

SECTION 4

HYDRAULICS

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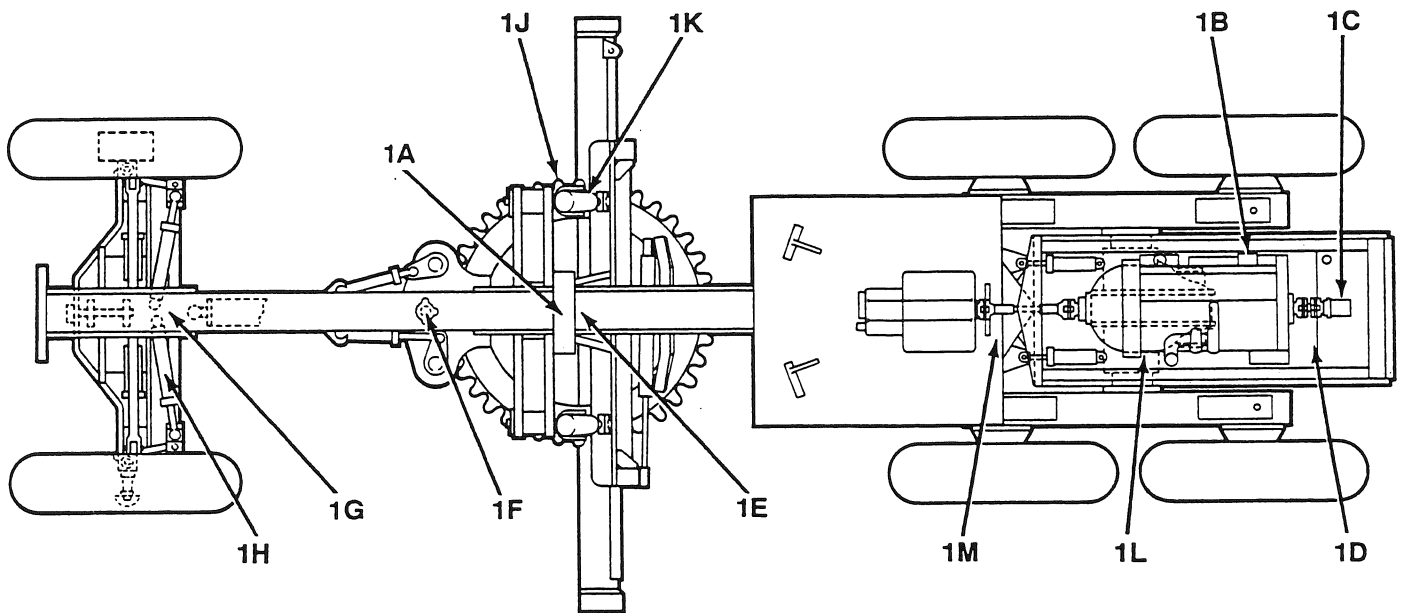


Fig. 1 Hydraulic System Components

Item	Description and Location
1A	Manifold valve assembly (on top of front frame)
1B	Main hydraulic pump (rear, right-hand side of engine)
1C	Transmission/Steering hydraulic pump (under radiator at rear of grader)
1D	Relief valves (front face of hydraulic tank on left-hand side)
1E	Hydraulic swivel joint (center of circle and beneath drawbar)
1F	Circle turn valve (on top of drawbar)
1G	Cushion valves (on top of drawbar and in nose section of front frame)
1H	Hydraulic cylinders (various locations)
1J	Power tilt lock valves (on either side of circle outer diameter)
1K	Counterbalance valves (on the blade lift cylinders and in nose section of front frame)
1L	Solenoid valves (various locations; depending on attachments and if grader is articulated)
1M	Accumulators (on the blade lift cylinders, circle shift cylinder and oil disc brakes)

Key to Fig. 1

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General

A clean work area will reduce the chance of foreign matter entering and contaminating the hydraulic system.

Make sure proper shop tools are available and in good working order. You will need a workbench with a vise.

Refer to the 700 Series Parts Manual P/N L 3008 for spare parts information. For specific major repair kits and seal kits, refer to both the 700 Series Parts Manual and the Champion Service Parts Kit Booklet P/N L 21000.

Service Position Precaution

NOTE: Always place the grader in the *SERVICE POSITION* before attempting any overhaul, maintenance or inspection procedure. Refer to the *SERVICE POSITION* procedure on page (ii) in the front of this Shop Manual.

Description

Champion graders use separate hydraulic circuits for the right-hand manifold valves, left-hand manifold valves, transmission and steering system.

The primary hydraulic system to the right-hand and left-hand manifold valve is an open center design. Oil is supplied from the hydraulic tank through two suction strainers to the main and steering hydraulic pumps. The primary hydraulic circuit uses a dual section gear type pump which is directly driven from the engine. The transmission/steering circuit uses a dual section gear type pump mounted behind the engine and driven by a driveshaft.

Two relief valves, mounted to the front of the hydraulic tank, regulate pressure in the primary circuits.

On articulated machines, the articulation circuit is connected in series with the left-hand primary hydraulic circuit. When the operator energizes the electric solenoid valve, oil is directed by the valve spool to the cylinders. Oil leaving the cylinders continues to the left-hand manifold valve assembly and does not return directly to the hydraulic tank. Thermal relief lock and cross-over relief valves are built into the electric solenoid valve to protect the system from excessive pressure.

The manifold valve assemblies each contain four valve sections. Cables connect the hydraulic control levers to the control valve spools. Moving the control levers directs oil through the valve sections to the cylinders.

All of the hydraulic cylinders are double-acting and the basic design varies only in diameter and stroke.

Oil returns from the cylinders through the manifold valve sections into the return line. Return oil from both manifold valve assemblies and the steering circuit flows to the hydraulic filter.

The spin-on, 7 micron hydraulic filter is mounted directly below the fuel tank on the left-hand side of the grader. A bypass valve built into the filter head protects the filter from excessive pressure. The valve allows return oil to bypass the filter if the oil is too cold and thick to flow through the filter, or the filter is plugged by contamination.

NOTE: Changing the filter at 500 hour intervals and the hydraulic oil at 1000 hour intervals is essential for long hydraulic component life.

A counterbalance/lock valve is used in the leaning wheel circuit. It is also used in the blade lift circuit of some models without optional blade float. The valve traps oil in the cylinder and prevents the leaning wheel cylinders "drifting" or the blade lift cylinder piston rods "creep descending" faster than the pump can supply oil. Without the valve, cavitation (voids in the oil) could result.

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Oil for the power tilt and moldboard slide shift cylinders is directed through the hydraulic swivel joint. The hydraulic swivel joint includes a spool and an outer body. The spool is sealed by O rings. The hydraulic swivel joint prevents hoses from twisting when the circle turns a complete 360 degrees.

The cushion valve is a crossover relief valve used in the steering and circle turn hydraulic circuits. The valve protects these systems from excessive pressure caused by shock loads. As the oil pressure reaches the preset level of the valve, the internal poppet unseats and allows oil to bypass into the other line.

The circle turn valve is mounted to the top of the drawbar. The valve controls the operation sequence of the two circle turn cylinders. The circle turn valve sprocket meshes with the circle teeth and turns the valve spool. The circle turn valve directs oil to the correct end of the cylinders at the proper time.

Cleaning and Inspection

Cleaning

Immerse small parts into a cleaning solvent. You can use a hot tank system and a mild alkali solvent. Agitate parts to remove all foreign matter.

Parts should remain in the solvent long enough to be thoroughly cleaned. In the hot tank system, heated parts help to evaporate the solvent and rinse water. Thoroughly rinse parts to remove all traces of dirt and solvent.

After rinsing, immediately dry the parts using moisture-free compressed air or lint-free rags. Make sure all oil passages are unblocked. Apply system oil to undamaged parts that are ready for assembly. If storing parts for some time, apply a rust inhibitor to all surfaces. Wrap parts in rust inhibitor impregnated paper before storing.

Inspection - General

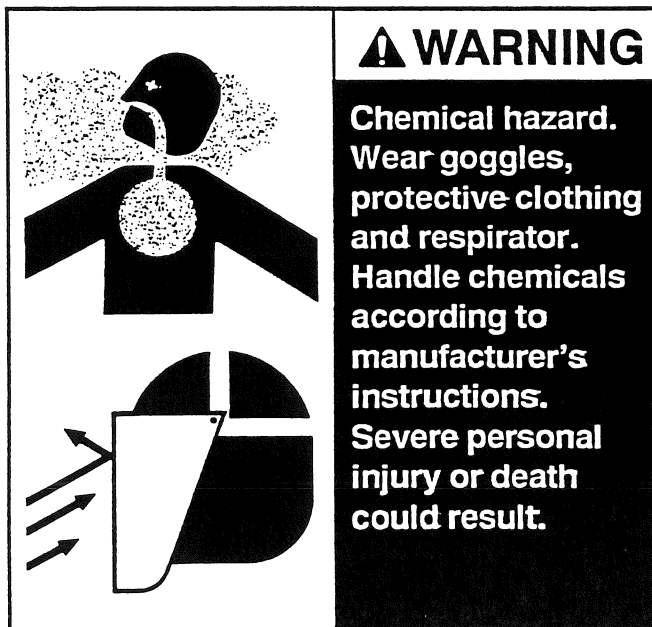
A careful and thorough inspection of all parts is extremely important. Replace all parts showing indications of wear or damage.

Inspection - Gaskets, Oil Seals, O Rings and Snap Rings

Replace all gaskets, oil seals, O rings and snap rings. Lubricant loss through a worn seal can cause expensive parts of the assembly to fail. Handle sealing components carefully, particularly when being installed. Cutting, scratching or curling of the seal lip seriously reduces efficiency. Lubricate all oil seal lips with fresh system oil.

Inspection - Gears and Shafts

Examine teeth of all pump gears for wear caused by contamination, misalignment, etc. Inspect shafts for signs of bent or twisted splines and seal wear. Replace any deformed shafts.



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Torque Guide

Sub-section/ Fig. No.	Application	Torque Value		
		lbf·ft	N·m	kgf·m
4A / 16	Spool collar	10	14	1,4
4A / 17	Capscrews retaining spool positioner cap	10	14	1,4
4A / 18	Load check plugs	20	27	2,8
4A / 34	Load check plug	20	27	2,8
4A / 37	Capscrews retaining float positioner cap	10	14	1,4
4A / 38	Anti-cavitation check body	20	27	2,8
4A / 42	Nuts retaining tie studs	32	43	4,4
4A / 42	Bolts holding down manifold valve assy.	19	26	2,6
4A / 44	Bolts retaining bonnet plate	10	14	1,4
4B / 40	Nuts retaining primary hydraulic pump	57	77	7,9
4C / 42	Bolts retaining trans./steering hyd. pump	45	61	6,2
4C / 44	Bolts retaining hyd. pump to bracket	80	108,5	11,1
4G / 12	Seat to cushion valve housing	13	17	1,8
4G / 19	Bolts retaining cushion valve	13	17	1,8
		lbf·in.	N·m	kgf·m
4L / 21	Tube assembly into solenoid valve body	100	11	1,1
4L / 22	Nut retaining solenoid coil	65 - 75	7 - 8	0,75 - 0,86
4L / 24	Nuts securing mounting foot tie rod	115	13	1,3

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Hydraulic Test Procedure - All Models

Main Hydraulic Pump and Circuit - Both Sides

Specifications

2100 psi \pm 100 psi at 2100 rpm (full flow) and oil temperature at 100° F.

145 bar \pm 6,9 bar at 2100 rpm (full flow) and oil temperature at 38° C.

WARNING

Do not work under grader or near wheels when engine is running.

Equipment

0 - 3000 psi (0 - 200 bar) pressure gauge. Hose must be long enough to easily read the gauge from the cab.

Test Procedure

1. Lower the moldboard and all attachments. Block all wheels. Apply the hand brake.
2. Remove the transmission guard cover. Connect the pressure gauge to the inlet hose of the left-hand manifold valve.

NOTE: Graders S/N 20121 and up are supplied with a quick disconnect coupler P/N 51286; otherwise install a tee fitting connecting the pressure gauge to the inlet hose. Champion recommends that you use only this location for testing. Never "dead head" the gauge into the hose.

3. Make a visual check, then start the engine. Operate the blade lift control levers and fully retract the cylinders.
4. Run the engine at 2100 rpm, pull the left-hand blade lift control lever and read the gauge. Do not use the hand throttle.

NOTE: Do not hold at the relief position for more than 15 seconds.

5. Record the pressure reading and shut down the engine.
6. To test the right-hand side, repeat steps 1 to 5, but in step 2 connect the gauge to the inlet hose of the right-hand manifold valve and in step 4 pull the right-hand blade lift control lever.

NOTE: If two pressure gauges are available, both sides can be checked at the same time.

Adjustment Procedure - If adjustment is required, proceed as follows:

1. Place the grader in the SERVICE POSITION (refer to the procedure on page (ii) in the front of this Shop Manual). Drain the oil from the hydraulic tank into a clean container - capacity 25 U.S. gallons (95 liters).
2. Remove the cartridge from the relief valve body needing adjustment. Replace the internal O ring and back-up ring as described in this Shop Manual section under Relief Valves.

NOTE: The left-hand relief valve is for the left-hand manifold valve.

Champion Part No.	Thickness		Approximate Change	
	Inches	mm	psi	bar
50065	0.040 in.	1,02 mm	250	17,2
50066	0.020 in.	0,50 mm	150	10,3
50067	0.010 in.	0,25 mm	75	5,2

NOTE: Do not add shims between the end cap and spring. This will limit poppet travel and reduce flow rate of the relief valve. This could lead to component damage.

4. Refill the hydraulic tank with clean oil. Refer to your 700 Series Operator's Manual for the recommended types and viscosities. Bleed the hydraulic system.

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Hydraulic Test Procedure - All Models continued

Steering System - Main Relief

Specifications

2100 psi \pm 100 psi at 2100 rpm (full flow) and oil temperature at 100° F.

158 bar \pm 6,9 bar at 2100 rpm (full flow) and oil temperature at 38° C.

Equipment

0 - 3000 psi (0 - 200 bar) pressure gauge. Hose must be long enough to easily read the gauge from the cab. #8 JIC steel cap and plug.

Test Procedure

1. For a detailed test procedure, refer to Product Support Bulletin No. 512 (page 2 of form F-503). **Champion recommends that you use the approved test method.** Place the grader in the SERVICE POSITION.
2. Connect the pressure gauge to the test port of the steering control unit (Orbitrol valve) inlet hose.

NOTE: Graders S/N 20121 and up are supplied with a quick disconnect coupler P/N 51286; otherwise install a tee fitting connecting the pressure gauge to the inlet hose. **Never "dead head" the gauge into the hose.**

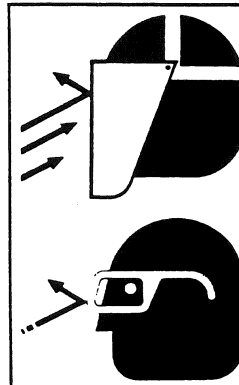
3. Disconnect one hose at the steering control unit leading to the front axle. Use a **steel cap** and **steel plug** to plug the open port and hose. Do not use plastic caps.
4. Do not touch the steering wheel. Make a visual safety check, then start the engine and run at 2100 rpm. Slowly turn the steering wheel and observe the pressure gauge. Return the grader to the SERVICE POSITION and reconnect the hose to the steering control unit.
5. Refer to Product Support Bulletin No. 512 (page 3 of form F-503) for information on pressure adjustment.

NOTE: On the remote mounted steering relief/priority valve, flow adjustment is made externally. Pressure adjustment is made internally. Refer to Product Support Bulletin No. 512 (page 3 of form F-503).



WARNING

Do not work under grader or near wheels when engine is running.



WARNING

Danger of spraying oil.
Always wear face or eye protection when loosening hydraulic fittings. Oil under pressure can penetrate skin and cause serious personal injury.

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Hydraulic Test Procedure - All Models continued



WARNING

Do not work under grader or near wheels when engine is running.

Steering System - Cushion Valve

Specifications

Method 1: On grader - 1150 psi \pm 100 psi (79 bar \pm 6,9 bar) at 2100 rpm.

NOTE: The steering wheel must be turned one complete revolution every two seconds.

Method 2: Off grader - 800 psi \pm 50 psi (55 bar \pm 3,5 bar). Cracking pressure - can only be checked by using a hand pump.

Equipment

0 - 3000 psi (0 - 200 bar) pressure gauge. Hose must be long enough to easily read the gauge from the cab.

Test Procedure

1. For a detailed test procedure, refer to Product Support Bulletin No. 512 (page 3 of form F-503). **Champion recommends that you use the approved test method.**
2. Connect the pressure gauge to the test port of the steering control unit (Orbitrol valve) inlet hose.

NOTE: Graders S/N 20121 and up are supplied with a quick disconnect coupler P/N 51286; otherwise install a tee fitting connecting the pressure gauge to the inlet hose. Never "dead head" the gauge into the hose.

3. Turn the steering wheel until the front wheels reach the locked position.
4. Run the engine at 2100 rpm and continue to evenly turn the steering wheel one complete revolution every two seconds. Record the gauge reading.
5. Repeat steps 3 and 4 for the other side and record the gauge reading.
6. Return the grader to the SERVICE POSITION.

NOTE: It is important that you turn the steering wheel at the correct speed.

Adjustment Procedure

Refer to Product Support Bulletin No. 512 (page 4 of form F-503).

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Hydraulic Test Procedure - All Models continued

Circle Cushion Valve

Specifications

2000 psi \pm 100 psi (138 bar \pm 6,9 bar). Cracking pressure - can only be checked by using a hand pump.

Test and Adjustment Procedure

Refer to this Shop Manual section under Cushion Valves.

***NOTE:** The circle cushion valve cannot be checked or adjusted using the grader hydraulic system. Excessive back pressure will give inaccurate readings.*

STEERING HYDRAULIC SYSTEM CHECKS AND ADJUSTMENTS

Ref. No. F-503(01/90)

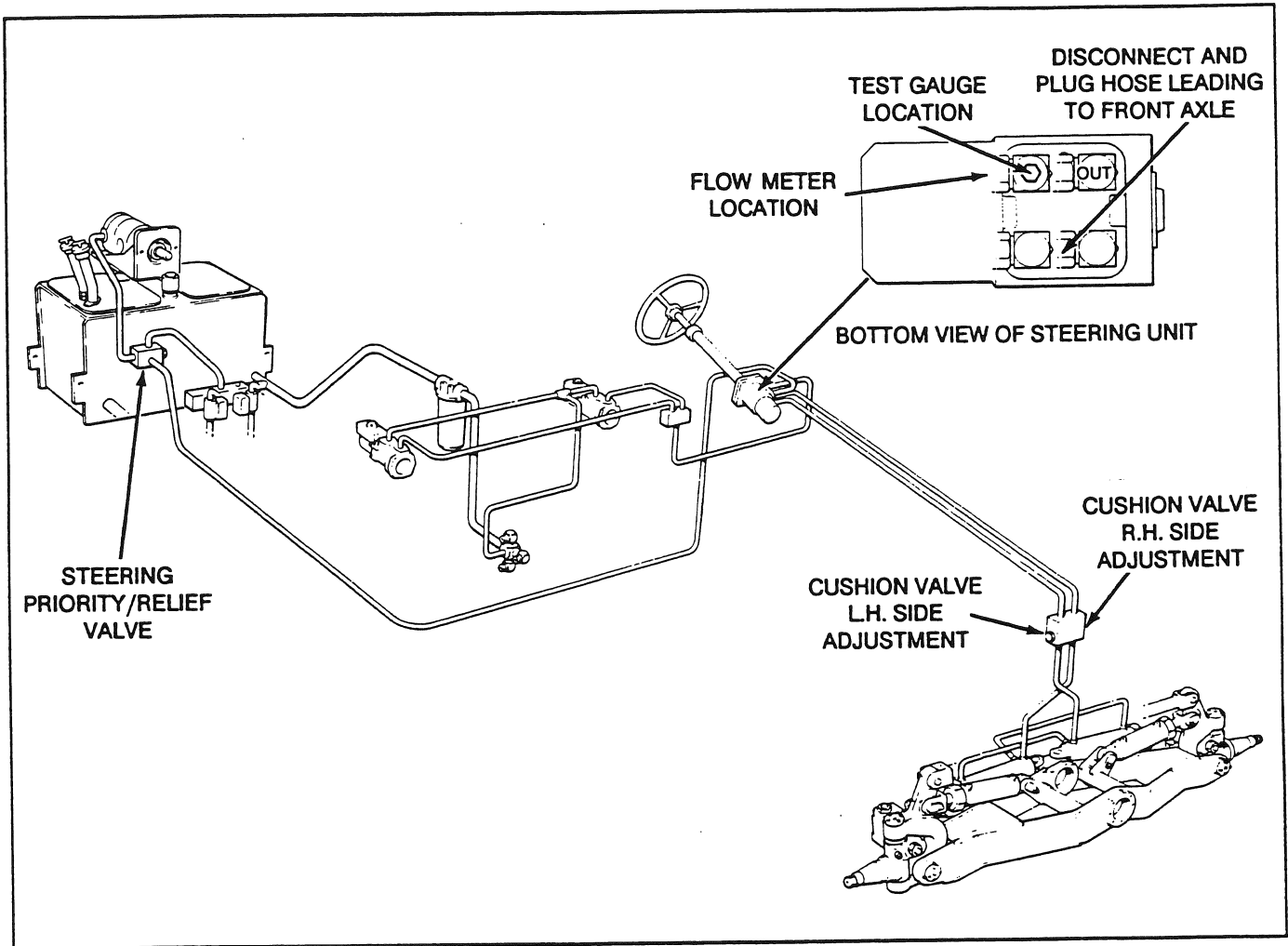


Fig. 1

Steering hydraulic system effective on grader serial numbers 19982, 19984, 19985, 19996, 20005, 20104, 20106, 20120 and up.

Steering System Pressure Checks (Fig. 1)

IMPORTANT NOTE: Some graders are equipped with the supplemental steering assist system. Do not test this system as described in steps 4 and 5, following. No pressure relief is incorporated. Perform the supplemental steering assist system daily pre-start check as described in the 700 Series Operator's Manual P/N L 4012. Check the basic steering system as follows.

1. Install a 0 - 3000 psi (0 - 207 bar) test gauge in the 1/8 in. pipe port on the inlet line fitting to the steering unit. Position the gauge so that it can be easily read from inside the cab.

NOTE: Some machines do not have the inlet line fitting with the 1/8 in. pipe port. You can use a tee fitting or drill and tap the existing fitting. On machines S/N 20312 and up, except S/N 20324, a male quick-disconnect coupling P/N 51286 is installed in the inlet line fitting. The mating female quick-connect coupling P/N 51287 is found in the tool box.

2. **NOTE:** Before starting step 2, ensure the primary hydraulic system relief valves are operating and set correctly.

When it is safe to do so start the engine. Run the engine for one minute at idle; then raise the rpm to high idle. Operate the blade lift control levers and retract the cylinders. Hold the control levers in the retracted position for 30 seconds, and release them for 15 seconds. Cycle the levers this way until the hydraulic oil temperature in the tank reaches approximately 100°F (38°C).

3. To test the steering system relief valve, place the grader in the SERVICE POSITION (refer to your 700 Series Shop Manual P/N L 2005). Clean around the hydraulic tank filler neck cap. Remove and replace the cap to relieve the tank pressure. Disconnect one hose at the steering unit leading to the front axle (refer to Fig. 1). Use a steel cap and steel plug to plug the open port and hose. Do not use plastic caps. Danger of hot oil.



4. Do not touch the steering wheel. **When it is safe to do so** start the engine and run at idle. Slowly turn the steering wheel while observing the pressure gauge. You will only be able to physically turn the steering wheel 1/4 revolution. If the gauge reading is above the specification listed on Page 6 (i.e., the relief setting is too high for the gauge), release the steering wheel. This allows the steering unit to revert to 'open center' and reduces the pressure. This is a check only. If the setting does not meet the specification, return the grader to the SERVICE POSITION and adjust the steering system relief valve as explained later in this procedure.
5. For the actual hydraulic test, adjust the engine speed to 2100 rpm. Repeat the above test and note the gauge reading. The steering system relief valve setting is listed on Page 6. If the setting does not meet this specification, return the grader to the SERVICE POSITION and adjust the steering system relief valve as explained later in this procedure. Repeat steps 4 and 5.

NOTE: Do not hold at the relief position for more than 5 seconds. Never "dead head" the pressure line into the steering unit with a pressure gauge. Damage to the gauge and pump could result.

6. Return the grader to the SERVICE POSITION. Remove the steel cap and plug. Reconnect the hose from the front axle to the steering unit. Danger of hot oil.

7. **When it is safe to do so** start the engine and adjust the engine speed to 2100 rpm.

8. Turn the steering wheel to the left until the wheels reach the locked position. **At 2100 rpm, continue to evenly turn the steering wheel 1 revolution every 2 seconds.** It is important to turn the steering wheel at this rate to maintain a consistent output flow rate from the steering unit, test to test. Observe the pressure gauge and record the value as "left side cushion valve"

9. Repeat step 8, but turn the steering wheel to the right lock and record the gauge reading under "right side cushion valve".

10. If the values obtained in steps 8 and 9 do not meet the specification listed on Page 6, adjust or repair the cushion valve. The grader must be in the SERVICE POSITION when you adjust or repair the cushion valve. Retest as described in steps 7, 8 and 9 **only when it is safe to do so.** Danger of hot oil.

Steering Relief Valve Adjustment (Fig. 2)

1. Place the grader in the SERVICE POSITION.
2. Carefully remove the cap and spring. A small amount of oil will escape.
3. Use a magnet to remove the spool. Place the spool on a clean workbench.
4. Use a flat bladed screwdriver to prevent the spool from turning.
5. Insert an Allen wrench into the set screw at the opposite end of the spool.
6. **Be careful,** as little as one turn on the set screw changes the relief setting by 400 to 500 psi (28 to 34 bar). Turn the set screw counter-clockwise to reduce pressure and clockwise to increase pressure. Do not allow the spool to turn when making adjustments.

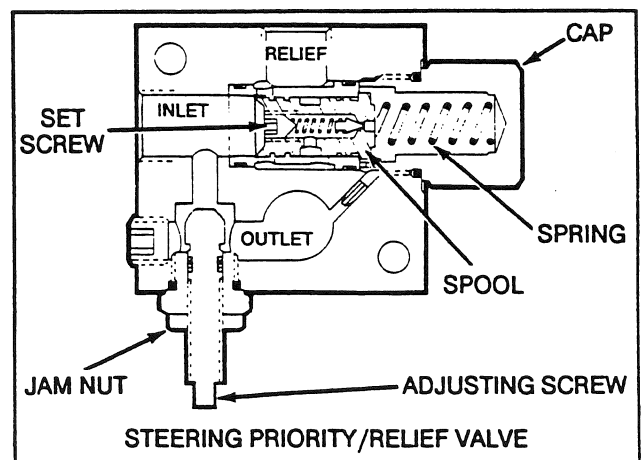


Fig. 2

7. Install the spool into the valve body.

NOTE: *The spool and valve body are a matched set. You cannot interchange other spools and valve bodies.*

8. Install the spring and cap. Ensure the spring seats correctly on the spool end. Retest according to the instructions described in **Steering System Pressure Checks**.
9. If any adjustment does not meet the specification listed on Page 6, rebuild or replace the valve P/N 53619. Order repair kit P/N 55249 from Champion's Parts Distribution Centre or your Champion Distributor.

Steering Cushion Valve Adjustment (Figs. 1 and 3)

1. Place the grader in the SERVICE POSITION.
2. Determine if the left-hand or right-hand side of the cushion valve requires adjusting:
 - a. If the gauge reading is incorrect when steering to the right, the adjustment is on the left-hand side when viewed from the operator's seat.
 - b. If the gauge reading is incorrect when steering to the left, the adjustment is on the right-hand side when viewed from the operator's seat.
3. Clean around the hydraulic tank filler neck cap. Remove and replace the cap to relieve the tank pressure.

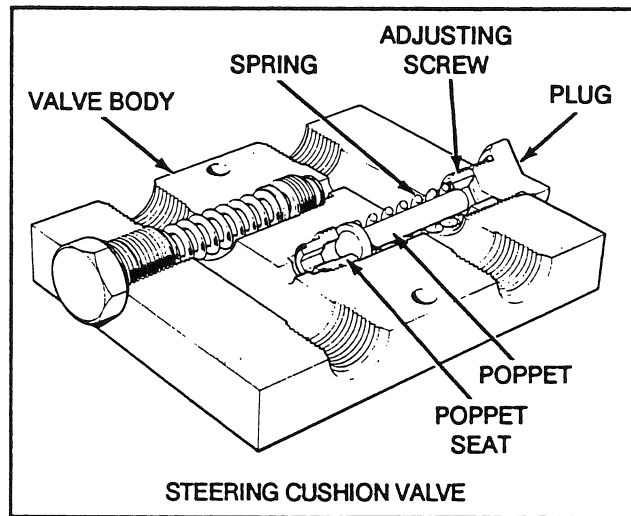


Fig. 3

4. Remove the plug on the side of the valve requiring adjustment (see step 2). Use an Allen wrench to turn the adjusting screw. Turn counter-clockwise to reduce pressure and clockwise to increase pressure.

NOTE: *One complete turn changes the setting by approximately 500 to 700 psi (34 to 48 bar).*

5. Install the plug and retest as described in steps 8 and 9 in **Steering System Pressure Checks**.
6. If you cannot obtain the correct setting, rebuild or replace the valve P/N 23748. Order repair kit P/N 26317 from Champion's Parts Distribution Centre or your Champion Distributor.
7. To bench test a rebuilt steering cushion valve, install a pressure gauge and hand pump. The valve should crack open at 1000 psi (69 bar). Refer to service video tape #VS 2015 - Hydraulic Components for full details.

Steering System Flow Checks

1. Place the grader in the SERVICE POSITION.
2. Clean around the hydraulic tank filler neck cap. Remove and replace the cap to relieve the tank pressure
3. Connect a 0 - 25 U.S. gpm (0 - 95 L/min) in-line flow meter to the inlet hose of the steering unit. Connect the output end of the flow meter with the inlet fitting of the steering unit. If the flow meter has a built in shut-off valve, open the valve fully.
4. **NOTE:** Before starting step 4, ensure the primary hydraulic system relief valves are operating and set correctly.

When it is safe to do so start the engine. Operate the blade lift control levers and retract the cylinders. Hold the control levers in the retracted position for 30 seconds, and release them for 15 seconds. Cycle the levers this way until the hydraulic oil temperature in the tank reaches approximately 100°F (38°C)

5. Check and record the flow meter readings at 750 rpm and at 2100 rpm. Do not turn the steering wheel and do not press either the clutch or brake pedals during the flow tests.

Flow at 750 rpm should be 7 U.S. gpm (26 L/min)

Flow at 2100 rpm should be 12 ± 1 U.S. gpm (45 ± 4 L/min).

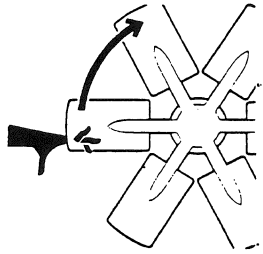
6. Test conditions	Results	Remedy
Flow at 750 rpm Flow at 2100 rpm	Low Low	Rebuild or replace pump. Clean or repair steering priority/relief valve
Flow at 750 rpm Flow at 2100 rpm	O.K. Low (e.g., 10 U.S. gpm)	- Adjust priority valve and increase flow to 12 ± 1 U.S. gpm (45 ± 4 L/min)
Flow at 750 rpm Flow at 2100 rpm	O.K. High (e.g., 14 U.S. gpm)	- Adjust priority valve and decrease flow to 12 ± 1 U.S. gpm (45 ± 4 L/min)

Steering System Flow Adjustment (Fig. 2)

1. To adjust the priority valve, loosen the jam nut. Turn the adjusting screw in to decrease flow and out to increase flow.

NOTE: A one half turn of the adjusting screw changes the flow rate by approximately 3 U.S. gpm (11 L/min).

2. Tighten the jam nut and retest the system.
3. After correctly adjusting the priority valve, remove the flow meter. Danger of hot oil.

⚠ WARNING	
	<p>Rotating fan, drive shaft and belts.</p> <p>Do not run engine when working in this area.</p> <p>Severe personal injury could result.</p>

⚠ WARNING	
	<p>Hot pressurized oil.</p> <p>Wear face and hand protection when working with hoses.</p> <p>Failure to do so could result in severe personal injury.</p>

Specifications

Steering system relief valve setting	2300 (±100) psi (158 [±7] bar)
Steering system cushion valve setting (L.H. and R.H.)	1150 (±100) psi (79 [±7] bar)
Steering system flow at 750 rpm	7 U.S. gpm (26 L/min)
Steering system flow at 2100 rpm	12 U.S. gpm (45 L/min)

NOTE: The steering system cushion valve setting listed above applies specifically to the checking and adjustment procedure detailed in this publication.

700 SERIES SHOP MANUAL

SECTION 4A

HYDRAULICS

Manifold Valve Assembly

S/N 16224, 16245 to 19291. U.S. S/N 2021-2 to 2658-2

700 SERIES SHOP MANUAL

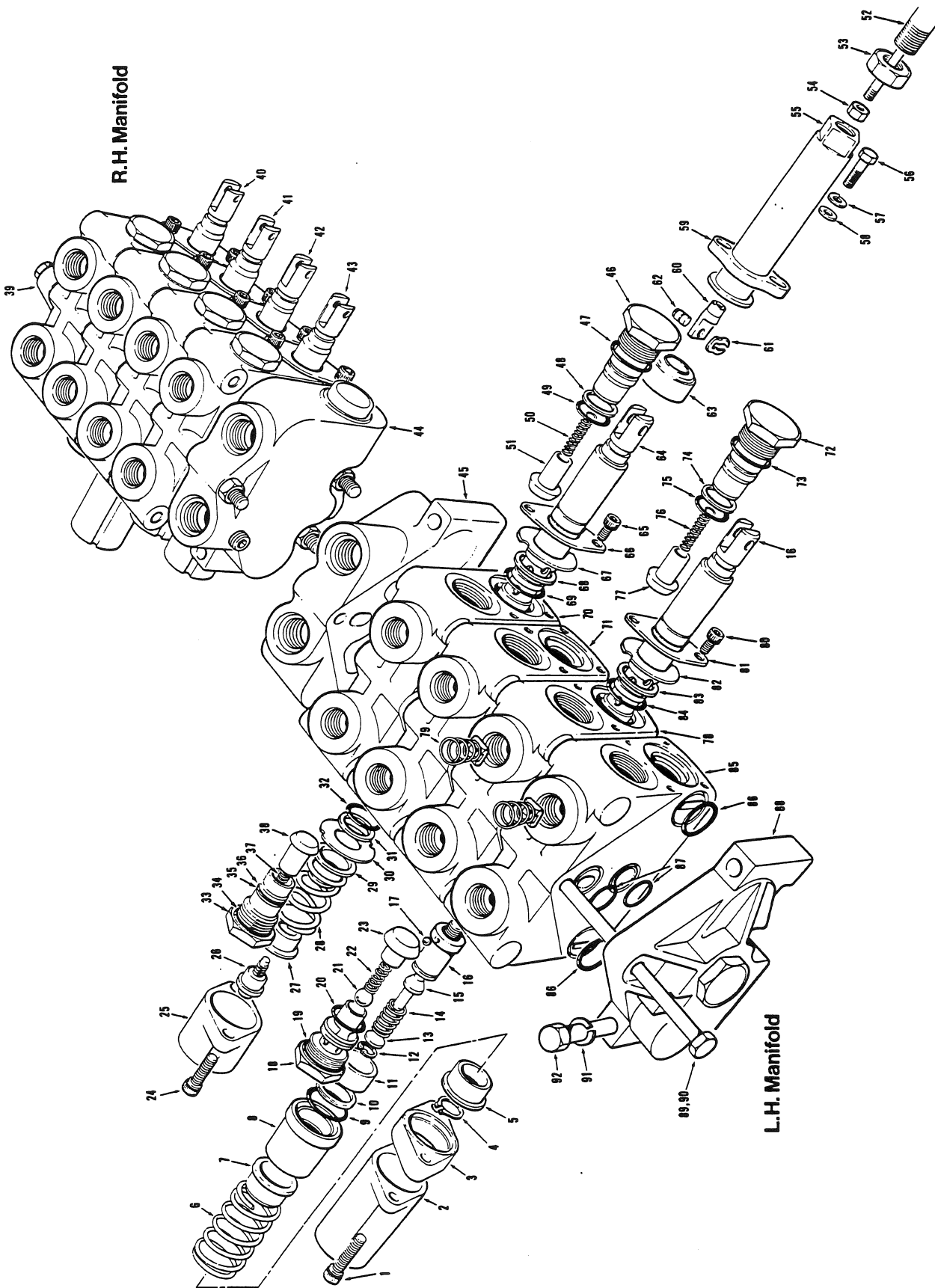


Fig. 1A Manifold Valve Assembly

S/N 16224, 16245 to 19291. U.S. S/N 2021-2 to 2658-2

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Item	Description	Item	Description	Item	Description
1	Capscrew	32	O ring	63	Spacer
2	Float positioner cap	33	Load check plug	64	Spool
3	Spacer	34	O ring	65	Capscrew
4	Retainer ring	35	Back-up washer	66	Seal plate
5	Spring collar	36	O ring	67	Retainer plate
6	Spring	37	Spring	68	Back-up washer
7	Spring collar	38	Poppet	69	O ring
8	Detent sleeve	39	End cover	70	Valve section - L.H.
9	O ring	40	Valve section - R.H.	71	Valve section - R.H.
10	Seal	41	Blade lift valve section - R.H.	72	Load check plug
11	Sleeve	42	Valve section - R.H.	73	O ring
12	Retaining ring	43	Valve section - R.H.	74	Back-up washer
13	Shim	44	Inlet cover	75	O ring
14	Spring	45	Inlet cover	76	Spring
15	Poppet	46	Load check plug	77	Poppet
16	Spool	47	O ring	78	Blade lift valve section
17	Steel ball	48	Back-up washer		L.H./optional float
18	Anti-cavitation check body	49	O ring	79	Orifice restrictor
19	O ring	50	Spring	80	Capscrew
20	O ring	51	Poppet	81	Seal plate
21	Steel ball	52	Cable	82	Retainer plate
22	Spring	53	Jam nut	83	Back-up washer
23	Poppet	54	Nut	84	O ring
24	Capscrew	55	Bonnet	85	Blade tilt valve section - L.H.
25	Spool positioner cap	56	Bolt	86	O ring (large)
26	Spool collar	57	Lockwasher	87	O ring (small)
27	Spring collar	58	Flatwasher	88	End cover - L.H.
28	Spring	59	Plate	89	Tie stud
29	Spring collar	60	Adapter	90	Nut
30	Retainer plate	61	Retaining ring	91	Lockwasher
31	Back-up washer	62	Pin	92	Bolt

Key to Fig. 1A

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Manifold Valve Assembly - Removal

Fig. 2

Descriptive procedures for removal, disassembly, assembly and installation are the same for the left-hand and right-hand manifold valve assemblies. The left-hand manifold is described in this sub-section. Steam clean the manifold. Place the grader in the SERVICE POSITION. Refer to the procedure on page (ii) in the front of this Shop Manual. Remove the hydraulic tank filler cap to release any pressure and replace the cap loosely.

Fig. 3

Identify all hoses, tubes and cables with their respective valve sections. Identify the orientation of the valve sections to the cable ends (see Fig. 5).

NOTE: *The spool and valve sections are a matched set and cannot be separately interchanged with another spool or valve section.*

Fig. 4

Remove the hoses and tubes as required. Cap all fittings and ports to prevent contamination.

Fig. 5

To ensure the proper cable adjustment for assembly, measure the location of the jam nut (53) on the cable hub and note this measurement. With two wrenches, hold the cable (52) and remove the jam nut (53). Do not rotate the bonnet (55). Remove the bolts (56) and washers (57 and 58) securing the bonnet to the valve section. Remove the bonnet and spacer (63) from the valve section.

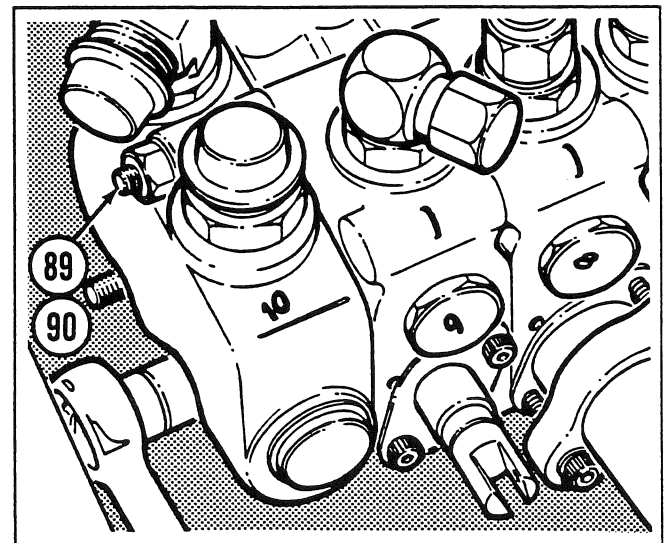
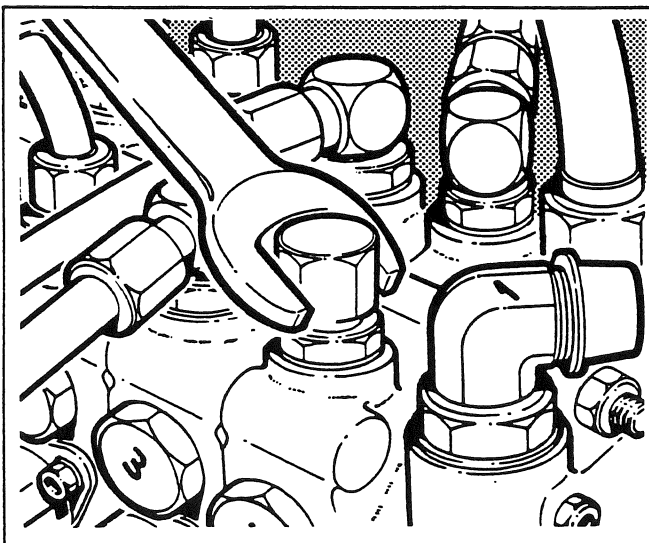
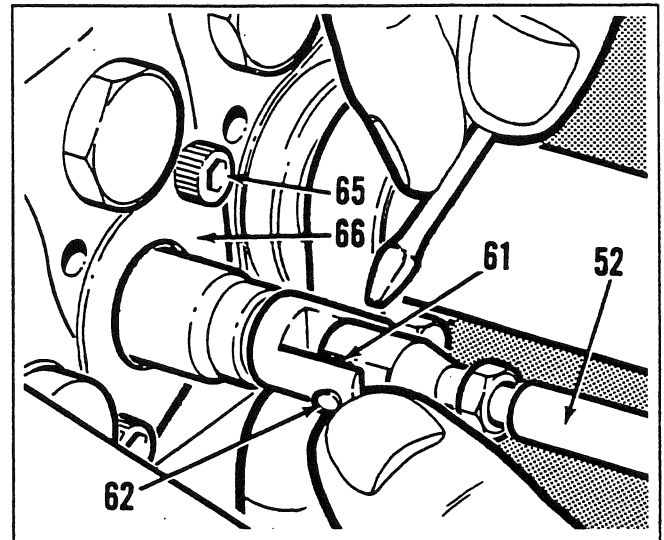
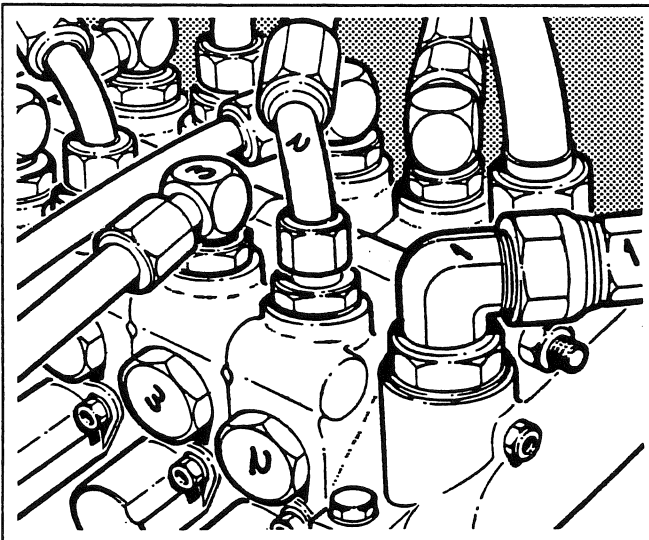
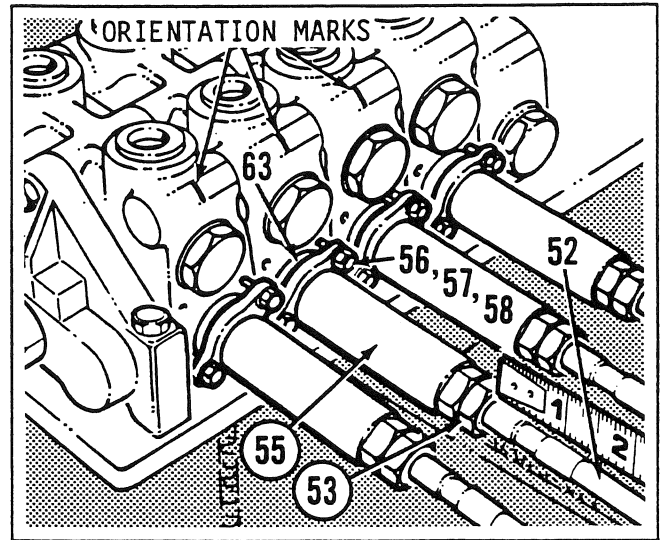
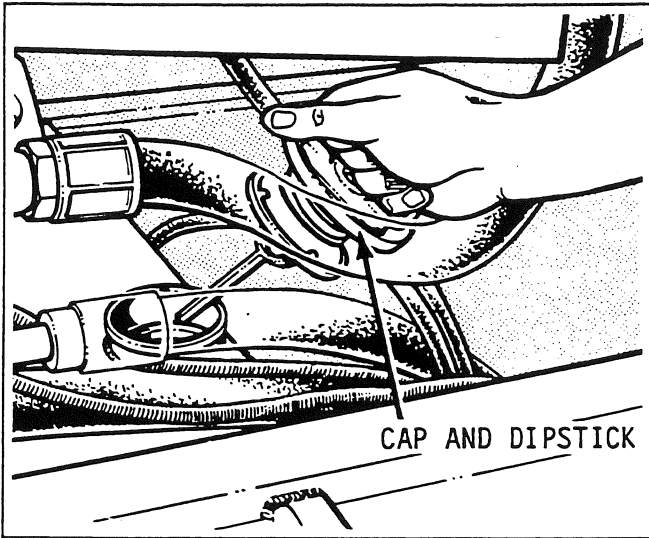
Fig. 6

Install two capscrews (65) to finger tightness to retain the seal plate (66). Remove the retaining ring (61) and pin (62) from the cable (52). Do not sharply bend the cable when removing it. Ensure the components do not slide down the cable between the cab and frame.

Fig. 7

Evenly loosen the three hold down bolts (92) and the three tie studs (89) and nuts (90). Remove the hold down bolts and lockwashers (91).

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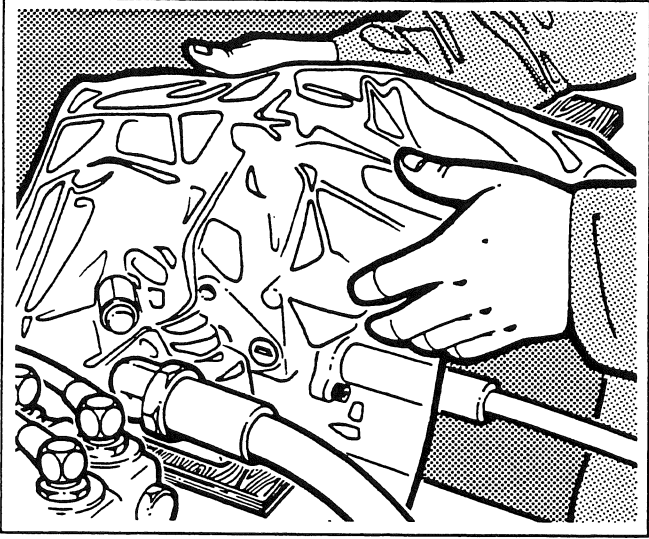


Fig. 8

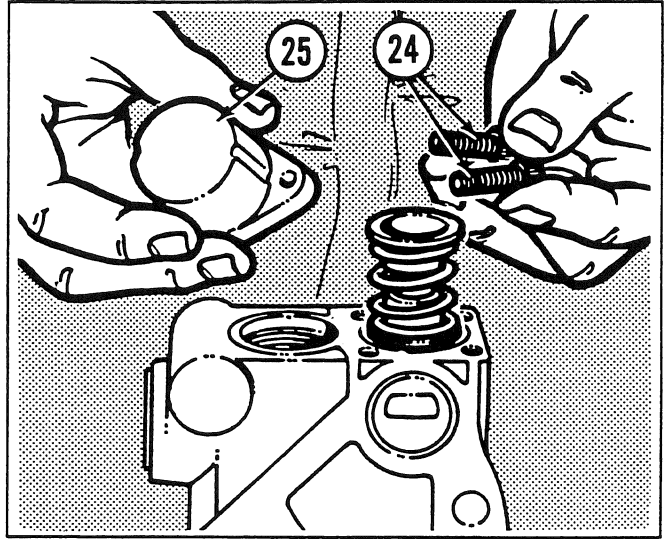


Fig. 11

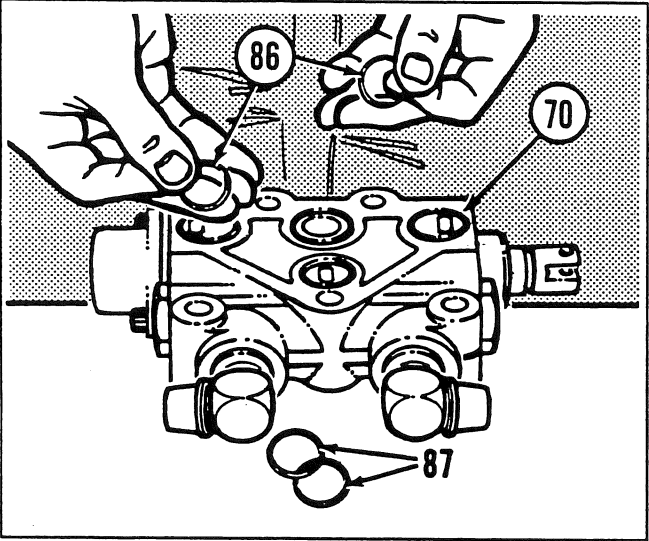


Fig. 9

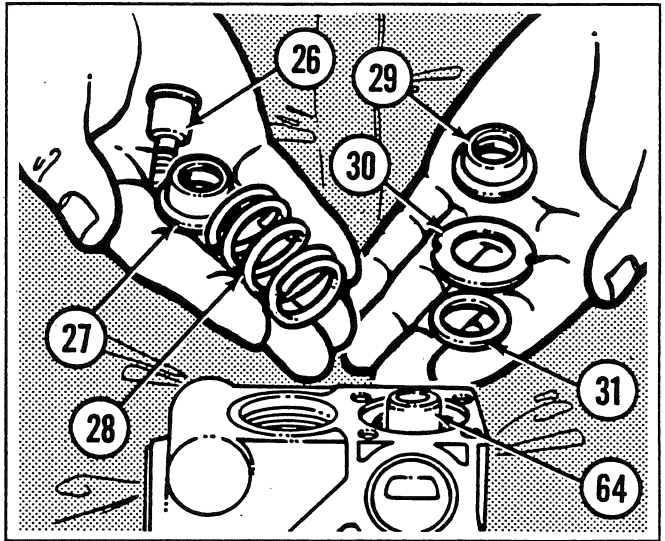


Fig. 12

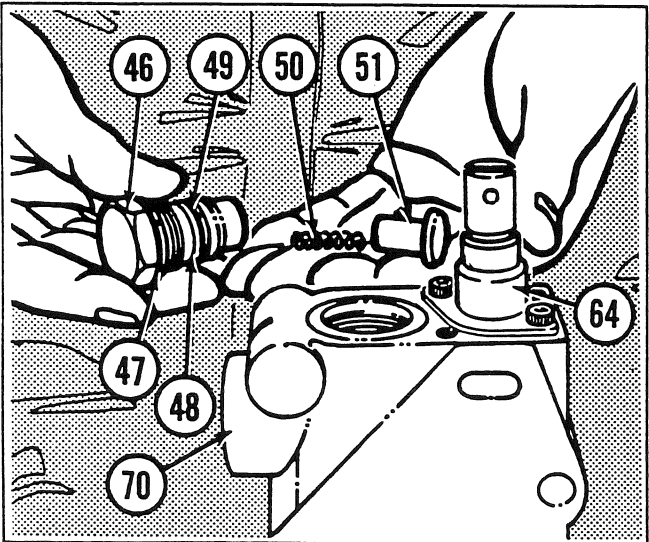


Fig. 10

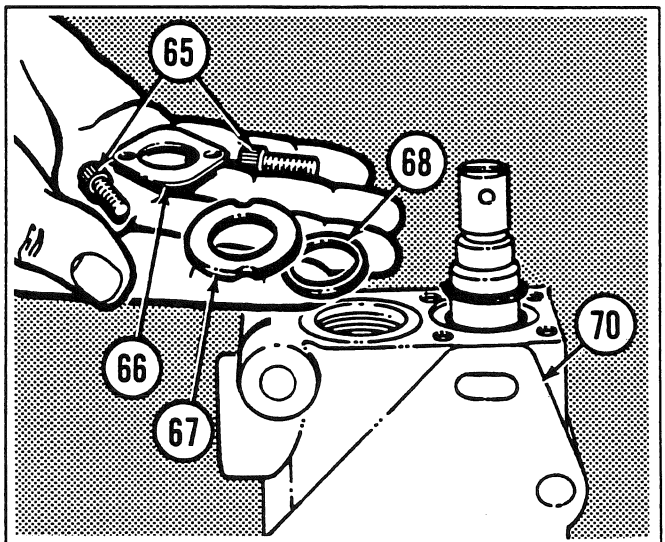


Fig. 13

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Manifold Valve Assembly - Removal continued

Fig. 8

Insert a flat smooth plywood board under the manifold valve assembly making the service procedures much easier. Remove the nuts (90) and the three tie studs (89). Carefully separate the valve sections. Remove the valve section requiring service and place it on a clean workbench. Cover the remaining manifold valve sections with a clean plastic sheet to prevent contamination of the hydraulic system.

Disassembly (Standard Valve Section)

Fig. 9

Remove and discard the O rings (86 and 87).

Fig. 10

Place the valve section (70) in a vise with soft jaws. Do not overtighten the vise. Remove the fittings and load check plug (46). Be careful that the wrench does not damage the spool (64). Using a magnetic pick-up tool, remove the spring (50) and poppet (51). Invert the valve section in the vise and remove the other load check plug (33), spring (37) and poppet (38). Discard both the O rings (47 and 49) and back-up washers (35 and 48) from each load check plug. Note the orientation of the back-up washer relative to the O ring.

Fig. 11

Remove the capscrews (24) and the spool positioner cap (25).

Fig. 12

Prevent the spool (64) from rotating. Do not use pliers as they will destroy the surface finish. Unscrew the spool collar (26) and remove the spring collar (27), spring (28) and the remaining spring collar (29). Using a magnetic pick-up tool, remove the retaining plate (30) and back-up washer (31). Discard the back-up washer.

Fig. 13

Invert the valve section (70) in the vise. Remove the two temporary capscrews (65), seal plate (66) and retainer plate (67). Discard the back-up washer (68).

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Disassembly (Standard Valve Section)

continued

Fig. 14

Remove the spool and discard the O rings (32 and 69). Inspect all components for serviceability. Refer to **Cleaning and Inspection** found in the front of this Shop Manual section.

Fig. 17

Install the spool positioner cap (25) with the drain opening facing downwards when the valve is assembled on the grader. Install and tighten the capscrews (24) to the specified torque.

Assembly (Standard Valve Section)

Fig. 15

Place the valve section (70) in a vise with soft jaws. Generously lubricate the valve section and spool (64) and install the spool according to the orientation mark. Lubricate and install a new O ring (69) and new back-up washer (68) on the spool. Install the retainer plate (67), seal plate (66) and secure the assembly with capscrews (65) to finger tightness only.

Fig. 18

Lubricate and install the poppet (38) and spring (37). Lubricate and install new O rings (34 and 36) and back-up washers (35 and 48) on both load check plugs (33 and 46). Ensure the correct location of the back-up washer. Lubricate and install both load check plugs into the valve section (70). Tighten them to the specified torque. Inspect the hose fitting O rings and install the fittings into the valve section.

Fig. 16

Invert the valve section (70) in the vise. Lubricate and install a new O ring (32) and a new back-up washer (31) on the spool (64). Install the retainer plate (30), spring collar (29) and spring (28). Prevent the spool from rotating. Do not use pliers as they will destroy the surface finish. Insert the spool collar (26) into the spring collar (27) onto the spool. Tighten the spool collar to the specified torque.

Fig. 19

Remove the valve section (70) from the vise and place it on a clean workbench. Lubricate and install new O rings (86 and 87) in the counterbores of the valve section. Servicing a standard valve section is now complete. Refer to the installation procedures if no other valve sections need servicing.

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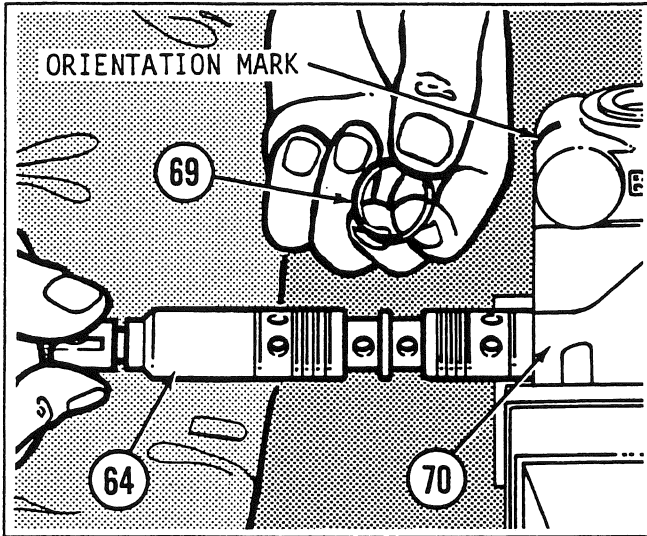


Fig. 14

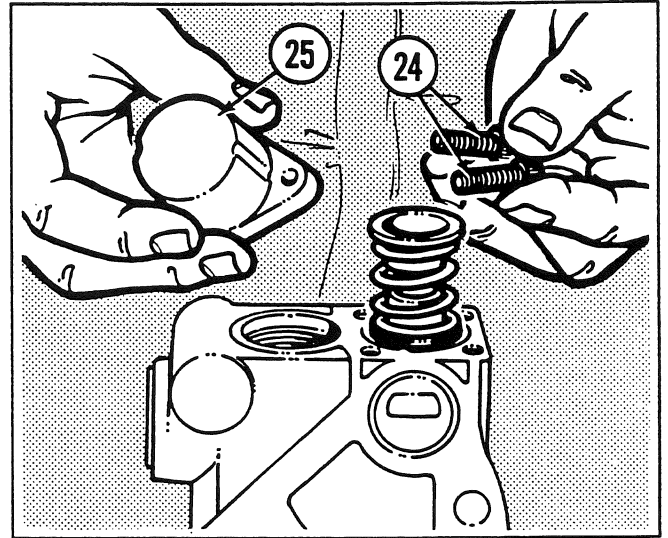


Fig. 17

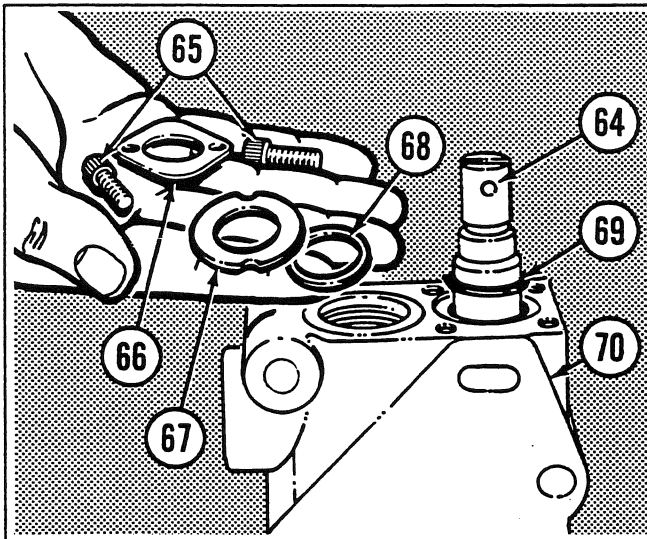


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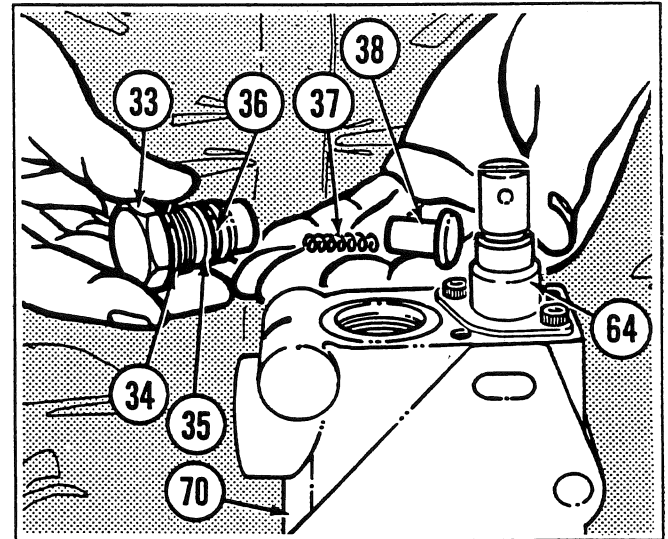


Fig. 18

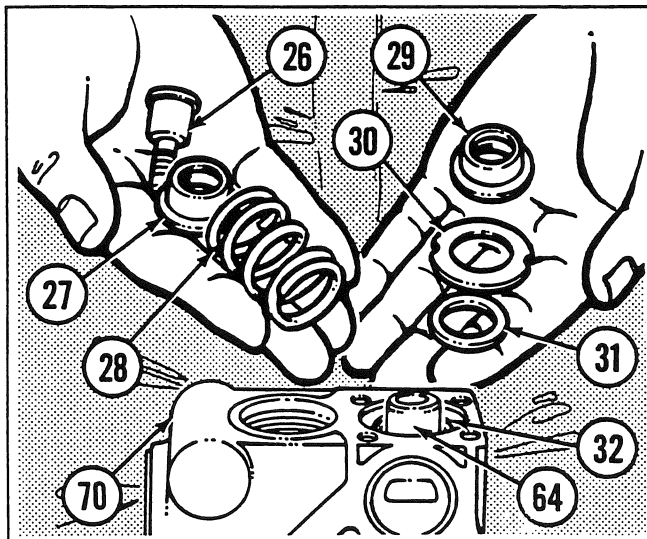


Fig. 16

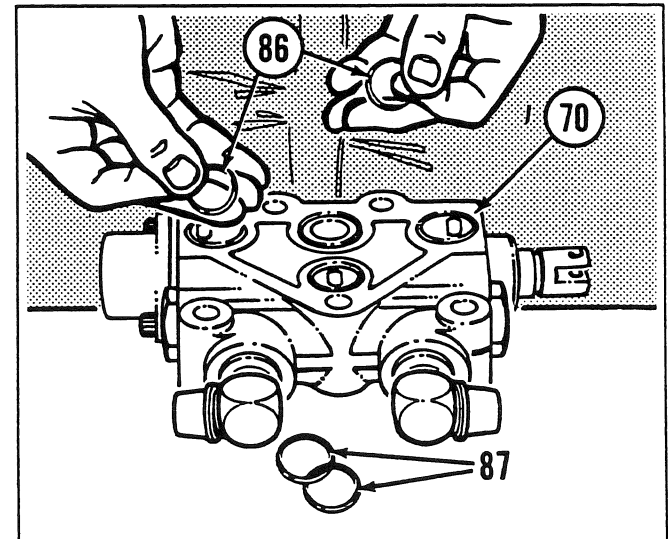


Fig. 19

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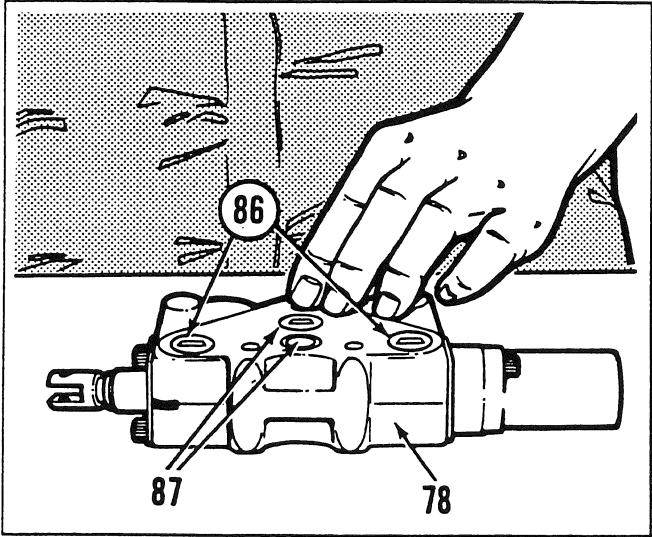


Fig. 20

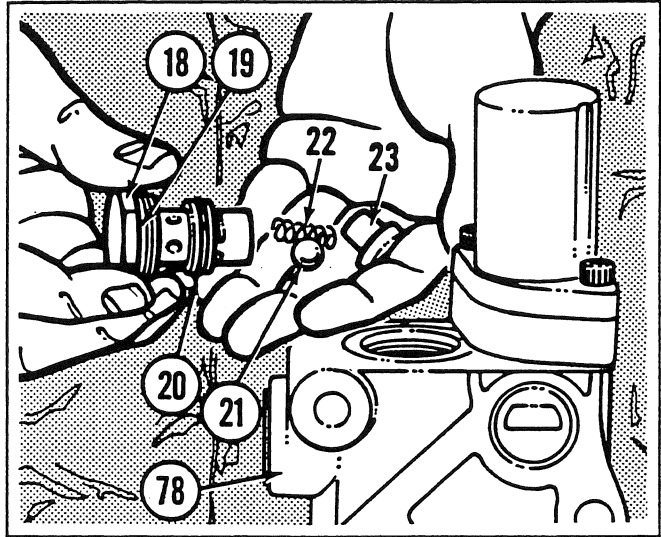


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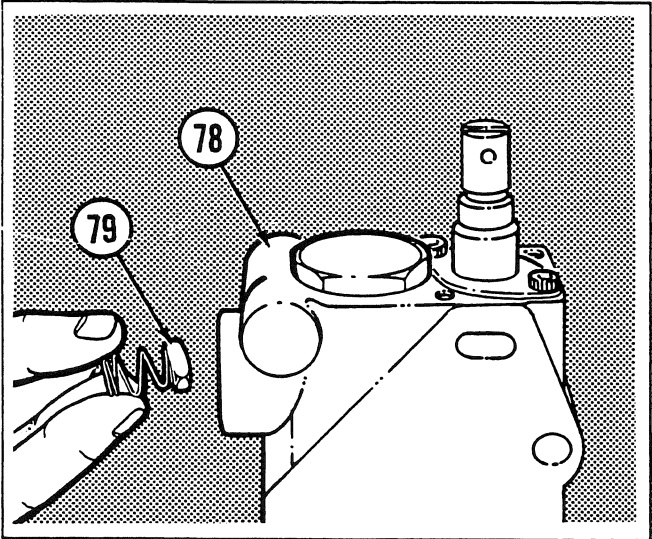


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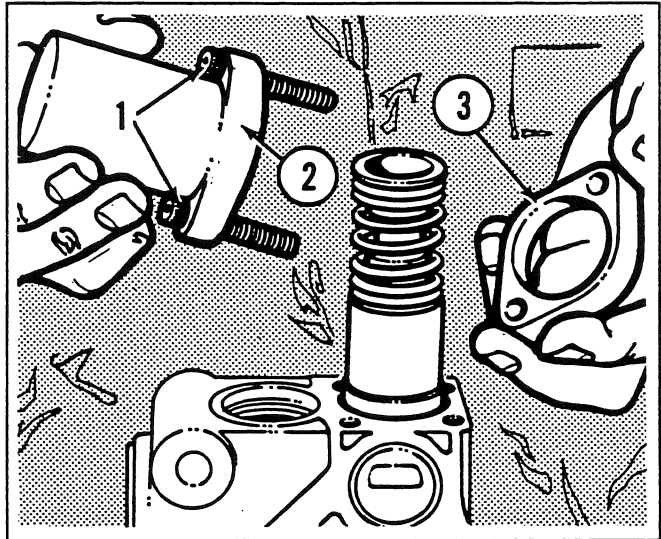


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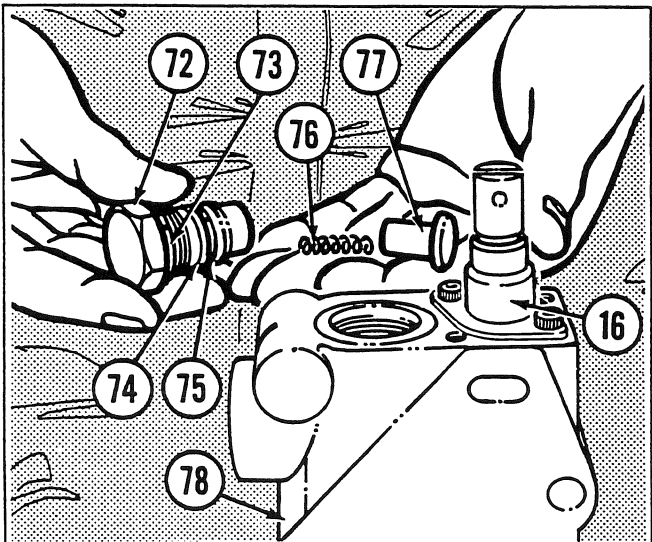


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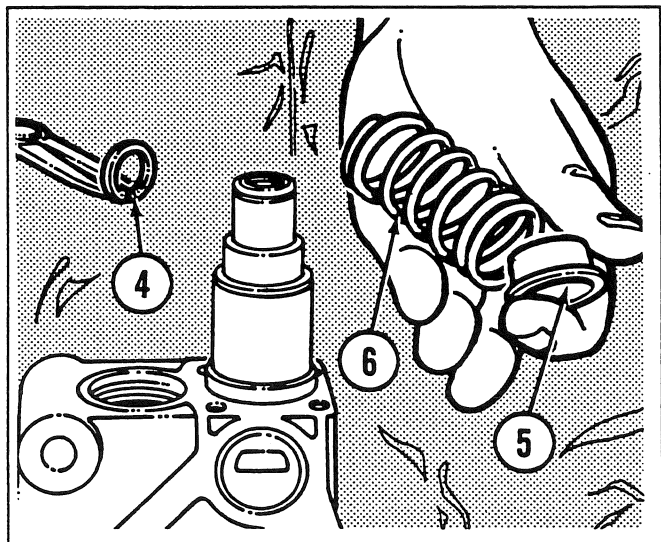


Fig. 25

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Disassembly (Blade Lift Valve Section with Optional Float)

Fig. 20

With the manifold valve assembly already disassembled, remove the valve section (78) and place it on a clean workbench. Remove and discard the valve section O rings (86 and 87).

