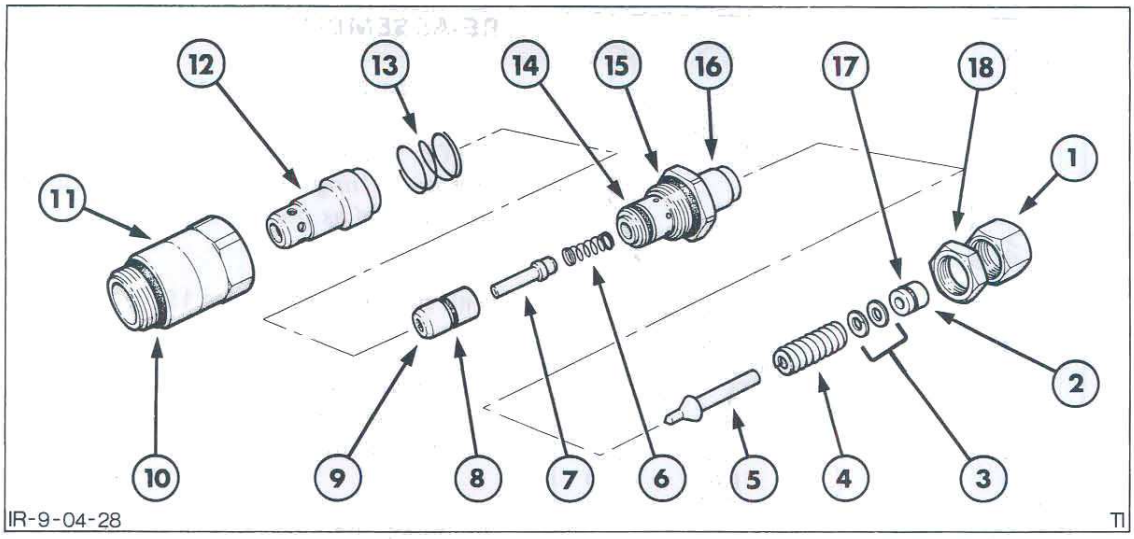

Figure 19
Pilot Operated with Anti-Cavitation Feature Circuit Relief Valve – Exploded View

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

SYSTEM RELIEF VALVE

With a small soft rod, depress the sleeve poppet fully into the body. When the rod is quickly removed, the sleeve poppet should snap back to the extended position. Repeat this procedure for the poppet and piston. If any of these items fail to snap back to the extended position disassemble the valve, Figure 19.

1. Check all 'O' rings and back-up rings for wear, damage or swelling. Mating parts must move freely with the 'O' rings and back-up rings installed.

2. Inspect the inside of the sleeve poppet for evidence of wear caused by the poppet 'O' ring and back-up ring. A slight groove may cause the poppet to stick open when operating under pressure, yet the poppet may move freely when depressed by hand.

3. Inspect the ground seating surface of the piston for nicks or excessive wear. The piston should be free of nicks and abrasion.

4. Inspect the pilot valve seat in the valve housing and the seat on the pilot valve. These seats should indicate a complete seating surface.

5. Visually inspect the springs for "setting" by comparing their lengths with a new stock item.

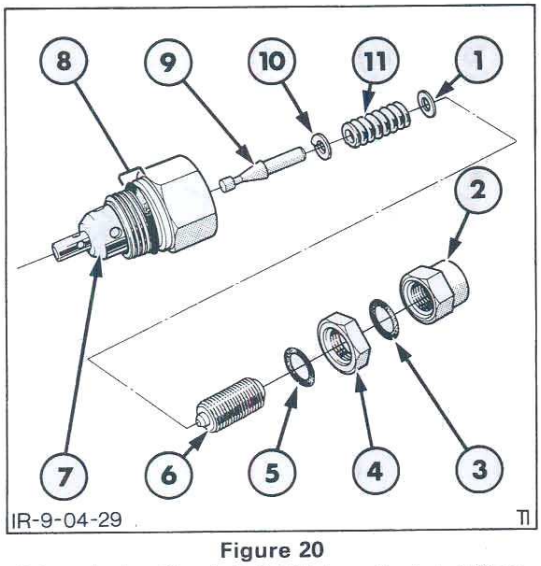

Figure 20
Direct Acting Circuit Relief Valve – Exploded View

1. Shim
2. Security Cap
3. 'O' Ring
4. Locknut
5. 'O' Ring
6. Adjusting Screw
7. Housing
8. Back-up and 'O' Ring Seals
9. Poppet
10. Spring Seat
11. Spring

DIRECT ACTING RELIEF VALVES

If the operation of a direct acting relief valve is in question disassemble the valve, Figure 20.

1. Check all 'O' rings and back-up ring for wear, damage or swelling.

2. Inspect the seating surface of the poppet and valve housing. The seat should indicate a complete seating surface.

3. Visually inspect the poppet return spring for damage and compare its length with a new stock item.

RE-ASSEMBLY

SYSTEM RELIEF VALVE

NOTE: *Individual parts except for the two external 'O' rings are not serviced. The valves are serviced as pre-set assemblies.*

With reference to Figure 19.

1. Install new 'O' rings on the valve body and over the large threaded diameter of the housing.

2. Insert the piston into the poppet and place the small spring onto the end of the piston. The diameter of the spring is smaller at one end than the other and the smaller diameter must locate on the piston.

3. Slide the poppet assembly into the sleeve.

4. Position the large spring over the sleeve and insert the sleeve assembly into the valve body.

5. Assemble the housing to the body ensuring that both the piston and sleeve springs are correctly located in the housing. Tighten the body and housing thread to the specified torque, see "Specifications" – Chapter 11.

6. Insert the pilot valve, springs, shims and adjusting plug, into the housing and retain with the locknut and adjusting cap.

7. Set the valve to the correct pressure setting as detailed in "Hydraulic Trouble Shooting and Pressure Testing" – Chapter 11.

NOTE: *The valve must not be set outside the specification stamped on the tag wrapped around the body of the valve.*

DIRECT ACTING CIRCUIT RELIEF VALVES

With reference to Figure 20

1. Position the spring seat onto the poppet ensuring that the concave side of the seat is positioned towards the nose on the poppet.

2. Insert the poppet into the valve housing and locate the spring and shim over the stem of the poppet.

3. Install new 'O' ring seals in the locknut and end cap. Screw the adjusting plug into the housing and retain in position with the locknut.

4. Install new back-up and 'O' ring seals onto the housing ensuring that the back-up seal is adjacent to the shoulders of the housing.

5. Set the valve to the correct pressure setting as detailed in "Hydraulic Trouble Shooting and Pressure Testing" Chapter 11.

VALVE SECTION SPOOLS

LOADER BUCKET VALVE SECTION

With reference to Figure 21

1. Lubricate the spool with hydraulic oil and insert the eye end of the spool into the valve section. Do not force the spool, use a slight twisting motion which will aid assembly.

2. Install a new 'O' ring seal into the centring spring end of the valve section and secure in position with the retainer.

NOTE: *If the centring spring has not been removed from the end of the spool during overhaul, locate the retainer and 'O' ring onto the spool before inserting the spool into the bore in the valve section. This procedure will minimise the possibility of damaging the 'O' ring during reassembly.*

3. Locate the centring spring and spring seats onto the spool and install the retaining screw.

NOTE: *Apply 2 drops of Loctite 270 to the retaining screw thread and tighten to the specified torque, see "Specifications" – Chapter 11.*

4. Position the return to dig button on the end of the spool and install the retaining screw. Tighten the screw to the specified torque, see "Specifications" – Chapter 11.

5. Install the electromagnet into the end cap and ensuring the 'O' ring and retainer are fully seated, install the end cap over the centring spring end of the spool, tightening the screws to the specified torque, see "Specifications" – Chapter 11.

6. Position a new 'O' ring on the retainer located at the eye end of the spool and slide the retainer over the spool onto the end of the valve section.

7. Install a new 'O' ring seal and wiper seal on the eye end of the spool and slide them into the recess in the retainer. Secure the seals in position with the seal plate and two spacers, tightening the retaining screws to the specified torque, see "Specifications" – Chapter 11.

8. Install the circuit relief valves.

LOADER LIFT VALVE SECTION

With reference to Figure 22.

1. Locate new 'O' ring seals on the end and in the bore of the seal retainer which is positioned at the centring spring end of the spool.
2. Lubricate the spool with hydraulic oil and slide the retainer onto the centring spring end of the spool.
3. If previously disassembled insert the spring, detent poppet and balls into the end of the spool. Carefully locate the balls in the holes in the side of the spool, allowing the detent poppet and spring to retain the balls in position.
4. Install the centring spring and spring seats onto the spool and retain in position with the retaining screw.

NOTE: *Apply 2 drops of Loctite 270 to the retaining screw thread, and tighten to the specified torque, see "Specifications" – Chapter 11.*

5. Insert the eye end of the spool into the valve section. Do not force the spool, use a slight twisting motion which will aid assembly.
6. Ensure the retainer is fully seated in the valve section and install the end cup over the centring spring. Tighten the Allen screws to the specified torque, see "Specifications" – Chapter 11.
7. Slide a new 'O' ring and wiper seal over the eye end of the spool and retain in the counterbore of the valve section with the seal plate.

MULTIPURPOSE HYDRAULIC BUCKET VALVE SECTION

Re-assembly of the multipurpose hydraulic bucket valve section is similar to that described for valve sections used on the backhoe valve chest and reference should be made to Chapter 4 of this Part for the re-assembly procedure.

VALVE SECTIONS

1. Install a nut on one end of each of the tie rods and insert the tie rods into the inlet end cover.

NOTE: *The two tie rods farthest from the cylinder outlet ports (nearest base) have $^{7}/_{16}$" – 20 thread ends. The other tie rod has a $^{1}/_{2}$" – 20 thread end. Ensure these rods are installed in this way.*

2. Install a new 'O' ring on the inlet cover and place the loader bucket valve section on the tie rods and seat it on the inlet end cover.
3. Install the check valve and spring and a new 'O' ring in the outer groove of the valve section face.
4. Position the loader lift and multipurpose hydraulic bucket valve section (where fitted) in a similar manner followed by the outlet end cover.
5. Install the nuts on the tie rod ends. Tighten the nuts of the tie rods to the specified torque, see "Specifications" – Chapter 11. Note that there are two torque figures, one for the $^{7}/_{16}$" and one for the $^{1}/_{2}$"diameter.

INSTALLATION

Installation of the loader control valve follows the removal procedure in reverse. During installation observe the following:-

- Replace all seals disturbed during the overhaul.
- Tighten all bolts to the specified torque, see "Specifications" – Chapter 11.
- Check the hydraulic oil level and add the specified oil as necessary.
- Check the system and circuit relief valve settings.

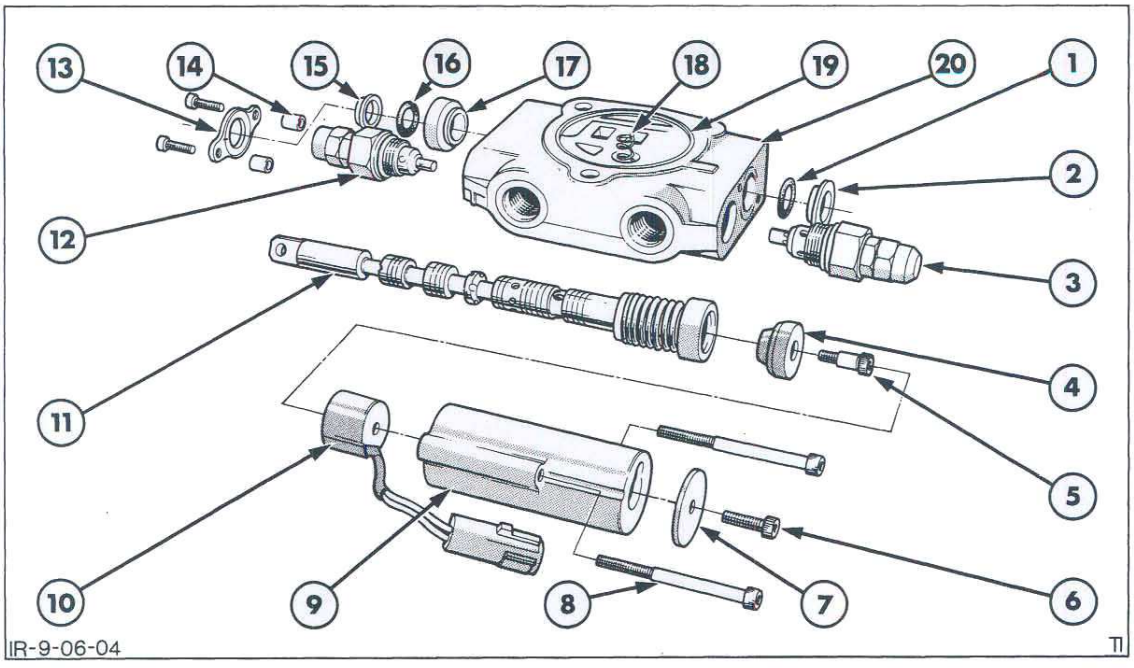

Figure 21
Loader Bucket Valve Section

1. 'O' Ring
2. Retainer
3. Circuit Relief Valve
4. Return to Dig Button
5. Screw
6. Screw
7. Washer
8. Screw
9. Cap
10. Electromagnet
11. Spool Assembly
12. Circuit Relief Valve
13. Seal Plate
14. Spacer
15. Wiper Seal
16. 'O' Ring
17. Retainer
18. Check Valve and Spring
19. 'O' Ring
20. Valve Housing

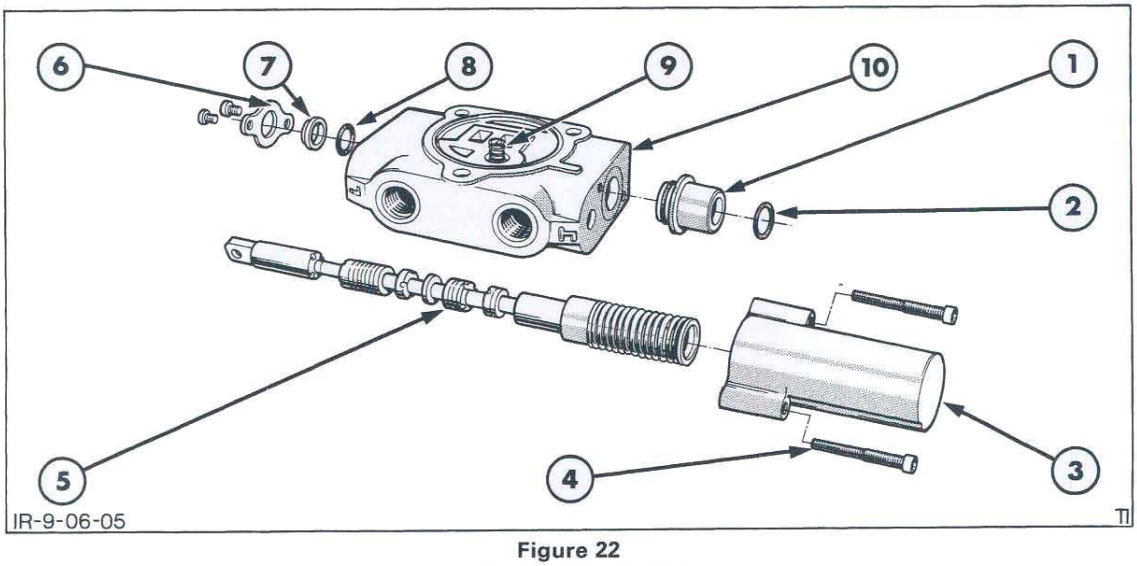

Figure 22
Loader Lift Valve Section

1. Retainer
2. 'O' Ring
3. Cap
4. Screw
5. Spool Assembly
6. Seal Plate
7. Wiper Seal
8. 'O' Ring
9. Check Valve and Spring
10 Valve Housing

PART 8

HYDRAULIC SYSTEM, CONTROLS AND FRAME

Chapter 7
SWING SYSTEM, HYDRAULIC CYLINDERS AND FLOW RESTRICTOR VALVES

A. SWING SYSTEM – DESCRIPTION AND OPERATION

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

This movement is obtained by the use of two interconnected hydraulic cylinders coupled between the mainframe and swing post see Figure 1.

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

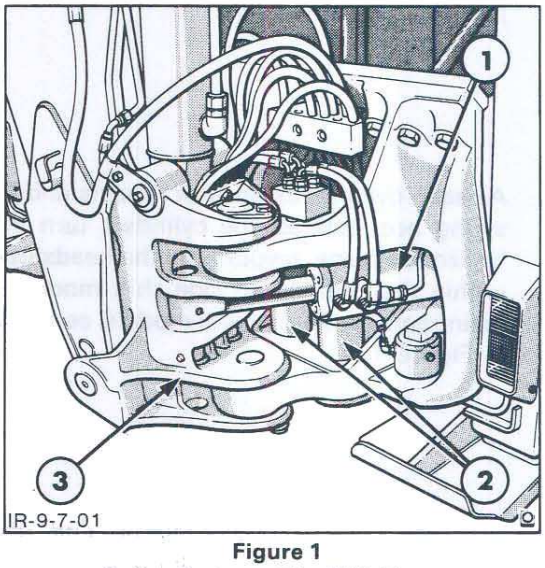

Figure 1
Swing System – Side Shift Shown

1. Cylinder
2. Cylinder Pivot
3. Swing Post

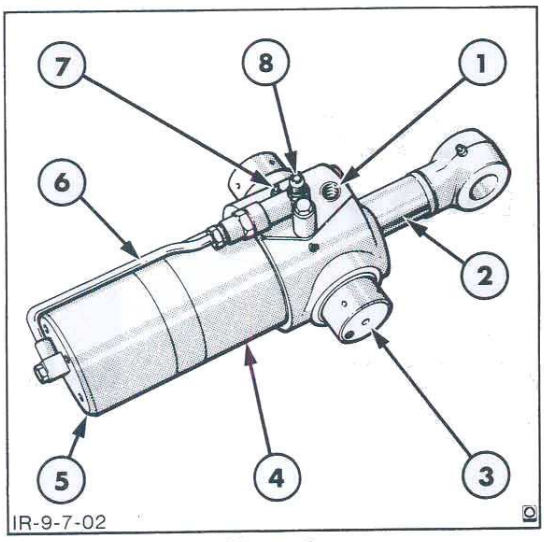

Figure 2
Swing Cylinder – Side Shift Type

1. Oil Return/Supply Port
2. Cylinder rod
3. Trunnion/Headstock
4. Cylinder Barrel
5. Barrel End Cap
6. Piston End Supply Tube
7. Trunnion Greaser
8. Oil Return/Supply Port

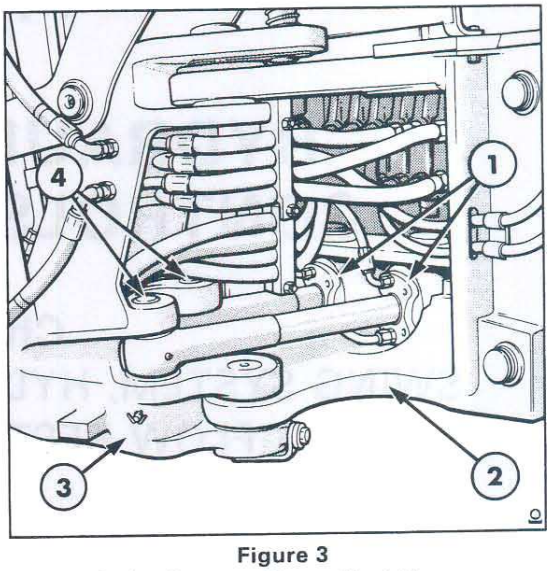

Figure 3
Swing System – Centre Pivot Shown

1. Swing cylinders
2. Mainframe
3. Swing Post
4. Cylinder Rod Fulcrum Point

Each cylinder incorporates a headstock consisting of two large trunnions positioned near the gland carrier. In fact, the gland carrier and headstock share the same casting, Figure 2.

As each cylinder extends or retracts and the swing post rotates, the cylinders turn in a horizontal plane, pivoting on the headstocks within the carriage on side shift models or mainframe on centre pivot models, as shown in Figure 3.

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

Hydraulic feed to the swing cylinders is controlled by a section of the backhoe control valve which contains pilot operated relief valves with anti cavitation feature to protect the circuit and cylinders should an overload condition occur.

On sideshift units a one way restrictor is also fitted in the cylinder supply/return hoses and restricts the exhaust oil returning into the valve section.

The operation of these valves, the cylinders and cushioning devices are described in detail in the following paragraphs. Note that the illustrations depict a side shift system however the principal is also representative of the centre pivot type.

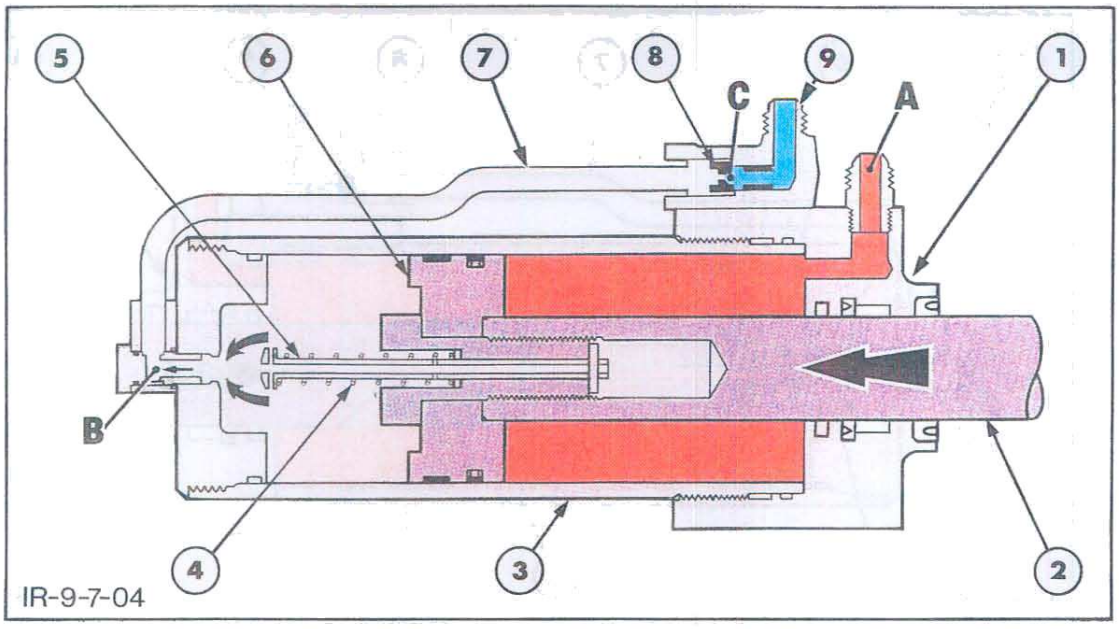

Figure 4
Swing Cylinder Retraction

Pump Pressure Oil

Restricted Oil Flow by External Restrictor

Unrestricted return Oil

1. Headstock/Gland Carrier
2. Cylinder Rod
3. Cylinder Barrel
4. Spring
5. Sliding Restrictor
6. Piston
7. External Tube
8. Restrictor
9. Outlet Port/Restrictor Housing

Figure 4 shows the oil flow through one cylinder during cylinder retraction, and cushioning at maximum travel is shown in Figure 5.

Oil enters the cylinder at 'A', acts on the rod side of the piston and retracts the cylinder rod. Exhausting oil from the piston side leaves the cylinder at point 'B' and is routed to a manifold containing a restrictor.

The restrictor is directional and during cylinder retraction is automatically moved to its restrict position by the oil flow. Oil can only escape from the cylinder through the small drilling 'C' in the centre of the restrictor. Oil flow passes to the other cylinder as described later.

As the cylinder approaches maximum travel, a secondary restrictor automatically slows the rate of rod retraction, Figure 5. This restrictor slides in the piston retaining bolt which is bored to accept the restrictor and its return spring.

Oil leaving the cylinder at port 'B' has its exit route restricted as the head of the restrictor covers the port 'B'. Oil can now only escape by flowing through the small drilling and subsequently the rate of flow and speed of retraction is slowed.

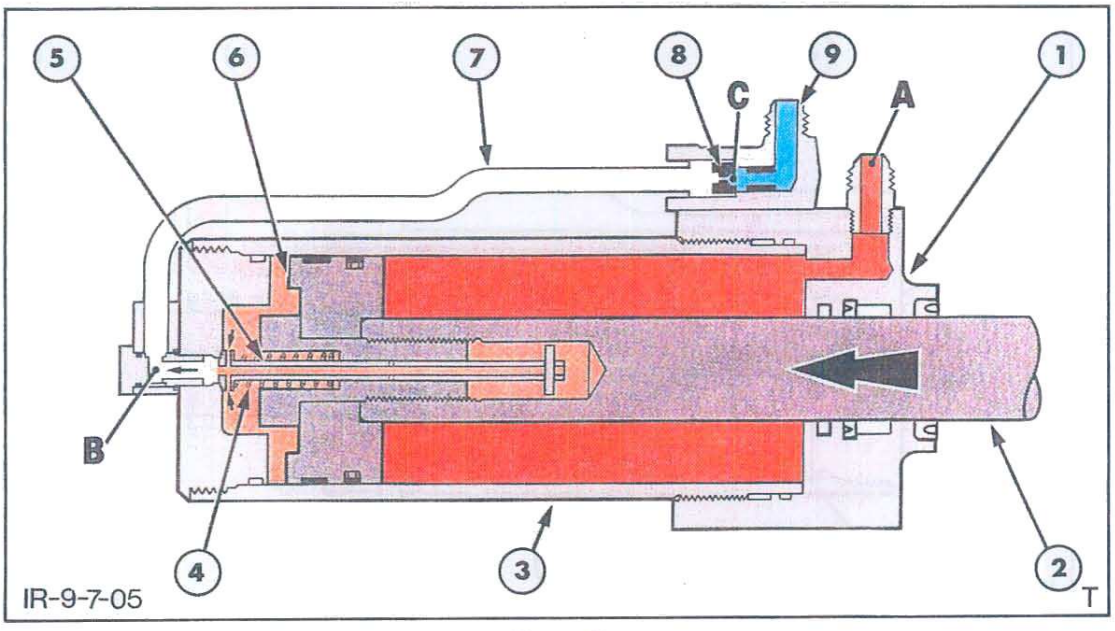

Figure 5
Swing Cylinder Cushions at Maximum Travel

Pump Pressure Oil
Oil Restricted by Second Restrictor
Restricted Cylinder Exhaust Oil
Unrestricted Return Oil

1. Headstock Gland Carrier
2. Cylinder Rod
3. Cylinder Barrel
4. Spring
5. Sliding Restrictor
6. Piston
7. External Tube
8. Restrictor
9. Outlet Port/Restrictor Housing

The position of the sliding restrictor in the piston bolt is such that, on maximum retraction, the restrictor, when subjected to oil flowing in the reverse direction to extend the cylinder, is able to enter the cylinder unrestricted by lifting the restrictor off its seat against the return spring.

When oil flows in this direction entering the cylinder at port 'C', the restrictor in the manifold is moved by the oil flow and oil is able to pass through and around the restrictor. With both restrictors now not restricting oil flow, a rapid acceleration of the swing cylinder is assured.

Figure 6 shows the side shift swing cylinders interconnected and the section of the excavator main control valve controlling swing.

The centre pivot model is similar in principle but has the following differences: (a) no restrictor valves are fitted to the main control valve and, (b) the manifold assembly is incorporated into the headstock of each cylinder, Refer to Figure 8, for a swing cylinder working schematic on centre pivot units.

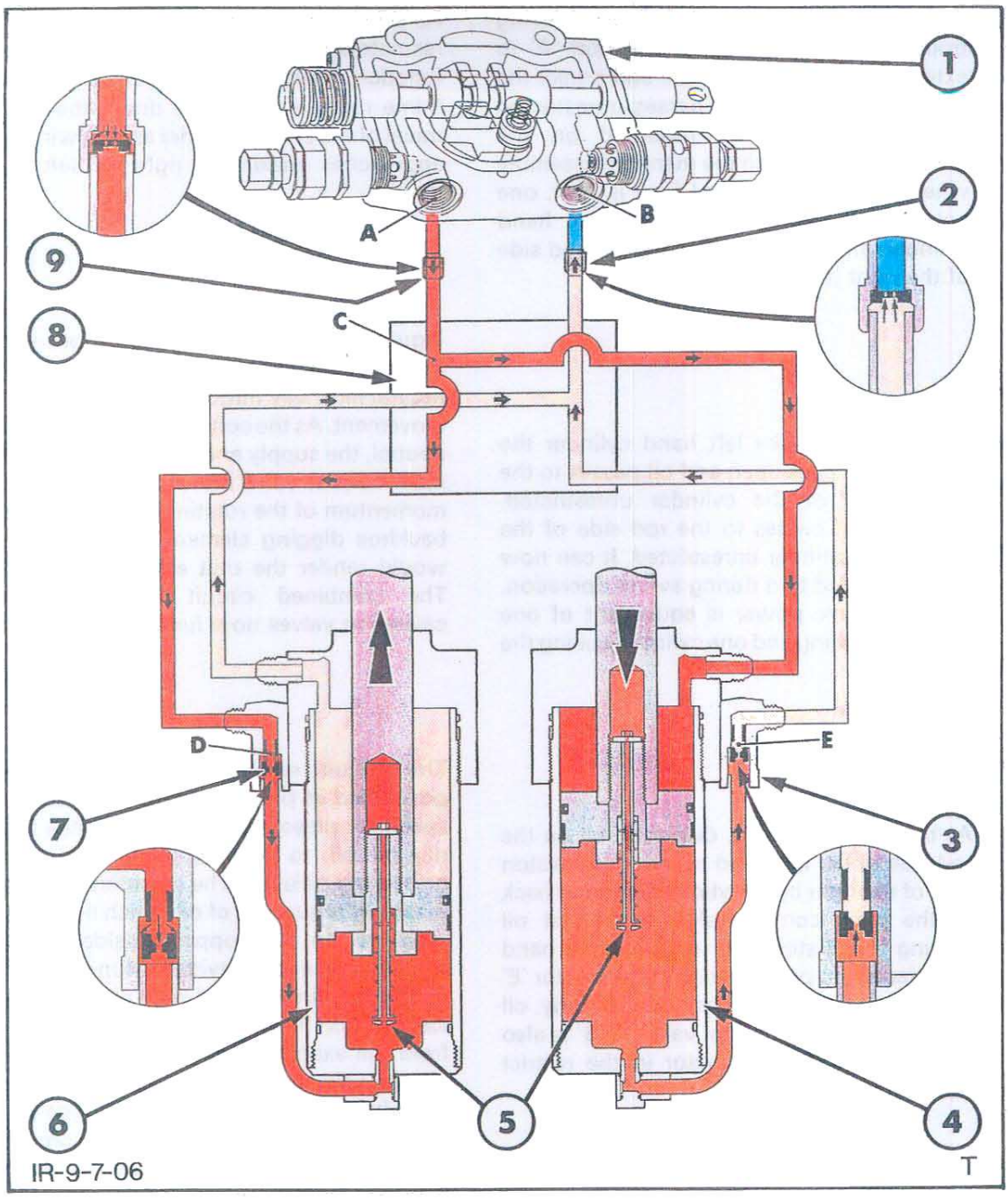

Figure 6
Swing Cylinders – Working Schematic Normal Swing (Sideshift shown)

Pump Pressure Oil

1st Stage Restricted Return Oil

2nd Stage Restricted Return Oil

Return to Reservoir Oil

1. Swing Section of Main Control Valve
2. Line Restrictor in Restrict Position
3. Cylinder Restrictor in Restrict Position
4. Cylinder Assembly
5. Sliding Internal Restrictors
6. Cylinder Assembly
7. Cylinder Restrictor in Open Position
8. Manifold Assembly
9. Line Restrictor in Open Position

Referring to Figure 6, oil is shown flowing from the main control valve at port 'A' to extend the left hand cylinder and retract the right hand cylinder. Oil passes unrestricted through the restrictor mounted on the control valve through the manifold assembly where at point 'C' the oil flow is split, one entering the piston side of the left hand cylinder, and the other entering the rod side of the right hand cylinder.

As oil flows to the left hand cylinder the restrictor at 'D' is open and oil passes to the piston side of the cylinder unrestricted. Similarly, oil passes to the rod side of the right hand cylinder unrestricted. It can now be appreciated that during swing operation, total hydraulic power is equivalent of one cylinder pushing and one cylinder pulling the swing frame.

As the cylinders move, displaced oil on the rod side of the left hand cylinder and piston side of the right hand cylinder is routed back to the main control valve. Note that oil leaving the piston side of the right hand cylinder has to pass through the restrictor 'E' which is in the restrict position. Similarly, oil entering the main control valve at 'B' is also passing through a restrictor in the restrict position.

Whichever direction of swing occurs, returning oil is restricted by two restrictors. These restrictors determine the speed of swing. They are positioned on the exhaust oil side so that unrestricted oil flow can be applied on the power side. This ensures a smooth controlled swing at optimum speed. Note that on centre pivot models restrictors are only installed in the swing cylinder operating segment. Refer to Figure 7.

As previously described cushioning sliding restrictors incorporated in each piston only function towards the extremes of swing frame rotation and slow down the rate of travel of the swing cylinder as the swing post approaches maximum right or left hand travel.

Figure 7 illustrates the oil flow when the main control valve is suddenly returned to neutral mid-way through a full power swing movement. As the control valve is returned to neutral, the supply and exhaust routes in the main control valve are totally blocked. The momentum of the rotating swing frame and backhoe digging elements, if not relieved, would render the unit extremely unstable. The combined circuit relief and anti-cavitation valves now function.

The circuit relief portion of the valve positioned at port 'B' opens as soon as its specified pressure setting is reached and dumps oil to exhaust until the excess pressure is relieved. The cylinders have then displaced a quantity of oil which needs to be replaced on the opposite sides of the cylinders. The anti-cavitation function of the combined circuit relief and anti-cavitation valve at Port 'A' now operates and passes oil from the exhaust channels within the main control valve to re-supply the piston side of the left hand cylinder and the rod side of the right hand cylinder. This oil supply proceeds to both cylinders unrestricted as the restrictors in the control valve ports and the cylinder ports allow oil to flow freely in this direction.

If swing movement is in the other direction then the circuit relief and anti-cavitation valve at port 'A' relieves the high pressure oil and the similar valve at port 'B' re-supplies the lost oil volume.

