

Service Manual

ST-80C

Iron Roughneck

Reference	Reference Description	
	Iron Roughneck, ST-80C	
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Document Number		Rev.
D811000124-MAN-001		03



NATIONAL OILWELL VARCO

Revision History

03	16.06.2010	Changed manual type to Service Manual. Removed the Recommended Lubricant section. Added note in chapter 5. Removed chapter 7.	C. Rodriguez	E. Axelson	E. Axelson
02	08.07.2008	1. Add General Specifications 2. Correct technical data	P. Solovyov	E. Axelson	B. Winter
01	11.05.2007	First Issue	P. Solovyov	K. Schmidt	B. Winter
Rev	Date (dd.mm.yyyy)	Reason for issue	Prepared	Checked	Approved

Change Description

Revision	Change Description
01	First Issue
02	1. Add General Specifications. 2. Correct technical data.
03	Changed "User Manual" to "Service Manual" in title page. Made the following changes to Chapter 5: - Removed section titled "Recommended Lubricants", - added a statement referring to the Lubricants and Hydraulic Fluids document, - added a note related to lubrication intervals and severity of use. Removed Chapter 7: Service Locations.

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Chapter 1: General Information

Overview

Intended Audience

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.

Conventions

Note, Caution, Warning, and Hot Surface

Notes, cautions, warnings and hot surfaces safety messages provide readers with additional information 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 topics.

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 observe and follow proper procedures could result in serious or fatal injury to personnel, significant property loss, or significant equipment damage.

Conventions

Note, Caution, Warning, and Hot Surface

Hot Surface



The hot surface symbol indicates the presence of a hot surface or component. Touching this surface could result in bodily injury. To reduce the risk of injury from a hot component, allow the surface to cool before touching.

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 Drawing Package* included with your NOV documentation.

Safety Requirements

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 NOV 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 in rig safety, tool operation, and maintenance to ensure their safety.



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

Contact the NOV Drilling Equipment training department for more information about equipment operation and maintenance training. Refer to the Service Location document listed in the User Manual.

Safety Requirements

Recommended Tools

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

General System Safety Practices

The equipment discussed in this manual may require or contain one or more utilities, such as electric, 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.



During operation, surfaces may become hot enough to cause bodily injury. To reduce the risk of injury from a hot component, allow the surface to cool before touching.

- ❑ 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 installation.
- ❑ Replace failed or damaged components with NOV certified parts. Failure to do so could result in equipment damage or injury to personnel.

Safety Requirements

Routine Maintenance

Equipment must be maintained on a routine basis. See *Chapter 5, Maintenance, Inspection and Lubrication* 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.

Chapter 2: Overview

Tool Description

The ST-80C Iron Roughneck is an oil-rig tool used for make-up and break-out of drilling tubular connections. Designed for use on smaller rigs where floor space is limited, the durable ST-80C Iron Roughneck features an extend/retract scissor-arm system and is available in standard and tall models. With the tall pedestal Iron Roughneck model, the operator has the capability of raising the Iron Roughneck above the deck crew's head in the parked position. Thus, the ST-80C allows clearance around well center and mousehole both during use and when placed in the parked position.



For safety considerations, the ST-80C Iron Roughneck cannot be operated when placed in the parked position.

The control console, which mounts on the front left or right side of the Iron Roughneck carriage, operates the hydraulic components safely and quickly providing up to 80,000 ft.-lbs. of torque to make-up and break-out drilling tubular connections.

The ST-80C is installed on the drill floor and uses either a single, floor-mounted socket or a floor-mounted bearing and upper mast attachment for elevated storage. No hanging cable is needed. The ST-80C works at well center and the mousehole. This automated Iron Roughneck can be rotated by hand about the pedestal for storage when not in use.

Tool Description

Iron Roughneck Components

ST-80C Standard

Carriage

The carriage is connected to the pedestal and is a compact, heavy-duty enclosure for the Iron Roughneck components. The control console support is located on the front of the carriage.

Control Console

The ST-80C Iron Roughneck operator-controlled control console is installed on the front of the Iron Roughneck carriage. The control console can be mounted on the front left or front right side, depending on space requirements of the rig floor.

Pedestal

The pedestal, which is mounted on the drill floor, provides vertical and rotational travel for the Iron Roughneck for required alignment with either the mousehole or well center.

Scissor-Arm

Capable of extending and retracting, the scissor arm assembly supports and provides horizontal travel of the Iron Roughneck for positioning at the mousehole, well center, and parked/standby positions.

Torque Wrench with Spin Rollers

The ST-80C uses a combination spinner and torque wrench. The dies of the upper jaws are located between the spin rollers. The spin rollers grip the connection and spin with a torque of 1,750 ft.-lb.

The torque wrench can make up the connection with a maximum torque of 60,000 ft.-lb. The wrench can break out connections with a maximum torque of 80,000 ft.-lb.

The ST-80C Iron Roughneck can make or break all tool connections from 4-1/4" to 8-1/2" outside diameter, and can handle nominal drill pipe from 3-1/2" up to 6-5/8".

ST-80C Tall

Remote Hoist/Lower Kit

The remote hoisting and lowering kit operates as an extension to raise the Iron Roughneck to the parked/stored position above the deck floor. This feature is only available for the ST-80 tall model.

Tool Description

ST-80C Range of Operation

The ST-80C is compact and flexible for positioning as required according to rig floor specifications and dimensions. Models are available in standard and tall pedestal heights. The tall pedestal model can be raised to a high parked position using a hoist/lower kit. Refer to 4, *Hoist/Lower Kit*



Information and illustrations in this document feature the Tall pedestal model. However, information can be used for the ST-80C standard pedestal model or tall pedestal model.

