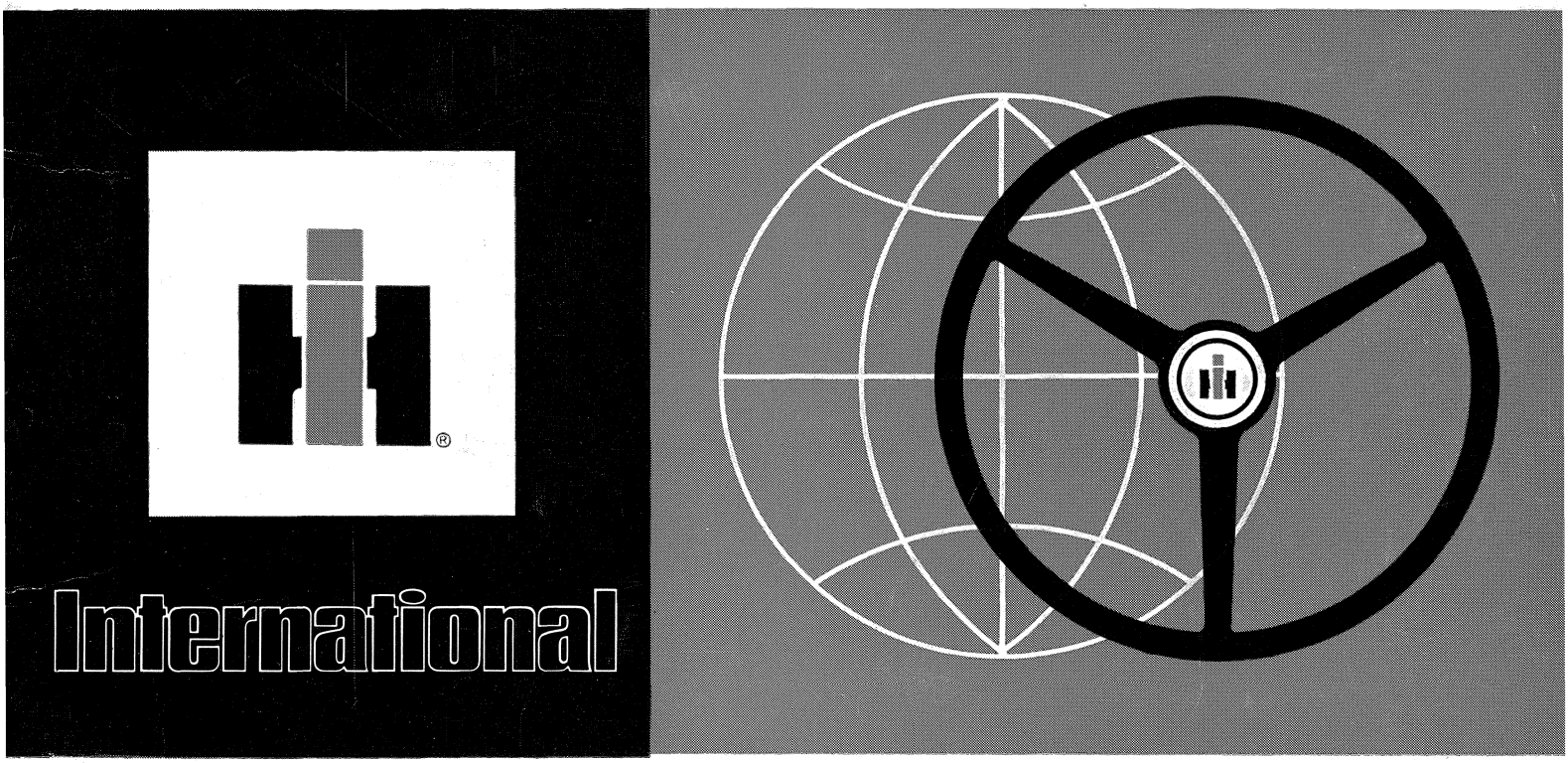

SERVICE MANUAL

Hydraulic Draft Control

323 + 353 + 383
423 + 453 + 433 + 533
DIESEL TRACTORS
Standard, V + E Versions

SERVICE MANUAL

Hydraulic Draft

and

Position Control System

Additional Control Valves

323, 353, 383
423, 453, 433, 533
DIESEL TRACTORS
Standard, V+E Versions

3 000 936 R2 6.73

INTRODUCTION

Sound engineering, good workmanship and extensive field tests have made this IH-draft control system a reliable unit.

However, functional disturbances may still occur if dirt, the enemy No. I of any hydraulic system gets into the circulating fluid as for example through careless maintenance. After years of operation, natural wear, too, may present service problems. The use of wrong hydraulic fluid, or fluid which has lost much of its lubricating properties through age, is yet another possible cause of trouble.

Service personnel is expected to be quick in spotting the source of any trouble that might develop and to take reliable corrective measures. This can only be done when the principle of operation is fully understood.

This manual has been prepared to familiarize Service Personnel with the operating principles and proper servicing techniques of the IH-draft and position control hydraulic system.

The procedures and "trouble shooting" techniques are based on the experience of the men responsible for developing and testing the draft control system. You, too, can take full advantage of their experience and offer an efficient service to your customer.

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3 000 936 R2
6.73

Specifications

Maximum lifting force on lower link balls	V–433/V–533 = 1360 kp (3000 lbs.) E–433/E–533 = 1000 kp (2205 lbs.) 323 = 1200 kp (2645 lbs.) 353,383,423,453 = 1250 kp (2755 lbs.)
Lifting time over full range	2.8sec.max.
Maximum permissible oil temperature	90°C = 190°F
323/V–323 Pump delivery at 3000 rpm (pump) free flow, against 150 bar = 2130 PSI pressure	21–21.5 l/min. = 5.54–5.67 gpm 20–21 l/min. = 5.28–5.54 gpm
353/383/423/433/453/533 Tractors – V+E Versions Pump delivery at 3000 rpm (pump) free flow, against 185 bar = 2600 PSI pressure	24–24.5 l/min. = 6.34–6.47 gpm 21.5–22 l/min. = 5.67–5.80 gpm

Maximum system pressures	160–170 bar = 2280–2420 PSI version		140–150 bar = 1990–2130 PSI version		For checking pressures see Illust.:
	bar	PSI	bar	PSI	
Flow divider (pilot stream pressure)	6 – 7	85 – 100	6 – 7	85 – 100	29 + 35
Cut-out relief valve (operating pressure)	160 – 170	2280 – 2420	140 – 150	1990 – 2130	29, 30 or 31a
Additional relief valve (shock loads)	180 – 190	2560 – 2700	160 – 170	2280 – 2420	26
Cylinder cushion valve (static pressure)	190 – 210	2700 – 3000	220 – 250	3130 – 3560	48
Relief valve-auxiliary hydraulic system	180 – 190	2560 – 2700	160 – 170	2280 – 2420	109

1

Important Notice

The operating pressure of the hydraulic system (cut-out relief valve) has been increased on some tractor models, as per chart below. The opening pressure of the additional relief valve has been increased accordingly.

Opening Pressures in bar/PSI

	Cut-out relief valve (25) Illust. 6		Additional relief valve (37) Illust. 6	
	bar	PSI	bar	PSI
323 V–323	140-150	1990-2130	160-170	2280-2420
353, 423 up to Hydraulic-Ser.No.R–11 194	140-150	1990-2130	160-170	2280-2420
from Hydraulic-Ser.No.R 11 195 up	160-170	2280-2420	180-190	2560-2700
V–353, V–423 up to Hydraulic-Ser.No.P–12 210	140-150	1990-2130	160-170	2280-2420
from Hydraulic-Ser.No.P–12 211 up	160-170	2280-2420	180-190	2560-2700
383, 453 V–383, V–453, V–533, V–433 E–353, E–383, E–423 E–453, E–433, E–533	160-170	2280-2420	180-190	2560-2700

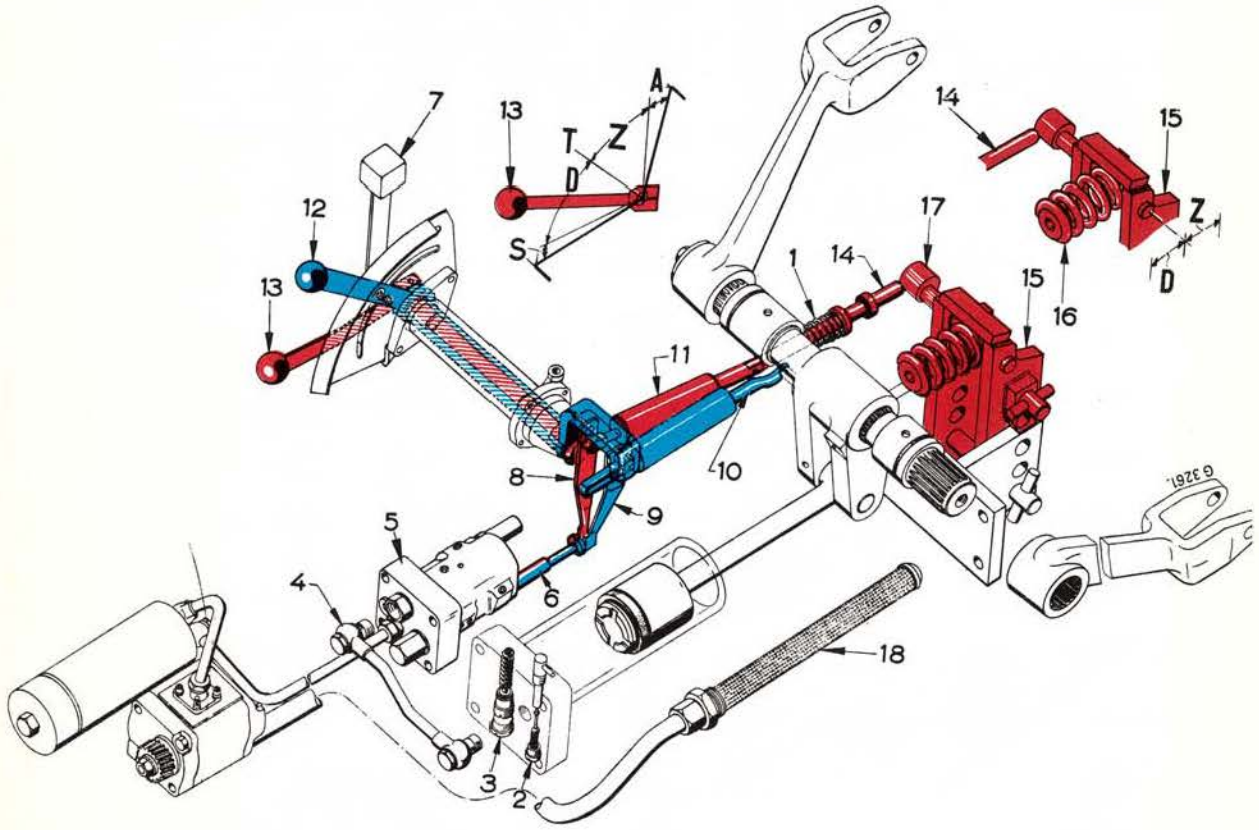
Note: The opening pressure of the cylinder cushion valve has been reduced from 220-250 bar to 190-210 bar = 3130-3560 PSI to 2700-3000 PSI respectively; for changed components of this valve see Parts Catalog.

When replacing a control valve or the mounting block for auxiliary circuit take care to select parts that correspond with the operating pressure of the system. For details see Parts Catalog.

Special Tools

A minimum of special tools is required. Details are given in the Parts Catalog. A set of pressure gages and fast equipment with connections etc. has been added lately, for quick and efficient pressure checks. Since use of this test equipment is not restricted to the hydraulic system, and standardized test connections are being provided, no workshop should be without this equipment.

PRINCIPLE OF OPERATION



Illust. 1

		present	former
Z =	Tension range		
	Lever range	45°	30°
	Spring range	18mm(.709")	12mm(.472")
T =	Dead position		
	Possible deviation to both sides	10°	10°
D =	Pressure range		
	Lever range	45°	60°
	Spring range	18mm(.709")	24mm(.945")
A =	Lifting range	10°	10°
S =	Float position		

= Draft control linkage
= Position control linkage

1 — Plunger spring
2 — Lowering control valve
3 — Cylinder cushion valve
4 — Pressure line
5 — Control valve
6 — Control valve spool
7 — Marker lever
8 — Draft spool lever
9 — Position spool lever
10 — Position actuator rod
11 — Spring element
12 — Position control lever
13 — Draft control lever
14 — Draft link plunger
15 — Bellcrank
16 — Bellcrank spring
17 — Bellcrank cam
18 — Suction strainer

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Draft Control

The draft control system operates on the principle of draft loads i.e. resistance acting on the implement while it is being pulled through the ground. These draft loads are transferred to the bellcrank (15) Illust. 1 by the upper link of the three-point hitch and can either be pressure or tenison.

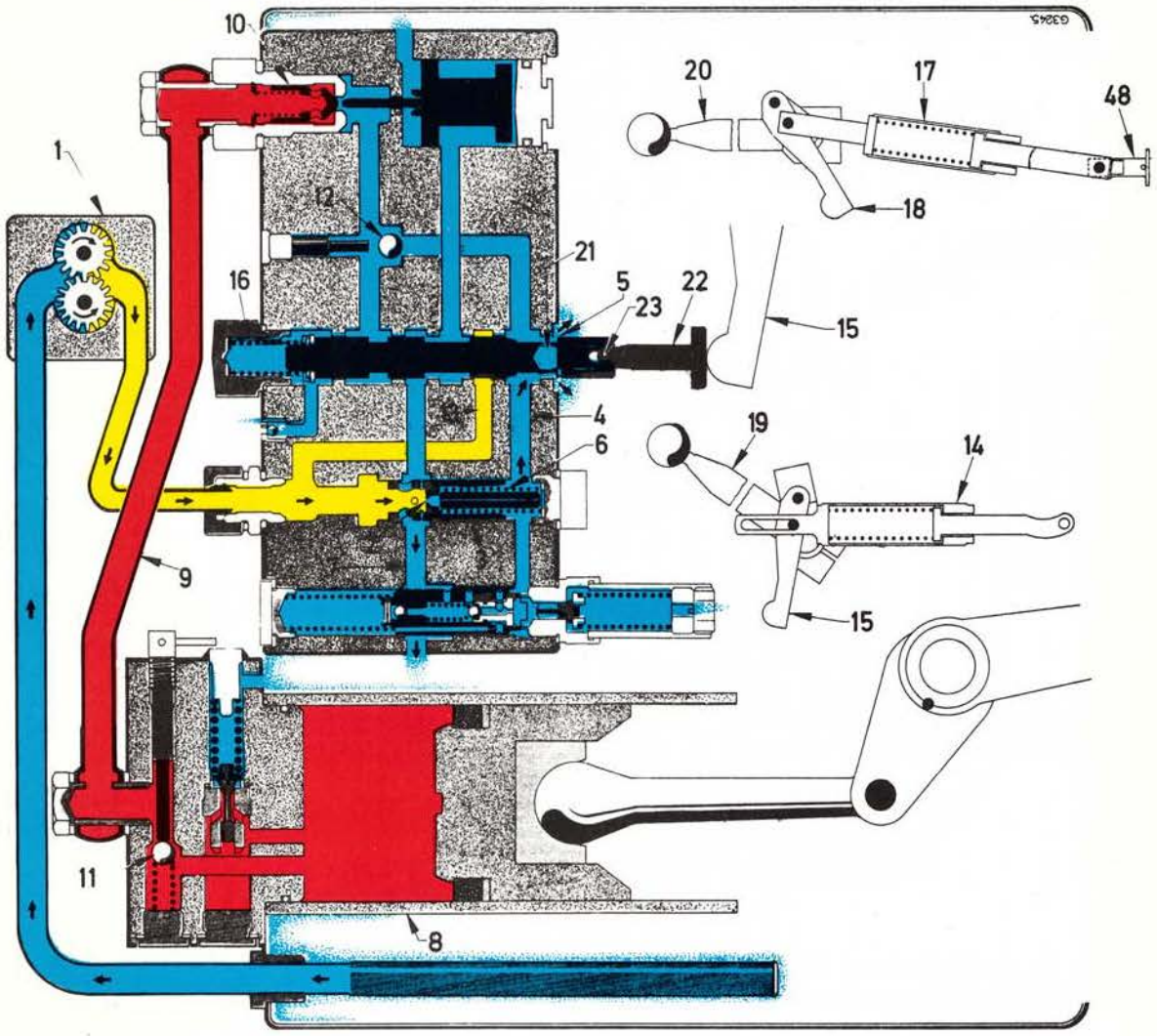
The bellcrank spring (16) partly balances the forces transmitted from the plow to the bellcrank, causing the latter to reciprocate. This reciprocative motion is taken up by the draft link plunger (14) and transmitted to the control valve, spool (6) via bellcrank (15), spring element (11) and draft spool lever (8) to initiate lifting or lowering. The heavier and longer the signal the more the implement will raise or lower.

Position Control

Mounted implements which operate above the ground are controlled entirely by the position control linkage (blue Illust. 1). The draft control lever (13) is down all the way and thus rendered ineffective. The height above the ground of any mounted implement is determined by the position of control lever (12).

Should an internal leakage develop, resulting in the rocker arms going down, the position actuator rod (10), being connected to the rocker shaft, moves forward to correct the rocker arm position by moving the spool (6) towards the lifting position.

Neutral Position



Illust. 2

Operating pressure

Pilot stream pressure

Low pressure

Pump (1) operates against flow divider or pilot stream pressure. Pump delivery depends on engine rpm. Part of the oil flows through the orifice (2) of the flow divider (3), through passage (4) and drains into the lift housing past the spool at (5). As only a fraction (5 L/min = 1.3 US gpm) of the pump capacity goes through orifice (2), the flow divider (3) is forced back by the resulting pressure build-up against its spring (6) until the oil can escape through passage (7). The largest proportion of the pump delivery is displaced this way and returned into the lift housing. The control valve spool is approximately central. Main lift passage (13) is blocked.

Pressure in power cylinder (8) depends on the hitched load and the leverage ratio of the rocker arm mechanism. The block valve (10) is closed, preventing return flow. Non-return valve (12) is open. Draft control lever is down all the way. Position control lever is approx. halfway up.

Auxiliary Change-Over

This hydraulic device is designed to assist in a smooth change-over from "neutral" to "lifting" and from "lifting" to "neutral" without intermediate or restricted position.

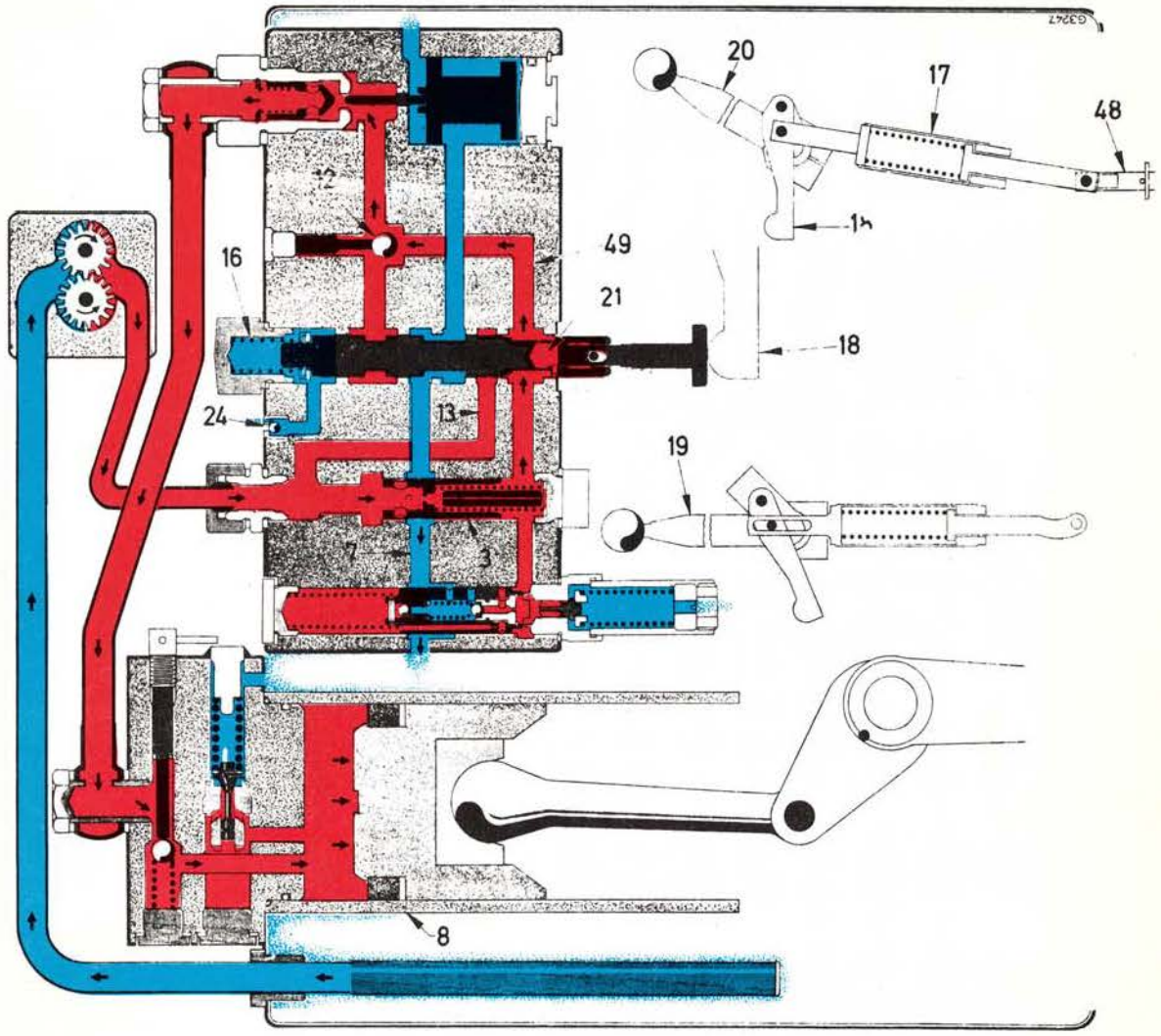
The internal spool cylinder (21) is filled through a small orifice from passage (4). In neutral position this fluid drains through three relief ports in the spool into the reservoir. Roll pin (23) in spool rests against rear end of lost-motion slot in tappet (22).

As the spool is moved in towards "lifting", pressure begins to build up in cylinder (21) as soon as the rear land of the spool begins to restrict the draining outflow In this position, tappet (22) covers the three relief ports, preventing drainage. The rising pressure acting on tappet (22) forces the spool forward against spring (16) in a quick positive motion until the roll pin (23) rests against the front end of the lost–motion slot in the tappet (lifting position).

When changing from lifting position to "neutral", pressure fluid drains out through relief ports in cylinder (21). As pressure breaks down, spring (16) reasserts itself, forcing the spool rearwards with a quick positive motion until the roll pin (23) contacts the rear end of the lost-motion slot. The valve spool is now in "neutral".

Refer also to Illust. 3-5 and 7 and compare tappet position.

Lifting with Pilot Stream



Illust. 3

= Operating pressure

= Low pressure

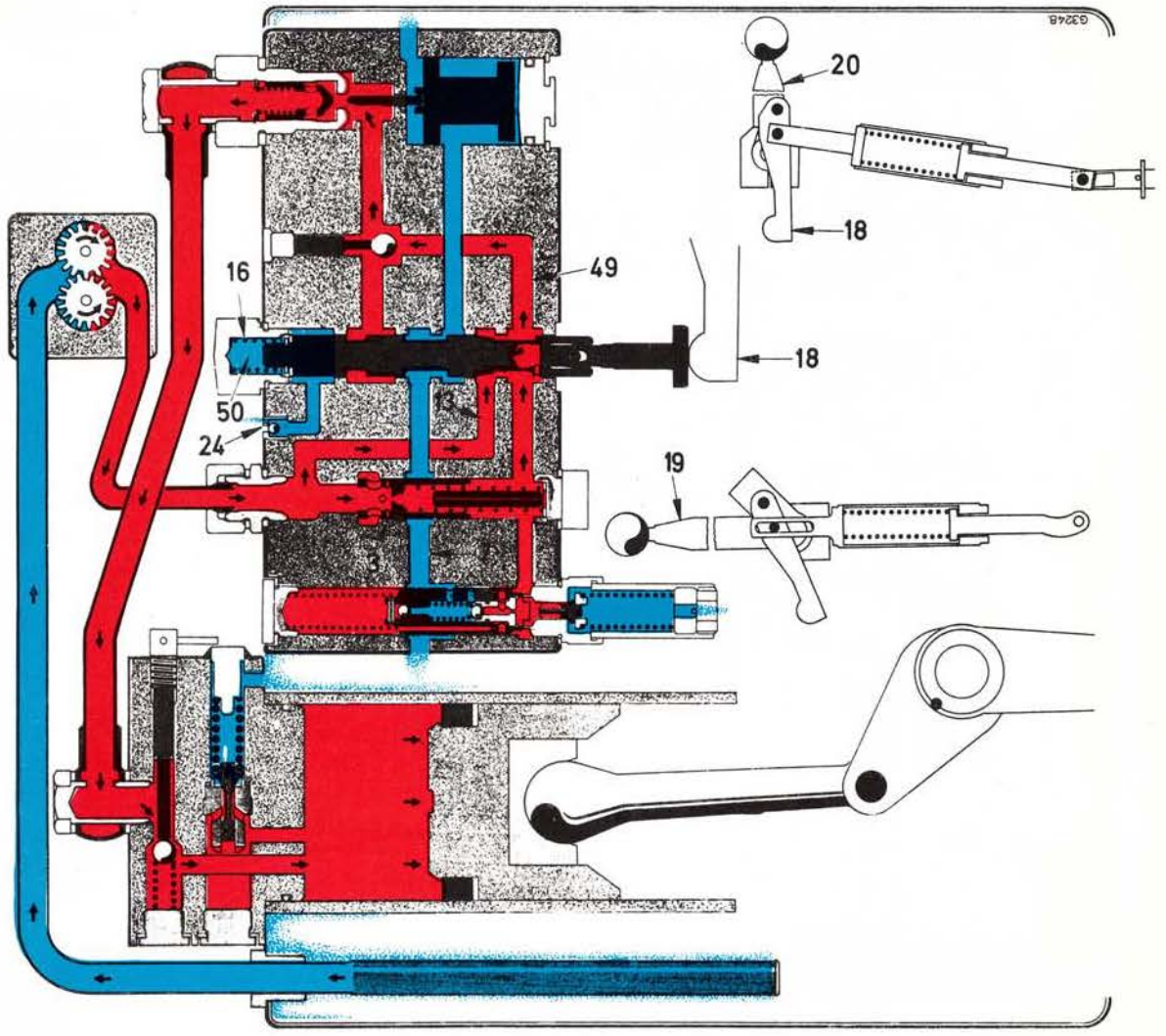
This condition will occur when operating with the draft control system and the sensing link of the implement gives a light signal for a minor correction of operating depth towards lifting. The pilot stream passing through the central orifice of the flow divider (3) is 5 L/min = 1.3 US gpm and makes for a precise depth control.

Position control lever (19) is down all the way and rendered ineffective. Draft control lever (20) is approx. one third up.

The draft link plunger gives the signal for lifting. The valve spool stops the drainage outflow of the pilot stream and the auxiliary change-over moves the spool towards lifting position. The pilot stream now goes through passage (49), dislodges non-return ball (12) and opens block valve toward the power cylinder. Pressure in front and behind the flow divider is determined by the resistance i.e. the back pressure from the power cylinder (8). Slowly the implement is lifted to its predetermined operating depth.

When lifting with pilot stream the flow divider piston (3) opens return passage (7) just sufficiently to maintain the required pressure, yet allows the large volume of oil to drain into the reservoir, via passage (7). The flow divider is thus held in a state of hydraulic balance.

Lifting with full Capacity



Illust. 4

= Operating pressure
= Low pressure

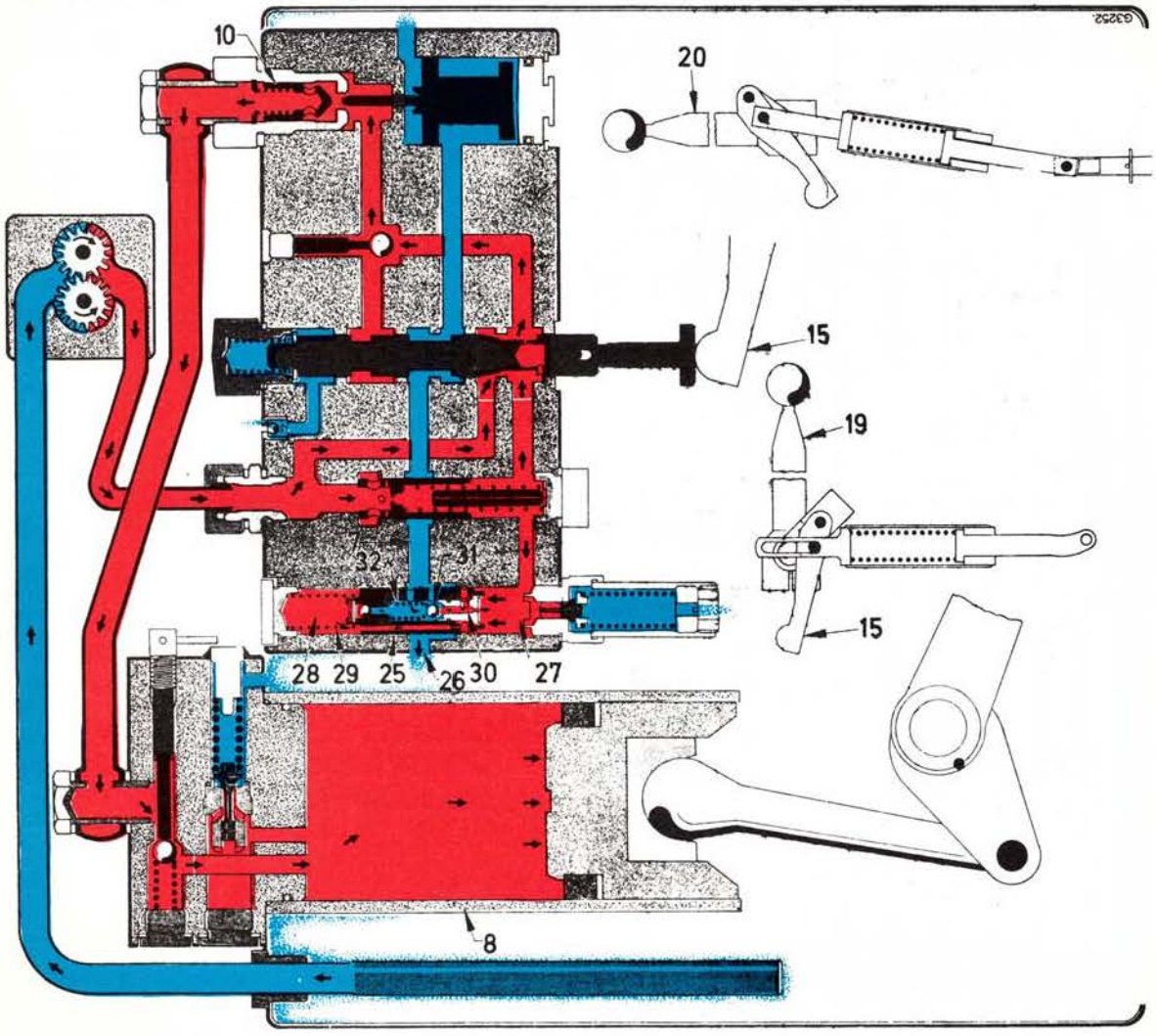
When "lifting with full capacity", the valve spool is run in all the way against spring (16). Main lift passage (13) is now open, allowing full flow to passage (49). Hydraulic pressure being equal in front and behind the flow divider (3), the spring expands, moving the flow divider forward all the way and blocking return passage (7). The full pump capacity flows to the power cylinder resulting in an increased lifting rate, as for example when lifting the plow at head lands.

