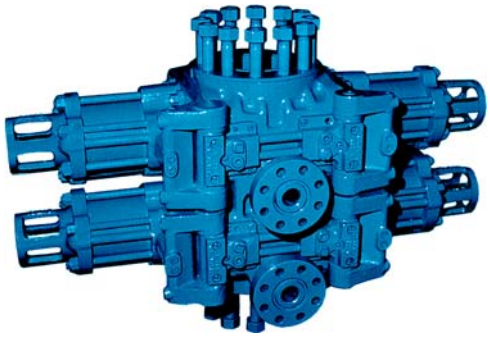

User's Manual

LWS Ram Blowout Preventer

Reference	Reference Description
Standard IOM	

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Change Description

Revision	Change Description
A	First issue

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Table of Contents

General Information

Conventions

This manual is intended for use by field engineering, installation, operation, and repair personnel. Every effort has been made to ensure the accuracy of the information contained herein. National Oilwell Varco (NOV), will not be held liable for errors in this material, or for consequences arising from misuse of this material.

Notes, Cautions, and Warnings

Notes, cautions, and warnings provide readers with additional information, and to advise the reader to take specific action to protect personnel from potential injury or lethal conditions. They may also inform the reader of actions necessary to prevent equipment damage. Please pay close attention to these advisories.

Note:

The note symbol indicates that additional information is provided about the current topic.

Caution:

The caution symbol indicates that potential damage to equipment, or injury to personnel exists. Follow instructions explicitly. Extreme care should be taken when performing operations or procedures preceded by this caution symbol.

Warning:

The warning symbol indicates a definite risk of equipment damage or danger to personnel. Failure to follow safe work procedures could result in serious or fatal injury to personnel, significant equipment damage, or extended rig down time.

Illustrations

Illustrations (figures) provide a graphical representation of equipment components or screen snapshots for use in identifying parts, or establishing nomenclature, and may or may not be drawn to scale.

For component information specific to your rig configuration, see the technical drawings included with your equipment documentation.

Safety Requirements

The National Oilwell Varco equipment is installed and operated in a controlled drilling rig environment involving hazardous situations. Proper maintenance is important for safe and reliable operation. Procedures outlined in the equipment manuals are the recommended methods of performing operations and maintenance.

To avoid injury to personnel or equipment damage, carefully observe requirements outlined in this section.

Personnel Training

All personnel performing installation, operations, repair, or maintenance procedures on the equipment, or those in the vicinity of the equipment, should be trained on rig safety, tool operation, and maintenance to ensure their safety.

Personnel should wear protective gear during installation, maintenance, and certain operations.

Contact the National Oilwell Varco training department for more information about equipment operation and maintenance training.

Recommended Tools

Service operations may require the use of tools designed specifically for the purpose described. The equipment manufacturer recommends that only those tools specified be used when stated. Ensure that personnel and equipment safety are not jeopardized when following service procedures and that personnel are not using tools that were not specifically recommended by Manufacturer.

General System Safety Practices

The equipment discussed in this manual may require or contain one or more utilities such as electrical, hydraulic, pneumatic, or cooling water.

Read and follow the guidelines below before installing equipment or performing maintenance to avoid endangering exposed persons or damaging equipment.

- Isolate energy sources before beginning work.
- Avoid performing maintenance or repairs while the equipment is in operation.
- Wear proper protective equipment during equipment installation, maintenance, or repair.

Replacing Components

- Verify that all components (such as cables, hoses, etc.) are tagged and labeled during assembly and disassembly of equipment to ensure correct installment.
- Replace failed or damaged components with original equipment manufacturer certified parts. Failure to do so could result in equipment damage or injury to personnel.

Routine Maintenance

Equipment must be maintained on a routine basis. See product-specific service manuals for maintenance recommendations.

Failure to conduct routine maintenance could result in equipment damage or injury to personnel.

Proper Use of Equipment

National Oilwell Varco equipment is designed for specific functions and applications, and should be used only for its intended purpose.

Introduction

General Description

The Shaffer manual lock Model LWS ram blowout preventer (LWS BOP) provides a rugged, reliable preventer that is easily serviced in the field. Special features include:

- Doors that simplify ram changes
- Door seals with special backing to prevent extrusion and pinching
- Standard internal H_2S trim
- Wear rings between the piston and cylinder to increase seal life and to virtually eliminate cylinder bore wear
- Polyurethane lip-type piston seals with lifetime lubrication
- Lip-type ram shaft seals to hold the wellbore pressure and the opening hydraulic pressure
- Secondary ram shaft seals to permit injection of plastic packing if the primary lip-type seal ever fails
- Some sizes provide booster cylinder capability for shearing pipe

The manual lock LWS BOP is available in single and double models. Contact Shaffer Sales for special configurations. This manual provides the installation, operation, and maintenance procedures for standard manual lock LWS BOP models.

Shaffer supplies manual lock LWS BOPs in the sizes shown in the table titled "LWS BOP Available Sizes and Working Pressures" below.

LWS BOP Available Sizes and Working Pressures

Working Pressure	Size
10,000 psi (690 bar)	4 1/16" (103.19 mm)
5,000 psi (345 bar)	11" (279.40 mm)
	9" (228.60 mm)
	7 1/16" (179.39 mm)
	4 1/16" (103.19 mm)
3,000 psi (207 bar)	20 ¾" (527.05 mm)
	11" (279.40 mm)
	9" (228.60 mm)
2,000 psi (138 bar)	21 ¼" (539.75 mm)

These BOPs are designed for drilling and workover service. They are hydraulically operated and can be manually locked by turning handwheels. The standard trim unit is

suitable for internal H_2S environments. Units can be manufactured for Arctic (to -75 ºF or -59 ºC) and full H_2S environmental services. Standard units can be retrofitted for full environmental H_2S service. Shaffer preventers are manufactured in accordance with the American Petroleum Institute (API) specification 6A (current edition) and the National Association of Corrosion Engineers (NACE) document NACE Standard MR 01 75". Shaffer preventers can also be manufactured in accordance with the API specification 16A.

Hydraulic pressure of 1,500 psi (103 bar) will close any model LWS ram BOP with its rated wellbore pressure of 10,000 psi (690 bar) or less.

The specifications and dimensions given are for manual lock LWS BOPs.

Safety Precautions

Exposure to the daily hazards of drilling can lead rig crews and service personnel to disregard or overlook hidden hazards. The safety precautions listed below should be observed at all times.

Equipment Repairs or Adjustments

Turn off the system power and bleed all pressure prior to making any repairs or adjustments that do not require system power.

Hydraulic Lines

Hydraulic lines carrying fluids at high pressures can inflict potentially fatal injuries if the pressure escapes. Protect hydraulic lines from cutting, scraping, pinching, or other physical damage. Always wear hard hats and safety glasses when working around hydraulic lines. Bleed the pressure from any hydraulic line prior to disconnecting any fittings. Respect the prescribed ASME code minimum bend radius for hydraulic lines. Bending around too short a radius can rupture the line.

Welding and Cutting

Do not weld or operate acetylene-cutting torches near unprotected electrical cable, flexible hose, or hose bundles. Weld spatter can seriously damage the hose or cable. Ensure no slag or spatter enters the hydraulic system.

Replacement Parts

Many of the BOP components, though apparently similar to commercial hardware, are manufactured to system design specifications. To avoid possible hazardous failures, use only exact replacement parts or assemblies (see the section titled "Specifications and Parts Lists" on page 5-1).

Installation and Operation

Inspection

The inspection process includes the activities listed below.

- Thoroughly clean the LWS manual lock blowout preventer (BOP) before installation. Refer to the table titled "LWS Ram BOP Cleaning and Lubricating Instructions" on page 4-39
- Clean and inspect the sealing surface of the ring groove for minor pits and scratches. Remove these with emery cloth. If there is excessive damage, call a Shaffer service representative.
- Clean and inspect studs and nuts. Replace any that are damaged.
- Ensure the correct size rams are in each cavity. The part number is stamped into the block of each ram.
- Thoroughly clean and oil the inside of the LWS BOP.

Condition of BOP is Unknown

If the condition of the BOP is unknown, e.g., stored for some length of time, has not been maintained on a scheduled maintenance program, etc., perform a three-month maintenance check as described in the section titled "Three-Month Preventive Maintenance" on page 4-4. A three-month maintenance check includes:

- Visually inspecting and thoroughly greasing the inside of the BOP
- Performing a field wellbore pressure test as described in the section titled "Field Wellbore Pressure Test" on page 4-7
- Performing an hydraulic pressure test as described in the section titled "Hydraulic Pressure Test" on page 4-9
- Operating the manual locks as described in the section titled "Manual Locking" on page 3-14

BOP Maintained on a Scheduled Maintenance Program

If the BOP has been properly maintained (scheduled maintenance program), a monthly maintenance check (the section titled "Monthly Preventive Maintenance" on page 4-4) is all that is required. A monthly maintenance check includes:

- Performing a field wellbore pressure test per the section titled "Field Wellbore Pressure Test" on page 4-7
- Checking for external hydraulic leaks while pressure testing

Cleaning, inspection and testing of the LWS BOP immediately after completion of drilling operations reduces installation time on the next well (see the section titled "Cleaning and Storage of the LWS BOP" on page 4-35).

Installation Instructions

Install BOP Right-Side-Up

1. Some models have 'Top' or 'This Side Up' cast into the BOP housing.
2. Some models have lifting lugs above the mud flange outlets (see Figure 3-1).

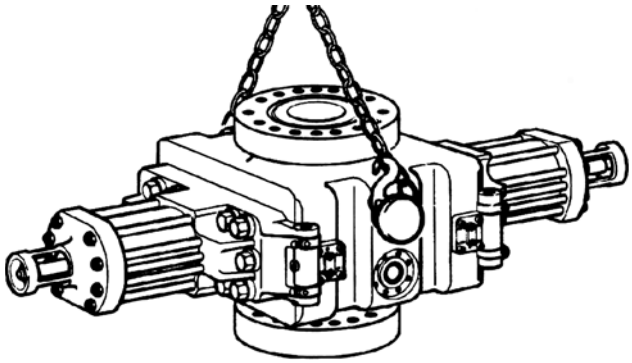

Figure 3-1. Lifting LWS BOP

3. On all models and on models without stampings or lugs:
   - Externally, the side outlets for the choke and kill lines are below the rams
   - Internally, the skids in the ram compartments are below the rams, and ram sealing seats are located in the top of the ram cavity

If the BOP is installed upside-down, it will not contain wellbore pressure.

Lift the LWS Manual Lock BOP

1. On models with lifting lugs cast into the body, the BOP is lifted by wrapping a chain or cable of sufficient strength around the lug (see Figure 3-1).
2. On models without lifting lugs, place a strap or chain around the door flat as close to the body as possible. Lift the BOP by attaching this chain to the lifting cable or chain.

Do not lift the BOP by the cylinders. This will damage the cylinders, piston assembly and/or the ram shaft and prevent the BOP from working correctly.

See Table 4-1 for the weight of the BOP. Use a chain or cable capable of lifting the weight given.

Flanged and Studded Connections

(see Figure 3-2)

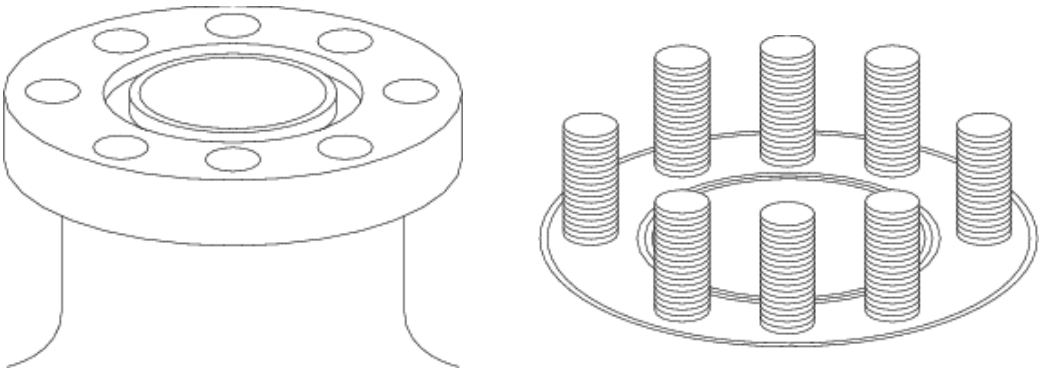

Figure 3-2. End Connections

1. Install the ring gasket dry. See the table titled "API Ring Gaskets" on page 5-34, for the proper part number.
2. Install the BOP on the mating flange.
3. Lubricate the stud threads and nut faces with grease specified in API BUL 5A2: Thread Compounds.
4. Install the studs and/or nuts. See the table titled "API Nuts" on page 5-32 and the table titled "Tap End Studs for API Flanges" on page 5-33 for the proper part number.

Use extreme care during the removal and installation of studs and nuts. Inspect the threads of the studs and the stud hole for damage such as deformation, stripping or burns. Do not over torque studs when installing in studded flange.

Use specified lubricants.

Do not use loctite or similar compounds.

5. Tighten all nuts uniformly in a diametrically staggered pattern as shown in Figure 3-3. See the table titled "Recommended Flange Bolt Torque" on page 3-5 for proper torque specifications.

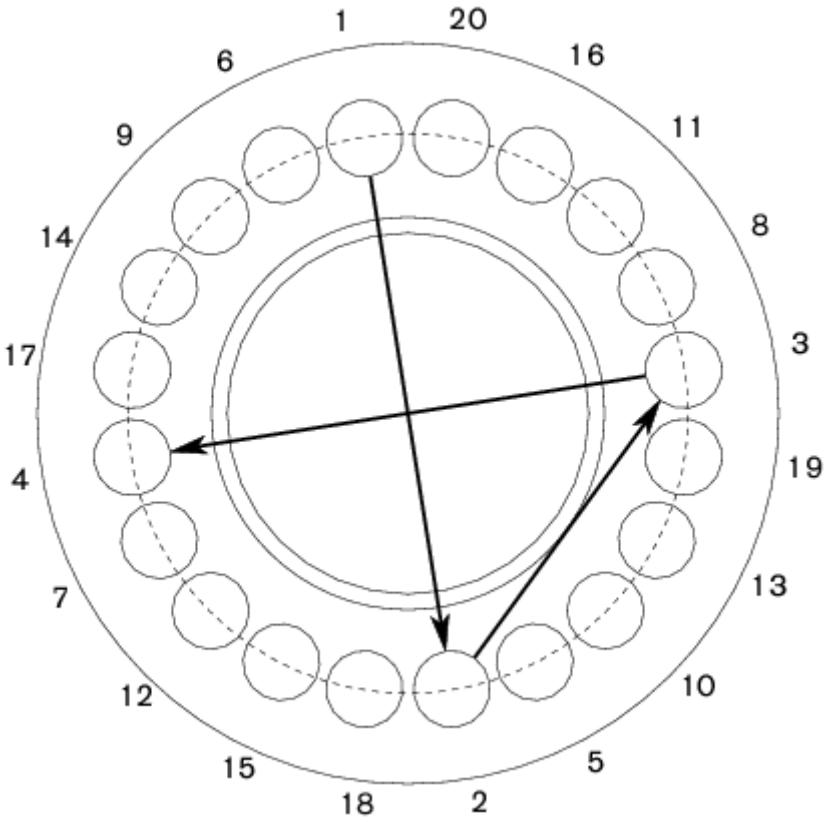

Figure 3-3. Flange Bolting Sequence

Recommended Flange Bolt Torque

Bolt Size	Torque*	
	ft-lb	N-m
¾"-10 UNC	200	271.2
7/8"-9 UNC	325	440.6
1"-8 UNC	475	644.0
1 1/8"-8 UNC	600	813.5
1 ¼"-8 UNC	900	1,220.2
1 3/8"-8 UNC	1,200	1,627.0
1 ½"-8 UNC	1,400	1,898.2
1 5/8"-8 UNC	1,700	2,304.9
1 ¾"-8 UNC	2,040	2,765.9
1 7/8"-8 UNC	3,220	4,365.7
2"-8 UNC	3,850	5,219.9
2 ¼"-8 UNC	5,250	7,130.0
2 ½"-8 UNC	7,250	9,860.0

** Torque values are satisfactory for both standard and H_2S studs. Reference API specification 6A. This table shows torque values arrived at by using new commercial stud bolts and nuts, well-lubricated threads, and nut faces with API thread compound (API Bul. 5A2: Thread Compounds). This produces a stress of 52,500 psi (362.0 MPa) in the bolting.*

Connect the Side Flanges

Connect the side flanges as in step 3 on page 3-3.

Hub Connections

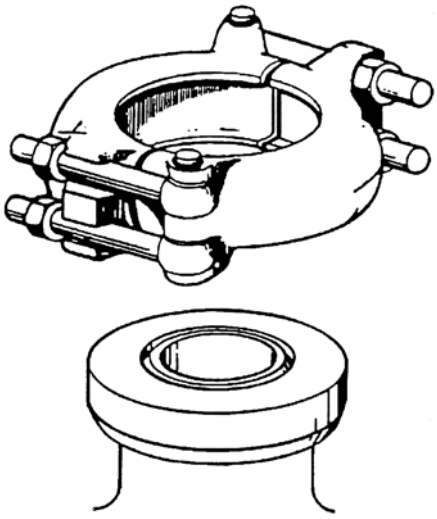

Figure 3-4. Hub Connections

1. Install the ring gasket dry. See table titled: LWS Recommended Bolt Torque for API Clamp Connectors or table titled: Recommended Bolt Torque* for Non-Standard Clamp Connectors for the correct gasket.
2. Install the BOP on the mating hub.
3. Clean and lubricate the raised surface of the hub, the internal surfaces of the hub clamp, the stud threads, and the nut faces with the grease specified in API BUL 5A2: Thread Compounds.
4. When assembling the clamp joint, tighten the studs alternately from one side to the other.
5. Maintain the same distance between the two clamp halves.
   - The the table titled "LWS Recommended Bolt Torque for API Clamp Connectors" on page 3-7 lists standard API clamp sizes for LWS manual lock BOP with stud size, wrench size (across the nut flats), and recommended torques.
   - The the table titled "Recommended Bolt Torque* for Non-Standard Clamp Connectors" on page 3-7 lists non-standard clamp sizes for LWS manual lock BOP with stud size, wrench size (across the nut flats), and recommended torques.

LWS Recommended Bolt Torque for API Clamp Connectors

Working Pressure	Hub Size	Clamp Number	Bolt Size	Make-Up Torque* ft-lb	Ring Gasket	Wrench Size
10,000 psi	4 1/16"	6	1 1/8"-8 UN	400-600	BX 155	11 3/16"
5,000 psi	11"	10	1 7/8"-8 UN	1,800-3,220	BX 158	21 5/16"
	9"	8	1 ½"-8 UN	920-1,690	BX 157	2 3/8"
	7 1/16"	8	1 ½"-8 UN	920-1,690	BX 156	2 3/8"
	4 1/16"	5	1"- 8 UN	270-480	BX 155	1 3/8"
3,000 psi	11"	9	1 3/8"-8 UN	700-1,200	RX 53	2 3/16"
2,000 psi	21 ¼"	18	2 ¼"-8 UN	3,200-5,000	RX 73	3 ½"

** Torques calculated to produce stress of 40,000 psi (276 MPa) in bolt when thread and nut bearing surfaces are well-lubricated with API 5A2 thread compound. Use of other compounds without proper change in torque can result in: (1) overstressing clamp and bolt; or (2) insufficient preload on connection. (API Specification 6A, Table 2.7A).*

Recommended Bolt Torque* for Non-Standard Clamp Connectors

Working Pressure	Hub Size	Clamp Number	Bolt Size	Make-Up Torque* ft-lb	Ring Gasket	Wrench Size
10,000 psi	4 1/16"	6	1 1/8"- 8 UN	400-600	RX 35	11 3/16"
5,000 psi	11"	10	7/8"- 8 UN	1,800-3,220	RX 53	21 5/16"
	9"	8	1 ½"- 8 UN	920-1,690	RX 49	2 3/8"
	7 1/16"	7	1 ½"- 8 UN	920-1,690	RX 45	2 3/8"
	4 1/16"	5	1"- 8 UN	270-480	RX 35	1 5/8"
3,000 psi	20 ¾"	17	2 ¼"- 8 UN	3,200-5,000	RX 73	3 ½"
	20 ¾"	18	2 ¼"- 8 UN	3,200-5,000	RX 73	3 ½"
	11"	9	1 3/8"- 8 UN	700-1,200	RX 53	2 3/16"
2,000 psi	21 ¼"	16	1 5/8"- 8 UN	1,200-1,850	RX 73	2 9/16"

** Torques calculated to produce stress of 40,000 psi (276 MPa) in bolt when thread and nut bearing surfaces are well-lubricated with API 5A2 thread compound. Use of other compounds without proper change in torque can result in: (1) overstressing clamp and bolt; or (2) insufficient preload on connection. (API Specification 6A, Table 2.7A).*

Connect the Hydraulic Lines from the BOP Closing Unit

Connect the hydraulic lines from the BOP closing unit to the 'Open' and 'Close' ports of the BOP. Make sure all connections are clean and tight. Each set of rams requires one opening and one closing line (see Figure 3-5).

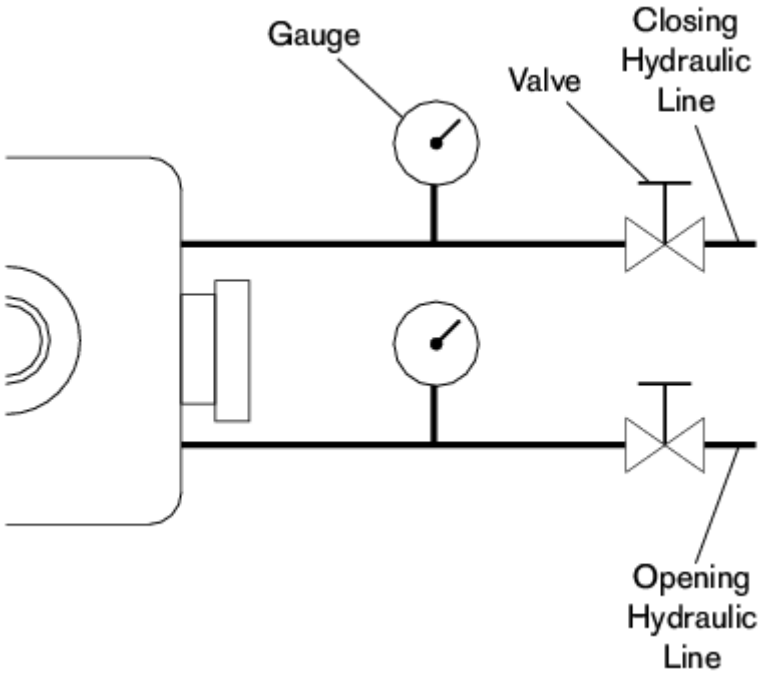

Figure 3-5. Recommended Hydraulic Line Hookup

Two opening and two closing hydraulic ports are clearly marked on the back (hinge) side of the BOP (see Figure 3-7). The extra hydraulic ports are provided to facilitate hydraulic hookup and only one opening port and one closing port is to be used.

A gauge and valve should be included in the opening and closing hydraulic lines to the BOP. This will facilitate testing procedures (see Figure 3-5).

Handwheel

A universal joint and handwheel are furnished for each locking shaft. Handwheel extensions are cut from standard weight 2" (50.80 mm) pipe furnished by the customer.

Fabricate a handwheel extension for each locking shaft. Attach a handwheel to one end of each extension. Attach a universal joint to the other end of each handwheel extension (see Figure 3-6).

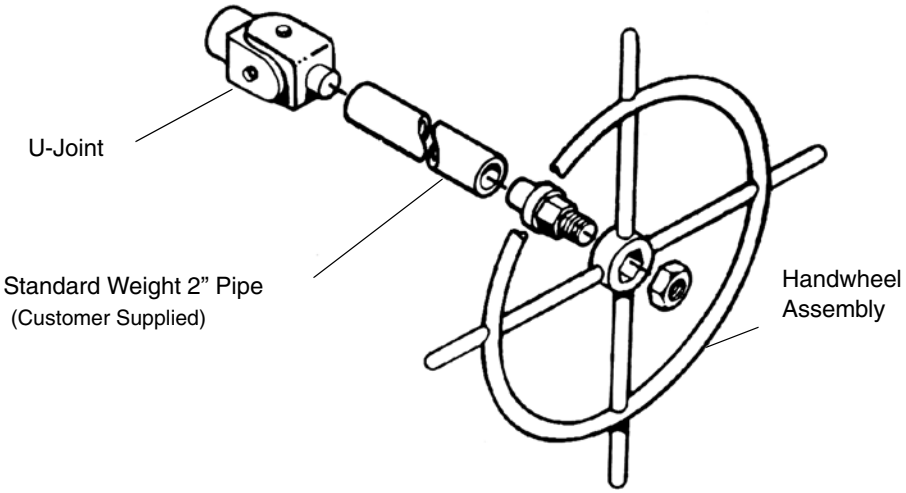

Figure 3-6. Manual Lock Handwheel Assembly

Handwheel extensions can be tack-welded or pinned to the universal joints and handwheels.