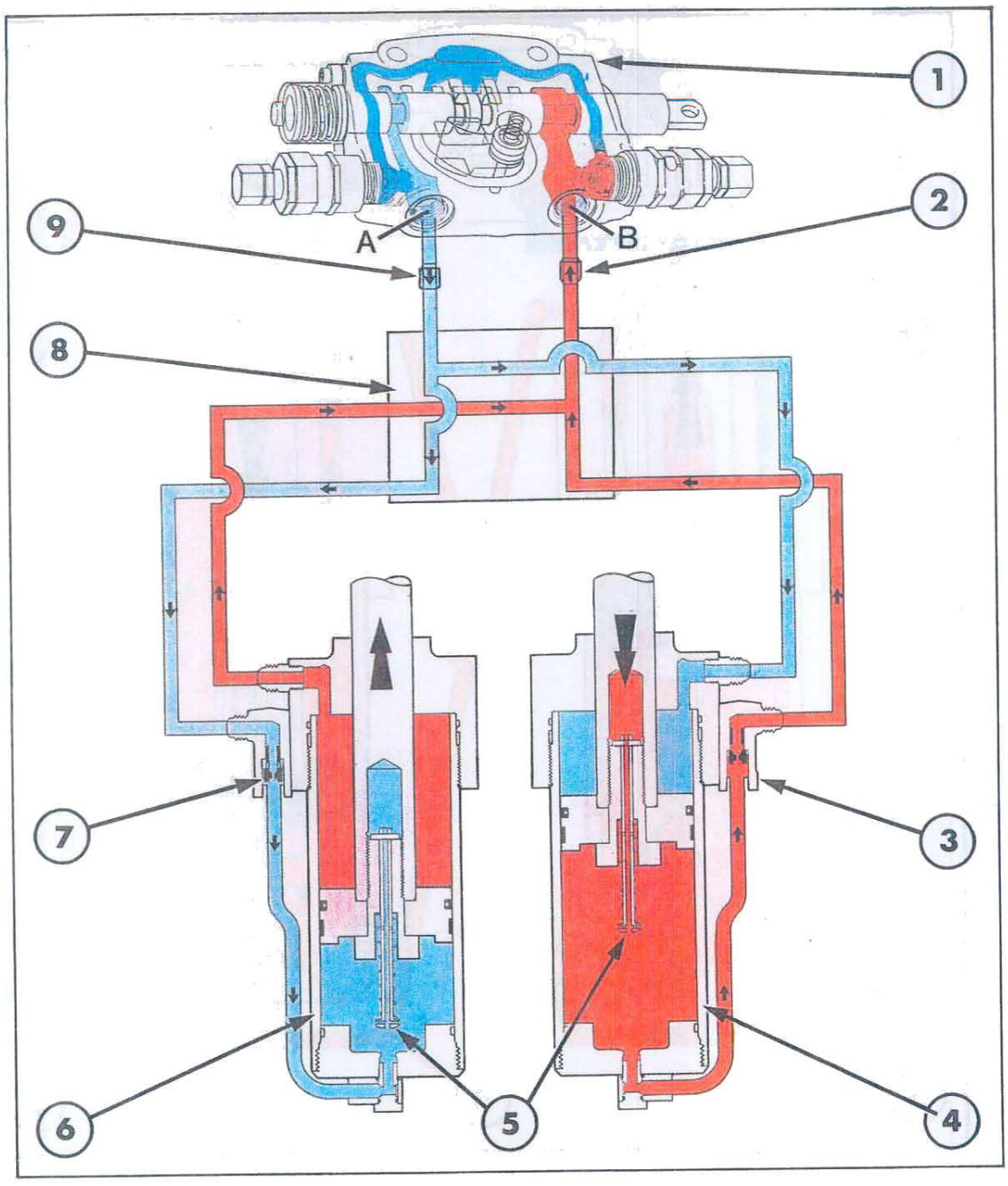

Figure 7
Swing Cylinders – Working Schematic Control Valve Suddenly Returned to Neutral (Sideshift shown)

Generated High Pressure | Re-supplied/Anti-cavitation Oil | Back Pressure Oil/Reservoir Oil

1. Swing Section of Main Control Valve
2. Line Restrictor in Restrict Position
3. Cylinder Restrictor in Restrict Position
4. Cylinder Assembly
5. Sliding Internal Restrictors
6. Cylinder Assembly
7. Cylinder Restrictor in Open Position
8. Manifold Assembly
9. Line Restrictor in Open Position

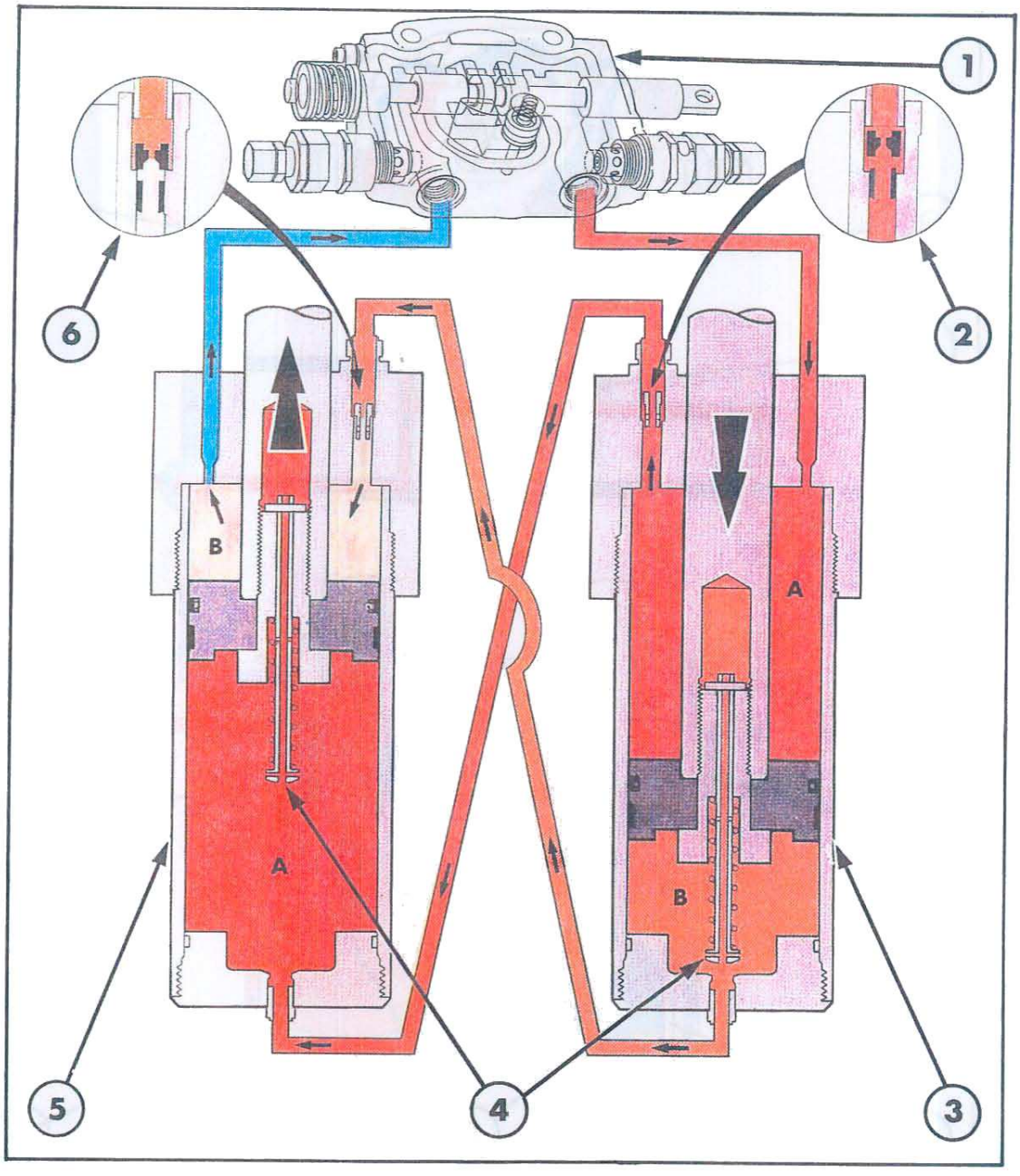

Figure 8
Swing Cylinders – Working Schematic Normal Swing (Centre Pivot shown)

Pump Pressure Oil

1st Stage Restricted Return Oil

2nd Stage Restricted Return Oil

Return to Reservoir Oil

1. Control Valve Swing Section
2. One Way Restrictor
3. Left Swing Cylinder
4. Cushioning Rod
5. Right Swing Cylinder
6. One Way Restrictor

B. HYDRAULIC CYLINDERS – DESCRIPTION AND OPERATION

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

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

Rod sealing on all cylinders is accomplished by a "snap-in" polyurethane "U" cup seal facing the internal pressure and positioned in a machined groove in the cylinder gland.

A loose fitting polyurethane buffer seal is also incorporated in a groove immediately in front of the "U" seal and protects the seal during operating pressures. A single small groove moulded across the face of one side of the buffer seal and positioned facing the pressure side of the cylinder permits the ecape of oil from between the buffer and "U" seal during cylinder retraction and consequently prevents ballooning and leaking of the seals.

In order to prevent the ingress of foreign matter to the cylinders a wiper seal is also positioned in the outer edge of the gland.

There are two differing methods of retaining the gland assembly to the cylinder. On backhoe cylinders with the exception of the extendible dipstick cylinder and side shift stabiliser cylinder the gland has a threaded method of retention, Figure 9. It should also be noted that on this design a rod bearing sleeve is also installed between the wiper and "U" seal.

On loader, side shift stabilisers extendible dipstick and multi-purpose bucket cylinders the gland is retained in the cylinder barrel using a locking wire which is fed into a mating semi-circular annuli machined into the barrel and gland, Figure 10. Installation of this locking wire is achieved by rotating the gland within the barrel whilst feeding the wire into the groove at the same time. A short piece of wire is left exposed on the cylinder barrel outer surface, to be pulled, whilst the gland is counter-rotated during removal of the gland.

All cylinder pistons utilise a one piece leaded 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, one 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 pressured, oil acts on the seal and expands it against the outer, rigid, glass-filled PTFE seal, forcing it outward against the barrel wall and against the piston groove, ensuring efficient sealing with minimum friction.

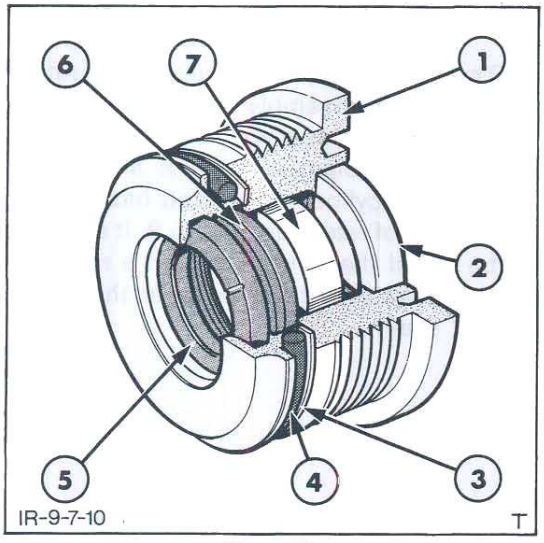

Figure 9
Threaded Type Gland Assembly

1. Gland
2. Wiper Seal
3. Back-up Ring
4. 'O' Ring Seal
5. Buffer Seal
6. "U" Seal
7. Rod Bearing Sleeve

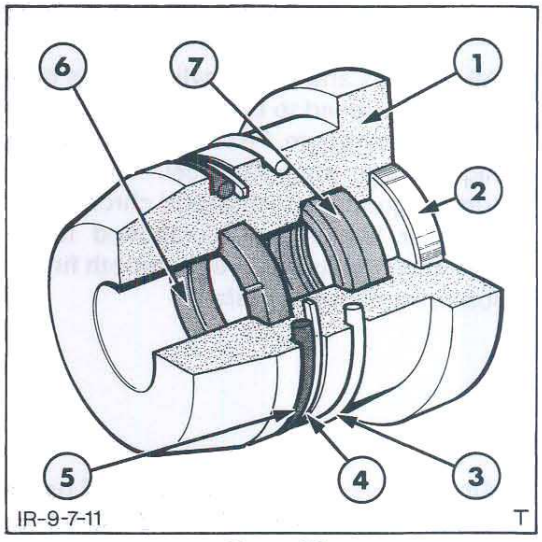

Figure 10
Wired Type Gland Assembly

1. Gland
2. Wiper Seal
3. Locking Wire
4. Back-Up Ring
5. 'O' Ring Seal
6. Buffer Seal
7. 'U' Seal

Figure 11 illustrates the various pistons used together with the appropriate method of attaching the piston to the cylinder rod.

Listed below are the various gland and piston types that are identified in Figure 11.

Piston Design	Element Cylinder
A	Backhoe Lift Ford 555 and 655 only
B	Backhoe Lift 4.3. metre backhoe only
C or D	Backhoe Bucket
E or F	Centre Pivot Stabiliser
G	Backhoe Crowd
H	Loader Bucket Loader Lift Extendible Dipstick Multi-purpose Bucket Sideshift Stabiliser
J or K	Backhoe Swing

Figure 11
Hydraulic Cylinder Piston Design and Application

1. Piston
2. Inner Soft Back Up Seal
3. Washer
4. Spacer
5. Ring
6. Washer
7. Bolt
8. Decelerator
9. Piston Ring
10. Wear/Bearing Rings
11. Outer Stiff Piston Seal

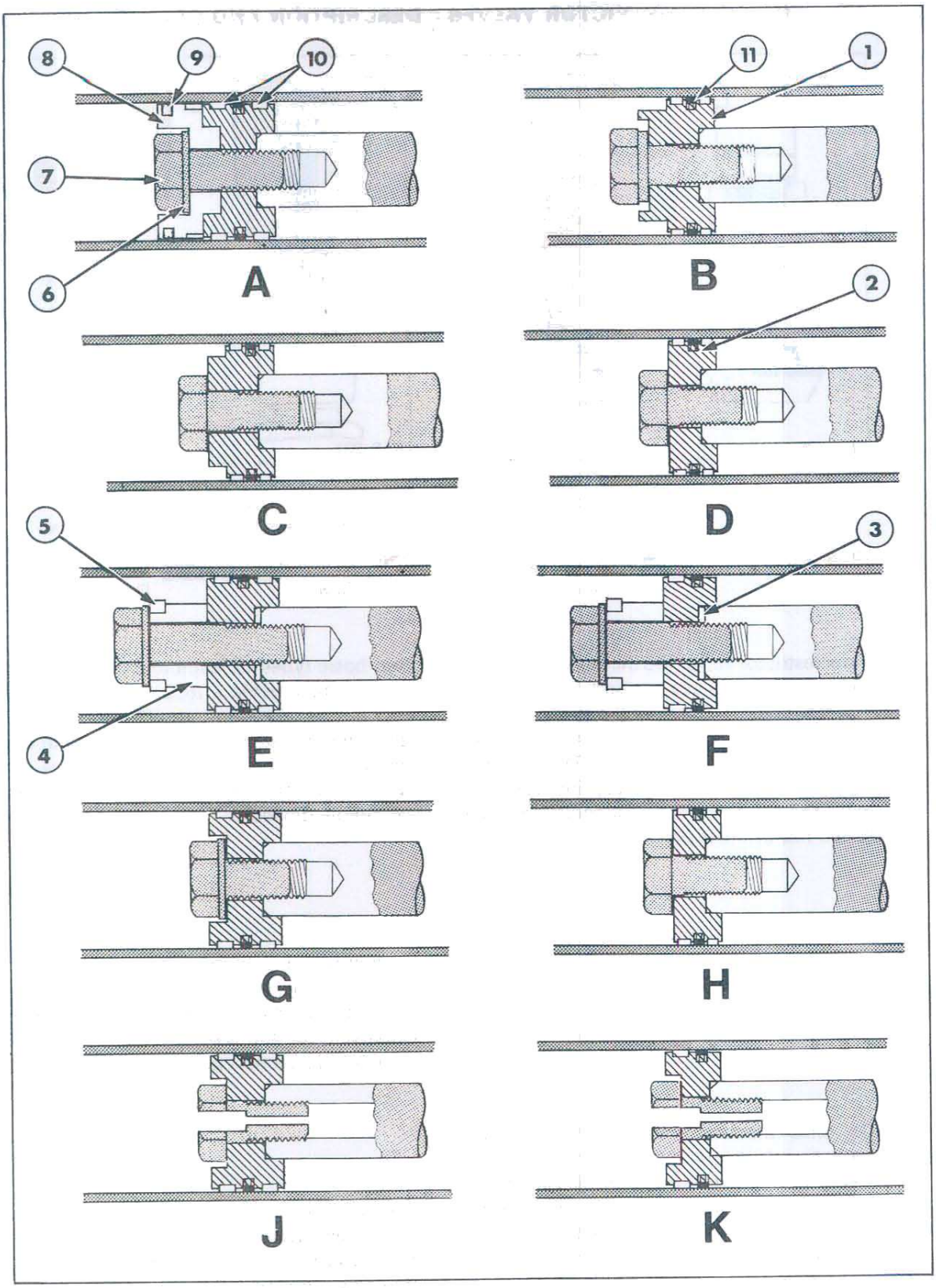

Figure 11
Hydraulic Cylinder Piston Design and Application

C. FLOW RESTRICTOR VALVES – DESCRIPTION AND OPERATION

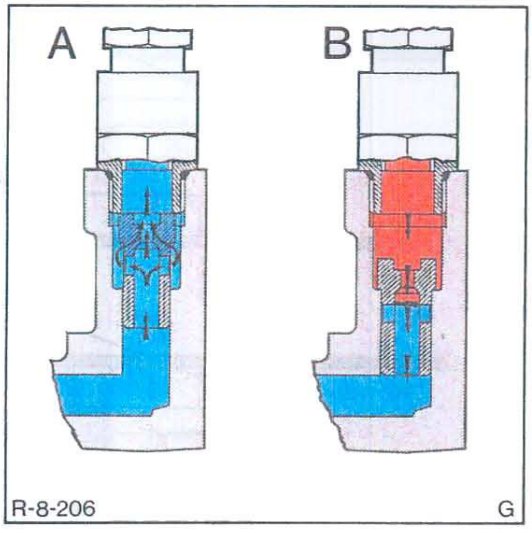

Figure 12
Swing Cylinder Restrictor – Operating Principle

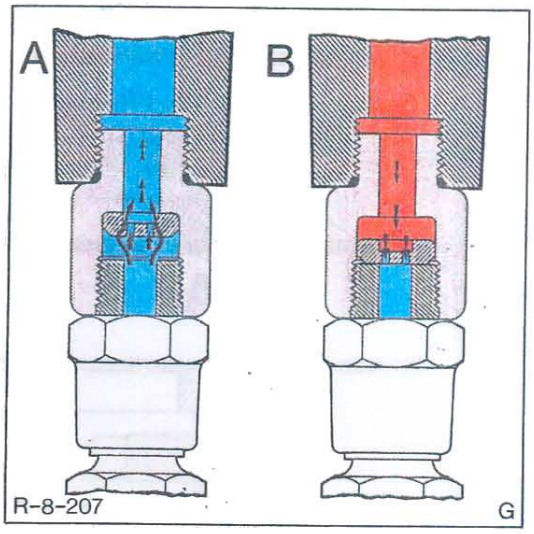

Figure 13
Lift Cylinder and Side Shift
Swing System Control Valve End Restrictor

Restricted Oil Flow

Unrestricted Oil Flow

Restricted Oil Flow

Unrestricted Oil Flow

Flow restrictor valves are incorporated in the swing system circuits on both centre pivot and side shift models, and the swing section outlet ports of the backhoe main control valve on side shift models only. The backhoe lift cylinder also has a restrictor incorporated in the rod side feed tube connection adjacent to the rod cylinder port.

On units manufactured for Scandinavian markets a lock-out restrictor valve is also incorporated in the rod end circuit of the stabilisers. This valve prevents the sudden collapse of a stabiliser leg should a feed hose be severed during working operations and is housed in an assembly attached to each stabiliser leg.

Two basic types of restrictors are used and function to provide a reduced or restricted flow in one direction only. Rate of oil flow restriction or size of restrictor varies with the particular circuit or, in the case of the lift cylinder, whether equipped with, or less, an extendible dipstick.

Section A described in principle the function of the swing system restrictors. The lift cylinder restrictor is similar to the type employed on the side shift main control valve/swing section ports.

The swing cylinder restrictors incorporated in the feed tube connections of side shift models and integral with the centre pivot cylinders are similar, and are unique to the swing cylinders.

Figure 12 illustrates the oil flow path in the restrict and un-restrict positions for the swing cylinder restrictors. Oil entering the restrictor from the control valve on route to the cylinder, automatically moves the restrictor to the un-restrict position – 'A'. Oil can pass through the hollow centre and out through the cross drilling, around the outer spaces and exit via the milled slot to the cylinder.

Oil exhausting from the cylinder returning to the control valve moves the restrictor to the opposite position 'B' and the cross drilling becomes blocked because the head of the restrictor has become seated. The only path available to the oil flow is the pre-determined centre orifice.

The orifice for side shift swing cylinders is 0.126" (3.20 mm) diameter and for centre pivot swing cylinder is 0.143" (3.65 mm). Each restrictor can be recognised by its identification stamp "S" for side shift and "C" for centre pivot.

Figure 13 illustrates the oil flow path for the restrictors in the sideshift swing section of the backhoe main control valve and the lift cylinder restrictor.

Oil flowing to the swing cylinders from the control valve and to the lift cylinder rod side from the control valve, moves the restrictor to the un-restrict position – 'A' allowing oil to pass around the outside of the restrictor across the milled slot and on to the cylinder. Oil exhausting from the cylinder returning to the valve block automatically shifts the restrictor to the restrict position – 'B'. The only path the oil can follow is now through the four small drillings in the centre of the restrictor.

This operating principle also applies to the restrictors on Scandanavian tractor stabilisers.

The restrictors for the side shift swing section lift cylinder and Scandanavian tractor stabilisers are identified as follows:-

Swing section (side shift)	4 holes 0.075 in. (1.9 mm) diameter stamped 4.8 on face
Lift cylinder rod end – less extendible dipstick	4 holes 0.125 in. (3.19 mm) diameter stamped 8 on face
Lift cylinder rod end – with extendible dipstick	4 holes 0.109 in. (2.78 mm) diameter stamped 7 on face
Stabiliser cylinder rod end – Scandanavian build only	4 holes 0.048 in. (1.21 mm) diameter stamped 6 on face

D. HYDRAULIC CYLINDERS – OVERHAUL

GENERAL

For reasons of cleanliness and ease of handling, all cylinders should be removed from the unit for overhaul. However, it is strongly recommended that the gland on all cylinders except swing, extendible dipstick and side shift stabiliser cylinders be loosened prior to removal from the attaching points. In the case of loader cylinders which have a wire locking device securing the gland, removal of the wire may also be eased with the cylinder still attached to the frame.

Ensure all residual pressures are relieved before disconnecting hydraulic connections. Use care in the handling of cylinders. Secure cylinders with a sling as shown in Figure 14 during removal and installation. Dropping or mishandling can cause damage to the surface of the rod or cylinder bore.

WARNING: *Do not remove cylinders from the excavator without first providing ample support and blocking for structural members.*

High torques are required to secure threaded glands and therefore require considerable torque to loosen. The cylinder anchor points with the pins installed, provide a good anchor while the loosening force is applied to the gland. During production a locking sealant is applied to threaded glands and will naturally increase the torque required to loosen the gland than that applied to tighten. If difficulty in loosening is experienced, gently heat the surrounding area of the gland thread to 300°F (150°C), which will soften the sealant and assist loosening. If heat is used, it is essential that gland seals, 'O' rings and wiper seals be renewed.

The following listing shows the special tools for the 'peg' type or 'C' type wrench used for loosening or tightening a particular cylinder gland. Note that the 'C' wrenches are for use with the wire type locking system.

Procedures for removing each cylinder are basically the same, with the exception of the swing, extendible dipstsick and side shift stabiliser cylinders. Ensure the loader bucket is positioned flat on the ground or the backhoe is positioned and supported in such a way that subsequent cylinder removal will be safe and non-hazardous to other personnel.

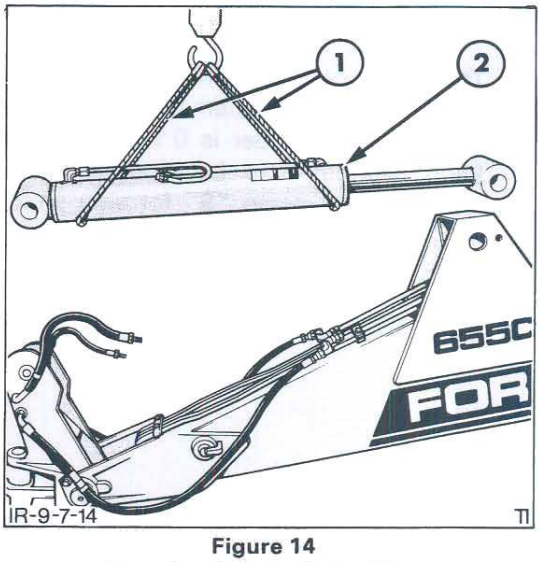

Figure 14
Removing Cylinder Using Sling

1. Sling
2. Cylinder

APPLICATION	TYPES	TOOL NO. (VL CHURCHILL)
Lift Cylinder	Side shift and centre pivot backhoe with and without extendible dipstick	FT 8549 (Peg Wrench)
Crowd Cylinder	Side shift and centre pivot backhoe	FT 8549 (Peg Wrench)
Bucket Cylinder	Side shift and centre pivot backhoe	FT 8550 (Peg Wrench)
Extendible Dipstick	Side shift and centre pivot backhoe	FT 8553 ('C' Wrench)
Swing Cylinder	Side shift and centre pivot backhoe	FT 8552 (Peg Wrench)
Stabiliser Cylinder	Centre pivot backhoe	FT 8551 (Peg Wrench)
Stabiliser Cylinder	Side shift backhoe	FT 8554 ('C' Wrench)
Lift Cylinder	Loader	FT 8553 ('C' Wrench)
Bucket Cylinder	Loader	FT 8553 ('C' Wrench)
Multi-Purpose Bucket Cylinder	Loader	FT 8554 ('C' Wrench)

REMOVAL

Backhoe Lift, Crowd and Bucket Cylinders

1. Park the unit on a level, firm surface and place the backhoe elements in a suitable position to best enable the particular cylinder to be removed. Block or support the structural members so that they will be stable and safe to work around.

2. Using hydraulic pressure, relieve any loadings on the cylinder pins so that subsequent pin removal will be aided. Stop the engine and relieve all residual pressures.

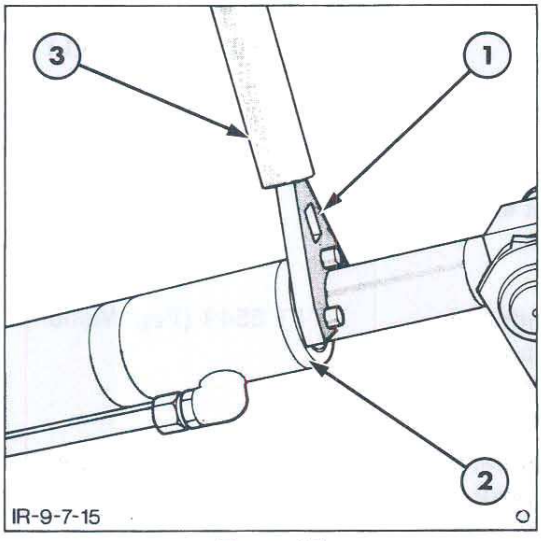

Figure 15
Loosening Cylinder Gland – Threaded Type

1. Peg Wrench
2. Gland
3. Suitable Tube for added Leverage

3. Loosen the cylinder gland using the appropriate peg wrench as shown in Figure 15.

4. Disconnect the hydraulic hoses from the tubes and cylinder ports and cap or plug all openings.

5. Position a sling, as shown in Figure 14, around the cylinder or use other suitable lifting equipment to support the weight of the cylinder.

6. Remove the cylinder pivot pin retaining bolts or snap rings and washers.

NOTE: *The lift cylinder rod end and crowd cylinder piston end use a common attaching pin. When either cylinder is being removed, the other cylinder must be securely supported and the dipstick positioned in such a way that no movement is possible.*

7. Drive the attaching pins from the cylinder using a brass drift and hammer. Accurate positioning of the cylinder prior to hose disconnection will aid pin removal.

8. Remove the cylinder, drain the contained oil and re-cap the openings.

Swing Cylinder – Side Shift

1. Position the unit on a hard level surface and rest the digging elements on the ground in a safe position.

2. With the engine stopped, relieve residual pressures by moving all control levers in all directions.

3. Disconnect the hoses from the cylinder to be removed and cap all exposed openings.

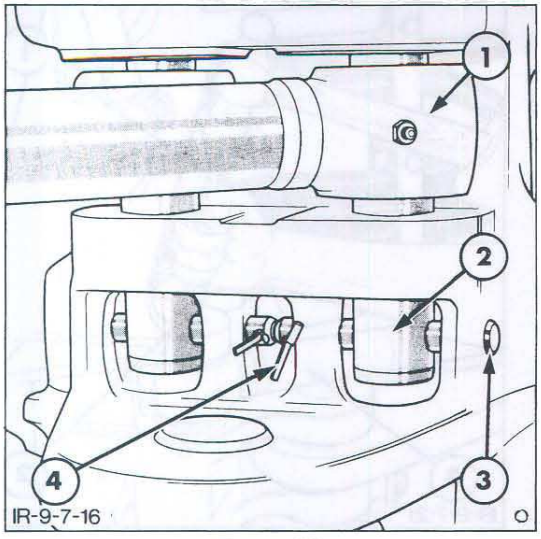

Figure 16
Swing Cylinder Rod End Retainer – Side Shift

1. Cylinder Rod
2. Rod End Pivot Pin
3. Pin Retainer
4. Cotter Pin (Split Pin)

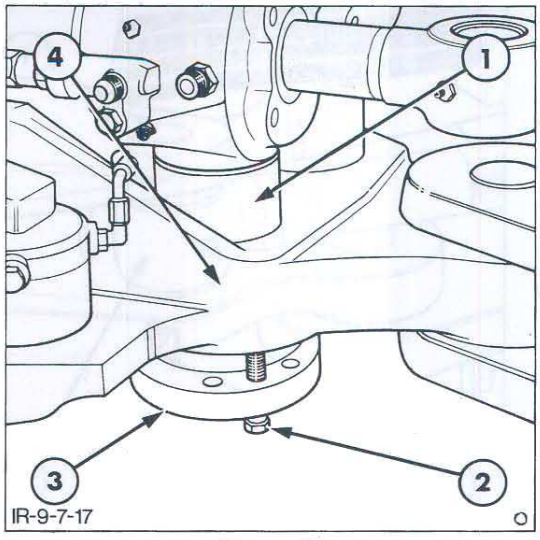

Figure 17
Removing Trunnion Retainers – Side Shift

1. Upper Portion of Trunnion
2. Jacking Bolt
3. Trunnion Flange
4. Carriage

4. Remove the cylinder rod pin by removing the cotter pin securing the pin retainers and driving out the retainer. It may be necessary to remove both pin retainers in order to remove the one required, Figure 16. Drive out the rod end pivot pin.

5. Remove the cylinder trunnion retainer fixing bolts from the underside of the carriage.

6. Using suitable bolts in the jack threads provided, jack out the trunnion retainers, Figure 17.

7. Using suitable levers, ease out the cylinder rod from the swing frame, taking care to support the cylinder in case it drops from its upper bearing in the carriage. If necessary, lever the cylinder downward. Avoid using your hands during this operation as the cylinder is heavy.

8. If assistance is available, remove the cylinder from its position within the carriage. If necessary, use suitable lifting slings/craneage to remove the cylinder.

9. Drain any contained oil and recap all openings.

Swing Cylinder – Cente Pivot

1. Position the unit on a hard, level surface and rest the digging elements on the ground in a safe position.

2. With the engine stopped, relieve residual pressures by moving all control levers in all directions.

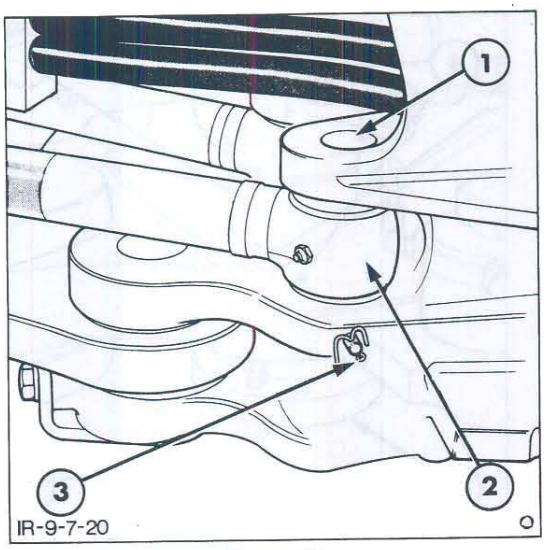

Figure 18
Swing Cylinder Rod End Retainer – Centre Pivot

1. Rod End Pivot Pin
2. Cylinder Rod
3. Pivot Pin Retainer

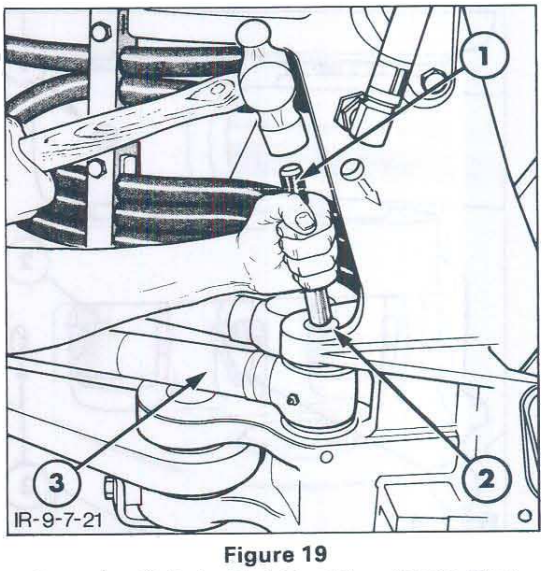

Figure 19
Removing Cylinder Rod Pivot Pin – Centre Pivot

1. Drift
2. Pivot Pin
3. Cylinder Rod

3. Disconnect the hoses and tubes from the swing cylinder to be removed. Ensure the rear feed hose is clear for subsequent removal.

4. Remove the cotter pins from the rod end pin retainer and drive out the pin. Note that this pin retains both cylinder rod pins, Figure 18.

5. Using a suitable drift, drive out the rod end pivot pin, Figure 19.

6. Remove the 6 bolts, Figure 20, securing the cylinder trunnion retainer and bushing plate assembly. Collect the loose nut bars.

7. Lever the plate upwards from both cylinder upper trunnions.

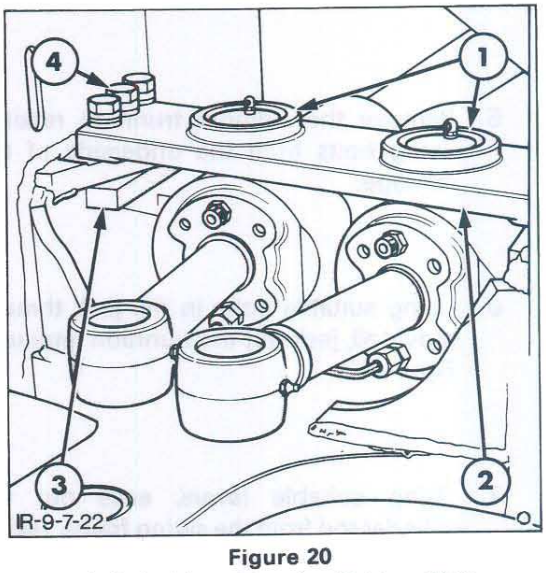

Figure 20
Cylinder Upper Trunnion Retainer Plate

1. Cylinder Upper Trunnions
2. Retainer and Bushing Plate
3. Nut Bar
4. Fixing Bolts

8. Lever the rod end out of the swing frame, retracting the cylinder so that it is clear of the frame.

9. Using a suitable jack and distance piece with a diameter slightly smaller than the trunnion diameter, push the cylinder upwards until it is clear of the lower trunnion bearing. It may be necessary to rock or rotate the cylinder slightly to prevent binding.

10. With assistance, or the use of suitable sling and lifting equipment, remove the cylinder from the main frame.

11. Drain the oil from the cylinder and re-cap the exposed openings.

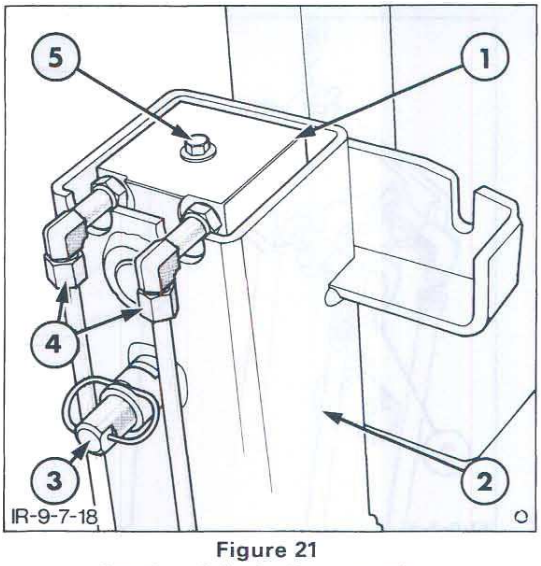

Figure 21
Stabiliser Cylinder Upper Retainer

1. Cylinder
2. Outer Casing (Mainframe)
3. Locking Pin (where fitted)
4. Oil Supply Connections
5. Locking Bolt

NOTE: *In certain markets a locking pin is installed in the stabiliser leg to prevent accidental lowering of stabiliser and should be removed where fitted, Figure 21.*

3. Lift the stabiliser leg exposing the rod end of the cylinder and rotate the rod 90°.

Stabiliser Cylinder – Side Shift

1. Position the unit on a hard level surface and rest the digging elements on the ground in a safe position.

2. Remove the stabiliser pad. Lower the stabiliser to the ground and with the engine stopped relieve residual pressures.

4. Disconnect the hydraulic feed tubes and where fitted, remove the lock-out valve assemblies. (These valves are fitted in certain markets only and are installed between the oil supply connections and the cylinder). Cap all exposed openings.