Restrictor Orifice

The purpose of this orifice is to slow down spool speed while "lifting" by restricting the outflow from chamber (50), thereby making for a smoother operation of the entire draft control system.

When changing to "neutral" or "lowering", the non-return ball becomes unseated, allowing oil in large quantity to fill chamber (50), preventing a "suction" condition.

Cut-out Relief Valve



Illust. 5

= Operating pressure

= Low pressure

Illust. 5 shows the system in position "lifting with full capacity", actuated this time by the position control lever, see also Illust. 4.

Rocker arms are loaded to such an extent that pressure (red) in power cylinder and control valve rises to 160–170 bar (2280–2420 PSI).

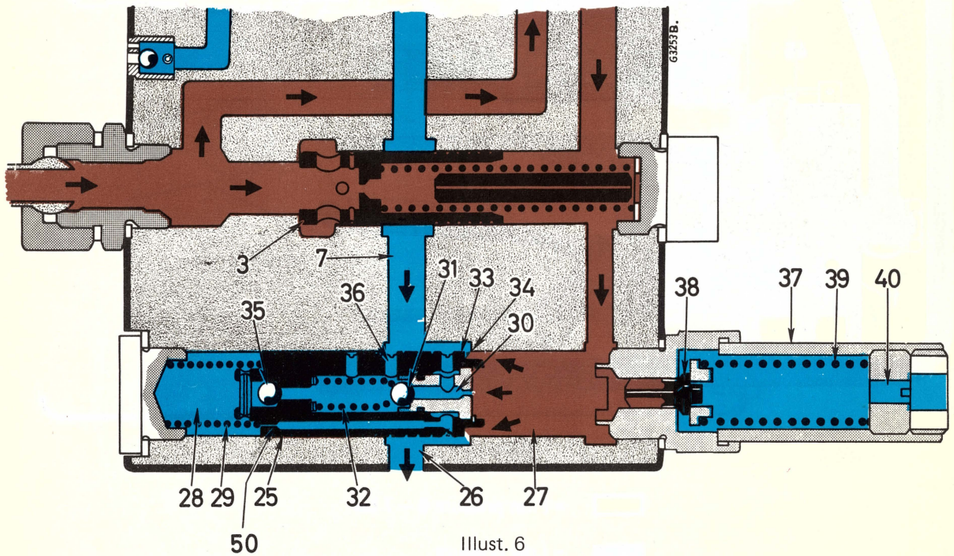
This pressure, being balanced in the whole pressurized system, also acts on pressure chamber (27), throttle chamber (28) and ball valve (31). As the pressure build-up continues this ball becomes unseated and moves against spring (32). Restriction orifice (50) Illust. 6 and orifice of passage (30) are designed in such a way that pressure in this passage is approx. 5 bar (71 PSI) lower than in pressure chamber (27) when the ball valve (31) is open. This results in fluid from both chambers (27) and (28) flowing into passage (30) and draining through valve (31) into the reservoir. As the volume in chamber (28) decreases, the complete valve (25) moves forward against spring (29), displacing the fluid through passage

(50) and valve (31). As soon as the valve (33) Illust. 6 clears edge (34) pressure in the system breaks down and oil drains into the reservoir at port (26). The time lapse for the cut-out valve to open is 0.6 seconds. As pressure breaks down, ball valve (31) is reseated. Pressure in chamber (27) is 8 – 9 bar (115–130 PSI) (brown in Illust. 6). The whole pump delivery is drained into the reservoir through port (26). The control valve spool remains in lifting position. Block valve (10) Illust. 5 closes, preventing backflow and lowering.

The cut-out valve does not reseat itself automatically. A constant residual pressure of 8 – 9 bar (115–130 PSI) remains in the system. By this "cutout action" the pump is protected from operating against continuous high pressure.

To make the system operable again, the cut-out valve must be retarded. Spring (29) can only reassert itself when chamber (27) is pressureless. To do this, the system must be briefly put in the lowering position to obtain "neutral", as shown in Illust. 2, i.e. the flow divider piston (3) must be run back, permitting most of the pump capacity to drain into the reservoir through return passage (7). As the cut-out valve slides back, chamber (28) must be filled with fluid. However, only a small quantity can pass through restrictor orifices (30) and (50), resulting in a suction condition in chamber (28). This unseats ball valve (35), permitting oil in large volume from passage (7) and (26) to fill chamber (28). Rising pressure in chamber (28), due to a pressure build-up in chamber (27), will reseat ball (35).

Important: Do NOT remove restrictor nozzle (50). This is not a replacement part!



Illust. 6

Present design of flow divider, cut-out relief valve and additional relief valve.

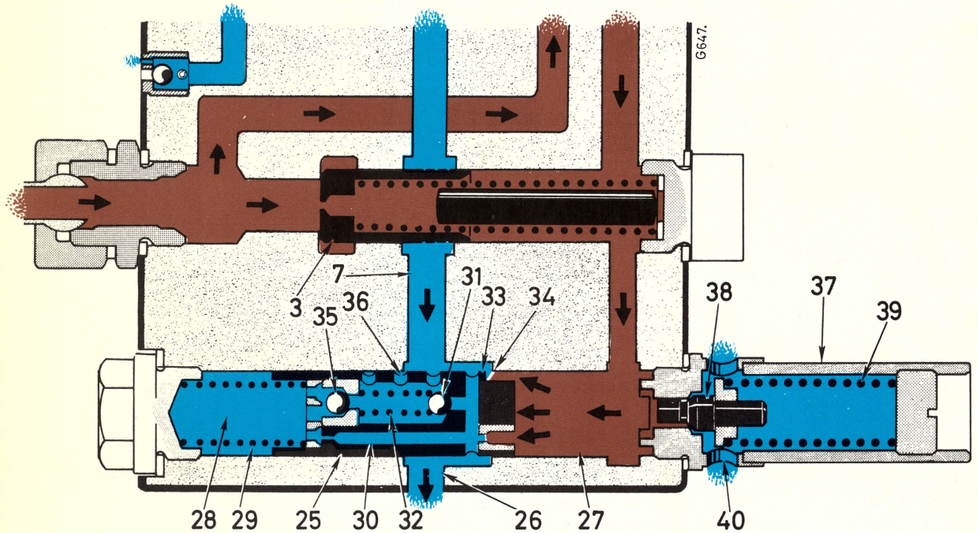
= System pressure with cut-out valve open 8 – 9 bar (115–130 PSI)

= Low pressure

Additonal Relief Valve

We have seen that the cut-out relief valve opens only when the pressure build-up exists for 0.3 to 0.5 seconds or longer. Shock loads of 180–190 bar (2560–2700 PSI) that might occur instantaneously are reduced by the additional relief valve (37). Poppet (38) thereby becomes unseated and moves against spring (39). The pressure oil from chamber (27) can now drain into the reservoir through apertures (40).

The additional relief valve also protects the system when the cut-out relief valve should fail. The hydraulic system must, however, not be used when the cut-out valve is known to be defective because of the higher opening pressure setting of the additional relief valve.

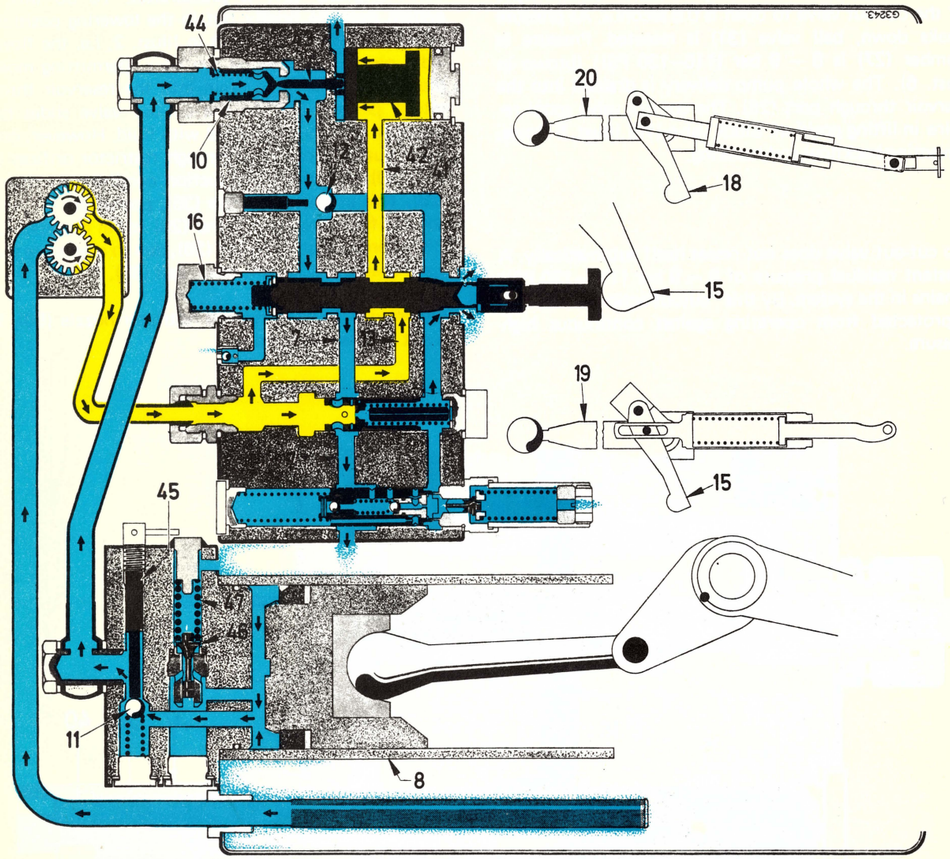


Illust. 6a
Displaced design of flow divider, cut-out relief valve and additional relief valve

= System pressure with cut-out vaive open 8 – 9 bar (115–130 PSI).

= Low pressure

Lowering and Float Position



Illust. 7

= Pilot pressure 6 – 7 bar

= Low pressure

When lowering, one of the levers (19) or (20), which is up in the quadrant, is shifted down. This will ease pressure on the spool lever (15) or (18), permitting the spool spring (16) to reassert itself and run out the spool to lowering position, Illust. 7. As the spool slides back, main lift passage (13) is connected with passage (41). Pilot stream pressure of 6 – 7 bar (85–100 PSI) begins to act on block valve piston (42), moving it forward. Thrust pin (43) transmits this motion and opens block valve (10). Hydraulic fluid from the power cylinder (8) now drains past closed non-return valve (12) through passage (7) into the reservoir.

Lowering operation is ended when the valve spool slides forward to "neutral", i.e. connection between passage (13)and (41) is interrupted and connection between passage (41) and return passage (7) is established. This allows the pressure fluid behind the pilot piston to escape and spring (44) reseats the block valve, pushing pilot pin (43) and pilot piston (42) back, see also Illust. 2.

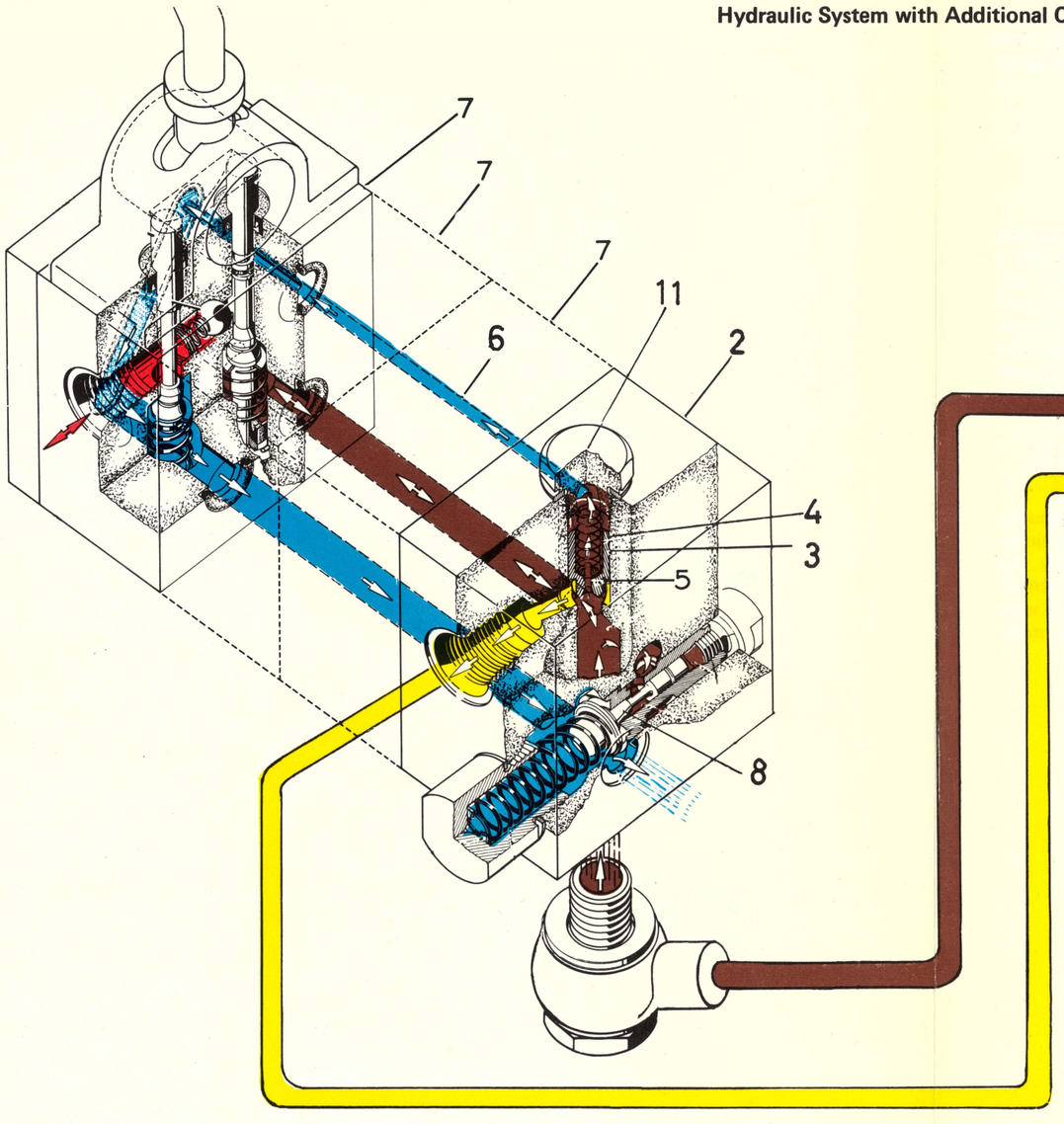
With both operating levers all the way down, the system is in float position. The circuit is the same as in the lowering position, i.e. spool is run out all the way, passages (13) and (41) are connected, pilot piston (42) is pressurized, keeping block valve (10) open. The piston in power cylinder (8) is in its forward position. The ball-type connecting rod is free to move inside the power cylinder, following the fluctuations of the floating implement.

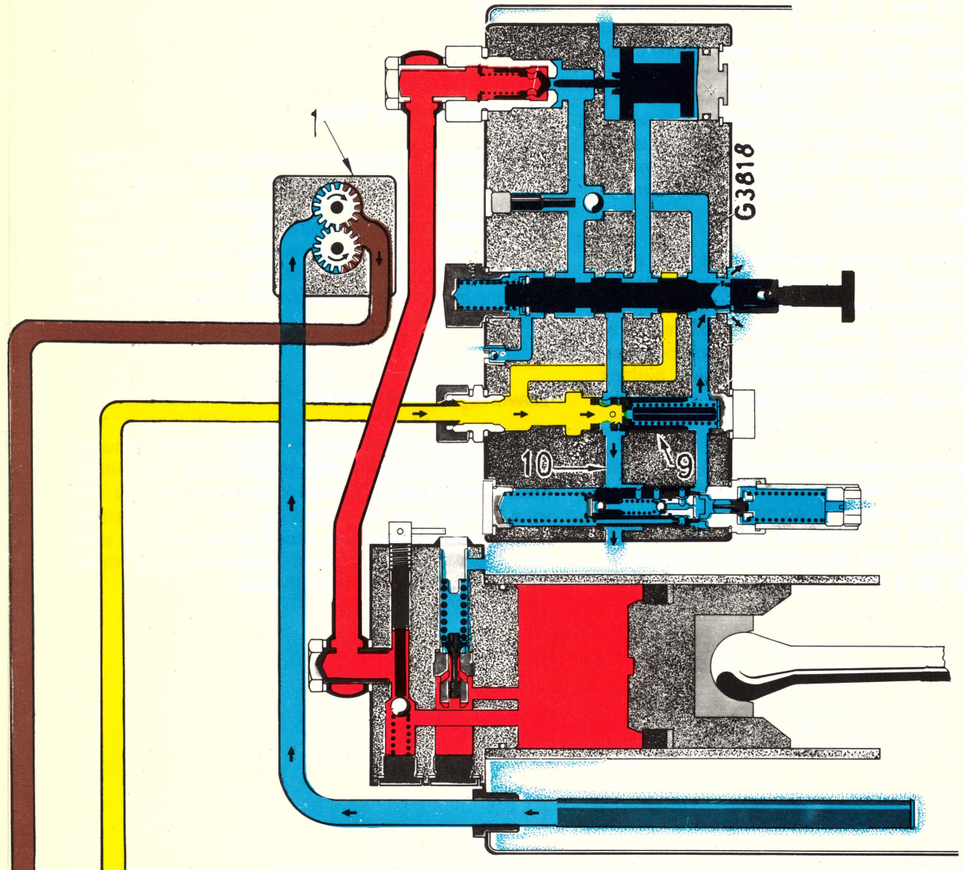
Cylinder Cushion Valve

The purpose of the cylinder cushion valve is to protect the system against shock loads when driving over a bumpy road with a bouncing implement. In this way, shock loads of many thousand PSI may result. As soon as these shock loads exceed specified limits, the cylinder cushion valve (46) will become unseated, relieving pressure in the power cylinder. For pressure setting see table on page 4.

Lowering Control Valve

Lowering rate is controlled by means of the manually operated lowering valve (45), located inside the cylinder head. With the spindle turned to the left all the way, this valve can be used as a lowering lock. The return oil passage is now completely closed by the ball-type valve (11). This is necessary when transporting long implements hitched on the 3 point linkage.





Illust. 7a
Oil flow with draft control – and additional circuit in "Neutral position"

= Low pressure

= Pilot pressure 8 – 9 bar (115–130 PSI) controlled by flow divider piston (3) within mounting block (2)

= Pilot pressure 6 – 7 bar (85–100 PSI) controlled by flow divider (9) in draft control valve

= Static oil, pressure depending on load

Note: For functional description of auxiliary circuit and components see "Additional Control Valves".

1 – Pump
2 – Mounting block
3 – Flow divider piston
4 – Spring
5 – Restrictor orifice
6 – Restricted passage
7 – Control valve
8 – System relief valve
9 – Flow divider
10 – Return passage
11 – Check point for system pressure

Removal and Disassembly

Before starting to remove hydraulic components, be sure to wash the tractor thoroughly. On a dirty tractor, the hydraulic system must not be opened. Be sure to cap all ports and ends of hydraulic lines as they are removed. Cleanliness cannot be overemphasized. Even the smallest particles of foreign matter may cause trouble.

Plan your work before starting to remove units.

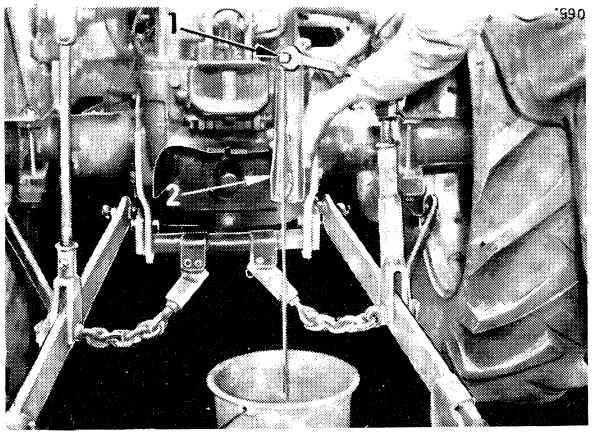
First, check the complete system using a reliable pressure gauge, to detect the faulty part or unit prior to commencing disassembly, if possible.

Refer to "Specifications" for operating pressure and opening pressures of relief valves.

For test procedure refer to section "Checking and Adjusting Cut-out Relief Valve".

Additional control valves, draft control valve and cylinder head may be removed and reinstalled without removing the lift housing from the tractor. It may, however, be of advantage to remove the complete unit for better accessibility. In the following procedure it is assumed that the lift housing must be removed when, for example, it is necessary to remove the power arm. Proceed as follows:

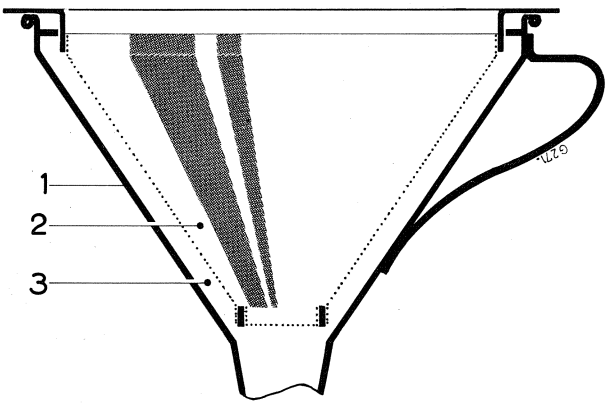
Remove the operator's seat.



Illust. 8

Drain hydraulic fluid. To do this, remove drain plug (1) Illust. 8. In order to drain the oil into a container, it is good practice to use a suitable, clean oil chute.

If the oil is to be reused, it must be strained through a fine mesh funnel (.035 to .05 mm = .0013 to .002"). A suitable filtering device, as shown in Illust. 9, can be made locally.

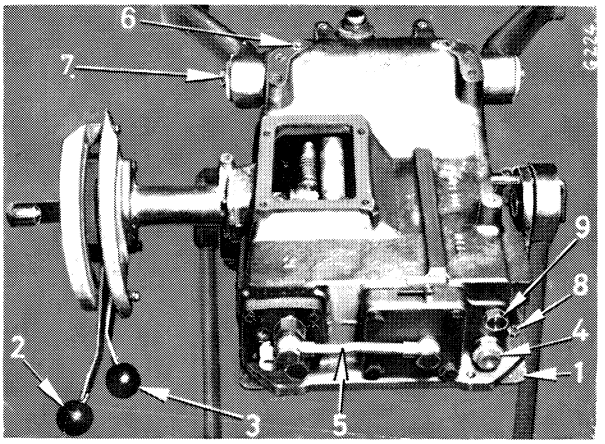


Illust. 9

1 — Funnel
2 — Filter insert
3 — Clearance

Insert (2) rests on the funnel rim. Clearance (3) should not be more than 10 mm = .4" to keep the filtering area as large as possible.

Remove lifting rods and upper link.
Remove cross pin for bellcrank.
Remove pipe lines.
Remove lift housing mounting bolts and carefully lift the housing off its dowel pins, using a hoist.



Illust. 10

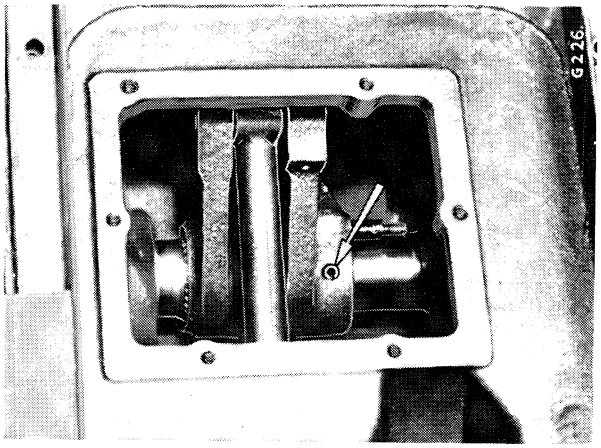
1 — Stand or trolley
2 — Draft control lever
3 — Position control lever
4 — Suction strainer
5 — Connecting line
6 — Dog-point set screw
7 — Retainer bolt
8 — Mounting bolts
9 — Plug (return connection from additional control valves)

To facilitate handling of the housing, it is advisable to make a stand with a swivelling base plate. This plate should have four holes for mounting bolts (8) Illust. 10 and a cut-out large enough to make the housing accessible from the bottom.

Rockshaft Assembly

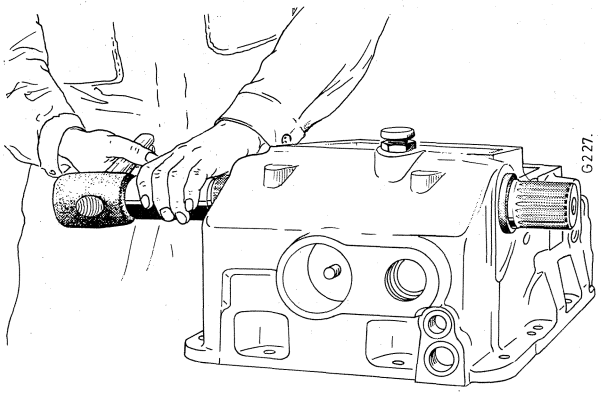
Sealing of the rockshaft has been changed. Refer to Illusts. 58 and 59 for present and displaced type sealing.

Remove retainer bolts (7) Illust. 10 and dog-point set screws (6). Slide off rocker arms and remove shims, if any. Invert lift housing and remove bottom cover, see Illust. 11.



Illust. 11

Drive roll pin (arrow) Illust. 11 into the rockshaft to free the power arm. Drive out the rockshaft to the right with a few light hammer blows until the bushing dislodges the oil seal (or O–ring).

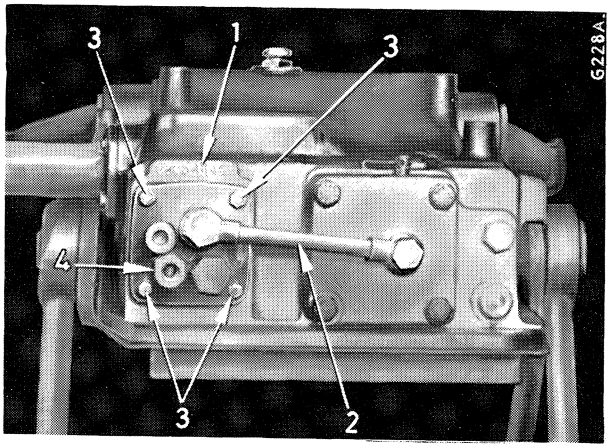


Illust. 12

Take out the rockshaft and remove the power arm.
Insert the rockshaft again, shoulder (1) Illust. 59 ahead, to drive out the left seal.
Discard old seals.

Note: On present design rockshafts there is no shoulder (1) Illust. 59. Therefore, be careful not to damage bushing (3) Illust. 58 when driving out bushing (4) and RH sealing parts. To remove bushing (3) and LH sealing parts use a suitable drift punch.

Draft Control Valve



Illust 13

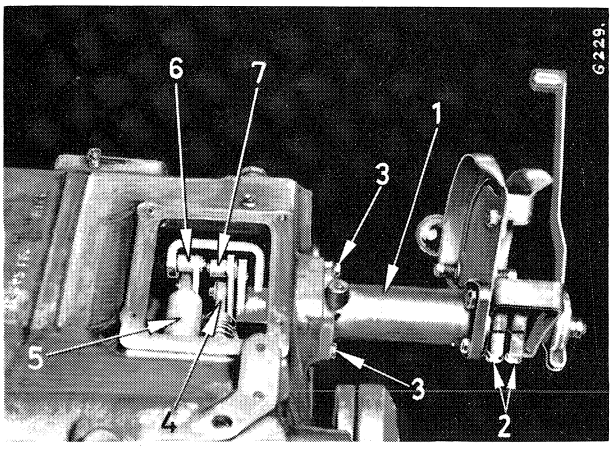
1 – Serial number
2 – Connecting line
3 – Retainer bolts
4 – Pressure input port

Remove connecting line (2) Illust. 13. Remove retainer bolts (3) and take out the control valve.

Control Lever Assembly

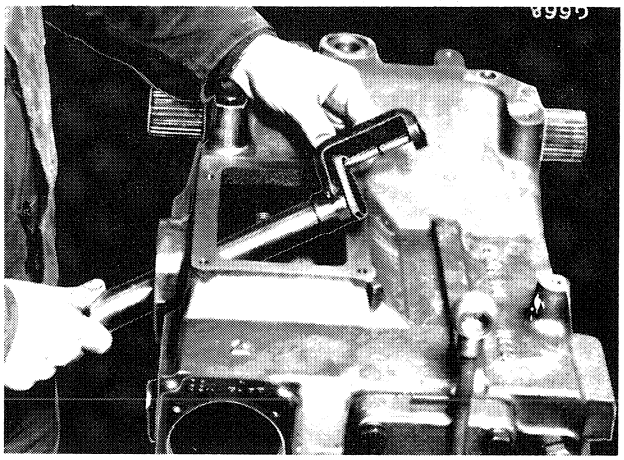
Remove cotter pins and washers from spool levers (6) and (7) Illust. 14. Remove mounting bolts (3) to take off bearing assembly (1).

Slide spring element (4), actuator (5) and levers (6) and (7) from their respective pins. To facilitate this, move the bearing assembly slightly to and fro. Loosen clamping bolts (2).



Illust. 14

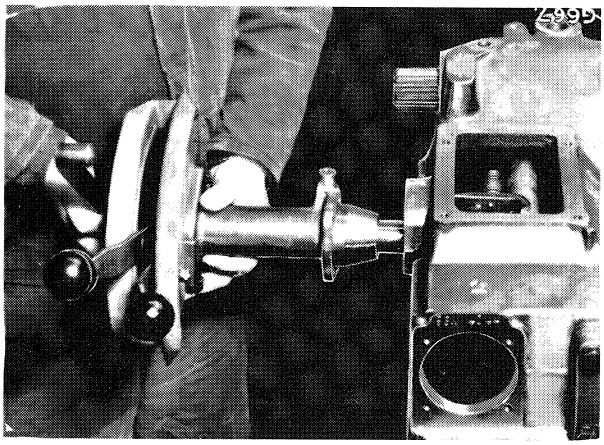
1 — Bearing assembly
2 — Clamping bolts
3 — Mounting bolts
4 — Spring element, draft control
5 — Position actuator
6 — Position spool lever
7 — Draft spool lever



Illust. 16
Removing or installing control lever shaft with tube

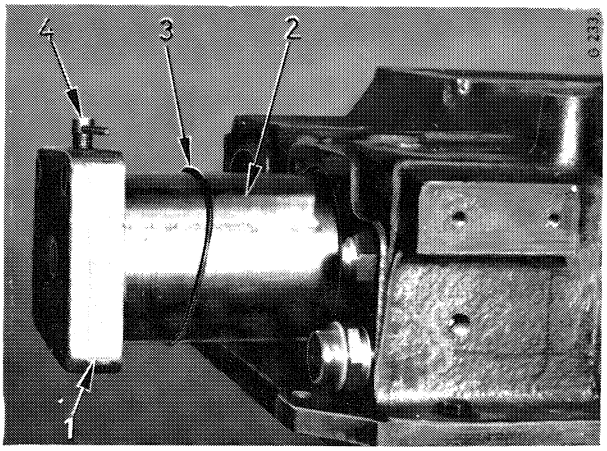
Cylinder Head and Power Cylinder

To remove the cylinder head, it is necessary to take off connecting line (2) Illust. 13 and the four cylinder head retainer bolts.