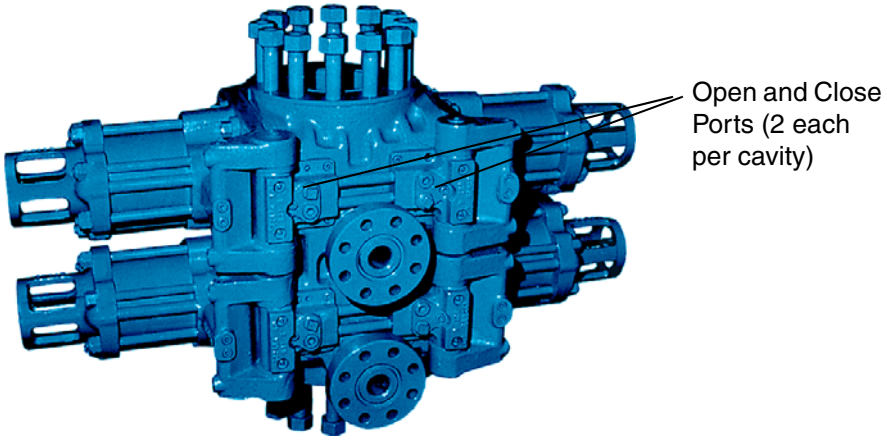

Figure 3-7. Open and Close Hydraulic Ports

Perform a Field Wellbore Pressure Test

See the section titled "Field Wellbore Pressure Test" on page 4-7.

Operation

Hydraulic Operation

The rams can be hydraulically closed and manually locked.

Operating Pressure

Under normal operating conditions, 1,500 psi (103 bar) hydraulic pressure is recommended. This operating pressure will close any model LWS BOP with its rated wellbore pressure, except the 11" (279.40 mm) and 13 5/8" (346.08 mm) 15,000 psi (1,034 bar) models. Both the 11" (279.40 mm) and 13 5/8" (346.08 mm) 15,000 psi (1,034 bar) models are operated at 1,500 psi (103 bar) with wellbore pressure of 10,000 psi (690 bar) or less. For wellbore pressure greater than 10,000 psi (690 bar), the regulator must be bypassed to apply full accumulator pressure (up to 3,000 psi 207 bar). Regulated pressure up to 2,500 psi (172 bar) can be used. At a working pressure of 15,000 psi (1,034 bar), a minimum of 2,200 psi (152 bar) closing pressure is necessary. Normal hydraulic operating pressure may be increased to 3,000 psi (207 bar) on any LWS BOP if desired.

The table titled: LWS Fluid Volume Requirements provides closing ratio and gallons to open and close.

LWS Fluid Volume Requirements

Working Pressure	Bore Size	Piston Size	Closing Ratio	Gallons to Open	Gallons to Close
10,000 psi	4 1/16"	6"	8.45	0.52	0.59
5,000 psi	11"	14"	16.00	8.9	9.5
	11"	8 ½"	5.57	2.62	2.98
	9"	8 ½"	5.57	2.27	2.58
	7 1/16"	6 ½"	5.45	1.18	1.45
	4 1/16"	6"	8.45	0.52	0.59
3,000 psi	20 ¾"	15 ¼" x 15 ¼"	10.5	35.20	35.55
	20 ¾"	15 ¼"	10.5	17.52	17.87
	20 ¾"	14"	16.00	13.59	14.50
	20 ¾"	10"	8.16	6.86	7.80
	20 ¾"	8 ½"	5.57	4.46	5.07
	11"	6 ½"	5.45	1.45	1.74
	9"	8 ½"	5.57	2.27	2.58
2,000 psi	21 ¼"	15 ¼" x 15 ¼"	10.5	35.20	35.55
	21 ¼"	15 ¼"	10.5	17.52	17.87
	21 ¼"	14"	16.00	13.59	14.50
	21 ¼"	10"	8.16	6.86	7.80
	21 ¼"	8 ½"	5.57	4.46	5.07

Hydraulic Fluid

Hydraulic fluid under pressure drives the pistons, which open and close the rams. Hydraulic fluid should have the following characteristics:

- Non-freezing in cold climates
- Lubricity to reduce wear
- Chemical compatibility with the elastomer seals
- Corrosion inhibitors for metal surfaces

Recommended Hydraulic Fluid

The recommended hydraulic fluid is listed in the order of preference:

1. Hydraulic oil with viscosity between 200 and 300 SSU at 100 ºF (38 ºC). In the LWS closed hydraulic system, there is no waste of oil and fluid costs are negligible.
2. Where pollution due to accidental spillage of hydraulic fluid is a problem, use a water soluble oil or premix control fluid.

To prevent freezing at lower temperatures, ethylene glycol without any additives is recommended. Do not use commercial antifreeze mixes.

Emergency Fluid Recommendations

In an emergency where hydraulic fluid is lost, and the BOP must be operated, the fluids listed below can be substituted.

1. When using hydraulic oil:
   - Add motor oil (SAE 10W is recommended but heavier oils can be used)
   - Add water if motor oil is not available, but after the emergency, the hydraulic system must be flushed and refilled with hydraulic oil
2. When using a water soluble mixture or premix fluid, add more water.

After the emergency, replace the fluid in the system with the proper mixture.

(See caution on next page.)

Do not use diesel fuel or kerosene as these fluids will cause the rubber goods to swell and deteriorate.

Do not use drilling mud as the grit in this fluid will cause the pistons and cylinders to wear and gall rapidly.

Closing and Opening the Rams

Closing Rams

Apply 1,500 psi (103 bar) closing hydraulic pressure (see the section titled "Manual Locking" on page 3-14). Verify that the rams close by observing the inward movement of the handwheels, locking shaft or ram shaft (see Figure 3-8 and Figure 3-9).

Opening Rams

Apply 1,500 psi (103 bar) opening hydraulic pressure. Verify that the rams open by observing the outward movement of the handwheels, locking shaft or ram shaft (see Figure 3-8 and Figure 3-9).

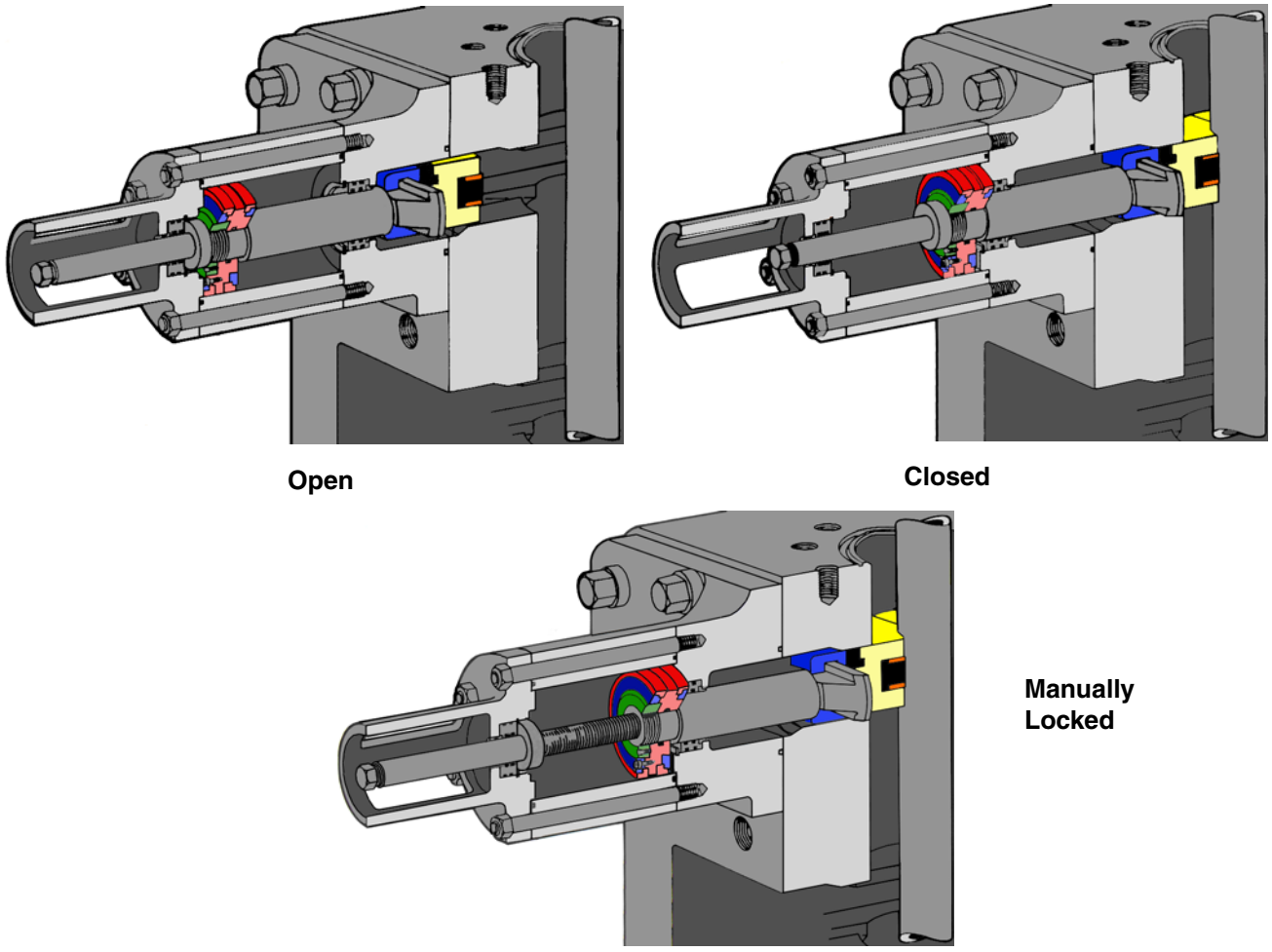

Figure 3-8. Standard LWS Cylinder Operation

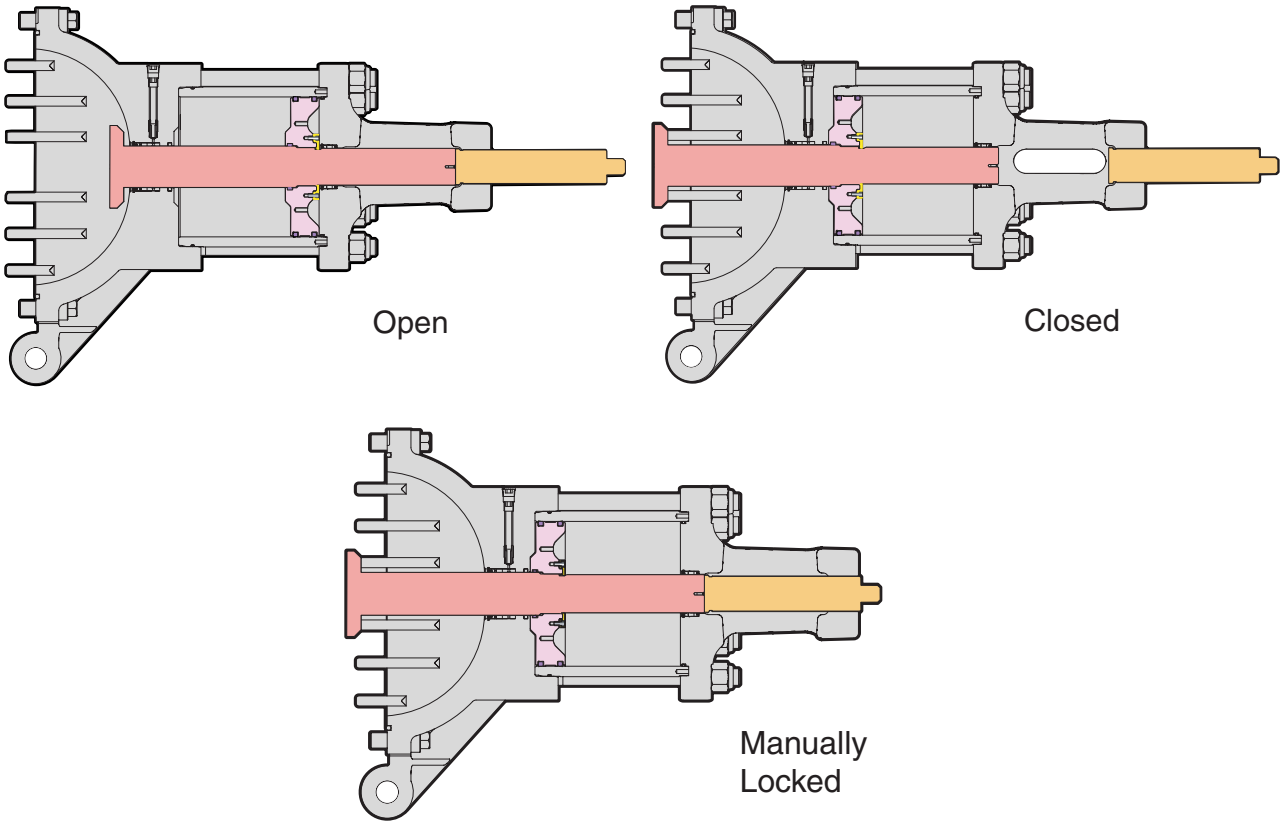

Figure 3-9. 15.25 inch LWS Cylinder Operation

Before opening the rams, turn both handwheels counter-clockwise to ensure that the rams are unlocked. If the rams are partly locked, the locking shaft threads may be damaged when the rams are hydraulically opened.

Manual Locking

1. Apply 1,500 psi (103 bar) closing hydraulic pressure.
2. Rotate each locking shaft clockwise until it locks; each locking shaft will move outward until it stops against the cylinder head.
3. Do not overtighten to avoid shaft damage.
4. Control system pressure may now be removed.

Do not over tighten. If over tightened, the locking shaft can be damaged.

Unlocking Operation

1. Apply 1,500 psi (103 bar) hydraulic closing pressure.
2. Rotate the locking shaft counterclockwise until it stops.
3. Rotate $^{1}/_{8}$ of a turn clockwise to prevent temperature changes from jamming the locking shaft in the unlocked position.

Do not apply opening hydraulic pressure while the BOP is manually locked. This may damage the locking shaft threads.

4. See the section titled "Opening Rams" on page 3-12.

Maintenance

Maintenance Schedule

The purpose of this maintenance schedule is to detect wear in an Shaffer manual lock Model LWS BOP so that it can be repaired before a failure occurs in a drilling emergency. The inspection sequence avoids repetition of work so that minimum time is required for a thorough maintenance program.

Additional information is available in the following publications:

- API Spec. 6A, 16A
- API RP53
- Shaffer General Catalog

When to Call for Service

Repairs are performed by either the rig crew or a Shaffer service representative. This section describes the repairs normally performed by the rig crew and provides guidelines to determine when a service representative should be called.

The rig crew normally performs the following:

- Changing rams to different pipe sizes
- Running wellbore pressure tests and hydraulic pressure tests
- Replacing worn ram rubbers and door seals
- Chasing damaged threaded holes on preventer body
- Buffing out minor scratches on the ram sealing seat and door sealing area of the body

A Shaffer service representative will normally be called to make any repairs, which require the hydraulic system to be opened, including the following:

- Re-packing the ram shaft
- Replacing piston seals
- Replacing cylinder seals
- Replacing manifold pipe seals
- Replacing hinge seals
- Re-packing the locking shaft
- Run yearly inspections to determine if the BOP needs to be sent to a repair facility for major rework

The annual inspection includes wellbore pressure tests, hydraulic pressure tests, inspection and measurement of the ram cavities.

Maintenance Schedule, Manual Lock Ram BOP[1]

	Performed		
Interval[2]	**At**	**By**	**Summary**
Daily	Rig	Rig Personnel	Operate all rams. Look for external hydraulic leaks (see "Daily Maintenance).
Monthly	Rig	Rig Personnel	Do not open doors. Run a field wellbore pressure test. Look for external hydraulic leaks (see the section titled "Monthly Preventive Maintenance" on page 4-4).
Three Months	Rig	Rig Personnel	Open doors and inspect visually. Run a field wellbore pressure test and an internal hydraulic pressure test. Operate manual locks (see the section titled "Three-Month Preventive Maintenance" on page 4-4).
Yearly[3]	Rig	Shaffer Service Representative	Open doors. Measure rams and ram cavity. Do field repairs as needed. Run a field wellbore pressure test and an internal hydraulic pressure test. Operate manual locks (see the section titled "Yearly Preventive Maintenance" on page 4-6).
Three Years[4]	Service/ Repair Facility	Shaffer Service Personnel	Completely disassemble. Repair or replace all parts as required. Replace all seals. Run a field wellbore pressure test and an internal hydraulic pressure test. Operate manual locks (see the section titled "Three-Year Maintenance" on page 4-6).

1. *Specific data is required for ordering parts. See the section titled "LWS BOP Data Location" on page 4-36 for location and explanation of BOP data (serial number, heat treat lot number, etc.)*
2. *These intervals are typical and serve as convenient designations to separate the simpler from the more complex inspections.*
3. *Some operators use the yearly maintenance inspection as a rig acceptance test.*
4. *Three-year maintenance will be performed only after a yearly inspection indicates the need for it.*

Daily Maintenance

The steps described below should be performed daily.

1. All rams should be functioned to verify that they operate properly. If possible, watch the rams move by using a mirror to obtain a reflected image of the rams. If this is not possible, observe the movement of the handwheels or locking shafts.

Pipe rams should be closed on pipe. Blind rams should be closed and opened when the pipe is out of the hole.

2. Check the locking shaft seal areas, cylinder head o-ring areas, manifold pipe seals, door seal areas, weep holes, hinges, hydraulic connections, and the socket head pipe plug for possible leakage of hydraulic fluids (see Figure 4-1).

To observe if the ram shaft packings are leaking, the weep hole plugs must be removed on each door.

3. Check areas for possible leakage of well fluid and/or hydraulic fluid (see Figure 4-1).

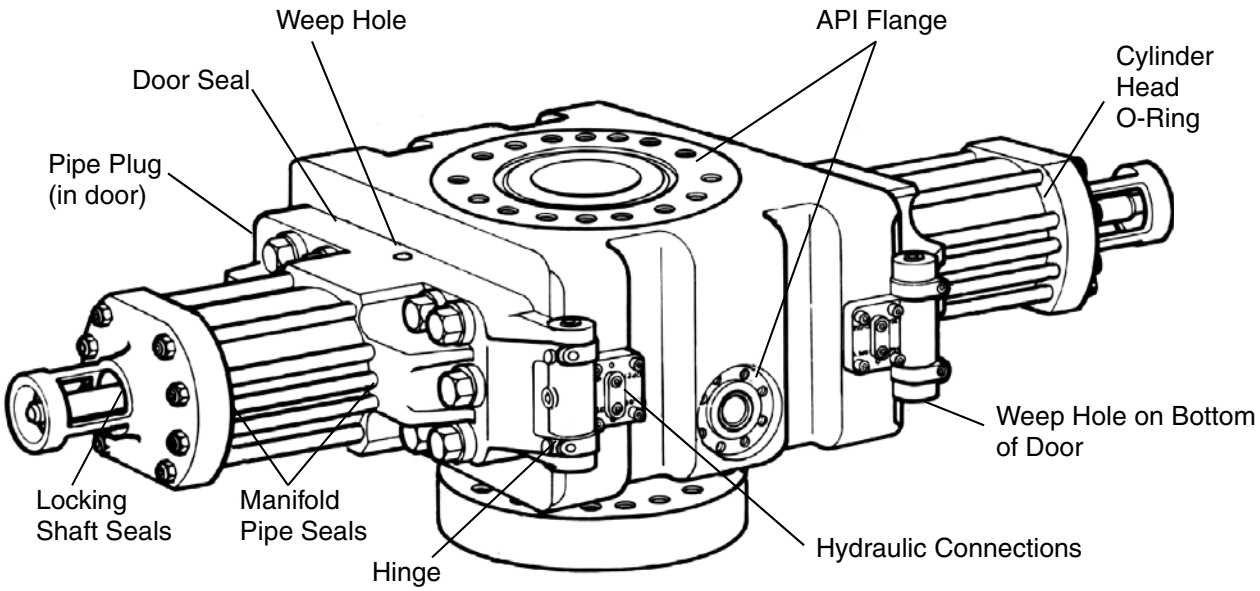

Figure 4-1. Possible Leak Areas

Monthly Preventive Maintenance

Run this test series before starting a new well and at least monthly while drilling.

Do not open the BOP doors.

1. Ensure all door cap screws are properly torqued.
2. Run a field wellbore pressure test as described in the section titled "Field Wellbore Pressure Test" on page 4-7.
3. While running the field wellbore pressure test, look for external hydraulic leaks (see Figure 4-1).
4. Check the universal joints to ensure that they are tight on the locking shaft and grease if equipped with alamite fittings.
5. Grease the hinges.

Three-Month Preventive Maintenance

1. Before opening the doors, run a field wellbore pressure test as described in the section titled "Field Wellbore Pressure Test" on page 4-7 and a hydraulic pressure test as described in the section titled "Hydraulic Pressure Test" on page 4-9. This information will be very helpful in the following inspections. Also, a Shaffer service representative can be called at this time if hydraulic system repairs are required.
2. While the rams are closed, turn the handwheels approximately two turns clockwise and then turn them back to the fully unlocked position. This will verify that the manual locks function satisfactorily.
3. Disconnect the universal joints from the locking shafts.
4. Open the rams with 1,500 psi (103 bar).
5. Bleed all hydraulic pressure.
6. Open the doors and remove the rams (see the section titled "Ram Assembly Removal and Inspection Procedures" on page 4-12).
7. Clean and inspect rams (see the section titled "Ram Assembly Removal and Inspection Procedures" on page 4-12).
8. Wash out the inside of the BOP so that it can be inspected.
9. If any door cap screw was excessively hard to remove, chase the thread in the body with a tap. Replace any cap screw, which has damaged threads.
10. Remove minor pits and scratches from the seat sealing surface with emery cloth.
11. Smooth any deep gouges and scratches on the skids and side pads. These are not sealing surfaces so remove only enough material to allow the rams to slide smoothly over them.
12. Check the bore for accidental damage. Smooth as required. Occasionally the drill pipe will rotate against the bore and cause excessive wear. Measure the maximum bore diameter and estimate the maximum wear on any side. If any radius is more than $^{1}/_{8}$" (3.18 mm) oversize, send the BOP to a Shaffer repair facility for a complete rework.
13. Check the door sealing area on the BOP body for pits and scratches. Remove pits and scratches with emery cloth.
14. Inspect the shafts using the following steps:
    a. Apply reduced closing hydraulic pressure to fully extend both ram shafts for inspection.

b. Visually check the OD of each ram shaft for pits and scratches. The ram shafts should be replaced by a Shaffer service representative if pits or scratches are visible.

c. Visually check the end of each ram shaft for cracks in the neck between the end and the shaft. The ram shafts should be replaced by a Shaffer service representative if cracks are visible.

15. Inspect the locking shafts using the following steps:

    a. Apply opening hydraulic pressure to extend the locking shafts.

    b. If a locking shaft is bent or cracked, it should be replaced. If replacement is necessary, call a Shaffer service representative.

16. Inspect the door seal grooves using the following steps:

    a. Remove the door seals (see Figure 4-2).

    b. Inspect the grooves. Smooth minor pits with emery cloth.

    c. Replace the door seals if extruded, brittle, cut, or nicked (see the section titled "Door Seal Replacement" on page 4-10 and the section titled "Troubleshooting" on page 4-37).

17. Reinstall the rams (see the section titled "Installation of Rams" on page 4-15).

18. Run a final field wellbore pressure test (see the section titled "Field Wellbore Pressure Test" on page 4-7) before the BOP is returned to service.

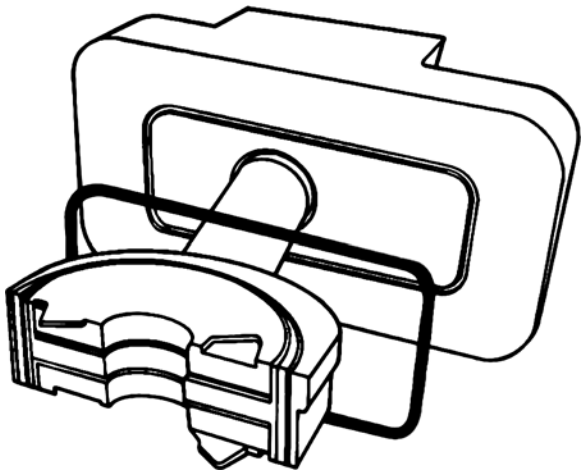

Figure 4-2. Remove Door Seal

Yearly Preventive Maintenance

Yearly maintenance is performed by a Shaffer service representative. The purpose of the yearly maintenance operation is to evaluate wear in the BOP so that a major overhaul (three-year maintenance) can be scheduled at a convenient time, but before a failure occurs. The yearly maintenance includes:

- Wellbore pressure test
- Hydraulic pressure test
- Inspection and measurement of cavity for wear and damage
- A complete review of BOP performance to determine if the BOP should be sent to a Shaffer repair facility for a major overhaul

Three-Year Maintenance

Three-year maintenance is performed in a Shaffer repair facility after a yearly maintenance check determines it is necessary. The BOP is completely disassembled, cleaned, and inspected. All elastomer seals are replaced and all parts are repaired or replaced as required. Hydraulic and wellbore pressure tests are run and the BOP is returned to service.

All elastomer seals should be replaced after three years regardless of condition.

Field Wellbore Pressure Test

The final details of the test sequence will be established by the operator and contractor; therefore, modifications to this procedure may be required. See API Spec. 6A and API RP53, paragraph 7.A.2 for additional information.

