USER'S MANUAL

TW60-61

Torque Wrench

Original Instructions

REFERENCE TW60-61	REFERENCE DESCRIPTION Torque Wrenches
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NATIONAL OILWELL VARCO

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SECTION I
GENERAL DESCRIPTION

1-1. INTRODUCTION

1-2. This manual provides installation, operation, and maintenance procedures for the Varco Torque Wrench Assembly, TW-60, part number 16000.

1-3. The torque wrench (TW-60) is a hydraulically operated tool used in place of tongs to make up or break out tool joints. During makeup the correct torque for the tubular goods being run can be held to precise limits, with accurate repeatability.

1-4. DESCRIPTION

1-5. The TW-60 torque wrench consists of an upper and lower gripping body, and a vertical positioning system (Figure 1-1).

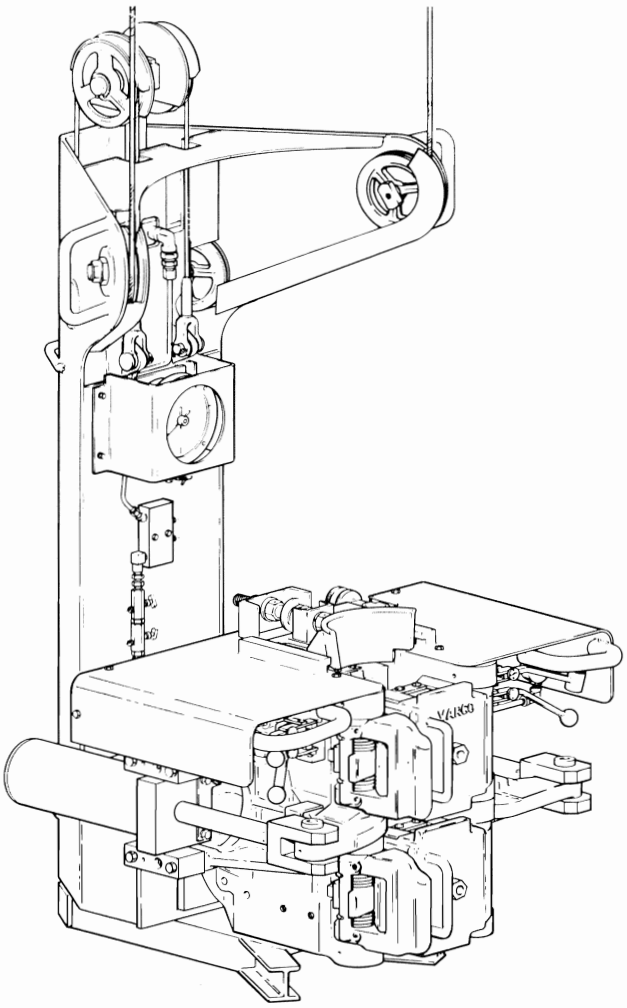


Figure 1-1. TW-60 Torque Wrench

1-6. **TORQUE WRENCH BODY.** The torque wrench body consists of two segments, upper and lower (Figure 1-2). Each segment has two opposing jaws with die holders, one fixed on the gate and one movable on the clamping piston. The gate on each segment swings open on a hinge pin to allow the wrench to swing onto a tool joint. The jaws are equipped with spring loaded buttons to center the wrench around the pipe connection.

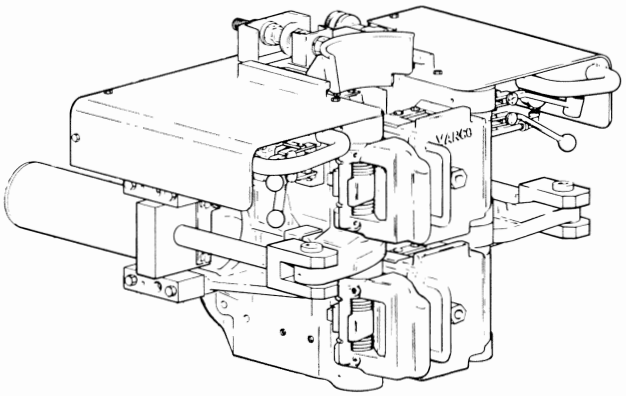


Figure 1-2. TW-60 Body

1-7. The two segments of the torque wrench are connected by two torque cylinders. A torque cylinder mounted on each body is connected to the other body with a rod end clevis and pin. These two torque cylinders provide the rotation of the two body segments which produces the torque on the tool joint.

1-8. **Upper and Lower Clamp Controls.** (1 and 2, Figure 1-4) The clamp control valve, located on the left side of the upper body, is divided into two segments. The upper half controls the upper clamping cylinder and the lower half controls the lower clamping cylinder. the valve is a three-position (in-neutral-out) valve detented in the in and out positions. Pulling the lower clamping valve control lever all the way out will clamp the lower clamp on the tool joint box. Pushing the lower clamping valve control lever all the way in will release the clamp from the tool joint box. The upper clamping valve control lever performs the same functions on the tool joint pin.

1-9. **Dump Valve.** (3, Figure 1-4) The dump valve is a two-position, normally closed valve located on the left torque cylinder. It is mechanically actuated when the cylinder is fully retracted, and reduces the pressure on the torque gauge to near zero. A loss of pressure on the torque gauge indicates that the TW-60 has rotated to the limit of its 34-degree travel.

1-10. **Torque Makeup/Breakout Control.** (5, Figure 1-4) The torque makeup/breakout valve is spring centered, located on the right side of the TW-60, and has a spherical knob. Pulling the knob provides make up torque until either the preset torque is reached, or the cylinders reach the end of their stroke. Pulling the knob before clamping on the tool joint pin will cock the TW-60 for breakout. Clamp the pin and push the torque knob in to break out.

1-11. **Pressure Reducing Valve.** (7, Figure 1-4) The pressure reducing valve (PRV) adjusts the torque applied by the TW-60. The PRV is located on the right side of the back guard and is manually adjusted.

1-12. **Supply Pressure Gauge.** (6, Figure 1-4) The supply pressure gauge is a 0-3000 psi direct reading gauge located on the right side of the TW-60 behind the torque handle. This gauge provides an indication of inlet system pressure from the hydraulic power supply.

1-13. **VERTICAL POSITIONING SYSTEM.** The TW-60 lower body segment is attached to the vertical position hanger. Using a double sheave arrangement and a 2-1/2-inch diameter hydraulic cylinder with a 3-foot stroke, the system provides a total of 6 feet vertical travel (Figure 1-3). The vertical positioning system is suspended from a hanger plate by two wire rope assemblies reeved thru the sheaves.

1-14. **Actuator Manifold Assembly.** The actuator manifold assembly is a double pilot check valve used to prevent the TW-60 from drifting downward. The manifold also prevents a sudden drop of the TW-60 if the hydraulic power is shut off.

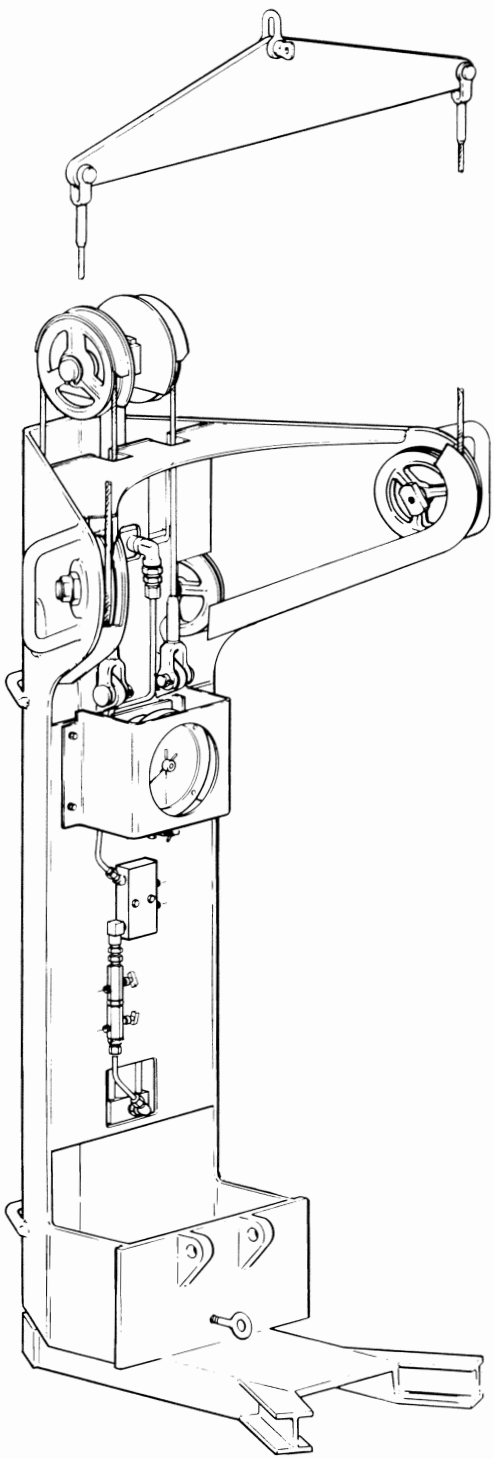


Figure 1-3. Vertical Positioning System

1-15. **Flow Control Valves.** (9, Figure 1-4) A pair of adjustable flow control valves, installed in the hydraulic line to the lifting cylinder, control the speed of the TW-60 travel. Rotating the handles clockwise will reduce the flow to reduce speed. The lower valve controls the down speed and the upper valve controls the up speed.

Index	Control/Indicator	Type	Function
1	CLAMP TOP	Valve lever	Detent valve, pull to clamp upper body, will stay clamped until pushed (unclamped).
2	CLAMP BTM	Valve lever	Same as above; clamps lower body.
3	Dump valve	Normally closed valve	Actuated when left torque cylinder reaches full stroke, causes torque gauge to read near zero.
4	LIFT	Valve lever (with cylindrical handle)	Controls height of TW-60. Pull to raise, push to lower. Movement stops when lever is released.
5	TORQUE	Valve lever	Controls application of torque. Pull for makeup torque; pull, then push for breakout torque. Torquing stops when lever is released.
6	Supply pressure gauge	Pressure gauge (psi and bar)	Indicates pressure from hydraulic power supply. Flow control is on power supply.
7	TORQUE ADJUSTMENT	Pressure reducing valve	Presets torque for makeup. Equipped with a locking knob, rotate outer knob to adjust torque.
8	Torque gauge	Bourdon tube pressure gauge	Indicates torque being applied. Red target pointer for verification. Zero adjust knob on back of case.
9	Flow control valves (2)	Inline flow control valve	Control raising and lowering speed. Upper valve controls raising and lower valve controls lowering.

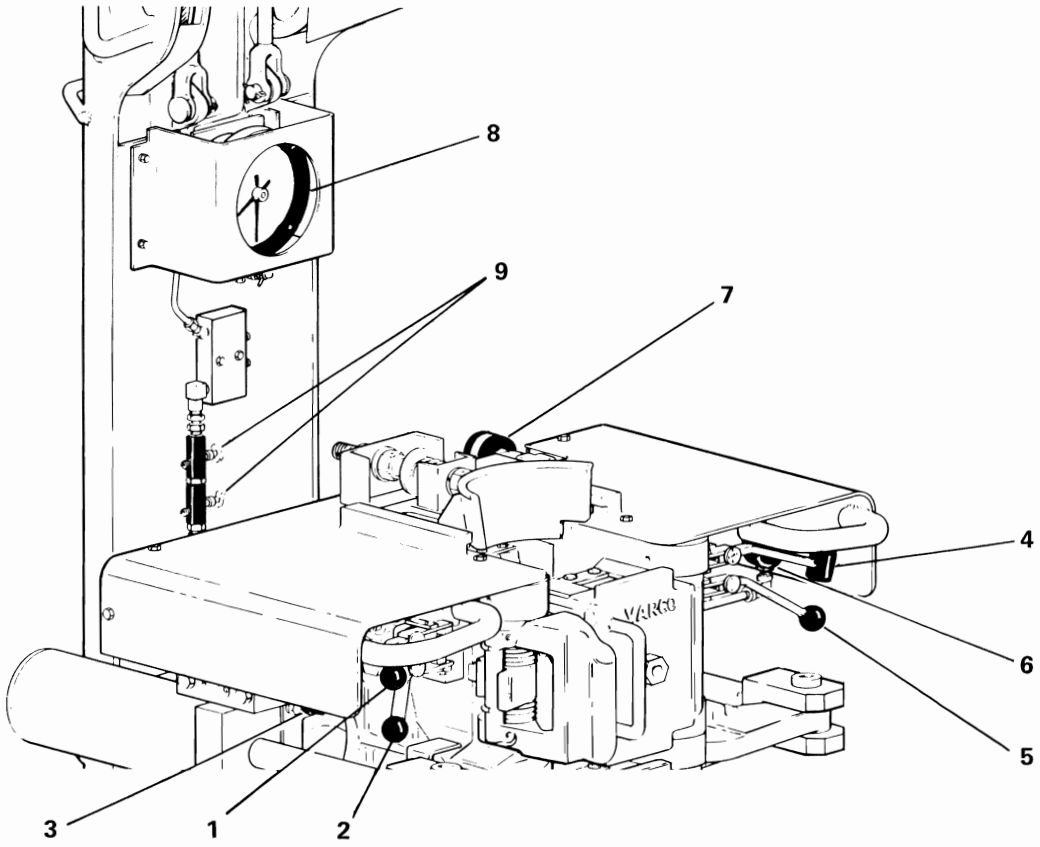


Figure 1-4. TW-60 Controls and Indicators

1-16. **Torque Gauge.** (8, Figure 1-4) The torque gauge is located on the front face of the vertical positioning system hanger and is direct reading to indicate makeup torque in foot-pounds and either kilogram meters or Newton meters. A damper is provided to smooth severe fluctuations in the pressure. A red adjustable pointer assists torque gauge readings and a zero adjust knob on the back of the gauge case allows the gauge to be set to 0 when no torque pressure is applied.

1-17. **Vertical Lift Control.** (4, Figure 1-4) The vertical lift control valve is located on the right side of the TW-60 above the torque control valve. The lift control valve has a cylindrical handle. Pulling out on the handle raises the TW-60 and pushing in lowers it. The valve is spring loaded to the center position, when it is released, movement stops.

1-18. THEORY OF OPERATION

1-19. The TW-60 operates on a closed center hydraulic system, that is, the spools in the direction control valves do not allow the hydraulic fluid to return to the resevoir when in the neutral position (Figure 1-5). If a power supply other than a Varco closed center hydraulic power supply is used to drive the TW-60, a Varco Open-to-Closed-Center Converter may have to be installed.

1-20. The TW-60 torquing capability is used after spinin during makeup operations or before spinout during breakout operations (Figure 1-5). For makeup, with the gates open, the TW-60 is pushed against the drill stem at the tool joint level. The lower gate is latched on the tool joint box and the lower body clamp is actuated to provide a firm grip. The pin is stabbed, spun in, upper gate latched, and the upper body clamp is actuated. Power is applied to the torque cylinders to rotate the upper body to a maximum of 34 degrees or until the preset torque value is achieved. If the 34-degree travel limit is reached it will be necessary to take another bite and torque again. For breakout, the gates are latched around the tool joint and the lower jaw is clamped. The upper body is torqued to full travel and the upper jaw is clamped. The torque cylinders are actuated to return the upper body to center, thereby preparing the pipe stand for spinout.

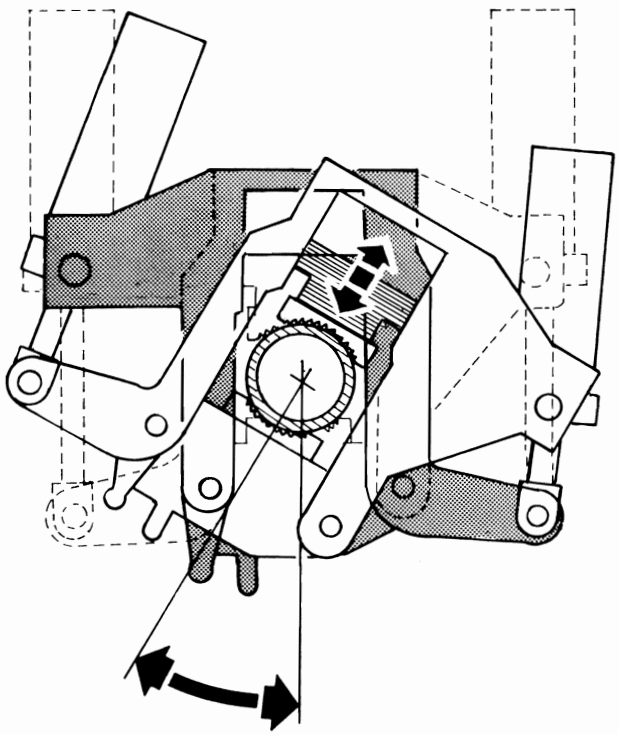


Figure 1-5. Functional Schematic

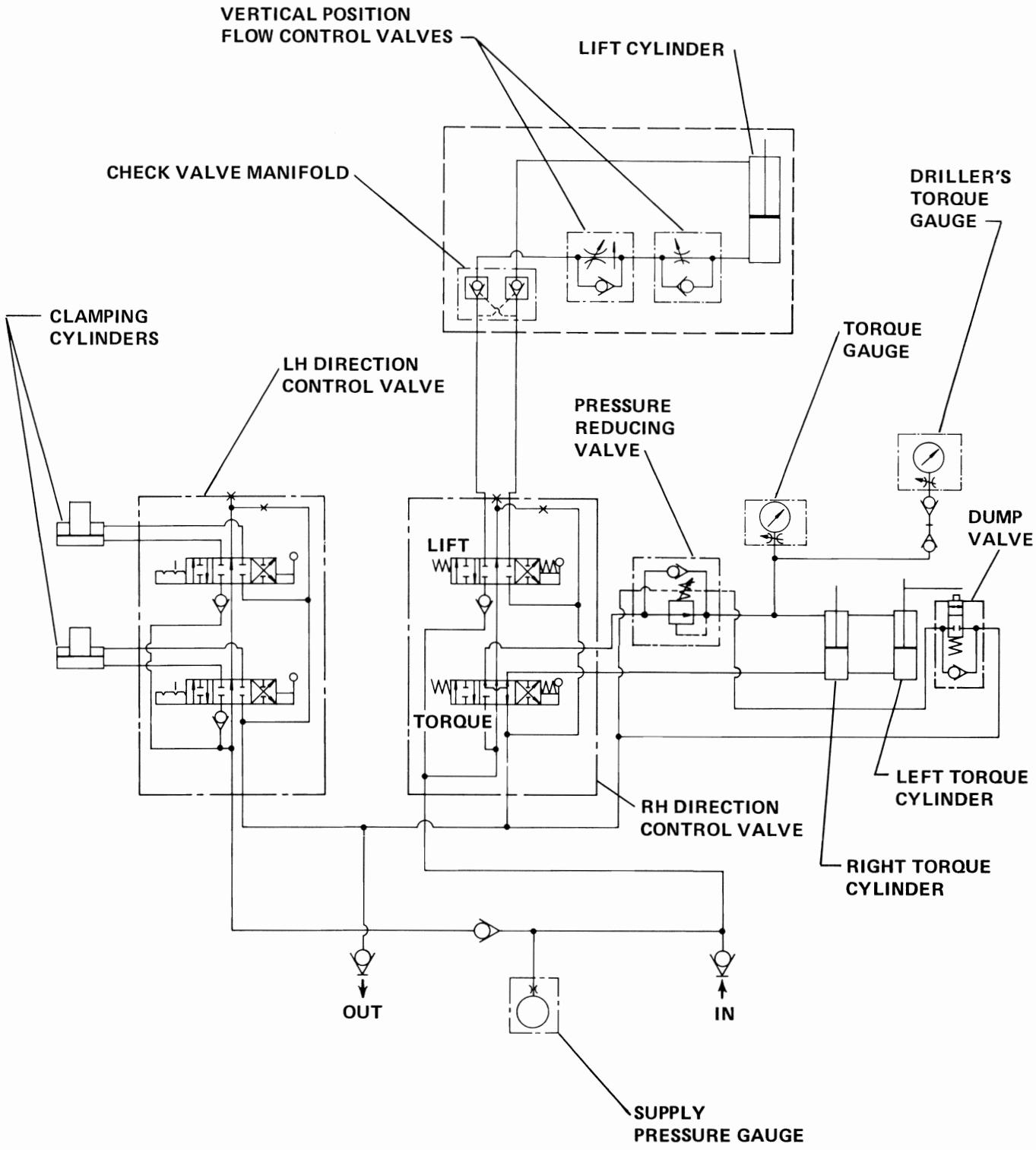
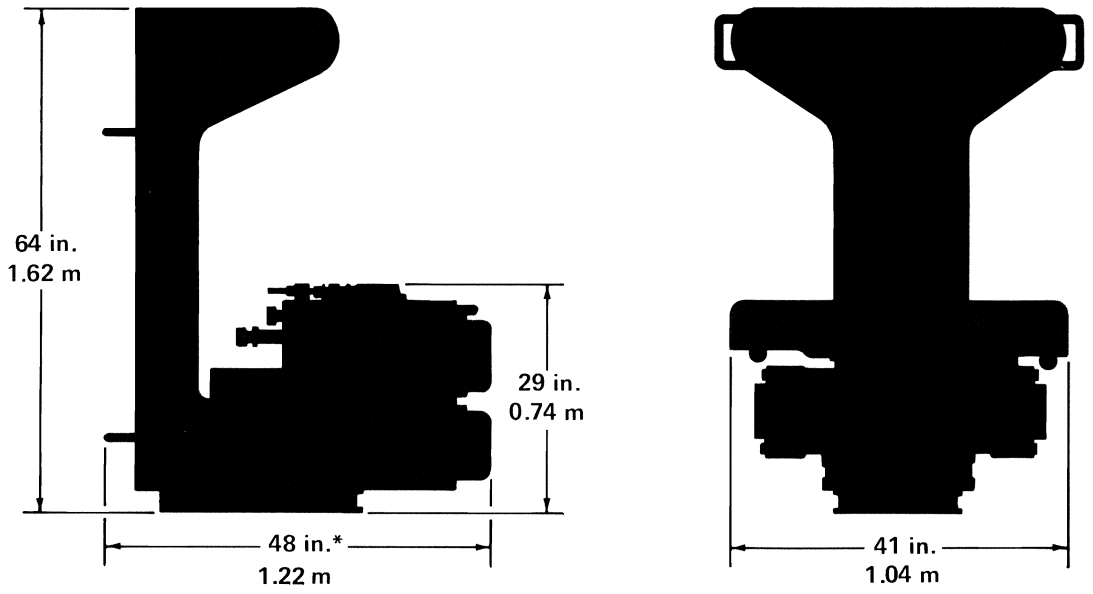


Figure 1-6. Hydraulic Schematic

1-21. SPECIFICATIONS

Table 1-1. Specifications

	English	Metric
Weight (Including hanger)	2,250 lb	1.219 kg
Size range (tool joint dia)	4- thru 8-in.	101- thru 203-mm
Makeup torque	63,000 ft-lb	83.428 N·m
Breakout torque	75,000 ft-lb	101.700 N·m
Normal operating pressure	2000 psi	13,79 MPa
Hydraulic power requirements (Closed center system)	38-45 GPM to 1500 psi and 5-15 GPM from 1500 to 2000 psi	8,6 to 10,2 m^3/h to 10,33 MPa and 1,1 to 3,3 m^3/h from 10,33 to 13,79 MPa
Vertical positioning system		
Stroke (vertical travel)	72 in.	1,83 m
Rate of travel	2-in./sec	50 mm/sec
Cycle time (@ 40 GPM)		
Clamping both jaws	2.5 sec max	
Clamping upper jaw	1.25 sec max	
Torquing 34 degrees	2.0 sec max	



*ADD 6.25 in. FOR OPEN GATE

Figure 1-7. Outline Drawing

SECTION II
INSTALLATION

2.1 INSTALLATION

2-2. **POWER SUPPLY REQUIREMENTS.** The TW-60 operates as a closed-center hydraulic system in that flow thru the directional control valves is blocked in the center position. Varco's hydraulic power supply is designed for closed-center system operation and can be used with the TW-60 without modification. If a hydraulic power supply operating as an open centered system is used to drive the TW-60, a Varco Hydraulic Open-to-Closed-Center Converter (P/N 15404) must be installed. The converter is an accumulator unloading system that prevents possible overheating and damage likely to result to an open-center power unit if it were used alone for a closed-center tool. Refer to Table 2-1. for specific power supply requirements.

Table 2-1. Power Supply Requirements

	English	Metric
Power requirements	38 to 45 GPM to 1500 psi and 5 to 15 GPM from 1500 to 2000 psi	8, 6-10, 2 m^3/h to 10,33 MPa and 1,1 to 3,3 m^3/h from 10,33 to 13,79 MPa
Filtration	25 micron	25 micron
Maximum oil temp	180 deg F	82 deg C
Fluid recommendations	Petroleum based industrial hydraulic fluid with additives which provide oxidation inhibition, anti-rust, anti-foam, deaerating and anti-wear properties are recommended. The fluid viscosity should be 150-225 SSU (SAE 10W) at 100 deg F (37,8 deg C) with a viscosity index of 90 minimum.	

2-3. **LOCATION.** Rig-up location of the TW-60 is dependent upon the type of rig and other equipment being used. Figure 2-1 shows two typical rig floor layouts and the most desirable locations for installation of the TW-60. As a general rule, the TW-60 should be placed on the opposite side of the rotary table from the set-back zone. This will facilitate handling the stands and allow a straight swing from pick up to stabbing.

2-4. **HANGING THE TW-60.** The TW-60 is suspended from a cable as high in the derrick as possible. The longer the cable the easier the TW-60 can be swung into position for operation. Use 5/8-inch cable long enough to reach from the attach point in the derrick to a point to suspend the hanger plate 13 feet-9-inches off the rig floor (Figure 2-2).

a. Attach cable to derrick girt at selected height.

CAUTION

Do not drag TW-60 across the rig floor, use a hoist to lift it into position to avoid damage to the equipment.

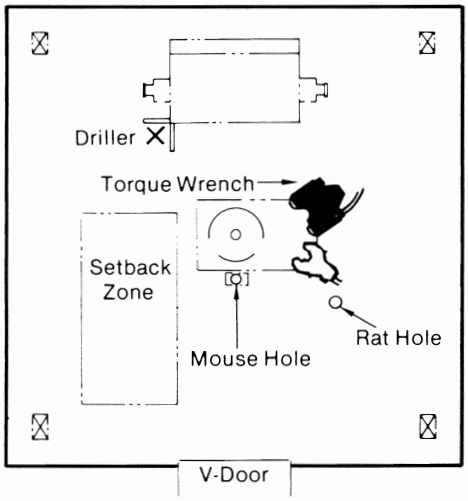
b. Lift TW-60 onto rig floor and place opposite the set-back zone across the rotary table. Distance to drill pipe should be 2- to 2-1/2 feet.

Note

Allow clearance for elevator to work with torque wrench. Adequate space is required for elevator latching and unlatching.

c. With the lift cylinder fully retracted, and the TW-60 resting on the floor, hang the hanger plate on the cable 13 feet 9 inches above the floor.

STANDARD DERRICK



JACKKNIFE DERRICK

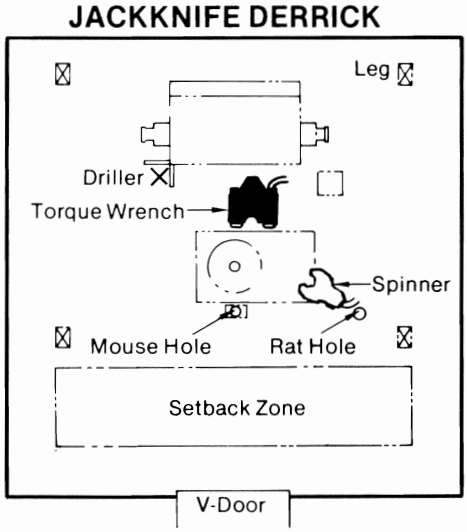


Figure 2-1. Typical Rig Layouts

2-5. CONNECTING POWER SUPPLY.

a. Unwind the 1-inch pressure hose and 1-1/4-inch return hose and hoist them onto the derrick floor.

b. Route the hydraulic hoses thru the derrick floor. Tie off the hoses with enough slack so as not to interfere with TW-60 operation.

c. Check hydraulic hoses and TW-60 quick-disconnects for mud or sand and clean as necessary before attempting connection.

CAUTION

The 1-inch and 1-1/4-inch self-sealing quick-disconnects must be fastened together until fully shouldered. If only partially closed, the internal self-sealing valves will be partially open or not open at all. This will cause a severe pressure drop to occur thru the quick-disconnects causing oil to overheat and the hydraulic power supply to overload.

d. Connect hoses to quick-disconnects mounted on back of TW-60.

e. Connect other ends of hoses to hydraulic power supply.

2-6. CHECKING OPERATION.

a. Check the reservoir of the hydraulic power supply for sufficient fluid, and then start up. Hydraulic oil must be clean.

b. Check entire system for leaks, tighten as required.

c. Cycle clamping cylinders, torque cylinders, and vertical position cylinder several times to verify their proper operation and force any trapped air from the system.

d. Recheck fluid level of hydraulic power supply and top up if necessary.

