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FORD

Series 765 Backhoe

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REPAIR MANUAL

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FOREWORD

This manual contains service procedures for the Series 765 Ford Industrial Backhoe, models 19-800 thru 19-806. Detailed information is given on Description and Operation, Trouble Shooting, Tests and Adjustments, Maintenance, Lubrication and Specifications.

Installation of the basic backhoes, the attaching kits, and the hydraulic kits are not covered in this publication. Refer to the appropriate operating and assembly manuals for installation information.

Each model backhoe is similar in construction and operation. However from model to model, particular attention should be given to the correct model identification when ordering parts or when servicing the unit.

The service procedures in this manual are the most apparent, practical, and efficient methods; however, a procedure may not prove to the most desirable in all situations. Alternate methods are sometimes required, depending upon the tools and equipment available.

Reference to direction in the operation and servicing of the backhoe is made as viewed from the backhoe seat. When ordering parts, left and right are reversed and referenced as facing in the direction of tractor travel.

Keep this manual with your other service material so that it will be readily available when required.

SERVICE DEPARTMENT
FORD TRACTOR OPERATIONS
FORD MOTOR COMPANY

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SAFETY PRECAUTIONS

Practically all service work involves the need to drive the tractor. The Operator's Manual, supplied with each tractor, contains detailed safety precautions relating to driving, operating and servicing that tractor. These precautions are as applicable to the service technician as they are to the operator, and should be read, understood and practiced by all personnel.

Prior to undertaking any maintenance, repair, overhaul, dismantling or reassembly operations, whether within a workshop facility or out "in the field," consideration should be given to factors that may have an effect upon safety, not only upon the mechanic carrying out the work, but also upon bystanders.

PERSONAL CONSIDERATIONS

- The wrong clothes or carelessness in dress can cause accidents. Check to see that you are suitably clothed. Some jobs require special protective equipment.

- **Skin Protection**
  Used engine oil may cause skin cancer. Follow work practices that minimize the amount of skin exposed and the length of time used oil remains on the skin.

- **Eye Protection**
  The smallest eye injury may cause loss of vision. Injury can be avoided by wearing eye protection when engaged in chiseling, grinding, discing, welding, painting, etc.

- **Breathing Protection**
  Fumes, dust and paint spray are unpleasant and harmful. These can be avoided by wearing respiratory proteciton.

- **Hearing Protection**
  Loud noise may damage your hearing and the greater exposure the worse the damage. If you feel the noise is excessive, wear ear protection.

- **Hand Protection**
  It is advisable to use a protective cream before work to prevent irritation and skin contamination. After work clean your hands with soap and water. Solvents such as white spirit, paraffin, etc. may harm the skin.

- **Foot Protection**
  Substantial or protective footwear with reinforced toe-caps will protect your feet from falling objects. Additionally, oil-resistant soles will help to avoid slipping.

- **Special Clothing**
  For certain work it may be necessary to wear flame or acid-resistant clothing.

- Avoid injury through incorrect handling of components. Make sure you are capable of lifting the object. If in doubt get help.

EQUIPMENT CONSIDERATIONS

- **Machine Guards**
  Before using any machine, be sure the machine guards are in position and serviceable. These guards not only prevent body and clothing from coming in contact with the moving parts of the machine, but also ward off objects that might fly off the machine and cause injury.

- **Lifting Appliances**
  Always ensure that lifting equipment, such as chains, slings, lifting brackets, hooks and eyes are thoroughly checked before use. If in doubt, select stronger equipment than is necessary.

  Never stand under a suspended load or a raised implement.

- **Compressed Air**
  The pressure from a compressed air line is often as high as 100 psi (6.9 bar) 7 (kgf/cm^2). It is perfectly safe if used correctly. Any misuse may cause injury.

Never use compressed air to blow dust, filing, dirt, etc., away from your work area unless the correct type of nozzle is fitted.

Compressed air is not a cleaning agent, it will only move dust, etc., from one place to another. Look around before using an air hose as bystanders may get grit into their eyes, ears or skin.

- **Hand Tools**
  Many cuts, abrasions and injuries are caused by defective tools. Never use the wrong tool for the job, as this generally leads either to some injury, or to a poor job.

  Never use

  — A hammer with a loose head or split handle.
  — Spanners or wrenches with splayed or worn jaws.
  — Spanners or files as hammers; or drills, clevis pins or bolts as punches.

  For removing or replacing hardened pins use a copper or brass drift.

  For dismantling, overhaul and assembly of major and sub components, always use the Special Service Tools recommended. They will reduce effort, labor and repair cost.

  Always keep tools clean and in good working order.

- **Electricity**
  Electricity has become so familiar in day to day usage that it's potentially dangerous properties are often overlooked. Misuse of electrical equipment can endanger life.

  Before using any electrical equipment — particularly portable applicances — make a visual check to make sure that the cable is not worn or frayed and that the plugs, sockets, etc., are intact. Make sure you know where the nearest isolating switch for your equipment is located.

GENERAL CONSIDERATIONS

- **Solvents**
  Use only cleaning fluids and solvents that are known to be safe. Certain types of fluids can cause damage to components such as seals, etc., and can cause skin irritation. Use only solvents that are suitable for the cleaning of components and parts, and that do not affect the personal safety of the user.

- **Housekeeping**
  Many injuries result from tripping or slipping over, or on, objects or material left lying around by a careless worker. Prevent these accidents from occurring. If you notice a hazard, don't ignore it — remove it.

  A clean, hazard-free place of work improves the surroundings and daily environment for everybody.

- **Fire**
  Fire has no respect for persons or property. The destruction that a fire can cause is not always fully realized. Everyone must be constantly on guard.

  — Extinguish matches/cigars/cigarettes, etc., before throwing them away.
  — Work cleanly, disposing of waste material into proper containers.
  — Locate the fire extinguishers and find out how to operate them.
  — Do not panic — warn those near and raise the alarm.
  — Do not allow or use an open flame near the tractor fuel tank, battery or component parts.

- **First Aid**
  In the type of work that mechanics are engaged in, dirt, grease, fine dusts, etc., all settle upon the skin and clothing. If a cut, abrasion or burn is disregarded it may be found that a septic condition has formed within a short time. What appears at first to be trivial could become painful and injurious. It only takes a few minutes to have a fresh cut dressed, but it will take longer if you neglect it. Make sure you know where the First Aid box is located.

- **Cleanliness**
  Cleanliness of the tractor hydraulic system is essential for optimum performance. When carrying out service and repairs plug all hose ends and component connections to prevent dirt entry.

  Clean the exterior of all components before carrying out any form of repair. Dirt and abrasive dust can reduce the efficiency and working life of a component and lead to costly replacement. Use of a high pressure washer or steam cleaner is recommended.

OPERATIONAL CONSIDERATIONS

- Stop the engine, if at all possible, before performing any service.
- Place a warning sign on tractors which, due to service or overhaul, would be dangerous to start. Disconnect the battery leads if leaving such a unit unattended.
- Do not attempt to start the engine while standing beside the tractor or attempt to by-pass the neutral start switch.
- Avoid prolonged running of the engine in a closed building or in an area with inadequate ventilation as exhaust fumes are highly toxic.
- Always turn the radiator cap to the first stop to allow pressure in the system to dissipate when the coolant is hot.
- Never work beneath a tractor which is on soft ground. Always take the unit to an area which has a hard working surface — concrete for preference.
- If it is found necessary to raise the tractor for ease of servicing or repair, make sure that safe and stable supports are installed beneath axle housings, casings, etc., before commencing work.
- Use footsteps or working platforms when servicing those areas of the backoe that are not within easy reach.
- Before loosening any hydraulic hoses or tubes be sure the engine is shut off and all residual hydraulic pressure is removed by operating each of the control levers several times.
- Be sure that all of the hydraulic components are resting firmly on solid ground before disconnecting any hoses or tubes.
- Prior to pressure testing, make sure all hoses and tubing connectors are in good condition and tightly sealed. Pressure readings must be taken with the gauges specified. The correct procedure should be rigidly observed to prevent damage to the system or equipment and to eliminate the possibility of personal injury.
- Always lower the backhoe to the ground when leaving the tractor.
- When transporting or driving the tractor and backhoe, be aware of overhead power lines, telephone cables and bridge clearance.
- Do not park or attempt to service the tractor or backhoe unit on an incline. If unavoidable, take extra care and block all wheels.
- When inflating tires beware of over inflation—constantly check the pressure. Over inflation can cause tire to burst and result in personal injury.
- Escaping hydraulic/diesel fluid under pressure can penetrate the skin causing serious injury. Do not use your hand to check for leaks. Use a piece of cardboard or paper to search for leaks. Stop the engine and relieve the pressure before connecting or disconnecting oil lines. Tighten all connections before starting the engine or pressurizing the lines. If fluid is injected into the skin, obtain medical attention immediately or gangrene may result

Safety precautions are very seldom the figment of someone's imagination. They are the result of sad experience, where most likely someone has paid dearly through personal injury.

Heed these precautions and you will protect yourself accordingly. Disregard them and you may duplicate the sad experience of others.

SERVICE TECHNIQUES

A. SERVICE SAFETY

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all machinery as well as the personal safety of the individual doing the work. This Shop Manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. This Manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this Manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

B. SERVICE TECHNIQUES

Clean the exterior of all components before carrying out any form of repair. Dirt and abrasive dust can reduce the efficient working life of a component and lead to costly replacement.

Time spent on the preparation and cleanliness of working surfaces will pay dividends in making the job easier and safer and will result in overhauled components being more reliable and efficient in operation.

Use cleaning fluids which are known to be safe. Certain types of fluid can cause damage to 'O' rings and cause skin irritation. Use solvents that are suitable for cleaning components and do not risk the personal safety of the user.

Replace 'O' rings, seals or gaskets whenever they are disturbed. Never mix new and old seals or 'O' rings, regardless of condition. Always lubricate new seals and 'O' rings with hydraulic oil before installation.

When replacing component parts use the correct tool for the job.

HOSES AND TUBES

Always replace hoses and tubes if the end connections are damaged.

When installing a new hose loosely connect each end and make sure the hose takes up the designed position before tightening the connection. Clamps should be tightened sufficiently to hold the hose without crushing and to prevent chafing.

The hoses are the arteries of the unit; be sure they are in good condition when carrying out repairs or maintenance, otherwise the machine's output and productivity will be affected.

After hose replacement to a moving component be sure the hose does not foul by moving the component through the complete range of travel.

Be sure any hose which has been installed is not kinked or twisted.

Hose connections which are damaged, dented, crushed or leaking restrict oil flow and the productivity of the components being served. Connectors which show signs of movement from the original swaged position have failed, and will ultimately separate completely.

A hose with a chafed outer cover will allow water entry. Concealed corrosion of the wire reinforcement will subsequently occur along the hose length with resultant hose failure.

Ballooning of the hose indicates an internal leakage due to structural failure. This condition rapidly deteriorates and total hose failure soon occurs.

Kinked, crushed, stretched or deformed hoses generally suffer internal structural damage which can result in oil restriction, a reduction in the speed of operation and ultimate hose failure.

Free-moving, unsupported hoses must never be allowed to touch each other or related working surfaces. This causes chafing which reduces hose life.

BEARINGS

Bearings which are considered suitable for further service should be cleaned in a suitable solvent and immersed in clean lubricating oil until required.

Installation of a bearing can be classified in two ways: press fit on rotating parts such as shafts and gears, and push fit into static locations such as reduction gear housings. Where possible, always install the bearing onto the rotating component first.

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DESCRIPTION AND OPERATION

DESCRIPTION AND OPERATION

GENERAL

The Ford 765 Backhoe consists of a main frame, swing post, cylinders, boom, dipstick, hoses and tubing, control valves and controls, bucket and attaching hardware. Refer to Figure 1 for locaion of the components. Power for the backhoe is supplied by a hydraulic pump mounted on the tractor.

All dimensions of the backhoe are measured in metrics. This includes bolts, nuts, washer, pivot pins, structural components and cylinders. However, tubing, hose connections and control valve components are of standard size.

PUMP

The hydraulic pump is located at the front of the engine and is driven by the engine crankshaft. Information covering the pump service procedures is explained in the appropriate loader service manual.

MAIN FRAME

The main frame is of welded construction. Internally it houses the swing cylinder and main control valve. Externally it supports the control tower, stabilizers and the swing post. The swing post and stabilizers are secured by means of pins.

The front of the main frame is open, which allows access to the main control valve, system and circuit relief valves and hose connections. The swing cylinders can be removed from the rear of the main frame without removing the unit from the tractor.

Access panels are located on the top of the main frame to permit access to the control valve tubes, hoses and valves. The main control valve can also be removed from the main frame by removing the access panels and control tower.

STABILIZERS

Stabilizers are attached to the lower right and left side of the backhoe main frame to level the unit and maintain stability during operation. Stabilizer spread is 10 feet (304.8 cm) while working and 7 feet 1 inch (215.9 cm) in transport. Each stabilizer is controlled by a cylinder which is actuated by a control lever.

A new stabilizer control valve section containing cylinder port shut off valves was incorporated in the six spool backhoe control valves effective on October 1, 1985 backhoe production. The seven spool control valves (extendible dipstick) incorporated the lock-out valves November 1, 1985.

The function of the new stabilizer valve section is to provide a positive shut-off between the cylinder ports and the control valve spool when the valve spool is in the neutral position. The shut-off valves are hydraulically activated to open the valve ports when the spool is moved to raise or lower the stabilizers and spring loaded to close off the ports when the control valve is in neutral. The tractor must be running to provide hydraulic power to either raise or lower the stabilizers.