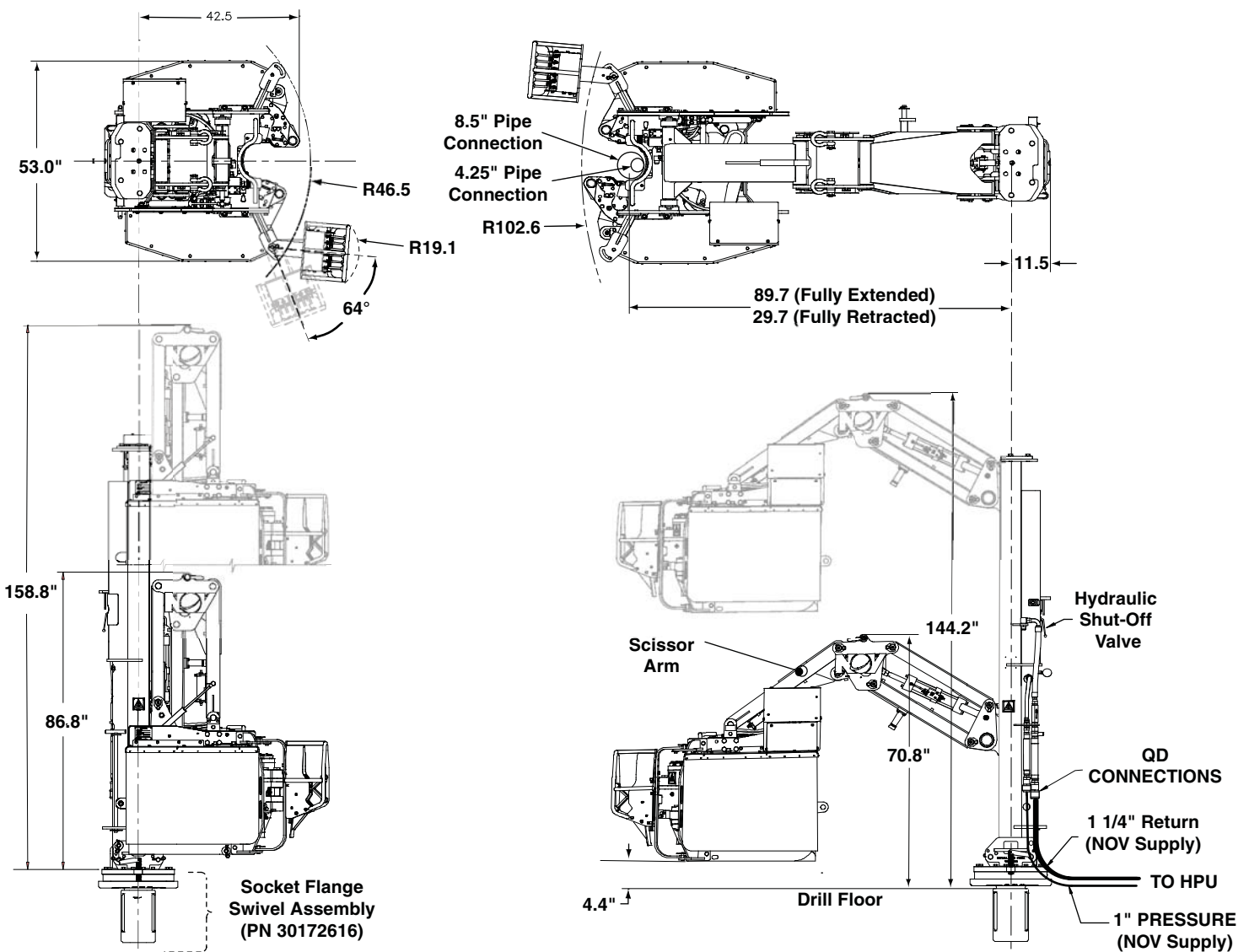


Figure 2-1. ST-80C Range of Operation

Tool Description

Pinch Point Hazards

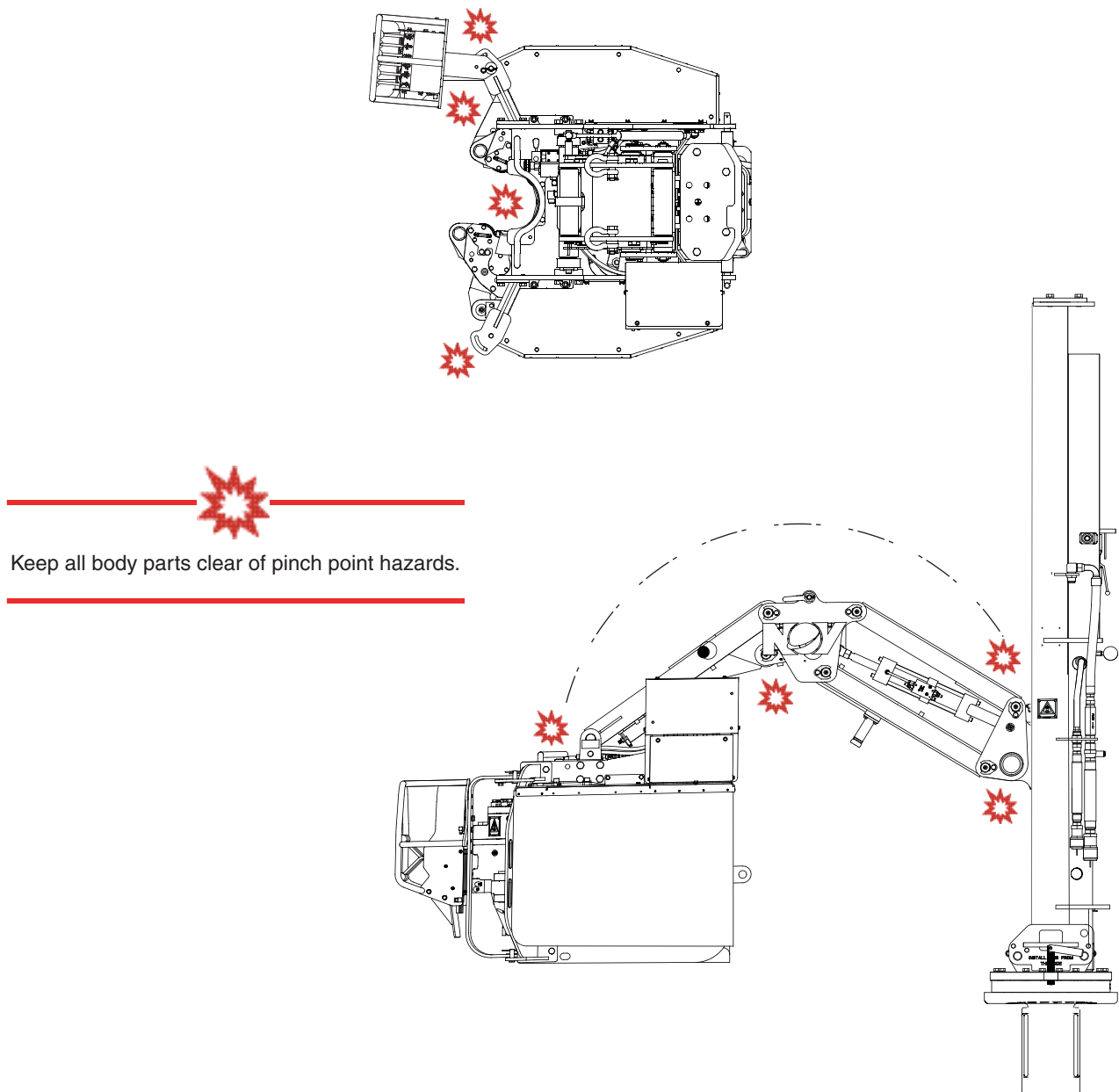


Figure 2-2. ST-80C Pinch Point Hazards

General Specifications

Hydraulic Requirements

Hydraulic supply pressure (Max.)	2,500 psi (172 bar)
Hydraulic supply pressure (Min.)	2,100 psi (145 bar)
Hydraulic flow rate required (Min.)	28 gpm @ 1000 psi
Hydraulic flow rate required (Max.)	40 gpm (151 L/pm)
Supply connections (Min.)	1 - inch Hose (1-1/4 - inch if hose length > 20 ft.)
Return connections (Min.)	1-1/4 - inch Hose (1-1/2 - inch if hose length > 20 ft.)

Wrench Assembly

Motor spinning roller ratio	2:1
Spin speed (rollers)	135 rpm
Spin speed (8 1/2" OD)	90 rpm
Make up torque (Max.)	60,000 ft.-lb Max.
Break out torque (Max.)	80,000 ft.-lb Max.

Shipping Data (approx., allowing for crate/palette)

Height (in shipping skid)	97.6"	Tall: 125"	Short: 87"
Width	60"		
Depth	66"		
Weight	7,400 lbs.		

General Specifications

Allowable Tool Joint Differentials



Neither pin nor box may be smaller than 4-1/4" nor larger than 8-1/2".

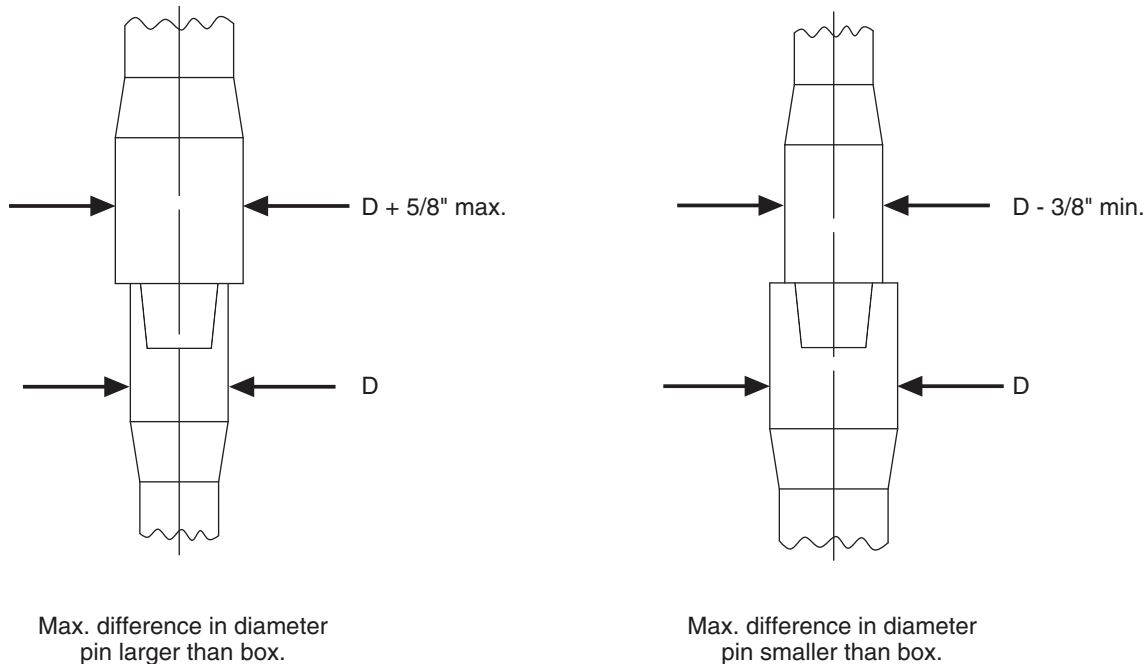


Figure 2-3. Drill Pipe Allowable Tool Joint Differentials

Tool Orientation

The ST-80C front is positioned over the well center or mousehole for pipe handling procedures. For positioning information, refer to 4, *Positioning ST-80C for Operation*

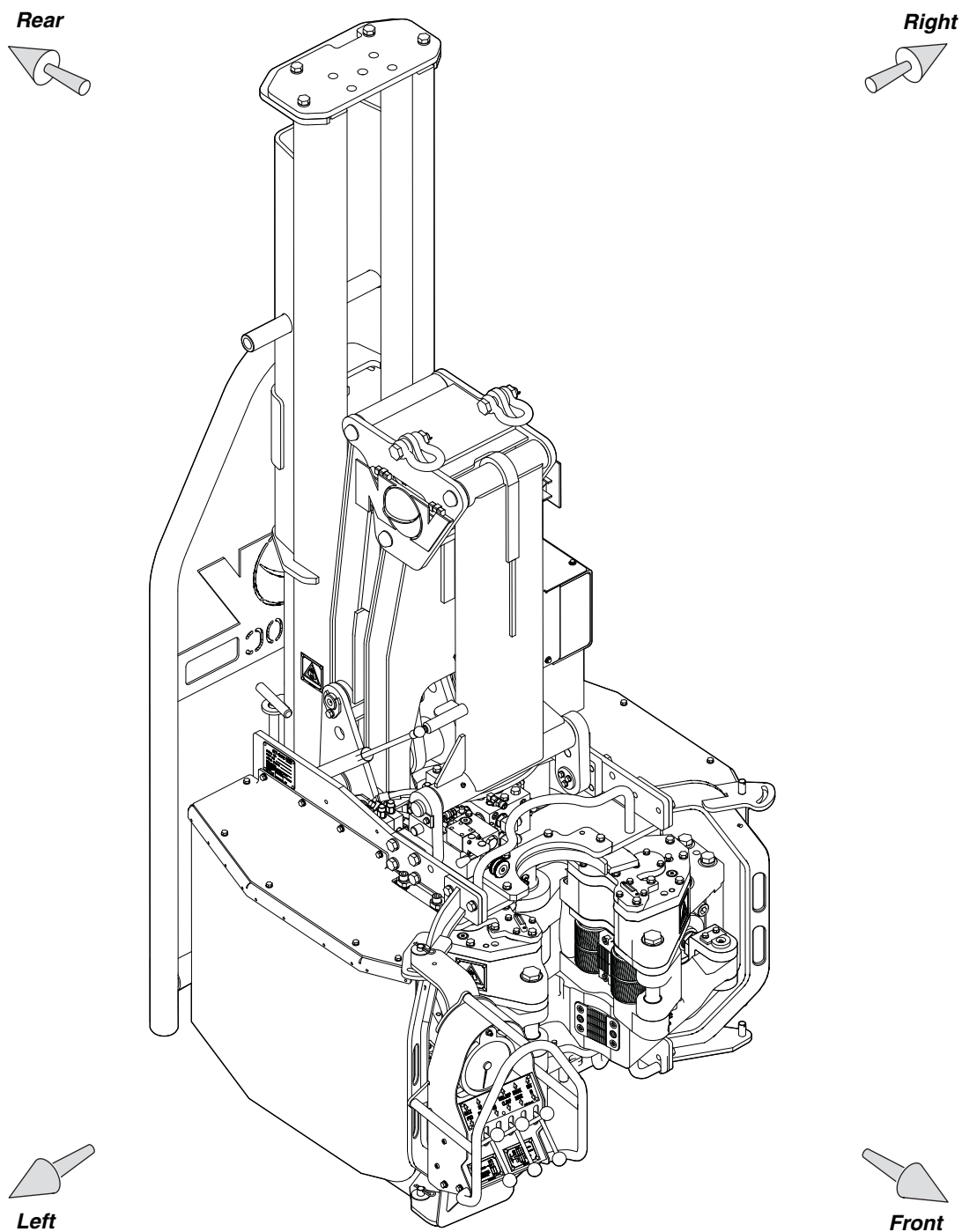


Figure 2-4. Tool Orientation

General Description

The ST-80C Iron Roughneck can make-up or break-out tubular connections from 4-1/4" to 8-1/2" outside diameter, and can handle drill pipe from 3-1/2" up to 6-5/8".