Equipment Required

Connect the listed equipment as shown in Figure 4-3:

- Two pressure gauges
- Three valves
- A test pump

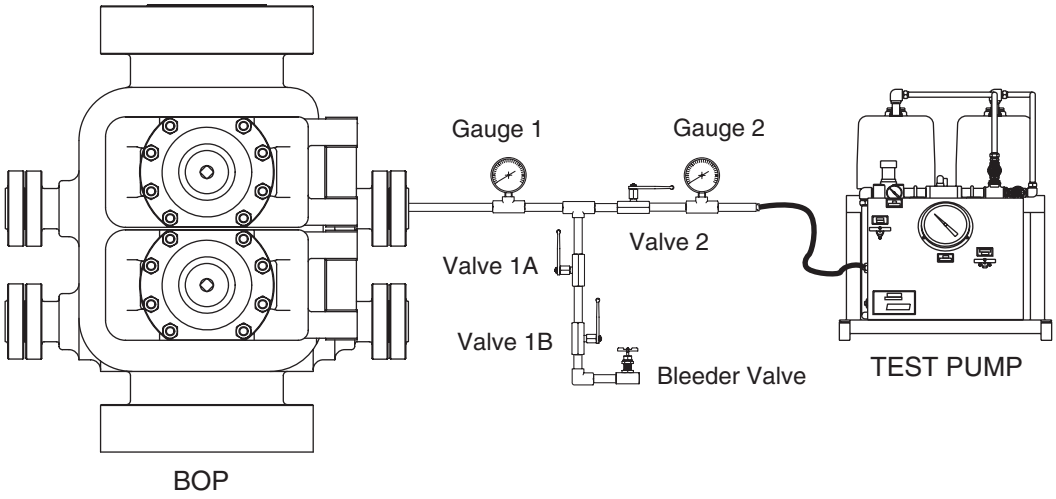

Figure 4-3. Recommended Field Wellbore Pressure Test Equipment Set-up

Test Locations

The BOP can be tested in any of the following locations:

- In a wellhead mounted stack
- On a test stump
- On a blind flange

Test Pressure

The test pressure should not exceed the lowest rated working pressure of any component or connection pressurized during the test. This includes one or more of the following:

- BOP(s)
- Wellhead
- Casing string, if it will be pressurized during the test or if a leak in the test tool could cause it to be pressurized
- All connections

Test Fluids

The recommended wellbore pressure test fluid is cold water, but drilling fluid may be used.

1. Fill the BOP with water or drilling fluid.
2. Close the pipe rams on an appropriate test tool using 1,500 psi (103 bar) hydraulic pressure (3,000 psi or 207 bar is optional).

Pressure Test

1. Close valves #1A and #1B. Open valve #2 (see Figure 4-3).
2. Apply 200-300 psi (14-21 bar) wellbore pressure below the rams. Close valve #2. Hold test pressure for a minimum of 3 minutes. Check for low-pressure leaks. Monitor gauge #1.
3. Open valve #2. Increase the wellbore pressure to the test pressure determined in "Test Pressure.
4. Close valve #2.
5. Hold the pressure for a minimum of 3 minutes.
6. Check for leaks on pressure gauge #1, the BOP exterior at the API connections, the door seals, the ram shaft weep holes, and at the rams if they are visible (see Figure 4-1 on page 4-3).

Do not look into the ram bore while pressure is under the rams. Use a mirror to obtain a reflected image of the rams.

7. Bleed wellbore test pressure to 0 psi (0 bar).
   a. Fully open valve #2.
   b. Open valve #1A.
   c. Open valve #1B.
8. Repeat steps 1-7 for the second pressure holding period.
9. If leaks are detected, see the table titled "Troubleshooting-LWS Manual Lock BOP" on page 4-37.

Leak Repair

To repair leaks, reduce all hydraulic pressure and wellbore pressure to 0 psi (0 bar).

- API connection – Tighten bolts or replace ring gasket as required (see the section titled "Installation Instructions" on page 3-2).
- Door Seal – Replace door seal (see the section titled "Door Seal Replacement" on page 4-10).
- Ram Shaft Weep Hole – Call a Shaffer service representative. For an emergency repair, see the section titled "Emergency Ram Shaft Packing Repair" on page 4-10. As soon as possible after the emergency call a Shaffer service representative to repack the ram shaft.
- Ram – Replace the ram rubbers (see the section titled "Changing Pipe and Blind Ram Rubbers" on page 4-17).

Hydraulic Pressure Test

The final details of the test sequence will be established by the operator and contractor; therefore, modifications to this procedure may be required. See API Spec. 6A and API RP53, paragraph 7.A.2 for additional information.

If the hydraulic system was opened before this test, close and open the rams three times to purge air from the system.

Pipe rams should always be closed on pipe to avoid excessive ram rubber wear. Closure on a tool joint will damage the block.

Blind rams should only be closed on an open hole. Closing on pipe will damage the rubber and possibly the block.

Opening Hydraulic Pressure Test

The opening hydraulic pressure test is performed according to the steps listed below.

1. Vent hydraulic closing pressure to zero psi (zero bar).
2. Apply 1,500 psi (103 bar) (2,250 psi or 155 bar optional) opening pressure.
3. Close the valve in the opening hydraulic line (see Figure 3-5 on page 3-8).
4. Observe the gauge between the valve and the BOP.

If there is no pressure drop, end the test. If there is a pressure drop, perform the steps listed below.

1. Check for external leaks at the following locations (see Figure 4-1 on page 4-3):
   - Hinge pins – If leaking, call a Shaffer service representative.
   - Weep holes for ram shaft seal leaks – If leaking, call a Shaffer service representative.
   - Cylinder seal leaks – If leaking, call a Shaffer service representative.
   - Door seal leaks – If leaking, see "Door Seal Replacement.
2. Check for internal leaks past the pistons in the following manner:
   a. Disconnect the closing hydraulic line. A small amount of fluid will flow out of the BOP initially and stop. If fluid continues to flow out of the BOP, it is leaking past the piston and repairs are required.

b. Reinstall the closing hydraulic line.

c. Call a Shaffer service representative to repair the leak.

Closing Hydraulic Pressure Test

The closing hydraulic pressure test is performed according to the steps listed below.

1. Vent hydraulic opening pressure to zero psi (zero bar).
2. Apply 1,500 psi (103 bar) (2,250 psi or 155 bar optional) closing pressure.
3. Close the valve on the closing hydraulic line (see Figure 3-5 on page 3-8).
4. Observe the gauge between the valve and the BOP.

If there is no pressure drop, end the test. If there is a pressure drop, perform the steps listed below.

1. Check for external leaks at the following locations (see Figure 4-1 on page 4-3):
   - ❑ Hinge pins – If leaking, call a Shaffer equipment service representative
   - ❑ Cylinder head seals – If leaking, call a Shaffer service representative
   - ❑ Locking shaft seals – If leaking, call a Shaffer service representative
   - ❑ Manifold pipe seals – If leaking, call a Shaffer service representative
2. Check for internal leaks past the pistons in the following manner:
   a. Disconnect the opening hydraulic line. A small amount of fluid will flow out of the BOP initially and stop. If fluid continues to flow out of the BOP, it is leaking past the piston and repairs are required.
   b. Reinstall the opening hydraulic line.
   c. Call a Shaffer service representative to repair the leak.

Door Seal Replacement

The door seal is replaced by performing the steps listed below.

1. Disconnect the universal joints from the locking shafts.
2. Open the doors.
3. Remove the door seal from its seat (see Figure 4-2 on page 4-5).
4. Clean the door seal seat and face.
5. Inspect the door seal seat for damage. Remove minor pits and scratches with emery cloth. If the seat is badly damaged, call a Shaffer service representative.
6. Clean and oil the door sealing surface on the body.
7. Oil the door seal seat and face.
8. Install a new door seal.
9. Apply thread lubricant (503 MOLY/FELPRO C670) to the door cap screws both on the threads and under the heads.
10. Close the door and tighten the door cap screws.

Emergency Ram Shaft Packing Repair

An emergency repair can be made by reducing the hydraulic pressure to 0 psi (0 bar) and activating the secondary ram shaft seal on the BOPs that have this feature (see Figure 4-4). As soon as possible after the emergency, call a Shaffer service representative to repack the ram shaft.

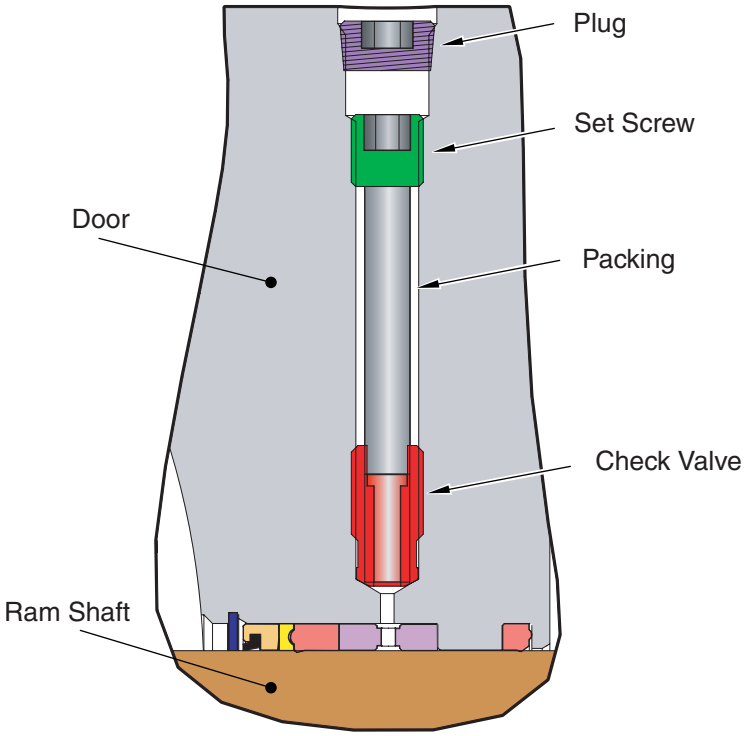

Figure 4-4. Secondary Seal Assembly

Not all LWS Models have the secondary sealing feature.

1. Remove the pipe plug from the front of the door.

Some preventers have a straight- in pipe plug while others have the pipe plug set in at an angle. All are located on the same door surface of the preventer.

2. With the pipe plug removed, a second socket head set screw plug is exposed. Tighten this to inject the secondary seal through the check valve and into the ram shaft seal assembly.

Additional packing may be injected until the leak stops. Remove the set screw and insert the packing sticks.

3. Replace the socket head pipe plug removed in step 1.
4. Call a Shaffer service representative to repack the ram shaft.

Ram Assembly Removal and Inspection Procedures

Procedures for removal and installation of pipe, blind and shear rams in the LWS BOP are the same.

Removal of Rams

Remove the rams according to the steps listed below.

The BOP door must be securely bolted prior to opening the rams with hydraulic pressure.

1. Open the rams with 1,500 psi hydraulic pressure.
2. Bleed hydraulic pressure to 0 psi (0 bar) so that the door will swing open easily and to prevent possible damage to the hinge pin O rings.
3. Unscrew the door cap screws and open the door.

Do not use the hydraulic system to open the door. This will severely damage the BOP.

If the BOP is not flanged to a wellhead or securely fastened, open only one door at a time. The weight of two open doors can tip the BOP over.

4. Notice the ram in the cavity of the BOP door as shown in Figure 4-5.
5. Slowly apply reduced closing hydraulic pressure until the ram is out of the BOP door cavity as shown in Figure 4-6.

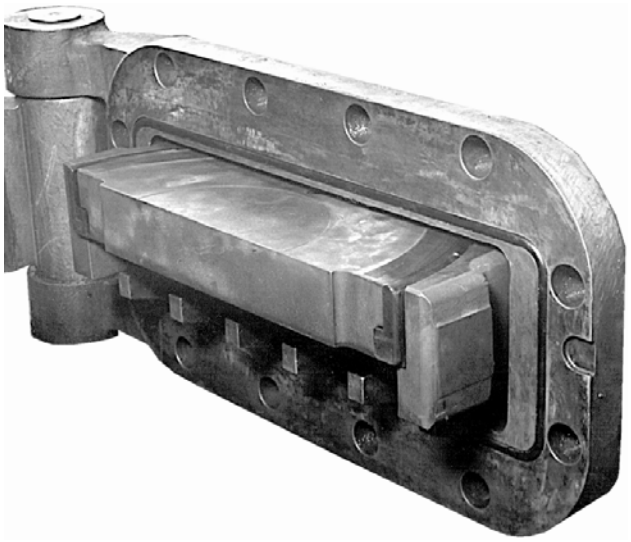

Figure 4-5. Ram Located in Door Cavity

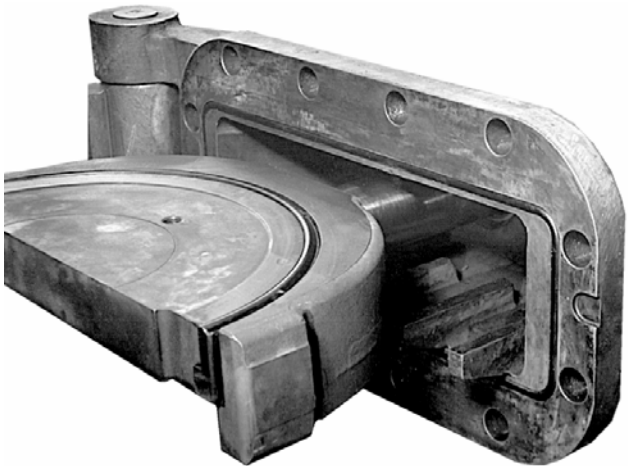

Figure 4-6. Ram Out of Door Cavity

Install a suitable valve on the opening and closing ports on the hinge brackets to control the speed of ram movement.

6. Bleed off the closing hydraulic pressure to zero psi (zero bar).

Care should be taken to avoid turning the ram assembly and allowing it to slide off the ram shaft.

7. Install $^{5}/_{8}$" (15.88 mm) eyebolt in the top of the ram as shown in Figure 4-7.
8. Slowly lift the ram to take the weight off the ram shaft and slide the ram horizontally as shown in Figure 4-7.
9. After the ram is removed, slowly open the ram with reduced hydraulic pressure so the ram shaft is in the cavity of the BOP door (see Figure 4-8 and Figure 4-9). This will prevent the ram shaft from being damaged.

Stay clear when opening pressure is applied to the ram shaft.

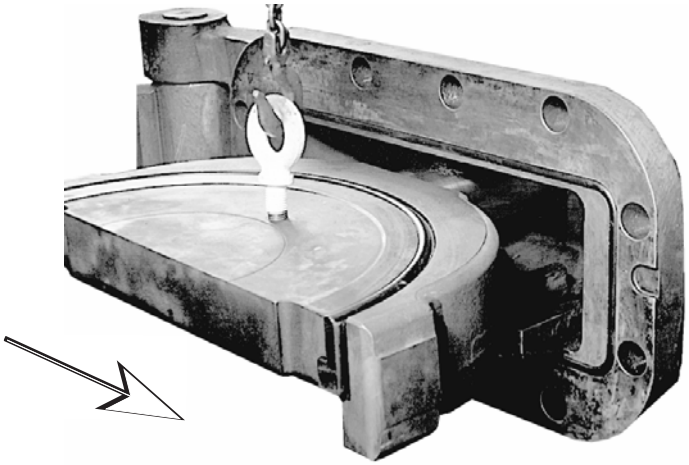

Figure 4-7. Install Eyebolt and Slide Ram Horizontally

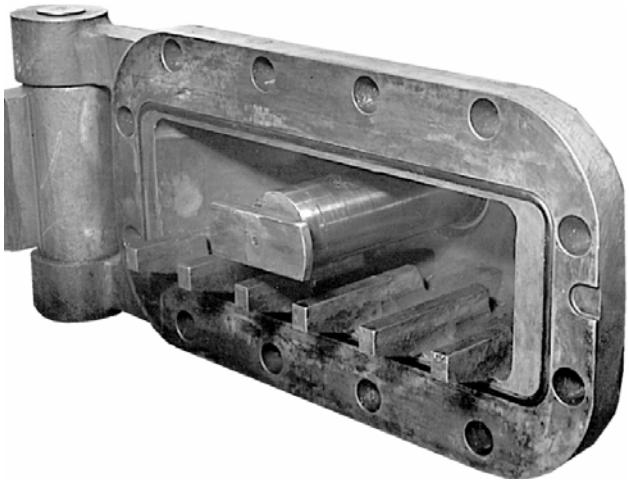

Figure 4-8. Ram Removed from Ram Shaft

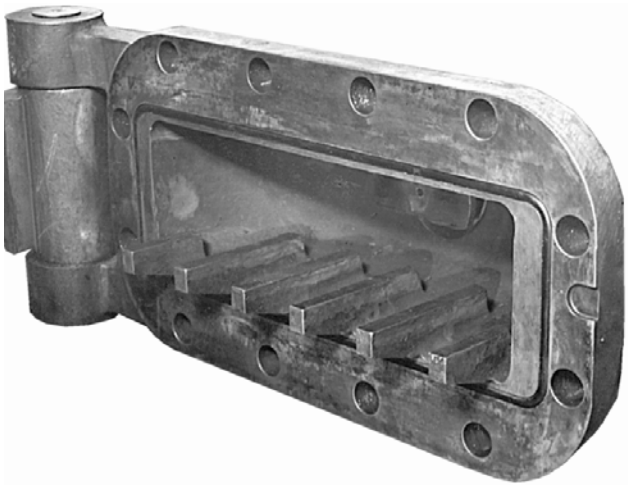

Figure 4-9. Ram Shaft Inside Door Cavity

Cleaning and Inspection of Rams

1. Clean the rams.
2. Inspect the ram rubbers for damage such as cracking, gouging, chunking, or splitting. Replace the rubbers if damaged (see the section titled "Changing Pipe and Blind Ram Rubbers" on page 4-17 and the section titled "Changing Type 72 Shear Ram Rubbers" on page 4-27).

Installation of Rams

1. Thoroughly grease all ram exterior surfaces and the ram shaft-mounting slot.
2. Grease the inside of the BOP body at the following locations:
   - The ram shaft mounting head
   - The side pads in the body cavity
   - The skids in the bottom of the body cavity
   - The ram sealing seat in the top of the body cavity

3. Apply thread lubricant specified in API 5A2 to the door cap screws both on the threads and under the heads.
4. Clean and oil the door face and replace the door seal if damaged (see the section titled "Door Seal Replacement" on page 4-10).
5. Clean and oil the door sealing surface on the body.

Do not use grease on door faces or sealing surfaces.

6. Swing the door of the preventer to the open position, approximately 57°.
7. Slowly apply reduced closing hydraulic pressure until the ram shaft is extended out of the BOP door cavity as shown in Figure 4-10.
8. Bleed off the closing hydraulic pressure to 0 psi (0 bar).
9. Install a $^{5}/_{8}$" eyebolt in the top of the ram assembly.
10. Slowly lift the ram into position to slide the assembly horizontally onto the ram shaft foot. Make sure the ram assembly is centered within the front of the door cavity as shown in Figure 4-11.
11. After the ram assembly is installed on the ram shaft, slowly open the ram with reduced hydraulic pressure. This action will pull the ram assembly into the door cavity.
12. Manually close the door of the preventer and torque the door cap screws (see the table titled "Model LWS Manual Lock BOP Door Bolt Torque Valves" on page 5-42).

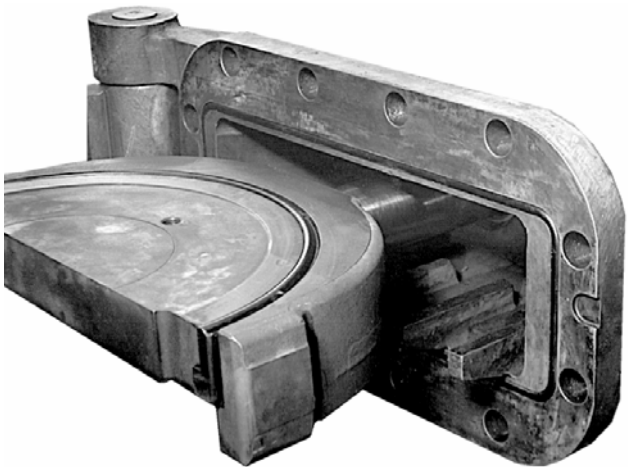

Figure 4-10. Ram Out of Door Cavity

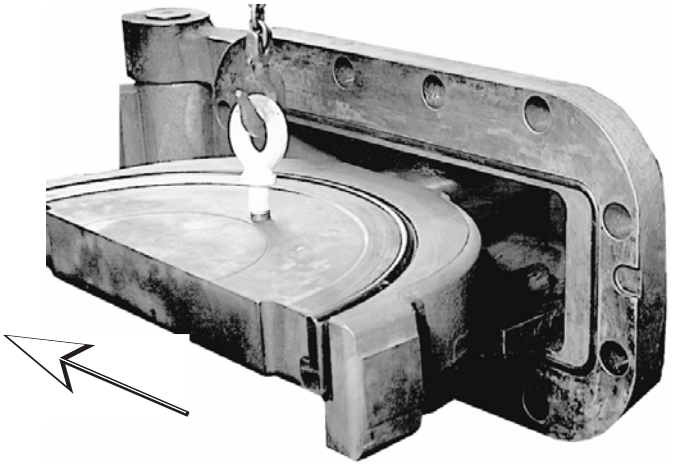

Figure 4-11. Install Eyebolt and Slide Ram Horizontally

Changing Pipe and Blind Ram Rubbers

1. Clean the ram.
2. Remove the two ram block retracting screws as shown in Figure 4-12. See table below for proper wrench size.

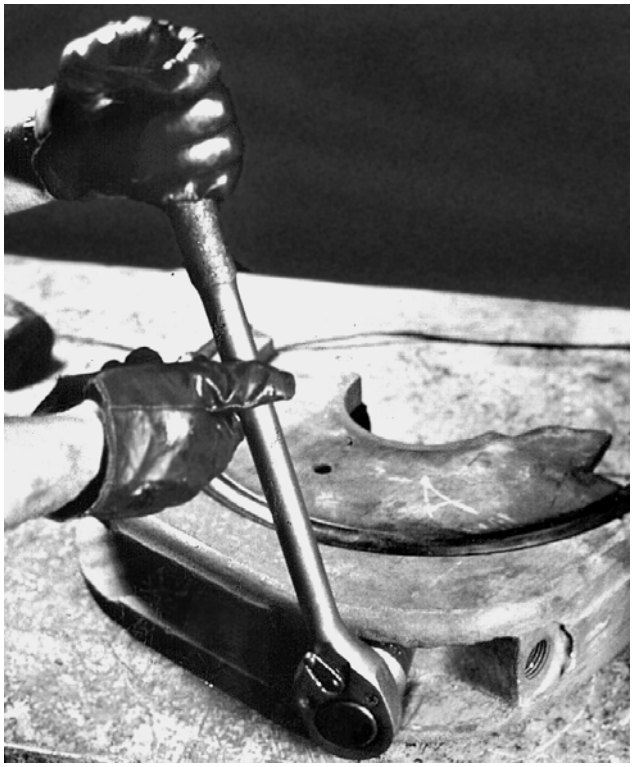

Figure 4-12. Remove Retracting Screws

LWS Ram Block Retracting Screw Data

Working Pressure	Size	P/N	Thread	Torque ft-lb	Wrench Size Across Flats
10,000 psi	4 1/16"	117778	3/4"-10 UNC	35-50	0.635"
5,000 psi	11"	141200	1 1/8"-8 UNC	100-175	1.750"
	9"	141200	1 1/8"-8 UNC	100-175	1.750"
	7 1/16"	141202	1"-8 UNC	75-125	1.750"
	4 1/16"	117778	3/4"-10 UNC	35-50	0.635"
3,000 psi	20 3/4"	142061	1 7/8"-8 UNC	200-400	0.877"
	11"	141200	1 1/8"-8 UNC	100-175	1.750"
	9"	141200	1 1/8"-8 UNC	100-175	1.750"
2,000 psi	21 1/4"	142061	1 7/8"-8 UNC	200-400	0.877"

3. Remove the ram holder by sliding it away from the block as shown in Figure 4-13.
4. Remove the two ram rubber retaining screws as shown in Figure 4-14. See the table titled "LWS Ram Block Retaining Screw Data" on page 4-19 for proper wrench size.

Figure 4-13. Remove Holder

Figure 4-14. Remove Retaining Screws

LWS Ram Block Retaining Screw Data

Working Pressure	Size	P/N	Thread	Torque ft-lb	Wrench Size Across Flats
10,000 psi	4 1/16"	117777	½"-13 UNC	100-125	3/8"
5,000 psi	11"	135546	½"-13 UNC	100-125	3/8"
	9"	135541	½"-13 UNC	100-125	3/8"
	7 1/16"	135545	½"-13 UNC	100-125	3/8"
	4 1/16"	117777	-	*	-
3,000 psi	20 3/4"	135160	½"-13 UNC	100-125	3/8"
	11"	135546	½"-13 UNC	100-125	3/8"
	9"	135541	½"-13 UNC	100-125	3/8"

LWS Ram Block Retaining Screw Data (Continued)

Working Pressure	Size	P/N	Thread	Torque ft-lb	Wrench Size Across Flats
2,000 psi	21 1/4"	135160	½"-13 UNC	100-125	3/8"

** Hand tighten.*

5. Insert two screwdrivers between the ram block and the ram rubber as shown in Figure 4-15. Remove the ram rubber from around the back of the block as shown in Figure 4-16. Pry top seal over ram block as shown in Figure 4-17.
6. Insert a punch into the rubber retaining screw holes and drive the rubber out of the ram block as shown in Figure 4-18. The punch must be smaller than the retaining screws to prevent damage to the threads.