Pads attached to the stabilizer ends support the backhoe and provide stability. A variety of pads are available for various ground requirements.

In transport, the stabilizers are secured in the raised position by chains to prevent accidental lowering.

SWING POST

The swing post is a one-piece casting incorporating replaceable bushings and bushing seals at the lift cylinder pivot point.

The swing cylinder rod ends are attached to the swing post by means of pins.

BOOM

The boom frame is of reinforced, welded, tapered box construction. It supports the tubing for the crowd, bucket and extendible dipstick cylinders. It also supports the rod end of the lift cylinder and the piston end of the crowd cylinder at a common attaching point. The boom also utilizes replaceable bushings and bushing seals at the swing post-to-boom pivot.

A boom transport lock (13), Figure 1, (14 ft. and 15 ft. only) is used to lock the boom in an up position and prevent it from swinging during transport.

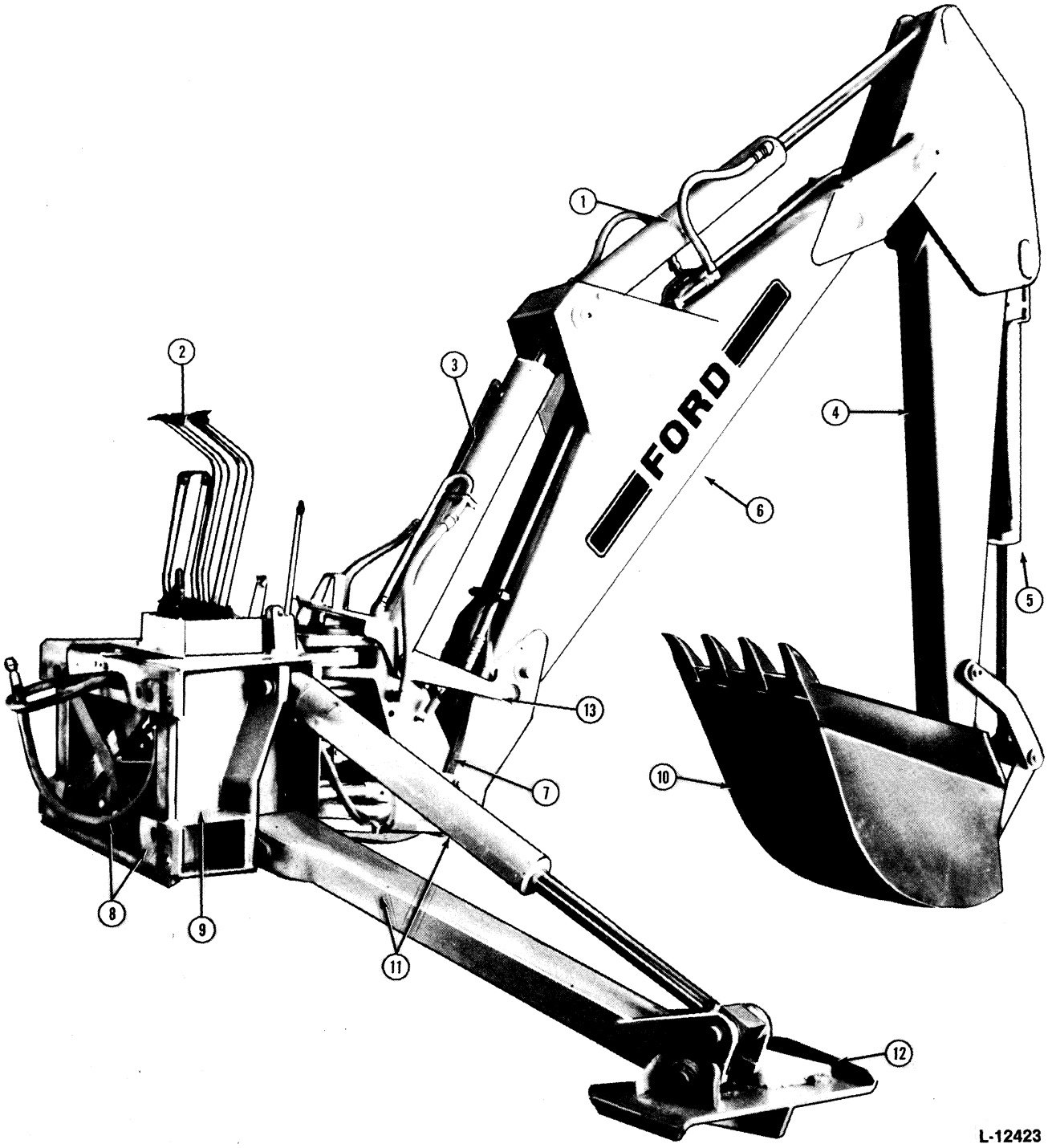

Figure 1
Backhoe Components

1. Crowd Cylinder
2. Controls — Four Lever
3. Lift Cylinder
4. Dipstick
5. Bucket Cylinder
6. Boom
7. Swing Post
8. Swing Cylinder
9. Main Frame
10. Bucket
11. Stabilizer and Stabilizer Cylinder
12. Stabilizer Pad — Standard
13. Boom Transport Lock

DIPSTICKS

Both the standard and extendible dipsticks (3 and 4 ft. sizes) are of reinforced, welded, tapered and box type construction, respectively. They both support the bucket cylinder and the rod end of the crowd cylinder. In addition, they utilize replaceable bushings and bushing seals at the boom-to-dipstick pivot and at the bucket and bucket idler link pivots.

The extendible dipstick increases the digging depth capability. This is accomplished by using telescoping components controlled by a cylinder housed in the components. The cylinder is controlled by a foot pedal on the operator's platform next to the control tower. Also, the telescoping components utilize replaceable wear plates.

BUCKETS

Buckets are of welded construction and have replaceable bushings and teeth. Bushings are utilized in all pivot pin locations. Bucket tooth points are available in standard or heavy duty points as desired. Repositioning the bucket links permits maximum bucket curl for straight wall digging or maximum bucket power.

HYDRAULIC CYLINDERS

Reference — Figures 2 and 3

All backhoe cylinders are double acting, designed to extend and retract under hydraulic pressure. Piston rods are die drawn, high tensile strength steel. The rods are hardened, turned, ground polished and chrome plated. Cylinder barrels are skived and burnished to close tolerance, straightness and smooth finish for long piston packing life.

All cylinders, with the exception of the backhoe stabilizer and extendible dipstick cylinders, have bushed barrel and rod pivots. Grease retention seals are fitted to the backhoe bucket, crowd, lift and swing cylinders.

All cylinder pistons utilize a one piece, steel piston with either one or two glass-filled, nylon bonded coating strips on the outer diameter to prevent metal-to-metal contact with the cylinder barrel. Sealing is accomplished by the use of a piston ring assembly consisting of two ring seals, on over the other. The bottom or inner seal is soft rubber and has pre-determined side play within the ring groove. When the cylinder is pressurized, oil acts on the seal and expands it against the outer, rigid, glass-filled seal, forcing it outward against the barrel wall and against the piston groove, assuring efficient sealing with minimum friction.

Backhoe cylinder rod gland sealing is accomplished on all cylinders by chevron packings and a urethane wiper seal. The packing gland supports and retains the rod packing, bearing sleeve, rod wiper and gland "O' ring and back-up ring. All backhoe cylinders have threaded retention of the gland carrier.

SWING CYLINDERS

The backhoe boom and digging elements can be moved in an arc of 180° about the main frame.

This movement is obtained by the use of two interconnected hydraulic cylinders coupled between the main frame and the swing frame, see Figure 4.

The cylinders act directly on the swing frame, without the use of connecting links or bellcranks.

Each cylinder incorporates a headstock consisting of two large trunnions which pivot in the main frame, Figure 5.

The backhoe boom and digging elements can be rotated in an arc of 180° about the main frame. This movement is accomplished by the use of two interconnected hydraulic cylinders coupled between the main frame and the swing post, Figure 4. The cylinders are mounted in the main frame and the cylinder rods attach directly to the swing post. Each cylinder incorporates a headstock (1), Figure 5, consisting of two large trunnions which pivot in the main frame.

As each cylinder extends or retracts and the swing post rotates, the cylinders turn in a horizontal plane pivoting on the trunnions within the main frame as shown, Figure 4.

Each swing cylinder is double acting and each cylinder piston end is connected hydraulically to the rod end of the mating swing cylinder. Consequently, as hydraulic oil is fed to a cylinder to turn the swing post, one cylinder pushes on one side of the post while the opposite cylinder pulls on the other side of the post.

One section of the backhoe multi-section control valve is used to supply oil to the swing cylinders.

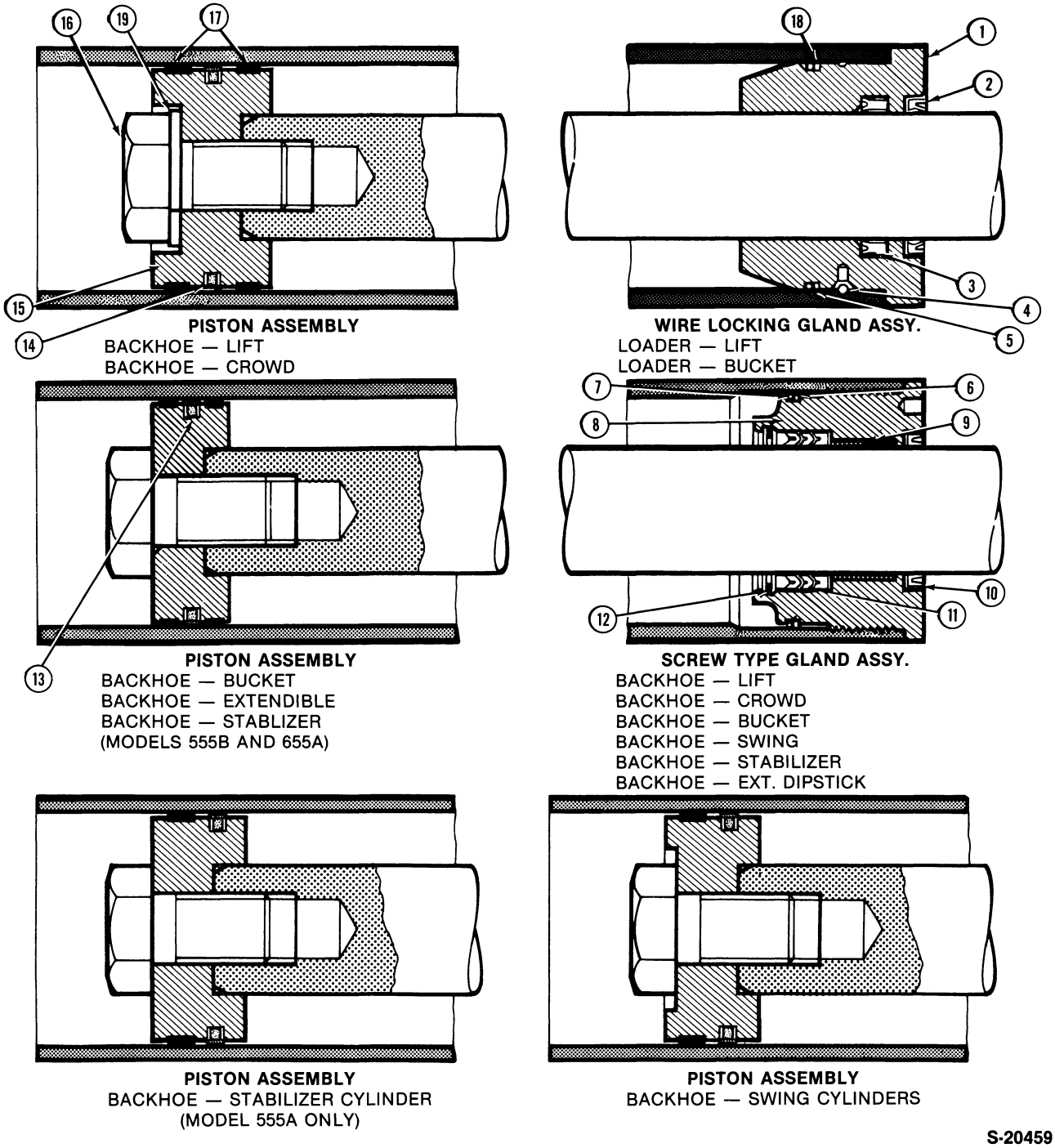

Figure 2
Cylinder Gland and Piston Types

1. Wire Type Gland
2. Wiper Seal
3. Gland Seal
4. Locking Wire
5. O-Ring Seal
6. Back-up Ring
7. O-Ring Seal
8. Screw Type Gland
9. Bearing
10. Wiper Seal
11. Chevron Pack Seal
12. Snap Ring
13. Inner Soft Back-up Seal
14. Outer Stiff Piston Seal
15. Piston
16. Piston Retaining Bolt
17. Wear/Bearing Ring
18. Back-up Ring
19. Washer

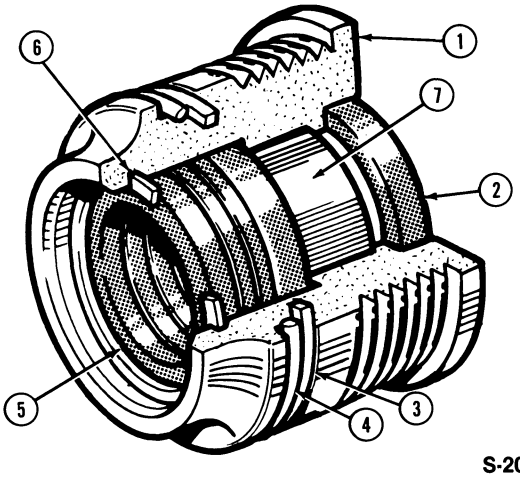

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Figure 3
Threaded Type Gland Assembly
(All Backhoe Cylinders)

1. Gland Carrier
2. Wiper Seal
3. Back-up Ring
4. O-Ring Seal
5. Chevron Seal Pack
6. Snap Ring
7. Bearing

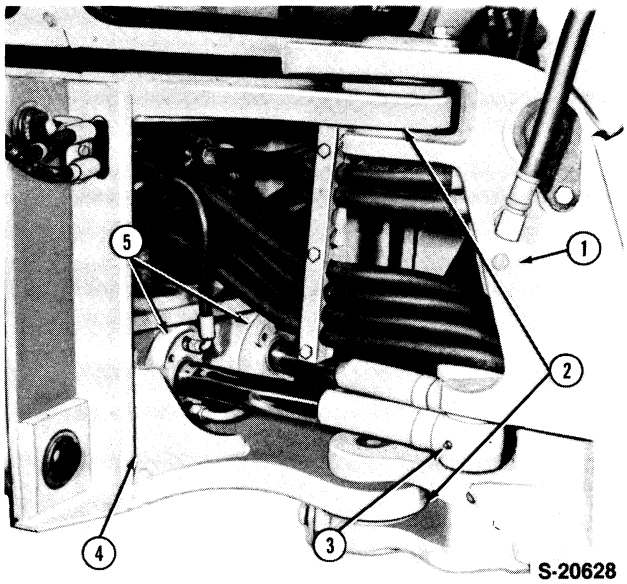

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Figure 4
Swing System

1. Swing Post
2. Pivot
3. Cylinder Rod and Pin
4. Main Frame
5. Swing Cylinders

The swing hydraulic circuit contains conbined circuit relief an anti-cavitation valves. The operation of these valves, cylinders and cushioning devices are described in the " BACKHOE MAIN CONTROL VALVE" section.