Fig. 21

Place the valve section (78) in a vise with soft jaws. Do not overtighten the vise. Remove the hose fittings and the orifice restrictor (79) in the port closest to the clevis end of the spool. Cap the ports.

Fig. 22

Remove the load check plug (72) from the valve section (78) and discard the O rings (73 and 75) and back-up washer (74). Using a magnetic pick-up tool, remove the spring (76) and poppet (77).

Fig. 23

Invert the valve section (78) in the vise. Remove the anti-cavitation check body (18) and discard the O rings (19 and 20). Using a magnetic pick-up tool, remove the steel ball (21), spring (22) and poppet (23).

Fig. 24

Remove the capscrews (1), float positioner cap (2) and spacer (3).

Fig. 25

With care, force down the spring collar (5) and spring (6) by hand. Remove the retaining ring (4).

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Disassembly (Blade Lift Valve Section with Optional Float) continued

Fig. 26

Carefully remove the remaining spring collar (7). Using a magnetic pick-up tool, remove the four steel balls (17) from underneath the spring collar. Be ready, they could drop out. Remove the detent sleeve (8).

Fig. 27

Remove and discard the O ring (9) and seal (10) from inside the detent sleeve (8).

Fig. 28

Remove the steel sleeve (11).

Fig. 29

Invert the valve section (78) in the vise. Remove the two temporary capscrews (80), seal plate (81) and retainer plate (82). Remove and discard the back-up washer (83). Remove the valve section from the vise and place it on a clean workbench.

Fig. 30

Carefully remove the spool (16) from the valve section (78) and discard the O ring (84).

Fig. 31

Remove the retaining ring (12) from the spool end (16). Using a magnetic pick-up tool, remove the shim (13), spring (14) and poppet (15). Inspect all parts for serviceability. Refer to **Cleaning and Inspection** found in the front of this Shop Manual section.

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Assembly (Blade Lift Valve Section with Optional Float)

Fig. 32

Assemble the spool (16) by inserting the poppet (15), spring (14) and shim (13). Secure the assembly with a new retaining ring (12).

Fig. 33

Generously lubricate the spool (16) with system oil. Carefully install the spool in the valve section (78) according to the orientation marks. Place the valve section in a vise with soft jaws. Do not overtighten the vise. Lubricate and install a new spool O ring (84) and back-up washer (83). Install the retainer plate (82) and seal plate (81). Retain them with two capscrews (80) to finger tightness only.

Fig. 34

Install the spring (76) into the poppet (77) and place them into the valve section (78). Install new O rings (73 and 75) and back-up washers (74). Lubricate and install the load check plug (72) into the valve section and tighten it to the specified torque. Be careful not to damage the spool (16).

Fig. 35

Invert the valve section (78) in the vise. Install the steel sleeve (11) over the spool (16). Lubricate and install a new seal (10) and O ring (9) into the detent sleeve (8). Lubricate the spool (16) and carefully install the detent sleeve with a back and forth rotation into position on the spool. Using grease to hold the four steel balls (17) in the spool (16), install the spring collar (7) over the steel balls.

Fig. 36

Install the spring (6) and the remaining spring collar (5). With care, compress the spring and install a new retainer ring (4).

Fig. 37

Install the spacer (3) with the counterbore towards the valve section (78). Install the float positioner cap (2) with the drain opening facing downwards when the valve is assembled onto the grader. Install and tighten the capscrews (1) to the specified torque.

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Assembly (Blade Lift Valve Section with Optional Float) continued

Fig. 38

Lubricate and install new O rings (19 and 20) on the anti-cavitation check body (18). Install the steel ball (21) and apply a small amount of grease to retain it in the check body. Place the spring (22) into the poppet (23). Install and seat them into the valve section (78). Install and tighten the anti-cavitation check body (18) to the specified torque.

Fig. 39

Inspect and install the hose fitting closest to the float positioner cap (2). Install the orifice restrictor (79) and the remaining hose fitting.

Fig. 40

Remove the valve section (78) from the vise. Lubricate and install four new O rings (86 and 87). Servicing a blade lift valve section is now complete. Refer to the installation procedures if no other valve sections need servicing.

Manifold Valve Assembly - Installation

Fig. 41

Remove the plastic sheet from the manifold valve assembly. Lubricate and install new O rings (86 and 87) in the counterbores of each valve section including the inlet cover (45) and end cover (88). Make sure the valve section O rings do not drop out of position. Install the serviced valve sections into their correct locations.

Fig. 42

Be careful not to dislodge any O rings (86 and 87) and insert a tie stud (89) through the valve sections. Secure the assembly with a nut (90). Install the remaining tie studs and nuts. Evenly tighten the nuts to the specified torque. Remove the plywood board and install the hold down bolts (92) and lockwashers (91). Tighten the bolts to the specified torque.

Fig. 43

Remove the two capscrews (65) holding the seal plate (66). Ensure the cable (52) has not been kinked and install the pin (62). Secure the spring with the retaining ring (61). Position the spacer (63) and thread the bonnet into place. Secure the plate (59) with the flatwashers (58), lockwashers (57) and bolts (56) to finger tightness.

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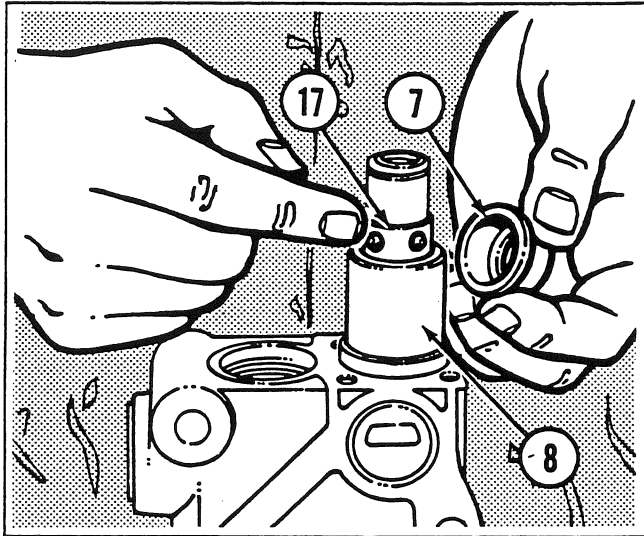


Fig. 26

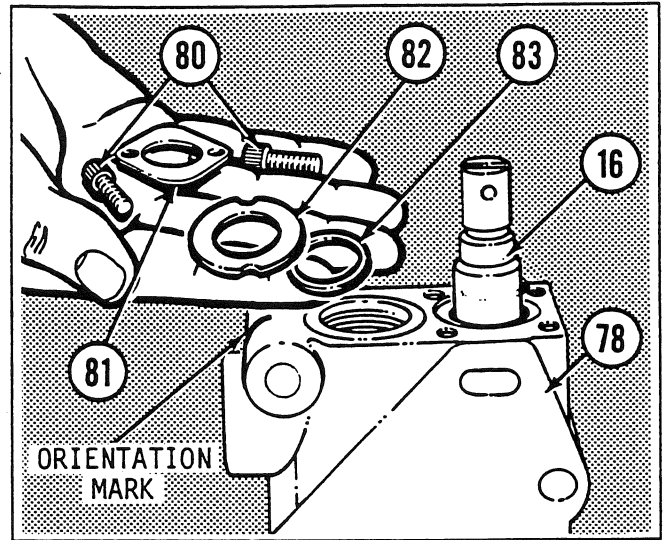


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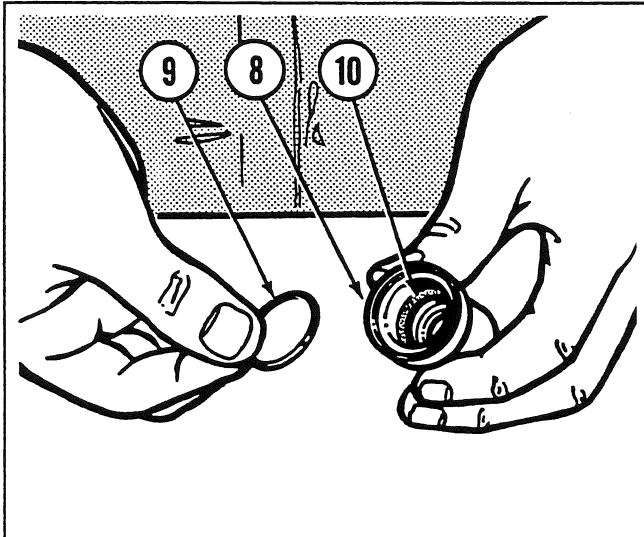


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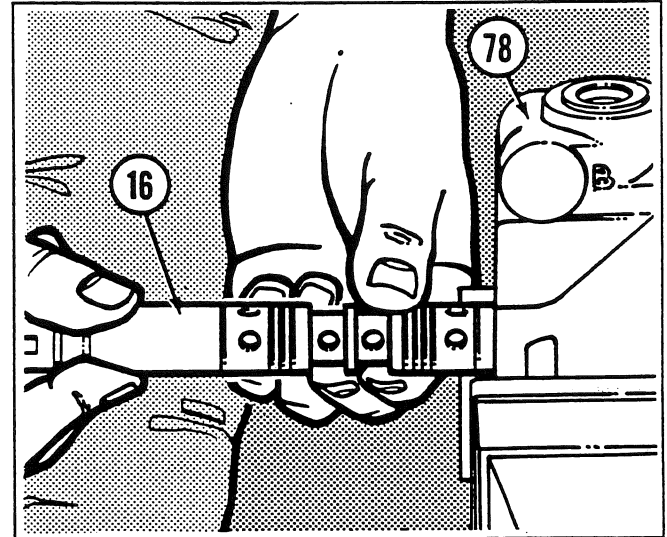


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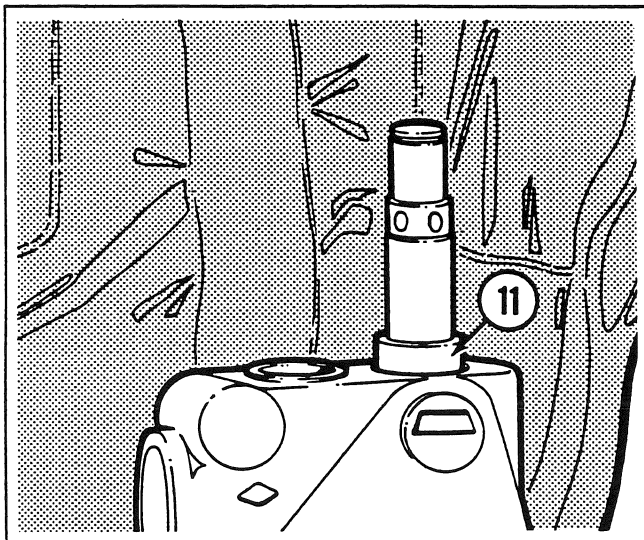


Fig. 28

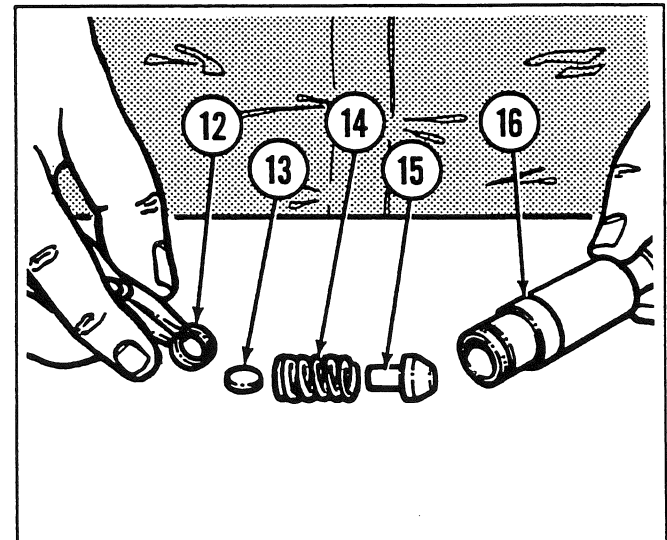


Fig. 31

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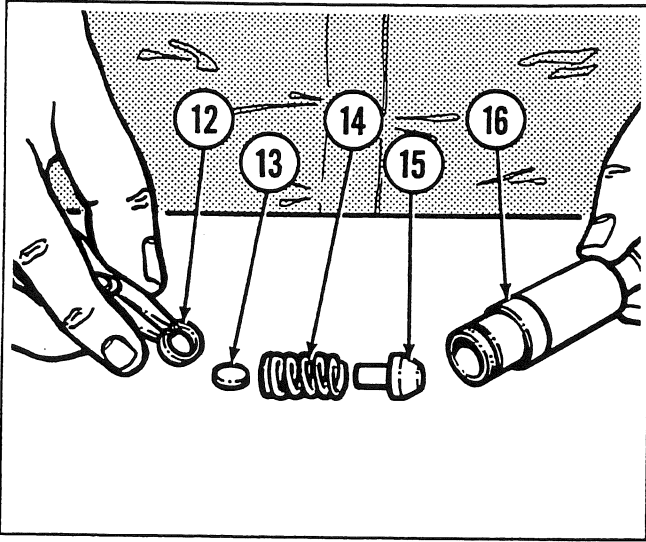


Fig. 32

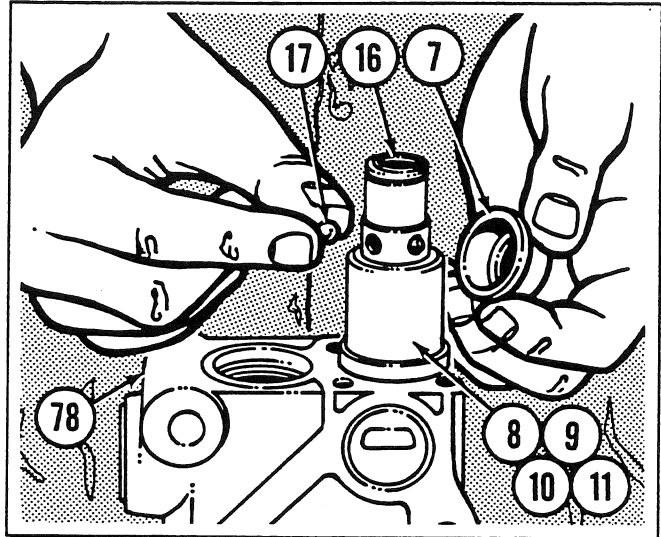


Fig. 35

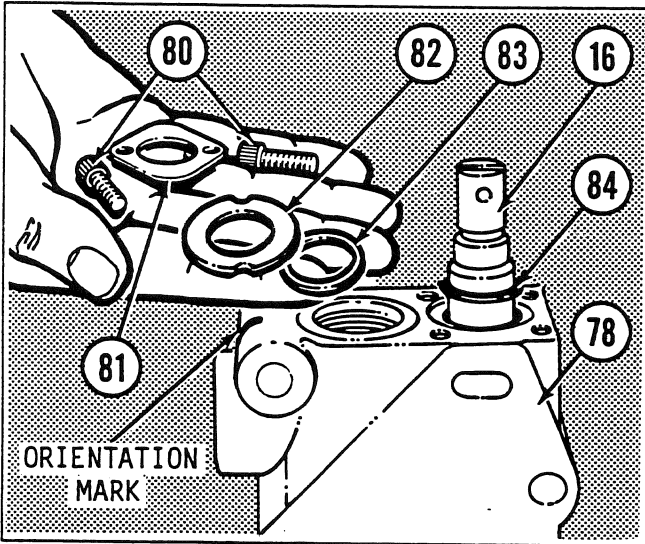


Fig. 33

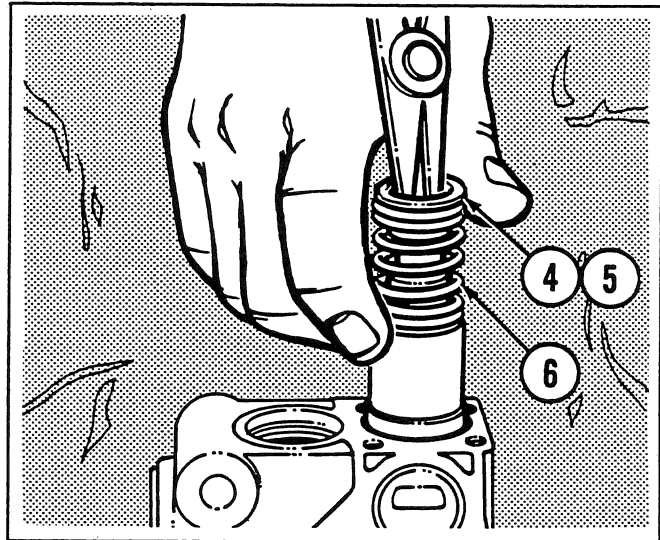


Fig. 36

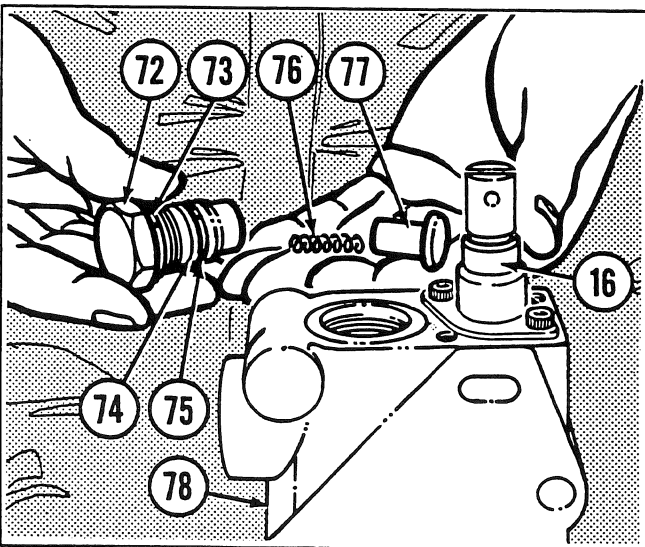


Fig. 34

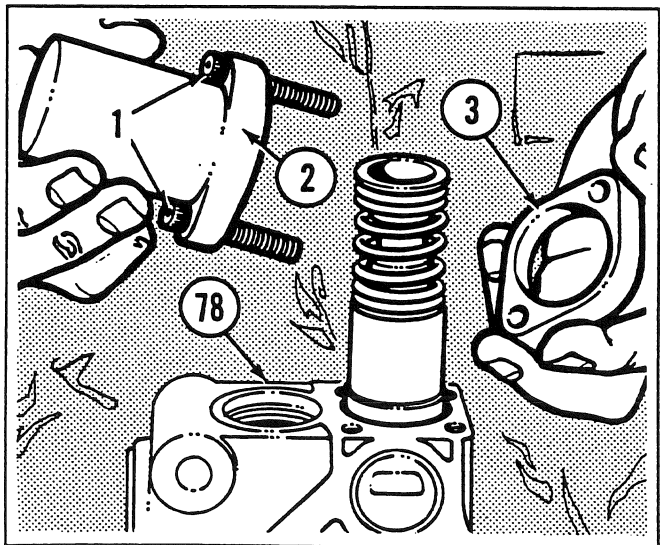


Fig. 37

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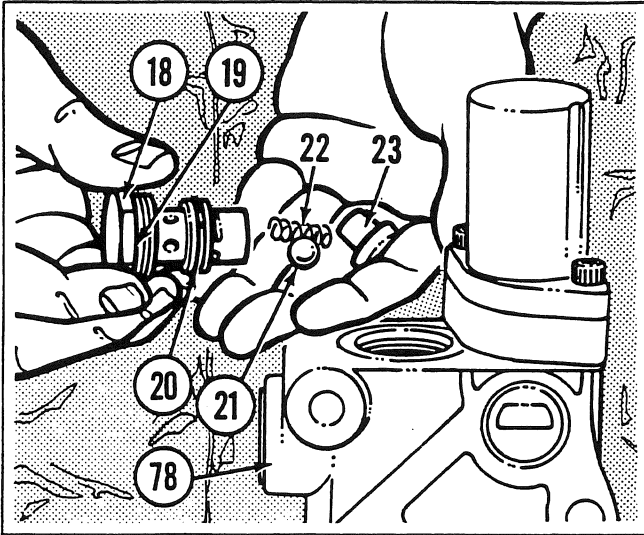


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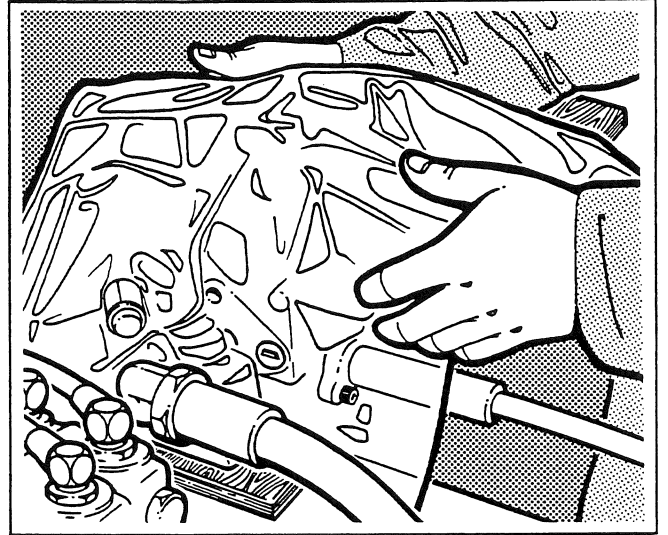


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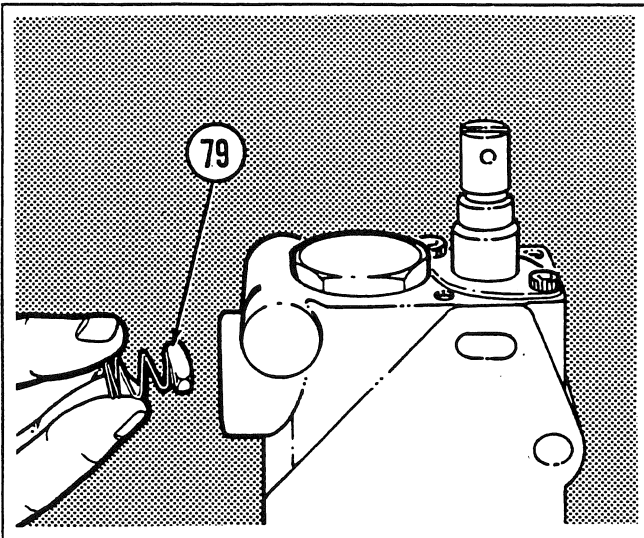


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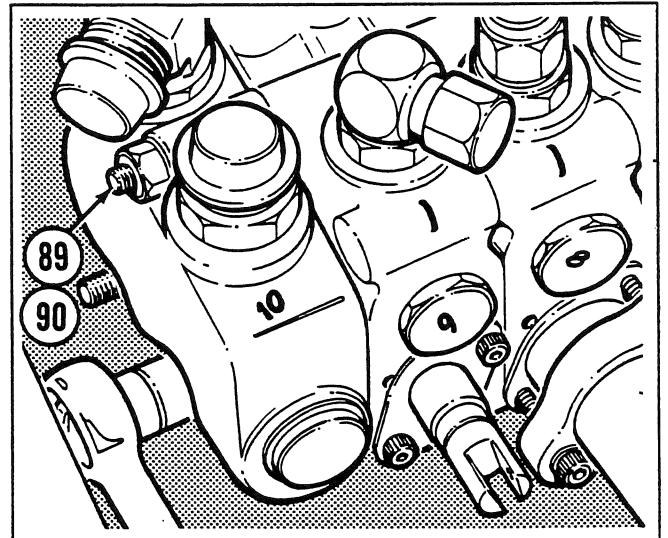


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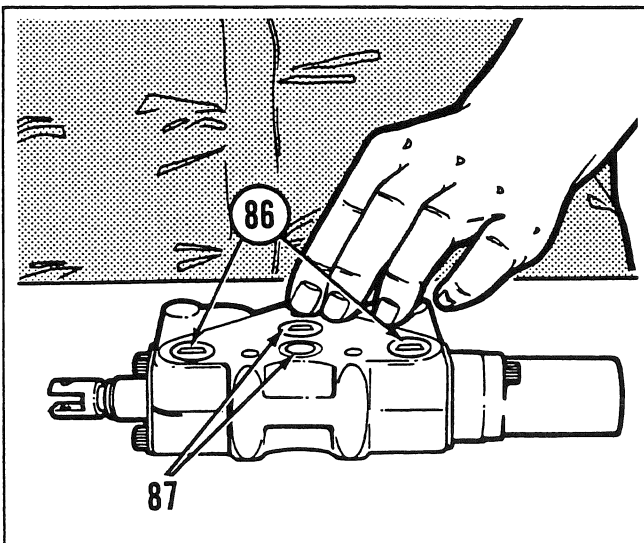


Fig. 40

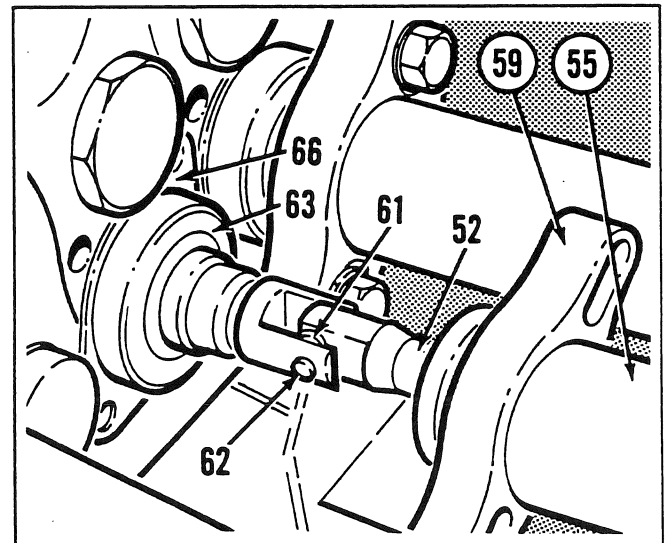


Fig. 43

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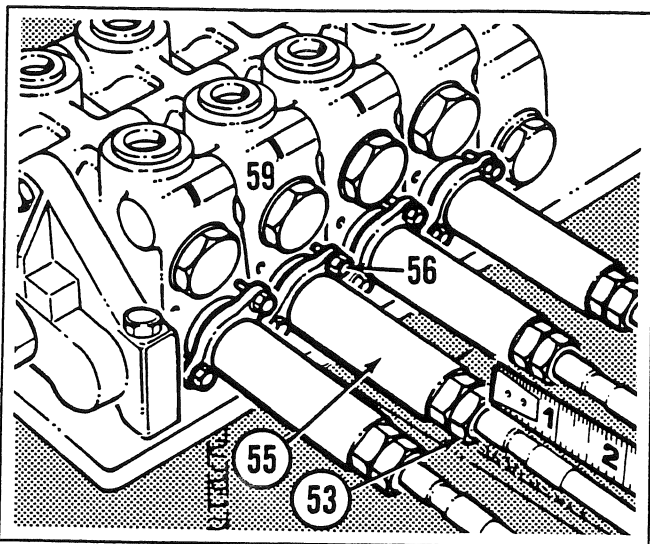


Fig. 44

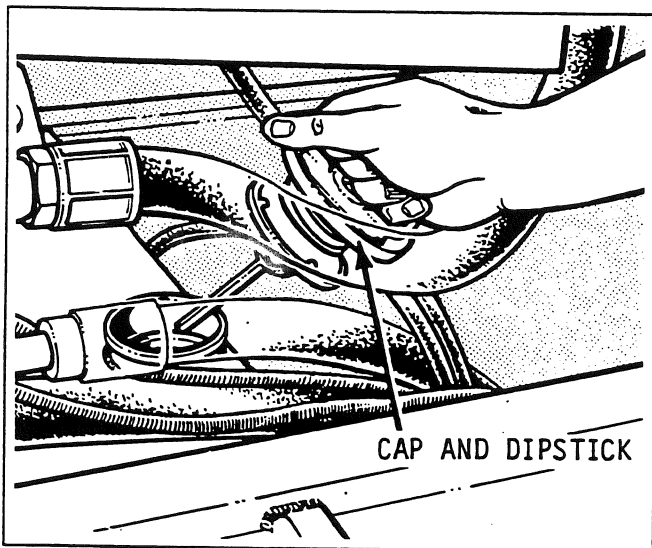


Fig. 45

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Manifold Valve Assembly - Installation

continued

Fig. 44

Install and tighten the jam nut (53) against the bonnet (55). Referring to the measurement noted in Fig. 5, reposition the bonnet and make any adjustments. Tighten the two bolts (56) retaining the plate (59) to the specified torque. Uncap and connect the hoses and tubes. Repeat the procedures (Figs. 43 and 44) to install any remaining cables. Operate all the control levers to ensure that no binding or sticking occurs. Refer to **Inspection - Binding/Sticking Problems**.

Fig. 45

Perform the daily pre-start checks detailed in the 700 Series Operator's Manual. Make a visual check around the grader. Signal your intention to start the engine. Start the engine when it is safe to do so and operate all hydraulic control levers. Lower the moldboard and all attachments to the ground. Do not apply down pressure. Shut down the engine. Check the grader hydraulic filter strainer for damage. Replace it if necessary. Check the hydraulic fluid level and for leaks.

Inspection - Binding/Sticking Problems

When servicing the manifold valve assembly, binding or sticking could occur. With the grader in the SERVICE POSITION, operate all the control levers. If binding or sticking occurs, use the following procedure.

1. Loosen and remove the manifold hold down bolts.
2. Evenly loosen the manifold tie studs and ensure the valve section is free of contamination and the O rings have not dislodged.
3. Evenly torque the tie studs to 30 lbf·ft (40,7 N·m; 4,2 kgf·m).
4. Install the hold down bolts and tighten them to the specified torque.

5. Operate the control levers and check for binding or sticking.

6. Check the cables for kinks or the lever bushings for binding.

If problems persist, repeat steps 1 through 6, but reduce the tie bolt torque by 2 lbf·ft (2,7 N·m; 0,3 kgf·m) each time these steps are required to a minimum torque of 26 lbf·ft (35,3 N·m; 3,6 kgf·m). If binding or sticking continues, you must service the defective valve sections.

Cables

Teflon-lined cables, introduced on grader S/N 18063, reduce binding problems. Champion recommends installing teflon-lined cables on earlier machines.

700 SERIES SHOP MANUAL

SECTION 4B

HYDRAULICS

Main Hydraulic Pump

S/N 16224, 16245 to 20804 and 20807. U.S. S/N 2021-2 to 2658-2

700 SERIES SHOP MANUAL

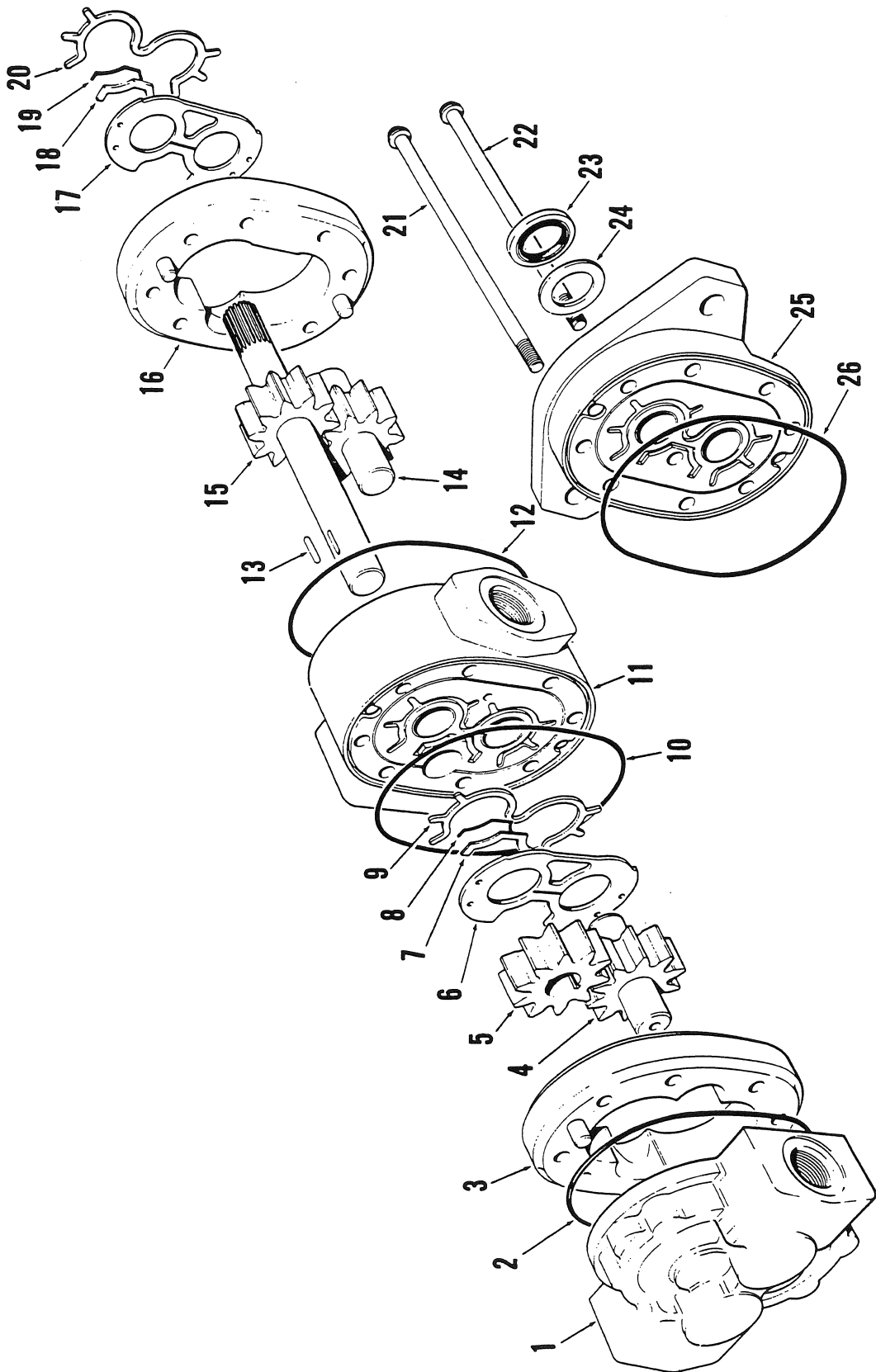


Fig. 1B Main Hydraulic Pump

S/N 16224, 16245 to 20804 and 20807. U.S. S/N 2021-2 to 2658-2

700 SERIES SHOP MANUAL

Item	Description	Item	Description	Item	Description
1	Backplate	10	O ring	19	Molded O ring
2	O ring	11	Adapter plate	20	Gasket
3	Rear body	12	O ring	21	Capscrews (hex. head)
4	Idler gear	13	Key	22	Capscrews (hex. head)
5	Slip fit gear	14	Idler gear	23	Oil seal
6	Wear plate	15	Driveshaft assembly	24	Back-up washer
7	Seal	16	Front body	25	Front plate
8	Molded O ring	17	Wear plate	26	O ring
9	Gasket	18	Seal		

Key to Fig. 1B

S/N 16224, 16245 to 20804 and 20807. U.S. S/N 2021-2 to 2658-2

Introduction of Premium Quality Gear Pumps

Starting at grader S/N 20805, 20806, 20808 and up, Champion has changed the main hydraulic pump installation on all models. The new pump and hydraulic changes introduced with Series III models provide an efficient, extended-life system.

On all models, the main hydraulic pump is mounted onto the engine accessory drive housing. The end of the pump is supported by a bracket attached to the engine block. The proven twin-flow hydraulic system concept is retained and the pump configurations are as follows:

Graders Equipped with Oil Disc Brakes

These graders use a two-section pump. Each pump section has its own 1-1/4 in. diameter suction hose (versus the single 1-1/2 in. suction hose) and separate, identical relief valves as before. Nitrogen accumulators in the hydraulic system provide reserve braking power for these graders.

Graders Equipped with Drum Brakes

On graders equipped with drum brakes, a third section is added. This third section is small and supplies oil only to the reserve braking device. This effectively uses different hydraulic circuits for the braking and steering functions.

Oil for the third section is supplied internally from the adjacent pump section. The third section uses a relief valve mounted to the manifold block on the hydraulic tank. All three relief valves have identical part numbers. Oil leaving the brake booster joins the main hydraulic and steering return flow at the five-way connector located below the cab on the left-hand side of the frame.

Kits, containing shaft and section seals for the two- and three-section pumps, are available from Champion's Distribution Center or your Champion Distributor.

700 SERIES SHOP MANUAL

Main Hydraulic Pump - Removal

Fig. 2

Place the grader in the SERVICE POSITION. Refer to the procedure on page (ii) in the front of this Shop Manual section. Remove the side panels. Remove the hydraulic tank filler cap to release any pressure and replace the cap loosely. The primary hydraulic pump is a single inlet, dual output gear pump. It is mounted to the adaptor plate and driven directly from the engine accessory drive. Both output sections are identical in displacement and each section uses a remote mounted relief valve located at the front of the hydraulic tank.

Fig. 5

Identify the pressure hoses with their respective pump sections.

Fig. 3

Before removing any hoses, make sure that the pump and surrounding area are clean.

Fig. 6

Remove the pressure hoses. Cap all fittings and ports to prevent contamination.

Fig. 4

Loosen the suction hose clamp and remove the hose from the pump. Cap the suction hose and port to prevent contamination.

Fig. 7

While supporting the weight of the pump with your hand, remove the mounting nuts. Remove the pump.

NOTE: Effective on models 710 through 730A S/N 19982, 19984, 19985, 19986, 20005, 20104, 20106, 20120 and up, a support bracket is installed between the engine block and the main hydraulic pump. Remove the bolts and lock-washers securing the pump to the bracket.

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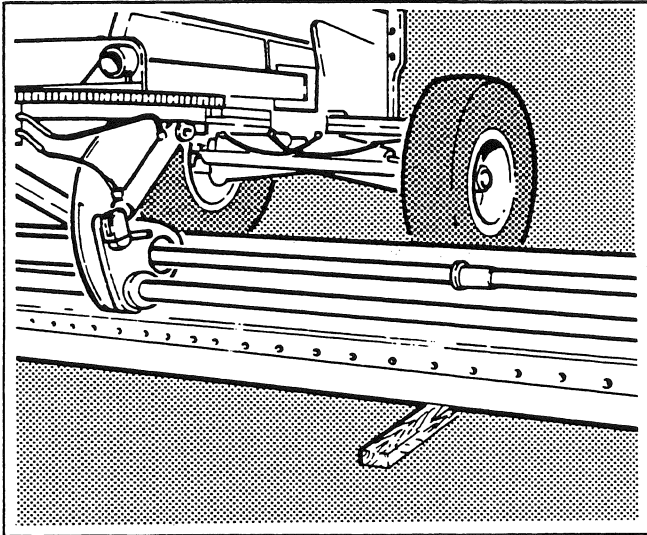


Fig. 2

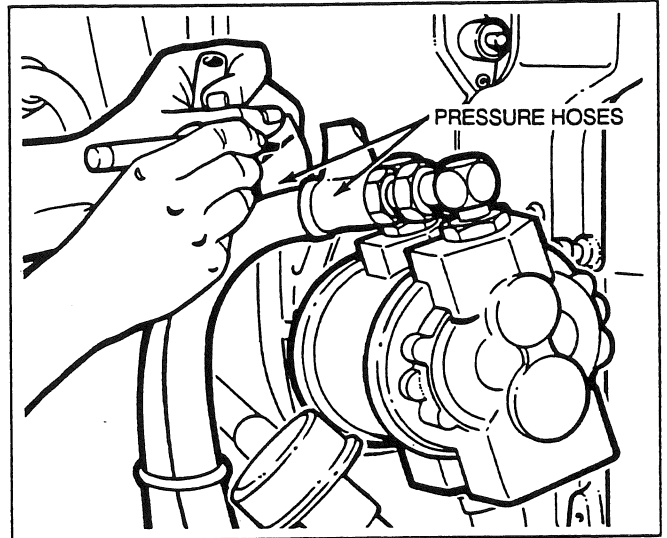


Fig. 5

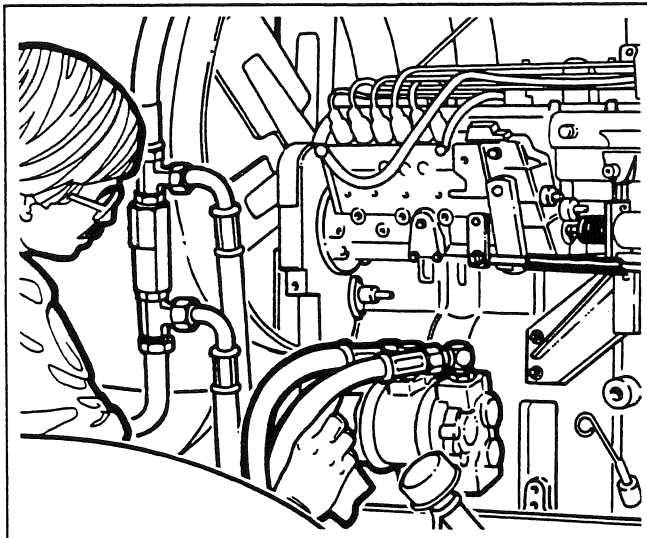


Fig. 3

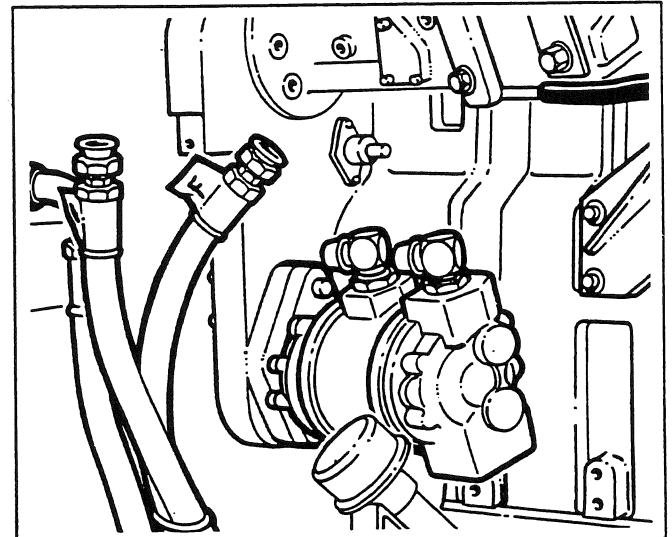


Fig. 6

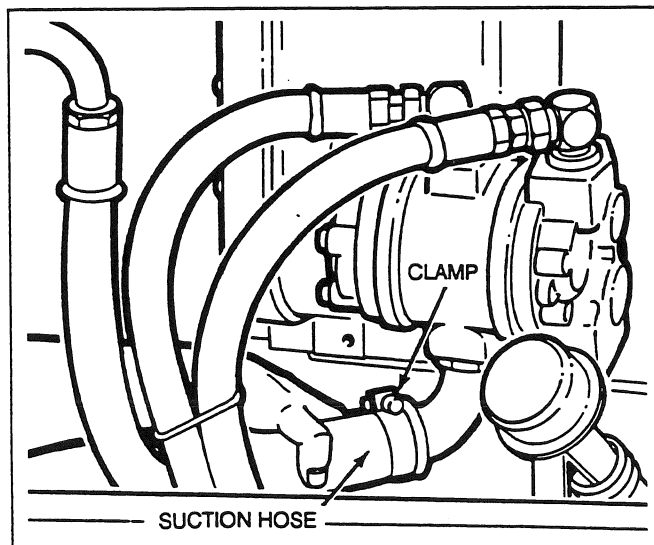


Fig. 4

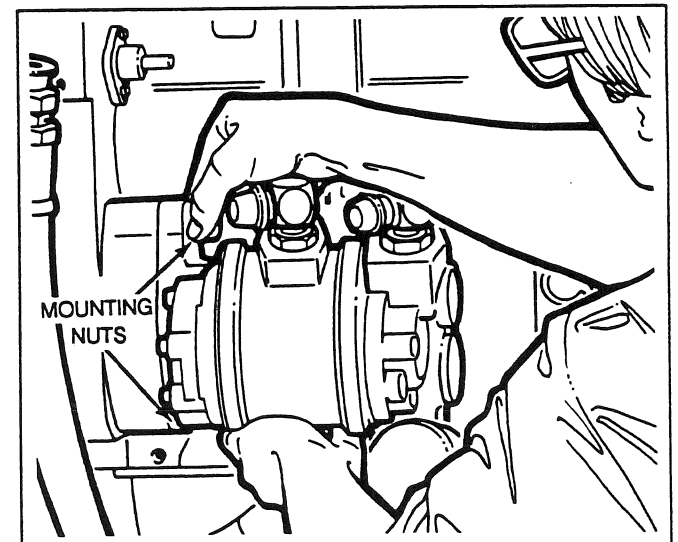


Fig. 7

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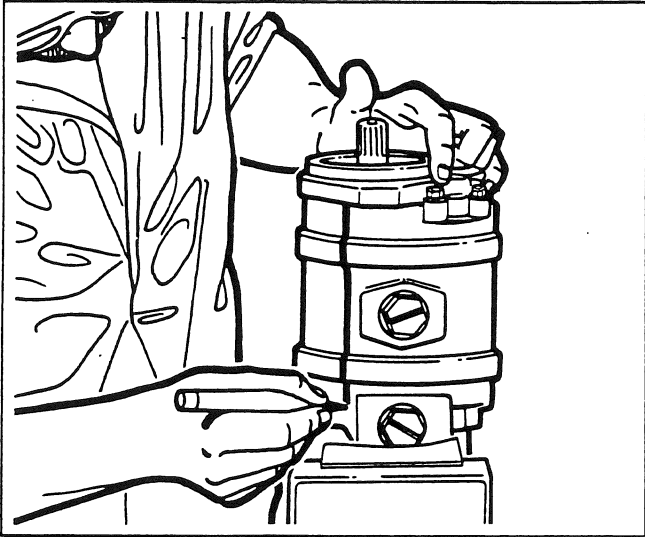


Fig. 8

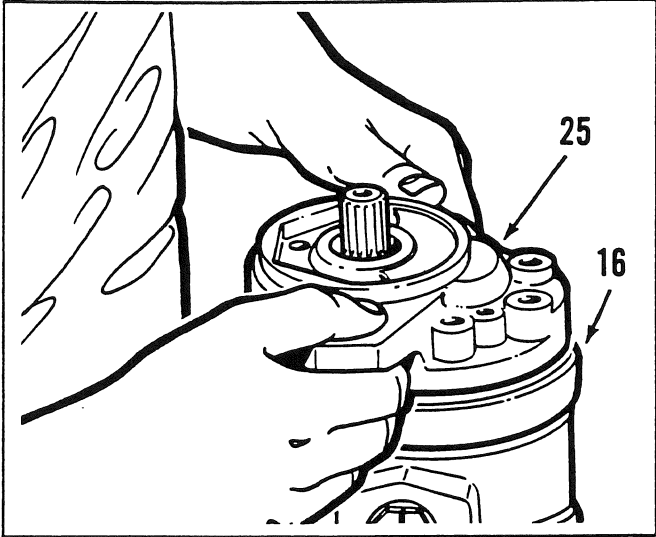


Fig. 11

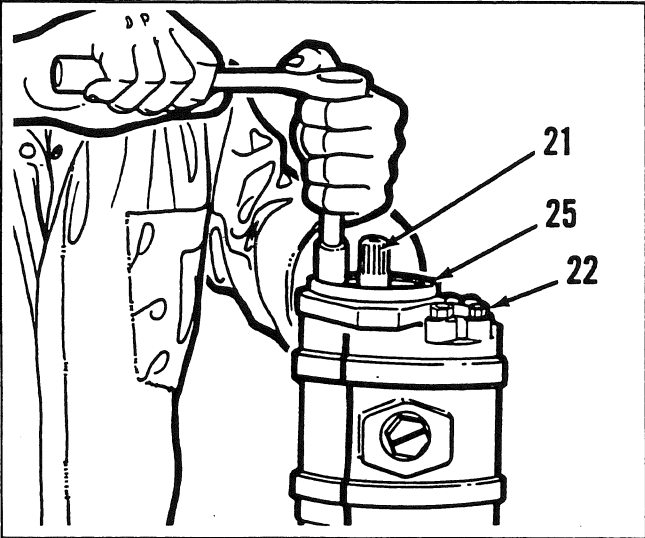


Fig. 9

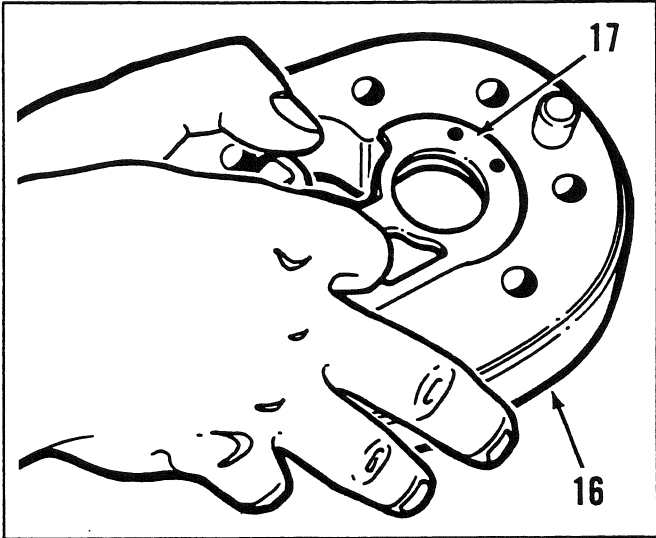


Fig. 12

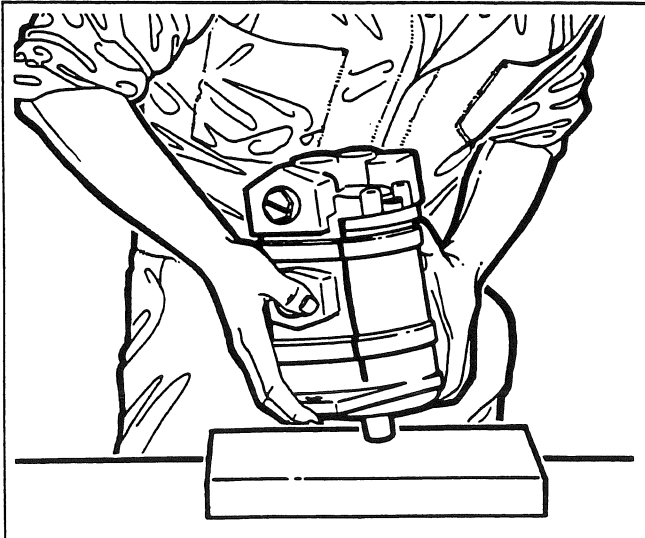


Fig. 10

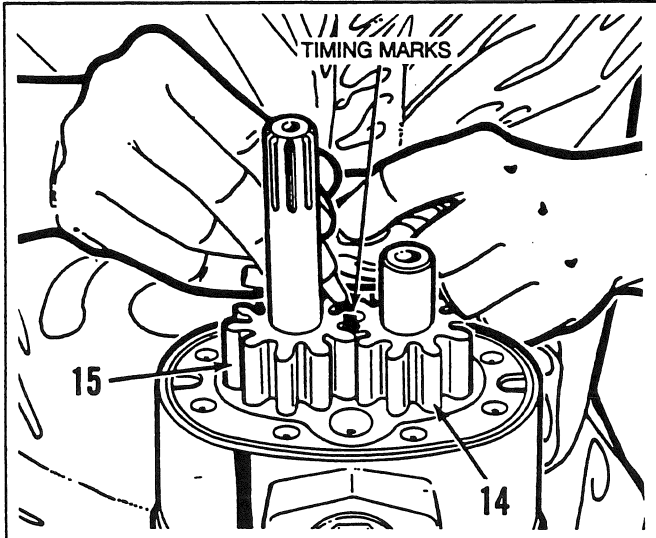


Fig. 13

700 SERIES SHOP MANUAL

Main Hydraulic Pump - Disassembly

Fig. 8

Secure the back plate end of the pump in a vise with soft jaws. Mark the pump across all sections. This will help when you assemble the pump.

Fig. 11

With the back plate (1) again secured in a vise with soft jaws, separate the front plate (25) from the front body (16).

Fig. 9

Loosen the capscrews (21 and 22) in a star pattern to prevent warping the front plate (25). Remove the capscrews.

Fig. 12

Remove the front body (16) and discard the wear plate (17).

Fig. 10

Remove the pump from the vise. Carefully bump the end of the shaft on a block of wood to separate the plates.

Fig. 13

Apply a marking dye to the mating teeth of the driveshaft assembly (15), and idler gear (14). This ensures correct timing during assembly. Remove the idler gear.

700 SERIES SHOP MANUAL

Main Hydraulic Pump - Disassembly

continued

Fig. 14

Remove the adapter plate (11) from the rear body (3).

Fig. 17

Apply a marking dye to the mating teeth of the idler gear (4), and slip fit gear (5). This ensures correct timing during assembly. Remove the idler gear and slip fit gear.

Fig. 15

Remove the key (13) and withdraw the driveshaft assembly (15) from the adapter plate (11).

Fig. 18

Remove the rear body (3) from the back plate (1). Remove and discard the O ring (2).

Fig. 16

Remove and discard the wear plate (6).

Fig. 19

Remove and discard the gasket (20), seal (18), molded O ring (19) and O ring (26) from the front plate (25). Remove and discard the gasket (9), seal (7), molded O ring (8) and O rings (10 and 12) from the adapter plate (11).

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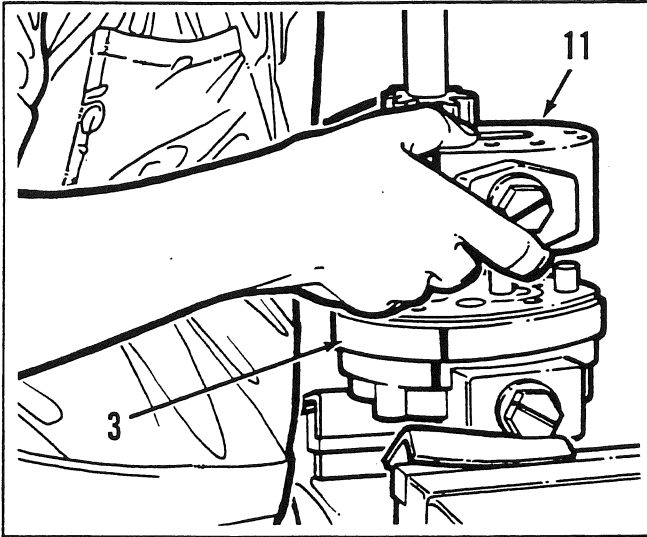


Fig. 14

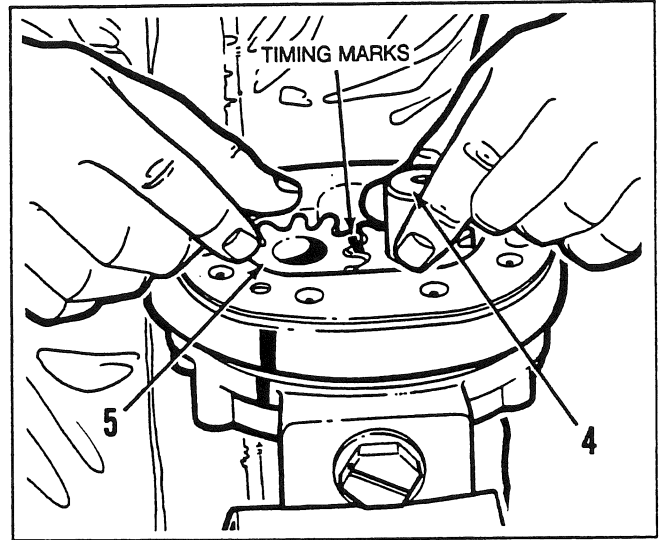


Fig. 17

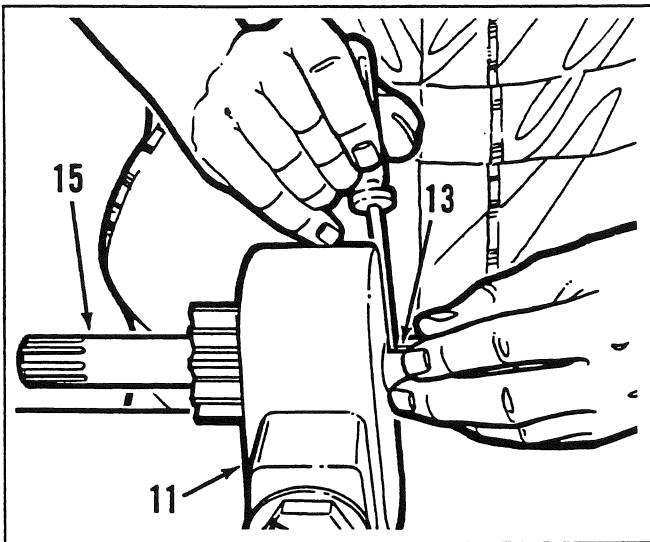


Fig. 15

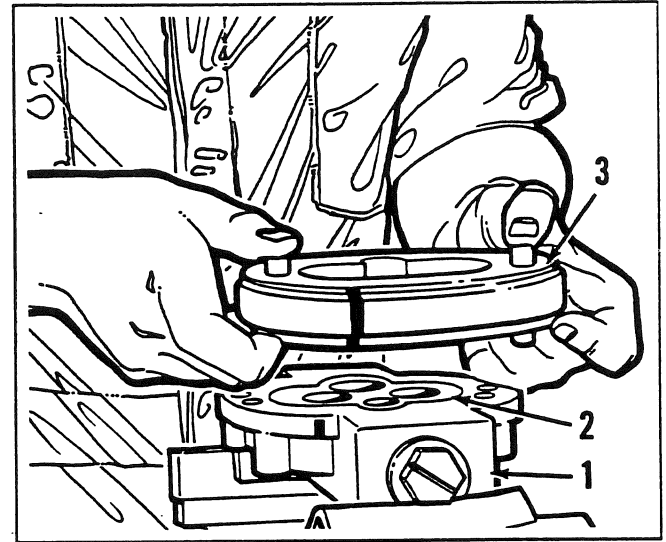


Fig. 18

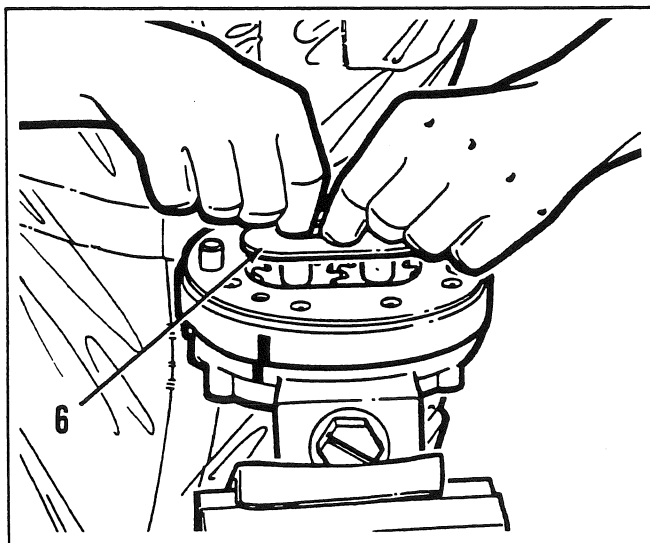


Fig. 16

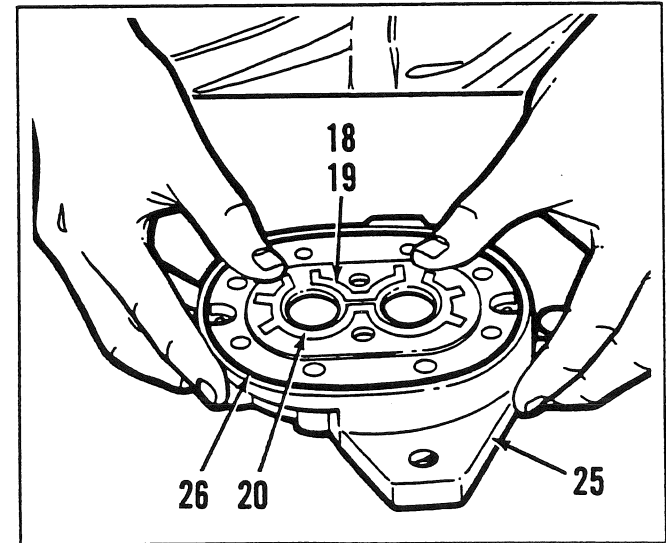
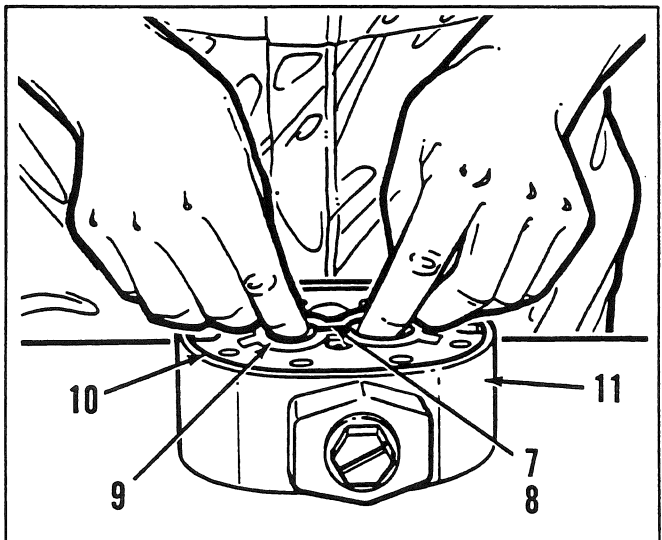
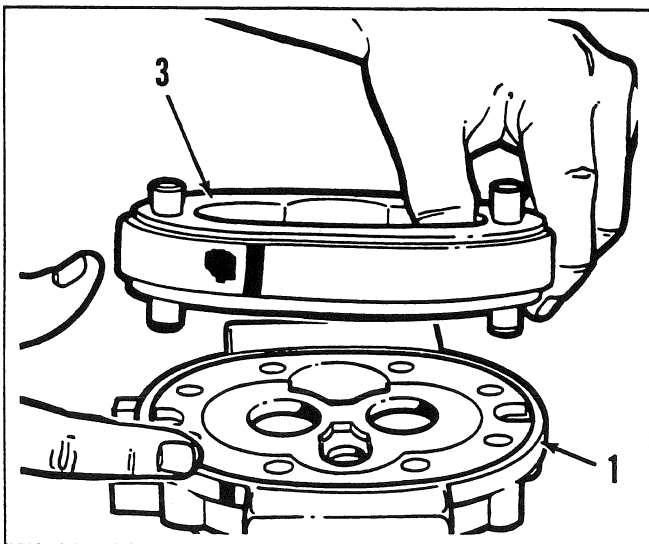
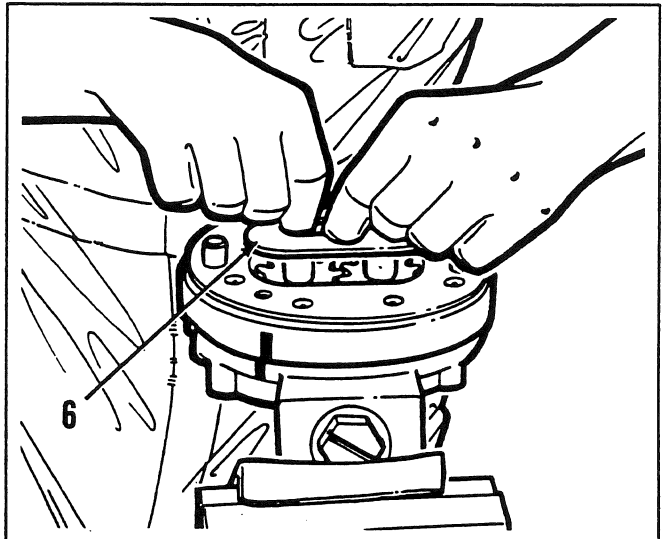
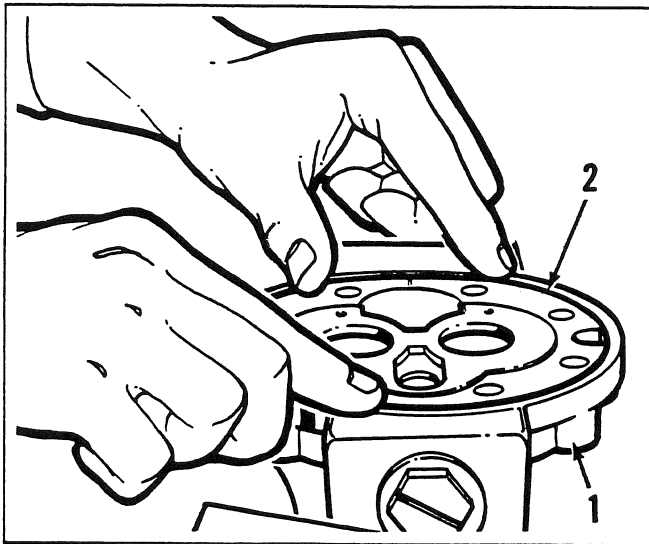
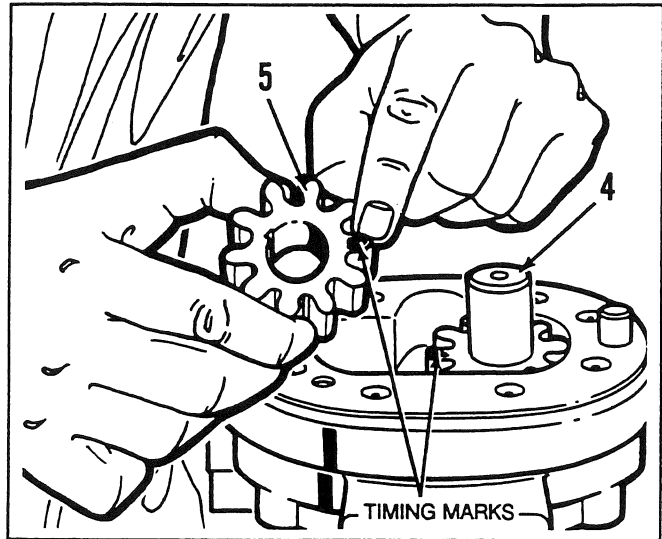
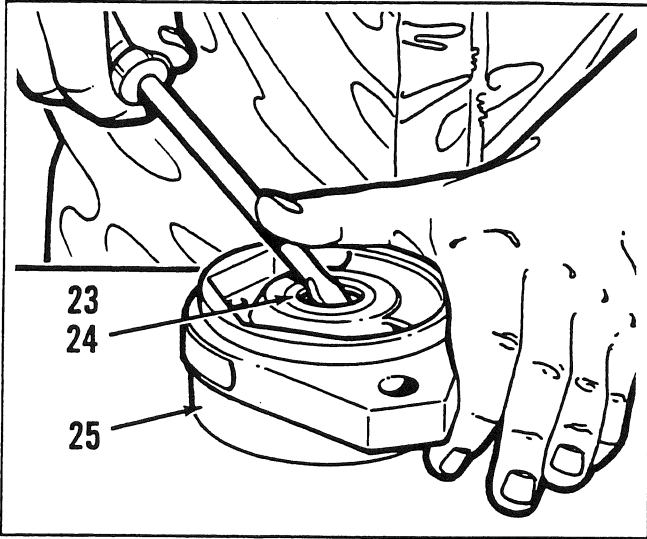


Fig. 19

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Main Hydraulic Pump - Disassembly

continued

Fig. 20

Use a flat blade screwdriver to remove the main shaft oil seal (23) from the front plate (25). Be careful not to damage the bore. Discard the oil seal and back-up washer (24). Disassembly is now complete. Inspect all parts for serviceability. Refer to **Inspection** at the end of this sub-section.

Main Hydraulic Pump - Assembly

Fig. 21

When assembling the pump, ensure all components are free from contamination. Always use clean system oil to lubricate parts before assembly. With the back plate (1) in a vise with soft jaws, lubricate and install a new O ring (2).

Fig. 22

Align the assembly marks on the back plate (1) and rear body (3). Install the rear body and carefully tap into place.

Fig. 23

Lubricate and install the idler gear (4) and slip fit gear (5) so that the timing marks are aligned and exposed.

Fig. 24

Install a new wear plate (6) with the bronze side toward the gear set and the cut-out on the suction side of the pump.