Figure 4-15. Insert Two Screwdrivers Between Ram Block and Ram Rubber

Figure 4-16. Pry Ram Rubber from Around Back Side

Figure 4-17. Pry Top Seal over Ram Block

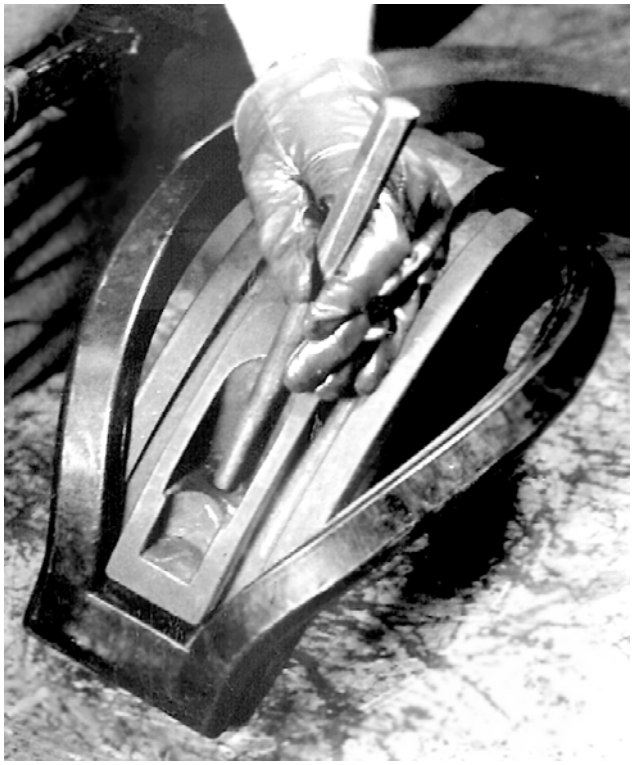

Figure 4-18. Use Punch to Remove Ram Rubber from Block

Check the retaining screw holes in the new rubber. Clean out any rubber which is in the hole itself. This allows the retaining screws to freely engage the thread in the holes.

7. Pry ram rubber off the ram block as shown in Figure 4-19. See Figure 4-20 for ram rubber showing thread area in trunnion nut.
8. Prior to installing a new ram rubber into the ram block, lubricate with oil. Install new ram rubber as shown in Figure 4-21.
9. Place the rubber onto the block. Using a rubber mallet hammer the rubber until it bottoms in the ram block (see Figure 4-22).
10. Pry the top seal over the ram block as shown in Figure 4-23. Force the rubber into position using a rubber mallet.
11. Install the ram rubber retaining screws as shown in Figure 4-24.
12. Place the ram holder into the block as shown in Figure 4-25.
13. Install the ram block retracting screws and tighten securely as shown in Figure 4-26.

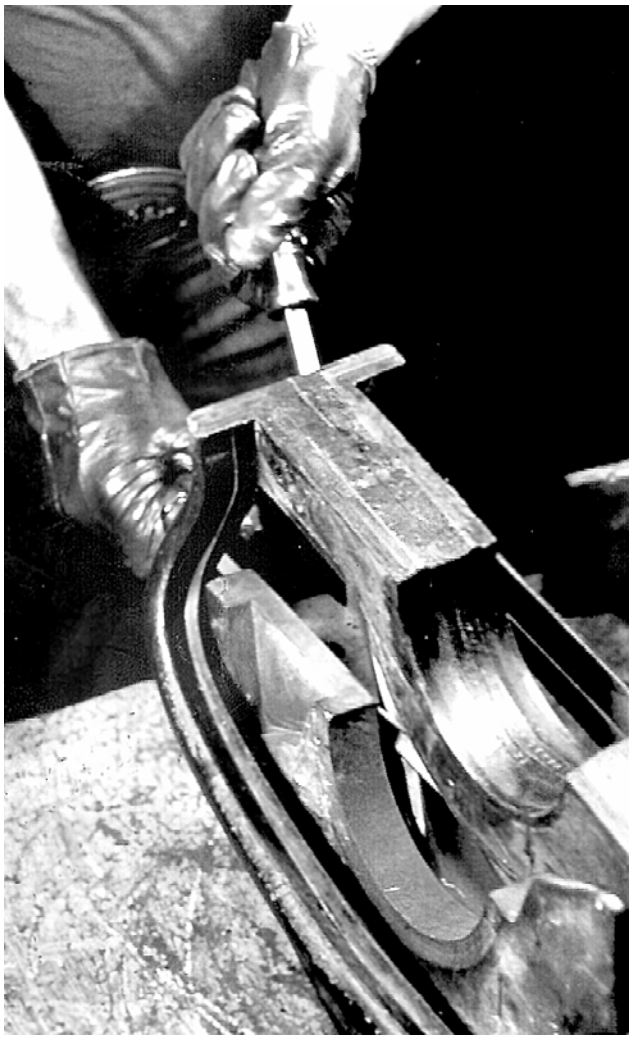

Figure 4-19. Pry Ram Rubber Off the Ram Block

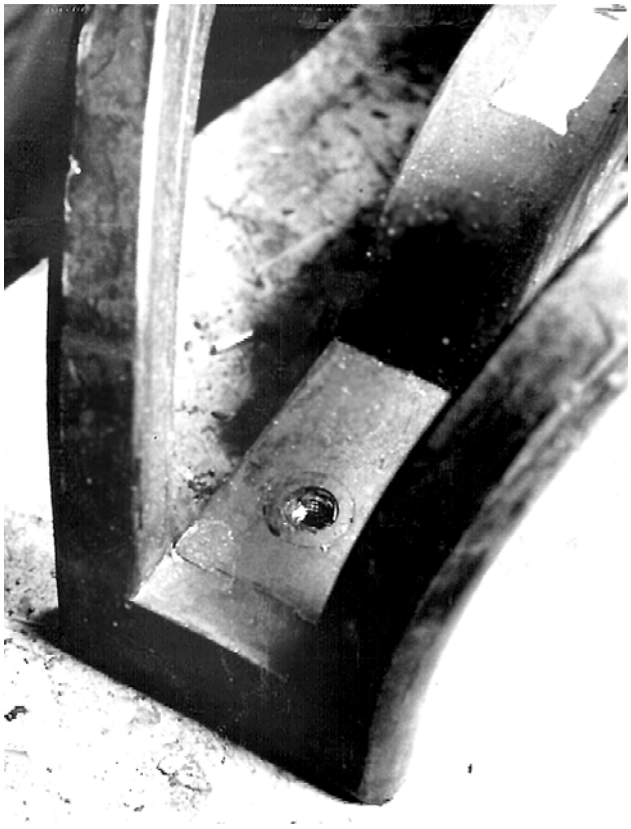

Figure 4-20. Thread Area in Trunnion Nut

Figure 4-21. Install Ram Rubber

Figure 4-22. Hammer Ram Rubber into Ram Block

Figure 4-23. Pry Top Seal Over Ram Block

Figure 4-24. Install Retaining Screws

Figure 4-25. Install Holder

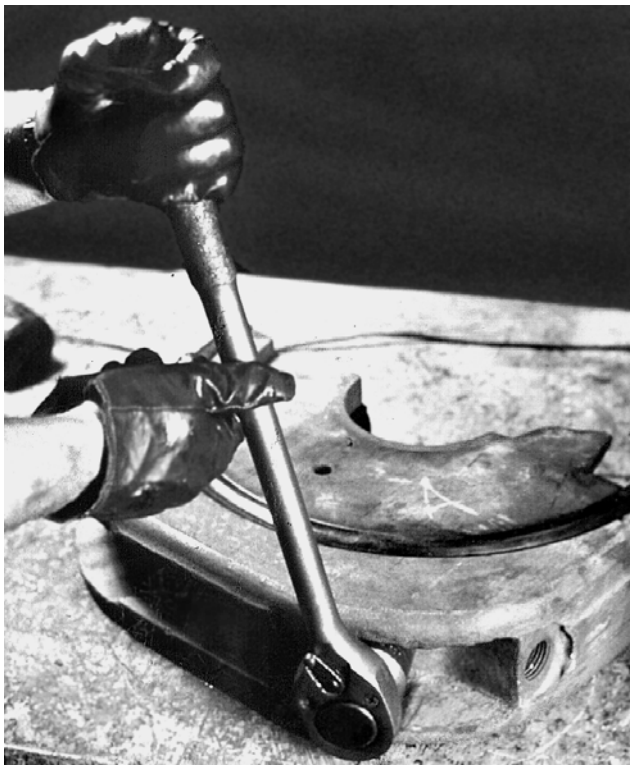

Figure 4-26. Install Retracting Screws

Changing Type 72 Shear Ram Rubbers

Disassembly of the Type 72 Shear Ram

1. Clean the shear ram.
2. Lay the ram on a level surface and turn it upside-down so the retainer screws on the bottom are exposed.
3. Remove the retainer rings using a screwdriver. There are three retainer rings on each ram, except for the rams on the 21 $^{1}/_{4}$", 18 $^{3}/_{4}$", and 16 $^{3}/_{4}$", 10,000 psi models. The rams on these models have four retainer rings.
4. Remove the retainer screws using a hex key wrench. There are three retainer screws on each ram, except for the rams on the 21 $^{1}/_{4}$", 18 $^{3}/_{4}$", and 16 $^{3}/_{4}$", 10,000 psi models. The rams on these models have four retainer screws (see "Type 72 Retainer Screw - H2S Service" and "Type 72 Retainer Screw - Standard Service" tables below for correct wrench size).

Type 72 Retainer Screw - H_2S Service

Working Pressure	Size	P/N	Thread	Qty.	Wrench Size	Torque ft-lb
5,000 psi	11"	121927	1 1/8"-8 UNC	6	3/4" hex key	150
	9"	121927	1 1/8"-8 UNC	4	3/4" hex key	150
	7 1/16"	121927	1 1/8"-8 UNC	4	3/4" hex key	150
3,000 psi	20 3/4"	121970	1 3/8"-8 UNC	8	7/8" hex key	400
	11"	121927	1 1/8"-8 UNC	6	3/4" hex key	150
	9"	121927	1 1/8"-8 UNC	4	3/4" hex key	150
2,000 psi	21 1/4"	121970	1 3/8"-8 UNC	8	7/8" hex key	400

Type 72 Retainer Screw - Standard Service

Working Pressure	Size	P/N	Thread	Qty.	Wrench Size	Torque ft-lb
5,000 psi	11"	136658	1 1/8"-8 UNC	6	3/4" hex key	150
	9"	136658	1 1/8"-8 UNC	4	3/4" hex key	150
	7 1/16"	136658	1 1/8"-8 UNC	4	3/4" hex key	150
3,000 psi	20 3/4"	136645	1 3/8"-8 UNC	8	7/8" hex key	400
	11"	136658	1 1/8"-8 UNC	6	3/4" hex key	150
	9"	136658	1 1/8"-8 UNC	4	3/4" hex key	150
2,000 psi	21 1/4"	136645	1 3/8"-8 UNC	8	7/8" hex key	400

5. Separate the blocks from the holders (see Figure 4-27).
6. Replace the retainer screw o-rings. There are three or four retainer screw o-rings on each ram, depending on the model.

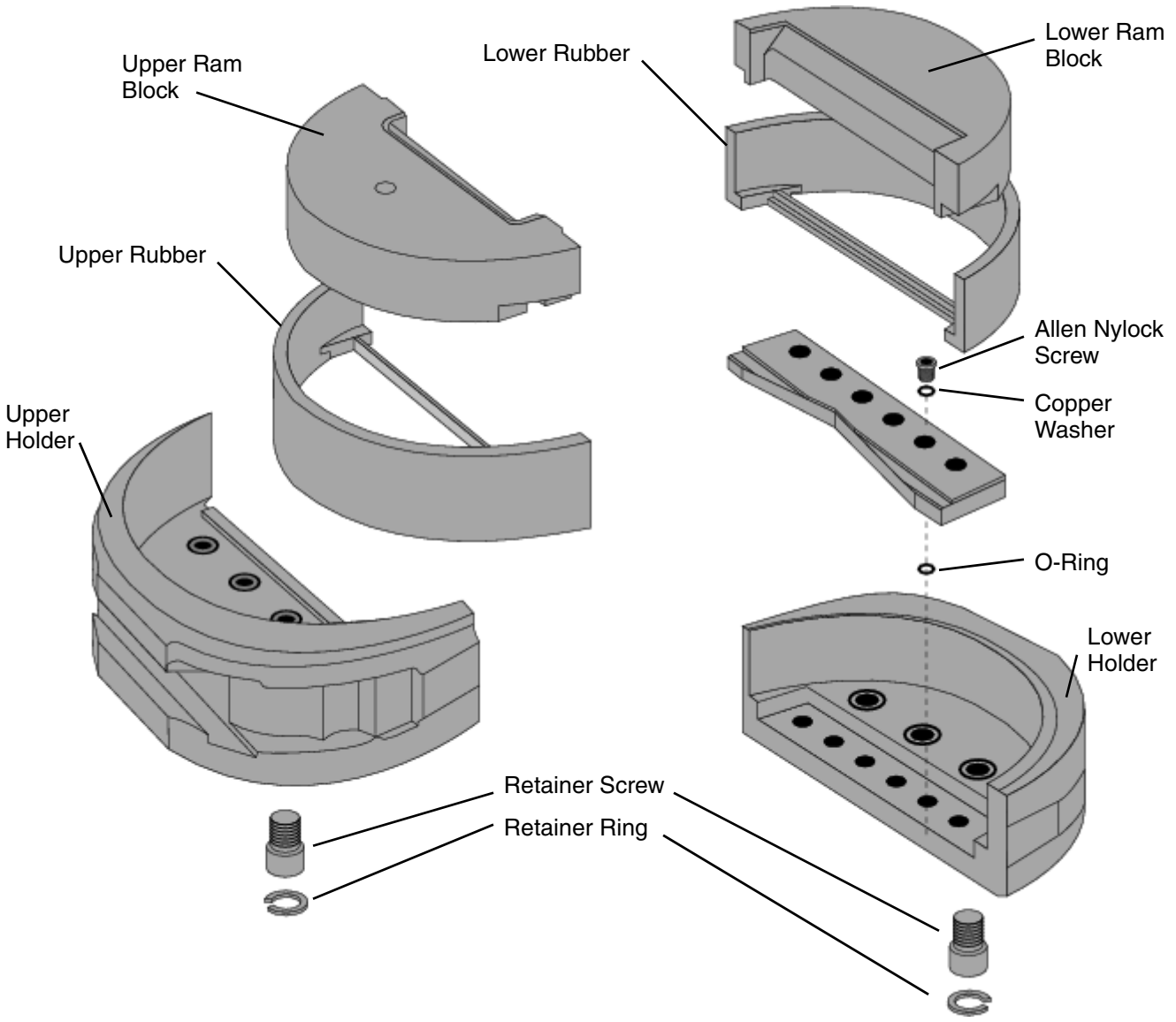

Figure 4-27. Type 72 Shear Ram Assembly

7. Inspect the lower shear blade for damage. If damaged, replace it according to the steps listed below.

   a. Remove the six, seven, eight, or eleven allen nylok screws and copper washers (the number of screws and washers varies with the different models). See the table titled "Type 72 Allen Nylok Screw - H2S Service" and the the table titled "Type 72 Allen Nylok Screw - Standard Service" on page 4-30 for correct wrench size.

The allen nylok screws and the copper washers cannot be used again, Discard them and replace with new allen nylok screws and copper washers.

b. Lift the lower shear blade from the lower ram block holder.

c. Remove the nylok screw o-rings. Clean the o-ring seat and install new nylok screw o-rings. The number of o-rings varies with the model. Always use new o-rings.

d. Install the lower shear blade in the lower ram block holder.

e. Insert the new allen nylok screws with new washers and tighten to torque specifications given in the table titled "Type 72 Allen Nylok Screw - H2S Service" and the the table titled "Type 72 Allen Nylok Screw - Standard Service" on page 4-30.

8. Separate the blocks from the rubbers.

Type 72 Allen Nylok Screw - H_2S Service

Working Pressure	Size	P/N	Thread	Qty.	Wrench Size	Torque ft-lb
5,000 psi	11"	011281	5/8"-11 UNC	6	½" hex key	20
	9"	011281	5/8"-11 UNC	5	½" hex key	20
	7 1/16"	011281	5/8"-11 UNC	5	½" hex key	20
3,000 psi	20 3/4"	011285	3/4"-10 UNC	8	5/8" hex key	25
	11"	011281	5/8"-11 UNC	6	½" hex key	20
	9"	011281	5/8"-11 UNC	5	½" hex key	20
2,000 psi	21 1/4"	011285	3/4"-10 UNC	8	5/8" hex key	25

Type 72 Allen Nylok Screw - Standard Service

Working Pressure	Size	P/N	Thread	Qty.	Wrench Size	Torque ft-lb
5,000 psi	11"	010953	5/8"-11 UNC	6	½" hex key	20
	9"	010953	5/8"-11 UNC	5	½" hex key	20
	7 1/16"	010953	5/8"-11 UNC	5	½" hex key	20

Type 72 Allen Nylok Screw - Standard Service (Continued)

Working Pressure	Size	P/N	Thread	Qty.	Wrench Size	Torque ft-lb
3,000 psi	20 3/4"	010881	3/4"-10 UNC	8	5/8" hex key	25
	11"	010953	3/4"-10 UNC	6	5/8" hex key	25
	9"	010953	3/4"-10 UNC	5	5/8" hex key	25
2,000 psi	21 1/4"	010881	3/4"-10 UNC	8	5/8" hex key	25

Reassembly of Type 72 Shear Ram

1. Clean any mud and debris off the bottom of the block and out of the holder.
2. Thoroughly oil the bottom and sides of the block and the inside of the holder.
3. Install a new rubber on the block as shown in Figure 4-27 on page 4-29.

The upper rubber has the wider cross bar and a steel rod towards the rear of the cross bar. The lower rubber has a narrow cross bar and no steel rod.

4. Install the o-rings.
5. Install the blocks on the holders (see Figure 4-27 on page 4-29).
6. Install the retainer screws and tighten to the proper torque as given in the table titled "Type 72 Retainer Screw - H2S Service" on page 4-28 and the table titled "Type 72 Retainer Screw - Standard Service" on page 4-28 (see Figure 4-27 on page 4-29).
7. Install the retainer rings (see Figure 4-27 on page 4-29).

Changing V-Shear Ram Rubbers

Disassembly of the V-Shear Ram

1. Clean the shear ram.
2. Lay the ram on a level surface and remove the retracting screws.
3. Separate the blocks from the holders (see Figure 4-27).

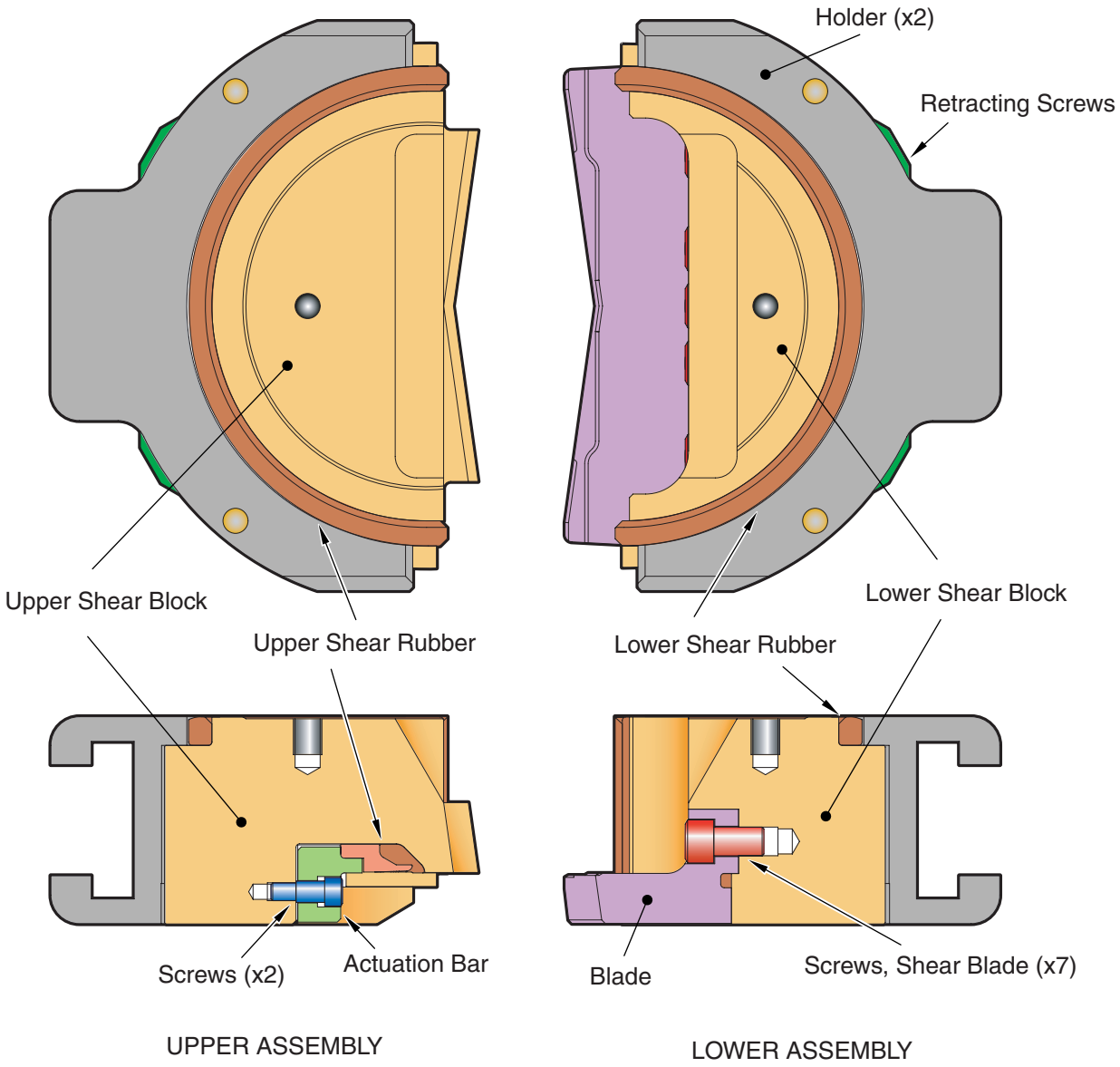

Figure 4-28. Shear Ram Assembly

4. Inspect the lower shear blade for damage. If damaged, replace it according to the following steps.
   a. Remove the seven socket head screws and Nord-lock washers (washers not used in every application).

If the Nord-Lock washers are used they should not be re-used again, Discard them and replace with new washers.

b. Lift the lower shear blade from the lower ram block holder.
c. Clean blade area of the lower block
d. Install the new lower shear blade in the ram block.
e. Insert the cap screws with new washers (if used) and tighten to proper torque.

5. Remove the two cap screws and actuator bar from the upper ram assembly.
6. Separate the blocks from the rubbers.

Reassembly of the Shear Ram

1. Clean any mud and debris off the bottom of the block and out of the holder.
2. Thoroughly oil the block and the inside of the holder.
3. Install a new rubber on the block as shown in Figure 4-28 on page 4-32.

The upper rubber has the wider cross bar and a steel rod towards the rear of the cross bar. The lower rubber has a narrow cross bar and no steel rod.

4. Clean and reinstall the actuator bar with the two cap screws.
5. Install the blocks on the holders (see Figure 4-28 on page 4-32).
6. Install the retracting screws and torque (see Figure 4-28 on page 4-32).

V-Shear Ram Screw Torque Values

Working Pressure	Size	P/N	Part	Qty.	Torque ft-lb
3,000 psi	20 3/4"	012766	Shear Blade Cap Screw	7	500
		142061	Retracting Screw	2	250 - 300
		011335	Actucating Bar Screw	2	100

V-Shear Ram Screw Torque Values (Continued)

Working Pressure	Size	P/N	Part	Qty.	Torque ft-lb
2,000 psi	21 1/4"	012766	Shear Blade Cap Screw	7	500
		142061	Retracting Screw	2	250 - 300
		011335	Actucating Bar Screw	2	100

Offset Rams for Dual Completions

Single offset rams have only one bore, which is offset to API centerline standards. This allows complete control of a dual completion when the second tubing string is to be run later.

Dual offset rams are furnished to API centerline standards for complete control of a dual completion when both tubing strings are run together.

Contact your local Shaffer sales representative for part numbers and delivery dates. Be sure to specify the following when ordering:

- BOP size and working pressure
- If single or dual offset rams are required
- Tubing OD and type of coupling so the coupling OD can be determined
- Casing size and weight so that the casing ID can be determined
- Tubing hanger centerline dimensions

Aluminum Drill Pipe Rams

Since aluminum drill pipe has an oversize OD, these rams must have oversize bores in both the ram blocks and in the ram rubber extrusion plates. Contact your local Shaffer sales representative for part numbers and the following:

- BOP size and working pressure
- Aluminum drill pipe OD

Cleaning and Storage of the LWS BOP

A BOP should be cleaned immediately after it is taken out of service. Proper cleaning of a BOP before it is stored will increase its life significantly. If a BOP is in an active drilling program, this cleaning should be done approximately every three months or when the rig is between wells see the table titled "LWS Ram BOP Cleaning and Lubricating Instructions" on page 4-38.

1. Open the doors and remove the rams (see the section titled "Removal of Rams" on page 4-12).

If the BOP is not flanged to a wellhead or securely fastened, open only one door at a time. The weight of two open doors can tip the BOP over.

Observe the following guidelines when working with rubber parts:

- Store rubber parts in their natural shape. Do not hang o-rings on nails or hooks.
- Storage areas should be kept as dry as possible. Oil, grease or other fluids should be stored elsewhere to avoid spillage.
- If storage is for a long duration, it is recommended that rubber parts be placed in sealed containers or be given a protective surface covering impervious to temperature or light, This will extend the shelf life.
- Rubber parts should be used on a first in, first out basis.

2. Inspect rubber parts according to the instructions listed below:
   - Each rubber part must be inspected before it is put into service.
   - Bend, stretch, or compress each part and look for cracks.
   - Observe if the rubber part has a hard skin or small cracks which may become chalky or barklike in appearance.

Some cracks are not obvious, but when the rubber part is bent, stretched or compressed, very minute cracks will become apparent.

LWS BOP Data Location

See Figure 4-29 for the location of serial numbers (doors and body). A data plate is fastened in the location shown. This same information is stamped into the body in the location shown in Figure 4-29.