Illust. 15
(displaced design)

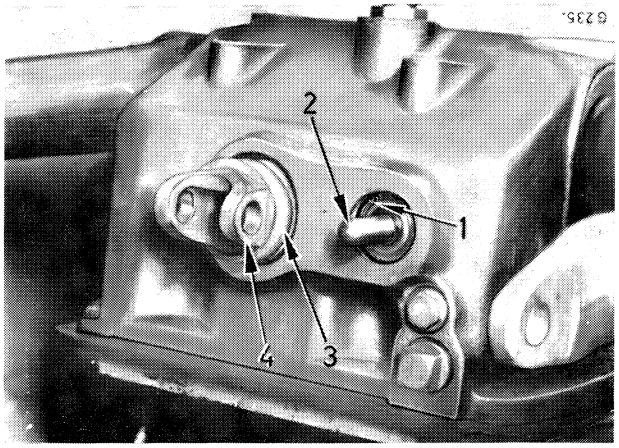
When taking off the control lever assembly Illust. 15, the control lever shaft with tube stays in the lift housing and has to be removed separately, as shown in Illust. 16.



Illust. 17

1 — Cylinder head
2 — Power cylinder
3 — O-ring
4 — Lowering control valve lever

The cylinder head is sealed in the power cylinder by means of an O-ring which, by its light pressure, keeps these parts together. When removing the cylinder head, the power cylinder and piston will slide out also. Separate these parts after removal.

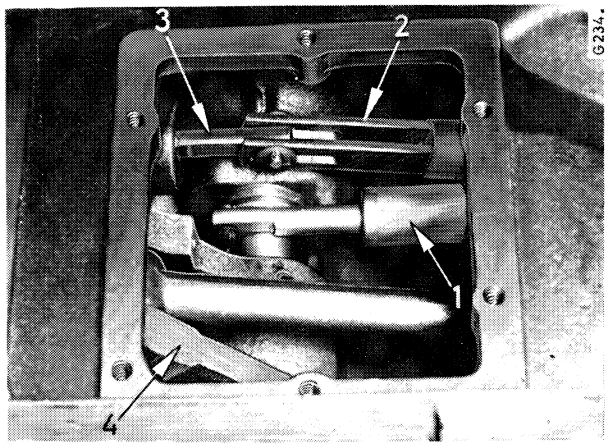


Illust. 19
(Displaced design)

1 — Circlip
2 — Draft link plunger
3 — Bellcrank spring
4 — Screw-type plug

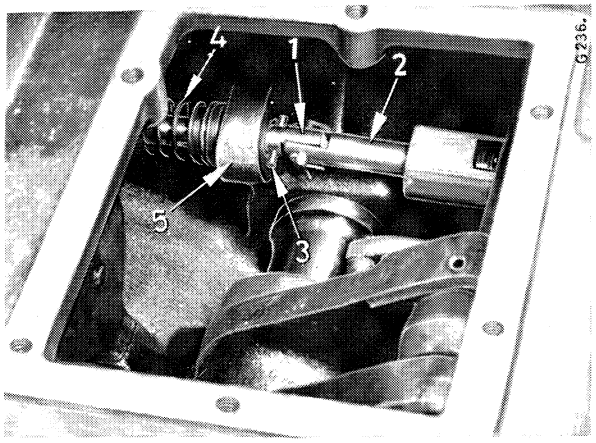
Spring Element, Draft Link Plunger and Power Arm

Remove rockshaft assembly, see Illust. 11 and 12.



Illust. 18
(Displaced design)

1 — Position actuator
2 — Spring element
3 — Draft link plunger
4 — Power arm



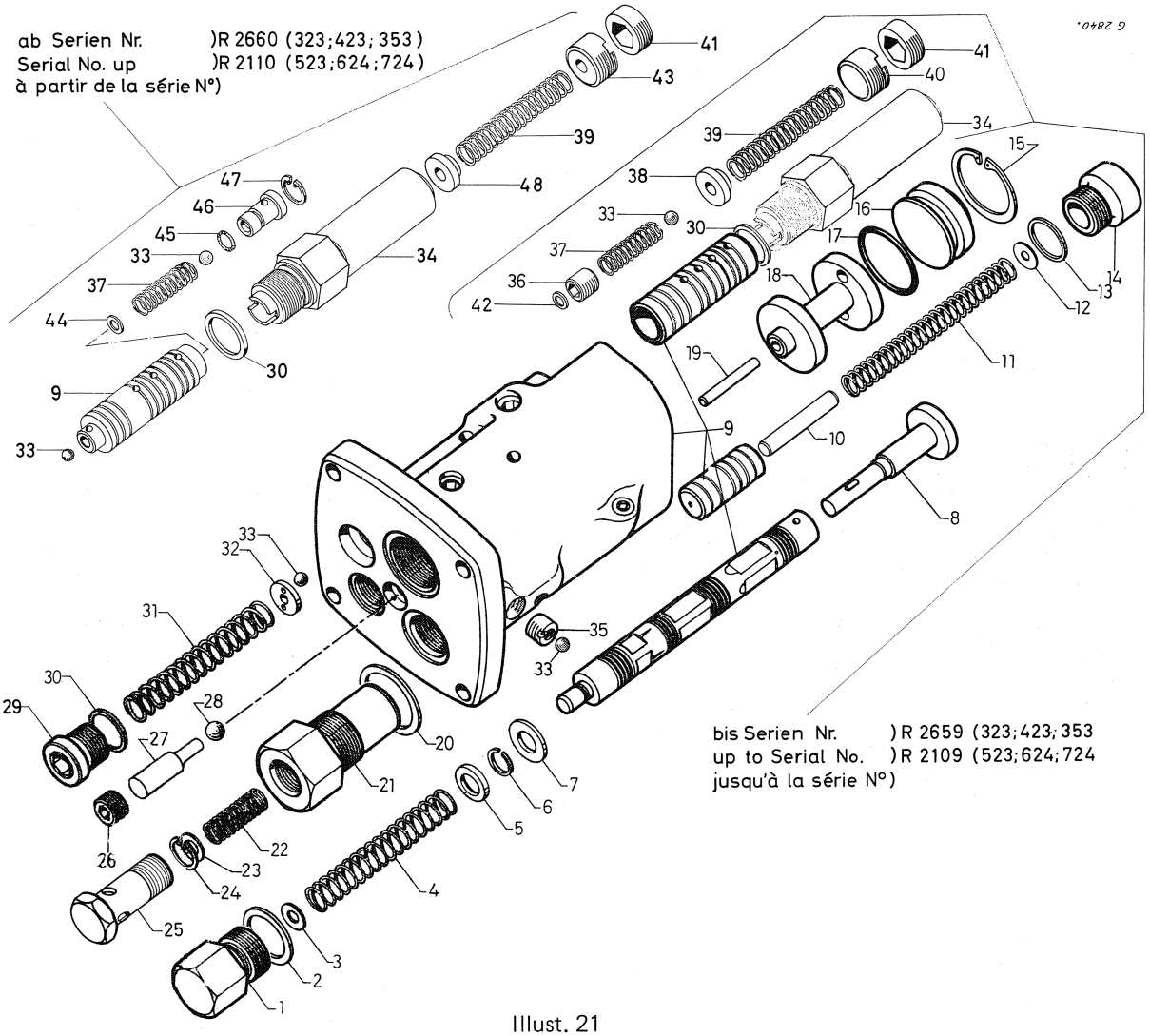
Illust. 20
(Present design)

1 — Draft link plunger
2 — Spring element
3 — Roll pin stop
4 — Follow-up spring
5 — Housing boss

Take off position actuator (1) Illust. 18 and spring element (2) from their respective spool levers as described under Illust. 14. Then remove position actuator from power arm (4) and spring element from draft link plunger (3). Lift out the power arm. Draft link plunger (2) Illust. 19 is secured either by circlip (1) or, on machines of later design, by roll pin (3) Illust. 20.

To remove present design draft link plunger (1) Illust. 20, separate element (2) first. After the draft link plunger has been removed, follow-up spring (4) with its two spring cups is wedged in between housing wall and boss (5) and is free to be removed also.

All precision made parts with highly finished surfaces, such as draft control valve, power cylinder, etc., should only be cleaned with a suitable solvent. As such solvent evaporates rapidly as a rule, there is no need for drying parts. If however, drying becomes necessary, compressed air should be used for this purpose. Never use rags for cleaning hydraulic components as these leave particles of lint hardly visiblé to the naked eye. These minute particles prevent valves from seating properly and are sure to cause trouble which is very difficult to locate.



Illust. 21

Draft Control Valve

All components keyed to reference 9 are not available separately for service. If one of these parts is damaged and must be replaced, a new control valve should be used.

As any trouble on the control valve is generally due to foreign matter in the oil, it is advisable to disassemble and clean all components thoroughly, checking to see if they are fit for reuse.

Note: When repairing or replacing the draft control valve, take care to select parts that correspond with the operating pressure of the system. For details see Parts Catalog.

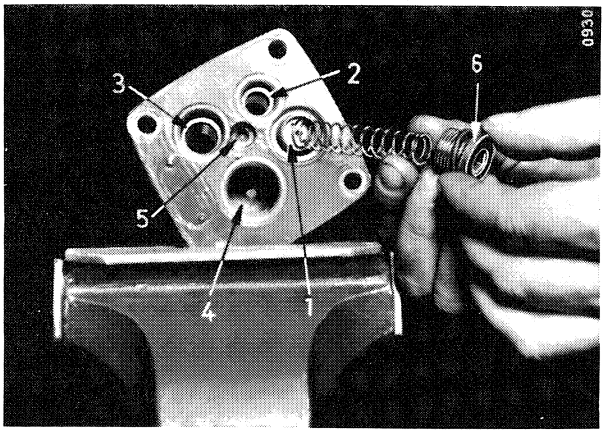
Specifications

Values at operating pressure	140–150 bar (1990–2130 PSI)	160–170 bar (2280–2420 PSI)
Opening pressure of cut-out relief valve	140–150 bar (1990–2130 PSI)	160–170 bar (2280–2420 PSI)
Free length of spring (37) Illust. 21.	24.3 mm = .957"	23.2 mm = .913"
Test length	18.5 mm = .728"	18 mm = .708"
Test load	12 kg = 26.4 lbs	15 kg = 33 lbs
Opening pressure of additional relief valve (34)	160–170 bar (2280–2420 PSI)	180–190 bar (2560–2700 PSI)
Opening pressure of relief valve for auxiliary hydraulic system	160–170 bar (2280–2420 PSI)	180–190 bar (2560–2700 PSI)
Opening pressure of cylinder cushion valve	220–250 bar (3130–3560 PSI)	190–210 bar (2700–3000 PSI)
Spring for cushion valve (4) Illust. 46/47		
Free length	56.5 mm = 2.22"	53 mm = 2.1"
Test length	40 mm = 1.57"	43 mm = 1.7"
Test load	81 kg = 178.6 lbs	58 kg = 127.9 lbs
Values at flow divider and cut-out relief valve version:	Illust. 6a	Illust. 6
Free length of spring (31)	70 mm = 2.75"	65 mm = 2.56"
Test length	43 mm = 1.7"	37 mm = 1.45"
Test load	1.55 kg = 3.4 lbs	1.55 kg = 3.4 lbs
Free length of flow divider spring (11)	105 mm = 4.13"	90 mm = 3.54"
Test length	54.5 mm = 2.15"	53.4 mm = 2.10"
Test load	12 kg = 26.45 lbs	12.8 kg = 28.2 lbs
Free length of valve spring (39)	55.2 mm = 2.17"	50 mm = 1.97"
Test length	40 mm = 1.57"	39 mm = 1.53"
Test load	37.1 kg = 81.8 lbs	39.6 kg = 87.3 lbs
Free length of block valve spring (22)	25 mm = 1"	
Test length	15 mm = .59"	
Test load	3.5 kg = 7.7 lbs	

Specifications, contd.

Free length of lowering valve spring (10) Illust. 46/47	60 mm = 2.36"
Test length	48 mm = 1.9"
Test load	1.8 kg = 4.0 lbs
Running clearance of cut-out valve and flow divider piston in housing bore	.008 – .015 mm = .00032 – .00059"
Maximum permissible out-of-round and taper	.002 mm = .00008"
Running clearance of valve spool in housing bore	.004 – .012 mm = .00016 – .00048"
Maximum permissible out-of-round and taper	.002 mm = .00008"
Free length of valve spool spring (4)	143 – 147 mm = 5.6 – 5.8"
Test length	41 mm = 1.6"
Test load	4.16 kg = 9.2 lbs

Cut–out Relief Valve and Additional Relief Valve



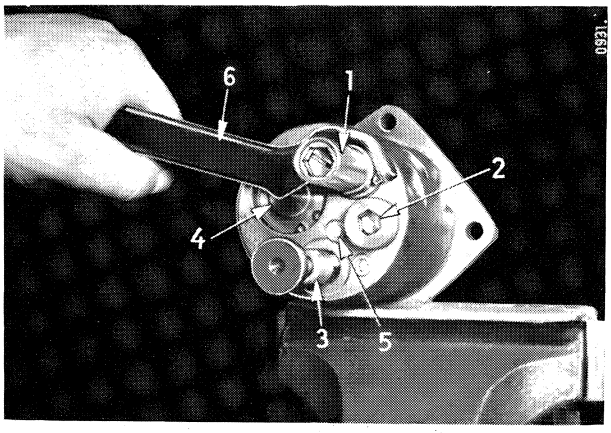
Illust. 22

1 – Cut-out relief valve
2 – Inlet connection to flow divider
3 – Spool bore
4 – Bore for block valve
5 – Bore for non-return valve (28) Illust. 21
6 – Plug

The complete cut-out relief valve can be removed either towards the front with the control valve in place or towards the rear, after removing the control valve.

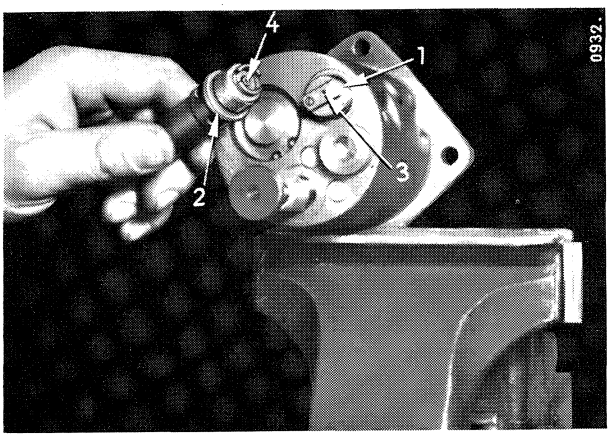
Remove plug (6) Illust. 22 with spring. Tilt the complete valve and shake out disc (32) and ball (33) Illust. 21. Bump the control valve housing lightly on a block of wood to remove valve (1) Illust. 22.

Note: With the control valve in place, these parts must be removed with a clean pair of tweezers.



Illust. 23

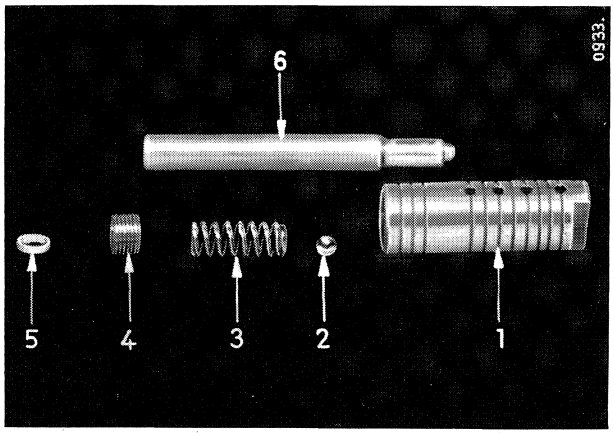
1 – Additional relief valve
2 – Plug (flow divider)
3 – Valve spool
4 – Cover with O-ring (pilot piston)
5 – Plug non-return valve
6 – Hook wrench (for early model valves only)



Illust. 24

1 – Cut-out relief valve
2 – Additional relief valve
3 – Inlet orifice
4 – Valve poppet

Valve piston (1) Illust. 24 must slide in the housing bore with a light drag. There must be no binding or tight spots anywhere. Orifice (3) and all internal passages must be completely clean. Carefully inspect the piston surfaces and the housing bore for signs of scoring or other damage. Replace the complete control valve if such damage is noted.



Illust. 25

1 – Cut-out valve piston
2 – Valve ball
3 – Spring
4 – Pressure setting plug
5 – Locking ring
6 – Special tool

Check valve spring (3) Illust. 25 against specifications and replace if signs of scoring or fatigue are noted.

Note: Spring length is different between operating pressures 160–170 bar (2280–2420 PSI) and 140–150 bar (1990–2130 PSI). To remove this spring from the valve, take out the pressure setting plug (4) Illust. 25 with an Allen wrench. The locking ring (5) is forced out also.

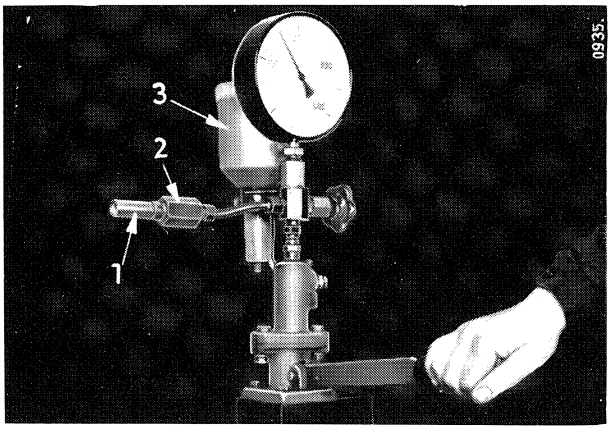
Carefully inspect all parts. Valve ball (2) must seat in piston (1) without leakage. Locking ring (5) must be replaced with a new one whenever pressure setting plug (4) is removed.

When reassembling, first place ball (2) on its seat followed by spring (3) with its tapered end toward the ball. Install pressure setting plug and tighten in such a way that two threads are visible above the plug.

Final adjustment must be made later when the valve is installed in the system. Do not yet install locking ring (5) at this stage. This ring is only installed after final pressure setting on the tractor, using special tool (6). This special tool must be used to spread the locking ring, to ensure that ball (12) Illust. 28 can move freely in and out of the Allen screw, see also "Pressure Setting of Cut-out Relief Valve".

Install ball (12) and spring cup (14), taking care not to cock the latter in the bore.

Additional Relief Valve



Illust. 26

1 – Additional relief valve
2 – Adapter (special tool)
3 – Oil reservoir for test pump

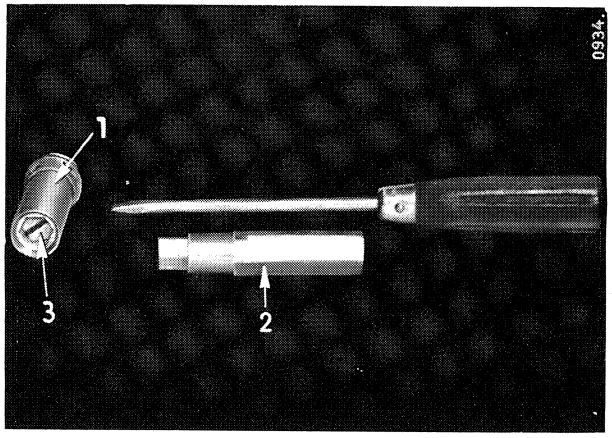
Check spring and pressure setting of additional relief valve (1) Illust. 26. See "Specifications". Closing pressure is approx. 80 bar below opening pressure. To check for leakage, slowly increase pressure and watch the gauge. There must be no leakage up to 2 bar (28 PSI) from the opening point.

This pressure is properly set at the factory and normally requires no adjustment. It is good practice, however, to check this pressure setting whenever the control valve is taken down for repair. A test pump, as shown in Illust. 26 is required for such a check.

To adjust pressure, loosen the lock nut behind the slotted plug, using special tool (2). Turn the headless plug (3) in or out until the pressure setting is correct. Then tighten the lock nut. Take care when tightening to hold the slotted plug with a screw driver so as not to change the pressure setting.

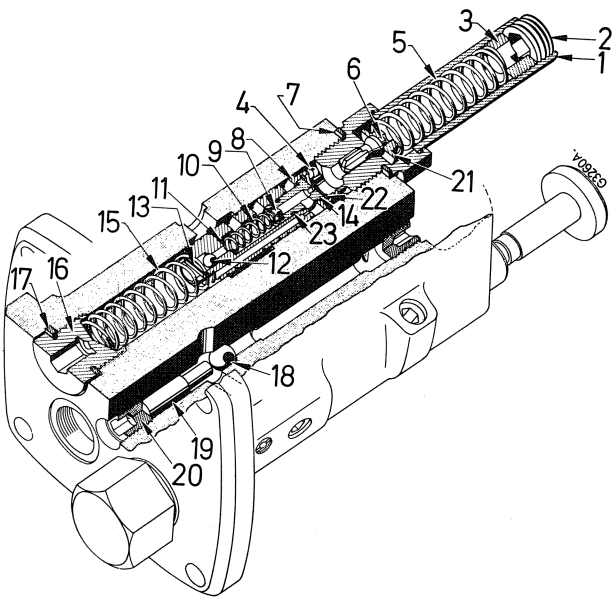
Should the first test reveal a marked deviation from the regular specified pressure it is advisable to remove and check the valve spring against specifications. Replace with a new spring, if necessary. Also check the valve poppet for tight sealing.

A very slight deformation of the sealing face can be corrected by lapping the poppet into its seat. Then reassemble the valve and set the pressure. If the sealing face is badly damaged, the complete relief valve must be replaced.



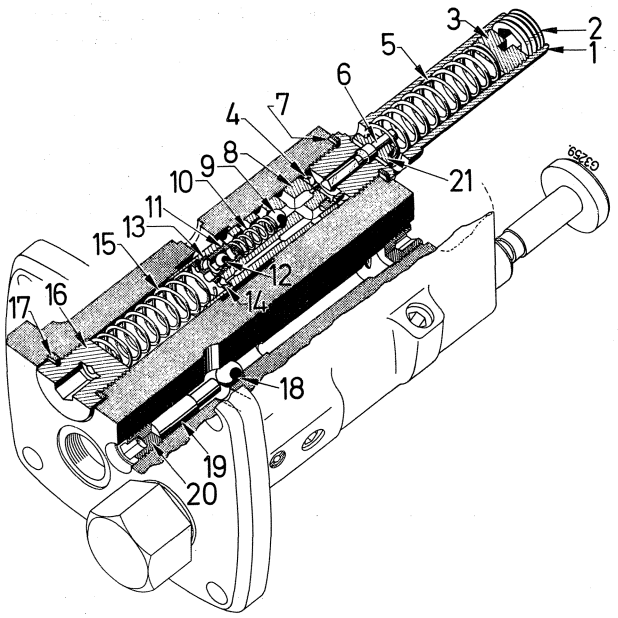
Illust. 27

1 – Additional relief valve
2 – Special tool (tubular)
3 – Slotted headless plug



Illust. 28
Cut-out relief valve and additional relief valve (present design)

1 – Valve sleeve
2 – Lock nut
3 – Slotted headless plug
4 – Bore
5 – Valve spring
6 – Valve poppet
7 – Packing ring
8 – Piston, cut-out relief valve
9 – Valve ball
10 – Valve spring
11 – Shims
12 – Valve ball
13 – Roll pin
14 – Sleeve
15 – Return spring
16 – Plug
17 – Packing ring
18 – Non-return valve ball
19 – Retainer pin
20 – Plug
21 – Pilot washer
22 – Circlip
23 – O-ring



Illust. 28a
Cut-out relief valve and additional relief valve (displaced design)

11 – Adjusting plug
12 – Valve ball
13 – Locking ring
14 – Spring disc

Install cut-out relief valve and additional relief valve as shown in Illust. 28 or 28a.

CHECKING AND ADJUSTING CUT–OUT RELIEF VALVE

When taking pressure readings on units where additional control valves are mounted, it should be borne in mind that there are three relief valves which could affect the pressure reading:

a) The cut-out relief valve. Pressure will rise to "cut-out pressure" then suddenly drop to 8 – 9 bar (115–130 PSI) within 0.6 seconds.

b+c) Additional relief valve. If, on a loaded system, pressure does not reach cut-out level, this might be due to a malfunction of the additional relief valve or, on the other hand, to a faulty relief valve in the additional control valve mounting block.

In order to distinguish between the two, first check pressure on the additional circuit. If this pressure is correct, check the draft control valve relief valve setting.

Note: If the opening pressure of the three relief valves is correct, the cause for insufficient operating pressure may be a faulty cylinder cushion valve.

Before performing checks, be sure the fluid level is correct and the filter is not restricted. The fluid should be at operating temperature 40° – 60°C = (105° to 160°F) and the system should be cycled a sufficient number of times to eliminate all air from the system.

Depending on the hydraulic equipment used, checks can be made on the three following points:

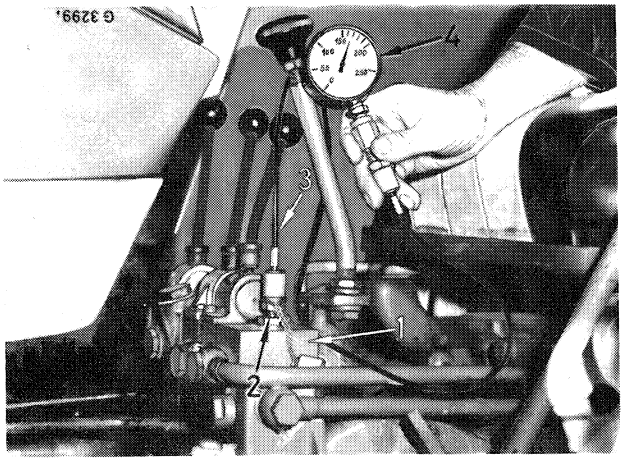
1. on mounting block for additional control valves (Restrictor device not required)

2. on pressure oil filter (Restrictor device required)

3. on draft control valve (Restrictor device required)

Checks should be made on mounting block Illust. 29 whenever possible. If the tractor is not so equipped, check either on pressure filter or draft control valve, as described below.

Checking on Mounting Block (additional control valves)

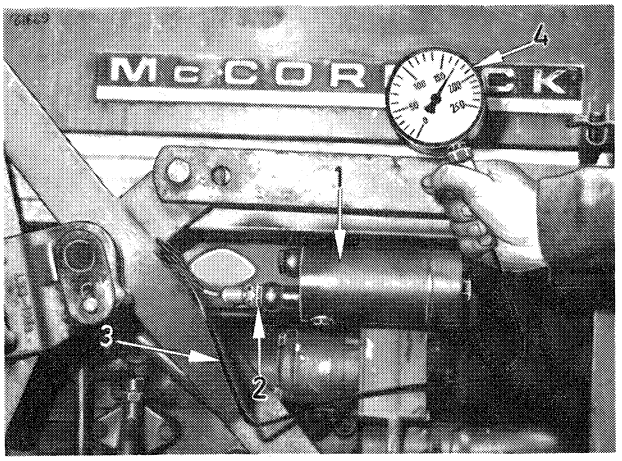


Illust. 29

1 — Mounting block
2 — Test connector
3 — Pressure hose
4 — Gauge 0—250 bar (3500 PSI)

Remove plug and take out flow divider piston with spring. Connect pressure gauge as shown in Illust. 29.

Checking on Pressure Oil Filter



Illust. 30

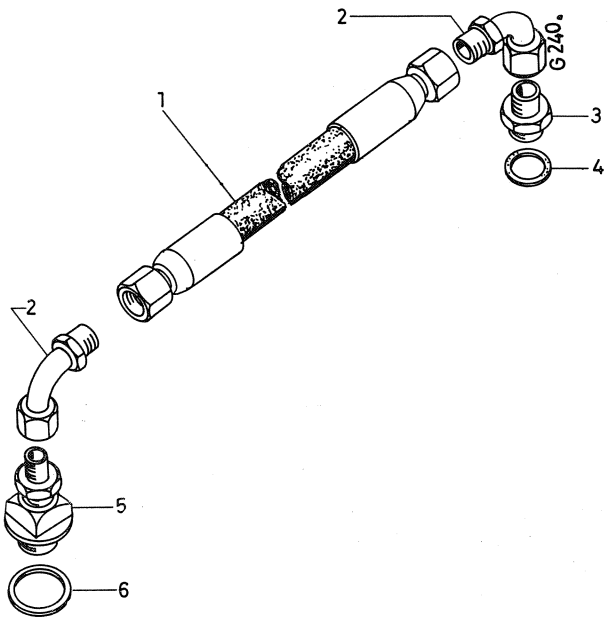
1 — Pressure oil filter
2 — Test connector
3 — Pressure hose
4 — Gauge 0—250 bar (3500 PSI)

When checking on pressure oil filter Illust. 30 (or on draft control valve) the restrictor device Illust. 31 must be installed to obtain a gradual rise of system pressure.

Connect pressure gauge as shown in Illust. 30.

Remove pressure line between control valve and cylinder head and fit the restrictor device elbow (2) Illust. 31 at the control valve port of line (2) Illust. 31a. Fit the restrictor union (5) Illust. 31 of the device in place of the oil level gauge in the lift housing.

The pressure oil is now no longer flowing to the power cylinder but is re-routed to the reservoir through device union (5).



Illust. 31

1 — Pressure hose
2 — Elbow
3 — Union adapter
4 — Packing ring
5 — Restrictor union
6 — Packing ring

Check the pressure setting as follows. The draft and position control levers should be down all the way. Make sure that the gear shift lever is in "neutral". Start the engine. Place the position lever in a lifting position and gradually increase engine speed while observing the pressure build-up on the gauge. Take the highest pressure reading before the cut-out valve cuts off the pressure. The setting is correct when system pressure rises to the specified values and then suddenly drops to 8—9 bar (115—130 PSI). Repeat this test several times.

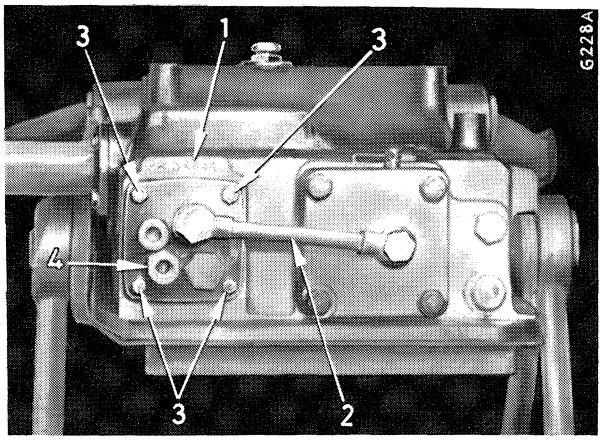
By this cut-out action the relief valve immobilizes the complete system, but leaves the valve spool in lifting position. To repeat the pressure test reading, it is necessary to move the control lever towards "lowering", and then initiate the next lifting operation.

If the opening pressure deviates from the specified values, adjust the relief valve by adding or subtracting shims (11) Illust. 28 or by turning the adjusting plug (11) Illust. 28a.

When the pressure setting is correct punch the babbitt locking ring (5) Illust. 25 into the threads against plug (4) using special tool (6) to secure the adjustment.

Before checking pressure the second time, allow the system to switch off for several times in order to vent the cushion chamber.

Checking on Draft Control Valve



Illust. 31a

1 – Serial Number
2 – Connecting line
3 – Retainer bolts
4 – Pressure input port

Connect restrictor device as for "Checking on Pressure Oil Filter" above.

Fit test connector to port (4) Illust. 31a and repeat the above procedure.