Fig. 25

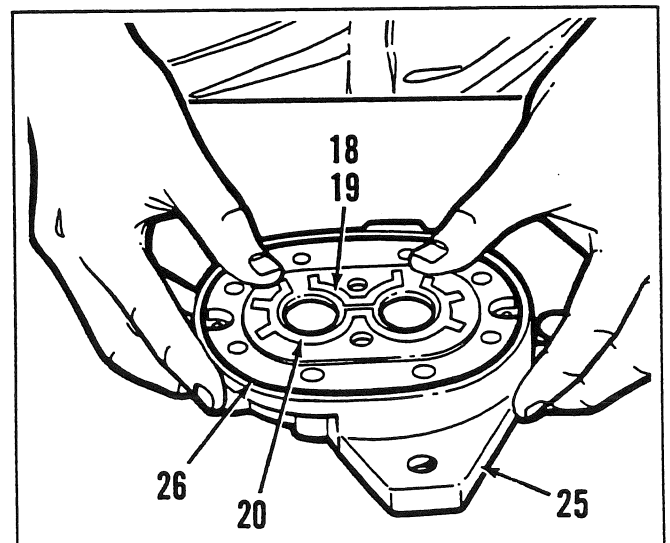
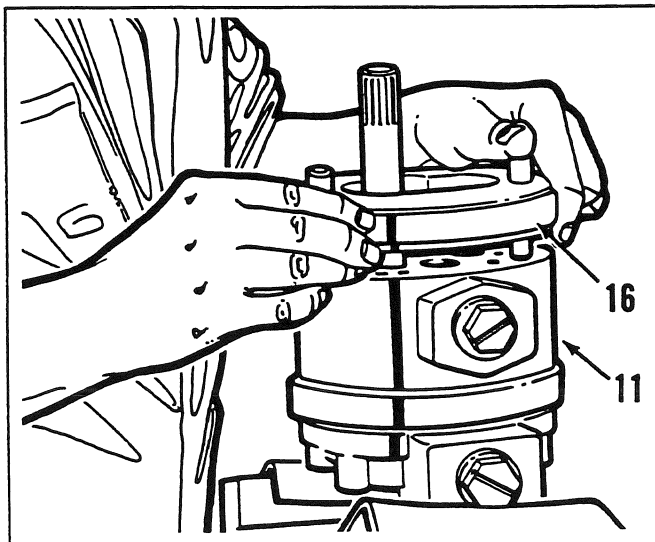
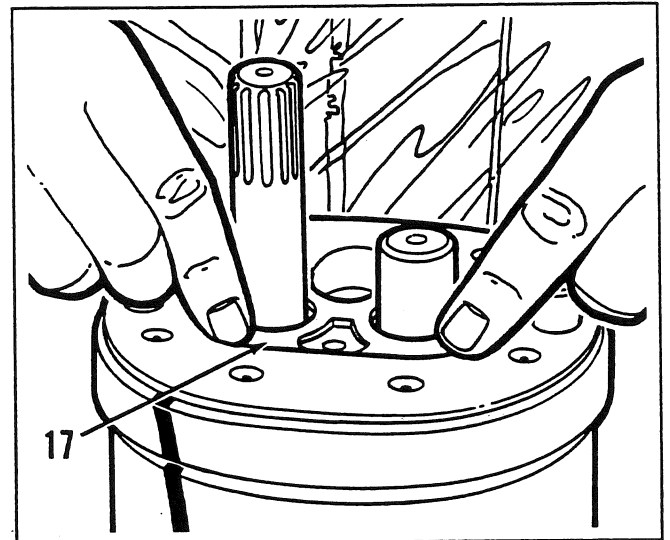
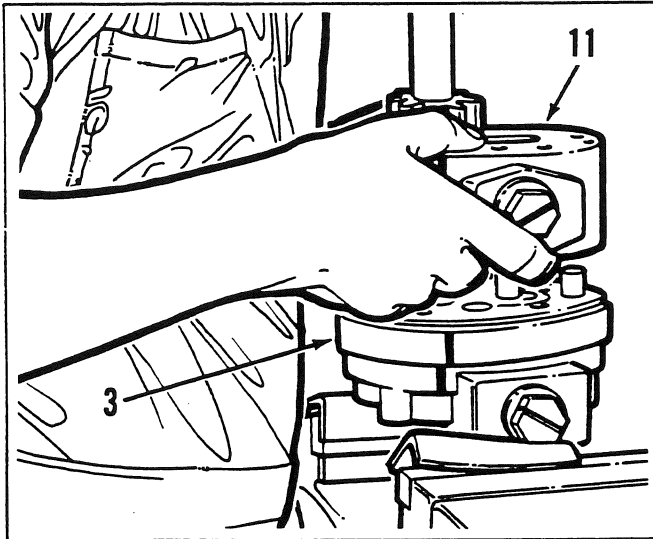
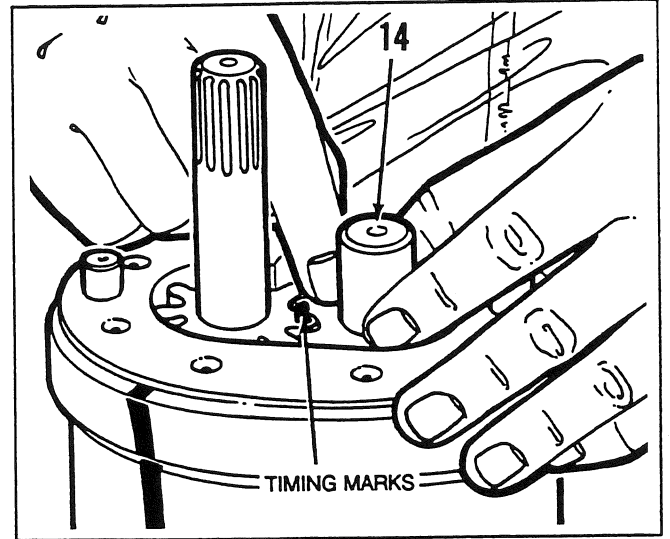
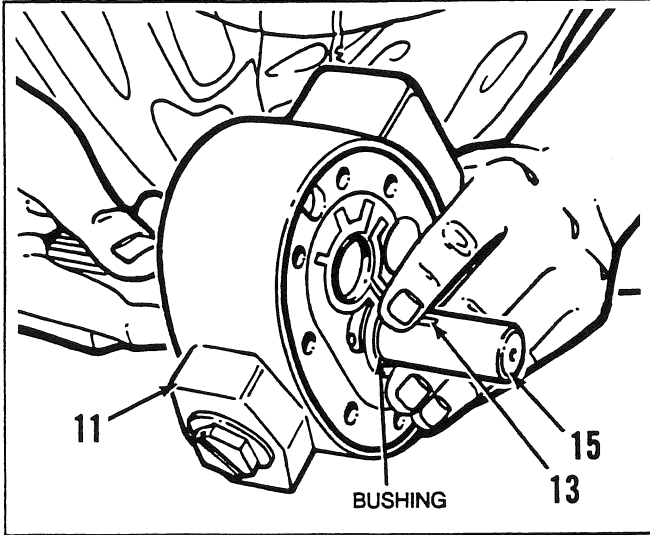
Working on the adapter plate (11), lubricate and install new O rings (10 and 12). Note the V groove in the gasket (9). Lubricate and install a new gasket with the groove facing down. Ensure that it seats correctly. Lubricate and install a new molded O ring (8) and new seal (7).

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Main Hydraulic Pump - Assembly continued

- Fig. 26**
Lubricate the bushing and install the driveshaft assembly (15) into the adapter plate (11). Install the key (13) into the driveshaft.
- Fig. 27**
Install the adapter plate (11) onto the rear body (3). Ensure you align the assembly marks and that the key (13) engages the slip fit gear (5).
- Fig. 28**
Install the front body (16), and carefully tap into place. Ensure you align the assembly marks on the front body and adapter plate (11).
- Fig. 29**
Install the idler gear (14), making sure to align the timing marks.
- Fig. 30**
Lubricate and install a new wear plate (17) with the bronze side towards the gears and the cut-out on the suction side of the pump.
- Fig. 31**
Note the V groove in the gasket (20). Lubricate and install a new gasket with the groove facing down. Ensure that it seats correctly. Lubricate and install a new molded O ring (19), seal (18) and O ring (26) in the front plate (25).

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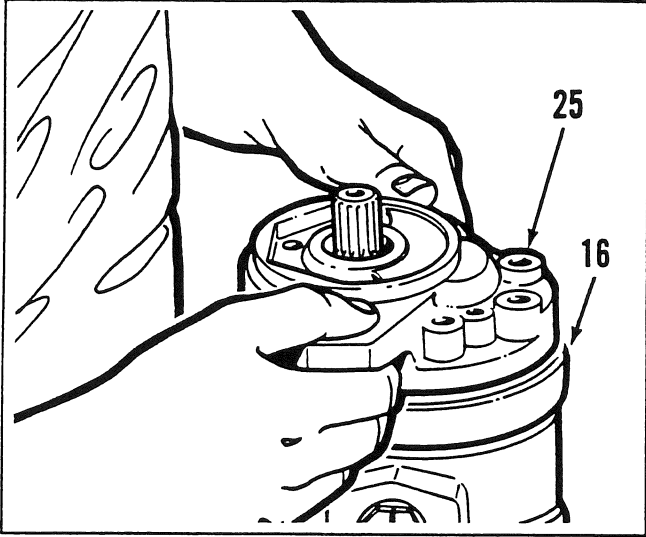


Fig. 32

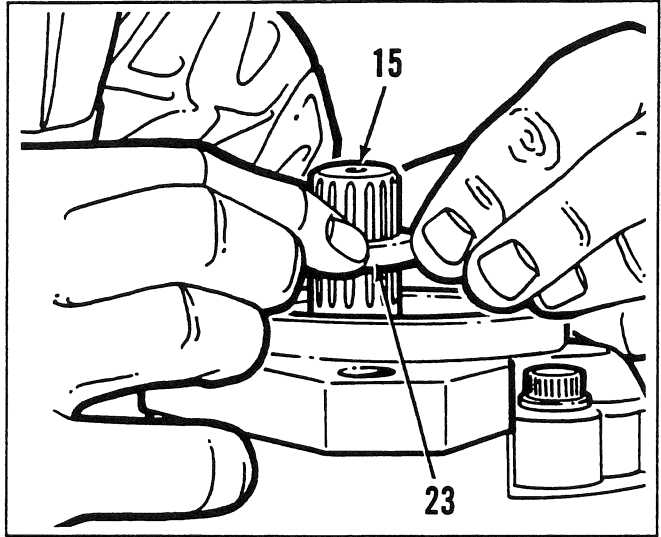


Fig. 35

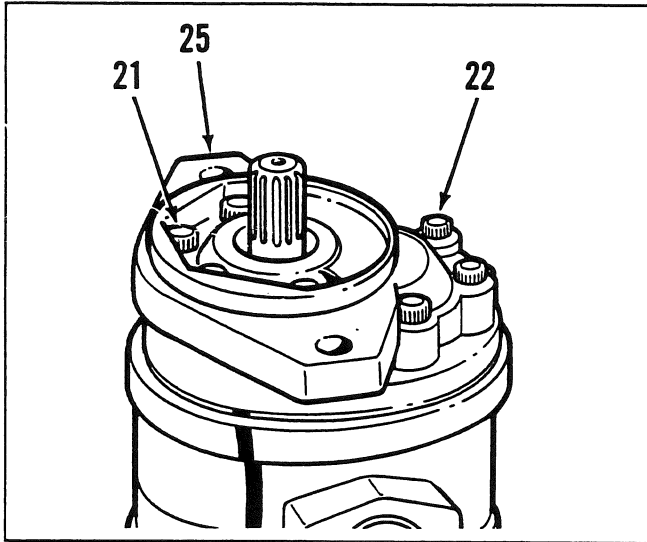


Fig. 33

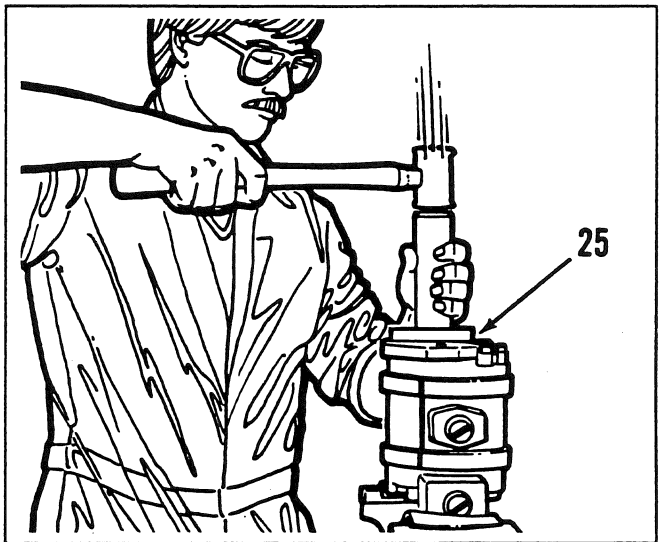


Fig. 36

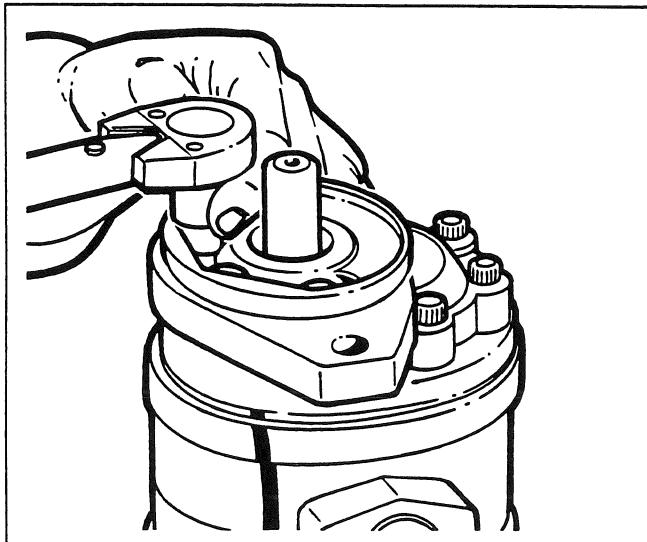


Fig. 34

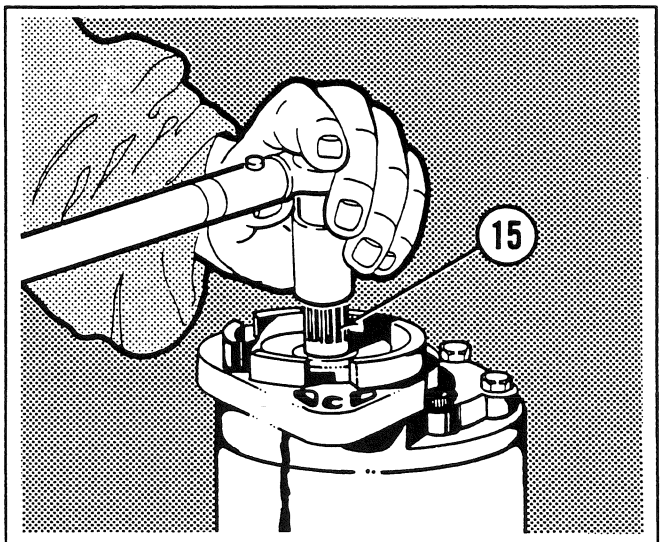


Fig. 37

700 SERIES SHOP MANUAL

Main Hydraulic Pump - Assembly continued

Fig. 32

Install the front plate (25) onto the front body (16). Check the alignment marks and carefully tap the front plate into place.

Fig. 33

All capscrews (21 and 22) are made of stress-proof material and must not be replaced with standard capscrews. Note the two lengths of capscrews. Install the longer capscrews (21) in the front plate (25) first. Install the shorter capscrews (22) in the remaining holes of the front plate. Rotate each capscrew counterclockwise until a click is heard and felt; then continue installing the capscrews. This prevents cross-threading.

Fig. 34

The capscrews must be torque-tightened in three increments: 25 lbf-ft (33,9 N·m; 3,5 kgf·m), 35 lbf-ft (47,4 N·m; 4,8 kgf·m), and 45 lbf-ft (61 N·m; 6,2 kg·m) in a star pattern.

Fig. 35

With a single layer of transparent tape covering the driveshaft assembly splines (15), slide a new back-up washer (24) into place. Lubricate the lip of a new oil seal (23) and slide it over the shaft, lip end first. Completely remove the transparent tape. Ensure no adhesive or tape stay under the seal.

Fig. 36

Use an appropriate soft metal drift to seat the oil seal (23) square to the front plate (25).

Main Hydraulic Pump - Installation

Fig. 37

Priming the pump is an important step during installation. Begin by filling each pump cavity, through the inlet side, with the correct system oil. Turn the driveshaft (15) in the proper direction of operation, then refill the pump cavities. The pump is now ready for installation.

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Main Hydraulic Pump - Installation

continued

Fig. 38

Install a new Cummins gasket between the engine block and adapter, and a new Champion gasket on the pump side of the adapter.

Fig. 41

Remove the caps from the pressure hose fittings. Check the condition of O rings and install the pressure hoses to their correct locations.

Fig. 39

As you install the pump, ensure it seats fully, then secure with the mounting nuts and washers.

NOTE: Do not draw the pump into place with the nuts.

Fig. 42

Remove the caps from the suction hose and port. Install the hose. Tighten the clamp securely to ensure a leak-proof seal and to prevent air entering the hydraulic system. This is extremely important to prevent pump cavitation.

Fig. 40

Tighten the mounting nuts to the specified torque.

NOTE: Effective on models 710 through 730A S/N 19982, 19984, 19985, 19986, 20005, 20104, 20106, 20120 and up, a support bracket is installed between the engine block and the main hydraulic pump. Secure the pump to the bracket with the bolts and lockwashers. Champion recommends updating earlier machines to include the support bracket. Contact your Champion Distributor for details.

Fig. 43

Perform the daily pre-start checks detailed in the 700 Series Operator's Manual. Make a visual check around the grader. Signal your intention to start the engine. Start the engine when it is safe to do so. Run the pump at half engine speed and no load. Build pressure by operating the left-hand blade lift cylinder control lever for approximately ten seconds. Operate the right-hand blade lift cylinder control lever for approximately ten seconds. Continue to build pressure intermittently for three to four minutes. Increase engine speed to full throttle and repeat the above procedure. Lower the moldboard to the ground. Do not apply down pressure. Shut down the engine. Check the hydraulic fluid level and for leaks. Replace the side panels.

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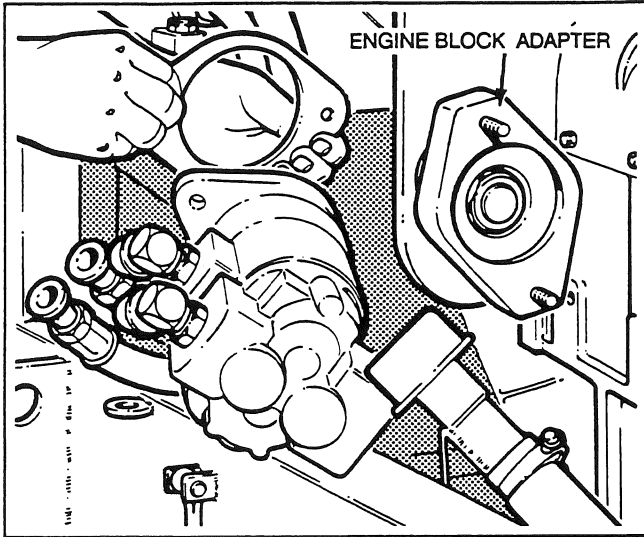


Fig. 38

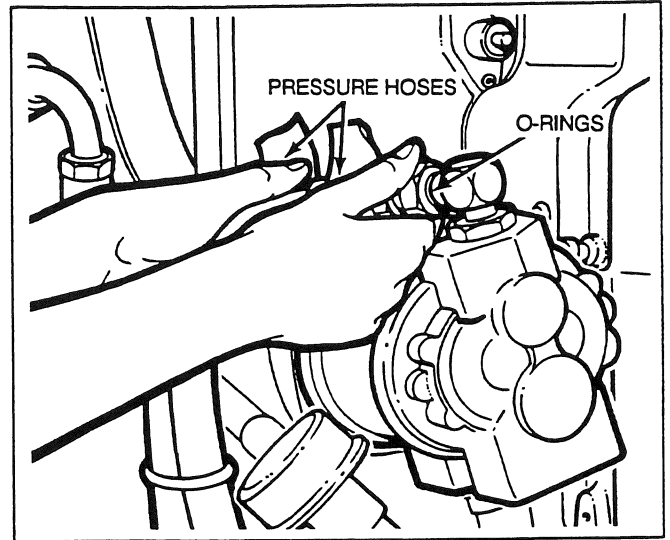


Fig. 41

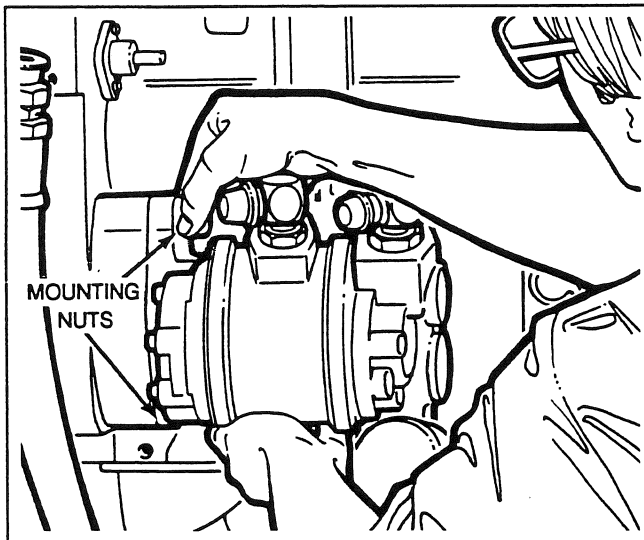


Fig. 39

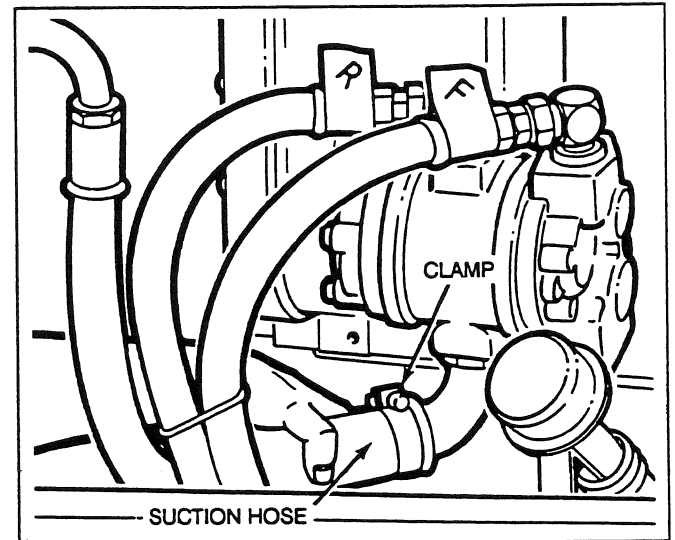


Fig. 42

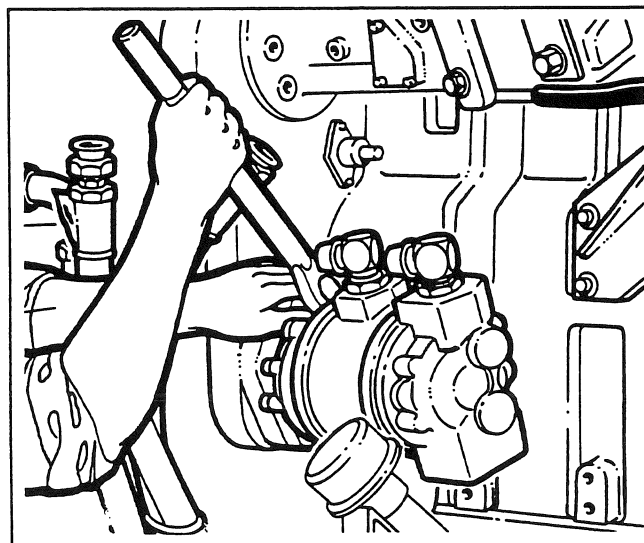


Fig. 40

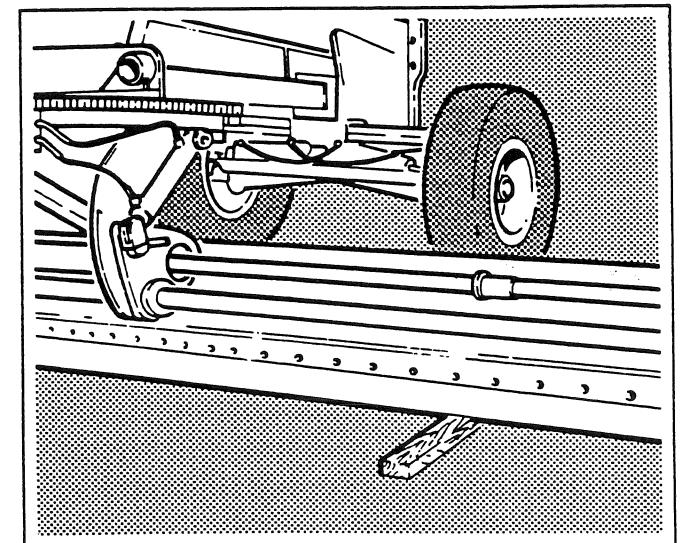


Fig. 43

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Main Hydraulic Pump - Inspection

Inspection - General

1. Clean and dry all parts.
2. Remove nicks and burrs from all parts with emery cloth.

Inspection - Gear Assembly

1. Check the driveshaft assembly splines (15) for twisted or broken teeth. Check for a broken keyway in the driveshaft where the slip fit gear (5) is installed.
2. Inspect both the driveshaft assembly (15) and idler gear shafts (4 and 14) at bushing points and oil seal (23) area for rough surfaces and excessive wear.
3. If the bushing area for the driveshaft assembly (15) or idler gear shafts (4 and 14) is less than 0.873 inch (22,2 mm), replace the gear assembly.
4. Inspect gear faces for scoring and excessive wear.
5. If the gear face widths for models 710 through 730A are less than 0.909 inch (23,1 mm), or 1.045 inch (26,5 mm) for models 740 through 780A, replace the gear assembly.
6. Ensure the retaining rings are in the grooves on either side of the driveshaft assembly gear (15) and idler gears (4 and 14).
7. Smooth any sharp gear teeth edges with emery cloth.

Inspection - Front Plate, Back Plate and Adapter Plate

1. The oil grooves in the bushings of the front plate (25), back plate (1), and adapter plate (11) should align with the dowel pin holes and be 180 degrees apart. This places the oil grooves closest to their respective dowel pin holes.

2. If the inside diameter of the bushings exceeds 0.879 inch (22,3 mm), replace the front plate (25), back plate (1) and adapter plate (11). Bushings are not available as separate items.
3. Bushings in the front plate (25) and the gasket side of the adapter plate (11) should be flush with the face.
4. Check for scoring on the face of both the back plate (1) and adapter plate (11). Replace either plate if the wear exceeds 0.0015 inch (0,038 mm).

Inspection - Body

1. Check the inside gear pockets for excessive scoring or wear.
2. Replace the body assemblies (3 and 16) if the inside diameter of the gear pockets exceeds 2.108 inches (53,5 mm).

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Main Hydraulic Pump - Troubleshooting

Problem	Cause	Remedy
Noisy pump caused by cavitation	Oil too heavy	Change to the proper viscosity
	Oil filter plugged	Clean the filters
	Suction hose plugged or too small	Clean the hose and check for size
Hot oil	Oil supply low	Fill the hydraulic tank
	Contaminated oil	Drain the hydraulic tank and refill with fresh system oil
	Relief valve setting too high or too low	Set to the correct pressure
	Oil viscosity too light	Drain the hydraulic tank and refill with the proper viscosity system oil
	Excessive internal wear	Disassemble the pump and replace parts as needed
Oil seal leakage	Worn oil seal	Replace the oil seal
	Worn driveshaft	Replace the driveshaft
	Broken seal or gasket	Replace the seals or gaskets only if the leak persists after replacing the oil seal and driveshaft
	Bushings out of position	Disassemble the pump and replace the front plate
	Excessive internal wear	Disassemble the pump and replace parts as needed
Foaming oil	Low oil level	Fill the hydraulic tank with fresh system oil
	Air leaking into the suction hose	Tighten the suction hose clamp
	Wrong kind of oil	Drain the hydraulic tank and refill with non-foaming system oil as specified in the 700 Series Operator's Manual

700 SERIES SHOP MANUAL

SECTION 4C
HYDRAULICS

Transmission/Steering Hydraulic Pump

**S/N 16224, 16245 to 19981, 19883, 19986 to 19995, 19997 to 20004, 20006 to 20103, 20105,
20107 to 20119, 20804 and 20807. U.S. S/N 2021-2 to 2658-2**

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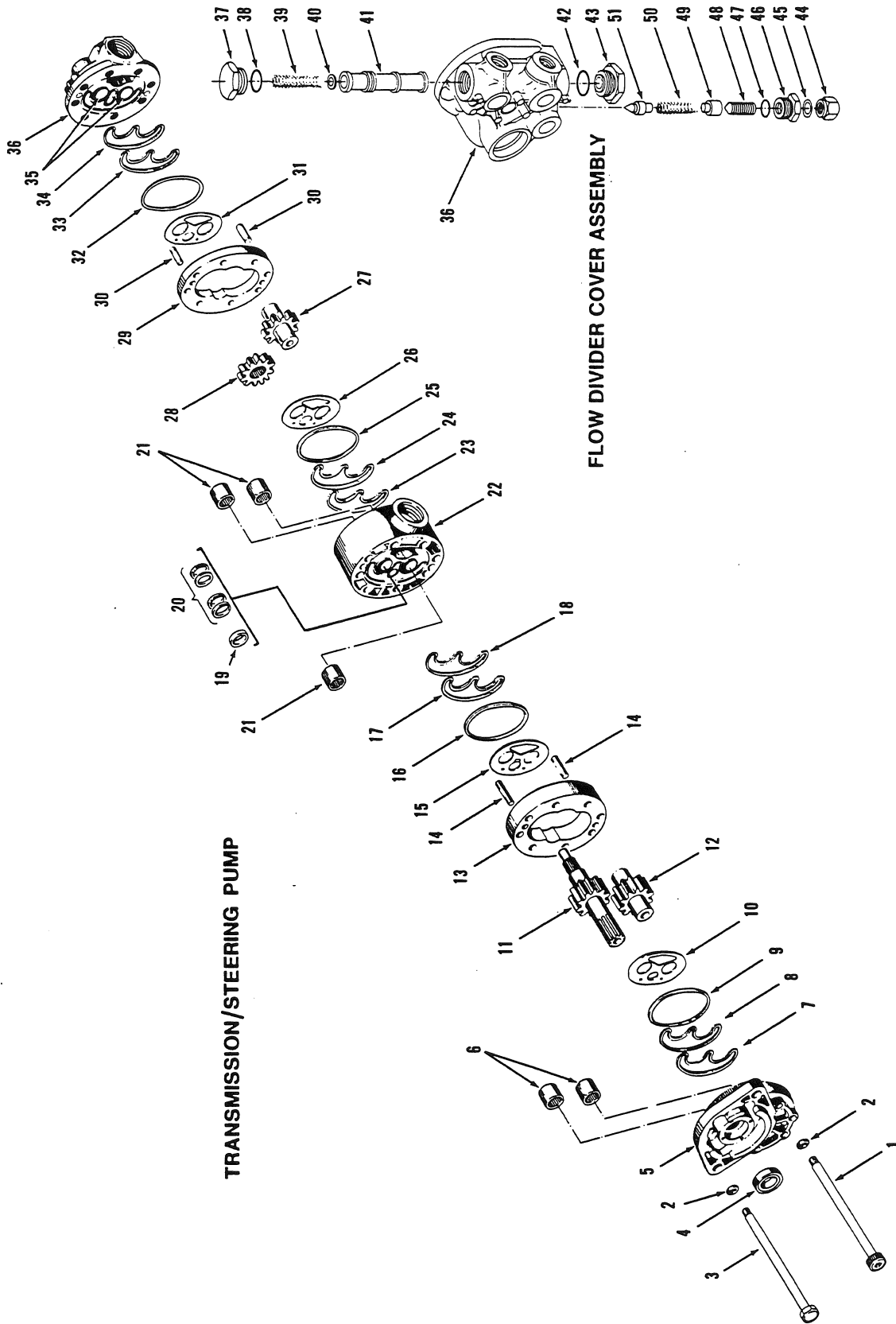


Fig. 1C Transmission/Steering Hydraulic Pump

S/N 16224, 16245 to 19981, 19883, 19986 to 19995, 19997 to 20004, 20006 to 20103, 20105, 20107 to 20119, 20804 and 20807. U.S. S/N 2021-2 to 2658-2

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Item	Description	Item	Description	Item	Description
1	Capscrews (socket hex. head)	18	E ring	35	Needle bearings
2	Flatwasher	19	Back-up ring	36	Flow divider cover
3	Capscrews (hex. head)	20	Shaft seals	37	Plug
4	Shaft seal	21	Needle bearings	38	O ring
5	Front plate	22	Bearing plate	39	Spring
6	Needle bearings	23	E ring	40	Orifice disc
7	E ring	24	E seal	41	Flow divider piston
8	E seal	25	Sealing ring	42	O ring
9	Sealing ring	26	Wear plate (grooved)	43	Plug
10	Wear plate	27	Idler gear	44	Cap
11	Drive gear	28	Drive gear	45	Copper gasket
12	Idler gear	29	Gear plate	46	Plug
13	Gear plate	30	Dowel pin	47	O ring
14	Dowel pin	31	Wear plate	48	Setscrew
15	Wear plate (grooved)	32	Sealing ring	49	Spring guide
16	Sealing ring	33	E seal	50	Spring
17	E seal	34	E ring	51	Relief poppet

Key to Fig. 1C

S/N 16224, 16245 to 19981, 19883, 19986 to 19995, 19997 to 20004, 20006 to 20103, 20105, 20107 to 20119,
20804 and 20807. U.S. S/N 2021-2 to 2658-2

NOTE: Items 37 to 51 are not found on graders S/N 19982, 19984, 19985, 19996, 20005, 20104, 20106, 20120 and up. These machines are equipped with a remote mounted flow divider/relief valve. Refer to Product Support Bulletin No. 512 and form No. F-503 (01/90) for details.

Introduction of Premium Quality Gear Pumps

Starting at grader S/N 20805, 20806, 20808 and up, Champion has changed the transmission/steering hydraulic pump installation on all models. The new pump and hydraulic changes introduced with Series III models provide an efficient, extended-life system.

The two-section transmission/steering hydraulic pump is located below the radiator and driven by the engine crankshaft as before. The increased displacement of the transmission section eliminates the need for the belt-driven clutch pump introduced at grader S/N 19885. The steering section installation remains unchanged as the priority flow divider/relief valve was remote mounted when Series III models were introduced.

Two spring-type lip seals provide sealing between the transmission and steering sections. The cavity between the seals is vented to the clutch housing through a 3/8 in. hose. This prevents pressure build-up and dirt entering the pump.

A kit containing shaft and section seals is available. Contact Champion Parts Distribution Center or your Distributor.

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Transmission/Steering Hydraulic Pump - Removal

Fig. 2

Place the grader in the SERVICE POSITION. Refer to the procedure on page (ii) in the front of this Shop Manual section. Remove the hydraulic tank filler cap to release any pressure and replace the cap loosely. The transmission/steering pump is located below the radiator and is driven by a driveshaft. Remove the panels to gain access to the pump. For more information on steering, refer to Section 1, **Front Axle**, and Section 5, **Steering Unit and Column**, in this Shop Manual.

Fig. 3

Loosen both ends of the hydraulic suction hose. Remove the tank end first since the hose may contain oil. Remove the other end. Cap the hose and fitting to prevent contamination.

Fig. 4

Remove the steering pressure hose. Cap the hose and fitting. Remove the steering bypass hose. Cap the hose and fitting. Place a container under the transmission pressure hose and remove the hose. Oil from the transmission cooler will drain into the container. Cap the port and fitting.

Fig. 5

Remove the transmission suction hose. Cap the hose and fitting to prevent contamination.

Fig. 6

Remove the hydraulic pump mounting bolts. Remove the pump.

Transmission/Steering Hydraulic Pump - Disassembly

Fig. 7

Secure the flow divider cover (36) in a vise with soft jaws. Do not overtighten the vise. Evenly loosen the cap-screws (1 and 3) in a star pattern. Remove the cap-screws and flatwashers (2). Clearly identify each section to its mating section, preferably with light punch marks, to ensure proper assembly.

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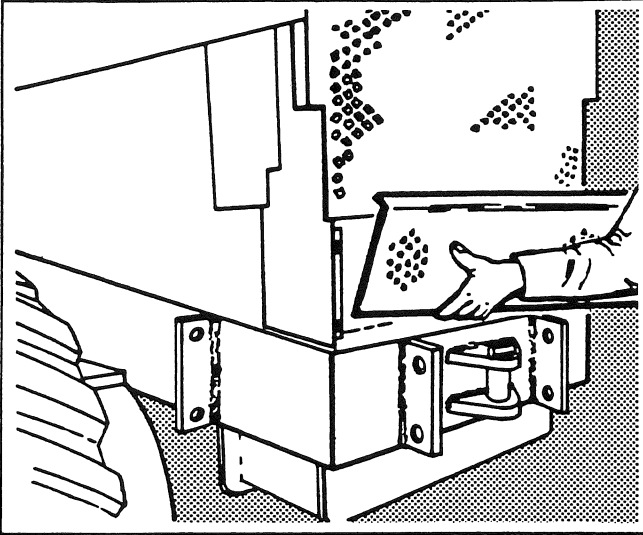


Fig. 2

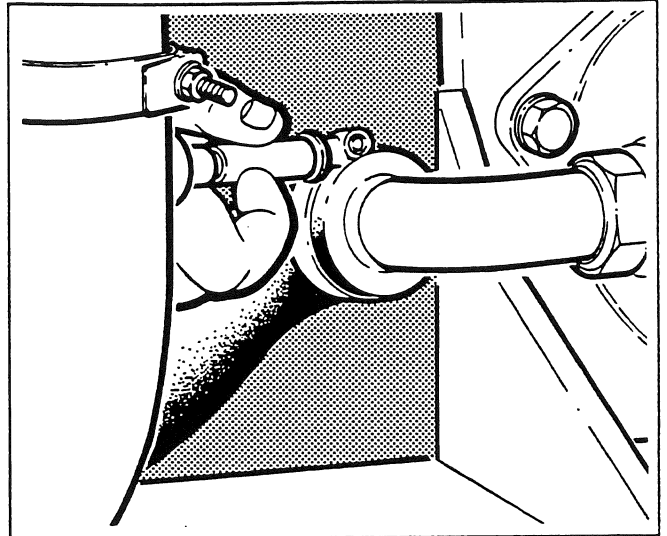


Fig. 5

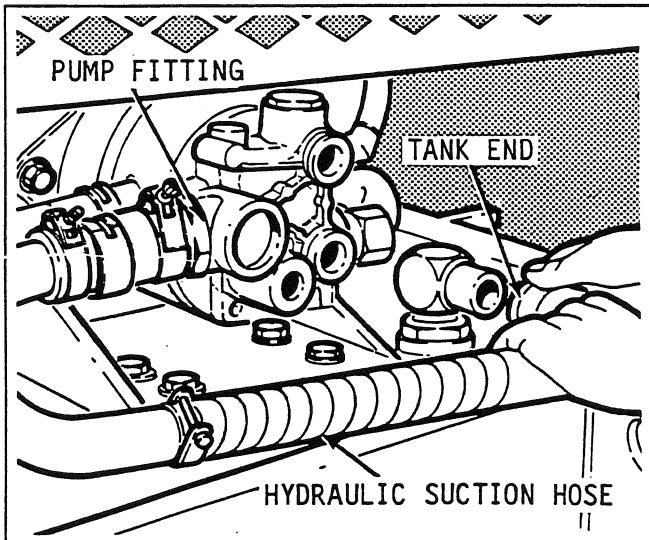


Fig. 3

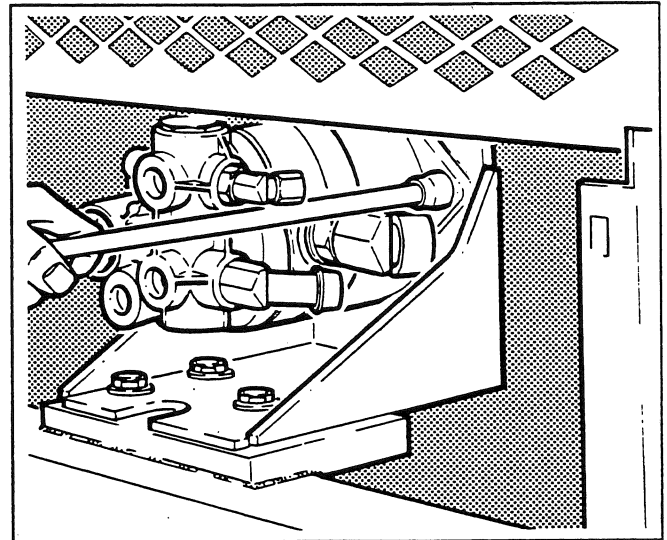


Fig. 6

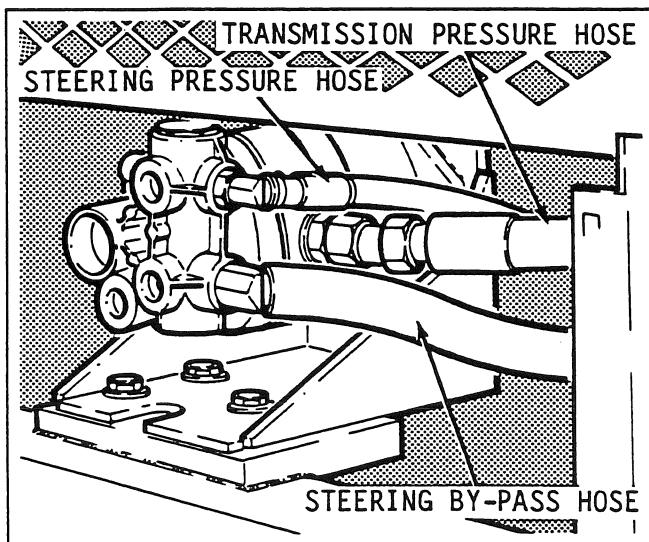


Fig. 4

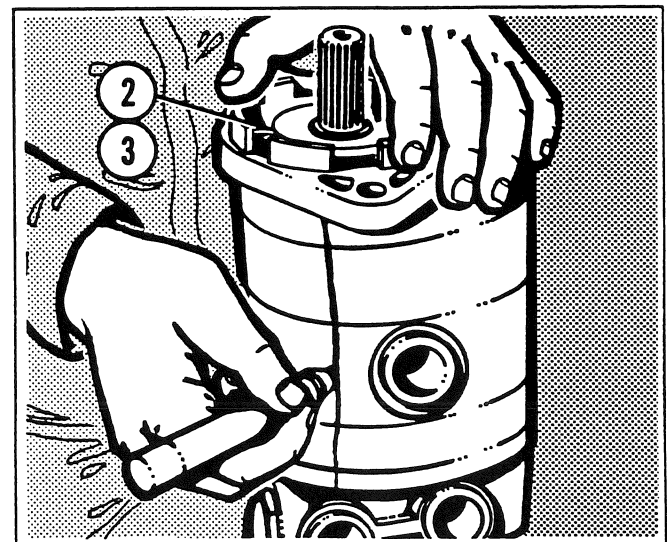


Fig. 7

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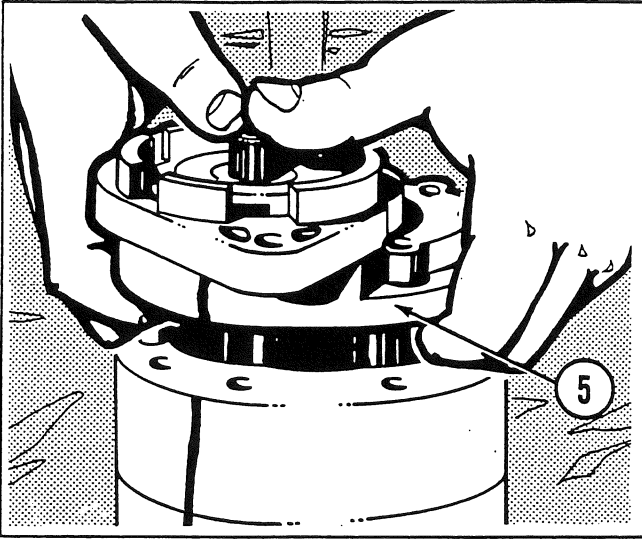


Fig. 8

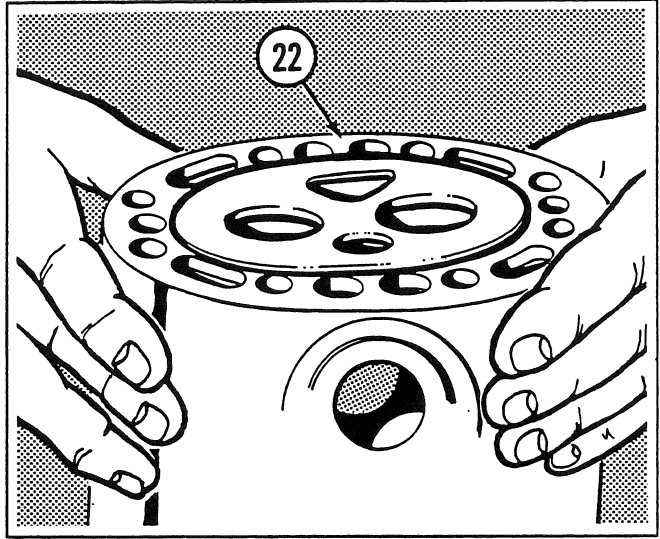


Fig. 11

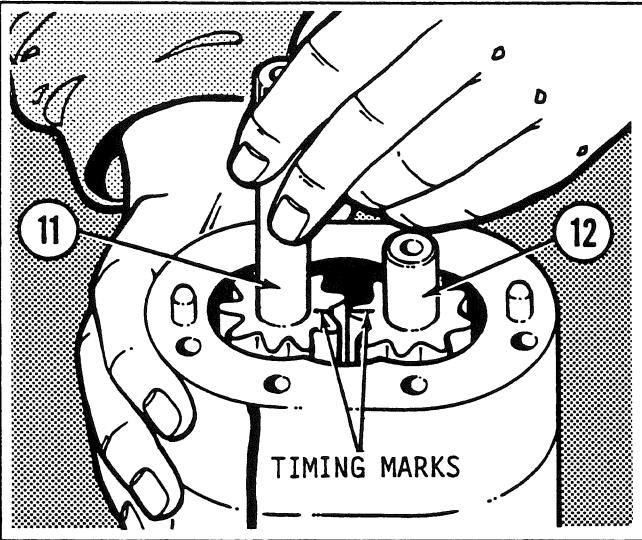


Fig. 9

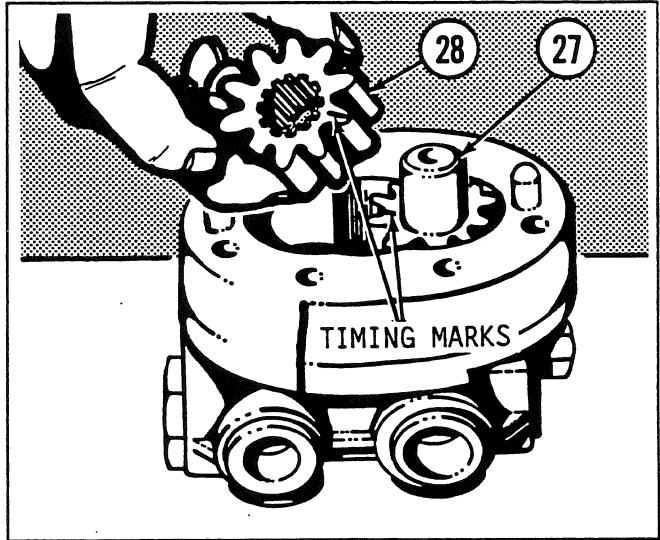


Fig. 12

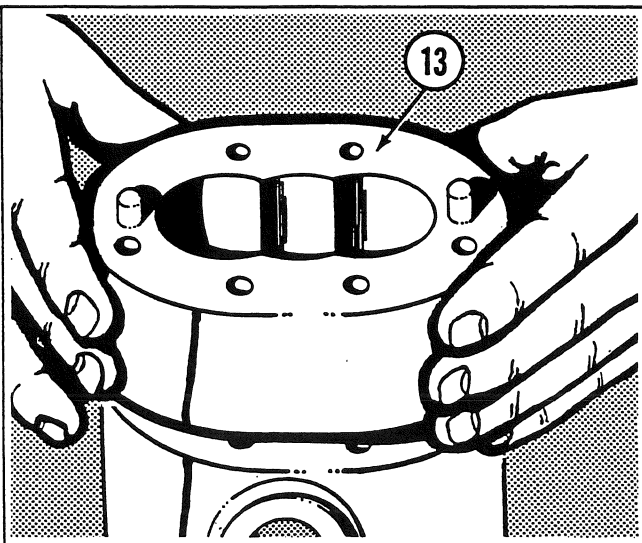


Fig. 10

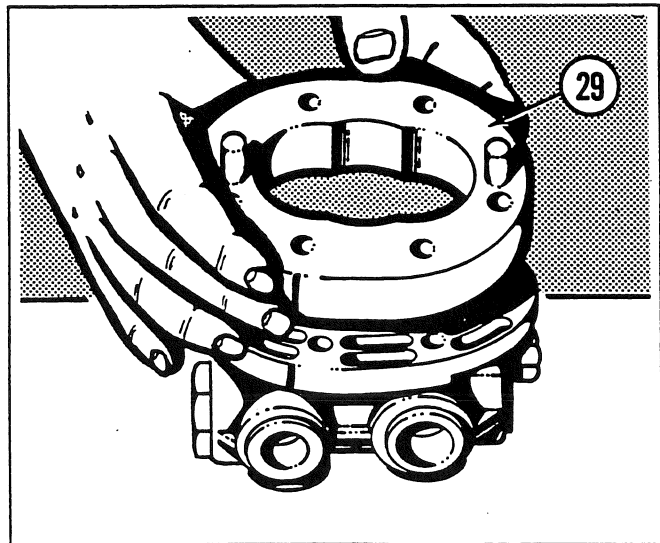


Fig. 13

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Transmission/Steering Hydraulic Pump - Disassembly continued

Fig. 8

Carefully remove the front plate (5).

Fig. 11

Remove the bearing plate (22).

Fig. 9

Apply a marking dye to the mating gear teeth of the drive gear (11) and idler gear (12). This ensures correct timing during assembly. Remove the gears.

Fig. 12

Apply a marking dye to the mating gear teeth of the drive gear (28) and idler gear (27). This ensures correct timing during assembly. Remove the gears.

Fig. 10

Remove the gear plate (13).

Fig. 13

Remove the gear plate (29).

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Transmission/Steering Hydraulic Pump - Disassembly *continued*

Fig. 14

Working on the flow divider cover (36), carefully remove and discard the wear plate (31) and sealing ring (32). Remove and discard the E seal (33) and the E ring (34). If using a screwdriver, be careful not to damage the aluminum housing.

Fig. 15

Invert the flow divider cover (36) in the vise. Remove the cap (44) and copper gasket (45).

NOTE: Steps Fig. 15 through Fig. 18 apply only to graders S/N 16224, 16245 to 19981, 19983, 19986 to 19995, 19997 to 20004, 20006 to 20103, 20105 and 20107 to 20119. U.S. S/N 2021-2 to 2658-2.

Fig. 16

Accurately count and record the number of exposed threads on the setscrew (48). You will use this as a starting point for setting the relief valve. Unthread the set screw to relieve the spring (50) tension.

Fig. 17

Remove the plug (46) and inspect the O ring (47). Using a small magnetic pick-up tool, remove the spring guide (49), the spring (50) and the relief poppet (51).

Fig. 18

To reduce spring tension on the flow divider piston (41), loosen both plugs (37 and 43). Remove the plugs, piston and spring (39). Using a magnetic pick-up tool, remove the orifice disc (40) from the piston.

Fig. 19

Working on the bearing plate (22), remove and discard the grooved wear plate (15), sealing ring (16), E seal (17) and E ring (18). Repeat for the other side of the bearing plate.

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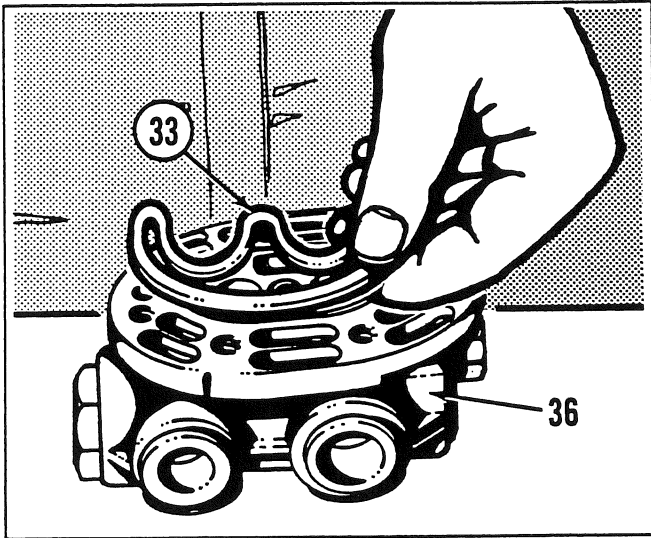


Fig. 14

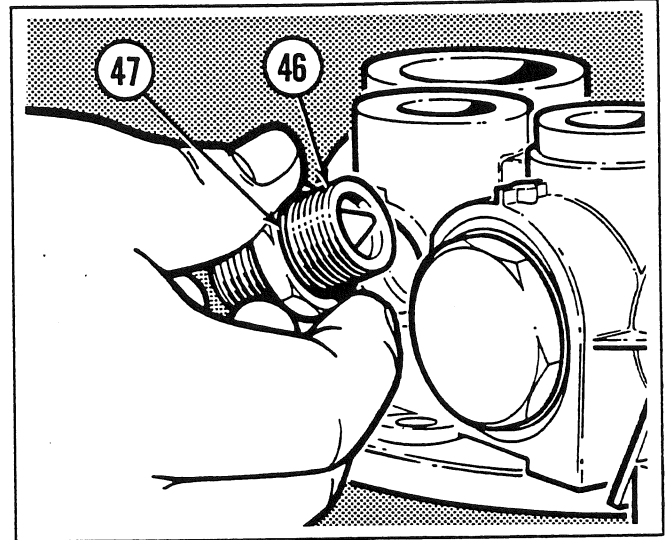


Fig. 17

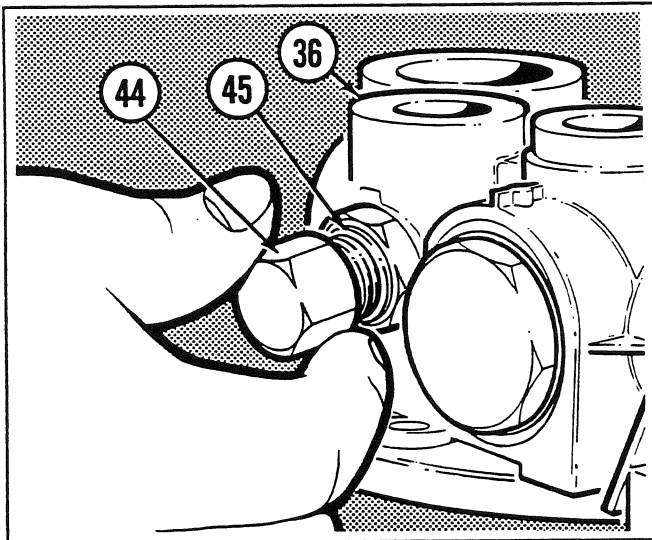


Fig. 15

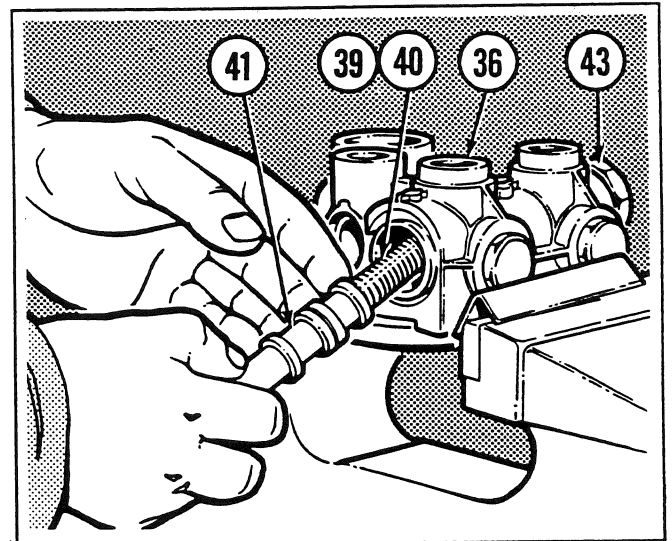


Fig. 18

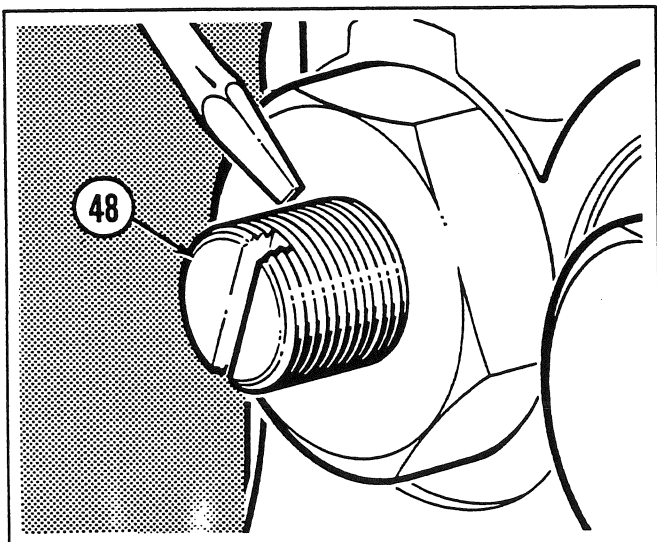


Fig. 16

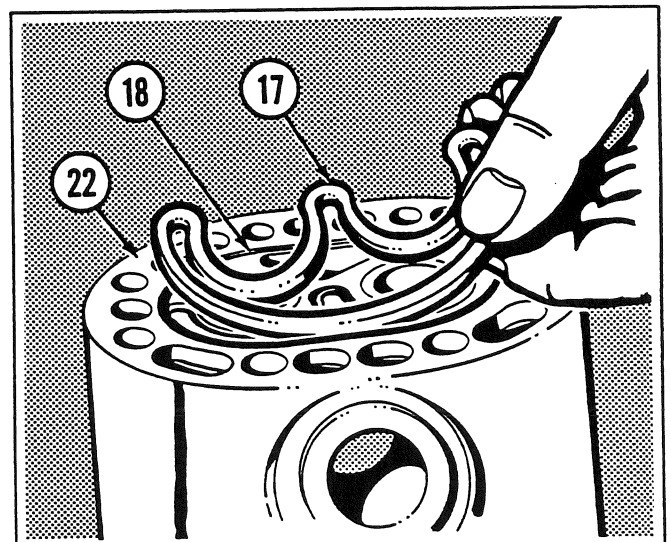


Fig. 19

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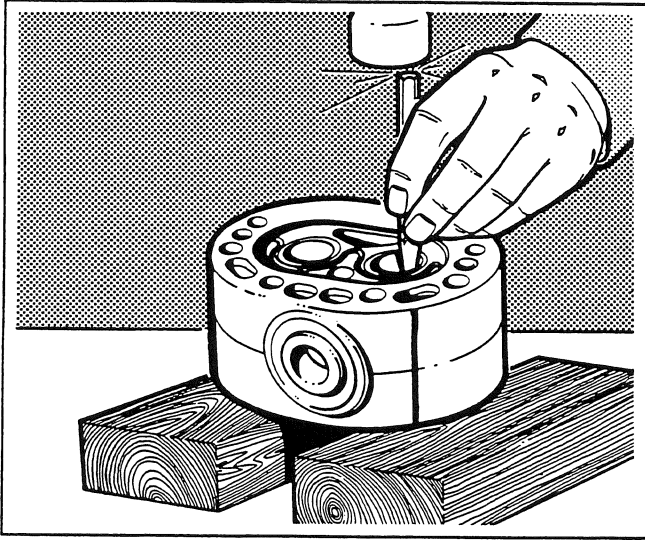


Fig. 20

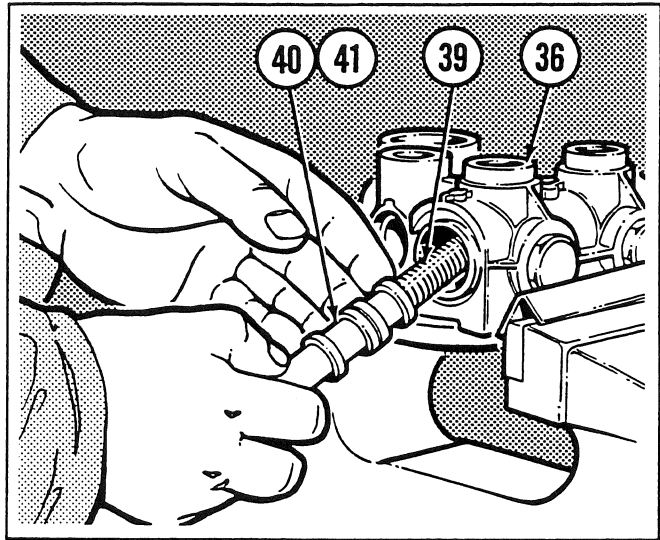


Fig. 23

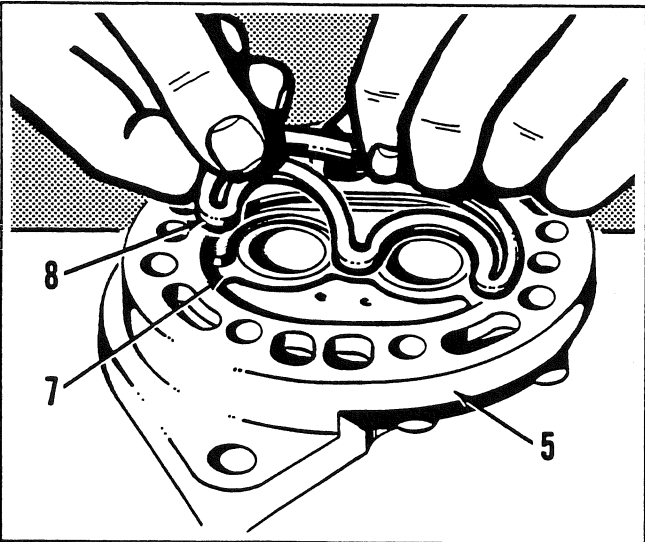


Fig. 21

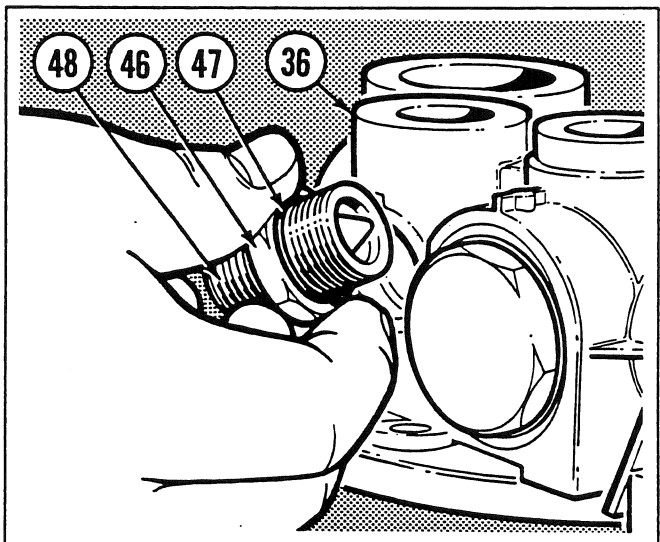


Fig. 24

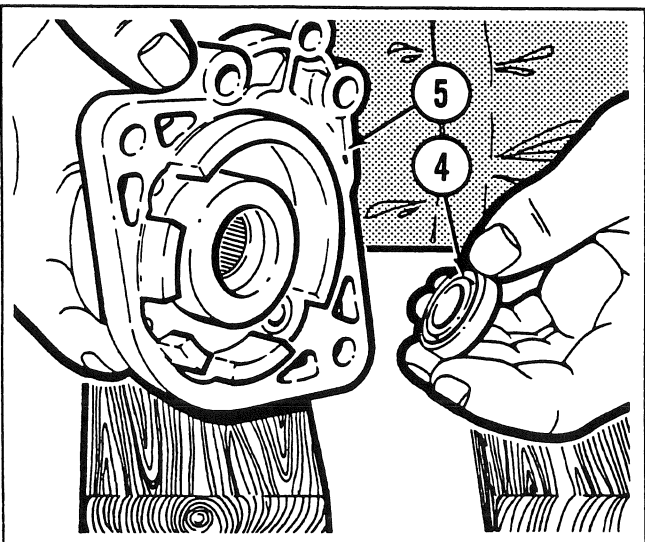


Fig. 22

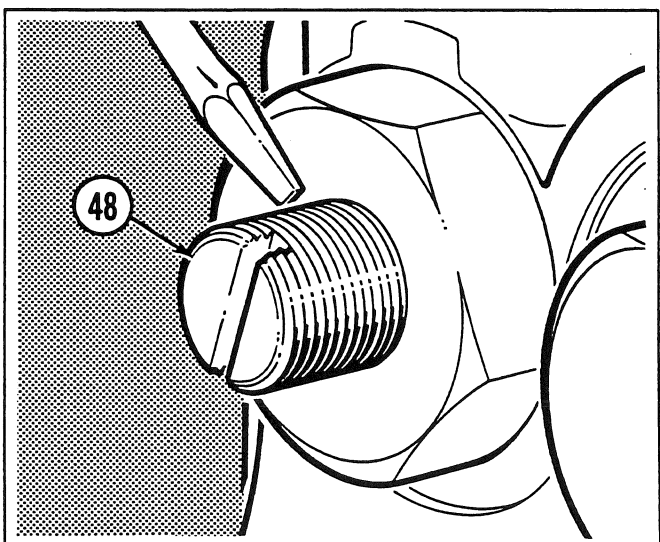


Fig. 25

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Transmission/Steering Hydraulic Pump - Disassembly continued

Fig. 20

Using a punch, carefully remove the back-up ring (19) and the four shaft seals (20). Be careful not to damage the bore with the punch (damaged pumps must be replaced). Discard the seals and back-up ring.

Fig. 21

Working on the front plate (5), remove and discard the wear plate (10). Notice there are no grooves on the underside of the wear plate. Remove and discard the sealing ring (9), E seal (8) and E ring (7).

Fig. 22

Support the front plate (5) on wooden blocks. Using a punch and being careful not to damage the bore, remove and discard the main shaft seal (4). Disassembly is now complete. Inspect all parts for serviceability. Refer to **Inspection and Cleaning** found at the front of this Shop Manual section.

Transmission/Steering Hydraulic Pump - Assembly

Fig. 23

Place the orifice disc (40) into the flow divider piston (41) followed by the spring (39). Generously lubricate the piston and insert it into the flow divider cover (36) from the same direction it was removed. Inspect the O rings (38 and 42) on each of the plugs (37 and 43). Generously lubricate each plug and install them into the flow divider cover. Tighten the plugs.

NOTE: Steps Fig. 23 through Fig. 26 apply only to graders S/N 16224, 16245 to 19981, 19983, 19986 to 19995, 19997 to 20004, 20006 to 20103, 20105 and 20107 to 20119. U.S. S/N 2021-2 to 2658-2.

Fig. 24

Place the relief poppet (51) into the flow divider cover (36) followed by the spring (50) and the spring guide (49). With the O ring (47) inspected and lubricated, install the plug (46) and setscrew (48). Install the flow divider cover in a vise with soft jaws. Do not overtighten the vise. Tighten the plug.

Fig. 25

Thread the setscrew (48) into the plug (46) leaving the same number of threads exposed as noted before (Fig. 16). This will be a base setting for adjustment. Always use an accurate pressure gauge for the final setting.

700 SERIES SHOP MANUAL

Transmission/Steering Hydraulic Pump - Assembly continued

Fig. 26

Install the copper gasket (45) and cap (44). Tighten the cap to protect the setscrew (48).

Fig. 29

Install the gear plate (29) and align the dowel pins (30) and the assembly marks. Tap the dowel pins to ensure that they are fully seated.

Fig. 27

Invert the flow divider cover (36) in the vise. Do not overtighten the vise. Generously lubricate the seal ring grooves. Install a new E ring (34) and E seal (33), making sure they are seated correctly.

Fig. 30

Install and align the idler gear (27) and drive gear (28), with the timing marks exposed, into the flow divider cover (36).

Fig. 28

Install a new ungrooved wear plate (31) with the bronze side up. Ensure it is correctly positioned in the flow divider cover. Install a new sealing ring (32) and generously lubricate the seal, wear plate and bearings.

Fig. 31

Sealing compound is applied to the outside diameter of all new shaft seals (20) during manufacture and must not be removed before installation. Ensure that you have inspected the bearing plate (22). Using an appropriate drift, install the first seal with the lips facing downward into the bearing plate bore. Seat the seal against the inner ridge face of the bore. Install the second seal, touching the first seal, with the lip facing upward. Install the remaining six seals with the lips of the seals alternately facing down and up. The lips of the eighth seal should be facing downward. Inspect and install a new back-up ring (19) so it is just below the surface of the bearing plate bore. Ensure the weep hole is plugged.