- The serial number on the door is located on the hinge boss and consists of the letters SND followed by numbers.
- The body serial number is located in various places on the body and consists of SN followed by a six digit number.
- The heat treating number consists of the letters HT followed by a series of numbers.

Always give the serial numbers and size of the LWS BOP when ordering parts.

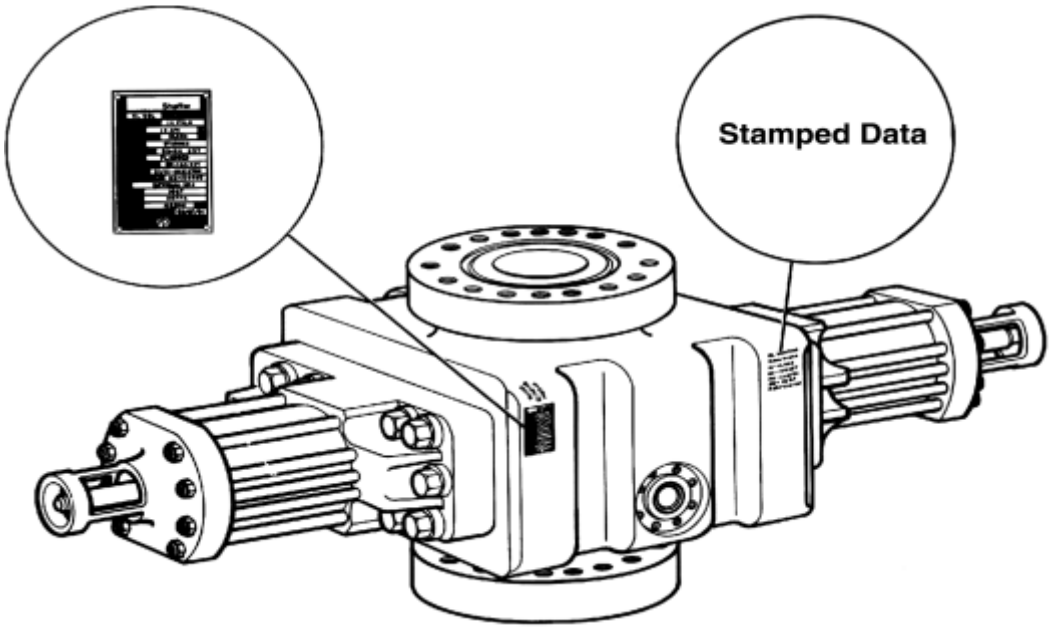

Figure 4-29. Data Information Location

Troubleshooting

The following table provides possible causes and corrective action for some of the more common problems likely to be encountered.

Troubleshooting-LWS Manual Lock BOP

Problem	Possible Cause	Correction
Will not hold well pressure	BOP is upside-down.	When BOP is right side up, the side outlets are below the skids. Inside the BOP, the side outlets are below the rams (see the section titled "Installation Instructions" on page 3-2).
	Bad ram rubbers	Check ram rubbers and replace if necessary (see the section titled "Ram Assembly Removal and Inspection Procedures" on page 4-12 and the section titled "Troubleshooting" on page 4-37).
	Damaged seat	Check seat sealing area for cuts and sealing surface scratches. Smooth minor damage with emery cloth (see the section titled "Three-Month Preventive Maintenance" on page 4-4).
	Leaking ram shaft seal	Check the weep holes in the doors for leakage. Replace the ram shaft seal if necessary. A temporary repair can be made by energizing the plastic packing, but the seal should be replaced as soon as possible (see the section titled "Emergency Ram Shaft Packing Repair" on page 4-10, Figure 4-1 on page 4-3).
	Leaking door seal	Check for leaks between the doors and the body. Tighten door bolts or replace the door seals as required (see the section titled "Monthly Preventive Maintenance" on page 4-4 and the section titled "Door Seal Replacement" on page 4-10).
	Pump leaking in the test unit	Install isolation valve in the pump line close to the BOP. Install a pressure gauge between the isolation valve and the BOP. No indication of pressure drop indicates a leak in the test unit.
Rams will not close	Hydraulic fluid not reaching the BOP	Remove the closing line from BOP and pump a small amount of hydraulic fluid through it. If no fluid appears, the line is plugged. Clear the closing line.
	Opening hydraulic line plugged or piston seal damaged	Remove opening line from the BOP and apply closing hydraulic pressure. 1. If hydraulic fluid spurts out of BOP briefly and stops and rams close, the opening hydraulic line is plugged. Call a Shaffer service representative. 2. If hydraulic fluid spurts out of BOP continuously, the piston seal is damaged. The rams would also move, but there would be no pressure buildup. Call a Shaffer service representative.
	Foreign substance in the wellbore area	Open the door(s) and inspect for cement, metal fragments, etc. Clean the ram cavity.
	Both hydraulic lines are connected to an 'Open' or a 'Close' port on the BOP.	This can happen because there are two opening and two closing ports on the BOP. The closing unit will unload itself very quickly. Be sure that one line is connected to a port marked 'Close' and the other line is connected to a port marked 'Open'.

Troubleshooting-LWS Manual Lock BOP (Continued)

Problem	Possible Cause	Correction
One (or both) rams will open partly, but will not move out of the wellbore	Manual lock(s) rams partly locked	Unlock rams. Check for damage to the locking shafts, threads, or bent shaft (see the section titled "Three-Month Preventive Maintenance" on page 4-4).
	Retracting screw(s) not made up and head(s) striking BOP door	Remove ram and tighten retracting screws (see the section titled "Ram Assembly Removal and Inspection Procedures" on page 4-12 and the section titled "Changing Pipe and Blind Ram Rubbers" on page 4-17).

LWS Ram BOP Cleaning and Lubricating Instructions

Part	How to Clean	Lubricants
1. LWS exterior	Steam, high pressure water, diesel fuel **WARNING** **Diesel fuel is a Flammable liquid. It will cause rubber goods to swell and deteriorate.**	N/A
2. LWS interior	Steam, high pressure water	SAE-10W hydraulic oil or equivalent.
3. Studs/nuts	Water, wirebrush	Grease specified in API 5A2.
4. Ring groove*	Emery Cloth	(Grease if not immediately in service).
5. Ram assembly	Steam, high pressure water, diesel fuel (See warning above.)	Grease
6. Lifting eye threads	Water, wire brush	Pack heavy grease to prevent corrosion.
7. Seat sealing surfaces	Emery cloth	SAE-10W hydraulic oil or equivalent.
8. Bore	Steam, high pressure water	SAE-10W hydraulic oil or equivalent.
9. Skids and side pads	Steam, high pressure water, emery cloth	Grease
10. Sealing areas (door face, door sealing surface)	Emery Cloth	SAE-10W hydraulic oil or equivalent.
11. Seals	Wipe with damp cloth	SAE-10W hydraulic oil or equivalent.
12. Door seal grooves	Emery cloth	SAE-10W hydraulic oil or equivalent.

** Do not use a wire brush to clean the ring groove. Install new ring gaskets dry.*

Specifications and Parts Lists

Parts Identification

All parts required for maintenance or repair are available from National Oilwell Varco. Assembly drawings and exploded views correspond to the parts list which identifies each part by number. Using this part number and part name will ensure procurement of the proper part when ordering spare parts.

Correspondence

Direct all correspondence to the appropriate address listed below.

Mailing Address

National Oilwell Varco
P.O. Box 1473
Houston, Texas 77251, U.S.A.

Shipping Address

12950 West Little York
Houston, Texas 77041
Tel. (713) 937-5000
Fax (713) 937-5779

National Oilwell Varco Repair Center Address

5900 Brittmoore
Houston, Texas 77041
Tel. (281) 847-9990
Fax (281) 847-9993

Ordering Replacement Parts

When ordering replacement parts, please specify the following information:

- Part name – List part name as called out on the applicable drawing.
- Part number – List part number as called out on the applicable drawing.
- Drawing number – List engineering drawing number and the item number for the drawing.
- Quantity – List the quantity needed.
- Serial number – List the serial number (if applicable) as shown on the nameplate.

Model LWS Manual Lock Specifications

Working Pressure (psi)			10,000	5,000	5,000	5,000	5,000	5,000	3,000	3,000	3,000	3,000	2,000	2,000
Bore			**4 1/16"**	**11"**	**11"**	**9"**	**7 1/16"**	**4 1/16"**	**20 3/4"**	**20 3/4"**	**11"**	**9"**	**21 1/4"**	**21 1/4"**
Piston Size			**6"**	**14"**	**8 1/2"**	**8 1/2"**	**6 1/2"**	**6"**	**14"**	**8 1/2"**	**6 1/2"**	**8 1/2"**	**14"**	**8 1/2"**
Manual-Lock		Length	42 1/4"	100 3/4"	89 1/4"	79 1/8"	58 1/4"	42 1/4"	161 3/4"	127 1/2"	72 5/8"	79 1/8"	161 3/4"	127 1/2"
		F	14 1/8"	37 5/8"	29 3/8"	27 7/16"	20 3/8"	14 1/8"	54 5/16"	42"	23 15/16"	27 7/16"	54 5/16"	42"
		G	23 13/16"	56 13/16"	48 5/8"	46 5/16"	32 1/2"	23 13/16"	79 15/16"	67 5/8"	39 31/32"	46 5/16"	79 15/16"	67 5/8"
Width			15 3/8"	28 3/4"	28 3/4"	23 1/16"	21 1/2"	15 11/16"	41 1/4"	41 1/4"	25 15/16"	23 1/16"	40 7/8"	40 7/8"
Height	Single:	Studded	15 3/4"	19 1/2"	19 1/2"	14 1/2"	15"	15 3/4"	23 1/8"	23 1/8"	14 1/2"	14 1/2"	23 1/8"	23 1/8"
		Flanged	20 3/4"	37"	37"	30 1/8"	28 1/4"	20 3/4"	41 5/8"	41 5/8"	27 1/8"	30 1/8"	37 3/4"	37 3/4"
		Hub	—	30 1/16"	30 1/16"	22"	-	-	35 3/8"	35 3/8"	22"	22"	34 5/8"	34 5/8"
Height	Double:	Studded	—	33"	33"	29 1/2"	26 3/4"	-	49 1/4"	49 1/4"	29 3/8"	29 1/2"	49 1/4"	44 7/16"
		Flange	—	50 1/2"	50 1/2"	45 7/16"	40"	-	62 15/16"	62 15/16"	42"	45 7/16"	59 1/16"	59 1/16"
		Hub	—	43 9/16"	43 9/16"	37"	-	-	55 15/16"	49 1/4"	36 7/8"	37"	60 3/4"	55 15/16"
D			6 7/16"	12 5/8"	12 5/8"	11"	9 3/16"	6 7/16"	17 3/8"	17 3/8"	11 9/16"	11"	17 1/4"	17 1/4"
E			8 15/16"	16 1/8"	16 1/8"	12 1/16"	12 5/16"	9 1/4"	23 5/8"	23 5/8"	14 3/8"	12 1/16"	23 5/8"	23 5/8"
I			—	15 1/2"	15 1/2"	15"	11 3/4"	-	21 5/16"	21 5/16"	14"	15"	26 1/8"	21 5/16"
J			—	11"	11"	10 1/2"	7 1/4"	-	20 1/8"	20 1/8"	9 1/2"	10 1/2"	20 1/8"	15 5/16"
K	Single:	Studded	—	5 1/2"	5 1/2"	3 1/4"	3 3/4"	-	6"	6"	3 7/8"	3 1/4"	6"	6"
		Flanged	7 1/8"	14 1/4"	14 1/4"	11 1/16"	10 3/8"	7 1/8"	15 1/4"	15 1/4"	10 3/16"	11 1/16"	13 5/16"	13 5/16"
		Hub	—	10 25/32"	10 25/32"	7"	-	-	-	-	7 5/8"	7"	11 3/4"	11 3/4"
	Double:	Studded	—	4 1/2"	4 1/2"	3 1/4"	3 1/4"	-	6"	6"	4 5/16"	3 1/4"	6"	6"
		Flanged	7 1/8"	13 1/4"	13 1/4"	11 1/4"	10 3/8"	7 1/8"	15 1/4"	15 1/4"	10 5/8"	11 1/4"	13 5/16"	13 5/16"
		Hub	—	9 25/32"	9 25/32"	7"	-	-	11 3/4"	13"	8 1/16"	7"	11 3/4"	11 3/4"
M	Single:	Studded	5 7/16"	7"	7"	5"	5"	3 7/8"	7 1/8"	7 1/8"	4 3/8"	5"	7 1/8"	7 1/8"
		Flanged	8 7/8"	15 3/4"	15 3/4"	12 13/16"	11 5/8"	8 7/8"	16 3/8"	16 3/8"	10 11/16"	12 13/16"	14 7/16"	14 7/16"
		Hub	—	12 9/32"	12 9/32"	8 3/4"	-	-	-	-	8 1/8"	8 3/4"	12 7/8"	12 7/8"
	Double:	Studded	—	6"	6"	5"	5"	-	-	-	4 13/16"	5"	7"	7 1/8"
		Flanged	—	14 3/4"	14 3/4"	12 13/16"	11 5/8"	-	16 3/8"	16 3/8"	11 3/16"	12 13/16"	14 7/16"	14 7/16"
		Hub	—	11 9/32"	11 9/32"	8 3/4"	-	-	-	-	8 9/16"	8 3/4"	12 7/8"	12 7/8"
N			3"	4 1/2"	4 1/2"	4 1/2"	4 1/2"	3"	7"	7"	4 1/2"	4 1/2"	6"	6"

Model LWS Manual Lock Specifications (Continued)

Working Pressure (psi)			10,000	5,000	5,000	5,000	5,000	5,000	3,000	3,000	3,000	3,000	2,000	2,000
Bore			**4 1/16"**	**11"**	**11"**	**9"**	**7 1/16"**	**4 1/16"**	**20 3/4"**	**20 3/4"**	**11"**	**9"**	**21 1/4"**	**21 1/4"**
Piston Size			**6"**	**14"**	**8 1/2"**	**8 1/2"**	**6 1/2"**	**6"**	**14"**	**8 1/2"**	**6 1/2"**	**8 1/2"**	**14"**	**8 1/2"**
O*	2”		9 5/8”	20 1/16"	20 1/16"	18 7/16"	14 1/2"	12 9/16"	25 7/8"	25 7/8"	16 3/4"	18 7/16"	25 7/8"	25 7/8"
	3”		—	21 11/16"	21 11/16"	20 1/16"	14 3/4"	-	25 1/16"	26 5/16"	15 3/4"	20 1/16"	26 5/16"	26 5/16"
	4”		—	20 1/16"	20 1/16"	-	14 1/2"	-	25 7/16"	25 7/16"	16 1/8"	-	25 7/16"	25 7/16"
P*	2”		12 9/16”	19 13/16"	19 13/16"	18 7/16"	15 1/16"	9 5/8"	25 7/8"	25 7/8"	17 3/16"	18 7/16"	25 7/8"	25 7/8"
	3”		—	21 7/16"	21 7/16"	20 1/16"	16 1/16"	-	25 1/16"	26 5/16"	17 3/16"	20 1/16"	26 5/16"	26 5/16"
	4”		—	19 13/16"	19 1/16"	-	18 7/8"	-	28 3/8"	25 7/16"	18"	-	25 7/16"	25 7/16"
Total Weight without Rams (lb)	Single:	Studded	830	6,000	4,150	2,870	1,385	830	1,068	7,448	2,116	2,870	9.905	7,285
		Flanged	975	6,670	4,.820	3,230	1,585	975	11,170	8,550	2,580	3,230	10,605	7,985
		Hub	—	6,250	4,400	2,820	—	—	9,795	7,175	2,150	2,820	10,032	7,412
	Double:	Studded	—	11,500	7,725	5,750	2,504	—	19,854	14,615	2,096	5,750	19,700	14,455
		Flanged	—	12,500	8,385	6,110	2,706	—	20,955	15,715	4,560	6,110	20,400	15,155
		Hub	—	11,800	7,975	5,700	—	—	19,580	14,340	4,130	5,700	19,822	14,582
1 Ram Assembly			30	130	130	76	64	30	435	435	111	76	435	435
1 Door Assembly			200	1,871	946	785	301	200	2,885	1,575	490	785	2,885	1,575
Weight Breakdown (lb)	Single Body:	Studded	430	1,995	1,995	1,125	670	430	3,760	3,760	1,000	1,125	3,790	3,790
		Flanged	575	2,925	2,925	1,660	980	575	5,400	5,400	1,600	1,660	4,835	4,835
		Hub	—	2,245	2,245	1,250	—	—	4,025	4,025	1,170	1,250	4,262	4,262
	Double Body:	Studded	—	3,674	3,674	2,436	1,190	—	7,776	7,776	2,000	2,436	7,810	7,810
		Flanged	—	4,600	4,600	2,970	1,502	—	9,415	9,415	2,600	2,970	8,855	8,855
		Hub	—	3,917	3,917	2,560	-	—	8,038	8,038	2,170	2,560	8,281	8,281
Closing Ratio			8.45	16.00	5.57	5.57	5.45	8.45	16.00	5.57	5.45	5.57	16.00	5.57
Opening Ratio			4.74	3.41	2.09	3.00	1.93	4.74	2.21	.78	1.16	3.00	2.21	.78
Gallons to Close			59	9.5	2.98	2.58	1.45	.59	14.50	5.07	1.74	2.58	14.50	5.07
Gallons to Open			.52	8.9	2.62	2.27	1.18	.52	13.59	4.46	1.45	2.27	13.59	4.46
Maximum Ram Size			2 7/8”	8 5/8”	8 5/8”	7”	5 9/16”	2 7/8”	16”	16”	8 5/8”	7”	16”	16”
Door Screw	Across Flats		1 7/8”	1 1/2”	1 1/2”	1 5/8”	1 1/2”	1 7/8”	1 5/8”	1 5/8”	1 1/4”	1 5/8”	1 5/8”	1 5/8”
	Torque (ft-lb)		500	1,500	1,500	1,500	1,100	500	1,200	1,200	910	1,500	1,200	1,200

** For flanged side outlets. Studded or hub side outlets are shorter*

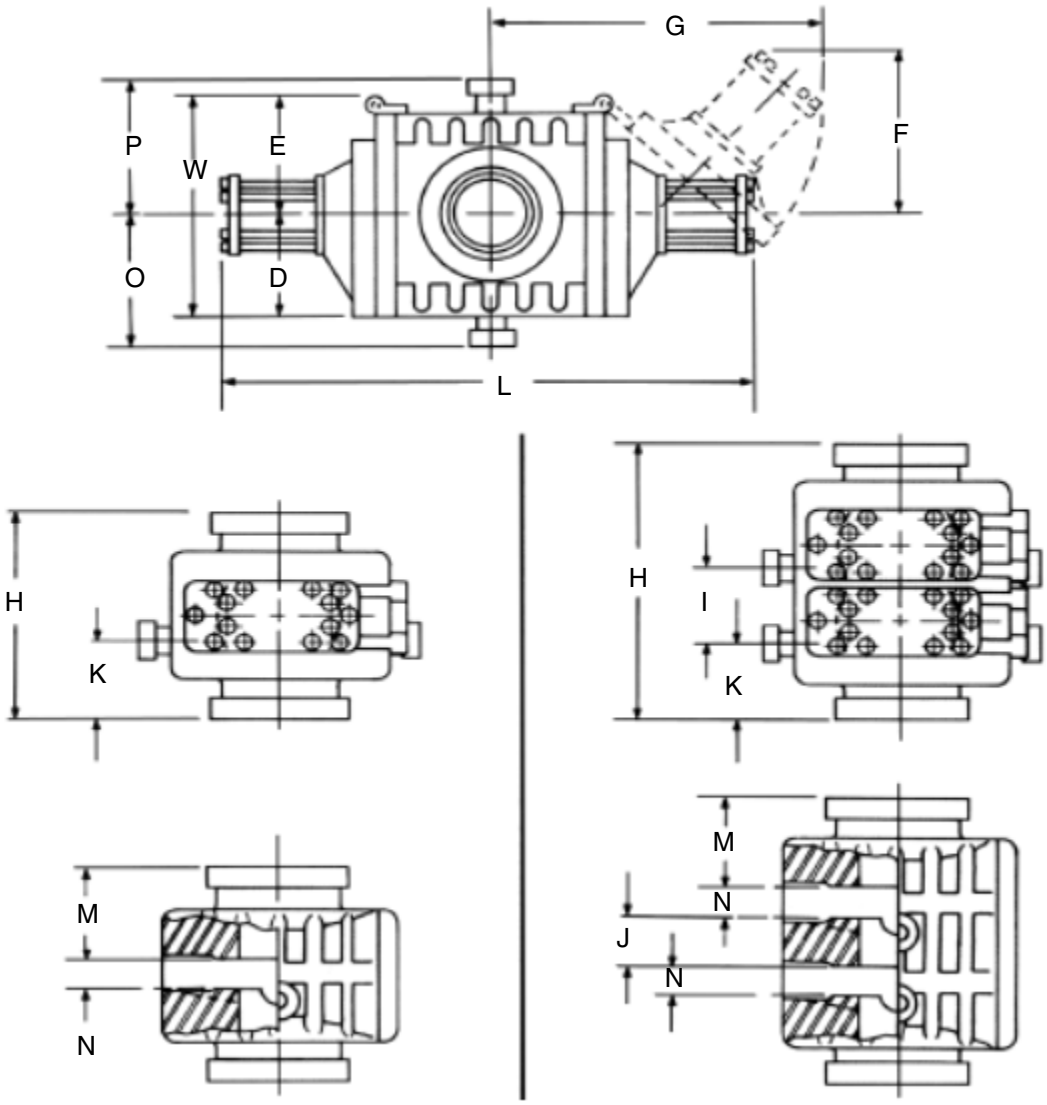

Figure 5-1. Model LWS BOPs - Dimensions and Specifications

LWS with 15 1/4" Cylinders Specification

Working Pressure (psi)			3,000	2,000
Bore			**20 3/4"**	**21"**
Piston Size			**15 1/4"**	**15 1/4"**
Manual-Lock		Length	162.45”	—
		F	52.12”	—
		G	77.64”	—
Width			—	—
Height	Double:	Studded	—	—
		Flange	62.938”	—
		Hub	—	—
D			—	—
E			—	—
I			—	—
J			—	—
K	Double:	Studded	—	—
		Flanged	26.38”	—
		Hub	—	—
M	Double:	Studded	—	—
		Flanged	—	—
		Hub	—	—
N			—	—
O	4”		26.25”	—
P	4”		26.25”	—
Total Weight without Rams (lb)	Single:	Studded	—	—
		Flanged	—	—
		Hub	—	—
	Double:	Studded	—	—
		Flanged	20,011	—
		Hub	—	—
1 Ram Assembly			435	—
1 Door Assembly			2,650	—
Weight Breakdown (lb)	Single Body:	Studded	—	—
		Flanged	—	—
		Hub	—	—
	Double Body:	Studded	—	—
		Flanged	9,000	—
		Hub	—	—
Closing Ratio			10.5	10.5
Opening Ratio			—	—
Gallons to Close			8.93	8.93
Gallons to Open			8.76	8.76
Maximum Ram Size			16”	16”
Door Screw	Across Flats		1 5/8”	1 5/8”
	Torque (ft-lb)		1,450	1,200
	Lubricant		503 Moly/FelPro C670	

Rams for Model LWS Blowout Preventers

BOP		Ram (Type or Model)							
Working Pressure	Bore	Assembly		Current Components			Discontinued Components		
		Regular Duty	Support Drill Type	Holder	Rubber	Block	Holder	Rubber	Block
10,000 psi	4 1/16"	77	None	77	77	77	76	76	76
5,000 psi	11"	70-H	73	70	70	70-H, 73	60*	60‡	60**
	9"	70-H	None	70	70	70-H	60*	60‡	60**
	7 1/16"	61	None	61	61	61	None	None	None
	4 1/16"	76	None	76	76	76	None	None	None
3,000 psi	20 3/4"	70-H	73	70	70	70-H, 73	50†	50†	50†
	11"	70-H	73	70	70	70-H, 73	60*	60‡	60**
	9"	70-H	None	70	70	70-H	60*	60‡	60**
2,000 psi	21 1/16"	70-H	73	70	70	70-H, 73	50†	50†	50†

** Type 60 holder is interchangeable with Type 70 holder.*

*** Type 60 block can be used in current assembly, but it must be placed opposite another Type 60 block. The self-centering angular guides are a different size on the later types.*

† Type 70 rubbers available for these (requires Type 70 holder and block). Type 50 is obsolete and no longer available.

‡ Type 70 rubbers are interchangeable with these discontinued Type 60 rubbers and can be used on the discontinued Type 60 blocks.

Exploded Views and Parts Lists

Figure 5-2 on page 5-7 shows an exploded view of the LWS Manual-Lock BOP and the table titled “Parts List for Model LWS Manual Lock BOPs” lists the parts.