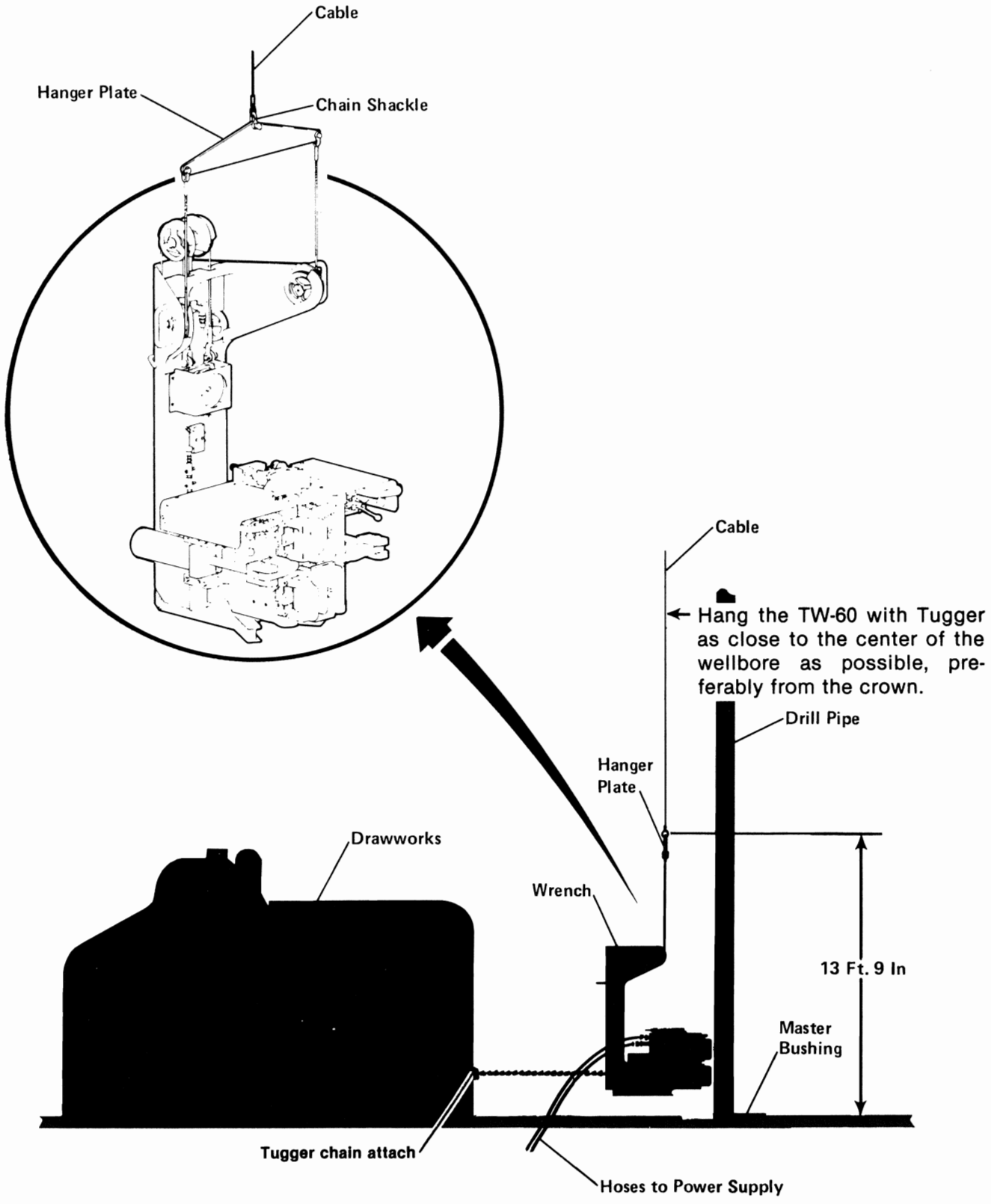


Figure 2-2. Hanging the TW-60 with Tugger

SECTION III
OPERATION

3-1. OPERATION.

3-2. After installation the TW-60 is ready for operation. Refer to Figure 3-1 for controls and indicators.

Index	Control/Indicator	Type	Function
1	CLAMP TOP	Valve lever	Detent valve, pull to clamp upper body, will stay clamped until pushed (unclamped).
2	CLAMP BTM	Valve lever	Same as above; clamps lower body.
3	Dump valve	Normally closed valve	Actuated when left torque cylinder reaches full stroke, causes torque gauge to read near zero.
4	LIFT	Valve lever (with cylindrical handle)	Controls height of TW-60. Pull to raise, push to lower. Movement stops when lever is released.
5	TORQUE	Valve lever	Controls application of torque. Pull for makeup torque; pull, then push for breakout torque. Torquing stops when lever is released.
6	Supply pressure gauge	Pressure gauge (psi and bar)	Indicates pressure from hydraulic power supply. Flow control is on power supply.
7	TORQUE ADJUSTMENT	Pressure reducing valve	Presets torque for makeup. Equipped with a locking knob, rotate outer knob to adjust torque.
8	Torque gauge	Bourdon tube pressure gauge	Indicates torque being applied. Red target pointer for verification. Zero adjust knob on back of case.
9	Flow control valves (2)	Inline flow control valve	Control raising and lowering speed. Upper valve controls raising and lower valve controls lowering.

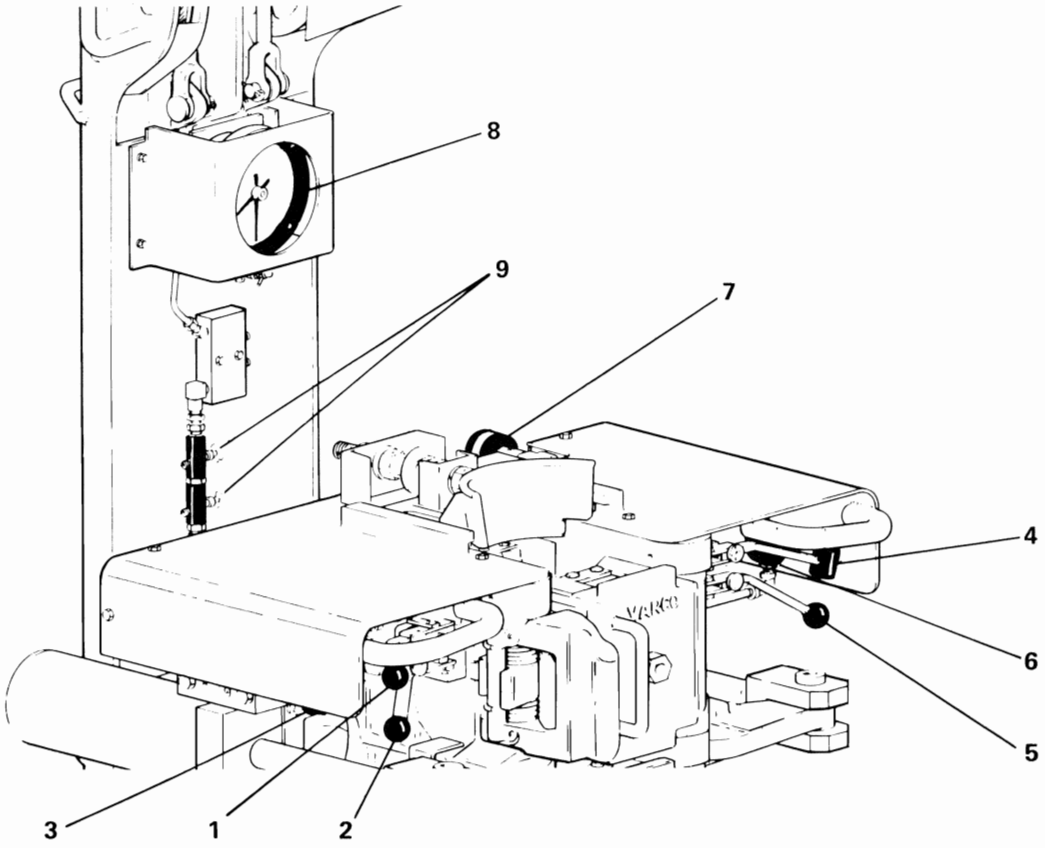


Figure 3-1. TW-60 Controls and Indicators

3-3. CHANGING JAW TOOL JOINT RANGE.

The TW-60's jaws must match the tool joint diameter. For TW-60's serial numbered up to, and including 143 use the add on spacers per Table 3-1 and Figure 3-2. For serial number 144 and on, use interchangeable jaws and spacers per Table 3-2. A retrofit kit can be ordered in early 1979 to change TW-60's serial numbered prior to 144 to the later configuration.

Table 3-1. Old Style Jaw Size

Tool Joint OD (inches)	No. of Spacers (P/N 15141)
4 to 5-3/4	2
5-1/2 to 7	1
6-3/4 to 8	0

3-4. CHANGING OLD STYLE JAW TOOL JOINT RANGE.

Note

Do not interchange upper and lower gate jaws. The lower jaw is 3/8-inch thicker than the upper jaw.

a. Determine number of spacers required (Table 3-1).

b. Loosen jaw retainer sleeve (Figure 3-2) on both gates and add or remove spacers as indicated.

CAUTION

Ensure retainer sleeve is tight to prevent damage to equipment.

c. Tighten retainer sleeve. Torque 150 to 160 ft-lb (203 to 217 N·m).

3-5. CHANGING NEW STYLE JAW TOOL JOINT RANGE.

Note

Do not interchange upper and lower gate jaws. The lower jaws are thicker than the upper jaws.

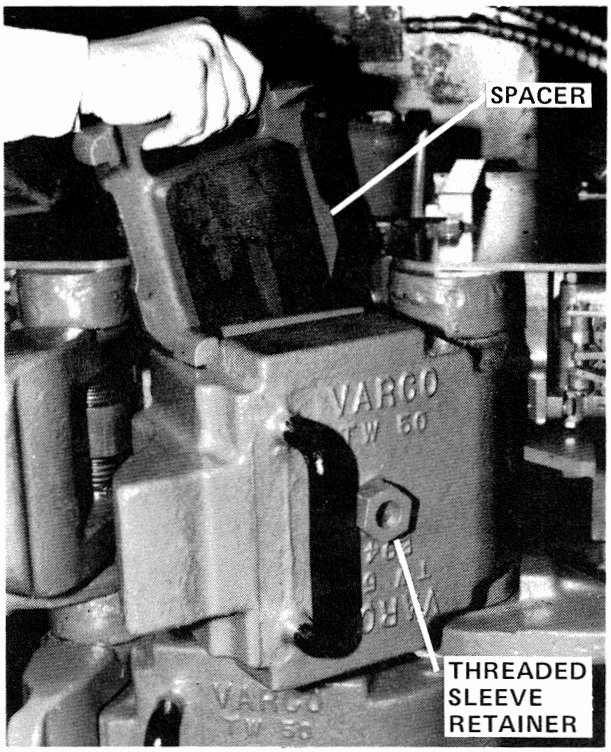


Figure 3-2. Changing Jaw Size

a. Determine jaw and spacer requirements (Table 3-2). If changing the spacer only, loosen jaw retainer sleeve (Figure 3-3) on both gates and make the change.

b. If jaw changeout is required, remove jaw retainer sleeves and jaws. Install jaws, and spacers, if required.

c. Tighten retainer sleeve. Torque 150 to 160 ft-lb (203 to 217 N·m).

Table 3-2. New Style Jaw Size

Range	Jaw		Spacer (P/N 18064)
	Upper	Lower	
6-3/4 to 8-in	15128	15129	No
5-3/4 to 7-1/4-in	15128	15129	Yes
4-3/4 to 6-1/4-in	18059	18058	No
4- to 5-1/4-in	18059	18058	Yes

3-6. TONG DIE CHANGING.

Tong dies and spacers shipped with TW-60 are as shown in Figure 3-3. Note that the dies are 5-7/8 inches long and the spacers are in the middle. For use with hard band pipe, the dies and spacers must be the same as Figure 3-4. Lower jaws, both piston and gate, use 5-inch dies with two spacers at the bottom of the

slots to prevent excess wear of the dies. The upper jaws have the 5-7/8-inch dies, but the spacers are located at the top of the slots to equalize the pressure on the pin when the clamp is operated. If the dies are stuck and are difficult to remove, use a Wooley Tong Die Driver (or equivalent) and a hammer to tap out dies and spacers. This will also serve to dress the slots.

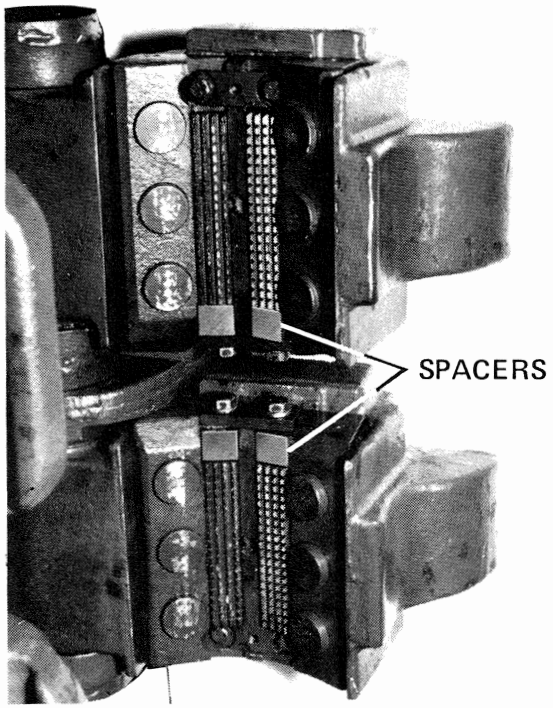


Figure 3-3. Standard Tong Die Arrangement

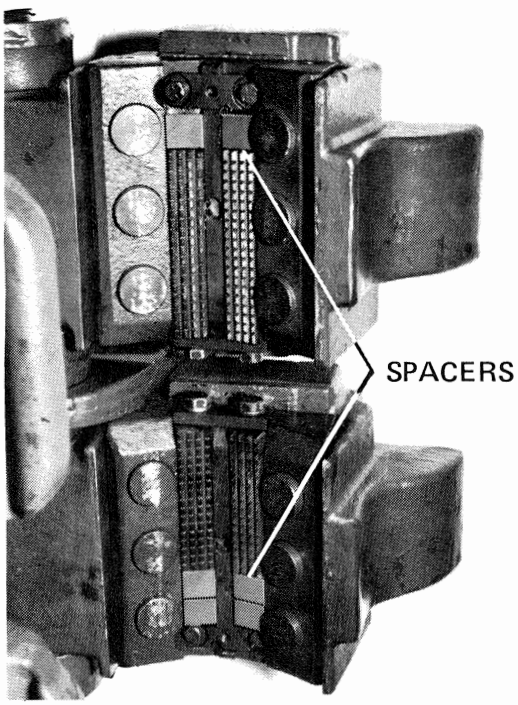


Figure 3-4. Hard Band Tong Die Arrangement

3-7. ADJUSTING STABBING GUIDE.

a. Swing TW-60 onto tool joint box and close lower gate.

b. Adjust height of TW-60 so that center of connection is centered between upper and lower clamping jaws.

c. Clamp lower jaw on box.

d. Loosen two rear nuts (1, Figure 3-5) and align inside edge of stabbing guide (2) with outer circumference of the box. Tighten nuts.

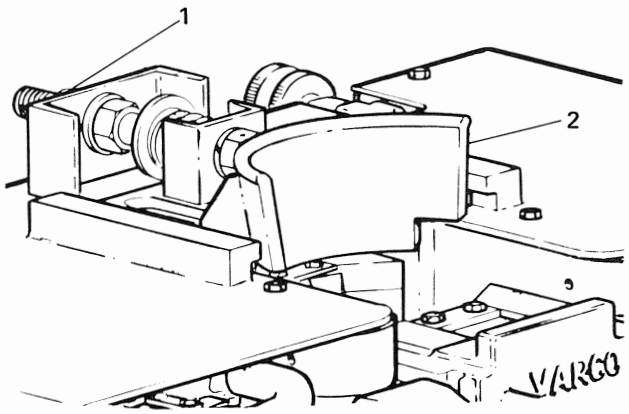


Figure 3-5. Adjusting Stabbing Guide

3-8. ADJUSTING TORQUE.

a. Swing TW-60 onto tool joint box and close lower gate.

b. Adjust height of TW-60 so that center of the connection is centered between upper and lower clamping jaws.

c. Clamp lower jaw on box. Spin pin into box, close gate and clamp upper jaw.

d. Loosen inner knob (1, Figure 3-6) on TORQUE ADJUSTMENT valve and unscrew outer knob (2) until it turns without resistance.

e. Pull TORQUE knob (3) full out and hold. Watch torque gauge (4) and screw outer knob until gauge indicates required torque. Lock inner knob to prevent setting from drifting.

f. Rotate center knob on torque gauge until red target pointer indicates the same torque as adjusted in step e. Release TORQUE knob.

Note

If TW-60 is rotated to its fullest extent during this procedure (indicated by the torque gauge indicating near zero) it will be necessary to release the upper clamp and push the TORQUE knob full in until the upper body is centered. Clamp upper jaw and repeat steps e and f.

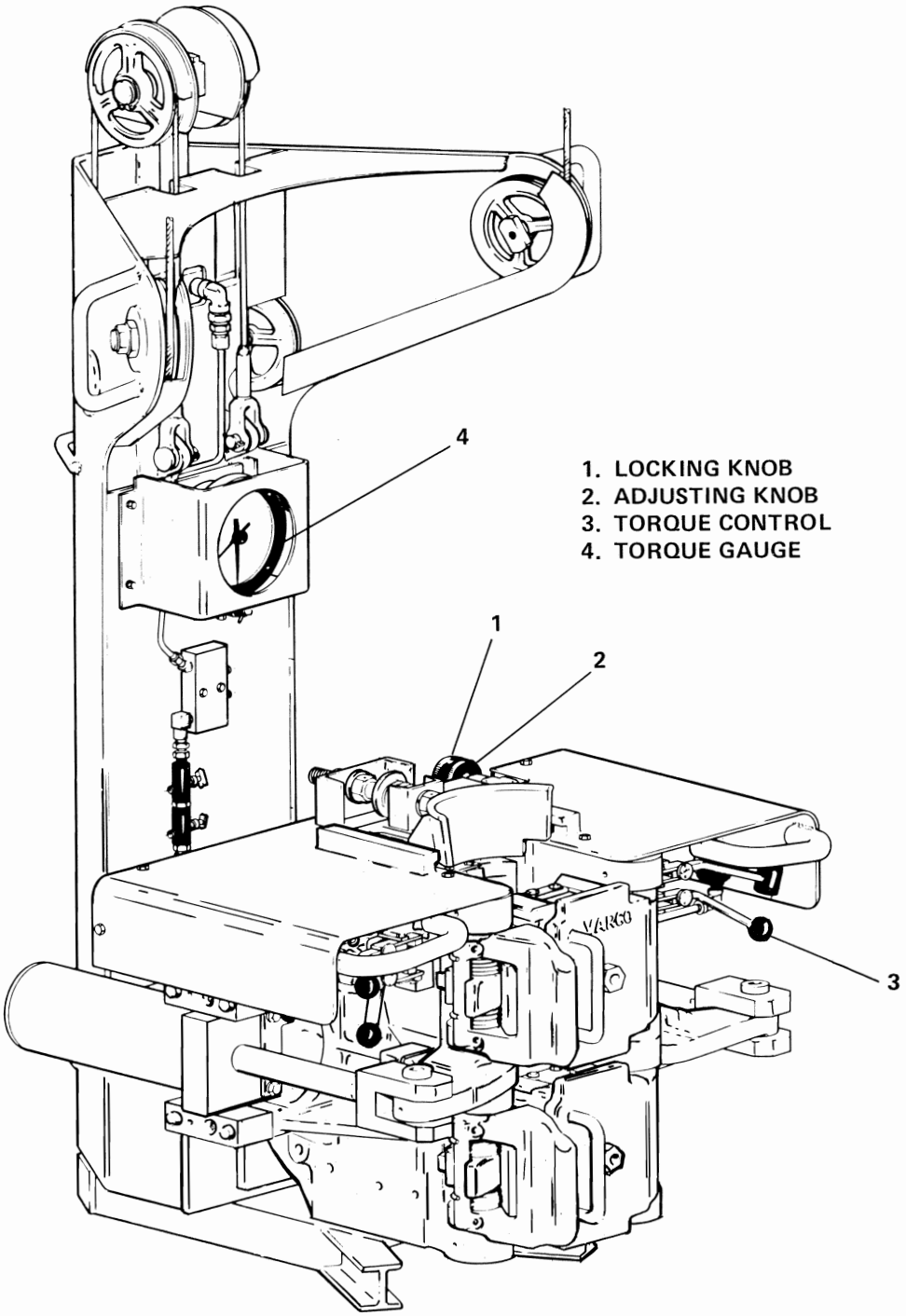
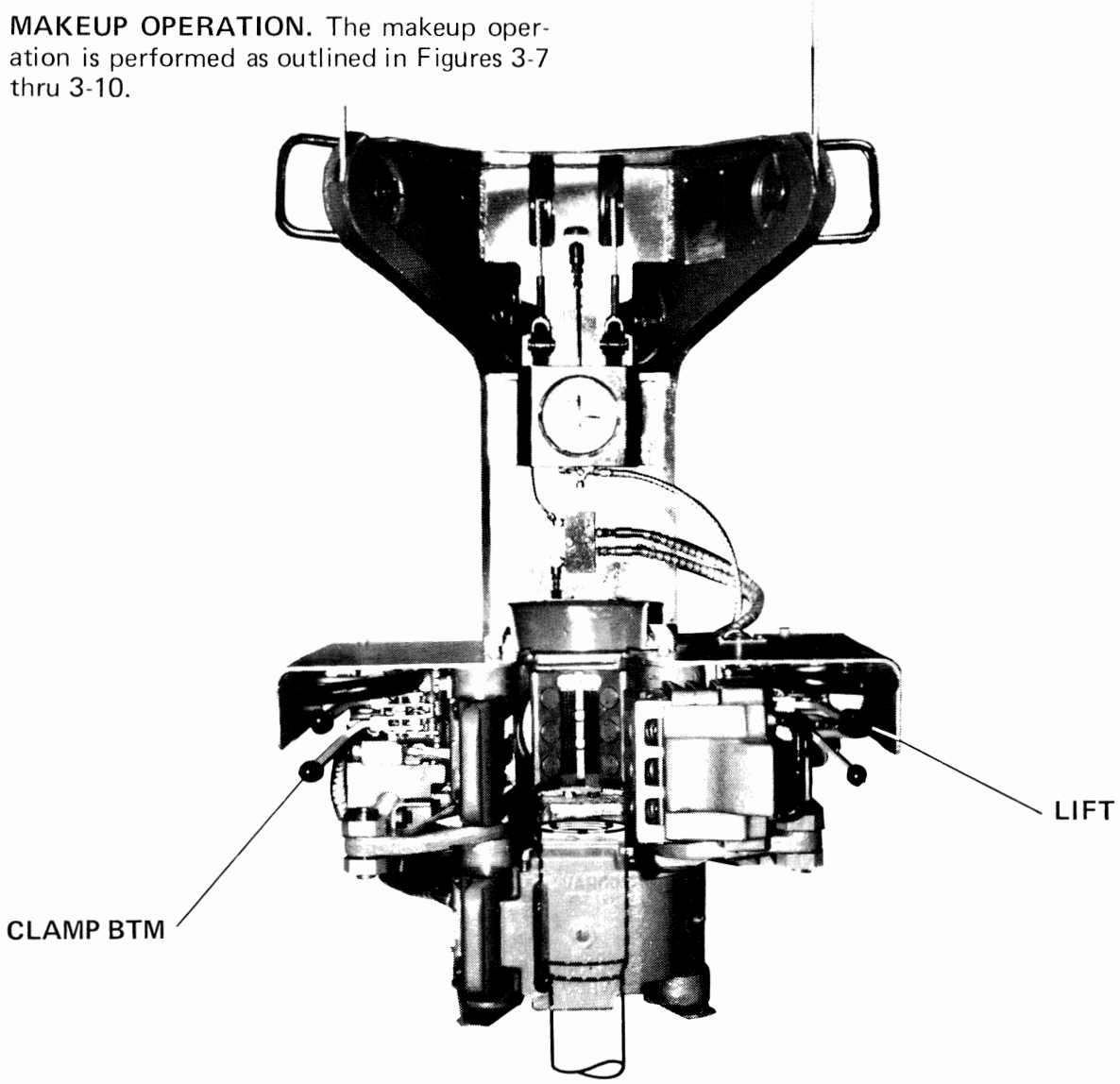


Figure 3-6. Adjusting Torque

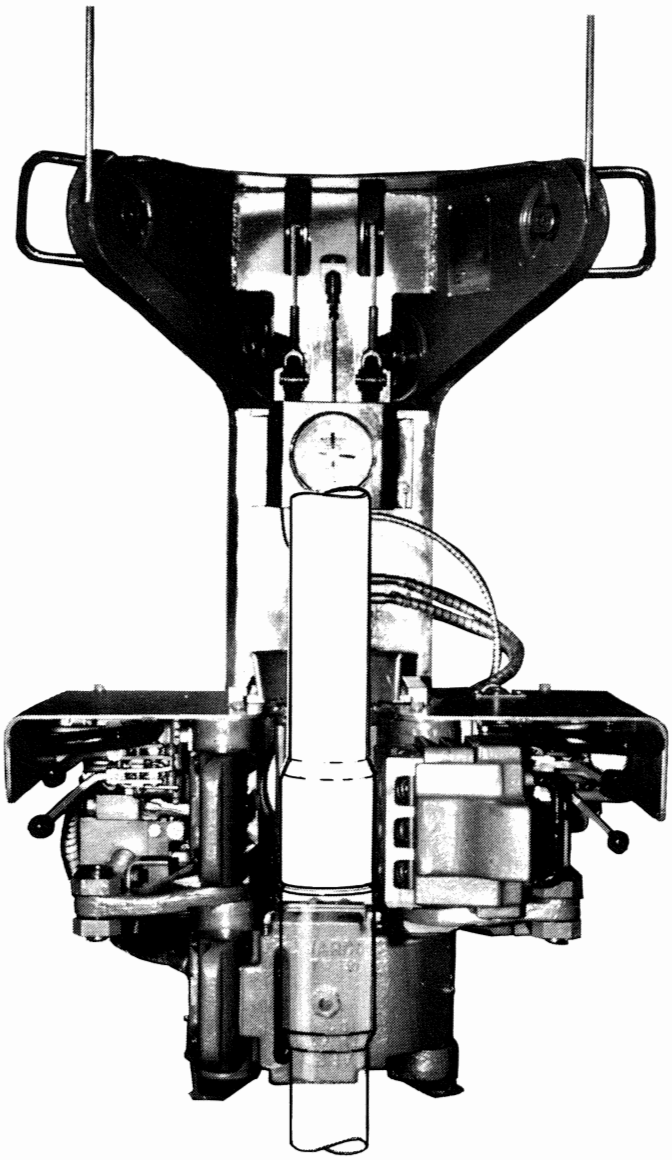
3-9. **MAKEUP OPERATION.** The makeup operation is performed as outlined in Figures 3-7 thru 3-10.