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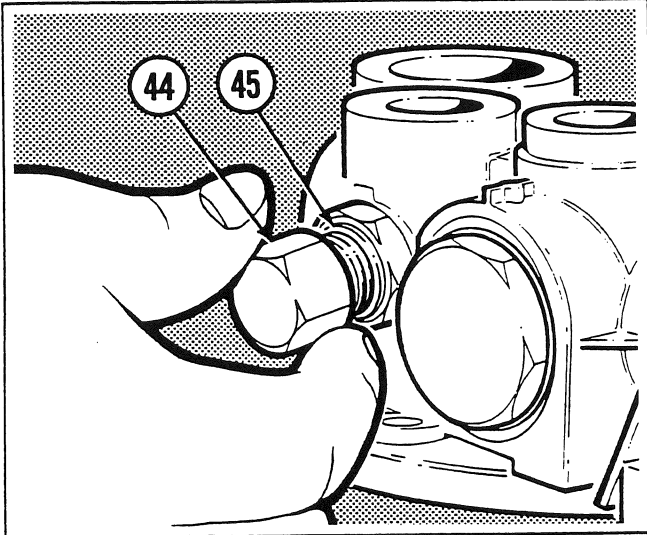


Fig. 26

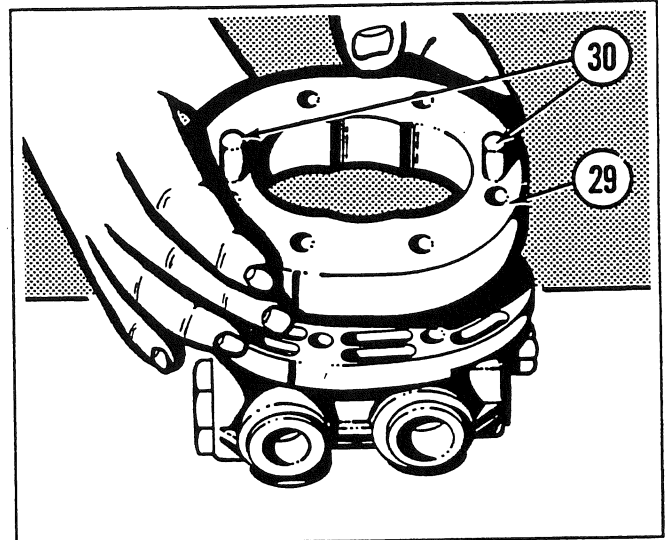


Fig. 29

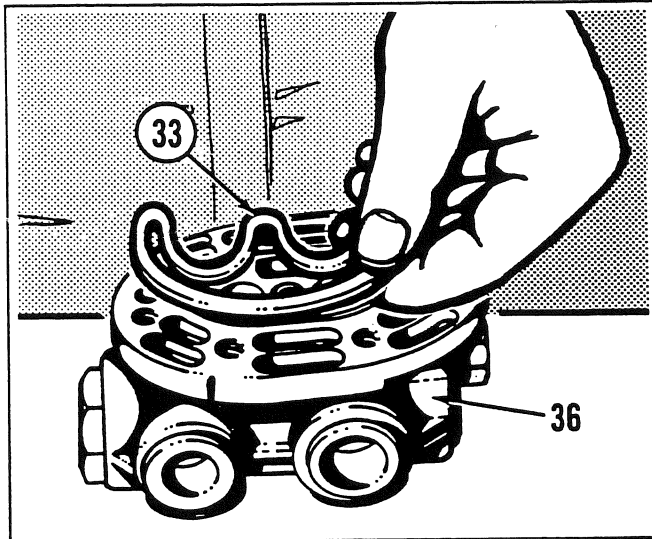


Fig. 27

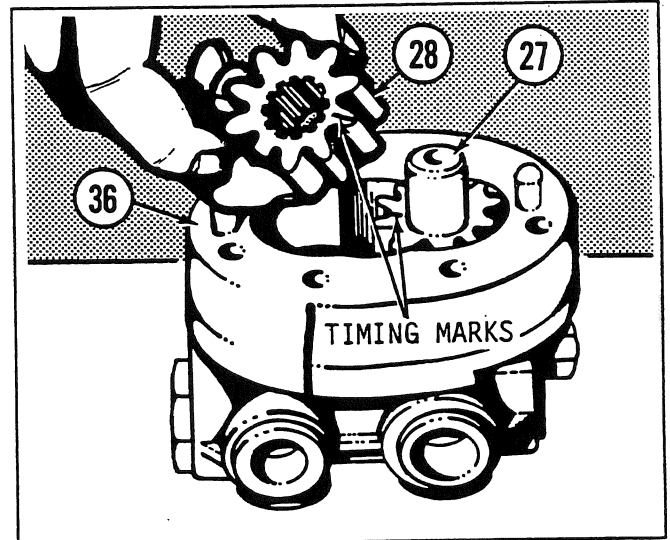


Fig. 30

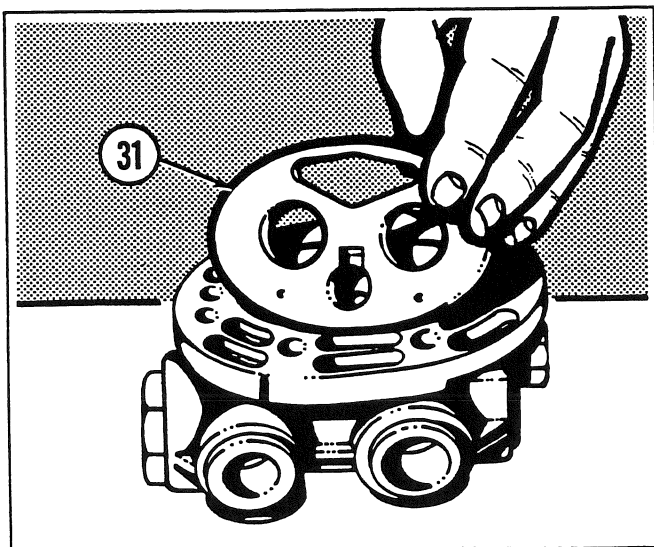


Fig. 28

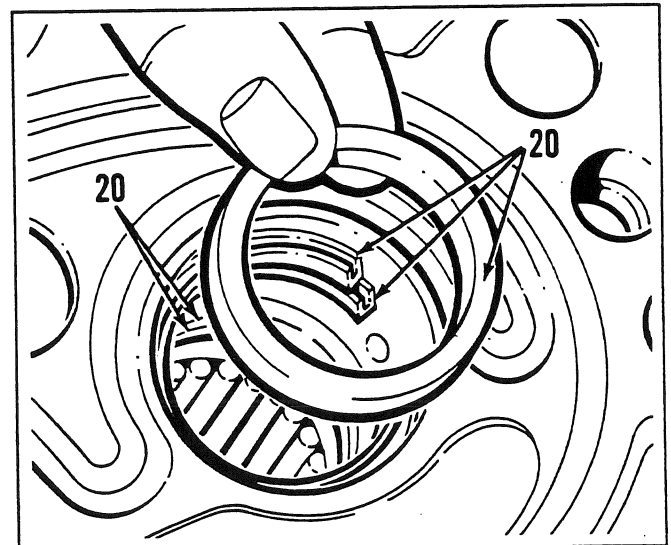
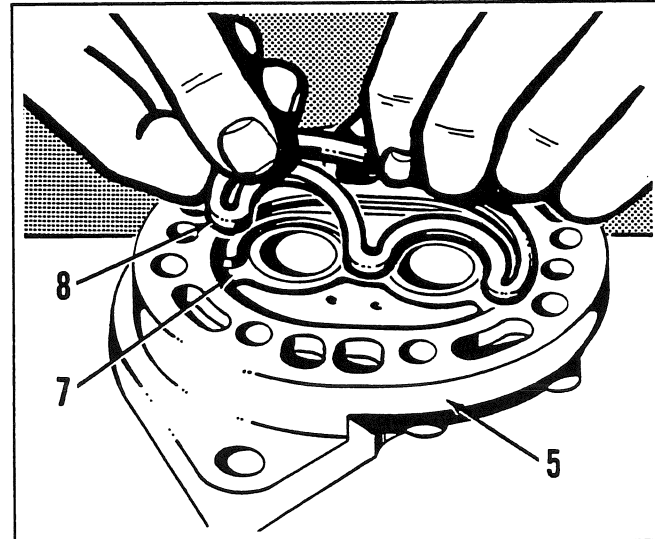
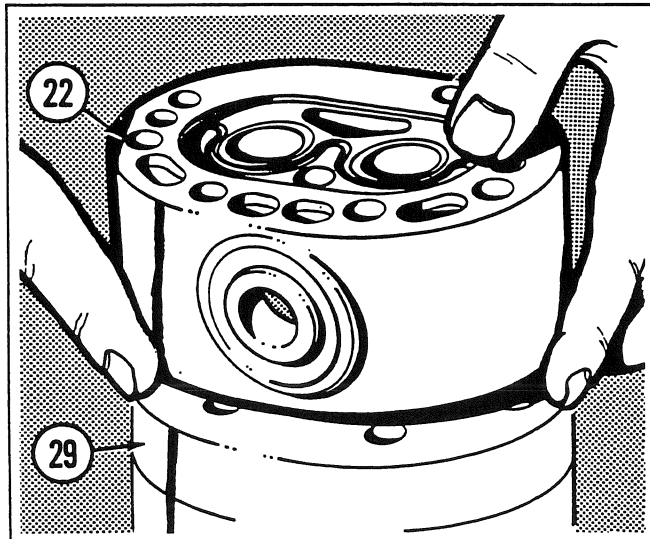
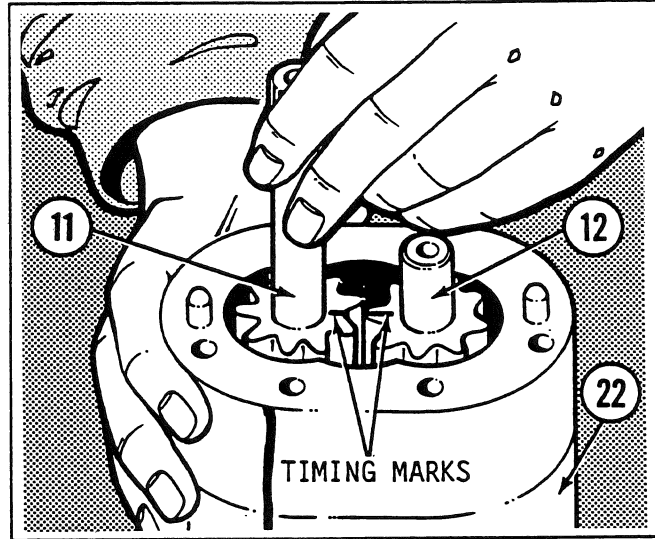
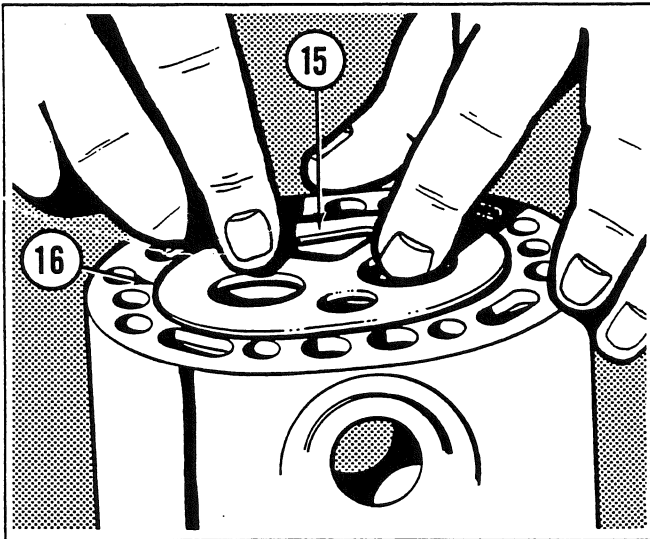
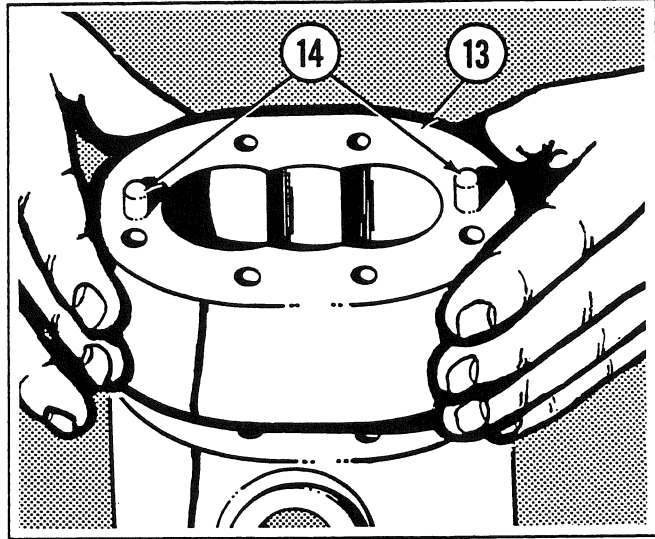
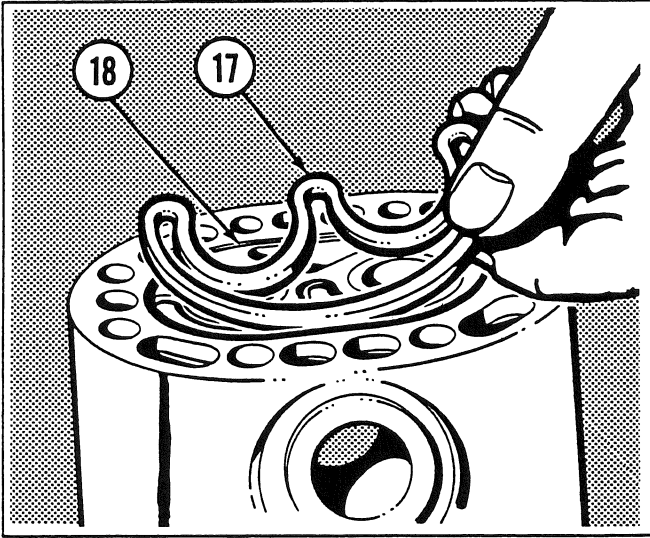


Fig. 31

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Transmission/Steering Hydraulic Pump - Assembly continued

Fig. 32

Generously lubricate the grooves of the bearing plate (22). Lubricate and install a new E ring (18) and E seal (17). Ensure that they are seated correctly in the grooves.

Fig. 33

Note the two grooves on the underside of the new wear plate (15). Apply a light coating of grease and install the wear plate with the bronze side up. Ensure it is correctly positioned in the bearing plate. Lubricate and install a new sealing ring (16). Repeat for the other side of the bearing plate.

Fig. 34

Generously lubricate the bearings and install the bearing plate (22) onto the gear plate (29). Ensure the assembly marks are aligned and engage the dowel pins.

Fig. 35

Install the remaining gear plate (13) and align the assembly marks. Ensure the dowel pins (14) are seated by tapping them into place.

Fig. 36

Generously lubricate the wear plate (15), shaft seals (20) and needle bearings of the bearing plate (22). Install the drive gear (11) with a slight twisting action as it slides through the seals. Install the idler gear (12) with the timing mark exposed and matched with the drive gear timing mark.

Fig. 37

Working on the front plate (5), lubricate the grooves. Lubricate and install a new E ring (7) and E seal (8). Ensure that they seat correctly in the grooves.

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Transmission/Steering Hydraulic Pump - Assembly continued

Fig. 38

Apply grease to the underside of a new wear plate (10) and install it with the bronze side up. Ensure it is correctly positioned in the front plate (5). Lubricate and install a new sealing ring (9) into the front plate.

Fig. 39

Place a single layer of transparent tape over the splines on the drive gear (11) shaft. Lubricate the needle bearings (6) and the wear plate (10) and slide the front plate (5) onto the gear plate (13).

Fig. 40

Generously lubricate the inner lip of a new shaft seal (4) and slide it down over the drive gear (11) shaft. Completely remove the transparent tape. Ensure no adhesive or tape stay under the seal. Use an appropriate drift to seat the seal. Ensure that it is square to the shaft and flush with the housing bore. Stake the front plate around the seal in three places. Take care not to damage the seal.

Fig. 41

All capscrews (1 and 3) are made of stress proof material and should not be replaced with standard capscrews. Install the capscrews and the flatwashers (2). Turn each capscrew counterclockwise until a click is heard and felt; then fully install the capscrews. This prevents the capscrews from cross-threading into the flow divider cover (36).

Fig. 42

The capscrews must be torque-tightened in three increments: 25 lbf·ft (33,9 N·m; 3,5 kgf·m), 35 lbf·ft (47,4 N·m; 4,8 kgf·m), and 45 lbf·ft (61 N·m; 6,2 kgf·m) in a star pattern. After each increment is completed, rotate the pump drive gear (11) shaft.

Transmission/Steering Hydraulic Pump - Installation

Fig. 43

Priming the pump is an important step during installation. Begin by filling each pump cavity, through the inlet side, with the correct system oil (refer to the 700 Series Operator's Manual). Turn the pump shaft in the proper direction of operation, then refill the pump cavities. Apply a light coating of anti-seize compound P/N 30453 to the drive coupler and splines of the transmission/steering pump driveshaft. Install the pump.

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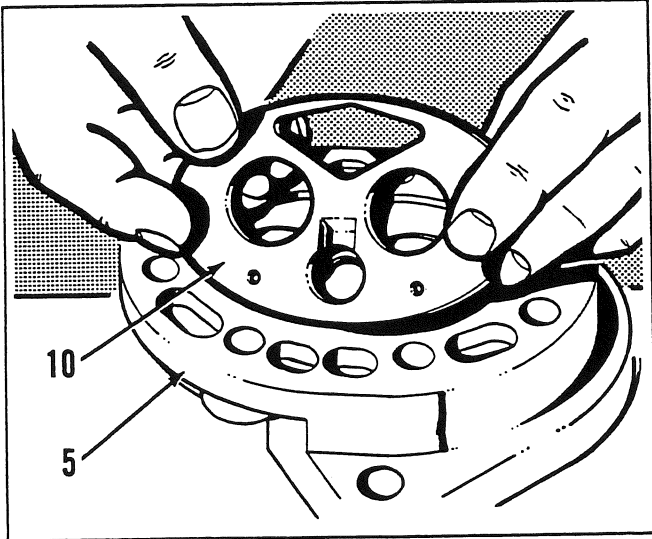


Fig. 38

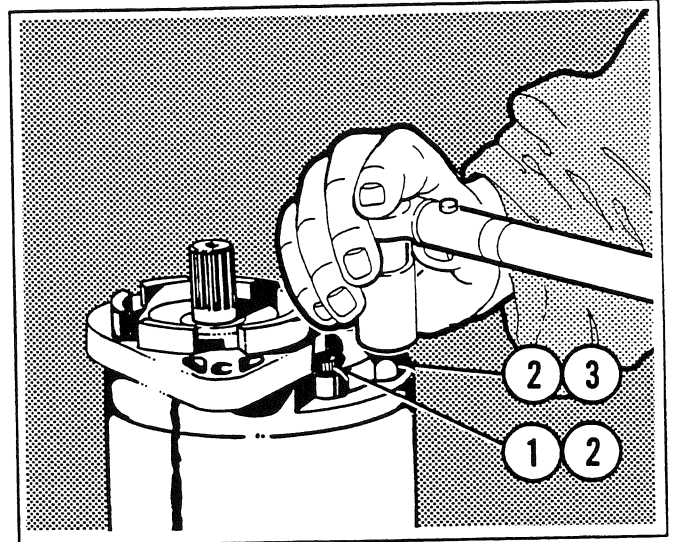


Fig. 41

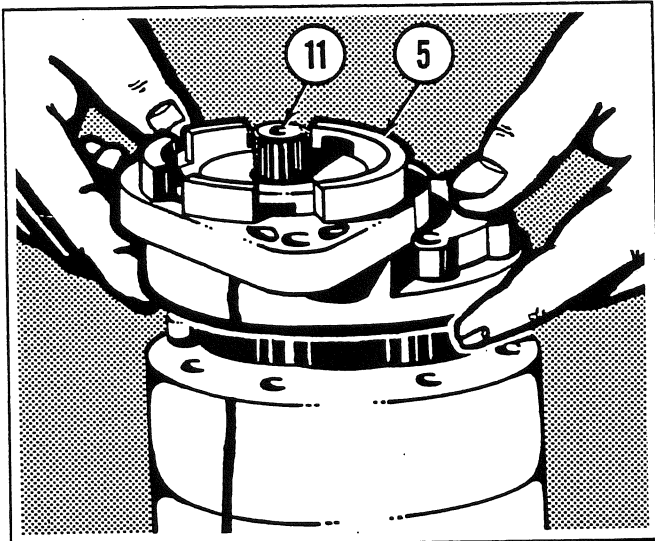


Fig. 39

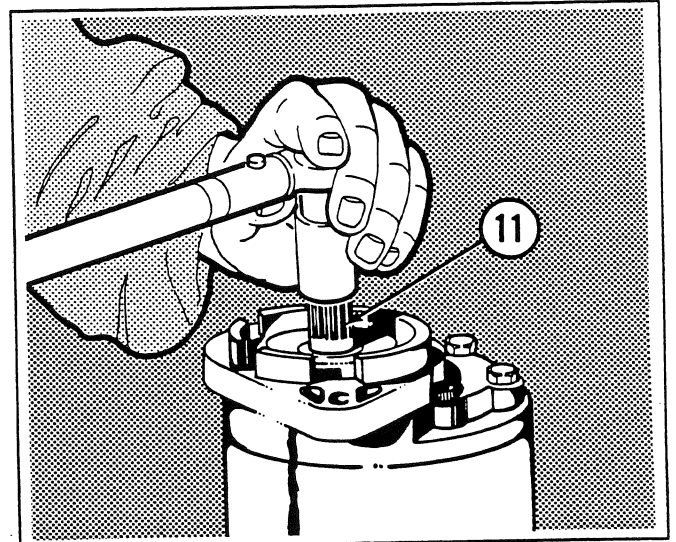


Fig. 42

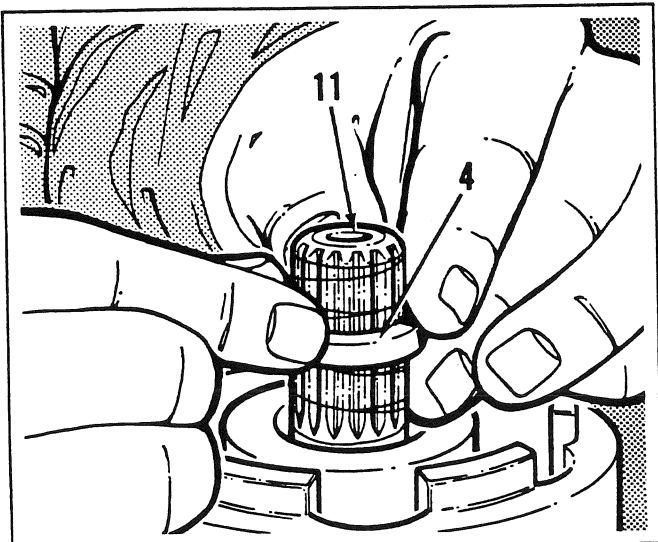


Fig. 40

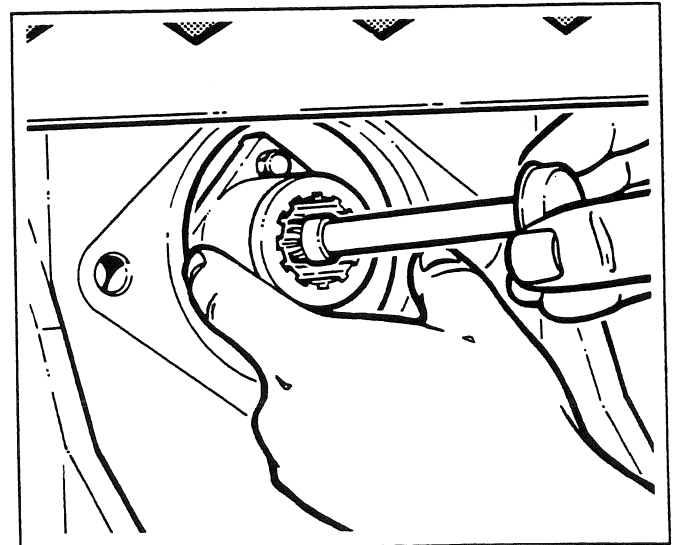


Fig. 43

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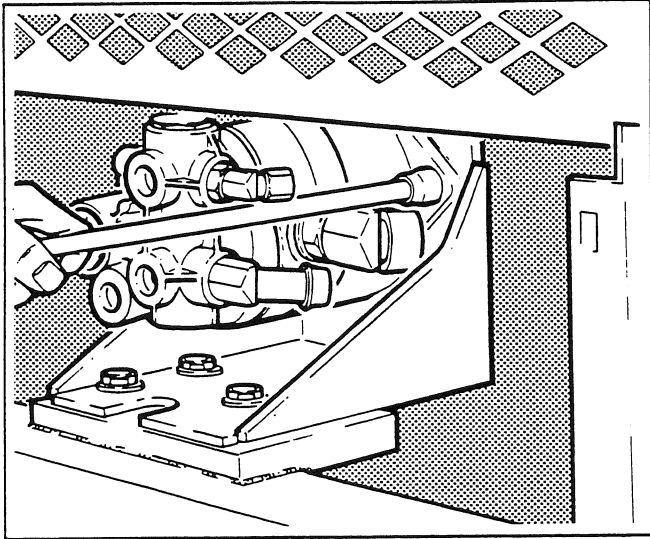


Fig. 44

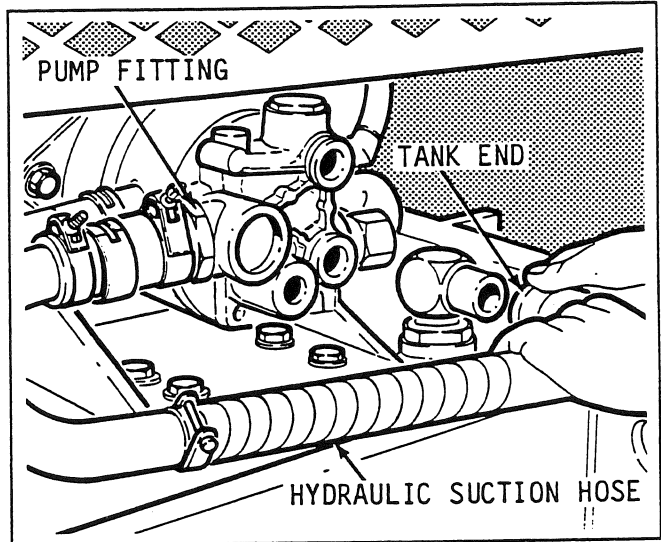


Fig. 47

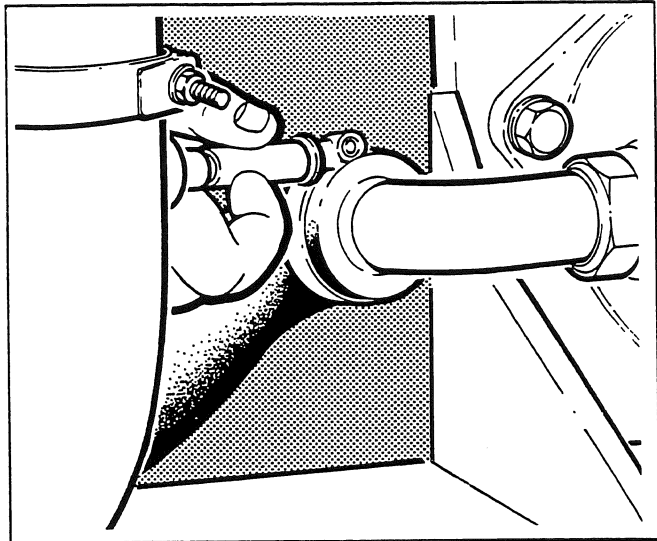


Fig. 45

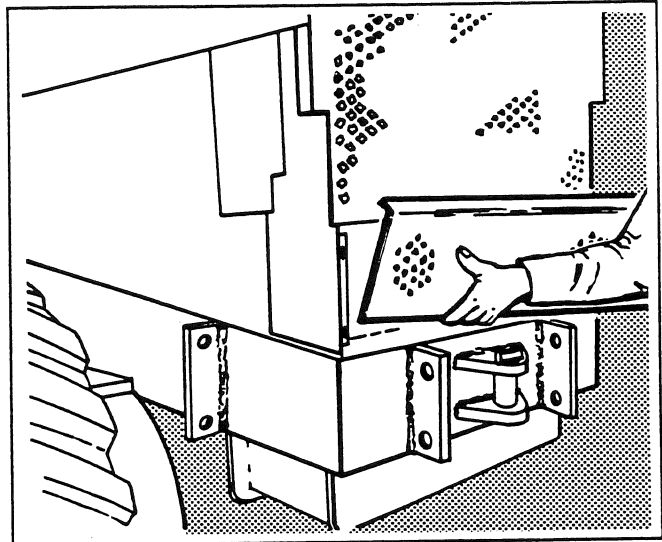


Fig. 48

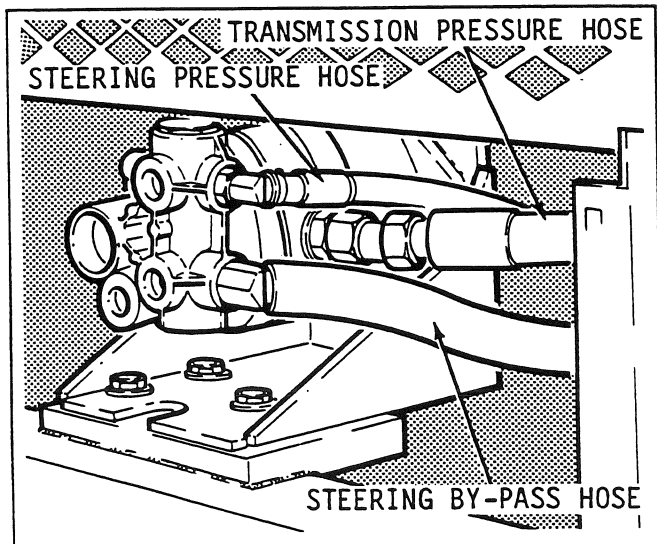


Fig. 46

700 SERIES SHOP MANUAL

Transmission/Steering Hydraulic Pump - Installation continued

Fig. 44

Support the weight of the pump. Install the two mounting bolts and lockwashers. Ensure that the pump is tight against the mounting bracket before tightening the bolts to the specified torque.

Fig. 45

Remove the caps from the transmission suction hose and port. Install the hose. Tighten the clamp securely to ensure a leak-proof type seal and to prevent air entering the hydraulic system. This is extremely important to prevent pump cavitation.

NOTE: *You can buy upgrade kits to reduce transmission suction line restriction. Champion recommends updating earlier machines. Refer to Product Support Bulletin No. 461 or contact your Champion Distributor for details.*

Fig. 46

Uncap the transmission pressure hose and fitting. Install the hose. Uncap the steering bypass and steering pressure hoses and fittings. Install the hose. Ensure a tight seal on all three hoses.

Fig. 47

Uncap the steering pump suction hose and fittings. Install the hose. Tighten the hose clamps securely to prevent air being drawn into the suction hose of the pump.

Fig. 48

Inspect the hose connections for leaks. Check the hydraulic fluid level and the transmission fluid level. Replace the side panels. The transmission/steering pump is now ready for a break-in period. Make a visual check around the grader. Signal your intention to start the engine. Start the engine when it is safe to do so. Idle the engine for a minimum of 60 seconds. Shut down the engine. Check the fluid levels and for leaks. Test the flow and pressure of the steering system before putting the grader back into service. Refer to Product Support Bulletin No. 512 and form No. F-503 (01/90). After completing all checks, replace the panels.

SECTION 4D

HYDRAULICS

Relief Valves

Effective on grader S/N 19982, 19984, 19985, 19996, 20005, 20104, 20106, 20120 and up, the relief valves are mounted onto a return manifold block. However, the overhaul procedure and specifications remain unchanged.

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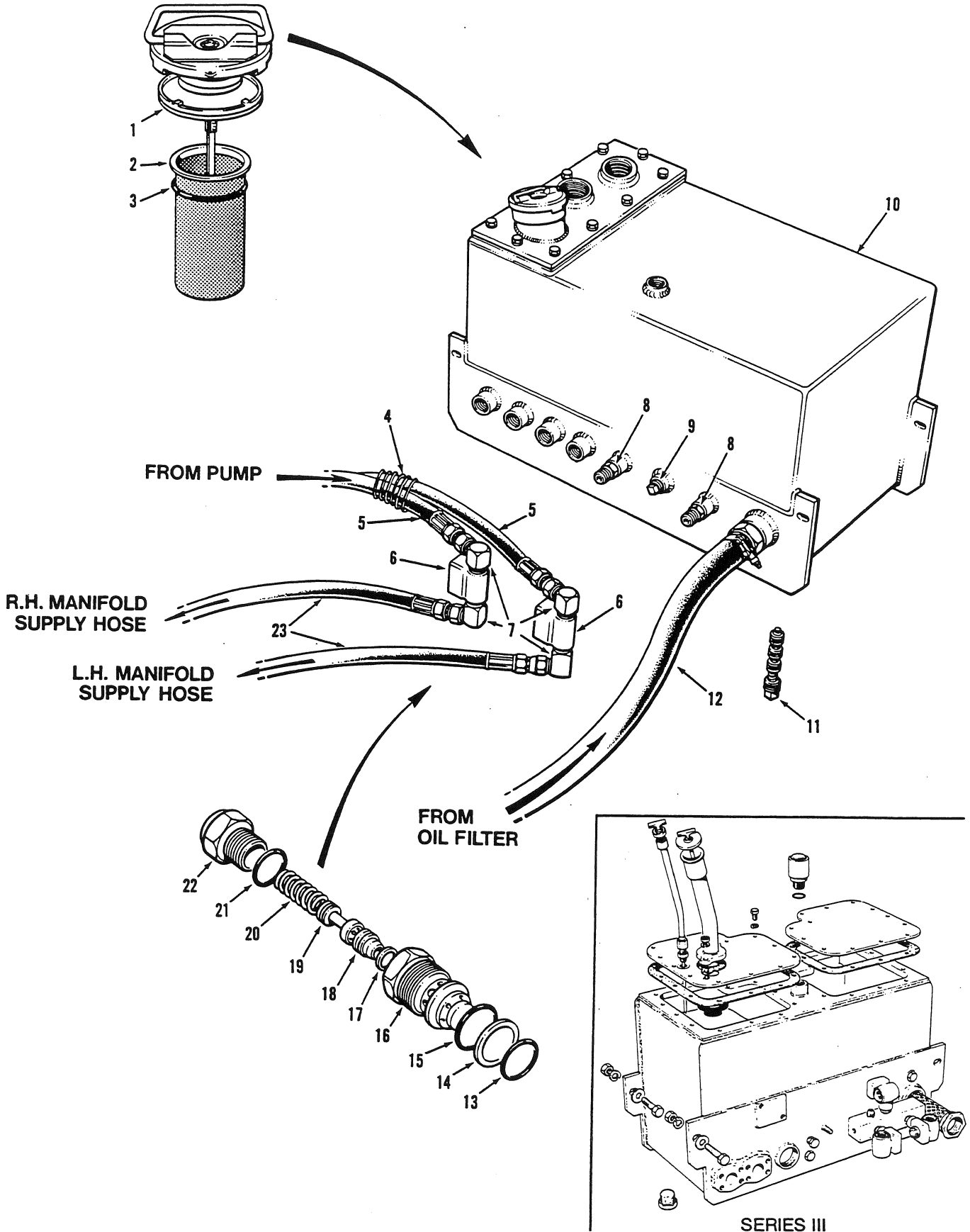


Fig. 1D Relief Valves

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Item	Description	Item	Description	Item	Description
1	Filler cap	9	Plug	17	Piston ring
2	Strainer	10	Hydraulic oil tank	18	Poppet
3	O ring	11	Magnetic plug	19	Shims (various thicknesses)
4	Hose straps	12	Hose - return	20	Spring
5	Hoses - from hydraulic pump	13	O ring	21	O ring
6	Relief valves	14	Back-up washer	22	Cap
7	Fittings	15	O ring	23	Hoses - supply (to hydraulic manifold valve assembly)
8	Jam nut (connectors)	16	Body		

Key to Fig. 1D

Relief Valves - Description (Fig. 1D)

The relief valves protect parts by limiting the pressure in the hydraulic system. Two relief valves are installed on the front of the hydraulic tank and are connected to both supply hoses from the primary hydraulic pump. When pressure in the system exceeds the relief valve setting, the poppet moves off its seat and opens a passage to the hydraulic tank.

To check a relief valve setting, install a 0 - 3000 psi (0 - 207 bar) pressure gauge in one of the test ports on the inlet section of the manifold valve assembly. Operate the blade lift cylinders to the full retracted stroke. The pressure gauge shows the setting of that section's relief valve. To adjust to the specified 2100 psi (145 bar), remove the cap and add shims to increase the pressure or remove shims to decrease the pressure. Refer to the shim chart below. Install the cap. Recheck the pressure setting. Repeat this procedure for the other relief valve.

Relief Valve Settings - Full Flow

Valve Description	Rigid and Articulated Frame
Left-hand and Right-hand Relief Valve	2100±100 psi (145±7 bar)

Relief Valve Shim P/N	Approximate psi (bar) Change
50065	250 psi (17 bar)
50066	150 psi (10 bar)
50067	75 psi (5 bar)

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Relief Valves - Removal and Disassembly

Fig. 2

Place the grader in the SERVICE POSITION. Refer to the procedure on page (ii) in the front of this Shop Manual section. Remove the hydraulic tank filler cap (1) to release any pressure and replace the cap loosely. Place a 25 U.S. gallon (96 liter) capacity container under the hydraulic tank (10). Remove the magnetic plug (11) from the tank and drain the oil. Clean and inspect the magnetic plug. Clean the threads of the magnetic plug and apply thread sealant P/N 19167. Install the magnetic plug in the tank. Do not overtighten.

NOTE: *You need not remove the entire valve body to adjust the valve. Remove the body (16) and inspect the O ring (13) and back-up washer (14) - see step Fig. 6.*

Fig. 3

Identify the hoses (5 and 33) to prevent confusion during assembly. Remove the hoses from the relief valve (6) and clean up any oil leakage. Cap the hoses and fittings to prevent contamination.

Fig. 4

Loosen the jam nut (8) on the connector joining the relief valve (6) to the hydraulic oil tank (10). Remove the relief valve and cap the connector to prevent contamination.

Fig. 5

Place the relief valve (6) in a vise. Unscrew the body (16) until a second wrench will fit on the cap (22). Loosen the cap.

Fig. 6

Remove the body as an assembly. Remove and discard the back-up washer (14) and O ring (13) from the relief valve (6). Note the location of each.

Fig. 7

Remove the cap (22) from the body (16). Withdraw the spring (20) and poppet (18). Remove and discard the O ring (21). Note that the shims (19) located between the spring and poppet may stick on either the spring or poppet. Remove the shims. Remove and discard the O ring (15) from the body (16). Inspect all parts for serviceability. Inspect the relief valve body for cracks. Refer to **Cleaning and Inspection** found at the front of this Shop Manual section.

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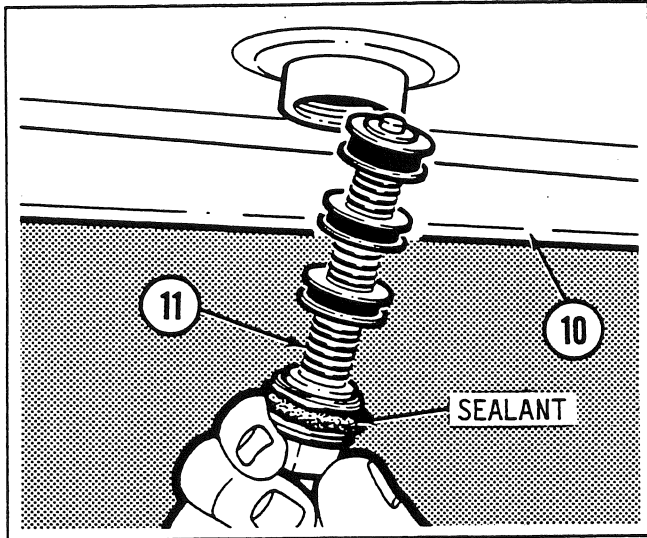


Fig. 2

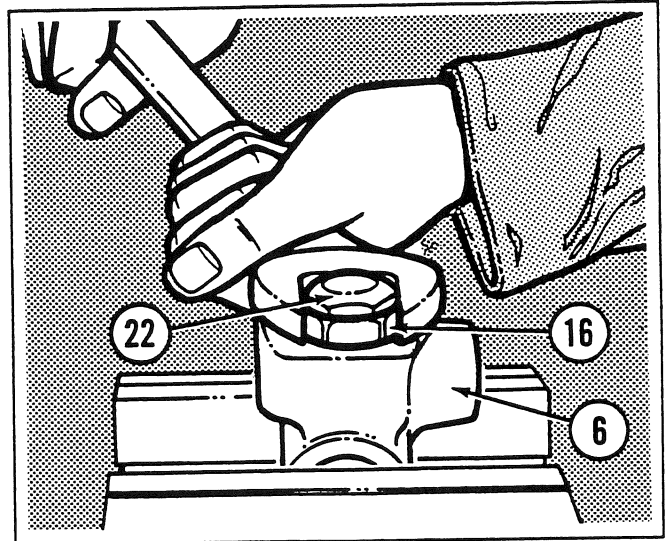


Fig. 5

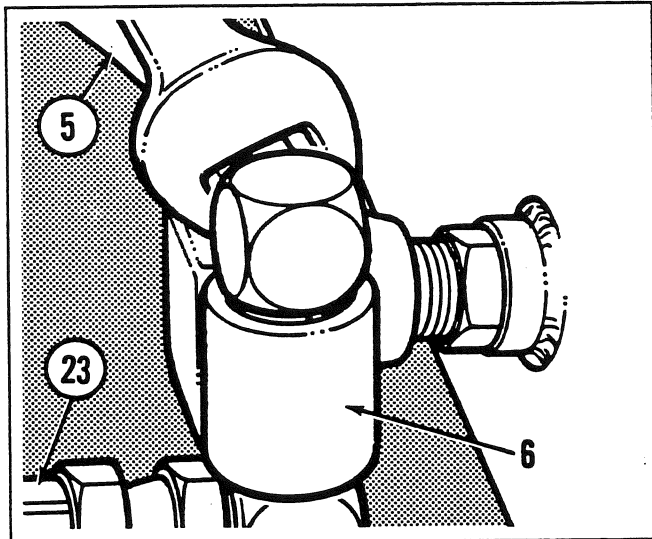


Fig. 3

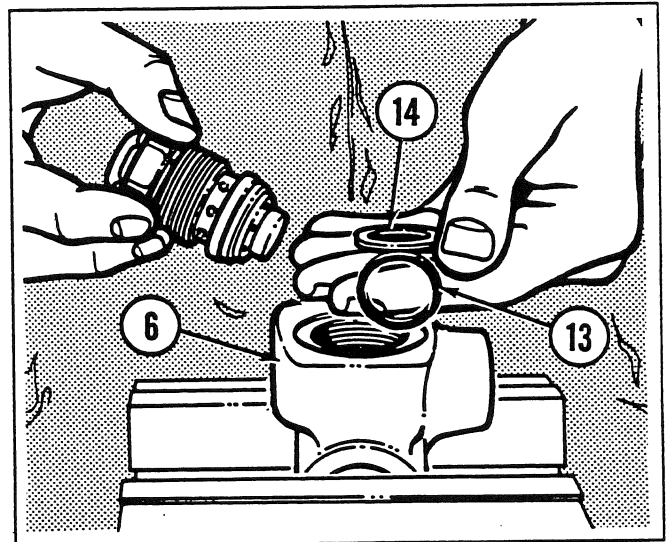


Fig. 6

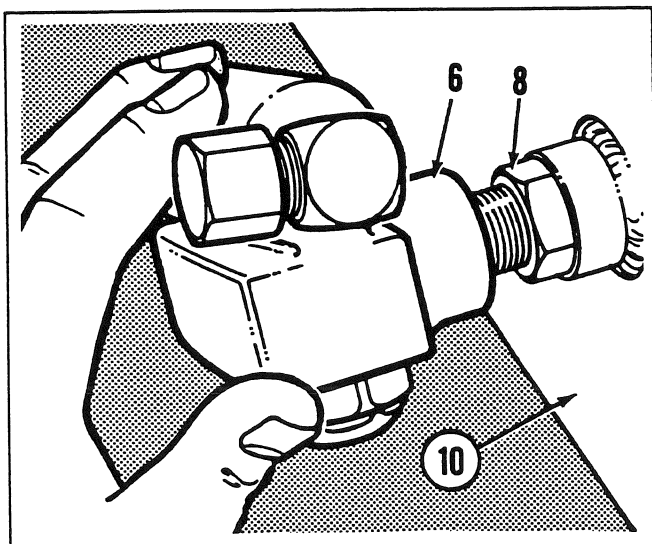


Fig. 4

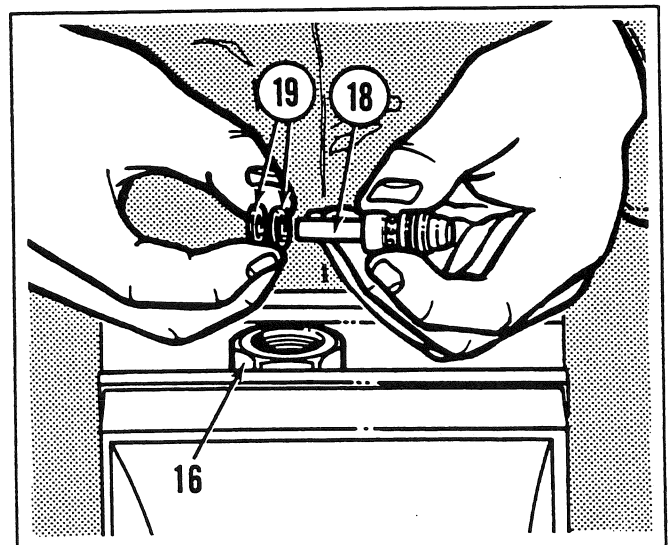


Fig. 7

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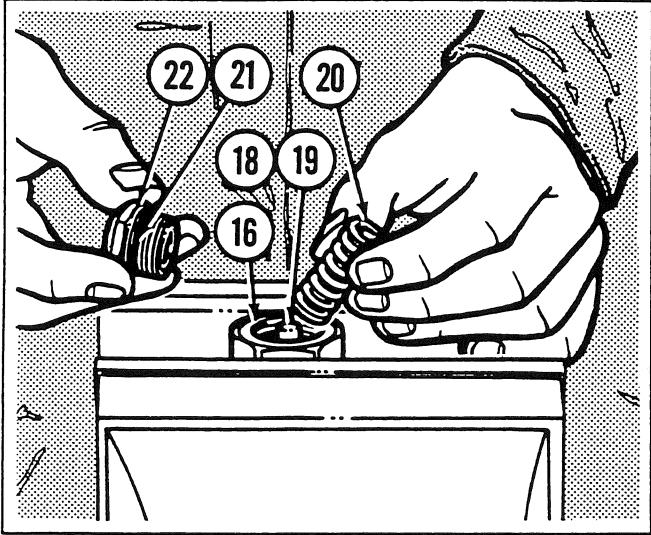


Fig. 8

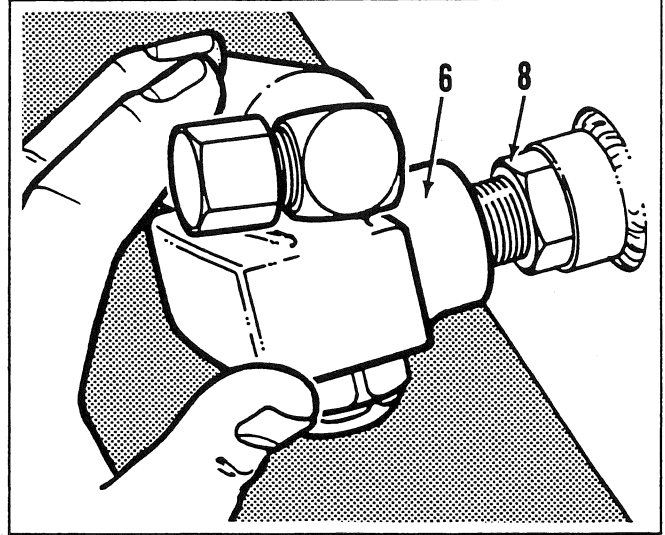


Fig. 11

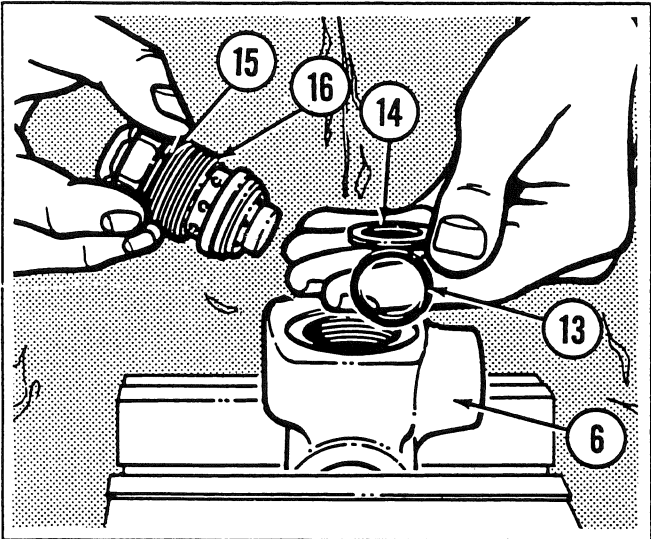


Fig. 9

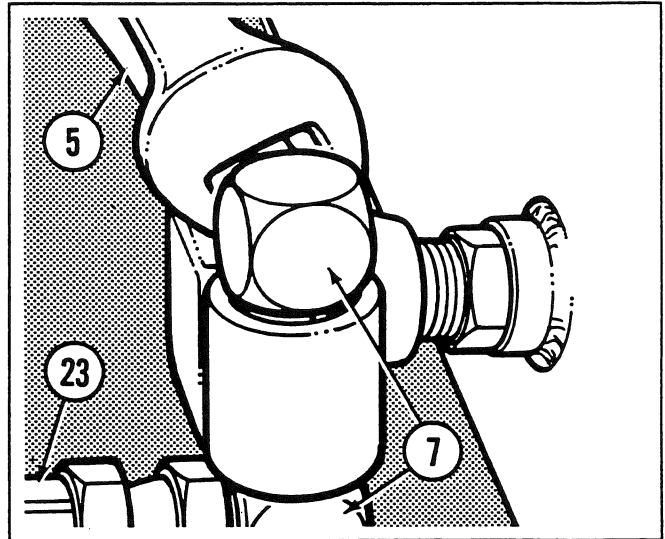


Fig. 12

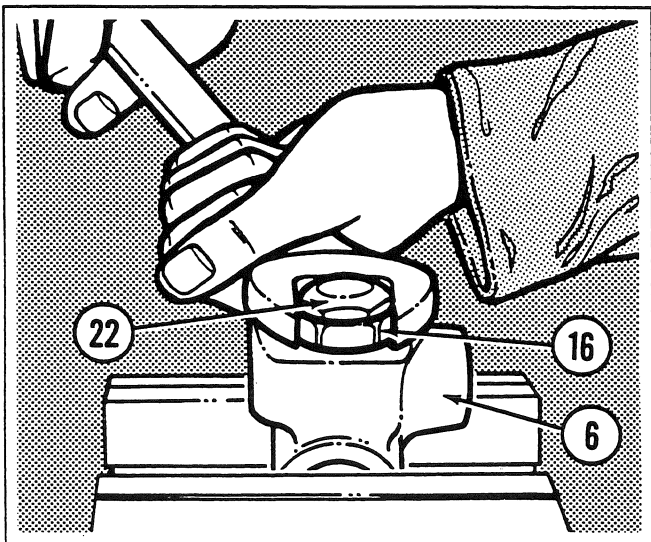


Fig. 10

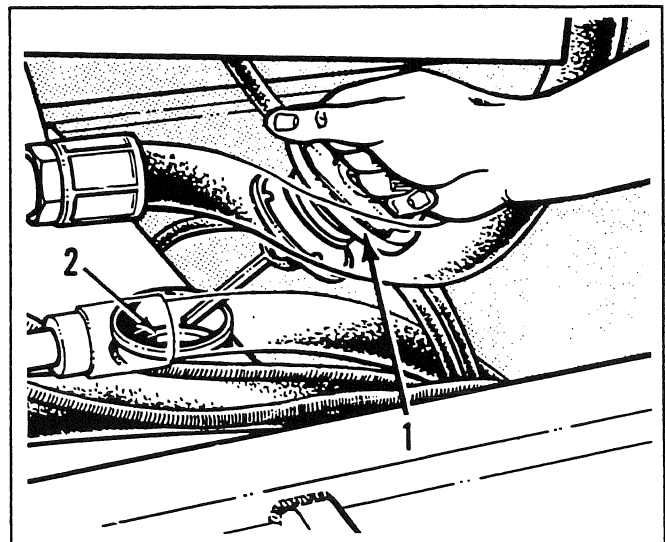


Fig. 13

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Relief Valves - Assembly and Installation

Fig. 8

Lubricate and install a new poppet (18) in the body (16). The piston ring (17) on the poppet is not available separately. The poppet and piston ring must be replaced as a complete assembly. Place the shims (19) on the poppet followed by the spring (20).

NOTE: *Replace the exact thickness of shims removed. The shims determine the relief valve setting. See page 4D-1 for more information. Never add shims between the spring (20) and the cap (22). This will restrict poppet movement and increase back pressure by reducing flow rating. Component damage could result.*

Lubricate the new O ring (21) and install it on the cap (22). Install the cap onto the body (16).

Fig. 9

Install the relief valve (6) in a vise. Lubricate and install a new O ring (13) followed by a new back-up washer (14). Ensure that they seat properly. Lubricate and install a new O ring (15) on the body (16).

Fig. 10

Install the body (16) into the relief valve (6). Install the cap (22) into the body. Do not overtighten. Tighten the body into the relief valve. Do not overtighten. Test the relief setting before installation.

Fig. 11

Uncap and inspect the O ring on the hydraulic tank connector. Install the relief valve onto the connector. Tighten the jam nut (8) to secure the relief valve.

Fig. 12

Inspect the O rings on the fittings (7) and install the hoses (5 and 23) to the correct locations. Secure the hoses with plastic tie straps (4).

Fig. 13

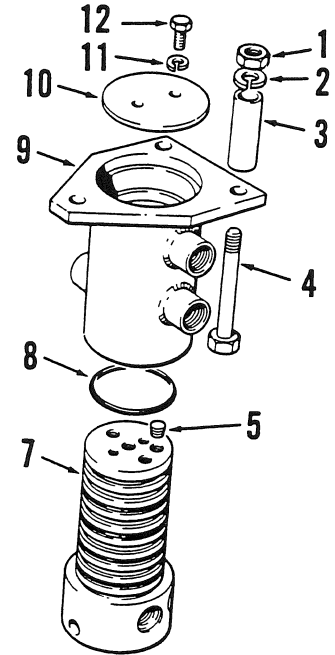
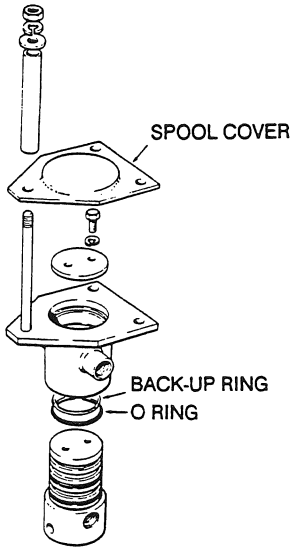
Remove the hydraulic tank filler cap (1). Inspect the strainer (2) and replace if damaged. Fill the hydraulic tank with fresh system oil as listed in the 700 Series Operator's Manual. Check for the correct fluid level. Make a visual check around the grader. Signal your intention to start the engine. Start the engine when it is safe to do so. Operate all hydraulic functions and inspect for leaks. Test the relief valve settings with an accurate pressure gauge. The relief valve settings for both rigid and articulated frame graders are listed on page 4D-1. Lower the moldboard and all attachments to the ground. Shut down the engine. Recheck the hydraulic fluid level. Replace the side panels.

SECTION 4E

HYDRAULICS

Hydraulic Swivel Joint

700 SERIES SHOP MANUAL



Hydraulic Swivel Joint from Grader S/N 18590

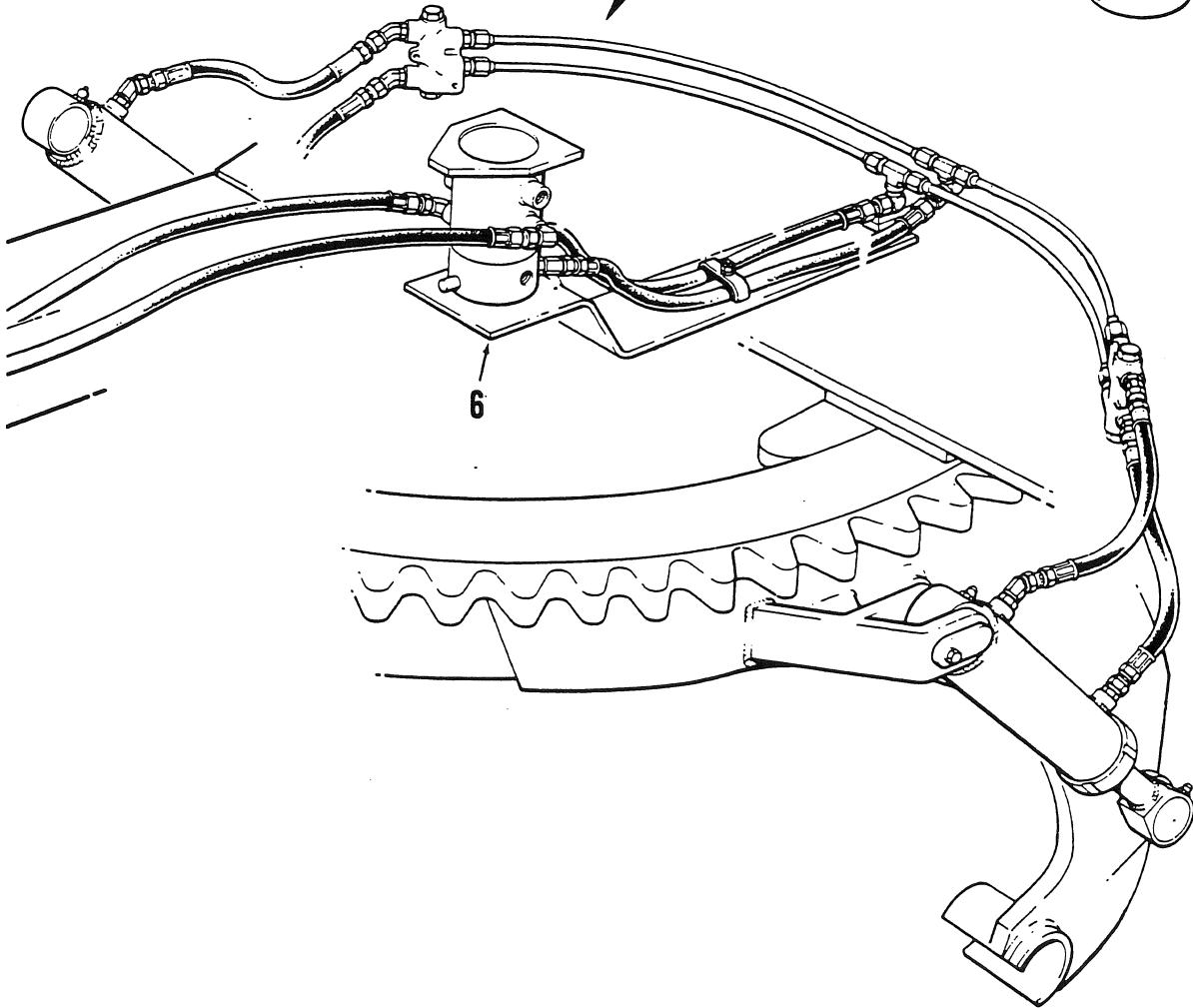


Fig. 1E Hydraulic Swivel Joint

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Item	Description	Item	Description	Item	Description
1	Nut	5	Pipe plug	9	Body
2	Lockwasher	6	Drive arm	10	Washer
3	Spacer	7	Spool	11	Lockwasher
4	Bolt	8	O ring	12	Bolt

Key to Fig. 1E

Hydraulic Swivel Joint - Description (Fig. 1E)

The hydraulic swivel joint is used on all Champion road graders. It is located in the center of the circle and underneath the drawbar frame.

The hydraulic swivel joint spool is turned by a drive arm fastened to the circumference of the circle. The hydraulic swivel joint allows 360 degrees of circle rotation without twisting the hoses to the moldboard slide shift cylinder and power tilt cylinders.

The spools used in the power moldboard tilt and the manual moldboard tilt are different and are not interchangeable. Although the overhaul procedure is the same for both types of hydraulic swivel joints, be careful when ordering parts.

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Hydraulic Swivel Joint - Removal

Fig. 2

This sub-section describes the service procedure for the hydraulic swivel joint used with power moldboard tilt. Servicing the manual moldboard tilt hydraulic swivel joint is identical except the spool is shorter and has a smaller diameter.

Fig. 3

Ensure the moldboard blade is fully rolled back and resting on the ground. Place the grader in the SERVICE POSITION. Refer to the procedure on page (ii) in the front of this Shop Manual section.

Fig. 4

Remove the four nuts and lockwashers securing the cover plate to the drawbar. Remove the three nuts (1) and lockwashers (2) securing the cover plate to the hydraulic swivel joint. Remove the cover plate.

Fig. 5

Remove the three spacers (3).

NOTE: Effective on graders from S/N 18590, remove the cover protecting the spool washer (10).

Fig. 6

Identify the hoses to prevent confusion during assembly.

Fig. 7

Support the drive arm (6) with a block of wood. Remove the hoses from the body(9) and clean up any oil leakage. Cap the fittings to prevent contamination.

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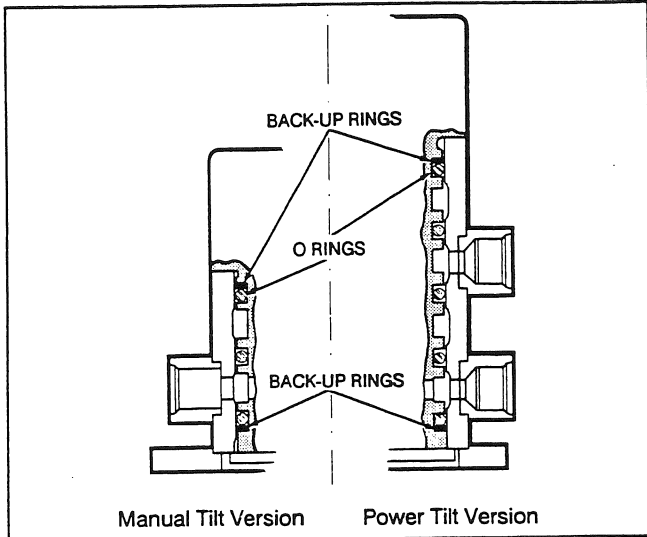


Fig. 2

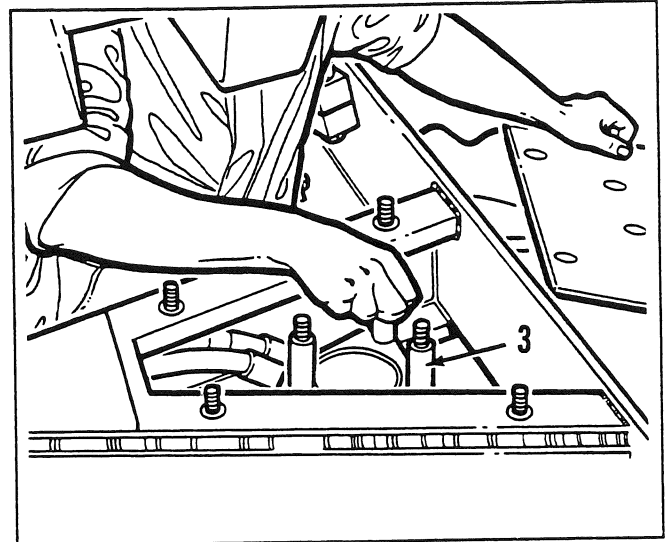


Fig. 5

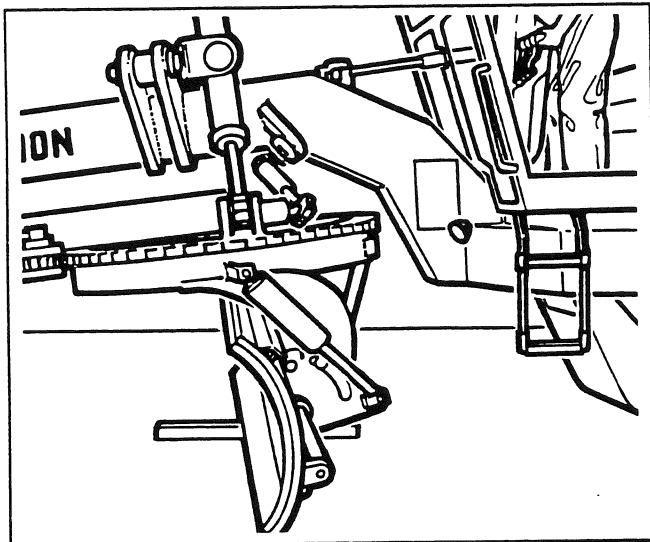


Fig. 3

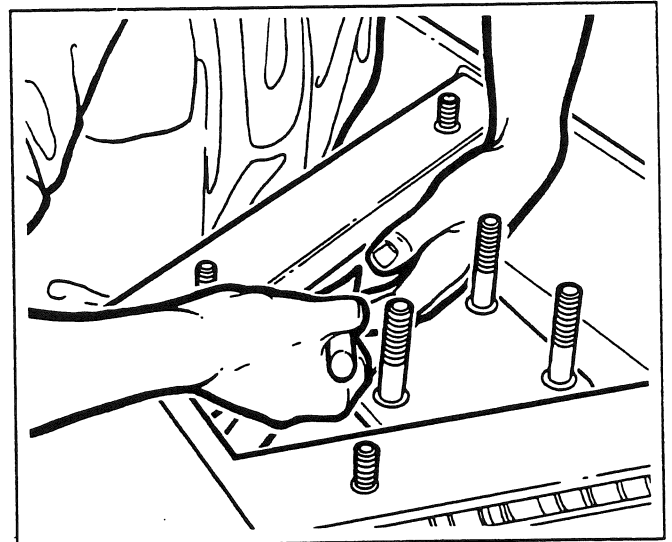


Fig. 6

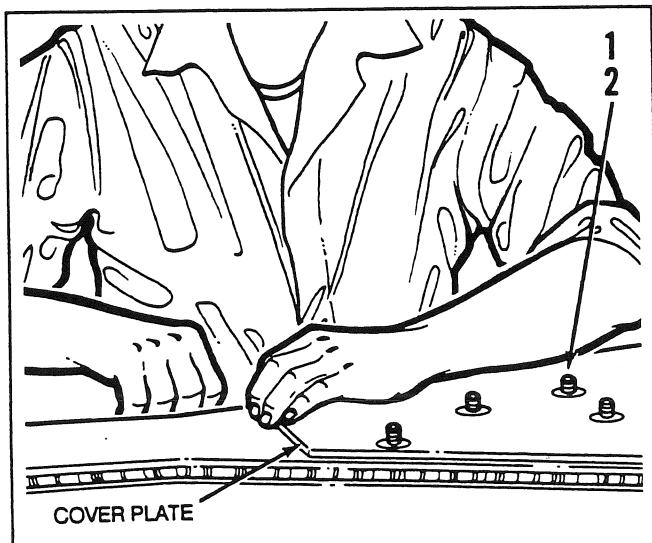


Fig. 4

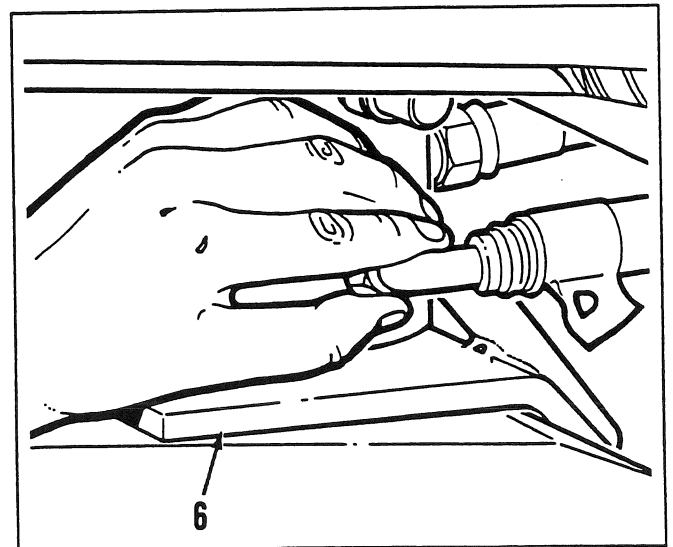


Fig. 7

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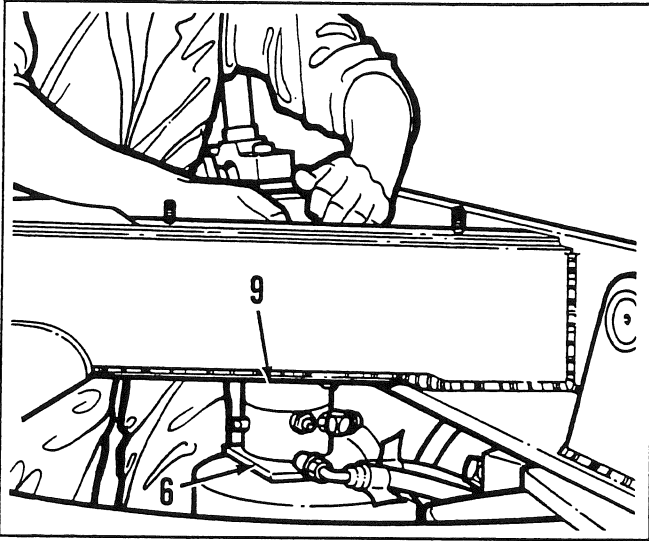


Fig. 8

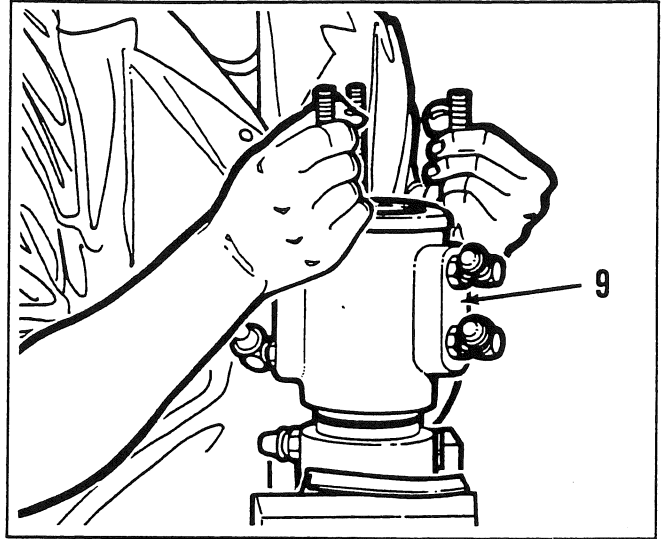


Fig. 11

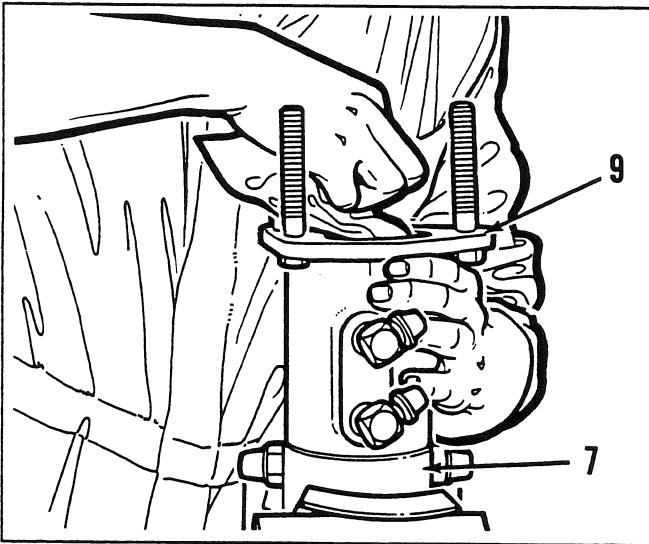


Fig. 9

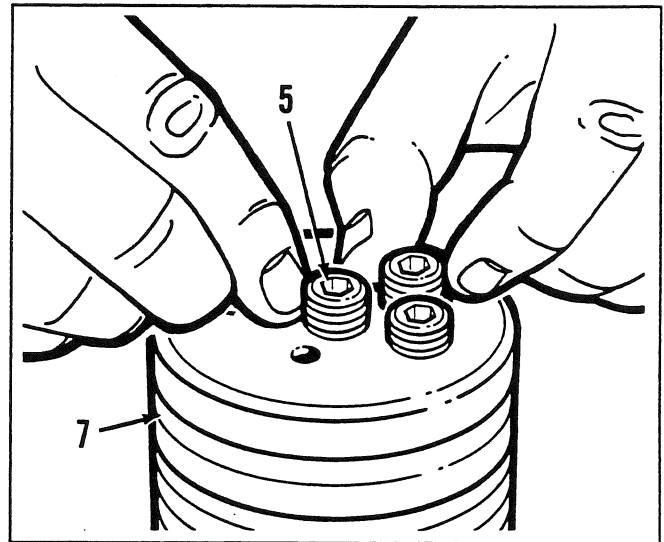


Fig. 12

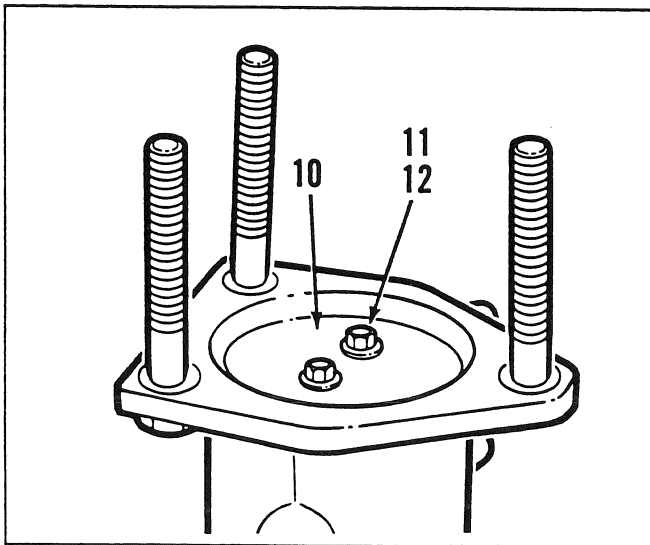


Fig. 10

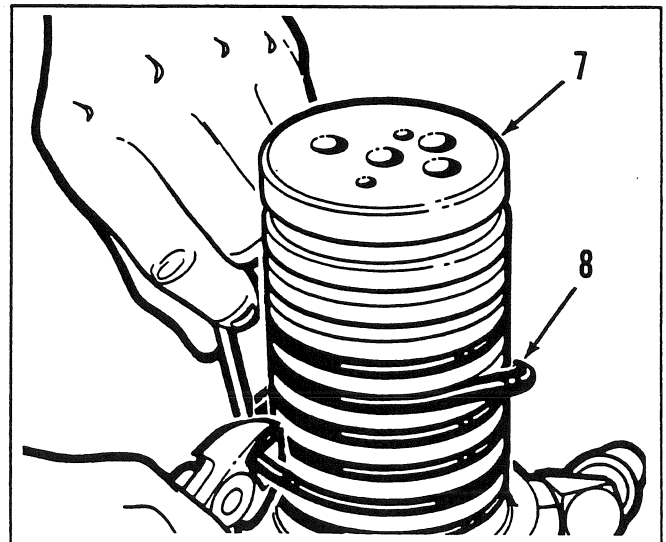


Fig. 13

700 SERIES SHOP MANUAL

Hydraulic Swivel Joint - Removal *continued*

Fig. 8

Rotate the body (9) 90 degrees and slide the body from the drive arm (6).