5. Remove the cylinder locating pin locking bolt.

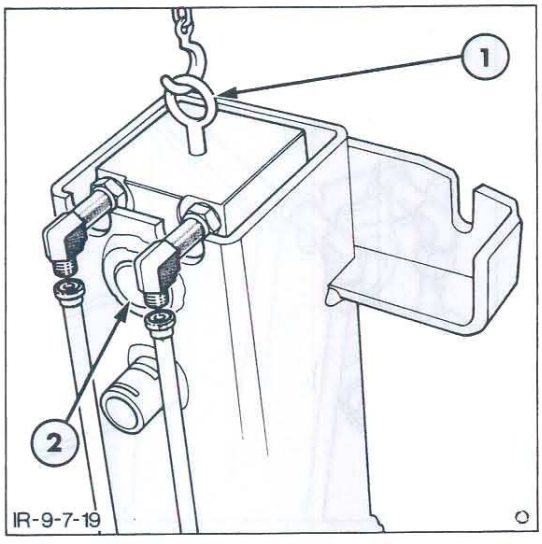

Figure 22
Supporting Stabiliser Cylinder Prior to Pin Removal

1. Eye bolt
2. Locating Pin

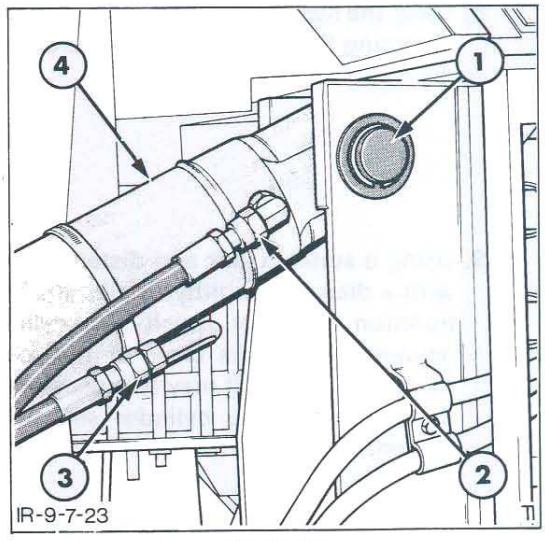

Figure 23
Stabiliser Cylinder Upper Retainer

1. Cylinder Upper Retaining Pin
2. Piston End Hose Connection
3. Rod End Hose Connection
4. Cylinder Barrel

6. Fit a suitable eye bolt in the threaded bore on the top of the cylinder, ensuring that the threaded portion does not re-lock in the waisted section of the locating pin and support the weight of the cylinder with suitable lifting equipment, Figure 22.

7. Drive out the locating pin and lift the cylinder from the casing.

Stabiliser Cylinder – Centre Pivot

1. Position the unit on a hard level surface and rest the digging elements on the ground in a safe position.

2. Lower the stabilisers to the ground and with the engine stopped relieve any residual pressures by moving the stabiliser control levers.

3. Disconnect the hydraulic hoses on the cylinder to be removed, Figure 23.

4. Securely support the cylinder using a suitable hoist. Remove the snap rings and washers at the cylinder retaining pins and drive out each pin. Withdraw the cylinder from the vehicle.

Extendible Dipstick Cylinder

The extendible dipstick cylinder is totally enclosed in the telescoping dipstick structure. For servicing the cylinder it is recommended that the whole dipstick assembly be removed from the boom assembly.

1. Retract the dipstick and remove the extendible dipstick assembly as described in Chapter 8 of this Part.

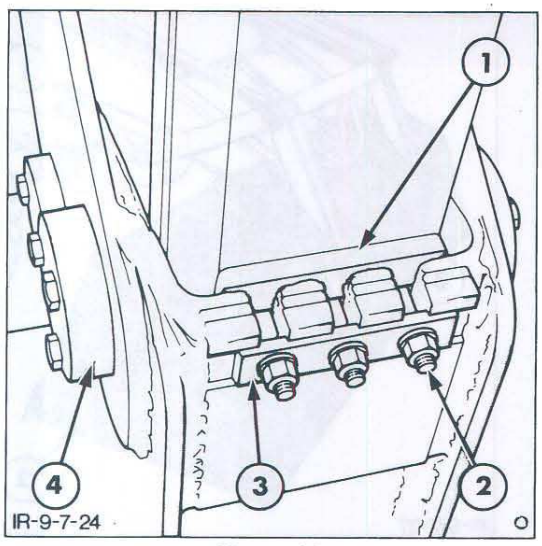

Figure 24
Extendible Dipstick Wear Plates

1. Wear Plate
2. Wear Plate Retaining Nuts
3. Anchor Bracket
4. Wear Plug Retaining Cap

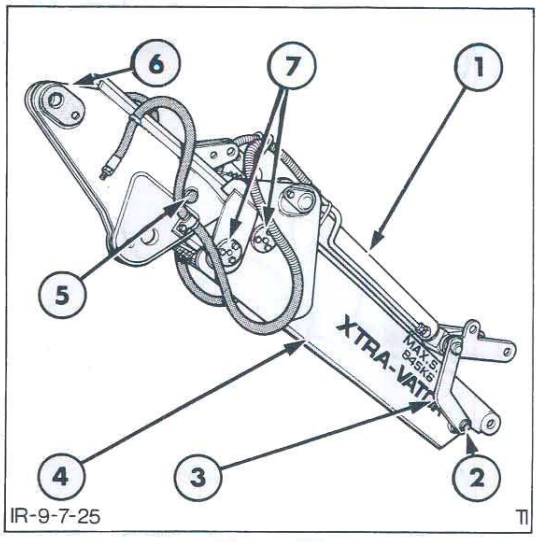

Figure 25
Extendible Dipstick Assembly

1. Bucket Cylinder
2. Extendible Dipstick Cylinder Attaching Pin-Rod End
3. Idler Links
4. Extendible Dipstick – Outer Section
5. Extendible Dipstick Cylinder Attaching Pin-Piston End
6. Extendible Dipstick – Inner Section
7. Wear Button Retaining Caps

2. Loosen the external wear plate nuts, Figure 24, from upper and lower sides of the dipstick and remove the wear plates.

3. Remove the four wear button retaining caps and withdraw the buttons.

4. Remove the snap rings and washers at the idler link, Figure 25, and drive out the cylinder rod end attaching pin.

NOTE: *The rod end attaching pin also secures the bucket idler links. Make a note of their position.*

5. Separate the two parts of the extendible dipstick.

6. Support the extendible dipstick cylinder and remove the snap rings and pin securing the cylinder barrel to the dipstick. Carefully remove the cylinder taking care not to damage the cylinder tube or hoses.

Loader Cylinders

1. Park the unit on a firm level surface and position the loader assembly with the bucket fully rolled out as if for bucket removal. With the engine stopped, relieve any residual pressures by moving the loader control valve lever in all operating planes.

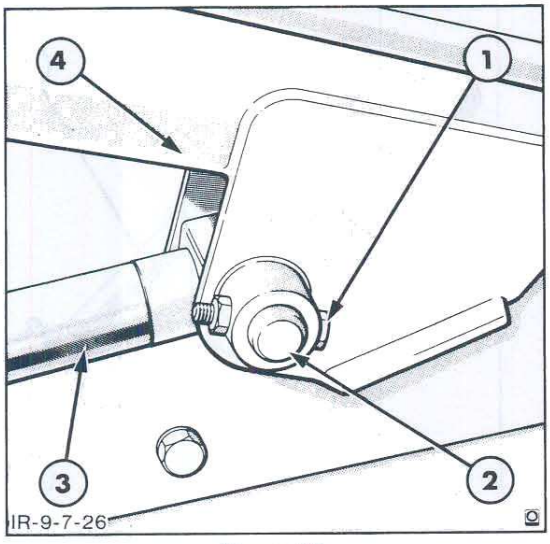

Figure 26
Loader Lift Cylinder Installation

1. Retaining Bolt
2. Rod Pin
3. Cylinder
4. Lift Arm

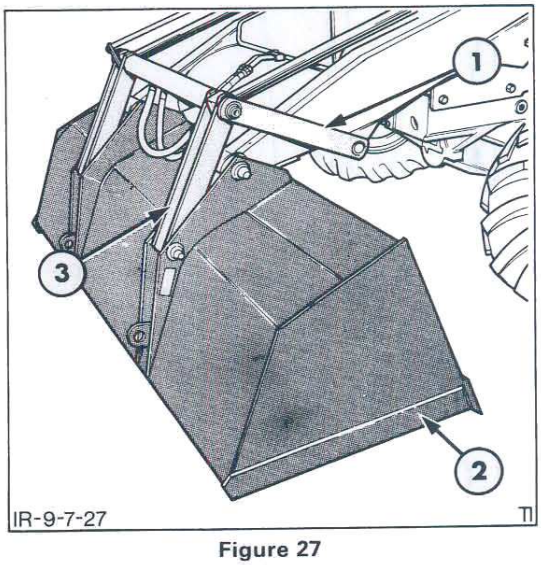

Figure 27
Loader Bucket In Removal Position

1. Idler Link
2. Bucket
3. Tipping Links

2. Lift Cylinder

(i) Position a suitable support between the cylinder barrel and ground.

(ii) Remove the rod pin by removing the pin to loader arm retaining bolt and nut, Figure 26.

NOTE: *The pin must be removed towards the outside of the unit. If the pin is tight, raise the loader arms, drive the pin towards the centre to the unit and install a dummy pin of slightly smaller diameter. Lower the arms to the original position and remove the dummy pin.*

(iii) Using hydraulic power, very slowly retract the cylinder so that the cylinder rod end comes clear of the attaching point on the lift arm.

(iv) Relieve any residual pressures and disconnect the hydraulic hoses. Cap or plug all exposed openings.

(v) Release the barrel from the subframe by removing the retaining bolt and washer.

(vi) With an assistant, or using suitable lifting equipment, remove the cylinder.

3. Bucket Cylinder

(i) Remove the bucket level linkage if the right hand cylinder is to be removed.

(ii) Fully roll out the bucket to the bucket removal position, Figure 27, and position a suitable support between the cylinder barrel and upper surface of the lift arm.

(iii) Disconnect the cylinder barrel from the loader arm by removing the pin retaining bolt and driving the pin out, Figure 28.

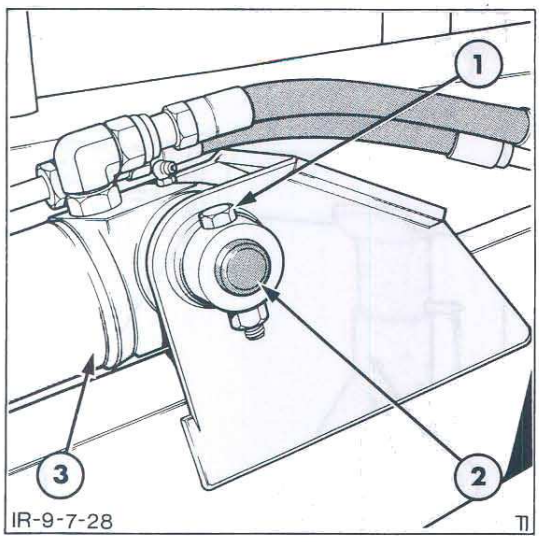

Figure 28
Loader Bucket Cylinder Barrel End Retainer

1. Bolt
2. Barrel Retaining Pin
3. Cylinder Barrel

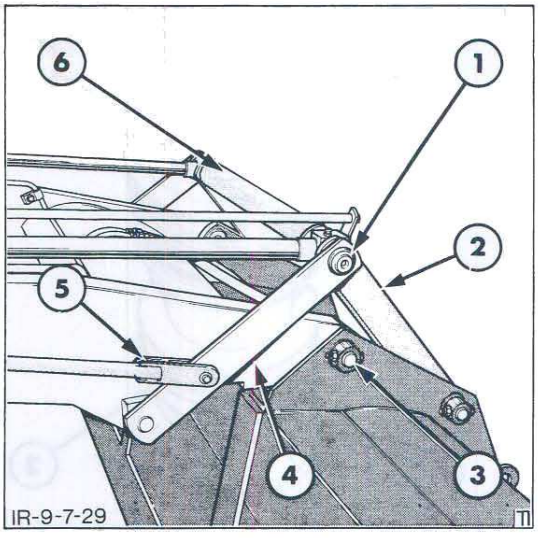

Figure 29
Bucket Cylinder Rod to Link Retainers

1. Snap Ring and Washer
2. Tipping Link
3. Pin
4. Idler Link
5. Bucket Level Linkage
6. Spacer Bar

(iv) Very slowly, using hydraulic power, retract the cylinder so that its barrel pivot is clear of the lift arm attaching point.

(v) Relieve any residual pressure and disconnect the hydraulic hoses. Cap or plug all exposed openings.

(vi) Remove the bucket tipping link retaining pin.

(vii) Remove the idler link retaining snap rings and washers at both ends of the link, Figure 29.

(viii) Remove the idler link, outer tipping link and, using assistance, lift the bucket cylinder from the lift arms.

DISASSEMBLY

Backhoe lift, crowd, bucket and centre pivot stabiliser cylinders

All the above cylinders follow the same disassembly procedure. Obviously, differences exist in cylinder barrel diameter, rod diameter and stroke, other differences in piston shape and method of attaching piston to rod also exist. Refer to Figure 9. Note that the extendible dipstick cylinder has a spacer positioned on the rod between the piston and gland carrier.

1. Thoroughly drain the cylinder of all oil from both ports. Re-cap these ports and thoroughly clean the exterior so that the internal parts will not become contaminated.

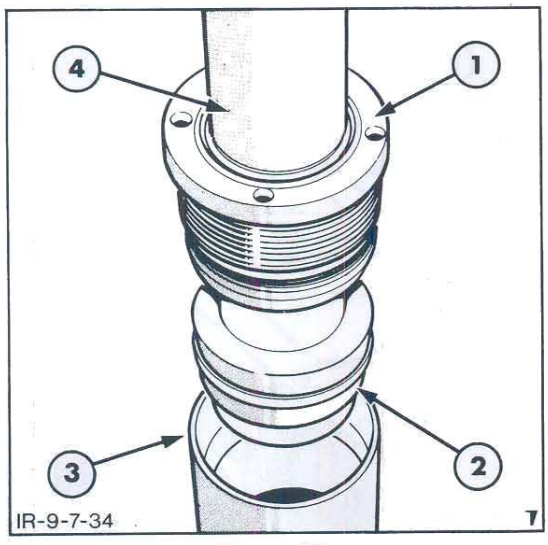

Figure 30
Piston, Rod and Gland Removal

1. Gland
2. Piston
3. Barrel
4. Rod

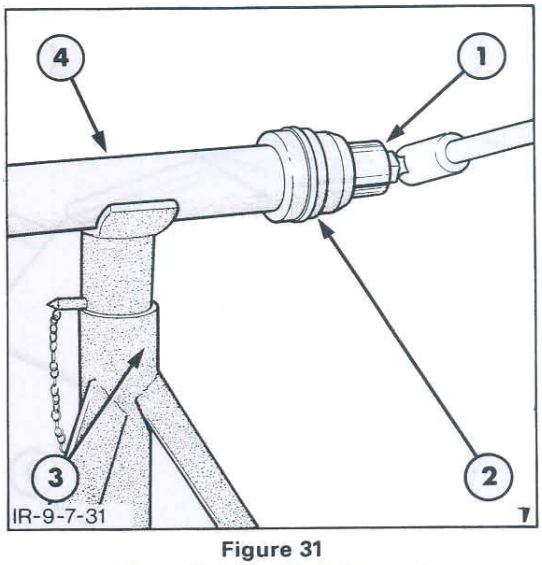

Figure 31
Piston Retaining Bolt Removal

1. Socket
2. Piston Assembly
3. Support
4. Rod

2. Unscrew the gland. If the gland was not loosened prior to cylinder removal, firmly secure the cylinder pivot end to an immovable object. The cylinder attaching point on the unit with the pin installed is ideal. Use the particular peg wrench detailed under 'Description and Operation' for the cylinder being disassembled. If necessary, heat the gland carrier to 300°F (150°C) to soften the sealant applied during manufacture. If heat is used, remember to renew all seals.

3. Pull the cylinder rod, gland and piston from the barrel, Figure 30.

NOTE: *Use care in removing the rod and piston assembly. Ensure the rod surface is not damaged during handling.*

4. Secure the rod trunnion in a vice or, preferably, secure to an anchor point on the machine using a retaining pin. Unscrew the piston retaining bolt using a high quality socket and drive system. Figure 31. Considerable torque may be necessary to loosen the bolt.

5. Remove the bolt, washer decelerator (555C/655C backhoe lift cylinder only) and piston assembly, Figure 32. Note that on backhoe bucket cylinders a washer is not positioned between the bolt and piston. Differences in the assembly of stabiliser cylinder pistons also exist and reference should be made to Figure 9 for component identification.

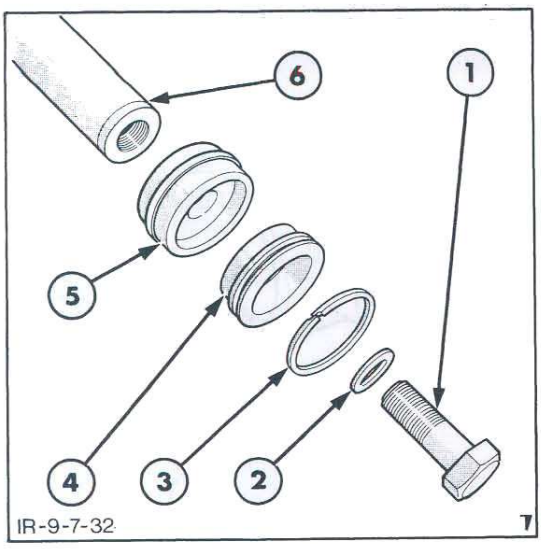

Figure 32
Piston Separated from Cylinder Rod – Ford 555C/ 655C Backhoe Lift Cylinder Shown

1. Retaining Bolt
2. Washer
3. Ring
4. Decelerometer
5. Piston Assembly
6. Cylinder Rod

6. Remove the gland from the rod, Figure 33.

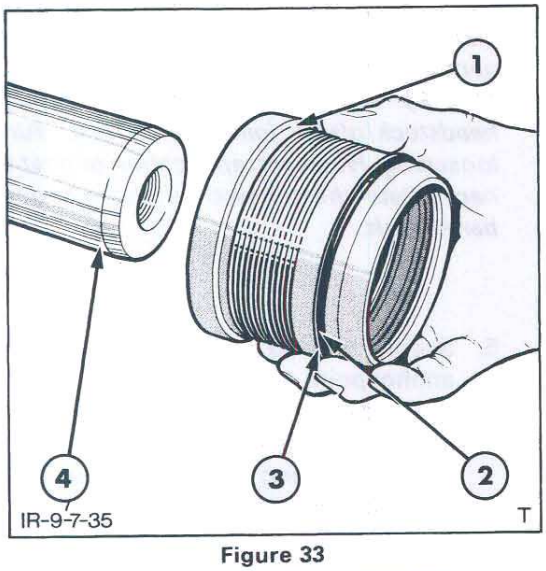

Figure 33
Removing Gland from Cylinder Rod

1. Gland
2. 'O' Ring Seal
3. Back-up Ring
4. Cylinder Rod

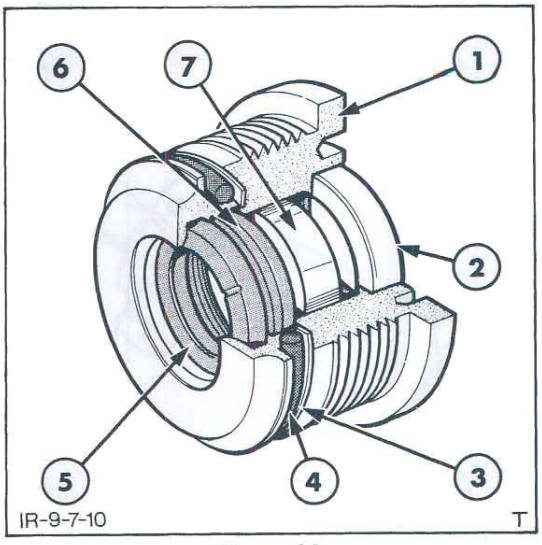

Figure 34
Threaded Type Gland Assembly – Section View

1. Gland
2. Wiper Seal
3. Back-up Ring
4. 'O' Ring Seal
5. Buffer Seal
6. 'U' Seal
7. Bearing Sleeve

NOTE: *That on the extendible dipstick cylinder a spacer is positioned on the rod between the piston and gland.*

7. Remove the 'O' ring and back-up ring from the outer diameter of the gland.

8. Remove the seals and nylon bearing from the gland taking care to note the orientation of the groove in the buffer seal, Figure 34.

Swing Cylinders – Side Shift and Centre Pivot

1. Drain the cylinder of all oil, re-cap the openings and thoroughly clean the exterior so that internal parts will not become contaminated.

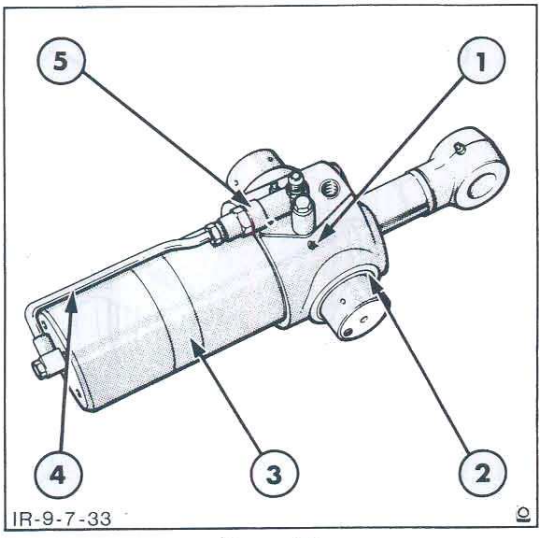

Figure 35
Swing Cylinder Assembly
Side Shift Shown

1. Barrel Locking Screw
2. Trunnion Seal
3. Barrel
4. Oil Supply Tube
5. Restrictor Valve Housing

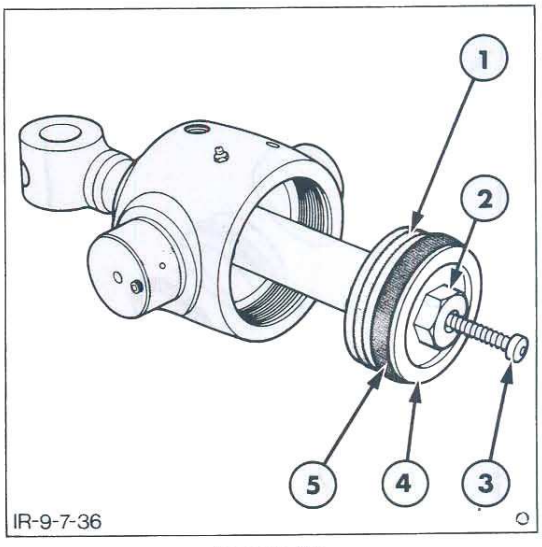

Figure 36
Barrel Removed from Swing Cylinder

1. Piston Seal
2. Piston Retaining Bolt
3. Sliding Restrictor
4. Piston
5. Piston Wear Ring

2. Remove the locking screw from the headstock/gland, Figure 35.

3. **Centre Pivot Units**
Remove the feed port connector and the restrictor valve from centre pivot cylinders.

Side Shift Units
Remove the piston end oil supply tube and restrictor valve housing from side shift cylinders.

4. Position the headstock/gland trunnion in a vice in such a fashion that all movement is prevented, and using Tool No. FT 8549, unscrew the barrel from the headstock, remove the barrel from the rod and piston assembly, Figure 36.

NOTE: *The barrel is screwed into the headstock/gland and an end cap is screwed into the piston end of the barrel. The torque and locking sealant application is identical. If gland leakage was evident before repair, gently heating the headstock/gland to 300°F (150°F) will ensure that the barrel to headstock/gland joint yields first during loosening. However, application of heat will necessitate the renewal of the gland and barrel seals.*

5. Secure the rod end in a vice or to an anchor point on the unit using a retaining pin, and using a high quality deep-welled socket and drive system, unscrew the piston retaining bolt. Take care not to damage the sliding restrictor assembly.

6. Remove the piston and slide the rod out of the headstock/gland assembly, Figure 37.

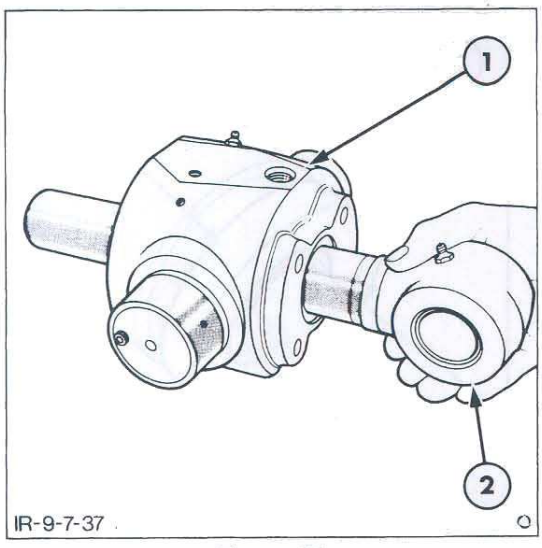

Figure 37
Piston Rod from Headstock Removal

1. Headstock/Gland Assembly
2. Piston Rod

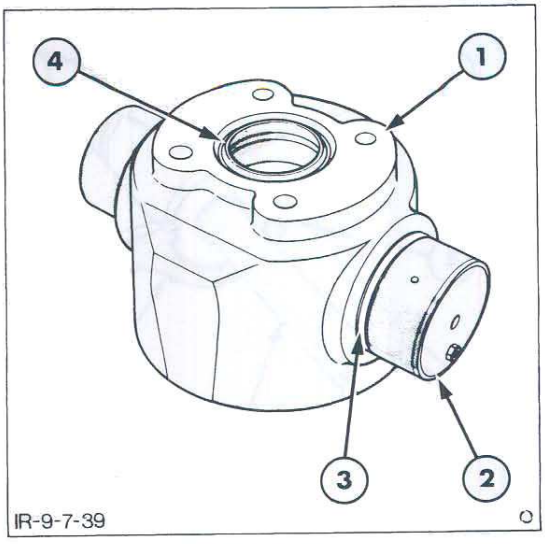

Figure 39
Swing Cylinder Headstock

1. Headstock
2. Bushing
3. Seal
4. Wiper Seal

7. From within the headstock remove the 'O' ring and back up ring which create the seal between headstock and barrel.

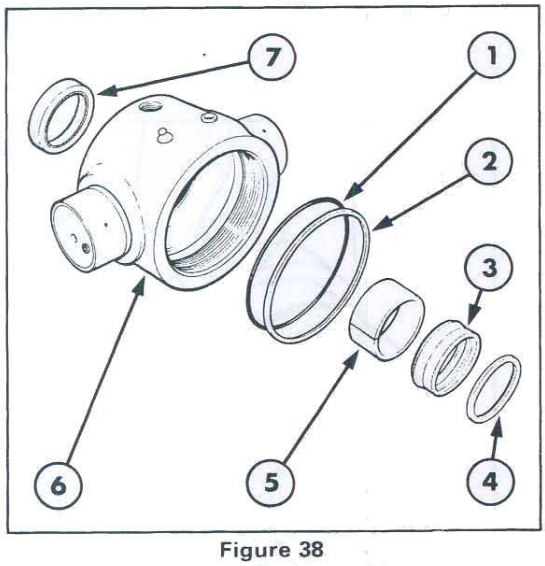

Figure 38
Headstock Seal Assembly

1. 'O' Ring
2. Back-up Ring
3. Rod Seal
4. Buffer Seal
5. Bearing Sleeve
6. Headstock
7. Wiper Seal

8. Remove the buffer seal, rod seal and bearing sleeve from the headstock/ gland, Figure 38. Note the orientation of the small groove in the buffer seal.

9. Remove the wiper seal, Figure 39.

NOTE: *Only remove the headstock bushing and seal if damaged.*

Loader Lift, Bucket, Extendible Dipstick and Side Shift Stabiliser Cylinders

1. Thoroughly drain the cylinder of all oil from both ports. Re-cap these ports and thoroughly clean the exterior so that the internal parts will not become contaminated.

2. Support the cylinder and secure the base end in a vice.

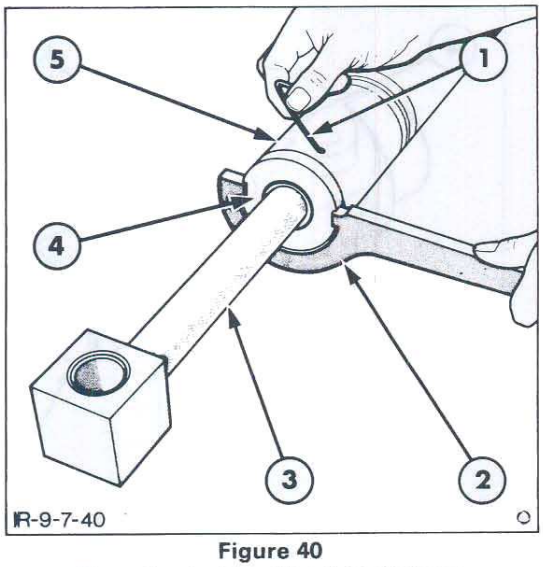

Figure 40
Removing Locking Wire from Cylinder

1. Locking Wire
2. Tool No. FT 8553 or 8554
3. Cylinder Rod
4. Gland
5. Cylinder Barrel

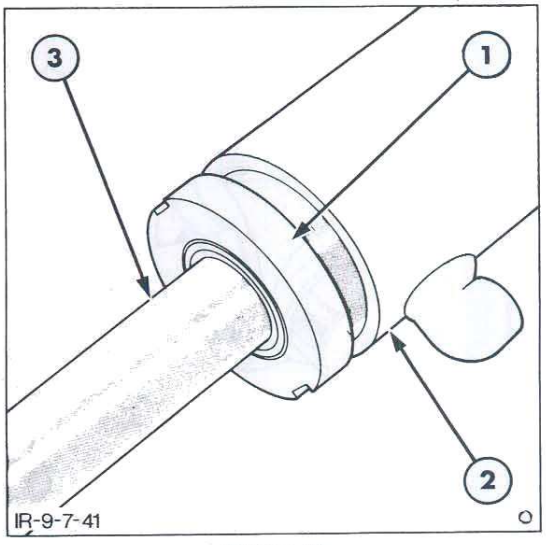

Figure 41
Removing Gland from Cylinder Barrel

1. Gland
2. Cylinder Barrel
3. Cylinder Rod

3. Using the special 'C' spanner applicable to the cylinder being disassembled and pulling the exposed tang of the locking wire, rotate the gland anti-clockwise and remove the wire, Figure 40.

4. Pull out the rod from the cylinder and knock the gland from the cylinder end. If necessary, continue to rotate the gland during this operation. Figure 41.

5. Support the rod and secure the rod end in a vice. Using a good quality socket and drive system, remove the piston retaining bolt. If necessary, apply heat up to 300°F (150°C) to loosen the locking sealant applied during manufacture. Note that the piston assembly must be renewed if heat is applied.

6. Remove the piston and slide the gland from the rod, Figure 42.

7. Remove the 'O' ring and back-up washer from the outer diameter of the gland and prise out the buffer seal gland seal and wiper seal, Figure 43.

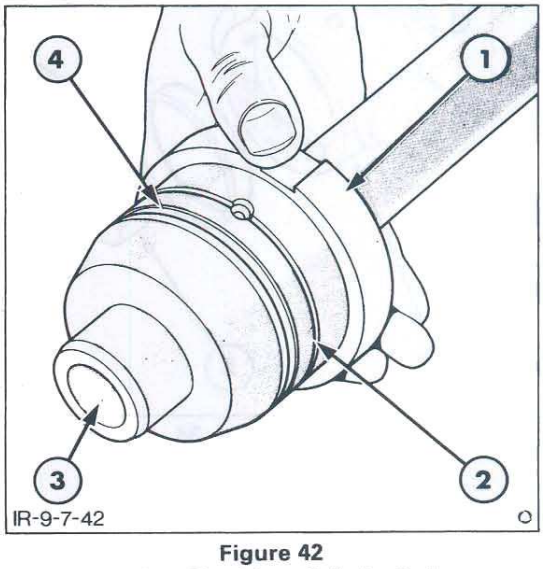

Figure 42
Sliding Gland from Cylinder Rod

1. Gland
2. Locking Wire Groove
3. Cylinder Rod
4. Back-up Ring and 'O' Ring Seal

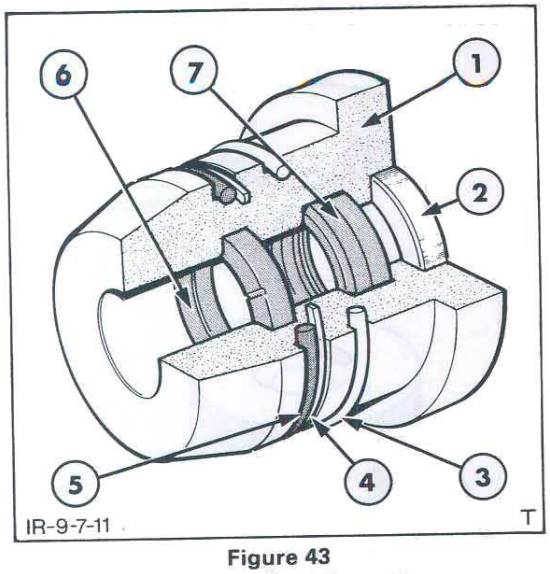

Figure 43
Wired Type Gland Assembly

1. Gland
2. Wiper Seal
3. Locking Wire
4. Back-up Ring
5. 'O' Ring Seal
6. Buffer Seal
7. 'U' Seal

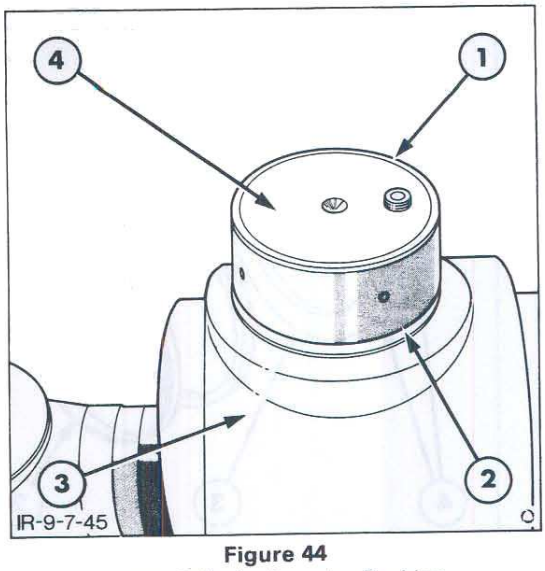

Figure 44
Swing Cylinder Trunnion Bushing

1. Bushing
2. Grease Seal
3. Headstock/Gland
4. Trunnion

INSPECTION

1. Thoroughly clean all parts in a suitable solvent and dry using compressed air or a lint free cloth.

2. Carefully inspect all components. Small nicks, burrs or other damage may be hidden by oil film. It is therefore essential that a thorough cleaning process be adopted.