Non-Return Valve

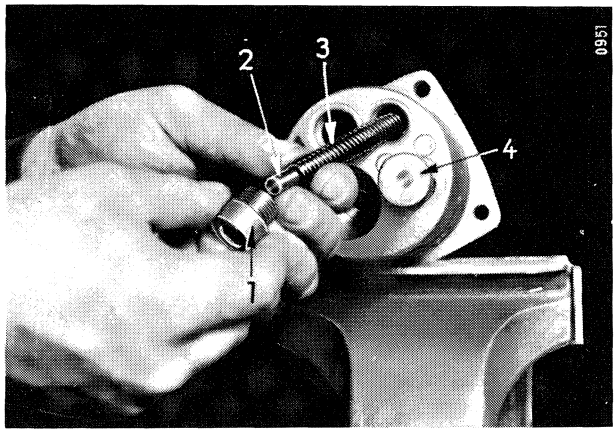
While lowering, the non-return valve (18) Illust. 28 becomes unseated, allowing the return oil to pass over the spool into the lift housing.

The non-return valve is not subject to any appreciable wear or change and any trouble that might develop will not originate here. When disassembling, therefore, it is good practice to leave the non-return valve in place.

Flow Divider

The flow divider has been changed, Illust. 33 and 34, see also Parts Catalog.

To disassemble the flow divider the control valve must be removed.

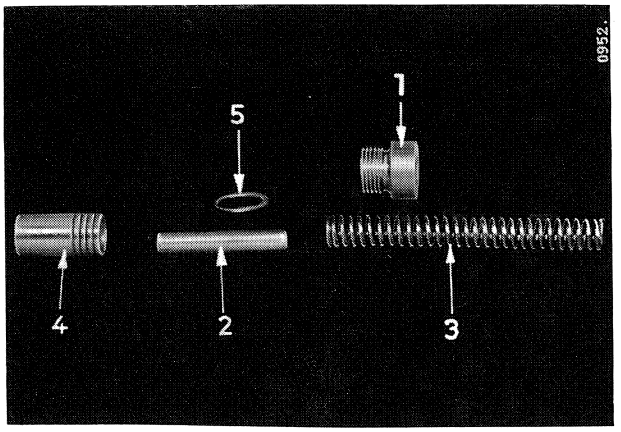


Illust. 32

1 – Plug
2 – Stabilizer pin
3 – Flow divider spring
4 – Valve spool tappet

Remove plug (1) Illust. 32 and take out packing ring, stabilizer pin (2) and spring (3). Use a pair of clean tweezers to remove the flow divider piston or push the piston out from the front, using a clean pencil.

Carefully inspect the flow divider piston (4) Illust. 33 for signs of scoring, etc. The piston must slide in the housing bore without any "tight spots", check against specifications.



Illust. 33
Flow divider (displaced design)

1 — Plug
2 — Stabilizer pin
3 — Flow divider spring
4 — Flow divider piston
5 — Packing ring

If signs of erosion, seizure or scoring are noted, replace the complete control valve as the flow divider piston is not serviced separately. Some localized minor defects can be corrected by careful lapping with a mild lapping compound or a very fine grade of emery cloth, using oil to make it less harsh. This may not always be successful, depending on the degree of damage, the skill of the serviceman or the suitability of the lapping agent available. Check spring (3) against specifications.

Note: Spring length is different between present-and displaced design.

Reassemble parts in the order shown in Illust. 32 and 34.

The flow divider controls pilot stream pressure which must be checked whenever the flow divider has been disassembled.

Check pilot stream pressure on mounting block, Illust. 29.

Piston and spring must remain in the mounting block.

On tractors without additional control valves, check on pressure oil filter (Illust. 30), or on draft control valve (Illust. 31a).

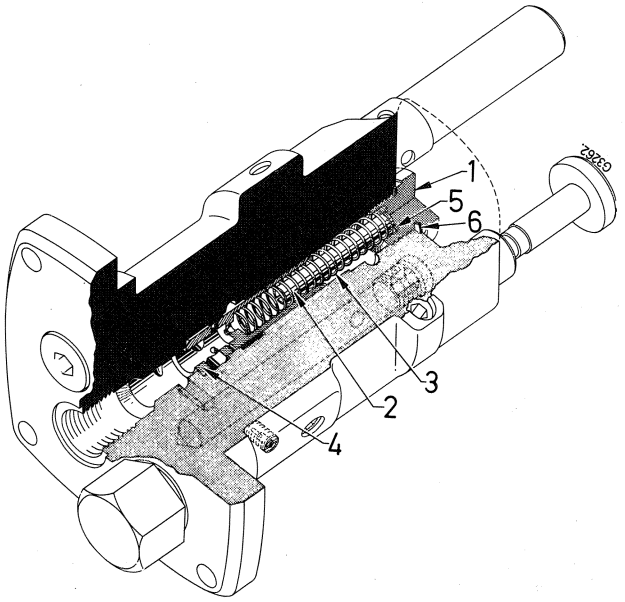
The pilot stream pressure must be:

7–9 bar (100–130 PSI) on mounting block Illust. 29.
6–8 bar (85–115 PSI) on presure oil filter, Illust. 30.
6–7 bar (85–100 PSI) on draft control valve, Illust. 31a.

Check pressure as follows:

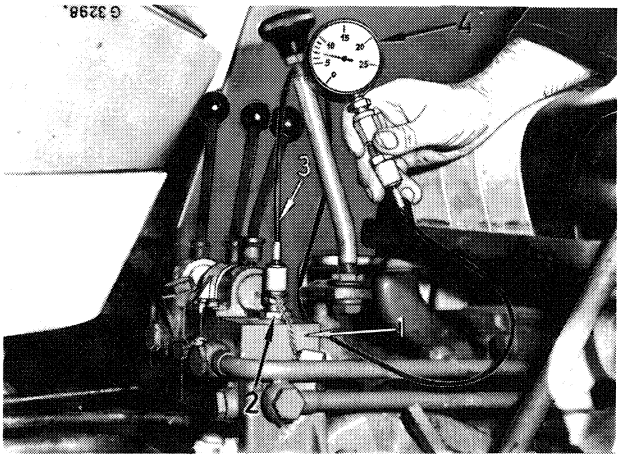
Bring hydraulic oil temperature to + 40–60° C = 100–140°F. Connect a pressure gauge with a range of up to 25 bar according to Illust. 29–30, and 31a.

Move both operating levers down all the way to lowering position.



Illust. 34
Flow divider (present design)

1 — Plug
2 — Stabilizer roll pin
3 — Flow divider spring
4 — Flow divider piston
5 — Spring washer
6 — Packing ring



Illust. 35

1 — Mounting block
2 — Test connection
3 — Pressure hose
4 — Gauge (0–25 bar)

Start the engine and accelerate to 1200 rpm. Observe the pressure gauge. Pilot stream pressure, as registered on the gauge must correspond with the pressures mentioned above.

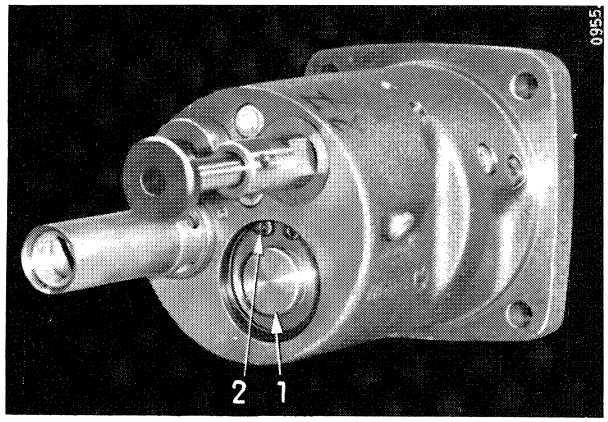
Note: With cold oil, this pressure may be slightly higher. Under no circumstances should pilot stream pressure be appreciably below this specification because the pilot stream would then not be strong enough to open the block valve for lowering. If necessary, use a new flow divider spring (3) Illust. 34.

Caution: Be sure when checking pilot stream pressure that both control levers (2 and 3) Illust. 10 are down all the way. Never move a lever up as long as the engine is running and the sensitive gauge is connected, as this would destroy the instrument.

Block Valve

Note: The pilot piston (3) Illust. 37 has been changed, Illust. 37 and 40 show the displaced -and present design, respectively.

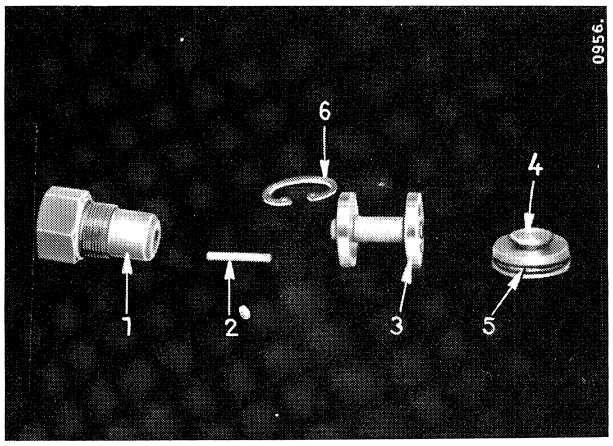
The block valve (1) Illust. 37 can be removed with the control valve in place. If removal of the pilot piston (3) or cover (4) should become necessary, the complete draft control valve must be removed.



Illust. 36

1 – Cover with O-ring
2 – Circlip

Take out circlip (2) Illust. 36, using a pair of needlepoint pliers. Remove cover (1) and take out pilot piston. Use a pair of tweezers to remove the thrust pin if necessary.

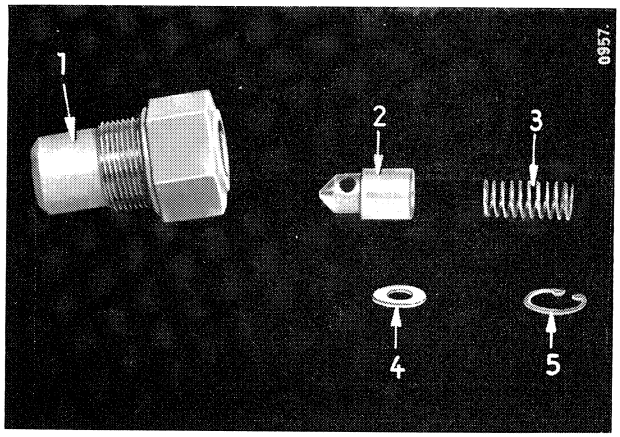


Illust. 37

1 – Block valve housing
2 – Thrust pin
3 – Pilot piston (displaced design)
4 – Cover
5 – O-ring
6 – Circlip

Clean parts shown in Illust. 37 and inspect for any possible damage or wear. It is not likely that the pilot piston (3) should show signs of wear. Nonetheless, it must be inspected to see if discs are still secure on the central stem. The O-ring (5) must be replaced as a rule.

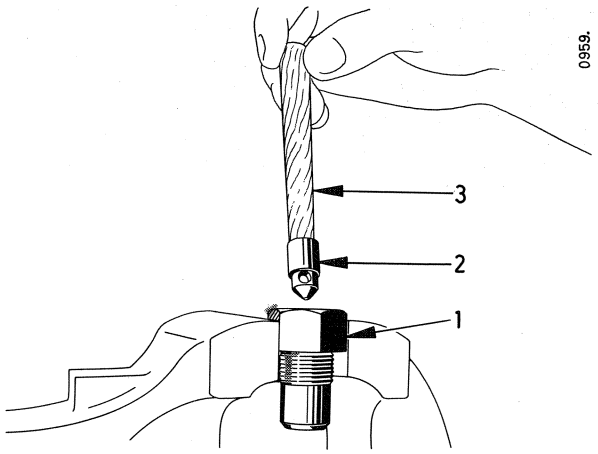
It is important that the block valve (2) Illust. 38 does not leak. Otherwise the implement would slowly drop to the ground when the engine is stopped. When the engine is running, a leaking block valve results in the implement being lowered imperceptibly and the system corrects the implement position from time to time resulting in a "hiccup" condition.



Illust. 38

1 – Block valve housing
2 – Valve poppet
3 – Valve spring
4 – Spring washer
5 – Circlip

To check the condition of block valve components, remove circlip (5) from block valve housing (1) and take out washer (4), spring (3) and poppet (2). Inspect the sealing face of poppet (2) and its counterface in the housing (1). Minor defects can be corrected by lapping poppet (2) into its seat as shown in Illust. 39.



Illust. 39
Lapping block valve into its seat

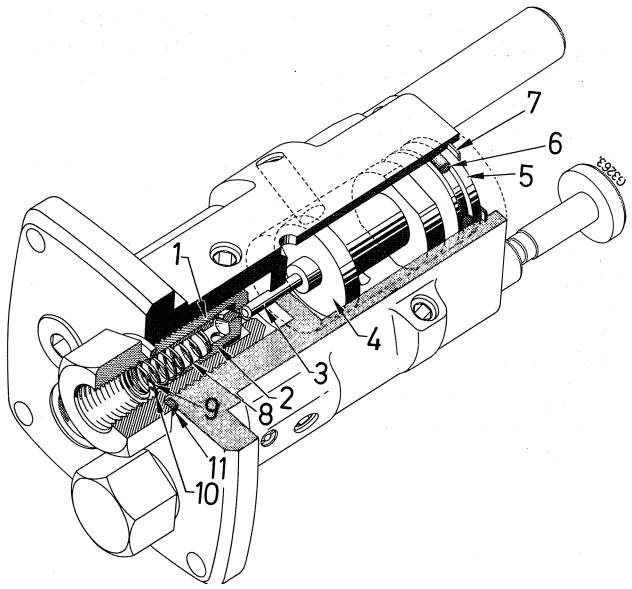
1 – Valve housing
2 – Valve poppet
3 – Wooden peg

If signs of hammering or other severe damage is noted, replace the complete block valve assembly. Housing (1) and poppet (2) are mated components and are not available as individual service parts.

Check valve spring (3) Illust. 38 against specifications and replace with a new one if necessary.

Clean and reassemble all parts as shown in Illust. 40.

When installing pilot piston (4) and thrust pin (3), make sure to see that these slide freely in the housing. Take care not to overtighten block valve housing (1) as the poppet (2) might have the tendency to stick as a result. After reassembly, check the function of the block valve.



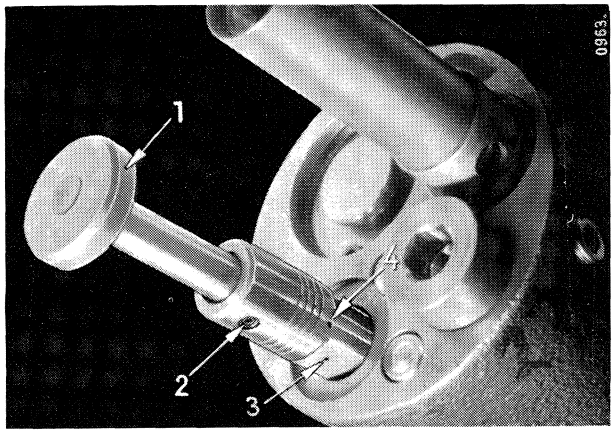
Illust. 40

1 – Block valve housing
2 – Valve poppet
3 – Thrust pin
4 – Pilot piston (present design)
5 – Cover with O-ring
6 – O-ring
7 – Circlip
8 – Block valve spring
9 – Spring washer
10 – Circlip
11 – Packing ring

Valve Spool, Auxiliary Change–Over, Restrictor Orifice

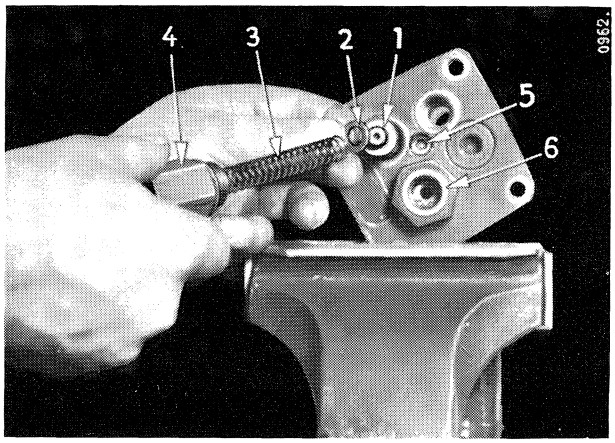
The valve spool has a running clearance of .004 to .012 mm = .00016" – .00048" in the housing. Out-of-round and taper must not exceed .002 mm = .00008". These dimensions are given to show that any repairs are not likely to meet with success. Therefore, do not attempt to lap or polish the valve spool in any way as this would entail a change in dimensions and cause trouble.

To ensure trouble-free operation, the valve spool must slide freely in the housing. Tappet (1) must also be free to move all the length of the lost-motion slot to ensure smooth operation of the auxiliary change-over, see also Illust. 43. Should the tappet stick, there is danger that the valve spool will not react positively and slide from one position to another but may stick in an intermediate position. If there are doubts as to the proper operation of the valve spool and auxiliary change-over, remove the spool and check as follows.



Illust. 41

1 – Tappet
2 – Double roll pin
3 – Filling orifice
4 – Relief ports



Illust. 42

1 – Stop washer
2 – Spring washer
3 – Spool spring
4 – Plug
5 – Non-return valve
6 – Block valve

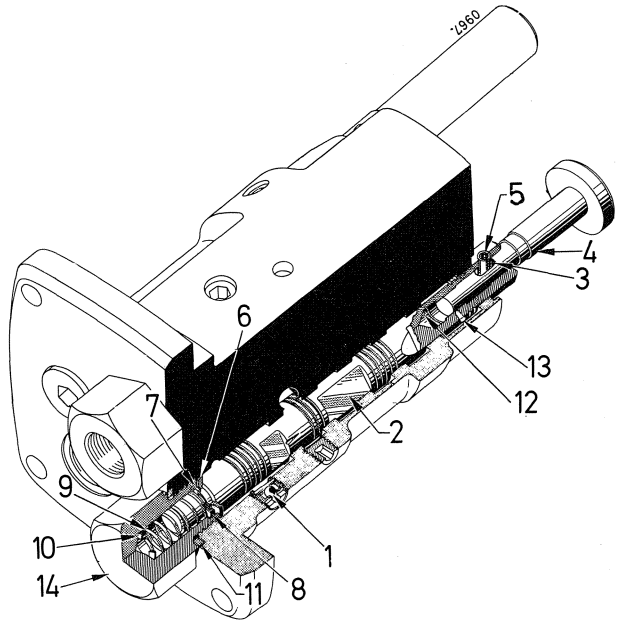
Remove plug (4) Illust. 42 and take out spring (3) and spring washer (2). Use a pair of needle-point pliers to remove the circlip, securing washer (1). Remove the washer and slide out the spool toward the rear.

Inspect valve spool and its bore in the housing for signs of scoring, seizure or other damage. Install a new control valve if such damage is noted. Check to see if tappet (1) Illust. 41 moves freely all the length of the lost-motion slot.

If necessary, remove roll pin (2) and clean the respective parts. Lost-motion slot must be free from burrs. The roll pin must not contact the slot sides. Polish the tappet carefully in a rotary motion if necessary. Filling orifice (3) and relief ports (4) must be clear. Clean them with compressed air.

Check spool spring (3) Illust. 42 against specifications.

Restrictor orifice (1) Illust. 43 is not susceptible to wear but foreign matter in the oil may prevent it from functioning properly. Should this orifice become clogged, the draft control system would respond sluggish and slow. Remove the orifice union and clean with compressed air. On reassembly clean all parts and dip them in hydraulic oil. Illust. 43 shows the correct relation of parts to each other. Make sure to assemble spring washers (8 and 10). Spring washer (8) fits with its recessed side over circlip (7). Do not over-tighten plug (14).



Illust. 43

1 – Restrictor orifice
2 – Valve spool
3 – Lost-motion slot
4 – Tappet
5 – Double roll pin
6 – Stop washer
7 – Circlip
8 – Spring washer
9 – Spool spring
10 – Spring washer
11 – Packing ring
12 – Filling orifice
13 – Relief ports
14 – Plug

Cylinder Head

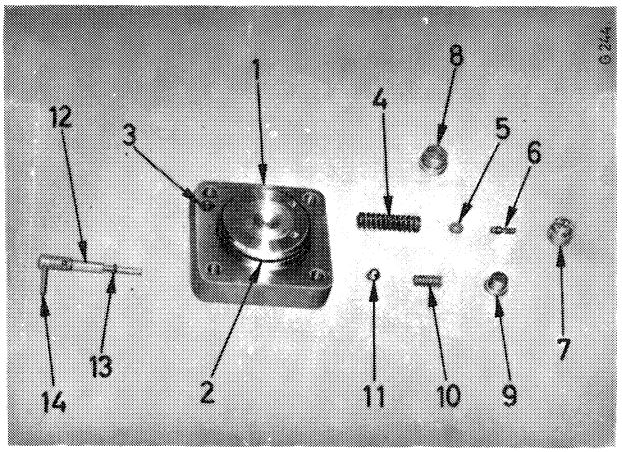
The cylinder head serves as a cover for the power cylinder front end and accommodates the lowering control valve and cylinder cushion valve. The cylinder head is not subject to wear and, if handled with care, should give many years of trouble-free service. If the cylinder head must be removed and disassembled for some reason, refer to Illust. 17 for details.

Lowering Control Valve

Lowering speed is controlled by means of the lowering control valve (9—14) Illust. 44 located inside the cylinder head. The lowering control valve is not prone to trouble as a rule, except for an occasional leakage or valve spring failure. To remove these parts, take out plug (9). The spindle (12) can be removed from the other side. It is possible, when doing so, that the O-ring (13) remains in the cylinder head. Use a small wire hook to remove this O—ring through the pressure intake port.

Check all parts to see if they are fit for reuse.

Inspect springs (4) and (10) against specifications.

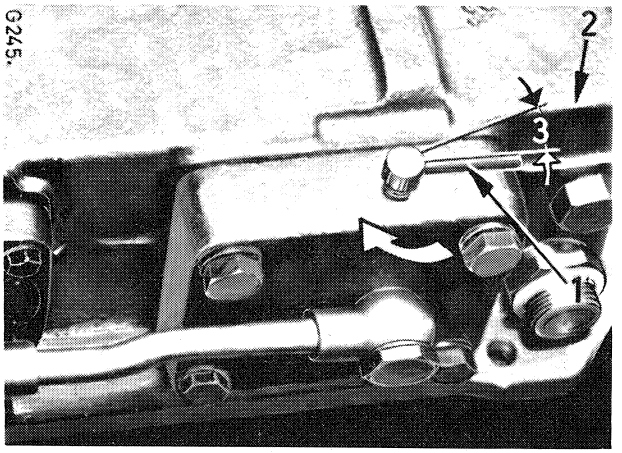


Illust. 44

1 — Cylinder head
2 — O-ring
3 — O-ring
4 — Valve spring
5 — Spring washer
6 — Valve poppet
7 — Valve seat
8 — Plug (cylinder cushion valve)
9 — Plug (lowering control valve)
10 — Valve spring
11 — Ball (lowering control)
12 — Spindle (lowering control)
13 — O-ring
14 — Lever

A plastic locking pellet (15) Illust. 46 is provided in the spindle to secure the adjustment. It is good practice to replace this pellet whenever the spindle is removed. The same applies to the O-ring. After cleaning and checking, reassemble all components, reversing the removal order. Be sure O-rings are not twisted. Screw in the spindle until approximately three to four threads are showing.

Do not yet fit lever (14) at this stage.



Illust. 45
The white arrow indicates opening direction

1 — Lever (roll pin or flat iron)
2 — Stop
3 — Approximately 15°to 30°

To adjust the lowering spindle, the system must be operable. Proceed as follows:

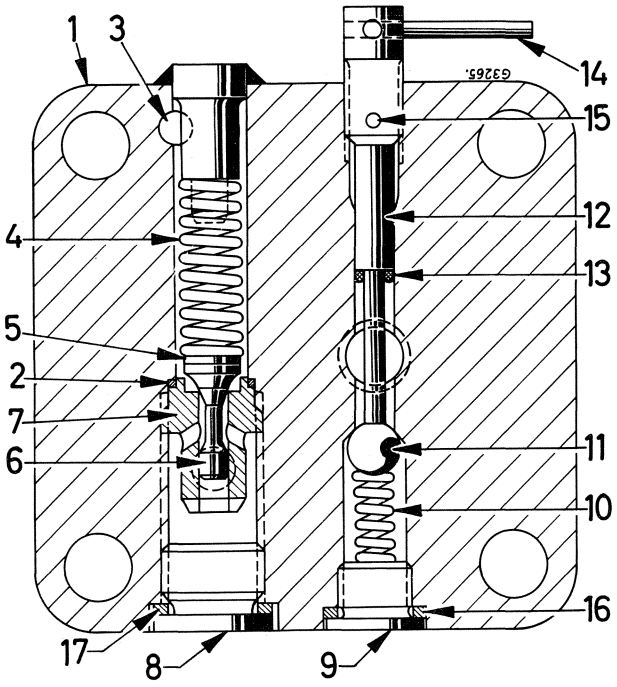
Start the engine and lift rocker arms all the way. Put the system in lowering position and turn the spindle counterclockwise (in the opposite direction as indicated by the arrow Illust. 45) until the lowering process is stopped by the valve. Now fit the hand lever on the spindle in such a way that there is approx. 15—30° of clearance between rear edge of lever (1) and stop (2).

Check spindle adjustment as follows:

Turn the spindle until lever (1) contacts stop (2). No lowering must be possible in this position. To check this, put the system in lifting and lowering position with the position control lever. Now turn the spindle as indicated by the white arrow, approximately 15° to 30°. In this position, the system should start lowering. The further the spindle is turned, the greater the lowering speed.

Note: Should the system lower slowly with the spindle fully closed, check ball (11) Illust. 44 for proper seating. If necessary, settle ball carefully on its seat using a copper punch.

Cylinder Cushion Valve



Illust. 46
Cylinder cushion valve
(present design)

1 – Cylinder head
2 – Packing ring
3 – Relief passage
4 – Valve spring
5 – Shim
6 – Valve poppet
7 – Valve seat
8 – Plug
9 – Plug
10 – Valve spring
11 – Valve ball
12 – Spindle (lowering control)
13 – O-ring
14 – Lever
15 – Locking pellet
16–17 – Packing rings

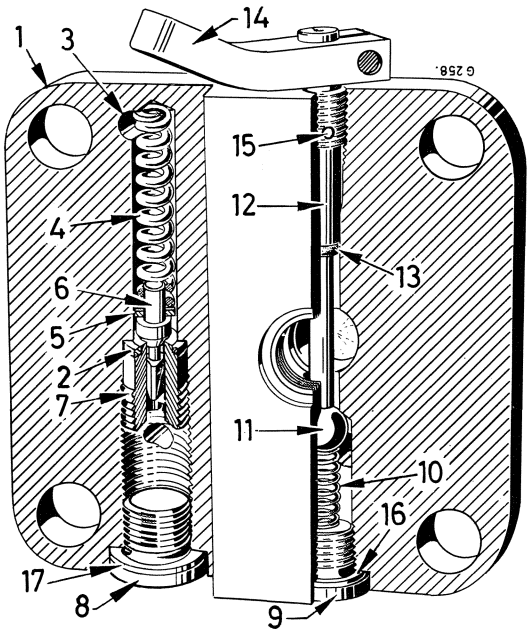
The purpose of the cylinder cushion valve is to protect the system in neutral position of the valve spool against shock loads when driving over a bumpy road with a bouncing implement. Valve (6) Illust. 46 will open briefly to cushion these shock loads in the power cylinder.

The opening pressure of the cylinder cushion valve has been reduced in connection with an increase of the operating pressure on some tractor models. Refer to chart on page 4.

The cylinder cushion valve is not susceptible to trouble. The main considerations are leak- proof seating and correct adjustment. If this valve leaks, remove all parts and replace valve poppet (6) and valve seat (7). If no service parts are at hand and the unit is required urgently, lapping may be tried as a temporary measure.

Reassemble all parts as shown in sectional view Illust. 46 + 47. Screw in valve seat (7) all the way to the stop, using a new packing ring (2).

Opening pressure cannot be adjusted on this valve seat, only with shims (5).



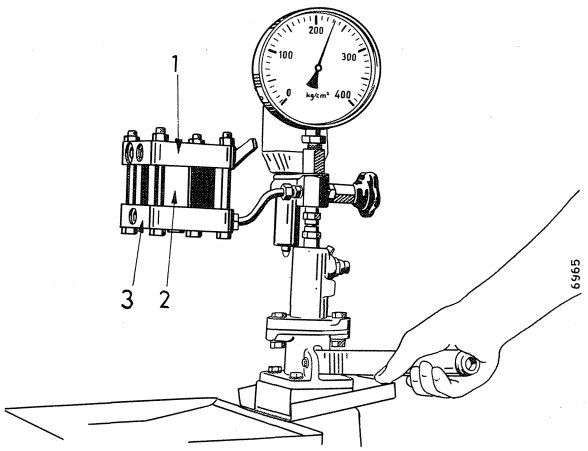
Illust. 47
Cylinder cushion valve (displaced design)

For reference Nos see Illust. 46

Shims (5) are provided in two thicknesses for adjustment of the operating pressure:

0.5 and 1 mm for valve Illust. 46
0.5 and 2 mm for valve Illust. 47

Install the same amount of shims as found in disassembly.
If opening pressure is below the specified value, add a corresponding shim (5).



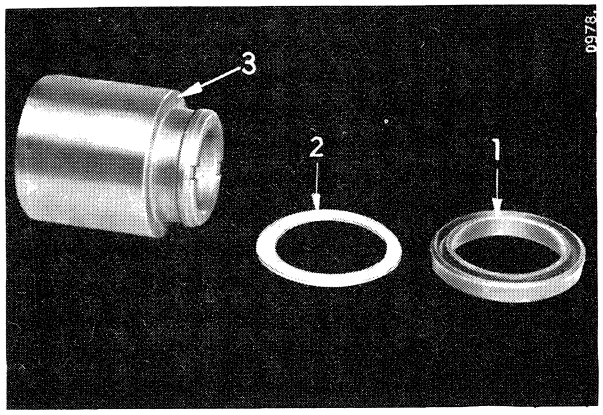
Illust. 48

1 — Cylinder head (to be checked)
2 — Part of a power cylinder
3 — Second cylinder head

To check the opening pressure, a test pump, as shown in Illust. 48 is necessary. Use an old power cylinder (2) to seal the cylinder head. Open the lowering control valve to allow air to escape and close it as soon as oil begins to flow out. Should opening pressure be too low, install an additional shim (5), Illust. 46 and 47.

Power Cylinder and Piston

Oil, leaking past the piston seal or the O-rings in the power cylinder can be diagnosed by tendency of rocker arms to drop when the engine is shut down. When the engine is running, rocker arms are "jerked" up as the system corrects this imperceptible lowering.



Illust. 49

1 — Piston seal
2 — Back-up ring
3 — Shoulder of piston

Refer to Illust. 17 for details on removal of power cylinder and piston.

Slide the piston out of the cylinder and inspect both parts for signs of scoring and seizure.

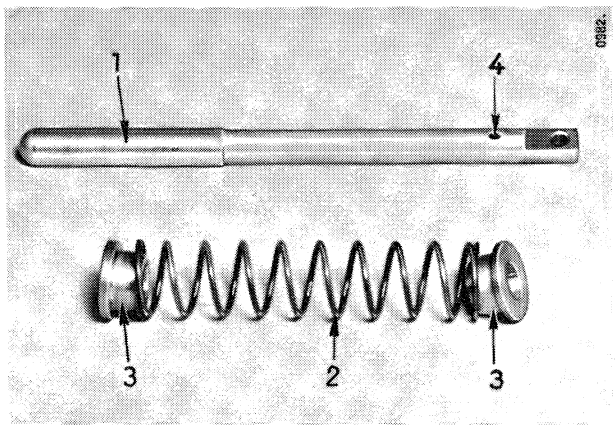
Check piston seal (1) Illust. 49 and back-up ring (2) for wear and replace when in doubt. To fit a new back-up ring, heat it in hot oil of approximately 80°C = 175°F, to facilitate getting it over the piston collar without damage. The back-up ring must contact piston shoulder (3).