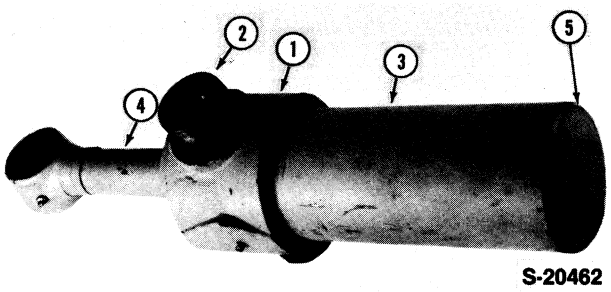

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Figure 5
Swing Cylinder Assembly

1. Trunnion
2. Trunnion Bushing
3. Cylinder Barrel
4. Cylinder Rod
5. End Plug

The swing cylinders each contain a sliding restrictor that slows the swing operation by reducing the oil flow when the cylinder is nearing the end of its stroke.

SWING CYLINDER — OIL FLOW

Reference — Figure 6

Figure 6 shows swing cylinder oil flow during normal left hand swing operation.

High pressure oil enters the left swing cylinder on the rod side of the piston through line (4) to retract the cylinder. High pressure oil is simultaneously directed to the piston side of the right hand cylinder causing it to extend. Oil being exhausted from the piston side of the left hand cylinder flows into the rod side of the piston on the right hand cylinder after having passed through a line restrictor (2) located in the headstock of the right hand cylinder. Oil in the rod side of the rigid hand cylinder then flows unrestricted to the main control valve and returns to sump through line (5). The restricted oil passage in the line restrictor (2) in the return oil circuit determines the speed of swing and provides a smooth, controlled swing at optimum speed.

As the cylinder approaches maximum travel in the retracting cycle, Figure 7, the sliding restrictor (5) comes in contact with the outlet port in the end of th cylinder to restrict the flow of oil and automatically slow the rate of cylinder rod retraction. This restrictor slides in the piston retaining bolt which is bored to accept the restrictor and its return spring.

Oil leaving the cylinder at this point is restricted as the head of the restrictor covers the port and oil can now escape only by flowing through a small drilling in the head of the sliding restrictor.

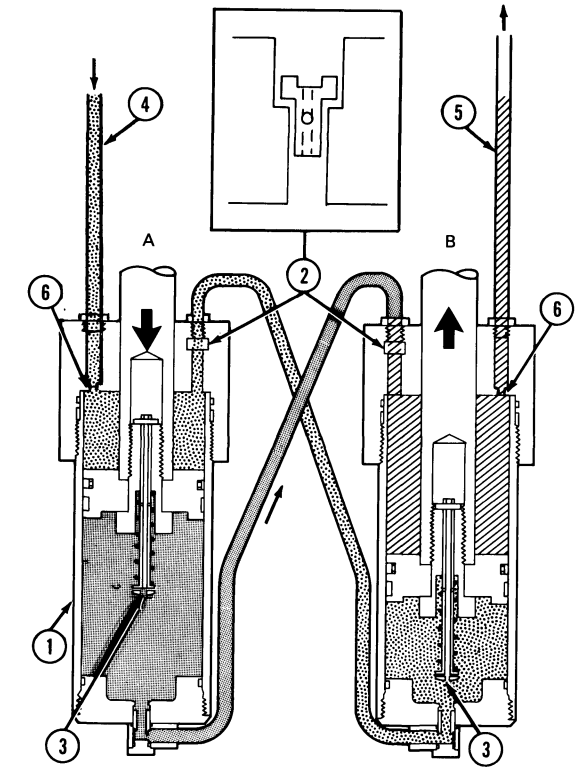

Figure 6
Swing Cylinder Oil Flow — Left Swing

1. Cylinder Assembly
2. Line Restrictor
3. Sliding Restrictor
4. High Pressure Line From Control Valve
5. Exhaust Oil Return Line to Control Valve
6. Orifice

The position of the sliding restrictor in the piston bolt is such that when subjected to oil flow in the reverse direction, as when extending the cylinder, the restrictor is lifted off its seat against the return spring and oil flows into the cylinder unrestricted. The restrictor has sufficient movement for its stem to move into the cylinder rod to fully open the oil passage.

MAIN CONTROL VALVE

GENERAL

The main control valve, Figure 8, is a stack type assembly consisting of six sections when a standard dipstick is used and seven sections when the extendi-

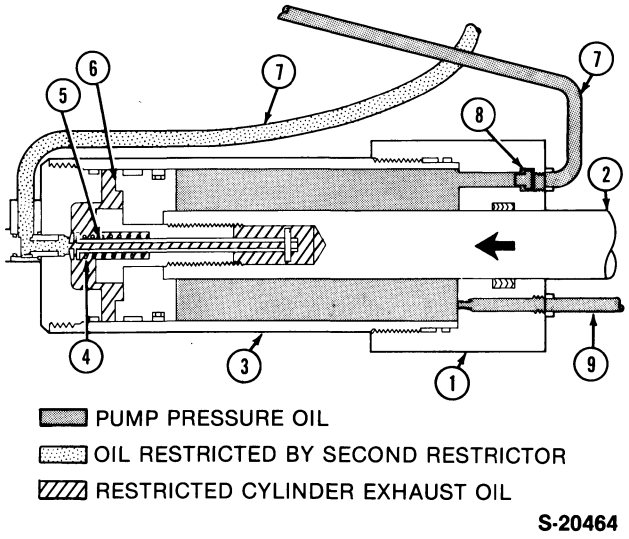

Figure 7
Swing Cylinder Cushioning Operation

1. Headstock Gland Carrier
2. Cylinder Rod
3. Cylinder Barrel
4. Spring — Slide Restrictor
5. Sliding Restrictor
6. Piston
7. External Tube to Opposite Swing Cylinder
8. Line Restrictor
9. Tube to Main Control Valve

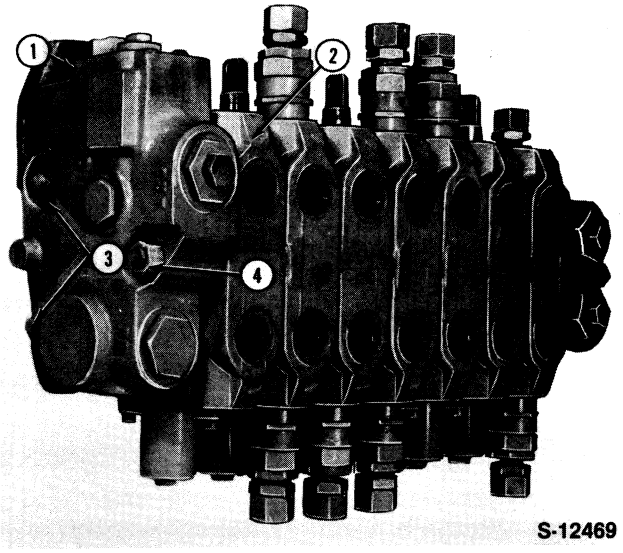

Figure 8
Control Valve Assembly

1. Outlet End Cover
2. Stabilizer Section
3. Tie Rod — 7/16-20"
4. Tie Rod — 1/2-20"

ble dipstick feature is used. In either case, the sections contain spring centered, manually operated control spools which direct high pressure pump oil to the individual cylinder circuits. Each circuit contains a spring loaded check valve to check the flow from either cylinder port to the valve pressure passage. The check valves are located between each section and not externally accessible unless the sections are separated, Figure 9. Also, each section except the two stabilizer sections contain adjustable circuit relief valves to protect their respective cylinders against pressure overloading during actual digging operations. The stabilizer sections have a pilot operated lockout to reduce by-passing at the plunger. All circuit relief valves except the lift cylinder rod end circuit incorporate a anti-cavitation valve component to prevent cylinder voiding.

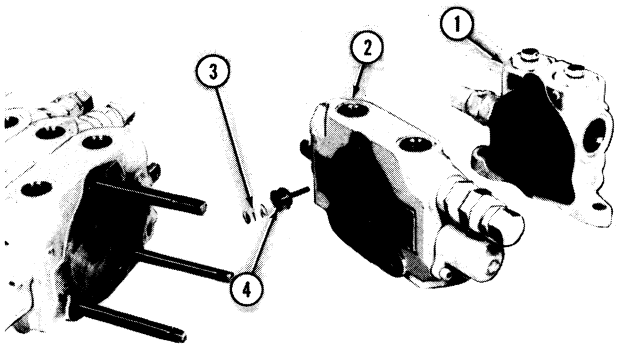

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Figure 9
Control Valve Section Removed — Showing Load Check Valve

1. Inlet End Cover
2. Spool Section
3. Check Valve Spring
4. Load Check Valve

The main control valve is also equipped with an inlet and outlet cover. The inlet end cover contains the inlet port and system relief valve.

On 12 ft. and 14 ft. backhoes the outlet cover contains outlet and power beyond ports.

On the 15 ft. backhoe the outlet end cover also contains a back pressure relief valve, an unload valve and a regenerative valve. The function and operation of the backhoe control valve components is described under the appropriate headings in this section.

CONTROL VALVE SPOOL — FUNCTION AND OPERATION

NEUTRAL-OPEN CENTER: Figure 10 illustrates the lift circuit valve section in the "neutral" condition. However, all other circuit sections have the same internal passages. Oil enters the control valve section through the inlet port in the inlet end cover. This pump oil, Figure 10, is diverted in the inlet end cover to the open center passages (A), (B) and (C) and also to the high pressure passage (D). The high pressure passage goes through all the valve sections and ends at the outlet end cover.

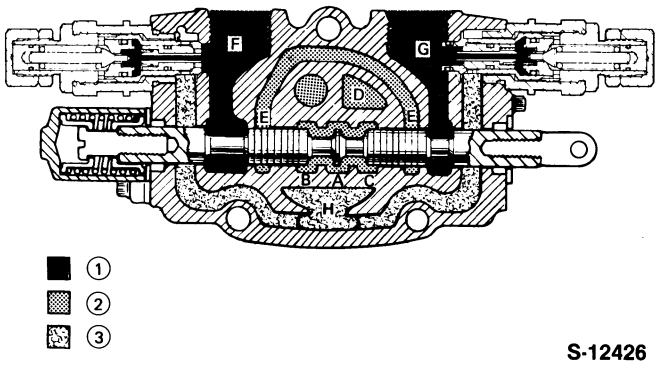

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Figure 10
Lift Control Valve — Neutral Position

1. Static Oil
2. Pump Pressure
3. Return-to-Sump

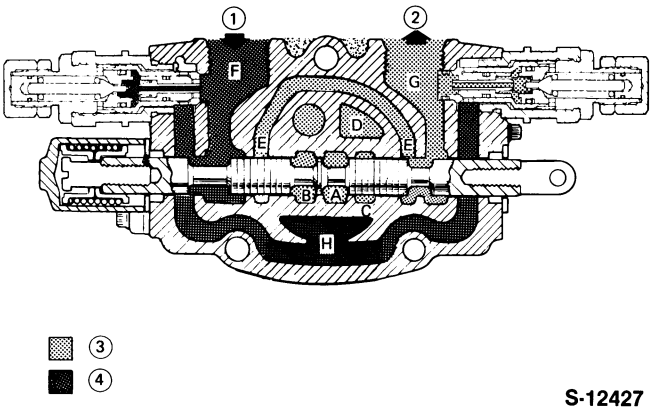
On the 15 ft. backhoe, oil flow in the opposite direction (from the outlet end cover) is possible due to the regenerative feature. As long as the spools remain in the neutral position, oil in the high pressure passage (D) is static and at system pressure.