NOTE: *Where grease seals are fitted, the bushings have a recess on the seal end to accommodate the seals. Install new seals accordingly. The swing cylinder rod end bushings do not have a seal recess. The seals are pressed in after the bushing has been installed. Install new seals accordingly. The crowd cylinder piston end attaching point is of a yoke type, therefore it uses two bushings and four grease seals.*

Bushings and Seals

1. Where fitted remove the grease seals.

2. Inspect the bushes in the rod and barrel ends where fitted. If wear exists, press out the bushings and install new bushes using a hydraulic press and suitable step plate.

3. Inspect the swing cylinder headstock trunnion bushes. If wear is apparent, pull the bushings from the trunnions and remove the grease seal. Thoroughly clean the grease channels, install new grease seals and press on new bushings flush with the horizontal surface of the trunnion, Figure 44.

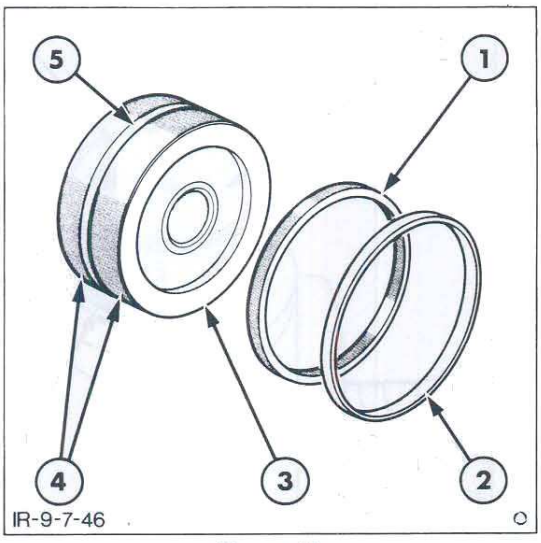

Figure 45
Piston and Seal Assembly

1. Expander Ring
2. Piston Seal
3. Piston
4. Wear Rings
5. Piston Seal Locating Groove

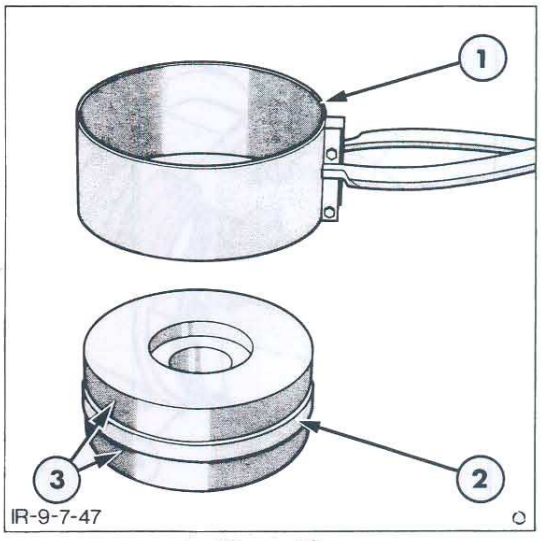

Figure 46
Using Ring Compressor to Resize Piston Seal

1. Ring Compressor
2. Piston Seal
3. Wear Rings

Piston Assemblies

1. Remove the piston seal and the rubber expander ring, Figure 45.

2. Inspect the wear ring(s) for wear and damage. These ring(s) are not removable and if damaged will require the procurement of a piston assembly which is supplied complete with the piston seal and rubber expander seal pre-assembled.

3. If the wear rings are in good condition and the piston is devoid of any major nicks or burrs, install a new rubber expander ring and ease a new seal into its recess. Avoid over-stretching the seal. Resize the seal once in position by compressing it with a suitable piston ring compressor, Figure 46. Ensure the surface of the piston ring compressor is clean and unmarked.

4. Thoroughly clean all traces of sealant (where used) from the piston retaining nut, and where possible, the threads in the piston rod.

5. On swing cylinders, inspect the moving restrictor rod, Figure 47, in the piston retaining bolt for freedom of movement. If the restrictor rod is damaged replace the bush located in the centre of the restrictor retaining bolt.

6. Inspect the return spring for cracks and the restrictor head for damage, wear, or poor seating. If evidence of poor seating exists, similarly inspect the mating part in the cylinder barrel end cap and replace worn components as necessary.

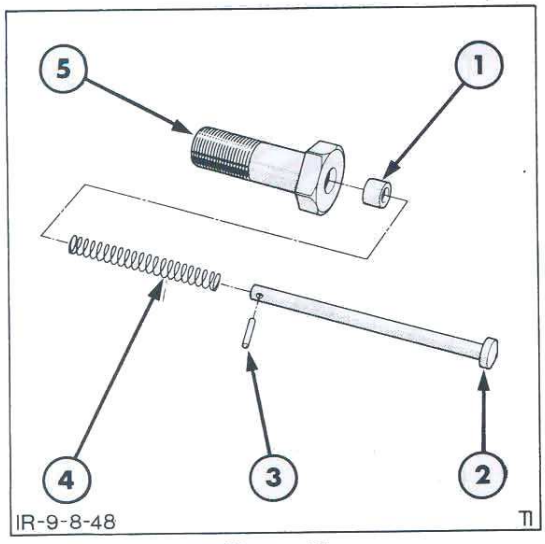

Figure 47
Swing Cylinder Moving Restrictor Assembly

1. Bush
2. Sliding Restrictor
3. Retaining Pin
4. Return Spring
5. Piston Retaining Bolt

Cylinder Barrels

1. Clean the bore with a suitable solvent.

2. Inspect the bore using a suitable light source for scratches, dents, burrs or other damage. Install a new cylinder if there is any evidence of damage.

3. Inspect the barrel threads or locking wire groove as applicable. The threads must be in good condition and undamaged. Similarly, the half groove for locking wire type retention should be clean, non-corroded and fully formed.

Cylinder Rods

1. Clean and inspect the rod for scratches, nicks and other damage. If damage cannot be repaired by buffing with a very fine abrasive, or the rod surface is distorted after buffing, a new rod should be installed. The chrome surface should be intact to provide a rust-resistant surface. Blemishes on the rod surface will damage the rod seal, bearing (where fitted) and wiper seal, causing gland leakage after a short period of operation following re-assembly.

2. Inspect the internal threads on the rod ends and remove any old sealant. The threads must be in good condition because of the high piston bolt torque required to secure the piston. Repair any damage noted.

Gland Assemblies

1. Discard all seals in the gland.

2. On threaded gland assemblies inspect the rod bearing sleeve for wear and renew as necessary.

3. Inspect the gland for cracks or other distortion. Check the threads on threaded glands. The threads must be in a good condition because of the high torque required to secure them. Ensure all traces of old sealant are removed. Similarly, check the half groove on the outer surface for those glands retained by locking wire. Ensure the groove is clean, undistorted and uncorroded.

4. Renew the outer 'O' ring seal and back-up ring.

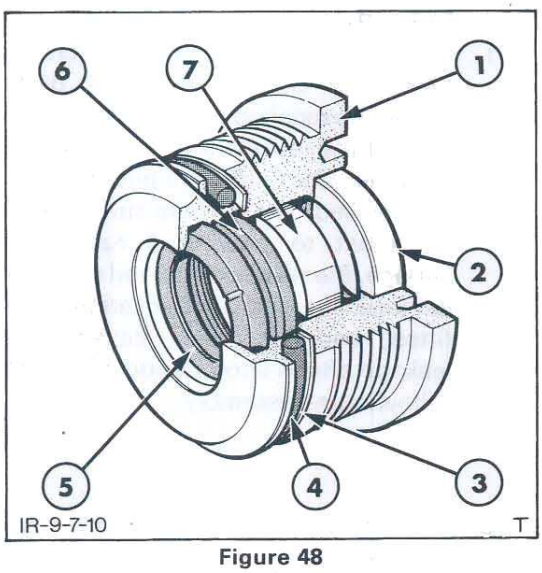

Figure 48
Threaded Type Gland Assembly

1. Gland
2. Wiper Seal
3. Back-up Ring
4. 'O' Ring Seal
5. Buffer Seal
6. 'U' Seal
7. Bearing Sleeve

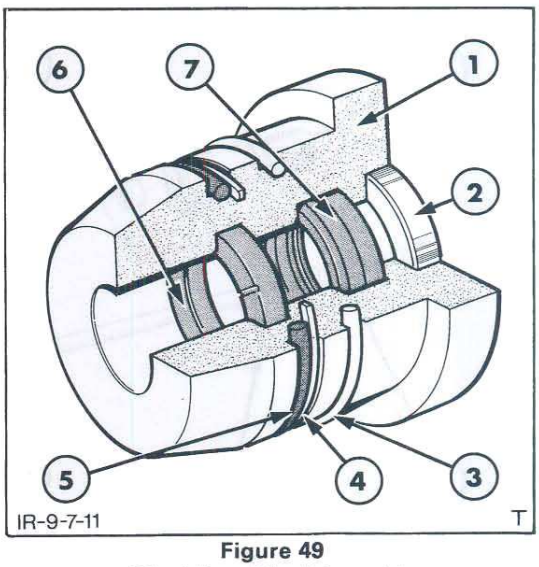

Figure 49
Wired Type Gland Assembly

1. Gland
2. Wiper Seal
3. Locking Wire
4. Back-up Ring
5. 'O' Ring Seal
6. Buffer Seal
7. 'U' Seal

RE-ASSEMBLY

1. Install the 'O' ring seal and back-up ring on the outer diameter of the gland, refer to Figures 48 and 49. Ensure that the concave face of the back-up ring abuts the 'O' ring and that the 'O' ring is positioned towards the barrel. Note that on swing cylinders these seals are positioned in the large internal groove of the headstock, Figure 50.

2. Install a new wiper seal in the outer end of the gland and ensure that it is fully seated.

3. On threaded glands install the nylon bearing sleeve in the gland and ensure that it is fully seated.

4. Install the rod seal by forming the seal into a 'U' shape, seating it in the locating groove and straightening the seal back into its original shape.

5. Install the piston buffer seal ensuring that the groove moulded into one face of the seal faces towards the cylinder barrel.

6. Lightly lubricate the cylinder rod and gland assembly with hydraulic oil.

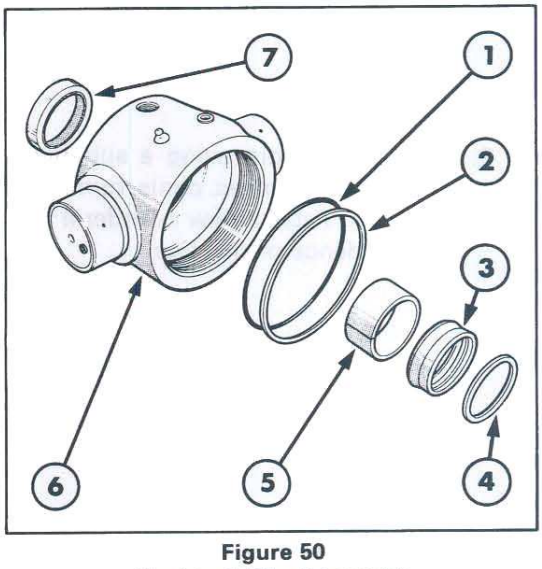

Figure 50
Headstock/Gland Assembly

1. 'O' Ring
2. Back-up Ring
3. Rod Seal
4. Buffer Seal
5. Bearing Sleeve
6. Headstock
7. Wiper Seal

7. Slide the gland assembly onto the cylinder rod taking great care not to damage the seals.

8. On the extendible dipstick cylinder install the spacer on the rod.

9. **All Cylinders except swing cylinder.** Position the piston assembly and any associated components onto the cylinder rod. Refer to Figure 9 of this chapter for details of piston assemblies for the cylinder being overhauled. Apply 4 drops of the Loctite 271 thread locking sealant to the piston retaining bolt and install into the piston and rod assembly. Tighten the bolt to the specificied torque, see "Specifications" – Chapter 11.

Swing Cylinders
Install the bush, spring and sliding restrictor into the piston bolt and retain with the pin. Position the piston on the cylinder rod, apply 6 drops of the Loctite 271 thread locking sealant to the piston retaining bolt and install into the piston and rod assembly. Tighten the bolt to the specified torque, see "Specifications" – Chapter 11.

10. Taking great care not to damage the rod end bushings and seals (where fitted) secure the rod end in a vice or on a suitable anchor point on the unit. Support the rod and using a good quality socket and drive system tighten the piston retaining bolt to the specified torque, see "Specifications" – Chapter 11. Use either a proprietory torque multiplier or a suitable extension to the socket drive system with a pull scale to achieve the specified torque.

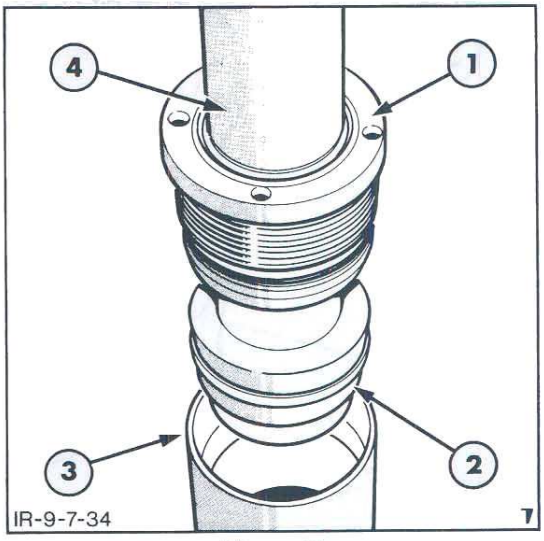

Figure 51
Piston, Rod and Gland Installation

1. Gland
2. Piston
3. Barrel
4. Rod

11. Lubricate the inside of the cylinder barrel, and the piston assembly with hydraulic oil.

12. Place the cylinder barrel in a vertical position open end uppermost and insert the piston and rod assembly into the barrel, Figure 51. On cylinders with threaded gland retention take care not to damage the piston wear rings and seal by rubbing against the internal threads of the barrel.

13. Slowly rock the rod back and forth so the piston assembly slides past the chamfer and into the barrel. Once the piston has fully entered the barrel and has passed the chamfer, lift and gently tap the cylinder barrel on the floor until the rod is about three quarters retracted.

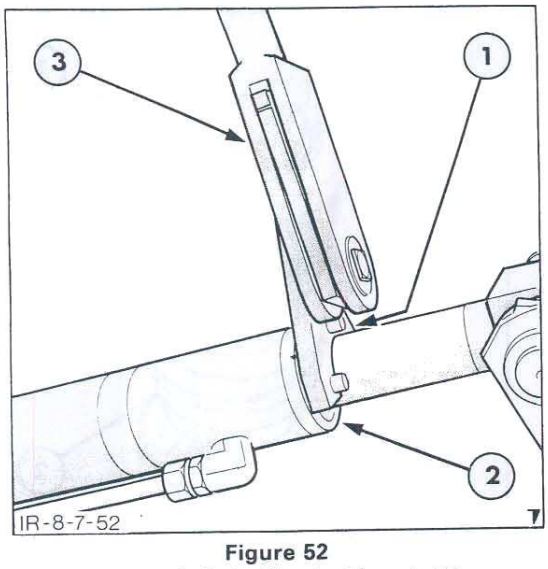

Figure 52
Tightening Cylinder Gland – Threaded Type

1. Peg Wrench
2. Gland Carrier
3. Torque Wrench

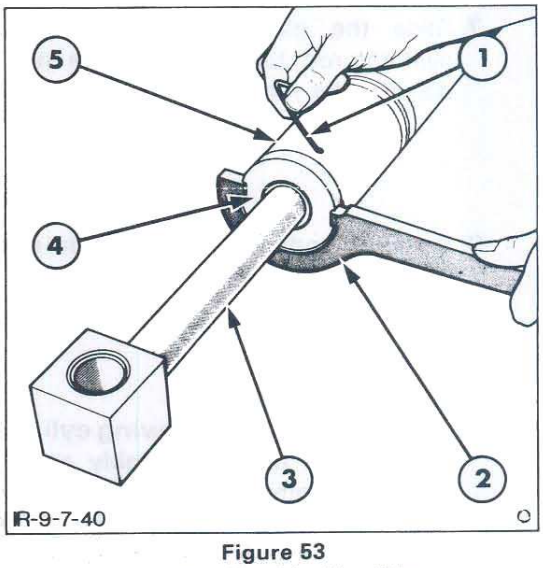

Figure 53
Installing Gland Locking Wire

1. Locking Wire
2. Tool No. FT 8553 or 8554
3. Cylinder Rod
4. Gland
5. Cylinder Barrel

14. **Threaded Gland Cylinders**
Apply 6 large drops of Loctite 271 thread locking sealant to the threads of the gland. Tighten the gland to the specified torque, see "Specifications" – Chapter 11, using the special tool peg wrench spanner applicable to the cylinder, Figure 52. If necessary use a cylinder anchor point on the unit to secure the cylinder.

NOTE: *It is advisable to fully tighten the gland as soon as possible after the application of Loctite.*

Wire Retained Gland Cylinders
Lightly coat the outer surface of the gland and lead in area of the cylinder barrel with a lithium base high melting point type grease. Gently tap the gland in to the barrel until fully seated. Slowly rotate the gland until the small hole in the locking wire groove aligns with the hole in the side of the barrel.

Push the short right angled bend on the locking wire into the entry hole in the barrel and using the special 'C' spanner applicable to the cylinder rotate the gland clockwise (as if it were threaded) and feed in the wire, Figure 53. The rotation of the gland will become tight when the wire has completely rotated around the barrel. Ensure at least 0.375 in. (8 mm) of wire is left exposed for future disassembly. Seal the wire entry hole with a proprietory non-solidifying sealant.

INSTALLATION

Installation of loader and backhoe cylinders follows the removal procedure in reverse, however, the following points should be observed.

1. When installing either a backhoe, crowd or lift cylinder, the rod of the lift and the base end of the crowd cylinder must both be supported to replace the pivot pin. Ensure that the grease seals are not displaced during pin installation.

2. When reconnecting the 'O' ring face seal (ORFS) fittings on hydraulic hoses replace the 'O' ring seal and tighten the fitting to the specified method and torque detailed in Chapter 11 of this Part. Incorrect tightening of ORFS fittings will result in leaks. Ensure that hoses are not twisted that they do not rub structural members and are neatly routed.

3. Lubricate all pins prior to installation and grease all pivots with the specified grade of grease.

4. Swing Cylinders — After replacing the headstock trunnion retainers, ensure the cylinder pivots in its headstock bushings freely before connecting the rod end to the swing frame.

5. Replenish any lost oil from the reservoir – see "Specifications" – Chapter 11, for oil specification.

6. Start engine, operate at low idle and cycle the replacement cylinder to purge all air from the circuit. Check for leaks and re-check the oil reservoir level.

PART 8
HYDRAULIC SYSTEM, CONTROLS AND FRAME

Chapter 8
BACKHOE FRAME, BOOM, DIPSTICK AND BUCKETS, CONTROL SYSTEM, HOSES AND TUBES

A. BACKHOE FRAME, BOOM, DIPSTICK AND BUCKETS — DESCRIPTION AND OPERATION

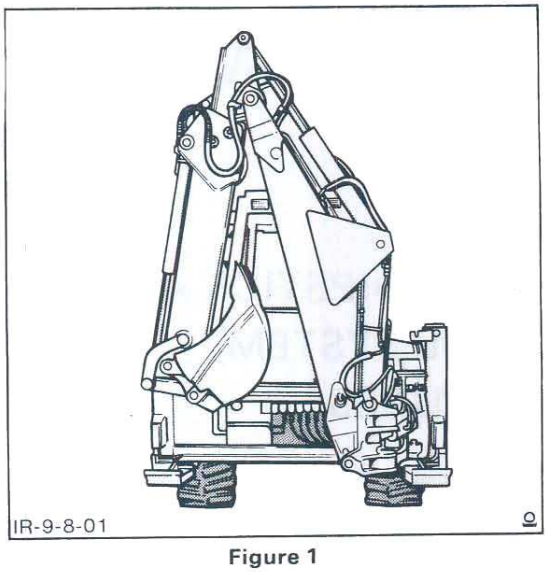

Figure 1
Sideshift Backhoe Assembly
(With Extendible Dipstick)

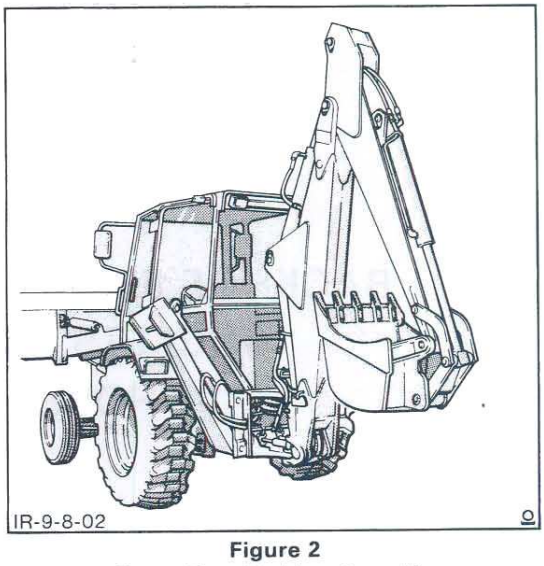

Figure 2
Centre Pivot Backhoe Assembly

Two models of backhoe assembly are available for installation on Ford 555C and 655C Industrial tractors and are identified as sideshift and centre pivot. Figures 1 and 2.

On the Ford 455C tractor the centre pivot backhoe assembly is only available.

The sideshift Unit allows the carriage and swing post on which the excavator boom is attached to be variably positioned on the backhoe frame. On centre pivot Units the swing post pivots about a fixed central point on the frame.

The two designs of mainframes available are of welded construction and attach to the main structural members of the Unit and two link assemblies by eight specially designed attaching bolts.

The backhoe swing post is a heavy one-piece iron casting which attaches to the frame on centre pivot Units and carriage on sideshift Units by means of two large pivot pins.

Movement of the swing post is obtained by the use of two interconnected hydraulic cylinders coupled between the swing post and mainframe on centre pivot Units and carriage on sideshift Units. The cylinders act directly on the swing post without the use of any connecting links or bellcranks.

Both the boom and dipstick are constructed of high strength steel welded to form box-type members offering maximum strength and rigidity. Both Units may be fitted with an optional hydraulically operated extendible dipstick which can be operated simultaneously with other boom, dipstick and bucket movements to increase overall backhoe versatility during most operations. The tubing for the crowd and bucket cylinders is clamped on the outer surface of the boom and provides total visibility during servicing operations.

The boom provides attaching points for the rod end of the lift cylinder and piston end of the crowd cylinder. Similarly the dipstick provides attaching points for the rod end of the crowd cylinder and the piston end of the bucket cylinder as well as attaching points for the bucket and bucket links.

Stability of the Unit during backhoe operations is achieved by two independently operated box-type constructed stabiliser legs. The stabilisers can support the Unit in a level operating position irrespective of the ground contours.

On centre pivot Units the two stabilisers are attached to the base of the mainframe by pivot pins. Each stabiliser is operated by a double acting hydraulic cylinder connected via pivot pins to the top of the excavator frame and the base of the backhoe leg. Operation of the stabiliser cylinders causes the legs to pivot in an arc about the base of the frame and raise or lower each side of the Unit accordingly. Pads attached to the ends of the stabilisers provide support for maintaining stability during operation.

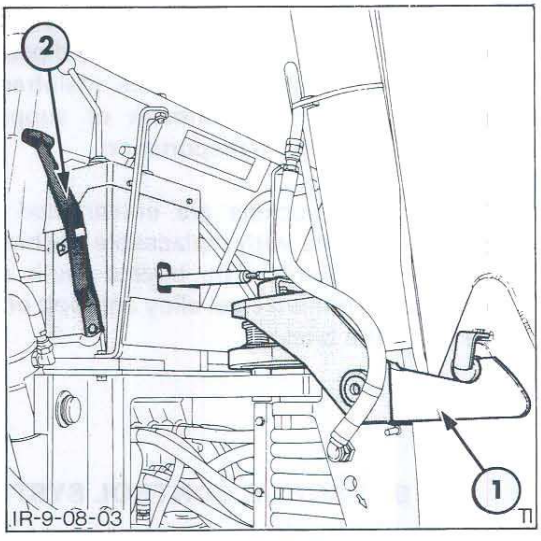

Figure 3
Backhoe Transport Lock – Centre Pivot
1. Boom Lock
2. Lever

On Ford 555C and 655C Units the backhoe is locked in position during transportation with a sprung loaded boom lock which is operated from the backhoe control console, Figure 3. On 455C Units transport chain keyhole slots are provided at the pad end of each stabiliser for the attachment of chains to the boom and stabiliser during Unit transportation.

On sideshift Units two vertical stabilisers are mounted at each side of the backhoe mainframe. The stabilisers are operated independently by double acting hydraulic cylinders mounted within the stabiliser assembly. The sliding members of the stabilisers are equipped with renewable wear plates. When the wear plates are renewed, shims are installed behind the wear plates to maintain the correct sliding clearance.

Different stabiliser pads are available for various site conditions. On sideshift Units the general purpose pad can also be turned through 180° to provide greater lateral stability.

On sideshift Units, transport chain keyhole slots are provided at the end of the dipstick bucket linkage and top of the mainframe stabiliser legs for attachment of support chains during Unit transportation.

The backhoe buckets are constructed of heavy steel plate with replaceable bushings at all pivot points. The bucket teeth are constructed of hard steel alloy and bolt onto the lip of the bucket.

Two bucket linkage pin attaching positions are available to provide optimum efficiency. The hole nearest the bucket opening is best suited for straight wall operations as it provides maximum bucket rollout and curl. It also provides maximum clearance at full height, but slightly reduces bucket tearout power. The hole farthest from the bucket opening is suitable for the majority of backhoe operations as it provides greatest bucket power.

B. BACHOE CONTROL SYSTEM – DESCRIPTION AND OPERATION

The backhoe digging elements are controlled by a set of two main control levers, Figures 4 and 5.

However a four lever dealer installed system is available as an option where required.

Two additional small levers control the stabilisers and on sideshift Units a 'T' handle lever releases the swing frame carriage from the main frame to allow the backhoe to be repositioned about the frame. The extendible dipstick, where fitted, is operated by a foot pedal located on the left hand side of the control console.

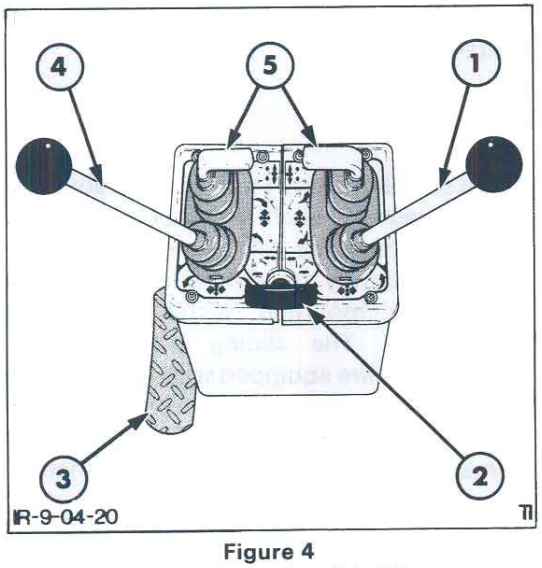

Figure 4
Backhoe Controls – Sideshift

1. Right Hand Control Lever
2. Swing Frame Clamp Lever
3. Extendible Dipstick Pedal
4. Left Hand Control Lever
5. Stabiliser Levers

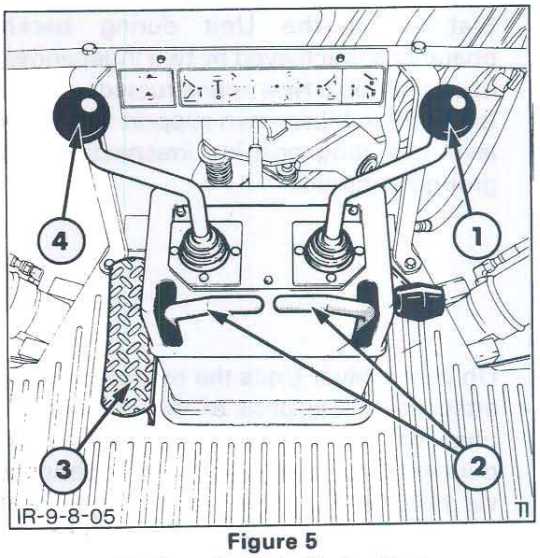

Figure 5
Backhoe Controls Centre Pivot

1. Right Hand Control Lever
2. Stabiliser Levers
3. Extendible Dipstick Pedal
4. Left Hand Control Lever

BACKHOE CONTROLS

Operation for each element of the boom, dipstick and bucket are as follows:

The LEFT HAND CONTROL LEVER

Pull the lever back – boom lifts.

Push the lever forward – boom lowers.

Move the lever to the left – boom swings left.

Move the lever to the right – boom swings right.

The RIGHT HAND CONTROL LEVER

Pull the lever back – dipstick crowds in.

Push the lever forward – dipstick crowds out.

Move the lever to the left – bucket curls in.

Move the lever to the right – bucket curls out.

NOTE: *On units manufactured for Swedish, Norwegian and Finnish markets the control pattern is modified as follows:*

Pull the left hand lever back – dipstick crowds in.

Push the left hand lever forward – dipstick crowds out.

Pull the right hand lever back – boom lifts.

Push the right hand lever forward – boom lowers.

All other controls for the backhoe remain as standard.

SWING FRAME CLAMP LEVER (Sideshift Units Only)

On sideshift Unit backhoes the swing post carriage is hydraulically clamped to the frame and must be disengaged when repositioning the backhoe about the frame.

To side shift the backhoe proceed as follows:

- Position the boom parallel to the excavator frame and set the backhoe bucket teeth into the ground.
- Unclamp the swing post carriage by pulling the clamp lever 'T' handle upwards.
- Crowd the dipstick in or out to slide the carriage to the desired position. Maintain the carriage vertical in the slide channels by applying lift or lowering forces to the boom
- Push the 'T' handle down and fully curl the bucket in to pressurise the hydraulic system and operate the carriage clamps.

STABILISER CONTROLS

Operation of the stabilisers are as follows:

Pull the levers back – stabilisers raise.

Push the levers forward – stabilisers lower.

The left hand lever operates the left stabiliser and the right hand lever operates the right stabiliser.

EXTENDIBLE DIPSTICK

The extendible dipstick, Figure 6, can be operated simultaneously with other boom, dipstick and bucket movements to increase overall backhoe versatility during most operations.

The foot pedal located on the left hand side of the control console operates the dipstick and pivots about its centre. Tilting the pedal forward causes the dipstick to extend. Tilting the pedal rearwards causes the dipstick to retract.

Intermediate dipstick positions can be held by releasing the pedal which will return to the spring centred position.

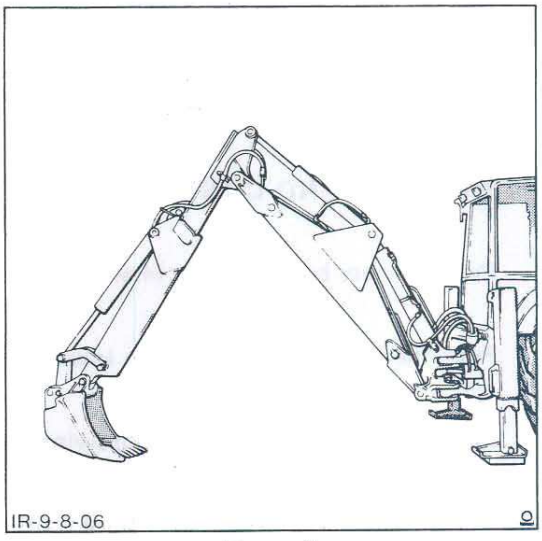

Figure 6
Backhoe With Extendible Dipstick

C. HOSES AND TUBES – DESCRIPTION AND OPERATION

The hydraulic hoses and tubes used on the Ford 455C, 555C and 655C backhoe loaders conform to the society of Automotive Engineers (S.A.E.) specifications.

The hoses are to specification S.A.E. 100 R2 and constructed from a synthetic rubber tube with double wire braid re-inforcement and synthetic rubber cover. The pressure rating for this design of hose exceeds 3000 lbf./in.^{2} (206 bar) with a minimum burst pressure exceeding 11,000 lbf/in^2 (758 bar).

The fittings utilised on these hoses are of the 'O' ring face seal design, Figure 7, and are renowned for their leak free operation.

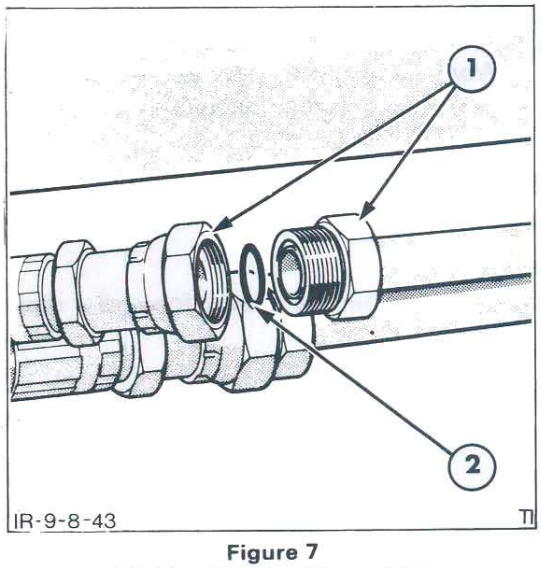

Figure 7
'O' Ring Face Seal Connection

1. 'O' Ring Face Seal Connectors
2. 'O' Ring

When servicing hoses and tubes incorporating the 'O' Ring face seal connector design a new 'O' ring should be installed whenever a joint is disturbed and care should be taken not to under or overtighten the fittings.

All hydraulic tubing is constructed from high strength seamless steel tubing with a zinc chromate plating.

The design of individual hoses has minimised the number of hoses that a dealer needs to stock for performing repairs.

To aid serviceability the tubing and hoses on the crowd and bucket cylinders are clamped on the outer (top) surface of the boom which allows protection during operation and excellent accessibility during servicing.

D. BACKHOE OR LOADER COUNTERWEIGHT – REMOVAL AND REPLACEMENT

BACKHOE REMOVAL

1. Position the Unit on a flat surface where the backhoe and swing mainframe will be stored or repaired.

2. Lower the stabilisers to the ground and position the backhoe parallel to the centre line of the Unit with the dipstick vertical and the bucket on the ground, Figure 8. On sideshift Units ensure the backhoe carriage is positioned in the centre of the mainframe.

3. Where fitted remove the extendible dipstick pedal by removing the pedal pivot bracket nuts beneath the cab or platform and disconnecting the linkage at the pedal.