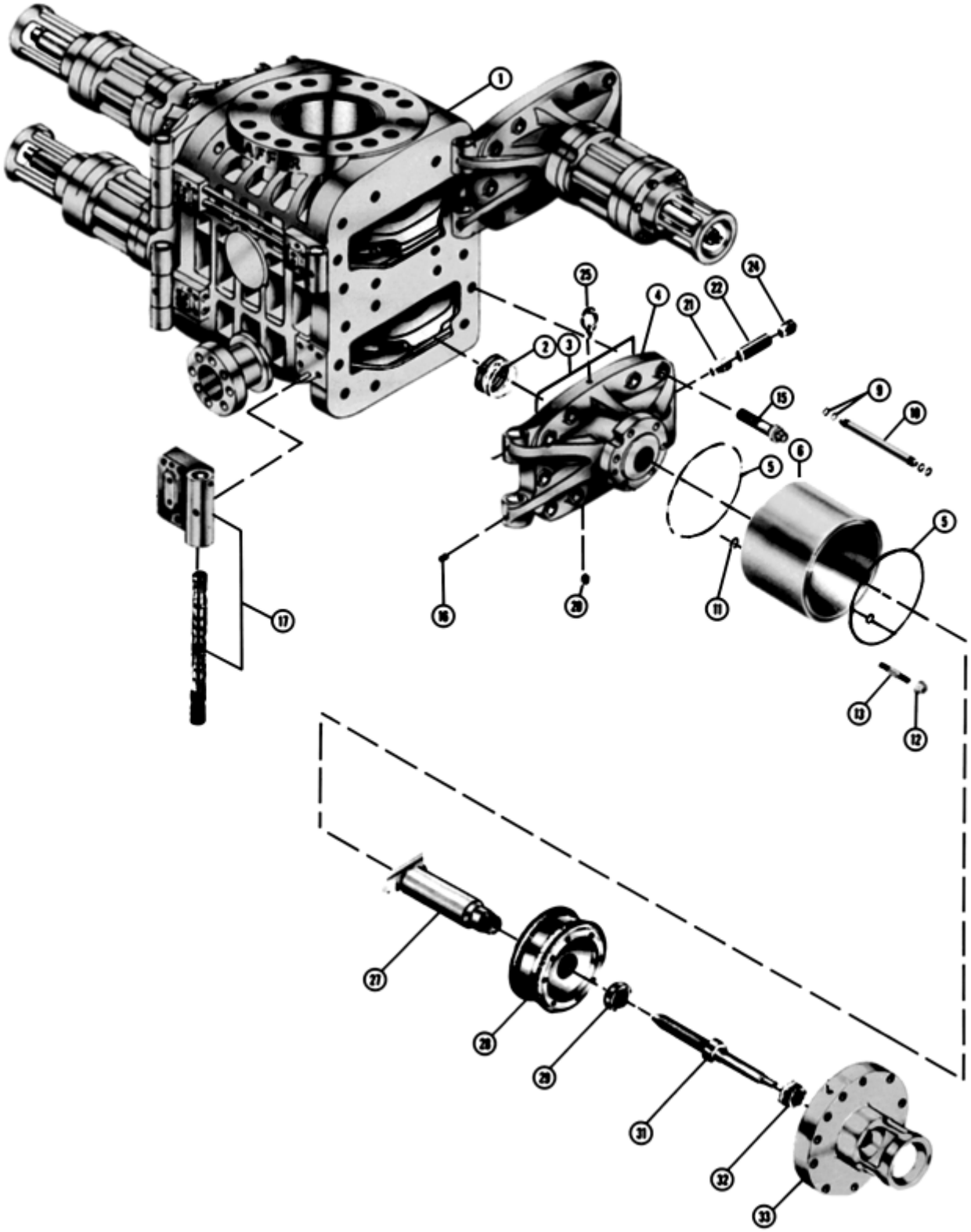

Figure 5-2. LWS Manual-Lock BOP

Parts List for Model LWS Manual Lock BOPs

Description				Part Number									
	Working Pressure (psi)			**10,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**3,000**	**3,000**	**3,000**	**2,000**
Item No.	**Working Pressure (bar)**	**Qty.**	**Spare Parts***	**690**	**345**	**345**	**345**	**345**	**345**	**207**	**207**	**207**	**138**
	Bore	—	—	4 1/16"	13 5/8"	11"	9"	7 1/16"	4 1/16"	20 3/4"	11"	9"	21 1/4"
	Bore (mm)			103.19	346.08	279.40	228.60	179.39	103.19	527.05	279.40	228.60	539.75
	Piston	—	—	6"	8 1/2"	8 1/2"	8 1/2"	6 7/16"	6"	8 7/16"	6 7/16"	8 1/2"	8 7/16"
	Piston (mm)			152.40	215.90	215.90	215.90	163.51	152.40	214.31	163.51	215.90	214.31
	Ram Shaft	—	—	2	3 1/2"	3 1/2"	3 1/2"	3"	2"	3 1/2"	3"	3 1/2"	3 1/2"
	Ram Shaft (mm)			50.80	88.90	88.90	88.90	76.20	50.80	88.90	76.20	88.90	88.90
	Locking Shaft	—	—	1 1/2	2"	2"	2"	1 1/2"	1 1/2"	2"	1 1/2"	2"	2"
	Locking Shaft (mm)			38.10	50.80	50.80	50.80	38.10	38.10	50.80	38.10	50.80	50.80
1	Body	—	—	—	—	—	—	—	—	—	—	—	—
2	Ram Shaft Seal Assembly†	2	2	116837	132534	132534	132534	122770	116837	132534	122770	132534	132534
3	Door Seal	2	2	030094	134014	030008	030105	030030	030094	030176	030106	030105	030176
4	Door (Right)	1	—	116831	134607	134807	134403	125782	116831	130722	132402	134403	130722
	Door (Left)	1	—	116831	134608	134808	134404	125781	116831	130723	132403	134404	130723
	O-Ring, Cylinder, Cylinder Head	4	4	—	030007	030007	030007	030141	—	030007	030141	030007	030007
5	O-Ring, Cylinder Head, Small	2	2	030087	—	—	—	—	030087	—	—	—	—
	O-Ring, Cylinder Head, Large	2	2	030090	—	—	—	—	030090	—	—	—	—
6	Cylinder (Right)	1	—	**	134005	—	—	—	**	130804	132404	—	130804
	Cylinder (Left)	1	—	**	134005	—	—	—	**	130804	132405	—	130804
7	Cylinder	2	—	—	—	134805	134405	—	—	—	—	134405	—
8	Cylinder	2	—	—	—	—	—	133004	—	—	—	—	—
9	O-Ring, Cylinder Manifold	8	8	—	—	—	—	030056	—	—	—	—	—
10	Cylinder Manifold	2	—	—	—	—	—	133007	—	—	—	—	—

Parts List for Model LWS Manual Lock BOPs (Continued)

Description				Part Number									
	Working Pressure (psi)			**10,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**3,000**	**3,000**	**3,000**	**2,000**
Item No.	**Working Pressure (bar)**	**Qty.**	**Spare Parts***	**690**	**345**	**345**	**345**	**345**	**345**	**207**	**207**	**207**	**138**
11	O-Ring, Cylinder Manifold Port	4	4	—	030058	030058	030058	—	—	030009	030058	030058	030009
12	Nut, Cylinder Head	12	—	—	134016	020103	020103	020101	—	—	020101	020103	—
	Nut, Cylinder Head	32	—	—	—	—	—		—	—	—	—	—
13	Stud, Cylinder Head	12	—	—	134016	134418	134417	133019	—	—	138795	134417	—
	Stud, Cylinder Head	32	—	—	—	—	—	—	—	—	—	—	—
14	Cap Screw, Hex Head	16	—	060424	—	—	—	—	060424	—	—	—	—
		32	—	—	—	—	—	—	—	011248	—	—	011248
15	Door Cap Screw	12	2	060426	—	—	—	—	060426	—	133012	—	—
		16	2	—	—	—	—	133012	—	—	—	—	—
		20	2	—	134606	134806	134415	—	—	130724	—	134415	130724
	Door Cap Screw, Short	4	1	—	—	—	—	—	—	—	—	—	—
16	Pipe Plug, Door and Body	6	—	—	—	—	—	065001	—	—	065001	—	—
		8	—	—	—	—	065009	—	—	—	—	065009	—
		10	—	—	—	—	—	—	—	065004	—	—	065004
		12	—	—	—	065001	—	—	—	—	—	—	—
17	Hinge Bracket Assembly, Right†	1	†	116839	134010	132662	116231	132660	116839	132657	132664	116231	132657
	Hinge Bracket Assembly, Left†	1	†	116840	134010	132662	116231	132660	116840	132657	132664	116231	132657
18	O-Ring, Hinge Manifold	8	8	—	030056	030056	030056	030054	—	—	030054	030056	—
19	Manifold, Hinge (Straight)††	2	—	—	134609	134812	134413	132427	—	—	132430	134413	—
20	Bleeder Plug, Door	2	—	—	—	136635	136635	—	—	136635	—	136635	136635
21	Check Valve	2	—	—	—	130368	130368	—	—	130368	—	130368	130368
22	Sealant, Secondary Seal	2	2	—	—	050000	050000	—	—	—	—	050000	—
		4	4	—	—	—	—	—	—	—	—	—	—
		6	6	—	—	—	—	—	—	050000	—	—	050000
23	Piston Screw	2	—	—	—	010004	010004	—	—	010004	—	010004	010004

Parts List for Model LWS Manual Lock BOPs (Continued)

Description				Part Number									
	Working Pressure (psi)			10,000	5,000	5,000	5,000	5,000	5,000	3,000	3,000	3,000	2,000
Item No.	Working Pressure (bar)	Qty.	Spare Parts*	690	345	345	345	345	345	207	207	207	138
24	Plug, Secondary Seal	2	—	—	—	065002	065002	—	—	065002	—	065002	065002
25	Eyebolt, Lifting	2	—	—	—	—	—	—	—	050004	—	—	050004
27	Ram Shaft	2	—	116842	141270	141270	141242	141213	116842	141299	141266	141242	141299
28	Piston Assembly†	2	†	133859	192006	192006	192006	132413	133859	192006	132413	192006	192006
29	Locknut, Piston	2	—	133483	192103	192103	192103	132414	133483	192103	—	192103	192103
30	Set Screw	2	—	—	010000	010000	010000	010015	—	010000	010015	010000	010000
31	Locking Shaft	2	—	142197	141273	141273	141247	141218	142197	141302	141268	141247	141302
32	Locking Shaft Seal Assembly†	2	2	132540	132540	132540	132540	132539	116843	132541	132539	132540	132541
	Bore	—	—	4 1/16"	13 5/8"	11"	9"	7 1/16"	4 1/16"	20 3/4"	11"	9"	21 1/4"
	Bore (mm)			103.19	346.08	279.40	228.60	179.39	103.19	527.05	279.40	228.60	539.75
33	Cylinder Head, Right	1	—	133837	134006	134006	134006	133005	133837	130909	132406	134006	130909
	Cylinder Head, Left	1	—	133837	134006	134006	134006	133006	133837	130909	132407	134006	130909
34	Plug	2	—	—	—	—	—	—	—	—	—	—	—
NI	Ram Assembly† (Recommended spare parts are two sets of rubbers for each set of rams.)												
NI	Door Wrench	1	—	050363	050459	050228	050478	050836	050363	050478	050363	050478	050478
NI	Handwheel	2	—	131107	115050	115050	115050	131107	131107	115050	131107	115050	115050
NI	Universal Joint	2	—	202011	202008	202007	202007	202011	202011	202007	202011	202007	202007
NI	Spare Parts Kit (Not standard assembly. Contains all necessary spare parts.) See Table 4-16.												

** Quantity for single model. Increase proportionally for dual or triple LWS Ram BOPs.*

† Recommended spare parts in detailed breakdown of assembly listed elsewhere in manual.

†† Manifold hinge for the 11", 5,000 psi with offset uses P/N 134813.

*** Cylinder is built into door of 4 1/16" 10,000 and 5,000 psi LWS.*

NI Not Illustrated

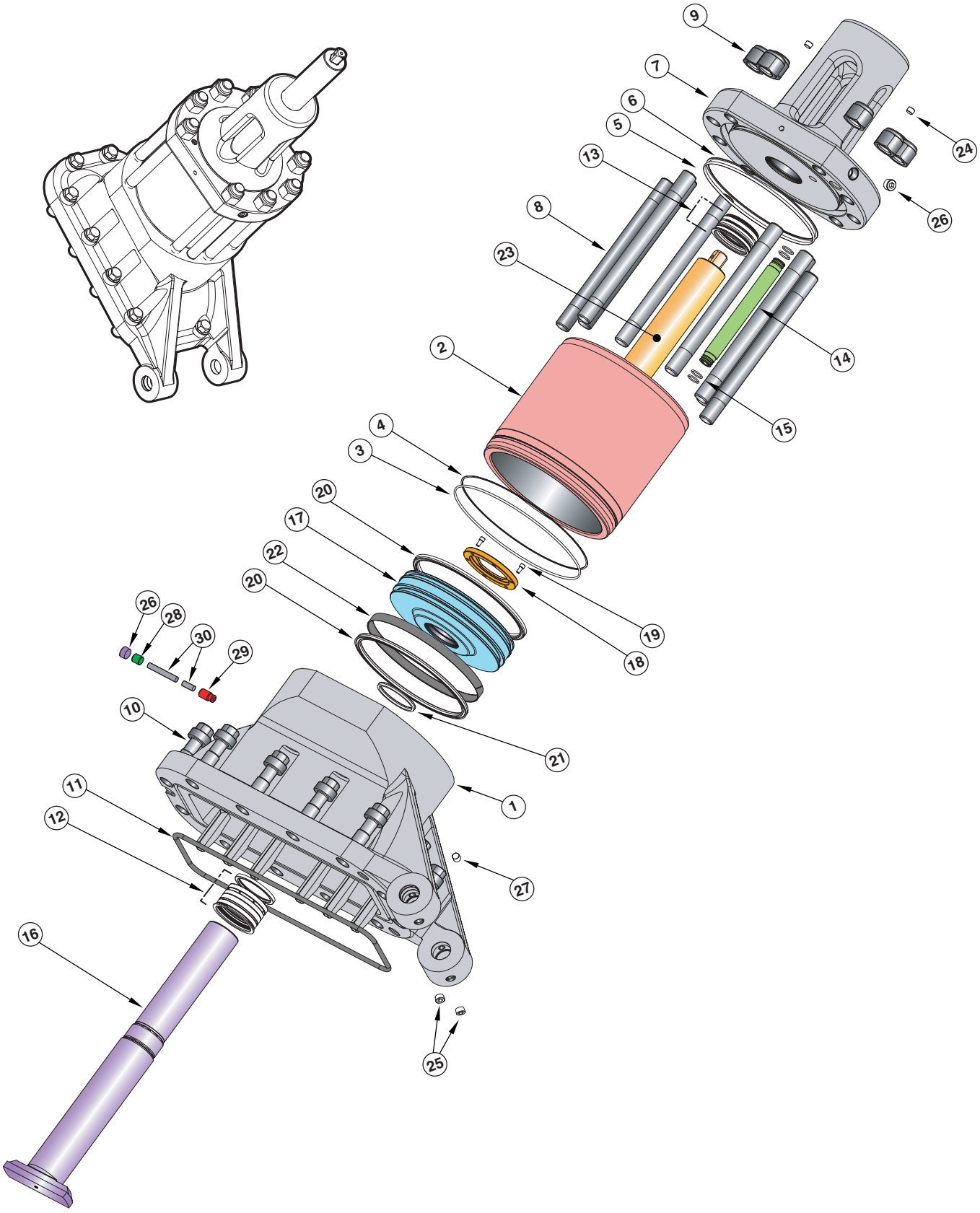

Figure 5-3. LWS 15 1/4" Cylinder Assembly

Parts List for 15 1/4" LWS Door Assembly

Description				Part Number
	Working Pressure (psi)			2,000 / 3,000
Item No.	Working Pressure (bar)	Qty.	Spare Parts*	138 / 207
	Bore	—	—	21 1/4" / 20-3/4 "
	Bore (mm)	—	—	539.75 / 527.05
	Piston	—	—	15.25
	Piston (mm)	—	—	387.35
	Ram Shaft	—	—	4 1/2"
	Ram Shaft (mm)	—	—	114.30
	Locking Shaft	—	—	3 3/4"
	Locking Shaft (mm)	—	—	95.25
1	Door	1		20023267
2	Cylinder	1		20023250
3	O-Ringf	1	2	030390
4	Back Up Ring	1	2	20023263
5	O-Ring	1	6	030645
6	Back Up Ring	1	6	20020128
7	Cylinder Head	1		20023249
8	Stud, Tap End	8		20023371
9	Nut, Locking	8		020108
10	Door Cap Screw	12		130724
11	Door Seal	1	2	030176
12	Ram Shaft Seal Assembly	1	2	20023567
13	Locking Shaft Seal Assembly	1	2	20023573
14	Cylinder Manifold	1		20023373
15	O-Ring	4	8	030061
16	Ram Shaft	1		20023257
17	Piston, Manual Lock	1		20023252
18	Retainer Plate	1		20023578
19	Screw, Socket Head	2		8002856
20	Seal, Polypak	2	4	20020124
21	Pip Seal Assembly	1	2	20023478
22	Wear Band 1"	60 in.	95 in.	150613
23	Screw, ocking	1		20023254
24	Plug, 1/2"	3		065001
25	Plug, 3/4"	2		065004
26	Plug, 1"	2		065002
27	Bleed Pliu, Secondary Seal	1		136635
28	Screw, Set	1		010004

Parts List for 15 1/4" LWS Door Assembly (Continued)

Description				Part Number
	Working Pressure (psi)			2,000 / 3,000
Item No.	Working Pressure (bar)	Qty.	Spare Parts*	138 / 207
29	Check Valve	1		130368
30	Plastic Packing, Injection	2	4	050000

** Quantity for single model. Increase proportionally for dual or triple LWS Ram BOP's.*

Model LWS Ram Shaft Seal Assemblies

Item No.	Description	Qty.	Part Number					
	Ram Shaft		2"	3"	3 1/2"	4 1/4"	4 1/4"	4 1/2"
	Assembly Number		116837	122770	132534	114677	132536	20023567
1	Retainer Ring	1 2	— 040999	141118 —	141243 —	— 141317	141317 —	20023474 —
2	Holder, Wiper Ring	1	—	—	116237	116242	116241	20023569
3	Wiper Ring	1	—	141214	116236	116240	116240	20023475
4	Packing Ring	1 2 4	— — 116834	— — —	116235 — —	— 116239 —	— 116239 —	20023480 — —
5	Packing							20023477
6	Modular Bearing	1	062247	—	—	—	—	—
7	Packing Adapter	1	—	122771	115025	—	116164	20023568
8	O-Ring, Adapter (Outer)	2	—	030122	—	—	—	—
9	O-Ring, Adapter (Inner)	2	—	030117	—	—	—	—
10	Back-Up Well Bore Seal	1	—	—	—	141230	—	—
11	Back-Up Hydraulic Seal	1	—	—	—	141366	—	—

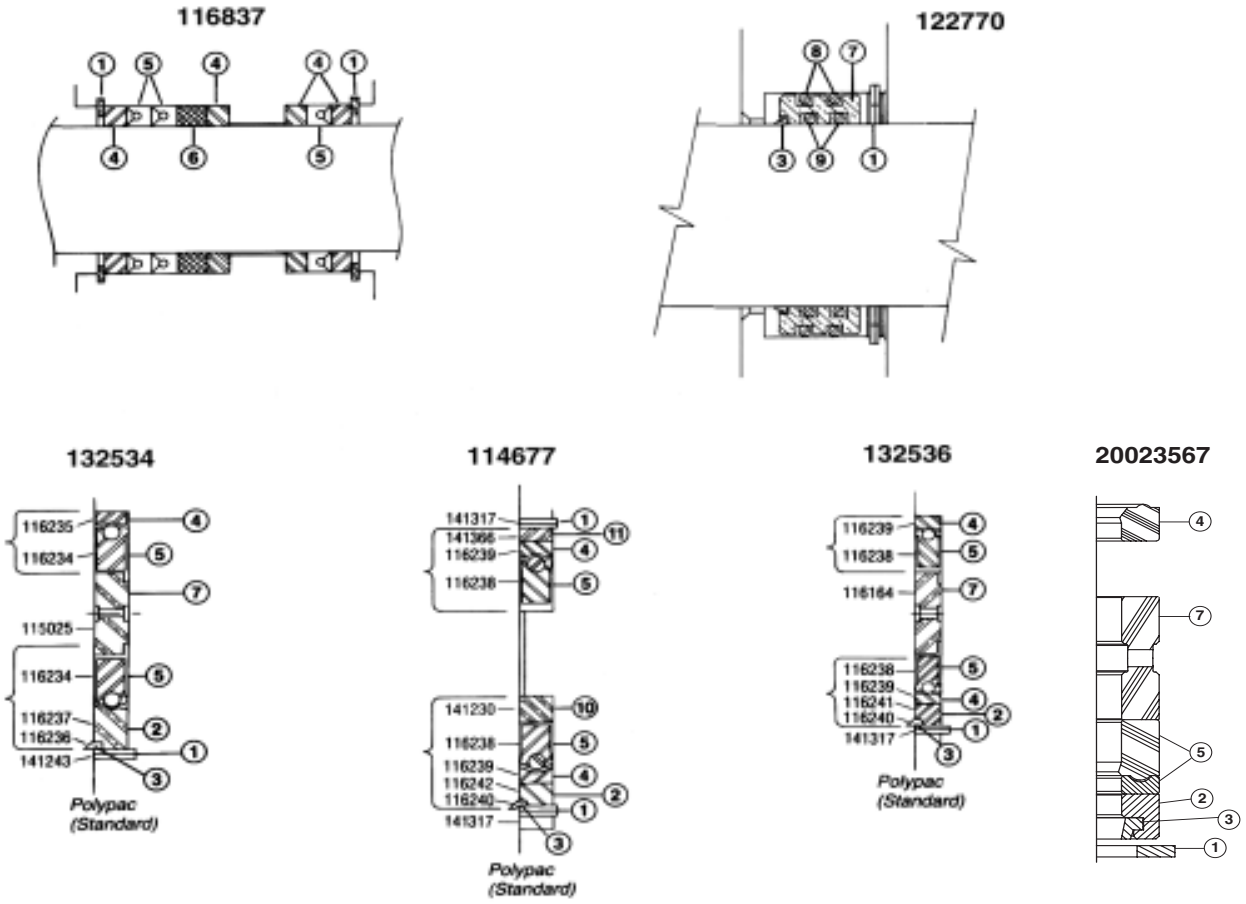

Figure 5-4. LWS Ram Shaft Seal Assemblies

Model LWS Manual Lock Piston Assemblies

Item No.	Description	Qty.*	Spare Parts*	Part Number			
	Assembly Part Number	1	—	133859	132413	192006	115514
	Cylinder Size	—	—	6"	6 1/2"	8 1/2"	14"
	Ram Shaft Size	—	—	2"	3"	3 1/2"	4 1/4"
	Locking Shaft Size	—	—	1 1/2"	1 1/2"	2"	2"
1	Body	1	—	133847	132420	192007	115509
2	Rubber	2	2	133846	132422	115021	115518
3	Retainer, Rubber	2	—	133845	132421	115020	115510
4	Cap Screw, Rubber Retainer	8 16	— —	010639 —	132423 —	010657 —	— 010657

Model LWS Manual Lock Piston Assemblies (Continued)

Item No.	Description	Qty.*	Spare Parts*	Part Number			
5	Lock Washer	8 16	— —	— —	— —	— —	— —
6	O-Ring	1	2	030067	030071	030000	030000

** Quantity shown is for 1 assembly. Note that a single model requires 2 assemblies, a double model requires 4 assemblies and a triple model requires 6 assemblies. Increase quantities as required.*

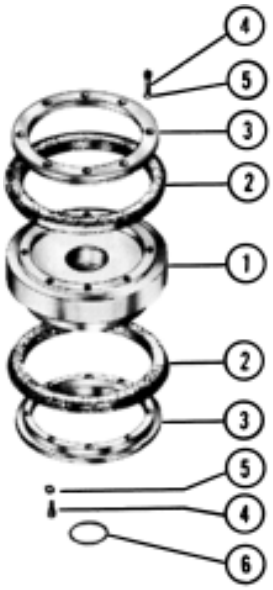

Figure 5-5. LWS Manual-Lock Piston Assemblies

Model LWS Locking Shaft Seal Assemblies

Item No.	Description	Qty.	Part Number				
	Locking Shaft	—	1 1/2"	1 1/2"	2"	2"	4"
	Assembly Number	—	116843	132539	132541	132540	20023573
1	Retainer, Bushing	1	040146	040146	040001	040001	20020662
2	Retainer, Wiper	1	†	†	040000	†	†
3	Thrust Bushing Spacer Ring	1	116854	141221	141258	134008	† 20023571
4	O-Ring, Bushing (Outer)	2	030011	030011	030002	†	†
5	O-Ring, Bushing (Inner)	2	030065	030065	030001	†	†
6	Packing	1	†	†	†	116201	031362

Model LWS Locking Shaft Seal Assemblies (Continued)

Item No.	Description	Qty.	Part Number				
7	Holder, Wiper Ring	1	†	†	†	141238	20023574
8	Wiper Ring	1 2	141222 †	141222 †	† 141237	141237 †	20023476

† Not applicable

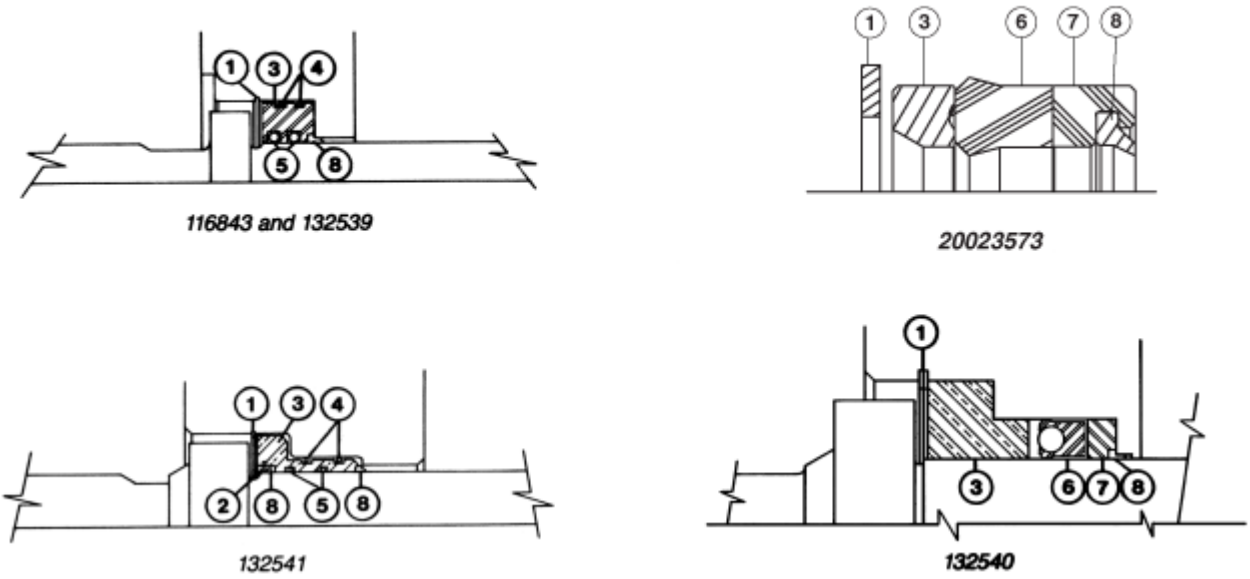

Figure 5-6. LWS Locking Shaft Seal Assemblies

Model LWS Ram Assemblies 4 1/16" Bore
5,000/10,000 psi (345/690 bar) Working Pressure

Pipe OD	Final Assembly	Face Seal	Ram Block	Ram Holder	See Note
†Type 77 Pipe Rams - Standard and H_2S Trim					
C.S.O.	117786	117750	117763	117770	†
1 1/16"	117787	117751	117764	117771	—
1 5/16"	117788	117752	117765	117772	†
1.660	117789	117753	117766	117773	†
1.990	117790	117754	117767	117774	†
2 3/8"	117791	117755	117768	117775	†

Model LWS Ram Assemblies 4 1/16" Bore
5,000/10,000 psi (345/690 bar) Working Pressure (Continued)

2 7/8"	117792	117756	117769	117776	—

Pipe OD	Final Assembly	Ram Block	Ram Holder	Face Seal	Snubbing Insert
Type 77 Snubbing Rams - Standard and H_2S Trim					
1.050	117798	117764	117771	117738	117757
1 5/16"	117799	117765	117772	117739	117758
1.660	117800	117766	117773	117740	117759
1 7/8"	117801	117767	117774	117741	117760
2 3/8"	117802	117768	117775	117742	117761

Common Part Numbers
All Pipe Sizes

117737 Outer Ram Holder
117778 Retracting Screw
117777 Retaining Screw

† Indicates blocks and rubbers normally available from stock.