The oil flowing through the open center passages (A), (B) and (C) continue through each valve section and to the outlet end cover. It leaves the control valve through the power-beyond port in the outlet end cover.

Oil in the cylinder ports (F) and (G) is static as it is trapped between the cylinder and control valve spool as long as the spool remains in the neutral position.

Oil in the return oil passage (H) is residual oil discharged from the spool circuit relief valves, system relief valve, or backhoe cylinders.

SPOOL ACTIVATED: Figure 11 illustrates the lift circuit valve in the "raise" condition. Other valve sections are similar.



S-12427

Figure 11
Lift Control Valve — Raise Position

1. From Lift Cylinder Piston End
2. To Lift Cylnder Rod End
3. Pumped Oil
4. Return Oil

Oil entering the control valve exerts equal pressure in the high pressure passage (D) and the open center passage (A), (B) and (C). When the spool is positioned to raise the boom (moved to the left as shown in Figure 11), flow is restricted through the open center.

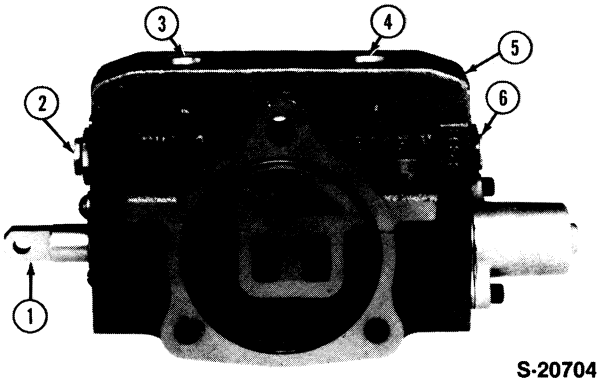
The pumped oil, tending to follow the path of least resistance, diverts to the high pressure passage (D) where it unseats the check valve and flows into passage (E), around the spool into port (G) and on to the rod end of the lift cylinder. As a result, oil is forced from the piston end of the lift cylinder into port (F) of the control valve where it flows around the spool and into the return oil passage (H). The return oil flows through passage (H) to the outlet end cover. When the return oil reachs the outlet end cover, it will contact the four regenerative valves which interact to prevent a moving cylinder from voiding by using return oil for regeneration as required. If the control valve spool is moved to the oppposite position, a reversal of the oil flow takes place. The check valve closes when oil flow stops.

CONTROLLED FEATHERING ACTION: The spool in each section is designed to provide controlled oil flow to the cylinders. Each land has four small notches. As the spool is moved, the notches meter a small amount of oil, slowly pressurizing the system before the entire land uncovers the passage and allows full flow. Easing the spool through its first stage of travel provides the pinpoint movement needed for accurate control.

CYLINDER CIRCUIT CHECK VALVE: The spring loaded check valve (4), Figure 9, prevents the cylinders from dropping under load. The check valve functions when the spool is initially moved from the neutral position and before the pump has time to build sufficient pressure to overcome the external load.

STABILIZER CONTROL VALVE

The stabilizer control valve sections, Figure 12, with cylinder port shut-off valves was incorporated in standard six spool backhoe production on October 1st, 1985.



S-20704

Figure 12
Stabilizer Control Valve Section
(with Port Shut-Off Valves)

1. Control Valve Spool
2. Shut-Off Valve Assembly—Cylinder Rod End
3. Port to Cylinder Rod End
4. Port to Cylinder Piston End
5. Stabilizer Control Valve Assembly
6. Shut-Off Valve Assembly—Cylinder Piston End

The seven spool main control valve (extendible dipstick) incorporated the shut-off valves November 1, 1985.

The function of the shut-off valves is to close the ports between the control valve and stabilizer cylinders when the valve spool is in the neutral position.

The shut-off valves (1) and (2), Figure 13, are power activated hydraulically to open when the control valve spool is moved to raise or lower the stabilizers, and spring loaded to close off the ports when the control valve spool is in neutral.

To protect the stabilizer cylinder components, the shut-off valve on the cylinder rod port side (1), Figure 14, has a small built-in high pressure relief valve (2), Figure 14. The relief valve is pre-set to open and relieve excess pressure build-up during backhoe operation.

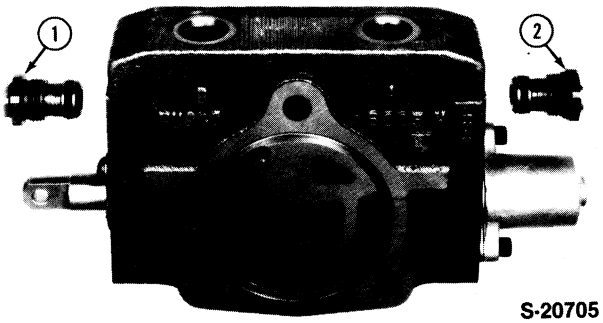


Figure 13
Stabilizer Control Valve

1. Shut-Off Valve
2. Shut-Off Valve

It is also a thermal relief valve to relieve excess pressure due to oil expansion when the cylinder is retracted.

The high pressure relief valve is non-adjustable and preset at the factory to open between 3500 and 4500 psi.

The shut-off valve located in the stabilizer piston end port (3), Figure 14, consists of a valve body, poppet, spring and cap.

IMPORTANT: *If both shut-off valve assemblies are removed for service inspection at one time, be sure the shut-off valve with the built-in high pressure relief is installed in the control valve spool eye end to protect the stabilizer cylinder components.*

Two small shuttle spools (4), Figure 14, react under pressure to open the shut-off valve on the return side port, so low pressure oil can be returned to sump from the stabilizer cylinder. This action takes place while the stabilizer cylinder is raising or lowering.

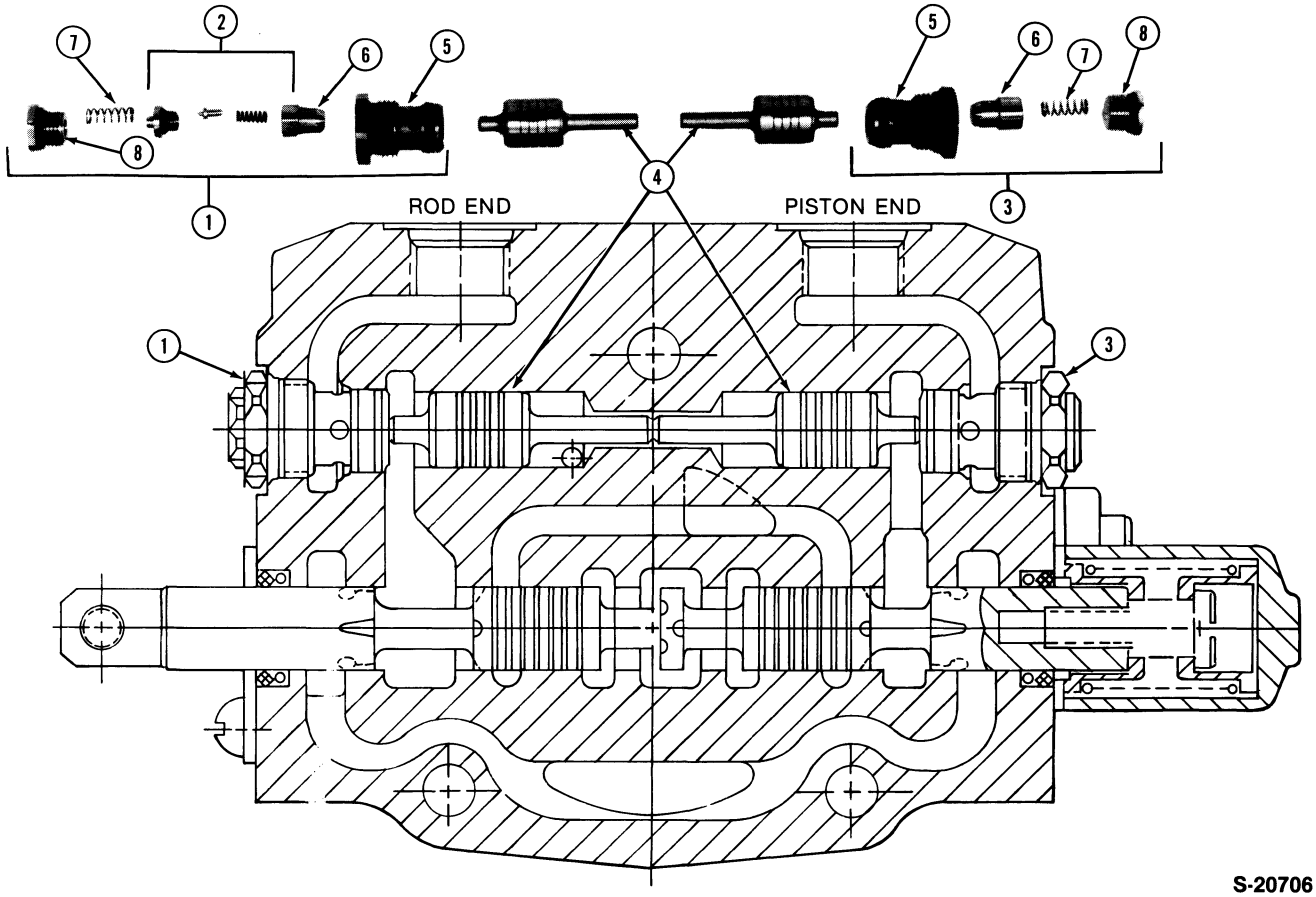


Figure 14
Stabilizer Control Valve

1. Shut-Off Valve — Rod End
2. High Pressure Relief Valve
3. Shut-Off Valve — Piston End
4. Shuttle Spool (2)
5. Body (2)
6. Poppet (2)
7. Spring (2)
8. Plug (2)

IMPORTANT: *The action of the stabilizer cylinder shut-off valves do not affect any of the other hydraulic circuits — lift, crowd, bucket or swing. To move the stabilizer cylinders with the new shut-off valves, the tractor must be running and the hydraulic pump delivering pressurized oil to the backhoe control valve.*

INLET END COVER: The inlet end cover, Figure 15, contains the main oil flow inlet port and the system relief valve which serves to protect the hydraulic pump against excessive high pressures which could be generated when, for example, a cylinder reaches the end of its stroke.

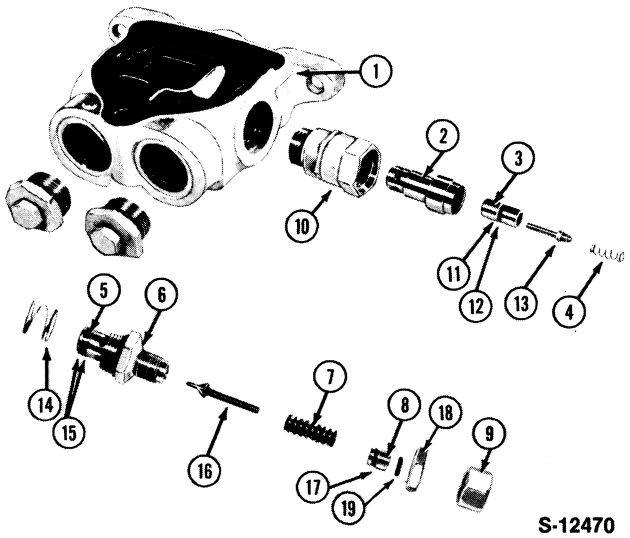


Figure 15
Inlet End Cover (System Relief Valve Typical to Circuit Relief Valves Except Lift Rod End)

1. Inlet End Cover
2. Sleeve Poppet
3. Poppet
4. Spring
5. O-Ring
6. Fitting
7. Spring
8. Adjusting Pin
9. Adjusting Cap
10. Body
11. Back-up Ring
12. O-Ring
13. Piston
14. Spring
15. Back-up Rings
16. Pilot Poppet
17. O-Ring
18. Lock Nut
19. Shims

OUTLET END COVER 12 and 14 ft. backhoe: The outlet end cover contains the return oil port, which returns low pressure oil to the reservoir and the power beyond port which supplies high pressure oil to the loader circuit. Therefore, all pumped oil is routed through the back main control valve before it reaches the loader circuit.

OUTLET COVER — 15 Ft. BACKHOE

(Models 19-805 and 19-806)

The 15 ft. backhoe outlet cover in addition to the return oil port and power beyond, also contains three additional valves; a backpressure relief valve (4), a regenerative valve (6) and a unload valve (5) as shown in Figures 16 and 17.

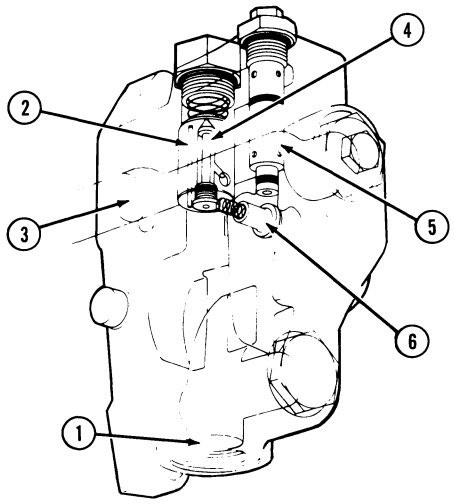


Figure 16
Outlet End Cover (15 Ft. Backhoe)

1. Power Beyond Outlet To Loader
2. Backpressure Valve
3. Outlet Port to Reservoir
4. Backpressure Relief Valve
5. Unload Valve
6. Regenerative Valve

These three valves operate only when a backhoe cylinder is being moved and return oil is being exhausted from the cylinder. The conditions under which the cylinder may be operated will determine which of the valves will function and is described as follows:

NOTE: *These three valves are not used in the 12 ft. and 14 ft. backhoe control valve.*

REGENERATIVE CHECK VALVE: The regenerative check valve, Figure 18, functions when a "fast drop" condition exists, when the system pressure becomes less than the sump pressure, such as rapid dropping of the boom.