1. Align two body halves, swing TW-60 onto tool joint and close lower gate.

2. Position TW-60 vertically so that top of box centers between upper and lower clamping jaws.

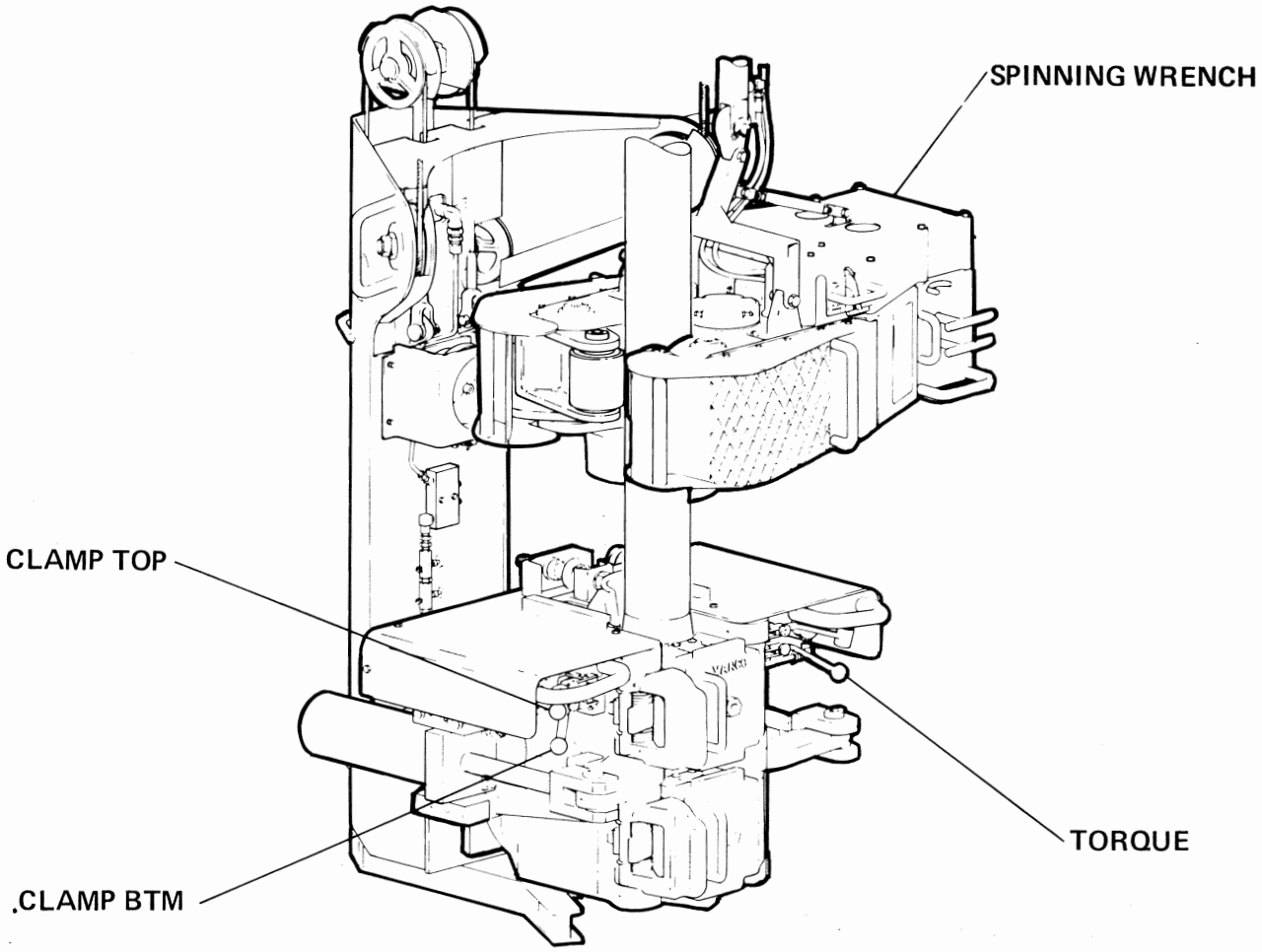
Figure 3-7. Setting Box End in Lower Jaw



1. With upper gate open, stab the pin of the add-on stand into box.

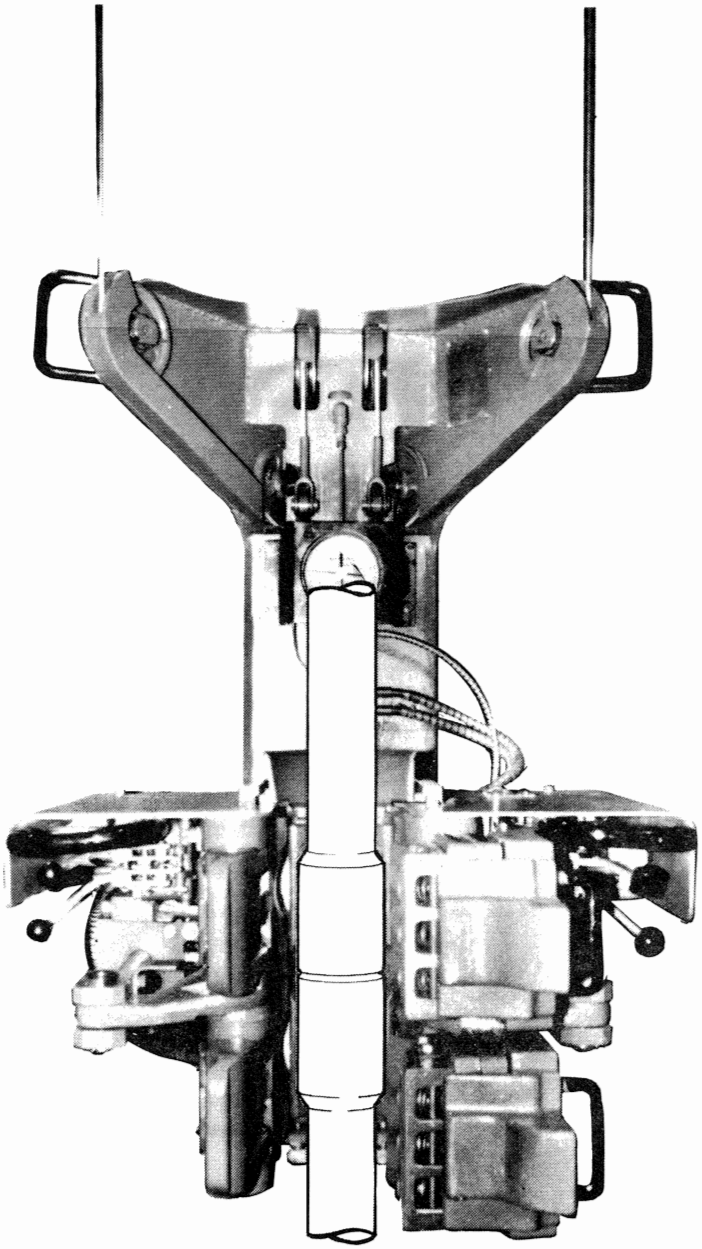
2. Close upper gate.

Figure 3-8. Stabbing Pin



1. After add-on stand is spun in, pull CLAMP TOP and CLAMP BTM handles.
2. Pull TORQUE handle out and hold until preset torque is reached, verify by reading on torque gauge.
3. Push CLAMP TOP lever to release pin.
4. Push TORQUE handle in and hold until upper body is in center position.
5. Push CLAMP BTM lever to release box.

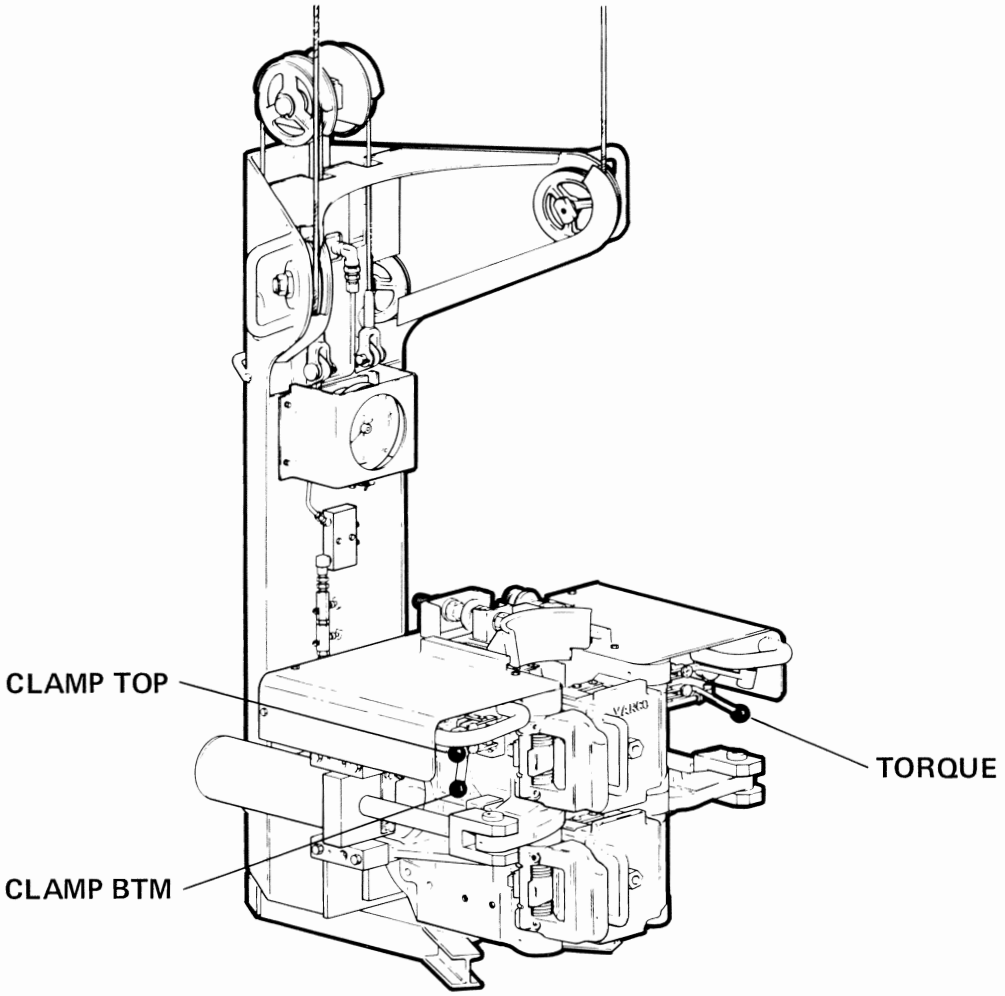
Figure 3-9. Spin-Up and Torque



1. Open both gates and swing TW-60 out of the way.

3-10. Completed Connection

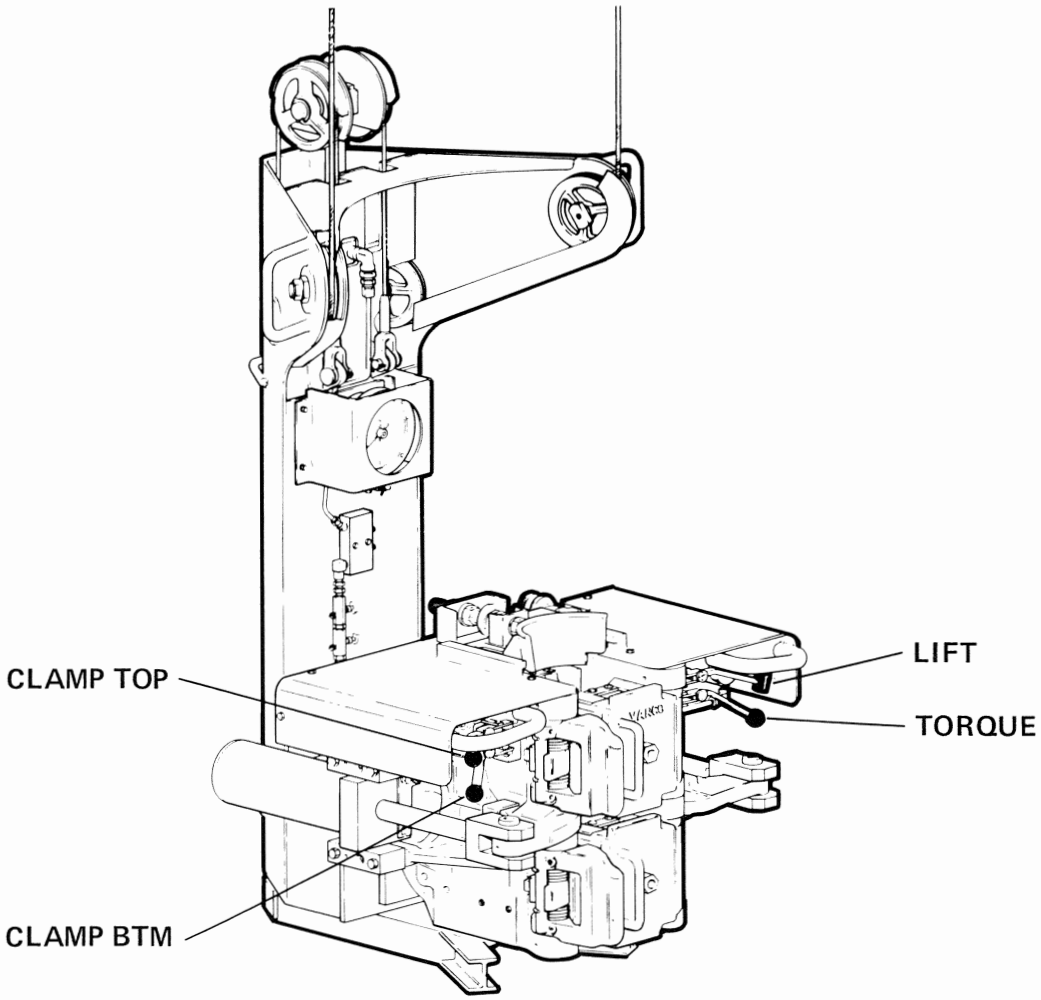
3-10. **RESETTING TORQUE CYLINDER FOR ADDITIONAL STROKE.** If the torque gauge reading suddenly drops to near zero before the desired torque indication has been reached, the cylinders have reached the end of their stroke. Take another bite per Figure 3-11.



1. Push CLAMP TOP lever to release upper clamp grip on pin.
2. Push TORQUE lever in and hold until upper body is in center position.
3. Pull CLAMP TOP lever to clamp on pin.
4. Pull TORQUE lever out and hold until preset torque is reached, verify by reading on the torque gauge.
5. Push CLAMP TOP lever to release upper clamp grip on pin.
6. Push TORQUE lever in and hold until upper body is in center position.
7. Push CLAMP BTM lever in to release box.

Figure 3-11. Resetting Torque Cylinders

3-11. **BREAKOUT OPERATION.** Refer to Figure 3-12.



1. Swing TW-60 onto tool joint and close both gates.
2. Adjust height as necessary to center joint between upper and lower bodies.
3. Pull CLAMP BTM lever to grip box.
4. Pull TORQUE lever and hold until upper body stops rotating.
5. Pull CLAMP TOP lever to grip pin.
6. Push TORQUE lever and hold until upper body stops rotating.
7. Push CLAMP TOP lever to release pin.

Note

Additional untorquing may be required before spinning out. Repeat steps 4 thru 7 as necessary to enable spinout.

8. Spinout pin and rack the stand.
9. Push CLAMP BTM lever to release box.

Figure 3-12. Breakout Operation

SECTION IV
MAINTENANCE

4-1. PREVENTIVE MAINTENANCE

4-2. **LUBRICATION.** Thorough lubrication is important to the well-being of the TW-60. To ensure trouble-free operation, the TW-60 should be lubricated per Figure 4-1. The grease used for lubrication should be a high quality multipurpose water resistant grease, NLGI grade 2.

Index No.	Item	No. of Lube Points	Application	Lube Cycle
1	Torque cylinders (2 on trunnion mounting, 1 on rod end pin)	6	Multipurpose water resistant grease	Every trip.
2	Gates (2 on latch, 1 on gate hinge)	6	Multipurpose water resistant grease	Every trip.
3	Vertical positioning (1 on each pulley shaft)	6	Multipurpose water resistant grease	Every trip.
4	Body to body contact surfaces (apply with upper body fully rotated)	A/R	Multipurpose water resistant grease	Every trip.
5	Pressure reducing valve (PRV)	1	SAE 10 oil	Every trip.
6	Valve handle links and spools	A/R	SAE 10 oil	Every trip.

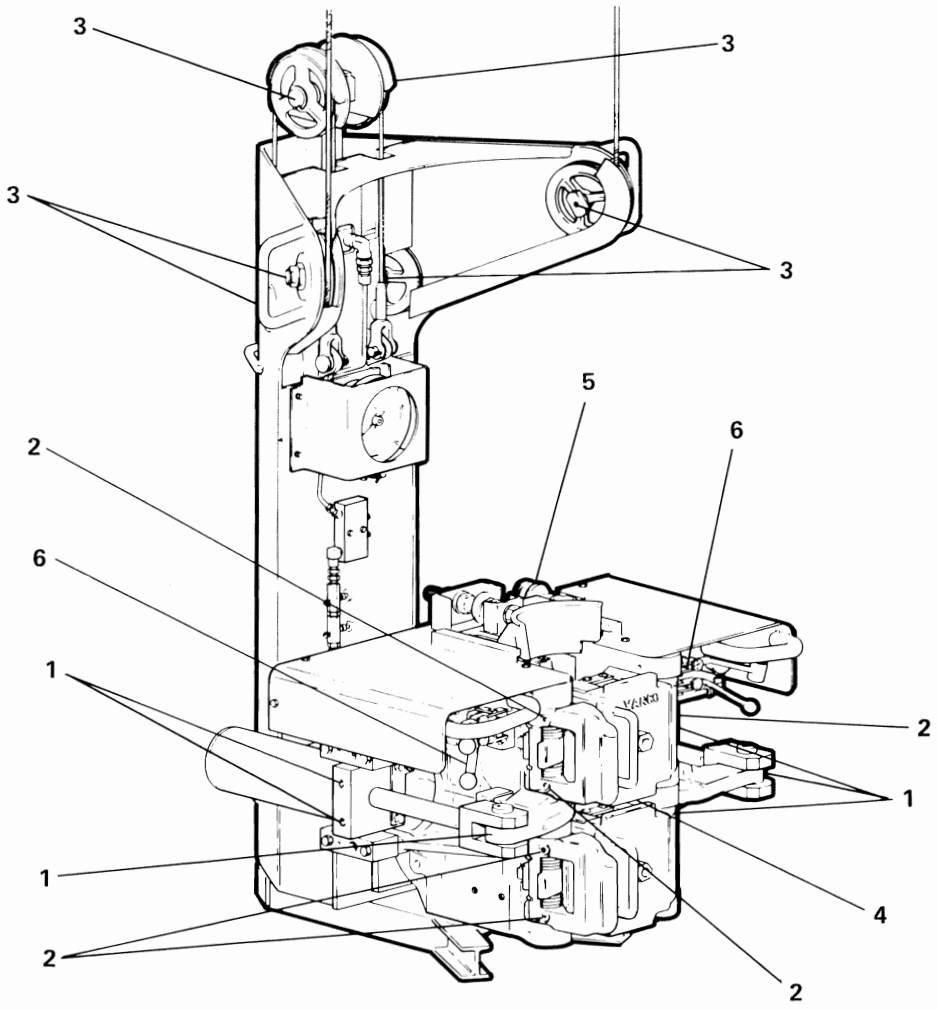


Figure 4-1. Lubrication Points

4-3. TROUBLESHOOTING

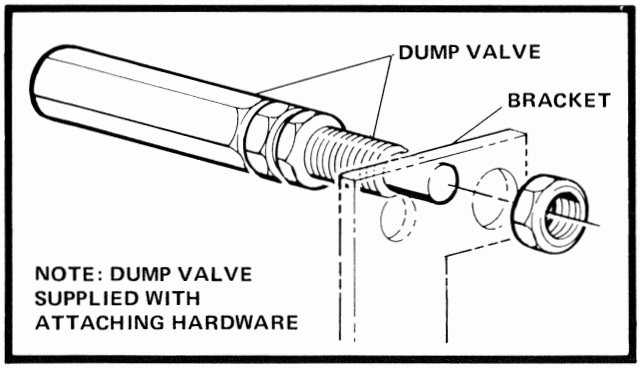
Table 4-1. Troubleshooting

Symptom	Probable Cause	Remedy
Vertical Positioning Assembly		
TW-60 moves in one direction only	Flow control valve closed	Open valve if closed.
	Actuator manifold assembly dirty	Clean and/or replace.
TW-60 does not move in either direction	Power supply not operating	Check power supply pressure gauge for indication. Check power supply per applicable manual. Operate TORQUE lever; if no response, problem is in TORQUE valve. Could also be dirty or contaminated line. Check and clean valve.
	Both flow control valves are closed	Check and open both valves.
	Individual component failure	Trace hydraulic circuit and check all components for adequate fluid flow and operation.
TW-60 does not maintain vertical position	Sticky LIFT valve	Return valve to center manually. If problem persists, replace valve (Para 4-6).
	Actuator manifold leaky	Clean or replace.
	LIFT valve excessively leaky	Replace O-rings (Para 4-7).
Torque Wrench Bodies		
Torque cylinders will not make up	Pressure reducing valve (PRV) setting incorrect	Check PRV setting is not too low.
	Dump valve stuck open (pressure will not build up)	Manually actuate valve, replace if faulty.
	PRV stuck closed, dirty or defective	Check PRV screwed in, clean or replace valve.
Torque cylinders will not break out	PRV stuck closed, dirty or defective	Check PRV screwed in; clean or replace valve.
Torque cylinders drift in make up direction	Sticky TORQUE valve	Return valve to center position manually. If problem persists, replace (Para 4-6).
Torque cylinders drift in break out direction	Sticky TORQUE valve	Return valve to center position manually. If problem persists, replace (Para 4-6).
	Excessive back pressure on return line	Check hydraulic power supply for defect or malfunction.

Table 4-1. Troubleshooting (Continued)

Symptom	Probable Cause	Remedy
Torque gauge does not indicate pressure during make up	Dirty inlet port to gauge.	Clean inlet port or replace gauge.
	Torque cylinders reached end of stroke and actuated dump valve	Reset for additional stroke (Para 3-7).
	Dirty orifice	Clean.
	Gauge damper closed	Open damper (rotate counter-clockwise).
Torque gauge does not return to zero	Gauge not adjusted to zero	Rotate zero adjust knob on back of gauge case. Recheck torque setting.
	Gauge defective	Replace (Figure 6-7).
Torque gauge fluctuates	Gauge damper out of adjustment	Adjust (push in to engage threads and rotate clockwise to smooth fluctuations).
CLAMP valve does not shift, or overtravels and will not return	Defective detent in control valve	Replace valve (Para 4-8).
Joint is not centered in wrench when clamped	Centering button spring broken or has taken a permanent set	Repair or replace (Para 4-16).
Hydraulic fluid leakage around either end of clamp cylinders	Worn or defective seals	Replace seals (Para 4-15).
Jaws will not grip joint	Worn or broken dies	Replace dies (Para 4-16).
	Incorrect spacer arrangement	Check die and spacer arrangement.

4-4. **DUMP VALVE REPAIR/REPLACEMENT.** If the dump valve is stuck open and cannot be jarred loose by tapping it, replace the valve (Figure 4-2).



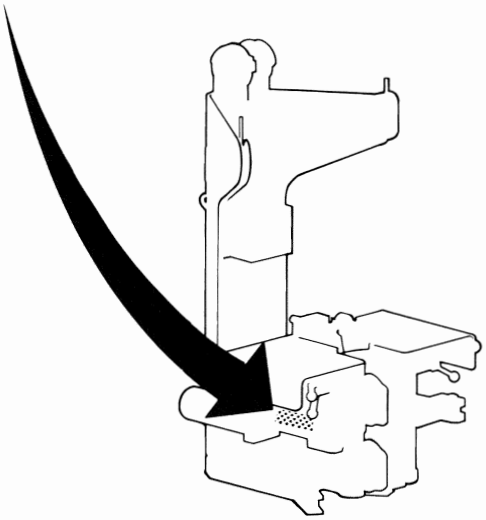


Figure 4-2. Dump Valve

4-5. **Dump Valve Adjustment.** Dump valve adjustment consists of loosening and tightening the jam nuts on either side of the dump valve bracket to move the valve in or out.

a. Close and latch both gates.

b. Pull and hold TORQUE handle until upper body rotates to its fullest travel.

c. Check dump valve has not interfered with upper body travel, and that the torque gauge has dropped to near zero.

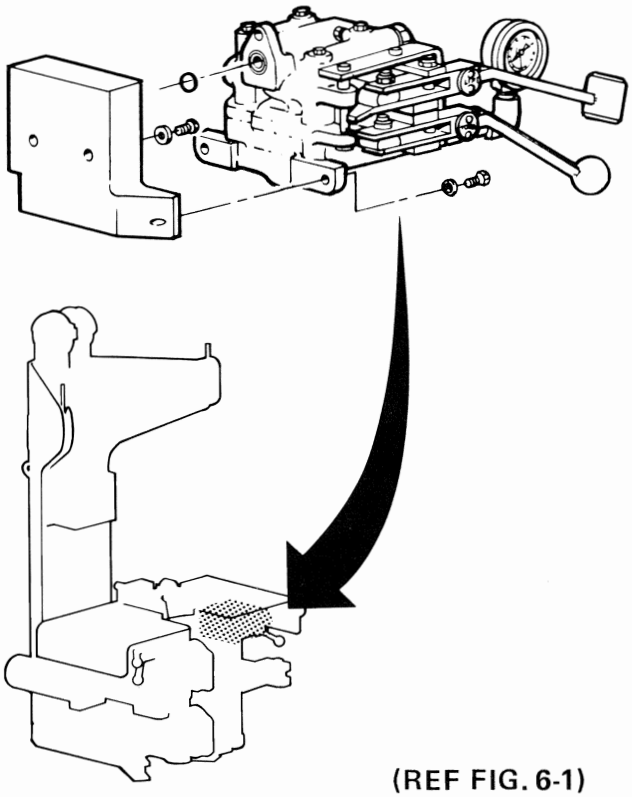
d. Loosen and tighten the jam nuts on the dump valve to change its position in relation to the dump valve stop.

Note

The dump valve should be positioned so that it is actuated and relieves the torque gauge pressure when the upper body reaches the full extent of its travel.

e. Upon completion of adjustment, tighten jam nuts to 45 to 50 ft-lb (61 to 68 N·m) and check that the valve is actuated by the upper body at full travel.

4-6. **RH DIRECTIONAL CONTROL VALVE REPAIR/REPLACEMENT.** The RH directional control valve (Figure 4-3) is the LIFT and TORQUE valve. If a valve becomes excessively leaky, replace the O-rings (Paragraph 4-7). If a valve becomes excessively sticky (will not return to center position when released) it must be replaced (Table 5-5).

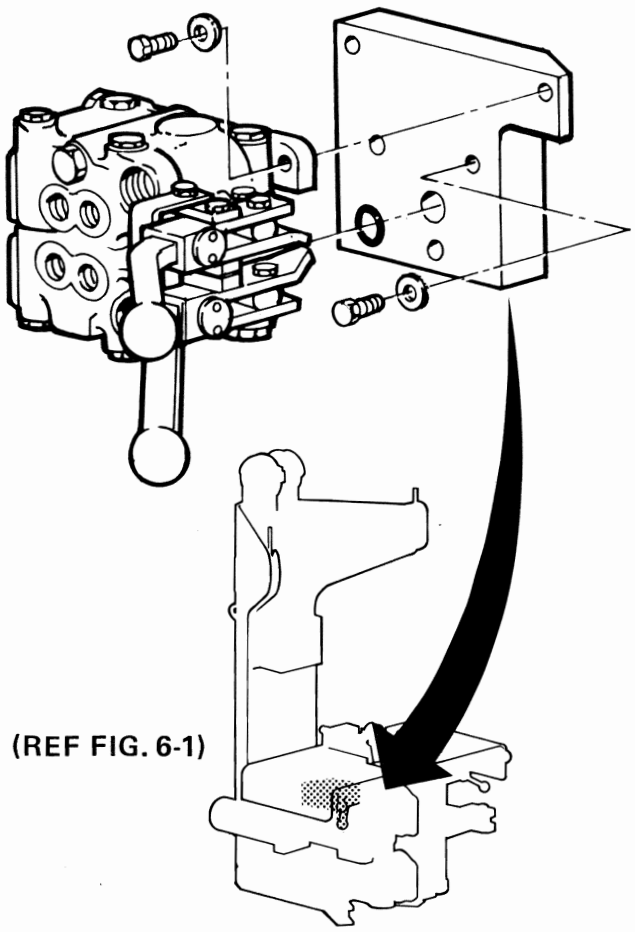


(REF FIG. 6-1)

Figure 4-3. RH Direction Control Valve

4-7. **RH Directional Control Valve O-Ring Replacement.** Seal kit P/N 13494-17 contains all of the O-rings and seals required to service the LIFT and TORQUE control valve. Remove the valve per Table 5-5 and install new O-rings and seals per Figure 6-5.

4-8. **LH DIRECTIONAL CONTROL VALVE REPAIR/REPLACEMENT.** The LH directional control valve (Figure 4-4)is the upper and lower (TOP and BTM) clamp valve. If a valve becomes excessively leaky, replace the O-rings (Paragraph 4-9). If a valve will not remain in either the in or out position, the detents are worn, or loose, and must be tightened or replaced (Table 5-5).



(REF FIG. 6-1)

Figure 4-4. LH Direction Control Valve

4-9. **LH Directional Control Valve O-Ring Replacement.** Seal kit P/N 13494-17 contains all of the O-rings and seals required to service the TOP and BTM clamp control valve. Remove the valve per Table 5-5 and install new O-rings and seals per Figure 6-4.

4-10. **LIFT CYLINDER REPAIR/REPLACEMENT** The lift cylinder (Figure 4-5) is part of the vertical positioning system. If the cylinder leaks, the most probable cause is faulty O-rings and packings. Another possible cause could be a scored rod, requiring replacement of the lift cylinder. Replace O-rings (Paragraph 4-11) or, if scratches or scoring are discovered by inspection, replace the cylinder per Table 5-3.

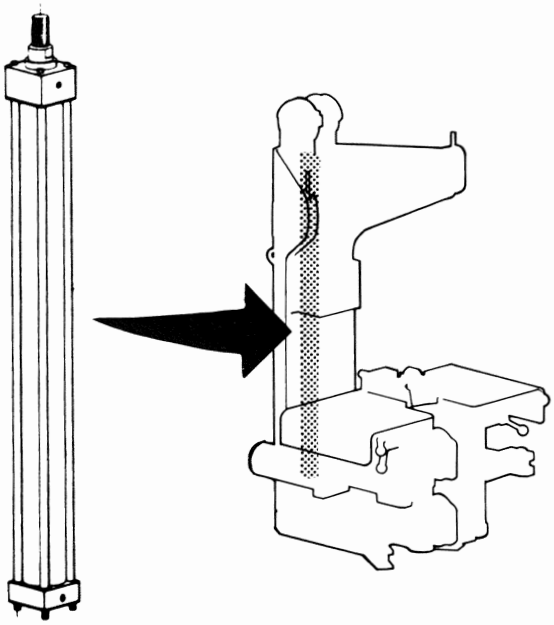


Figure 4-5. Lift Cylinder

4-11. **Lift Cylinder O-Ring Replacement.** Seal kit P/N 13192-1 contains all of the O-rings and packings required to service the lift cylinder. Remove the cylinder per Table 5-3 and install new O-rings and packings per Figure 6-7.

4-12. **TORQUE CYLINDER REPAIR/REPLACEMENT.** If the torque cylinders leak (Figure 4-6), the most probable cause is faulty O-rings and seals. Another possible cause could be a scored rod, requiring replacement of the damaged torque cylinder. Replace O-rings (Paragraph 4-13) or, if scratches or scoring are discovered by inspection, replace the damaged cylinder per Table 5-1. To open the torque cylinder, insert two 3/4-10 UNC bolts in cylinder cap. Place a bar between the bolts and rotate to break the joint.

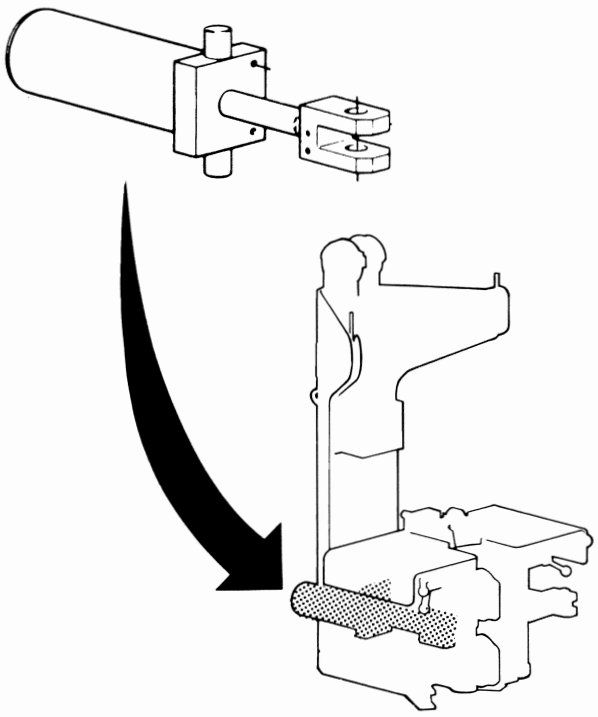


Figure 4-6. Torque Cylinders

4-13. **Torque Cylinder O-Ring Replacement.** Seal kit P/N 16049-1 contains all of the O-rings and seals required to service the torque cylinders. Remove the cylinders per Table 5-1 and install new O-rings and seals per Figure 6-6.