Model LWS Ram Assemblies 9" Bore
3,000/5,000 psi (207/345 bar) Working Pressure

		Complete Assembly[2]					
Pipe OD[1]	Ram Type	Standard Trim*	H_2S Trim	Block Sub Assembly[3]	Block	Rubber Sub Assembly[4]	See Note
C.S.O.	70-H	132028	140405	138999	136814	136815	†
1 5/16"	70-H	132030	141407	139000	136818	136819	—
1.660	70-H	132032	141409	139901	136822	136823	—
1.990	70-H	132034	141411	139002	136826	136827	—
2 1/16"	70-H	132036	141413	139003	136830	136831	—
2 3/8"	70-H	132038	141415	139004	136834	136835	†
2 7/8"	70-H	132040	141417	139005	136838	136839	†

Model LWS Ram Assemblies 9" Bore 3,000/5,000 psi (207/345 bar) Working Pressure (Continued)

		Complete Assembly[2]					
Pipe OD[1]	Ram Type	Standard Trim*	H_2S Trim	Block Sub Assembly[3]	Block	Rubber Sub Assembly[4]	See Note
3 1/2"	70-H	132042	141419	139006	136842	136843	†
4"	70-H	132044	141421	139007	136846	136847	†
4 1/2"	70-H	132046	141423	139008	136850	136851	†
5"	70-H	132048	141425	139009	136854	136855	—
5 1/2"	70-H	132050	141427	139010	136858	136859	—

Common Part Numbers All Pipe Sizes

135736 Holder

141200 Retracting Screw, H_2S Trim

141209 Cap Screw

135541 Retaining Screw

141200 Retracting Screw, Std. Trim

* Available on special request

1 Other Pipe OD sizes available on request.

2 Includes holder, retracting screws, block rubber, and retaining screws.

3 Includes block and rubber.

4 Includes two retaining screws. Rubber is nitrile (Shaffer spec. SS-204).

† Indicates blocks and rubbers normally available from stock.

Model LWS Ram Assemblies 11" Bore 5,000 psi (345 bar) Working Pressure

		Complete Assembly[2]					
Pipe OD[1]	Ram Type	Standard Trim*	H_2S Trim	Block Sub Assembly[3]	Block	Rubber Sub Assembly[4]	See Note
C.S.O.	70-H	132028	140405	138999	136814	136815	†
1 5/16"	70-H	132030	141407	139000	136818	136819	—
1.660	70-H	132032	141409	139901	136822	136823	—
1.990	70-H	132034	141411	139002	136826	136827	—

Model LWS Ram Assemblies 11" Bore 5,000 psi (345 bar) Working Pressure (Continued)

		Complete Assembly[2]					
Pipe OD[1]	Ram Type	Standard Trim*	H_2S Trim	Block Sub Assembly[3]	Block	Rubber Sub Assembly[4]	See Note
2 1/16"	70-H	132036	141413	139003	136830	136831	—
2 3/8"	70-H	132038	141415	139004	136834	136835	†
2 7/8"	70-H	132040	141417	139005	136838	136839	†
3 1/2"	70-H	132042	141419	139006	136842	136843	†
4"	70-H	132044	141421	139007	136846	136847	†
4 1/2"	70-H	132046	141423	139008	136850	136851	†
5"	70-H	132048	141425	139009	136854	136855	—
5 1/2"	70-H	132050	141427	139010	136858	136859	—

Common Part Numbers
All Pipe Sizes

135875 Holder

135575 Retracting Screw, Standard Trim

141200 Retracting Screw, H_2S Trim

135546 Retaining Screw

*Available on special request

1 Other Pipe OD sizes available on request.

2 Includes holder, retracting screws, block rubber, and retaining screws.

3 Includes block and rubber.

4 Includes two retaining screws. Rubber is nitrile (Shaffer spec. SS-204).

† Indicates blocks and rubbers normally available from stock.

Model LWS Ram Assemblies 7 1/16" Bore 5,000 psi (345 bar) Working Pressure

		Complete Assembly[2]					
Pipe OD[1]	Ram Type	Standard Trim*	H_2S Trim	Block Sub Assembly[3]	Block	Rubber Sub Assembly[4]	See Note
C.S.O.	61	135783	142627	135940	135842	135857	†

Model LWS Ram Assemblies 7 1/16" Bore
5,000 psi (345 bar) Working Pressure (Continued)

		Complete Assembly[2]					
Pipe OD[1]	Ram Type	Standard Trim*	H_2S Trim	Block Sub Assembly[3]	Block	Rubber Sub Assembly[4]	See Note
1 5/16"	61	135787	142633	135941	135788	135789	—
1.660	61	135791	142636	135942	135788	135793	—
1.990	61	135795	142639	135943	135788	135797	†
2 1/16"	61	136073	142642	142643	135075	142644	—
2 3/8"	61	135799	142645	135944	135863	135858	†
2 7/8"	61	135803	142648	135945	135863	135859	†
3 1/2"	61	135807	142651	135946	135808	135860	†
4"	61	135811	142654	135947	135840	135861	—
4 1/2"	61	135815	142657	135948	135840	135862	—
4 3/4"	61	136598	—	136599	136600	136601	—
5"	61	—	142723	142724	134392	142725	—

Common Part Numbers
All Pipe Sizes

135847 Holder

141202 Retracting Screw, H_2S Trim

141209 Cap Screw

135545 Retaining Screw

*Available on special request

1 Other Pipe OD sizes available on request.

2 Includes holder, retracting screws, block rubber, and retaining screws.

3 Includes block and rubber.

4 Includes two retaining screws. Rubber is nitrile (Shaffer spec. SS-204).

† Indicates blocks and rubbers normally available from stock.

Model LWS Ram Assemblies 13 5/8" Bore 5,000 psi (345 bar) Working Pressure

Pipe OD[1]	Ram Type	Complete Assembly[2] H_2S Trim	Block Sub Assembly[3]	Block	Rubber Sub Assembly[4]	See Note
C.S.O.	70-H	141581	139099	136714	136715	—
7/16"	70-H	141583	139100	136990	136991	—
1.315"	70-H	141585	139101	136994	136995	—
1.660"	70-H	141587	139102	136998	136999	—
1.900"	70-H	141589	139103	137002	137003	—
2 1/16"	70-H	141591	139104	137006	137007	—
2 3/8"	70-H	141593	139105	137010	137011	—
2 7/8"	70-H	141595	139106	137014	137015	—
3 1/2"	70-H	141597	139964	142143	136711	—
3 5/8"	70-H	141599	139965	142223	137019	—
4"	70-H	141601	139966	142225	137023	—
4 1/8"	70-H	141603	139667	142228	137027	—
4.200"	70-H	141605	141968	142315	131187	—
4 1/2"	70-H	141607	139969	142145	136707	—
4 5/8"	70-H	141609	139970	142230	137031	—
5"	70-H	141611	139971	142162	136701	—
5 1/2"	70-H	141613	139972	142147	137035	—
5 9/16"	70-H	141615	139115	137038	137039	—
6 1/2"	70-H	141617	139310	132964	131213	—
6 5/8"	70-H	141619	139116	137042	137043	—
7"	70-H	141621	139117	137046	137047	—
7 5/8"	70-H	141623	139118	137050	137051	—
8 5/8"	70-H	141625	132119	137054	137055	—

Model LWS Ram Assemblies 13 5/8" Bore 5,000 psi (345 bar) Working Pressure (Continued)

Pipe OD[1]	Ram Type	Complete Assembly[2] H_2S Trim	Block Sub Assembly[3]	Block	Rubber Sub Assembly[4]	See Note
9 5/8"	70-H	141627	132120	137058	137059	—
10 3/4"	70-H	141629	132121	137062	137063	—

Common Part Numbers All Pipe Sizes

135551 Holder

135575 Retracting Screw, Standard Trim

141200 Retracting Screw, H_2S Trim

135545 Retaining Screw

*Available on special request

1 Other Pipe OD sizes available on request.

2 Includes holder, retracting screws, block rubber, and retaining screws.

3 Includes block and rubber.

4 Includes two retaining screws. Rubber is nitrile (Shaffer spec. SS-204).

Model LWS Ram Assemblies 11" Bore 3,000 psi (207 bar) Working Pressure

		Complete Assembly[2]					
Pipe OD[1]	Ram Type	Standard Trim*	H_2S Trim	Block Sub Assembly[3]	Block	Rubber Sub Assembly[4]	See Note
C.S.O.	70-H	131001	141441	139030	136800	136801	—
2 5/16"	70-H	131003	141443	139031	136797	136796	—
1.660	70-H	131005	141445	139032	163793	136792	—
1.900	70-H	131007	141447	139033	136778	136779	—
2 1/16"	70-H	131009	141449	139034	136782	136783	—
2 3/8"	70-H	131011	141451	139035	136786	136787	†
2 7/8"	70-H	131013	141453	139036	136790	136791	†
3 1/2"	70-H	131015	141455	139881	142135	136807	†

Model LWS Ram Assemblies 11" Bore
3,000 psi (207 bar) Working Pressure (Continued)

		Complete Assembly[2]					
Pipe OD[1]	Ram Type	Standard Trim*	H_2S Trim	Block Sub Assembly[3]	Block	Rubber Sub Assembly[4]	See Note
4"	70-H	131017	141457	139882	142168	136775	†
4 1/8"	70-H	131019	141459	139883	142171	136769	—
4 3/16"	70-H	142610	—	142611	142612	142616	—
4 1/2"	70-H	131021	141463	139884	141137	136767	†
4 5/8"	70-H	131023	141467	139885	142150	136763	—
4 3/4"	70-H	131027	141465	139886	142176	136759	—
5"	70-H	131025	141469	139887	142173	136804	†
5 1/2"	70-H	131030	141471	139888	142139	136755	†
6 5/8"	70-H	131032	141473	139044	136750	136751	—
7"	70-H	131034	141475	139045	136746	136747	†
7 5/8"	70-H	131036	141477	139045	136742	136743	—
8 5/8"	70-H	132064	—	132065	132066	132067	—

Common Part Numbers
All Pipe Sizes

135571 Holder

135575 Retracting Screw, Standard Trim

141200 Retracting Screw, H_2S Trim

135546 Retaining Screw

*Available on special request

1 Other Pipe OD sizes available on request.

2 Includes holder, retracting screws, block rubber, and retaining screws.

3 Includes block and rubber.

4 Includes two retaining screws. Rubber is nitrile (Shaffer spec. SS-204).

† Indicates blocks and rubbers normally available from stock

Model LWS Ram Assemblies 21 1/4" Bore 2,000 psi (138 bar) and 20 3/4" Bore - 3,000 psi (207 bar) Working Pressure

		Complete Assembly[2+]					
Pipe OD[1]	Ram Type	Standard Trim*	H_2S Trim	Block Sub Assembly[3]	Block	Rubber Sub Assembly[4]	See Note
C.S.O.	70-H	131349	141835	139187	137792	137793	†
2 3/8"	70-H	131351	141837	139188	137796	137797	—
2 7/8"	70-H	131353	141839	139189	137800	137801	—
3 1/2"	73	132195	140870	133781	133782	137805	†
4"	73	132196	140873	133783	133784	137809	—
4 1/2"	73	132197	140876	133785	133786	137813	—
5"	73	132198	140879	133787	133788	137821	†
5 1/2"	73	132199	140882	133789	133790	137825	—
5 3/4"	70-H	131365	141851	139196	137828	137829	—
6"	70-H	131367	141853	139197	137832	137833	—
6 5/8"	70-H	131369	141855	139198	137836	137837	—
7"	70-H	131371	141857	139199	137840	137841	—
7 5/8"	70-H	131373	141859	139200	137844	137845	—
8 5/8"	70-H	131377	141861	139202	137852	137853	—
9"	70-H	131379	141863	139203	137856	137857	—
9 5/8"	70-H	131381	141865	139204	137860	137861	—
10 3/4"	70-H	131383	141867	139205	137864	137865	—
11 3/4"	70-H	131385	141869	139206	137868	137869	—
13 3/8"	70-H	131387	141871	139207	137872	137873	†
14 3/4"	70-H	142619	—	142620	142621	142622	—
16"	70-H	131389	141875	139208	137876	137877	—

Common Part Numbers All Pipe Sizes

138242 Holder

142061 Retracting Screw, Standard Trim

135546 Retaining Screw

*Available on special request

1 Other Pipe OD sizes available on request.

2 Includes holder, retracting screws, block rubber, and retaining screws.

3 Includes block and rubber.

4 Includes two retaining screws. Rubber is nitrile (Shaffer spec. SS-204).

† Indicates blocks and rubbers normally available from stock

Model LWS BOP Type 72 Ram Assemblies (H_2S Service)

			Part Number					
Item No.	**Description Working Pressure**	**Qty. (a)**	**5,000 psi (345 bar)**			**3,000 psi (207 bar)**		**2,000 psi (138 bar)**
	Bore	—	11"	9"	7 1/16"	20 3/4"	9	21 1/4"
	Complete Assembly	—	121916	125319	123393	116215	125319	116215
1	Holder, Upper	1	121918	125316	123397	124259	125316	124259
2	Holder, Lower	1	121923	125263	123398	124260	125263	124260
3	Ram Block, Upper	1	121920	125322	123389	125166	125322	125166
4	Ram Block, Lower	1	121925	125328	123409	125169	125328	125169
5	Rubber, Upper	1 (1)	116437	125269	139322	139293	125269	139293
6	Rubber, Lower	1 (1)	116445	125265	139323	139296	125265	139296
7	Shear Blade, Lower	1	121926	125325	123410	125171	125325	125171
8	Retainer Screw	8 (8) 6 (6) 4 (4)	— 121927 —	— — 121927	— — 121927	121970 — —	— — 121927	121970 — —
9	Retainer Ring	8 (8) 6 (6) 4 (4)	— 041463 —	— — 041463	— — 041463	041464 — —	— — 041463	041464 — —
10	Allen Nylok Screw	8 (8) 6 (6) 5 (5)	— 011281 —	— — 011281	— — 011281	011285 — —	— — 011281	011285 — —

Model LWS BOP Type 72 Ram Assemblies (H_2S Service) (Continued)

Item No.	Description Working Pressure	Qty. (a)	Part Number 5,000 psi (345 bar)			3,000 psi (207 bar)		2,000 psi (138 bar)
11	O-Ring, Nylok Screw	8 (8) 6 (6) 5 (5)	— — —	— — —	— — —	030009 — —	— — —	030009 — —
12	Washer	8 (8) 6 (6) 5 (5)	— 025073 —	— — 025073	— — 025073	025074 — —	— — 025073	025074 — —

(a) Parentheses indicate recommended quantity for spare parts.

Model LWS BOP Type 72 Ram Assemblies (Standard Service)

Item No.	Description Working Pressure	Qty. (a)	Part Number 5,000 psi (345 bar)			3,000 psi (207 bar)		2,000 psi (138 bar)
	Bore	—	11"	9"	$7\ ^{1}/_{16}$"	$20\ ^{3}/_{4}$"	9"	$21\ ^{1}/_{4}$"
	Complete Assembly	—	116429	125291	139317	116172	125291	116172
1	Holder, Upper	1	121918	125316	123397	124259	125316	124259
2	Holder, Lower	1	121923	125263	123398	124260	125263	124260
3	Ram Block, Upper	1	116435	125268	139320	116173	125268	116173
4	Ram Block, Lower	1	116444	125264	139321	139292	125264	139292
5	Rubber, Upper	1 (1)	116437	125269	139322	139293	125269	139293
6	Rubber, Lower	1 (1)	116445	125265	139323	139296	125265	139296
7	Shear Blade, Lower	1	116446	125266	139325	139298	125266	139298
8	Retainer Screw	8 (8) 6 (6) 4 (4)	— 136658 —	— — 136658	— — 136658	136645 — —	— — 136658	136645 — —
9	O-Ring, Retainer Screw	8 (8)	—	—	—	030012	—	030012

Model LWS BOP Type 72 Ram Assemblies (Standard Service) (Continued)

Item No.	Description Working Pressure	Qty. (a)	Part Number 5,000 psi (345 bar)			3,000 psi (207 bar)		2,000 psi (138 bar)
10	Retainer Ring	8 (8) 6 (6) 4 (4)	— 041458 —	— — 041458	— — 041458	041457 — —	— — 041458	041457 — —
11	Allen Nylok Screw	8 (8) 6 (6) 5 (5)	— 010953 —	— — 010953	— — 010953	010881 — —	— — 010953	010881 — —
12	O-Ring, Nylok Screw	8 (8) 6 (6) 5 (5)	— 030058 —	— — 030058	— — 030058	030009 — —	— — 030058	030009 — —
13	Washer	8 (8) 6 (6) 5 (5)	— 025050 —	— — 025050	— — 025043	025051 — —	— — 025050	025051 — —

(a) Parentheses indicate recommended quantity for spare parts.

Model LWS BOP V-Shear Ram Assemblies

Item No.	Description Working Pressure	Qty. (a)	2,000 / 3,000 psi (138 / 207 bar)
	Bore	—	21 1/4" / 20 3/4"
	Complete Assembly	—	20019143
	Lower Shear Assemby	—	20019146
	Upper Shear Assembly	—	20019144
1	Holder, Upper	1	126576
2	Holder, Lower	1	126576
3	Ram Block, Upper	1	20019145
4	Ram Block, Lower	1	20019147
5	Rubber, Upper	1 (1)	126583
6	Rubber, Lower	1 (1)	20126588
7	Shear Blade, Lower	1(1)	20019148
8	Retainer Screw	7 (7)	012766
9	Actuator Bar	1	126585

Model LWS BOP V-Shear Ram Assemblies (Continued)

Item No.	Description Working Pressure	Qty. (a)	2,000 / 3,000 psi (138 / 207 bar)
10	Shoulder Screw	2	011335
11	Retracting Screw	4	142061

(a) Parentheses indicate recommended quantity for spare parts.

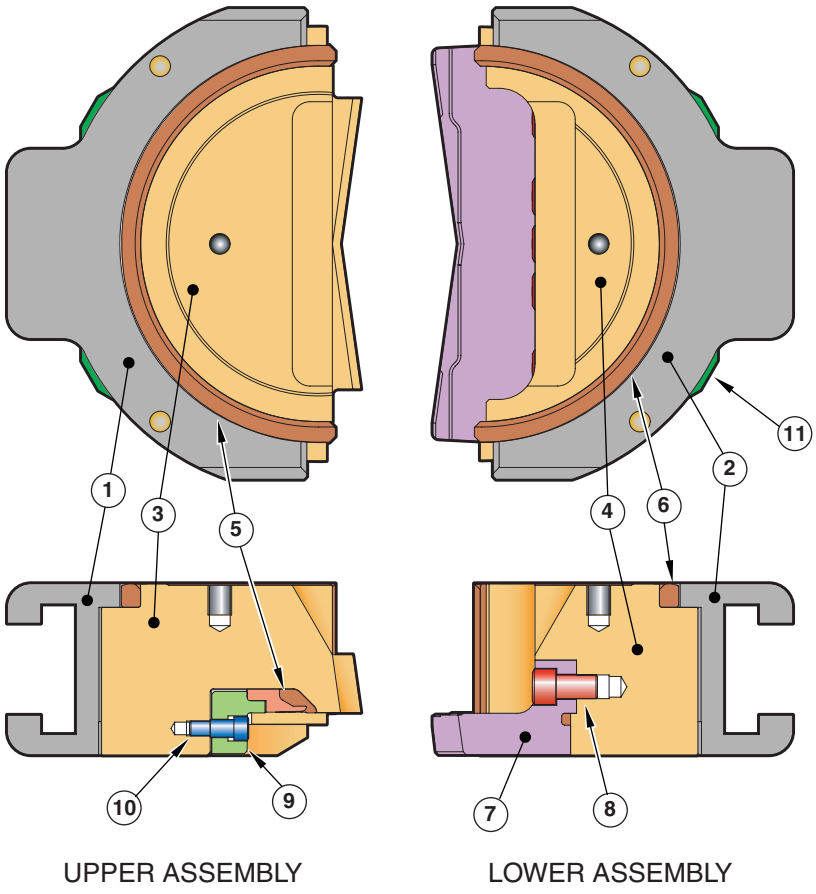

Figure 5-7. LWS V-Shear Assembly

Model LWS Hinge Bracket Assemblies

Item No.	Description	Qty. Req.	Spare Parts*	Part Number							
	Assembly Part Number	1	—	132657	132661	132662	116231	132660	132664	116839	116840
	Hinge Pin Diameter	—	—	2 1/4"	2"	1 3/4"	1 3/4"	1 1/2"	1 1/2"	1"	1"

Model LWS Hinge Bracket Assemblies (Continued)

Item No.	Description		Qty. Req.	Spare Parts*	Part Number							
1	Hinge Bracket		1	—	130815	115515	134810	134810	132411	132411	116833	116832
2	Hinge Pin		1	—	130827	115508	134811	134411	133010	132417	133850	133850
3	Plug	Hinge Pin	A2	2	065004	065001	065001	065001	065001	065001	142187	142187
		Hinge Bracket	B1 C2 C3	— — —	— 065002 —	— 065002 —	— 065002 —	— 065002 —	— 065002 —	— 065002 —	066327 — 142187	066327 — 142187
4	O-Ring, Hinge Pin		8 10	16 20	030001 —	— 030066	— 030064	— 030064	— 030061	— 030061	— 030054	— 030054
5	Cap Screw, Hinge Bracket	Short	2	—	—	—	—	—	010691	—	—	—
		Long	3 4 1	— — —	— 010750 010755	— 010727 —	— 010726 —	— 010726 —	— — 010622	— 010691 —	060423 — —	060423 — —
6	O-Ring, Hinge Bracket		2	4	030064	—	—	—	—	—	030156	030156
7	Dowel Pin		2	—	050460	050096	050096	050096	050080	050080	050066	050066
8	Retainer, Hinge Pin		1	1	—	013242	132424	132424	132424	132424	—	—
9	Grease Fitting		1	—	050267	050267	050267	050267	050267	050267	050267	050267
10	Bearing, Hinge Pin		2	—	045000	—	—	—	—	—	—	—
11	Retainer, Hinge Pin (Snap Ring)		2	—	040000	—	—	—	—	—	040022	040022
12	Protective Cap, Hinge Pin	Upper	1	—	050266	—	—	—	—	—	—	—
		Lower	1	—	050008	—	—	—	—	—	—	—

* *Quantity shown is for 1 assembly. Note that a single model requires 2 assemblies, a double model requires 4 assemblies and a triple model requires 6 assemblies. Increase quantities as required.*