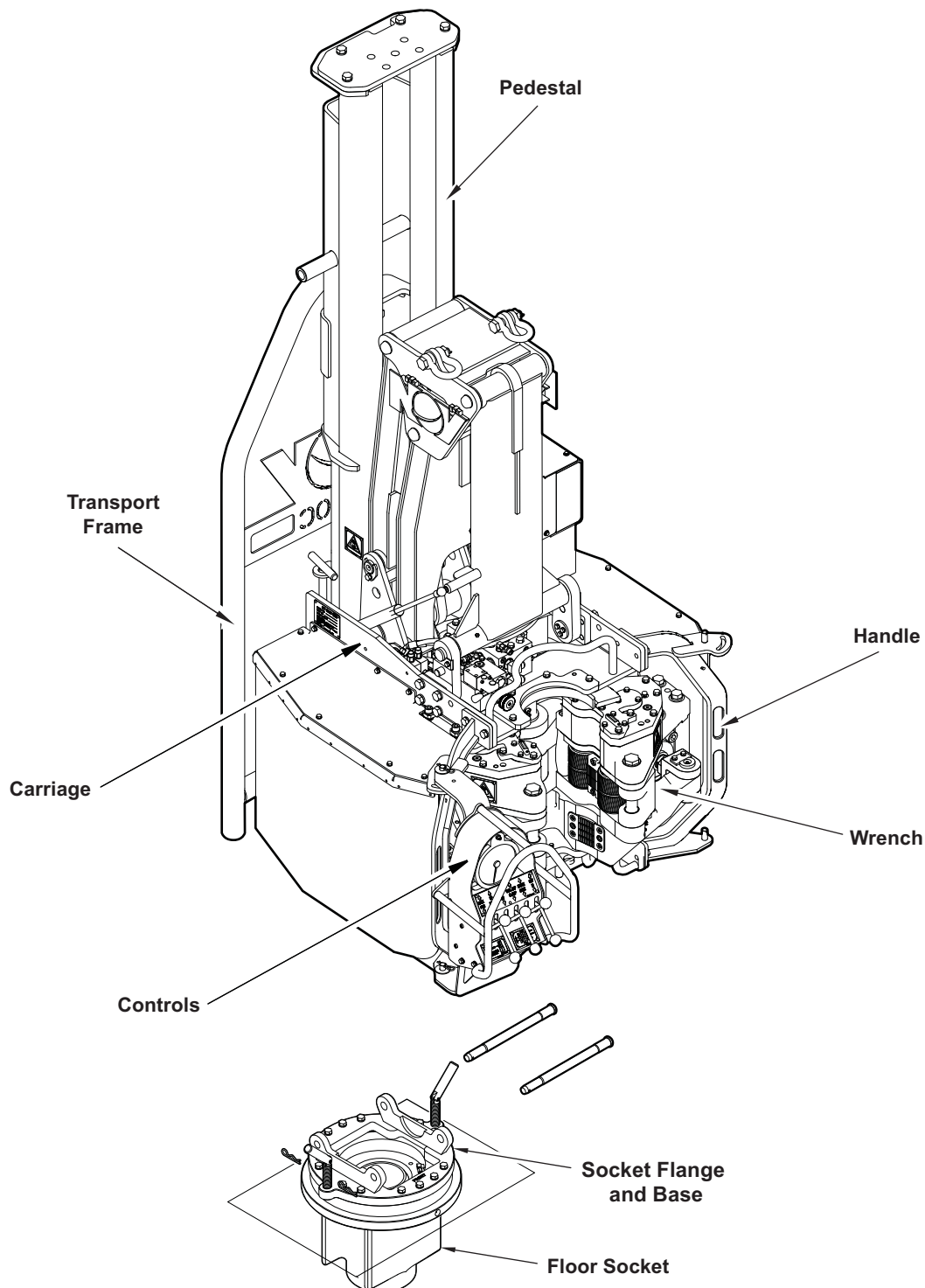


Figure 2-5. ST-80C General Description

General Description

Socket Flange

The ST-80C is installed on the drill floor using a single, floor-mounted socket. The socket flange enables the Iron Roughneck to be rotated for proper placement over the well center or mousehole.

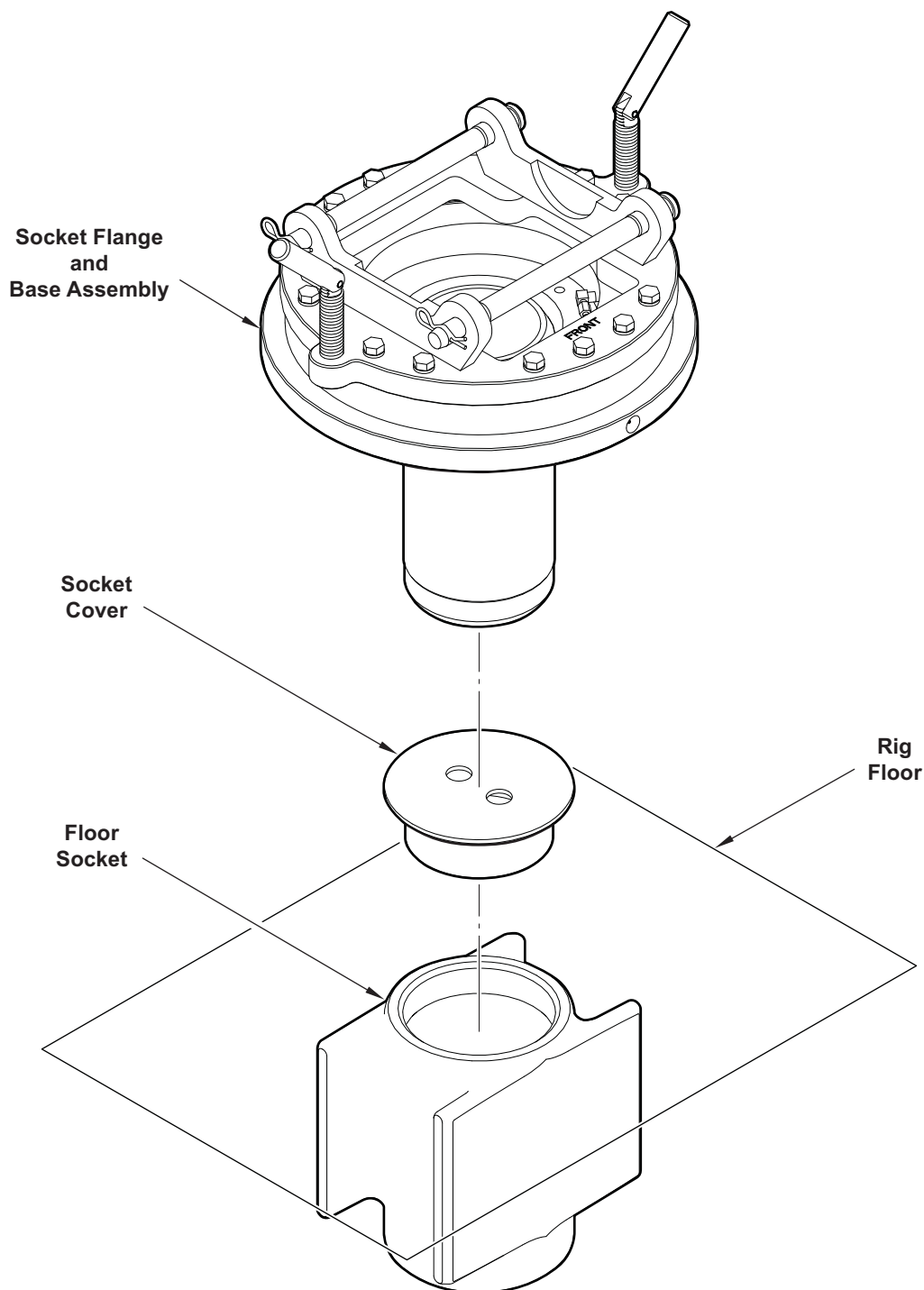


Figure 2-6. Socket Flange

General Description

Carriage

The Iron Roughneck carriage attaches to the scissor-arm which provides horizontal travel to align the Iron Roughneck with the well center or mousehole. The scissor-arm is retractable and can place the Iron Roughneck in operating, standby, or parked positions.