A spherical bearing insert is pressed into the recessed rear end of the piston (Early model pistons only.) This bearing insert is not replaceable and damage is not to be expected. Should replacement become necessary, a complete new piston must be used. O-rings should be replaced whenever the power cylinder is opened.

Draft Control Linkage

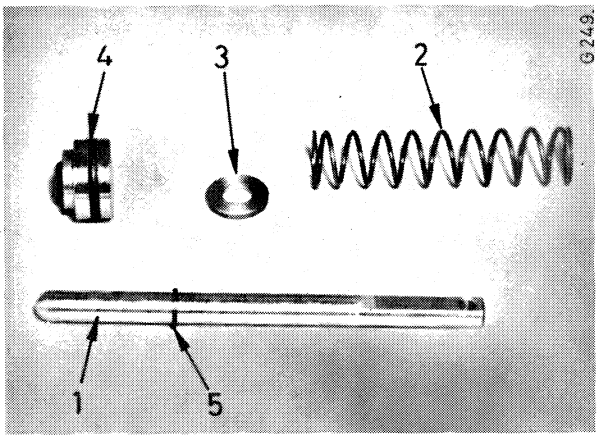
Components of the draft control linkage such as draft and position control levers, spool levers, spring element, draft link plunger and limit stop mechanism are not subject to any appreciable wear so that, under normal conditions, their life would exceed that of the tractor. However, it is possible after long service that the original setting has changed and readjustment becomes necessary. If making a new adjustment on the draft control linkage, closely inspect all parts for their condition and replace any defective part with a new one.

Note: The draft link plunger is used in two versions as shown in Illust. 50 and 51.



Illust. 50
Draft link plunger, present design

1 — Polished sealing face
2 — Follow-up spring
3 — Spring cups
4 — Roll pin hole



Illust. 51
Draft link plunger, displaced design

1 – Polished sealing face
2 – Follow-up spring
3 – Washer
4 – O-ring retainer
5 – Circlip

Closely inspect all O-rings and oil seals, see also Illust. 60 and 61.

Inspect the chromium-plated sealing face (1) Illust. 50 and 51 of draft link plunger for signs of scoring. If damage is noted, be sure to replace the draft link plunger together with oil seal or O-ring.

Check follow-up spring (2) against specifications.

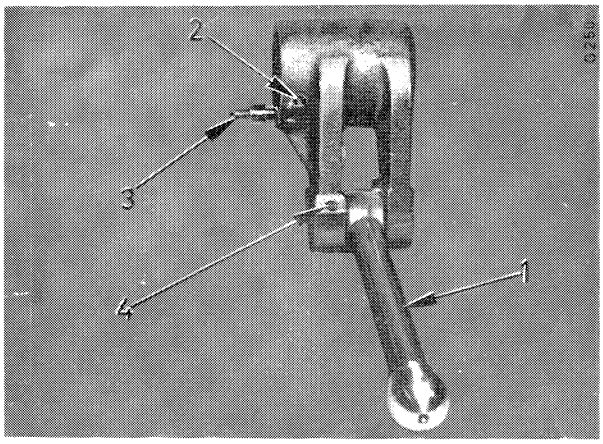
Free length	***129 mm***
Test load	***13.5 kg***
Test length	***70 mm***

When installing the draft link plunger, refer to instructions given below Illust. 60 and 61.

Power Arm and Connecting Rod

Power arm and connecting rod have been changed in design. See Illusts. 52, 58 and 59 and Parts Catalog.

To disassemble the connecting rod from the power arm, remove the roll pin (4) Illust. 52 and drive out the wrist pin. The bushing in the connecting rod is not considered a wear part and is, therefore, not available for service. It should seldom be necessary to replace the complete connecting rod.

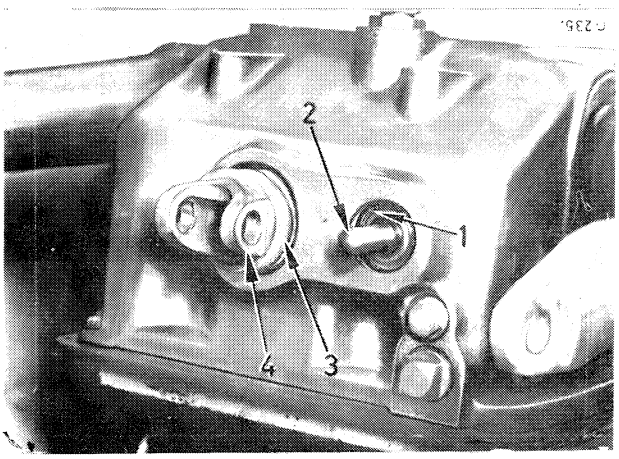


Illust. 52
(Displaced design)

1 – Connecting rod
2 – Locking hole
3 – Pin for position actuator
4 – Roll pin

Make sure that actuator pin (3) Illust. 52 is in good condition. If cracks or signs of failure are noted, the complete power arm must be replaced. Do not attempt welding, since the distortion caused thereby would change the position of the pin and result in functional disturbances.

Bellcrank Spring



Illust. 53

1 – Circlip
2 – Draft link plunger
3 – Bellcrank spring
4 – Screw-type plug

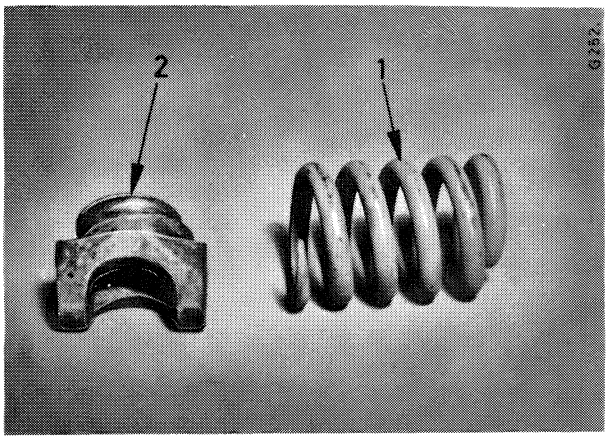
Signal forces from the upper link are taken up by the bellcrank spring (3) Illust. 53. This results in a definite movement of the spring in direct proportion to the strength of the signal. Draft link plunger (2) is following this motion and transmits the signal to the draft spool lever to initiate lifting and lowering operations.

Note: The bellcrank spring has been changed as per specification below:

	Displaced design Illust. 54	Present design Illust. 74
Free length	88-94 mm	93-97 mm
Test length	66 mm	75 mm
Test load	460 Kp	480 Kp

The new spring with plate is available as a field repair package, Illust. 74.

When a bellcrank spring has been replaced it is necessary to readjust spring tension range as described in the respective section of this manual, Illust. 75—77.



Illust. 54
(Displaced design)

1 — Bellcrank spring
2 — Screw-type plug

On the present design spring check dimensions "A" and "B", Illust. 76.

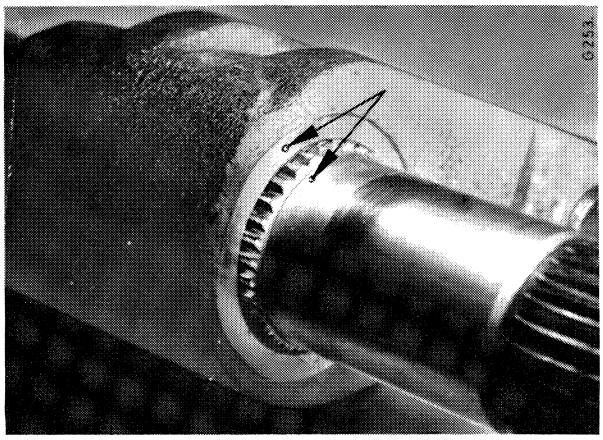
Inspect screw-type plug (2), bellcrank and cross pins for cracks and replace any defective part.

REASSEMBLY AND INSTALLATION

Broadly speaking, reassembly and installation are the reverse of the removal and disassembly procedure. All components must be checked, well cleaned, and reassembled in the order shown in the illustrations. Cleanliness is most important. Dip moving parts into hydraulic oil as they are reassembled.

Power Arm and Connecting Rod

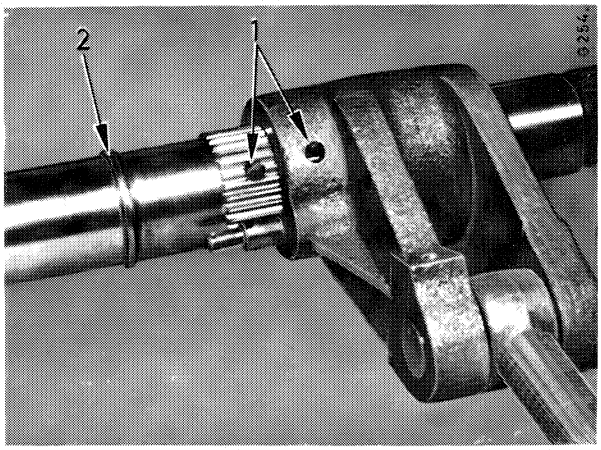
Enter power arm and connecting rod assembly as a unit into the lift housing. Power arm, rockshaft and rocker arms are provided with corresponding markings to ensure their reassembly in the correct position to each other.



Illust. 55
Markings on power arm and rockshaft

Slide the power arm on the serrations of the rockshaft in such a way that markings, Illust. 55, are in line. This will also ensure correct alignment of locking hole for roll pin. Drive roll pin into this hole to secure the power arm on the rockshaft, see (1) Illust. 56.

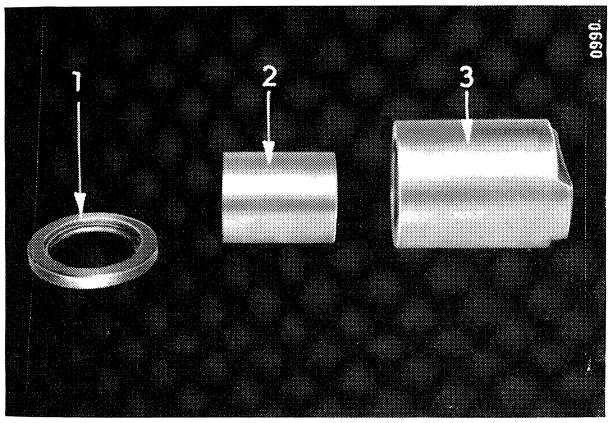
Assemble bushings (3 and 4) Illust. 58/59 in the lift housing, taking care to align their holes with the set screw bores. Insert and tighten dog-point set screws (5) using new packing rings. With bushings in place, install new oil seals.



Illust. 56
Power arm and rockshaft
(displaced design)

1 – Locking holes for roll pin
2 – Shaft shoulder

Ensure correct positioning of shoulder (2) Illust. 56 and (1) Illust. 59.

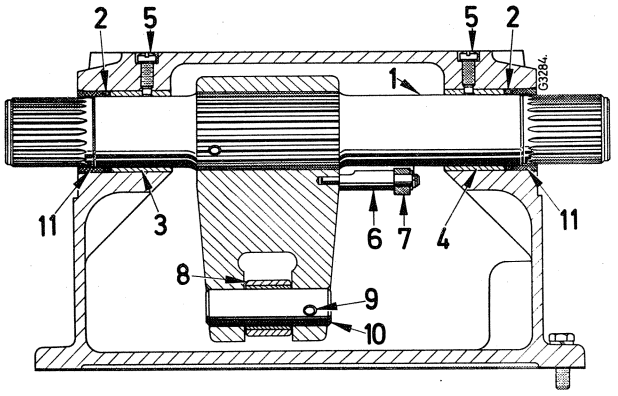


Illust. 57

1 – Oil seal
2 – Seal jumper
3 – Driver tool

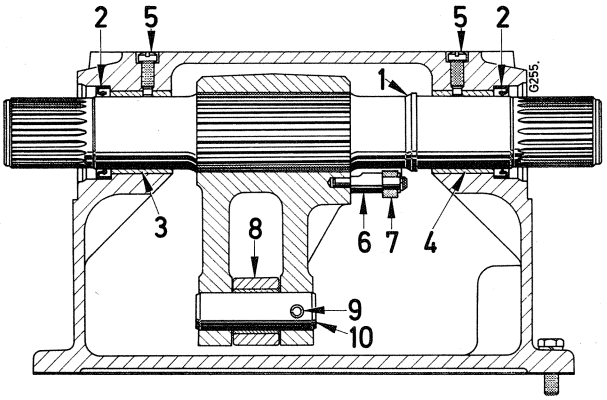
The lip of the oil seal is towards the inside of the housing. To protect the oil seal on installation, it is absolutely necessary to use seal jumper (2) Illust. 57. This seal jumper and driver tool (3) are available as a service tool set.

On present design rockshaft sealing, Illust. 58, install O-rings (2) and spacers (11). Use seal jumper or wrap splines with oil paper to protect O-rings. Make sure they are not twisted.



Illust. 58
(present design)

1 – Rockshaft, RH side
2 – O-rings
3 – Bushing, LH
4 – Bushing, RH
5 – Dog-point set screws
6 – Pin, position actuator
7 – Position actuator
8 – Connecting rod
9 – Roll pin
10 – Wrist pin
11 – Spacer rings



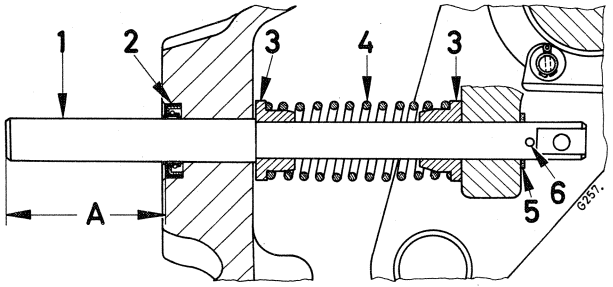
Illust. 59
(Displaced design)

2 – Oil seals

Illusts. 58 and 59 show the correct installation of rockshaft, power arm and related parts.

Draft Link Plunger

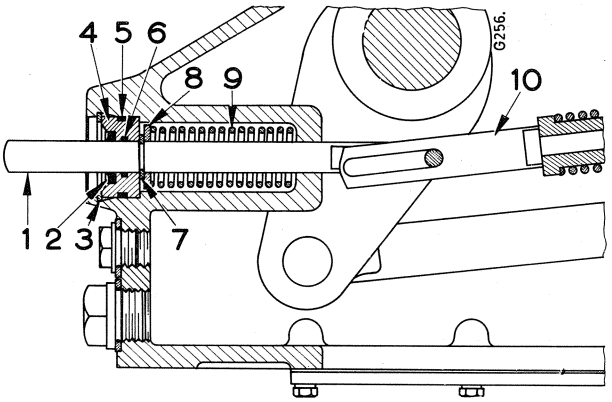
Assemble draft link plunger, referring to Illust. 60 or 61, depending on draft link plunger version.



Illust. 60
(Present design)

A – 58 mm = 2.28"
1 – Draft link plunger
2 – Oil seal
3 – Spring cups
4 – Follow-up spring
5 – Thrust washer
6 – Roll pin

To ensure proper sealing, use new oil seals and O-rings throughout. Check dimension (A) Illust. 60 before bellcrank (4) Illust. 74 is installed. If this dimension is larger than specified, install an additional washer (5).



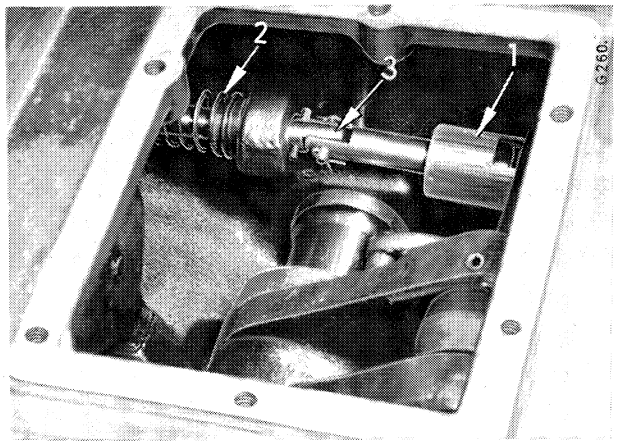
Illust. 61
(Displaced design)

1 – Draft link plunger
2 – Oil seal
3 – Circlip
4 – O-ring retainer
5 – O-ring, external
6 – O-ring, internal
7 – Circlip
8 – Thrust washer
9 – Follow-up spring
10 – Spring element, draft control

Important! After installation of the spring element (2) Illust. 67 and with the draft control lever all the way up (lifting position), dimension (A) Illust. 60 must be rechecked. In this position the control valve spool must be run in all the way.

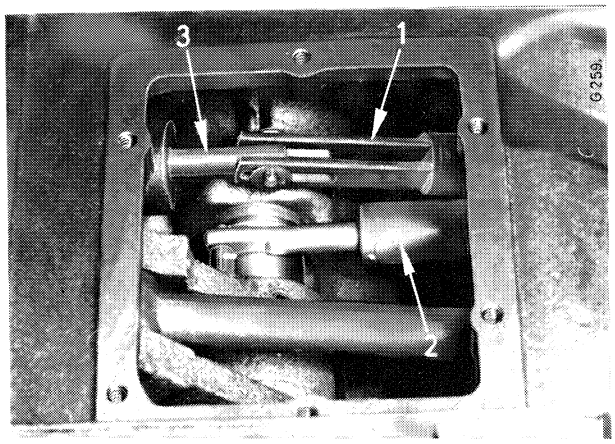
Control Linkage

Reassemble the internal linkage as shown in Illust. 62 and 63. All connections and adjustments require careful attention to ensure smooth operation of the draft control system.



Illust. 62
(Present design)

Where a spring element without lost-motion slot is installed, no washers are used for the cotter connection, see Illust. 62.

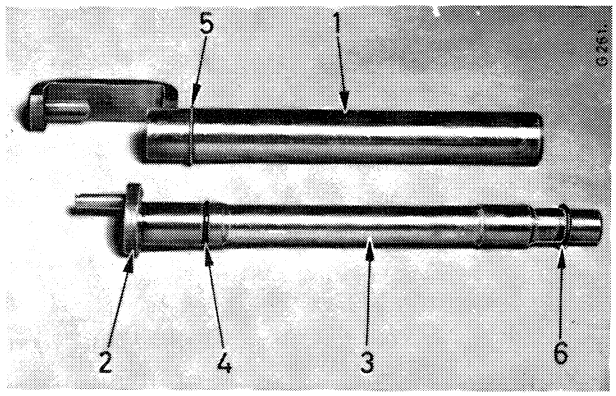


Illust. 63
(Displaced design)

1 – Spring element, draft control (with lost-motion slot)
2 – Position actuator
3 – Draft link plunger

Position Lever Tube and Draft Lever Shaft

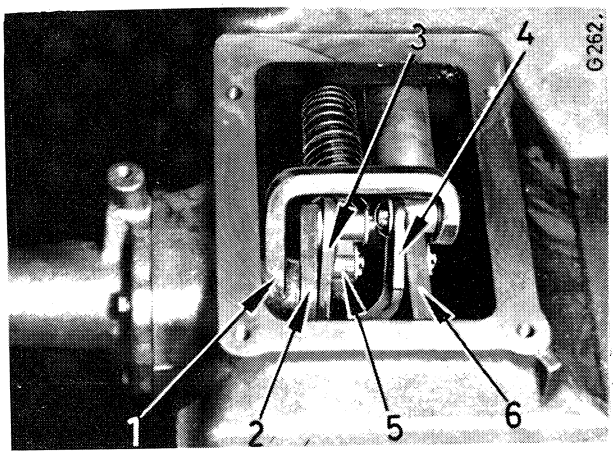
Clean tube (1) Illust. 64 and shaft (2) before installing, them. Fit circlip (5) and install a new O-ring (4), taking care not to twist it in its groove. Fill the hole length of the reduced shank (3) with chassis lubricant and insert the shaft into the tube. Install the assembly in the housing as shown in Illust. 16. Assemble bearing (1) Illust. 14 with a new gasket to the lift housing. Before tightening up, place spool levers (3) and (4) Illust. 65, spring element (5) and position actuator (6) on their respective pins.



Illust. 64

1 – Position lever tube
2 – Draft lever shaft
3 – Reduced shank (grease)
4 – O-ring
5 – Circlip
6 – O-ring

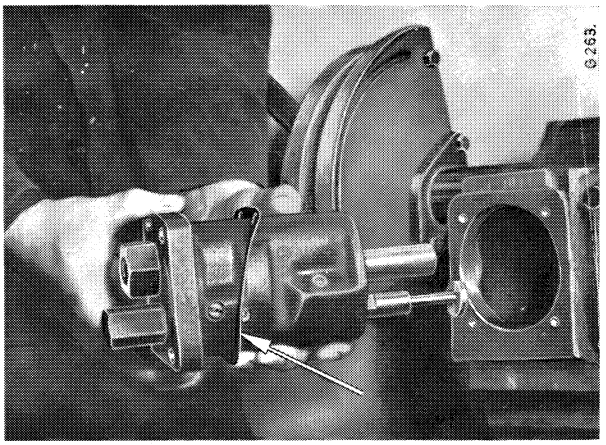
Correct assembly of the internal control linkage is shown in Illust. 67. Spread cotter pins fully.



Illust. 65

1 – Position lever tube
2 – Draft lever shaft
3 – Draft spool lever
4 – Position spool lever
5 – Spring element, draft control
6 – Position actuator

Draft Control Valve

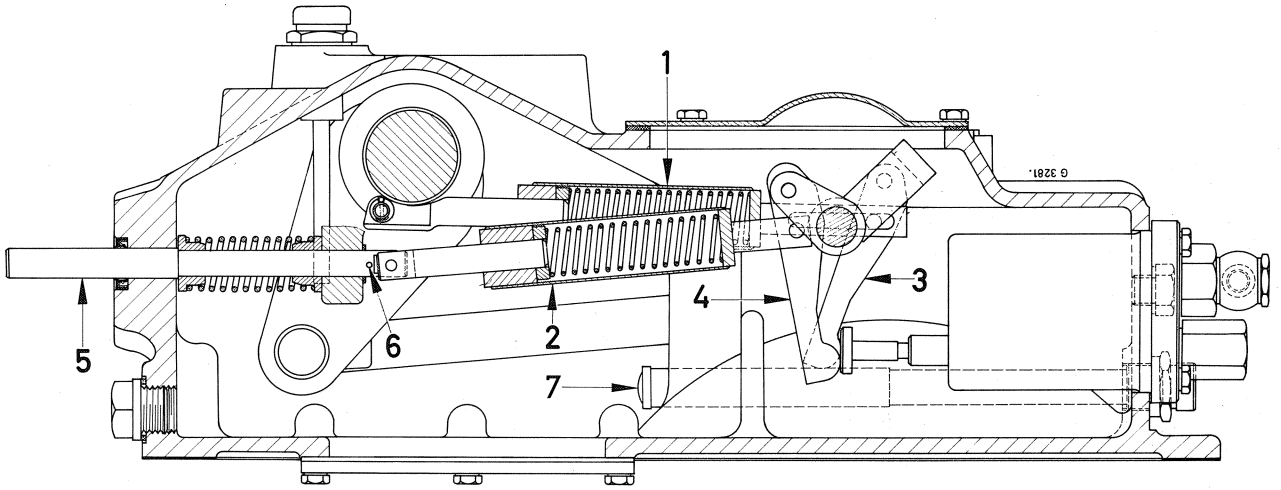


Illust. 66
Installing draft control valve

Install draft control valve, Illust. 66, using a new gasket (arrow). Tighten mounting bolts securely, following a crosswise sequence.

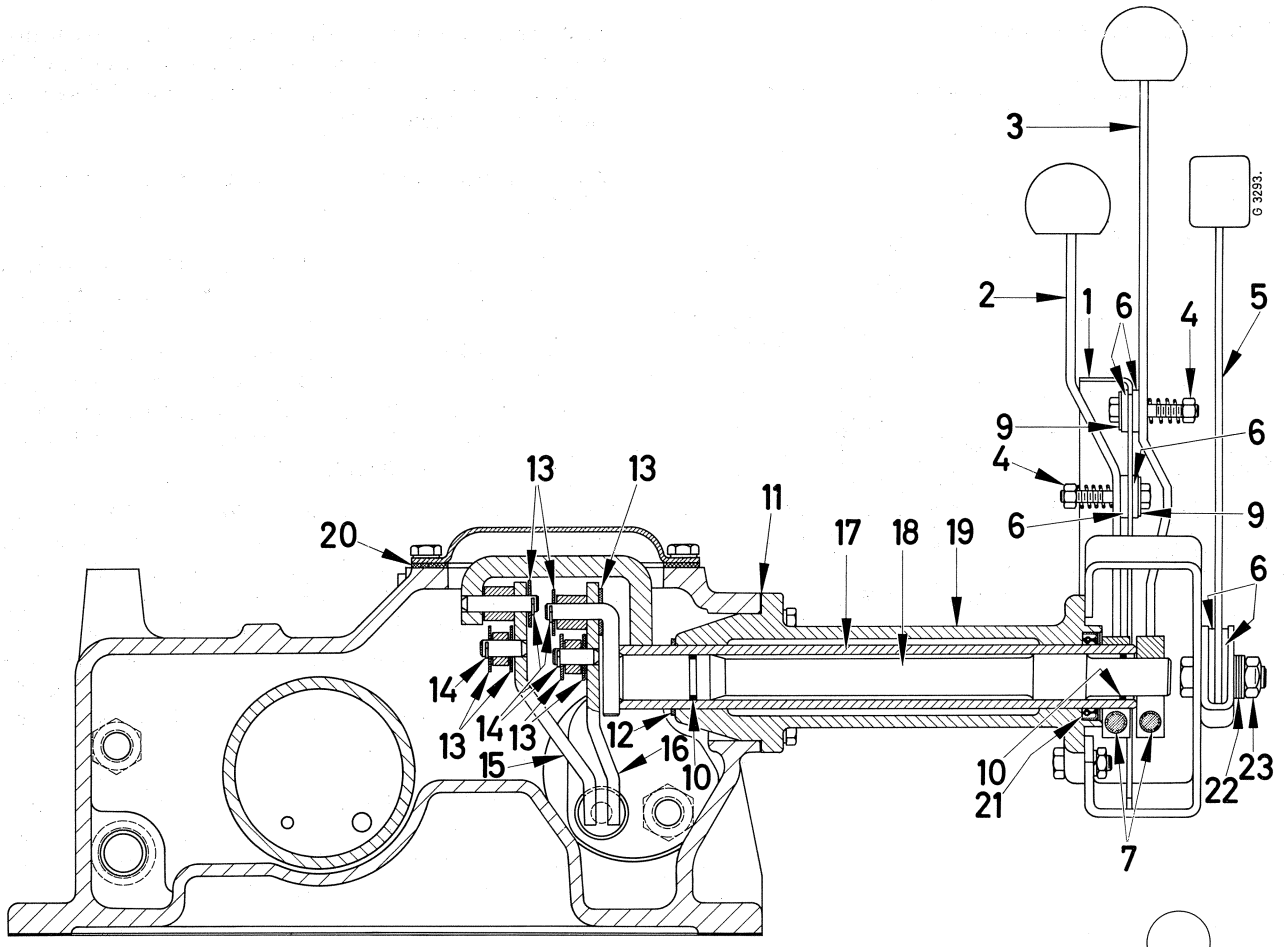
Operating Levers

Bolt the lever quadrant to the mounting flange. Install the operating levers without tightening the clamping bolts. Illusts. 67 and 68 show the internal control linkage assembled before adjustment.



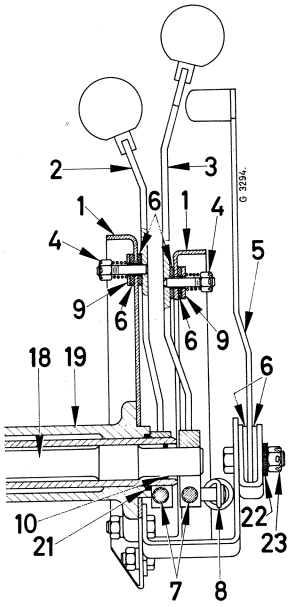
Illust. 67
Internal control linkage
(Present design)

1 — Position actuator
2 — Spring element, draft control
3 — Position spool lever
4 — Draft spool lever
5 — Draft link plunger
6 — Roll pin
7 — Suction strainer



Illust. 68
Control linkage
(Present design)

1 — Operating lever quadrant
2 — Position control lever
3 — Draft control lever
4 — Selflocking nut
5 — Marker lever
6 — Friction discs
7 — Clamping bolts
8 — Return spring
9 — Thrust washers
10 — O-rings
11 — Gasket
12 — Welded washer
13 — Flat round-hole washers
14 — Cotter pins
15 — Position spool lever
16 — Draft spool lever
17 — Position control tube
18 — Draft control shaft
19 — Bearing
20 — Gasket
21 — Oil seal
22 — Belleville washers (4)
23 — Selflocking nut

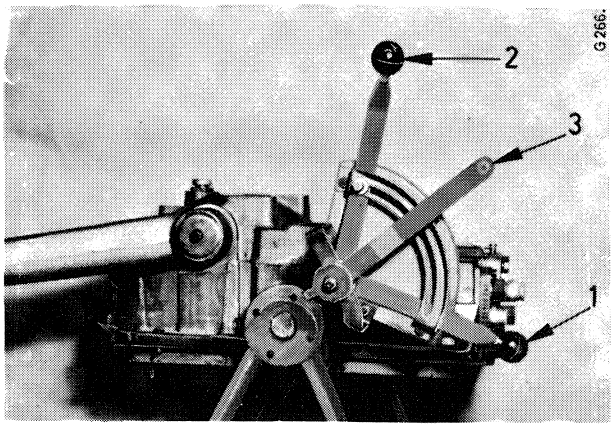


4 — Castellated nut (or 2 flat lock nuts)
12 — Circlip
21 — O-ring
23 — Castellated nut

Illust. 69
Control linkage
(Displaced design)

Adjusting Control Levers

Having installed all parts correctly, adjust the controls as follows:



Illust. 70

1 – Position control lever
2 – Draft control lever
3 – Marker lever

Move position control lever (1) Illust. 70 all the way down and draft control lever (2) all the way up. Turn draft control shaft (18) Illust. 68 until draft spool lever (16) depresses valve spool tappet all the way to "lifting with full capacity". Hold the draft control shaft in this position and, with the draft control lever all the way up, tighten the clamping bolt.

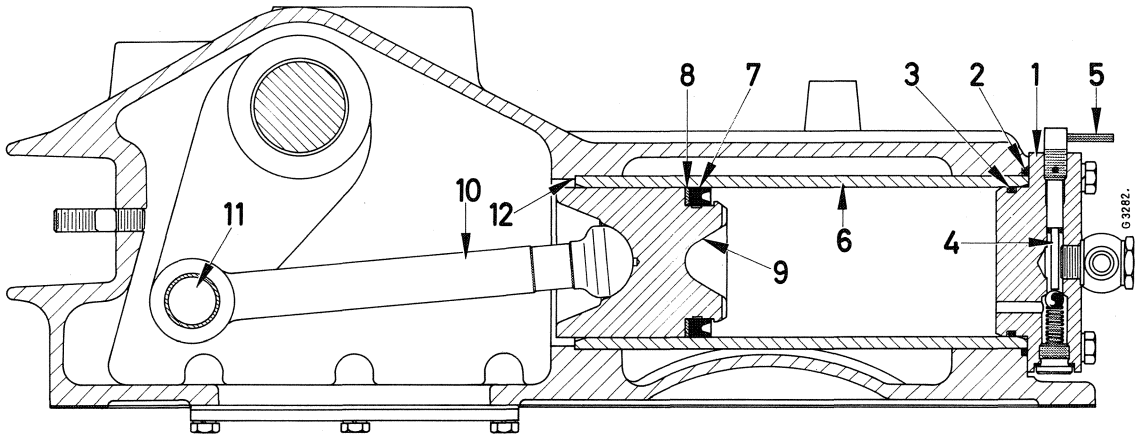
Spring element (2) Illust. 67 must not be preloaded in this position!