Fig. 11

Carefully remove the body (9) by lifting it straight up.

Hydraulic Swivel Joint - Disassembly

Fig. 9

Place the bottom of the spool (7) in a vise with soft jaws. Clean the top surface of the body (9).

Fig. 12

Remove the pipe plugs (5) from the spool (7).

Fig. 10

Remove the two bolts (12) and lockwashers (11). Remove the washer (10).

Fig. 13

Remove and discard the O rings (8) from the spool (7).

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Hydraulic Swivel Joint - Disassembly

continued

Fig. 14

Thoroughly clean the spool (7) and body (9). Inspect the spool and body for serviceability. Refer to **Cleaning and Inspection** found at the front of this Shop Manual section.

NOTE: The body and spool are a matched set and cannot be separately interchanged with another body or spool.

Hydraulic Swivel Joint - Assembly

Fig. 15

Place the base of the spool (7) in a vise with soft jaws. Place a clean plastic bag over the spool to prevent the O rings (8) from being cut when they are installed. Secure the bag in place with adhesive tape.

Fig. 16

Generously lubricate and install new O rings (8) over the bag on the spool (7). When all O rings are in place, remove the plastic bag and ensure the O rings are seated properly.

NOTE: Effective on graders from S/N 18590, lubricate and install back-up rings in the top and bottom grooves. Champion recommends you upgrade earlier machines. Refer to Product Support Bulletin No. 489.

Fig. 17

Apply thread sealant P/N 19167 to each of the pipe plugs (5). Install the pipe plugs into the spool (7). Tighten the pipe plugs and remove any excess thread sealant.

Fig. 18

Apply a coat of nonfibrous grease to the base of the spool (7) and O rings (8).

Fig. 19

Carefully install the body (9) over the spool (7) ensuring the O rings (8) are not damaged.

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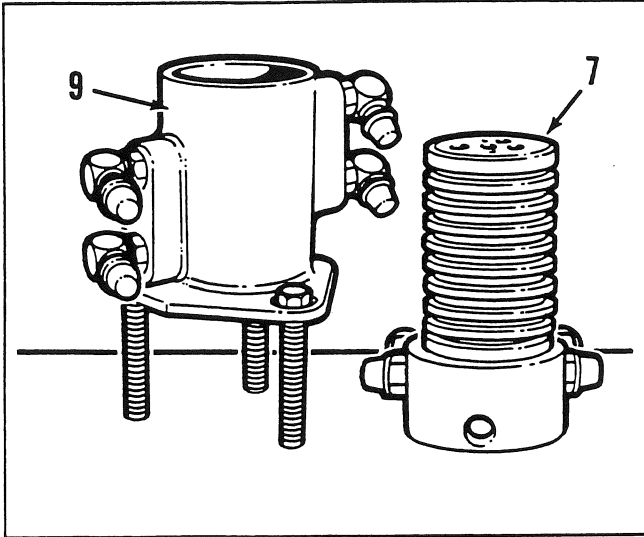


Fig. 14

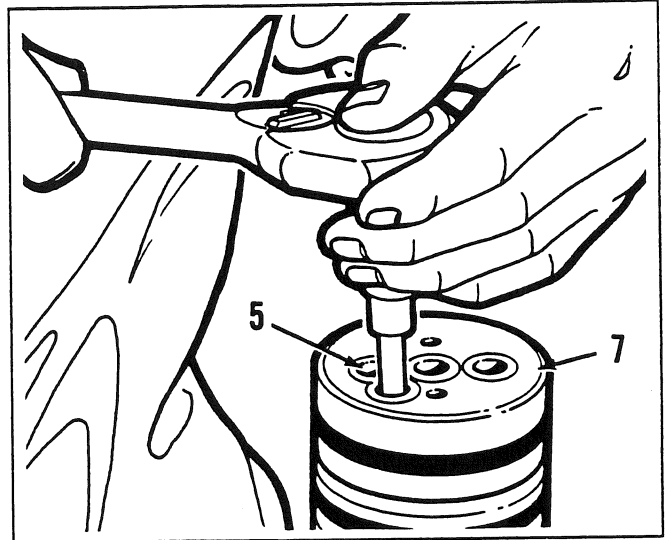


Fig. 17

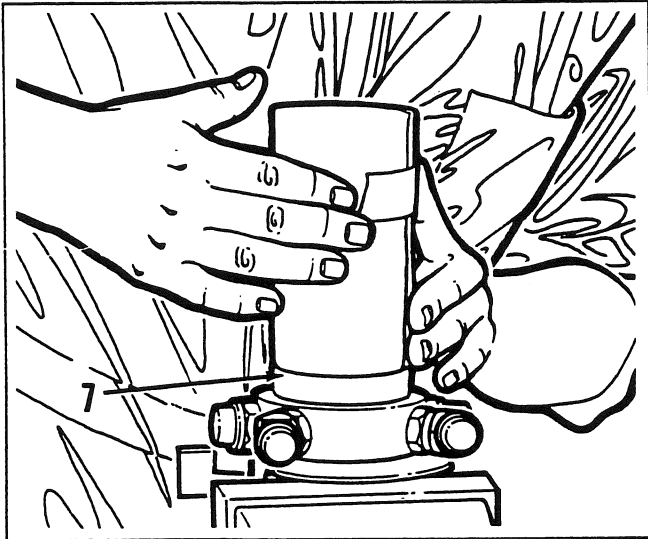


Fig. 15

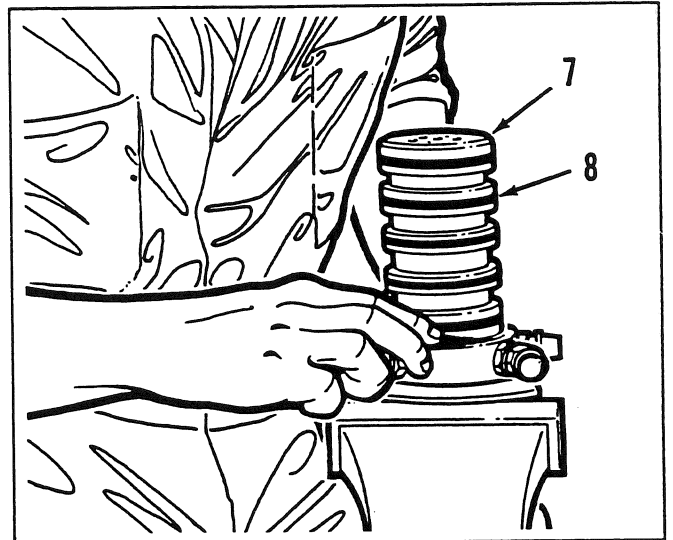


Fig. 18

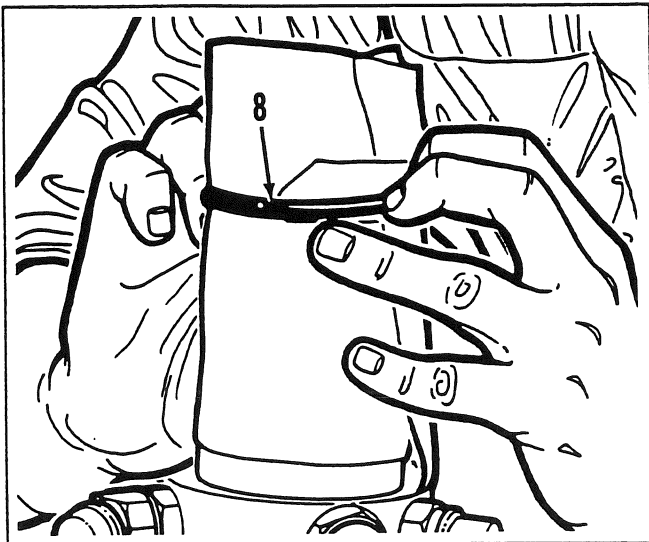


Fig. 16

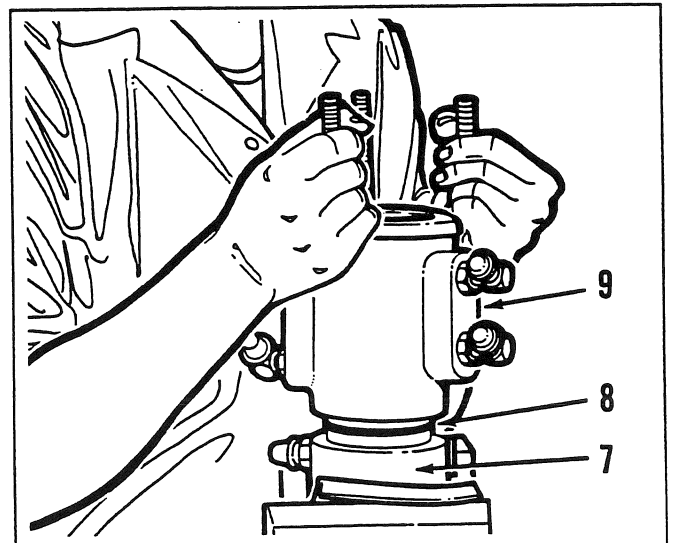


Fig. 19

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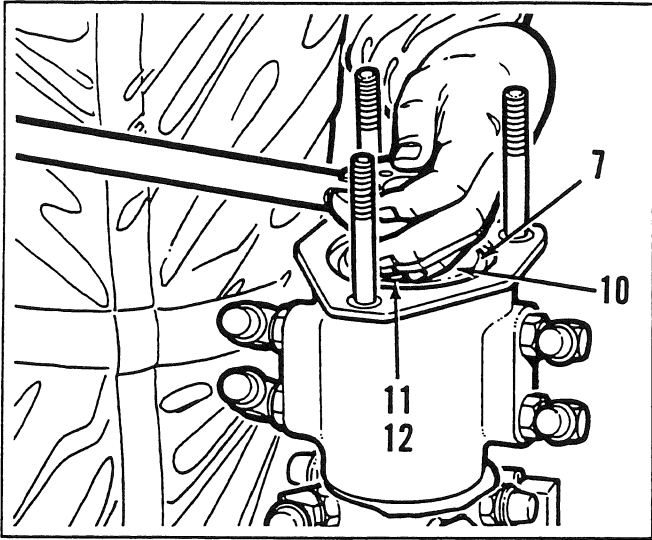


Fig. 20

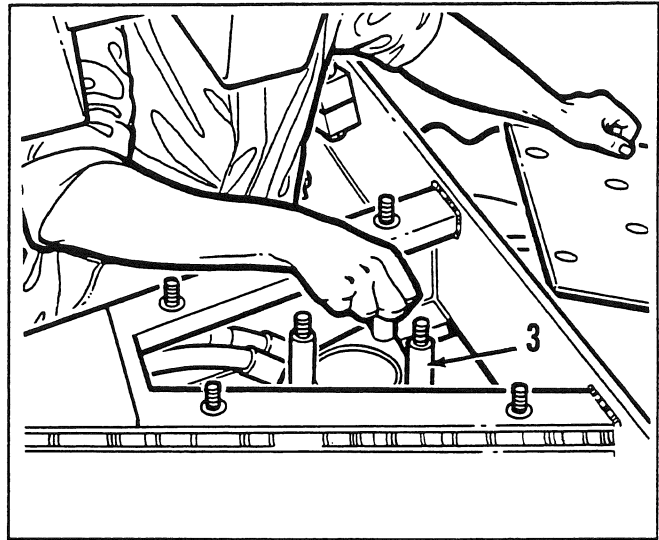


Fig. 23

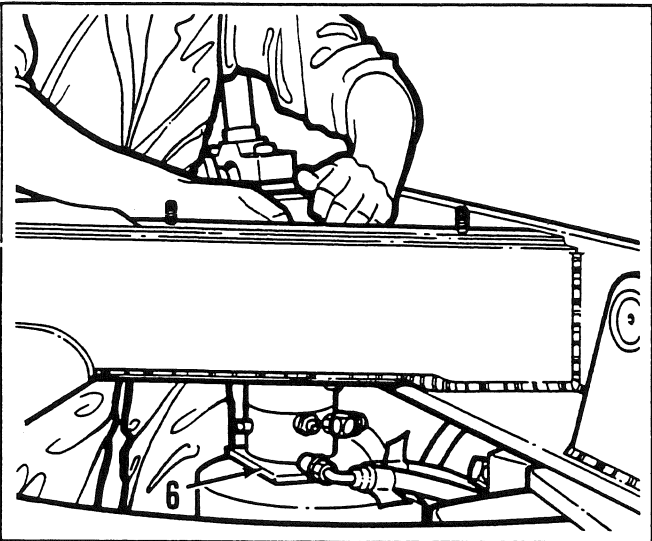


Fig. 21

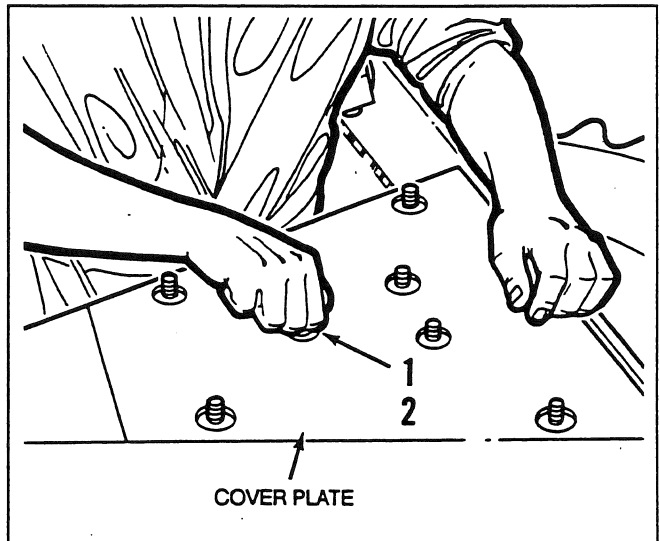


Fig. 24

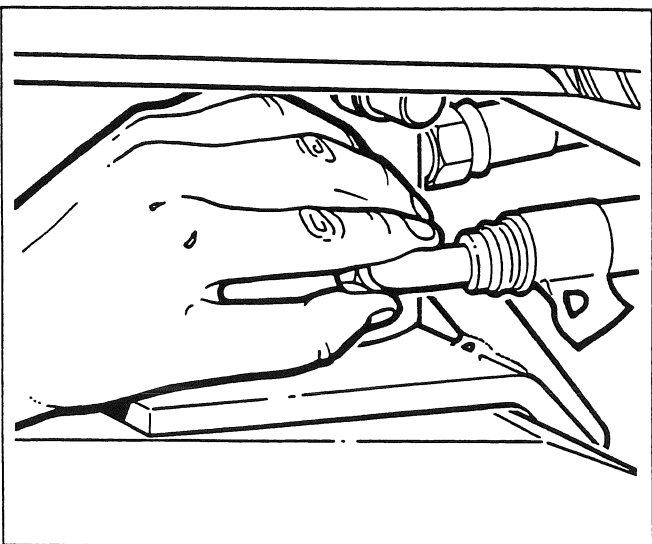


Fig. 22

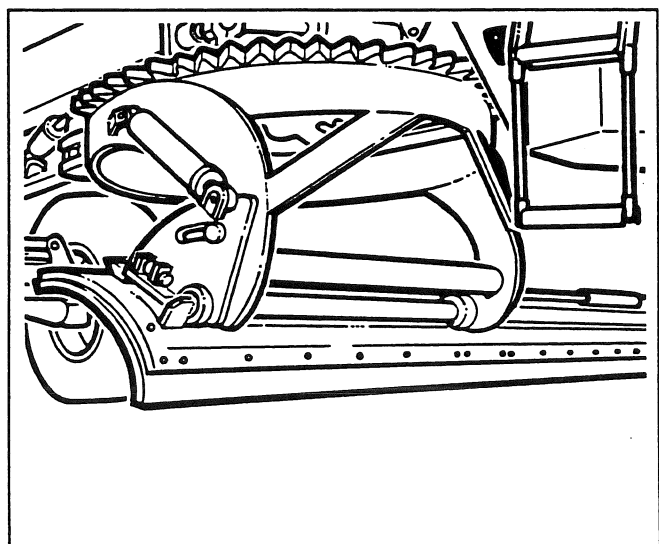


Fig. 25

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Hydraulic Swivel Joint - Assembly continued

Fig. 20

Coat the underside of the washer (10) with nonfibrous grease. Secure the washer to the spool (7) with bolts (12) and lockwashers (11).

NOTE: *Effective on graders from S/N 18590, install the cover protecting the spool washer (10). Seal the cover by applying a bead of gasket eliminator P/N 32338 around the joint. Refer to Product Support Bulletin No. 489.*

Hydraulic Swivel Joint - Installation

Fig. 21

Slide the body (9) onto the drive arm (6). Reposition the body.

Fig. 22

Connect all hoses to the correct locations.

Fig. 23

Install the three spacers (3).

Fig. 24

Position the cover plate. Secure it to the drawbar with the four nuts and lockwashers. Install the three nuts (1) and lockwashers (2) securing the hydraulic swivel joint to the cover plate.

Fig. 25

Perform the daily pre-start checks detailed in the 700 Series Operator's Manual. Make a visual check around the grader. Signal your intention to start the engine. Start the engine when it is safe to do so. Raise the moldboard off the ground. Operate the slide shift cylinder and power tilt cylinders to purge any air in the system. Test the hydraulic swivel joint by moving the slide shift cylinder and power tilt cylinder pistons to the end of their strokes in both directions. Do not hold the control lever in the power position with a cylinder at the end of its stroke for more than ten seconds. Shut down the engine. Inspect the hydraulic swivel joint for leaks.

SECTION 4F

HYDRAULICS

Circle Turn Valve

700 SERIES SHOP MANUAL

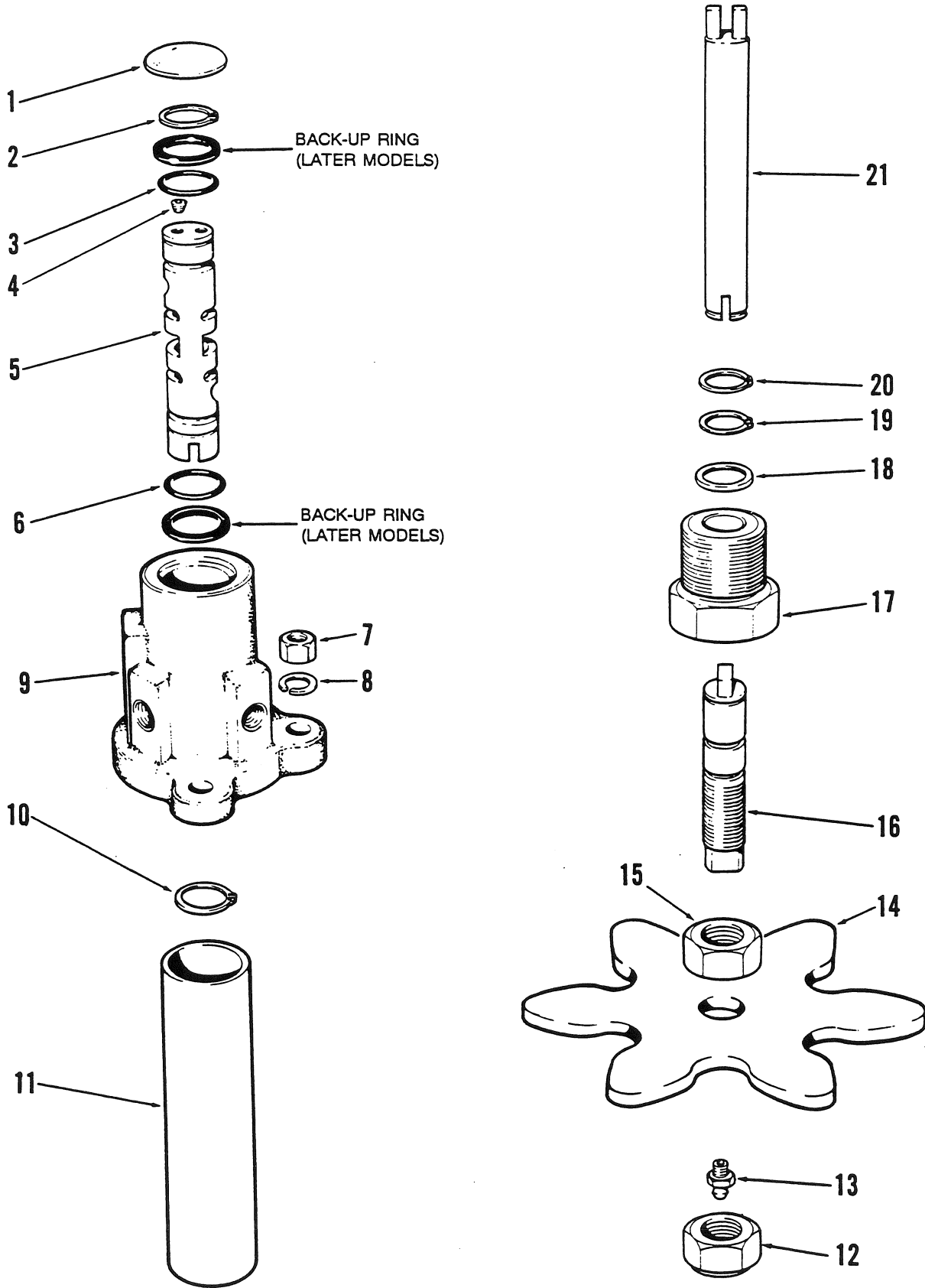


Fig. 1F Circle Turn Valve

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Item	Description	Item	Description	Item	Description
1	Expansion plug	8	Lockwasher	15	Nut
2	Snap ring	9	Body	16	Pinion shaft
3	O ring	10	Snap ring	17	Bearing
4	Pipe plug	11	Guard tube	18	Thrust race
5	Spool	12	Locknut	19	Snap ring
6	O ring	13	Grease fitting	20	Snap ring
7	Nut	14	Valve pinion	21	Driveshaft

Key to Fig. 1F

Circle Turn Valve - Description (Fig. 1F)

The circle turn valve is installed on top of the drawbar and is a major component of all Champion circle turn systems.

The function of the circle turn valve is to distribute oil to the correct end of each circle turn cylinder in the proper sequence, depending upon the direction of circle rotation.

Champion road graders use two hydraulic cylinders to turn the circle. For satisfactory operation and long life, the circle must be properly adjusted and kept that way. Now and then, for one reason or another, the circle will not turn smoothly and as part of the servicing procedure you will have to re-time the circle turn valve.

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Circle Turn Valve - Removal

Fig. 2

Rotate the circle and moldboard to the circle timing position. The right-hand circle turn cylinder should be fully retracted and the crank arm should point forward. A line should pass along its axis and through the center point of both anchor studs.

Fig. 3

The left-hand circle turn cylinder should be positioned so that the anchor stud, crank center line and crank stud make a 90 degree angle.

NOTE: *It is important you position the circle turn cylinders correctly. If this is not possible, refer to Section 2, Circle, Drawbar and Moldboard, of this Shop Manual before proceeding.*

Fig. 4

Place the grader in the SERVICE POSITION. Refer to the procedure on page (ii) in the front of this Shop Manual section.

Fig. 5

Identify all hydraulic hoses, tubes and fittings to prevent confusion during assembly. Carefully disconnect the hydraulic hoses and tubes from the circle turn valve. Cap all hydraulic hoses, tubes and fittings to prevent contamination.

Fig. 6

Remove the nuts (7) and lockwashers (8) securing the circle turn valve to the drawbar.

Fig. 7

Remove the circle turn valve from the drawbar.

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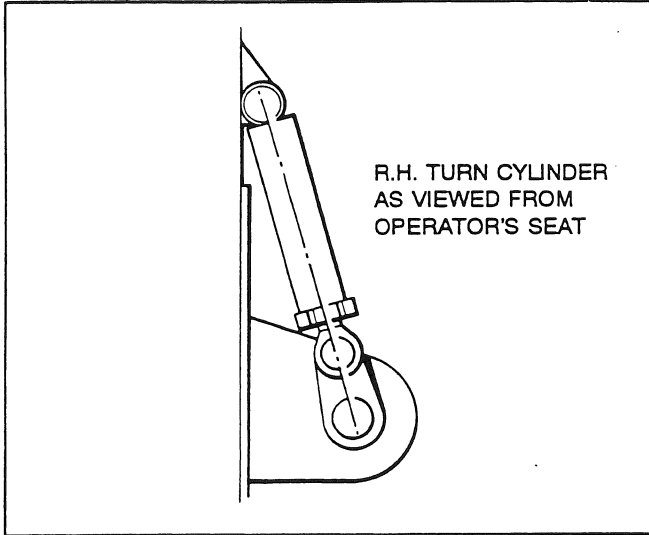


Fig. 2

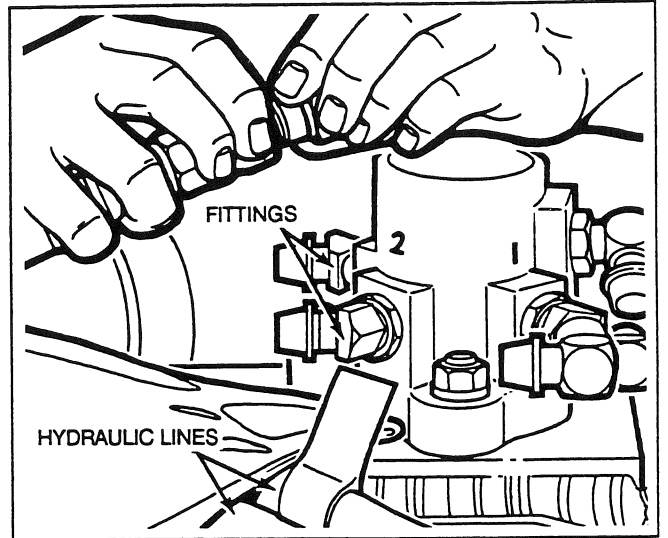


Fig. 5

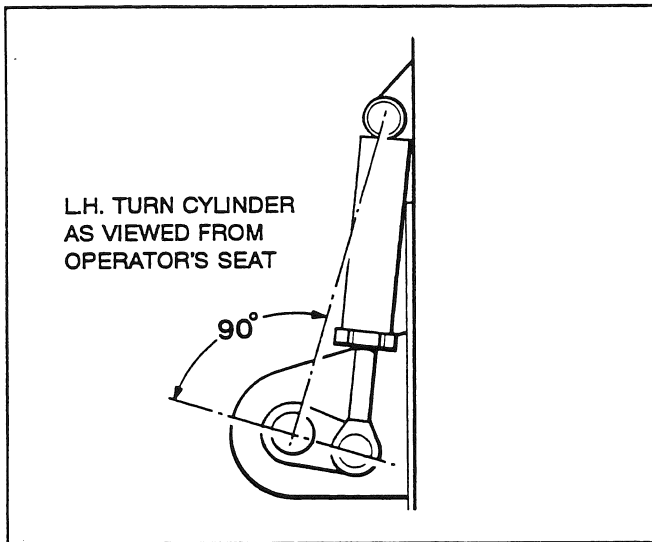


Fig. 3

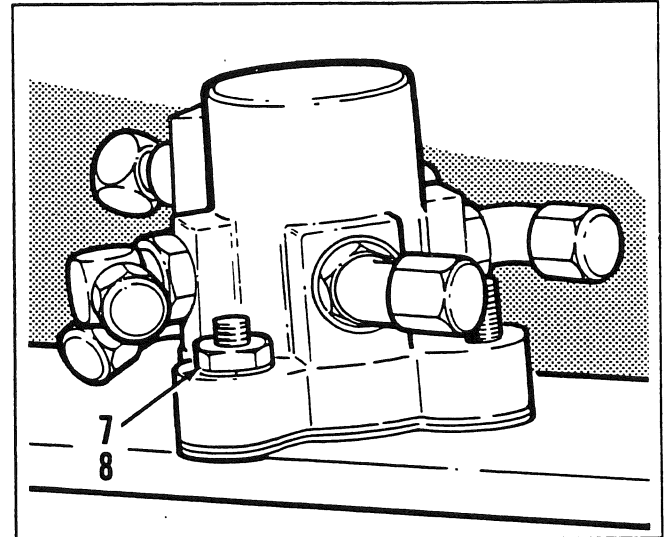


Fig. 6

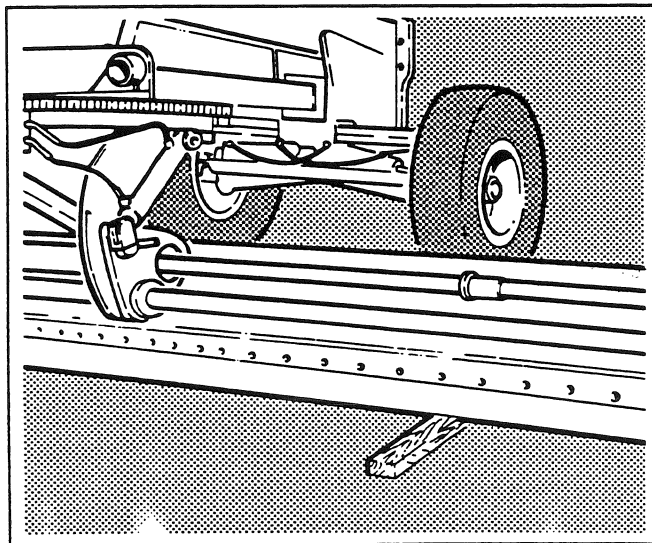


Fig. 4

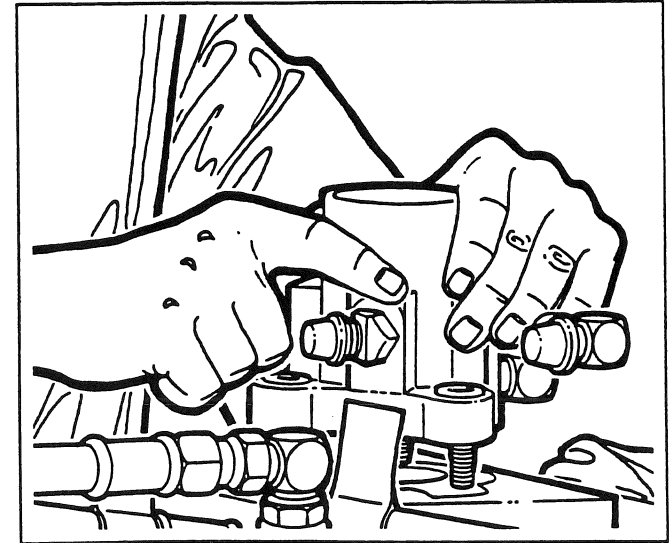


Fig. 7

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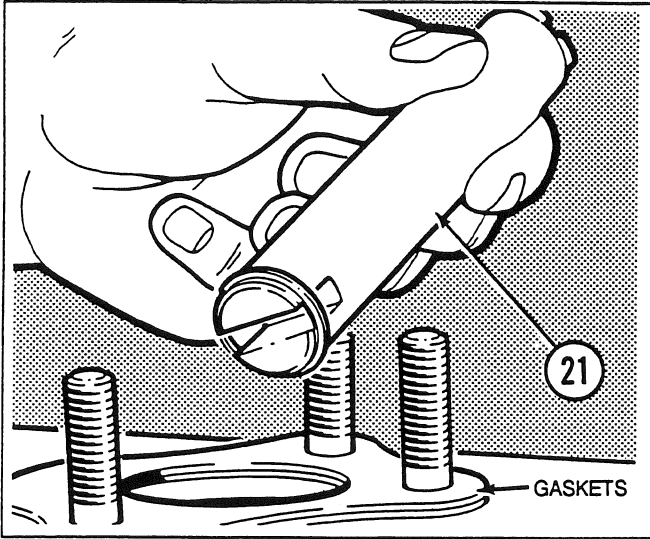


Fig. 8

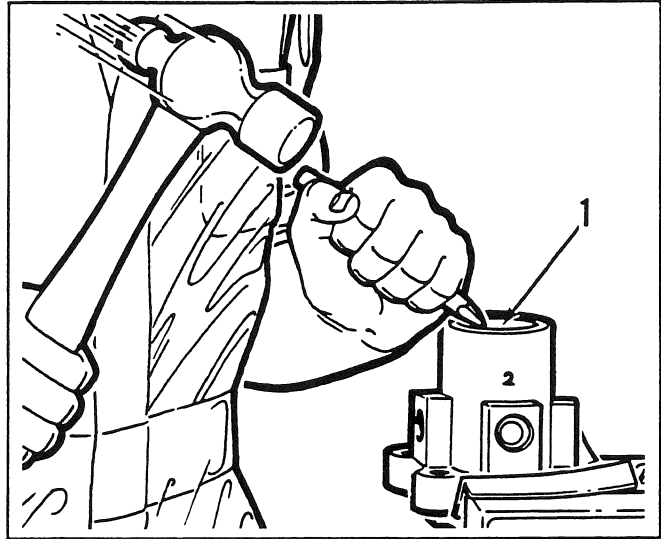


Fig. 11

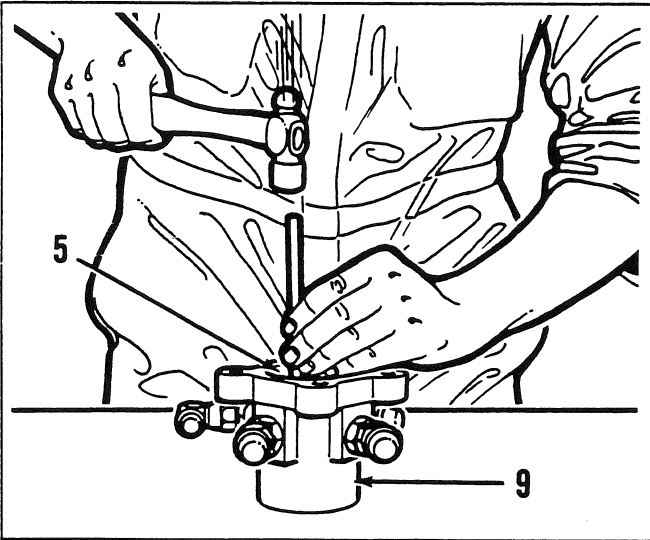


Fig. 9

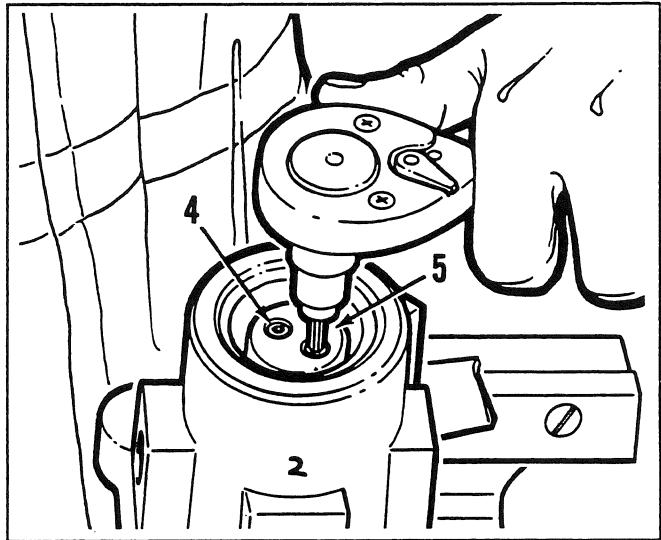


Fig. 12

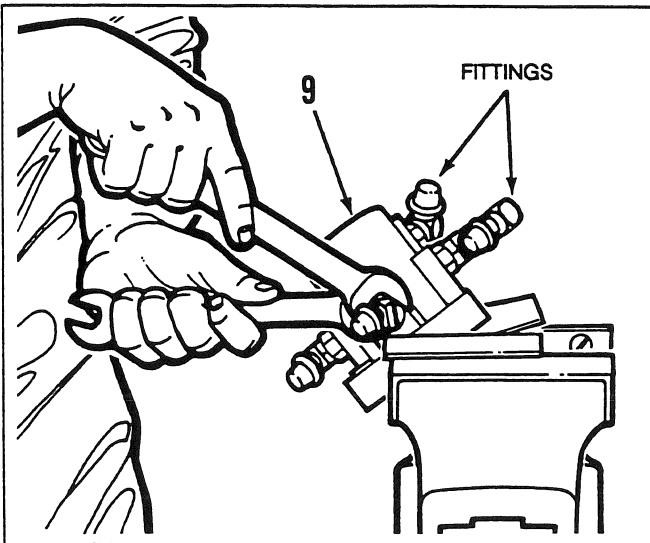


Fig. 10

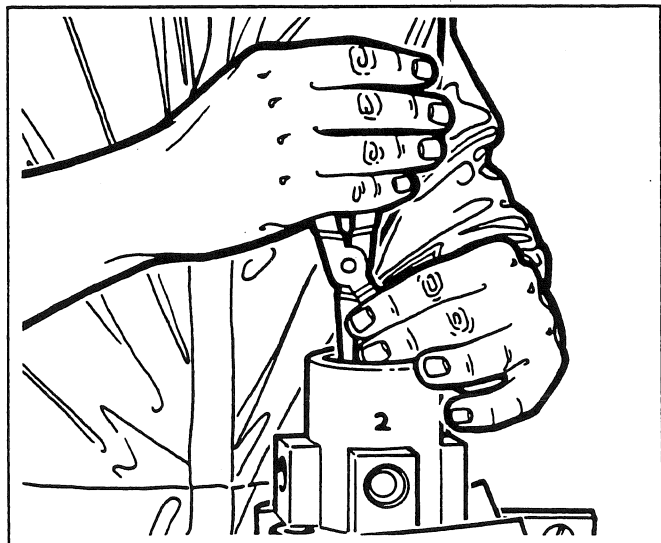


Fig. 13

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Circle Turn Valve - Removal continued

Fig. 8

Count and record the number of gaskets since they also serve as shims. Remove and discard the gaskets. Withdraw the driveshaft (21) and guard tube (11). Refer to Section 2 **Circle, Drawbar and Moldboard** of this Shop Manual for information regarding the removal of the valve pinion and bearing if required.

Fig. 11

Remove and discard the expansion plug (1).

Circle Turn Valve - Disassembly

Fig. 9

Mark the spool (5) to the body (9) with light punch marks. This will help you re-time the circle.

NOTE: *This step is valid only on graders where the circle turns in the correct direction relative to the control lever action. If this is not the case, do not mark the spool to the body.*

Fig. 12

Prevent the spool (5) from turning and remove the two pipe plugs (4).

Fig. 10

Clamp the base of the body (9) in a vise with soft jaws. Do not overtighten the vise. Be careful not to break the mounting lugs. Remove all fittings and inspect the O rings.

Fig. 13

Carefully remove and discard the snap ring (2).

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Circle Turn Valve - Disassembly continued

Fig. 14

Remove the body (9) from the vise. Remove and discard the snap ring (10).

Fig. 15

Use a slight twisting action to remove the spool (5) out of the bottom of the body (9). Ensure the punch marks made in step Fig. 9 do not damage the bore.

Fig. 16

Remove and discard the O rings (3 and 6) from the spool (5).

NOTE: Later graders also include back-up rings. Remove and discard the back-up rings.

Fig. 17

Inspect the body (9) and spool (5) for wear and scoring. Refer to **Cleaning and Inspection** found at the front of this Shop Manual section.

Circle Turn Valve - Assembly

Fig. 18

Ensure the body (9) and spool (5) are free from contamination.

NOTE: The body and spool are a matched set and cannot be separately interchanged with another body and spool.

Generously lubricate the spool (5) and new O rings (3 and 6). Carefully install the O rings over the spool. Champion recommends installing back-up rings on earlier graders. Lubricate and install new back-up rings. Ensure that the O rings are seated properly.

Fig. 19

Apply a generous amount of system oil to the spool (5) and use a slight twisting action to carefully install the spool into the body (9).

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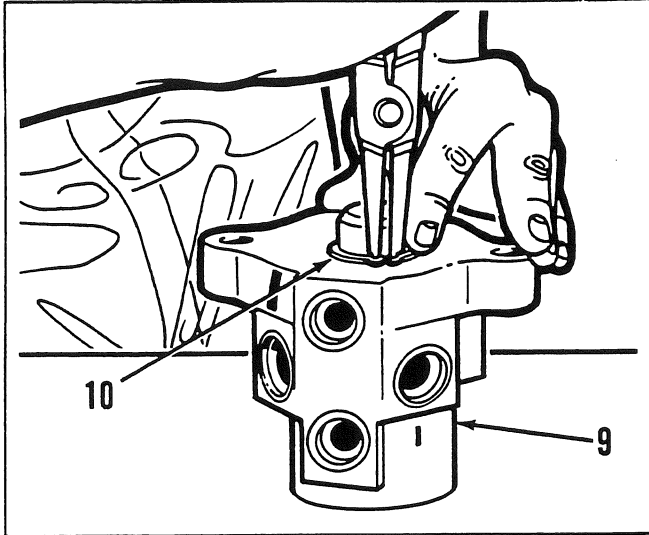


Fig. 14

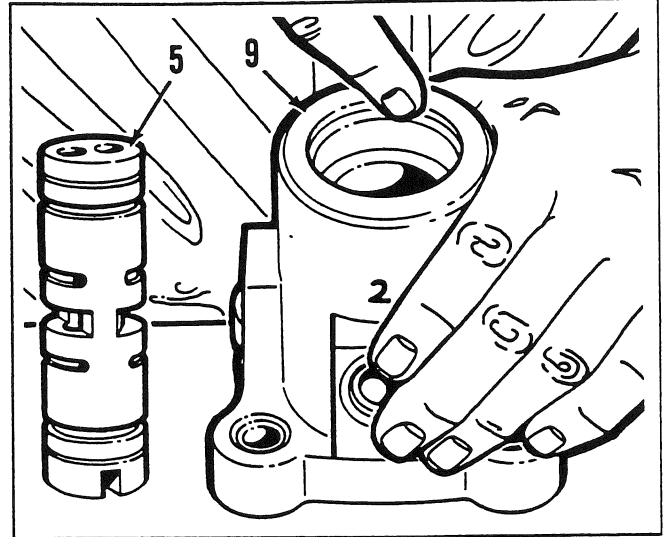


Fig. 17

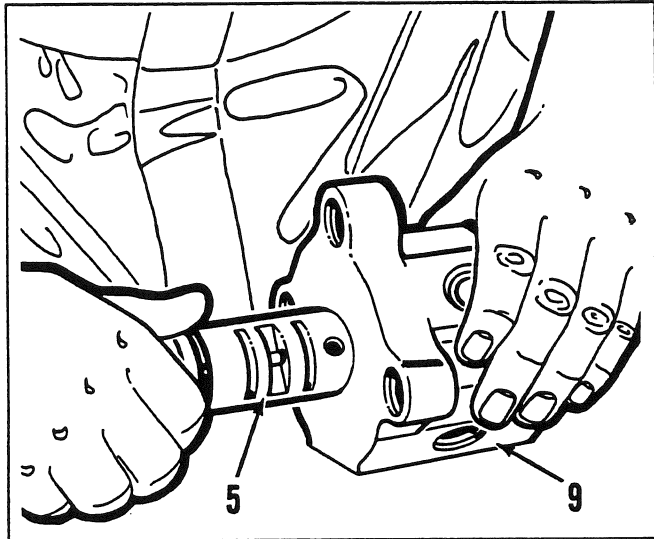


Fig. 15

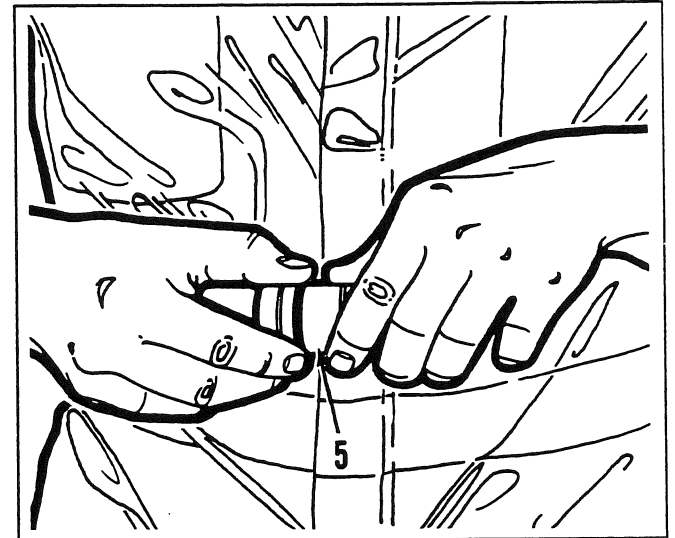


Fig. 18

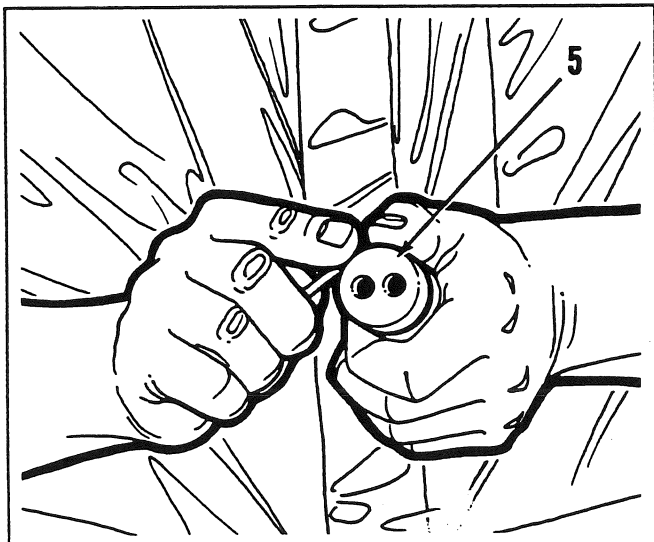


Fig. 16

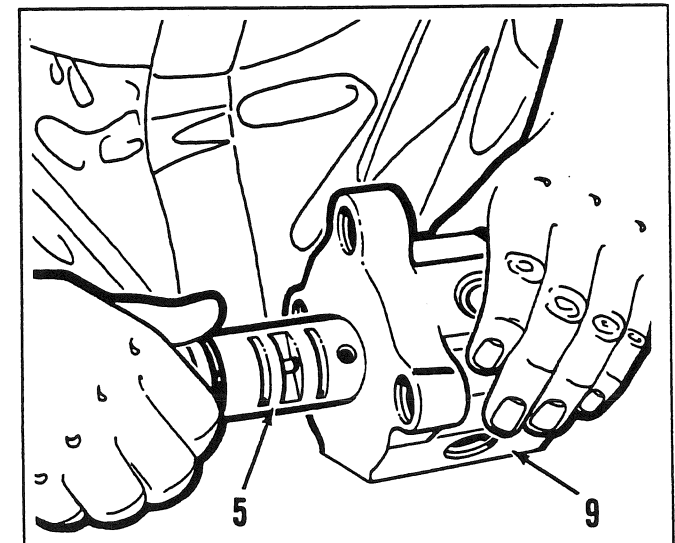


Fig. 19

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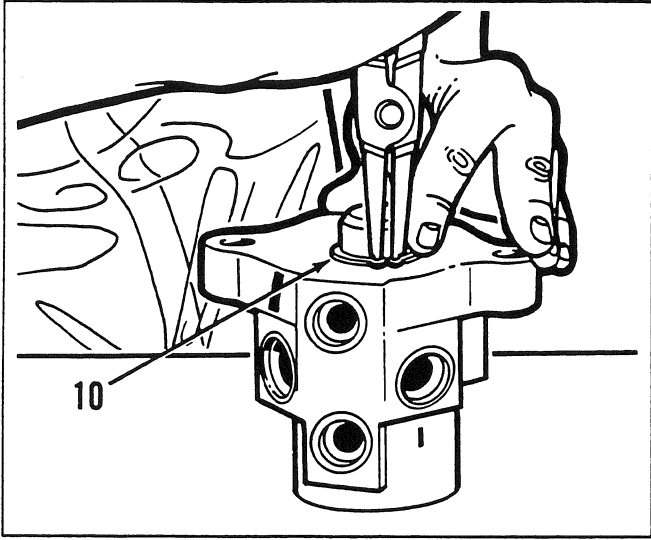


Fig. 20

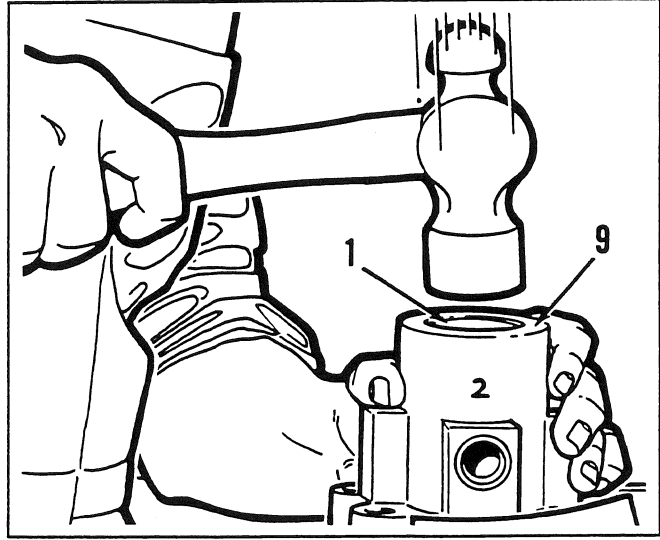


Fig. 23

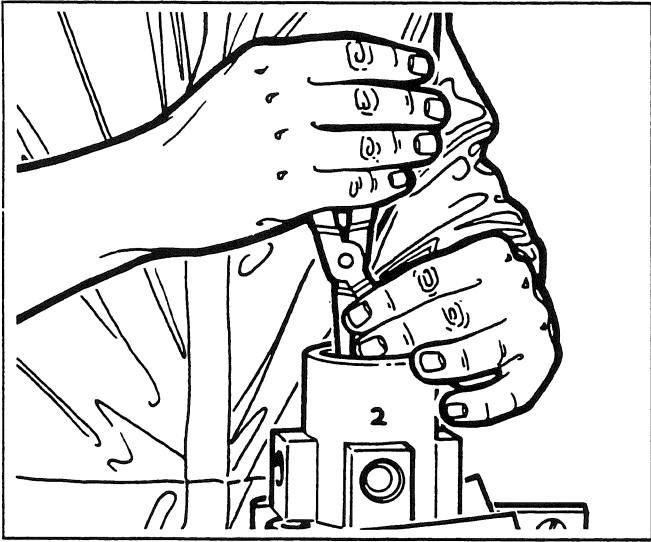


Fig. 21

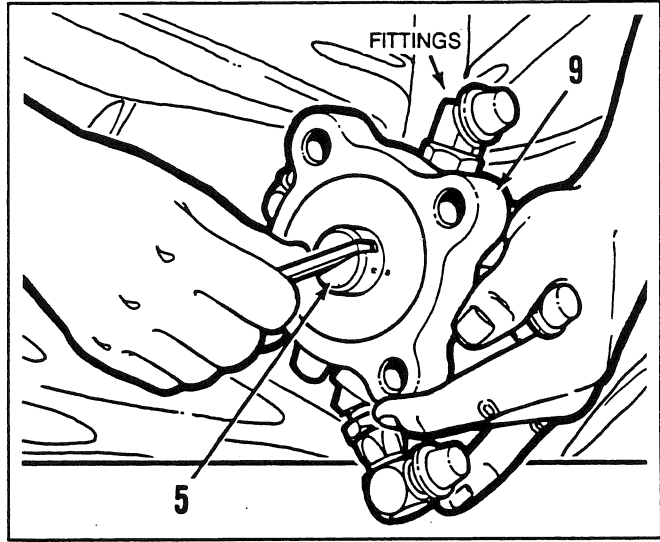


Fig. 24

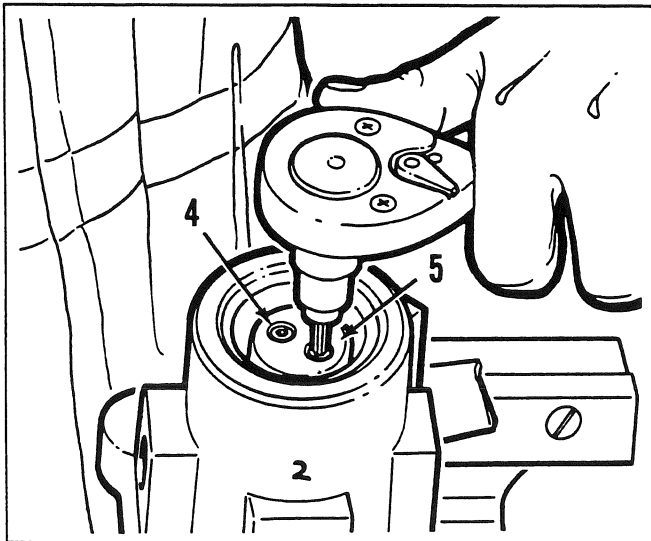


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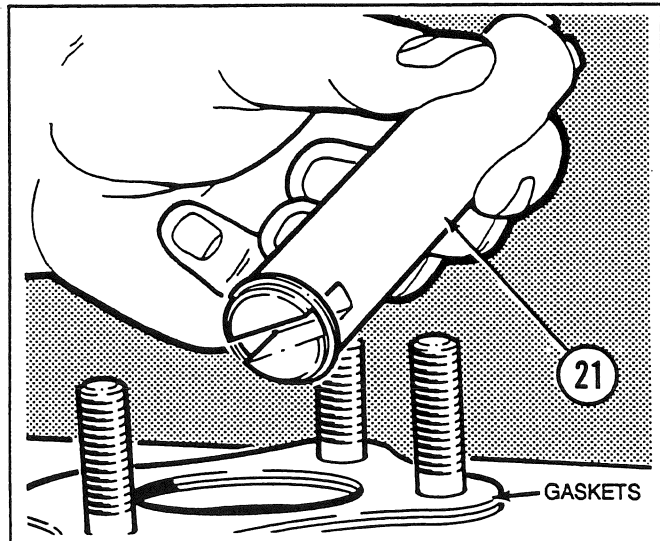


Fig. 25

700 SERIES SHOP MANUAL

Circle Turn Valve - Assembly continued

Fig. 20

Install a new snap ring (10) in the lower groove.

Fig. 23

Tap a new expansion plug (1) in place in the body (9). Retain the expansion plug by indenting the center.

Fig. 21

Place the circle turn valve in a vise with soft jaws. Do not overtighten the vise. Install a new snap ring (2).

Fig. 24

With the fittings installed to the proper locations, realign the spool (5) to the body (9) according to the punch marks. You will correctly time the circle turn valve later.

Fig. 22

Apply a light coating of thread sealant P/N 19167 to each pipe plug (4). Install the two pipe plugs into the spool (5). Prevent the spool from turning and fully tighten the pipe plugs. Wipe off any excess thread sealant.

Fig. 25

Install the guard tube (11). Lower the driveshaft (21) into the drawbar frame and connect the notched end into the pinion shaft (16). Place the same number of new gaskets on the drawbar as were removed during disassembly. The gaskets also act as shims to prevent the spool (5) from bottoming out on the driveshaft (21).

Circle Turn Valve - Installation

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Circle Turn Valve - Installation continued

Fig. 26

Install the circle turn valve.

Fig. 27

Retain the body (9) with the lockwashers (8) and nuts (7).

Fig. 28

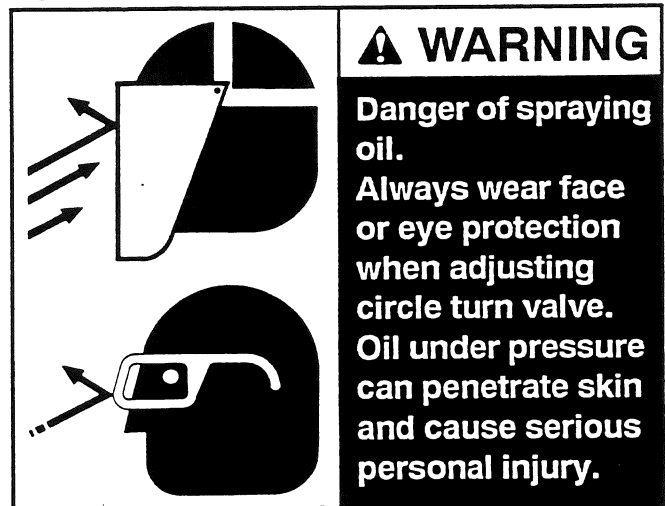
Remove the plugs from all hydraulic hoses, tubes and fittings. Connect each hydraulic hose and line to its correct location.

Circle Timing

Fig. 29

Whenever the circle turn valve has been removed, you must make a circle timing check. You have performed two of the three steps in the circle timing procedure by ensuring correct drive pinion clearance and positioning the circle turn cylinders and cranks. Refer to Section 2, **Circle, Drawbar and Moldboard**, of this Shop Manual for more information. The third step in the sequence is adjusting the circle turn valve spool (5). To start, find the forward left port on the circle turn valve. Disconnect the hydraulic hose and immediately cap the hose to prevent contamination. Remove the fitting.

Fig. 30



Look inside the open port. You should see the shiny surface of the spool (5) completely blocking the port. If this is the case, the spool is in the proper position. Reconnect the hydraulic hose.

Fig. 31

If you see a dark portion, the spool (5) needs adjustment.

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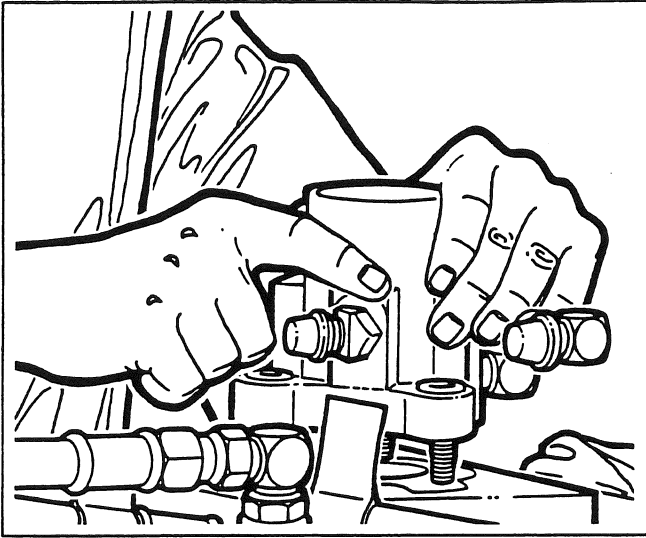


Fig. 26

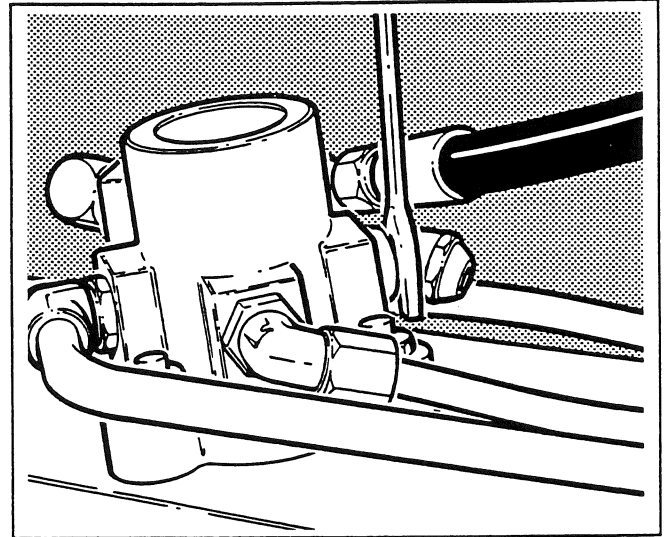


Fig. 29

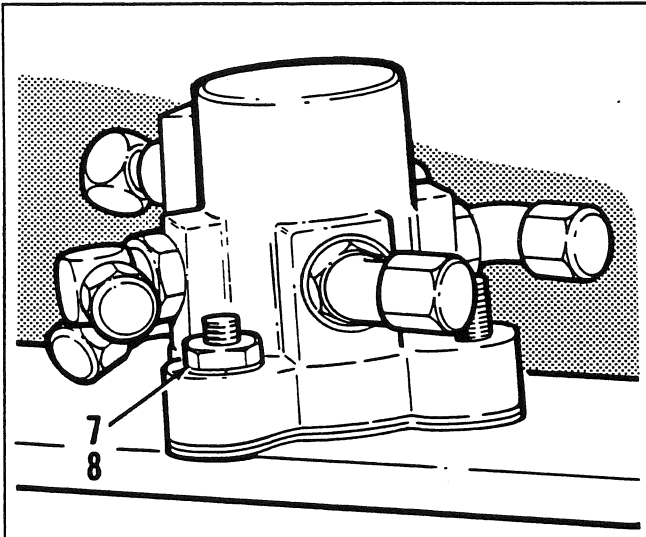


Fig. 27

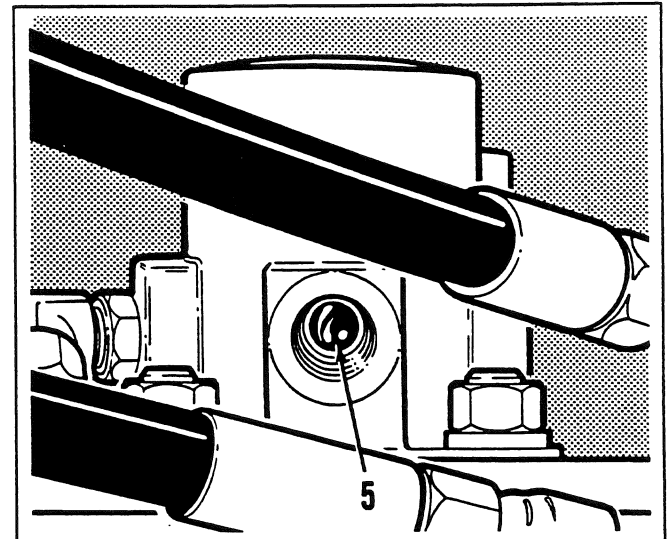


Fig. 30

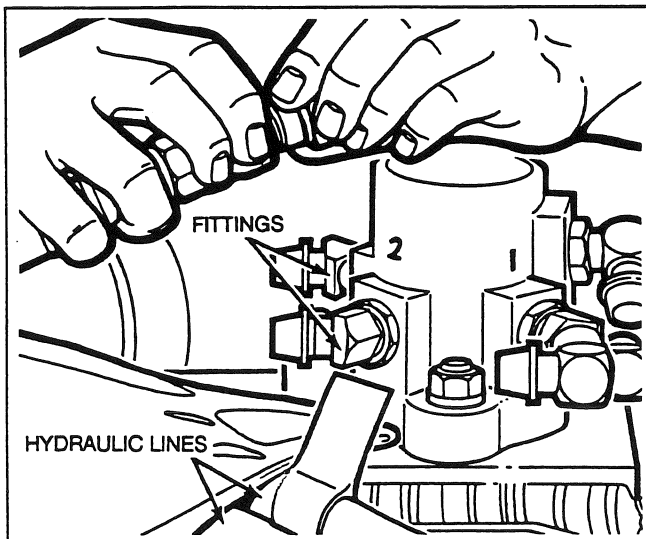


Fig. 28

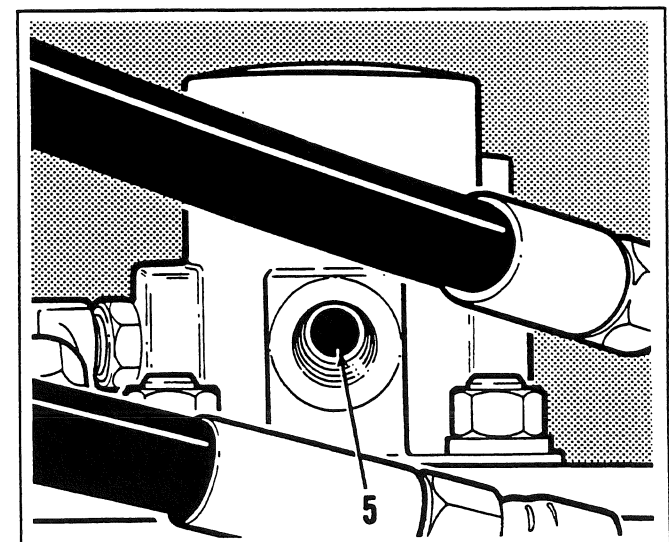


Fig. 31

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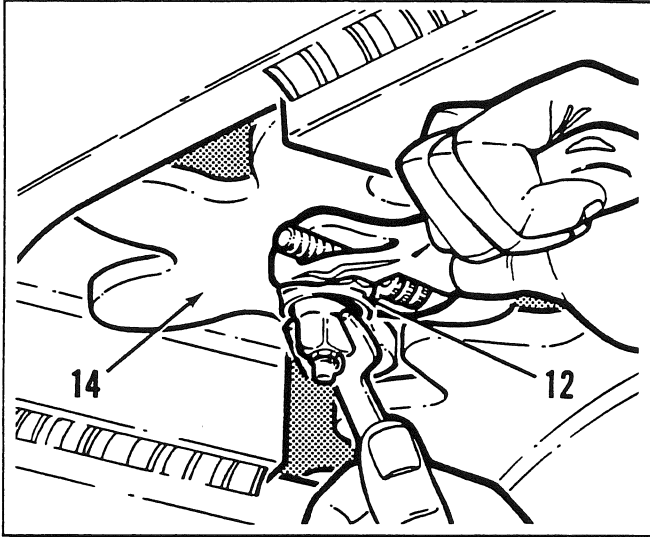


Fig. 32

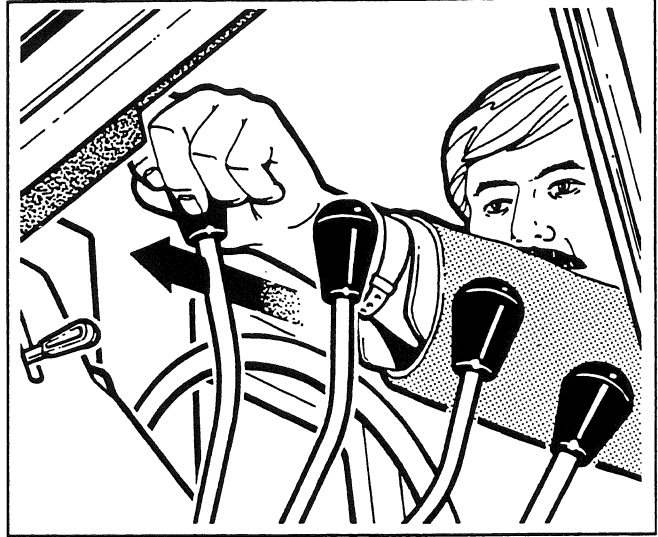


Fig. 35

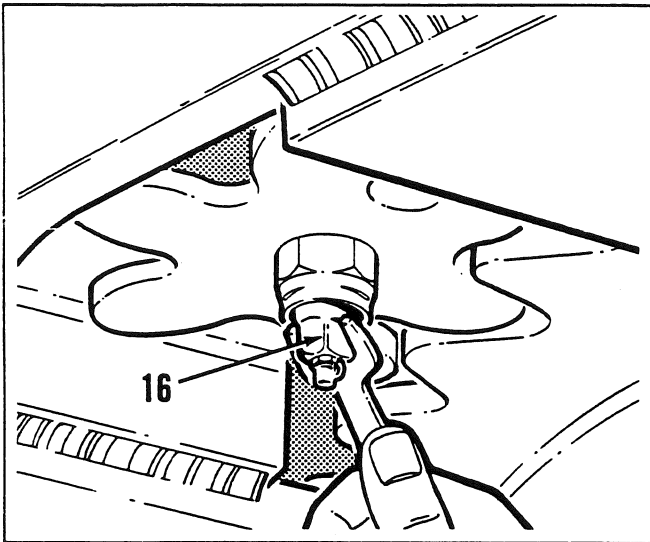


Fig. 33

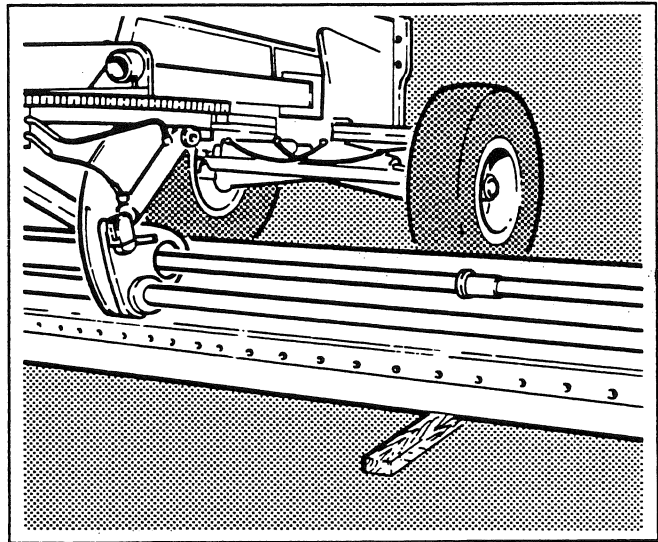


Fig. 36

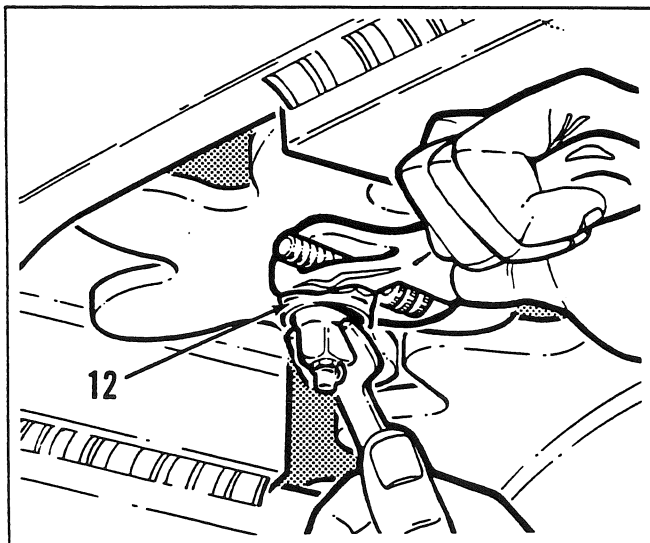


Fig. 34

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Circle Timing *continued*

Fig. 32

To adjust the spool (5), first loosen the locknut (12) retaining the valve pinion (14).