The controls can be installed on either the left or right side of the ST-80C carriage. Refer to 3, *Installing the Control Console*

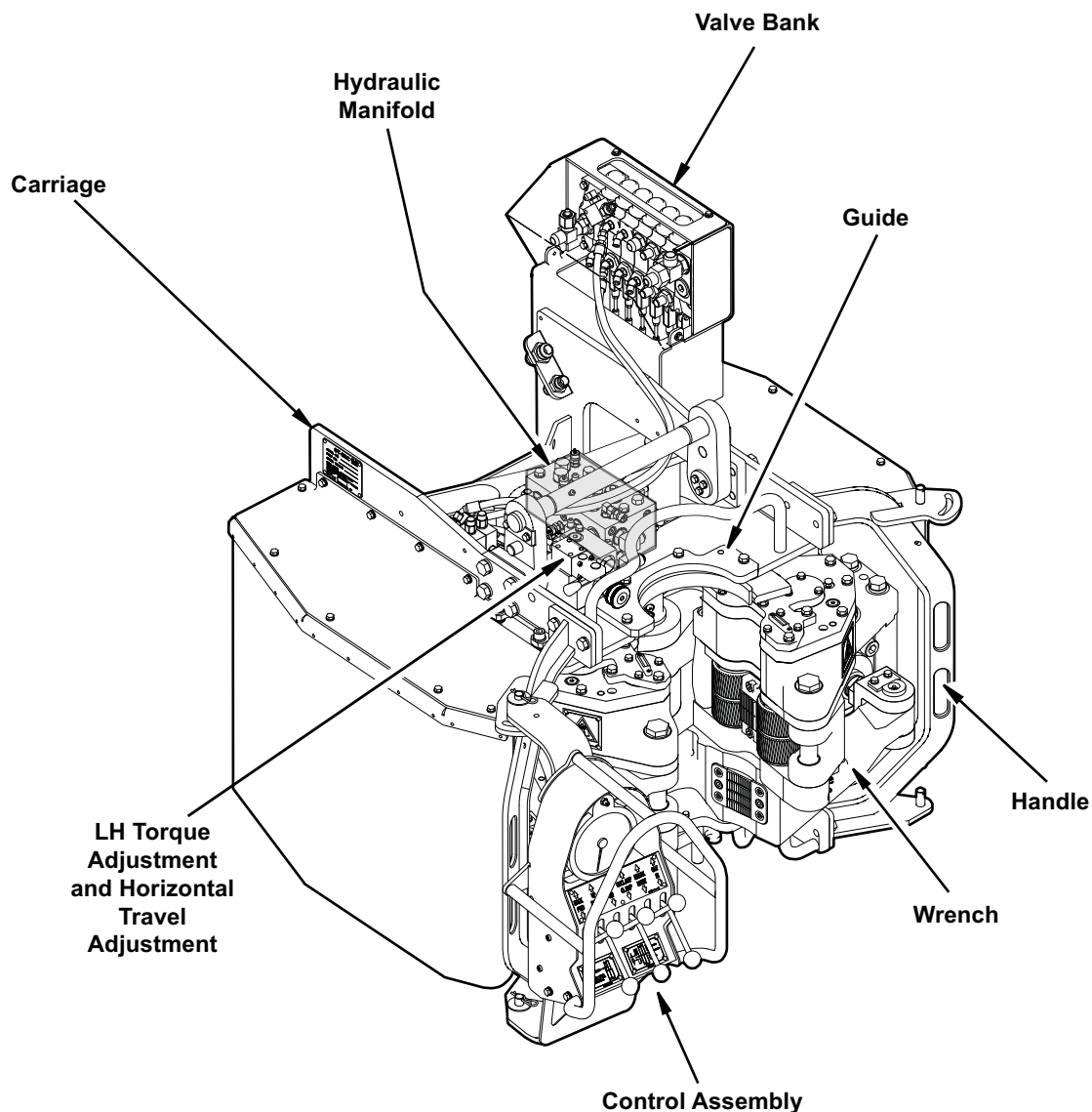


Figure 2-7. ST-80-C Carriage Assembly

General Description

Pedestal

The pedestal support is mounted on the drill floor using a single, floor-mounted socket or a floor-mounted bearing and upper mast attachment. The pedestal provides vertical and rotational travel to align the Iron Roughneck with the well center or mousehole.

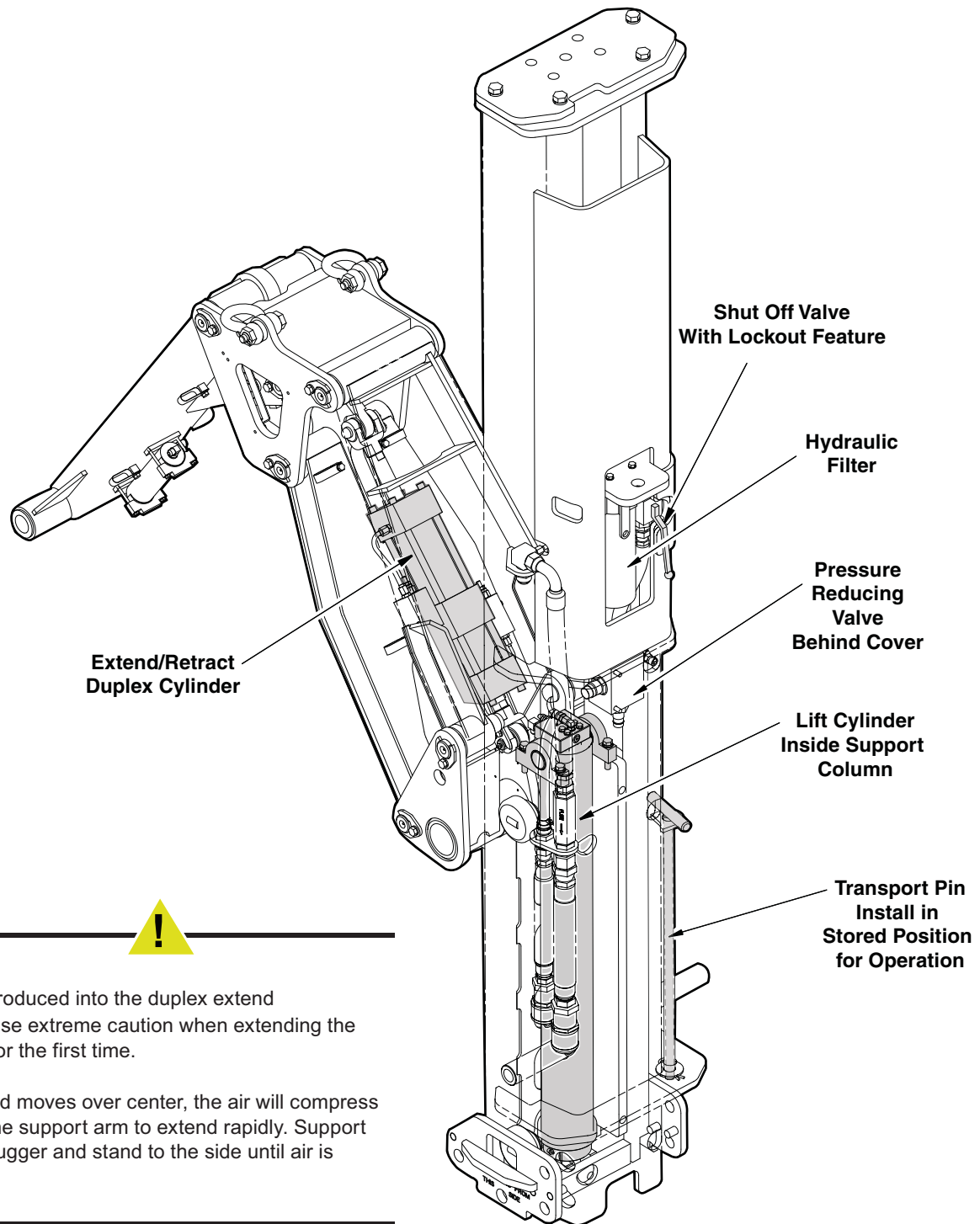


Figure 2-8. Pedestal Assembly

General Description

Wrench

The ST-80C uses a combination spinner and torque wrench. The dies of the upper jaws are located between the spin rollers. The spin rollers grip the connection and spin with a torque of 1,750 ft.-lb.

The torque wrench can make up the connection with a maximum torque of 60,000 ft.-lb. The wrench can break out connections with a maximum torque of 80,000 ft.-lb.

Follow general safety precautions when working around wrench spin rollers. Failure to follow the precautions in these warnings may result in serious injury to personnel and/or damage to equipment.



Ensure power is OFF to the wrench/spin rollers before touching or performing repairs and maintenance. Spin rollers present pinching hazards.



Spin rollers can become hot during operation. Ensure spin rollers are allowed to cool before touching or performing repairs and maintenance.



Ensure tools, clothing, or personal equipment do not come in contact with the spin rollers during operation. Objects can become tangled in the spin rollers and lead to serious injury to personnel, and/or damage to equipment.