NOTE: *The regenerative check valve enters the cover from the side.*

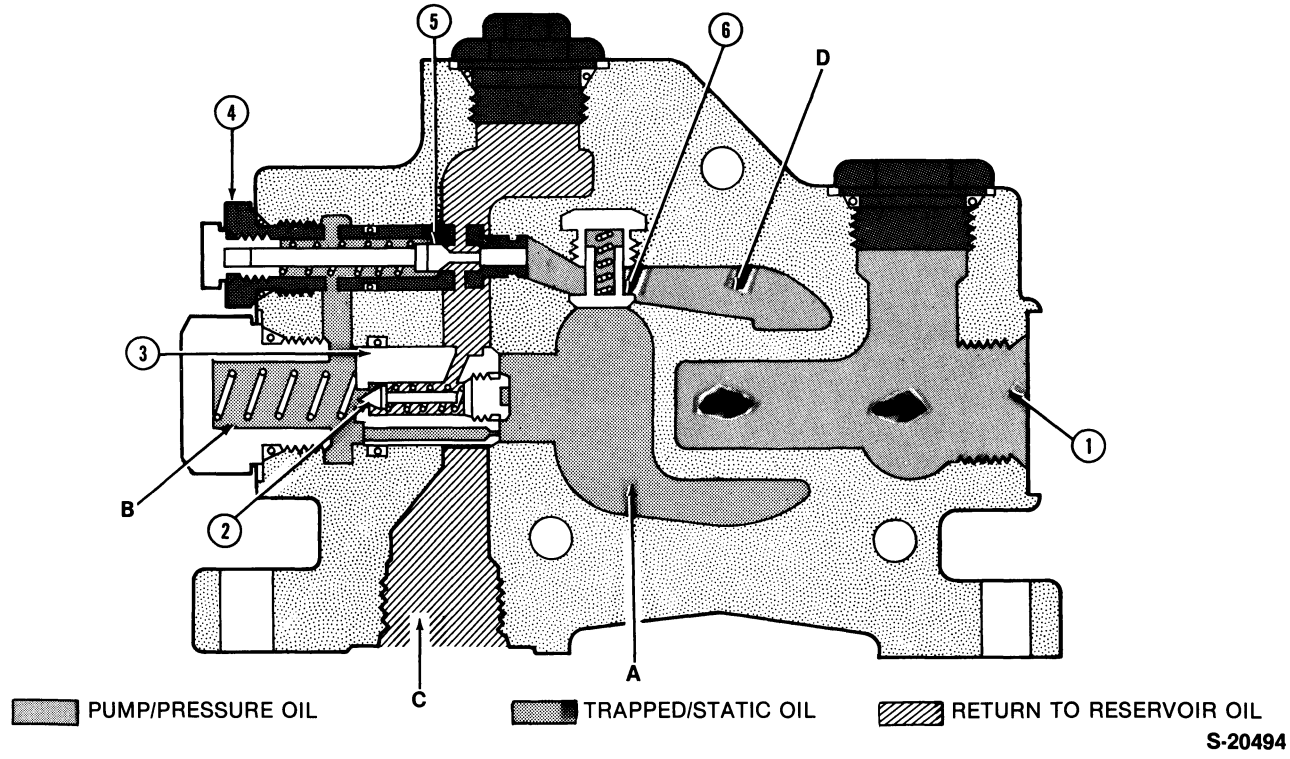


Figure 17
Outlet End Cover — Neutral Position

1. Power Beyond Port
2. Backpressure Pilot Valve
3. Backpressure Valve
4. Unload Valve Body
5. Unload Valve
6. Regenerative Valve

A. Exhaust Oil Gallery
B. Unload Valve Backpressure Oil
C. Return to Reservoir Port
D. Static Oil Passage

In the "fast drop" condition, for example when digging elements are lowered rapidly into a trench, the lift cylinder piston end is being supplied with pump oil flow, but the demand is so great that if engine speed is not at maximum or the control lever is not feathered, the pump will be unable to maintain the cylinder piston end full of oil and will cause a void. In this instance the high pressure passage D, Figure 18, has droppped to a pressure level lower than that in the exhaust gallery A. The now higher pressure level of gallery A is able to lift the regenerative check valve off its seat against the light retaining spring and allow oil to transfer from the exhaust gallery A into the high pressure gallery D and in effect allows oil to transfer from the rod end of the lift cylinder to the piston end, complementing the pump supply.

Under normal power operations the high pressure in gallery D keeps the regenerative check valve closed.

BACKPRESSURE VALVE

Reference — Figure 19

In the "no load" or "light load" condition the backpressure valve provides backpressure of 250 psi (17.5 bar) in the exhaust gallery A, which is in addition to the natural backpressure in the return to reservoir line. When a cylinder is operated the returning or cylinder exhaust oil passes from the control valve spool section to the exhaust gallery A. It cannot pass unrestricted to the reservoir return port C without opening the backpressure valve. The valve requires 250 psi (17.5 bar) differential pressure to open it and therefore creates the backpressure.

This backpressure is used to complement the function of the regenerative check valve, provide more positive cylinder control and aid the anti-cavitation function of

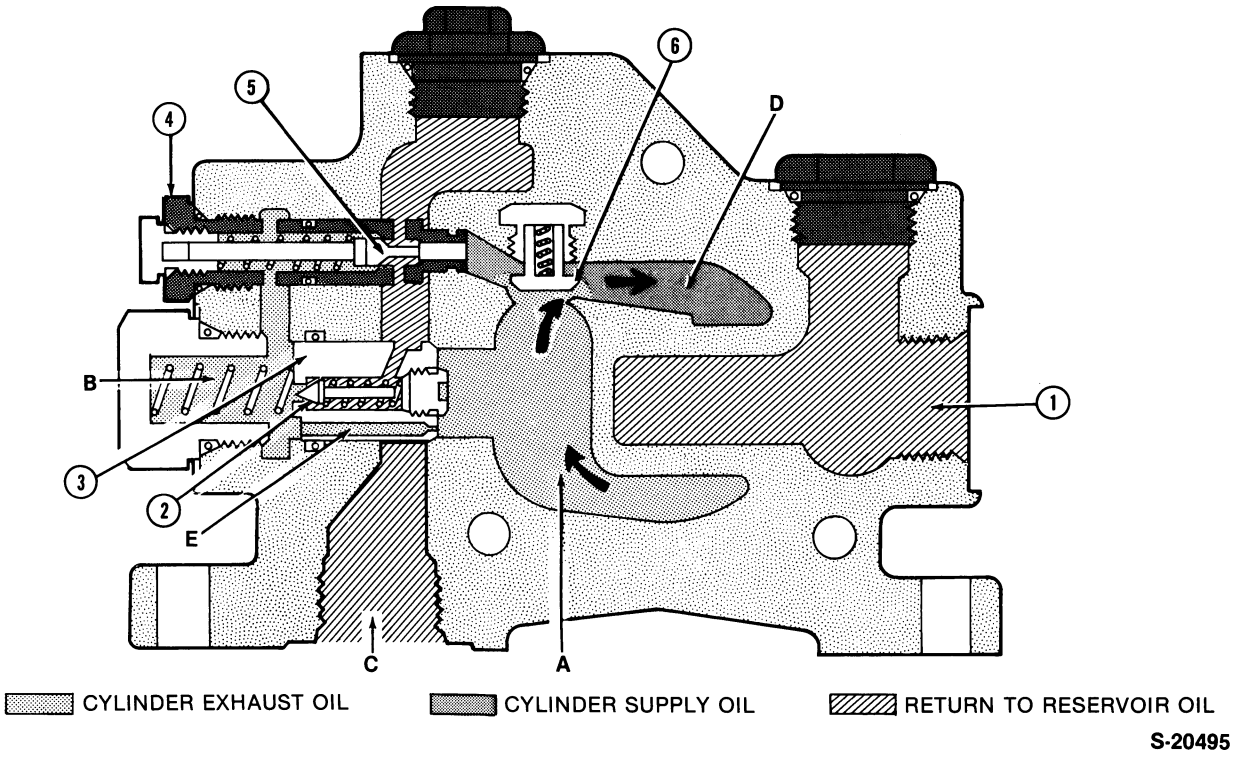


Figure 18
Regenerative Check Valve Operation

1. Power Beyond Tube
2. Backpressure Pilot Valve
3. Backpressure Valve
4. Unload Valve Body
5. Unload Valve
6. Regenerative Check Valve

A. Exhaust Oil Gallery
B. Unload Valve Backpressure Oil
C. Return to Reservoir Port
D. Static Oil Passage

the circuit relief valves under certain conditions. The backpressure valve opening operation is controlled by a pilot relief valve (2) (backpressure relief valve) and functions as follows:

Exhaust oil in gallery A initially acts on the face of the backpressure valve (3) which is held on its seat by a spring (7). Oil is bled through orifice E in the back-pressure valve to the rear of the valve and, due to similar surface areas, equalizes the pressure differential, the spring maintaining the valve in the closed position.

As the pressure of the totally restricted oil flow rapidly increases, the oil acting on the face of the pilot valve (2) overcomes the pilot valve spring and escapes into the return to reservoir port C.

This small oil flow upsets the pressure equalization and allows the pressure acting on the face of the valve (3) to move the valve to the left and open up the exhaust gallery A to the return to reservoir port C, Figure 19. The backpressure is maintained at this high level until the pressure in the high pressure gallery D reaches 900 psi (63 bar) above natural reservoir backpressure.

In the 'medium; or 'heavy loaded' condition, natural reservoir pressure is sufficient to complement the anti-cavitation functions of the various valves and the pre-servation of the 250 psi (17.5 bar) higher backpressure becomes unnecessary and wasteful due to the power demand required to do this. For example, if the pump (and its power source — the engine), has to exert energy into the crowd cylinder during bucket filling, it would also have to exert energy in overcoming the 250

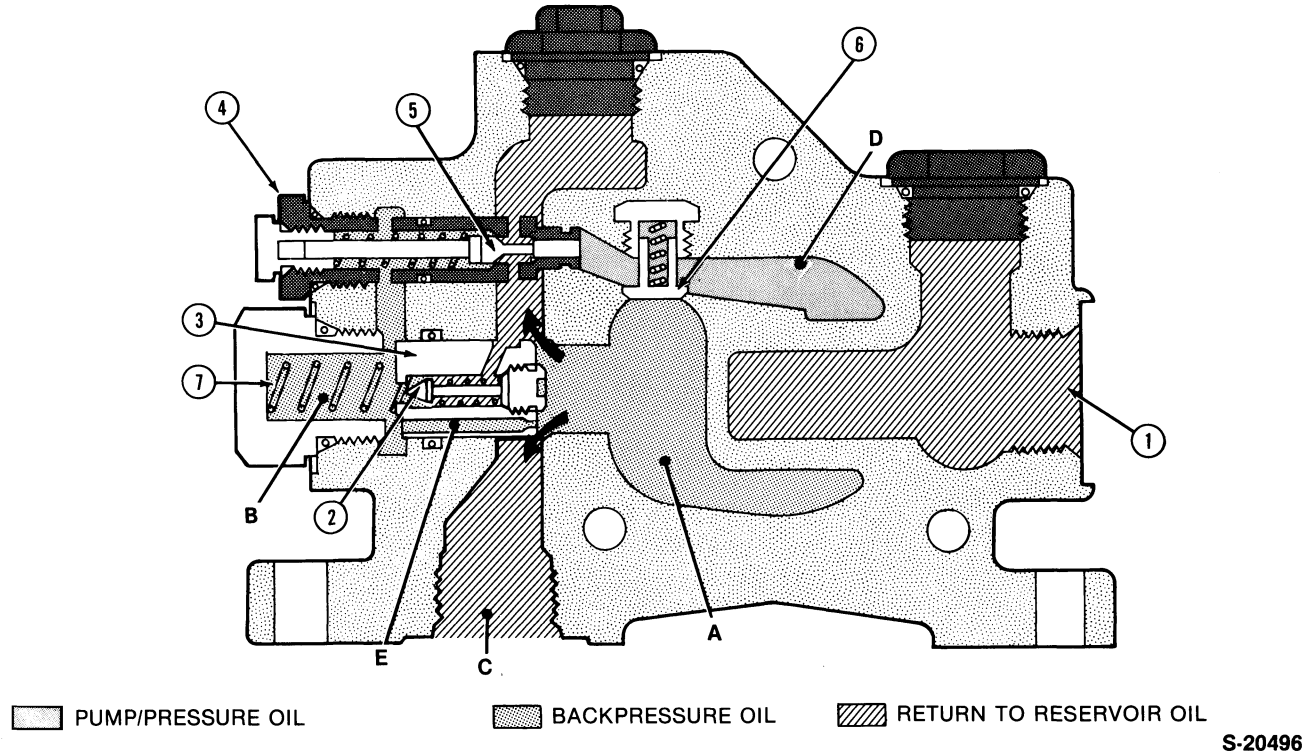


Figure 19
Backpressure Valve Operation

1. Outlet to Loader ("Power Beyond")
2. Backpressure Pilot Valve
3. Backpressure Valve
4. Unload Valve Body
5. Unload Valve
6. Regenerative Check Valve
7. Spring
A. Exhaust Oil Gallery
B. Unload Valve Backpressure Oil
C. Return to Reservoir Port
D. Static Oil Passage

psi (17.5 bar) pressure increase necessary to exhaust the oil from the opposite end of the cylinder. If this 250 psi (17.5 bar) pressure were reduced then the power saving would be available for the bucket filling cycle. Therefore, an unload valve is provided to fulfill this function.