4. Remove the rear floor mat.

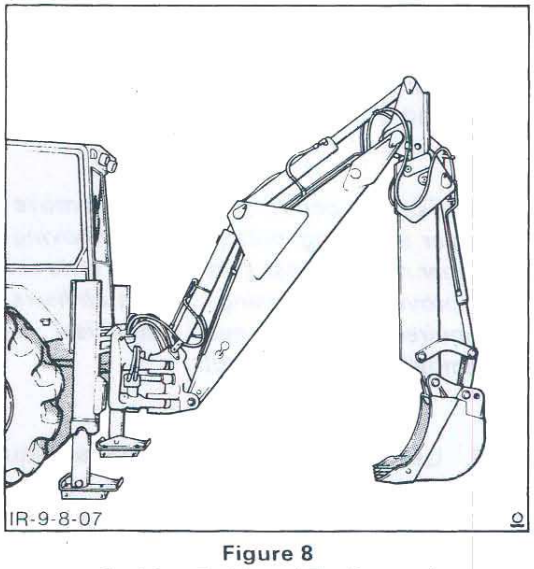

Figure 8
Backhoe Positioned For Removal

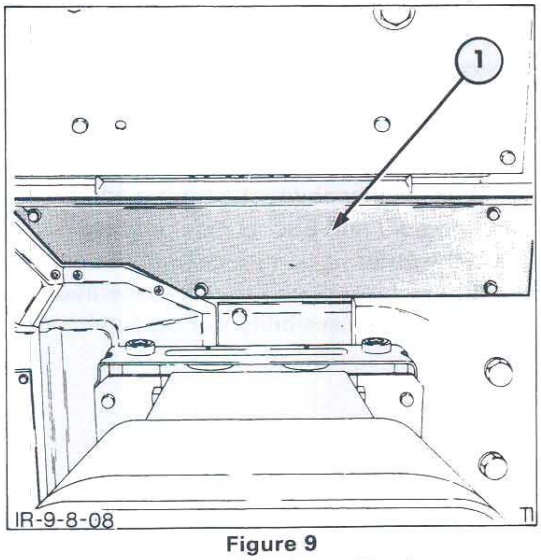

Figure 9
Backhoe Hose Access Panel

1. Access Panel

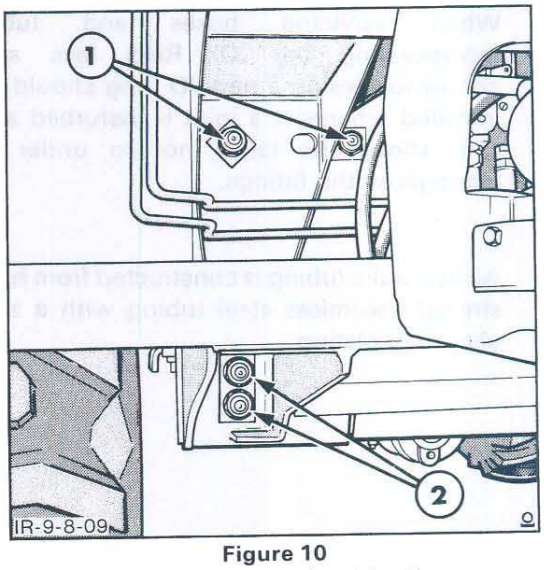

Figure 10
Backhoe Mainframe Attaching Nuts

1. Upper Attaching Nuts
2. Lower Attaching Nuts

5. Remove the access panels from between the cab floor and the backhoe deck, Figure 9.

6. Sideshift Units only:

   Disconnect the wiring to the rear lights, attached to the backhoe mainframe and remove any clips securing the harness to the rear fenders, cab or platform.

7. Remove the mainframe attaching nuts and bolts, Figure 10.

NOTE: *On centre pivot Units remove the lower attaching nuts prior to removing the upper nuts. Access to the lower nuts can be improved by raising the stabilisers as required. Lower each stabiliser upon removing the lower nuts.*

8. Use the stabilisers and boom as required to position the backhoe until the attaching bolts can be removed. Identify any shims fitted between the frame and link assemblies.

9. Pull the Unit forward to allow improved access to the hydraulic hoses.

WARNING: *Stretching the hoses when separating the Unit from the backhoe may damage the hoses and cause personal injury.*

10. Place a stand or suitable support under the backhoe mainframe for stability during storage.

11. With the engine switched off move each control lever to relieve any pressure which may be in the backhoe. Allow the frame to settle onto the support and relieve the stabiliser cylinders of pressure.

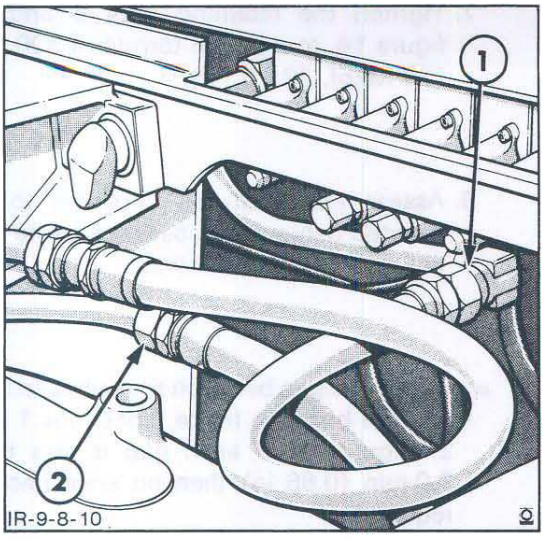

Figure 11
Unit to Backhoe Hose Connections

1. Backhoe Feed Hose Tube Connection
2. Return to Reservoir Hose Unit Connection

12. Disconnect the return to reservoir hose at the Unit fitting and the backhoe valve feed hose at the tube connection on the backhoe mainframe, Figure 11.

13. Connect each hose to the open fitting on the component to which that hose is fitted, Figures 12 and 13. This will complete the hydraulic circuits and prevent entrance of dirt and oil loss. Ensure the hoses are not twisted or kinked during installation.

14. The Unit may now be started and removed from the work area.

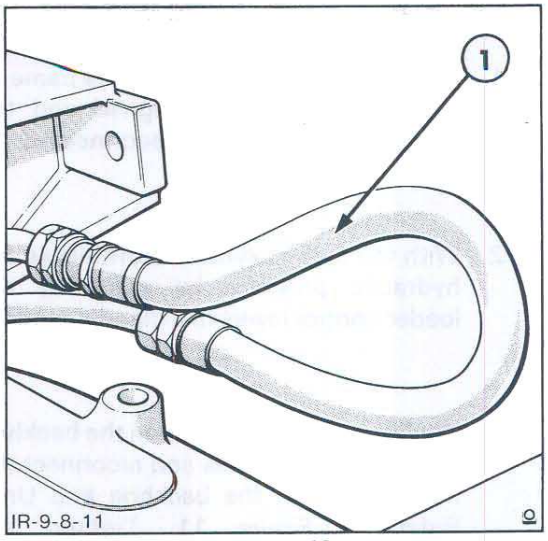

Figure 12
Unit Hose Connections – Backhoe Removed

1. Looped High Pressure Feed Hose

WARNING: *Do not start the Unit until the disconnected hoses have been connected as detailed above. Failure to comply will result in severe vehicle damage and possible personal injury.*

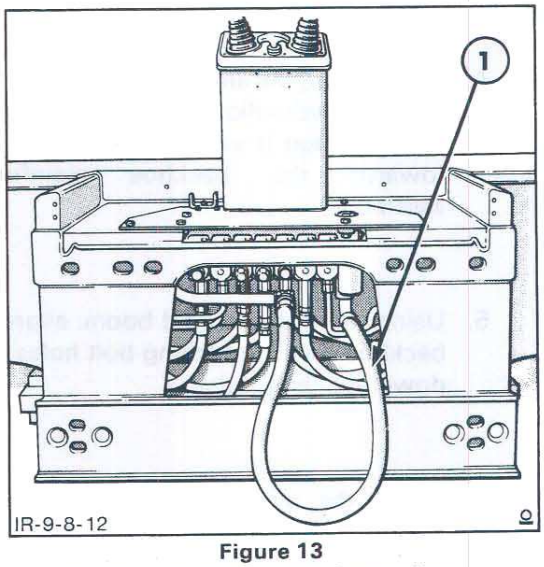

Figure 13
Backhoe Mainframe Hose Connections – Storage Position

1. Looped High Pressure Return Hose

BACKHOE INSTALLATION

1. Position the Unit to the backhoe frame so that the subframe is aligned and the hydraulic hoses can be reconnected.

2. With the engine switched off relieve the hydraulic pressure by actuating the loader control levers in a circular motion.

3. Replace the 'O' ring seals on the backhoe feed and return hoses and reconnect the hoses between the backhoe and Unit. Refer to Figure 11. Tighten the connections to the specified torque, see 'Specifications' – Chapter 11.

IMPORTANT: *Ensure that the hoses are correctly routed and are free from twists and kinks.*

WARNING: *Do not start the engine with the hoses disconnected. Failure to comply will result in severe vehicle damage and possible personal injury.*

4. Start the engine and examine the Unit to backhoe hydraulic connections for leaks. If no leakage is visible reverse the Unit towards the backhoe mainframe assembly.

5. Using the stabiliser and boom, align the backhoe frame, attaching bolt holes and dowel locating holes.

6. Install the eight mounting bolts and washers that secure the tractor and backhoe frame together. Position the reinforcing plates and washers over the bolts and loosely install the retaining nuts.

7. Tighten the retaining nuts B and D, figure 14, to a run-in torque of 300 Nm (30 Mkgf, 221 ft lbf).

8. Assess the thickness of shims to be inserted between the backhoe frame and link assembly as follows:

- Gauge the gap between the link assembly and the backhoe frame, Locations 1 and 2, Figure 14. If each gap is less than 2.0 mm (0.88 in) then no shim pack is required.

- If the gap is greater than 2.0 mm insert shims between the link assembly and backhoe frame to reduce the gap to less than 2.0 mm.

9. Tighten the frame retaining nuts to a torque of 970 Nm (100 Mkgf, 715 ft lbf) in the sequence B, D, A, C, E, F, G, H. Refer to Figure 14.

10. Re-torque the frame retaining nuts to the torque of 970 Nm in the sequence A, B, C, D, E, F, G, H.

NOTE: *When tightening the retaining nuts ensure that the heads of the bolts lock against the link and subframe assemblies and not against each other.*

11. Sideshift Units:

    Reconnect the rear light harness.

12. Install the floor access panel(s).

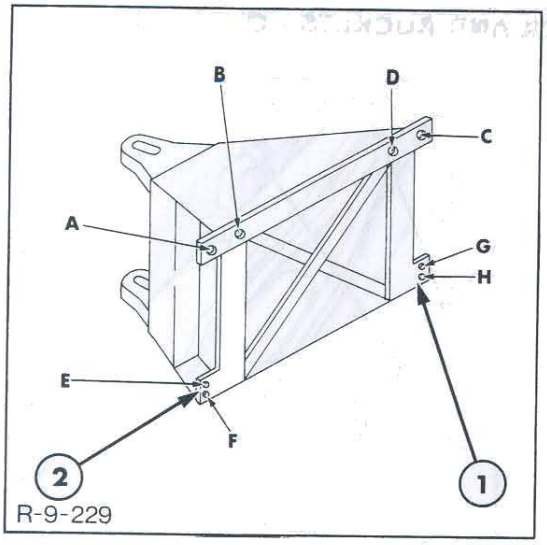

Figure 14
Mainframe Retaining Nut Torque Sequence
(Centre Pivot Shown)

1. Shim Location 2. Shim Location

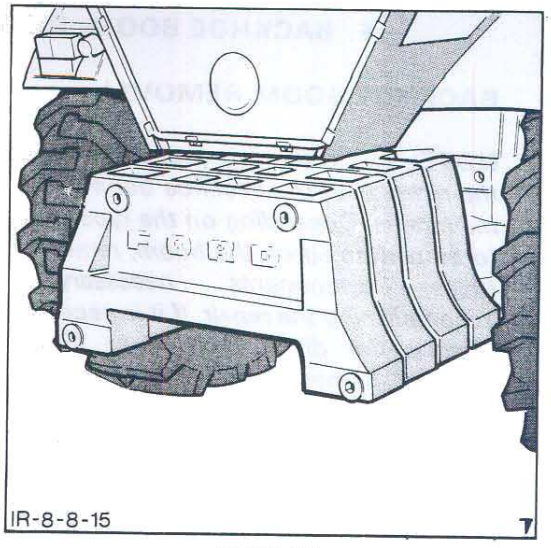

Figure 15
Loader Counterweights

13. Refit the rear floor mat and where fitted install the extendible dipstick pedal.

14. Check the hydraulic reservoir oil level and add the specified oil as required, see 'Specifications' – Chapter 11.

LOADER COUNTERWEIGHT REMOVAL

The Ford 455C, 555C and 655C Units may be operated without a backhoe, in which case four counterweights, Figure 1, each weighing 1000 lb (494 Kg) must be mounted on the rear of the Unit to provide stability during loader operation.

WARNING: *Do not operate the loader with backhoe removed unless the rear counterweights are installed.*

The counterweights are individually bolted to each other and the first is bolted directly to the subframe and link assemblies.

REMOVAL

1. Using a suitable sling, support the weight of the first counterweight.

2. Remove the attaching nuts and bolts from the weight to be removed and withdraw the weight.

3. Repeat the above procedure for the remaining weights.

INSTALLATION

Installation of the counterweights follows the removal procedure in reverse. During installation tighten the retaining nuts and bolts to the specified torque, see 'Specifications' – Chapter 11.

E. BACKHOE BOOM, DIPSTICK AND BUCKETS – OVERHAUL

BACKHOE BOOM REMOVAL

NOTE: *The following procedure explains the removal of the backhoe boom from the mainframe. Depending on the type of repair to be performed on the boom, remove only those components necessary for accomplishing the repair. If it is necessary to remove the dipstick, refer to 'Standard Dipstick Removal' or 'Extendible Dipstick Removal'. If overhaul of the lift and crowd cylinder attaching pins is required then the cylinders should be removed as detailed in PART 8, Chapter 7, Section D, 'Hydraulic Cylinders – Overhaul'.*

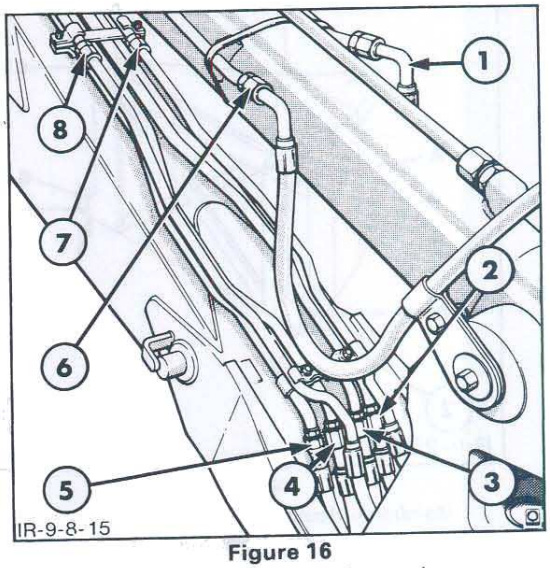

Figure 16
Backhoe Cylinder Hose Connections

1. Lift Cylinder – Piston End
2. Crowd Cylinder – Rod End
3. Bucket Cylinder – Rod End
4. Bucket Cylinder – Piston End
5. Crowd Cylinder – Piston End
6. Lift Cylinder – Rod End
7. Extendible Dipstick – Piston End
8. Extendible Dipstick – Rod End

1. Park the Unit on a firm, level surface, retract the crowd cylinder and lower the dipstick to the ground.

2. With the engine switched off, move each control lever to relieve any pressure which may be in the backhoe.

3. Using a suitable sling and hoist, support the backhoe boom and dipstick.

4. Disconnect the lift cylinder hoses, Figure 16. Cap the hoses and cylinder ports.

5. Identify and disconnect the hoses from the crowd and bucket cylinder tubes and extendible dipstick cylinder (where fitted). Figure 16. Cap the hoses and tubes.

6. Remove the hose clamp located at the lower end of the boom.

7. Sideshift Units only:

   Remove the hose clamps located on the lift cylinder to swing post attaching pin.

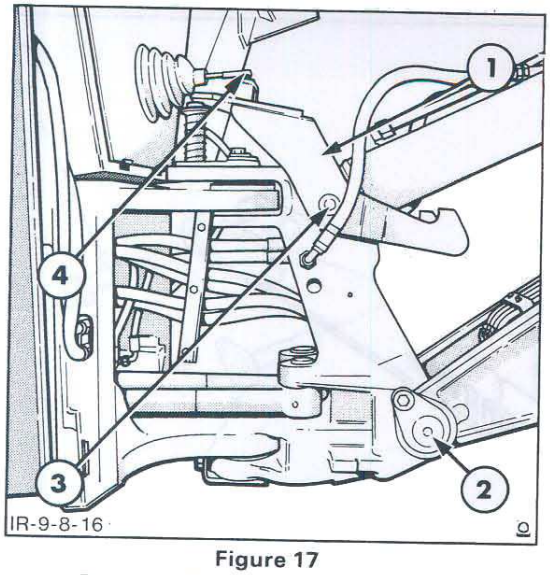

Figure 17
Backhoe Transport Lock-Centre Pivot
(555C and 655C)

1. Transport Lock
2. Boom Pivot Pin
3. Lift Cylinder Pivot Pin
4. Transport Lock Actuating Rod

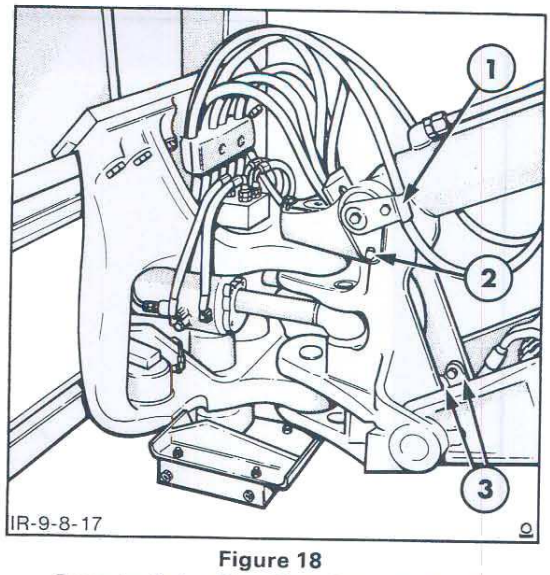

Figure 18
Boom to Swing Post Pivot Pins – Sideshift

1. Lift Cylinder Hose Clamp
2. Lift Cylinder Pivot Pin Retaining Bolt
3. Boom to Swing Post Pivot Pin Retaining Bolts

8. 455C Centre Pivot and 555C, 655C Sideshift Units:

   Support the lift cylinder and remove the lift cylinder to swing post pin retaining bolt. Using a brass drift remove the pin and allow the cylinder to rest against a wooden support installed between the boom and cylinder. Do not let the cylinder rest or drop against the tubes on the boom as damage may occur causing a restriction and affecting performance.

   555C and 655C Centre Pivot Units:

   Disconnect the transport lock actuating rod by removing the locking nuts beneath the bracket on the hook. Refer to Figure 17. Support the lift cylinder and remove the to swing post pin retaining snap rings and spacers.

   Using a brass drift, remove the pin while supporting the transport lock, and allow the cylinder to rest against a wooden support installed between the boom and cylinder. Do not let the cylinder rest or drop against the tubes on the boom as damage may occur causing a restriction and affecting performance.

9. Remove the boom to swing post pivot pin retaining bolts and remove the pins.

   NOTE: *On sideshift Units the pivot pin retaining bolts are located on the inner section of the boom, Figure 18.*

10. Withdraw the boom and dipstick assembly from the swing post.

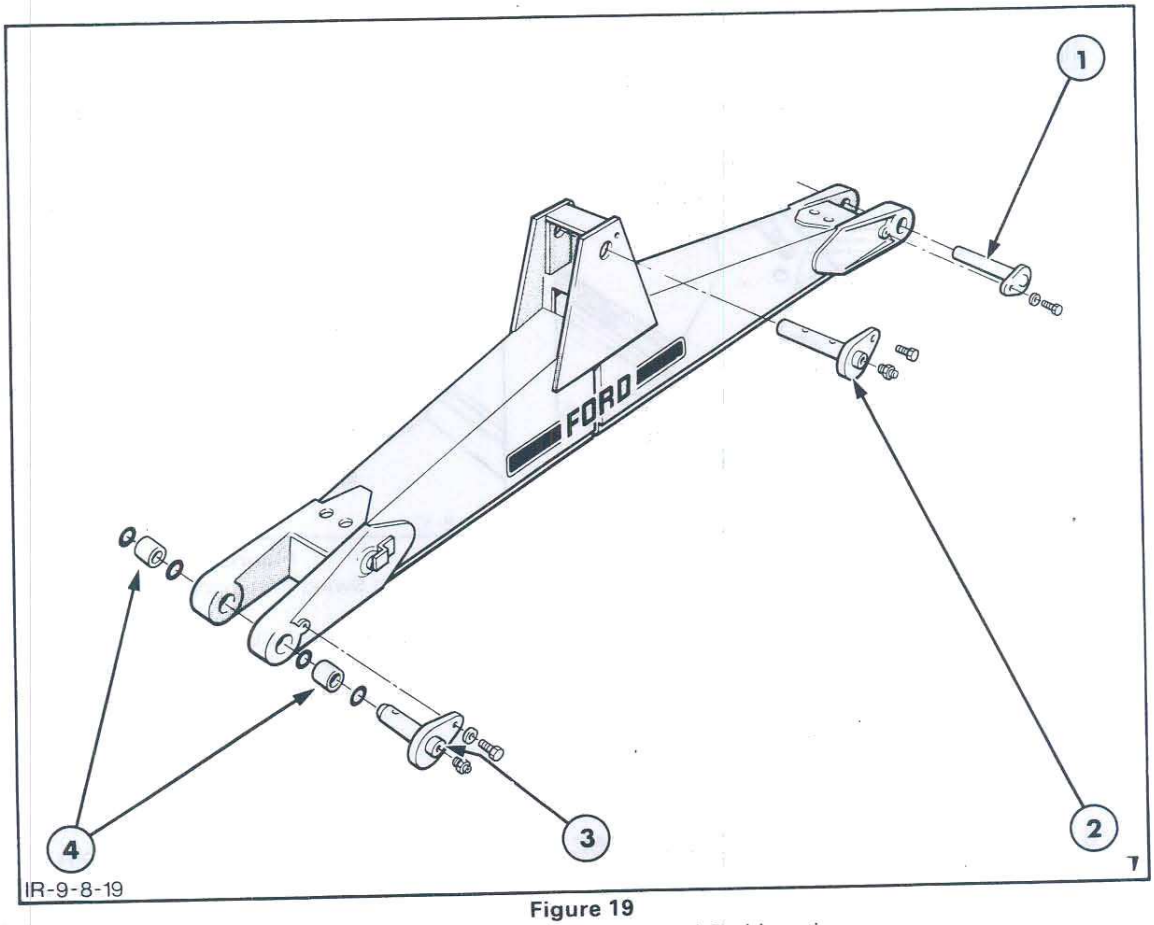

Figure 19
Backhoe Boom Pivot Pin, Bushing and Seal Locations

1. Boom to Dipstick Pivot Pin
2. Crowd Cylinder Attaching Pin
3. Boom to Swing Post Pivot Pin
4. Bushings and Seals

INSPECTION AND REPAIR

Primarily, servicing of the boom is limited to replacement of pivot pins, bushings and seals, Figure 19.

1. Inspect the boom for structural damage such as cracked welds or distortion. Repair or replace as required.

2. Inspect the bushings and seals located in the boom at the boom to swing post attaching point. If worn, pry out the seals and remove the bushings using a suitable puller.

3. Install new bushings using a suitable step plate and driver. Ensure the bushings are centred in their bores.

4. Using a suitable seal installer install new seals.

5. Further disassembly of the boom and dipstick is only necessary where damage is identified. Where it is necessary to remove additional components refer to the appropriate removal procedure in this section.

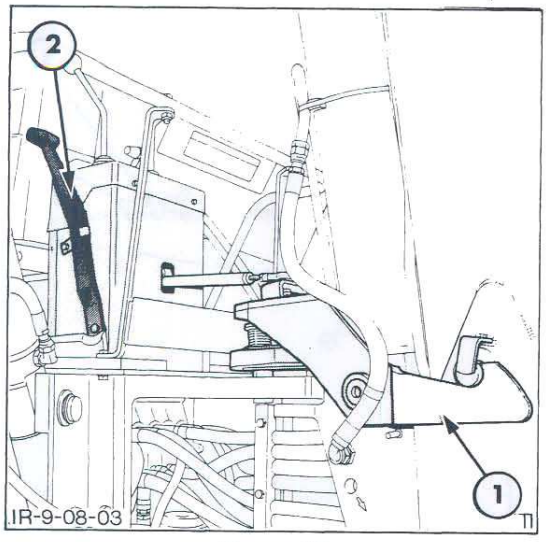

Figure 20
Backhoe Transport Lock – Centre Pivot

1. Boom Lock Hook
2. Locking lever

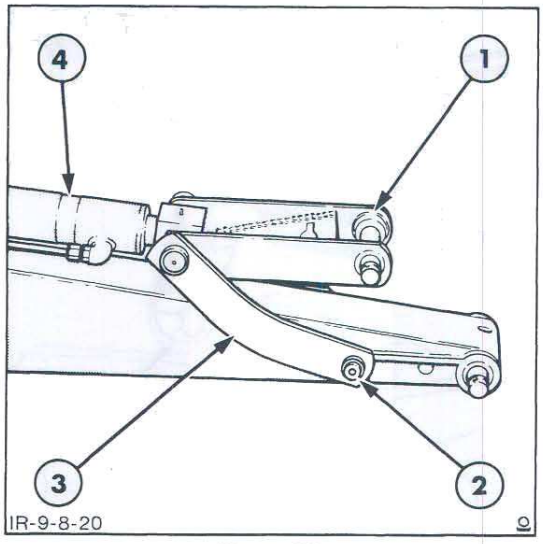

Figure 21
Bucket Cylinder Idler Arm

1. Tipping Link
2. Pin
3. Idler Arm
4. Bucket Cylinder

INSTALLATION

Installation of the boom follows the removal procedure in reverse. During installation observe the following requirements:

- Take care not to damage the lift cylinder trunnion seals when installing the retaining pin.
- Ensure all hose connections and pin retaining bolts are tightened to the specified torque, see 'Specifications' – Chapter 11.
- Check the hydraulic reservoir oil level and lubricate all grease fittings with the specified lubricant, see 'Specifications' – Chapter 11.
- Check all hose connections for hydraulic leaks.
- Ensure the 555C and 655C centre pivot transport lock is correctly adjusted. With the boom fully raised and the locking lever on the control console in the locked position, the locking hook must contact the engagement pin on the boom, Figure 20. Adjust the lever to hook connecting tube to ensure correct engagement.

STANDARD DIPSTICK REMOVAL

NOTE: *The following procedure explains the removal of the dipstick for dipstick overhaul. Where the dipstick is to be removed but not overhauled, all references to bucket cylinder and bucket link removal should be disregarded.*

1. Park the Unit on a firm level surface and remove the bucket as detailed in the bucket removal portion of this section.
2. Retract the crowd cylinder and lower the dipstick to the ground.
3. With the engine switched off, move the bucket cylinder control lever to relieve any pressure which may be in the bucket cylinder.
4. Support the bucket cylinder with a suitable hoist and remove the idler arm retaining pin from the dipstick, refer to Figure 21.

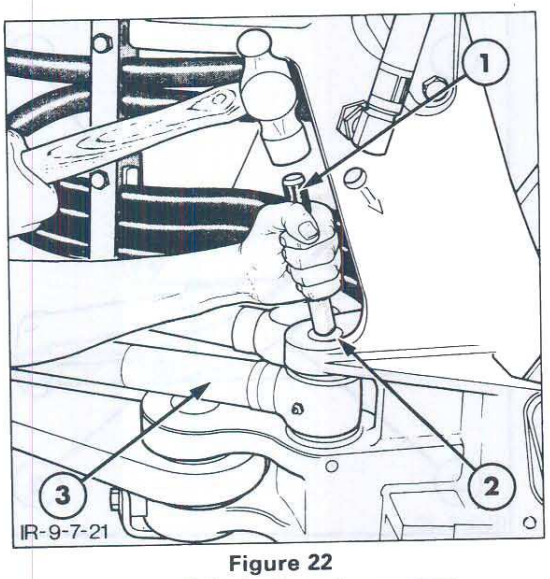

Figure 22
Bucket Cylinder Hose Connections

1. Dipstick
2. Bucket Cylinder Hose – Rod End
3. Bucket Cylinder Hose – Pistson End
4. Crowd Cylinder

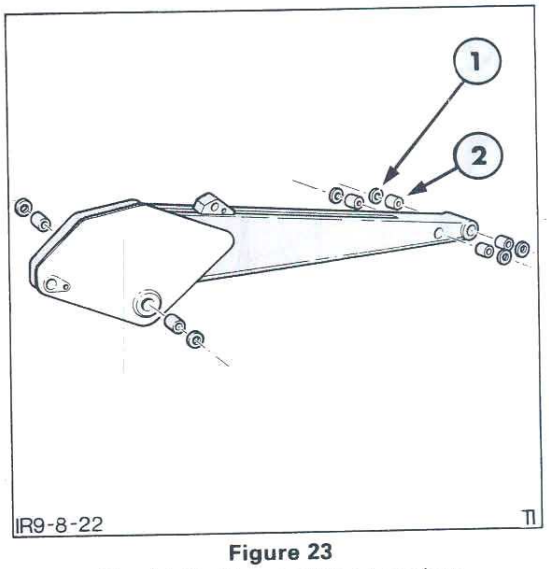

Figure 23
Dipstick Bushing and Seal Locations

1. Seal
2. Bush

5. Disconnect the bucket cylinder hoses at the boom, Figure 18 and cap the hoses and tubes.

6. Remove the retaining bolt from the bucket cylinder piston end attaching pin and using a brass drift and hammer remove the pin. Withdraw the cylinder along with the hoses, bucket link and idler arms from the dipstick.

7. Support the rod end of the crowd cylinder and remove the cylinder pin retaining bolt. Using a brass drift and hammer remove the pin. Do not let the crowd cylinder rest or drop on the tubes secured to the boom as damage may occur causing a restriction and affecting performance.

8. Support the dipstick using a suitable sling and hoist by installing the crowd cylinder attaching pin into the dipstick and securing the sling around the pin.

9. Remove the retaining bolt from the dipstick to boom pivot pin. Drive the pin from its position using a brass drift and hammer. Lower the dipstick to the ground.

INSPECTION AND REPAIR

1. Inspect the dipstick for structural damage such as cracked welds or distortion. Repair or replace as required.

2. Inspect the dipstick pivot pins, bushes and seals for wear and replace as necessary. For location of bushes and seals refer to Figure 23. If worn pry out the seals and remove the bushings using a suitable puller.

3. Install new bushings and seals using a suitable step plate and driver. Ensure the tapered end of the bushing is installed first.

NOTE: *The groove on the internal diameter of the bushing accepts the seal and should be flush with the dipstick frame.*

INSTALLATION

Installation of the dipstick follows the removal procedure in reverse.

During installation observe the following requirements:

- Lubricate the retaining pins and bushing prior to installation.
- Take care not to damage the crowd cylinder trunnion seals when installing the retaining pin.
- Ensure all hose connections and pin retaining bolts are tightened to the specified torque, see 'Specifications' – Chapter 11.
- Check the hydraulic reservoir oil lever and lubricate all grease fittings with the specified lubricant, see 'Specifications' – Chapter 11.
- Check all hose connections for hydraulic leaks.

EXCAVATOR BUCKET REMOVAL

1. Position the Unit on a firm level surface and rest the bucket on the ground.
2. Remove the two lynch pins that secure the attaching pins to the dipstick and bucket link, Figure 24. Withdraw the spacer from each pin.
3. Drive the attaching pins from the pivot holes using a brass drift and hammer and remove the bucket.

INSPECTION AND REPAIR

1. Examine the bucket bushings for wear. Remove and replace the bushings using a suitable step plate and driver.
2. Remove worn or damaged bucket teeth as necessary.

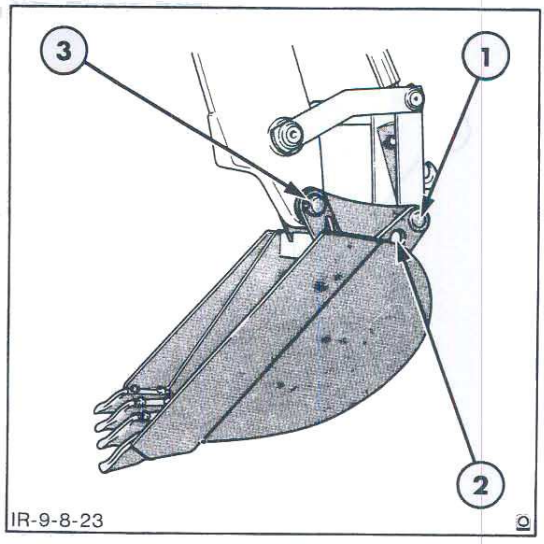

Figure 24
Backhoe Bucket Attaching Pins

1. Attaching Pin – Maximum Power Position
2. Maximum Rollout and Curl Pin Position
3. Dipstick to Bucket Attaching Pin

INSTALLATION

1. Position the bucket under the link and dipstick and install the attaching pins, spacers and lynch pins.
2. Lubricate the pin attaching the bucket to the dipstick. For correct grade of grease see 'Specifications' – Chapter 11.

NOTE: *Two bucket linkage positions are available as shown in Figure 24. Position (1) is suitable for the majority of backhoe operations as it provides greatest bucket power. Position (2) is best suited for straight wall operations as it provides maximum bucket rollout and curl. It also provides maximum clearance at full height but slightly reduces bucket tear-out power.*

F. BACKHOE SWING POST, CARRIAGE AND MAINFRAME – OVERHAUL

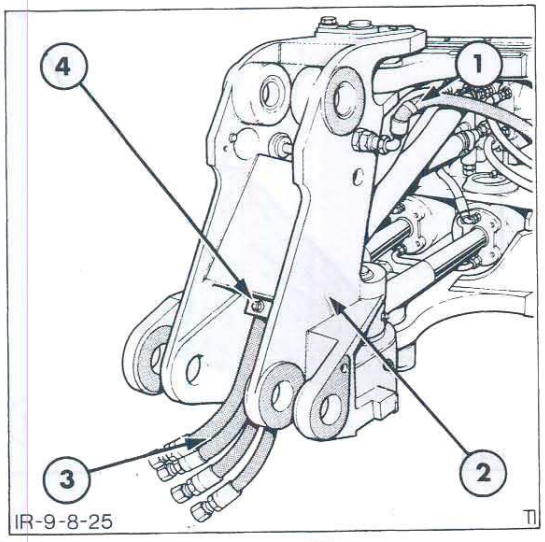

Figure 25
Swing Post Hose Clamp – Centre Pivot Unit Shown

1. Lift Cylinder Hose
2. Swing Post
3. Hoses
4. Clamp

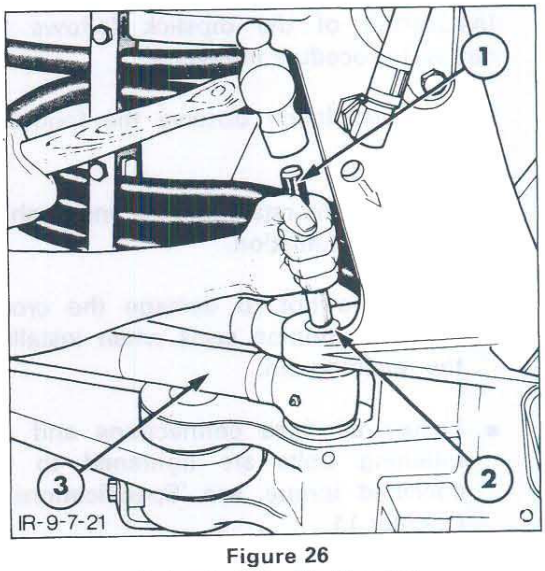

Figure 26
Swing Cylinder Pin Removal

1. Drift
2. Pin
3. Swing Cylinder Rod End

SWING POST REMOVAL

NOTE: *Removal and repair of the swing post is normally accomplished with the boom removed.*

1. Remove the boom as detailed in Section E 'Backhoe Boom, Dipstick and Buckets – Overhaul'.

2. Mark or measure the relation of the hoses in the clamp securing the hoses to the swing post and remove the clamp, Figure 25.

3. Draw the backhoe hoses through the swing post.

4. Centre Pivot Units:

   Disconnect and remove the lift cylinder hoses from the swing post. If the Unit is installed with an extendible dipstick similarly disconnect the extendible dipstick hoses. Cap the hose fittings.

5. Disconnect both swing cylinder rod end trunnions from the swing post by removing the split pins and retainers and driving the attaching pins out using a brass drift and hammer, Figure 26.

6. Support the swing post with a suitable chain and hoist.

7. Withdraw the upper and lower swing post pivot pin retaining bolts and drive the pins out using a brass drift and hammer. Remove the post from the Unit and retrieve the thrust washer, Figure 27.