General Description

Wrench

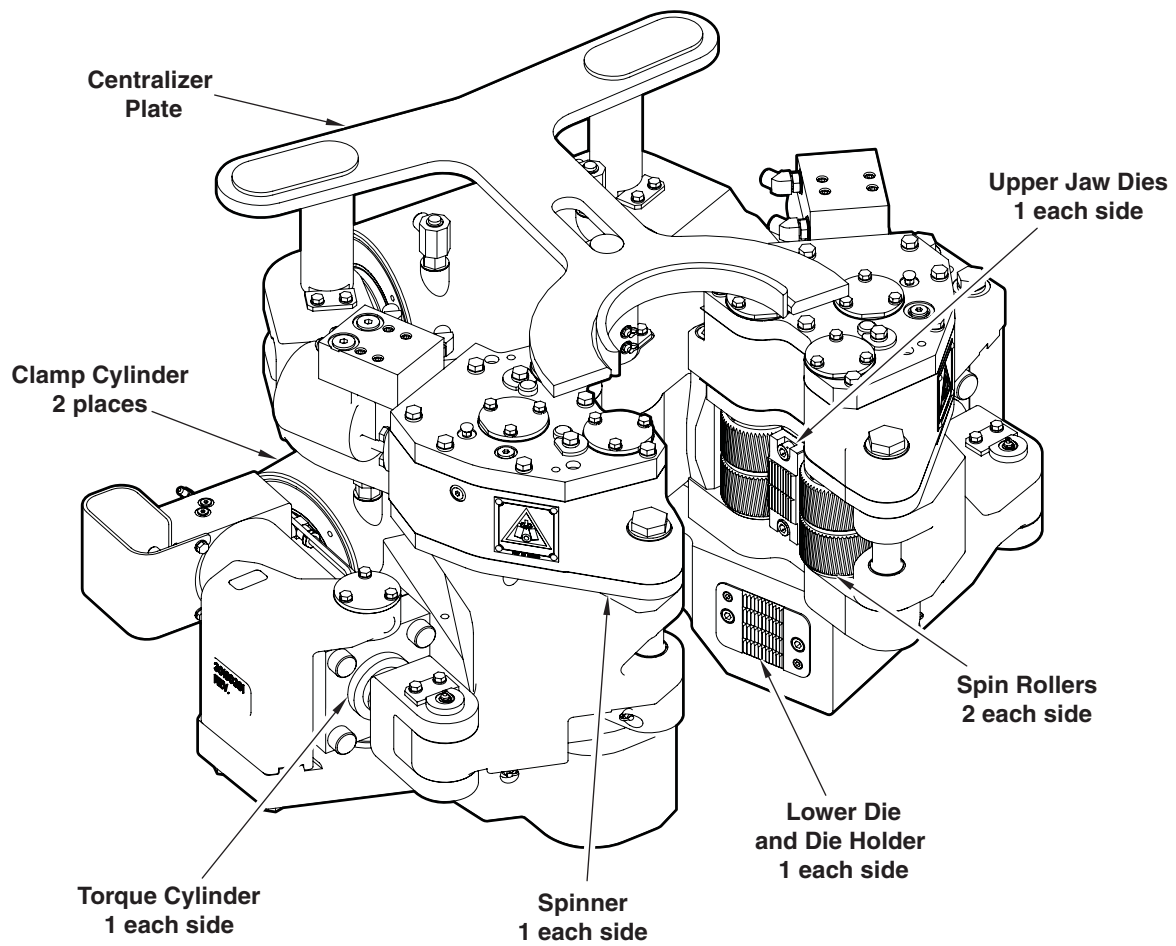


Figure 2-9. Wrench Assembly

General Description

Controls Positioning Range

The ST-80C control console can be located on the right or left side and can be adjusted out 64°.

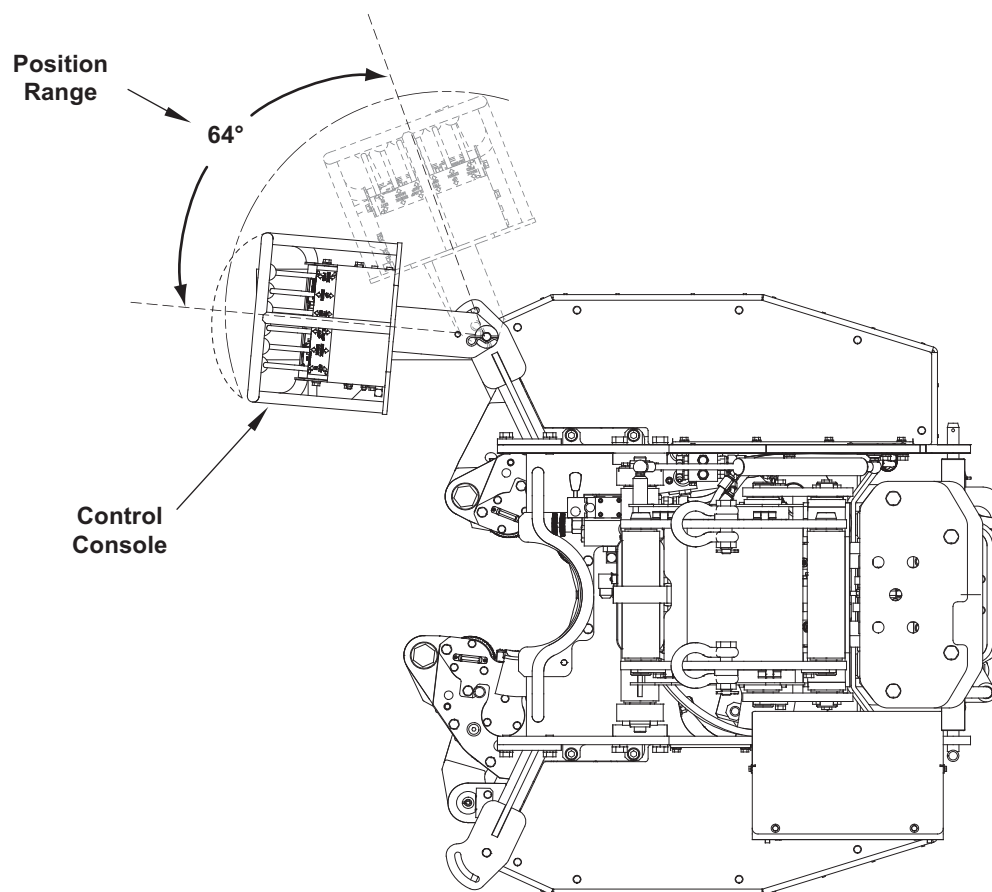
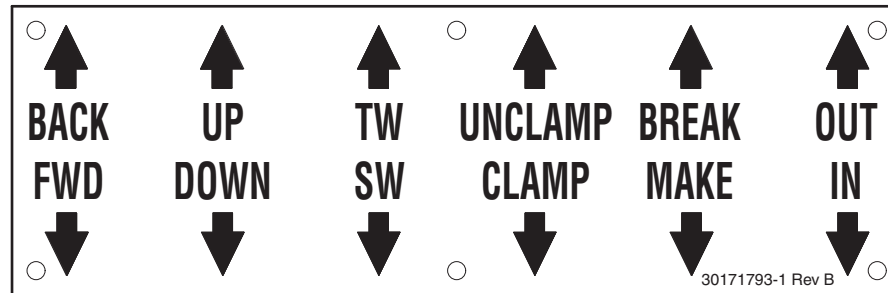