To adjust the position control lever (1) Illust. 70, it is necessary to load the system with a rocker arm to force the power arm all the way forward. With both control levers down all the way, turn the position control tube (17) Illust. 68 until position spool lever (15) just contacts the spool tappet without play. Now tighten up clamping bolt of the control lever, while holding the spool lever in contact with the tappet.

Place resistor discs (6) Illust. 68, thrust washers (9) and springs on pins of levers (2 and 3). Tighten selflocking nuts (4) in such a way that a resistance of approximately 8 to 10 kg = 18 – 22 lbs is felt on the ball when shifting the lever. Insert and spread cotters in nuts (displaced design). Install marker lever (5) with Belleville washers (22) and friction disks (6). Tighten the selflocking nut until a force of approximately 20 kg = 45 lbs is required to shift the marker lever.

Note: Protect friction disks (6) from oil and grease. Insufficient resistance at the marker lever is an indication that friction disks have been contaminated with lubricant. Fit return spring (8).

Power Cylinder and Cylinder Head



Illust. 71

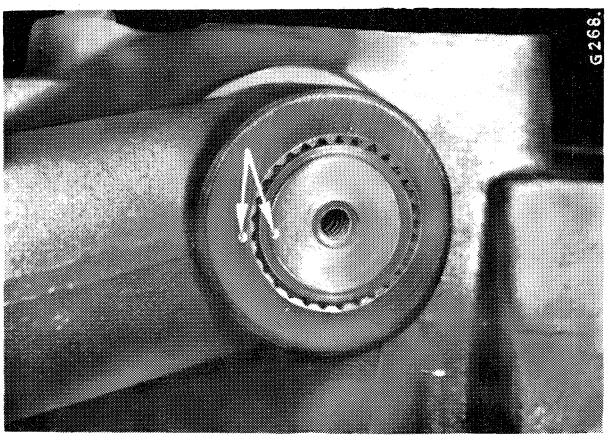
1 – Cylinder Head
2 – O-ring
3 – O-ring
4 – Spindle, lowering control valve
5 – Lever
6 – Power cylinder
7 – Piston seal
8 – Back-up ring
9 – Piston
10 – Ball-type connecting rod
11 – Wrist pin
12 – Power cylinder stop

Install the power cylinder as shown in Illust. 71, observing the following:

The cylinder (6) must rest against the stop (12). The larger chamfer is toward the front, on the cylinder head side. Cylinder end face must be flush with housing face but not deeper than 0.2 mm. Install piston (9) with back-up ring (8) and piston seal (7) from the front. Fit O-rings (2 and 3). Install cylinder head, taking care not to damage or twist O-rings. Tighten cylinder head bolts following a crosswise sequence. Fit connecting line (2) Illust. 13.

Rocker Arms

Rocker arms are the final step in the reassembly and installation procedure.



Illust. 72

Rocker arms are indentical and can be mounted right or left. Take care to align markings (arrows) Illust. 72. Secure the rocker arms in place with thrust washers, lock washers and bolts.

Illust. 73

Replace shims as found in disassembly, Illust. 73.

Lift Housing and Oil Lines

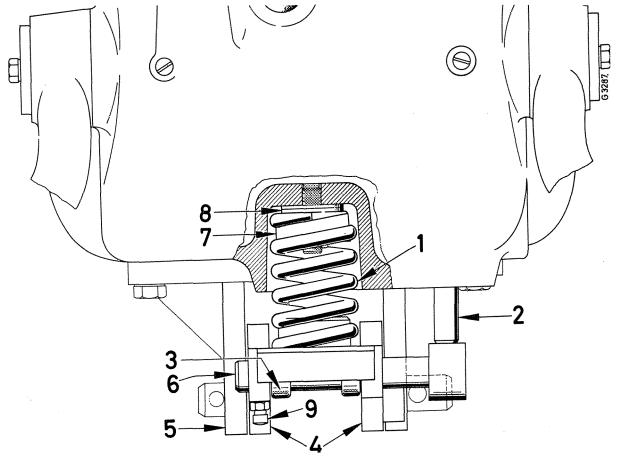
With a hoist carefully lower the lift housing onto the dowels of the main frame, using a new gasket. Tighten the flange bolts evenly. Take care that oil lines are installed without tension. Bend the lines slightly if necessary. Lines must not chafe on the tractor or against each other.

Do not overtighten nut unions.

Check the condition of the suction strainer before installing it. Use a new strainer if the screen is damaged or indented by excessive suction.

Bellcrank Spring

The bellcrank spring is bolted to the lift housing by means of a stud with nut and plate (7) Illust. 74 and 75.

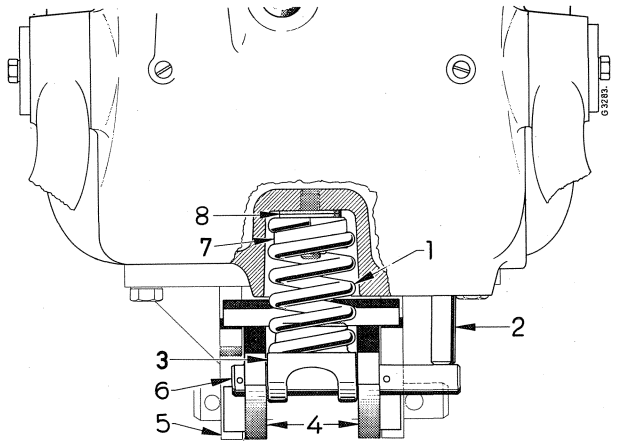


Illust. 74
(Present design)

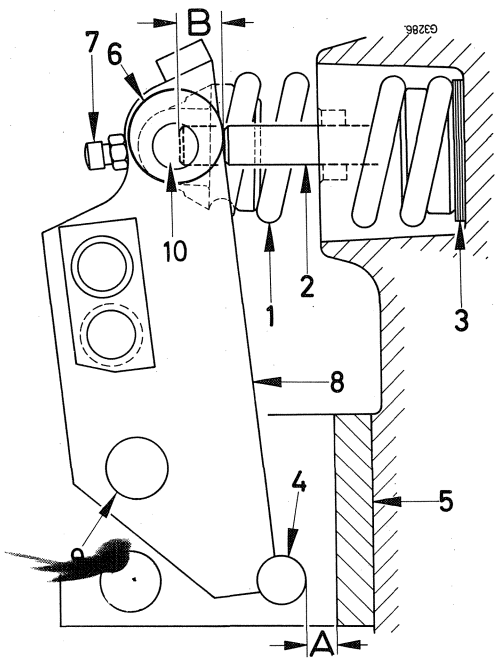
1 – Bellcrank spring
2 – Draft link plunger
3 – Screw-type plug
4 – Bellcrank
5 – Mounting bracket
6 – Spring retainer pin
7 – Spring plate
8 – Spacer washers
9 – Set screw and lock nut

When reinstalling the original bellcrank spring, be sure to fit all spacer washers (8) Illust. 74 as found on disassembly. To ensure proper alignment of the plug (3) hole with the bellcrank holes, first determine the correct position of the spring with the plug in place. Remove the plug and tighten the stud nut with a socket wrench. Replace the plug, making sure holes are in line. Retainer pin (6) must slide in freely.

Important: Retainer pin (6) Illust. 74 must be adjusted in accordance with Illust. 76.



Illust. 75
Displaced design and Vineyard versions



Illust. 76
(Present design)

A – 9.5 mm
B – 18 mm

1 – Bellcrank spring
2 – Draft link plunger
3 – Spacer washers
4 – Stop on bellcrank
5 – Mounting bracket for trailer hitch
6 – Eccentric cam (welded to retainer pin)
7 – Set screw with lock nut
8 – Bellcrank
9 – Pivot point of bellcrank
10 – Spring retainer pin

Tension Range of Bellcrank Spring

When a new bellcrank spring is installed, or if there is doubt about the spring adjustment, the tension range must be determined and adjusted, considering the design of the bellcrank, Illustrs. 75, 76 and 77.
Proceed as follows:

Shift draft control lever all the way up so that draft link plunger (2) Illust. 76 is run fully out. Measured from its oil seal metal case the plunger should protrude 58 mm, see A, Illust. 60.

Shift draft control lever down to pull in draft link plunger by 18 mm (tension range) i.e. in this position it must protrude 40 mm.

Install bellcrank spring (1) Illust. 76, see also Illust. 74. Determine distance A, Illust. 76, and correct by adding or removing washers (3). Adding of washers will decrease distance A, and vice-versa, at a 1 : 2 ratio. That is, a deviation of 1 mm at "A" means 2 mm of washers (3)!

Note: Should, in isolated cases, distance "A" still be too small with all washers (3) removed, this means that bellcrank spring is elongated or it is not properly screwed onto its spring plate or plug.

Distance "A" being correct, turn retainer pin (10) so that eccentric cam (6) just contacts draft link plunger (2) without play. Secure retainer pin and cam (6) in this position by set screw (7) and lock nut.

The following instructions also apply for the bellcrank design shown in Illust. 75.

In neutral or idle position, bellcrank (4) Illust. 77 is held in position by the bellcrank spring. In this position, draft link plunger (1) is pressed a certain distance into the lift housing by contact flap (3). This distance equals the tension range of the spring. It should be 9 – 12 mm (.36" – .47").

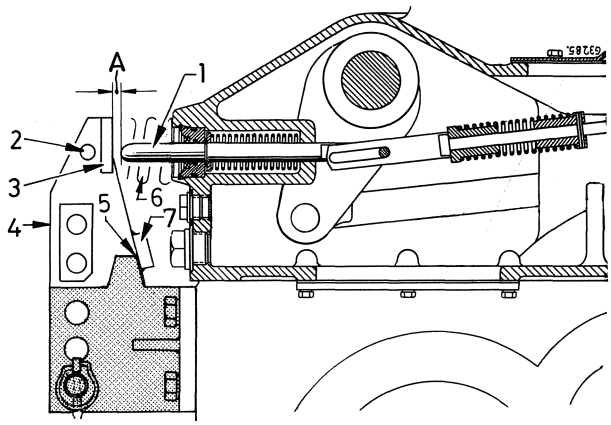
To determine the tension range, measure the distance between contact flap (3) and lift housing with the spring retainer pin (6) Illust. 75 installed. Remove the pin and measure length of protruding draft link plunger (2). The difference between the two dimensions is the tension range.

If the draft link plunger is depressed by more than 12 mm (.47"), add spacer washers (8); if the depression is less than 9 mm (.36") remove spacer washers.

When checking the tension range of the bellcrank spring, make sure that the basic bellcrank position is correct.

Remove spring retainer pin (2) Illust. 77 and pull bellcrank (4) all the way back so that stop (7) contacts stop (5). In this position there should be a clearance of 0.5 – 1 mm (.02" – .04") between contact flap (3) and draft link plunger (1). If necessary, bend the contact flap to obtain the specified clearance.

If dimension "A" deviates on the bellcrank design shown in Illust. 75, check length of draft link plunger at maximum protrusion (58 mm).



Illust 77
(Displaced design)
A = 0.5 – 1 mm (.02" – .04")

1 – Draft link plunger
2 – Spring retainer pin
3 – Contact flap for draft link plunger
4 – Bellcrank
5 – Stop on mounting bracket
6 – Bellcrank spring
7 – Stop on bellcrank

FINAL INSPECTION
(And venting the system)

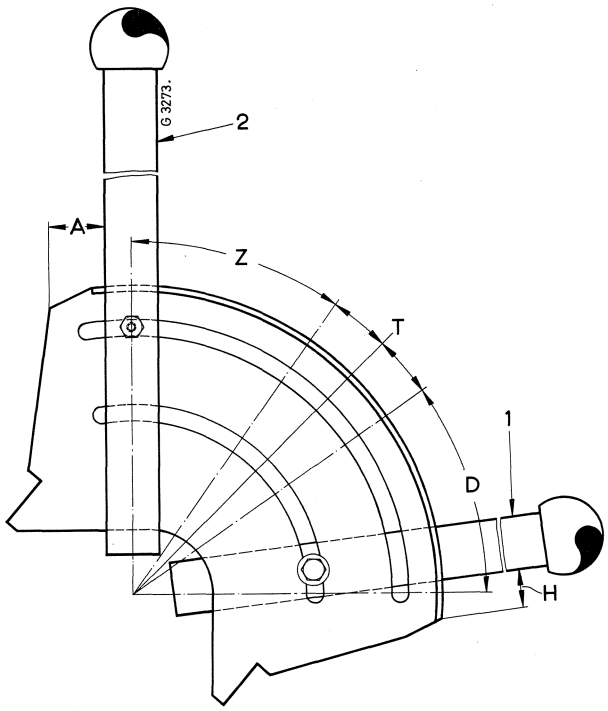
After the unit has been reassembled properly and filled with hydraulic fluid, vent the system and make a final inspection as follows:

Start the engine and run for three minutes at full speed. Operate the system, completing a few cycles of lifting and lowering. Check to see that all parts are working freely and that there is no interference with stationary tractor parts. Stop the engine and allow the oil to settle. The hydraulic fluid must now be free from air bubbles. Repeat the venting procedure if necessary.

Check the oil level with the engine stopped and top up to the upper mark of the dip stick.

Observe strict cleanliness! Great care must be taken on filling or adding oil to the system, to prevent water, dirt or any foreign matter from entering the lift housing. Inspect all seals, line connections etc. for evidence of leakage.

Check adjustment of operating levers (1) and (2) with the engine running, Illust. 78.



Illust. 78

1 – Position control lever
2 – Draft control lever
D – Pressure range 45°
Z – Tension range 45°
T – Dead position
(possible deviation 10° to both sides)
H – Float position 10–15 mm
A – Lifting range 10–15 mm

To check adjustment of position control lever, move both control levers (1 and 2) Illust. 78 all the way down to float position. The bellcrank pin or the adjusting cam must not contact the draft link plunger. Pull position control lever (1) over range (H), the system must now begin to lift.

If necessary readjust position control lever on its shaft.

The dead point of draft control lever must be within the range (T), to check this, pull lever up until the draft link plunger just contacts the bellcrank pin without play. The position of draft control lever must now be within range (T).

To check lifting range (A), move control lever (1) all the way down. Pull lever (2) up to range (A). The system must now lift to maximum height.

Note: The above inspection procedure applies equally to lever segment Illust. 69, with the exception of the "Dead Position", Illust. 1.

Check function of draft control valve spool. At a draft link plunger way of 1–2 mm = .039 – .078" in or out, the system must change over from neutral to either lifting or lowering respectively.

Check setting of lowering control valve spindle.

Check cut-out and pilot stream pressures.

Load the coupling balls of lower links with approx. 750 kg (1650 lbs) and check lifting speed. Operate the system at full engine speed, completing three to four cycles of lifting and lowering.

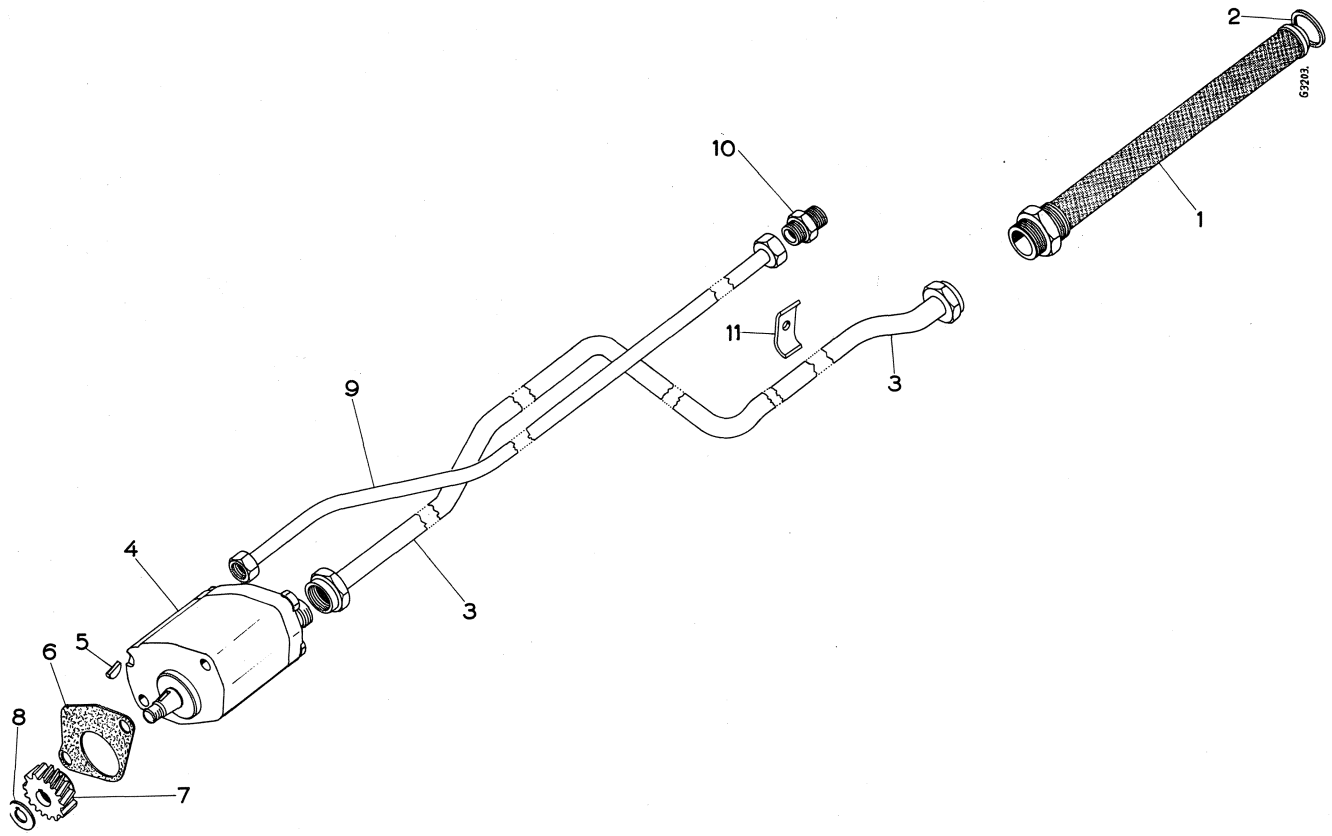
With a fluid temperature of 50–60°C = 120–140°F the lifting stroke should last no longer than 2.8 seconds to indicate that the unit is in good working order.

With the loaded rocker arms half-way up, stop the engine and mark rocker arm position. Check, after five minutes, if the rocker arm position has changed.

Lower the system and remove the load. Manually operate the rocker arm assembly over its full stroke to ensure free float.

Correct any possible faults, misadjustments etc. revealed by these checks as you go along. For the adjustment of the three-point linkage refer to the Operator's Manual of the tractor.

HYDRAULIC PUMP
(323 / V–323 Tractors)



Illust. 79

The system is equipped with a gear-type pump (4) Illust. 79 which is bolted to the crankcase front plate. The driver gear (7) is in mesh with the camshaft gear of the engine.

Idle capacity of a new pump ***at rated engine speed*** (1900 rpm) is 24–25 L/min.

The following data have been prepared to enable checking pump capacity on a test bench.

Pump is designed for:

Max. permissible rpm 3850.

Max. permissible pressure 150 bar (2130 PSI).

Idle capacity ***at 3000 pump rpm*** = 21 – 21.5 L/min.

Reduced pump capacity when operating against a pressure of 150 bar (2130 PSI) is 20 – 21 L/min.

Replace the pump if capacity is less than 19 L/min. ***at 1900 engine rpm*** and an operating pressure of 150 bar (2130 PSI).

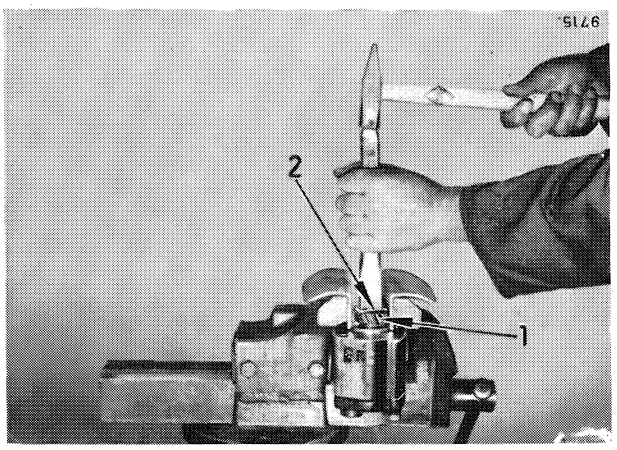
(At 3000 pump rpm and operating against a pressure of 150 bar (2130 PSI) capacity must be at least 16 L/min.)

Because of the close tolerances involved pump repairs are not considered practicable and are, as a rule, restricted to the replacement of sealing parts.

Drain the hydraulic fluid from the system.

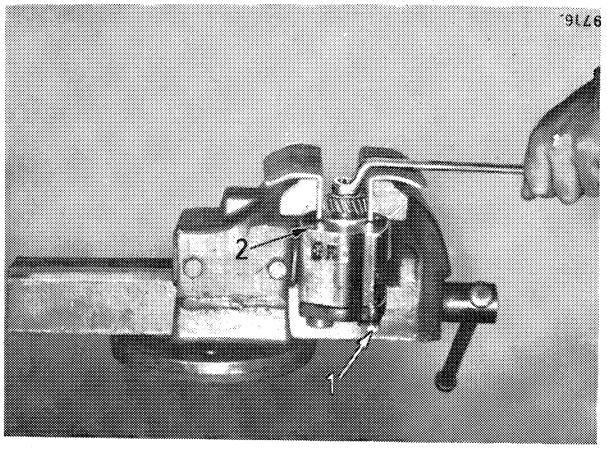
After removing the pump from the engine, cap up port (1) and (2) Illust. 82.

Clamp the pump drive gear (1) Illust. 80 in a vice with soft jaws. Bend up lock washer (2) and remove the drive shaft nut.



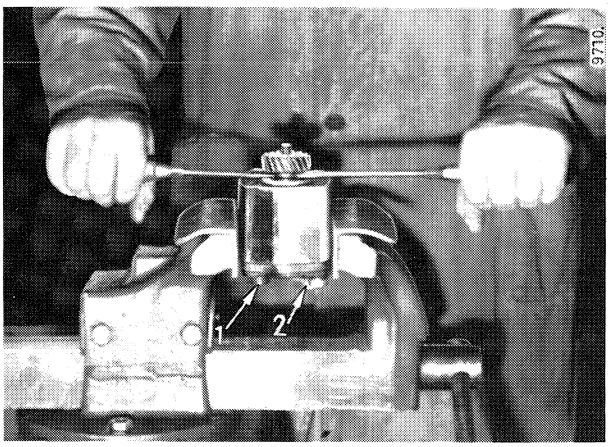
Illust. 80

1 – Pump drive gear
2 – Lock washer



Illust. 81

1 – Housing bolt
2 – Through hole, pump mounting



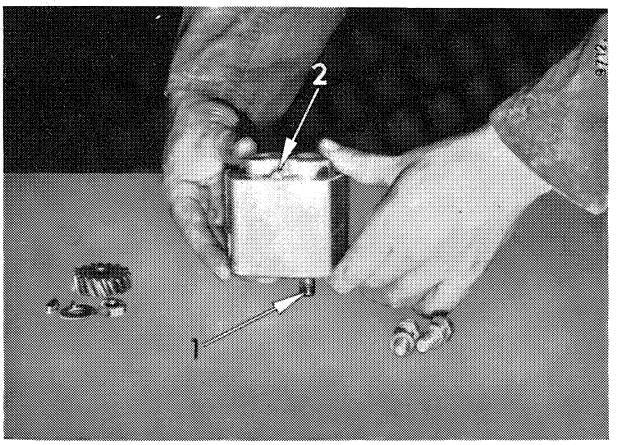
Illust. 82

1 – Capped pressure port
2 – Capped suction port

Remove the drive gear. If no suitable puller tool is available, carefully pry off the gear with two screwdrivers Illust. 82. Take the Woodruff key out of the drive shaft groove.

Remove the pump cover. If necessary, loosen the cover by lightly tapping the drive shaft on a piece of wood.

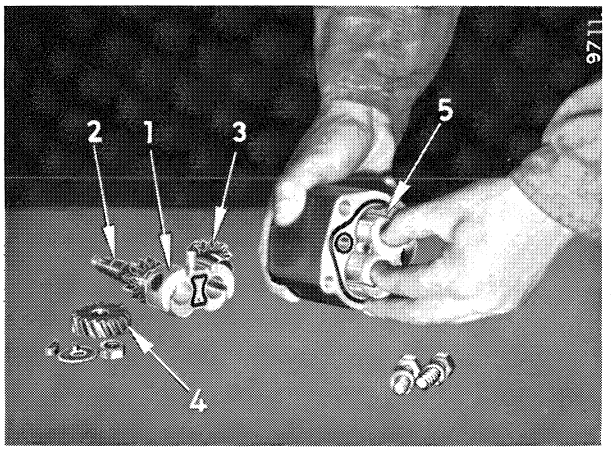
The rear pump bearing (2) Illust. 83 can be removed in the same manner.



Illust. 83

1 – Drive shaft
2 – Rear bearing

Before removing the two pump body gears mark their position to each other to ensure correct reassembly. Take out front pump bearing (5) Illust. 84.



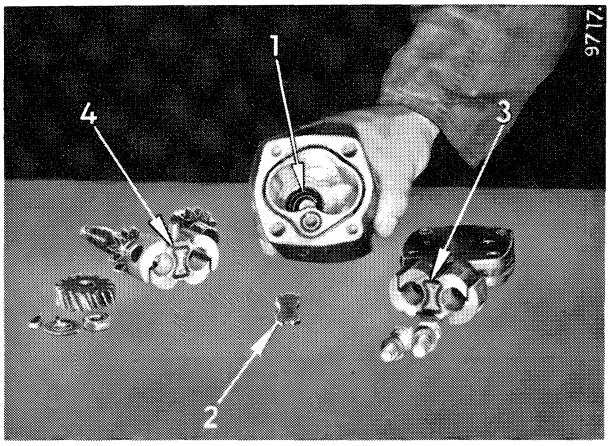
Illust. 84

1 – Rear bearing
2 – Drive shaft with gear
3 – Idler gear
4 – Pump drive gear
5 – Front bearing

Remove sealing plate (2) Illust. 85 and drive shaft oil seal (1). Thoroughly clean all parts in a suitable solvent and dry with compressed air.
Do not use rags!

Before reassembly dip the parts in hydraulic fluid to provide initial lubrication.

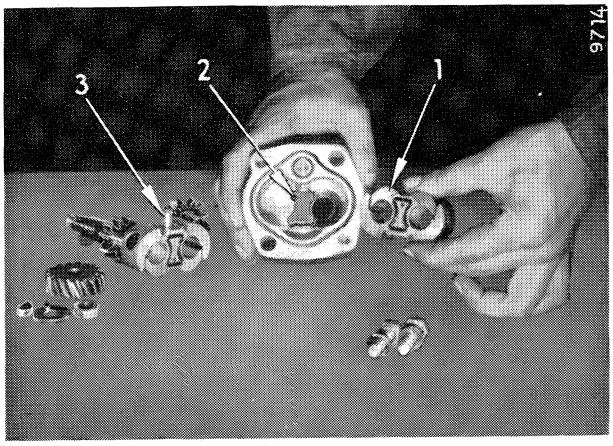
Install the new oil seal (1) Illust. 85 in the housing, using a suitable drift punch. The spring-loaded sealing lip must point inwards.



Illust. 85

1 – Drive shaft oil seal
2 – Sealing plate
3 – O-ring, front bearing
4 – O-ring, rear bearing

When installing the sealing plate (2) Illust. 86 take care that the sealing face points inwards and the sealing plate shoulder seats into the housing recess.



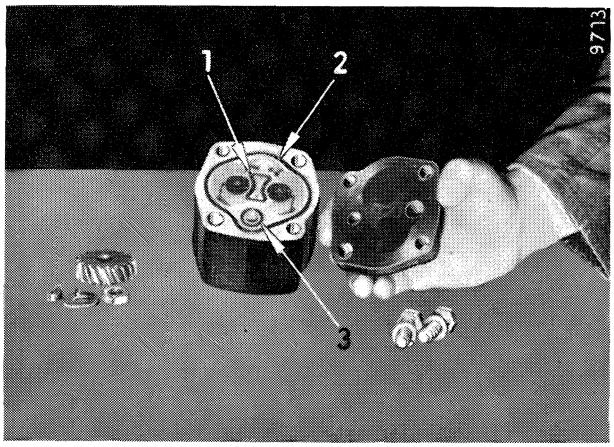
Illust. 86

1 – Front bearing
2 – Sealing plate
3 – Rear bearing

Slightly oil O-ring (3) Illust. 85 and install in the front bearing. Insert the front bearing, with the O-ring towards the sealing plate, into the housing.

Install the pump body gears, observing the markings made on disassembly.

Install O-ring (4) in its groove and insert the rear bearing, with the O-ring pointing outwards, into the housing.



Illust. 87

1 – O-ring, rear bearing
2 – O-ring, cover
3 – O-ring, pressure port

Install O-rings (2) and (3) Illust. 87.

Replace the pump cover and tighten the cover screws in two or three steps to a torque of 3–3.5 daNm (22–25 ft.lbs).