INSPECTION AND REPAIR

1. Inspect the swing post for damage and repair or replace as necessary.

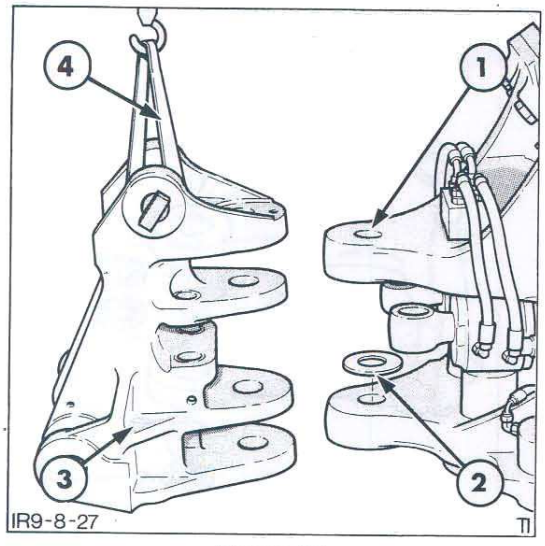

Figure 27
Swing Post Removal
Sideshift Shown

1. Carriage
2. Thrust Washer
3. Swing Post
4. Chain and Hoist

2. Examine the thrust washer for wear and replace if necessary.

3. Centre Pivot Units:

   Inspect the lift cylinder and extendible dipstick fittings on the sides of the swing post for damage and replace if necessary.

4. Inspect the two bushings and four seals in the mainframe/carriage on which the swing post pivots and replace if necessary. Figures 29 and 31. If worn pry out the seals and remove the bushings using a suitable step plate and driver.

INSTALLATION

1. Installation of the swing post follows the removal procedure in reverse.

During installation observe the following requirements:

- Ensure the thrust washer is positioned on top of the lower mainframe/carriage pivot point so that the thrust washer takes the wear and not the swing post or mainframe/carriage.
- Tighten all hose connections and pin retaining bolts to the specified torque, see 'Specifications' – Chapter 11.
- Check the hydraulic reservoir oil level and lubricate all grease fittings with the correct lubricant, see 'Specifications' – Chapter 11.
- Check all hose connections for hydraulic leaks.

BACKHOE CARRIAGE REMOVAL – SIDESHIFT UNITS

1. Park the Unit on a firm, level surface. Position the dipstick parallel to the centre line of the unit, retract the crowd cylinder and lower the dipstick to the ground.
2. Release the oil pressure on the clamping cylinders by pulling up the 'T' handle on the control console and retracting the stabiliser leg until the system relief valve operates.
3. With the engine switched off, move each control lever to relieve any pressure which may be in the system.
4. Remove the swing post as detailed earlier in this section.

NOTE: *Where overhaul of the carriage only is required the swing post may be removed with the boom in situ.*

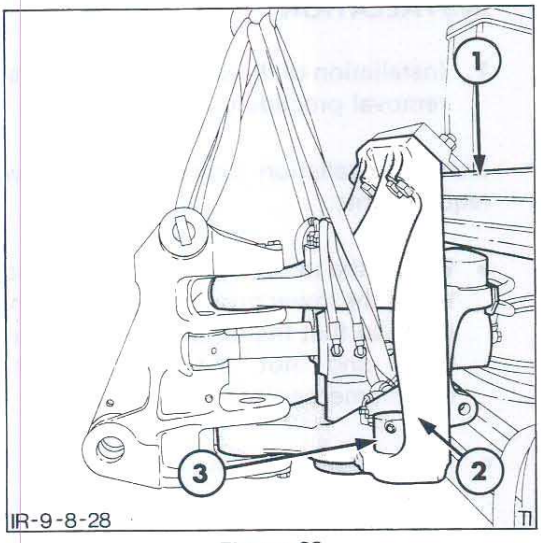

Figure 28
Removing Carriage

1. Mainframe
2. Carriage
3. Lower Clamping Cylinder

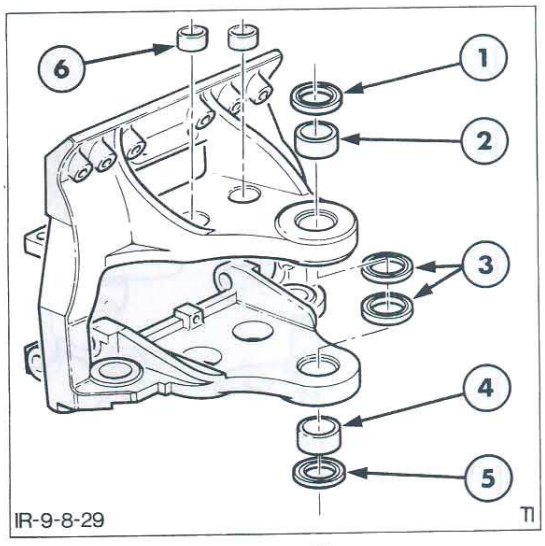

Figure 29
Carriage Bushings and Seals

1. Seal
2. Bush
3. Seals
4. Bush
5. Seal
6. Bushes

5. Remove the hose clamp securing the hoses to the carriage. Withdraw the hoses through the rear of the carriage.

6. Disconnect the hydraulic clamping system feed hose from the 'T' connection at the rear of the carriage. Cap the hose and 'T' fitting.

7. Support the carriage using a suitable sling and hoist.

8. Remove the bolt securing each clamping cylinder bellcrank pivot pin. Withdraw the pins and remove the bellcranks. Refer to Figure 28.

9. Ease the base of the carriage forwards and lift the carriage from the mainframe, Figure 28.

DISASSEMBLY

1. Disassembly of the carriage is limited to removal of the swing cylinders and side shift clamping cylinders. For removal of these items refer to Chapters 6 and 8 in PART 8 Hydraulic System, Controls and Frame.

INSPECTION AND REPAIR

1. Inspect the carriage for damage, and repair or replace as necessary.

2. Inspect the two bushings and four seals in the carriage on which the swing post pivots and replace if necessary, Figure 29. If worn pry out the seals and remove the bushings using a suitable step plate and driver.

3. Inspect the two bushes in which the upper trunnions of the swing cylinders sit and replace if worn or damaged.

INSTALLATION

Installation of the backhoe carriage follows the removal procedure in reverse. During installation observe the following requirements:

- Ensure hoses are not twisted or kinked and are correctly positioned in the hose clamps.

- Ensure the swing post thrust washer is positioned on top of the lower carriage pivot point so that the thrust washer takes the wear and not the swing post or carriage.

- Tighten all hose connections and pin retaining bolts to the specified torque, see 'Specifications' – Chapter 11.

- Check the hydraulic reservoir oil level and lubricate all grease fittings with the specified lubricant, see 'Specifications' – Chapter 11.

IMPORTANT: *When lubricating the swing cylinder bushes on sideshift Units, continue to pump grease through each fitting until clean grease is expelled through the hole in the grease retaining plug, Figure 30.*

- Check all hydraulic hose connections for hydraulic leaks.

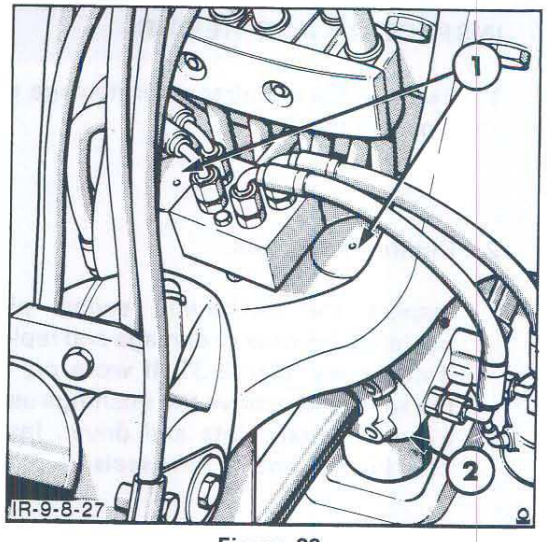

Figure 30
Swing Cylinder Grease Retaining Plugs

1. Grease Retaining Plugs
2. Swing Cylinder

MAINFRAME – OVERHAUL

GENERAL

Overhaul of the mainframe is limited to general inspection for damage and inspection/repair of all seals and bushings.

When overhauling the mainframe remove only those components necessary to complete the repair.

Where it is necessary to remove the stabilisers or swing cylinders (centre pivot Units), refer to Chapter 7 of Part 8.

For removal of the mainframe from the Unit refer to Section D of this Chapter 'Backhoe/Loader Counterweight Removal and Replacement'.

INSPECTION AND REPAIR

1. Examine the mainframe for damage and repair as necessary.

2. Centre Pivot Units:

   Inspect the mainframe swing pivot bushings for wear or damage and replace if necessary. Figure 31. If worn pry out the seals and remove the bushings using a suitable step plate and driver. Install new bushes and fit new seals.

3. Center Pivot Units:

   Inspect the swing cylinder trunnion pivot seals and bushings located in the mainframe and replace as necessary.

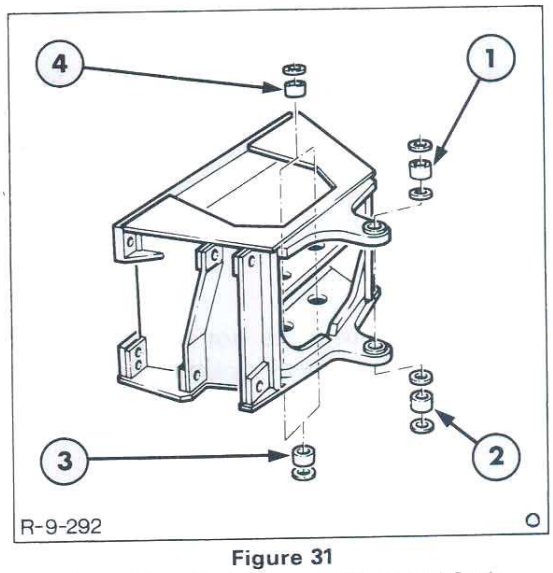

Figure 31
Centre Pivot Mainframe Bushings and Seals

1. Swing Pivot Bush and Seals
2. Swing Pivot Bush and Seals
3. Swing Cylinder Bush and Seal
4. Swing Cylinder Bush and Seal

G. BACKHOE EXTENDIBLE DIPSTICK – OVERHAUL

REMOVAL

1. For easier handling of the dipstick remove the bucket.

2. Retract the dipstick and install the transport pin to lock the sliding components of the dipstick together, Figure 32.

3. Fully retract the crowd cylinder, lower the dipstick to the ground and support the boom using a suitable hoist.

4. With the engine switched off, move the excavator control levers to relieve any pressure which may be in the system.

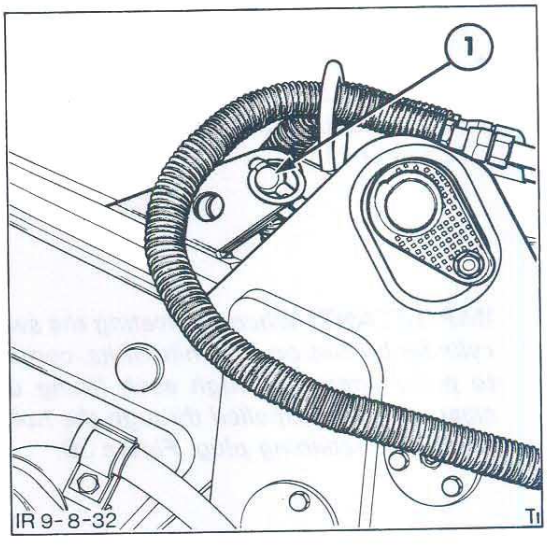

Figure 32
Extendible Dipstick Transport Pin

1. Transport Pin Locking Position

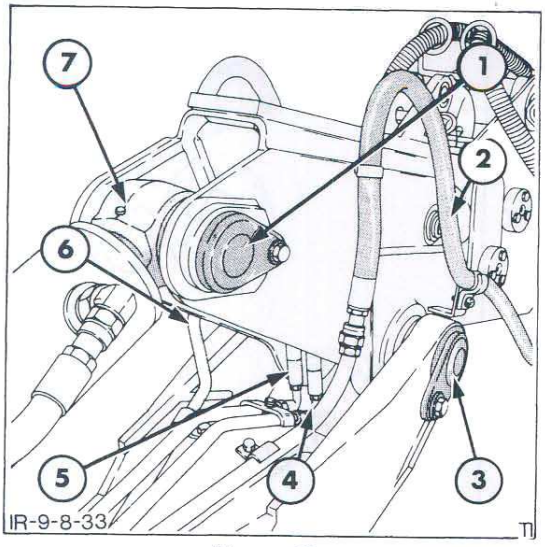

Figure 33
Extendible Dipstick and Bucket Cylinder Hoses

1. Crowd Cylinder Attaching Pin
2. Bucket Cylinder Hose Rod End
3. Boom to Dipstick Pivot Pin
4. Extendible Dipstick Cylinder Hose – Piston End
5. Extendible Dipstick Cylinder Hose – Rod End
6. Bucket Cylinder Hose – Piston End
7. Crowd Cylinder Rod End

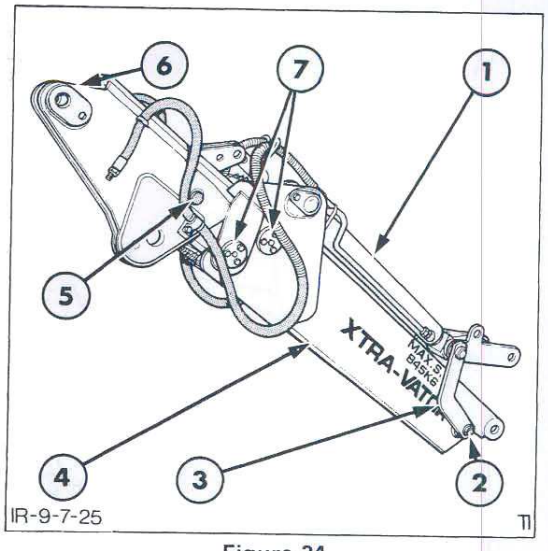

Figure 34
Extendible Dipstick Assembly

1. Bucket Cylinder
2. Extendible Dipstick Cylinder Attaching Pin – Rod End
3. Idler Links
4. Extendible Dipstick – Outer Section
5. Extendible Dipstick Cylinder Attaching Pin – Piston End
6. Extendible Dipstick – Inner Section
7. Wear Button Retaining Caps

5. If repairs require bucket cylinder removal support the cylinder with a suitable sling and hoist. Disconnect the bucket cylinder hoses and cap the hoses and ports. Remove the bucket cylinder piston end and idler arm retaining pins and remove the bucket cylinder from the dipstick.

6. If the bucket cylinder has been removed note the position of the hoses in the securing clamps. Remove the clamps securing the hoses to the dipstick frame.

7. Disconnect the extendible dipstick hoses from the boom tubes. Figure 33. Cap the fittings. If the bucket cylinder is not to be removed, disconnect the bucket hoses from the boom tubes.

8. Support the crowd cylinder and detach the rod end of the cylinder from the dipstick by removing the attaching pin. Do not let the crowd cylinder drop or rest on the boom tubes, doing so may damage the tubes causing a restriction, thus affecting performance.

9. Support the dipstick with a suitable chain and hoist. Remove the bolt securing the dipstick to boom pivot pin and drive the pin from its position with a brass drift and hammer. Lower the extendible dipstick assembly onto the workshop floor. Figure 34.

NOTE: *A suitable method of supporting the dipstick is to install the crowd cylinder attaching pin in the holes where the crowd cylinder rod attaches and connecting a chain and hoist to the pin.*

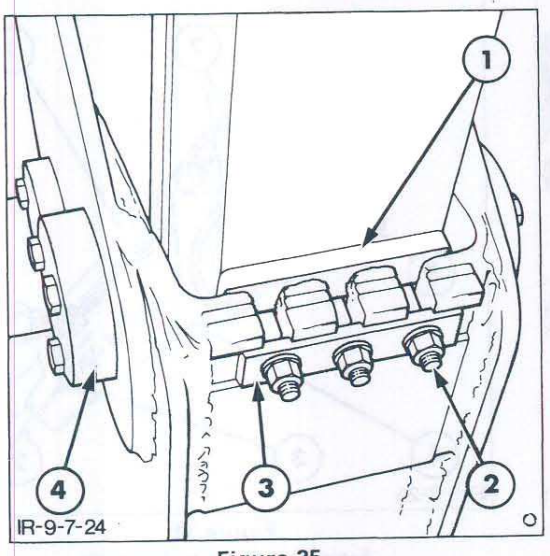

Figure 35
Extendible Dipstick Wear Plates

1. Wear Plate
2. Wear Plate Retaining Nuts
3. Anchor Bracket
4. Wear Button Retaining Cap

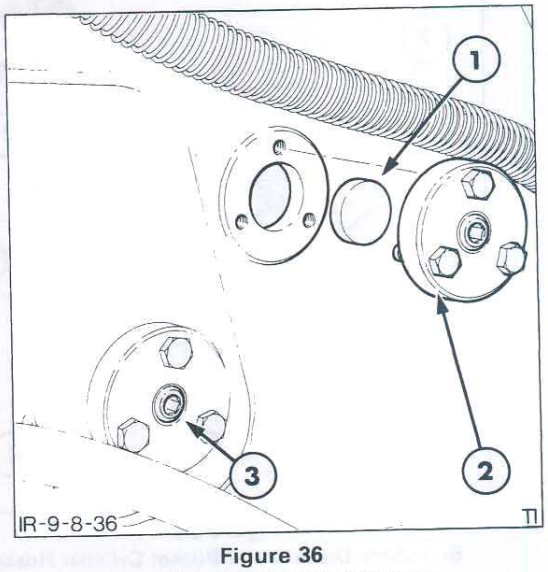

Figure 36
Extendible Dipstick Wear Buttons

1. Wear Button
2. Wear Button Retaining Cap
3. Wear Button Adjusting Screw

DISASSEMBLY

1. Loosen the external wear plate nuts, Figure 35, from upper and lower sides of the dipstick and remove the wear plates.

2. Remove the four wear button retaining caps and withdraw the buttons Figure 36.

3. Remove the snap rings and washers at the idler link, Figure 34 and drive out the cylinder rod end attaching pin.

NOTE: *The rod end attaching pin also secures the bucket idler links. Make a note of their position.*

4. Separate the two parts of the extendible dipstick.

5. Support the extendible dipstick cylinder and remove the snap rings and pin securing the cylinder barrel to the dipstick. Carefully remove the cylinder taking care not to damage the cylinder tube or hoses.

INSPECTION AND REPAIR

1. Inspect the dipstick for structural damage such as cracked welds or distortion. Repair or replace as required.

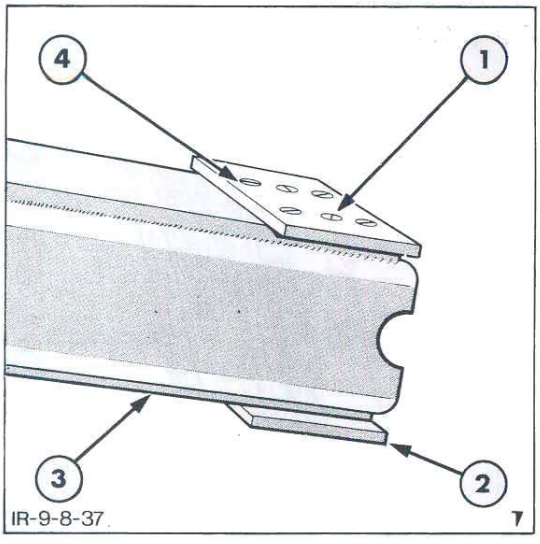

Figure 37
Dipstick Internal Wear Plates

1. Upper Wear Plate
2. Internal Dipstick Section
3. Lower Wear Plate
4. Fixing Bolts (6 off)

2. Inspect the bushings and seals for wear and if worn pry out the seals and remove the bushings using a suitable puller. Bushes and seals are installed at the bucket and idler arm attaching points and boom pivot attaching point.

3. Install new bushings using a suitable step plate and driver. Ensure that the tapered end of the bushing is installed first and that the bushings are flush with the dipstick frame. Install the new oil seal in the locating groove on each bush.

4. Inspect the wear plates on both the internal and external sections of the dipstick, for wear and replace where necessary. Refer to Figures 35 and 37.

5. Examine the wear buttons for excessive wear and replace as required.

REASSEMBLY

NOTE: *Coat the bushings and seals with grease prior to installation of the attaching pins.*

1. Position the extendible dipstick cylinder rod end in the external section of the dipstick and secure with the attaching pin, idler arms, spacers and snap rings. Ensure that the idler arms are installed in the same position as when removed.

2. Taking care not to damage the cylinder hoses and tubes, slide the internal section of the dipstick over the cylinder and into the external section.

3. Secure the piston end of the extendible dipstick cylinder with the attaching pin, washers and snap rings.

4. Install both external wear plates and tighten the bolts to the specified torque, see 'Specification' – Chapter 11.

5. Install the four wear buttons and retaining caps. Using the adjusting set screws adjust each button until they contact the inner dipstick section and provide equal clearance between the inner and outer sections of the dipstick assembly.

INSTALLATION

Installation of the extendible dipstick follows the removal procedure in reverse.

During installation lubricate the pivot pins and bushes. Replace the 'O' ring face seals on the cylinder hose connections.

Tighten all connections to the specified torque, see specifications – Chapter 11.

H. EXCAVATOR CONTROL SYSTEM (MECHANICAL) – OVERHAUL

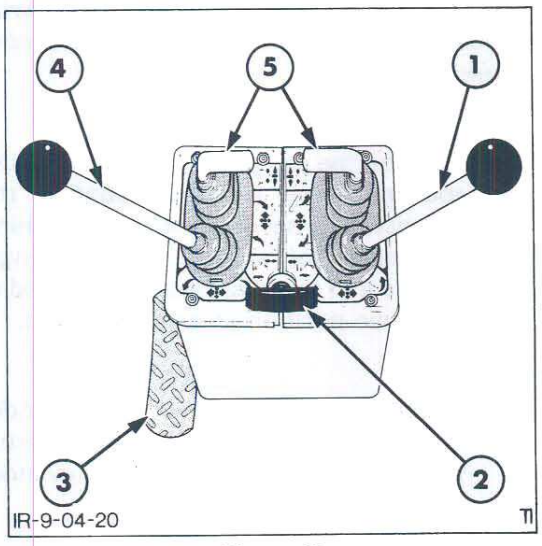

Figure 38
Backhoe Control Console
Sideshift Shown

1. Dipstick Control Lever
2. Carriage Clamp Lever
3. Extendible Dipstick Pedal
4. Boom Control Lever
5. Stabiliser Control Levers

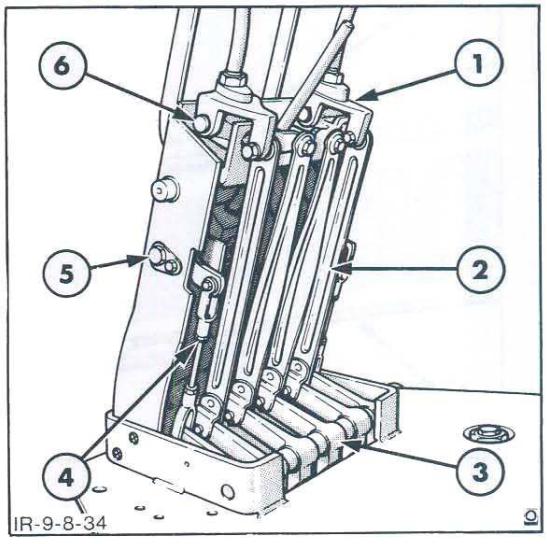

Figure 39
Backhoe Control Lever Linkage – Sideshift

1. Control Lever Pivot
2. Control Lever Link Assembly
3. Bellcrank
4. Stabiliser Lever Link Assembly
5. Stabiliser Lever Shaft
6. Control Lever Shaft

REMOVAL

1. Position the unit on a hard level surface and rest the digging elements on the ground in a safe position.

2. With the engine stopped, relieve residual pressures by moving all control levers in all directions.

3. Unscrew the control lever knobs and remove the rubber gaiters, Figure 38.

4. Sideshift Units:

   Using a suitable pin punch drive the retaining pin from the clamp lever 'T' handle and remove the handle.

5. Remove the excavator control levers and top and side covers to expose the control mechanism.

DISASSEMBLY – Side Shift Units

1. Remove the control lever and stabiliser lever link assemblies by disconnecting the pivot pins and removing the lever pivot to link bolts, Figure 39.

2. Disconnect the bellcrank, to valve spool link assembly pivot pins and remove the links, Figure 40.

3. Remove the bellcrank pivot shaft retaining bolt and withdraw the shaft bellcranks and spacers.

4. Remove the stabiliser lever pivot shaft securing bolts and withdraw the shafts and levers.

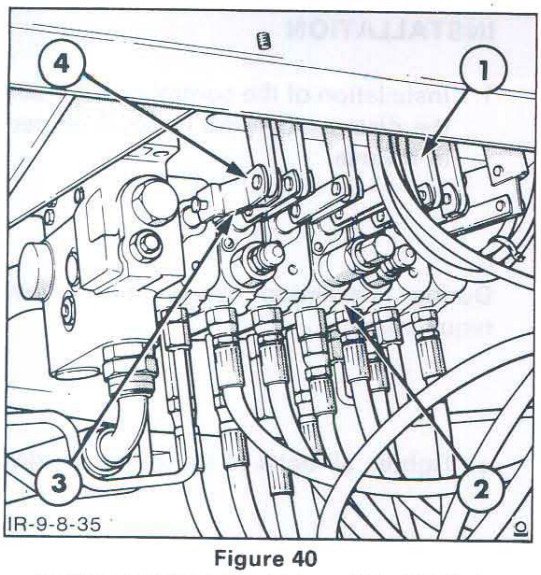

Figure 40
Backhoe Control Lever Linkage Sideshift Units

1. Bellcrank
2. Valve Assembly
3. Link
4. Pin

5. Remove the circlips on the control lever pivot shaft and withdraw both shafts retaining the lever assembly. Repeat the procedure for the second lever.

DISASSEMBLY – Centre Pivot Units

1. Remove the control and stabiliser lever link assemblies by removing the bolts at either end of the link Figure 41.

2. Position the retaining rings on the stabiliser lever pivot shaft to allow sideways movement of the shaft and removal of the lever assemblies. Remove the retaining rings and withdraw the shaft.

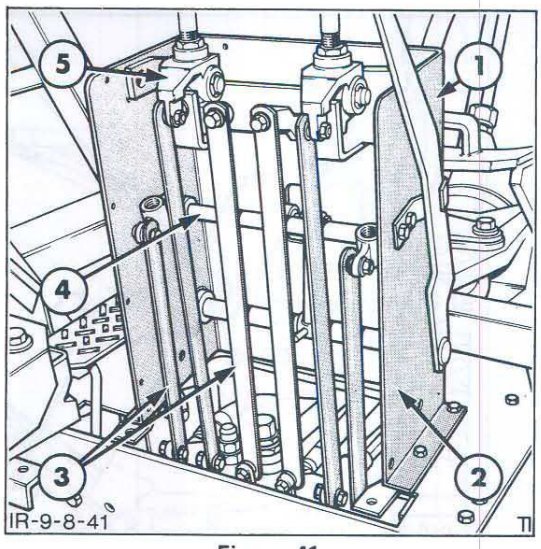

Figure 41
Backhoe Control Lever Linkage Centre Pivot Units

1. Boom Lock Lever
2. Console
3. Links
4. Stabiliser Shaft
5. Control Lever Pivot

3. Remove the circlips on the control lever pivot shaft and withdraw both shafts retaining the lever assembly. Repeat the procedure for the second lever.

4. 555C and 655C Centre Pivot Units. Disassemble the boom transport lock mechanism as follows with reference to Figure 42.

   a. Disconnect the actuating linkage at the boom lock lever and boom lock hook.

   b. Remove the roll pins securing the boom lock lever to the backhoe control console. Withdraw the lever from the console and retrieve the spacers.

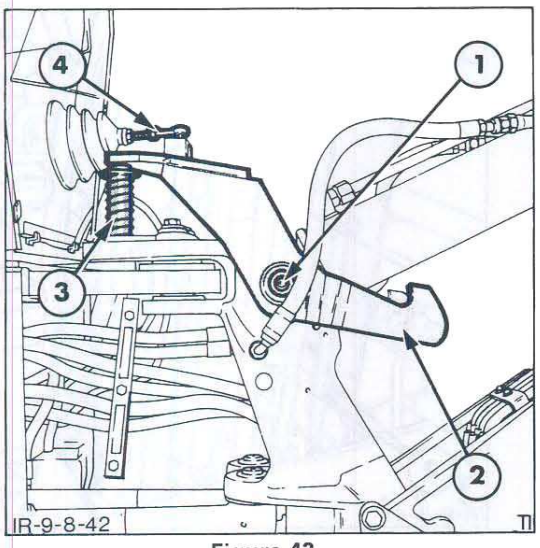

Figure 42
Transport Lock – Centre Pivot Units

1. Snap Ring and Washer
2. Boom Lock Hook
3. Release Pin and Spring
4. Actuating Linkage

c. Support the lift cylinder using a suitable piece of wood positioned between the boom and lift cylinder. Remove the snap ring and washer from the cylinder retaining pin and knock the pin from the cylinder. Lift the boom lock hook from the unit. Refer to Figure 42.

d. Remove the release pin and spring from the swing post.

INSPECTION

1. Inspect the pivot pins, bellcranks and control lever link assemblies for wear or damage and replace as necessary.

2. Examine all bushings for wear and replace as necessary.

INSTALLATION

1. Installation of the control system follows the disassembly and removal procedure in reverse.

During installation observe the following requirements:

- Tighten all bolts to the specified torque.

- On sideshift Units adjust the stabiliser link assemblies to align the stabiliser levers. The levers should be fully operational in both directions.

- Operate the backhoe to confirm correct lever operation.

- Ensure the 555C, 655C centre pivot transport lock is correctly adjusted. With the boom fully raised and the locking lever on the control console in the locked position, the locking hook must contact the engagement pin on the boom. Adjust the lever to hook linkage to ensure correct engagement.

EXTENDIBLE DIPSTICK FOOT CONTROL

Overhaul of the extendible dipstick foot control is limited to removal and inspection of the linkage assembly. There is no adjustment to the linkage and if worn or damaged it should be replaced.

J. HOSES AND TUBES – OVERHAUL

GENERAL

Figures 47 and 48 at the rear of this Chapter illustrate the hose routing at the mainframe and the main control valve for both sideshift and centre pivot Units manufactured for all countries except Sweden, Finland and Norway. On Units manufactured for Sweden, Finland and Norway the lift cylinder and crowd cylinder valve segments and hose routing are interchanged.

Overhaul of hoses and tubes is limited to replacement of 'O' rings on the hose and tubes where applicable and replacement of damaged hoses and tubes.

Repair all hydraulic oil leaks promptly to avoid loss of oil and possible damage and dirt entry into the system. When checking for hydraulic leaks, start and operate the engine at 1200-1500 rev./min.

Remove and install new hoses immediately, if they are severely damaged by a cut or scrape, swollen at the fittings or leaking. If leakage is observed, shut off the engine and relieve all hydraulic pressure.

The following points should be observed when removing hoses and tubes.

WARNING: *Never disconnect or tighten a hose or tube that is under pressure. If in doubt actuate the operating levers several times with the engine switched off prior to disconnecting a hose or tube.*

IMPORTANT: *Insure that when a hydraulic hose or tube is renewed/installed, all components are absolutely clean and free from dirt. Failure to ensure absolute cleanliness will result in the hose/tube leaking after installation or possible damage to other hydraulic system components.*

NOTE: *Use care in removal of hoses that will be re-installed. Be careful not to twist or kink a hose, doing so can damage the internal facing causing early hose failure.*

Before disconnecting any of the hoses or tubes from the control valves, tag and identify the hose, tube or connector.

Note the position of any hoses secured in clamps which will be loosened or removed and measure the length from the end of the hose or tube to the clamp so that re-installation will be correct.

NOTE: *Because of the close proximity of hose connections it may be necessary to remove more than one hose in order to service a particular hose. Loosening the hose at the connections away from the control valve will aid in gaining flexibility and hose movement within the mainframe.*

IMPORTANT: *On the swing cylinder hoses, make a note of the fitting position and routing of the hoses to ensure correct re-assembly and prevent early hose failure.*

Cap all hoses, connectors and ports to prevent entry of dirt into the system.

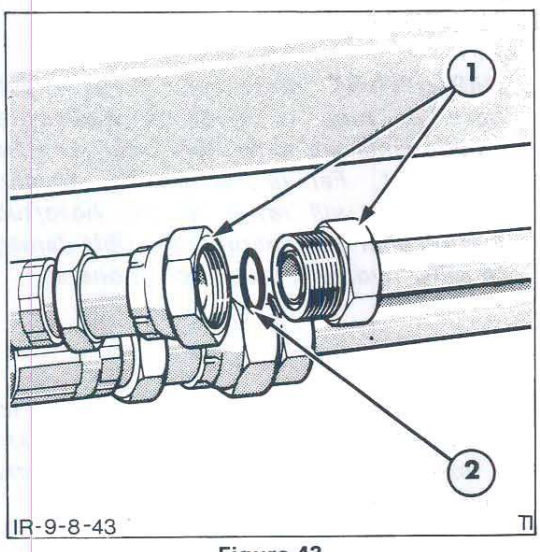

Figure 43
'O' Ring Face Seal (O.R.F.S.) Connector

1. O.R.F.S. Fitting
2. 'O' Ring Seal

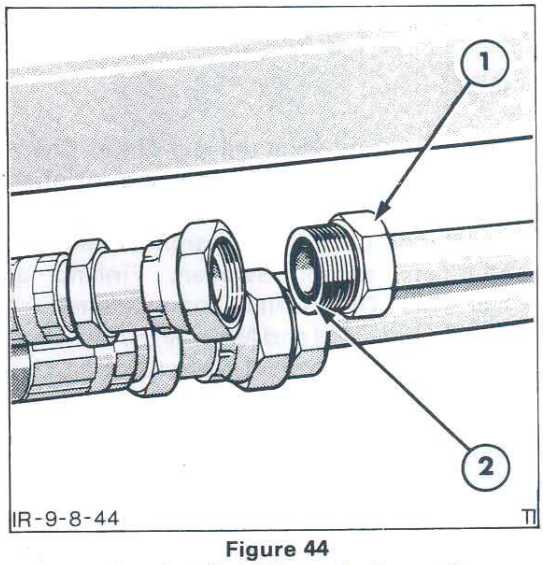

Figure 44
'O' Ring Installed Prior to Re-Connection

1. O.R.F.S. Fitting
2. 'O' Ring Seal

When repairing the 'O' ring Face Seal connectors used on 455C, 555C and 655C Units the following disconnection and re-assembly procedure should be observed.

NOTE: *Insure that when tightening the hose or tube fitting, the hose or tube assembly does not turn. If the hose or tube turns while tightening the fitting the 'O' ring seal may be damaged.*

1. Release the fittings and separate the hose or tube assembly, then remove and discard the 'O' ring seal from the fitting, Figure 43.

2. Dip a new 'O' ring seal into clean hydraulic oil prior to installation. Install the new 'O' ring into the fitting and if necessary retain in position using petroleum jelly, Figure 44.

3. Assemble the new hose or tube assembly and tighten the fitting finger tight, while holding the tube or hose assembly to prevent it from turning, Figure 45.