Figure 2-10. Controls Positioning Range

General Description

Control Console



Detail of Control Panel

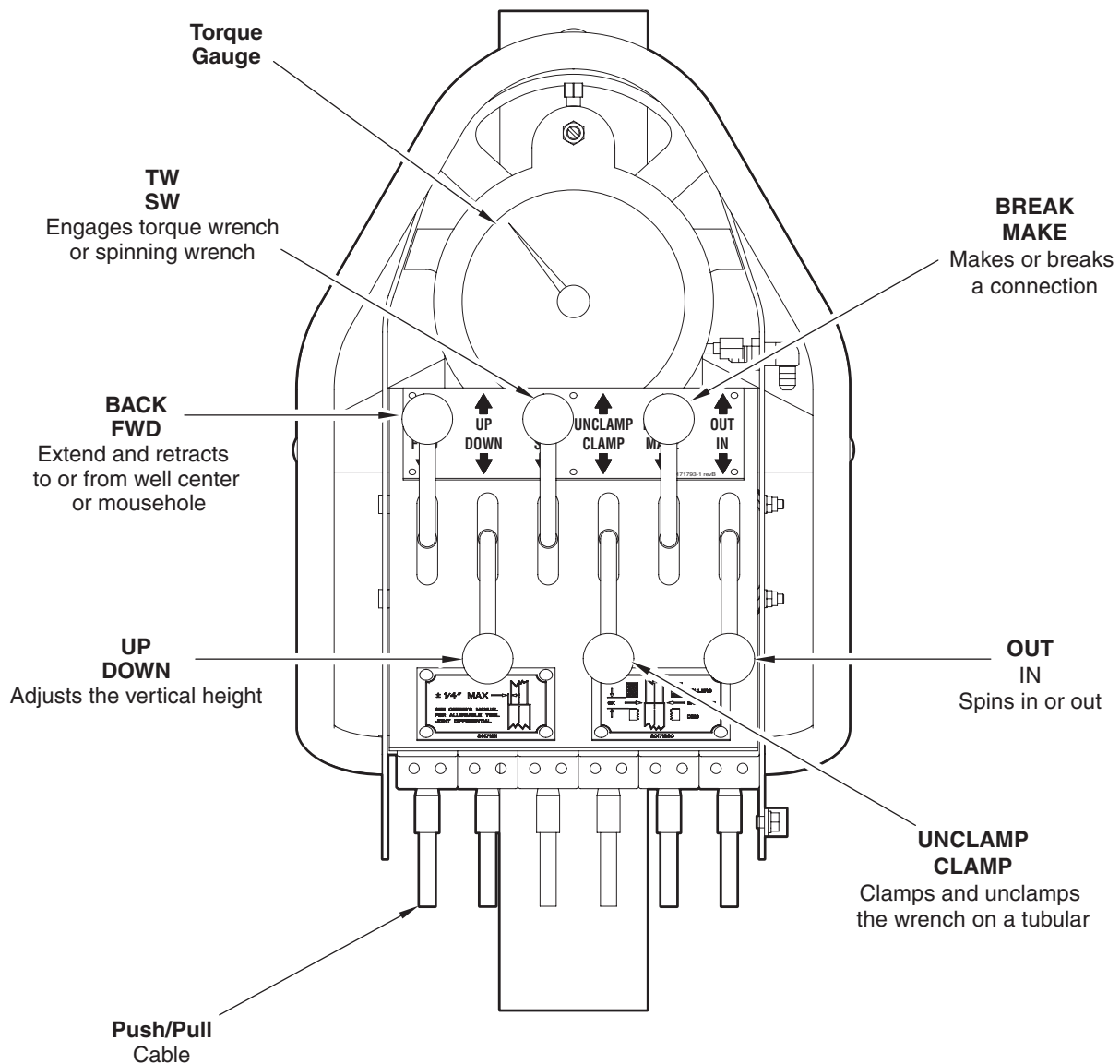


Figure 2-11. Control Console

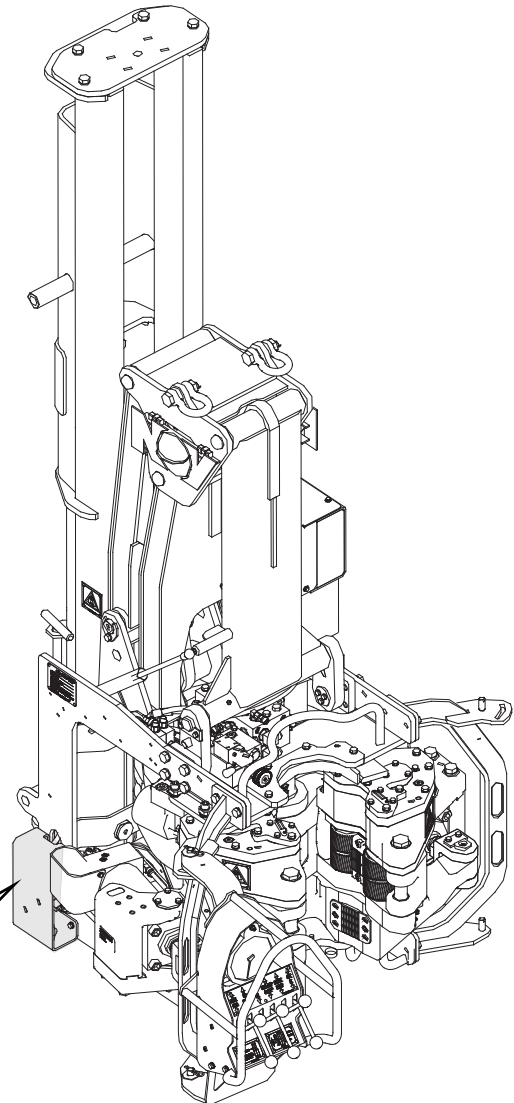
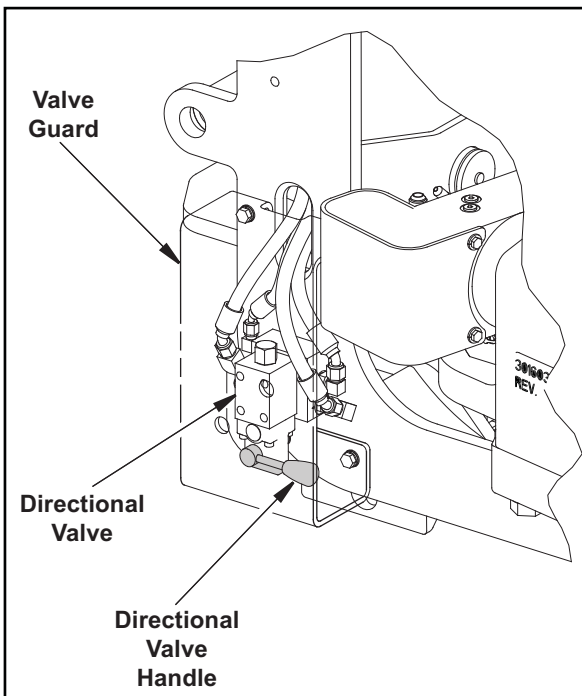
General Description

Hoist/Lower Kit (ST-80C Tall)

The ST-80C Tall model includes a hoist/lower kit. The hoist/lower valve enables the operator to move the Iron Roughneck between the parked/stored and operating positions. Refer to 4, *Hoist/Lower Kit*



Whenever hoisting or lowering the iron roughneck, ensure all personnel and equipment are clear of the operating area. Failure to follow this warning may result in injury to personnel or damage to equipment.



**ST-80C Iron Roughneck
Tall Model**

Figure 2-12. Hoist/Lower Kit (ST-80C Tall)

Chapter 3: Installation

Pre-Installation and Setup

The information in this chapter assumes that all pre-installation planning and rig-up has been accomplished prior to installation of the Iron Roughneck.

Requirements

Although many installation layout arrangements are possible, critical preparation and installation consideration must be performed before attempting to install the Iron Roughneck.

Before installing the Iron Roughneck system, consider the ideal location of the Iron Roughneck, HPU, and service loop to ensure accessibility and safety. Installation considerations help to prevent possible restrictions.

Prior to field installation, ensure all Iron Roughneck components are included and are in serviceable condition. Fill all lubricants systems to correct levels with specified lubricants.

Initial Inspection

After unpacking all Iron Roughneck components and parts, inspect as follows:

- ❑ Inventory all components and parts. Notify National Oilwell Varco if parts are missing or incorrect. Refer to *Chapter 7, Contact Information*.
- ❑ Inspect all components and parts for shipment damage and corrosion. Notify the carrier if components or parts were damaged during shipment.

Customer Verification of Hydraulic Fluid Cleanliness

Prior to attaching any National Oilwell Varco equipment to the customer's hydraulic plumbing, the customer must ensure that the hydraulic fluid/system cleanliness is at a level of ISO 440615/12 or better.

Equipment Differences

The National Oilwell Varco Iron Roughneck is available in standard pedestal and extended pedestal models. Each Iron Roughneck model is hydraulically similar. The illustrations and information in this document include the common systems and components installation.

Pre-Installation Requirements and Procedures

Hydraulic System and Components

Hydraulic systems and components are designed for the intended use in the drilling industry. The hydraulic operating pressure for this equipment is 2,100 psi.

- ❑ Before beginning work on any portion of the hydraulic system, familiarize yourself with the hydraulic schematics. Refer to the *Technical Drawing Package*.
- ❑ Isolate, lock out, and tag the hydraulic power controls.
- ❑ Take precautions when bleeding down residual system pressure, when using bleed valves or equivalent techniques.
- ❑ Properly discharge all system-stored fluid pressure.
- ❑ Collect all residual hydraulic fluid in a container to prevent rig or environmental contamination.
- ❑ Take precautions to prevent hydraulic oil from leaking into other open mechanical components such as junction boxes.

Pre-Installation Requirements and Procedures

Special Tools

The following table lists special tools and support equipment required to install and commission an Iron Roughneck.

Description	Supplier and Model No.	Accuracy	Range
Hydraulic Pressure Test Gauge	Various	3-5%-FS	0-3000 psi (0-206 Bar)

Equipment Motion Hazards

The Iron Roughneck equipment travels either horizontally or vertically.



Avoid placing objects in or near the path of motion for this equipment. Such interference could cause serious injury and/or death to personnel and/or damage to the equipment.



Keep the working envelope/zone of the equipment free from personnel.

Installation

Floor Socket Location

Before installing the floor socket support for the Iron Roughneck, determine the proper floor socket location. The placement and installation of the floor socket is specific to the rig.

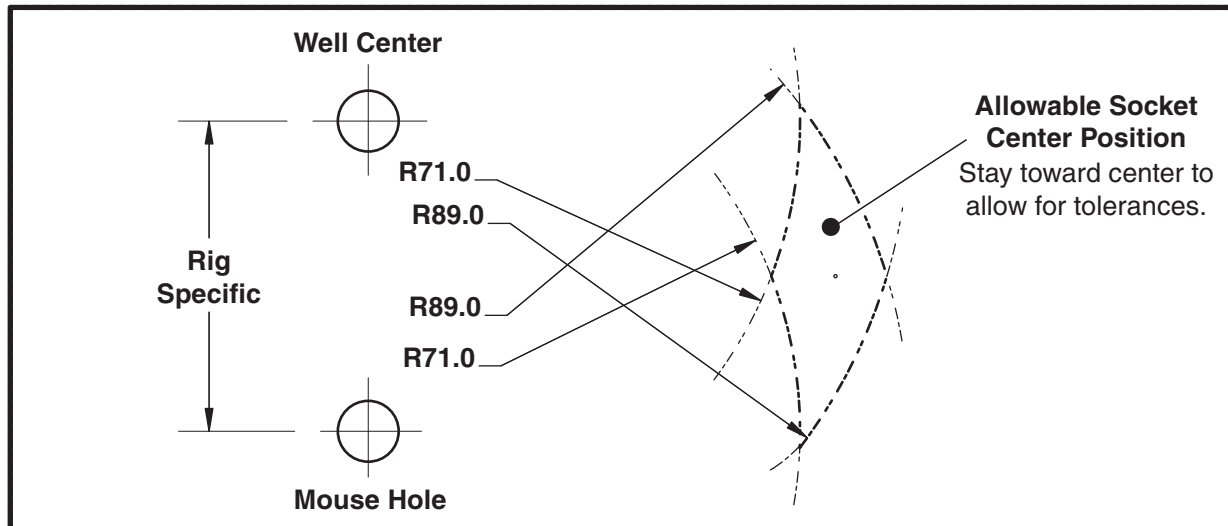


Figure 3-1. Floor socket Location Layout

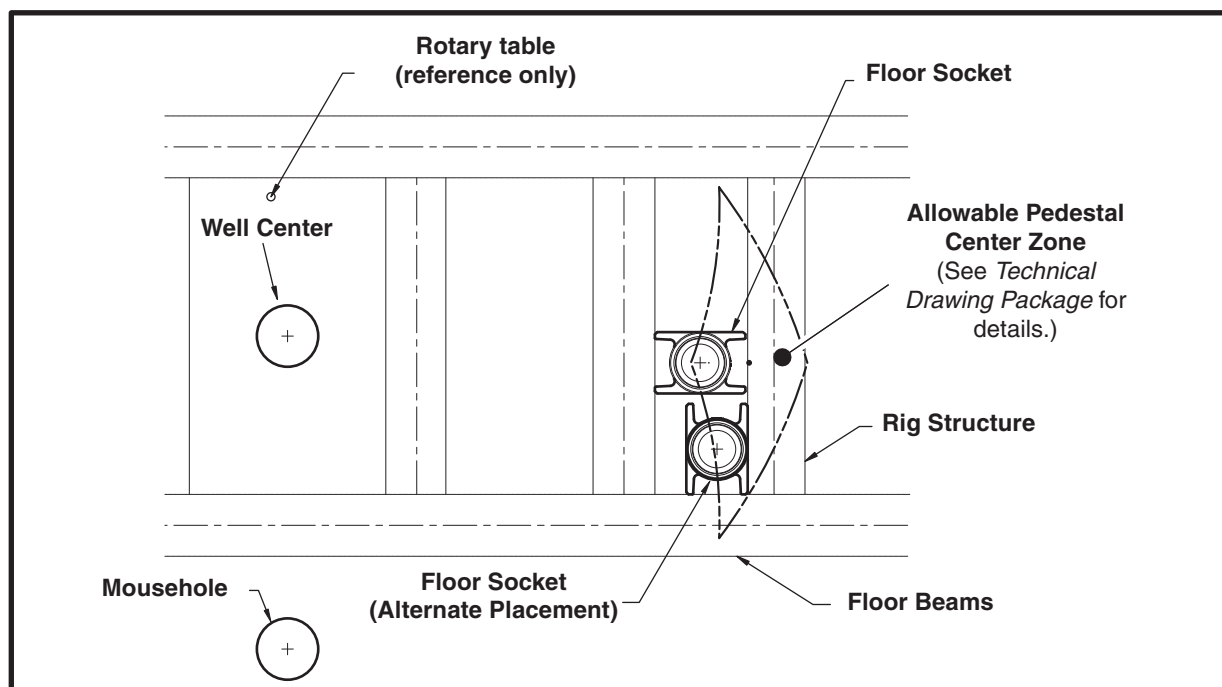


Figure 3-2. Floor Socket Placement

Installation

Floor Socket Location

Install the Iron Roughneck clear of the well center and mousehole position for tong applications.