Fig. 35

Perform the daily pre-start checks detailed in the 700 Series Operator's Manual. Make a visual check around the grader. Signal your intention to start the engine. Start the engine when it is safe to do so and push the circle turn control lever forward. The circle should turn smoothly in a clockwise direction. If the circle turns in a counter-clockwise direction as viewed from the operator's seat when the lever is pushed forward, the spool (5) is 180 degrees out of position. Repeat steps **Fig. 32** through **Fig. 34**, but this time, turn the pinion shaft (16) 180 degrees. Circle timing is now complete.

Fig. 33

Turn the pinion shaft (16) until the shiny surface of the spool (5) is visible and completely blocks the port. Move the spool back and forth until you can see the edges. Now centralize the spool.

Fig. 36

Shut down the engine. Check the hydraulic fluid level and for leaks.

Fig. 34

Tighten the locknut (12). Check the position of the spool (5) and make sure that it has not moved when tightening the locknut. Install the fitting and reconnect the hydraulic hose.



SECTION 4G

HYDRAULICS

Cushion Valves

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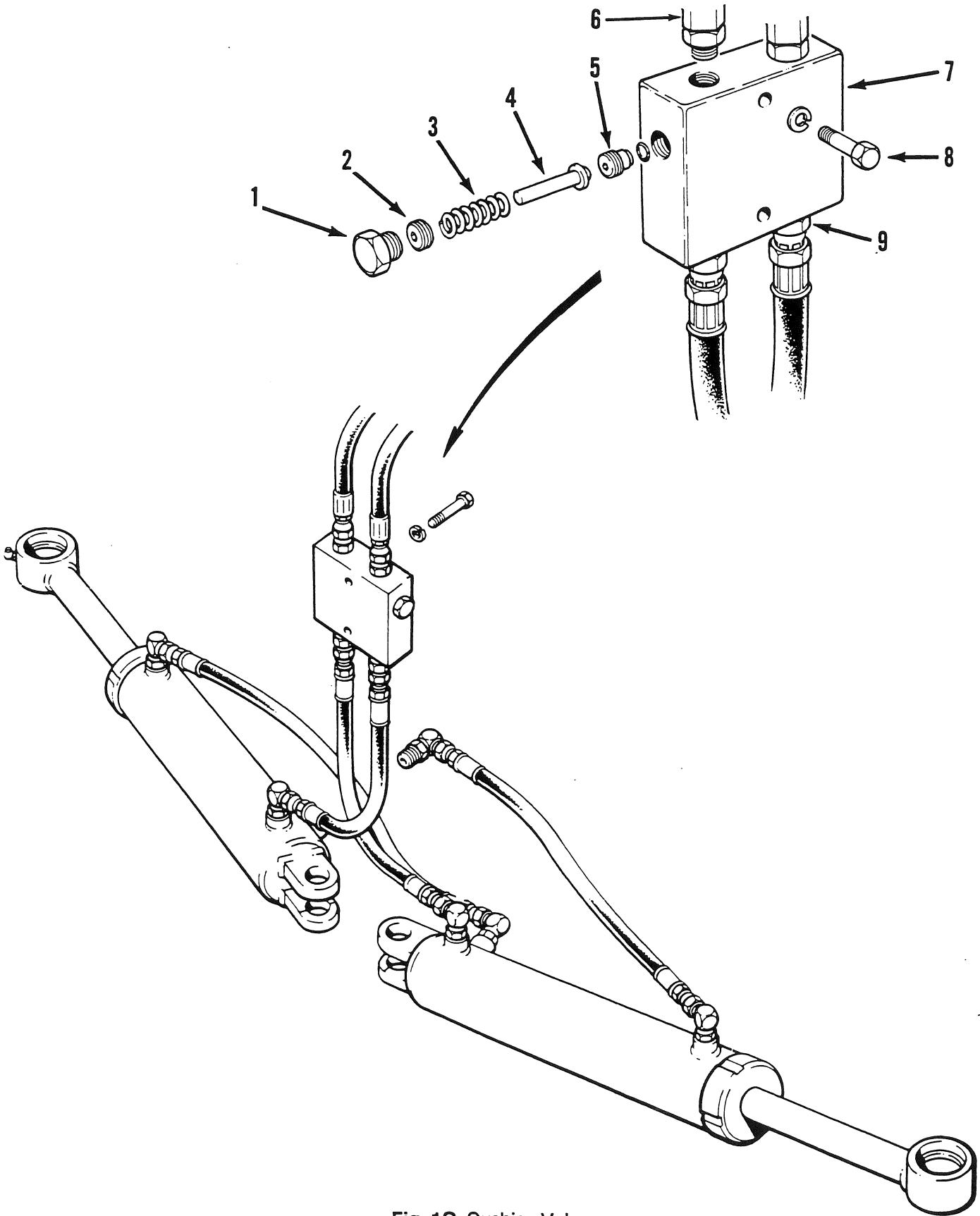


Fig. 1G Cushion Valve

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Item	Description	Item	Description	Item	Description
1	O ring plug	4	Poppet	7	Cushion valve
2	Adjusting screw	5	Seat	8	Bolt
3	Spring	6	Connector	9	Connector

Key to Fig. 1G

Cushion Valve - Description (Fig. 1G)

The cushion valve is a cross-over relief valve used in the Champion steering and circle turn hydraulic circuits to protect these systems from excess pressure caused by shock loads. As the pressure reaches the preset level of the valve, the poppet pushes against the spring and moves from its seat. This allows oil to bypass into the other line.

You will find the steering hydraulic circuit cushion valve located in the nose of the main frame. The circle turn hydraulic circuit cushion valve is mounted on top of the drawbar. Both cushion valves look identical, but each has a different pressure setting. The internal springs have different compression rates and pressure ranges. Therefore, the valves cannot be interchanged by simply adjusting the setting.

This sub-section describes bench servicing the steering hydraulic circuit cushion valve. However, the same procedure applies to the circle hydraulic circuit cushion valve.

Cushion Valve Location	Cracking Pressure 1/2 U.S. gpm (hand pump)	Reset Pressure Refer to Fig. 17, following
Circle	2000±100 psi (138±7 bar)	1600 psi (110 bar)
Steering	800±50 psi (55±3 bar)	650 psi (45 bar)

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Cushion Valve - Removal

Fig. 2

Place the grader in the SERVICE POSITION. Refer to the procedure on page (ii) in the front of this Shop Manual section.

Fig. 3

Identify the two hydraulic hoses from the steering cylinders to prevent confusion during assembly. Cap the fittings and ports to prevent contamination. Disconnect the hoses.

Fig. 4

Disconnect the top hydraulic hoses. Cap the fittings and ports to prevent contamination.

Fig. 5

Remove the two bolts (8) securing the cushion valve (7) to the frame. Remove the cushion valve.

Cushion Valve - Disassembly

Fig. 6

Place the cushion valve (7) into a vise with soft jaws. Do not overtighten the vise. Remove the connectors (6 and 9) and hoses.

Fig. 7

Remove the O ring plugs (1).

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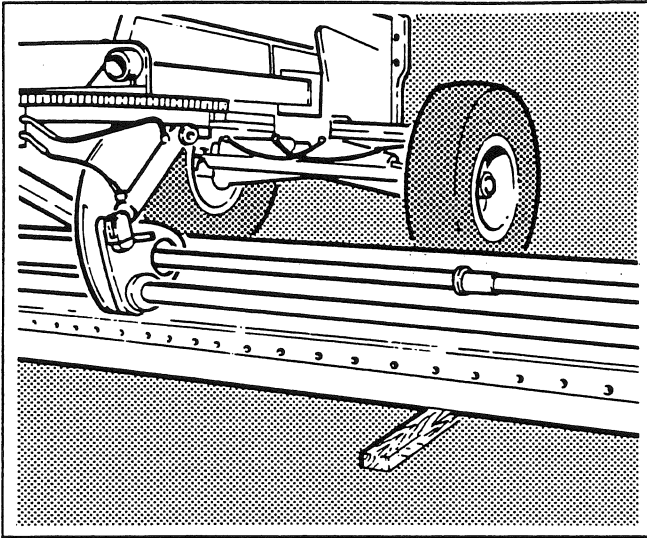


Fig. 2

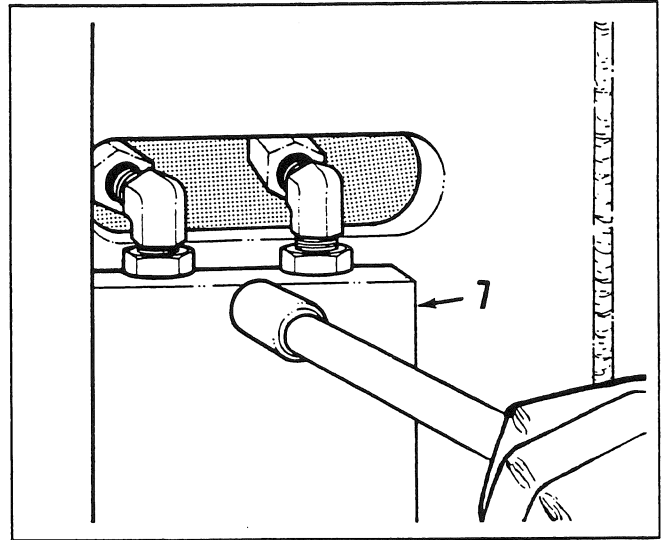


Fig. 5

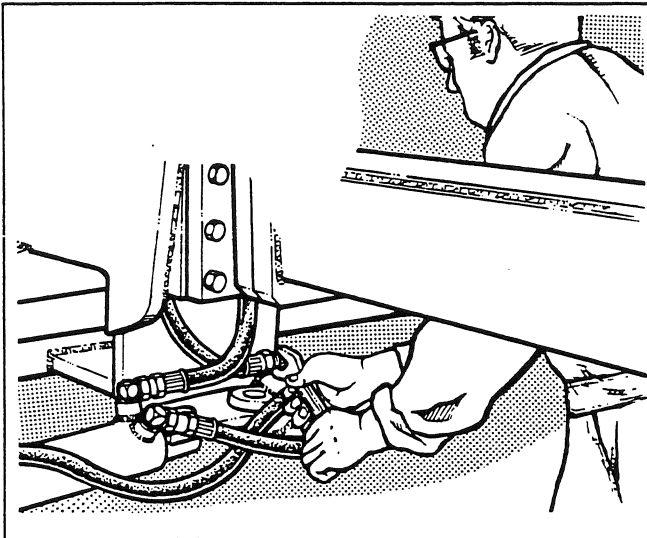


Fig. 3

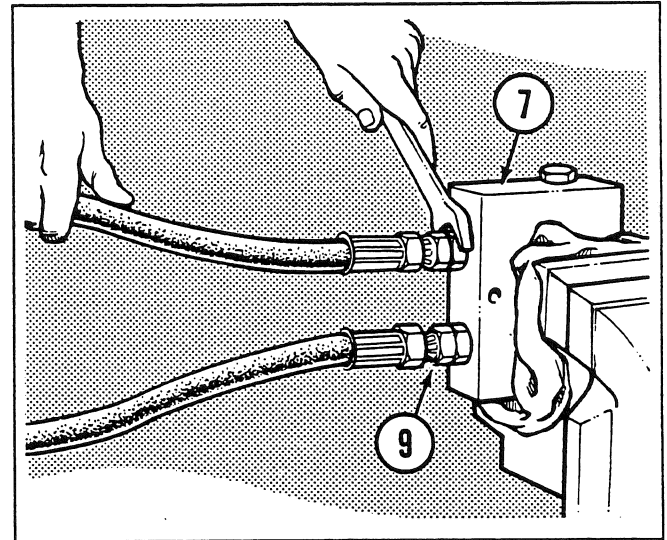


Fig. 6

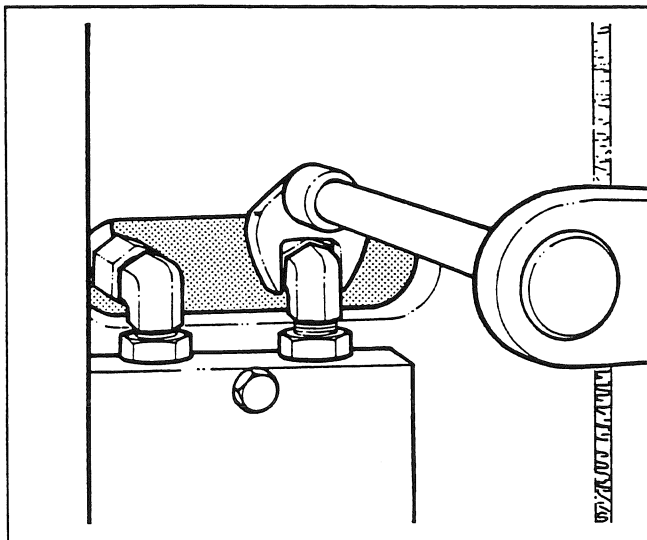


Fig. 4

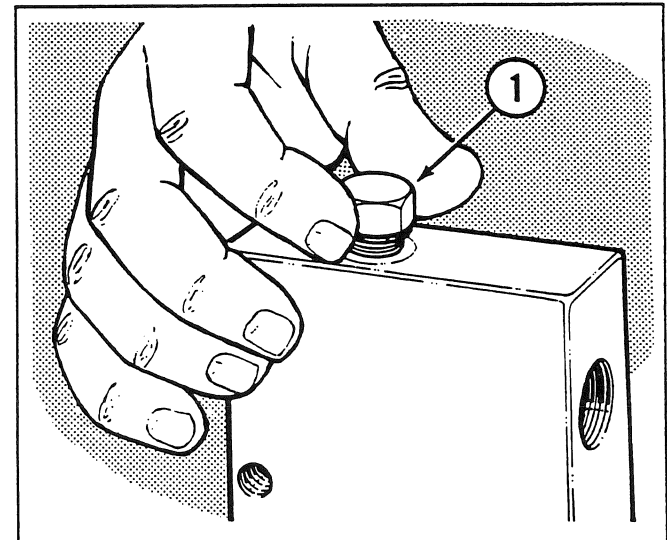


Fig. 7

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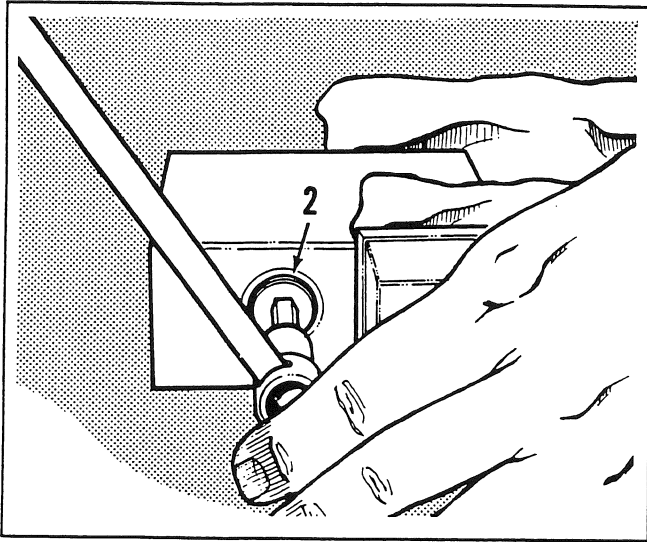


Fig. 8

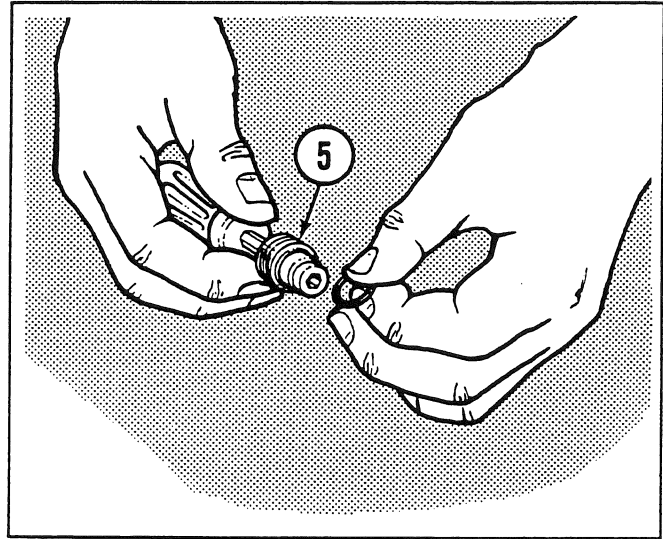


Fig. 11

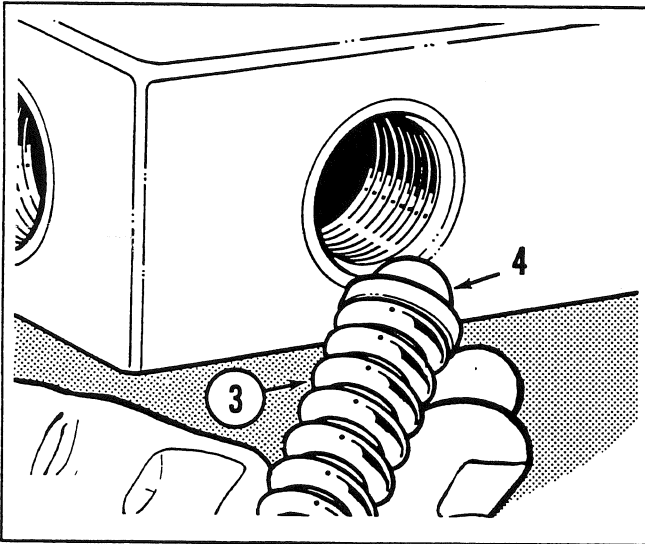


Fig. 9

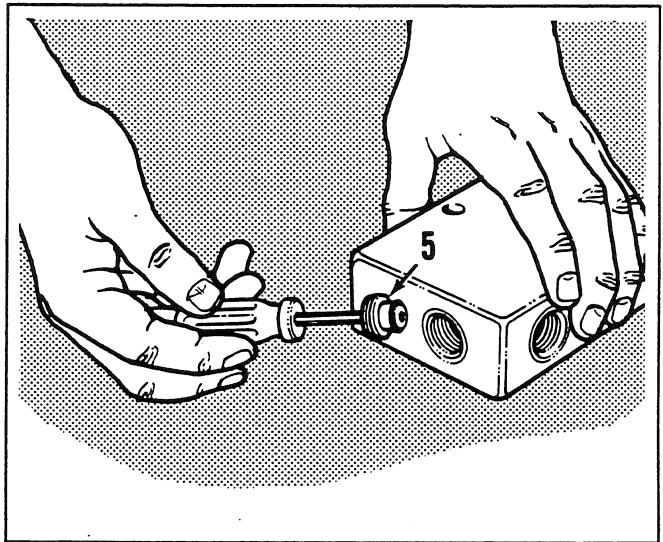


Fig. 12

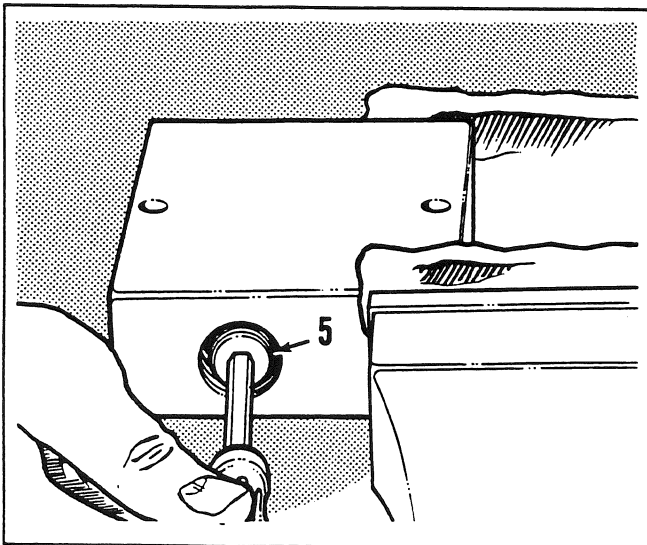


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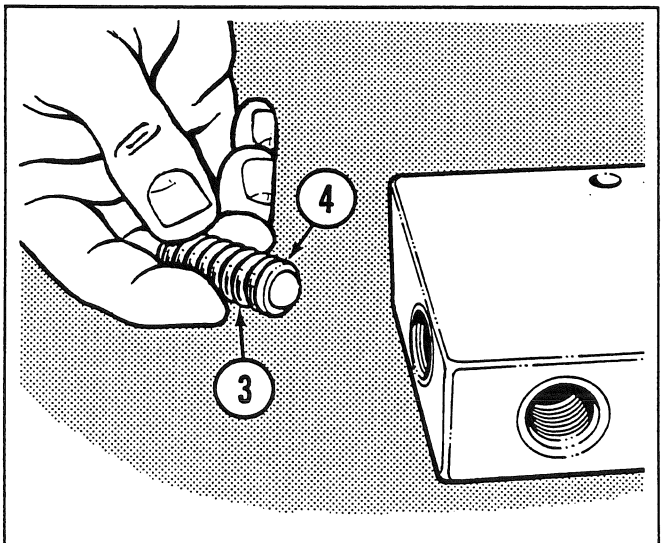


Fig. 13

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Cushion Valve - Disassembly continued

Fig. 8

Use an Allen wrench to remove the adjusting screws (2).

Fig. 9

Remove the springs (3) and poppets (4).

Fig. 10

Remove the seat (5). Remove and discard all O rings. Inspect all parts for serviceability. Refer to **Cleaning and Inspection** found in the front of this Shop Manual section.

Cushion Valve - Assembly

Fig. 11

Lubricate and install a new O ring on the seat (5).

Fig. 12

Install the seat (5) in the housing and tighten it to the specified torque. Prevent the seat from turning by staking it in three places.

Fig. 13

Install the poppet (4) and spring (3).

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Cushion Valve - Assembly continued

Fig. 14

Install the adjusting screw (2). Lubricate and install a new O ring onto the plug (1). Install the plug. Repeat this assembly procedure for the opposite side of the cushion valve (7).

Fig. 17

If adjustment is needed, remove the plug on the side opposite to the section that was pressurized. Use an Allen wrench to turn the adjusting screw (2) to the correct relief setting. Turn the adjusting screw clockwise to increase the setting or counterclockwise to decrease it. Repeat this operation for the opposite side of the cushion valve. Reduce the setting to the reset figure (see chart on Page 4G-1). The valve should close. Maximum leakage at reset pressure is 60 drops/minute.

Cushion Valve - Adjustment

Fig. 15

Install a steel plug in one port. In the other port on the same side, install a means of supplying hydraulic power, such as a hand pump, and a calibrated pressure gauge.

Cushion Valve - Installation

Fig. 18

Lubricate and install new O rings on the connectors (6 and 9). Install the connectors to finger tightness. Install the two hydraulic hoses. Uncap the top hydraulic hoses and connect them to the cushion valve (7).

Fig. 16

Build pressure with the hand pump until the gauge shows the cushion valve relieving oil to the opposite port. Carefully release the pressure.

Fig. 19

Fasten the cushion valve (7) to the frame with the two bolts (8). Tighten the bolts to the specified torque.

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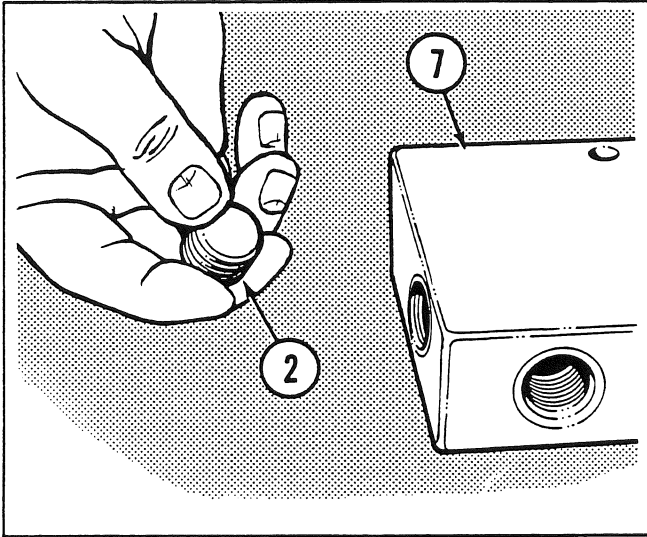


Fig. 14

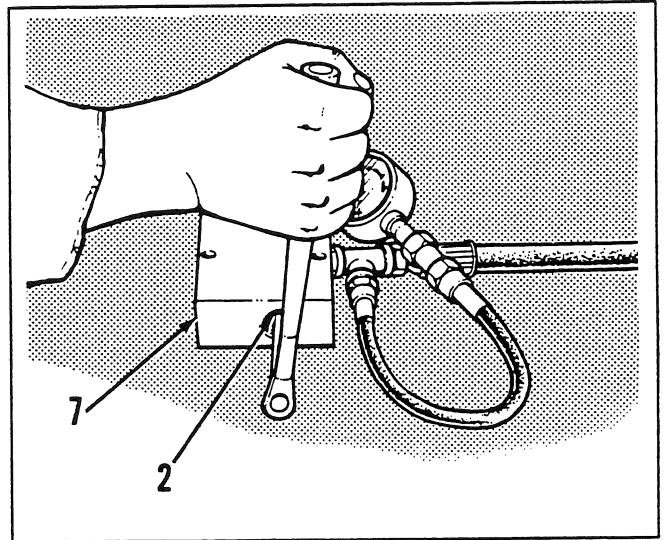


Fig. 17

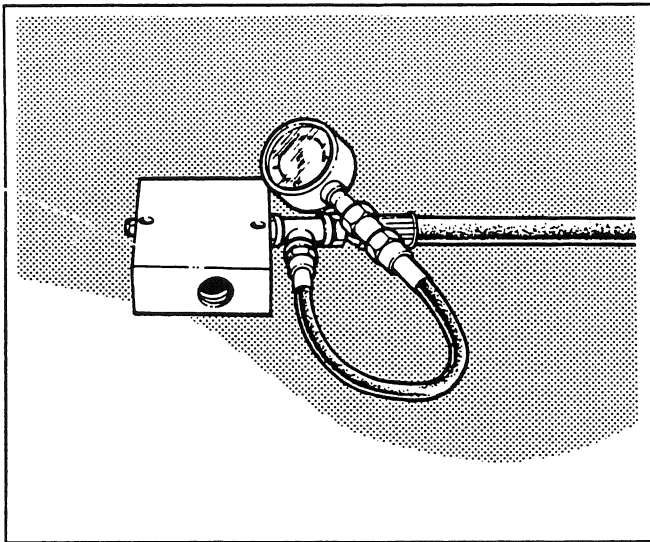


Fig. 15

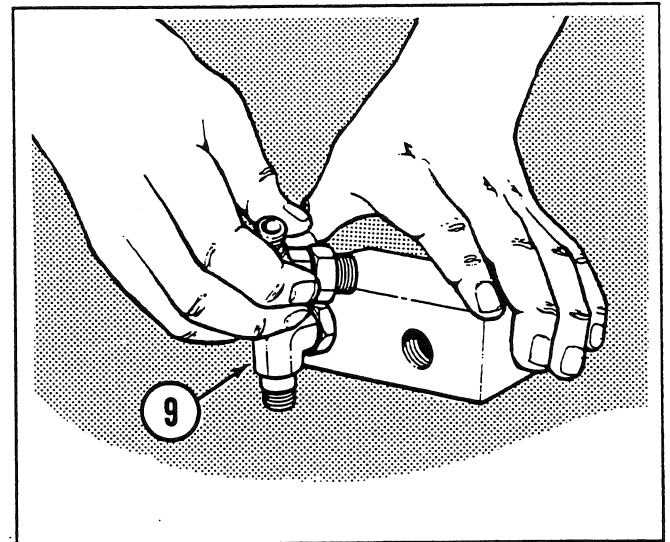


Fig. 18

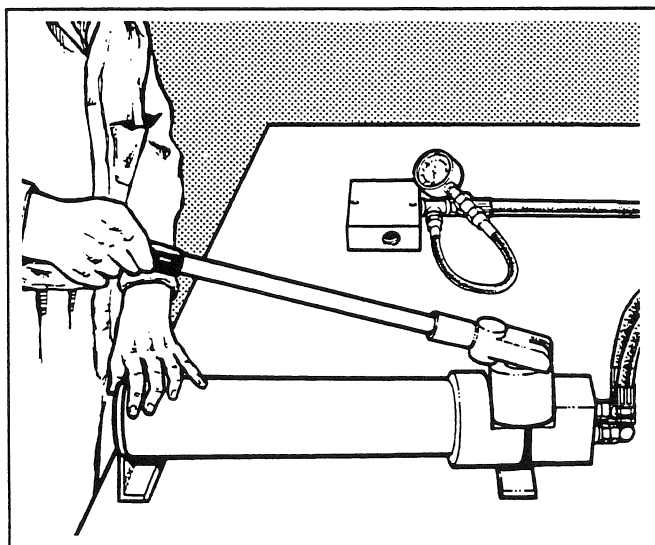


Fig. 16

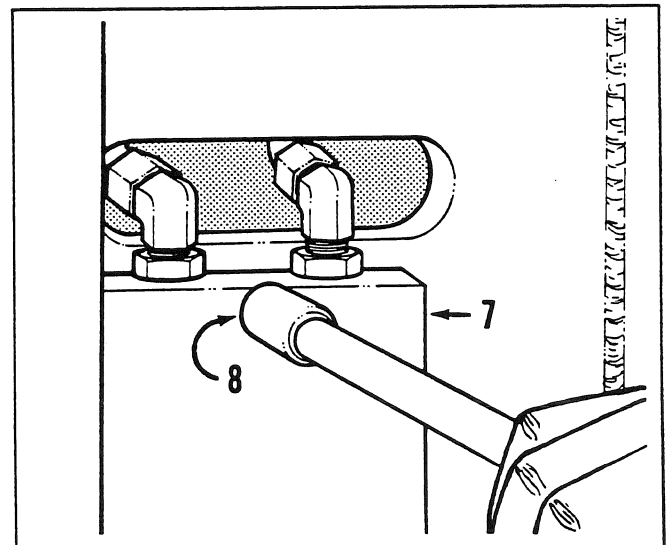


Fig. 19

700 SERIES SHOP MANUAL

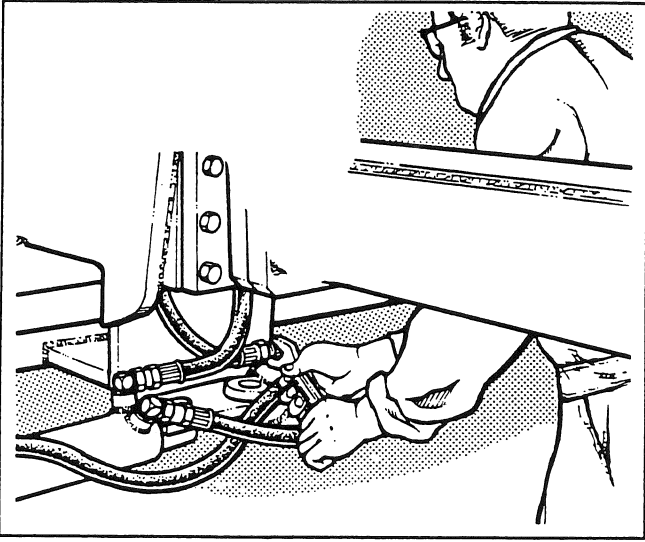


Fig. 20

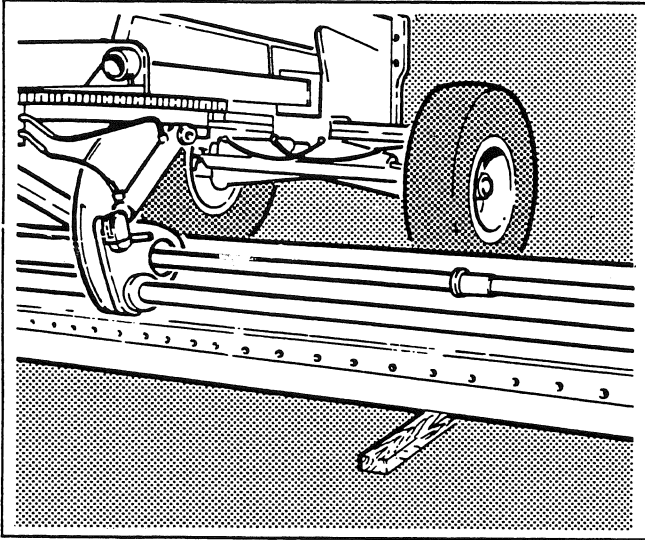


Fig. 21

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Cushion Valve - Installation continued

Fig. 20

Connect the hoses to the steering cylinders. Fully tighten the connectors (6 and 9) at the cushion valve (7).

Fig. 21

Perform the daily pre-start checks detailed in the 700 Series Operator's Manual. Make a visual check around the grader. Signal your intention to start the engine. Start the engine when it is safe to do so and operate the steering cylinders from one power stroke to the other. Shut down the engine. Check the hydraulic fluid level and for leaks.

SECTION 4H

HYDRAULICS

Hydraulic Cylinders

700 SERIES SHOP MANUAL

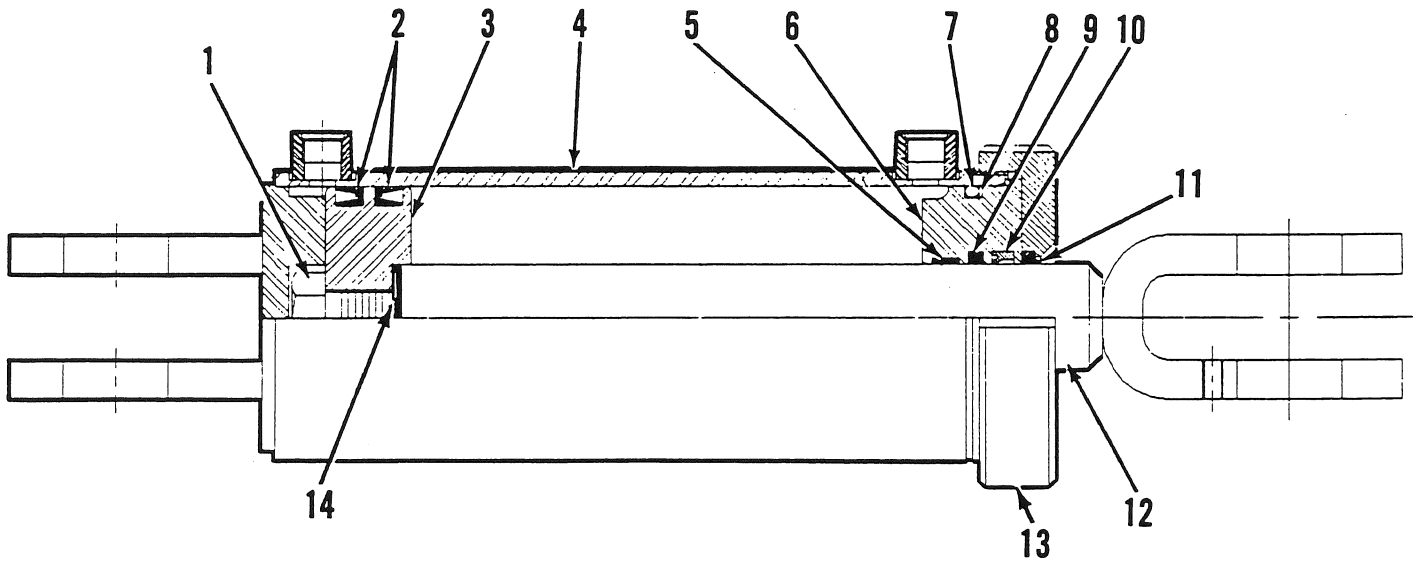


Fig. 1H Typical Hydraulic Cylinder

Item	Description	Item	Description	Item	Description
1	Piston retaining bolt	6	Gland	11	Wiper
2	Pison seals	7	90 durometer O ring	12	Piston rod
3	Piston	8	Back-up ring	13	Cylinder nut
4	Cylinder barrel	9	Buffer ring	14	O ring
5	Wear ring	10	Rod seal		

Key to Fig. 1H

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Torque Guide - Cylinder Nut and Piston Retaining Bolt

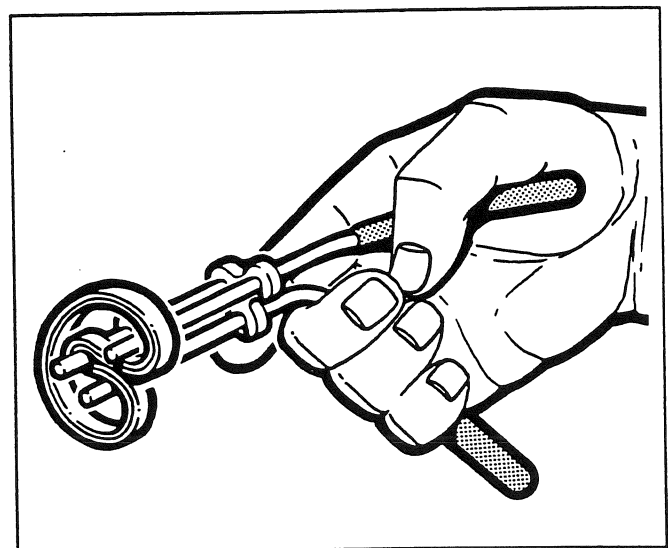
Cylinder Application	Cylinder Nut	Piston Rod Bolt
Slide shift (heavy duty with 1/2 in. NC tie bolts)	80 lbf-ft (108 N·m; 11 kgf·m)	680 lbf-ft (922 N·m; 94 kgf·m)
Circle turn (standard & heavy duty) Front-mounted wing lift Power tilt (standard & heavy duty) R.H. and L.H. leaning wheel (dual & 4+2) R.H. and L.H. steering (standard, heavy duty & 4+2) Windrow eliminator Wing slide	250 lbf-ft (339 N·m; 35 kgf·m)	280 lbf-ft (380 N·m; 39 kgf·m)
A-frame Articulation Circle shift (standard, rotary & heavy duty) R.H. and L.H. Hi-lift (standard, rotary & heavy duty) Leaning wheel (single, L.H. & R.H. heavy duty) Models 710/710A power tilt Rear mounted wing lift Ripper lift, tilt and tooth tilt Scarifier Slide shift (standard)	500 lbf-ft (678 N·m; 69 kgf·m)	680 lbf-ft (922 N·m; 94 kgf·m)
Rotary lock (moveable point blade lift only)	500 lbf-ft (678 N·m; 69 kgf·m)	1360 lbf-ft (1844 N·m; 188 kgf·m)

Torque Guide - Piston Nut

- P/N 37H-16 deflected thread nut - 400 lbf-ft (542 N·m; 55 kgf·m)
 P/N 37H-20 deflected thread nut - 400 lbf-ft (542 N·m; 55 kgf·m)
 P/N 37D-20 nylon insert locknut - 1500 lbf-ft (2034 N·m; 207 kgf·m)

Buffer Ring and Rod Seal Installation Tool (See Fig. 21)

Cylinder Size	Installation Tool Part Number
3 in. cylinder	49765
4 in. and 5 in. cylinders	49766
4 in. heavy duty cylinder	49822



Using Buffer Ring and Rod Seal Installation Tool

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NOTE: *Champion has made several improvements to hydraulic cylinders. This information concerns the current cylinder design. However, since there is a high degree of interchangeability with earlier cylinders, Champion strongly advises you to upgrade older style cylinders to current production standards.*

Hydraulic Cylinder - Disassembly

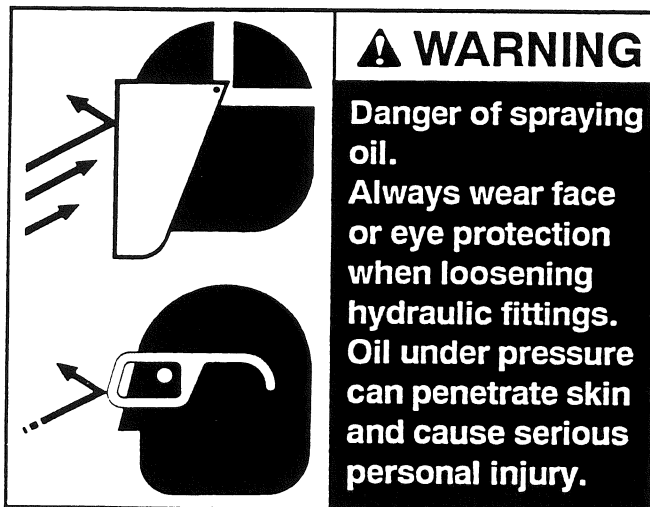


Fig. 2

Place the grader in the SERVICE POSITION. Refer to the procedure on page (ii) in the front of this Shop Manual section. Relieve all hydraulic pressure. Take care with hydraulic circuits that contain lock valves. Disconnect the hoses. Cap the fittings and ports to prevent contamination. Remove the cylinder from the grader.

Fig. 3

Drain any oil remaining in the cylinder in an appropriate container.

Fig. 4

Place the cylinder barrel (4) in a vise with soft jaws.

Fig. 5

Use the appropriate size cylinder wrench to remove the cylinder nut (13) from the barrel (4).

NOTE: *The cylinder nut is secured with threadlocking compound. You may have to heat the nut or apply considerable force when using the wrench.*

Fig. 6

Carefully remove the gland (6) from the cylinder barrel (4).

Fig. 7

Slowly remove the piston rod (12) and piston (3) from the cylinder barrel (4). Be prepared to catch any remaining oil in an appropriate container. Handle the piston rod with care to prevent accidentally damaging the chrome plated surface.

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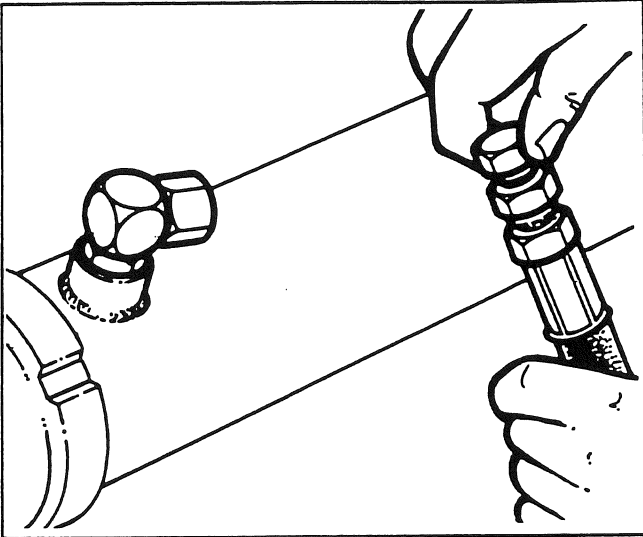


Fig. 2

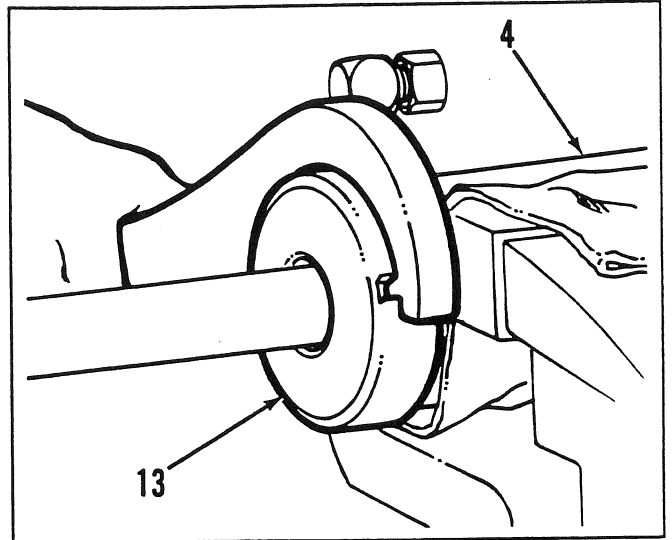


Fig. 5



Fig. 3

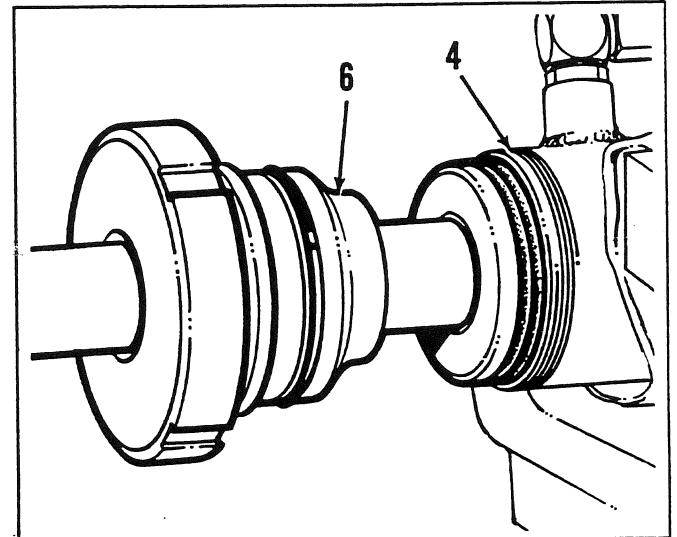


Fig. 6

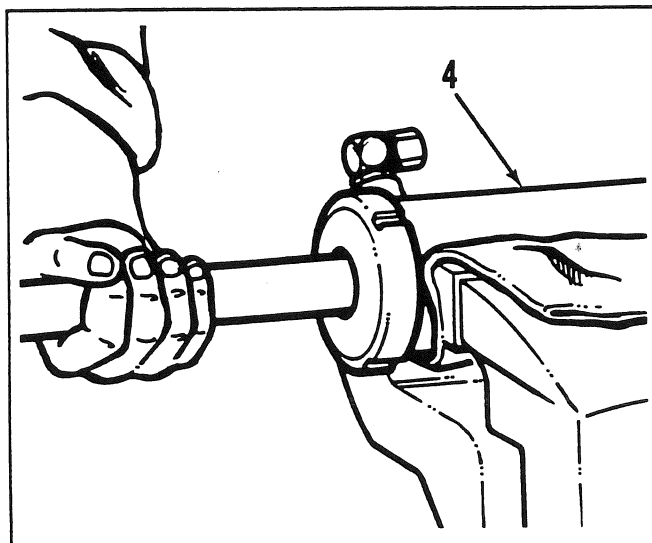


Fig. 4

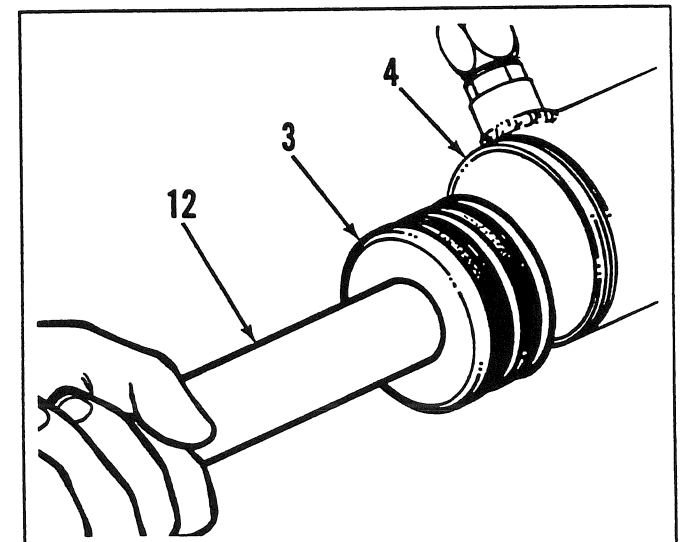


Fig. 7

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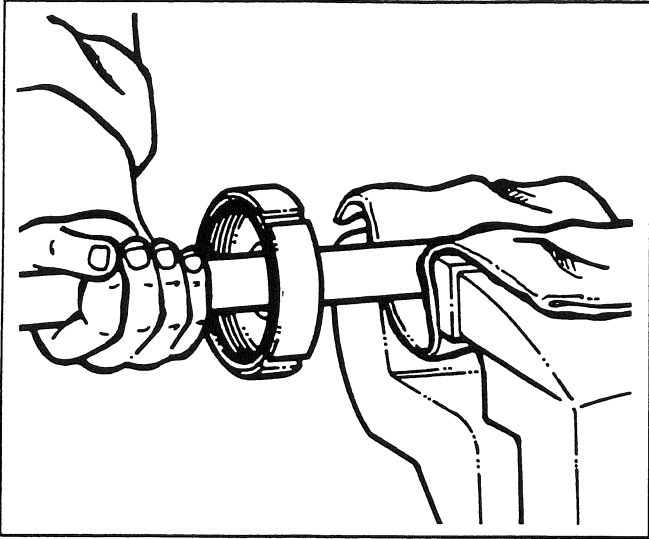


Fig. 8

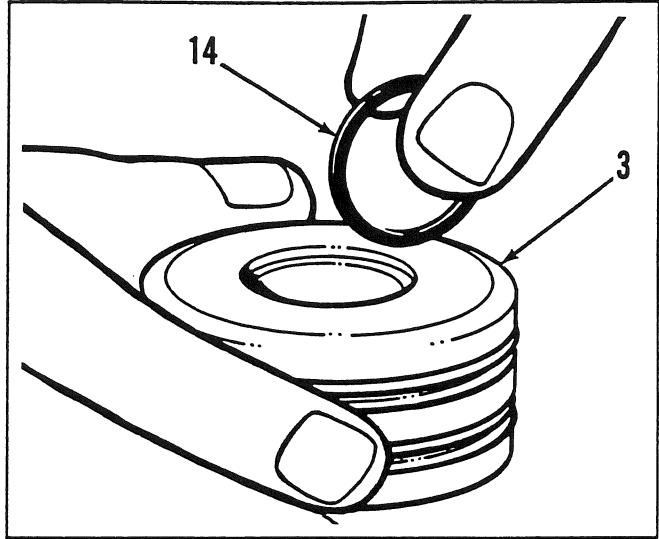


Fig. 11

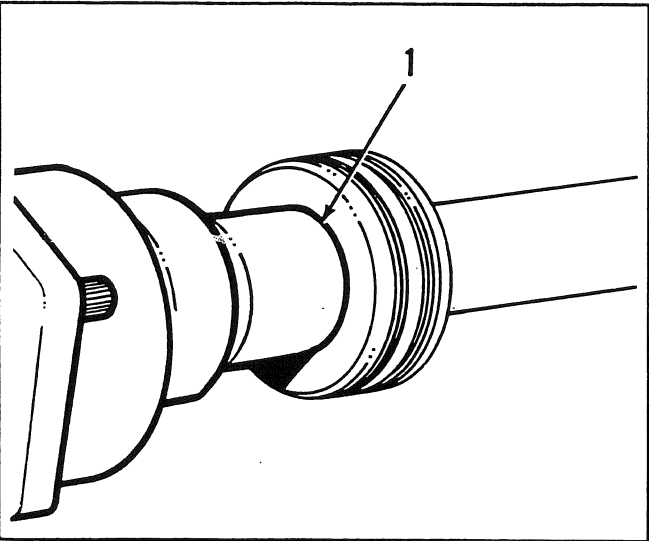


Fig. 9

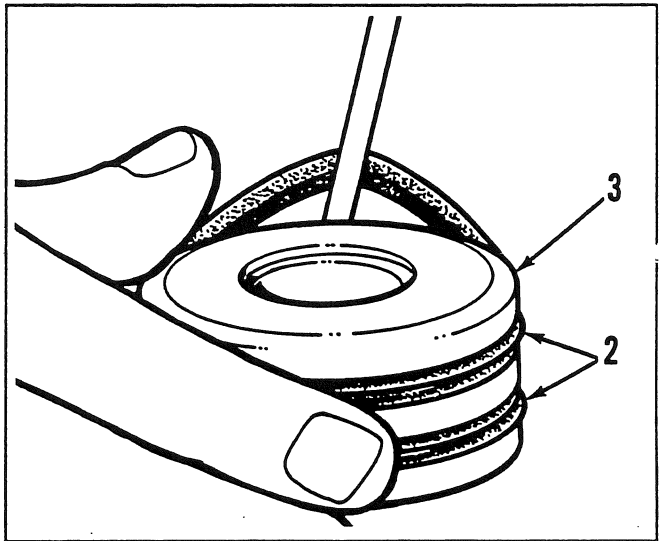


Fig. 12

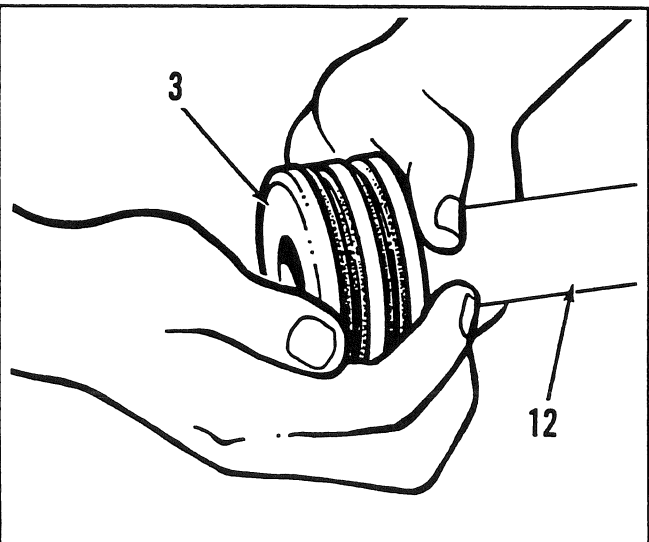


Fig. 10

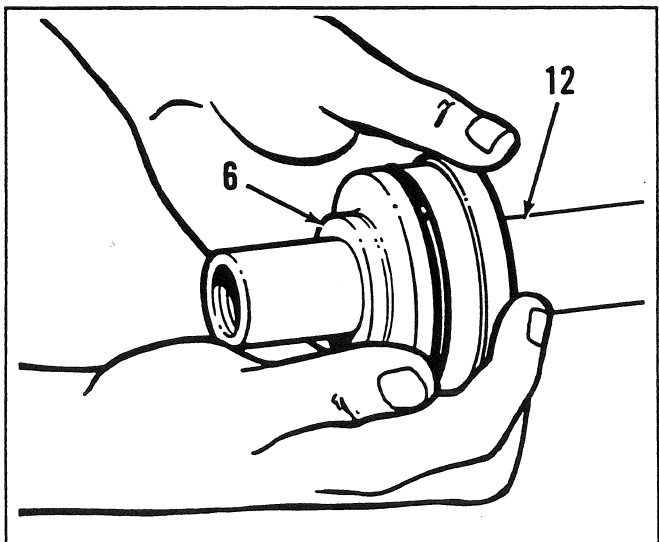


Fig. 13

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Hydraulic Cylinder - Disassembly continued

Fig. 8

Remove the cylinder barrel (4) from the vise. Secure the piston rod bearing end between the soft jaws of the vise.

Fig. 11

Remove and discard the O ring (14) from the piston (3).

Fig. 9

Remove the piston retaining bolt (1). For pistons retained by a nut, remove and discard the nut.

Fig. 12

Remove and discard the seals (2) from the piston (3).

NOTE: *The piston retaining bolt is secured with thread-locking compound.*

Fig. 10

Remove the piston (3) from the piston rod (12).

Fig. 13

Remove the gland (6) from the piston rod (12).

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Hydraulic Cylinder - Disassembly continued

Fig. 14

Remove and discard the 90 durometer O ring (7) and back-up ring (8) from the gland (6).

Fig. 15

Remove and discard the wear ring (5), buffer ring (9) and rod seal (10) from the gland (6).

Fig. 16

Remove the cylinder nut (13) from the piston rod (12).

Fig. 17

Remove and discard the wiper (11) from the cylinder nut (13). Inspect all parts for serviceability. Refer to **Cleaning and Inspection** found in the front of this Shop Manual section. Use a hone to remove shallow scratches from the cylinder barrel bore. Use fine emery paper to remove scratches from the piston.

Hydraulic Cylinder - Assembly

NOTE: *When upgrading older style hydraulic cylinders to current production standards, contact Champion's Parts Distribution Center for complete details of the appropriate FA kits.*

Fig. 18

Lubricate and install a new wiper (11) in the counterbore of the cylinder nut (13). Note that the wiper lip must point to the outside of the cylinder nut.

Fig. 19

Lubricate the piston rod (12) and carefully install the cylinder nut (13).

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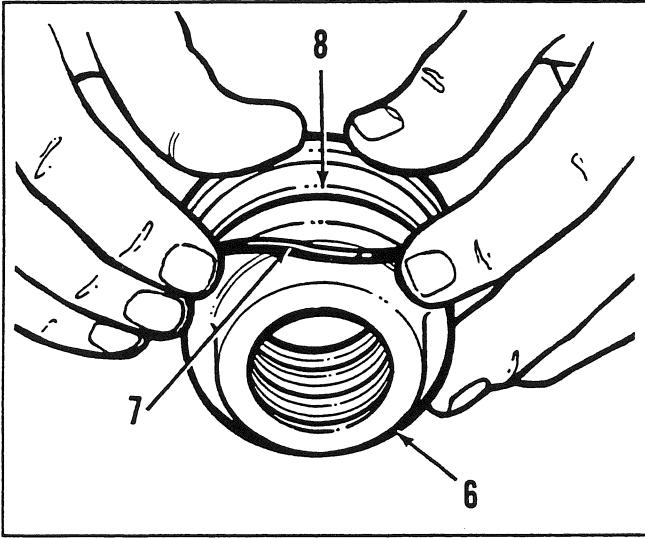


Fig. 14

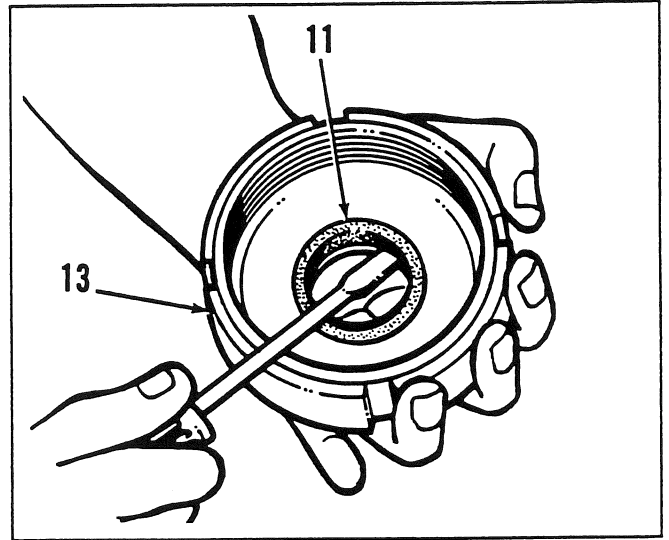


Fig. 17

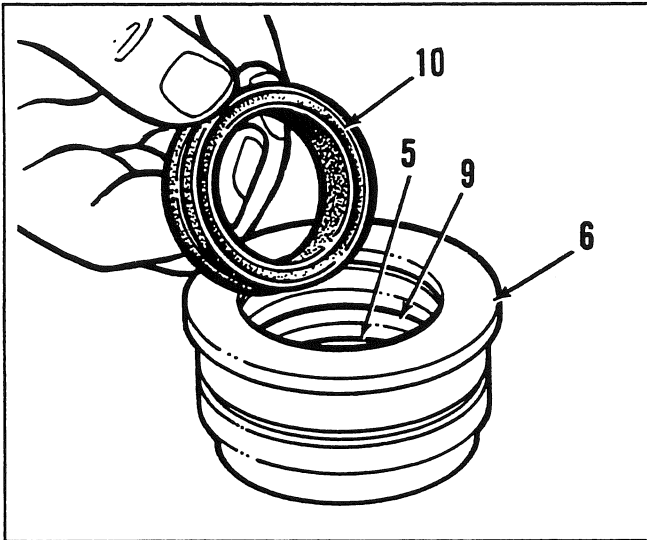


Fig. 15

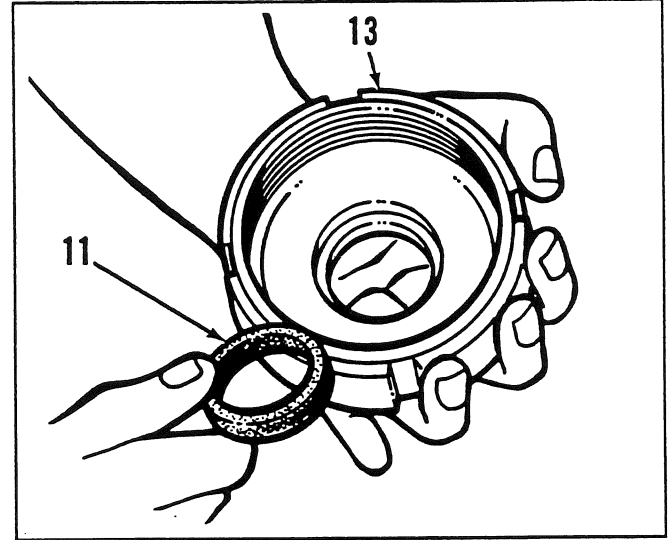


Fig. 18

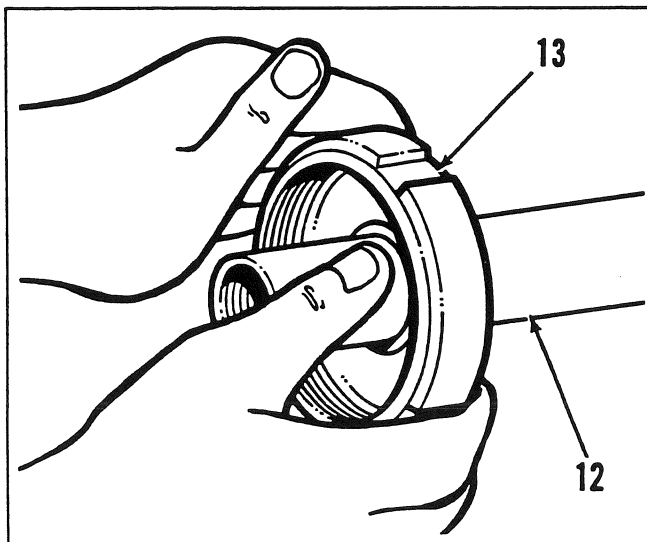


Fig. 16

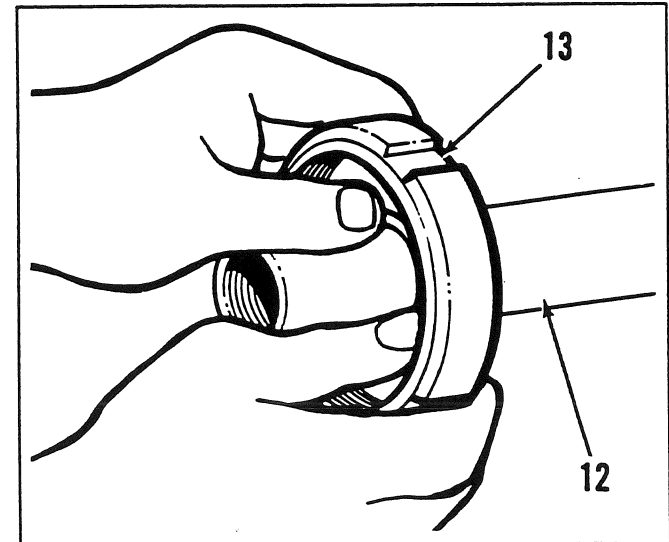


Fig. 19

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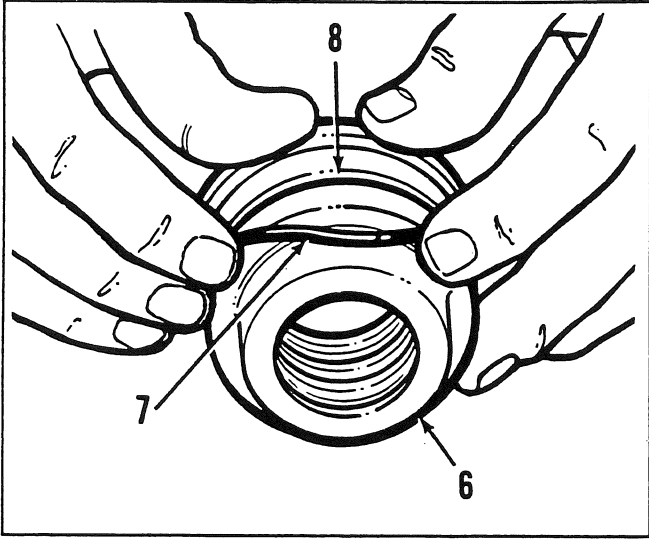


Fig. 20

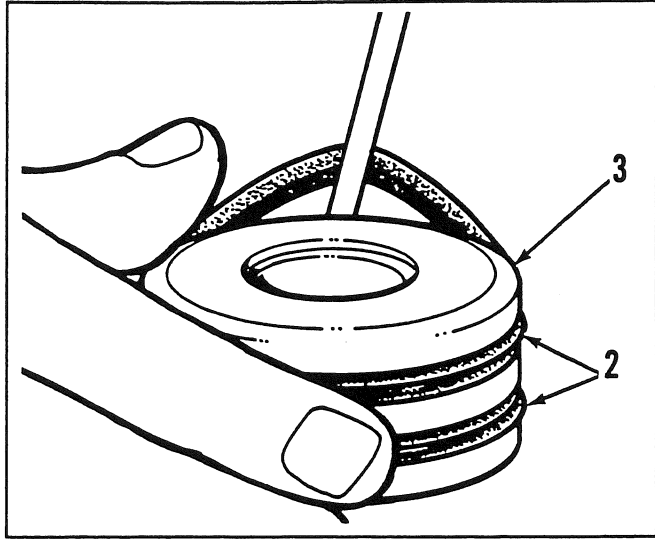


Fig. 23

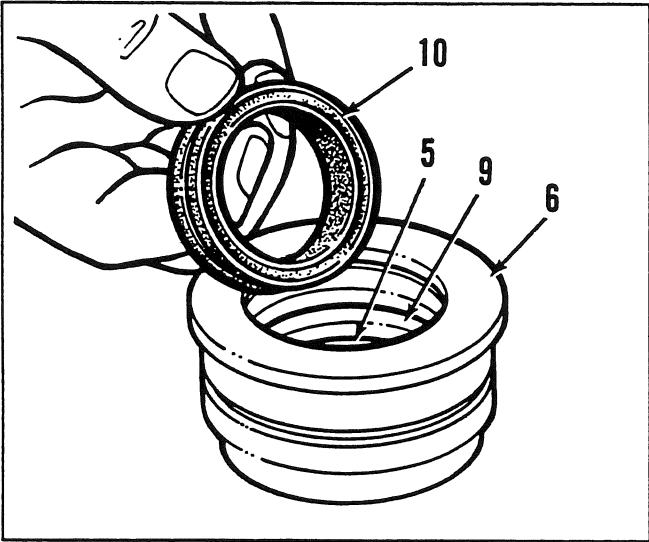


Fig. 21

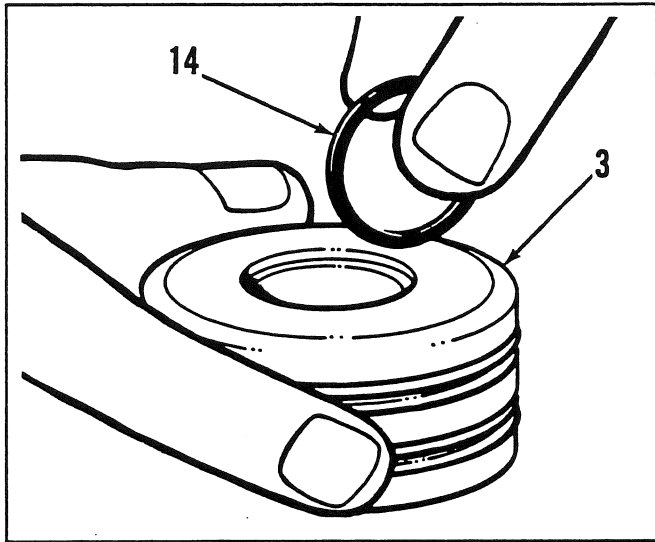


Fig. 24

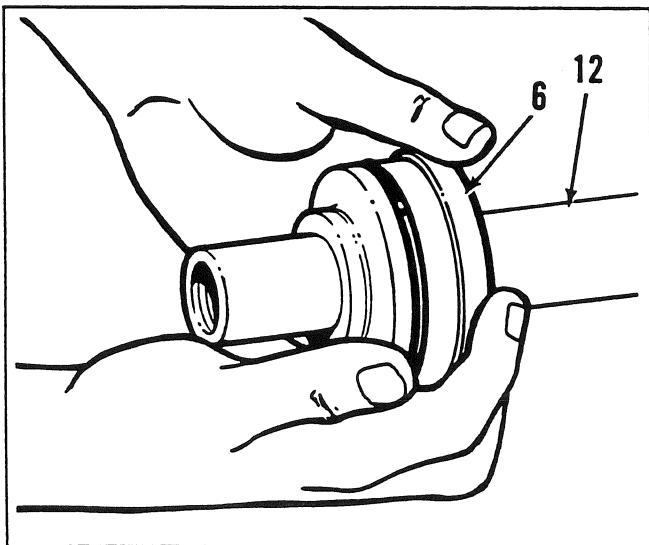


Fig. 22

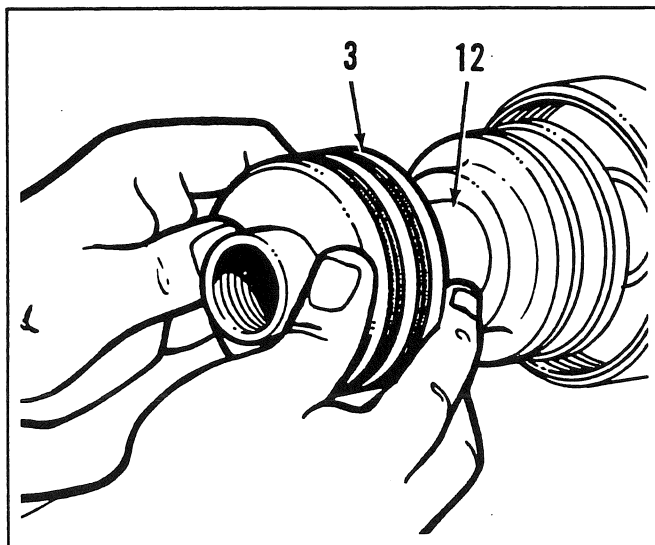


Fig. 25

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Hydraulic Cylinder - Assembly continued

Fig. 20

Lubricate and install a new 90 durometer O ring (7) and back-up ring (8) in the gland (6) outer groove.