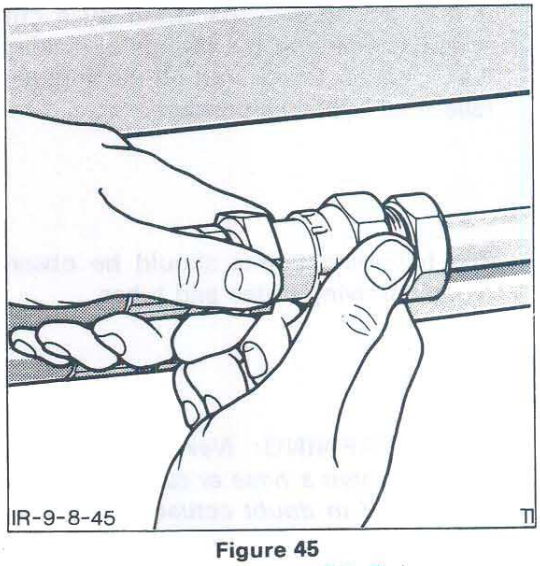

Figure 45
Hand Tightening O.R.F.S. Fitting

4. Using two suitable wrenches, tighten the fitting to the specified torque, see Specifications, Chapter 11.

NOTE: *To ensure a leak free joint is obtained, it is important that the fittings are not over torqued or under torqued.*

5. Bleed the air from the system any time a hydraulic hose is removed, a tube disconnected, or the system is opened to atmosphere. This is accomplished by running the engine at 1200-1500 rev./min., and actuating the loader or backhoe control levers (no load in the bucket) for approximately 15 minutes or until all air is expelled from the system.

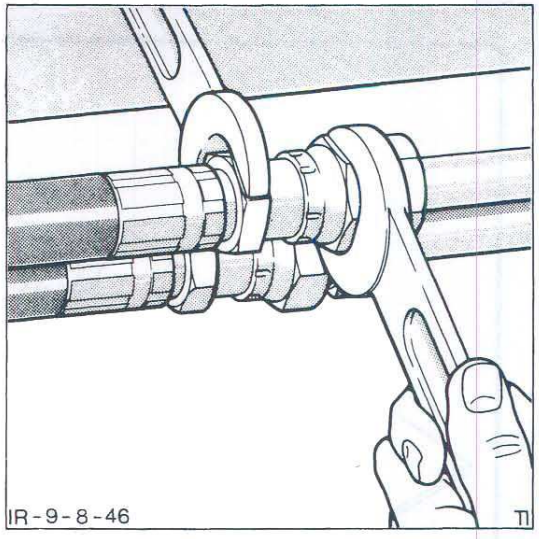

Figure 46
Tightening O.R.F.S. Fitting

6. After bleeding the system, position the loader bucket flat on the ground, put the backhoe into the transport position, and shut of the engine. Then check the hydraulic system oil level and add oil if necessary.

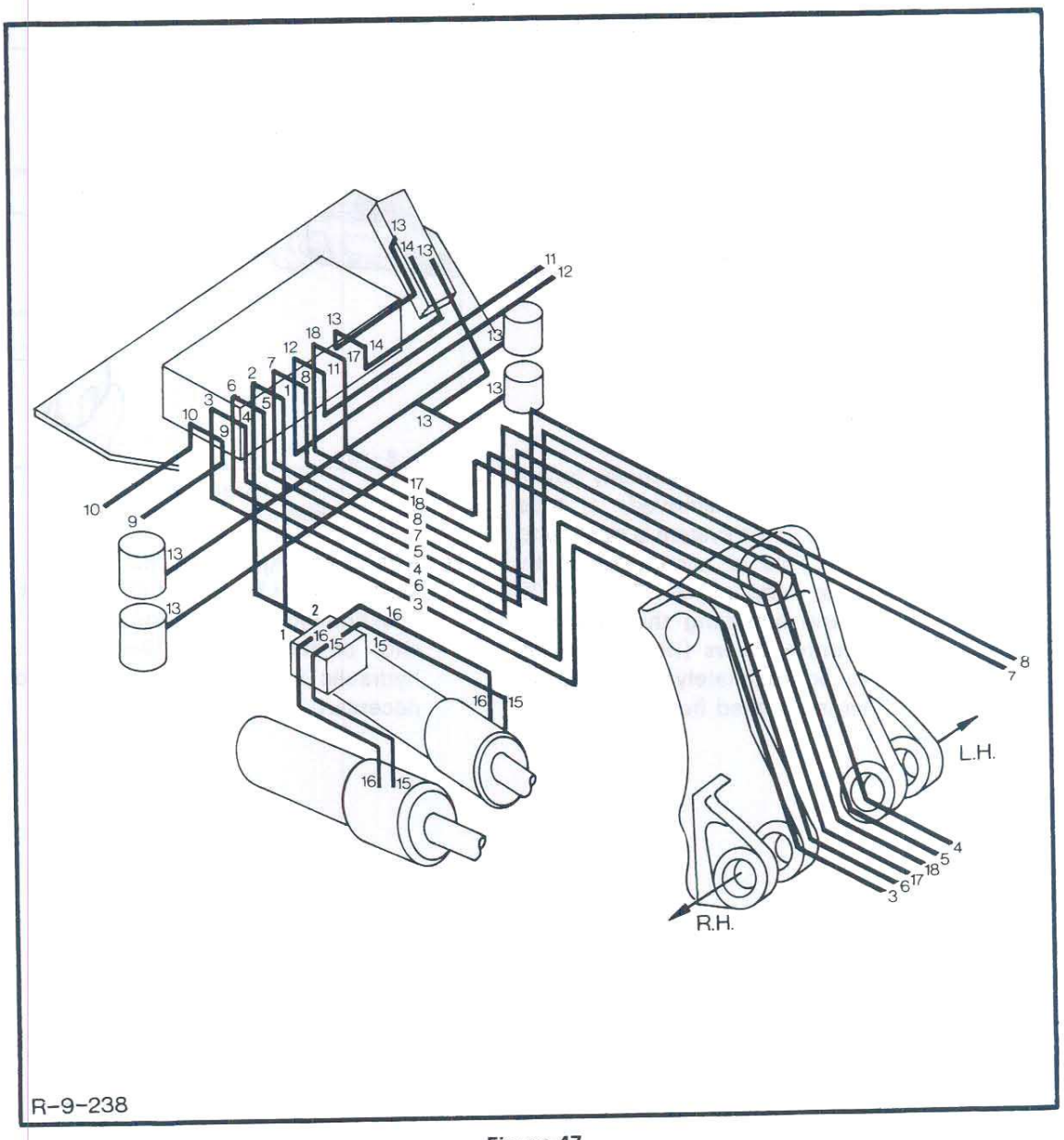

Figure 47
Backhoe Hose Routing – Sideshift Units

1. Swing Cylinder – Swing Left
2. Swing Cylinder – Swing Right
3. Crowd Cylinder – Rod End
4. Crowd Cylinder – Piston End
5. Bucket Cylinder – Piston End
6. Bucket Cylinder – Rod End
7. Lift Cylinder – Piston End
8. Lift Cylinder – Rod End
9. Right Stabiliser Cylinder – Rod End
10. Right Stabiliser Cylinder – Piston End
11. Left Stabiliser Cylinder – Rod End
12. Left Stabiliser Cylinder – Piston End
13. Clamp Cylinder – Pressure Line
14. Clamp Cylinder – Return Line
15. Swing Cylinder – Rod End
16. Swing Cylinder – Piston End
17. Extendible Dipstick Cylinder – Rod End
18. Extendible Dipstick Cylinder – Piston End

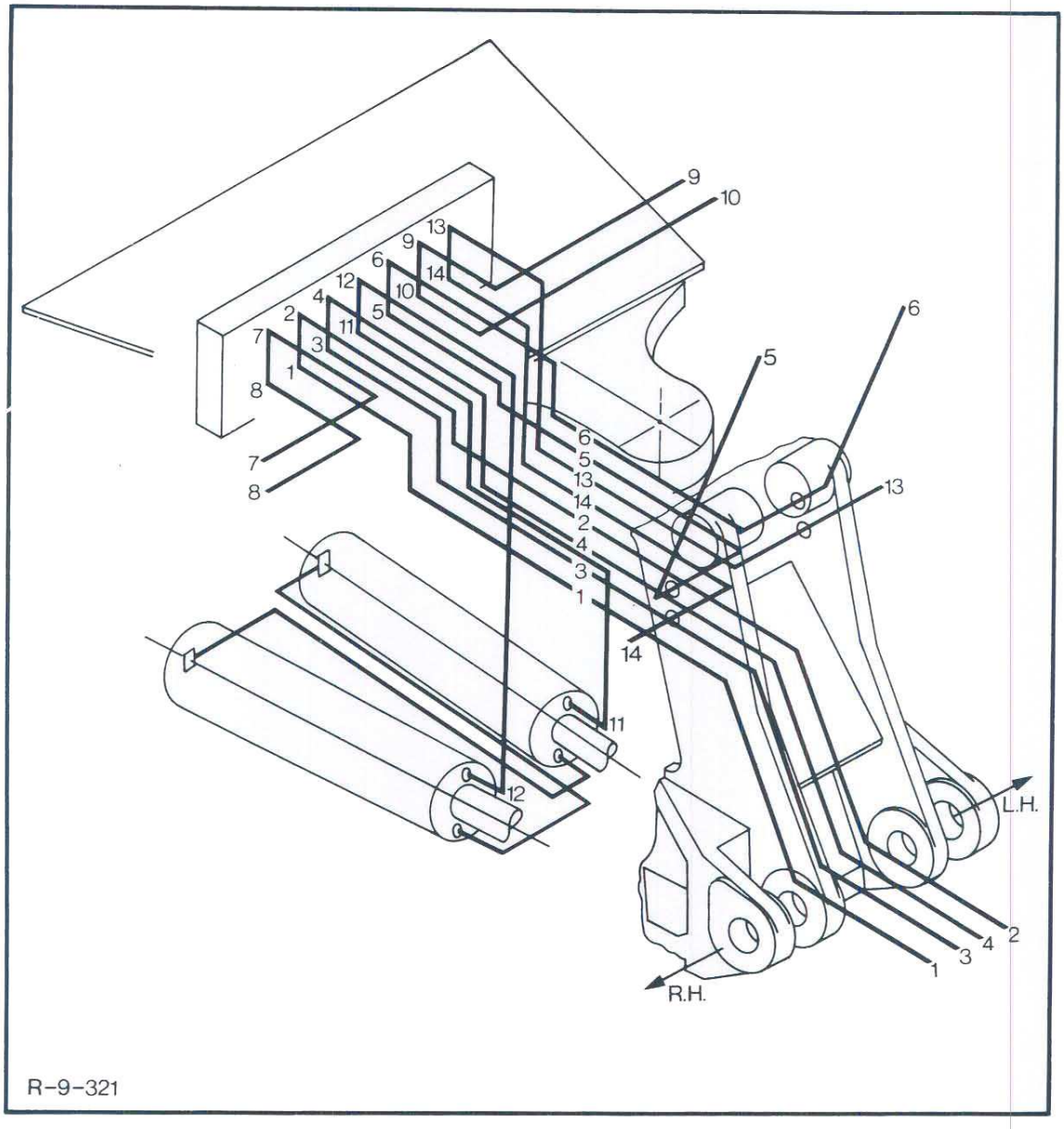

Figure 48
Backhoe Hose Routing – Centre Pivot Units

1. Crowd Cylinder – Rod Piston
2. Crowd Cylinder – Piston End
3. Bucket Cylinder – Rod End
4. Bucket Cylinder – Piston End
5. Lift Cylinder – Piston End
6. Lift Cylinder – Rod End
7. Right Stabiliser Cylinder – Rod End
8. Right Stabiliser Cylinder – Piston End
9. Left Stabiliser Cylinder – Rod End
10. Left Stabiliser Cylinder – Piston End
11. Left Swing Cylinder – Swing Left
12. Right Swing Cylinder – Swing Right
13. Extendible Dipstick Cylinder – Rod End
14. Extendible Dipstick Cylinder – Piston End

PART 8
HYDRAULIC SYSTEM, CONTROLS AND FRAME

Chapter 9
LOADER FRAME, BUCKETS, CONTROL SYSTEM, HOSES AND TUBES

A. LOADER FRAME AND BUCKETS – DESCRIPTION AND OPERATION

Ford 455C, 555C and 655C Units are available as a tractor-loader or as a tractor-loader backhoe, Figure 1. The loader lift arms are constructed of high strength low alloy steel and pivot on the two subframes bolted to the front support and rear axle. The lift arms and elliptical torque tube are welded to form a one piece closed structure. Joining the lift arms together with the torque tube forms a rigid structure, which enables the loader to withstand twisting and flexing should corner breakout of the bucket occur.

On 555C/655C tractors the loader arm is designed in a straight taper section increasing in depth to the section immediately at the rear of the torsion tube where the maximum bending and torsion strength is required.

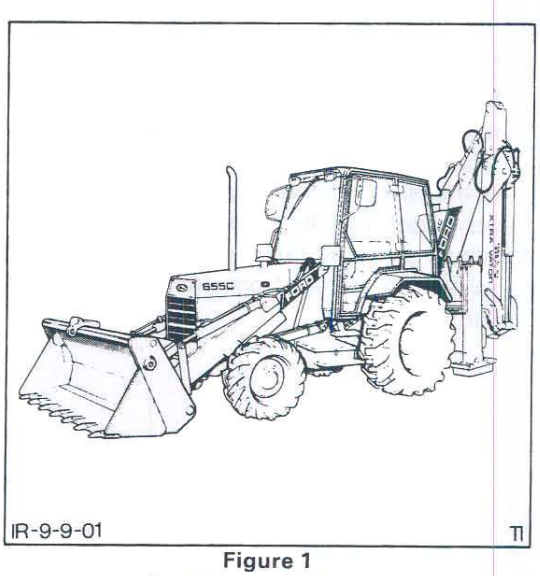

Figure 1
Tractor Loader Backhoe

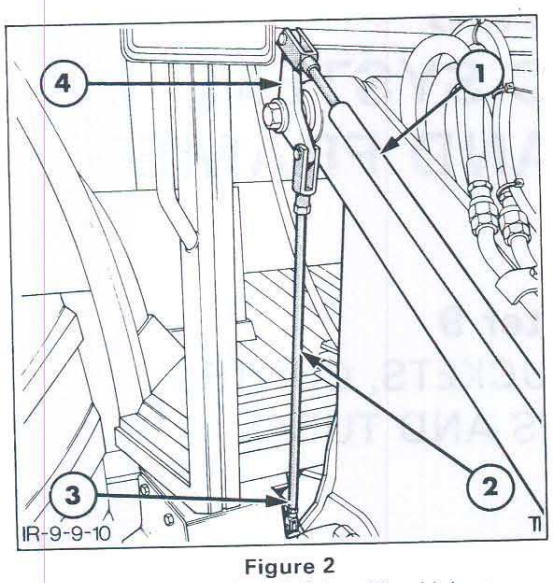

Figure 2
Hydro-Mechanical Self-Levelling Linkage

1. Loader Arm Rod and Tube Assembly
2. Vertical Linkage Rod
3. Lower Bellcrank and Locknut
4. Bellcrank

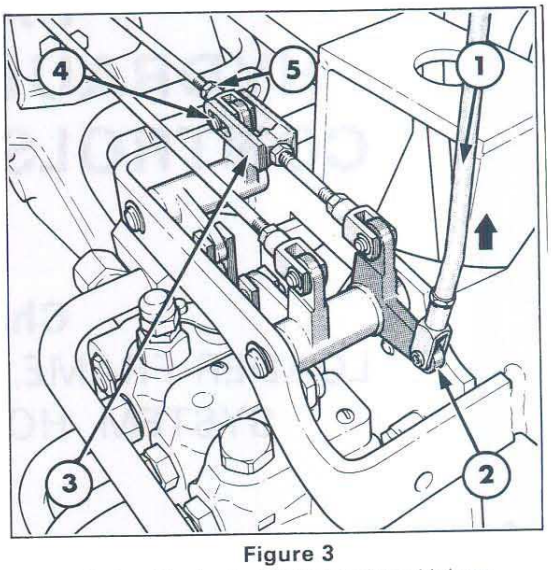

Figure 3
Hydro Mechanical Self-Levelling Linkage

1. Vertical Rod
2. Bell crank
3. Self-Levelling Linkage Clevis
4. Bucket Spool Bellcrank
5. Bucket spool Control Rod

On 455C tractors the loader arms are angled down at the position where the lift cylinder attaches to the loader arm. This design is compatible with the narrow front axle track width and enables optimum manoeuvrability of the vehicle.

The main subframes are firmly attached to both the vertical and horizontal planes of the rear axle half housings and attached to the front axle support casting in the vertical plane only. This allows loader forces to be absorbed by the subframe and rear axle whilst allowing the engine and transmission to be protected from loader compressive forces.

The idler and bucket links are attached to the rod end of the bucket cylinder to allow maximum rollback and dump angles while protecting the cylinder rods from bending forces.

A hydro-mechanical self-levelling linkage mounted on the right hand side of the loader arms and subframe and indirectly connected to the loader bucket spool ensures that the bucket remains in a constant position when lifting the loader. When the loader arms are raised the tube which is connected to the bucket idler link slides up the rod, Figure 2 and actuates the bellcrank causing the vertical rod to move upwards. The vertical rod movement actuates the lower bellcrank and causes a horizontal rod to slide in the self-levelling linkage clevis which connects the loader lever bucket spool control rod to the bellcrank operating the spool, Figure 3. When the horizontal rod reaches the end of its free travel in the sliding clevis the bucket spool is operated causing the bucket to roll forward in proportion to the loader lift arm movement and prevent bucket backspill.

WARNING: *The hydro-mechanical self-levelling linkage operates only when raising the loader. When lowering the loader it is necessary to level the bucket manually to prevent spillage of material.*

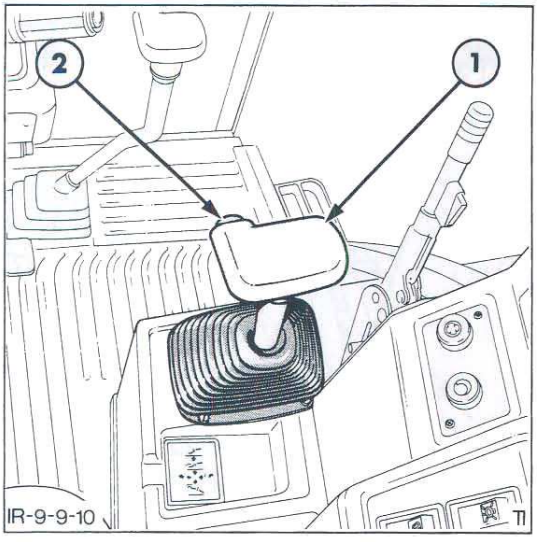

Figure 4
Loader Control Lever

1. Control Lever Knob
2. Transmission Dump Switch

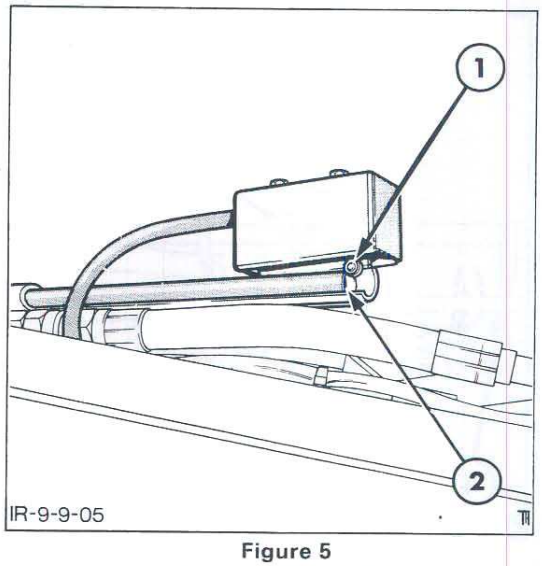

Figure 5
Return to Dig Switch

1. Switch
2. Bucket Level Indicator Rod

The standard loader bucket is constructed of welded steel plate and has the following capacities dependent on model.

455C	1.0 yd^3
555C	1.125 yd^3
655C	1.3 yd^3

A 1.12 cubic yd (765 litre) multi-purpose hydraulic bucket is also available for installation on the Ford 555C and 655C models.

The bucket breakout force and lift capacity to full height for each model of loader is as follows:

	Breakout Force	Lift Capacity to Full Height
455C	9000 lb (4082 Kg)	5000 lb (2268 Kg)
555C	12000 lb (5443 Kg)	6000 lb (2722 Kg)
655C	12000 lb (5443 Kg)	6500 lb (2998 Kg)

A single loader control lever, Figure 4, controls the lowering and raising of the loader lift arms, the rollback and dumping of the bucket and the opening and closing of the multi-purpose bucket where fitted. In addition to these movements a "float" and a "return to dig" position may be obtained.

The "float" position enables the loader lift arms and bucket to follow the contour of the ground and is obtained by moving the loader control lever fully forward into the detent position. The lever will remain in the "float" position until it is moved manually towards neutral.

On Ford 555C and 655C Units a bucket "return to dig" switch, Figure 5, is fitted to the loader enabling the bucket to be returned to the level digging position automatically after dumping. When the bucket is in the dump position, moving the control lever to the fully left position will engage an electrically operated automatic detent which will hold the bucket control valve spool in the rollback position until the bucket has returned to the level digging position.

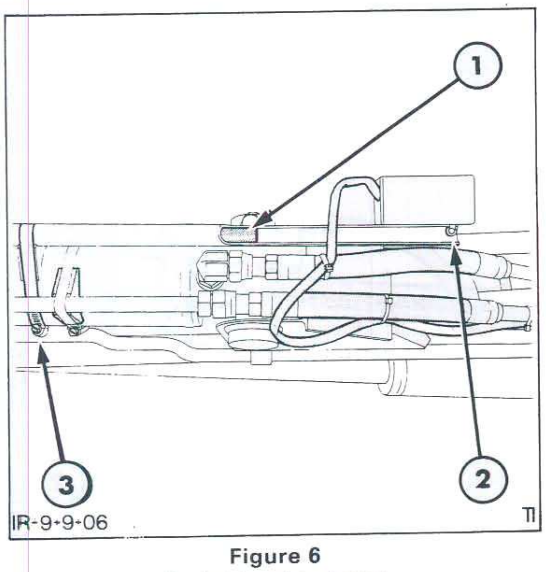

Figure 6
Bucket Level Indicator
555C and 655C Units

1. Indicator Rod
2. Indicator Tube
3. Tube Retaining Clamp

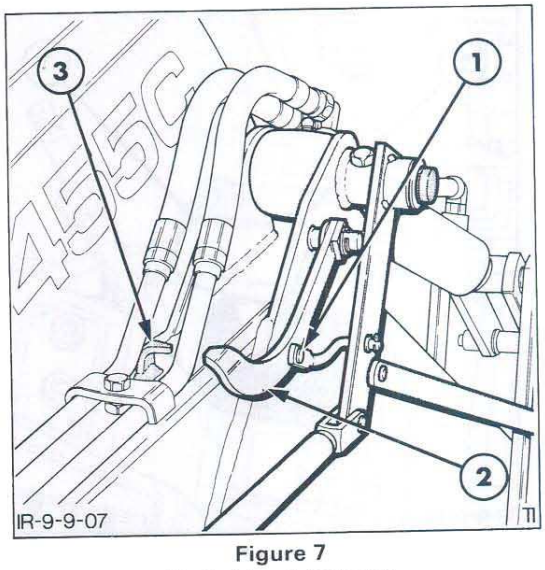

Figure 7
Bucket Level Indicator
455C Units

1. Indicator Arm Linkage
2. Indicator Arm
3. Fixed Pointer

The switch on the bucket level indicator is activated when the bucket has reached the level position and this releases the bucket control spool from the detent position.

Incorporated with the "return to dig" switch is a bucket level indicator. The loader bucket level indicator, Figure 6, indicates when the bucket is level with the ground. When the bucket is level the end of the rod will be at the end of the tube.

On Ford 455C Units a visual bucket level indicator is also installed, Figure 7. When the bucket is level with the ground the two pointers on the right hand loader arm will be aligned.

The control lever operating positions for each function of the loader are as follows:-

Lever back	– loader arms lift
Lever forward	– loader arms lower
Lever fully forward	– loader arms "float"
Lever left	– loader bucket rollback
Lever fully left	– loader bucket "return to dig" (Ford 555C and 655C Units only)
Lever right	– loader bucket dump

Multi-purpose bucket
(Ford 555C and 655C Units only)

Lever knob rotate right	– bucket opens
Lever knob rotate left	– bucket closes

Combinations of loader lift arm and bucket action can be obtained by moving the lever in a diagonal direction and/or rotating the knob to obtain movements simultaneously.

TRANSMISSION DUMP SWITCH

The transmission dump switches, Figure 8, located on the loader control lever and transmission gearshift lever knobs enable drive from the transmission to be engaged/disengaged without the need to move the power reversing lever to neutral. Either button will disengage the transmission when held in the depressed position.

The transmission dump switch feature allows full engine power to be available for operating the loader hydraulics. It is recommended that the loader control lever button is used to disengage the transmission at the point of bucket rollback and lift to increase loader productivity.

IMPORTANT: *To avoid possible damage to the transmission hydraulic clutches never use the dump switch control for inching the tractor forward. Inching the tractor forward with the dump switch will cause the clutches to slip excessively and overheat.*

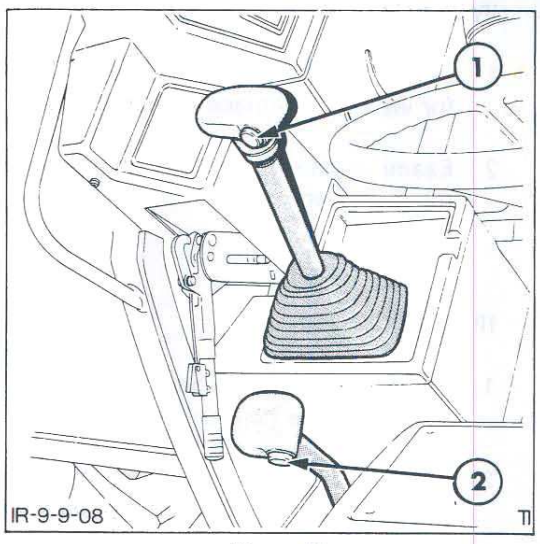

Figure 8
Transmission Dump Switches

1. Loader Control Lever Dump Switch
2. Gearshift Lever Dump Switch

B. LOADER BUCKET, LIFT ARMS AND SUBFRAMES – OVERHAUL

LOADER BUCKET – REMOVAL

1. Position the bucket on the ground with the open side down (full dump position), Figure 9.

2. Remove the bucket pivot pin securing bolts and using a brass drift and hammer, drive out the bucket link pivot pins.

3. Retract the bucket cylinder rods and drive out the lift arm to bucket pivot pins.

NOTE: *On Units with a multi-purpose bucket installed it is necessary to disconnect and plug the hydraulic hoses prior to loader bucket removal.*

WARNING: *To avoid personal injury, shut off the engine and relieve all hydraulic pressure by operating the control levers in all directions before any hydraulic connection is disconnected.*

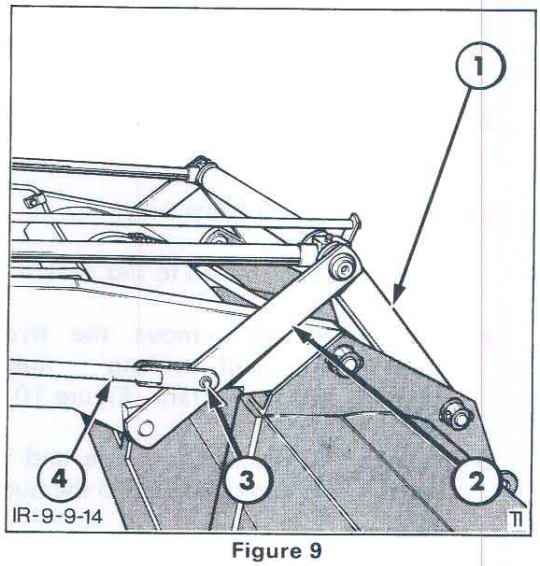

Figure 9
Loader Bucket Pivot Pins

1. Bucket Tipping Link
2. Bucket Pivot Pins
3. Bucket Idler Link

INSPECTION

1. Inspect the bucket pivot pins and bushes for wear and replace as necessary.

2. Examine the bucket for damage and repair as necessary.

INSTALLATION

1. Position the bucket on the ground with the open side face down.

2. Align the loader arm to bucket pivot points and install the pivot pins and pin retaining bolts.

3. Extend the bucket cylinder rods and align the bucket to link pivot points. Install the pivot pins and retaining bolts.

4. Tighten the pivot pin retaining bolts to the specified torque and lubricate the attaching points, see "Specifications" – Chapter 11.

LOADER LIFT ARMS – REMOVAL

1. Remove the sheet metal surrounding the fuel tank.

2. Remove the loader bucket as previously described in this section.

3. 555C and 655C Units only:

   Disconnect the return to dig switch.

4. Disconnect and remove the hydro-mechanical self-levelling linkage attached to the bellcrank, Figure 10.

5. Relieve any residual pressure and disconnect and cap the hoses to the bucket cylinders.

6. Position a suitable support between each lift cylinder barrel and ground. Remove the pins securing the rod end of each cylinder to the loader arms.

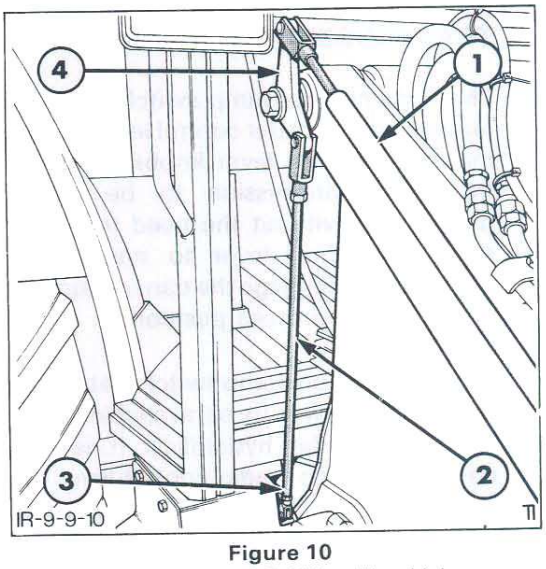

Figure 10
Hydro-Mechanical Self-Levelling Linkage

1. Loader Arm Rod and Tube Assembly
2. Vertical Linkage Rod
3. Lower Bellcrank and Locknut
4. Bellcrank

NOTE: *The pins must be removed towards the outside of the unit. If the pin is tight, raise the loader arms, drive the pin towards the centre to the unit and install a dummy pin of slightly smaller diameter. Lower the arms to the original position and remove the dummy pin.*

7. Using hydraulic power, very slowly retract the cylinder so that the cylinder rod end comes clear of the attaching point on the lift arm.

8. Relieve any residual pressures and disconnect the hydraulic hoses. Cap or plug all exposed openings.

9. Release each barrel from the subframe by removing the retaining bolt and washer.

10. With an assistant, or using suitable lifting equipment, remove the cylinders.

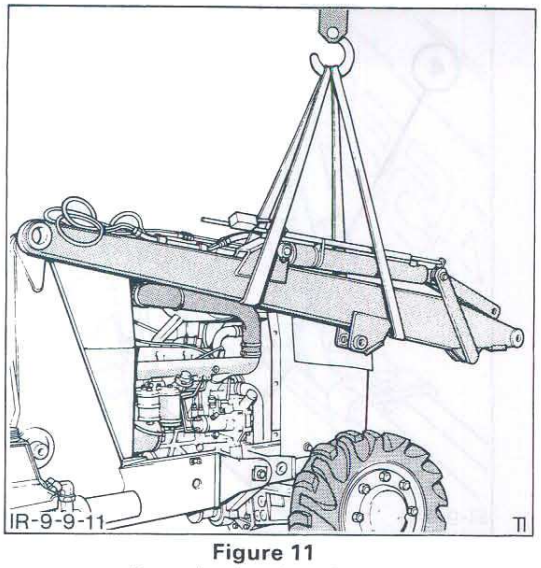

Figure 11
Removing Loader Lift Arms

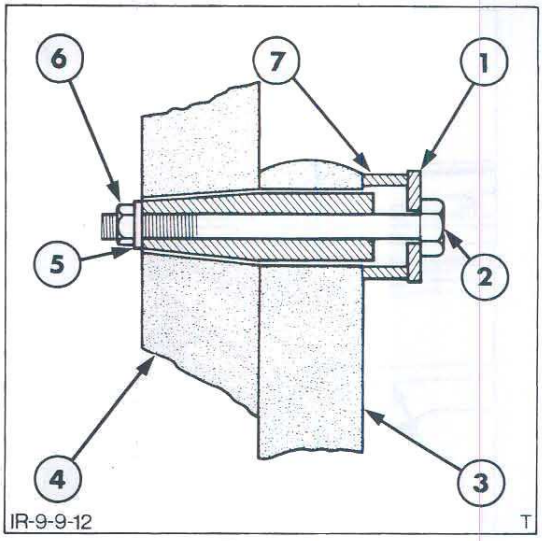

Figure 12
Loader Pivot Pin Removal

1. Washer
2. Bolt
3. Loader Arm
4. Loader Sub Frame
5. Washer
6. Nut
7. Spacer

11. Using a suitable hoist support the loader arms. Refer to Figure 11.

12. Remove each loader arm pivot pin using a suitable spacer, washer and the pivot pin bolt as shown in Figure 12. Tighten the nut and strike the bolt head with a copper faced hammer to free the pivot pin.

NOTE: *On the right hand pivot pin of with cab Units a split spacer located between the loader arm and levelling linkage bellcrank may be required as complete withdrawal of the pivot bolt at this stage can be restricted by the cab grab handle.*

13. Remove the loader arm assembly to the front of the vehicle taking care to ensure that the arms remain in the balanced position.

14. Disconnect the bucket cylinder tipping and idler links. Remove the cylinder barrel pivot pins and carefully lift the cylinders from the frame.

INSPECTION

1. Inspect the loader arms for wear and repair as necessary.

2. Inspect the pivot pins which attach the lift cylinder to the loader frame for wear or damage and replace as necessary using the removal method described for the loader arm pivot pins.

3. Inspect the loader arm bushings where fitted for wear or damage and replace as necessary. Damaged bushings can be replaced with suitable step plates and a driver.

INSTALLATION

1. Using a suitable hoist position the loader lift arms onto the subframes and locate the left hand lift arm pivot pin in the arm and subframe.

2. Locate the retaining bolt and washer in the pivot pin and retain in position using the washer and nut.

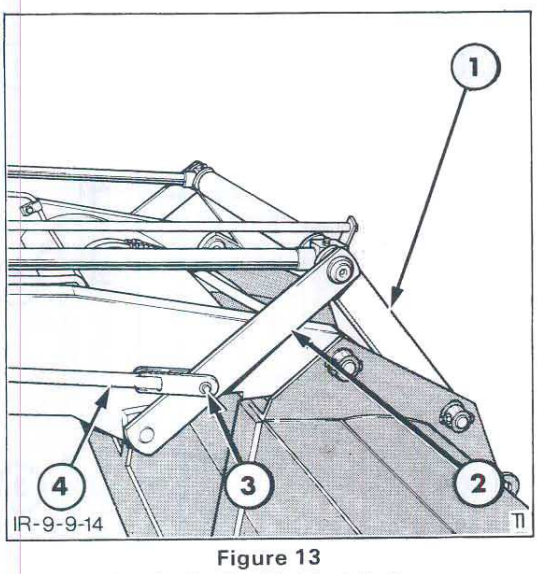

Figure 13
Loader Bucket Link Installation

1. Tipping Link
2. Idler Link
3. Welded Pin
4. Hydro Mechanical Levelling Linkage

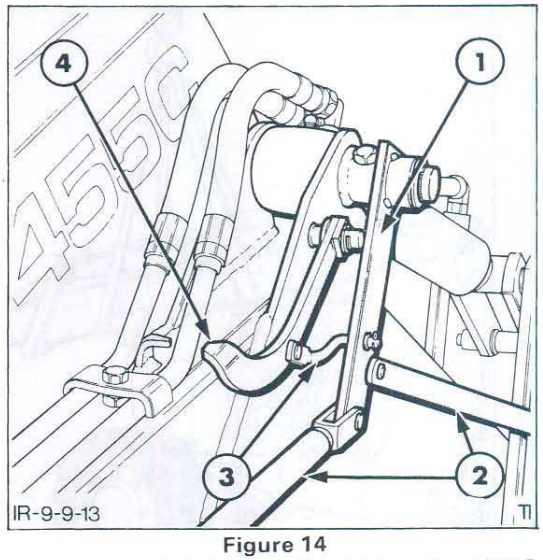

Figure 14
Hydro Mechanical Self Levelling Linkage Ford 455C

1. Arm
2. Hydro Mechanical Levelling Linkage
3. Indicator Arm Linkage
4. Indicator Arm

3. Position the washer, bellcrank, spacer, washer and pivot pin onto the right hand retaining bolt. Locate the bolt and pivot pin in the loader arm then retain the pin in position using the washer and nut previously removed.