The following illustration shows the Iron Roughneck in the closest installation position to the well center and mousehole.

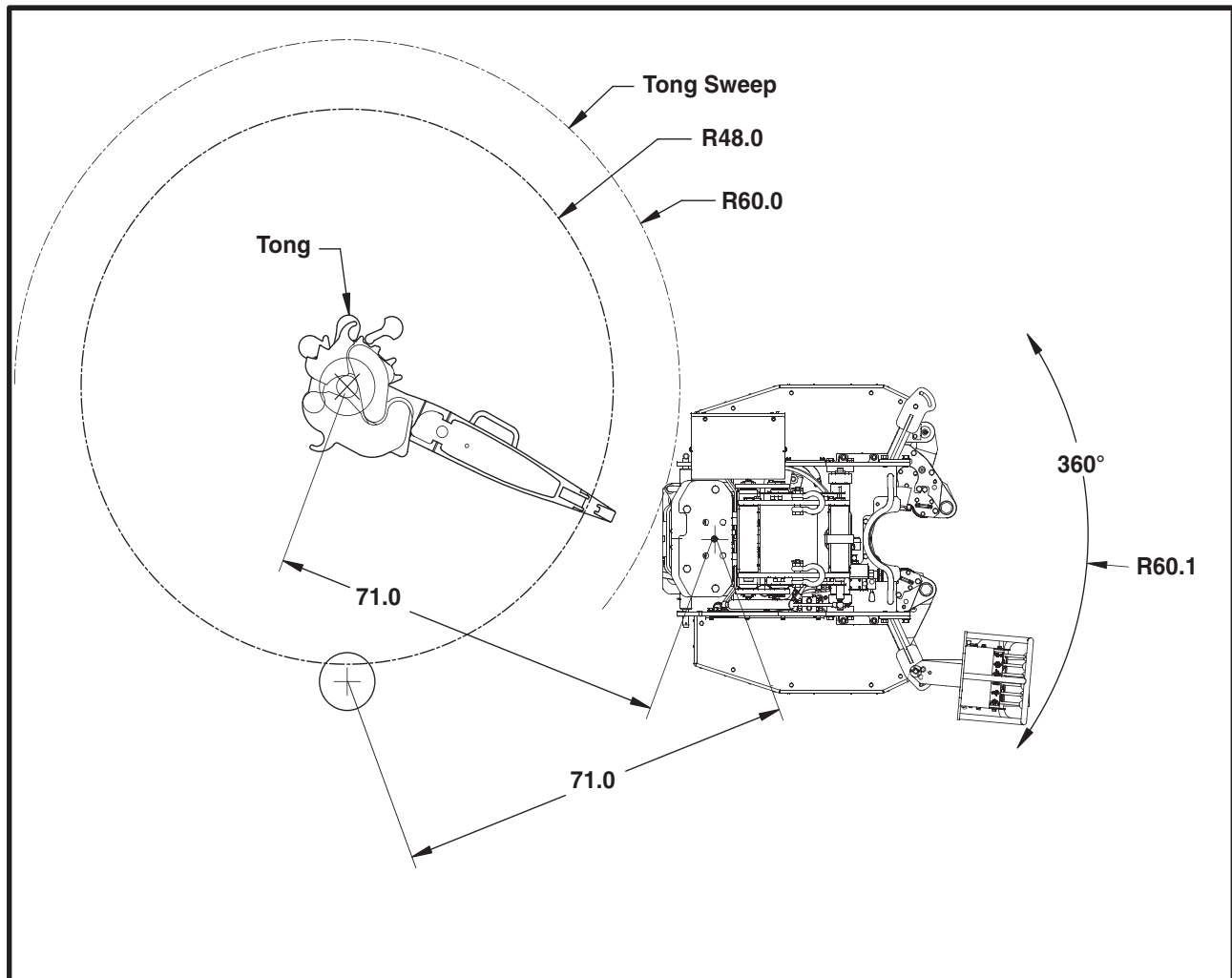
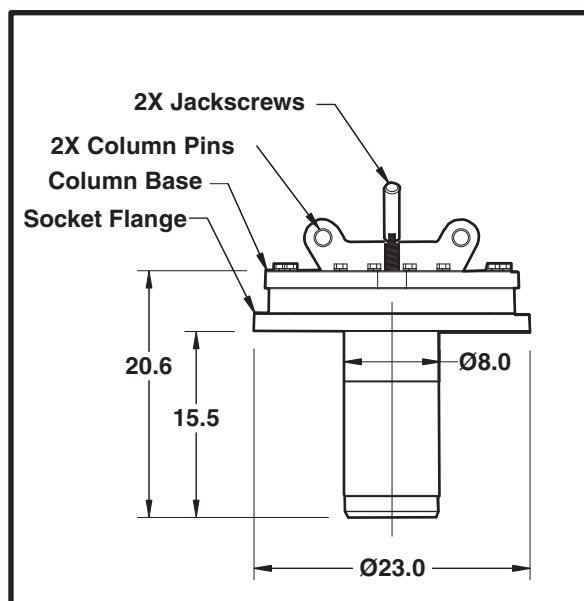
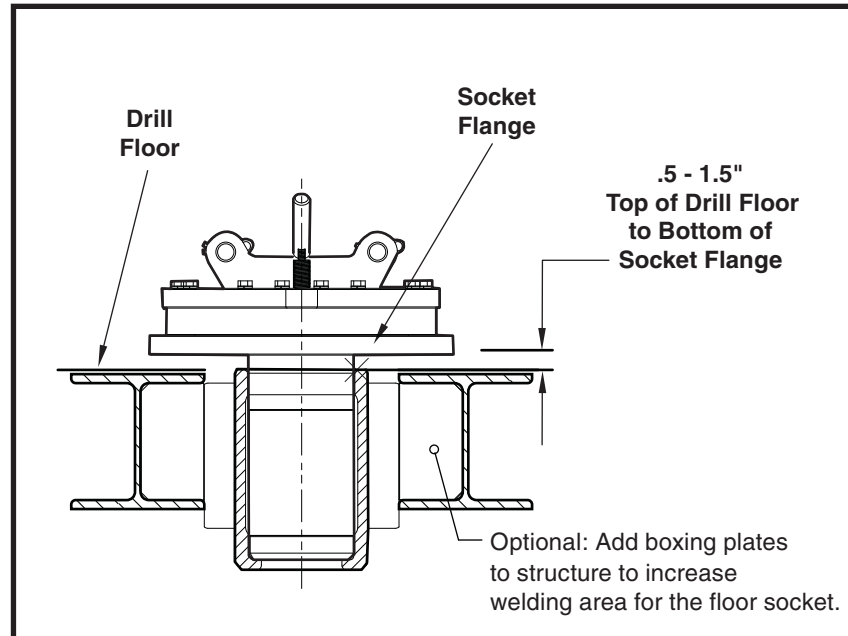


Figure 3-3. Tong Sweep for ST-80C

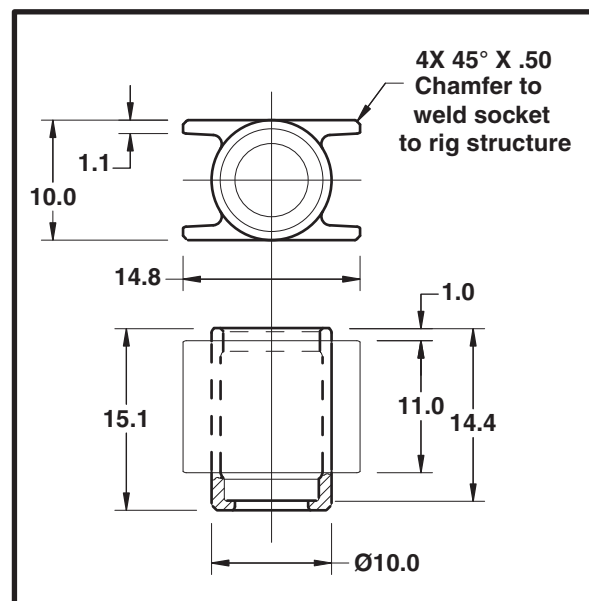
Installation

Floor Socket Installation

Install the floor socket into the rig floor as shown in the Figure 3-4. Ensure the floor socket is positioned to receive the Iron Roughneck pedestal facing forward.



Socket Flange and Assembly (480 lbs.)