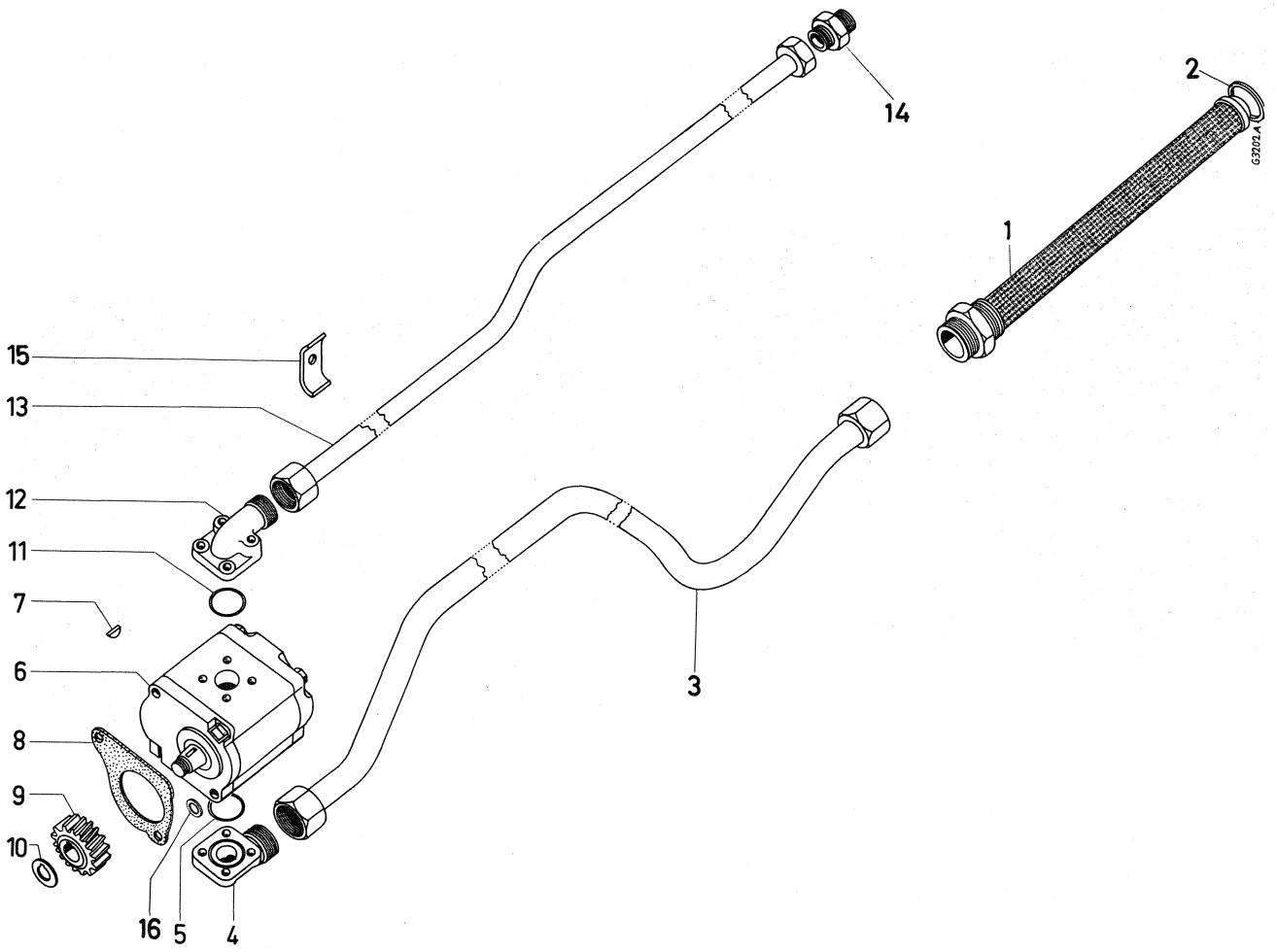
Install Woodruff key, pump drive gear, lock washer and nut. Tighten nut to a torque of 10–12 daNm (72–86 ft.lbs) and secure with a lock washer.

Pour some hydraulic fluid into the ports and check the pump for freedom of rotation. There should be a light drag due to the O-rings.

Reinstall the pump together with a new gasket. Torque the mounting bolts evenly to 3–3.5 daNm (22–25 ft.lbs). Connect pressure and suction line to the pump.

Fill the lift housing with the specified hydraulic fluid and vent the system, see "Final Inspection".

HYDRAULIC PUMP
(353 / 383 / 423 / 433 / 453 / 533 Tractors – V+E Versions)



Illust. 88

The tractors are equipped with a pump of "Bosch" manufacture.

The following illustrations do not show the "Bosch" pump. There are, however, no differences of any significance as regards size and capacity; and servicing procedures apply equally to the "Bosch" pump.

The pump (6) is bolted to the crankcase front plate. The drive gear (9) is in mesh with the camshaft gear of the engine.

Idle capacity of a new pump at ***rated engine speed*** (1900 rpm) is 25.0–25.6 L/min.

The following data has been prepared to enable checking pump capacity on a test bench.

Max. permissible pressure 185 bar (2630 PSI).

Idle capacity ***at 3000 pump rpm*** = 24 – 24.5 L/min. Reduced pump capacity when operating against a pressure of 185 bar (2630 PSI) 21.5 – 22.0 L/min.

Replace the pump if capacity is less than 18 L/min = ***at 1900 engine rpm*** and an operating pressure of 185 bar (2630 PSI).

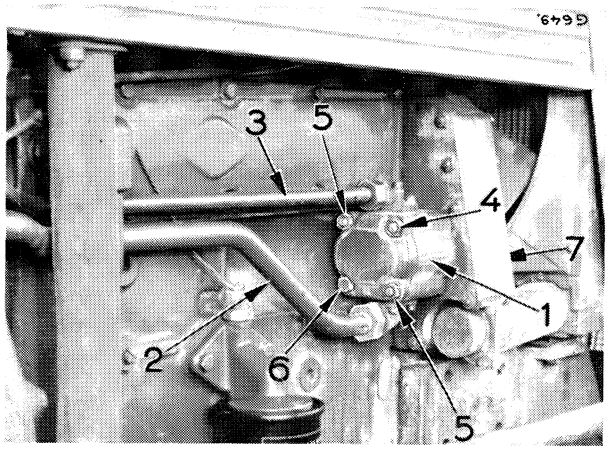
At 3000 pump rpm and operating against a pressure of 185 bar (2630 PSI) capacity must be at least 17 L/min.

Because of the close tolerances involved, pump repairs are not considered an economical proposition. If pump capacity is low, oil tends to heat up excessively.

The discoloration due to heat is a sure sign of low pump efficiency. Therefore, if this discoloration or flaking off of paint is noted, the pump must be replaced without delay.

Important: If a pump is replaced the hydraulic fluid must also be changed.

Pump repairs are restricted to replacement of seals and gaskets. For a pump service package see Parts Catalog.



Illust. 89

1 – Gear-type pump
2 – Suction line
3 – Pressure line
4 – Stud nut
5 – Pump housing bolts
6 – Mounting bolt
7 – Mounting bolt nut

Drain hydraulic fluid. Remove pressure and suction lines (3 and 2) Illust. 89. Remove stud nut (4) and mounting bolt (6). Unmesh the drive gear and take the pump unit out of its recess.

Remove drive gear nut and washer and take off the drive gear (9) Illust. 90 using a suitable puller. Check this gear for wear, cracks, scoring, chipping, etc. Should damage of this nature be noted, it is advisable to check the camshaft gear of the engine also. Refer to the respective service manual for engines.

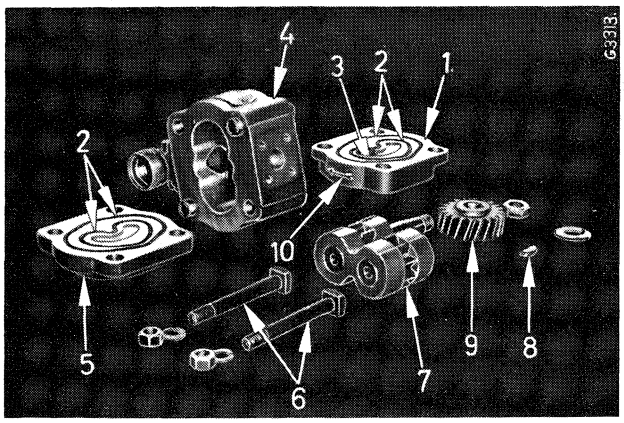
Disassemble the pump only as far as is necessary to replace seals, see Illust. 90.

Housing components (1, 4 and 5) are kept in alignment by dowel roll pins. To open the housing, apply a suitable mallet after removing the bolts.

Pump cartridge (7) is a thumb push fit in the housing. Do not use force to remove the cartridge.

Clean all parts in a suitable solvent and dry with compressed air, do not use rags!

Dip moving parts in clean hydraulic oil on reassembly.



Illust. 90

1 – Housing cover (drive end)
2 – O-rings
3 – Oil seal
4 – Pump housing
5 – Housing cover rear end
6 – Housing bolts
7 – Pump cartridge
8 – Woodruff key
9 – Drive gear
10 – Directional arrow

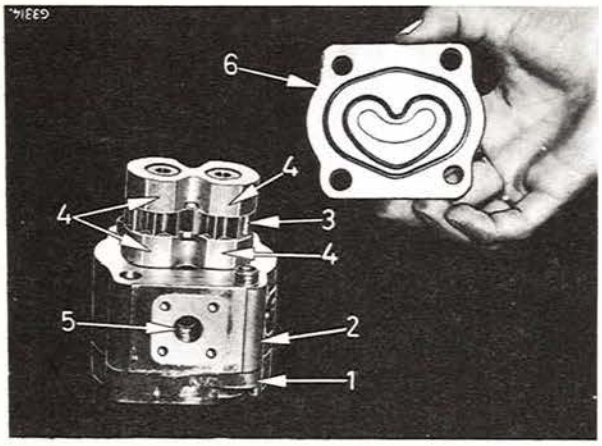
Replace covers (1 and 6) Illust. 91 using new O-rings (2) and oil seal (3) Illust. 90.

Press the oil seal all the way into the cover recess and secure in place with a circlip. Make sure when replacing cover (1), that directional arrow (10) points to the pressure side of housing (2) Illust. 91.

Enter pump cartridge (3) as illustrated, making sure that pressure side (4) is in line with ports (5).

Replace cover (6) and gradually tighten housing nuts to a final torque of 7.5 – 8 daNm (54 – 58 ft.lbs).

When fitting the pump drive gear (9) Illust. 90 on the tapered shaft, use a new woodruff key (8). Install lock washer and tighten the shaft nut to 10 to 12 daNm (72 – 86 ft.lbs). Secure the nut with lock washer. Insert the pump drive gear and mesh with the camshaft gear using a new gasket. Tighten stud nut (4) Illust. 89 and mounting bolt (6) to a final torque of 7.5 – 8 daNm (54 – 58 ft. lbs) alternating from nut (4) to nut (7) several times.



Illust. 91

1 – Housing cover (drive end)
2 – Pump housing
3 – Pump cartridge
4 – Pressure side, indicated by flat surfaces
5 – Pressure port
6 – Pump cover, rear end

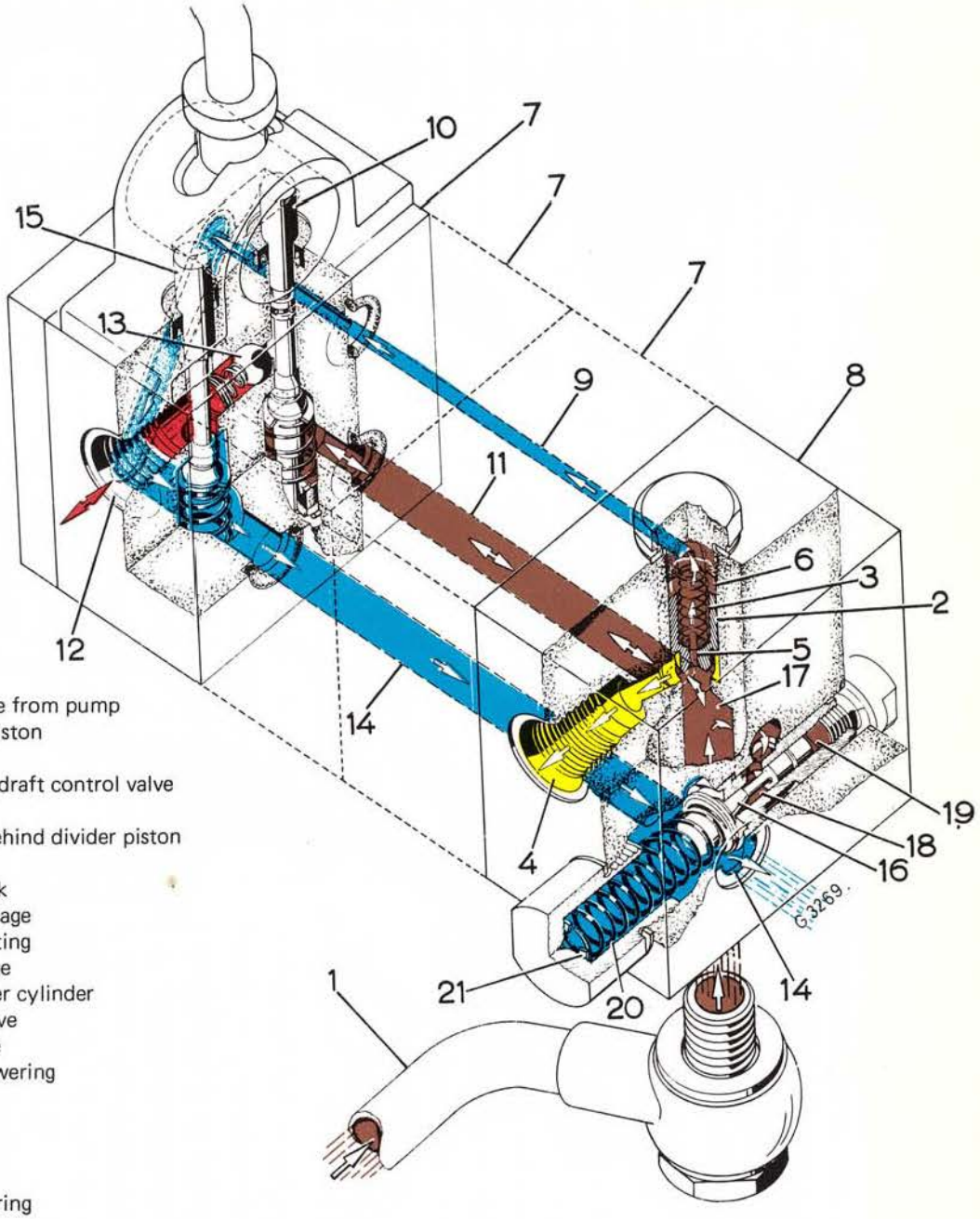
Nut (7) of mounting bolt (6) can be reached between radiator and water channel.

Note: Stud nut (4), mounting bolt (6) and its nut (7) are secured by belleville washers. Place a belleville washer each below the nuts of the mounting bolt, the stud and the bolt head, taking care that the small diameter contacts the bolt head or the nut.

Before connecting the oil lines, be sure to fill some hydraulic fluid into the pump to ensure initial lubrication. The oil circulating through the pump also takes care of its lubrication. With pump in place, the engine should therefore, not be started unless the system is properly filled with hydraulic fluid.

Fill up hydraulic fluid and vent the system as described under "Final Inspection". After a trial run allow the system to cool down and draw up the pump mounting bolt and stud nut (4 and 6) Illust. 89 to the specified torque.

ADDITIONAL CONTROL VALVES



Illust. 92

1 – Pressure oil line from pump
2 – Flow divider piston
3 – Spring
4 – Outlet port to draft control valve
5 – Orifice
6 – Oil chamber behind divider piston
7 – Control valve
8 – Mounting block
9 – Restricted passage
10 – Valve stem, lifting
11 – Pressure passage
12 – Outlet to power cylinder
13 – Non-return valve
14 – Return passage
15 – Valve stem, lowering
16 – Relief valve
17 – Oil chamber
18 – Oil chamber
19 – Oil cushion
20 – Relief valve spring
21 – Shims

= Operating pressure

= Return oil

= Pilot stream pressure, additional control valves 8 – 9 bar (115–130 PSI)

= Pilot stream pressure, draft control valve 6 – 7 bar (85–100 PSI)

General

Certain additional equipment such as front loaders, power mowers, etc. operated by remote hydraulic control, necessitate the use of additional control valves as shown in Illust. 92. Up to three control valves (7) can be mounted in series on a mounting block (8), using an end plate to close the ports on the outside. Control valves can be factory mounted on special order. Repairs on these valves are restricted to replacement of seals and gaskets. If trouble develops which cannot be rectified, replace the defective valve unit with a new valve available through the usual service parts channels. The operating principle is now briefly explained to help in finding the cause of any trouble that might develop. Illust. 7a shows the complete system as a unit.

Neutral

Illust. 92 shows the additional control valve assembly in neutral. The pressure oil from the pump enters the mounting block (8) from the bottom at line (1), forcing flow divider piston (2) up against spring (3). When the pressure build-up has reached 8–9 bar (115–130 PSI) (brown), the flow divider piston (2) is forced up from its seat clearing outlet port (4) to draft control valve and partly restricting passage (9) until pressure at (17) and (6) is nearly the same. This pilot stream is necessary for operating the flow divider piston (2). In neutral, this pilot stream is displaced through passage (9) and return passage (14) into the reservoir. When operating the draft control valve, pressure will build up in line (1), below flow divider piston (2) and in outlet port (4), depending on the load acting on the draft control system. The flow divider piston will again take up a restrictive position, nearly equalizing pressure at (17 and 6).

Lifting

To lift with a remote control cylinder, valve stem (10) must be depressed. By this action, the pilot stream return flow passage (9) is blocked, while the outlet port (12) is opened. Blocking passage (9) results in a pressure build-up in chamber (6) until a hydraulic balance is achieved between (6) and (17). At this point, spring (3) reasserts itself pushing down flow divider piston (2) to close outlet port (4). The complete pump capacity is now displaced through passage (11) and outlet port (12) to the additional remote control cylinder. Non-return valve (13) is opened by the pressure oil flow. The lifting operation is ended when valve stem (10) is free to move downwards, closing passage (11) and opening pilot stream return passage (9). Non-return valve (13) becomes re-seated, preventing return flow from the remote control cylinder.

Lowering

For lowering, valve stem (15) is depressed, opening the return passage (14). The remote control cylinder, being under load from the implement, will displace the oil, draining it into the reservoir through passage (14).

Flow divider piston (2) remains up in its "neutral" position permitting the pump capacity to be displaced through outlet port (4) to the draft control valve. Lowering operation is ended when the remote cylinder is at the end of its stroke or when the lowering valve stem (15) is allowed to go up, closing return flow passage (14). Non-return valve (13) remains on its seat. If lowering operation was interrupted by valve stem (15), the implement will be locked in the position it was in when the return was cut off.

Relief Valve

The additional remote control circuit is protected while lifting by a relief valve (16). Chambers (17 and 18) are connected by a small passage so that pressure build-up at (17) is equal to pressure at (18). The oil squeezes past the valve guide piston into chamber (19), resulting in a slightly delayed relief valve action. If the pressure limit is exceeded, valve (16) is forced off its seat against spring (20) by the pressure oil in chamber (19). Oil from chamber (18) can now drain into return passage (14).

Shims (21) are provided behind relief valve spring (20) to allow for a pressure setting.

Note: Should this relief valve not function properly, i.e., if the valve leaks or opens too early, the draft control system may be affected, resulting in loss of lifting power.

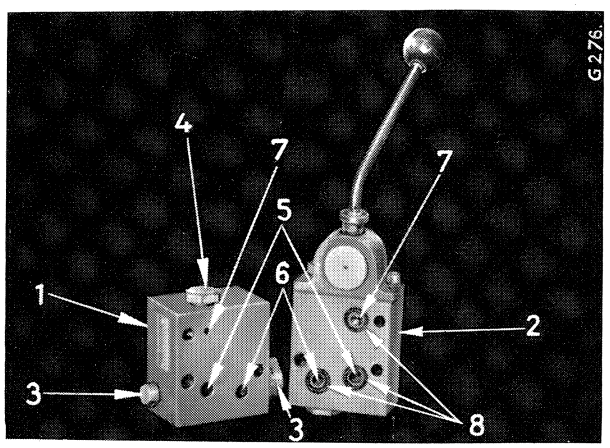
Removal and Disassembly

Wash the tractor thoroughly.

Disassemble oil lines taking care to tape them up so that no dust can enter. The complete control valve assembly can now be removed by taking out the two bottom mounting bolts.

The upper bolt secures the control valve assembly to the mounting block. Remove this bolt and take off individual control valves. Replace O-rings (8) Illust. 93 and (2) Illust. 94 whenever the unit is disassembled. The same applies to the O-ring for the mounting block return oil pipe.

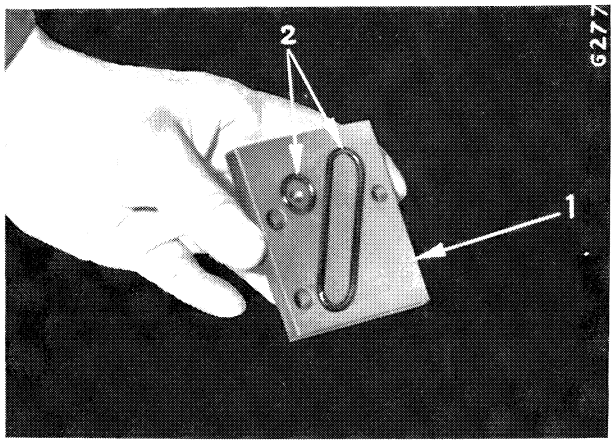
Remove relief valve assembly and flow divider from the mounting block (1) Illust. 93.



Illust. 93

1 – Mounting block
2 – Additional control valve
3 – Plugs (relief valve)
4 – Plug (flow divider)
5 – Feed passage (lifting)
6 – Return passage (lowering)
7 – Pilot stream passage (see also (9) Illust. 92)
8 – O-rings

Note: On control valves of present production series there are two plates (14 and 28) Illust. 110 instead of end plate (1) Illust. 94.



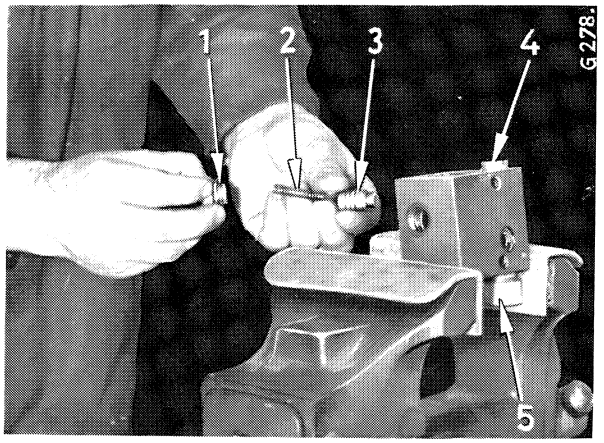
Illust. 94

1 – End plate
2 – O-rings

To remove the flow divider unit, take out plug (1) Illust. 95 with packing ring and spring (2). Tap the mounting block on a clean piece of wood or use a clean pair of tweezers to remove the flow divider piston.

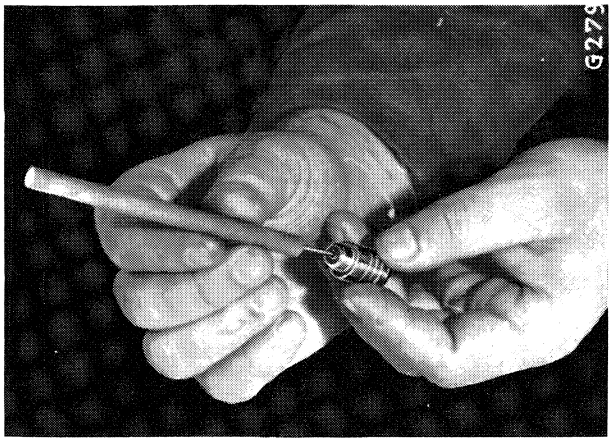
To remove the relief valve, take out plug (5). Remove valve spring, shim and packing ring. Shake the mounting block assembly to remove valve poppet (3) Illust. 97. To remove the valve housing (2), take out plug (4) Illust. 95.

Clean all parts in solvent. Blow passages in the mounting block dry with compressed air. Check to see if the central orifice of the flow divider is clogged.



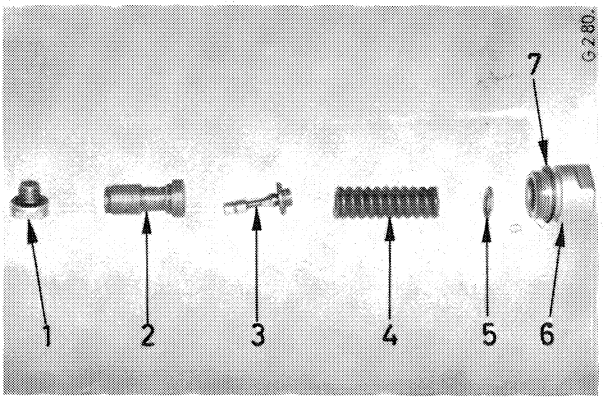
Illust. 95

1 – Plug
2 – Flow divider spring
3 – Flow divider piston
4 – Relief valve plug, rear
5 – Spring plug, front



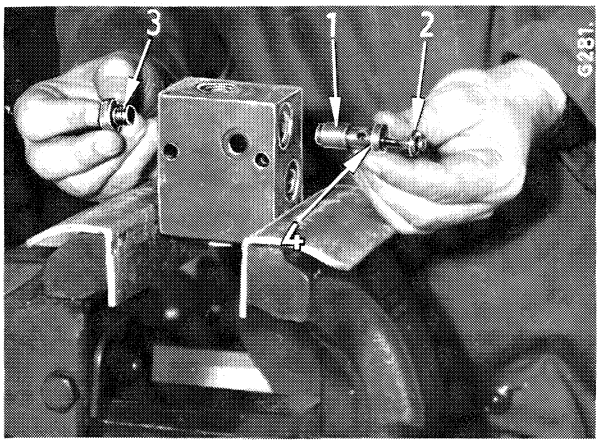
Illust. 96
Cleaning the flow divider orifice

Clean the orifice with a suitable needle, as shown in Illust. 96. Also clean the pilot stream passage (7) Illust. 93 in the mounting block, using a needle. Check the flow divider piston to see if it moves freely in the housing. If necessary clean the piston by removing minor localized damage with a mild lapping compound. Be careful to remove all remnants of this compound before installing the flow divider piston.



Illust. 97

1 – Relief valve plug, rear
2 – Relief valve housing
3 – Valve poppet
4 – Valve spring
5 – Shim
6 – Spring plug, front
7 – Packing ring

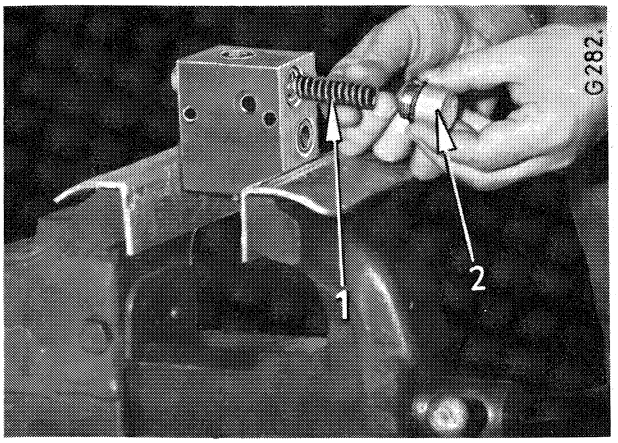


Illust. 98
Tighten plug (3) to 2.5 – 3 daNm (18 – 22 ft.lbs)

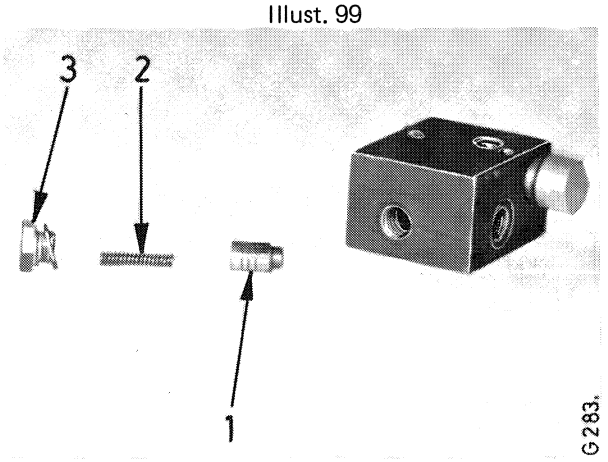
Inspect the sealing face and seat of poppet (3) and valve housing (2). If damage is noted on these parts, the complete mounting block unit should be replaced. To reassemble the relief valve, first install valve housing (1) and poppet (2), Illust. 98. Be sure to use a packing ring on plug (3) and on housing shoulder (4).

Note: When ordering service parts take care to select parts that correspond with the operating pressure of the system. For details see parts catalog.

Install relief valve spring (1) Illust. 99. Be sure to use the shim found on disassembly in the recess of plug (2). Install this plug, using a new packing ring and tighten to 5 – 7 daNm (36 – 50 ft.lbs).



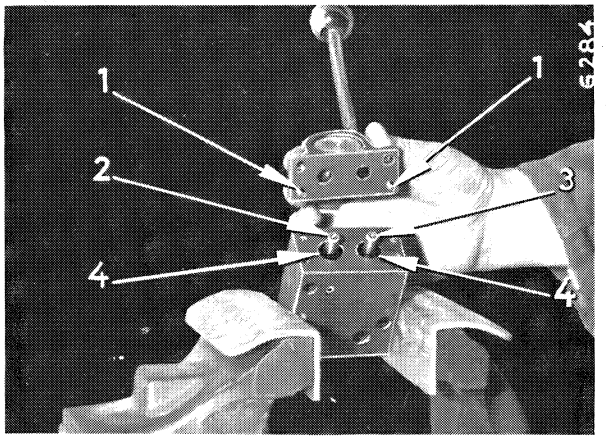
Illust. 99



Illust.100

Install flow divider piston (1) Illust. 100 with spring (2) using the washer found on disassembly. Install a new packing ring on plug (3) and tighten to 4–7 daNm (30–50 ft.lbs).

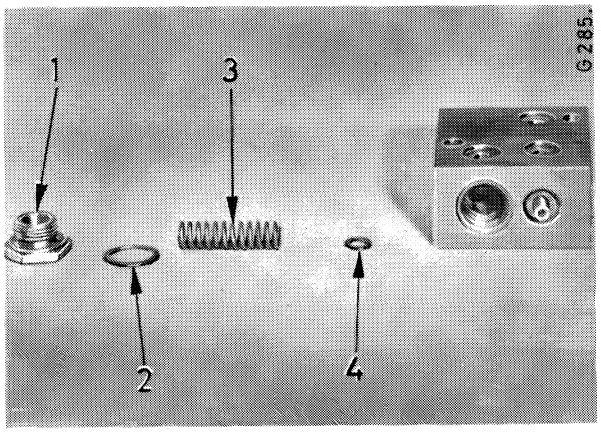
To disassemble the control valve, proceed as follows:



Illust. 101

1 – Roll pins
2 – Valve stem (lifting)
3 – Valve stem (lowering)
4 – Stem seals

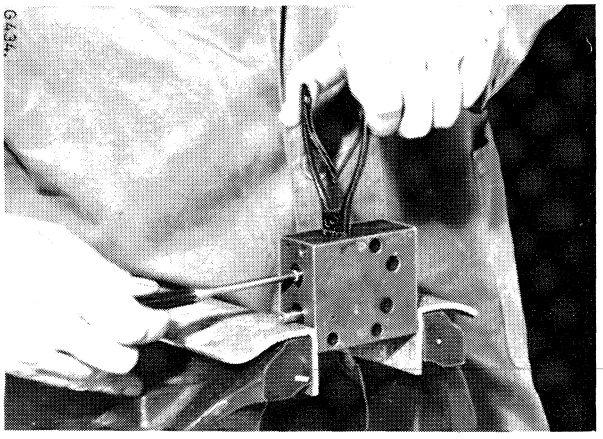
Remove "Allen" screws, securing lever head and lift off the assembly Illust. 101. Remove washers from stem seals (4). To remove valve stem (3), take out bottom plug with packing ring, spring and spring washer, Illust. 102.



Illust. 102

1 – Plug (bottom), torque load 4–5 daNm (30–50 ft.lbs)
2 – Packing ring
3 – Valve spring
4 – Spring washer

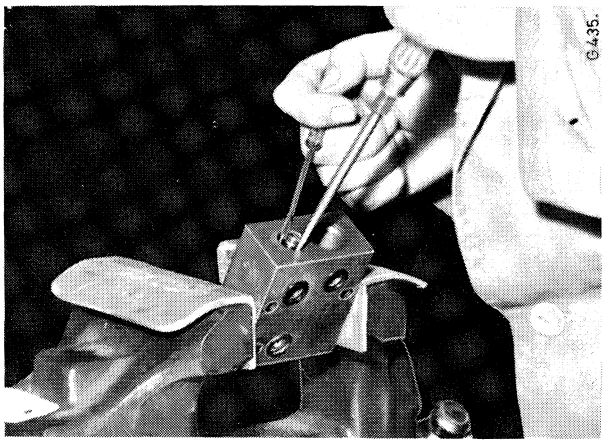
Then push out the valve stem towards the bottom while depressing the non-return valve spring with a suitable tool (tweezers or pliers, etc.), see Illust. 103.