BACKPRESSURE UNLOAD VALVE OPERATION (15 Ft. Backhoe)

Reference — Figure 20

Figure 20 illustrates the situation where medium to heavy loaded digging conditions occur. The high pressure parallel gallery D is at a working pressure greater than 900 psi (63 bar) above the return to reservoir pressure. This pressure acts on the actuator portion of the unload valve (5) and pushes the unload valve off its seat. This unseating action allows the exhaust gallery A pressure or backpressure which was acting on the rear side of the backpressure valve (3) in area B to escape across the open unload valve seat of the return to reservoir port C. This relief of backpressure from the rear of the backpressure valve immediately causes an unbalanced situation and the backpressure valve (3) opens. The exhaust oil pressure in gallery A is now able to return to reservoir port C without reaching the 250 psi (17.5 bar) above return-to-reservoir pressure. In effect, with the unload valve being operated by the high pressure, the backpressure valve can now be opened by a much lower order of exhaust gallery pressure than was possible in the no load or high load digging condition. It should be noted that there is no oil path between the paralleled high pressure gallery D and the return to reservoir port C.

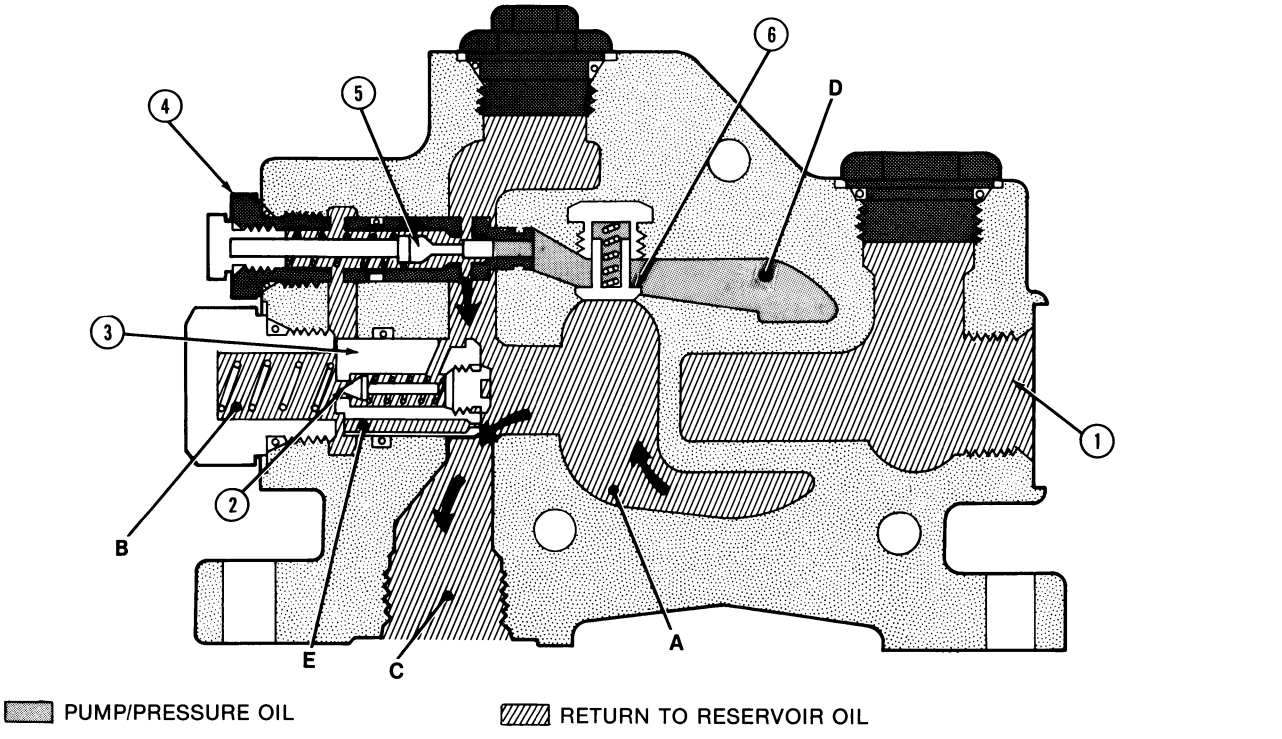


Figure 20
Backpressure Unload Valve Operation

1. Outlet to Loader ("Power Beyond")
2. Backpressure Pilot Valve
3. Backpressure Valve
4. Unload Valve Body
5. Unload Valve
6. Regenerative Check Valve

A. Exhaust Oil Gallery
B. Unload Valve Backpressure Oil
C. Return to Reservoir Port
D. Static Oil Passage

MAIN SYSTEM RELIEF VALVE

Reference — Figure 21

The main system relief valve is positioned in the inlet cover of the backhoe main control valve as shown, Figure 21. The relief valve serves to protect the hydraulic pump and backhoe — loader components from excessive internal hydraulic pressures. The valve is positioned between the high pressure passage and return to reservoir passage, so that in the event excessive pressure is created the relief valve opens and allows high pressure oil to return to sump.

The system relief valve is similar in design and operation to the circuit relief valves which are described under the following heading.

CIRCUIT RELIEF VALVE — OPERATION

Six circuit relief valves, (seven with extendible dipstick), Figure 22, are located in the backhoe control valve sections between the cylinder port and return passages. The circuit relief valves limit the pressure which can build up in a given circuit when the spool is closed during backhoe operation. Although the circuit relief valves are similar in construction and function, they are set to relieve at various pressures determined by the requirement of the circuit in which they are located. Excessive pressure can be developed in an inactive circuit because of leverage and forces during the digging cycle.

There are two styles of circuit relief valves used in the main control valve, as shown in Figure 23. The one on the right is used in the lift rod end circuit. Note that the

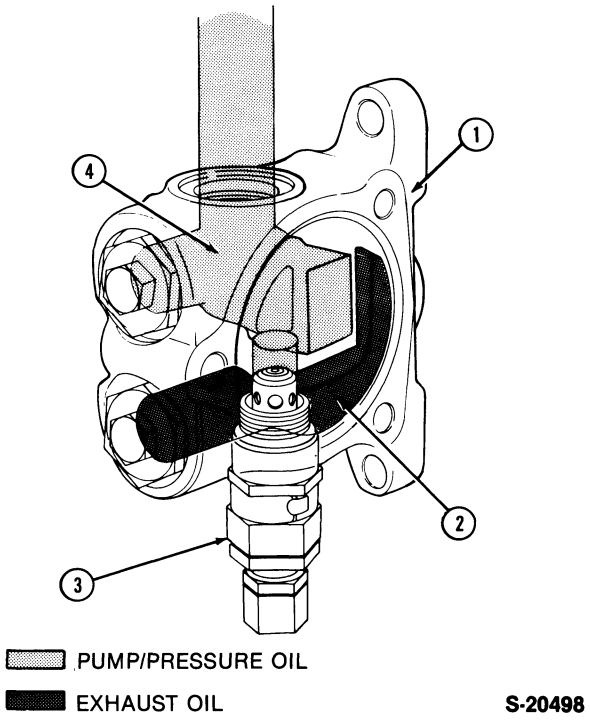


Figure 21
Main System Relief Valve in Inlet End Cover

1. Inlet End Cover
2. Exhaust/Return to Reservoir Gallery
3. System Relief Valve
4. Pump/Pressure Oil

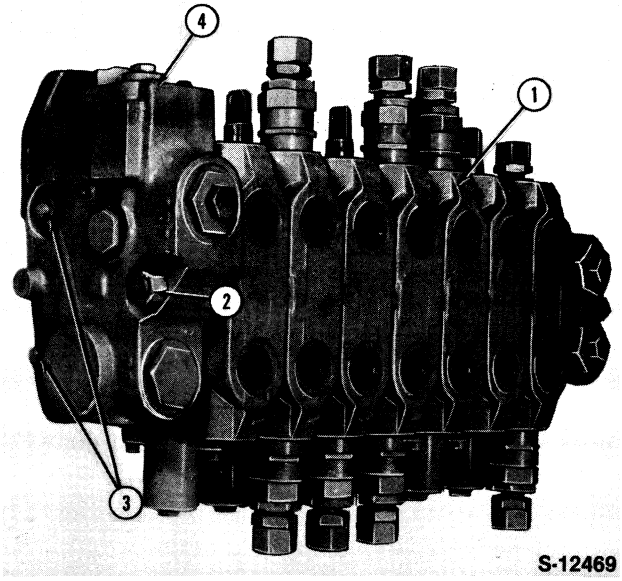


Figure 22
Control Valve Assembly

1. Sections
2. Tie Rods — 1/2"-20
3. Tie Rods — 7/16"-20
4. Outlet End Cover

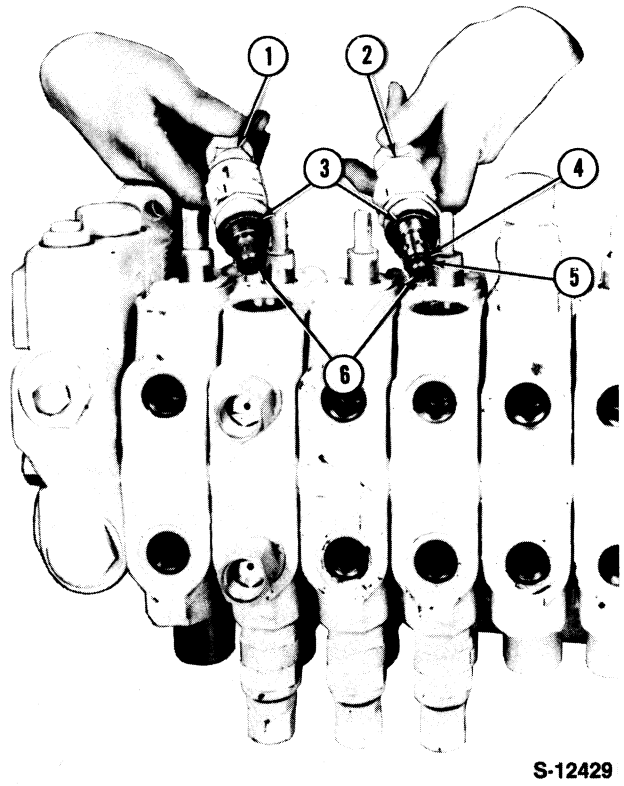


Figure 23
Circuit Relief Valve Type Identification

1. Circuit Relief — All Except Lift Rod End
2. Circuit Relief — Lift Rod End (Extended Nose)
3. O-Ring
4. Back-Up Ring
5. O-Ring
6. Sleeve Poppet

length of its sleeve is longer and also the addition of a O-ring and back-up ring for better sealing during a craning operation. The circuit relief valve on the left is common in construction to all other circuit relief valves and the system relief valve. Note that it has a tapered sleeve poppet with no sealing rings. This construction allows the sleeve poppet to move off its seat during cylinder voiding and allows oil to pass from the high pressure side of the poppet sleeve to the low pressure side of the valve.

Circuit relief valves are used at both ends of the lift circuit, both ends of the swing circuit, rod end of the bucket circuit, piston end of the crówd circuit, and the piston end of the extendible dispstick circuit. These circuits are subjected to externally caused high pressure during normal operation. The circuit relief valves function to limit the pressure which is allowed to build in these circuits during operation. The valves are positioned between the cylinder port and the return passage in the control valve.

RELIEF VALVE — OPERATION

Reference — Figure 24

Figure 24 shows a sectional view of a typical circuit relief valve with the anti-cavitation feature.

High pressure oil from the overloaded cylinder circuit is present in passage D. The pressure acting on the rear face of the poppet sleeve and piston, and the side faces of the sleeve poppet (anti-cavitation component), maintain the poppet valve seated against its seat on the poppet sleeve. The force exerted by the poppet valve on the sleeve, plus the pressure acting on the back side of the poppet sleeve, keeps the poppet firmly seated against its seat in the valve spool section. Pressure in passage B also acts on the pilot valve.

When the pressure in passage B rises to above the pressure setting, the force of the oil pressure overcomes the valve spring and lifts the pilot valve off its seat, as shown, Figure 25.

High pressure oil in area B can now flow past the pilot valve seat into the low pressure area A and on into the low pressure passage E. Oil flowing from behind the poppet valve (3), due to the opening of the pilot valve, lowers the pressure in that area and allows the piston (5) and poppet valve (3) to move toward the pilot valve and open the high pressure passage D to the low pressure passage E. The piston (5) seats against the pilot valve, Figure 26, and shuts off the flow of oil to the area behind the poppet valve so that pressure in that area remains low.

The outer poppet sleeve (4) remains seated, being held in this position by the spring.