NOTE: *Install only a 90 durometer O ring. Do not install any other type of O ring.*

Fig. 21

Lubricate and install a new wear ring (5), buffer ring (9) and rod seal (10) in the gland (6). Note that the rod seal lip must point toward the small diameter end of the gland.

NOTE: *Due to the type of material and position of the buffer ring and rod seal, Champion recommends that you use the appropriate special tool listed in the front of this sub-section for installation.*

NOTE: *You may have to remove a small piece from the wear ring to help installation.*

Fig. 22

Carefully install the gland (6) on the piston rod (12). Note that the small diameter end of the gland must point toward the threaded end of the rod.

Fig. 23

Lubricate and install new seals (2) on the piston (3). Note that the seal lips must point toward the ends of the piston. Allow a short time for the seals to return to their original shape.

NOTE: *Pistons for the windrow eliminator, moveable point blade lift and circle shift, and the Models 780/780A leaning wheel and steering hydraulic cylinders have one piston seal and one wear ring. The moveable point lock cylinder has two piston seals and one wear ring.*

Fig. 24

Lubricate and install a new O ring (14) in the piston (3) counterbore.

Fig. 25

Carefully install the piston (3) on the piston rod (12).

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Hydraulic Cylinder - Assembly *continued*

Fig. 26

Thoroughly clean the piston retaining bolt (1) and piston rod (12) with a solvent such as 'Varsol'. Dry using moisture-free compressed air. Ensure all threads are free of dirt, oil and grease.

NOTE: *Never substitute the piston retaining bolt with a bolt of a lower grade.*

Fig. 27

Apply threadlocking compound P/N 45472 evenly to 3/4 of the bolt thread engagement. Ensure the root areas are covered. Immediately install the piston retaining bolt (1). Take care not to displace the O ring (14). Tighten the bolt to the specified torque (see **Torque Guide** found in the front of this sub-section).

NOTE: *For hydraulic cylinder pistons retained by a nut, do not apply threadlocking compound. Install a new nut and tighten to the specified torque (see **Torque Guide** found in the front of this sub-section).*

Fig. 28

Lubricate the edge of the cylinder barrel (4). Carefully install the piston rod assembly.

Fig. 29

Thoroughly clean the cylinder barrel (4) and cylinder nut (13) with a solvent such as 'Varsol'. Dry using moisture-free compressed air. Ensure all threads are free of dirt, oil and grease.

Fig. 30

Apply threadlocking compound P/N 45472 evenly to 3/4 of the barrel thread engagement. Ensure the root areas are covered. Install the cylinder nut (13) and tighten to the specified torque (see **Torque Guide** found in the front of this sub-section). The hydraulic cylinder overhaul is now complete. Pressure check the cylinder at one end using a portable hydraulic power supply to 2700 psi (186 bar). Hold at that pressure to ensure there are no leaks. Repeat pressure check at the other end. Install the cylinder. Road test the grader before returning it to service.

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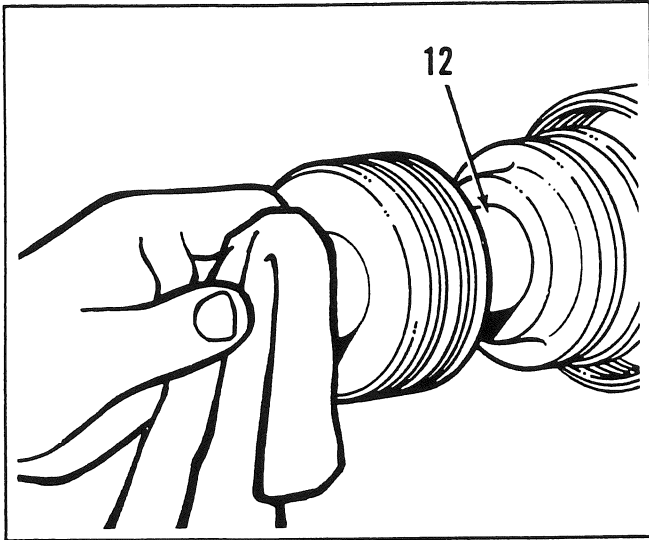


Fig. 26

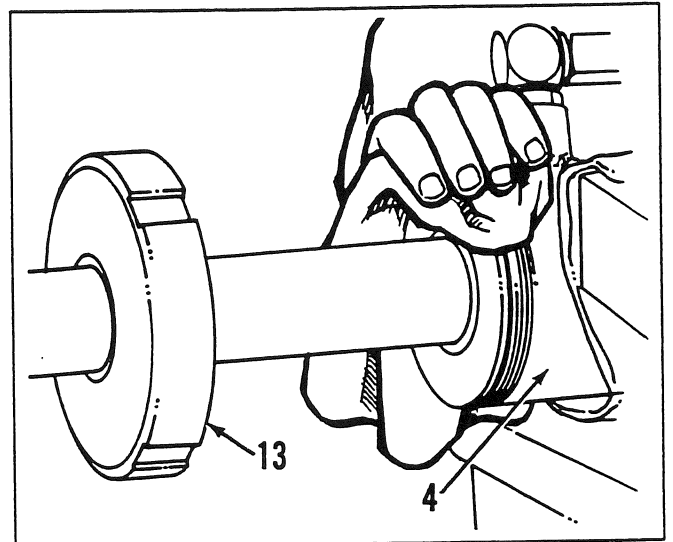


Fig. 29

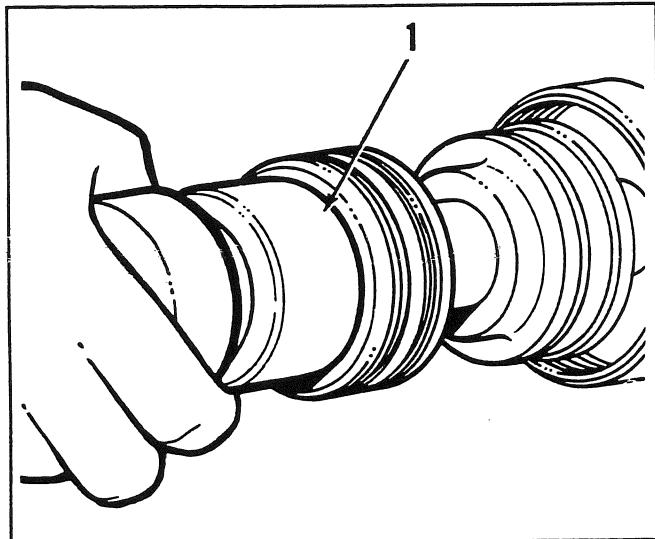


Fig. 27

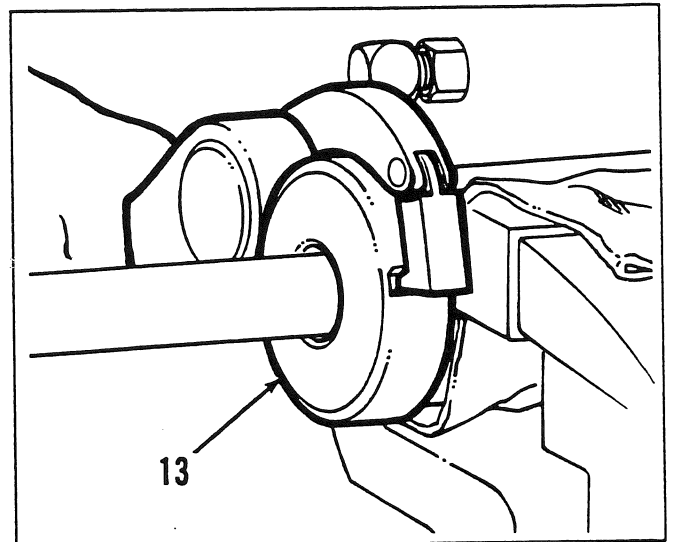


Fig. 30

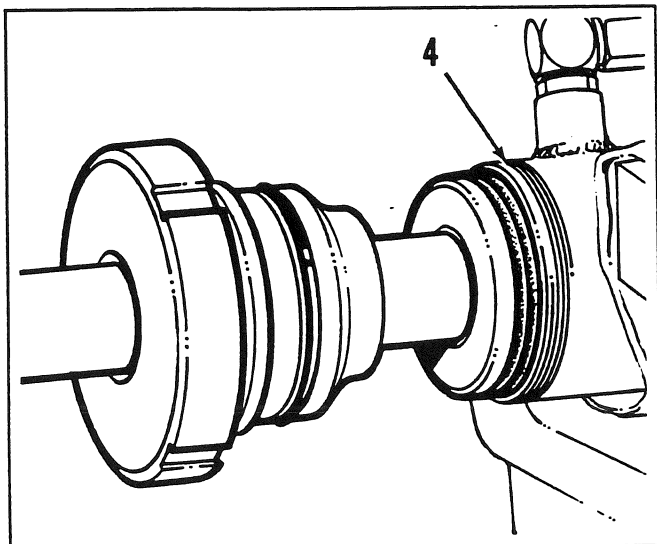


Fig. 28

SECTION 4J

HYDRAULICS

Power Tilt Lock Valves

700 SERIES SHOP MANUAL

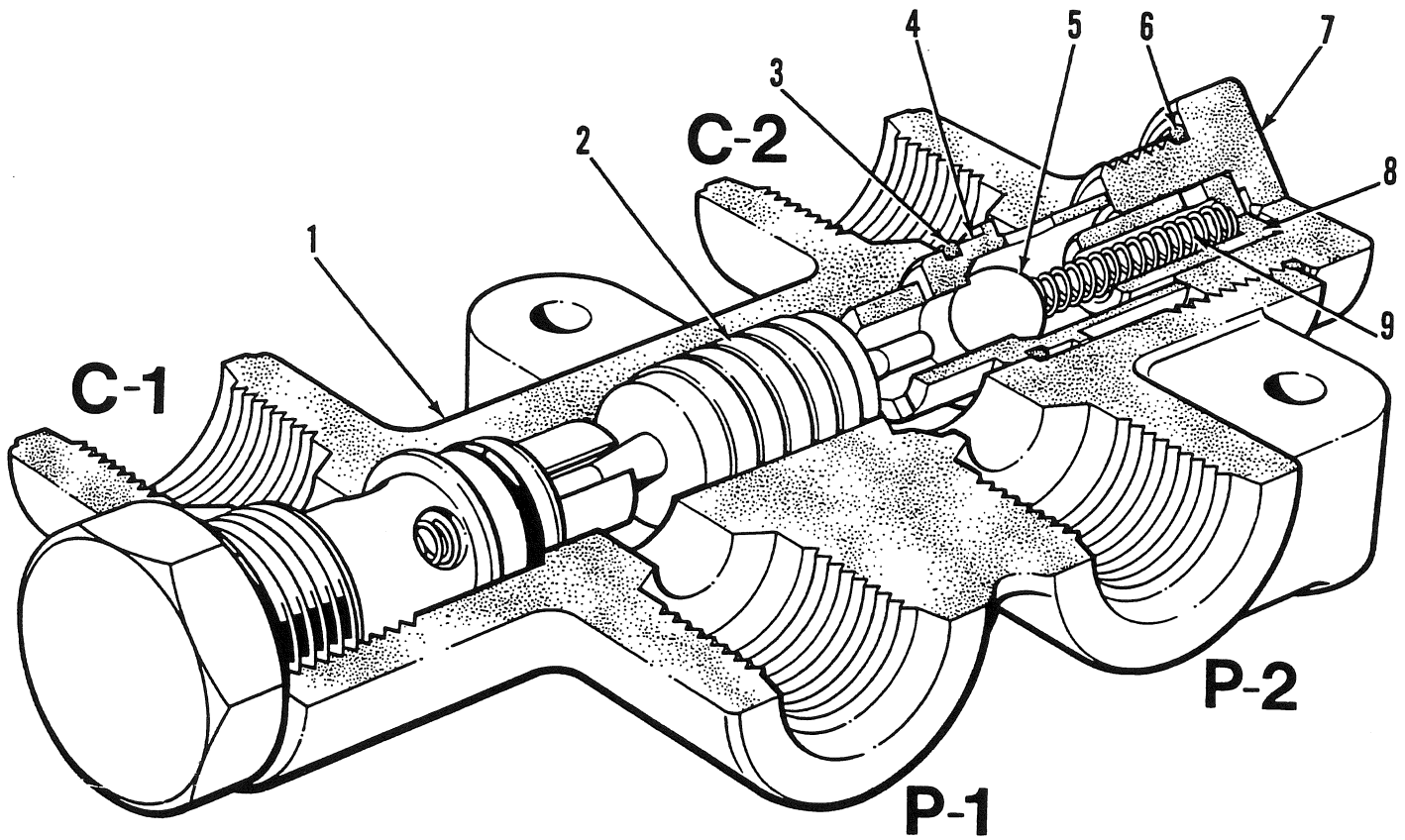


Fig. 1J Power Tilt Lock Valve

Item	Description	Item	Description	Item	Description
1	Valve body	4	Check valve seat	7	O ring cap
2	Pilot piston	5	Check ball	8	Spring seat
3	O ring	6	O ring	9	Spring

Key to Fig. 1J

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Power Tilt Lock Valve - Description (Fig. 1J)

The power tilt lock valve is a double pilot operated check valve. Two lock valves are used in the moldboard power tilt hydraulic circuit of Models 720 through 780A. The valves prevent moldboard twist caused by internal leakage in one cylinder and not the other. They are not installed on Models 710/710A as only one tilt cylinder is used.

Hydraulic fluid directed to one end of the cylinder pushes the check ball (5) off the check valve seat (4). At the same time, the pilot piston (2) moves to the left, which unseats the other check ball and allows hydraulic fluid to flow out of the cylinder. When you operate the cylinder in the opposite direction, the sequence is reversed.

When the manifold control valve section is in neutral, both check valves are closed. This effectively locks hydraulic fluid in both ends of the cylinder.

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Power Tilt Lock Valve - Removal and Disassembly

Fig. 2



Place the grader in the SERVICE POSITION. Refer to the procedure on page (ii) in the front of this Shop Manual section. Remove the tubes and hoses from the valve body (1) and clean up any oil leakage. Cap the tubes, hoses and fittings to prevent contamination.

Fig. 3

Remove the bolts retaining the valve body (1) to the circle outside diameter. Remove the power tilt lock valve assembly.

Fig. 4

Install the valve body (1) in a vise with soft jaws. Do not overtighten the vise. Remove the O ring cap (7). Remove the spring seat (8) and spring (9). Remove and discard the O ring (6).

Fig. 5

Remove the check ball (5) from the valve body (1).

Fig. 6

Remove the check valve seat (4) from the valve body (1). Remove and discard the O ring (3).

Fig. 7

Remove the pilot piston (2) from the valve body (1). Repeat steps Fig. 4 through Fig. 6 for the other end of the lock valve. Inspect the valve body bores and pilot piston for scoring, binding or wear. Refer to **Cleaning and Inspection** found at the front of this Shop Manual section.

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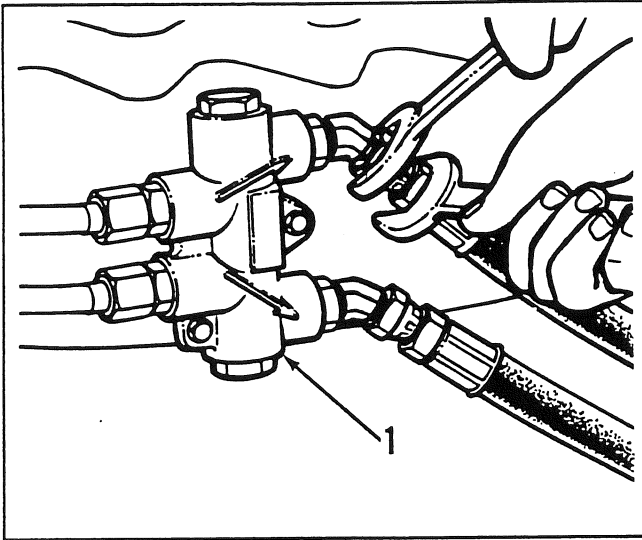


Fig. 2

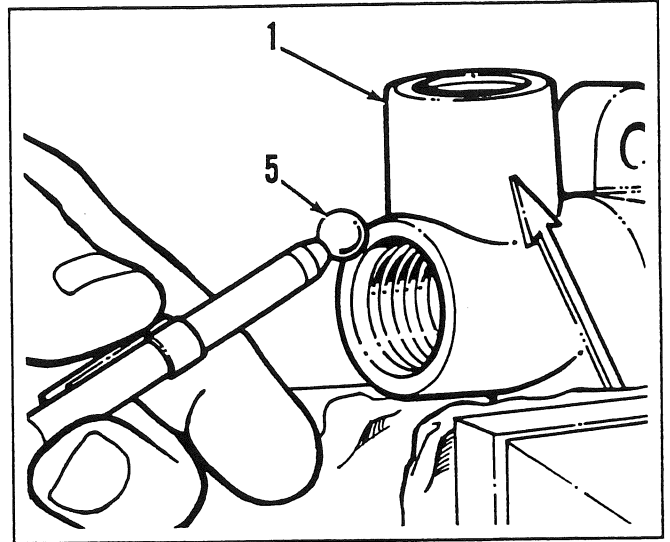


Fig. 5

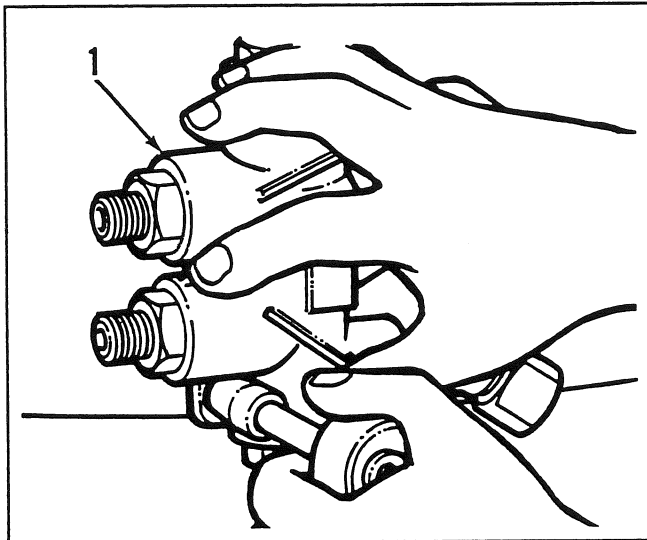


Fig. 3

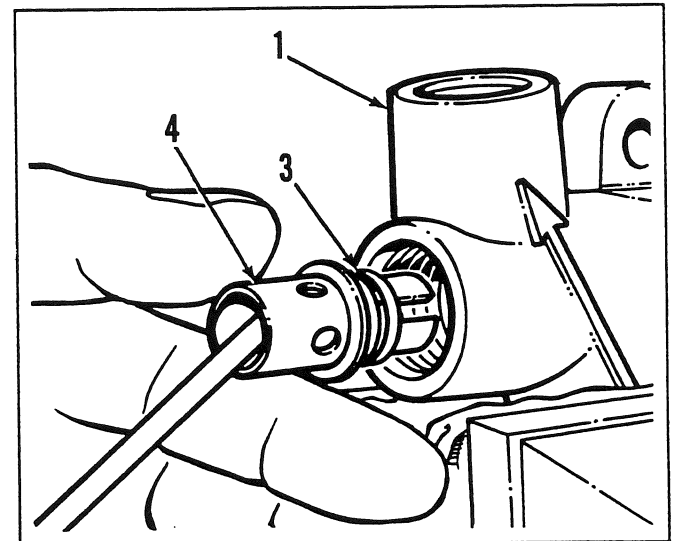


Fig. 6

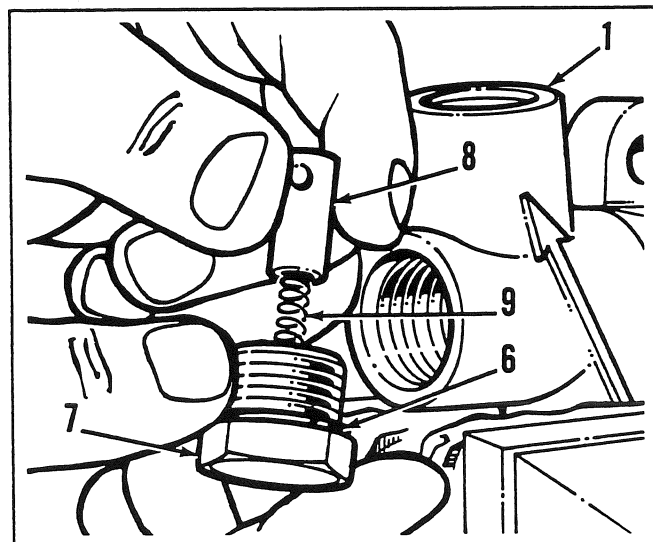


Fig. 4

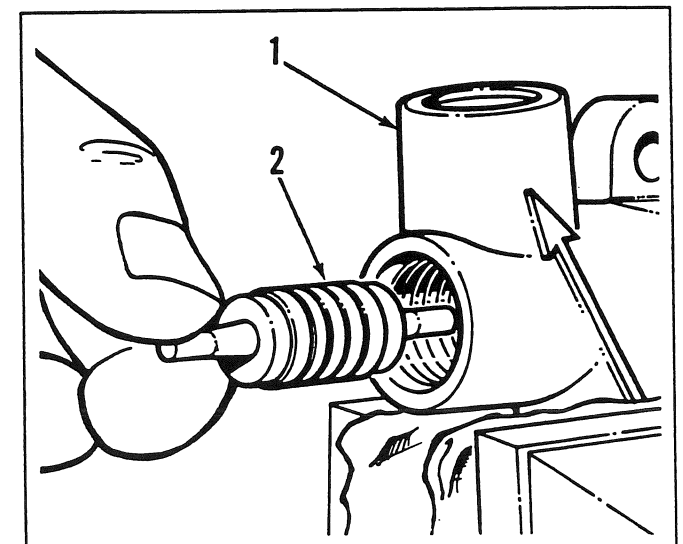


Fig. 7

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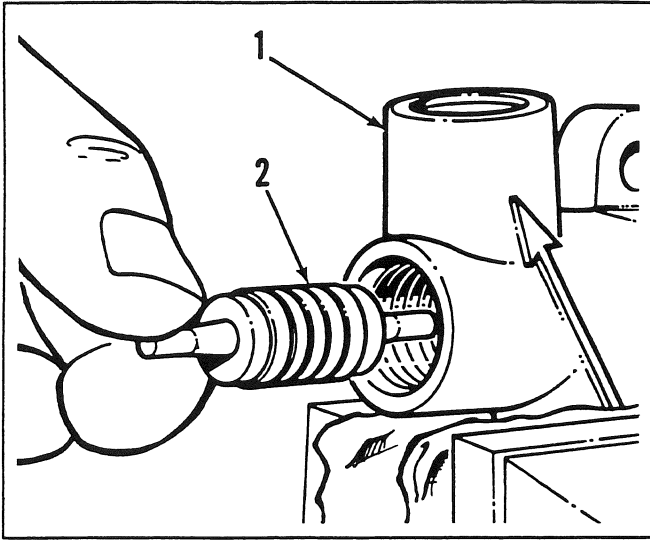


Fig. 8

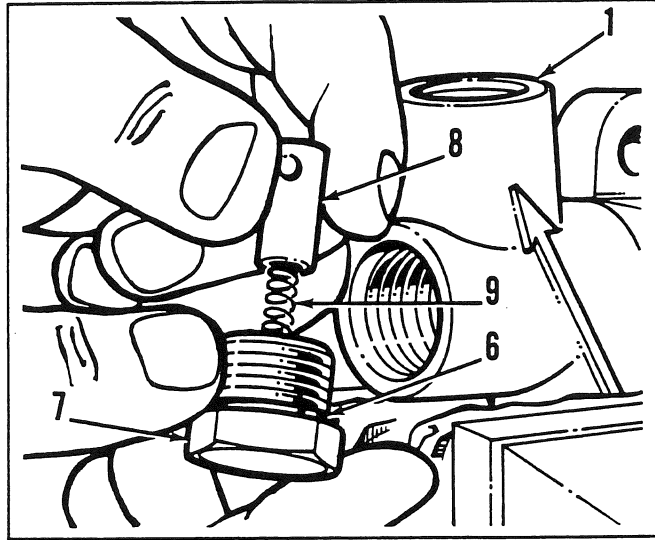


Fig. 11

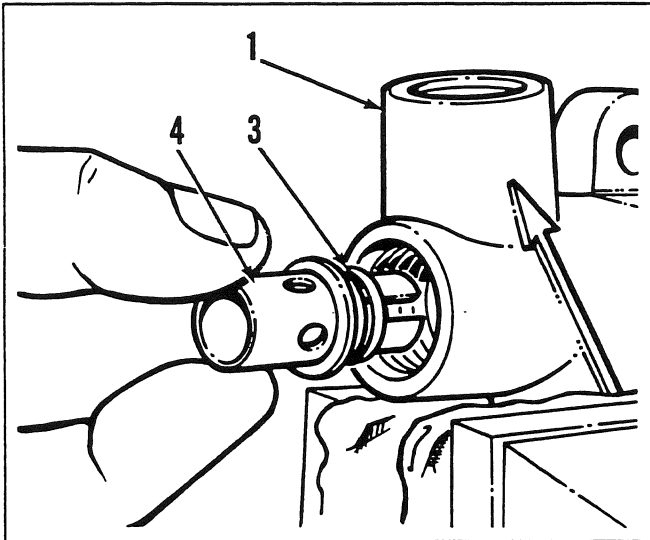


Fig. 9

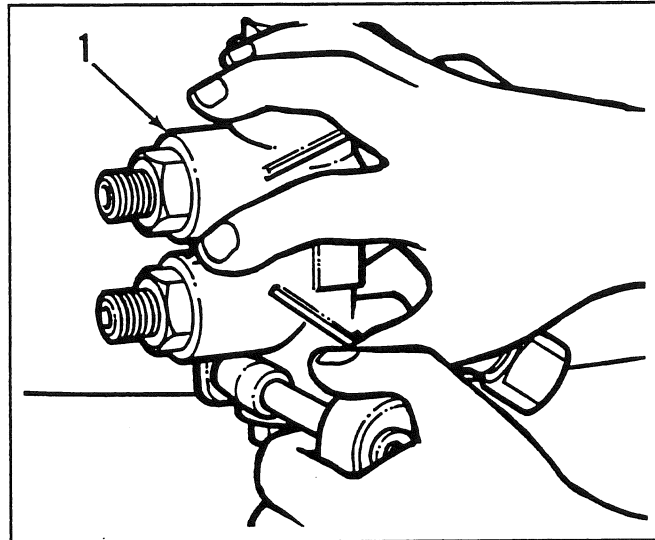


Fig. 12

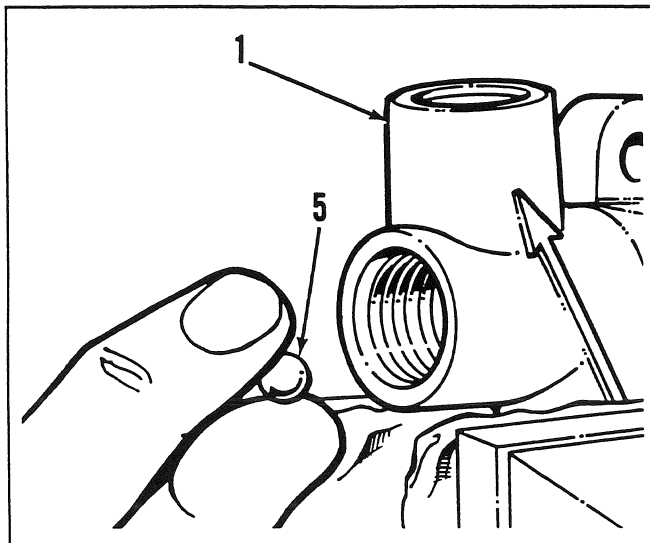


Fig. 10

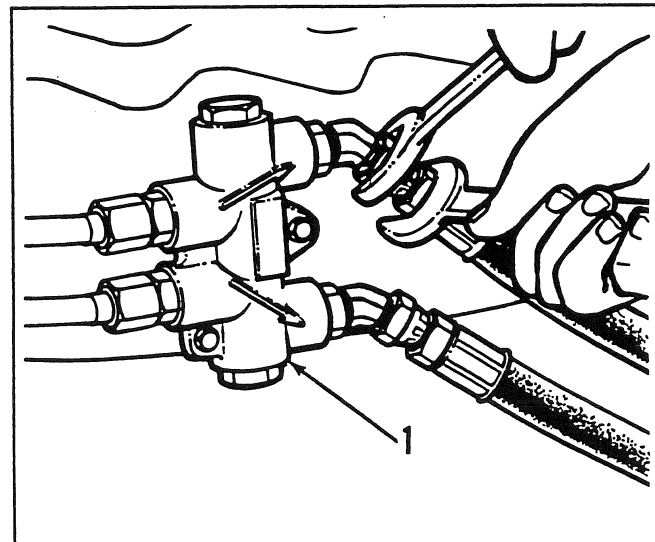


Fig. 13

700 SERIES SHOP MANUAL

Power Tilt Lock Valve - Assembly and Installation

Fig. 8

Install the pilot piston (2) into the valve body (1).

Fig. 11

Lubricate and install a new O ring (6) onto the O ring cap (7). Install the O ring cap, spring (9) and spring seat (8) into the valve body (1). Repeat steps Fig. 9 through Fig. 11 for the other end of the lock valve.

Fig. 9

Lubricate and install a new O ring (3) onto the check valve seat (4). Install the check valve seat into the valve body (1).

Fig. 12

Retain the valve body (1) to the circle outside diameter with the bolts.

Fig. 10

Install the check ball (5) into the valve body (1).

Fig. 13

Connect all hoses and tubes to the valve body (1). Tighten the fittings. Test the operation of the power tilt cylinders and check for leaks. It may take several cycles of operation to purge the hydraulic system of air.

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Counterbalance Valve - Description (Fig. 1K)

The counterbalance valve is a double pilot operated check valve installed in the blade lift, leaning wheel and moveable point lock cylinder hydraulic circuits. It is used to lock hydraulic fluid in the cylinders and prevents cylinder cavitation, blade lift or moveable lock "creep" and leaning wheel cylinder "drift".

Hydraulic fluid directed to one end of the cylinder pushes the check poppet (8) against the spring (11). Hydraulic fluid is then free to flow into the cylinder. Hydraulic fluid at the other end of the cylinder is locked in and pressure builds back to the pilot piston (3). The pilot piston pushes against the pilot poppet (9) which moves off its seat. Hydraulic fluid is then free to flow from the other end of the cylinder. Both the check poppet and pilot poppet are tapered to enable smooth, accurate hydraulic control of these circuits.

Two thermal relief valves (13) are incorporated in the counterbalance valve to vent high oil pressures, created by thermal expansion, from the cylinders to the manifold valve ports. Champion advises that you do not disassemble or adjust the thermal relief valves.

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NOTE: Refer to your 700 Series Parts Manual P/N L 3008 for the specific blade lift, leaning wheel and moveable point lock cylinder hydraulic circuit counterbalance valves installed on your grader.

Counterbalance Valve - Removal and Disassembly



Fig. 2
Place the grader in the SERVICE POSITION. Refer to the procedure on page (ii) in the front of this Shop Manual section. Loosen the hose and tube fittings slowly and carefully to release any accumulated pressure in the cylinder(s). Remove the hoses and tubes from the valve body (15) and clean up any oil leakage. Cap the hoses, tubes and fittings to prevent contamination.

Fig. 3
Remove the bolts, nuts and lockwashers retaining the valve body (15) to the blade lift cylinder bracket or grader frame. Remove the counterbalance valve assembly.

Fig. 4
Install the valve body (15) in a vise with soft jaws. Do not overtighten the vise. Remove the end caps (12) containing the check valve assemblies (2). Remove and discard the O rings (1).

Fig. 5
Remove the check valve seats (7) from the valve body (15). Remove and discard the O ring (6) and split ring (5) from the seats. Note the positions of the O ring and split ring.

Fig. 6
Remove the pilot piston (3) from the valve body (15). Remove and discard the O ring (4). Repeat steps Fig. 4 through Fig. 6 for the other end of the lock valve. Inspect all components for damage or wear. Refer to **Cleaning and Inspection** found at the front of this Shop Manual section.

Counterbalance Valve - Assembly and Installation

Fig. 7
Lubricate and install a new O ring (4) onto the pilot piston (3). Install the pilot piston into the valve body (15).

SECTION 4K

HYDRAULICS

Counterbalance Valves

700 SERIES SHOP MANUAL

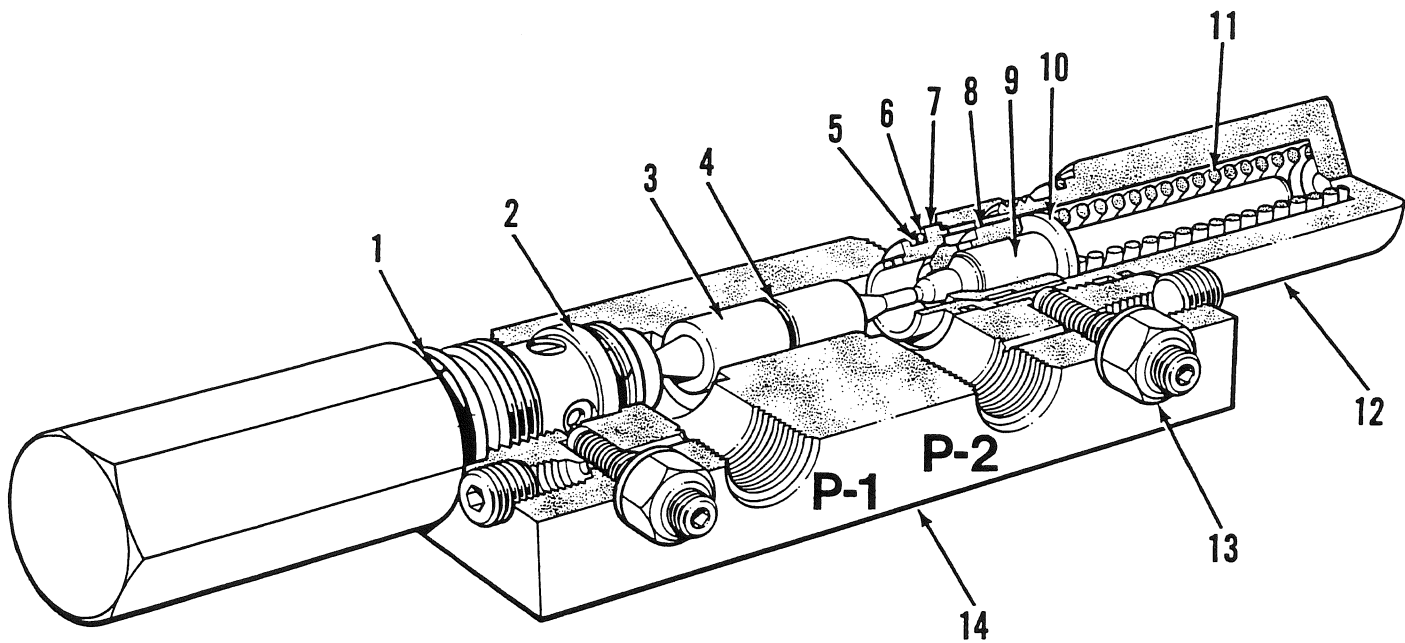


Fig. 1K Counterbalance Valve

Item	Description	Item	Description	Item	Description
1	O ring	6	O ring	11	Spring
2	Check valve assembly	7	Check valve seat	12	End cap
3	Pilot piston	8	Check poppet	13	Thermal relief valve assembly
4	O ring	9	Pilot poppet	14	Valve body
5	Split ring	10	Spring seat		

Key to Fig. 1K

700 SERIES SHOP MANUAL

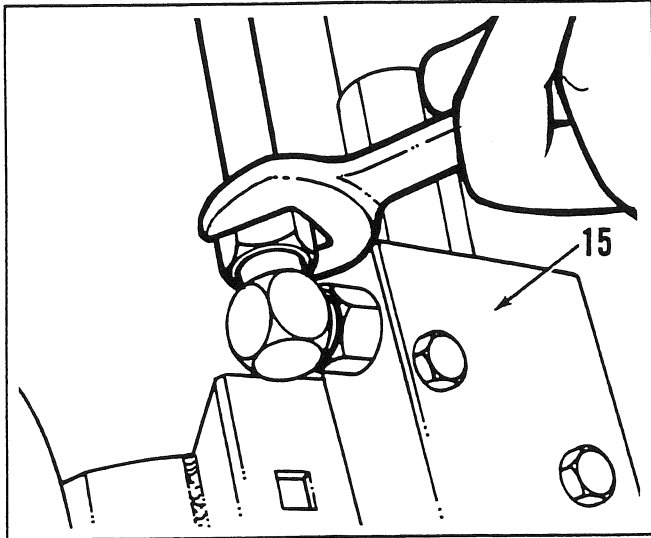


Fig. 2

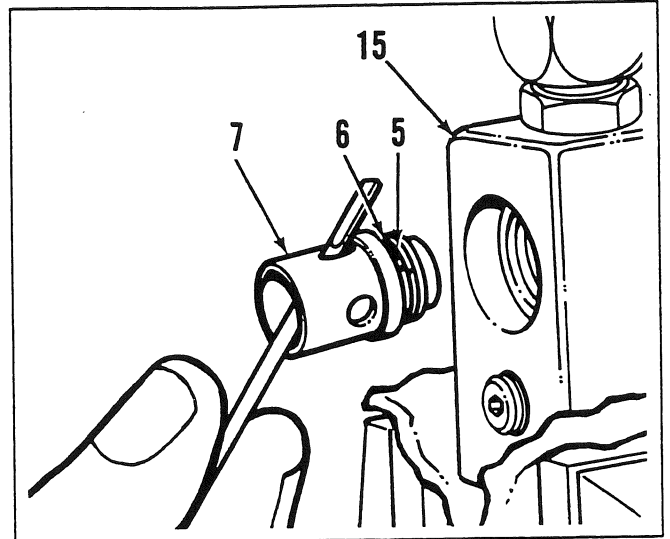


Fig. 5

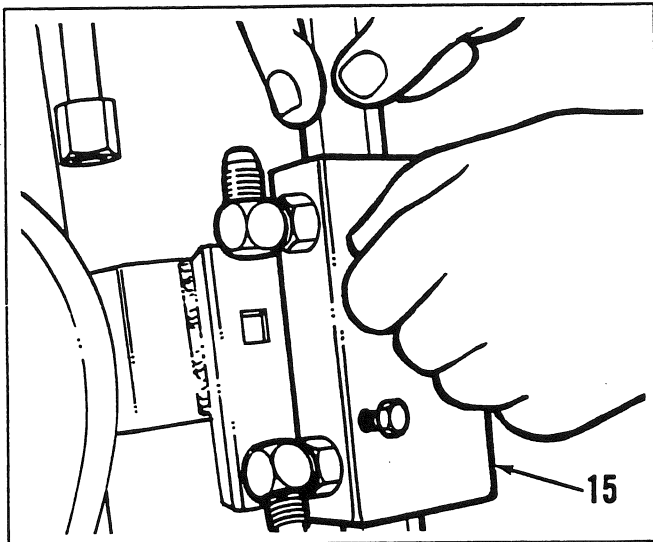


Fig. 3

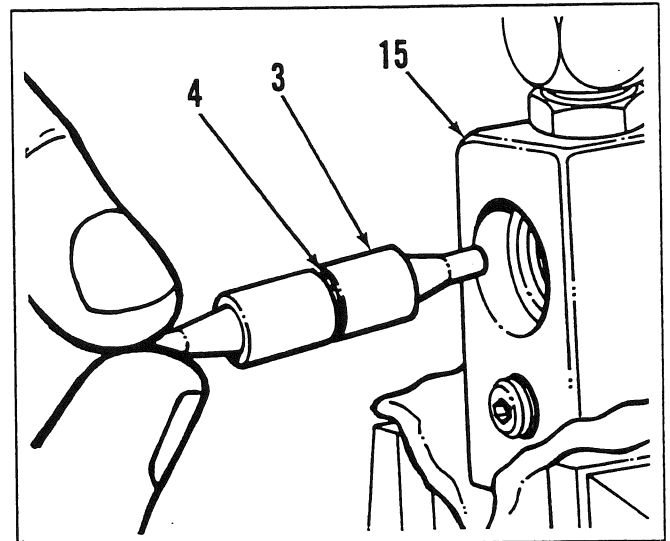


Fig. 6

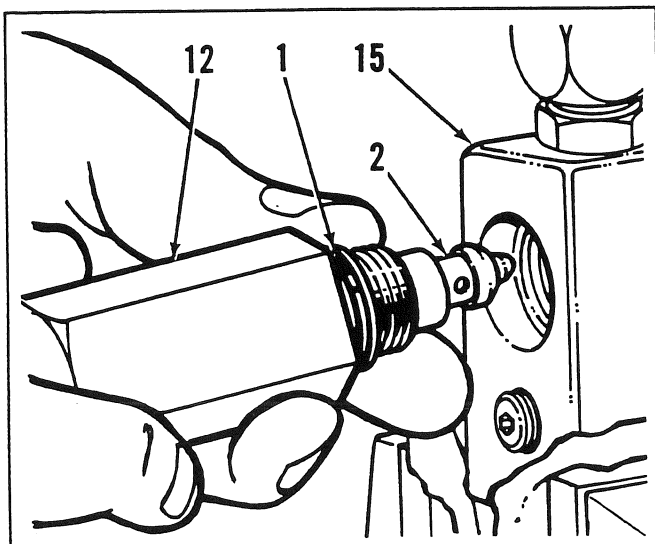


Fig. 4

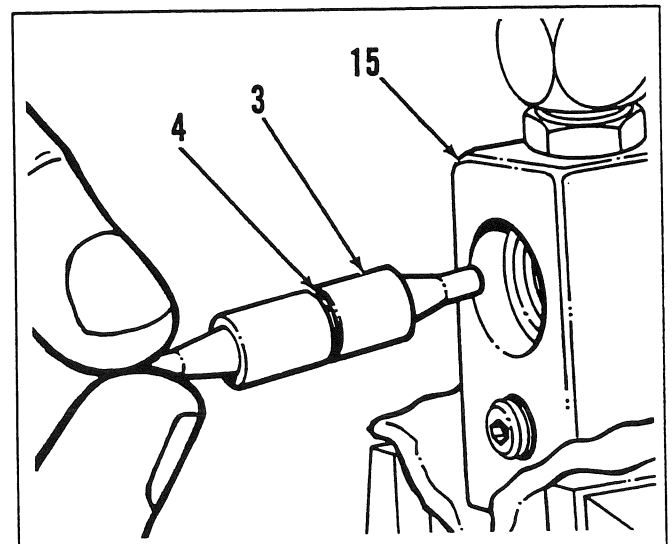


Fig. 7

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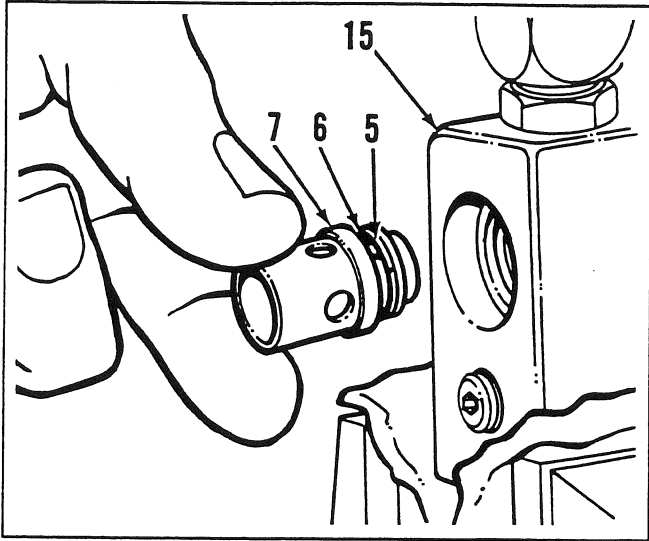


Fig. 8

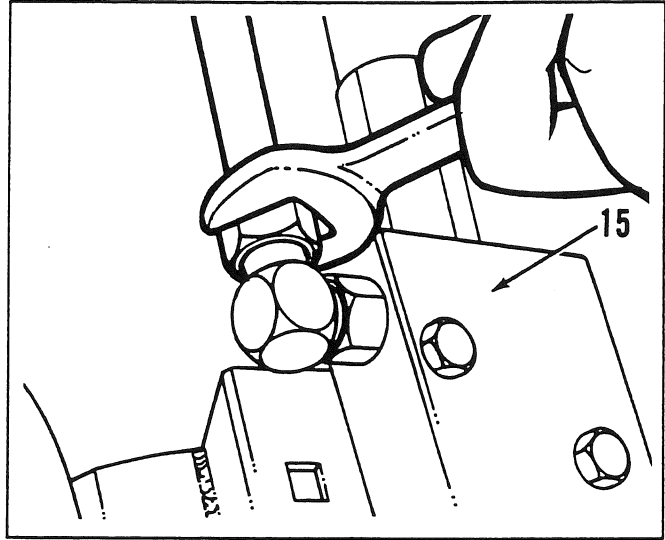


Fig. 11

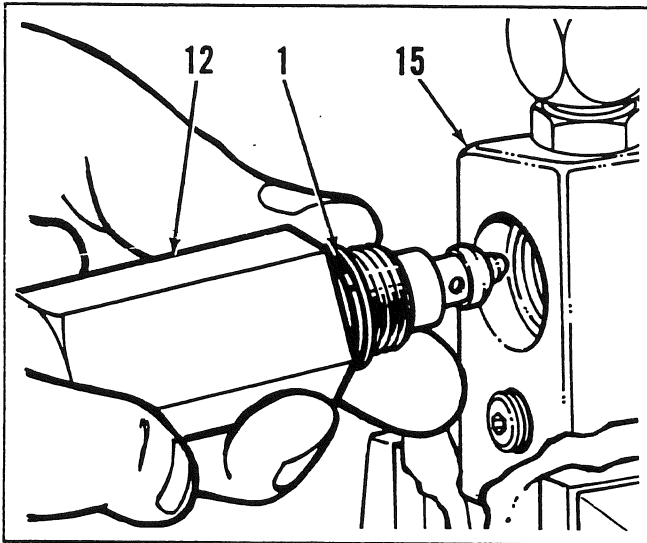


Fig. 9

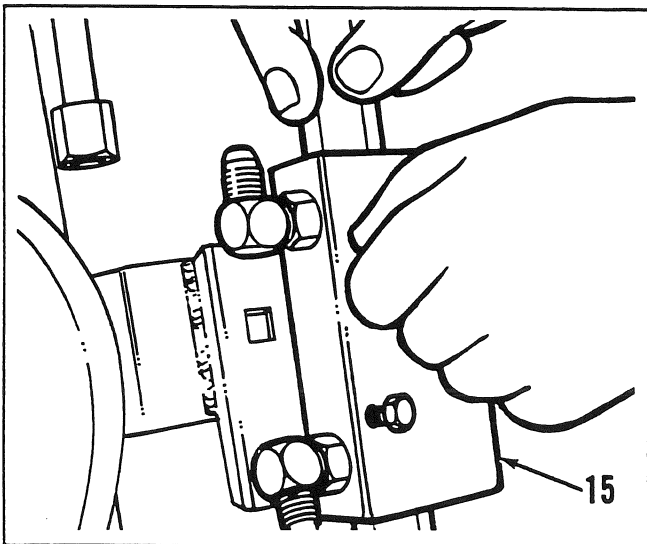


Fig. 10

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NOTE: *Champion recommends installing parts contained in seal kit P/N 23712 for counterbalance valves P/N 34951. Install parts contained in seal kit P/N 37215 for counterbalance valves P/N 27314. Refer to the Champion Service Parts Kit Booklet P/N L 21000 or 700 Series Parts Manual P/N L 3008.*

Counterbalance Valve - Assembly and Installation continued

Fig. 8

Lubricate and install a new O ring (6) and split ring (5) onto the check valve seats (7). Install the seats into the valve body (15). Ensure you install the split rings on the pilot piston side of the check valve seat.

Fig. 9

Lubricate and install new O rings (1) onto the end caps (12). Install the end caps containing the check valve assemblies into the valve body (15). Repeat steps Fig. 7 through Fig. 9 for the other side of the counterbalance valve.

Fig. 10

Retain the valve body (15) to the blade lift cylinder bracket or grader frame with the bolts, nuts and lock-washers.

Fig. 11

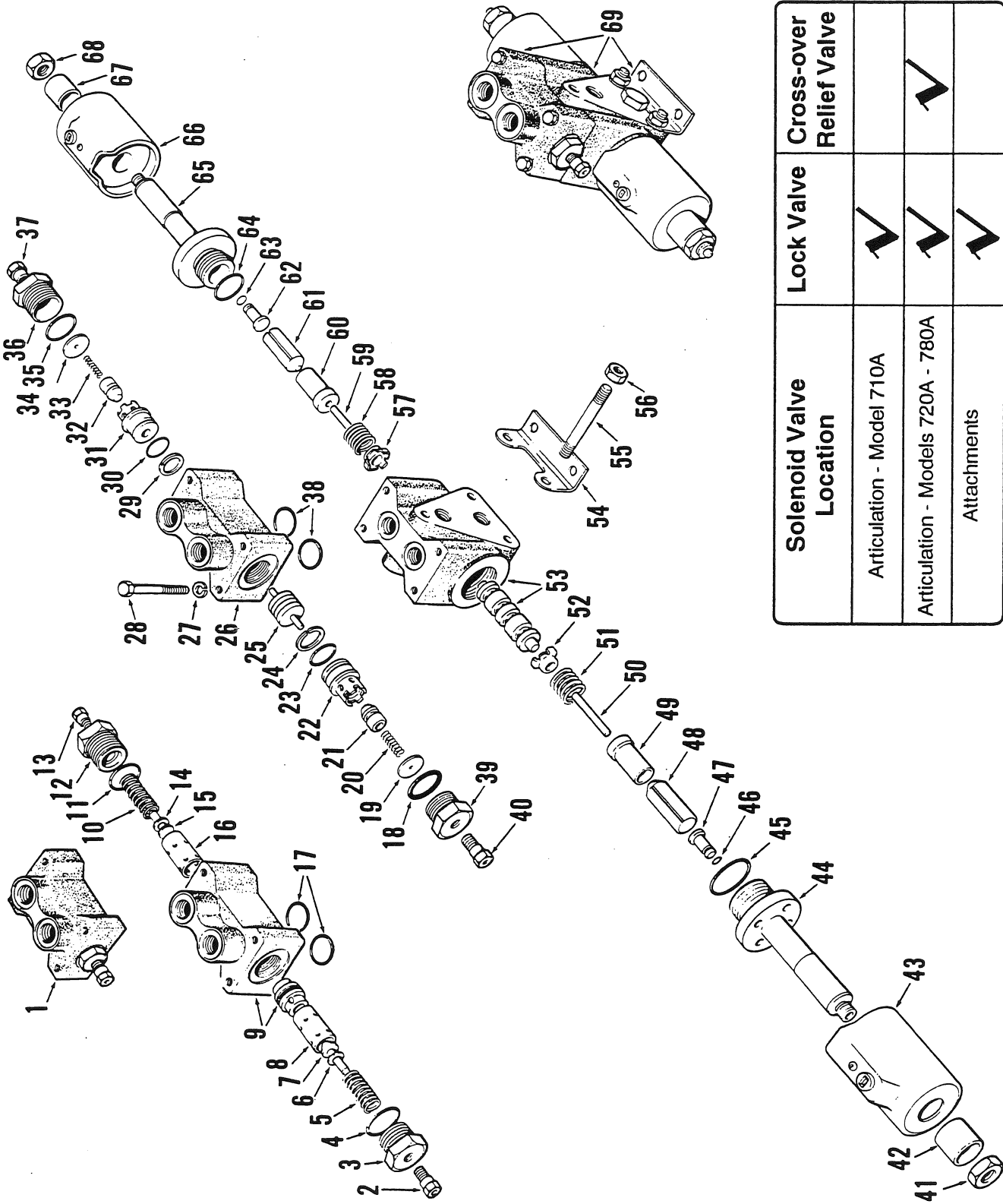
Connect all hoses and tubes to the valve body (15). Tighten the fittings. Test the operation of the blade lift cylinders, moveable point lock cylinder, or wheel lean cylinders and check for leaks. It may take several cycles of operation to purge the hydraulic system of air.

SECTION 4L

HYDRAULICS

Solenoid Valves

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Solenoid Valve Location	Lock Valve	Cross-over Relief Valve
Articulation - Model 710A	✓	
Articulation - Models 720A - 780A	✓	✓
Attachments	✓	

Fig. 1L Solenoid Valve

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Item	Description	Item	Description	Item	Description
1	Cross-over relief valve	25	Shuttle spool	49	Plug
2	Thermal relief valve	26	Lock valve body	50	Pin
3	Plug	27	Lockwasher	51	Spring
4	O ring	28	Bolt	52	Spring retainer
5	Spring	29	Back-up ring	53	Directional spool and body (matched set)
6	Shim	30	O ring	54	Foot
7	Poppet	31	Cage	55	Tie rod
8	Stop	32	Check	56	Nut
9	Cross-over relief valve body sub-assembly	33	Spring	57	Spring retainer
10	Spring	34	Washer	58	Spring
11	O ring	35	O ring	59	Pin
12	Plug	36	Plug	60	Plug
13	Thermal relief valve	37	Thermal relief valve	61	Plunger
14	Shim	38	O rings	62	Standard flush button (manual override)
15	Poppet	39	Plug	63	O ring
16	Stop	40	Thermal relief valve	64	O ring
17	O rings	41	Nut	65	Tube assembly
18	O ring	42	Sleeve	66	Solenoid coil
19	Washer	43	Solenoid coil	67	Spacer
20	Spring	44	Tube assembly	68	Nut
21	Check	45	O ring	69	Solenoid valve assembly
22	Cage	46	O ring		
23	O ring	47	Standard flush button (manual override)		
24	Back-up ring	48	Plunger		

Key to Fig. 1L

Graders S/N 16224, 16245 to 19983, 19986 to 19995, 19997 to 20004, 20006 to 20103, 20105 and 20107 to 20119; U.S. S/N 2021-2 to 2658-2, are equipped with solenoid valves with 1/2 in. SAE O ring pressure ports. Graders S/N 19982, 19984, 19985, 19996, 20005, 20104, 20106, 20120 and up are equipped with solenoid valves with 5/8 in. SAE O ring pressure ports. Only the directional spool and body (53) has changed. Champion recommends upgrading earlier machines and installing directional spool and bodies with the larger port sizes whenever possible.

Starting at grader S/N 20719, the external thermal relief valves (2) and (13) were replaced by internal thermal relief valves. The internal thermal relief valves are non-adjustable and require different internal porting in the directional control lock and cross-over relief sections. Do not mix them with external thermal relief valve components.

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Solenoid Valve - Removal

Fig. 2

Place the grader in the SERVICE POSITION. Refer to the procedure on page (ii) in the front of this Shop Manual section. Solenoid valves are used on articulated graders and for the operation of some attachments. Thoroughly clean the area where the solenoid valve is located. Identify all hoses and tubes to prevent confusion during assembly. Disconnect the hoses, tubes and wires. Cap the fittings and ports to prevent contamination. Remove the solenoid valve assembly (69) from the grader.

Solenoid Valve (All Models) - Disassembly

Fig. 3

Remove the nuts (56) and tie rods (55) securing the mounting feet (54). Remove the mounting feet. Secure the valve body in a vise with soft jaws. Do not overtighten the vise. Remove the bolts (28) and lockwashers (27) retaining the cross-over relief valve (1). Remove the cross-over relief valve from the solenoid valve body (53).

Fig. 4

Remove and discard the O rings (38) from the recesses in the solenoid valve body (53).

Fig. 5

Remove the nut (41) and sleeve (42) from the tube assembly (44). Remove the solenoid coil (43).

Fig. 6

Remove the tube assembly (44) from the solenoid valve body (53). Remove and discard the O ring (45).

Fig. 7

Remove the pin (50) from the tube assembly (44).

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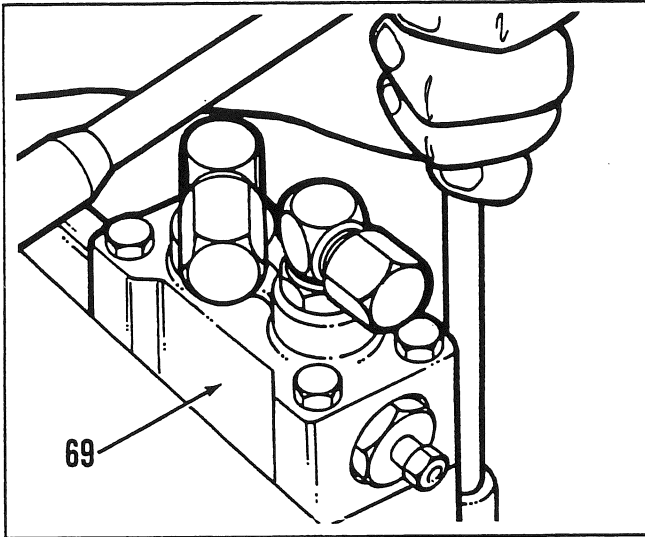


Fig. 2

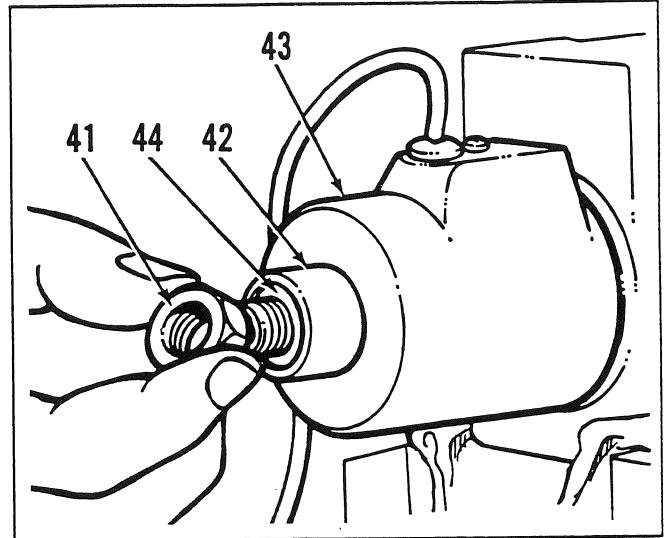


Fig. 5

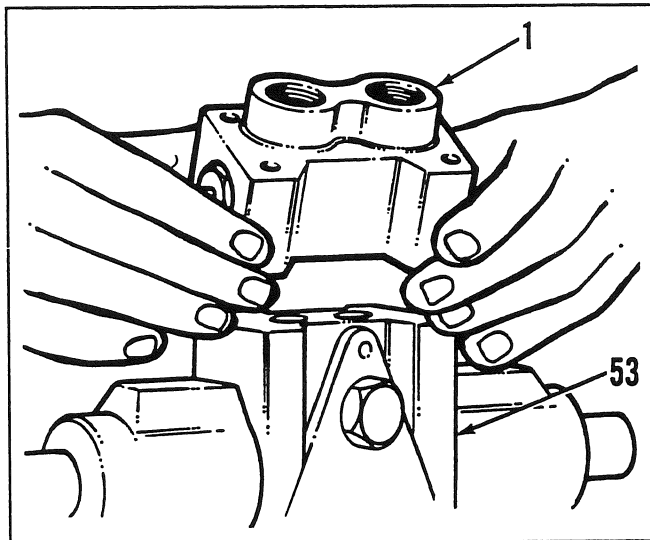


Fig. 3

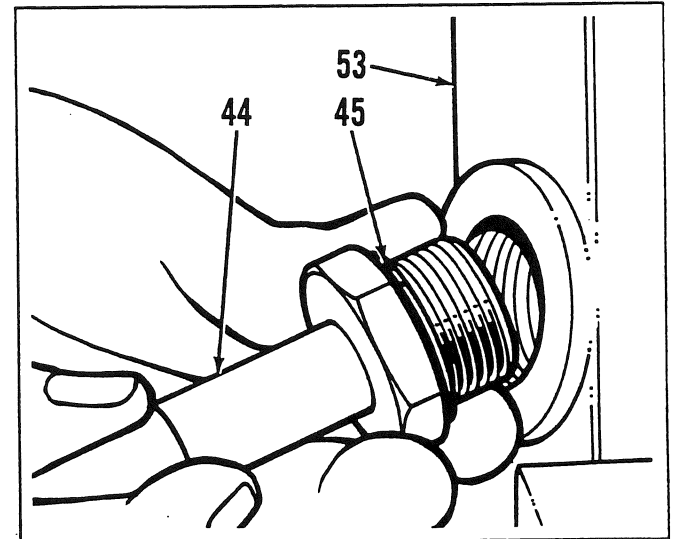


Fig. 6

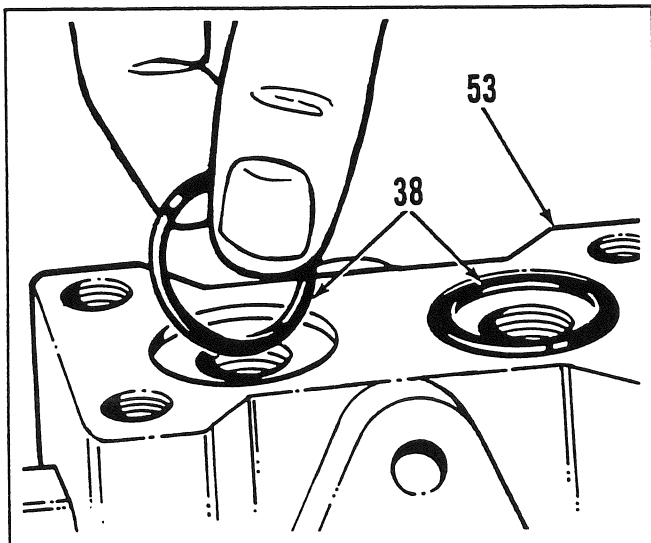


Fig. 4

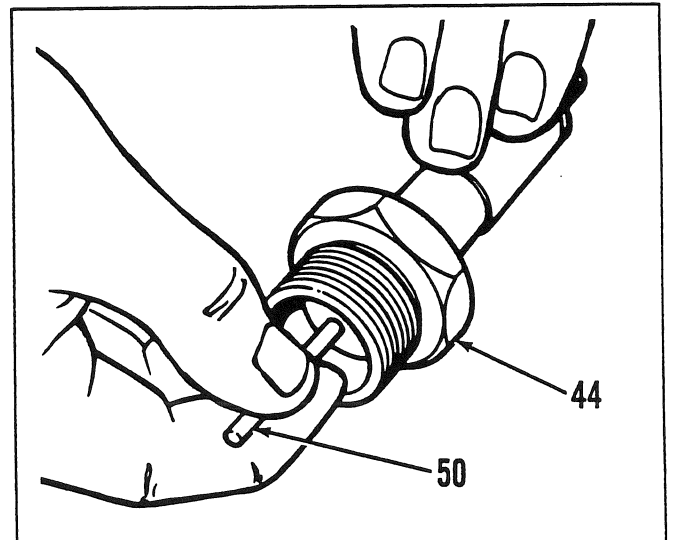


Fig. 7

700 SERIES SHOP MANUAL

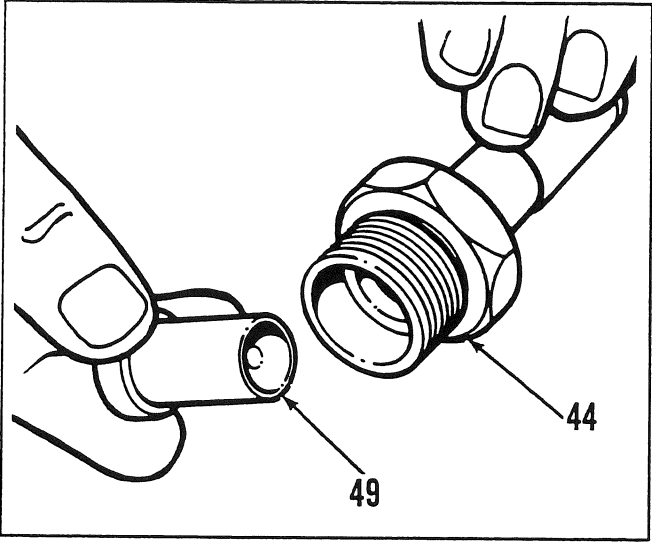


Fig. 8

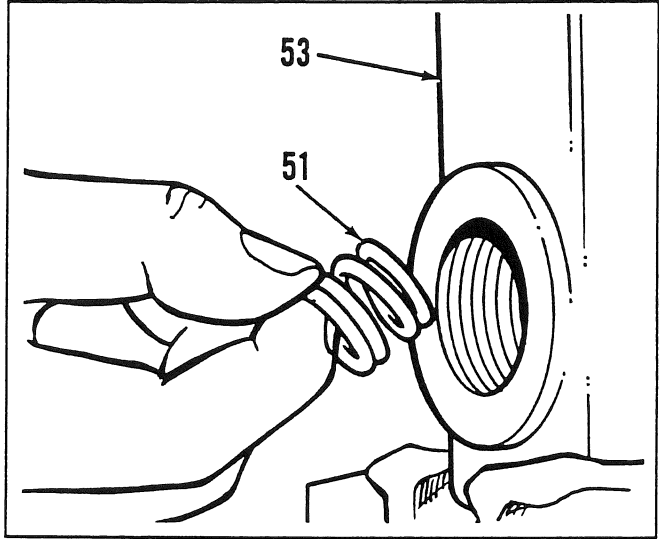


Fig. 11

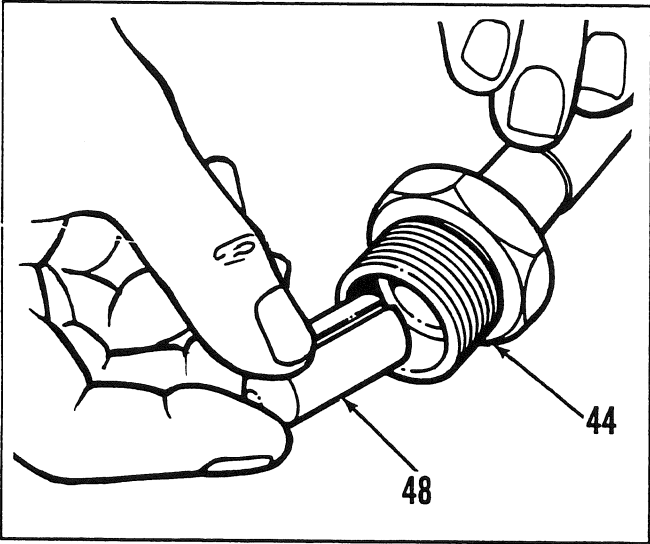


Fig. 9

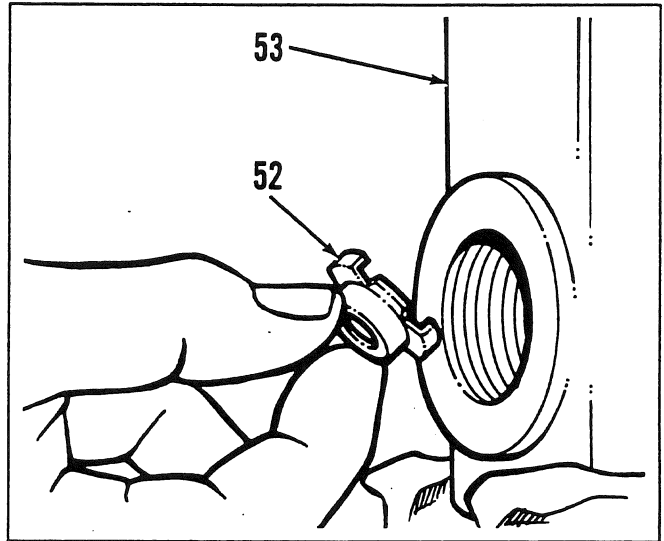


Fig. 12

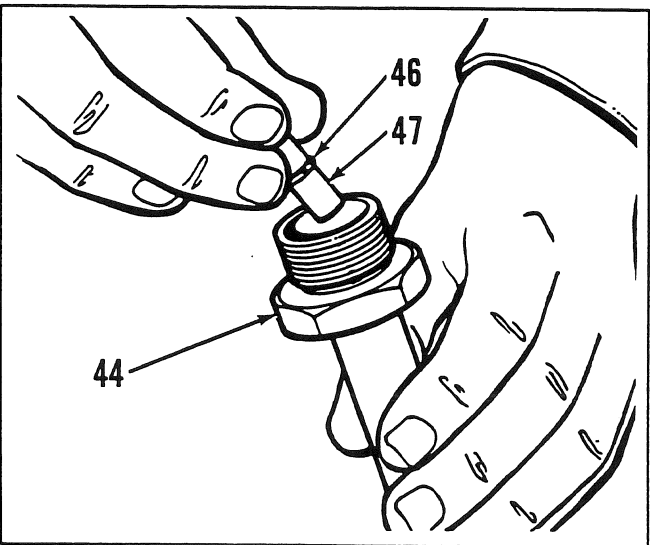


Fig. 10

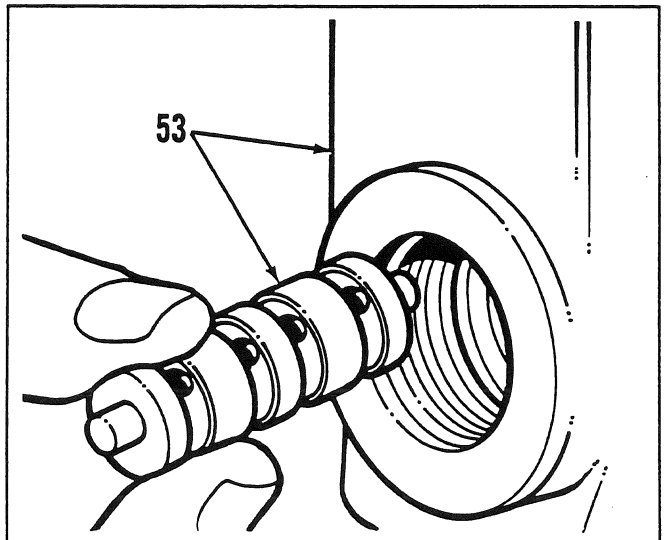


Fig. 13

700 SERIES SHOP MANUAL

Solenoid Valve (All Models) - Disassembly

continued

Fig. 8

Remove the plug (49) from the tube assembly (44).