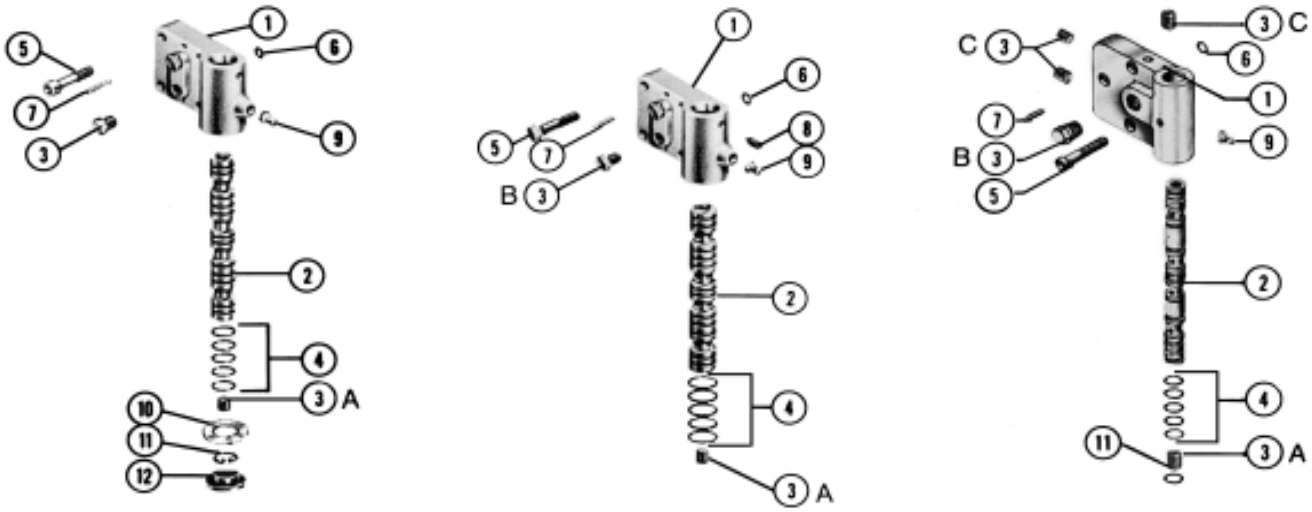

Figure 5-8. LWS Hinge Bracket Assemblies

Hinge Bracket for LWS Door 15 1/4" Cylinder

Item No.	Description		Qty. Req.	Spare Parts*	Part Number
	Assembly Part Number		1	—	20024137
	Hinge Pin Diameter		—	—	2 1/4"
1	Hinge Bracket		1	—	130815
2	Grease Fitting		1	—	050267
3	Dowel Pin		2	—	050460
4	Cap Screw, Hinge Bracket	Long	1	—	010755
5	Cap Screw, Hinge Bracket	Short	4	—	010750
6	Snap Ring		1		040000
7	Hinge Pin		1	—	20023917
8	Plug	Hinge Pin	2	2	065004
9	Protective Cap, Hinge Pin	Upper	1	—	050266
10	Protective Cap, Hinge Pin	Lower	1	—	050008
11	Bearing, Hinge Pin		2	2	045000
12	Seal, Hinge Pin		8	8	20019696
13	O-Ring, Hinge Bracket		2	2	030064

** Quantity shown is for 1 assembly. Note that a single model requires 2 assemblies, a double model requires 4 assemblies and a triple model requires 6 assemblies. Increase quantities as required.*

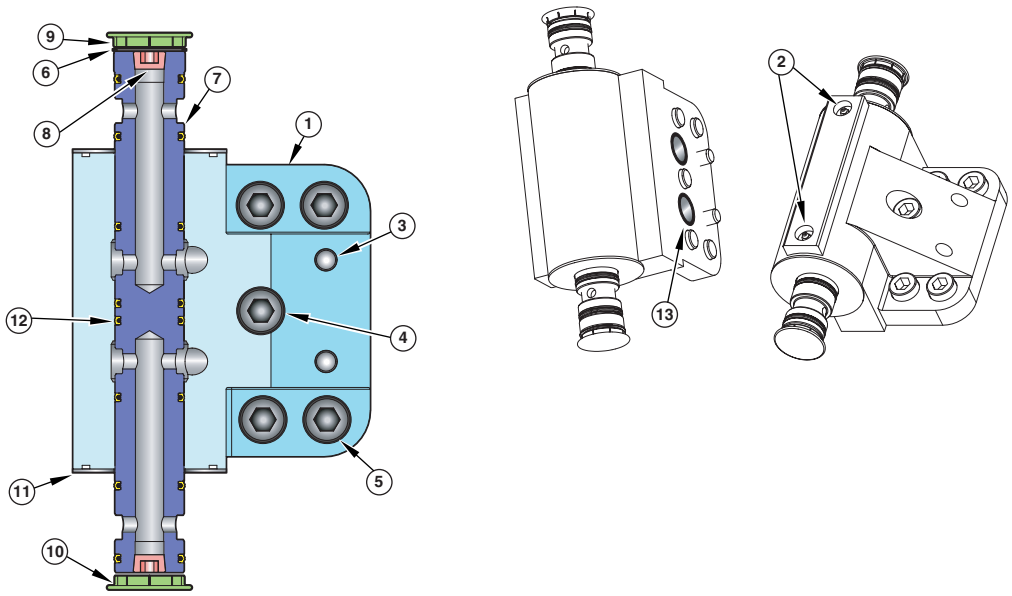

Figure 5-9. Hinge Bracket for 15 1/4" LWS Door

API Nuts

	Normal Temperatures		
Heavy Hex Nuts	**Black A194, Gr 2H**	**Cad. Plated A194, Gr 2H**	**Low Temperatures A194 Gr 4 or 7**
1/4" - 20 UNC	020018	020300	020301
5/16" - 18 UNC	020019	020304	020305
3/8" - 16 UNC	020020	020308	020309
1/4" - 14 UNC	020021	020312	020313
1/2" - 13 UNC	020006	020316	020317
9/16" - 12 UNC	020007	202320	020321
5/8" - 11 UNC	020008	020324	020325
3/4" - 10 UNC	020004	020328	020329
7/8" - 9 UNC	020009	020333	020334
1" - 8 UNC	020001	020338	020339
1 1/8" - 8 UN	020003	020343	020344
1 1/4" - 8 UN	020010	020347	020348
1 3/8" - 8 UN	020011	020351	020352
1 1/2" - 8 UN	020000	020356	020357
1 5/8" - 8 UN	020012	020361	020362
1 3/4" - 8 UN	020013	020366	020367
1 7/8" - 8 UN	020014	020371	020372
2" - 8 UN	020015	020376	020377
2 1/4" - 8 UN	020016	020381	020382
2 1/2" - 8 UN	020017	020386	020387
2 3/4" - 8 UN	020034	020391	020392
3" - 8 UN	020035	020396	020397

Tap End Studs for API Flanges

	Normal Temperature		Low Temperature
Tap End Studs	**Black A193, B7**	**Cad. Plated A193, B7**	**A320, L7**
1/2" x 2 3/4"	011000	012050	012051
5/8" x 3 1/2"	011001	012055	012056
3/4" x 3 3/4"	011002	012060	012061
3/4" x 4"	011003	012065	012066
7/8" x 4"	011004	012070	012071
7/8" x 4 1/4"	011005	012075	012076
7/8" x 4 1/2"	011006	012080	012081
1" x 4"	011037	—	—
1" x 4 3/4"	011007	012085	012086
1" x 5"	011008	012090	012091
1 1/8" x 5 1/4"	011009	012095	012096
1 1/8" x 5 1/2"	011010	012100	012101
1 1/8" x 5 3/4"	011011	012105	012106
1 1/8" x 7"	011036	012110	012111
1 1/4" x 6"	011012	012115	012116
1 1/4" x 6 1/4"	011013	012120	012121
1 3/8" x 6 1/2"	011014	012125	012126
1 3/8" x 6 3/4"	011015	012130	012131
1 3/8" x 7 1/4"	011016	012135	012136
1 3/8" x 7 1/2"	011017	012140	012141
1 1/2" x 7 1/4"	011019	012145	012146
1 1/2" x 7 3/4"	011020	012150	012151
1 1/2" x 8 1/4"	011021	012155	012156
1 1/2" x 8 1/2"	011022	012160	012161
1 5/8" x 8 1/4"	011023	012165	012166
1 5/8" x 8 1/2"	011024	012170	012171
1 5/8" x 13 1/8"	152150	012175	012176
1 3/4" x 8 1/4"	011034	012180	012181
1 3/4" x 9 1/2"	011025	012185	012186
1 7/8" x 9 1/2"	011026	012190	012191
1 7/8" x 10 1/4"	011018	012195	012196
1 7/8" x 10 3/4"	011033	012200	012201
1 7/8" x 11 1/4"	011027	012205	012206

Tap End Studs for API Flanges (Continued)

	Normal Temperature		Low Temperature
Tap End Studs	Black A193, B7	Cad. Plated A193, B7	A320, L7
2" x 10 1/4"	011028	012210	012211
2" x 11 1/4"	011035	012215	012216
2" x 11 1/2"	011029	012220	012221
2" x 12"	011030	012225	012226
2 1/4" x 12 1/4"	012240	012241	012242
2 1/4" x 13 1/4"	012246	012247	012248
2 1/4" x 14 1/4"	011031	012230	012231
2 1/4" x 15 1/2"	011032	012235	012236

API Ring Gaskets

Flange		R or RX Number	R (Oval)			RX	
Working Pressure (psi)	Nominal Size and Bore		Soft Iron Cad. Plated	Type 304 SS	Rubber Coated	Soft Iron Cad. Plated	Type 304 SS
2,000	2 1/16"	23	050192	050567	050420	050376	050603
3,000/5,000	2 1/16"	24	050193	050568	050421	050380	050604
2,000	2 9/16"	26	050194	050569	050422	050381	050606
3,000/5,000	2 9/16"	27	50195	050570	050423	050382	050607
2,000/3,000	3 1/8"	31	050196	050571	050424	050383	050608
5,000	3 1/8"	35	050197	050572	050426	050384	050609
2,000/3,000	4 1/16	37	050198	050573	050427	050385	050610
5,000	4 1/16"	39	050199	050574	050428	050386	050611
3,000	5 1/8"	41	050200	050575	050429	050387	050612
5,000	5 1/8"	44	—	050576	—	050388	050613
2,000/3,000	7 1/16"	45	050201	050577	050430	050373	050614
5,000	7 1/16"	46	050202	050578	050431	050389	050615
2,000/3,000	9"	49	050203	050580	050433	050390	050617
5,000	9"	50	050204	050581	050432	050391	050618
2,000/3,000	11"	53	050205	050582	050435	050377	050619
5,000	11"	54	050206	050583	050436	050392	050620
2,000/3,000	13 5/8"	57	050207	050584	050437	050393	050621
5,000	14"	63	050208	050585	050442	050394	050622

API Ring Gaskets (Continued)

Flange		R or RX Number	R (Oval)			RX	
Working Pressure (psi)	Nominal Size and Bore		Soft Iron Cad. Plated	Type 304 SS	Rubber Coated	Soft Iron Cad. Plated	Type 304 SS
2,000	16 3/4"	65	050209	050586	050443	050395	050623
3,000	16 3/4"	66	050210	050587	050444	050396	050624
2,000	17 3/4"	69	050306	050588	050445	—	050625
3,000	17 3/4"	70	050307	050589	050446	—	050626
2,000	21 1/4"	73	050211	050590	050448	050397	050627
3,000	20 3/4"	74	050156	050591	050449	050398	050628
2,000/3,000	9"	99	—	050601	—	050408	050638

API BX Ring Gaskets

Flange				
Working Pressure (psi)	Nominal Size	Soft Iron BX Number	Type 304 Cad. Plated	Stainless Steel
10,000, 15,000, 20,000	1 13/16"	151	050352	050644
	2 1/16"	152	050353	050645
	2 9/16"	153	050354	050646
10,000, 15,000	3 1/16"	154	050355	050647
	4 1/16"	155	050366	050648
	7 1/16"	156	050356	050649
	9"	157	050227	050650
	11"	158	050350	050651
10,0005,000	13 5/8"	159	050357	050652
	13 5/8"	160	050462	050653
5,0005,000/10,000	16 3/4"	161*	050536	050654
	16 3/4"	162	050661	050662
5,00010,000	18 3/4"	163	050663	050664
	18 3/4"	164	050665	050666
5,00010,000	21 1/4"	165	050667	050668
	21 1/4"	166	050690	050691

** For obsolete 16 3/4", 5,000 psi WP 7,500 psi test flange.*

All Thread Studs and Nuts for API Flanges

All Thread Studs WithTwo Nuts Each	Normal Temperature		Low Temperature
	Black A193, B7	Cad. Plated A193, B7	A320, L7
1/2" x 4 1/2"	011440	011442	011444
5/8" x 4 1/2"	011449	011451	011453
5/8" x 5 3/4"	011458	011460	011462
5/8" x 6"	011467	011469	011471
3/4" x 4"	011476	011478	011480
3/4" x 5 1/4"	011485	011487	011489
3/4" x 6"	011496	011498	011500
3/4" x 7"	011505	011507	011509
7/8" x 4 1/2"	011514	011516	011518
7/8" x 5 1/2"	011523	011525	011527
7/8" x 6"	011532	011534	011536
7/8" x 7 1/2"	011543	011545	011547
7/8" x 8"	011552	011554	011556
1" x 6"	011561	011563	011565
1" x 6 1/2"	011570	011572	011574
1" x 7"	011579	011581	011583
1" x 7 1/4"	011588	011590	011592
1" x 7 3/4"	011606	011608	011610
1" x 9 1/4"	011615	011617	011619
1" x 10"	—	011991	—
1 1/8" x 7"	011624	011626	011628
1 1/8" x 7 1/2"	011633	011635	011637
1 1/8" x 8 1/4"	011644	011646	011648
1 1/8" x 9"	011655	011657	011659
1 1/4" x 8"	011664	011666	011668
1 1/4" x 8 3/4"	011673	011675	011677
1 1/4" x 9 1/4"	011682	011684	011686
1 1/4" x 12"	011691	011693	011695
1 3/8" x 9"	011700	011702	011704
1 3/8" x 9 1/2"	011709	011711	011713
1 3/8" x 10 1/4"	011720	011722	011724
1 3/8" x 10 3/4"	011729	011731	011733
1 3/8" x 12 1/2"	011738	011740	011742
1 3/8" x 13 1/4"	011747	011749	011751
1 1/2" x 10 1/4"	011756	011758	011760
1 1/2" x 11 1/4"	011765	011767	011769
1 1/2" x 13"	011776	011778	011780

All Thread Studs and Nuts for API Flanges (Continued)

All Thread Studs WithTwo Nuts Each	Normal Temperature		Low Temperature
	Black A193, B7	Cad. Plated A193, B7	A320, L7
1 5/8" x 11"	011787	011789	011791
1 5/8" x 11 3/4"	011796	011798	011800
1 5/8" x 12"	011805	011807	011809
1 5/8" x 12 1/2"	011814	011816	011818
1 5/8" x 17"	011825	011827	011829
1 3/4 x 12 1/4"	011836	011838	011840
1 3/4 x 14 1/4"	011845	011847	011849
1 3/4 x 15"	011856	011858	011860
1 7/8" x 13 3/4"	011867	011869	011871
1 7/8" x 14 1/2"	011876	011878	011880
1 7/8" x 15 3/4"	011887	011889	011891
1 7/8" x 17 1/2"	011898	011900	011902
1 7/8" x 18 1/2"	011909	011911	011913
2" x 14 1/2"	011918	011920	011922
2" x 17 1/4"	011927	011929	011931
2" x 17 1/2"	011938	011940	011942
2" x 18 1/2"	011947	011949	011951
2" x 19 1/4"	011958	011960	011962
2 1/4" x 22 1/4"	011969	011971	011973
2 1/2" x 24 1/4"	011980	011982	011984

Recommended Spare Parts

The following table provides recommended spare parts coverage for the LWS preventer.

Model LWS Manual Lock BOP Spare Parts List

P/N	Description	Weight	Qty.
116858	Spare Parts Kit for Two Years of Service on Shaffer 4 $^{1}/_{16}$" 5,000 and 10,000 psi LWS BOP with Manual Ram Lock Cylinders (Elastomer Parts). Kit consists of the following:		
(132536)	Ram Shaft Seal Assembly	2.0 lb	2
(132539)	Locking Shaft Seal Assembly	3.0 lb	2
(030067)	O-Ring, Piston	.2 lb	2
(030054)	O-Ring, Hinge Pin	2.0 lb	20
(030156)	O-Ring, Hinge Bracket	.2 lb	2
(030087)	O-Ring, Cylinder Head (Small)	.2 lb	2
(030090)	O-Ring, Cylinder Head (Large)	.2 lb	2
(133846)	Seal, Piston	.4 lb	4
(030094)	Seal, Door	.6 lb	2
141966	Spare Parts for Two Years of Service on Shaffer 11", 5,000 psi LWS BOP with Manual Ram Lock Cylinders (Elastomer Parts). Kit consists of the following:		
(132534)	Ram Shaft Seal Assembly	12.0 lb	2
(132540)	Locking Shaft Seal Assembly	4.0 lb	2
(115021)	Rubber, Piston	4.0 lb	4
(030000)	O-Ring, Piston	.2 lb	2
(030064)	O-Ring, Hinge Pin	2.0 lb	20
(030007)	O-Ring, Cylinder and Cylinder Head	.4 lb	4
(030056)	O-Ring, Hinge Manifold	.8 lb	8
(030058)	O-Ring, Cylinder Manifold	.4 lb	4
(030008)	Seal, Door	.6 lb	2
(050000)	Sealant	.6 lb	6
141964	Spare Parts Kit for Two Years of Service on Shaffer 9" 3,000 and 5,000 LWS BOP with Manual Lock Cylinders (Elastomer Parts). Kit consists of the following:		
(132534)	Ram Shaft Seal Assembly	12.0 lb	2
(132540)	Locking Shaft Seal Assembly	4.0 lb	2
(115021)	Rubber, Piston	2.0 lb	4
(030000)	O-Ring, Piston	.2 lb	2
(030064)	O-Ring, Hinge Pin	2.0 lb	20
(030007)	O-Ring, Cylinder and Cylinder Head	.4 lb	4
(030056)	O-Ring, Hinge Manifold	.8 lb	8
(030058)	O-Ring, Cylinder Manifold	.6 lb	2
(050000)	Sealant	.6 lb	6

Model LWS Manual Lock BOP Spare Parts List (Continued)

P/N	Description	Weight	Qty.
141962	Spare Parts Kit for Two Years of Service on Shaffer 7 $^{1}/_{16}$", 5,000 psi LWS BOP with Manual Lock Cylinders (Elastomer Parts). Kit consists of the following:		
(122770)	Ram Shaft Seal Assembly	4.0 lb	2
(132539)	Locking Shaft Seal Assembly	3.0 lb	2
(132422)	Rubber, Piston	2.0 lb	4
(030071)	O-Ring, Piston	.2 lb	2
(030061)	O-Ring, Hinge Pin	2.0 lb	20
(030141)	O-Ring, Cylinder and Cylinder Head	.4 lb	4
(030054)	O-Ring, Hinge Manifold	.8 lb	8
(030056)	O-Ring, Cylinder Manifold	.4 lb	4
(030030)	Seal, Door	.4 lb	2
(050000)	Sealant	.6 lb	6
141965	Spare Parts Kit for Two Years of Service on Shaffer 11", 3,000 psi LWS BOP with Manual Lock Cylinders (Elastomer Parts). Kit consists of the following:		
(122770)	Ram Shaft Seal Assembly	2.0 lb	2
(132539)	Locking Shaft Seal Assembly	1.5 lb	2
(132422)	Rubber, Piston	.5 lb	4
(030071)	O-Ring, Piston	.1 lb	2
(030061)	O-Ring, Hinge Pin	.1 lb	20
(030141)	O-Ring, Cylinder and Cylinder Head	.1 lb	4
(030054)	O-Ring, Hinge Manifold	.1 lb	8
(030058)	O-Ring, Cylinder Manifold	.1 lb	4
(030094)	Seal, Door	.3 lb	2
140390	Spare Parts Kit for Two Years of Service on Shaffer 20 $^{3}/_{4}$", 3,000 psi and 21 $^{1}/_{4}$", 2,000 psi LWS BOP with Manual Lock Cylinders (Elastomer Parts). Kit consists of the following:		
(133368)	Ram Shaft Seal Assembly	12.0 lb	2
(132541)	Locking Shaft Seal Assembly	4.0 lb	2
(115021)	Rubber, Piston	4.0 lb	4
(030000)	O-Ring, Piston	.2 lb	2
(030001)	O-Ring, Hinge Pin	1.6 lb	16
(030007)	O-Ring, Cylinder and Cylinder Head	.4 lb	4
(030064)	O-Ring, Hinge Bracket	.4 lb	4
(030009)	O-Ring, Cylinder Manifold	.4 lb	4
(030176)	Seal, Door	3.0 lb	2
(050000)	Sealant	.6 lb	6

Model LWS Manual Lock BOP Spare Parts List (Continued)

P/N	Description	Weight	Qty.
20023262	Spare Parts Kit for Two Years of Service on Shaffer 20 $^{3}/_{4}$", 3,000 psi and 21 $^{1}/_{4}$", 2,000 psi LWS BOP with 15 $^{1}/_{4}$" Manual Lock Cylinders (Elastomer Parts). Kit consists of the following:		
(20023567)	Ram Shaft Seal Assembly	12.0 lb	2
(20023573)	Locking Shaft Seal Assembly	4.0 lb	2
(20020124)	Rubber, Piston	2.0 lb	4
(030390)	O-Ring, Cylinder Cylinder Head	.4 lb	2
(20023263)	Back Up Ring	.4 lb	2
(030645)	O-Ring, Cylinder Head	.4 lb	2
(20020128)	Back Up Ring	.2 lb	2
(20024138)	Seal Kit, Hinge Bracket	.6 lb	2
(030061)	O-Ring, Cylinder Manifold	.2 lb	8
(030176)	Seal, Door	.1 lb	2
(050000)	Sealant	3.0 lb	2
(20023478)	PIP Seal Assembly	.2 lb	4
(150613)	Wear Band, Piston	.3 lb	2
		.5 lb	95 in
117729	Emergency Parts Kit for Shaffer 4 $^{1}/_{16}$", 10,000 psi LWS BOP with Manual Lock Cylinders (Elastomer Parts). Kit includes:		
(116842)	Ram Shaft	0.0 lb	2
(142197)	Locking Shaft	7.0 lb	2
(060426)	Cap Screw, Door Long	2.0 lb	12
140235	Emergency Parts Kit for Shaffer 11", 5,000 psi LWS BOP with Manual Lock Cylinders (Elastomer Parts). Kit includes:		
(134806)	Door Screw	5.3 lb	20
(141270)	Ram Shaft	32.0 lb	2
(141273)	Locking Shaft	21.5 lb	2
140323	Emergency Parts Kit for Shaffer 9", 3,000/5,000 psi LWS BOP with Manual Lock Cylinders (Elastomer Parts). Kit includes:		
(134415)	Door Screw	3.0 lb	20
(141242)	Ram Shaft	28.0 lb	2
(141247)	Locking Shaft	20.5 lb	2
140322	Emergency Parts Kit for Shaffer 7 $^{1}/_{16}$", 5,000 psi LWS BOP with Manual Lock Cylinders (Elastomer Parts). Kit includes:		
(133012)	Door Screw	2.5 lb	16
(141213)	Ram Shaft	16.0 lb	2
(141218)	Locking Shaft	10.0 lb	2

Model LWS Manual Lock BOP Spare Parts List (Continued)

P/N	Description	Weight	Qty.
140324	Emergency Parts Kit for Shaffer 11", 3,000 psi LWS BOP with Manual Lock Cylinders (Elastomer Parts). Kit includes:		
(133012)	Door Screw	2.5 lb	12
(141266)	Ram Shaft	20.0 lb	2
(141268)	Locking Shaft	12.0 lb	2
	Emergency Parts for Shaffer 20 $^{3}/_{4}$", 3,000 psi and 21 $^{1}/_{4}$", 2,000 psi LWS BOP with Manual Lock Cylinders (Elastomer Parts). Kit consists of the following:		
(142088)	Door Screw	4.0 lb	12
(141299)	Ram Shaft	38.0 lb	2
(141302)	Locking Shaft	31.0 lb	2
	Emergency Parts for Shaffer 20 $^{3}/_{4}$", 3,000 psi and 21 $^{1}/_{4}$", 2,000 psi LWS BOP with 15 $^{1}/_{4}$" Manual Lock Cylinders (Elastomer Parts). Kit consists of the following:		
(130724)	Door Screw	4.0 lb	12
(20023257)	Ram Shaft	38.0 lb	2
(20023254)	Locking Screw	31.0 lb	2
	Spare Parts Kit for Two Years of Service on Shaffer 13 $^{5}/_{8}$", 5,000 psi LWS BOP with Manual Lock Cylinders (Elastomer Parts). Kit consists of the following:		
(132534)	Ram Shaft Seal Assembly	2.7 lb	4
(132541)	Locking Shaft Seal Assembly	2.0 lb	4
(115021)	Rubber, Piston	1.0 lb	4
(030000)	O-Ring, Piston	.02 lb	4
(030065)	O-Ring, Hinge Pin	.01 lb	40
(030007)	O-Ring, Cylinder and Cylinder Head	.1 lb	8
(030056)	O-Ring, Hinge Manifold	.1 lb	16
(030058)	O-Ring, Cylinder Manifold	.4 lb	8
(135252)	Seal, Door	0.2 lb	4
(050000)	Sealant	0.6 lb	12
	Emergency Parts Kit for Shaffer 13 $^{5}/_{8}$", 5,000 psi LWS BOP with Manual Lock Cylinders (Elastomer Parts). Kit includes:		
(193601)	Ram Shaft	98.0 lb	2
(141273)	Locking Shaft	29.0 lb	2
(134606)	Cap Screw, Door Long	30.8 lb	8

Model LWS Manual Lock BOP Door Bolt Torque Valves

	11", 5,000	9", 5,000	7", 5,000	20", 3,000	11", 3,000	21", 2,000	20", 3,000
LWS	1,500 ft-lb	1,500 ft-lb	1,100 ft-lb	1,200 ft-lb	1,100 ft-lb	1,200 ft-lb	1,450 ft-lb