NOTE: *The circuit relief valve described above is common to all circuit relief and system relief valves except the lift rod end circuit relief valve, Figure 27. However, it too functions in the same manner except that the sleeve poppet (9), Figure 27, uses an O-ring and back-up ring for sealing and not the tapered seat; therefore, it is not free to move.*

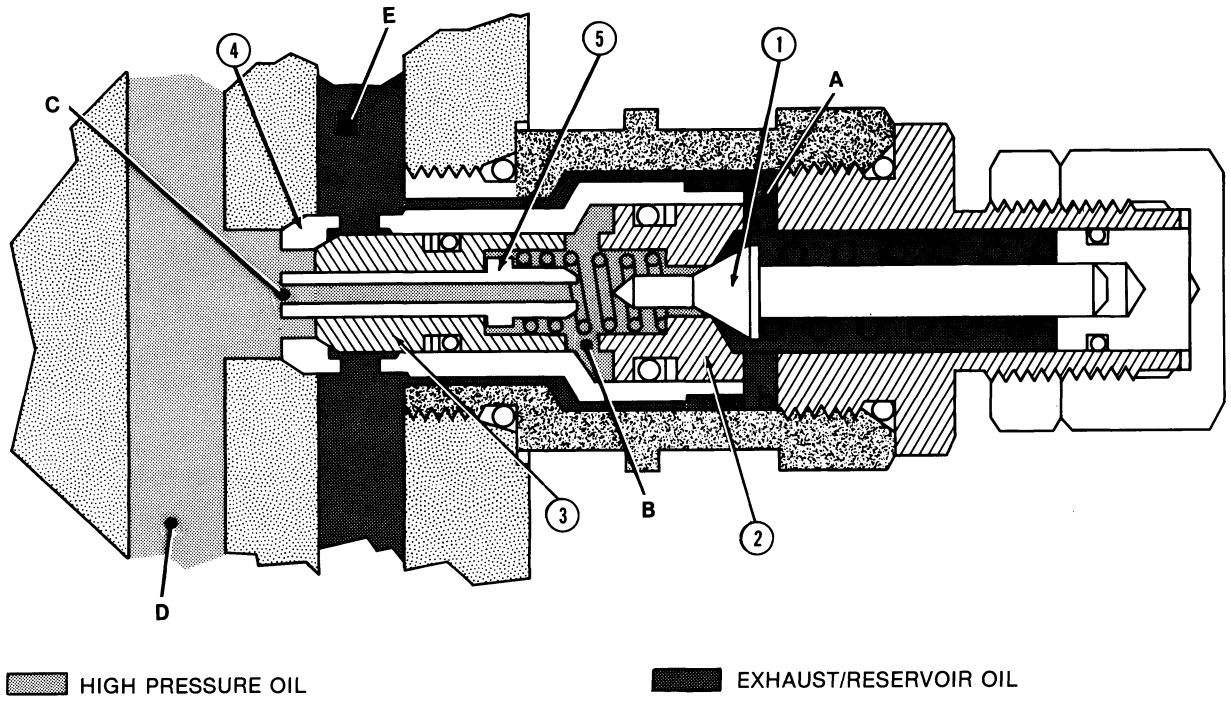


Figure 24
Circuit Relief Valve
(Not Subject to Overload Conditions)

1. Pilot Valve
2. Pilot Valve Body
3. Poppet Valve
4. Sleeve Poppet
5. Piston

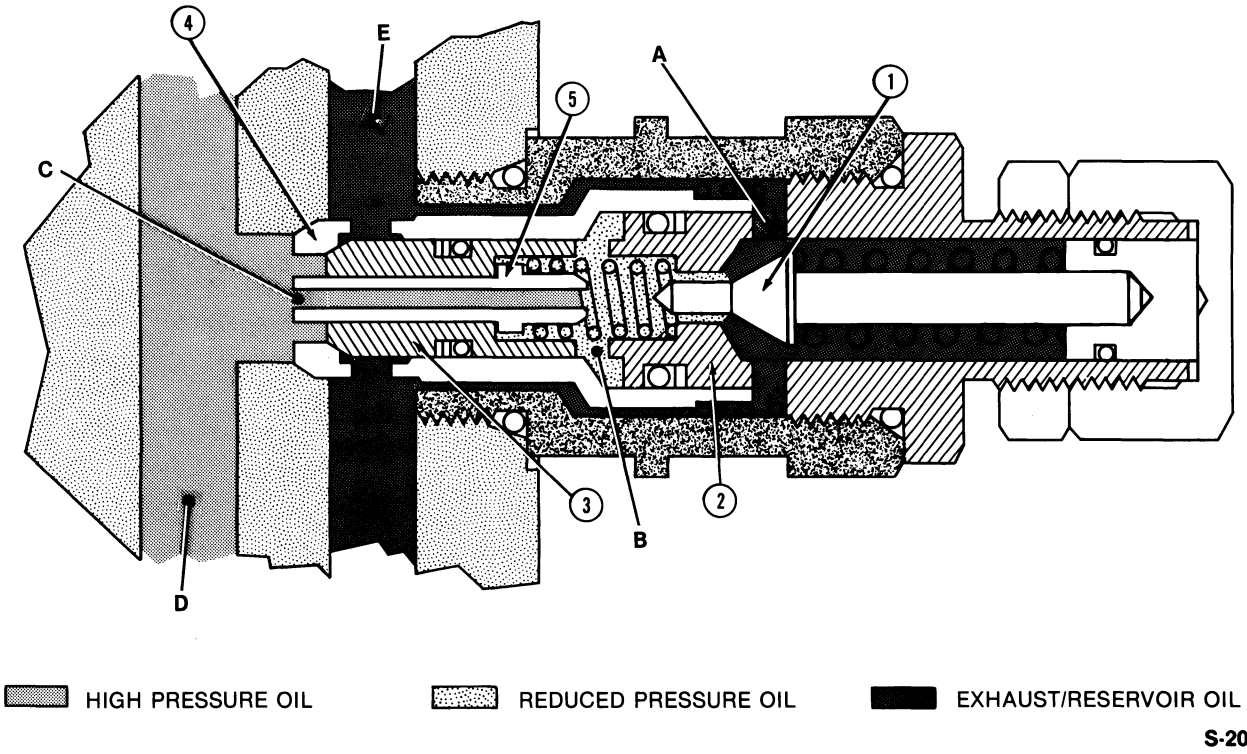


Figure 25
Circuit Relief Valve
(With Initial Pilot Valve Opening)

1. Pilot Valve
2. Pilot Valve Body
3. Poppet Valve
4. Sleeve Poppet
5. Piston

ANTI-CAVITATION — OPERATION

Reference — Figure 28

When the lift cylinder rod end circuit relief valve has operated, oil has been exhausted from the rod end of the cylinder causing the cylinder to extend and create a void in the piston end of the cylinder, as shown, Figure 28.

The void is automatically replenished by the anti-cavitation feature incorporated in the circuit relief valve installed in the cylinder piston end circuit.

Oil passage D, Figure 29, shows the void condition present in Figure 28. Passage E, Figure 29, has high pressure as a result of the operation of the circuit relief valve in the rod end circuit. Oil pressure in passage E acts on the poppet sleeve outer shoulder while at the same time the void or suction in passage D is sensed in area B. These forces cause the poppet sleeve to move off its seat against the light spring pressure and allows oil under the pressure in passage E to flow into passage D to replenish the void.

The relief valves are initially adjusted at the factory to the pressure setting marked on a steel band attached to the valve body.

NOTE: *It is important that only a valve of the correct pressure setting be used in a particular circuit. The use of a valve with a higher pressure setting than specified could cause structural damage to the backhoe.*

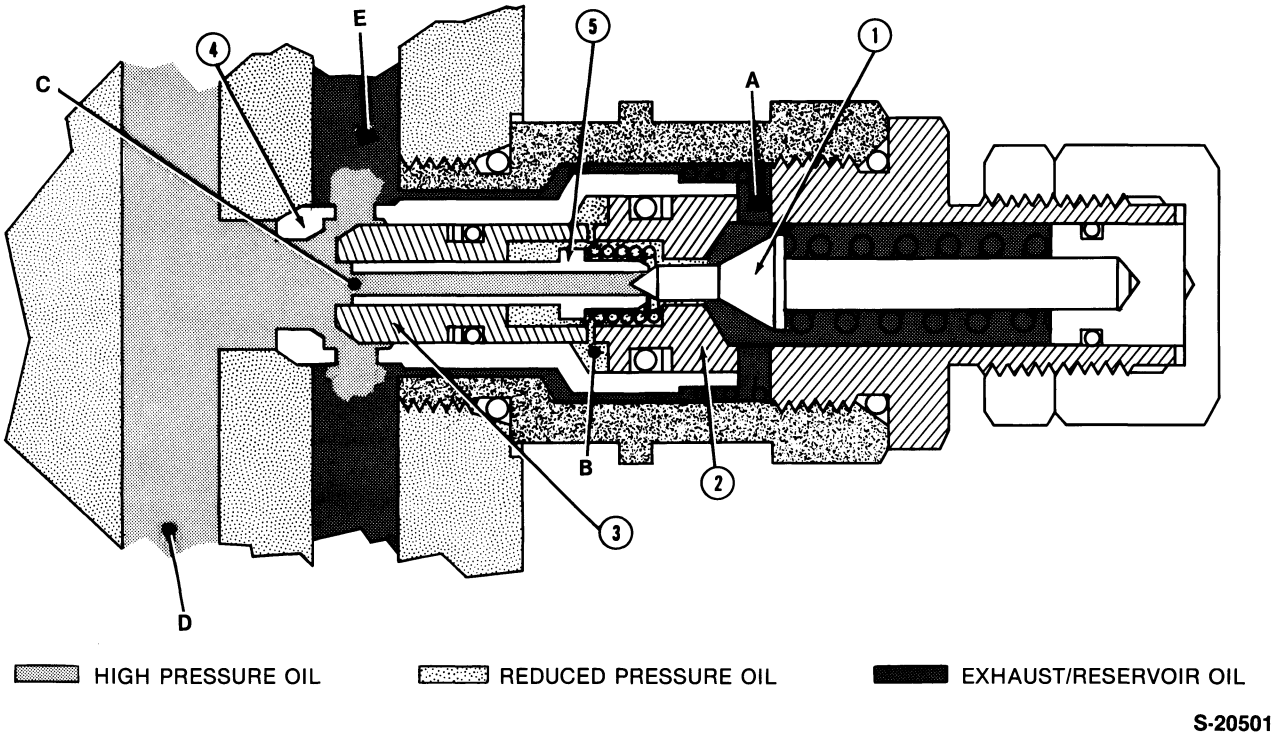


Figure 26
Circuit Relief Valve
(Fully Relieving High Pressure Oil)

1. Pilot Valve
2. Pilot Valve Body
3. Poppet Valve
4. Sleeve Poppet
5. Piston

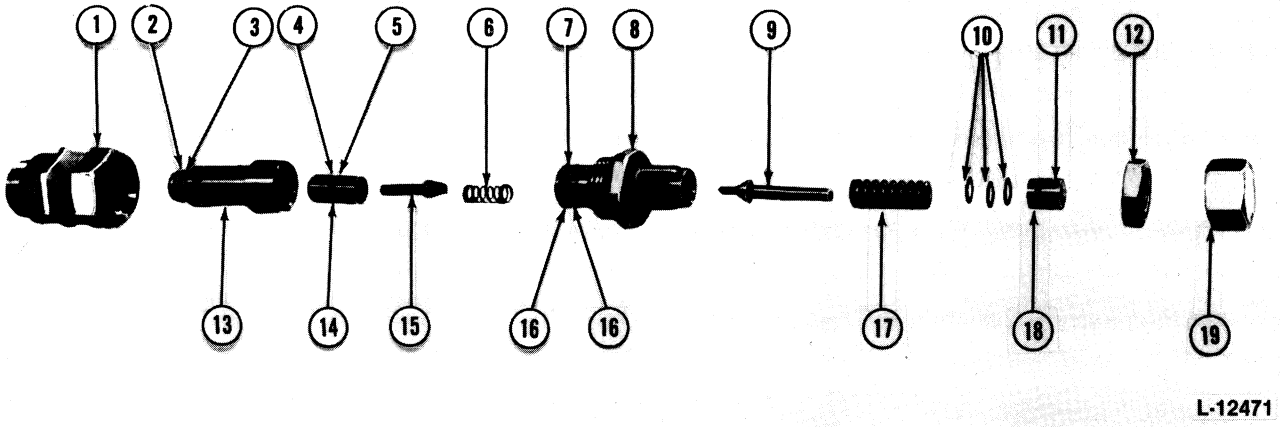


Figure 27
Lift Rod Circuit Relief Valve

1. Body
2. O-Ring
3. Back-up Ring
4. Poppet
5. O-Ring
6. Spring
7. O-Ring
8. Fitting
9. Pilot Poppet
10. Shim(s)
11. Adjusting Plug
12. Adjusting Nut
13. Sleeve
14. Back-up Ring
15. Piston
16. Back-up Rings
17. Spring
18. O-Ring
19. Adjusting Cap