4-14. **CLAMP CYLINDER REPAIR/REPLACEMENT.** The clamp cylinders are housed in the upper and lower bodies which are bored to form the cylinder barrels. If the clamp cylinders leak, the most probable cause is faulty O-rings. Replace O-rings per Paragraph 4-15.

4-15. **Clamp Cylinder O-Ring Replacement.** Remove clamp cylinder piston and head per Table 5-4 and install new O-rings per Figure 6-8.

4-16. **JAW REPAIR/REPLACEMENT.** If the jaws (Figure 4-7) do not grip properly to rotate the pipe, the gripping dies are worn or broken and must be replaced. Centering the pipe in the TW-60 jaws is important to the correct operation of the TW-60, the centering buttons are used to achieve this condition. If any of the centering button springs are broken, or have taken a set, they must be replaced. These springs are preloaded to approximately 600 pounds (282 kilograms) each at time of assembly. It is recommended that the jaws be returned to a Varco Service Center for replacement. Disassemble jaws per Table 5-2 and Figure 6-3.

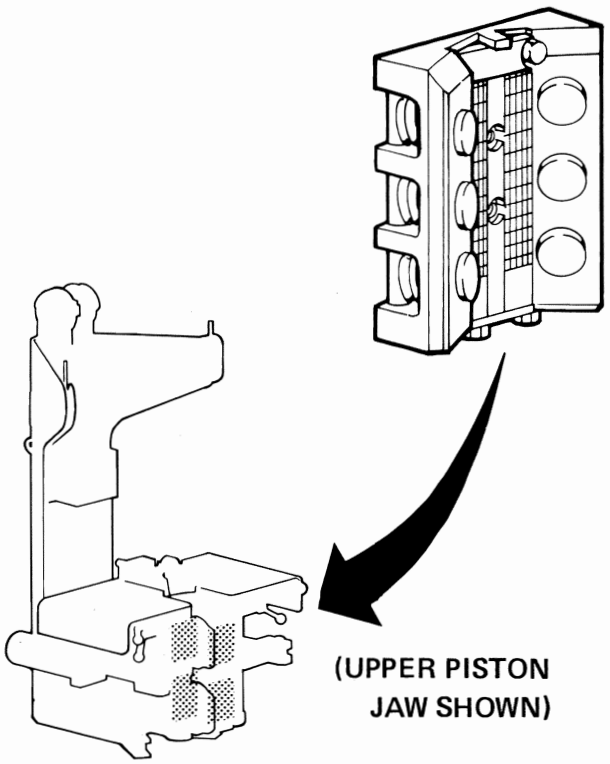


Figure 4-7. Jaw Dies

SECTION V

DISASSEMBLY AND ASSEMBLY

5-1. DISASSEMBLY

5-2. Disassembly is presented in Tables 5-1 thru 5-5 with the components of the TW-60 listed in disassembly sequence. The tables start with a complete assembly and end with a bare body. It is not necessary to start at the beginning and work thru the tables for every task; locate the part to be worked on and start at that point. Notes are provided, where applicable, to reference or explain a detail for the particular step of disassembly or assembly.

When used in the reverse order the tables provide assembly information as well as disassembly information.

5-3. ASSEMBLY

5-4. Assembly of the TW-60 can be performed by following the reverse order of Tables 5-1 thru 5-5. Notes peculiar to a particular step are provided to highlight critical assembly information, such as adjustment or torque values.

Table 5-1. Top Guard, Stabbing and Torque Cylinders

Step	Index Fig. No.	Part No.	1. 2. 3. Description	Qty per Unit	Notes	
					Disassembly	Assembly
		16450	WRENCH ASSY TW-60 Torque	Ref		
a.	Fig. 6-2	16371	. GUIDE ASSY Stabbing	1	Do not remove pinned nuts if not required.	Ref Fig. 5-1 for dim. X before pinning 2 nuts.
b.	10,	14460	. . GUIDE, Stabbing	1		
c.	11,	16370	. . GUARD, Top	1		
d.	24, Fig. 6-1	15978	. PIN, Clevis	2		Install new cotter pin (23, Fig. 6-1).
e.	21,	12644	. VALVE, Dump	1		Adjust per Para 4-5.
f.	22,	16064	. BRACKET, Dump valve	1		
g.	20,	16065	. STOP, Dump valve	1		
h.	Fig. 6-10	–	. HOSES AND FITTINGS, Hydraulic	–	Tag identify hoses for future use.	
i.	25, Fig. 6-1	15969	. BLOCK, Pillow	4		
j.	27,	17510	. CYLINDER ASSY, Torque	1		
k.	1, Fig. 6-6	50706-4-A	. . SETSCREW, Soc hd	2		Torque 1200-1300 ft-lb.
l.	2,	16330	. . SLUG, Locking	2		
m.	3,	15974	. . CLEVIS, Cylinder	2		
n.	–	16049	. . CYLINDER, Torque hydraulic	1		
o.	4,	16049-6	. . . CAP	1	Para 4-12.	
p.	5,	51300-157-B	. . . O-RING	1	Discard.	Install new.
q.	6,	51300-244-B	. . . O-RING	1	Discard.	Install new.
r.	7,	51301-244	. . . RING, Backup	1	Discard.	Install new.
s.	8,	51603-15	. . . PIN, Roll	1	Discard.	Install new.
t.	9,	55220-C-H	. . . NUT, Hex	1		
u.	10,	16907	. . . SEAL, Piston	2	Discard.	Install new.
v.	11,	51300-026-B	. . . O-RING	1	Discard.	Install new.
w.	12,	16049-5	. . . PISTON	1	Inspect for scoring or wear.	Install new if damaged.
x.	13,	10649-4	. . . ROD	1	Check for scoring or other damage.	
y.	14,	16049-3	. . . BUSHING	1		
z.	15,	16908	. . . SEAL, Trunnion	1	Discard.	Install new.
aa.	16,	16909	. . . WIPER, Rod	1	Discard.	Install new.
ab.	17,	16049-2	. . . BARREL, Hydraulic cylinder	1	Inspect for scoring or other damage.	

Table 5-2. Jaws, Dies, Gates, and Latches

Step	Index Fig. No.	Part No.	1. 2. 3. Description	Qty per Unit	Notes	
					Disassembly	Assembly
		16450	WRENCH ASSY, TW-60 Torque	Ref		
a.	3, Fig. 6-1	15128	. JAW ASSY, Upper gate	1		
b.	4,	15129	. JAW ASSY, Lower gate	1		
c.	6,	16662	. JAW ASSY, Piston	2		
d.	6, Fig. 6-3	16776	. . RETAINER, Die	1	Fig. 5-2.	Fig. 5-2.
e.	7,	16777	. . SPACER, Die	2		
f.	8,	12845	. . DIE, Tong	2		Apply multipurpose waterless grease.
g.	11,	16652	. . RETAINER, Die	1		
			WARNING *The centering button springs are preloaded to approximately 600 pounds (282 kilograms). Extreme care should be used during disassembly to avoid injury to personnel or damage to equipment. It is recommended that the jaws be returned to Varco International for replacement of centering buttons and springs (steps h, i, and j).*			
h.	12,	14622	. . PIN, Spring retainer	2		
i.	13,	14418	. . SPRING, Helical	6		Apply multipurpose waterless grease.
j.	14,	14649	. . BUTTON, Spring retainer	6		Apply multipurpose waterless grease.
k.	15,	15224	. . ROD, Threaded (used only on gate jaws P/N 15128 and 15129)	1	Clean.	Apply locking compound P/N 53200-271.
l.	16,	50008-8-C9	. . SCREW, Hex hd cap (used only on piston jaws P/N 16662)	2		
m.	17,	50908-C	. . LOCKWASHER (used only on piston jaws P/N 16662)	2		
n.	18,	15083	. . JAW, Upper gate	1	Para 3-6.	Para 3-6.
o.	19,	15084	. . JAW, Lower gate	1	Para 3-6.	Para 3-6.
p.	20,	16661	. . JAW, Piston	1	Para 3-6.	Para 3-6.
q.	8, Fig. 6-1	51604-28	. PIN, Roll	4	Unlock latch and swing gate full open. (Fig. 5-3.)	Fig. 5-3.
r.	9,	15967	. PIN, Hinge	2	Thread 1/2-in. eyebolt into pin to lift out.	
s.	11,	16359	. GATE, Modified	2		
t.	9,	15967	. PIN, Hinge	2	Thread 1/2-in. eyebolt into pin to lift out.	

Table 5-2. Jaws, Dies, Gates, and Latches (Cont.)

Step	Index Fig. No.	Part No.	1. 2. 3. Description	Qty per Unit	Notes	
					Disassembly	Assembly
u.	12,	16323	. SPRING, Torsion	2		
v.	13,	15924	. LATCH	2		
w.	14,	16317	. STOP, Latch	2		
x.	15,	16106	. STOP, Gate	1		

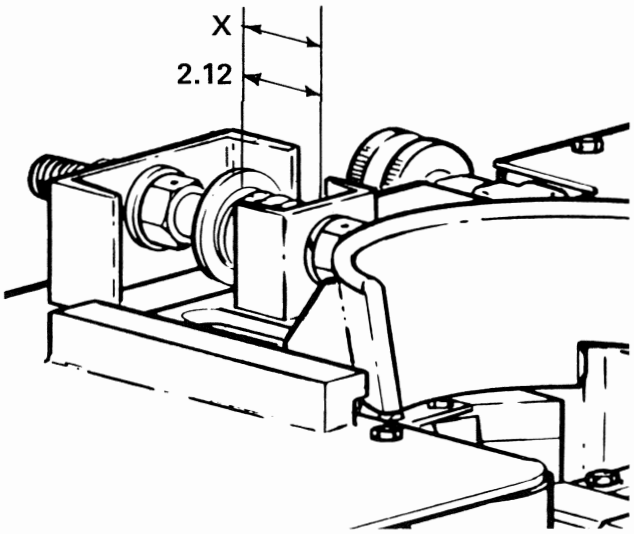


Figure 5-1. Stabbing Guide

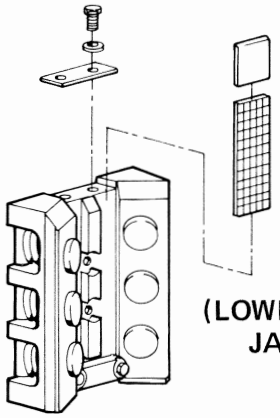


Figure 5-2. Jaw Assembly (Typical)

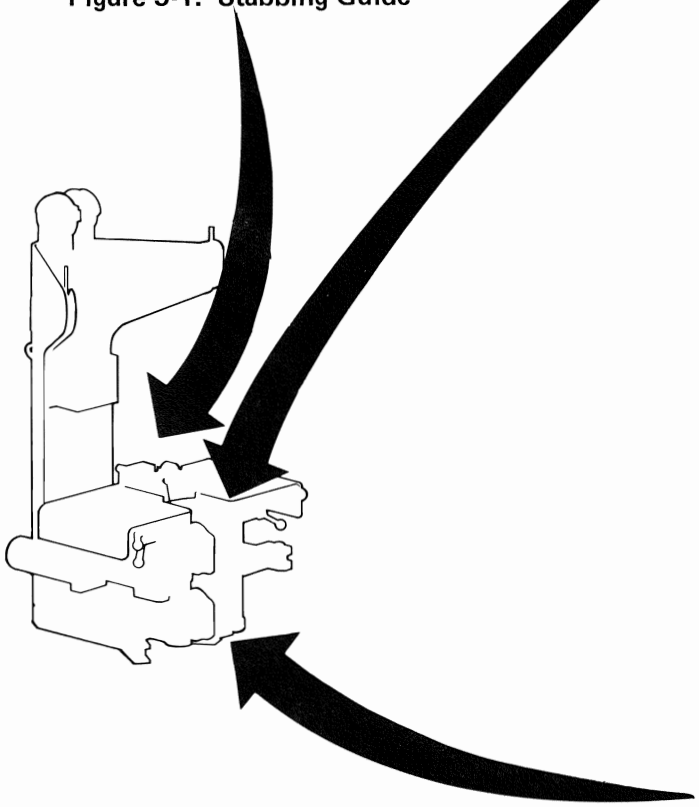


Figure 5-3. Hinge Pin with Eyebolt

Table 5-3. Vertical Positioning System

Step	Index Fig. No.	Part No.	1. 2. 3. Description	Qty per Unit	Notes	
					Disassembly	Assembly
	38, Fig. 6-1	15928	BODY, Upper and lower	Ref	Use lifting plate P/N 14337 (Fig. 5-4).	Use lifting plate P/N 14337 (Fig. 5-4).
	Fig. 6-7	16435	POSITIONING SYSTEM, Vertical	Ref		
a.	19,	51404-12-S	. PIN, Cotter	2		Install new.
b.	20,	50816-N-C	. WASHER, Flat	2		
c.	21,	16149	. PIN, Hinge	1		
d.	22,	51402-8-S	. PIN, Cotter	2		Install new.
e.	23,	50808-R-C	. WASHER, Flat	1		
f.	24,	56408-22	. PIN, Clevis	1		
g.	25,	50508-C	. NUT, Slotted hex	1		
h.	26,	50808-W-C	. WASHER, Wide flat	1		
i.	27,	16132	. Eyebolt	1		
j.	28,	16050	. PLATE, Mounting	1		Safety wire bolts to resist unscrewing.
k.	2,	13643	. PLATE, Hanger	1		
l.	3,	13640	. ROPE ASSY, Wire	2		Reeve per Fig. 5-5.
m.	4,	53602-150	. RING, Retaining	2		Install new.
n.	5,	51820	. NUT, Hex self-locking	4		
o.	6,	14275	. PIN ASSY, Outer sheave	2		
p.	7,	14927	. PIN ASSY, Inner sheave	2		
q.	8,	13638	. SHEAVE	6		
r.	9,	13512	. PLATE, Sheave guide	2		
s.	10,	13637	. BLOCK, Sheave mounting	1		
t.	Fig. 6-10	—	. FITTINGS AND TUBES, Hydraulic	—	Tag identify tubes for future use.	
u.	Fig. 6-7	16433	. GAUGE ASSY, Torque	1		
v.	12,	16365	. . GAUGE, Torque	1		
w.	13,	16436	. . BRACKET, Torque gauge mounting	1		
x.	—	14278	. MANIFOLD ASSY, Actuator	1		
y.	14,	11929	. . MANIFOLD, Pilot check valve	1		
z.	15,	15061	. VALVE, Flow control	2		Arrows point to each other.

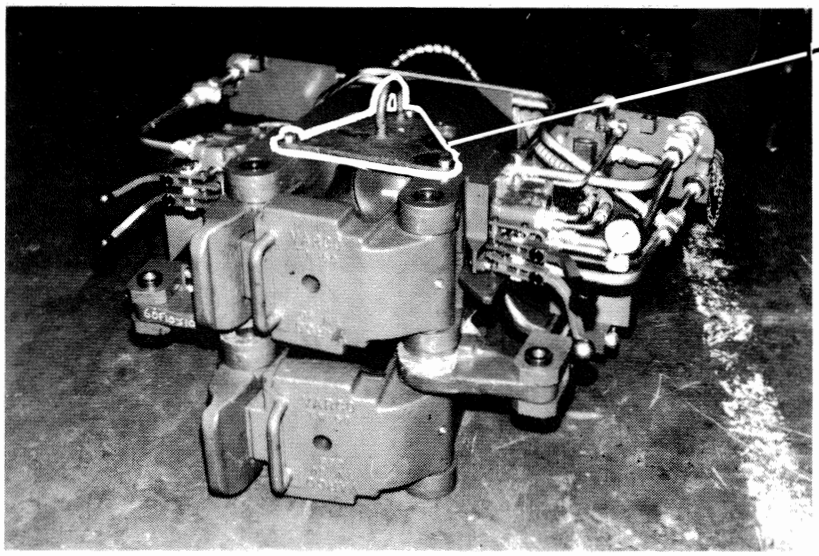


Figure 5-4. Lifting Plate Installation

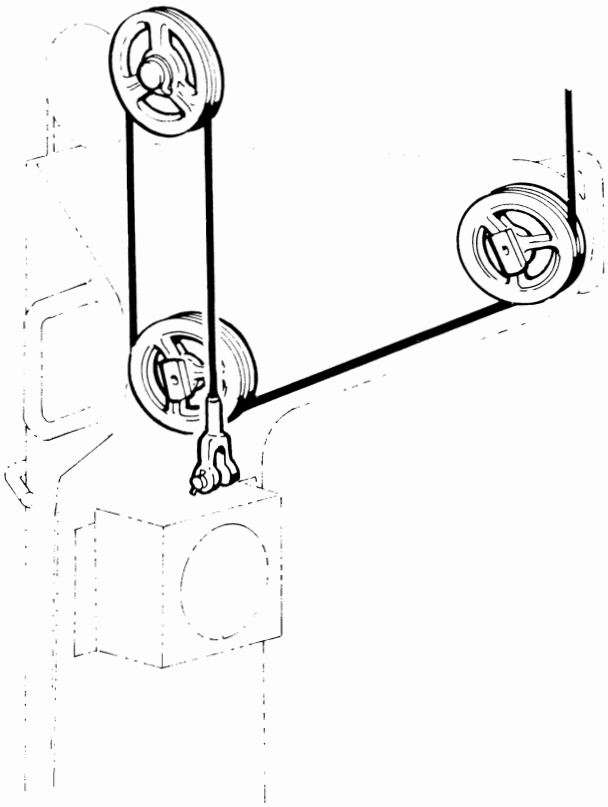


Figure 5-5. Vertical Position Wire Rope Reeving (Typical)

Table 5-3. Vertical Positioning System (Continued)

Step	Index Fig. No.	Part No.	1. 2. 3. Description	Qty per Unit	Notes	
					Disassembly	Assembly
aa.	–	13192	. CYLINDER, Lift	1		
ab.	29,	55408	. . NUT, Hex	8		
ac.	30,	13192-4	. . RETAINER, Bearing	1		
ad.	31,	13192-12	. . BEARING, Rod	1		
ae.	32,	13192-5	. . ADAPTER, Packing	1		
af.	33,	13192-6	. . HEAD, Rod end	1		
ag.	34,	13192-2	. . ROD, Piston	1	Check for scoring.	Install new if damaged.
ah.	35,	13192-7	. . BODY	1		
ai.	36,	13192-11	. . ROD, Tie	4		
aj.	37,	13192-8	. . PISTON	1		
ak.	38,	50704-4	. . SETSCREW, Soc hd	1		
al.	39,	13192-9	. . RING, Piston	4		
am.	40,	13192-10	. . HEAD, Blind end	1		
an.	41,	13192-15	. . NUT, Tie rod	4		
ao.	–	13192-1	. . KIT, Seal	1		
ap.	42,	51300-230-B	. . . O-RING	2		
aq.	43,	51300-24-B	. . . O-RING	1		
ar.	44,	13192-14	. . . PACKING, Rod	4		
as.	45,	13192-13	. . . PACKING, Upper Rod	1		
at.	46,	13192-12	. . . SCRAPER, Rod	1		
au.	47,	16432	. HANGER	1		

Table 5-4. Clamp Cylinders

Step	Index Fig. No.	Part No.	1. 2. 3. Description	Qty per Unit	Notes	
					Disassembly	Assembly
		—	CYLINDER, Clamp hydraulic	Ref		
a.	1, Fig. 6-8	11075	. HEAD, Cylinder	1	Fig. 5-6.	Fig. 5-6.
b.	2,	11085	. RING, Cylinder head	1		
c.	3,	12820	. PISTON	1		
d.	4,	51300-448-8	. O-RING	2	Discard.	Install new.
e.	5,	14079	. RING, Backup	4		
f.	6,	51300-445-8	. O-RING	1	Discard.	Install new.
g.	7,	14078	. RING, Backup	2		
h.	8,	12873	. RING, Scraper	1		

Table 5-5. Torque Bodies

Step	Index Fig. No.	Part No.	1. 2. 3. Description	Qty per Unit	Notes	
					Disassembly	Assembly
		–	TORQUE BODIES	Ref		
a.	Fig. 6-10	–	. HOSES, TUBES AND FITTINGS, Hydraulic	–	Tag identify hoses and tubes for future use.	
b.	Fig. 6-4	16415	. VALVE ASSY, LH direction control clamp	1		
c.	10,	15909	. . LINK, Handle	2		
d.	11,	15908	. . LINK, Handle	2		
e.	14,	16052	. . HANDLE, Upper	1		
f.	15,	16051	. . HANDLE, Lower	1		
g.	–	15637	. . VALVE, Clamp (modification)	1		
h.	18,	16133	. . . BALL, Detent	4		
i.	19,	50104-8-C	. . . SCREW, sch cap	4		
j.	20,	50904-C	. . . LOCKWASHER	4		
k.	–	13494	. . . VALVE, Clamp	1		Modify per steps h, i and j (Fig. 5-6).
l.	Fig. 6-5	16414	. VALVE ASSY, RH direction control torque and lift	1		
m.	18,	14783	. . GAUGE, Pressure	1		
n.	–	15638	. . VALVE, Lift and torque (modification)	1		
o.	20,	50104-8-C	. . . SCREW, Sch cap	4		
p.	21,	50904-C	. . . LOCKWASHER	4		
q.	–	13493	. . . VALVE, Lift and torque (modification)	1		Modify per steps o and p (Fig. 5-7).
r.	28, Fig. 6-1	14221	. VALVE ASSY, Pressure reducing	1		Adjust (Para 3-5).
s.	38,	15928	. BODY, Upper and lower	2	Use lifting plate P/N 14337 (Fig. 5-4).	Use lifting plate P/N 14337 (Fig. 5-4). Apply multipurpose waterless grease to mating surfaces.

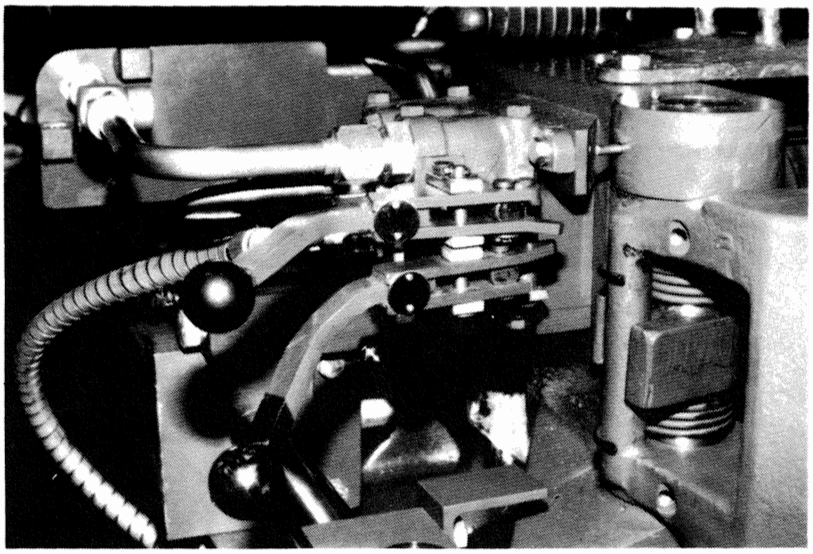


Figure 5-6. LH Direction Control Clamp Valve Assembly

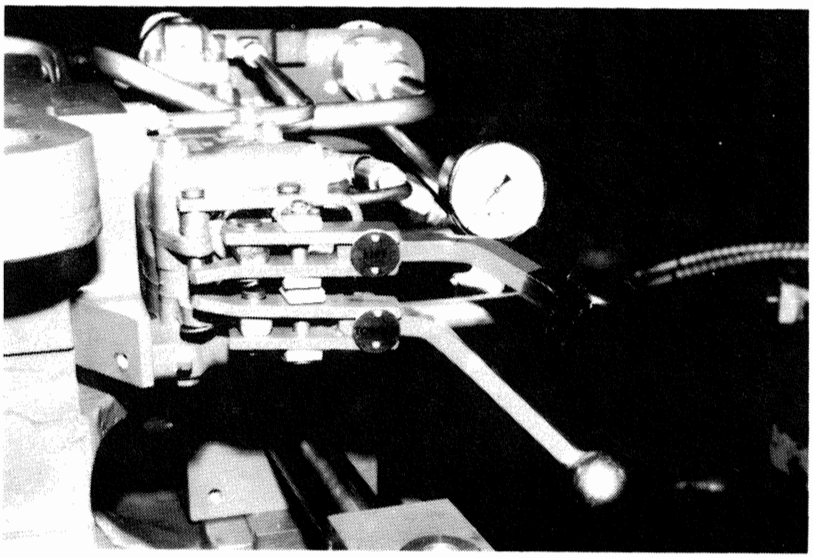


Figure 5-7. RH Direction Control Torque and Lift Valve Assembly

SECTION VI
PARTS LISTS

6-1. PARTS LISTS

6-2. The parts lists in this section reflect part numbers and quantities used on the TW-60. The parts lists use the indention method to show component/subassembly relationship. Items listed in the column to the right, under an assembly are detail parts of that assembly.