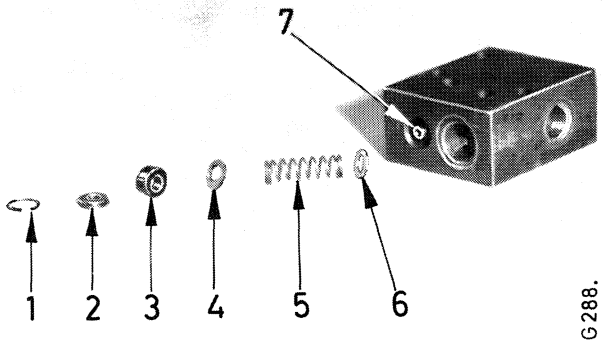
Illust. 103

Removal of the other valve stem (12) Illust. 108 necessitates removal of the bottom snap ring (16).

To do this, depress the spring washer with a suitable tool, then depress the snap ring center making both legs stand out, see Illust. 104. After removing the snap ring, the spring will lift out the stem seal and the respective washers. Be careful to keep the spring under control to avoid injuries.



Illust 104



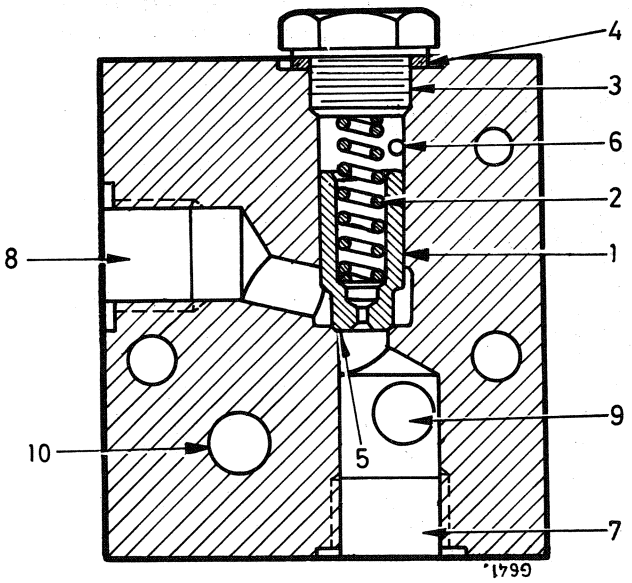
Illust. 105

1 – Snap ring
2 – Stepped washer
3 – Stem seal
4 – Spring washer (with oil passage)
5 – Valve spring
6 – Spring washer
7 – Valve stem (lifting)

Use a clean punch to push the valve stem (7) Illust. 105 out of the housing (there is a light drag due to the O-ring, see also (11) Illust. 108). Remove stem seals (4) Illust. 101.

Clean all components in solvent. Blow passages in the housing dry with compressed air. Carefully inspect all parts and use a new valve if defects are noted. If all parts are in order, reassemble the valve unit ***using new seals, O-rings and gasket throughout.***

Special seal and gasket packages are available for this purpose.



Illust. 106
Flow Divider in Mounting Block

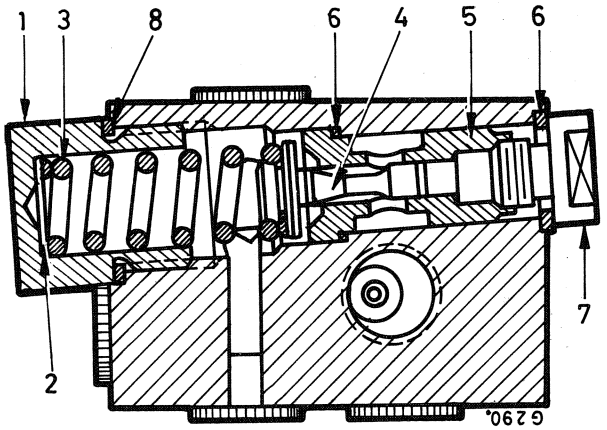
1 – Flow divider piston
2 – Flow divider spring
3 – Plug
4 – Packing ring (16 x 22 mm)
5 – Flow divider seat
6 – Pilot stream passage
7 – Inlet port from pump
8 – Outlet port to draft control valve
9 – Feed passage (lifting), additional control valve
10 – Return passage to reservoir

Note: Back-up washers (10) Illust. 108 included in the service package differ in their inner dia. viz 8.05 – 8.10 mm = .316 – .318" and 8.25 – 8.30 mm = .324 – .326". This is necessary because of the tolerances in valve stem dia.

When fitting the back-up washers take care that there is no more than 0.1 mm clearance between washer and valve stem.

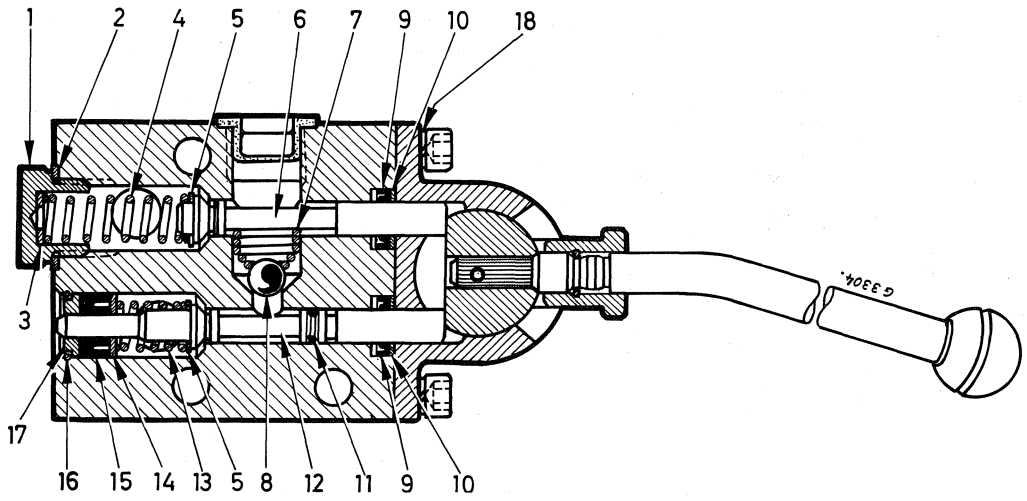
Reassembly is essentially the reverse of the disassembly procedure. The following Illust. 106 to 108 show the correct relation of components for reassembly.

Note: When installing valve stem (12) Illust. 108 be sure to depress O-ring (11) through the cross bore of non-return valve (8) with a suitable tool to avoid damage.



Ilust. 107
Relief valve in Mounting Block

1 – Spring plug (torque 5–7 daNm (35–50 ft.lbs)
2 – Shim
3 – Relief valve spring
4 – Valve poppet
5 – Valve housing
6 – Packing rings 14 x 18 mm (Part. No. 933 610 R1)
7 – Plug (torque 2.5 – 3 daNm (18–22 ft.lbs)
8 – Packing ring 22 x 27 mm



Illust. 108

1 – Plug
2 – Packing ring 20 x 24 mm
3 – Spring washer (lower)
4 – Valve spring
5 – Spring washer (upper)
6 – Valve stem (lowering)
7 – Tapered spring
8 – Non-return valve ball
9 – Stem seal
10 – Washer, back-up
11 – O-ring
12 – Valve stem (lifting)
13 – Valve spring
14 – Spring washer (with oil passage)
15 – Stem seal, bottom
16 – Snap ring
17 – Stepped washer
18 – Spring lock washers

Reassemble the control valve unit with mounting block and end plate(s) to the lift housing, taking care that all O-rings (12) Illust. 110, are in place. Tighten mounting bolts in several steps to a final torque of 2.5 daNm (18 ft.lbs).

Reconnect pressure lines (1 and 7) without tension.

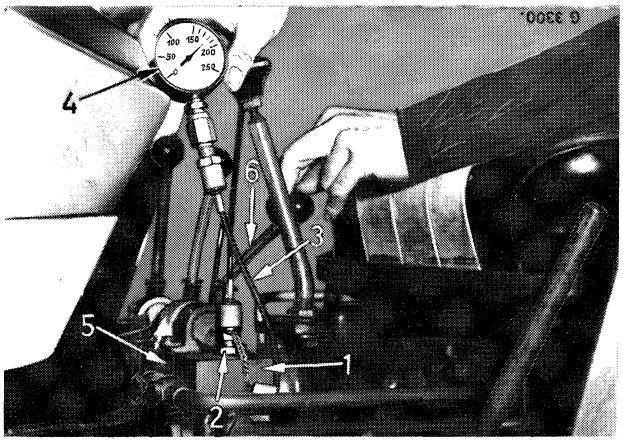
Replace all other oil lines. Fill and vent the system. Start the engine and check control valve action.
Check for any possible leakage.

Check relief valve Illust. 107 as follows.
Connect pressure gauge as shown in Illust. 109. Flow divider piston (1) Illust. 106 and spring (2) must remain in the mounting block.

Start the engine and accelerate to 1500 rpm. Oil temperature should be 40–60°C (100–140°F). Place lever (6) Illust. 109 in lifting position. Observe pressure build-up on the gauge.

If the opening pressure deviates from the specified values, adjust the relief valve by adding or removing shims (2) Illust. 107.

To check for proper flow divider action, put the draft control valve and one additional control valve into lifting position at the same time. If the flow divider is in order, the draft control system must not respond. Should the draft control system lift slightly, it indicates that the flow divider in the mounting block is either stuck or leaky.

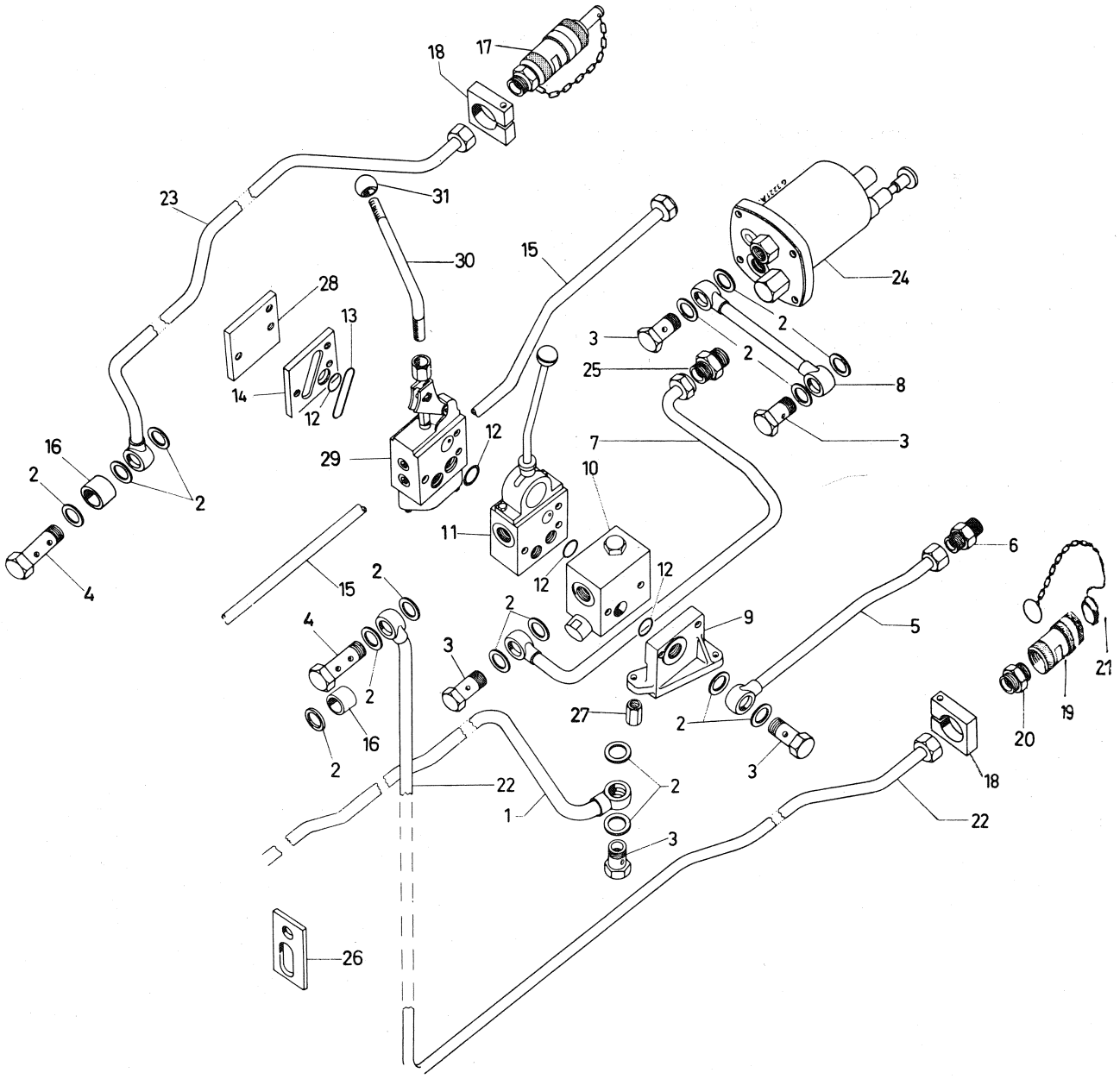


Illust. 109

1 – Mounting block
2 – Test connector
3 – Pressure hose
4 – Gauge 0–250 bar (3500 PSI)
5 – Additional control valve
6 – Control valve lever

Important: When installing mounting block carrier (9) Illust. 110 for additional control valves, carrier (9) is attached to an existing stud, the nut of which is replaced by spacer nut (28). Take care, when removing this stud nut, that the stud itself is not loosened.

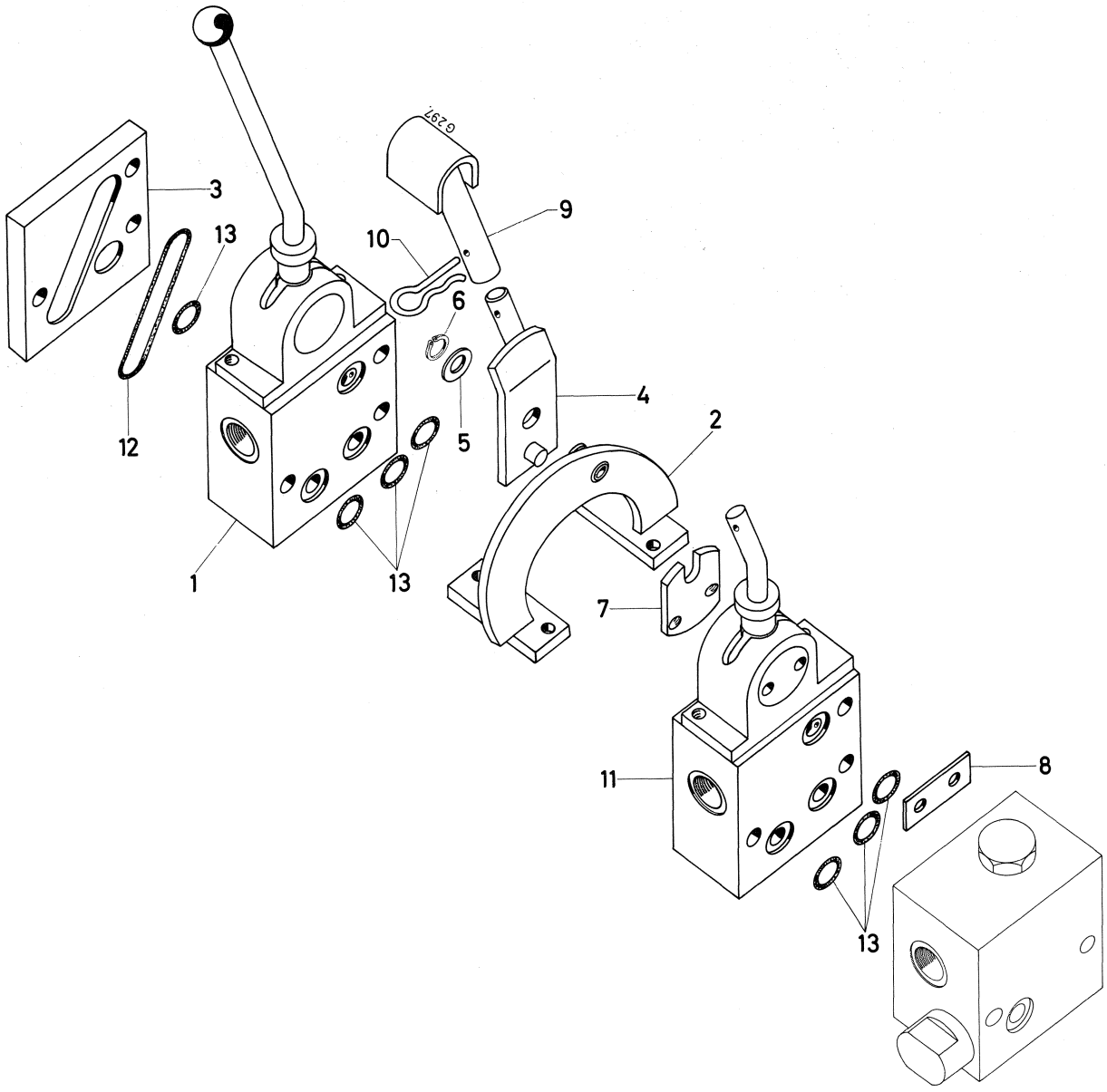
A tension spring is hooked to the stud inside the housing. Therefore, should the stud inadvertently be backed out, this spring must immediately be removed to prevent damage to the transmission.



Illust. 110
Additional control valves and connections

1 — Pressure line, oil filter-mounting block
2 — Packing rings 18 x 24 mm
3 — Hollow screw M18
4 — Hollow screw M18 long
5 — Return line to lift housing
6 — Adapter
7 — Pressure line to control valve
8 — Connecting line
9 — Carrier, mounting block
10 — Mounting block
11 — Additional control valve, single acting
12–13 — O-rings
14 — Intermediate plate
15 — Pressure line, pump-control valve
16 — Spacer bushing
17 — Break-away coupling
18 — Bracket for (17) and (19)
19 — Break-away coupling
20 — Adapter
21 — Dust cap
22–23 — Pressure line, control valve — break-away coupling
24 — Control valve
25 — Adapter
26 — Mounting plate
27 — Spacer nut 3/8"
28 — End plate
29 — Control valve, double acting
30 — Control lever
31 — Control lever knob

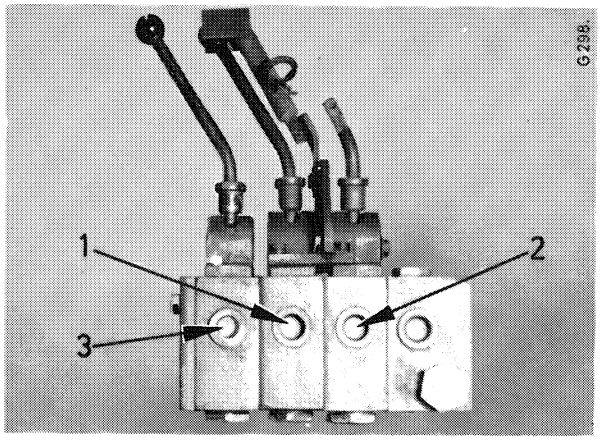
ADDITIONAL CONTROL VALVES FOR DOUBLE–ACTING POWER CYLINDERS
(Early type)



Illust. 111

For operating a double-acting power cylinder by remote control, two of the additional control valves can be arranged in such a way, that, when moving the operating lever of one control valve in one direction, the lever of the other one will move in the opposite direction resulting in a double-acting effect. A slightly modified control valve (11) is necessary for this purpose.

Control valves (1) and (11) Illust. 111 are mounted in the usual way. Bolt actuating plate (7) to control valve (11) before the latter is installed. Secure the bolt heads with locking plate (8). Secure intermediate lever (4) to the pivot pin on bracket (2) by means of washer (5) and circlip (6). Bolt bracket (2), with lever (4) in place, to the two control valves, see Illust. 112, engaging the pin of lever (4) in the slot of actuating plate (7).



Illust. 112

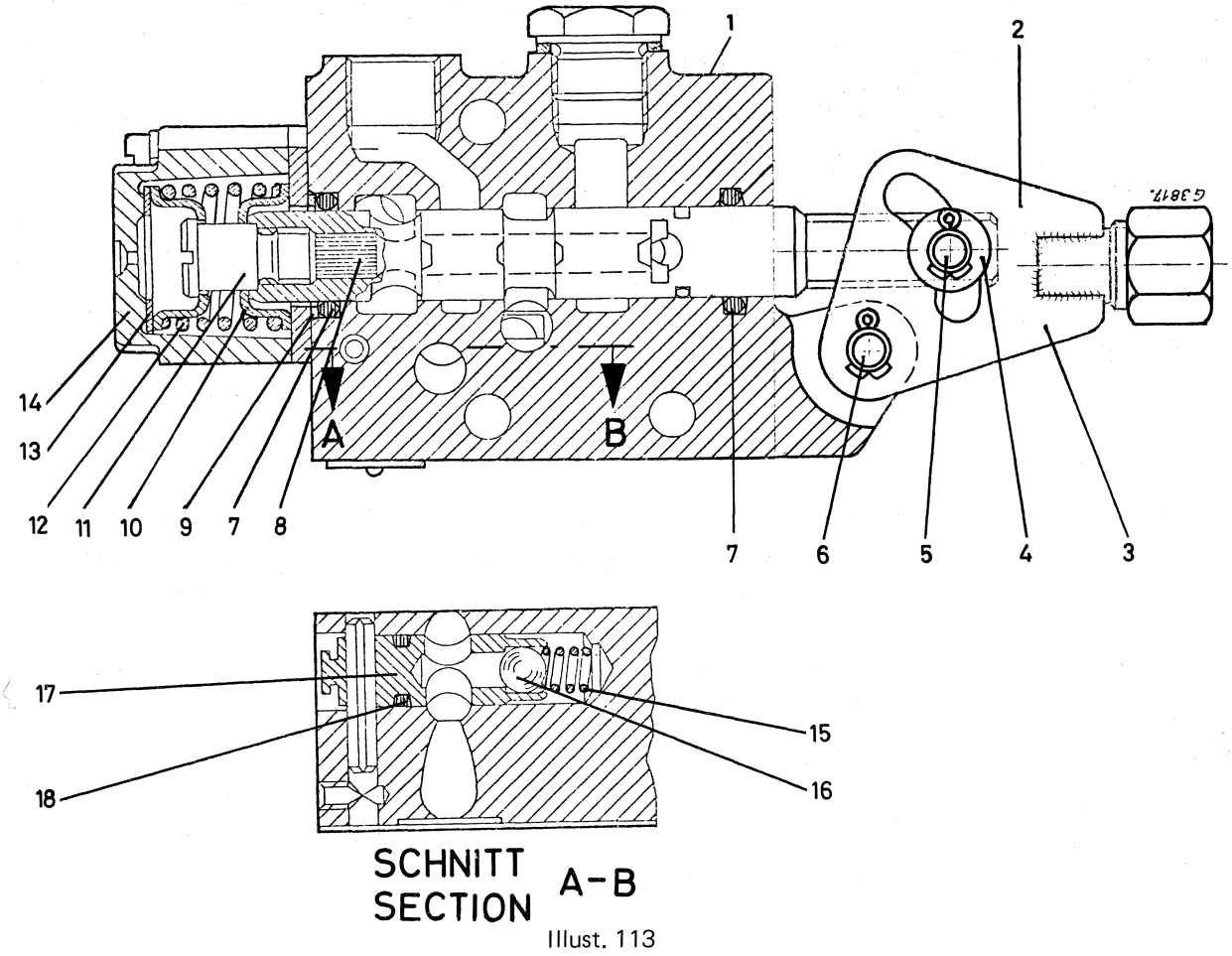
1 – Connection "lifting"
2 – Connection "lowering"
3 – Connection for single-acting cylinder

Secure operating lever (9) to the intermediate lever by means of spring clip (10), at the same time engaging it over the operating lever of control valve (1), see Illust. 112.

Connect the respective pressure lines of the double-acting cylinder to port (1) and (2).

To use this arrangement for the control of single-acting cylinders, remove operating lever (9) Illust. 111 from intermediate lever (4) and attach it to the shortened lever of control valve (11), securing it with spring clip (10).

Double Acting Control Valve (Present type)



Illust. 113

1 – Control valve
2 – Shifting head
3 – Lever
4 – Washer
5 – Bolt
6 – Bolt
7 – Packing ring
8 – Plug
9 – Washer
10 – Spring retainer
11 – Stripper bolt
12 – Centering spring
13 – Washer
14 – Cup
15 – Spring
16 – Ball
17 – Poppet
18 – Seal ring

Control valve Illust. 113 is used when operating power cylinders of the double acting type, e.g. front loaders with power dump cylinder.

The control valve is bolted to the mounting block in the same way as the single control valve.

Components with reference numbers are service parts. When oil leakage past the spool in neutral position exceeds specified limits, use a new control valve.

When using this kind of control valve it may be necessary to fit a different pressure feed line, see Parts Catalog.

TROUBLE SHOOTING

One of the most common complaints regarding any hydraulic system is "too hot". This is a very misleading and confusing statement.

How hot ***is*** hot?

The maximum ***desirable*** hydraulic fluid operating temperature in this draft control system is 80° – 90° C = 180 – 195° F. However, the hydraulic fluid, "O" rings and seals are tested at or above 100°C = 220°F for 100 hours or longer. At the end of this test, "O" rings and seals are still good, and the fluid has not been harmed.

Therefore, ***short*** periods of operation at 95°C = 200°F will not be harmful to "O" rings, seals, or hydraulic fluid. However, the fluid loses much of its lubricating property at higher temperatures, so bearings and gears could be damaged. ***Temperatures higher than 95°C = 200°F indicate a malfunction. Find the cause!***

A temperature of 80° – 90° C = 180° – 195° F will never harm any part of the system in any length of time.

The fact that some part of the hydraulic system is too hot for bare hands is ***not*** a sign of harmful heat. Temperatures of 50° – 60°C = 120° – 140°F are too hot for comfort on bare hands. ***Take the temperature of the system,*** using an accurate thermometer.

Important Note

Before investigating any service problem on the hydraulic system, the following must be checked:

1. Fluid level.
2. Condition of filters.
3. Efficiency of the hydraulic pump.
4. External leakage.
5. Age, condition, and type of fluid.
6. Air in the system or traveling with the fluid.

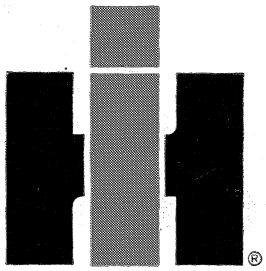
TROUBLE SHOOTING CHART

The Trouble Shooting Chart below keys a lot of trouble symptoms to their probable cause, to assist the memory of the experienced serviceman. To the novice in this field, or to service personnel which has less experience with this particular draft control system, this chart will not always be sufficient. It will then be necessary to study the principle of operation.and functional details by referring to the respective sections of this manual.

Problem	Probable Cause	Remedy
System is too hot	Excessive load	Move operating levers down all the way. Allow system to cool down. Reduce load
	Air in the system	Check oil level and connections of suction line. Vent the system
	Water in the system	Drain the system and fill up with new oil
	Valve spool or cut-out relief valve sticking	Clean or replace defective parts with new ones
	Cut-out pressure too high or additional relief valve opening pressure too low	Check pressure setting and readjust
	Internal leakage (control valve and power cylinder)	Check and replace defective parts
	Pump badly worn (due to foreign matter in the oil)	Replace pump and change hydraulic fluid. Clean or replace filters
Insufficient lifting power	Oil level too low	Top up to correct level
	Poor pump efficiency	Replace pump
	Suction screen clogged	Remove and clean the screen
	Excessive load	Reduce load
	Additional relief valve opens too early (whirling sound)	Check relief valve spring. Readjust
	Cut-out-valve opens too early Flow divider sticking (foreign matter)	Check and readjust Remove and clean
System remains at 8–9 bar (115–130 PSI) and does not lift	Cut-out relief valve sticks in open position	Clean, and if badly damaged, replace the control valve
	Fatigue of return spring (29) Illust. 6 or spring broken. Ball (35) Illust. 6 does not seat properly (foreign matter)	Replace spring Remove and clean

Problem	Probable Cause	Remedy
System will not lower	External obstruction of implement or linkage	Remove obstruction
	Lowering control valve closed	Turn hand lever clockwise
	Pilot stream pressure in control valve too low (this pressure must be 6–7 bar (85–100 PSI)	Add shims below flow divider spring until pressure is correct. Use a new spring if necessary
	Valve spool sticking	Disassemble and clean. If badly damaged, use a new control valve
	Block valve does not open. Block valve piston stuck or damaged	Replace or repair defective parts
System does not maintain its position and corrects repeatedly position of rocker arms (hiccups)	Leaking block valve	Grind valve into its seat or replace the block valve
	Cylinder cushion valve leaky	Replace
	External leakage on line (2) Illust. 13	Replace packing rings and tighten up
	O–rings or piston seal in cylinder damaged or brittle	Use new parts
System noisy	Oil level too low	Top up
	Air in the system	Check oil level and connections of suction line. Vent the system
	Suction screen clogged	Remove and clean
	Rocker arms interfering with tractor parts	Check to make sure that rocker arms and lower links with mounted implement are free to move over the complete stroke
	Restriction by foreign matter	Clean the system. Use new oil
	Oil lines vibrate	Check connections and pipe clamps Tighten up
	Pump worn or defective	Replace pump. (Check also timing gear train of engine)
	Cut-out relief valve does not open so that pump operates against high pressure of additional relief valve. (This is probably adjusted too low)	Remove control valve. Disassemble and clean components. Readjust relief valve settings. Replace complete control valve if necessary
System lowers too fast with lowering control valve closed or too slow with lowering control valve open.	Position of hand lever (roll pin) spindle incorrect	Remove hand wheel and readjust on spindle
Plow does not go deep enough or system does not lift high enough.	Operating levers not correctly positioned on shaft or tube	Check and readjust operating levers

Problem	Probable Cause	Remedy
Draft control does not respond	Draft link plunger spring or spring of element broken or weak	Check by moving draft link plunger 1–2 mm. This should bring the system from neutral to lifting or to lowering. Replace defective parts with new ones
	Plow not suitable for draft control operation	Adapt plow by changing hitch points or use another plow
	Draft control lever between pressure and tension range see (D) and (Z) Illust. 1	
	Bellcrank spring elongated	Check tension range and spring length
Additional remote control power cylinders do not lift (front loaders, mowers, etc.)	Flow divider (1) Illust. 106 stuck in top position or spring (2) broken	Remove and clean flow divider piston. If badly damaged, use a new mounting block
Front loader gradually lowers by its own weight	Non-return valve (13) Illust. 92 or valve stem (15) leaky	Replace additional control valve
	Piston seals of power cylinders defective or brittle	Install new seals
Insufficient lifting power on remote control cylinders	Relief valve (16) Illust. 92 in mounting block adjusted too low	Check pressure setting. If necessary add shims (21) Illust. 92. 1 mm shim changes the setting by 10 bar (140 PSI)
Remote control cylinders lift up to the end of the stroke although the additional control valve is returned to neutral	Valve stem (10) Illust. 92 stuck in open position	Replace the additional control valve
Oil leakage on valve stems (10) and (15) Illust. 92	Stem seals defective	Install new stem seals. If valve stems are damaged, use a new control valve



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