Fig. 11

Remove the spring (51) from the solenoid valve body (53).

Fig. 9

Remove the plunger (48) from the tube assembly (44).

Fig. 12

Remove the spring retainer (52) from the solenoid valve body (53). Repeat steps Fig. 5 through Fig. 12 for the solenoid cartridge on the other side of the valve body.

Fig. 10

Remove the standard flush button (manual override) (47) from the tube assembly (44). Remove and discard the O ring (46).

Fig. 13

Remove the directional spool (53) from the solenoid valve body (53). Thoroughly clean the directional spool and valve body. Inspect the directional spool and valve body for serviceability. Refer to **Cleaning and Inspection** found at the front of this Shop Manual section.

NOTE: *The directional spool and valve body are a matched set and cannot be separately interchanged with another directional spool or valve body.*

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Solenoid Valve (All Models) - Assembly

Fig. 14

Lubricate the directional spool (53) and solenoid valve body (53) bore with system oil. Carefully install the directional spool into the valve body and centralize it in the bore.

Fig. 15

Install the spring retainer (52) into the solenoid valve body (53).

Fig. 16

Install the spring (51) into the solenoid valve body (53).

Fig. 17

Lubricate and install a new O ring (46) onto the standard flush button (manual override) (47). Lubricate and install the flush button into the tube assembly (44). The flanged end of the standard flush button (manual override) must point toward the solenoid valve body (53) when the tube assembly is installed.

Fig. 18

Lubricate and install the plunger (48) into the tube assembly (44). The conical end of the plunger must point toward the solenoid valve body (53) when the tube assembly is installed.

Fig. 19

Lubricate and install the plug (49) into the tube assembly (44). The flanged end of the plug must point toward the solenoid valve body (53) when the tube assembly is installed.

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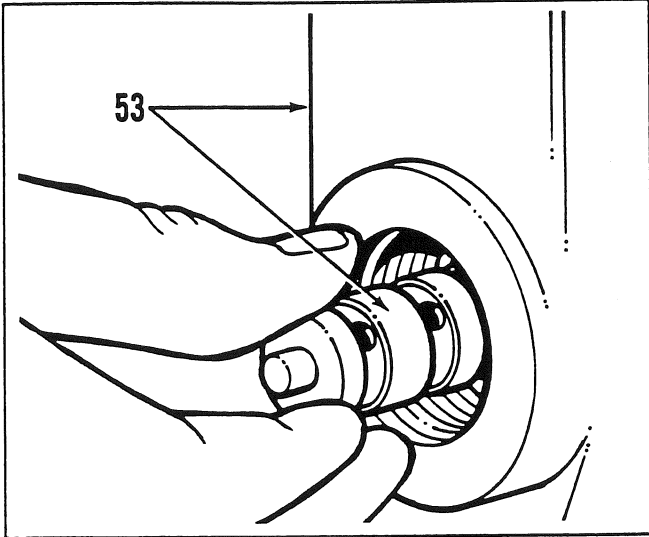


Fig. 14

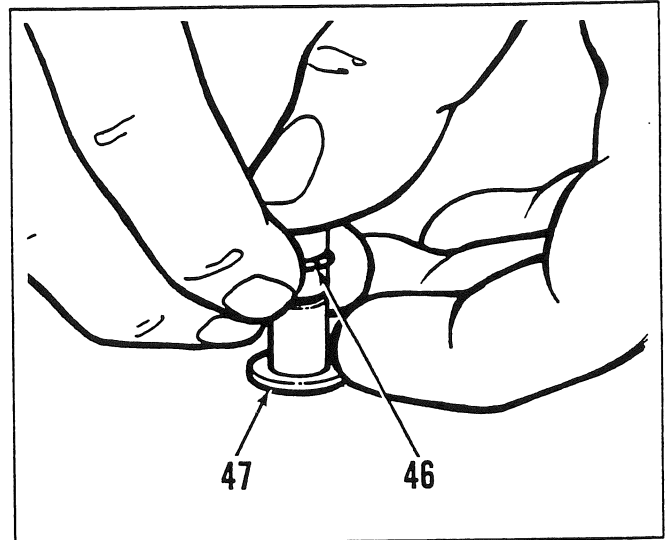


Fig. 17

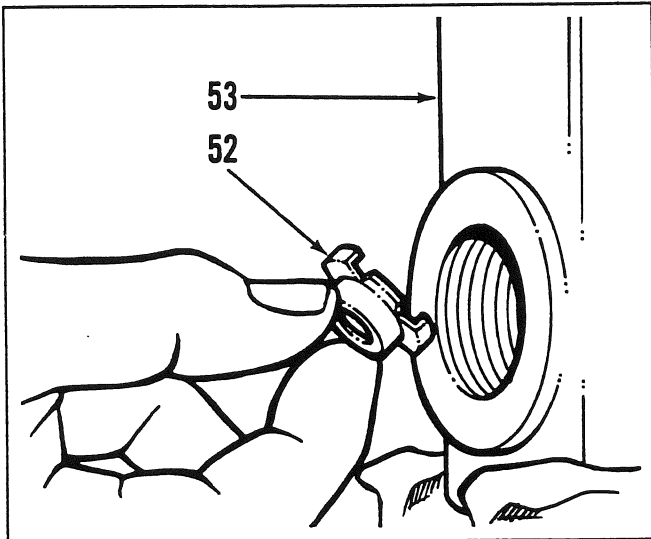


Fig. 15

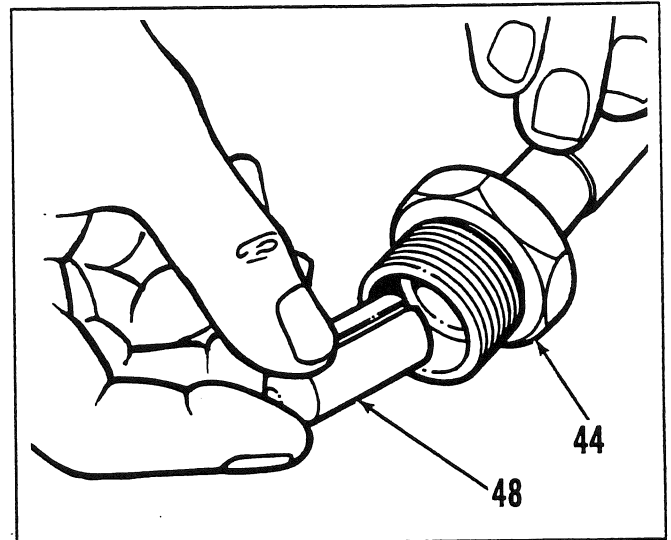


Fig. 18

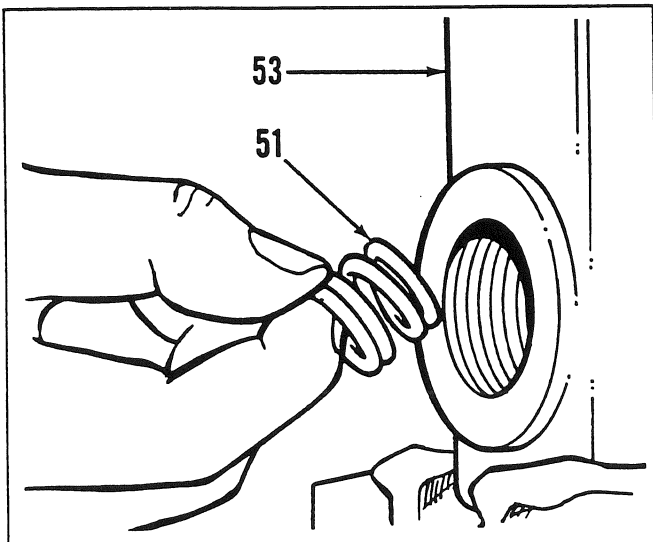


Fig. 16

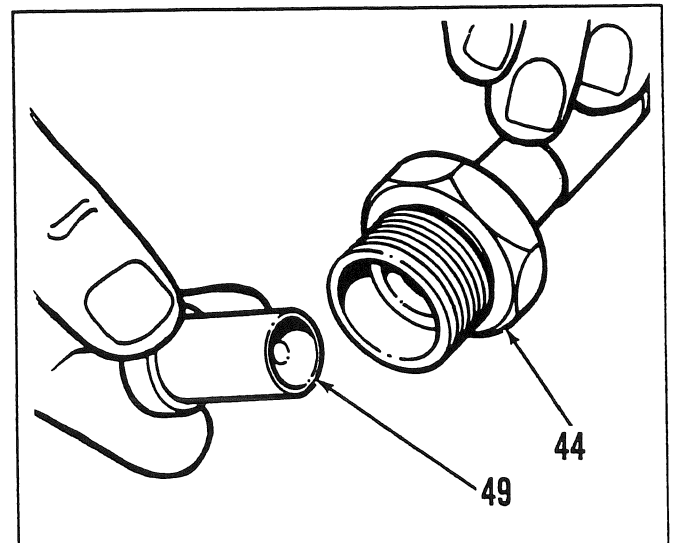


Fig. 19

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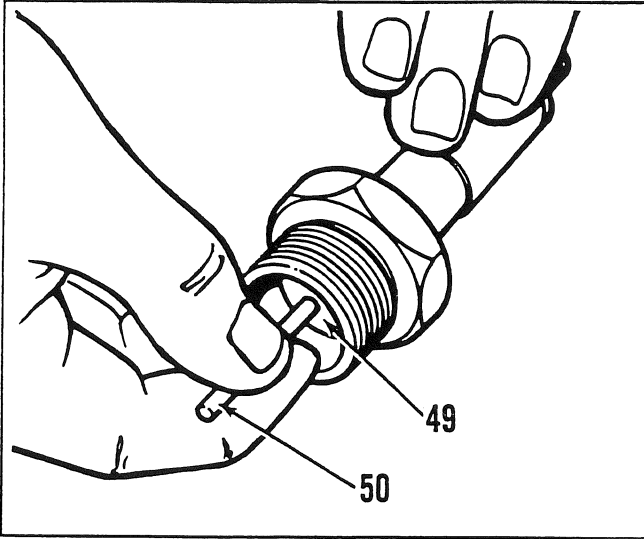


Fig. 20

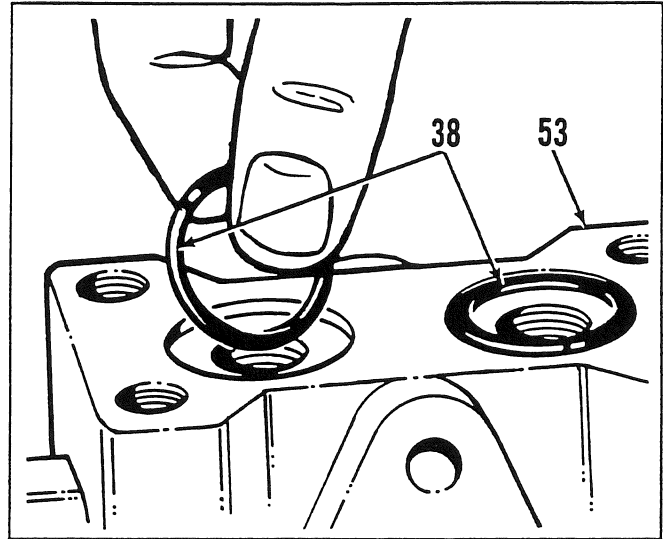


Fig. 23

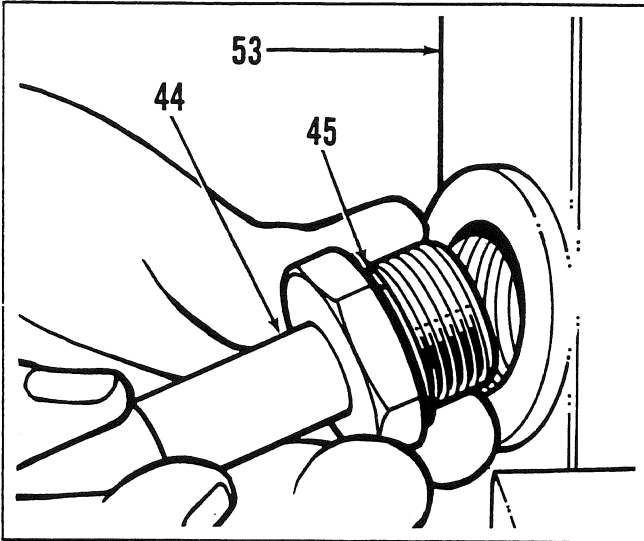


Fig. 21

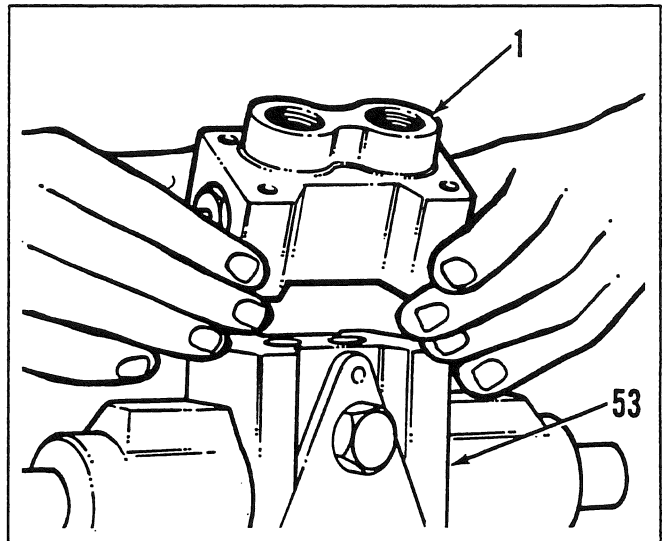


Fig. 24

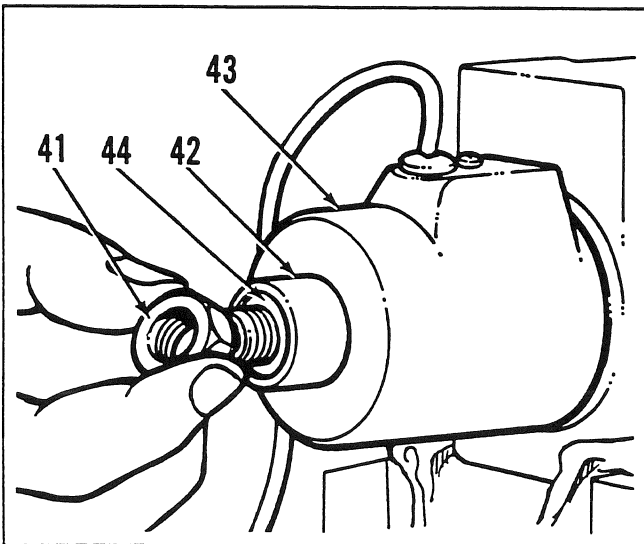


Fig. 22

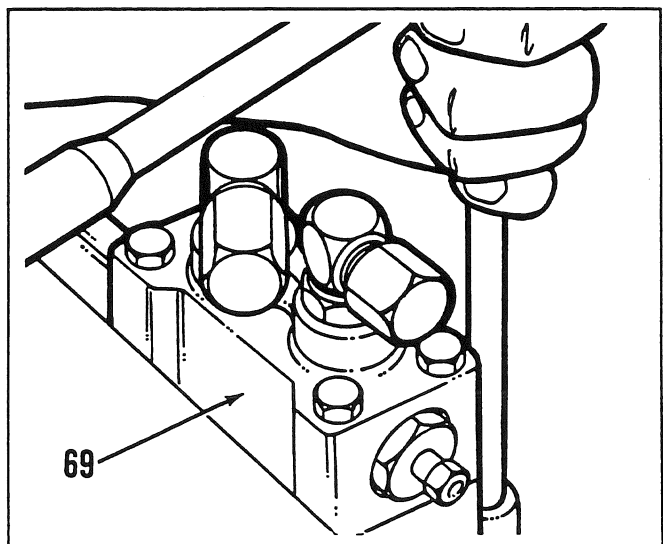


Fig. 25

700 SERIES SHOP MANUAL

Solenoid Valve (All Models) - Assembly

continued

Fig. 20

Lubricate and install the pin (50) into the bore of the plug (49).

Fig. 21

Lubricate and install a new O ring (45) onto the tube assembly (44). Install the tube assembly into the solenoid valve body (53). Tighten the tube assembly to the specified torque.

Fig. 22

Install the solenoid coil (43), sleeve (42) and nut (41) onto the tube assembly (44). Tighten the nuts to the specified torque. Repeat step Fig. 15 through Fig. 22 for the solenoid cartridge on the other side of the valve body.

Fig. 23

Lubricate and install two new O rings (38) in the recesses of the solenoid valve body (53).

Fig. 24

Carefully install the cross-over relief valve (1) and secure with the four bolts (28) and lockwashers (27). Install the mounting feet (54) on the solenoid valve body (53) and retain with the tie rods (55) and nuts (56). The nuts must be torque-tightened in three increments: 50 lbf-in. (6,0 N·m; 0,6 kgf·m), 90 lbf-in. (10 N·m; 1,0 kgf·m), and 115 lbf-in. (13 N·m; 1,3 kgf·m).

NOTE: *Torque-tighten one side at a time. Do not overtorque; possible bore distortion may cause spool binding or valve leakage.*

Solenoid Valve - Installation

Fig. 25

Install the solenoid valve assembly (69) onto the grader. Connect the hoses, tubes and wires to the solenoid valve. Perform the daily pre-start checks detailed in the 700 Series Operator's Manual. Make a visual check around the grader. Signal your intention to start the engine. Start the engine when it is safe to do so and test the function controlled by the solenoid valve. Shut down the engine. Check the hydraulic fluid level and for leaks.

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Cross-over Relief Valve (Articulation Solenoid Valve, Models 720A - 740A) - Disassembly

Fig. 26

Refer to **Solenoid Valve (All Models) - Removal** and remove the cross-over relief valve (1) from the solenoid valve body (53). Remove the plug (3), thermal relief valve (2) and spring (5) from the cross-over relief valve body sub assembly (9). Remove and discard the O ring (4).

Fig. 27

Remove the poppet (7), shims (6) and stop (8) from the cross-over relief valve body sub-assembly (9).

Fig. 28

Repeat steps **Fig. 26** and **Fig. 27** for the thermal relief on the other side of the cross-over relief valve body sub-assembly (9). Use a hammer and soft metal drift to gently force the seat (9) out of the valve body. Remove and discard the O ring and back-up rings. Thoroughly clean the seat and valve body. Inspect the seat and valve body for serviceability. Refer to **Cleaning and Inspection** found at the front of this Shop Manual section.

NOTE: *The seat and cross-over relief valve body are a matched set and cannot be separately interchanged with another seat or cross-over relief valve body.*

Cross-over Relief Valve (Articulation Solenoid Valve, Models 720A - 740A) - Assembly

Fig. 29

Lubricate and install a new O ring and back-up rings onto the seat (9). Lubricate and carefully install the seat in the cross-over relief valve body bore.

Fig. 30

Lubricate and install the stop (8), poppet (7) and shims (6) into the cross-over relief valve body sub-assembly (9).

Fig. 31

Lubricate and install a new O ring (4) onto the plug (3). Install the spring (5), plug and thermal relief valve (2) into the cross-over relief valve body sub-assembly (9). Repeat steps **Fig. 30** and **Fig. 31** for the thermal relief on the other side of the valve body. Install the solenoid valve assembly (69) onto the grader. Connect the hoses, tubes and wires to the solenoid valve. Perform the daily pre-start checks detailed in the 700 Series Operator's Manual. Make a visual check around the grader. Signal your intention to start the engine. Start the engine when it is safe to do so and test the function controlled by the solenoid valve. Shut down the engine. Check the hydraulic fluid level and for leaks.

700 SERIES SHOP MANUAL

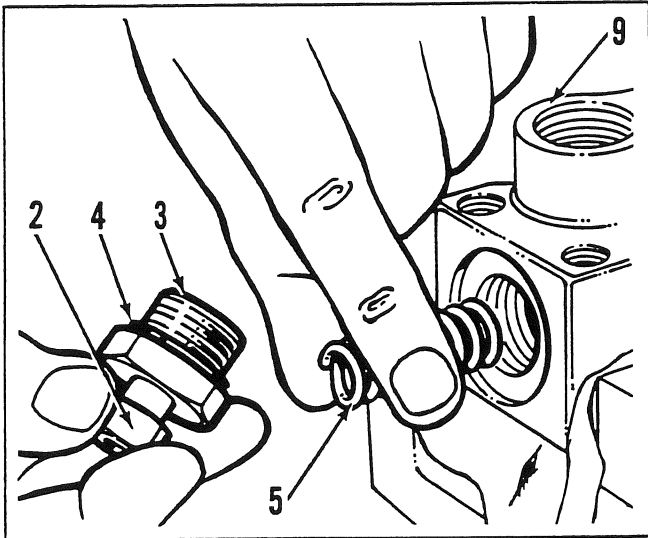


Fig. 26

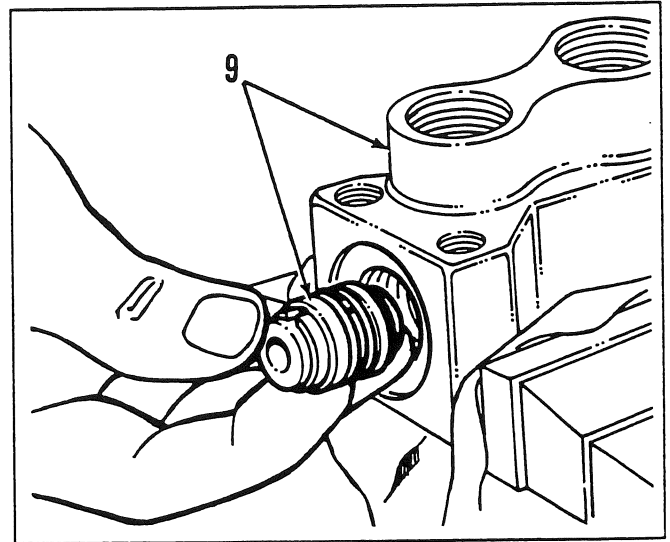


Fig. 29

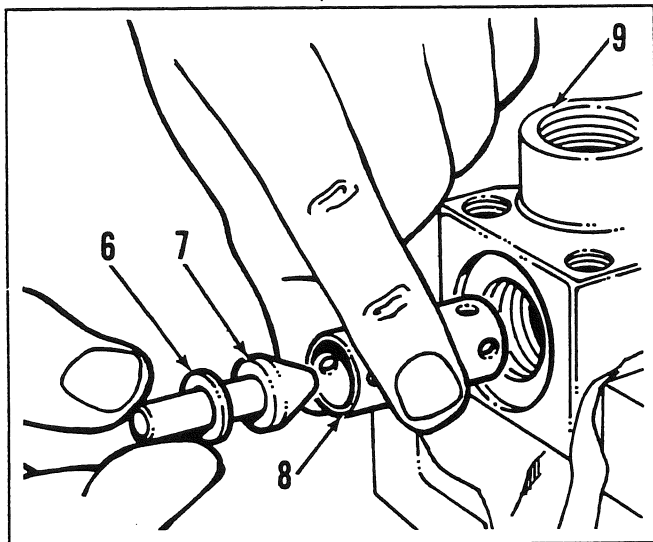


Fig. 27

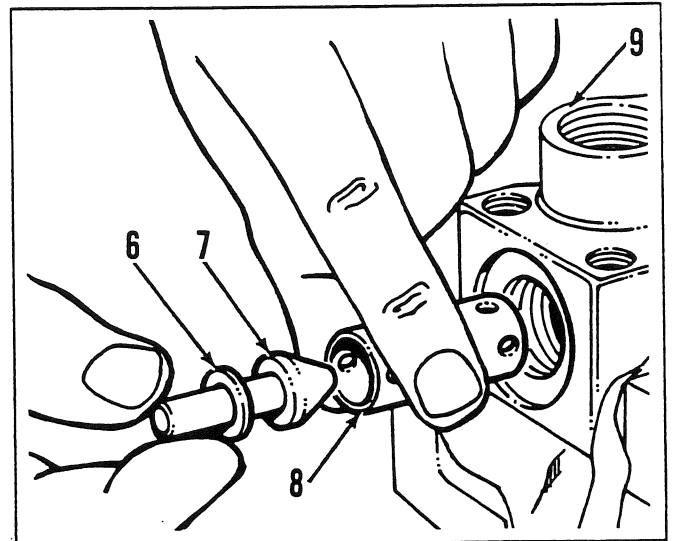


Fig. 30

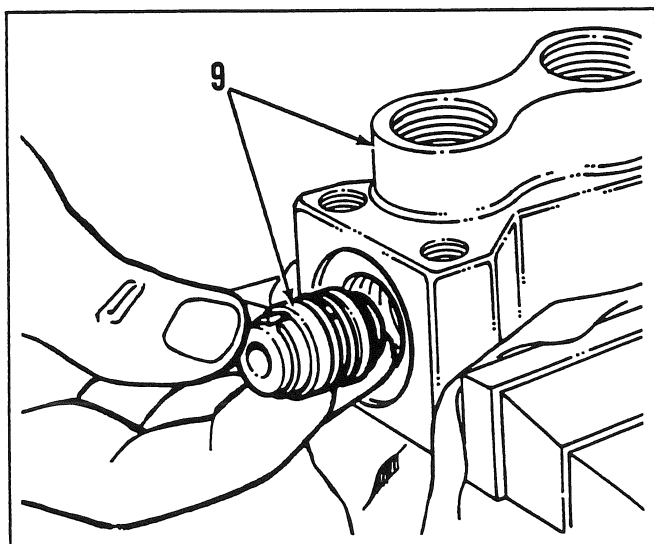


Fig. 26

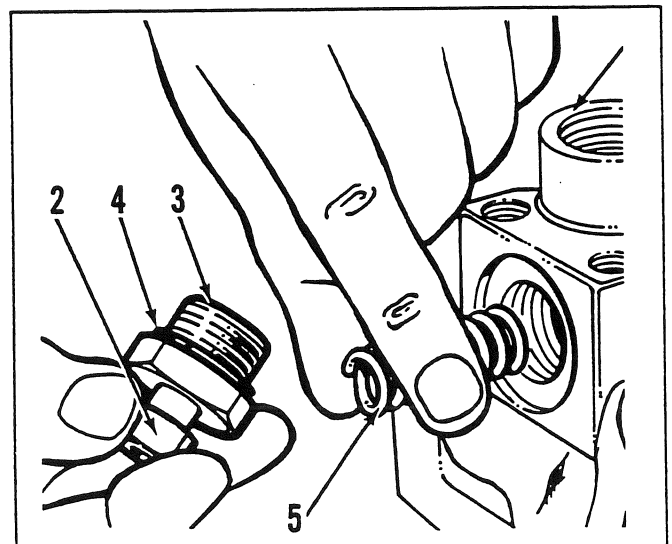


Fig. 31

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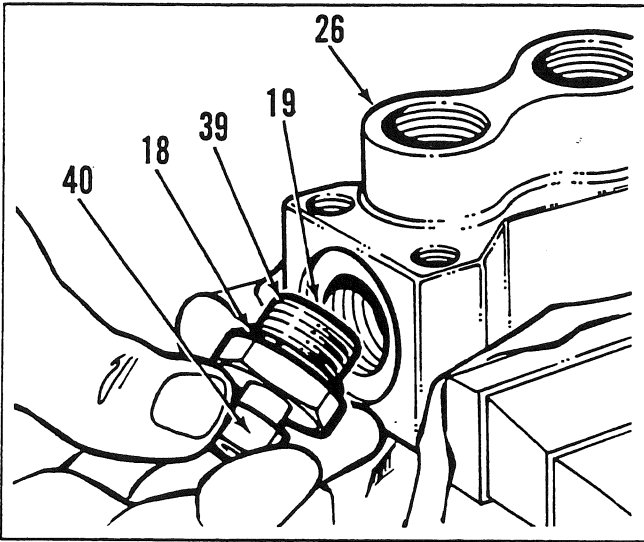


Fig. 32

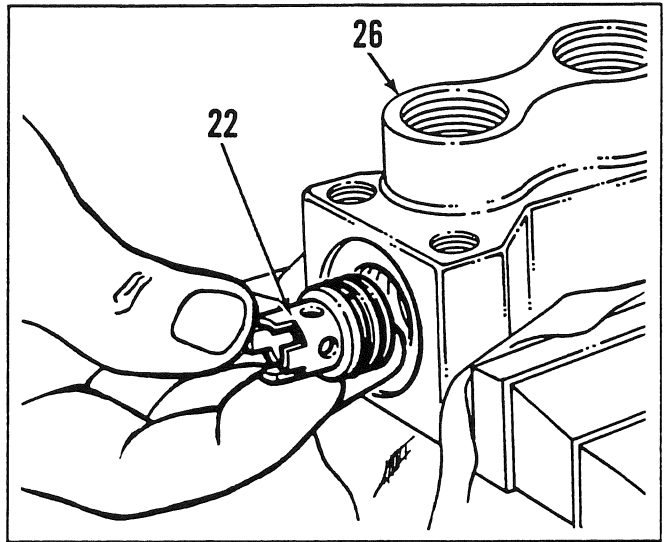


Fig. 35

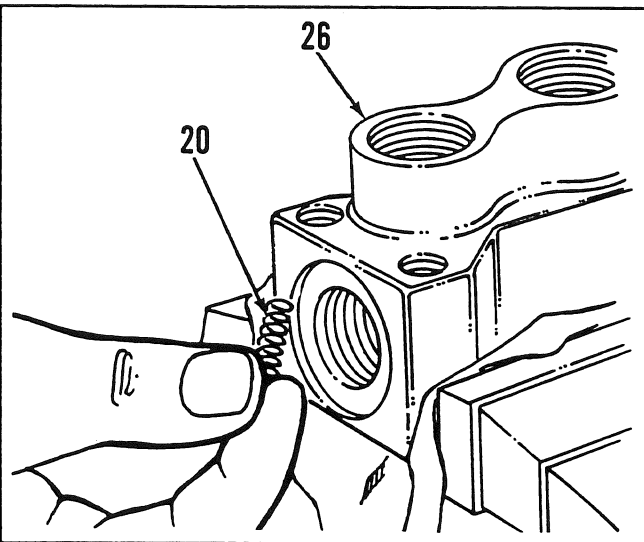


Fig. 33

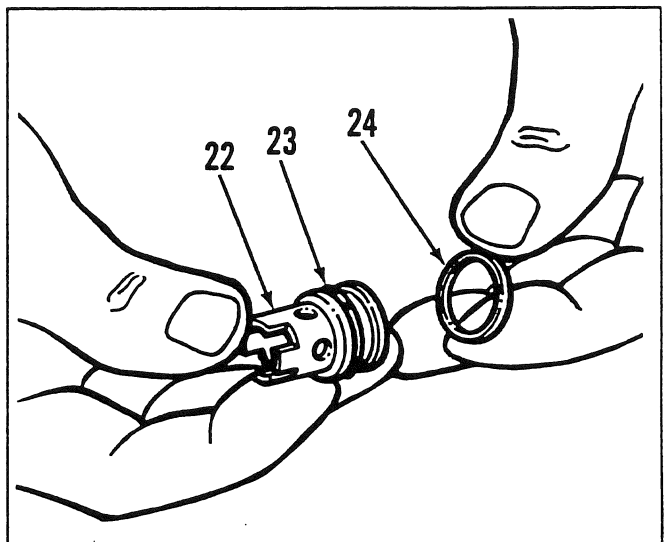


Fig. 36

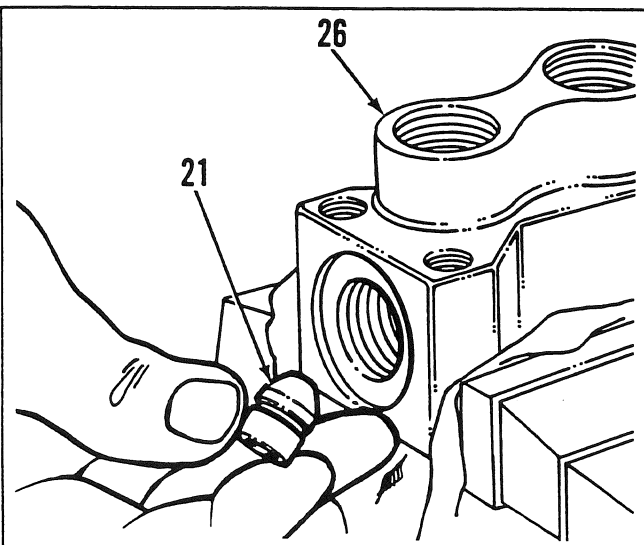


Fig. 34

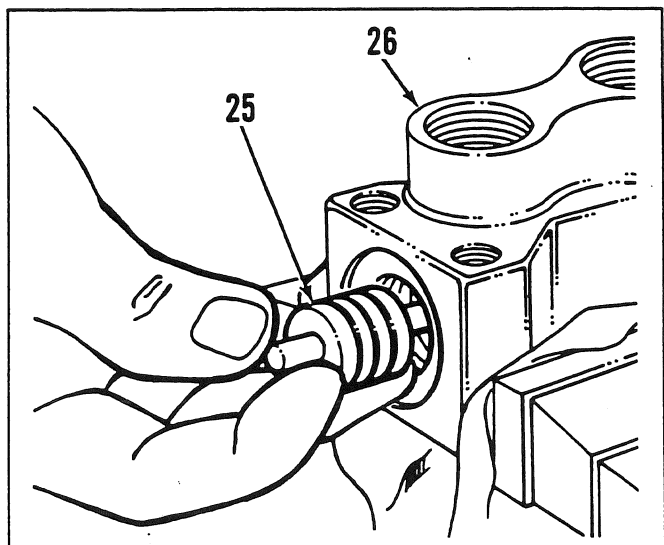


Fig. 37

700 SERIES SHOP MANUAL

Cross-over Relief Valve (Articulation Solenoid Valve, Model 710A, Attachment Solenoid Valves, All Models) - Disassembly

Fig. 32

Refer to **Solenoid Valve (All Models) - Removal** and remove the cross-over relief valve (1) from the solenoid valve body (53). Remove the plug (39), thermal relief valve (40) and washer (19) from the lock valve body (26). Remove and discard the O ring (18).

Fig. 33

Remove the spring (20) from the lock valve body (26).

Fig. 34

Remove the check (21) from the lock valve body (26).

Fig. 35

Remove the cage (22) from the lock valve body (26). Repeat steps **Fig. 32** through **Fig. 35** for the thermal relief on the other side of the lock valve body.

NOTE: *The checks, cages and lock valve body are a matched set and cannot be separately interchanged with another check, cage or lock valve body.*

Fig. 36

Remove and discard the O ring (23) and back-up ring (24) from the cage (22). Note the position of the O ring and back-up ring.

Fig. 37

Use a hammer and soft metal drift to gently force the shuttle spool (25) out of the lock valve body (26). Thoroughly clean the shuttle spool and lock valve body. Inspect the shuttle spool and lock valve body for serviceability. Refer to **Cleaning and Inspection** found at the front of this Shop Manual section.

NOTE: *There are two different shuttle spool designs, one for the articulation solenoid valve and one for the attachment solenoid valve. The articulation shuttle spool has larger diameter ends than the attachment shuttle spool.*

700 SERIES SHOP MANUAL

Cross-over Relief Valve (Articulation Solenoid Valve, Model 710A, Attachment Solenoid Valves, All Models) - Assembly

Fig. 38

Lubricate and install the shuttle spool (25) into the lock valve body (26).

Fig. 41

Install the check (21) into the lock valve body (26).

Fig. 39

Lubricate and install a new O ring (23) and back-up ring (24) into their appropriate positions in the cage (22) groove.

Fig. 42

Install the spring (20) into the lock valve body (26).

Fig. 40

Lubricate and carefully install the cage (22) into the lock valve body (26).

Fig. 43

Lubricate and install a new O ring (18) onto the plug (39). Install the washer (19), plug and thermal relief valve (40) into the lock valve body (26). Repeat steps Fig. 39 through Fig. 43 for the thermal relief on the other side of the lock valve body. Install the solenoid valve (69) onto the grader. Connect the hoses, tubes and wires to the solenoid valve. Perform the daily pre-start checks detailed in the 700 Series Operator's Manual. Make a visual check around the grader. Signal your intention to start the engine. Start the engine when it is safe to do so and test the function controlled by the solenoid valve. Shut down the engine. Check the hydraulic fluid level and for leaks.

700 SERIES SHOP MANUAL

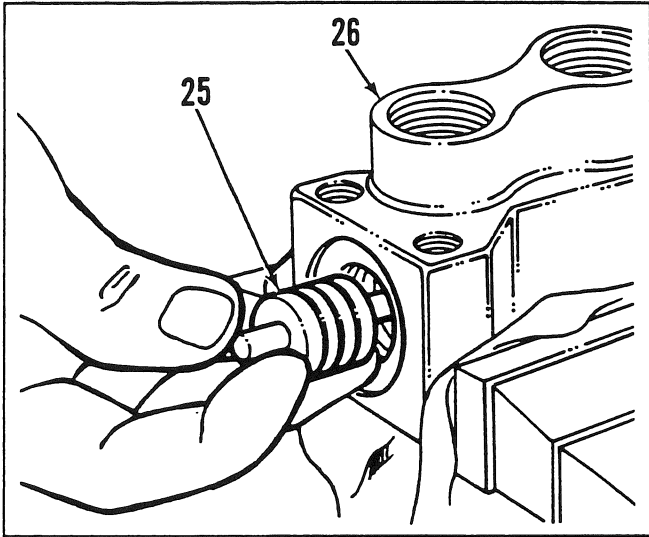


Fig. 38

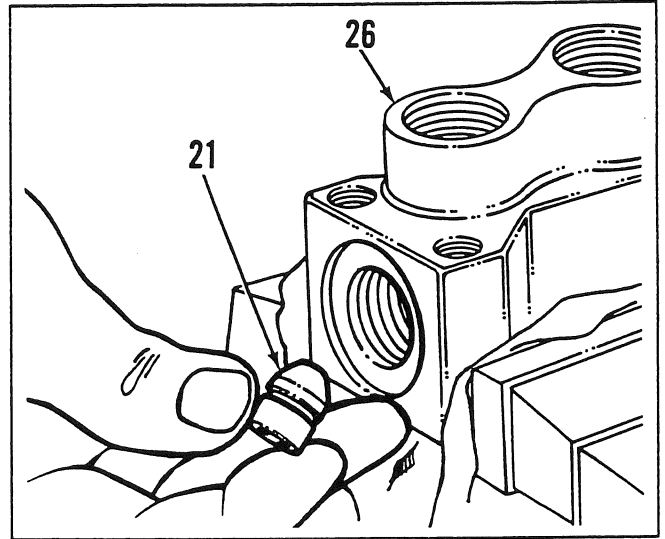


Fig. 41

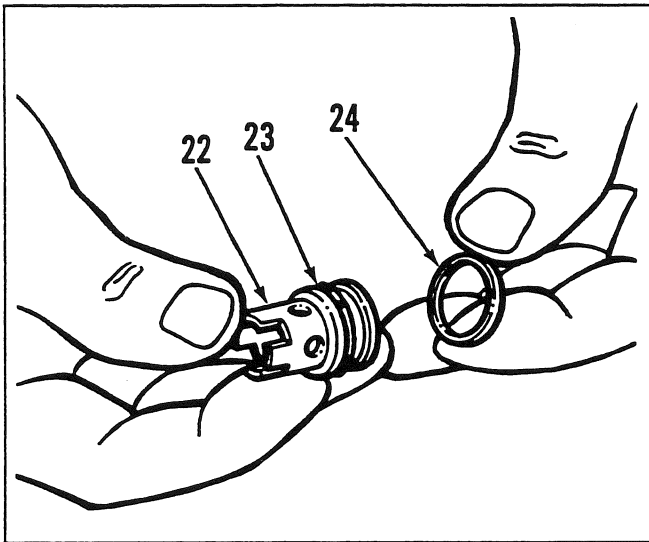


Fig. 39

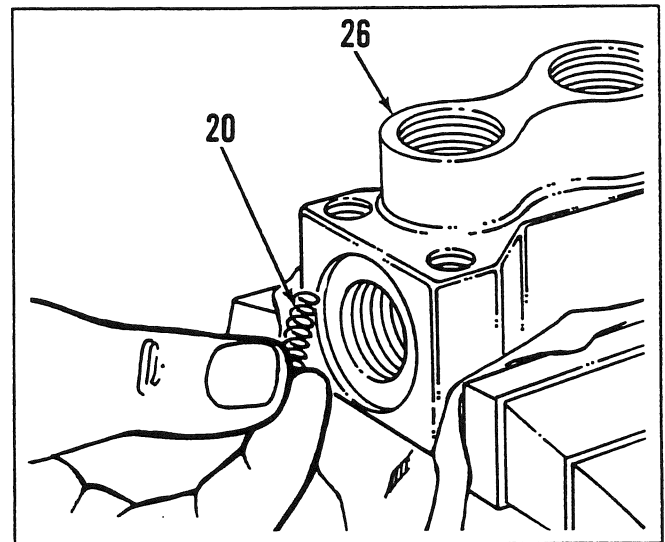


Fig. 42

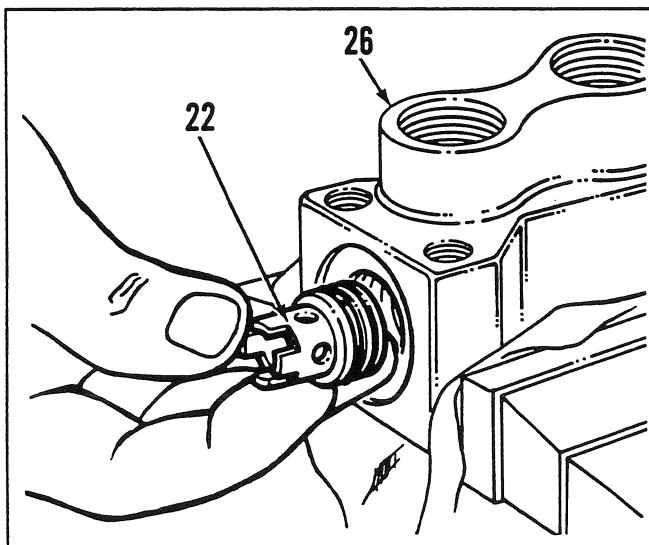


Fig. 40

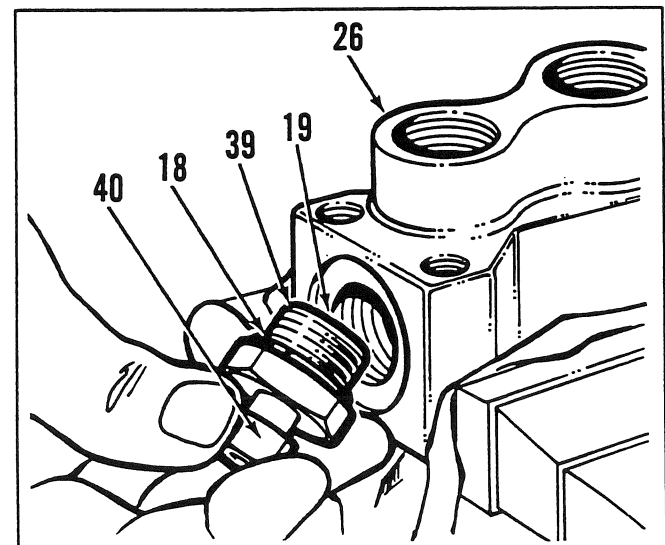


Fig. 43

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Installing Hydraulic Power Beyond Function for Snow Wing Attachments and Other Auxiliary Hydraulic Power

This information applies to graders S/N 19236 and up; plus any earlier machines upgraded with hydraulic manifold valve P/N 48435 and P/N 48555. When installing Champion front mounted and rear mounted snow wings or other attachments needing auxiliary hydraulic assistance, you can install a power beyond function on the right-hand manifold valve.

Hydraulic power beyond is taken from the right-hand manifold valve because auxiliary hydraulic assistance needed for articulation is taken from the left-hand main hydraulic system. It is important to install the hoses and power beyond plug P/N 49202 as shown in Fig. 44 otherwise damage to hydraulic components could result.

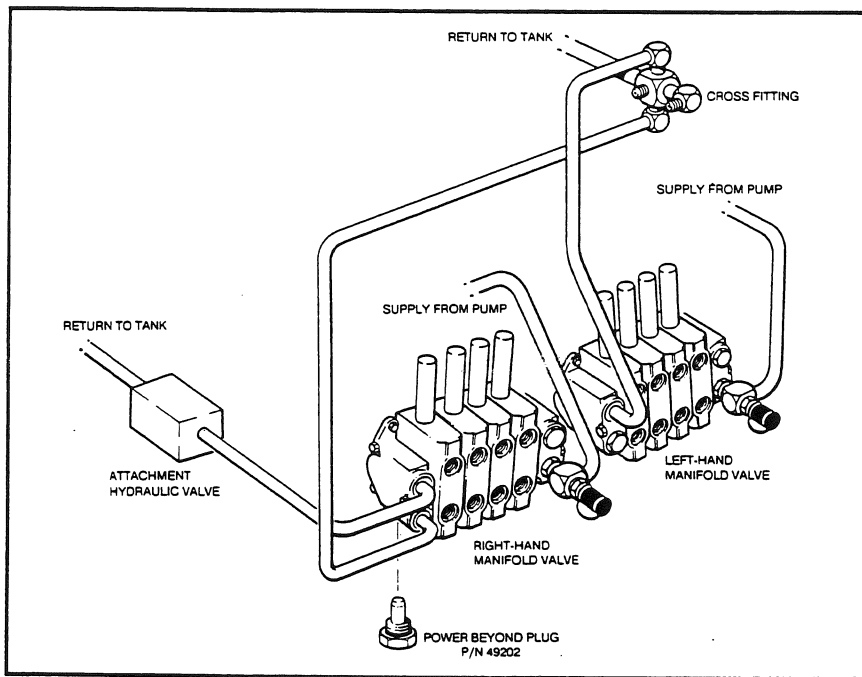


Fig. 44

When the power beyond plug is installed, ensure the existing drain hose is connected to the lower port of the manifold valve outlet section as shown in Fig. 44. This allows normal leakage within the manifold valve to return to tank. Without this hose, pressure may build up inside the valve and cause damage. The attachment hose must be connected to the upper port of the manifold valve outlet section.

Note that the left-hand manifold valve does not change. The right-hand manifold valve supplies oil flow for the power beyond function.

NOTE: The terms left-hand and right-hand indicate the directions when in the operator's cab looking toward the front of the grader.

SECTION 4M

HYDRAULICS

Accumulators

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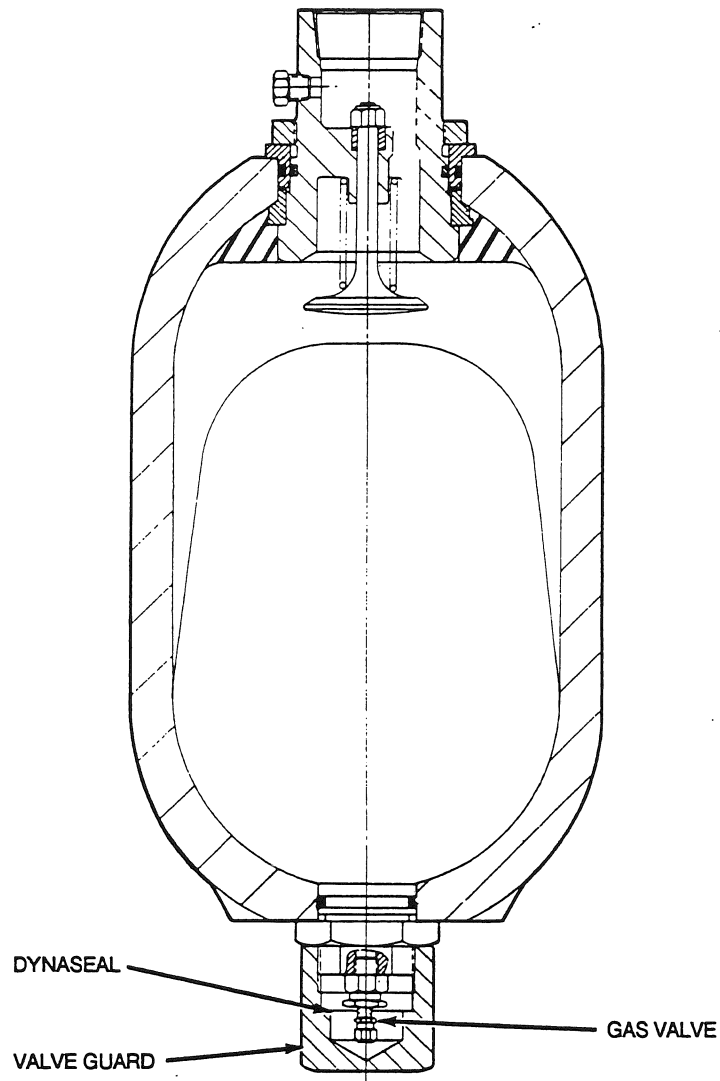


Fig. 1M Cross-section of Typical Bladder-type Accumulator

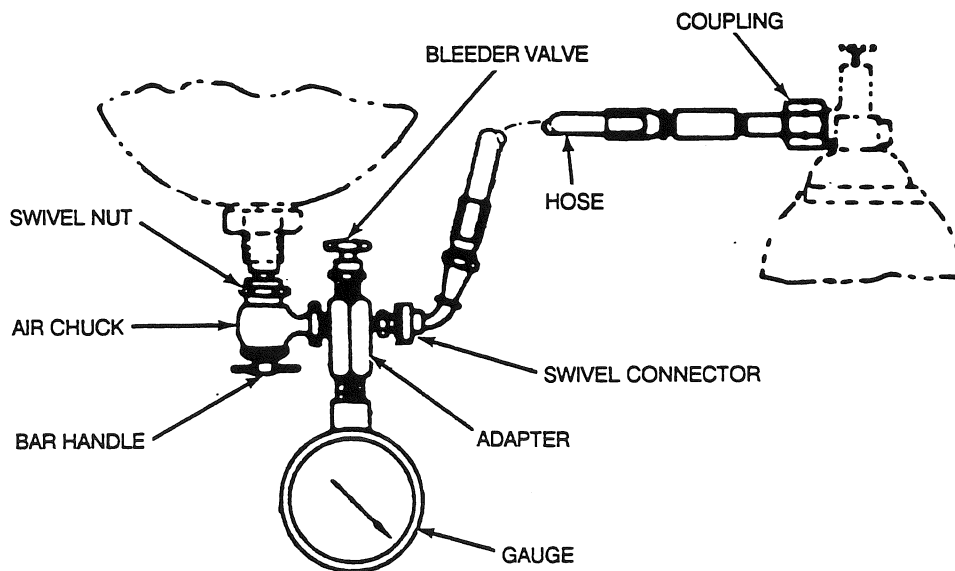


Fig. 2M Charging Kit P/N 16042 for Bladder-type Accumulators

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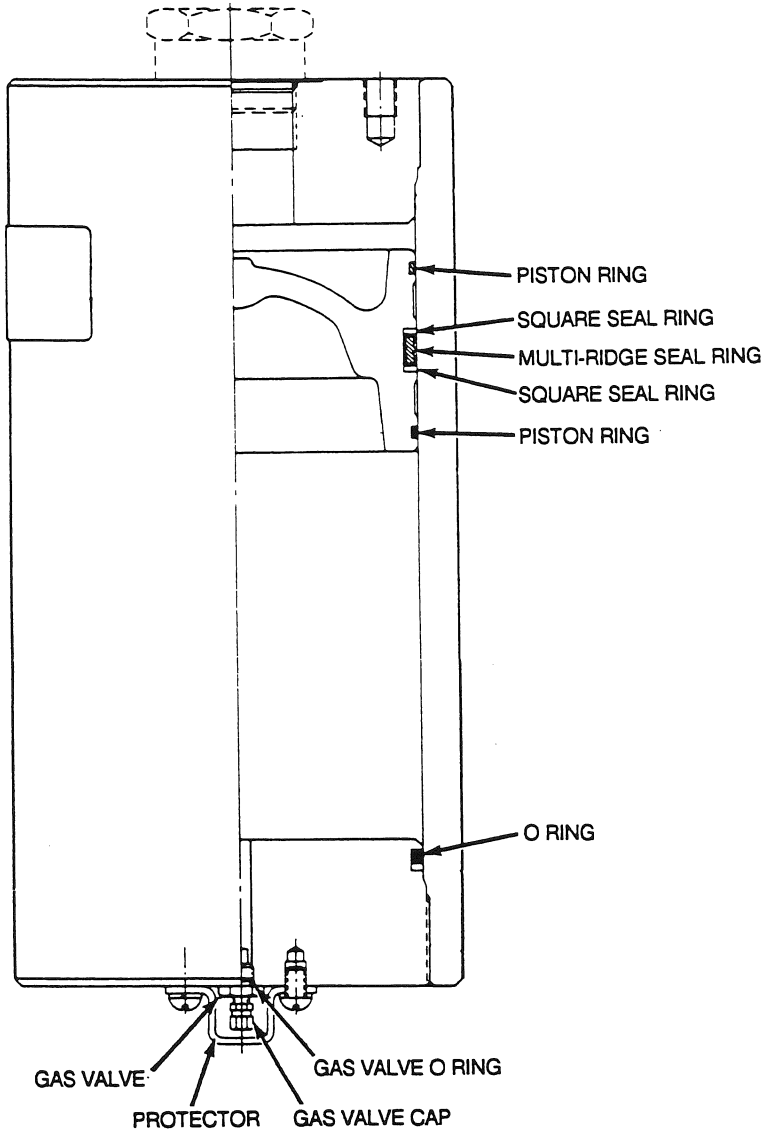


Fig. 3M Cross-section of Typical Piston-type Accumulator

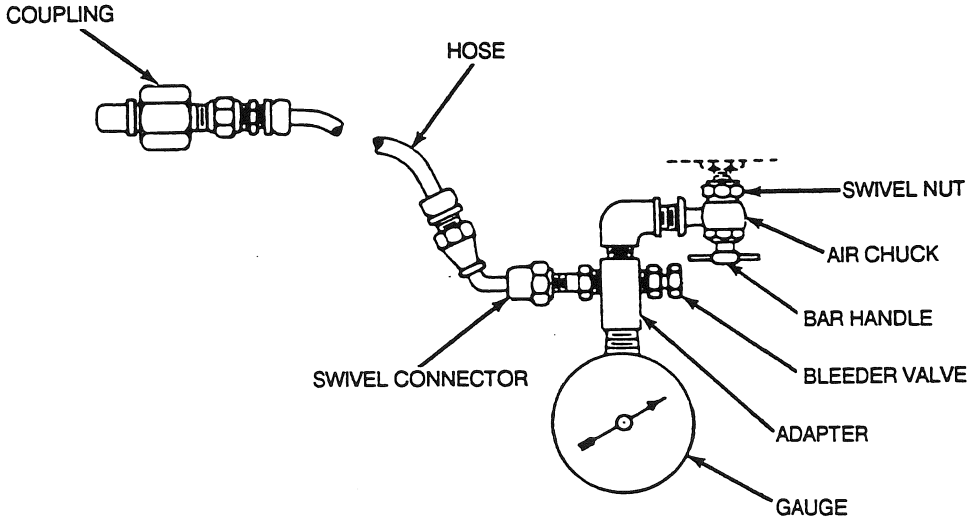


Fig. 4M Charging Kit P/N 56475 and Gauge P/N 56474 for Piston-type Accumulators

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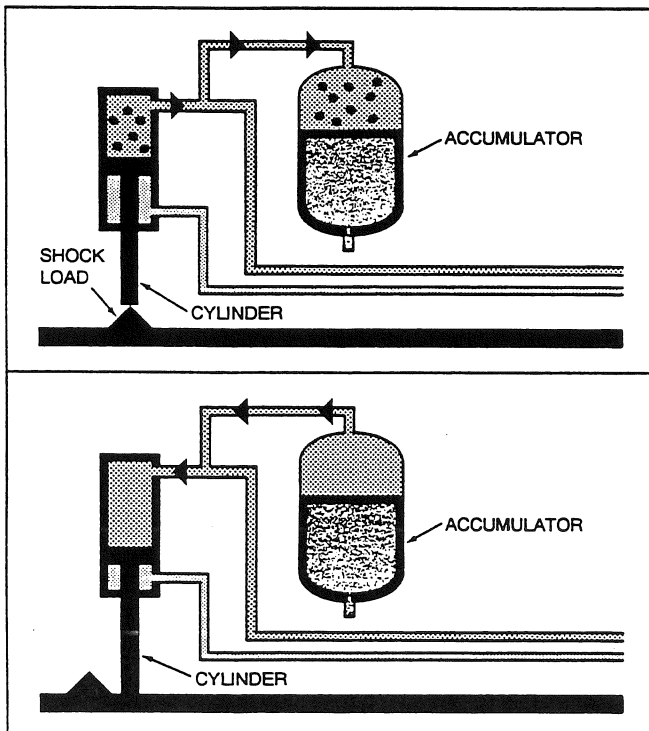
Accumulators - Description and Operation

Bladder-type or piston-type accumulators can be either a standard or optional feature, depending on your grader model. They are used in the blade lift, circle shift and oil disc brakes hydraulic circuits.

Both types of accumulators contain a precharged amount of nitrogen gas. The nitrogen absorbs shock loads in the hydraulic circuit. For blade lift and circle shift hydraulic circuits, shock loads can be caused by higher than normal pressure developing in the piston end of the cylinder. If this pressure is greater than the precharge pressure in the accumulator, hydraulic oil flows from the piston end of the cylinder into the accumulator. The cylinder then retracts.

After the shock load, the pressure at the piston end of the cylinder reduces. When the precharge pressure in the accumulator exceeds the pressure in the cylinder, hydraulic oil flows out of the accumulator and into the cylinder. The cylinder then extends to its position before experiencing the shock load.

In oil disc brake applications, accumulators are used to assist braking power. Refer to **Section 13, Oil Disc Brakes and Tandems** in this Shop Manual.



Preventive Maintenance

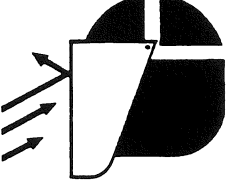
Check accumulators once a month for precharge pressure and signs of damage. Also, check the precharge pressure if an accumulator relieves too easily or requires excessive force to relieve. If you notice a continuous change in the precharge pressure of piston-type accumulators, you must replace the seals. A seal kit P/N 56473 is available. Champion recommends installing all the seals supplied in the kit at the same time.

Checking the Precharge Pressure

Checking the precharge pressure in bladder-type and piston-type accumulators is a similar procedure. For bladder-type accumulators, use charging kit P/N 16042. For piston-type accumulators, use charging kit P/N 56475 and gauge P/N 56474. Apply a light coating of thread sealing compound P/N 19167 onto the gauge connector threads. Install the gauge into the adapter.

NOTE: Accumulators should be at operating temperature when checking the precharge pressure and during the charging procedure.

1. Place the grader in the SERVICE POSITION. Remove the hydraulic tank filler cap to release any pressure and replace the cap loosely.
2. Remove the hydraulic hose from the accumulator. Cap the hose and fitting to prevent contamination.

	WARNING
	Relieve hydraulic system pressure BEFORE disconnecting hydraulic fittings. Pressurized oil spray.
	Always wear face or eye protection when disconnecting hydraulic fittings. Do not operate hydraulic system when accumulator is disconnected.

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3. Before installing the charging kit, turn the bar handle counter-clockwise and fully retract the air chuck stem. Install the air chuck onto the accumulator gas valve and secure with the swivel nut. Close the bleeder valve.
4. Turn the bar handle clockwise until the air chuck stem depresses the core in the accumulator gas valve. Check the precharge reading on the gauge. Refer to **Accumulator Precharge and Maximum Operating Pressures** listed below. Significant temperature differences can occur between the charging temperature and operating temperature. Adjust the precharge pressure using the appropriate cor-

rection factor listed in the **Accumulator Precharge Adjustment Chart** listed below.

- For example, if the precharge temperature is 90°F (33°C) and the expected accumulator operating temperature is 40°F (4°C), the accumulator precharge pressure should be increased by a factor of 1.10, i.e. 400 psi x 1.10 = 440 psi.
- If you anticipate operating temperatures below 30°F (-1°C), make the following correction. For every 10°F drop below 30°F (-1°C), increase the precharge pressure by using the formula:
Precharge minus (precharge multiplied by 520
530)

Accumulator Precharge and Maximum Operating Pressures

Accumulator Location	Accumulator Part No.	Accumulator Precharge Pressure	Accumulator Max. Operating Pressure
Circle shift cylinder	14007 37048 45807 54913	700 psi (48 bar) for all accumulator part numbers in this application	3,000 psi (207 bar) for all accumulator part numbers in this application
Blade lift cylinder	37048 45807	400 psi (28 bar) 400 psi (28 bar)	3,000 psi (207 bar) for all accumulator part numbers in this application
Fixed point blade lift	54913	400 psi (28 bar)	
Moveable point blade lift	54913	700 psi (48 bar)	
Oil disc brakes	24410 45810 45811 54790	500 psi (34 bar) for all accumulator part numbers in this application	2,000 psi (138 bar) for all accumulator part numbers in this application

Accumulator Precharge Adjustment Chart

		Charging Temperature (°F)									
		30	40	50	60	70	80	90	100	110	120
Operating Temperature (°F)	30	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.16	1.18
	40	0.98	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.16
	50	0.96	0.98	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14
	60	0.94	0.96	0.98	1.00	1.02	1.04	1.06	1.08	1.10	1.12
	70	0.92	0.94	0.96	0.98	1.00	1.02	1.04	1.06	1.08	1.09
	80	0.91	0.93	0.95	0.96	0.98	1.00	1.02	1.04	1.06	1.07
	90	0.89	0.91	0.93	0.95	0.96	0.98	1.00	1.02	1.04	1.05
	100	0.88	0.89	0.91	0.93	0.95	0.96	0.98	1.00	1.02	1.04
	110	0.86	0.88	0.89	0.91	0.93	0.95	0.96	0.98	1.00	1.02
	120	0.84	0.86	0.88	0.90	0.91	0.93	0.95	0.97	0.98	1.00

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- For example, at 10°F (-12°C), increase the precharge pressure for a 400 psi accumulator as follows:

$$\begin{aligned} &400 - (400 \times \frac{520}{530}) \times 2 \text{ (i.e. } 30^\circ \text{ less } 2 \times 10^\circ) \\ &= 400 - (392.5) \times 2 \\ &= 15 \\ \text{Precharge pressure} &= 400 + 15 \\ &= 415 \text{ psi} \end{aligned}$$

- Piston-type accumulator precharge pressure can rise if oil gathers on the gas side of the piston. Also, precharge pressure can fall if gas leaks into the oil side of the piston or out past the gas end seals.
- If the precharge reading is below the specified pressure (corrected according to temperature differences), you must charge the accumulator.

Charging the Accumulator



- Connect the hose coupling to a nitrogen bottle.

NOTE: Do not loop or twist the hose as it will stiffen when gas pressure is released from the nitrogen bottle.

- Connect the swivel connector to the adapter and hand tighten to prevent gas leaks. Slowly open the nitrogen bottle valve. Close the valve occasionally to allow the gauge to stabilize and show an accurate reading. When you reach the correct precharge pressure, close the nitrogen bottle valve.
- You can use the bleeder valve to exhaust gas that exceeds the correct precharge pressure.

4M-4

CAUTION

Do not reduce precharge by depressing the valve core of piston-type accumulators. High pressure may rupture the rubber valve seat. Slowly remove the gas valve until gas begins to escape through bleed hole in the valve threads. The hole is a safety feature. It warns of stored pressure whenever the gas valve is being removed. Install a new O ring each time you remove the gas valve.

- Before removing the charging kit, turn the bar handle counter-clockwise and fully retract the air chuck stem. Open the bleeder valve to relieve any gas pressure remaining in the charging kit and hose.
- Prevent the charging kit from turning and loosen the air chuck swivel nut. Remove the charging kit. Use soapy water or fresh system oil to check the accumulator gas valve for leaks.
- Bladder-type accumulators only: If the accumulator gas valve core is leaking, depress it quickly once or twice. You may have to tighten the gas valve core or replace it if leakage persists. Install the Dynaseal. Install the valve guard to finger tightness. Use a wrench and tighten the valve guard another half turn.
- Piston-type accumulators only: Install the accumulator gas valve cap and protector.
- Remove the caps and install the hydraulic hose onto the accumulator fitting.
- Make a visual check around the grader. Signal your intention to start the engine. Start the engine when it is safe to do so and test the accumulator function.
- If you test the blade lift cylinders, lower the moldboard to the ground. Shut down the engine. Check the hydraulic fluid level. If you see any oil leaks, check and tighten all connections. If leakage persists, disassemble the accumulator and replace any faulty parts. The accumulator precharge check and charging procedure is now complete.