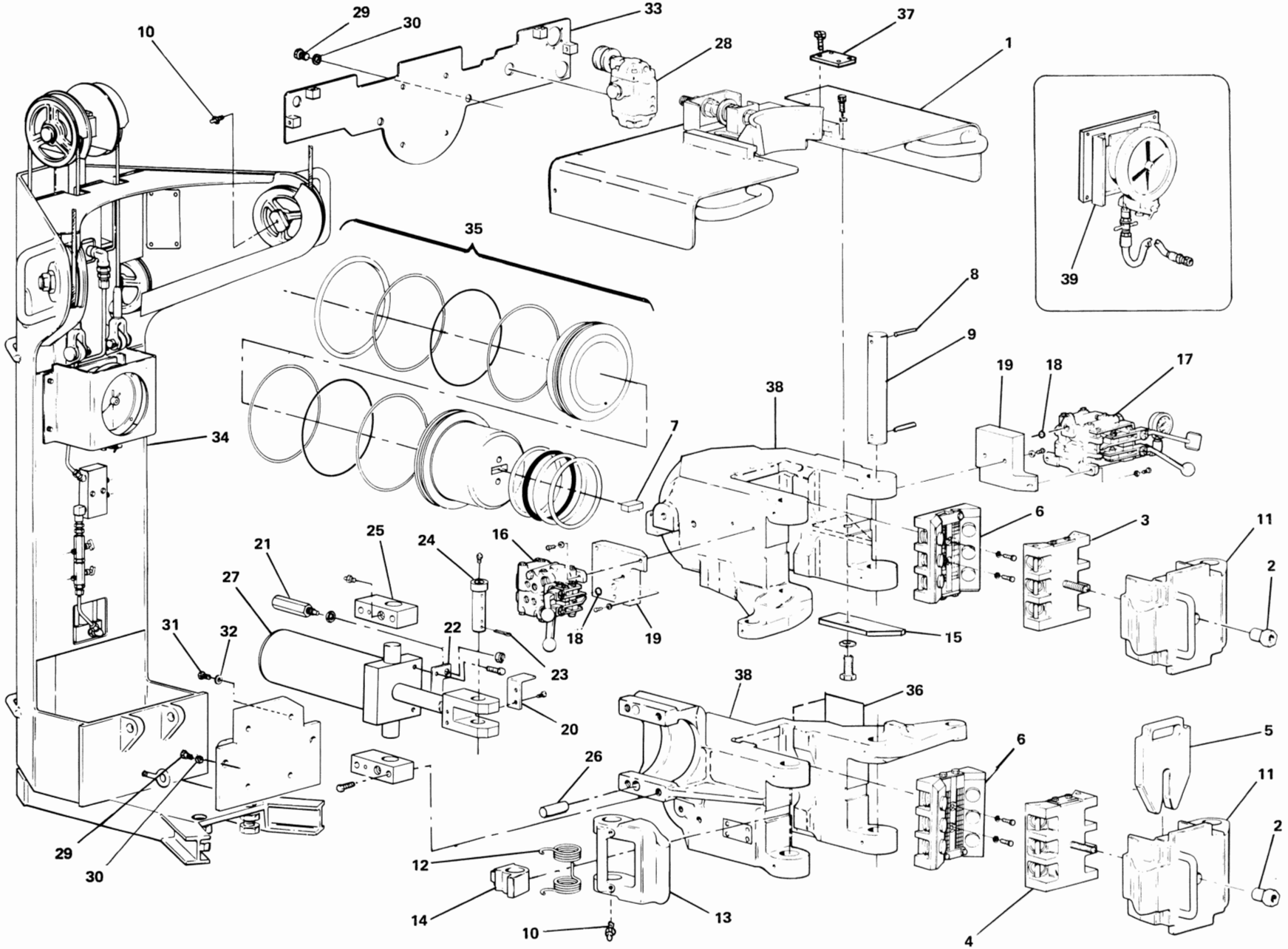


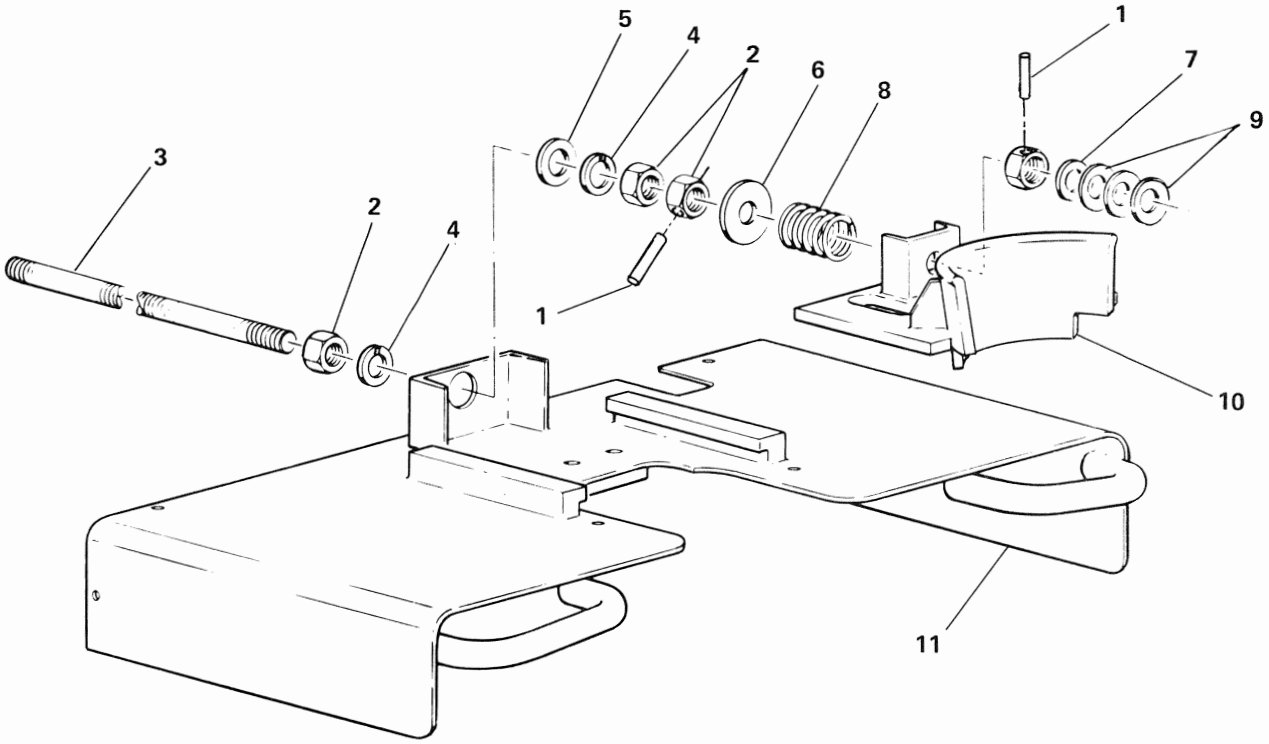
Figure 6-1 TW-60 Installation

Figure 6-1. TW-60 Installation

INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
–	16450	WRENCH ASSY, TW-60 torque (see Figure 6-10 for hydraulic breakdown) .	1
1	16371	. GUIDE ASSY, Stabbing (see Figure 6-2 for breakdown).	1
2	15223	. SLEEVE, Threaded.	2
3	15128	. JAW ASSY, Upper gate (see Figure 6-3 for breakdown)	1
4	15129	. JAW ASSY, Lower gate (see Figure 6-3 for breakdown)	1
5	15141	. SPACER, Jaw	4
6	16662	. JAW ASSY, Piston (see Figure 6-3 for breakdown)	2
7	16532	. KEY.	2
8	51604-28	. PIN, Roll.	4
9	15967	. PIN, Hinge.	4
10	53201	. FITTING, Grease	12
11	16359	. GATE, Modified.	2
12	16323	. SPRING, Torsion	2
13	15924	. LATCH.	2
14	16317	. STOP, Latch	2
15	16106	. STOP, Gate	1
		ATTACHING PARTS	
	50012-14-H5	. SCREW, Hex hd cap	2
	50912	. LOCKWASHER	2
		---*---	
16	16415	. VALVE ASSY, LH direction control clamp (see Figure 6-4 for breakdown) .	1
		ATTACHING PARTS	
	50006-8	. SCREW, Hex hd cap	3
	50906	. LOCKWASHER	3
		---*---	
17	16414	. VALVE ASSY, RH direction control lift and torque . . . . . (see Figure 6-5 for breakdown)	1
		ATTACHING PARTS	
	50006-8	. SCREW, Hex hd cap	3
	50906	. LOCKWASHER	3
		---*---	
18	51300-212-B	. O-RING	2
19	13497	. PLATE, Valve adapter	2
		ATTACHING PARTS	
	50006-10	. SCREW, Hex hd cap	4
	50906	. LOCKWASHER	4
		---*---	
20	16065	. STOP, Dump valve	1
		ATTACHING PARTS	
	50008-8	. SCREW, Hex hd cap	2
	50908	. LOCKWASHER	2
		---*---	
21	12644	. VALVE, Dump	1
22	16064	. BRACKET, Dump valve.	1
		ATTACHING PARTS	
	50008-8	. SCREW, Hex hd cap	2
	50908	. LOCKWASHER	2
		---*---	
23	51403-16-S	. PIN, Cotter	2
24	15978	. PIN, Clevis.	2

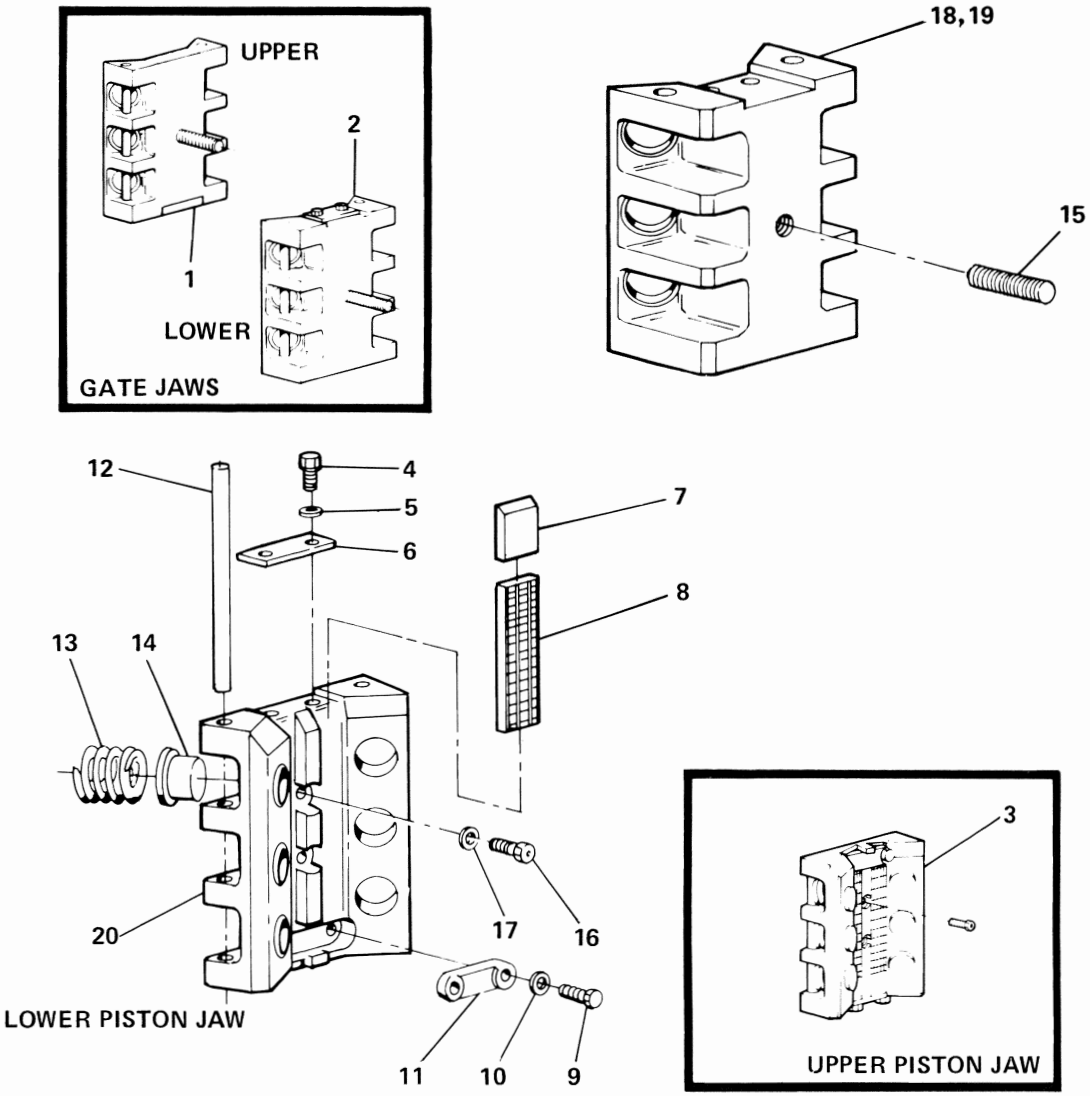
Figure 6-1. TW-60 Installation (Continued)

INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
25	15969	. BLOCK, Pillow.	4
		ATTACHING PARTS	
	50012-30-C9	. SCREW, Hex hd cap	8
	50912	. LOCKWASHER	8
		---*---	
26	51212-16	. PIN, Dowel	4
27	17510	. CYLINDER, Torque hydraulic (see Figure 6-6 for breakdown)	2
28	14221	. VALVE ASSY, Pressure reducing.	1
29	15051	. BOLT, Drilled hd	4
30	51110	. LOCKWASHER	4
31	15052	. BOLT, Drilled hd	4
32	51108	. LOCKWASHER	4
33	14872	. GUARD, Back	1
34	16435	. POSITIONING SYSTEM, Vertical (see Figure 6-7 for breakdown)	1
35	—	. CYLINDER, Clamp hydraulic (see Figure 6-8 for breakdown)	2
36	16635	. NAMEPLATE	1
37	15209	. PLATE, Instruction.	1
		ATTACHING PARTS	
	53301-10-16	. SCREW, Drive	8
		---*---	
38	15928	. BODY, Upper and lower	2
39	16384	. GAUGE ASSY, Driller's (see Figure 6-9 for breakdown).	1



INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
–	16371	GUIDE ASSY, Stabbing (see Figure 6-1 for NHA)	Ref
1	51603-11	. PIN, Roll	2
2	50216-C	. NUT, Hex	4
3	14459	. ROD	1
4	50916	. LOCKWASHER	2
5	15177	. SPACER	1
6	50816-R	. WASHER, Flat	1
7	50816-N	. WASHER, Flat	1
8	15031	. SPRING, Die	1
9	15032	. SPRING, Belleville	3
10	14460	. GUIDE, Stabbing	1
11	16370	. GUARD, Top	1

Figure 6-2. Stabbing Guide Assembly



INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
1	15128	JAW ASSY, Upper Gate (see Figure 6-1 for NHA)	Ref
2	15129	JAW ASSY, Lower Gate (see Figure 6-1 for NHA)	Ref
3	16662	JAW ASSY, Piston (see Figure 6-1 for NHA)	Ref
4	50008-8-C9	. SCREW, Hex hd cap	2
5	50908-C	. LOCKWASHER	2
6	16776	. RETAINER, Die	1
7	16777	. SPACER, Die	2
8	12845	. DIE, Tong	2
9	50006-6-C9	. SCREW, Hex hd cap	2
10	50906-C	. LOCKWASHER	2
11	16652	. RETAINER, Die	1
12	14622	. PIN, Spring retainer	2
13	14418	. SPRING, Helical	6
14	14649	. BUTTON, Spring retainer	6
15	15224	. ROD, Threaded (used only on Index 1 and 2)	1
16	50008-8-C9	. SCREW, Hex hd cap (used only on Index 3)	2
17	50908-C	. LOCKWASHER, (used only on Index 3)	2
18	15083	. JAW, Upper gate (used only on Index 1)	1
19	15084	. JAW, Lower gate (used only on Index 2)	1
20	16661	. JAW, Piston (used only on Index 3)	1

Figure 6-3. Upper Gate, Lower Gate, and Piston Jaw Assemblies

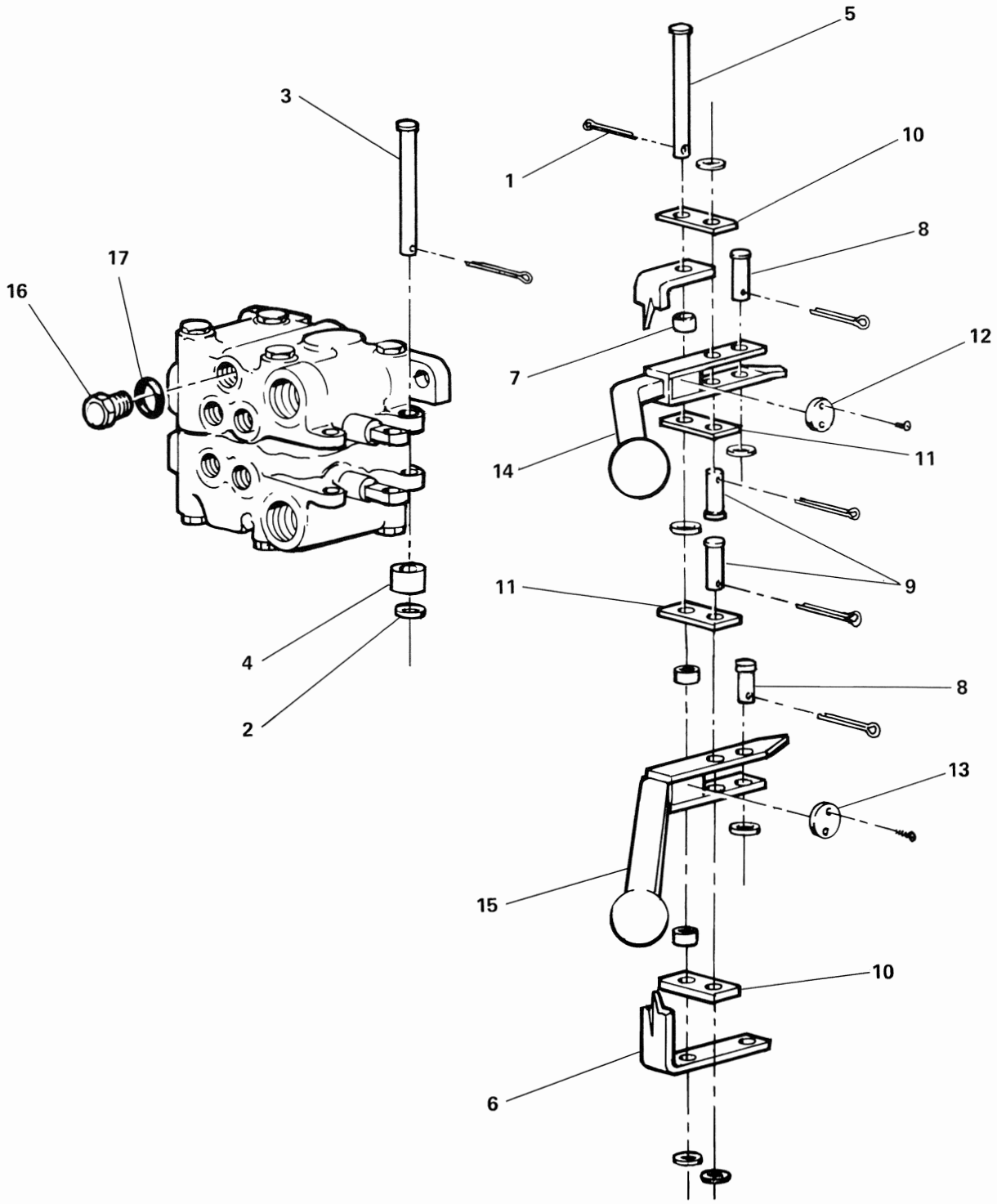


Figure 6-4. LH Direction Control Clamp Valve Assembly (Sheet 1 of 2)

Figure 6-4. LH Direction Control Clamp Valve Assembly

INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
—	16415	VALVE ASSY, LH direction control clamp (see Figure 6-1 for NHA)	Ref
1	51433-5-S	. PIN, Cotter	6
2	50806-N-C	. WASHER, Flat	7
3	56406-24-C	. PIN, Clevis	1
4	16189	. SPACER	1
5	56406-28-C	. PIN, Clevis	1
6	16188	. STOP	1
7	16549	. SPACER	3
8	56406-10-C	. PIN, Clevis	2
9	56406-13-C	. PIN, Clevis	2
10	15909	. LINK, Handle	2
11	15908	. LINK, Handle	2
12	16569	. TAG, CLAMP TOP	1
13	16570	. TAG, CLAMP BTM	1
		ATTACHING PARTS	
	53301-2-3	. SCREW, Drive	4
		---*---	
14	16052	. HANDLE, Upper	1
15	16051	. HANDLE, Lower	1
16	56531-12-S	. PLUG	1
17	51307-12	. . O-RING	1
—	15637	. VALVE, Clamp (modification)	1
18	16135	. . BALL, Detent	4
19	50104-8-C	. . SCREW, Sch cap	4
20	50904-C	. . LOCKWASHER	4
—	13494	. . VALVE, Clamp	1
21	13494-8	. . . CAP	2
22	13494-6	. . . SPRING	2
23	17933	. . . PLUG	2
24	13494-9	. . . EXTENSION, Spool	2
25	13494-17	. . . KIT, Seal	1
26	13494-15	. . . INLET SECTION, k (with D1 spool)	1
27	13494-14	. . . OUTLET SECTION, E (with D1 spool)	1
28	50206-C	. . . NUT	4
29	13494-4	. . . PLUG	1
30	13494-16	. . . SHIM	4
31	13494-13	. . . PLUG	1
32	50006-42-C	. . . SCREW, Hex hd	4
33	13494-12	. . . BALL	2
34	13494-11	. . . SPRING	2
35	13494-10	. . . PLUG	2

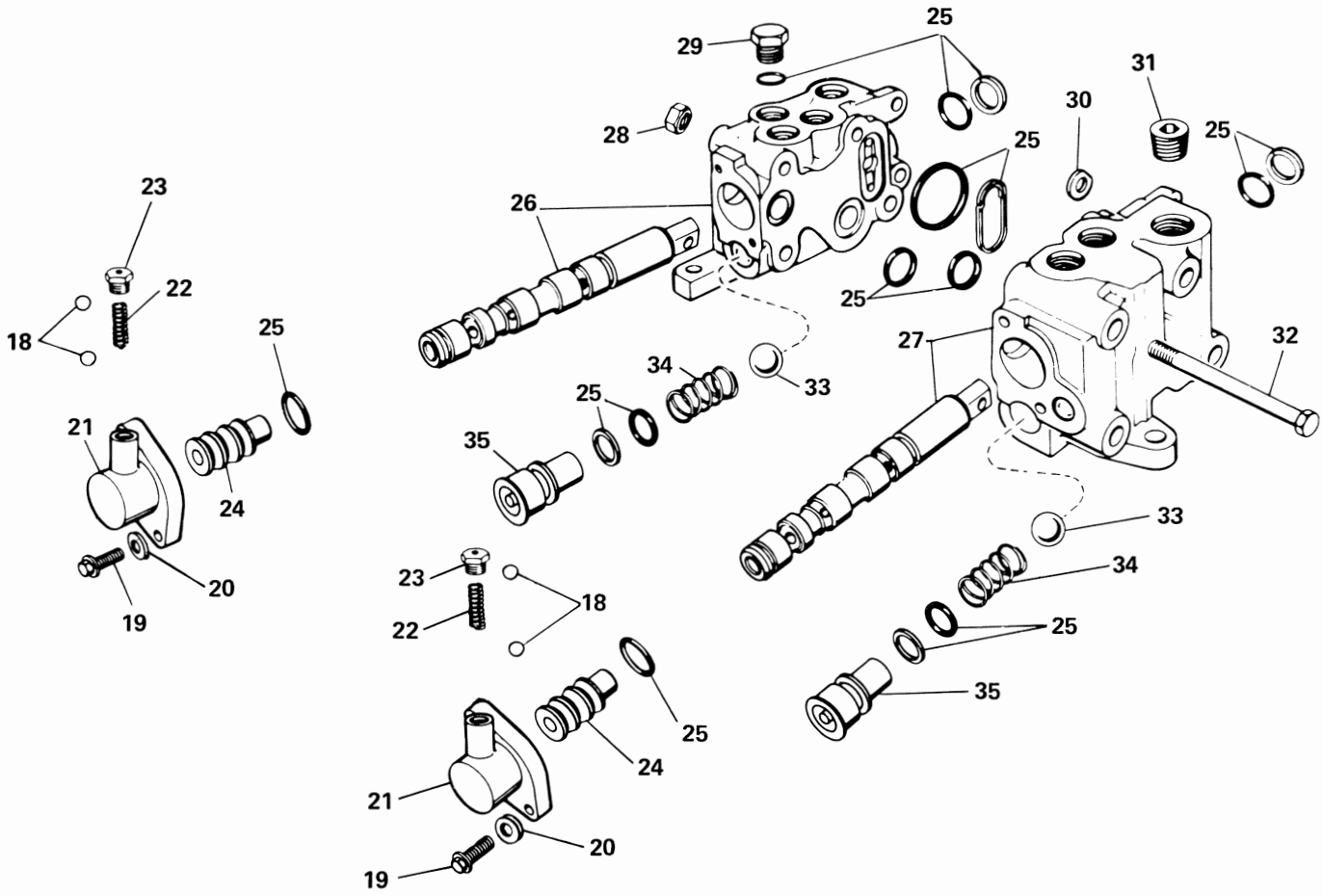


Figure 6-4. LH Direction Control Clamp Valve Assembly (Sheet 2 of 2)

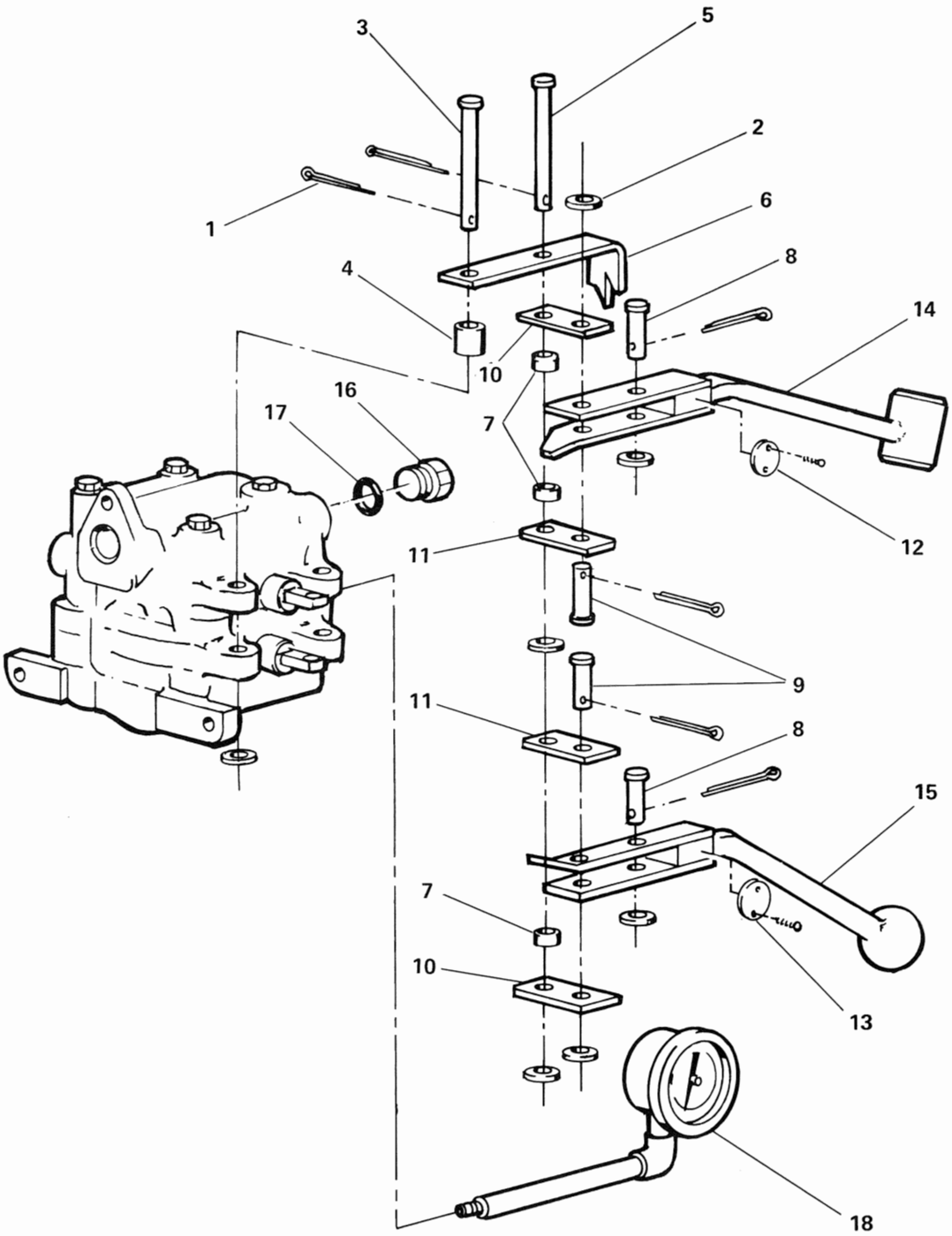


Figure 6-5. RH Direction Control Lift and Torque Valve Assembly (Sheet 1 of 2)

Figure 6-5. RH Direction Control Lift and Torque Valve Assembly

INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
—	16414	VALVE ASSY, RH direction control lift and torque (see Figure 6-1 for NHA)	Ref
1	51433-5-S	. PIN, Cotter	6
2	50806-N	. WASHER, Flat	7
3	56406-24-C	. PIN, Clevis	1
4	16189	. SPACER	1
5	56406-28-C	. PIN, Clevis	1
6	16188	. STOP	1
7	16549	. SPACER	3
8	56406-10-C	. PIN, Clevis	2
9	56406-13-C	. PIN, Clevis	2
10	15909	. LINK, Handle	2
11	15908	. LINK, Handle	2
12	16567	. TAG, LIFT	1
13	16568	. TAG, TORQUE	1
		ATTACHING PARTS	
	53301-2-3	. SCREW, Drive	4
		---*---	
14	16099	. HANDLE, Upper	1
15	16098	. HANDLE, Lower	1
16	56531-12-S	. PLUG	1
17	51307-12	. . O-RING	1
18	14783	. GAUGE, Pressure	1
19	13493-1	. COVER	2
	15638	. VALVE, Lift and torque (modification)	1
20	50104-8-C	. . SCREW, Sch cap	4
21	50904-0	. . LOCKWASHER	4
	13493	. . VALVE, Lift and torque	1
22	13493-2	. . . RETAINER	2
23	13493-3	. . . SLEEVE	2
24	13494-17	. . . KIT, Seal	1
25	13493-4	. . . SPRING, Centering	2
26	13494-2	. . . C-Washer	4
27	13493-5	. . . INLET SECTION, K (with B spool)	1
28	50206-C	. . . NUT	4
29	13494-16	. . . SHIM	4
30	13494-13	. . . PLUG	1
31	50006-42-C	. . . SCREW, Hex hd	4
32	13493-6	. . . OUTLET SECTION E (with D spool)	1
33	13494-12	. . . BALL	2
34	13494-11	. . . SPRING	2
35	13494-10	. . . PLUG	2

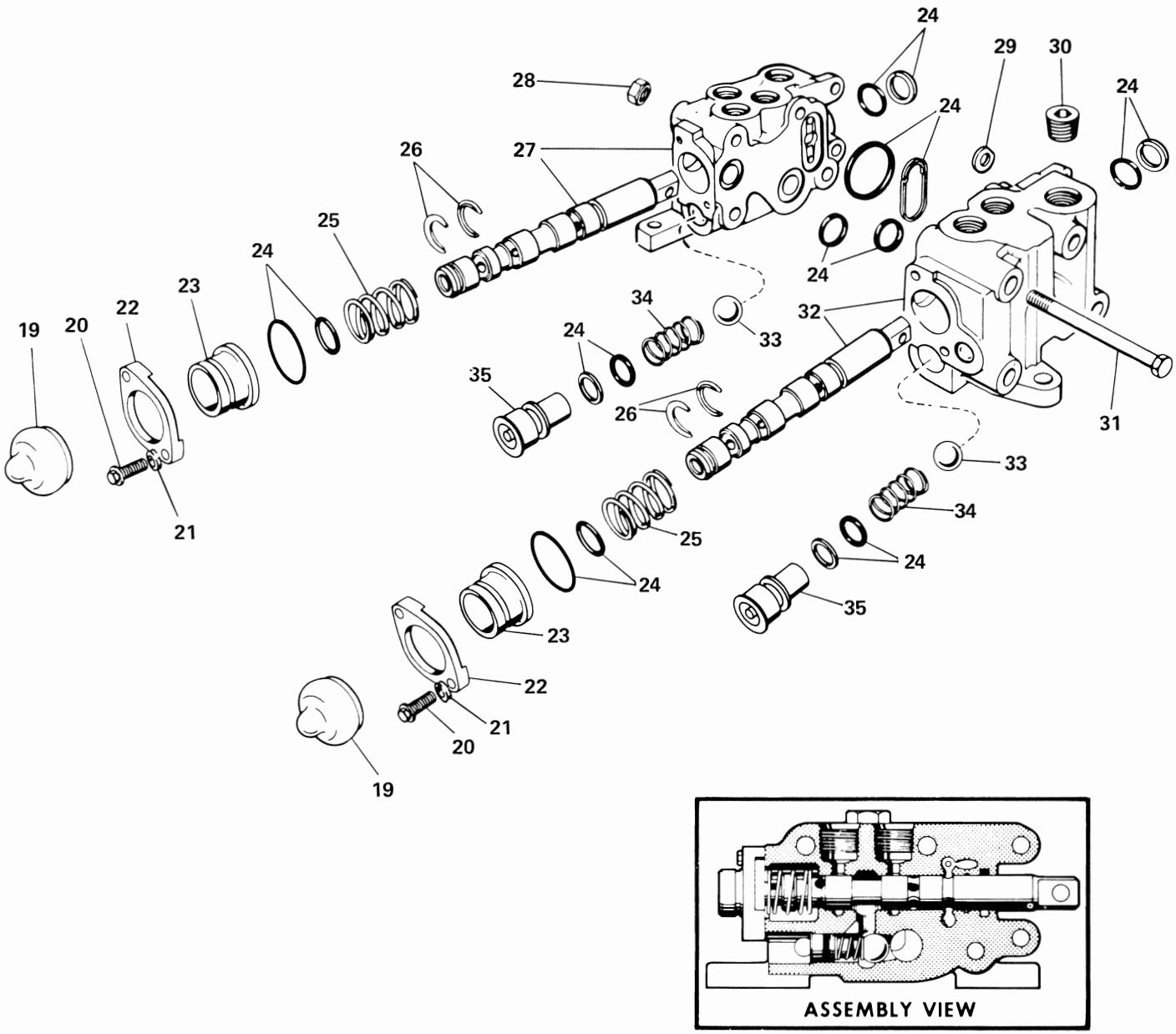


Figure 6-5. RH Direction Control Lift and Torque Valve Assembly (Sheet 2 of 2)

Figure 6-6. Hydraulic Torque Cylinder

INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
—	17510	CYLINDER ASSY, Torque (see Figure 6-1 for NHA)	Ref
1	50706-4-A-S	. SETSCREW, Soc hd	1
2	16330	. SLUG, Locking	1
3	15974	. CLEVIS, Cylinder	1
—	16049	. CYLINDER, Torque hydraulic	1
4	16049-6	. . CAP	1
5	51300-157-B*	. . O-RING	1
6	51300-244-B*	. . O-RING	1
7	51301-244*	. . RING, Backup	1
8	51603-15*	. . PIN, Roll	1
9	55220-C-H	. . NUT, Hex	1
10	16907*	. . SEAL, Piston	2
11	51300-026-B*	. . O-RING	1
12	16049-5	. . PISTON	1
13	16049-4	. . ROD	1
14	16049-3	. . BUSHING	1
15	16908*	. . SEAL, Trunnion	1
16	16909*	. . WIPER, Rod	1
17	16049-2	. . BARREL, Hydraulic cylinder	1

*These parts are included in Seal Kit (P/N 16049-1).