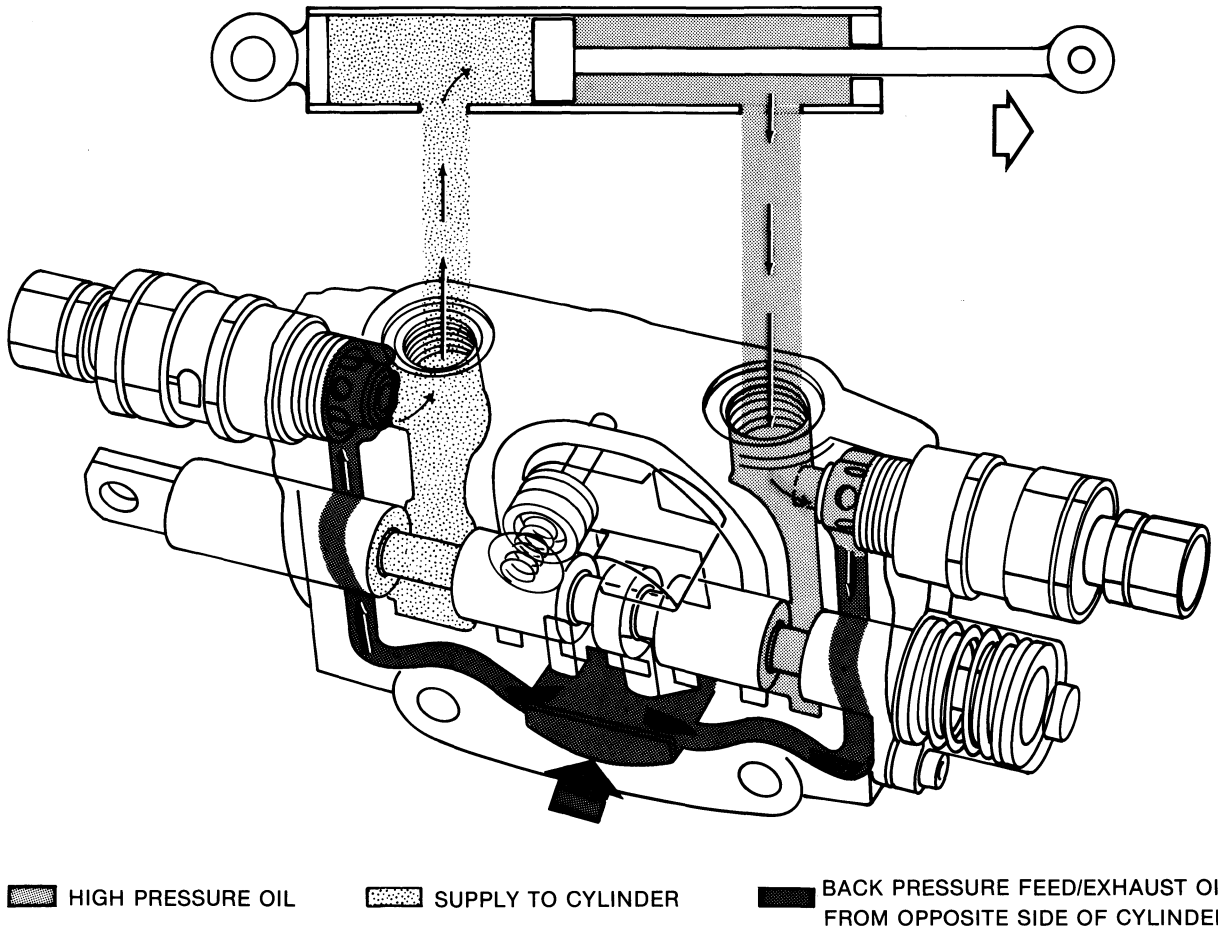


Figure 28
Spool Section in Neutral with Circuit Relief Valves Showing Circuit Relief and Circuit Replenishment (Anti-Cavitation)

VARIABLE FLOW RESTRICTORS

Variable flow restrictors are used in the lift cylinder (rod end) circuit and in both swing cylinders. Two types of restrictor valves are used.

The lift cylinder restrictor valve contains a loose fitting restrictor plate (2), Figure 30, which is free to slide in its bore. One side of the plate is flat and the other side has a slot in it. When oil is flowing against the flat side, the plate slides off its flat seat and allows unrestricted oil flow. When oil flows in the opposite direction, the plate seats on its surface causing a restriction of oil. The amount of restriction is dependent upon the size of the orifice in the plate. The size is stamped on the restrictor plate and indicates the orifice diameter in sixty-fourths of an inch.

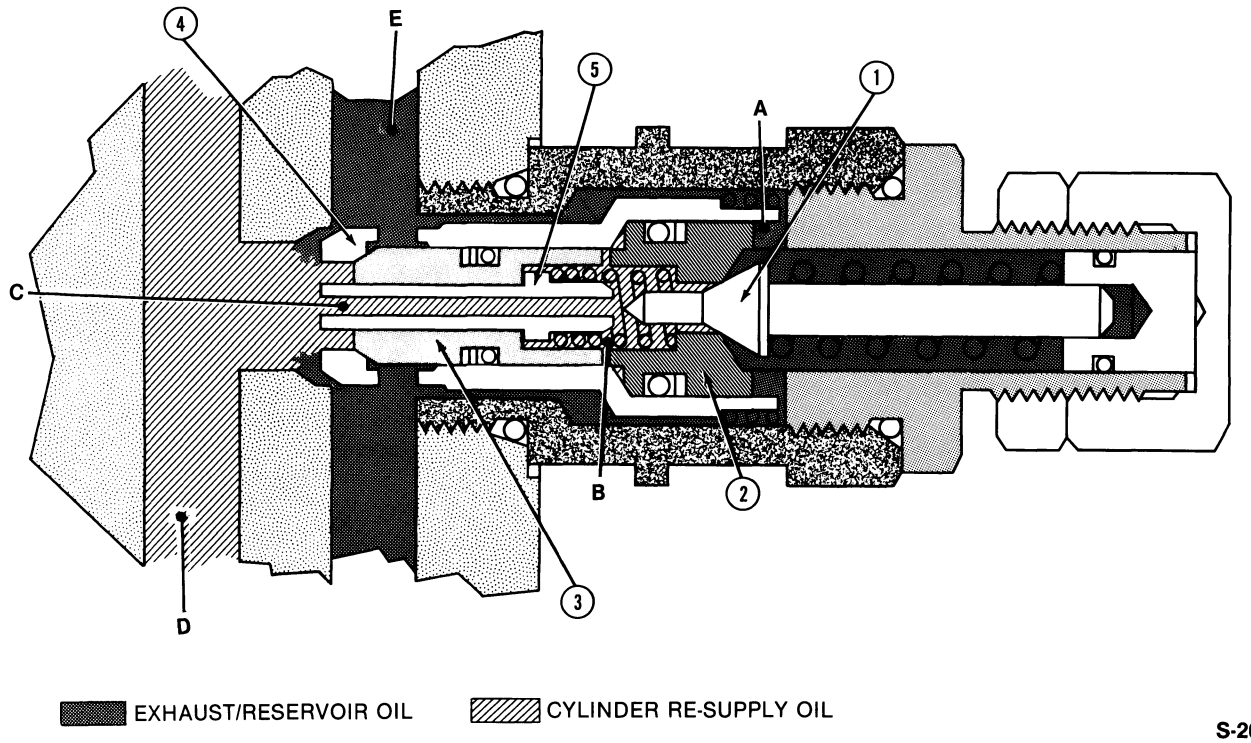


Figure 29
Circuit Relief Valve — Sectioned View Showing Circuit Replenishment (Anti-Cavitation) within Circuit Relief Valve

1. Pilot Valve
2. Pilot Valve Body
3. Poppet Valve
4. Sleeve Poppet
5. Piston

The lift circuit uses a variable restrictor at the lift cylinder rod port to restrict oil flow out of the rod end when the cylinder is externally loaded. This prevents a possible void in the piston end of the cylinder by allowing the pump to fill the piston end as rapidly as oil is being exhausted from the rod end. A number "14" plate is used on 15 ft. (4.6 m) backhoes equipped with an extendible dipstick and 12 and 14 ft. (3.7 and 4.3 m) backhoes with a standard dipstick. A number "16" plate is used on 15 ft. (4.6 m) backhoes with a standard dipstick.

The swing cylinder line restrictor (6), Figure 31, uses a loose fitting plunger type restrictor valve which is free to slide in its bore. The plunger has a flat plate on one end which seats on its surface when oil flows against the plate end and restricts the oil flow through the orifice drilling. When oil flows against the plunger end the valve moves off its seat and allows oil to flow freely past the plunger.

The function of the swing cylinder line restrictor and gland carrier orifice (6), Figure 32, is to restrict the flow of oil returning to sump from the swing cylinders.

With reference to Figure 32, return oil flowing out of cylinder "A" piston end forces the restrictor plunger in cylinder "B" onto its seat,thus restricting the oil flow out of cylinder "A" rod end. Pressure oil flowing out of cylinder "A" rod end pushes its restrictor off its seat allowing pressure oil to flow freeely into the piston end of cylinder "B."

Restricting the return oil flow provides a smooth, controlled swing action.

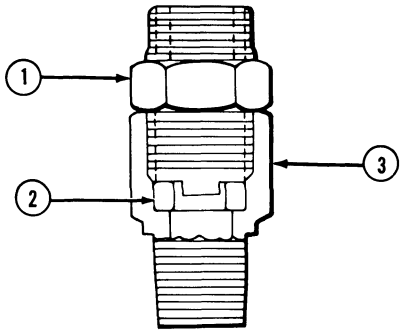


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Figure 30
Variable Restrictor
(Lift Cylinder Type)

1. Connector
2. Restrictor Plate — Loose Fitting
3. Body

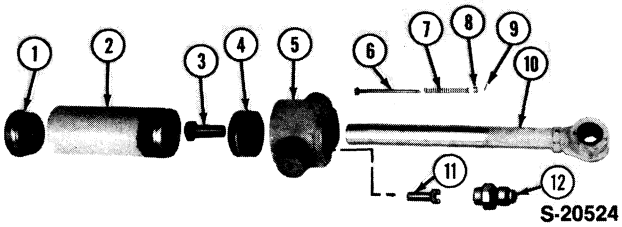

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Figure 31
Backhoe Swing Cylinder

1. End Plug
2. Cylinder Barrel
3. Bolt (Piston)
4. Piston
5. Trunnion
6. Sliding Restrictor
7. Spring
8. Bushing
9. Pin
10. Cylinder Rod
11. Restrictor (One-Way)
12. Fitting

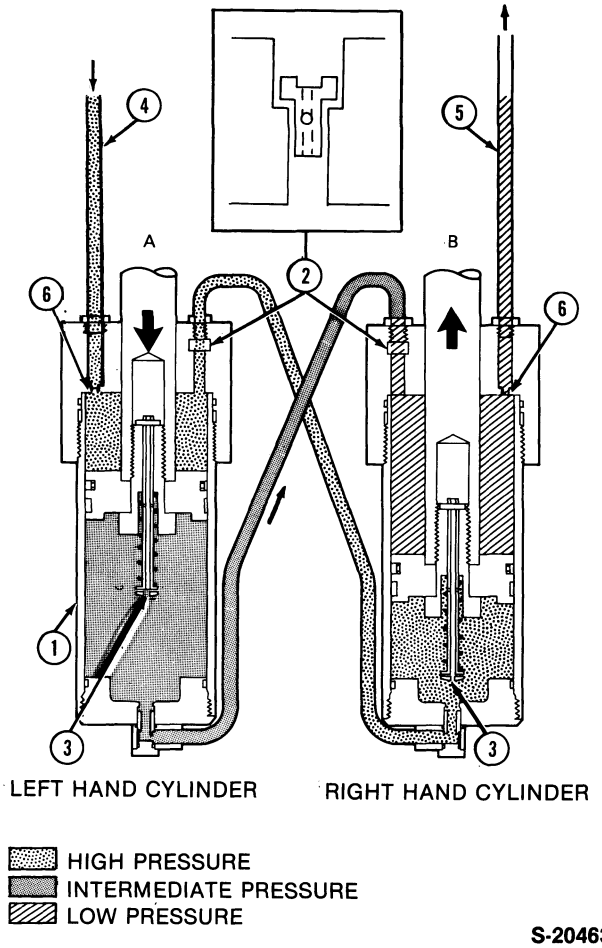

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Figure 32
Swing Cylinder Oil Flow — Left Swing

1. Cylinder Assembly
2. Line Restrictor
3. Sliding Restrictor
4. High Pressure Line From Control Valve
5. Exhaust Oil Return Line to Control Valve
6. Orifice

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TROUBLE SHOOTING

This portion of the repair manual is devoted to trouble shooting Ford 765 Backhoe malfunctions. If trouble shooting is approached in a systematic manner, the malfunction can be diagnosed quickly and accurately. Follow the step-by-step procedure outlined below.

Preliminary Checks

As a first step in the trouble shooting procedure, several preliminary checks should be made. These checks are essential in that once performed they need no longer be considered as a possible cause of the immediate malfunction.

- Check for proper backhoe and loader and/or hydraulic accessory installation.
- Check hydraulic oil level.
- Check for external oil leaks.
- Check for external mechanical damage such as kinked hoses or tubes, damaged cylinders, bent or binding structural members.
- Perform the system relief valve pressure check and adjust if necessary, as covered under "PRESSURE CHECKS." If the pressures cannot be adjusted to specifications, refer to Trouble Shooting, outlined below.

Trouble Shooting Procedure

Having performed the preliminary checks and failing to locate the cause of malfunctioning, the following procedures should be used.

1. If possible, operate the backhoe and make note of the operating characteristics. Cycle each control lever to operate each of the cylinders to both the extended and retracted positions.
2. Compare the operating characteristics observed in Step 1 with the problem listed in the Trouble Shooting Chart.

EXAMPLE: *"Backhoe lift circuit slow to raise, all other circuit positions work normally."*

Listed in the column under "PROBLEM" in the Trouble Shooting Chart, the malfunction relating to the example problem would be: "Lift fails to operate, is slow, or has loss of power."

- The column labeled "PROBLEM" lists the observed malfunctions when the backhoe or loader is operated.
- The column labeled "POSSIBLE CAUSES" lists the items in the circuit which could cause the observed malfunction.
- The column labeled "TEST" lists the test which should be used to determine the item causing the observed malfunction.

Refer to the "TEST" column and perform the recommended test. Proper testing will reduce the time required in locating the cause of the malfunction. Proper testing will also provide a more accurate indication of the malfunction and will save the time of unnecessary diassembly and inspection of all the components in the particular circuit. If adequate test equipment is not available, disassembly and inspection of the items listed under "POSSIBLE CAUSES" must be undertaken.

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