4. Tighten the retaining bolts to the specified torque, then sharply strike each bolt axially and repeatedly with a 10 lb (5 kg) hammer and retorque the bolt. Repeat this bolt tightening procedure until each bolt is torqued to the specified torque. See "Specifications" Chapter 11.

5. Install the loader bucket cylinder and idler and tipping links to the lift arms.

NOTE: *Ensure when installing the right hand bucket cylinder that the idler link is fitted with the welded pin closest to the lift arms, Figure 13.*

6. If removed install the lift cylinder pivot pin in the loader subframe.

7. Install the lift cylinder to the subframe pivot pin and install the retaining bolt and washer into the pin. Secure the bolt with the washer and nut previously removed.

8. Tighten the retaining bolts to the specified torque then sharply strike each bolt axially and repeatedly with a 10 lb (5 kg) hammer and retorque the bolt. Repeat this bolt tightening procedure until each bolt is torqued to the specified torque. See "Specifications" – Chapter 11.

9. Reconnect the lift cylinder hoses and tubes. Support and extend the cylinders until the rod ends enter the pockets in the lift arms.

10. Align the rod and lift arm pivot holes and install the pivot pins. Tighten the pivot pin retaining bolts to the specified torque and remove the lifting hoist.

11. Install the loader bucket as previously described in this section and reconnect the return to dig switch where fitted.

12. Re-install the sheet metal surrounding the fuel tank.

13. Lubricate all grease fittings. Check the hydraulic reservoir oil level and examine all hose connections for hydraulic leaks. Refer to 'Specifications' – Chapter 1 for correct lubricants.

14. Re-assemble the hydro-mechanical self-levelling linkage ensuring that the centre of the loader arm on 455C Units is installed as shown in Figure 14.

15. Position the bucket level with the ground and adjust the indicator arm to align with the fixed pointer on the loader lift arm.

LOADER SUBFRAMES – REMOVAL

1. Remove the loader lift arms as described previously in this section.

2. Remove the cab or platform as described in PART 9, Chapter 1.

3. Remove the backhoe frame as described in PART 8, Chapter 8, Section D.

4. Remove the loader valve as described in PART 8, Chapter 7, Section B, and disconnect all loader tubes passing over, or attached to, the subframes.

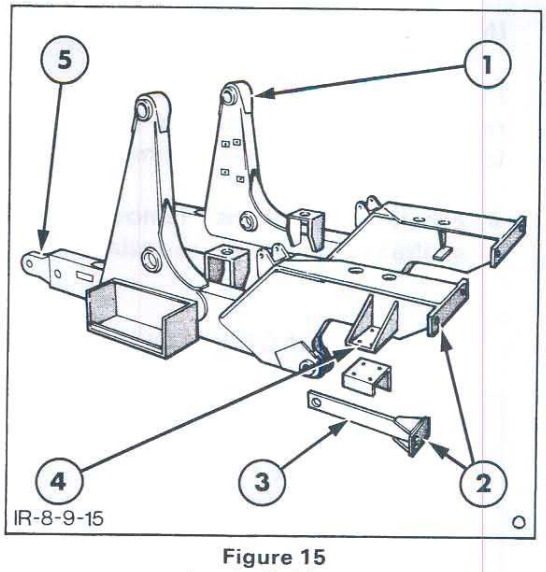

Figure 15
Loader Subframe

1. Loader Arm Pivot Point
2. Backhoe Attaching Brackets
3. Idler Link
4. Rear Axle Bracket
5. Subframe to Front Support Attachment

5. Remove the hydraulic filter mounted on the left hand subframe as described in PART 8, Chapter 2, Section C.

6. Lift the battery from the tray located on the right hand subframe.

7. Place a suitable sling in the subframe to loader pivot pin hole, refer to Figure 15 and support the subframe using the appropriate lifting equipment.

8. Disconnect the subframe idler links and remove the subframe rear axle securing bolts. Identify any shims positioned between the rear axle and subframe.

9. Remove the front support bolts and blocks.

10. Lift the subframe from the Unit.

INSTALLATION

Installation of the subframes follows the removal procedure in reverse. During installation observe the following requirements:

- Ensure any shims removed during subframe removal are re-installed.
- Ensure all retaining bolts are tightened to the specified torque, see "Specifications" – Chapter 11.
- Ensure the backhoe frame, loader and cab or platform are installed as detailed in the appropriate removal and installation section.

C. LOADER CONTROL SYSTEM (MECHANICAL) – OVERHAUL

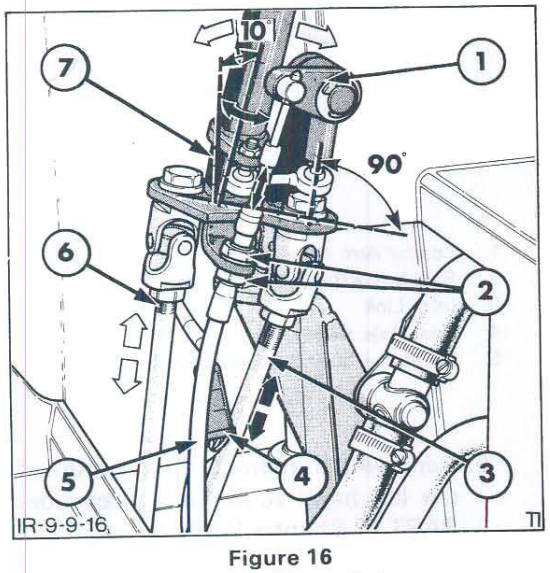

Figure 16
Loader Control Lever Linkages

1. Auxiliary Section Control Bellcrank
2. Cable Adjusters
3. Bucket Section Control Rod
4. Connector
5. Auxiliary Section Control Cable
6. Loader Boom Section Control Rod
7. Lever and Swivel Plate Assembly

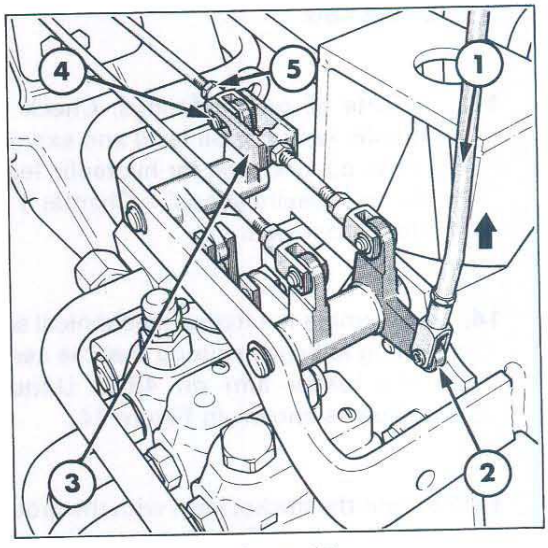

Figure 17
Control Valve Linkages

1. Vertical Rod (Self Level Linkage)
2. Bellcrank
3. Self Level Linkage Clevis
4. Bucket Spool Bellcrank
5. Bucket Spool Control Rod

REMOVAL

1. Lift the cab floor mat and unscrew the panel at the base of the loader control lever.
2. Slide the panel up the lever to expose the transmission dump switch wiring and disconnect the connector at the base of the lever linkage, Figure 16. Release the cable retaining strap.
3. Release the locking ring immediately beneath the control lever knob. Unscrew the knob and withdraw the knob and cable assembly from the control lever.
4. Remove the panel from the lever.
5. Disconnect the lever control linkage at the bellcranks and the multi-purpose bucket (auxiliary valve section) control cable where fitted.

6. Remove the bolt securing the lever assembly to the support bracket and withdraw the lever from the vehicle.

7. Disconnect the horizontal linkage and hydro-mechanical self-levelling sliding clevis from the valve spool operating bellcranks, Figure 17.

8. Disconnect the vertical hydromechanical self-levelling linkage from the valve bellcrank.

9. Disconnect the bellcranks from the valve spools and remove the retainers on each bellcrank pivot pin. Drive out the pins and remove the bellcranks.

INSPECTION

1. Inspect the control lever linkage for wear or damage and replace worn components as necessary.

2. On units installed with the multi-purpose bucket valve section inspect the control cable for damage and replace as necessary.

INSTALLATION

Installation of the loader lever control system follows the removal procedure in reverse. During installation ensure correct adjustment of the controls as follows and upon completion ensure that the loader control lever operates in all planes of movement, Figure 16.

LOADER AND BUCKET CONTROL

1. Adjust the loader and bucket control rods, Figure 16, so that when the control spools are in neutral the control lever is in a vertical plane across the axis of the vehicle and inclined at 10° rearwards along the axis.

2. Securely tighten the locknuts on each control rod.

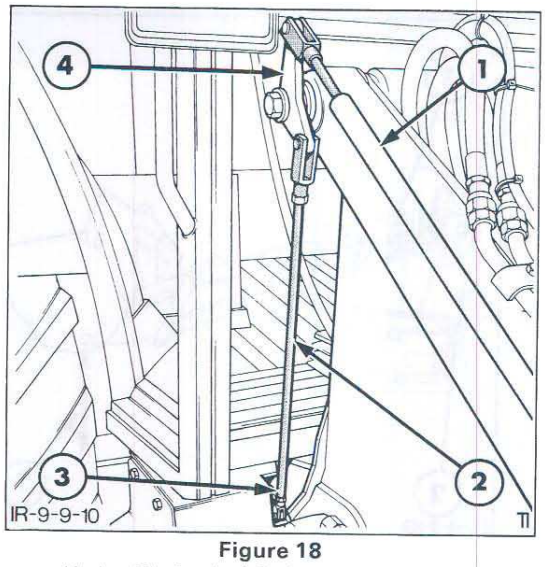

Figure 18
Hydro-Mechanical Self-Levelling Linkage

1. Loader Arm Rod and Tube Assembly
2. Vertical Linkage Rod
3. Lower Bellcrank and Locknut
4. Bellcrank

MULTI-PURPOSE BUCKET/AUXILIARY CONTROL (Where Fitted)

1. With valve section in neutral position adjust the operating cable until the vertical link of the control bellcrank is at 90° to the base plate of the control lever, Figure 16.

2. Securely tighten the locknuts and re-check adjustment.

HYDRO-MECHANICAL SELF-LEVELLING LINKAGE

1. Position the tractor on a hard level surface with the bucket on the ground.

2. Disconnect the vertical linkage rod at the lower bellcrank and loosen the locknuts. Refer to Figure 18.

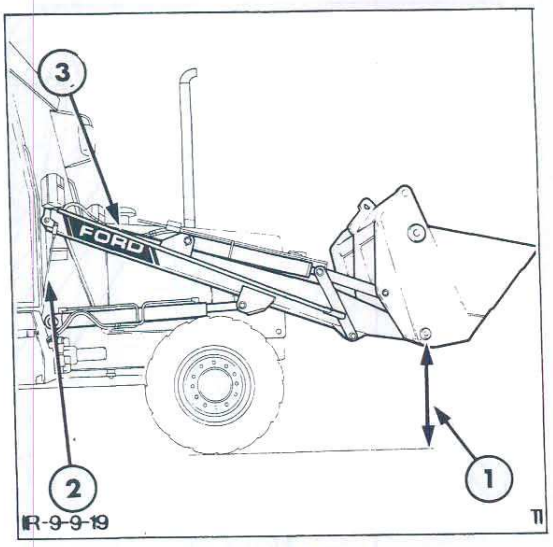

Figure 19
Hydro Mechanical Self levelling Linkage Dimensions – 555C and 655C Units

1. Height From Ground
2. Vertical Linkage Rod
3. Rod and Tube Assembly

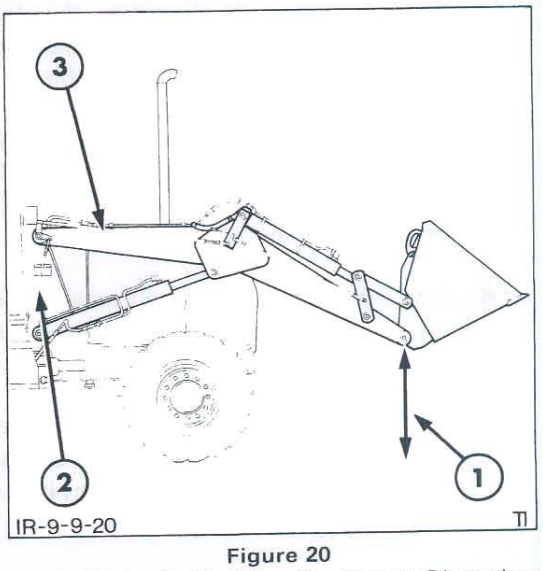

Figure 20
Hydro Mechanical Self-Levelling Linkage Dimensions – 455C Units

1. Height from Ground Level
2. Vertical Linkage Rod
3. Rod and Tube Assembly

3. Raise the loader arms upwards until the loader bucket pivot pin is 875mm – 925 mm (34 in – 36 in) above the ground. Figures 19 and 20.

4. Fully rollback the loader bucket.

5. Adjust the vertical linkage rod such that when re-connected the loader arm tube touches the end of the loader arm rod clevis. Refer to Figure 19.

6. Tighten the vertical linkage locknuts to the specified torque. See "Specifications" – Chapter 11.

RETURN TO DIG AND BUCKET LEVEL INDICATOR FORD 555C AND 655C ONLY

1. Place the loader bucket level with the ground and slacken the tube clamp which secures the level indicator tube to the bucket cylinder, Figure 21.

2. Slide the tube up or down the rod until the end of the tube is level with the end of the rod. Tighten the tube clamps.

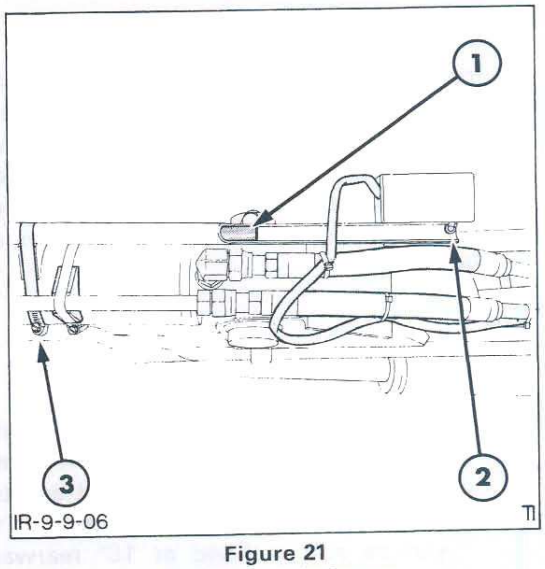

Figure 21
Bucket Level Indicator

1. Indicator Rod
2. Indicator Tube
3. Tube Retaining Clamp

3. Remove the "return to dig" switch cover, Figure 22.

4. Slacken the switch retaining nuts and move the switch until the rod just activates the switch. Tighten the switch retaining nuts.

5. Install the switch cover.

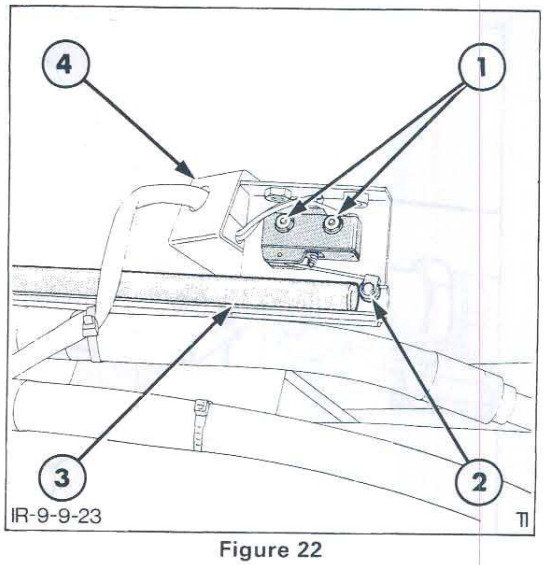

Figure 22
Return to Dig Switch Adjustment

1. Switch Retaining Nuts
2. Switch Arm
3. Indicator Rod
4. Switch Cover

D. HOSES AND TUBES – OVERHAUL

Overhaul of hoses and tubes is limited to replacement of 'O' rings on the hose and tube connectors and replacement of damaged hoses and tubes.

Repair all hydraulic oil leaks promptly to avoid loss of oil and possible damage and dirt entry into the system. When checking for hydraulic leaks, start and operate the engine at 1200-1500 rev/min.

Remove and install new hoses immediately, if they are severely damaged by a cut or scrape, swollen at the fittings or leaking. If leakage is observed lower the loader to the ground shut off the engine and relieve all hydraulic pressure.

The following points should be observed when removing hoses and tubes.

WARNING: *Never disconnect or tighten a hose or tube that is under pressure. If in doubt actuate the operating levers several times with the engine switched off prior to disconnecting a hose or tube.*

IMPORTANT: *Ensure that when a hydraulic hose or tube is renewed/installed, all components are absolutely clean and free from dirt. Failure to ensure absolute cleanliness will result in the hose/tube leaking after installation or possible damage to other hydraulic system components.*

NOTE: *Use care in removal of hoses that will be re-installed. Be careful not to twist or kink a hose, doing so can damage the internal facing causing early hose failure.*

Before disconnecting any of the hoses or tubing from the control valves, tag and identify the hose, tube or connector.

Cap all hoses, connectors and ports to prevent entry of dirt into the system.

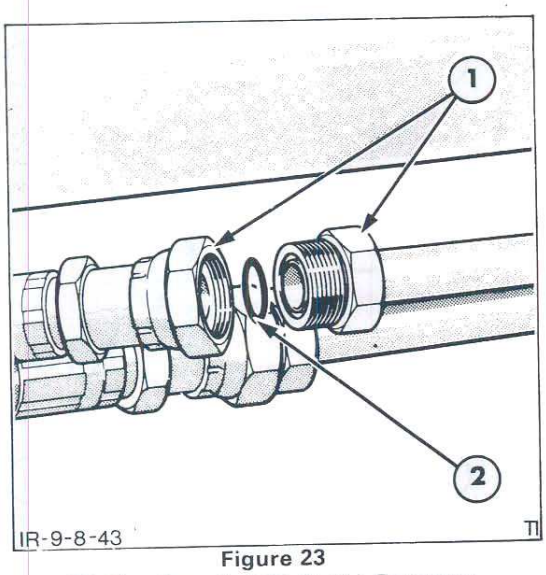

Figure 23
'O' Ring Face Seal (O.R.F.S.) Connector

1. O.R.F.S. Fitting
2. 'O' Ring Seal

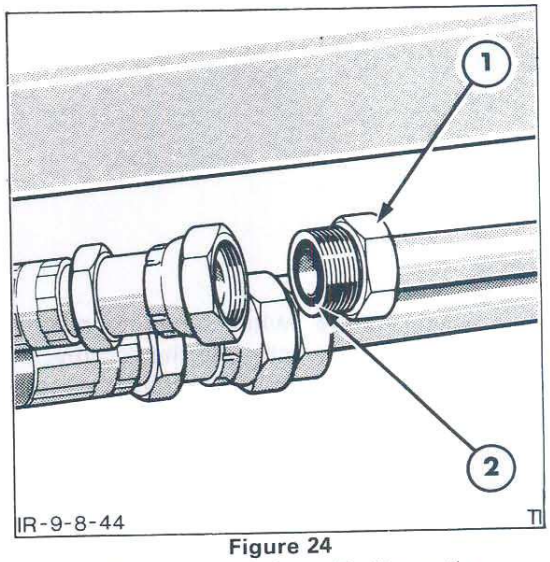

Figure 24
'O' Ring Installed Prior to Re-Connection

1. O.R.F.S. Fitting
2. 'O' Ring Seal

When repairing the 'O' ring Face Seal connectors used on 455C, 555C and 655C Units the following disconnection and reassembly procedure should be observed.

1. Release the fittings and separate the hose or tube assembly, then remove and discard the 'O' ring seal from the fitting, Figure 23.

2. Dip a new 'O' ring seal into clean hydraulic oil prior to installation. Install the new 'O' ring into the fitting and if necessary retain in position using petroleum jelly, Figure 24.

3. Assemble the new hose or tube assembly and tighten the fitting finger tight, while holding the tube or hose assembly to prevent it from turning, Figure 25.

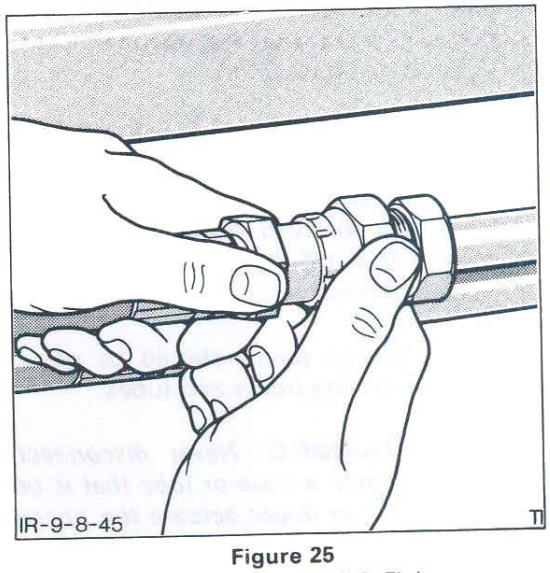

Figure 25
Hand Tightening O.R.F.S. Fitting

4. Using two suitable wrenches, tighten the fitting to the specified torque, Figure 26. See "Specifications" – Chapter 11.

NOTE: *To ensure a leak free joint is obtained, it is important that the fittings are not over or under torqued.*

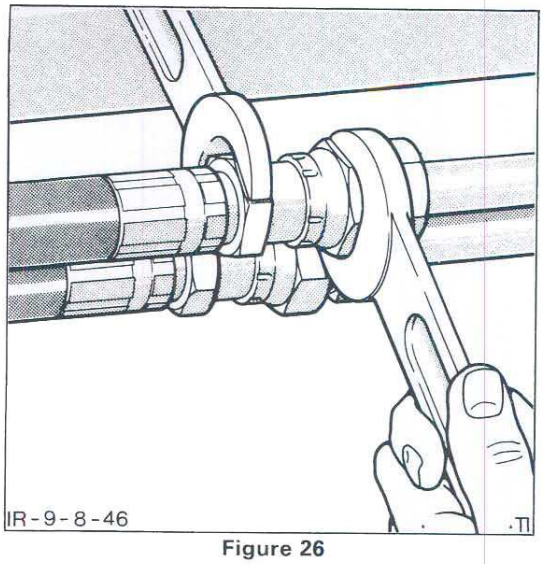

Figure 26
Tightening the O.R.F.S. Fitting

5. Bleed the air from the system any time a hydraulic hose is removed, a tube disconnected, or the system is opened to atmosphere. This is accomplished by running the engine at 1200-1500 rev/min., and actuating the loader or backhoe control levers (no load in the bucket) for approximately 15 minutes or until all air is expelled from the system.

6. After bleeding the system, position the loader bucket flat on the ground, put the backhoe into the transport position, and shut off the engine. Then check the hydraulic system oil level and add oil if necessary.

PART 8

HYDRAULIC SYSTEM, CONTROLS AND FRAME

Chapter 10
HYDRAULIC TROUBLE SHOOTING AND PRESSURE TESTING

A. TROUBLE SHOOTING AND PRESSURE TESTING – INTRODUCTION

If trouble shooting, pressure and flow testing is carried out in a systematic manner and the results analysed, the malfunction can be readily and accurately identified. If short cuts, assumptions and guesses are made, unnecessary strip-down or component renewal could result. Follow the step-by-step procedures outlined below.

Preliminary Checks

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

- Check that the hydraulic oil is at the correct level and of the correct specification. See "Specifications" Chapter 11.

- Check the loader, backhoe or any additional accessory such as hydraulic bucket, hammers etc., for correct assembly or installation and additionally for signs of external damage that might cause gross misalignment of structural members.

- Check in more detail for other mechanical damage such as kinked/twisted/worn or decayed hoses, damaged cylinders and bent elements. Do not forget to check underneath the unit for damaged steel tubework, particularly if the unit has been known to have operated in arduous conditions, been grounded or "bogged down".

- Ensure optimum operating temperature of the hydraulic oil is achieved.

- Perform the system relief valve pressure check.

- Perform the circuit relief valve pressure checks.

The preceding preliminary checks assume that the engine performance is not in question. Having performed these checks and failing to locate the cause of the malfunction the following procedures should be adopted:–

1. If possible, operate the backhoe and make notes of the operating characteristics. Cycle each control lever to operate each of the cylinders to the fully extended and retracted positions.

2. Compare the operating characteristics in the preceding stage with the malfunctions listed in the "Trouble Shooting Chart".

EXAMPLE: Backhoe lift circuit slow to raise, all other circuits appear to work normally.

Listed in the column under "Malfunction" in the "Trouble Shooting Chart", the description would be "lift fails to operate, is slow or has loss of power".

- The column headed "Malfunction" lists the observed malfunctions when the excavator or loader is operated.

- The column headed "Possible Cause" lists all the items in the circuit which could cause the observed malfunction.

- The column headed "Test/Repair" lists the test which should be used to determine the item causing the observed malfunction.

Refer to "Test/Repair" column and perform the recommended tests. 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 time by avoiding unnecessary disassembly 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.

B. TROUBLE SHOOTING CHART – WHOLE UNIT

MALFUNCTION	POSSIBLE CAUSE	TEST/REPAIR
All circuits fail to operate.	Pump drive inoperative.	Investigate and repair as necessary.
	Pump Worn.	Perform pump performance test and replace/reseal as necessary.
	Low oil level.	Check and add oil.
	Faulty system relief valve.	Check system relief valve adjust/overhaul as necessary.
	Restricted pump suction line.	Inspect suction line and reservoir, repair as necessary.
Slow operation or loss of power in all circuits.	Pump worn.	Perform pump performance test and replace/reseal as necessary.
	Restricted pump suction line.	Inspect suction line and reservoir, repair as necessary.
	Faulty system relief valve.	Check system relief valve adjust/overhaul as necessary.

C. TROUBLE SHOOTING – BACKHOE

Refer to the following backhoe trouble shooting chart after first considering the preceding chart. The backhoe chart should only be referred to if the supply circuit is performing normally, thereby confirming that the pump and hydraulic supply circuit is functioning to specification. See also "E". Trouble Shooting – Hydraulic Pump" page 7.

MALFUNCTION	POSSIBLE CAUSE	TEST/REPAIR
Lift fails to operate, is slow, has loss of power or is not holding.	Lift circuit relief valve stuck open, set too low or seat is leaking.	Lift circuit relief valve pressure test.
	Piston seal leaking or cylinder barrel damaged.	Cylinder packing leakage test.
	Valve spool leakage.	Examine lift section of backhoe control valve assembly for wear and scoring.
Crowd fails to operate, is slow, has loss of power.	Crowd circuit relief valve (piston end) stuck open, set too low or seat is leaking.	Crowd circuit relief valve test.
	Piston seal leaking or cylinder barrel damaged.	Cylinder packing leakage test.
	Valve spool leakage.	Examine crowd section of backhoe control valve assembly for wear and scoring.
Bucket fails to operate, is slow or has loss of power.	Bucket circuit relief valve (rod end) stuck open, set too low, or seat is leaking.	Bucket circuit relief valve test.
	Piston seal leaking or cylinder barrel damaged.	Cylinder packing leakage test.
	Valve spool leakage.	Examine bucket section of backhoe control valve assembly for wear and scoring.
Extendible dipstick fails to operate, is slow, has loss of power or is not holding.	Extendible dipstick circuit relief valve (piston end) stuck open, set too low or seat is leaking.	Extendible dipstick circuit relief valve test.
	Piston seal leaking or cylinder barrel damaged	Cylinder packing leakage test.
	Valve spool leakage.	Examine dipstick section of backhoe control valve assembly for wear and scoring.
All backhoe circuits fail to operate, are slow or have loss of power.	Regenerative check valve in control valve outlet end cover stuck open or seat is leaking.	Back pressure relief valve and unload valve test.

C. TROUBLE SHOOTING – BACKHOE (contd)

MALFUNCTION	POSSIBLE CAUSE	TEST/REPAIR
Right or left direction swing fails to operate is slow, or has loss of power.	Swing circuit relief valves not seating, set too low or seat is leaking.	Swing circuit relief valve test.
	Piston seal leaking or cylinder barrel damaged.	Cylinder packing leakage test.
	Valve spool leakage.	Examine swing section of backhoe control valve assembly for wear or scoring.
Swing fails to slow (cushion arrest) at end of travel.	Piston seal leaking or cylinder barrel damage.	Cylinder packing leakage test.
	Integral sliding restrictor damaged.	Disassemble and Inspect.
Swing continues to move when control lever returned to neutral (one direction only).	Circuit relief valve (return side) stuck open, set too low or seat leaking.	Swing circuit relief valve test.
	Valve spool leakage.	Examine swing section of backhoe control valve assembly for wear or scoring.
Swing drifts, slow to respond, hesitates.	Circuit relief valve anti-cavitation function stuck/ seized.	Disassemble and Inspect.
	Restrictors seized/incorrectly positioned.	Disassemble and Inspect.
Cylinders leak down (spools in neutral).	Piston seal leaking or cylinder barrel damaged.	Cylinder packing leakage test.
	Internal valve leakage.	Examine appropriate valve section of backhoe control valve assembly for wear or scoring.
Any one circuit drops momentarily when signalled to raise.	Load check valve between control valve sections damaged.	Disassemble and Inspect.
Lift cylinder hesitates when dropped rapidly then signalled to raise.	Lift cylinder rod end restrictor damaged or incorrectly positioned.	Disassemble and Inspect.
Right or left stabiliser is slow or has loss of power.	Piston seal leaking or cylinder barrel damaged.	Cylinder packing leakage test.
	Valve spool leaking.	Examine appropriate stabiliser section of backhoe control valve assembly for wear or scoring.
	Stabiliser cylinder rod end restrictor damaged or incorrectly positioned (Scandinavian units only).	Disassemble and Inspect.

D. TROUBLE SHOOTING – LOADER

MALFUNCTION	POSSIBLE CAUSE	TEST/REPAIR
Lift fails to operate, is slow or has loss of power.	Valve spool leakage.	Examine lift section of loader control valve assembly for wear or scoring.
	Piston seals leaking or cylinder barrel damaged.	Cylinder packing leakage test.
Bucket fails to operate is slow or has loss of power.	Circuit relief valves stuck open, set too low or seat leaking.	Bucket circuit relief valve test.
	Valve spool leakage.	Examine bucket section of loader control valve assembly for wear or scoring.
	Piston seals leaking or cylinder barrel damaged.	Cylinder packing leakage test.
Cylinder leak down (spools in neutral).	Piston barrel damaged.	Cylinder packing leakage test.
	Internal valve leakage.	Examine appropriate valve section of loader control valve assembly for wear or scoring.
Hesitation in loader lift or bucket cylinders when control initially moved.	Load check valve between control valve sections damaged.	Disassemble and Inspect.

E. TROUBLE SHOOTING – HYDRAULIC PUMP

MALFUNCTION	POSSIBLE CAUSE	TEST/REPAIR
System noisy.	Worn or damaged pump gears or pressure plates.	Hydraulic pump performance test.
	Aeration: Air entering the systems at: suction tube, pump shaft, fittings or cylinder glands.	Hydraulic pump performance test.
	Cavitation: Restrictions in the system at the suction line or at the suction screen in the reservoir.	Visual and/or hydraulic pump performance test.
	Water in the system.	Visual.
	System relief valve chatter.	Check system relief valve adjust/overhaul as necessary.
	Tubing vibration.	Visual.
	Cold hydraulic oil.	Check hydraulic oil operating temperature.
	Wrong type oil being used.	Investigate/drain and refill.
Hydraulic oil exhausts from breather at the reservoir.	Reservoir overfilled.	Check hydraulic oil level.
	Aeration: Air entering the system at: suction tube, pump shaft, fittings or cylinder glands.	Hydraulic pump performance test.
	Cavitation: Restriction in the system at the suction screen in the reservoir.	Visual and/or hydraulic pump performance test.
Oil heating.	Oil suppy low.	Fill reservoir.
	Contaminated oil.	Drain reservoir and refill with clean oil.
	Setting of relief valve too high or too low.	Drain reservoir and refill with clean oil. Test relief valves.
	Oil in system too light.	Drain reservoir and refill with correct viscosity oil.
	Oil cooler fins blocked.	Clean oil cooler.
Shaft seal oil leakage.	Worn shaft seal.	Replace shaft seal and inspect pump.
Foaming oil.	Low oil level.	Fill reservoir.
	Air drawn into suction line.	Check/tighten suction line.
	Wrong oil grade.	Drain and refill with correct oil.

F. HYDRAULIC PUMP PERFORMANCE TESTING

The hydraulic pump must deliver a specified quantity of oil through the backhoe and loader circuits within prescribed pressure limits. If the pump flow rate falls below specification and possibly fails to achieve specified pressure, the efficiency of the hydraulic system will be reduced.

The hydraulic pump performance test is performed with the pump isolated from the backhoe loader circuit so that system leakage is not a factor in the test.

With the tester properly installed, all oil is pumped directly to the tester unit, measured at the desired pressure and temperature and returned to the reservoir.

When measuring pump performance the working temperature of the oil must be at 180°F (82°C).

IMPORTANT: *Do not, under any circumstances, exceed the system pressure when testing the pump. Excessive pressures could cause major pump damage.*

Test Equipment Installation

1. Park the unit on a hard level surface. Park the backhoe elements and release all residual pressures by moving all control levers in all directions.
2. Disconnect the pump pressure inlet tube at the loader valve and install thread adaptor FT 8557 into the feed tube from the hydraulic pump ensuring that the 'O' ring face seal has been installed between the tube and adaptor.
3. Install thread adaptors FT 820–1 into the inlet and outlet parts of hydraulic tester (flowmeter) MS 820A and connect a hose with $1^{1}/_{16}$" JIC female ends between the inlet port of tester and adaptor FT 8557 on pump pressure feed tube. Figure 1.
4. Connect a suitable $1^{1}/_{16}$" JIC female hose to the outlet port of the hydraulic tester and route this hose to the reservoir filler opening. Position the hose so that the end is below the oil level. Support and tie the hose in this position, Figure 2.
5. Tighten all connections and ensure the tester load valve is fully open.

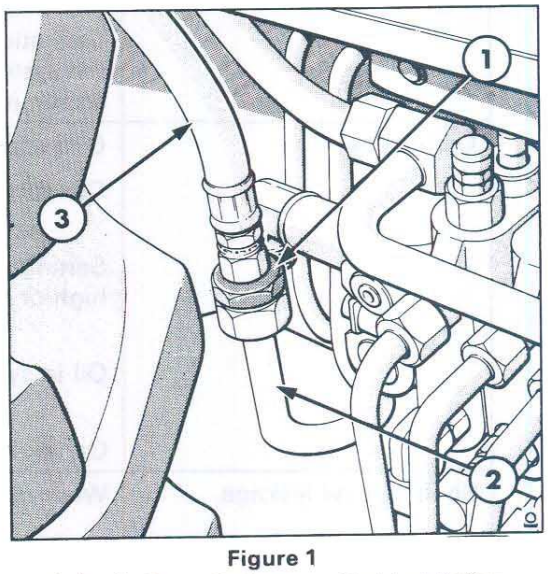

Figure 1
Hydraulic Pump Performance Test Installation

1. Adaptor FT 8557
2. Loader Feed Tube from Hydraulic Pump
3. Hose to Hydraulic Tester