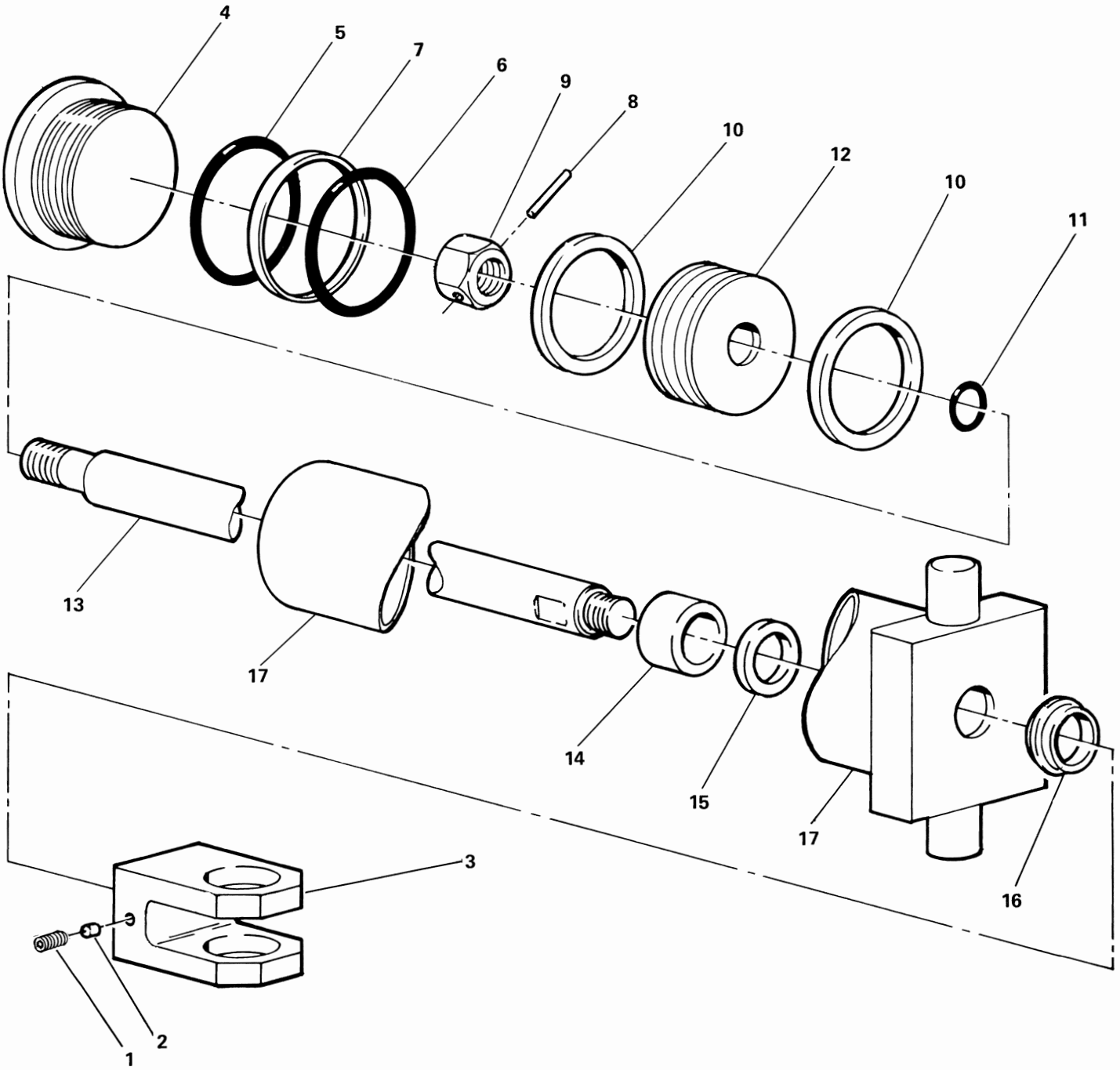


Figure 6-6. Hydraulic Torque Cylinder

Figure 6-7. Vertical Positioning System

INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
–	16435	POSITIONING SYSTEM, Vertical (see Figure 6-1 for NHA)	Ref
1	15417	. SHACKLE, Chain	1
2	13643	. PLATE, Hanger	1
3	13640	. ROPE ASSY, Wire	2
4	53602-150	. RING, Retaining.	2
5	51820	. NUT, Hex self-locking	4
6	14275	. PIN ASSY, Outer sheave	2
7	14927	. PIN ASSY, Inner sheave.	2
8	13638	. SHEAVE.	6
9	13512	. PLATE, Sheave guide	2
10	13637	. BLOCK, Sheave mounting	1
11	14461	. COVER, Torque wrench	1
		ATTACHING PARTS	
	50006-6	. SCREW, Hex hd cap	4
	50906	. LOCKWASHER	4
		---*---	
	16433	. GAUGE ASSY, Torque	1
		ATTACHING PARTS	
	50006-6	. SCREW, Hex hd cap	4
	50906	. LOCKWASHER	4
		---*---	
12	16365	. . GAUGE, Torque	1
		ATTACHING PARTS	
	16437	. . SCREW, Flat hd.	3
		---*---	
13	16436	. . BRACKET, Torque gauge mounting	1
	14278	. MANIFOLD ASSY, Actuator	1
		ATTACHING PARTS	
	50006-14	. SCREW, Hex hd cap	2
	50906	. LOCKWASHER	2
		---*---	
14	11929	. . MANIFOLD, Pilot check valve	1
15	15061	. VALVE, Flow control	2
16	15379	. PLATE, Instruction (gate spacers)	1
		ATTACHING PARTS	
	53301-10-6	. SCREW, Drive	4
		---*---	
17	16156	. SCREW, Leveling	2
18	50316-C	. NUT, Hex jam	2
19	51404-12-S	. PIN, Cotter	2
20	50816-N-C	. WASHER, Flat.	2
21	16149	. PIN, Hinge.	1
22	51402-8-S	. PIN, Cotter	2
23	50808-R-C	. WASHER, Flat.	1
24	56408-22	. PIN, Clevis.	1
25	50508-C	. NUT, Slotted hex	1
26	50808-W-C	. WASHER, Wide flat	1
27	16132	. EYEBOLT.	1
28	16050	. PLATE, Mounting (installed on torque wrench body)	1
	13192	. CYLINDER, Lift	1
		ATTACHING PARTS	
	55208	. NUT, Hex	4
	50908	. LOCKWASHER	4
		---*---	

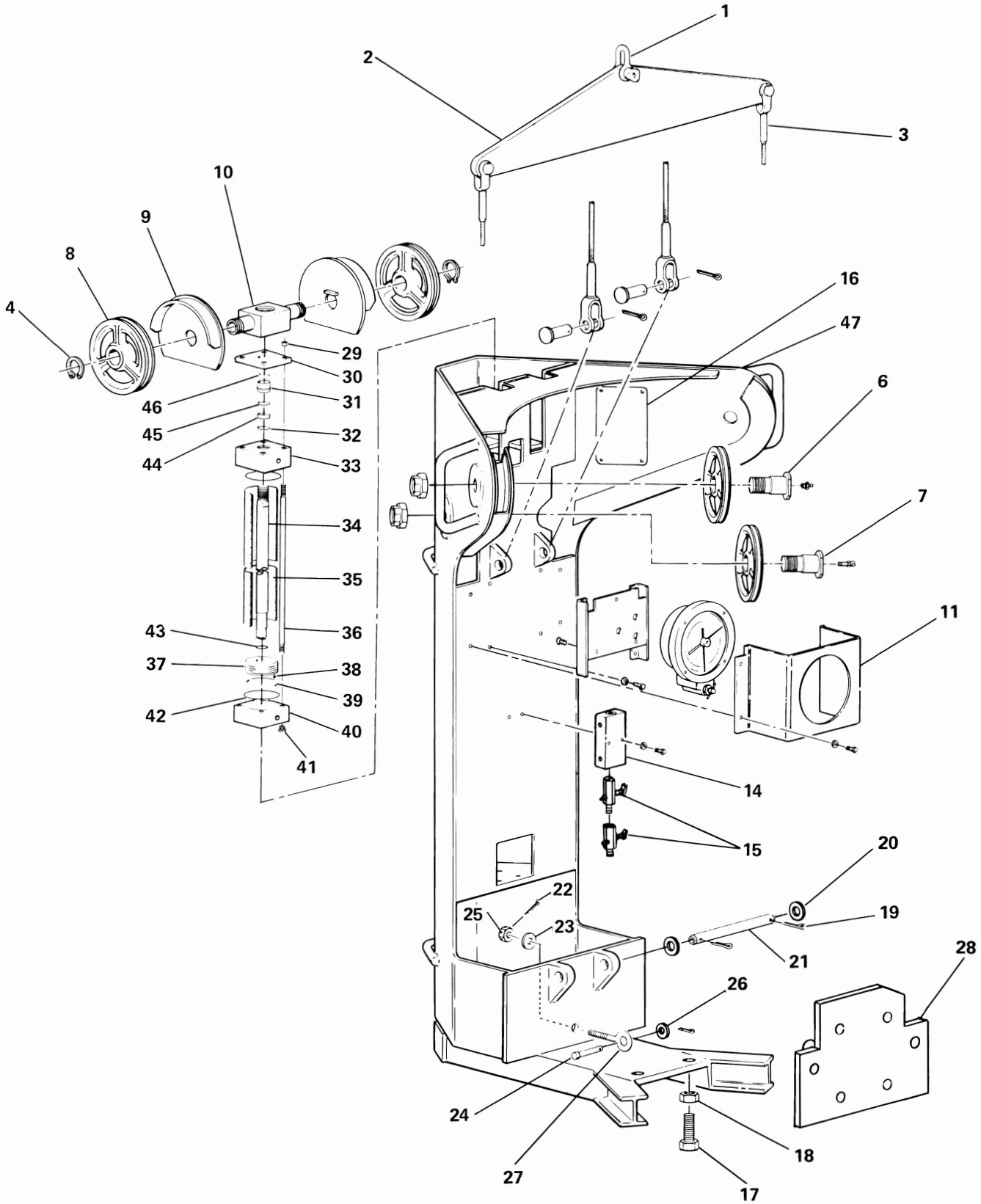
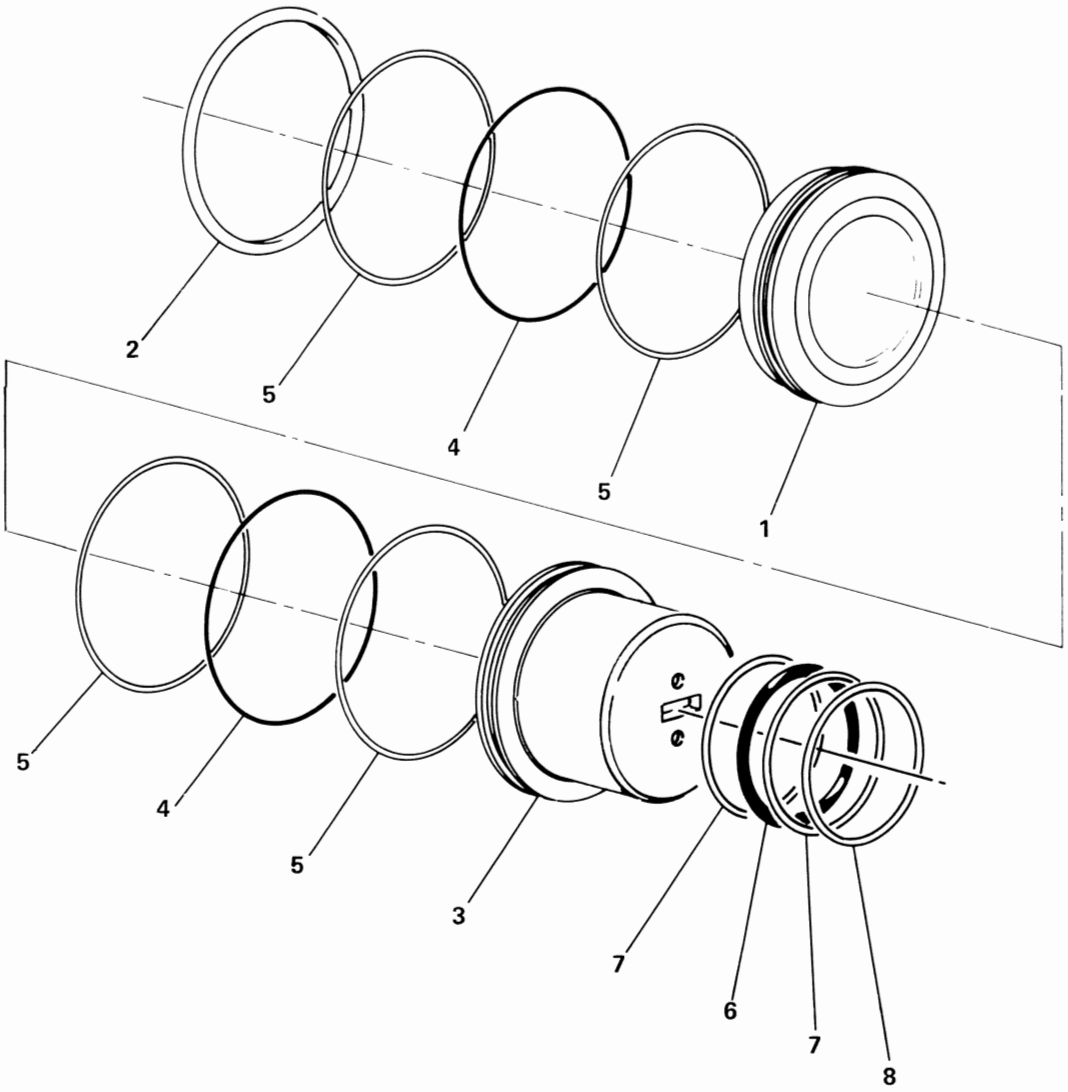


Figure 6-7. Vertical Positioning System

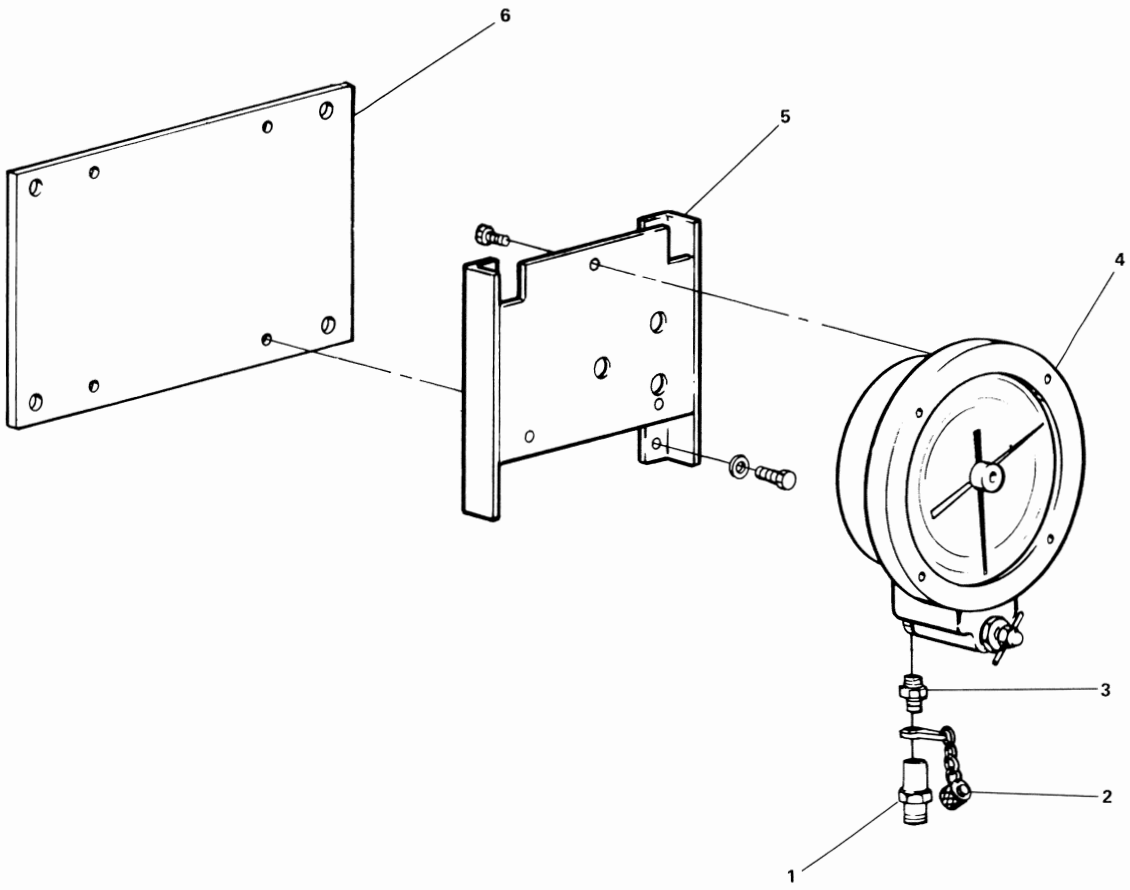
Figure 6-7. Vertical Positioning System (Continued)

INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
29	55408	. . NUT, Hex	4
30	13192-4	. . RETAINER, Bearing	1
31	13192-12	. . BEARING, Rod	1
32	13192-5	. . ADAPTER, Packing	1
33	13192-6	. . HEAD, Rod end	1
34	13192-2	. . ROD, Piston	1
35	13192-7	. . BODY	1
36	13192-11	. . ROD, Tie	4
37	13192-8	. . PISTON	1
38	50704-4	. . SETSCREW, Soc hd	1
39	13192-9	. . RING, Piston	4
40	13192-10	. . HEAD, Blind end	1
41	13192-15	. . NUT, Tie rod	4
	13192-1	. . KIT, Seal	1
42	51300-230-B	. . . O-RING	2
43	51300-24-B	. . . O-RING	1
44	13192-14	. . . PACKING, Rod	4
45	13192-13	. . . PACKING, Upper rod	1
46	13192-12	. . . SCRAPER, Rod	1
47	16432	. HANGER	1



INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
–	–	CYLINDER, Clamp hydraulic (see Figure 6-1 for NHA)	Ref
1	11075	. HEAD, Cylinder	1
2	11085	. RING, Cylinder head	1
3	12820	. PISTON	1
4	51300-448-8	. O-RING	2
5	14079	. RING, Backup	4
6	51300-445-8	. O-RING	1
7	14078	. RING, Backup	2
8	12873	. RING, Scraper	1

Figure 6-8. Clamp Hydraulic Cylinder



INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
–	16384	GAUGE ASSY, Drillers torque (see Figure 6-1 for NHA)	Ref
1	55904-6	. COUPLING HALF, Less flange	1
2	55903-8	. CAP, Dust	1
3	56703-4-4-S	. NIPPLE	1
	16433	. GAUGE ASSY, Torque	1
		ATTACHING PARTS	
	50006-6-C	. SCREW, Hex hd cap	4
	50906-C	. LOCKWASHER	4
		---*---	
4	16365	. . GAUGE, Torque	1
		ATTACHING PARTS	
	16437	. . SCREW, Flat hd.	3
		---*---	
5	16436	. . BRACKET, Torque gauge mounting	1
6	16440	. PLATE, Driller's gauge mounting.	1

Figure 6-9. Drillers Torque Gauge Assembly

Figure 6-10. Hydraulic Hoses, Tubes and Fittings

INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
—	—	HOSES, TUBES AND FITTINGS, TW-60 hydraulic (see Figure 6-1 for NHA)	Ref
1	55902-16	. COUPLING HALF, Mounting flange	1
		ATTACHING PARTS	
	54808-4-C	. SCREW, Pan hd cap	6
	50902	. LOCKWASHER	6
		---*---	
2	55903-16	. CAP, Dust (with chain)	1
3	55902-20	. COUPLING HALF, Mounting flange	1
		ATTACHING PARTS	
	50203	. NUT, Hex	5
	54810-5-C	. SCREW, Pan hd cap	5
	50903	. LOCKWASHER	5
		---*---	
4	55903-20	. CAP, Dust (with chain)	1
5	56700-16-12S	. REDUCER	1
6	56501-12-12S	. CONNECTOR	1
7	15293	. TUBE, Inlet to tee	1
8	56504-12-12S	. TEE, Union	1
9	15295	. TUBE, Tee to RH direction control valve	1
10	15294	. TUBE, Tee to backplate	1
11	56522-12-12S	. ELBOW	1
12	56547-12-S	. LOCKNUT, Bulkhead	1
13	14233	. TUBE, Backplate to tee	1
14	56160-12-12S	. TEE	1
15	53001-04-C	. PLUG	1
16	56700-12-4-S	. REDUCER	1
17	15487	. TUBE, Tee to LH direction control valve	1
—	16414	. VALVE ASSY, RH direction control	Ref
18	56529-12-12S	. . CONNECTOR	1
—	51307-12	. . . O-RING	1
19	56529-10-8-S	. . CONNECTOR	1
—	51307-10	. . . O-RING	1
20	56529-10-6-S	. . CONNECTOR	2
—	51307-10	. . . O-RING	1
21	56529-10-12S	. . CONNECTOR	1
—	51307-10	. . . O-RING	1
22	56707-4-4-S	. . ELBOW	1
23	52004-36-B-8	. . NIPPLE	1
24	56551-8-4-S	. . CONNECTOR	1
25	14783	. . GAUGE	Ref
—	16415	. VALVE ASSY, LH direction control	Ref
26	56518-12-12S	. . ELBOW	1
27	56529-10-12S	. . CONNECTOR	1
—	51307-10	. . . O-RING	1

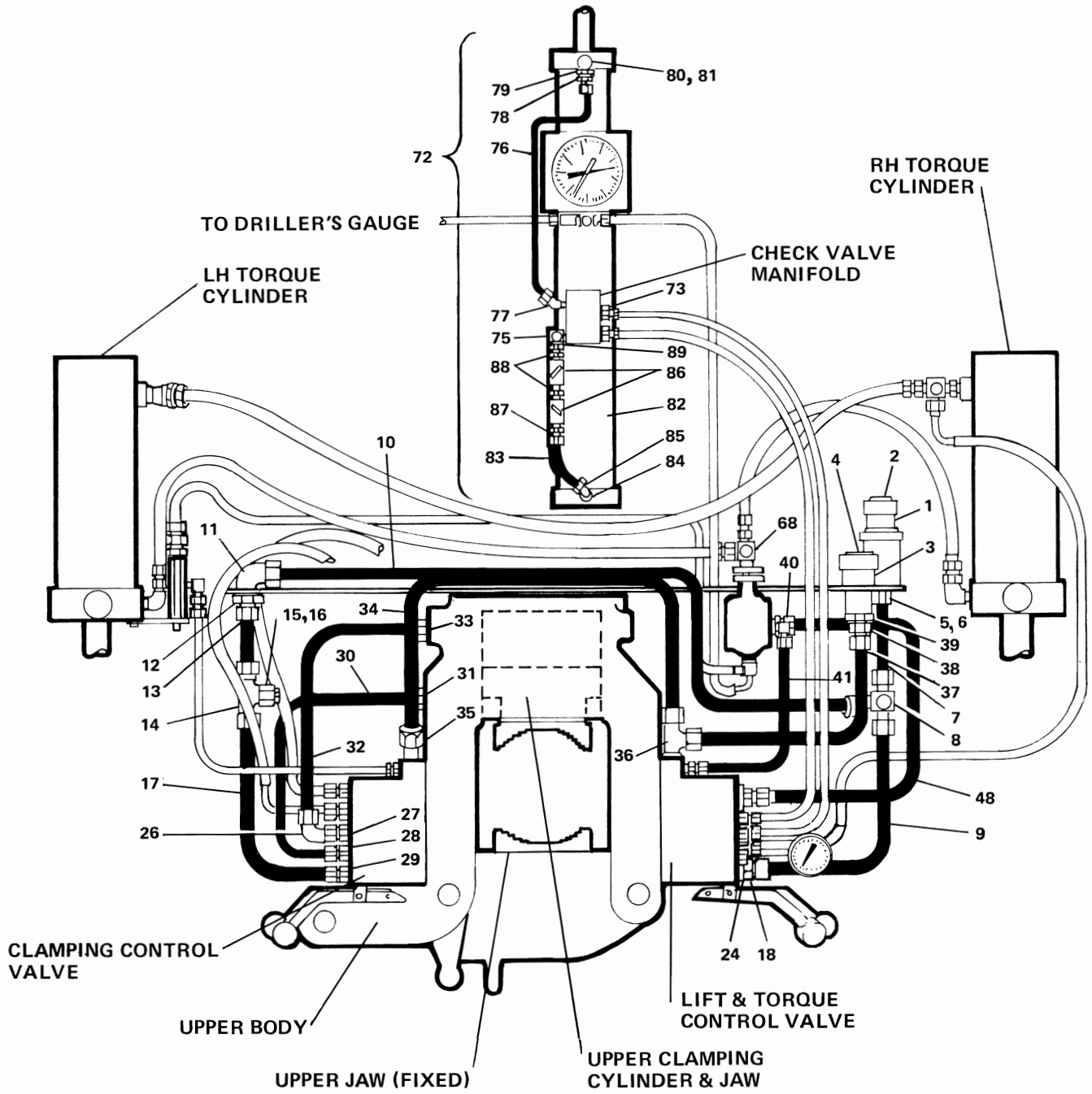


Figure 6-10. Hydraulic Hoses, Tubes and Fittings

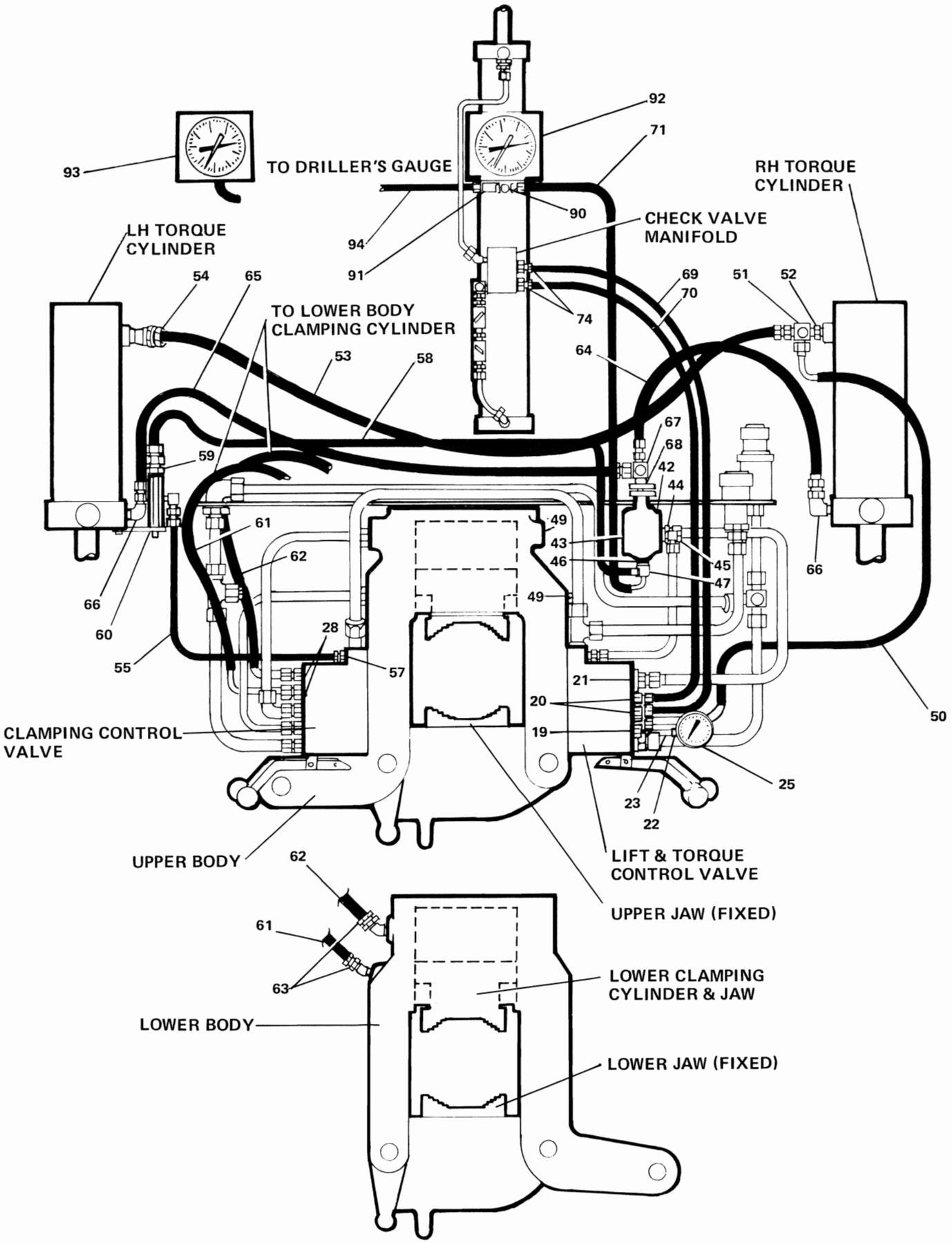


Figure 6-10. Hydraulic Hoses, Tubes and Fittings (Continued)

Figure 6-10. Hydraulic Hoses, Tubes and Fittings (Continued)

INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
28	56529-10-8-S	. . CONNECTOR	3
–	51307-10	. . . O-RING	1
29	56529-12-12S	. . CONNECTOR	1
–	51307-12	. . . O-RING	1
30	16269	. TUBE, Upper body to LH direction control valve	1
31	56501-8-8-S	. CONNECTOR	1
32	16268	. TUBE, Upper body to LH direction control valve	1
33	56501-8-12-S	. CONNECTOR	1
34	16275	. TUBE, LH adapter plate to RH adapter plate	1
35	56502-12-12S	. ELBOW	1
36	56533-12-12S	. TEE	1
37	14878	. TUBE, RH adapter plate to outlet	1
38	56501-12-12S	. CONNECTOR	1
39	56700-20-12S	. REDUCER	1
40	56501-4-6-S	. CONNECTOR	1
41	14888	. TUBE, PRV to RH adapter plate	1
42	14221	. VALVE ASSY, Pressure reducing	Ref
43	53001-12-C	. . PLUG	1
44	56501-12-12S	. . CONNECTOR	1
45	56506-4-6-S	. . ELBOW	1
46	56501-4-4-S	. . CONNECTOR	1
47	56501-6-4-S	. . CONNECTOR	1
48	14875	. TUBE, RH direction control valve to PRV	1
49	53002-08-S	. PLUG	4
50	16337	. HOSE, RH direction control valve to RH cylinder	1
51	56533-8-8-S	. TEE	1
52	56700-12-8-S	. REDUCER	1
53	16331	. HOSE, RH cylinder to LH cylinder	1
54	56502-12-8-S	. ELBOW	1
55	16332	. HOSE, Dump valve to LH adapter plate	1
56	56501-4-4-S	. CONNECTOR	1
57	56502-4-4-S	. ELBOW	1
58	15418-1	. HOSE, Dump valve to PRV	1
59	56501-4-4-S	. CONNECTOR	1
60	12644	. VALVE, Dump	Ref
61	16335	. HOSE, LH direction control valve to body	1
62	16389	. HOSE, LH direction control valve to body	1
63	56502-8-8-S	. ELBOW	2
64	16333	. HOSE, RH cylinder to PRV	1
65	16334	. HOSE, LH cylinder to PRV	1
66	56506-12-8-S	. ELBOW	2
67	56533-8-8-S	. TEE	1
68	56700-2-8-S	. REDUCER	1
69	14245	. HOSE, RH direction control valve to manifold	1
70	14239	. HOSE, RH direction control valve to manifold	1
71	15070	. HOSE, PRV to torque gauge	1
72	16435	. POSITIONING SYSTEM, Vertical	Ref
73	14278	. . MANIFOLD ASSY, Actuator	Ref
74	56501-6-6-S	. . . CONNECTOR	2
75	56705-6-6-S	. . . ELBOW	1

Figure 6-10. Hydraulic Hoses, Tubes and Fittings (Continued)

INDEX NO.	PART NO.	1. 2. 3. DESCRIPTION	QTY PER UNIT
76	16232	. . TUBE, Upper	1
77	56502-6-4-S	. . ELBOW	1
78	56501-4-4-S	. . CONNECTOR	1
79	56700-8-4-S	. . REDUCER	1
80	56707-8-8-S	. . ELBOW	1
81	52008-16-B-8	. . NIPPLE	1
82	13192	. . CYLINDER, Lift	Ref
83	15199	. . TUBE, Lower	1
84	56700-8-4-S	. . REDUCER	1
85	56506-4-4-S	. . ELBOW	1
86	15061	. . VALVE, Flow control	Ref
87	56501-4-4-S	. . CONNECTOR	1
88	56703-4-4-S	. . NIPPLE	2
89	56700-6-4-S	. . REDUCER	1
90	56501-4-4-S	. . CONNECTOR	1
91	56544-4-S	. . CAP, Female	1
92	16433	. . GAUGE ASSY, Torque	Ref
93	16384	. . GAUGE ASSY, Driller's torque	Ref
94	15066	. HOSE ASSY, Driller's	1

NOTES: UNLESS OTHERWISE SPECIFIED:

1. FOR SERVICE MANUAL SEE M103.
2. FOR HYDRUALIC SCHEMATIC SEE 70235.
3. APPLY GREASE TO ALL GREASE FITTINGS. APPLY LIBERALLY TO ALL AREAS NOTED.
4. LOCKWIRE ITEMS 64 & 65 USING ITEM 132.
5. APPLY ANTI-SEIZE TAPE TO ALL EXTERNAL PIPE THREADS.
6. ASSEMBLE WRENCH MINUS HANGER, TOP GUARD & PLUMBING AND PAINT WITH GARLOCK 515 ENAMEL FEDERAL SAFETY RED 0581 SELF-PRIMING MODIFIED URETHANE. SURFACES MUST BE CLEAN, DRY AND FREE OF OIL, GREASE, WAX, DIRT & RUST. DO NOT PAINT GAUGES, NAME PLATES, COUPLING HALF & DUST CAPS.
7. PRESS FIT ITEM 103 INTO ITEM 11.
8. FOR USE IN SERVICE, JAW SPACERS ARE USED IN COMBINATIONS AS REQUIRED TO ADAPT TO TOOL AND COLLAR SIZE RANGE 4 INCH TO 8 INCH O.D. (SEE INSTRUCTION PLATE NO. 18136 ON ASSY NO. 19899 -1, -2, -3 OR -4 AS APPLICABLE FOR CORRECT ADJUSTMENTS.
9. LUBRICATE O-RINGS WITH HYDRAULIC OIL PRIOR TO INSTALLATION.
10. GRIND CORNER TO .5R AFTER ASSY.
11. BEND EARS UP ON LOCK TAB ITEM 63 AFTER FINAL DUMP VALVE ADJUSTMENT AND NUT IS SECURELY TIGHTENED.
12. (DELETED)
13. STRAP ALL AIR LINES FROM AIR VALVE TO AIR HOSE AND EXISTING HYDRAULIC LINE FROM DUMP VALVE TO PRV TOGETHER WITH ITEM 60.
14. SEE 71930 FOR PNEUMATIC SCHEMATIC.
15. FOR USE IN SERVICE, JAW SPACERS ARE USED IN COMBINATIONS AS REQUIRED TO ADAPT TO TOOL AND COLLAR SIZE RANGE 4 INCH TO 8 1/2 INCH O.D. (SEE INSTRUCTION PLATE NO. 74063 ON ASSY 19899-5 & -6 AS APPLICABLE FOR CORRECT ADJUSTMENTS).
16. AFTER ASSEMBLY OF ITEM 105 (2 PL) INTO BODY PEEN DRILLED HOLE (BOTH ENDS) OF BODY.
17. ITEMS 102 & 106 SHOWN AS REF. ONLY. THEY ARE INCLUDED IN ASSY. 15928, 15928-1 & 15928-2 (ITEMS 8 &148).

-6	-5	-4	-3	-2	-1	PART NO.	DESCRIPTION	MATERIAL	ITEM NO.
QTY. REQ'D.									
4	4	4	4	4	4	50810-N-C	WASHER, FLAT		100
4	4	4	4	4	4	50910-C	WASHER, LOCK-REG		99
									98
10	10	10	10	10	10	50912-C	WASHER, LOCK-REG		97
16	16	16	16	16	16	50908-C	WASHER, LOCK-REG		96
10	10	10	10	10	10	50906-C	WASHER, LOCK-REG		95
5	5	5	5	5	5	50903-C	WASHER, LOCK-REG		94
6	6	6	6	6	6	50902-C	WASHER, LOCK-REG		93
6	6	6	6	6	6	50006-8-C5	SCREW, CAP - HEX HD		92
5	5	5	5	5	5	54810-5-C	SCREW, MACHINE PAN HD		91
6	6	6	6	6	6	54808-4-C	SCREW, MACHINE PAN HD		90
12	12	12	12	12	12	53301-10-6	SCREW, DRIVE		89
8	8	8	8	8	8	50012-34-C5	SCREW, CAP - HEX HD		88
2	2	2	2	2	2	50016-14-C5	SCREW, CAP - HEX HD		87
4	4	4	4	4	4	50008-10-C5	SCREW, CAP - HEX HD		86
8	8	8	8	8	8	50008-8-C5	SCREW, CAP - HEX HD		85
4	4	4	4	4	4	50006-10-C5	SCREW, CAP - HEX HD		84
							(REMOVED)		83
							(REMOVED)		82
									81
-	-	1	1	1	1	18060-1	JAW ASSY, PISTON LOWER		80
1	1	1	1	1	1	14878	TUBE ASSY		79
2	2	2	2	2	2	56501-12-12-S	CONNECTOR, EXT PIPE/37°		78
1	1	1	1	1	1	53001-8-S	PLUG, EXT PIPE - HEX HD		77
1	1	1	1	1	1	71036	PLATE, INSTRUCTION		76
-	-	1	1	1	1	15128	JAW ASSY, GATE - UPPER		75
-	-	1	1	1	1	15129	JAW ASSY, GATE - LOWER		74
1	1	1	1	1	1	15209	PLATE, TORQUE ADJUSTMENT		73
2	2	2	2	2	2	72221	WIPER, ROD		72
2	2	2	2	2	2	11085	RING, CYLINDER HEAD		71
4	4	4	4	4	4	14079	BACK UP RING		70
2	2	2	2	2	2	72220	SEAL, ROD		69
2	2	2	2	2	2	15978	PIN, CLEVIS		68
1	1	1	1	1	1	12644	VALVE, DUMP		67
1	1	1	1	1	1	56162-8-8-S	TEE, PIPE EXT/INT/INT		66
4	4	4	4	4	4	15052	BOLT, DRILLED HD		65
4	4	4	4	4	4	15051	BOLT, DRILLED HD		64
1	1	1	1	1	1	19813	LOCK TAB		63
1	1	1	1	1	1	56501-8-8-S	CONNECTOR, EXT PIPE/37°		62
2	2	2	2	2	2	56501-4-4-S	CONNECTOR, EXT PIPE/37°		61
3	3	3	3	3	3	53300-526	TIE, CABLE (TY-RAP)	13	60
2	2	2	2	2	2	18066	SLEEVE		59
2	2	2	2	2	2	16532	KEY		58
1	1	1	1	1	1	56512-4-4-S	ELBOW, X-LONG 90° EXT PIPE/37°		57
4	4	4	4	4	4	50904-C	WASHER, LOCK REG		56
4	4	4	4	4	4	50204-C	NUT, HEX STD (UNC-2B)		55
4	4	4	4	4	4	50004-10-C5	SCREW, CAP HEX HD		54
1	1	1	1	1	1	7735	COUPLER		53
2	2	2	2	2	2	58892P230038	HOSE ASSY		52
1	1	1	1	1	1	16377	HOSE ASSY		51

-6	-5	-4	-3	-2	-1	PART NO.	DESCRIPTION	MATERIAL	ITEM NO.
QTY. REQ'D.									
1	1	1	1	1	1	58893P230038	HOSE ASSY.		50
1	1	1	1	1	1	58872P230041	HOSE ASSY.		49
1	1	1	1	1	1	58872P230025	HOSE ASSY.		48
1	1	1	1	1	1	58792P080022	HOSE ASSY.		47
1	1	1	1	1	1	58792P080042	HOSE ASSY.		46
1	1	1	1	1	1	58774P08N048	HOSE ASSY.		45
1	1	1	1	1	1	58893P170045	HOSE ASSY.		44
1	1	1	1	1	1	58892P170044	HOSE ASSY.		43
1	1	1	1	1	1	16275	TUBE ASSY.		42
1	1	1	1	1	1	16269	TUBE ASSY.		41
1	1	1	1	1	1	16268	TUBE ASSY.		40
1	1	1	1	1	1	15487	TUBE ASSY.		39
1	1	1	1	1	1	15295	TUBE ASSY.		38
1	1	1	1	1	1	15294	TUBE ASSY.		37
1	1	1	1	1	1	15293	TUBE ASSY.		36
1	1	1	1	1	1	14888	TUBE ASSY.		35
1	1	1	1	1	1	71792	HOSE ASSY, MOTOR AIR		34
1	1	1	1	1	1	14875	TUBE ASSY.		33
1	1	1	1	1	1	14233	TUBE ASSY.		32
1	1	1	1	1	1	19438	VALVE ASSY, CLAMP		31
1	1	1	1	1	1	19437	VALVE ASSY, LIFT/TORQUE		30
2	2	2	2	2	2	18590	ADAPTER, VALVE		29
1	1	1	1	1	1	14221	VALVE ASSY, PRESSURE REDUCING		28
1	1	1	1	1	1	14872	GUARD, BACK (MACH)		27
1	1	1	1	1	1	19599	GUIDE ASSY, STABBING		26
-	-	1	1	1	1	18060	JAW ASSY, PISTON UPPER		25
									24
2	2	2	2	2	2	71791	HOSE ASSY, PILOT AIR		23
1	1	1	1	1	1	71790	HOSE ASSY, PILOT RETURN AIR		22
1	1	1	1	1	1	16106	STOP, GATE		21
2	2	2	2	2	2	16323	SPRING, TORSIONAL		20
2	2	2	2	2	2	16317	STOP, LATCH		19
2	2	2	2	2	2	15924	LATCH		18
4	4	4	4	4	4	15967	PIN, PIVOT		17
-	-	2	2	2	2	15905	GATE		16
1	1	1	1	1	1	71706	VALVE, DIRECTION CONTROL		15
2	2	2	2	2	2	17510-101	CYLINDER TORQUE ASSY.		14
1	1	1	1	1	1	16065	STOP, DUMP VALVE		13
1	1	1	1	1	1	16064	BRACKET, DUMP VALVE		12
4	4	4	4	4	4	15969	BLOCK, PILLOW		11
2	2	2	2	2	2	11075	CYLINDER HEAD		10
2	2	2	2	2	2	12820	PISTON		9
-	-	-	-	-	-	15928	BODY	17	8
1	1	1	1	1	1	18135-2	ANGLE BRACKET (LEFT)		7
1	1	1	1	1	1	18135-1	ANGLE BRACKET (RIGHT)		6
-	-	1	1	1	1	16635	NAMEPLATE		5
-	-	1	-	-	-	19899-4	VERTICAL POSIT SYS & TUGGER (DES S.I.)		4
-	-	-	1	-	-	19899-3	VERTICAL POSIT SYS & TUGGER (DES)		3
-	-	-	-	1	-	19899-2	VERTICAL POSIT SYS & TUGGER (S.I.)		2
-	-	-	-	-	1	19899-1	VERTICAL POSIT SYS & TUGGER (STD)		1

116492	KIT
19999	TW-61
19999	TW-60
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
MACHINED 250 MAX TORCH CUT 1000 MAX

UNLESS OTHERWISE SPECIFIED
INTERPRET DIM/TOL PER ASME Y14.5M
DIMENSIONS ARE IN INCHES
.X ± .1 .XX ± .03 .XXX ± .010
ANGLES ± .5°
DO NOT SCALE DRAWING

	CURRENT	INITIAL
DRAWN	D.HIRULKAR	R.ARRIAZA
CHECKED	B.RICE	R.BIANCHI
APPVD	S.WILLIAMS	MAURY BONAS
DATE	11/11/08	07/17/80

RIG SOLUTIONS
10000 RICHMOND AVE.
HOUSTON, TEXAS 77042 U.S.A.
(713) 346-7500

NATIONAL OILWELL VARCO

TITLE: TORQUE WRENCH & TUGGER ASSY.

SCALE: 1/2 | WT LBS: - | PROJECTION: | SIZE: D | SHEET: 1 OF 8

DRAWING NUMBER: 70630 | REVISION: T

DCF0022 (REV D)

-12	-11	-10	-9	-8	-7	PART NO.	DESCRIPTION	MATERIAL	
QTY. REQ'D.									
1	1	1	1	1	1	58893P230038	HOSE ASSY		50
1	1	1	1	1	1	58872P230041	HOSE ASSY		49
1	1	1	1	1	1	58872P230025	HOSE ASSY		48
1	1	1	1	1	1	58792P080022	HOSE ASSY		47
1	1	1	1	1	1	58792P080042	HOSE ASSY		46
1	1	1	1	1	1	58774P08N048	HOSE ASSY		45
1	1	1	1	1	1	58893P170045	HOSE ASSY		44
1	1	1	1	1	1	58892P170044	HOSE ASSY		43
1	1	1	1	1	1	16275	TUBE ASSY		42
1	1	1	1	1	1	16269	TUBE ASSY		41
1	1	1	1	1	1	16268	TUBE ASSY		40
1	1	1	1	1	1	15487	TUBE ASSY		39
1	1	1	1	1	1	15295	TUBE ASSY		38
1	1	1	1	1	1	15294	TUBE ASSY		37
1	1	1	1	1	1	15293	TUBE ASSY		36
1	1	1	1	1	1	14888	TUBE ASSY		35
1	1	1	1	1	1	71792	HOSE ASSY, MOTOR AIR		34
1	1	1	1	1	1	14875	TUBE ASSY		33
1	1	1	1	1	1	14233	TUBE ASSY.		32
1	1	1	1	1	1	19438	VALVE ASSY, CLAMP		31
1	1	1	1	1	1	19437	VALVE ASSY, LIFT/TORQUE		30
2	2	2	2	2	2	18590	ADAPTER, VALVE		29
1	1	1	1	1	1	14221	VALVE ASSY, PRESSURE REDUCING		28
1	1	1	1	1	1	14872	GUARD, BACK (MACH.)		27
1	1	1	1	1	1	19599	GUIDE ASSY, STABBING		26
–	–	1	1	1	1	18060	JAW ASSY, PISTON–UPPER		25
1	1	1	1	1	1	71791–1	HOSE ASSY., PILOT AIR		24
1	1	1	1	1	1	71791	HOSE ASSY, PILOT AIR		23
1	1	1	1	1	1	71790	HOSE ASSY, PILOT RETURN AIR		22
1	1	1	1	1	1	16106	STOP, GATE		21
2	2	2	2	2	2	16323	SPRING, TORSIONAL		20
2	2	2	2	2	2	16317	STOP, LATCH		19
2	2	2	2	2	2	15924	LATCH		18
4	4	4	4	4	4	15967–1	PIN, PIVOT		17
–	–	2	2	2	2	15905	GATE		16
1	1	1	1	1	1	71706	VALVE, DIRECTIONAL CONTROL		15
2	2	2	2	2	2	17510–101	CYLINDER–TORQUE ASSY		14
1	1	1	1	1	1	16065	STOP, DUMP VALVE		13
1	1	1	1	1	1	16064	BRACKET, DUMP VALVE		12
4	4	4	4	4	4	15969	BLOCK, PILLOW		11
2	2	2	2	2	2	11075	CYLINDER HEAD		10
2	2	2	2	2	2	12820	PISTON		9
–	–	–	–	–	–	15928	BODY	17	8
1	1	1	1	1	1	18135–2	ANGLE BRACKET (LEFT)		7
1	1	1	1	1	1	18135–1	ANGLE BRACKET (RIGHT)		6
–	–	1	1	1	1	16635	NAMEPLATE		5
–	–	1	–	–	–	19899–4	VERTICAL POSIT SYS & TUGGER (DES S.I.)		4
–	–	–	1	–	–	19899–3	VERTICAL POSIT SYS & TUGGER (DES)		3
–	–	–	–	1	–	19899–2	VERTICAL POSIT SYS & TUGGER (S.I.)		2
–	–	–	–	–	1	19899–1	VERTICAL POSIT SYS & TUGGER (STD)		1

-6	-5	-4	-3	-2	-1	PART NO.	DESCRIPTION	MATERIAL	
QTY. REQ'D.									
1	–	–	–	–	–	19899–6	VERTICAL POSIT. SYSTEM & TUGGER (S.I.) 8 1/2" DIA DRILL COLLAR		151
–	1	–	–	–	–	19899–5	VERTICAL POSIT. SYSTEM & TUGGER (DOMESTIC) 8 1/2" DIA DRILL COLLAR		150
2	2	–	–	–	–	15905–1	GATE		149
2	2	2	2	2	2	15928–2	BODY	17	148
1	1	–	–	–	–	74102	PLATE, NAME		147
1	1	–	–	–	–	18060–3	JAW ASSY, PISTON LOWER		146
1	1	–	–	–	–	18060–2	JAW ASSY, PISTON UPPER		145
1	1	–	–	–	–	15129–1	JAW ASSY, GATE UPPER		144
1	1	–	–	–	–	15128–1	JAW ASSY, GATE UPPER		143
4	4	4	4	4	4	53002–08–S	PLUG, PIPE SQUARE HEAD		142
1	1	1	1	1	1	53001–12–14–S	PLUG, EXTERNAL PIPE – HEX HD		141
1	1	1	1	1	1	55903–20	CAP, DUST W/CHAIN		140
1	1	1	1	1	1	55903–16	CAP, DUST W/CHAIN		139
1	1	1	1	1	1	56547–12–S	LOCKNUT, BULKHEAD		138
1	1	1	1	1	1	55902–20	COUPLING, HALF W/MTG FLANGE		137
1	1	1	1	1	1	55902–16	COUPLING, HALF W/MTG FLANGE		136
1	1	1	1	1	1	56700–20–12–S	REDUCER, PIPE–EXT/INT		135
1	1	1	1	1	1	56700–16–12–S	REDUCER, PIPE–EXT/INT		134
1	1	1	1	1	1	56700–12–8–S	REDUCER, PIPE–EXT/INT		133
A/R	A/R	A/R	A/R	A/R	A/R	Z6001	LOCKWIRE		132
									131
1	1	1	1	1	1	56504–12–12–S	TEE, UNION 37°		130
1	1	1	1	1	1	56533–12–12–S	TEE–EXT PIPE 37°/37°		129
2	2	2	2	2	2	56533–8–8–S	TEE–EXT PIPE 37°/37°		128
1	1	1	1	1	1	56160–12–12–S	TEE, 37°/37° INT PIPE		127
									126
1	1	1	1	1	1	56704–8–12–S	ELBOW, 90° EXT PIPE/INT STR SWIVEL		125
1	1	1	1	1	1	56522–12–12–S	ELBOW, 90° BULKHEAD 37°/37°		124
2	2	2	2	2	2	56506–12–8–S	ELBOW, 90° EXT PIPE/37°		123
									122
									121
1	1	1	1	1	1	56502–12–12–S	CONNECTOR, EXT PIPE/37°		120
1	1	1	1	1	1	56502–12–8–S	CONNECTOR, EXT PIPE/37°		119
2	2	2	2	2	2	56502–8–8–S	CONNECTOR, EXT PIPE/37°		118
1	1	1	1	1	1	56502–4–4–S	CONNECTOR, EXT PIPE/37°		117
1	1	1	1	1	1	56501–12–12–S	CONNECTOR, EXT PIPE/37°		116
1	1	1	1	1	1	56501–8–12–S	CONNECTOR, EXT PIPE/37°		115
1	1	1	1	1	1	56501–8–8–S	CONNECTOR, EXT PIPE/37°		114
1	1	1	1	1	1	56501–4–6–S	CONNECTOR, EXT PIPE/37°		113
2	2	2	2	2	2	56501–4–4–S	CONNECTOR, EXT PIPE/37°		112
2	2	2	2	2	2	51300–448–B	O–RING		111
2	2	2	2	2	2	72219	SEAL, PISTON		110
2	2	2	2	2	2	51300–212–B	O–RING		109
									108
10	10	10	10	10	10	53201	FITTING, GREASE		107
						113629	BEARING, 1 3/8 in NOMINAL PLAIN	17	106
4	4	4	4	4	4	51204–28–S	PIN, DOWEL		105
2	2	2	2	2	2	51403–16–S	PIN, COTTER		104
4	4	4	4	4	4	51212–16	PIN, DOWEL		103
						113628	BEARING, 2 IN NOMINAL PLAIN	17	102
5	5	5	5	5	5	50203–C	NUT, HEX–STD		101

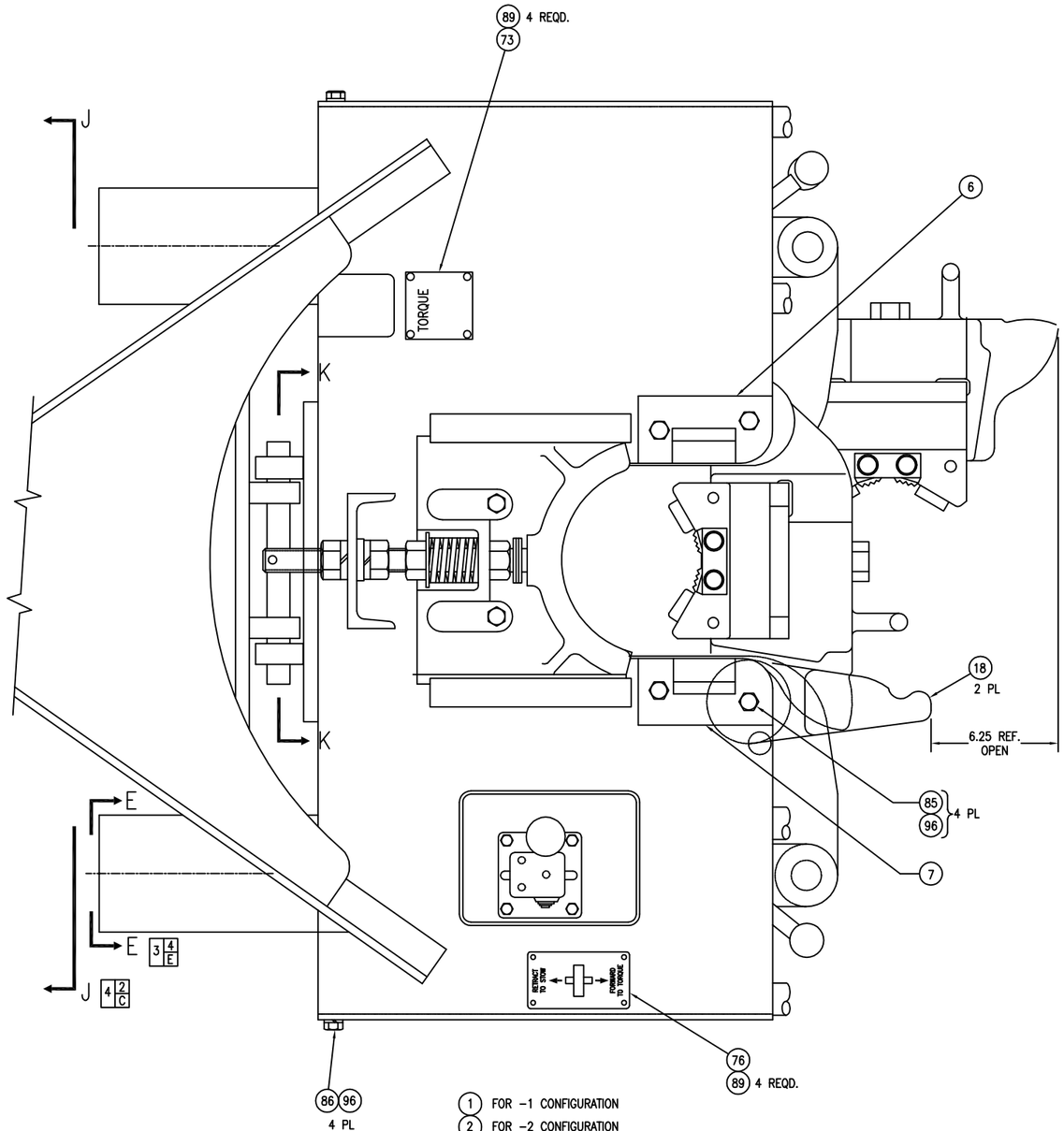
SIZE	DWG NO	REV
D	70630	T
SCALE –	WT LBS	SHEET 2 OF 8

DCF0022 (REV D)

-12	-11	-10	-9	-8	-7	PART NO.	DESCRIPTION	MATERIAL	ITEM NO.
QTY. REQ'D.									
1	–	–	–	–	–	19899–6	VERTICAL POSIT. SYSTEM & TUGGER (S.I.) 8 1/2" DIA DRILL COLLAR		151
–	1	–	–	–	–	19899–5	VERTICAL POSIT. SYSTEM & TUGGER (DOMESTIC) 8 1/2" DIA DRILL COLLAR		150
2	2	–	–	–	–	15905–1	GATE		149
2	2	2	2	2	2	15928–2	BODY	17	148
1	1	–	–	–	–	74102	PLATE, NAME		147
1	1	–	–	–	–	18060–3	JAW ASSY, PISTON LOWER		146
1	1	–	–	–	–	18060–2	JAW ASSY, PISTON UPPER		145
1	1	–	–	–	–	15129–1	JAW ASSY, GATE UPPER		144
1	1	–	–	–	–	15128–1	JAW ASSY, GATE UPPER		143
4	4	4	4	4	4	53002–08–S	PLUG, PIPE SQUARE HEAD		142
1	1	1	1	1	1	53001–12–14–S	PLUG, EXTERNAL PIPE – HEX HD		141
1	1	1	1	1	1	55903–20	CAP, DUST W/CHAIN		140
1	1	1	1	1	1	55903–16	CAP, DUST W/CHAIN		139
1	1	1	1	1	1	56547–12–S	LOCKNUT, BULKHEAD		138
1	1	1	1	1	1	55902–20	COUPLING, HALF W/MTG FLANGE		137
1	1	1	1	1	1	55902–16	COUPLING, HALF W/MTG FLANGE		136
1	1	1	1	1	1	56700–20–12–S	REDUCER, PIPE–EXT/INT		135
1	1	1	1	1	1	56700–16–12–S	REDUCER, PIPE–EXT/INT		134
1	1	1	1	1	1	56700–12–8–S	REDUCER, PIPE–EXT/INT		133
A/R	A/R	A/R	A/R	A/R	A/R	Z6001	LOCKWIRE		132
									131
1	1	1	1	1	1	56504–12–12–S	TEE, UNION 37°		130
1	1	1	1	1	1	56533–12–12–S	TEE–EXT PIPE 37°/37°		129
2	2	2	2	2	2	56533–8–8–S	TEE–EXT PIPE 37°/37°		128
1	1	1	1	1	1	56160–12–12–S	TEE, 37°/37° INT PIPE		127
									126
1	1	1	1	1	1	56704–8–12–S	ELBOW, 90° EXT PIPE/INT STR SWIVEL		125
1	1	1	1	1	1	56522–12–12–S	ELBOW, 90° BULKHEAD 37°/37°		124
2	2	2	2	2	2	56506–12–8–S	ELBOW, 90° EXT PIPE/37°		123
									122
									121
1	1	1	1	1	1	56502–12–12–S	CONNECTOR, EXT PIPE/37°		120
1	1	1	1	1	1	56502–12–8–S	CONNECTOR, EXT PIPE/37°		119
2	2	2	2	2	2	56502–8–8–S	CONNECTOR, EXT PIPE/37°		118
1	1	1	1	1	1	56502–4–4–S	CONNECTOR, EXT PIPE/37°		117
1	1	1	1	1	1	56501–12–12–S	CONNECTOR, EXT PIPE/37°		116
1	1	1	1	1	1	56501–8–12–S	CONNECTOR, EXT PIPE/37°		115
1	1	1	1	1	1	56501–8–8–S	CONNECTOR, EXT PIPE/37°		114
1	1	1	1	1	1	56501–4–6–S	CONNECTOR, EXT PIPE/37°		113
2	2	2	2	2	2	56501–4–4–S	CONNECTOR, EXT PIPE/37°		112
2	2	2	2	2	2	51300–448–B	O–RING		111
2	2	2	2	2	2	72219	SEAL, PISTON		110
2	2	2	2	2	2	51300–212–B	O–RING		109
									108
10	10	10	10	10	10	53201	FITTING, GREASE		107
\	\	\	\	\	\	113629	BEARING, 1 3/8 in NOMINAL PLAIN	17	106
4	4	4	4	4	4	51204–28–S	PIN, DOWEL		105
2	2	2	2	2	2	51403–16–S	PIN, COTTER		104
4	4	4	4	4	4	51212–16	PIN, DOWEL		103
\	\	\	\	\	\	113628	BEARING, 2 IN NOMINAL PLAIN	17	102
5	5	5	5	5	5	50203–C	NUT, HEX–STD		101
-12	-11	-10	-9	-8	-7	PART NO.	DESCRIPTION	MATERIAL	ITEM NO.
QTY. REQ'D.									
4	4	4	4	4	4	50810–N–C	WASHER, FLAT		100
4	4	4	4	4	4	50910–C	WASHER, LOCK–REG		99
									98
10	10	10	10	10	10	50912–C	WASHER, LOCK–REG		97
16	16	16	16	16	16	50908–C	WASHER, LOCK–REG		96
10	10	10	10	10	10	50906–C	WASHER, LOCK–REG		95
5	5	5	5	5	5	50903–C	WASHER, LOCK–REG		94
6	6	6	6	6	6	50902–C	WASHER, LOCK–REG		93
6	6	6	6	6	6	50006–8–C5	SCREW, CAP – HEX HD		92
5	5	5	5	5	5	54810–5–C	SCREW, MACHINE PAN HD		91
6	6	6	6	6	6	54808–4–C	SCREW, MACHINE PAN HD		90
12	12	12	12	12	12	53301–10–6	SCREW, DRIVE		89
8	8	8	8	8	8	50012–34–C5	SCREW, CAP – HEX HD		88
2	2	2	2	2	2	50016–14–C5	SCREW, CAP – HEX HD		87
4	4	4	4	4	4	50008–10–C5	SCREW, CAP – HEX HD		86
8	8	8	8	8	8	50008–8–C5	SCREW, CAP – HEX HD		85
4	4	4	4	4	4	50006–10–C5	SCREW, CAP – HEX HD		84
							(REMOVED)		83
							(REMOVED)		82
									81
–	–	1	1	1	1	18060–1	JAW ASSY, PISTON LOWER		80
1	1	1	1	1	1	14878	TUBE ASSY		79
2	2	2	2	2	2	56501–12–12–S	CONNECTOR, EXT PIPE/37°		78
1	1	1	1	1	1	53001–8–S	PLUG, EXT PIPE – HEX HD		77
1	1	1	1	1	1	71036	PLATE, INSTRUCTION		76
–	–	1	1	1	1	15128	JAW ASSY, GATE – UPPER		75
–	–	1	1	1	1	15129	JAW ASSY, GATE – LOWER		74
1	1	1	1	1	1	15209	PLATE, TORQUE ADJUSTMENT		73
2	2	2	2	2	2	72221	WIPER, ROD		72
2	2	2	2	2	2	11085	RING, CYLINDER HEAD		71
4	4	4	4	4	4	14079	BACK UP RING		70
2	2	2	2	2	2	72220	SEAL, ROD		69
2	2	2	2	2	2	15978	PIN, CLEVIS		68
1	1	1	1	1	1	12644	VALVE, DUMP		67
1	1	1	1	1	1	56162–8–8–S	TEE, PIPE EXT/INT/INT		66
4	4	4	4	4	4	15052	BOLT, DRILLED HD		65
4	4	4	4	4	4	15051	BOLT, DRILLED HD		64
1	1	1	1	1	1	19813	LOCK TAB		63
1	1	1	1	1	1	56501–8–8–S	CONNECTOR, EXT PIPE/37°		62
2	2	2	2	2	2	56501–4–4–S	CONNECTOR, EXT PIPE/37°		61
3	3	3	3	3	3	53300–526	TIE, CABLE (TY–RAP)	13	60
2	2	2	2	2	2	18066	SLEEVE		59
2	2	2	2	2	2	16532	KEY		58
1	1	1	1	1	1	56512–4–4–S	ELBOW, X–LONG 90° EXT PIPE/37°		57
4	4	4	4	4	4	50904–C	WASHER, LOCK REG		56
4	4	4	4	4	4	50204–C	NUT, HEX STD (UNC–2B)		55
4	4	4	4	4	4	50004–10–C5	SCREW, CAP HEX HD		54
1	1	1	1	1	1	7735	COUPLER		53
2	2	2	2	2	2	58892P230038	HOSE ASSY		52
1	1	1	1	1	1	16377	HOSE ASSY		51
-12	-11	-10	-9	-8	-7	PART NO.	DESCRIPTION	MATERIAL	ITEM NO.
QTY. REQ'D.									

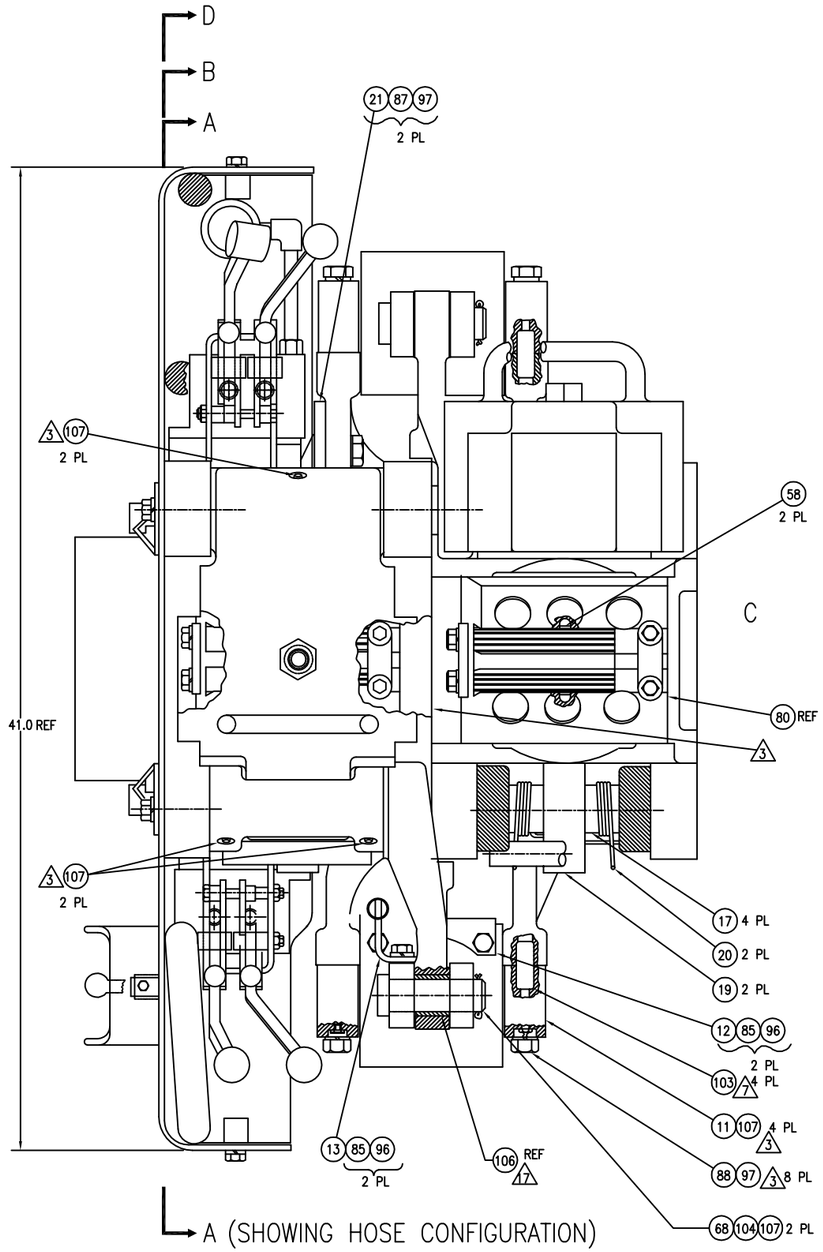
SIZE	DWG NO	REV
D	70630	T
SCALE –	WT LBS	SHEET 3 OF 8

DCF0022 (REV D)



(1) FOR -1 CONFIGURATION
(2) FOR -2 CONFIGURATION
(3) FOR -3 CONFIGURATION
(4) FOR -4 CONFIGURATION
(150) FOR -5 CONFIGURATION
(151) FOR -6 CONFIGURATION

-1 CONFIGURATION SHOWN
-2, -3, -4, -5 & -6 CONFIGURATIONS SAME EXCEPT AS NOTED



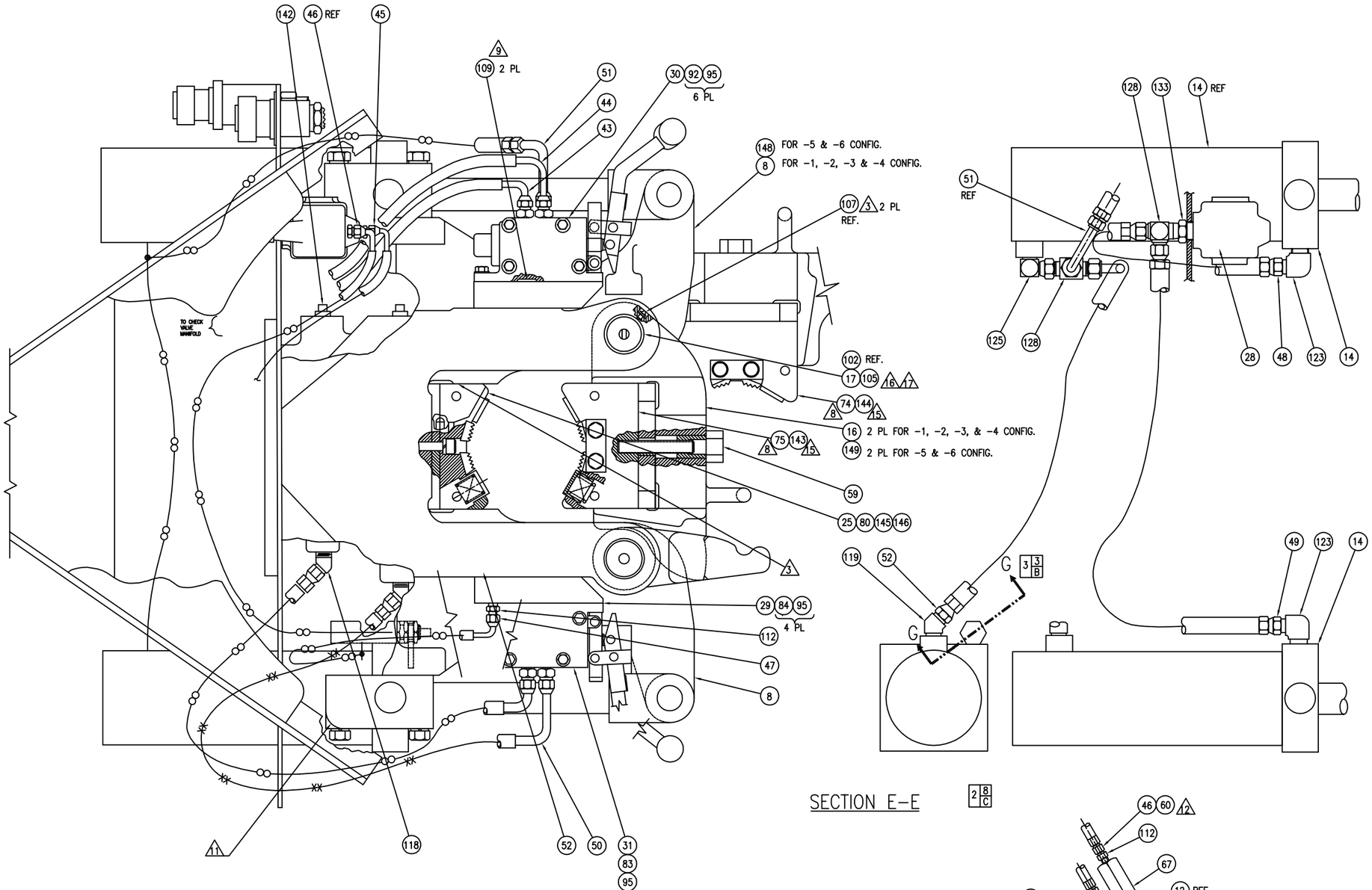
A (SHOWING HOSE CONFIGURATION)

B (SHOWING TUBE CONFIGURATION)

D (SHOWING TUGGER HOSE AND TUBING CONFIGURATION)

SIZE	DWG NO	REV
D	70630	T
SCALE –	WT LBS	SHEET 4 OF 8

DCF0022 (REV D)

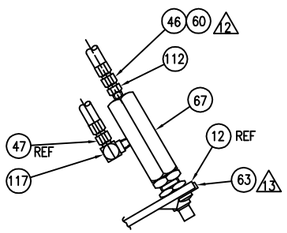


SECTION A-A

(SHOWING HOSE CONFIGURATION)

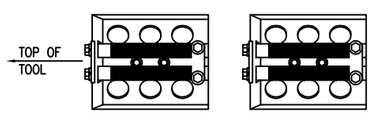
SECTION E-E

2 8 C



SECTION G-G

3 3 D

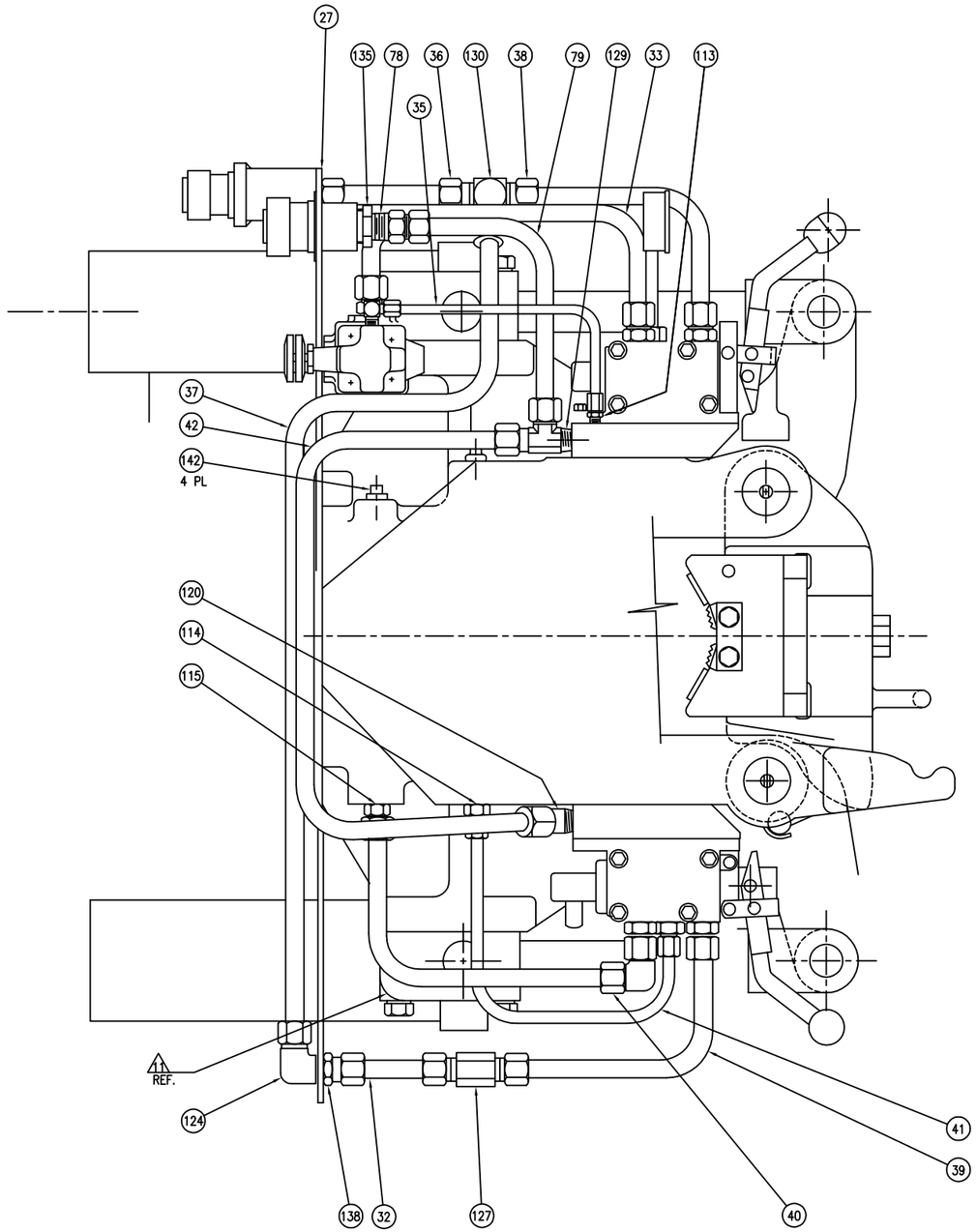


VIEW G-G

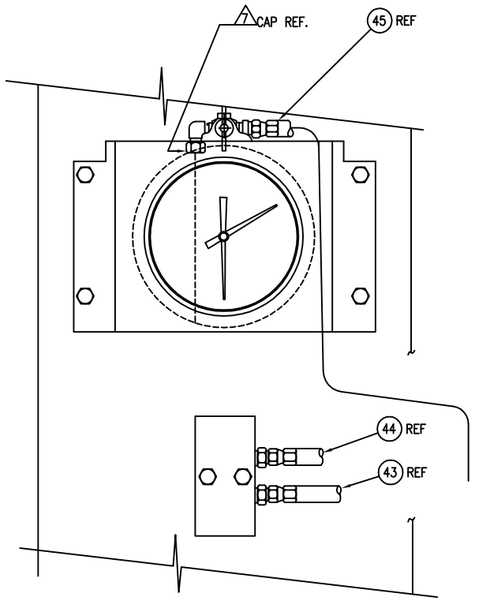
SCALE: NONE

SIZE	DWG NO	REV
D	70630	T
SCALE —	WT LBS	SHEET 5 OF 8

DCF0022 (REV D)



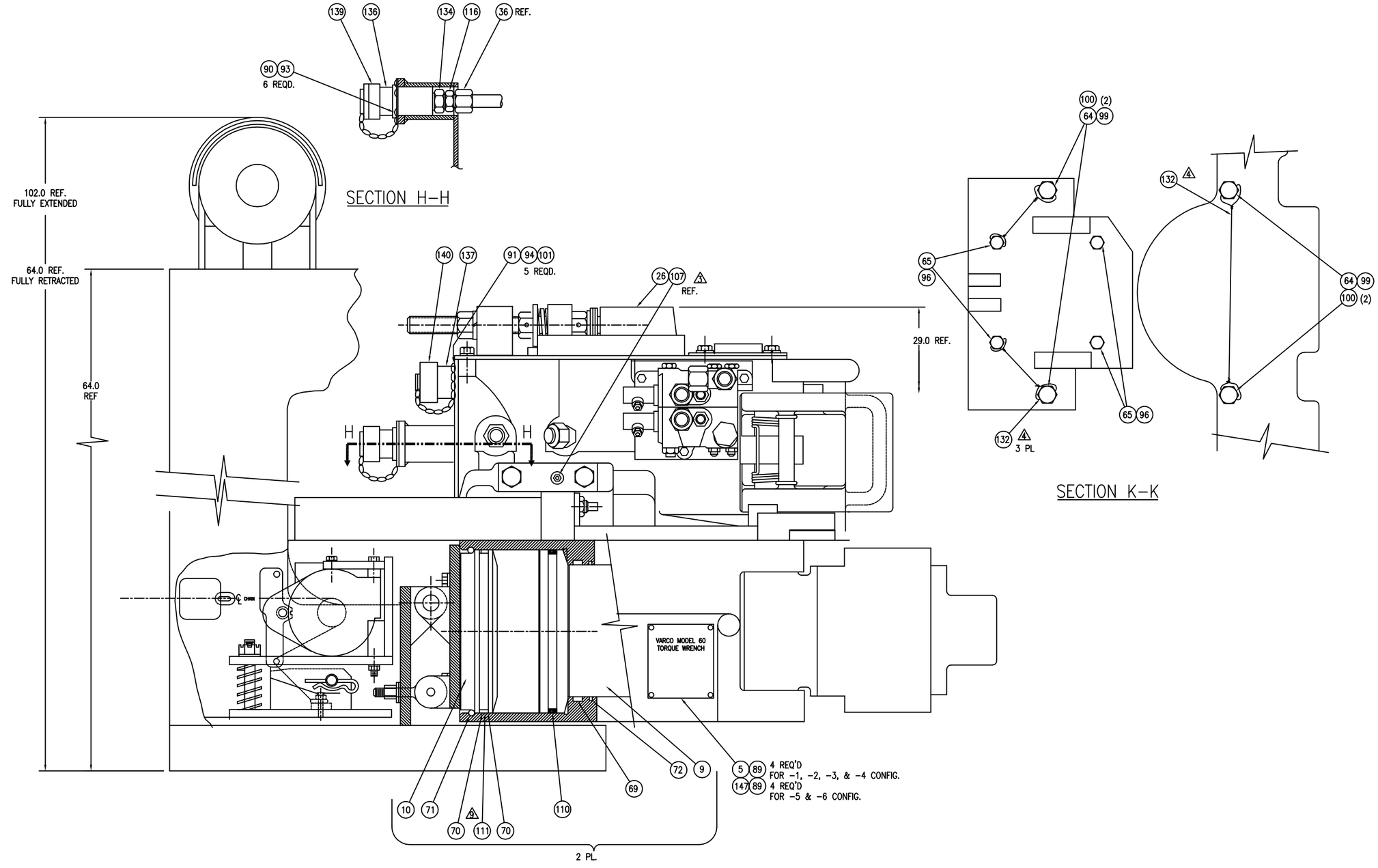
SECTION B–B
(SHOWING TUBE CONFIGURATION)



SECTION J–J
(ROTATED 90° CLOCKWISE)

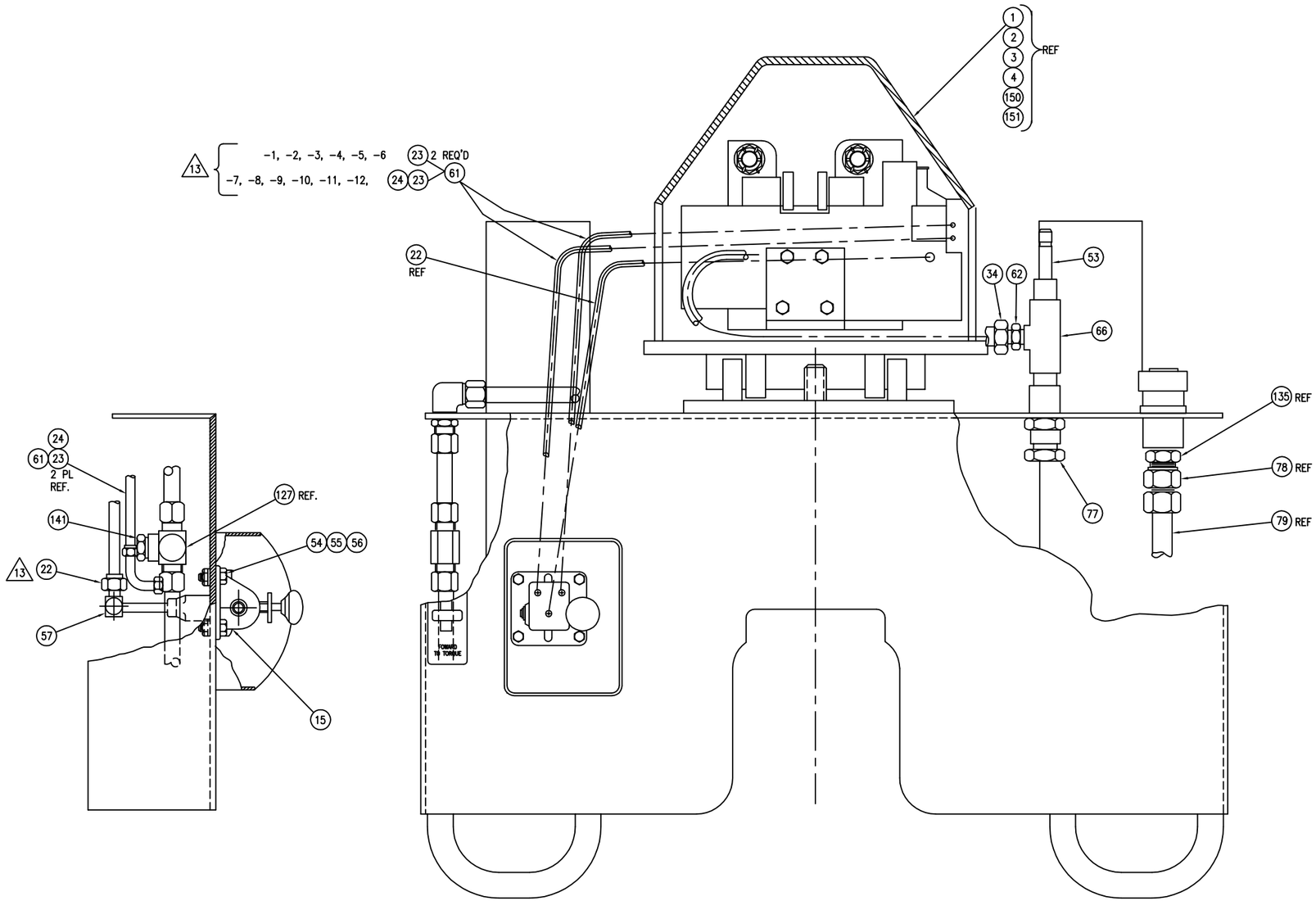
SIZE	DWG NO	REV
D	70630	T
SCALE —	WT LBS	SHEET 6 OF 8

DCF0022 (REV D)



SIZE	DWG NO	REV
D	70630	T
SCALE —	WT LBS	SHEET 7 OF 8

DCF0022 (REV D)



SECTION D–D ROTATED 90° CW
(TUGGER HOSE AND TUBING CONFIGURATION OTHER
DETAILS NOT SHOWN FOR CLARITY)

SIZE	DWG NO	REV
D	70630	T
SCALE –	WT LBS	SHEET 8 OF 8

DCF0022 (REV D)