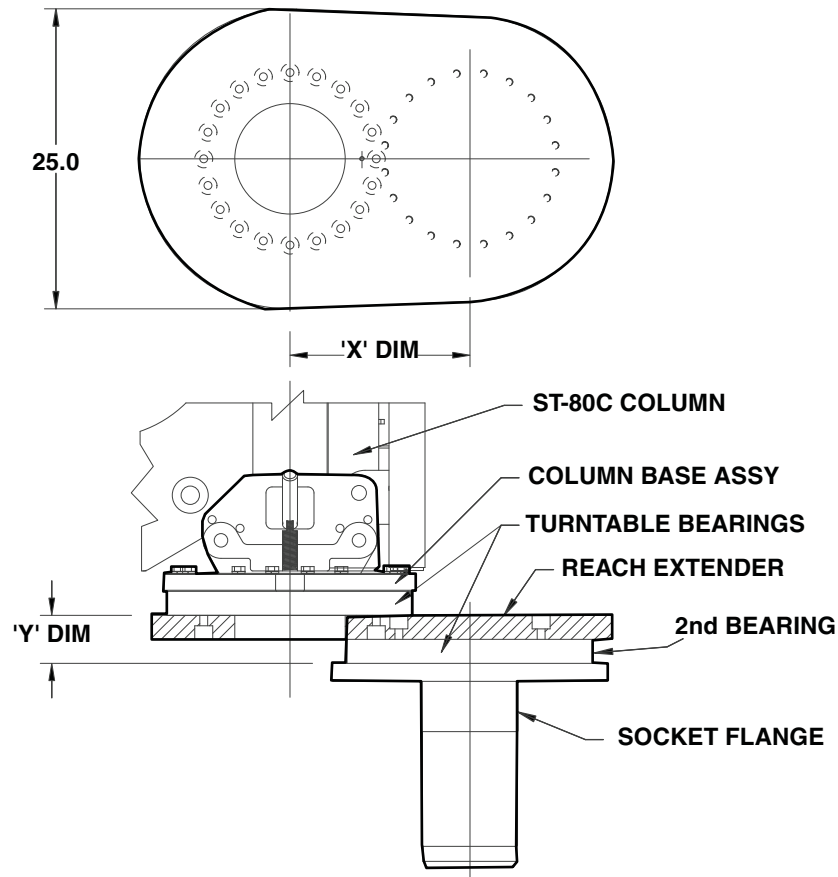


Floor Socket (190 lbs.)

Figure 3-4. Floor Socket Components

Installation

Reach Extender Plate (Optional)



ST-80C Reach Extender Plate

Choose Optional Reach Extender

PART NO.	'X' DIM	'Y' DIM	2nd BEARING
30172058	15.00	2.50	NO
30172505	21.00	4.56	YES
30174040	25.00	5.06	YES



The use of extenders is optional if the position diamond covers area that contains an obstruction.

Figure 3-5. Reach Extender Plate Installation

Installation

Use of Optional Reach Extender

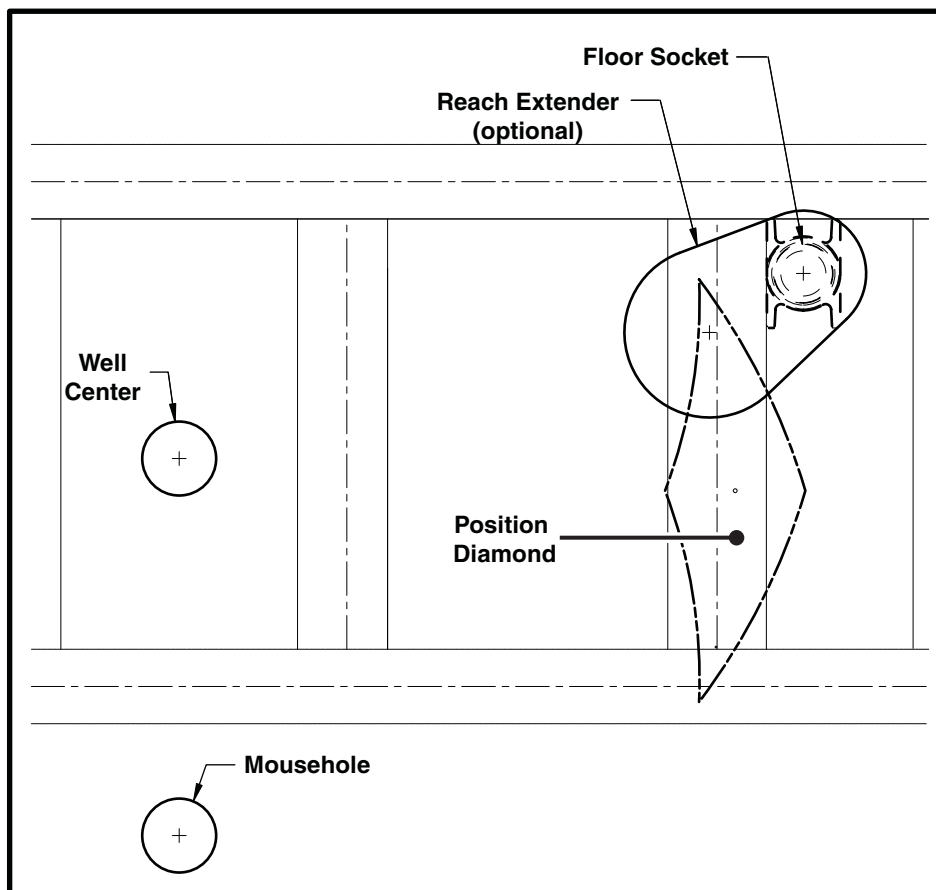


Figure 3-6. Reach Extender (Optional)

Installation

Lifting the Iron Roughneck

Before lifting the Iron Roughneck, ensure that the pedestal is in the full down position and that the transport pin is installed in the transport position. When the Iron Roughneck is in use, store the transport pin in the brackets located on the back of the pedestal. Use a lifting device attached to the two lifting shackles attached to lugs on top of the support arm when lifting the Iron Roughneck.

National Oilwell Varco recommends using a double chain sling with master link when lifting the Iron Roughneck.



When lifting the Iron Roughneck, always use the lifting lugs and shackles provided. No other part of the Iron Roughneck is rated for, nor intended to support the full weight of the Iron Roughneck (7,420 lbs.)

The ST-80C has a transportation skid that can be used to hoist the Iron Roughneck through the V-door onto the drill floor, where the ST-80C will be installed in the floor socket.



Always ensure hoisting operations are conducted safely to avoid equipment damage and/or injury to personnel.

Installation

Lifting the Iron Roughneck

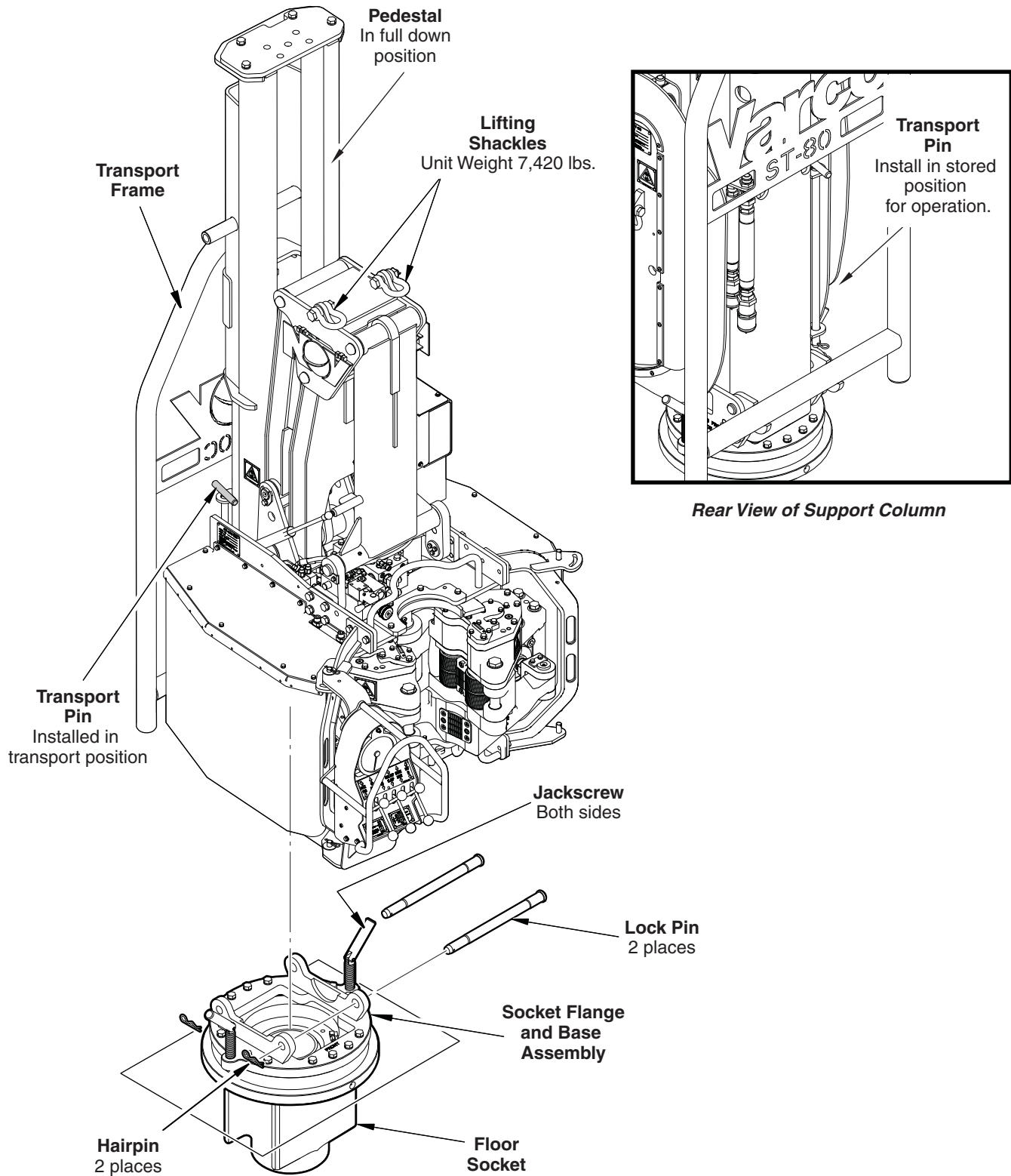


Figure 3-7. Lifting the Iron Roughneck

Installation

Removing Transport Frame and Skid

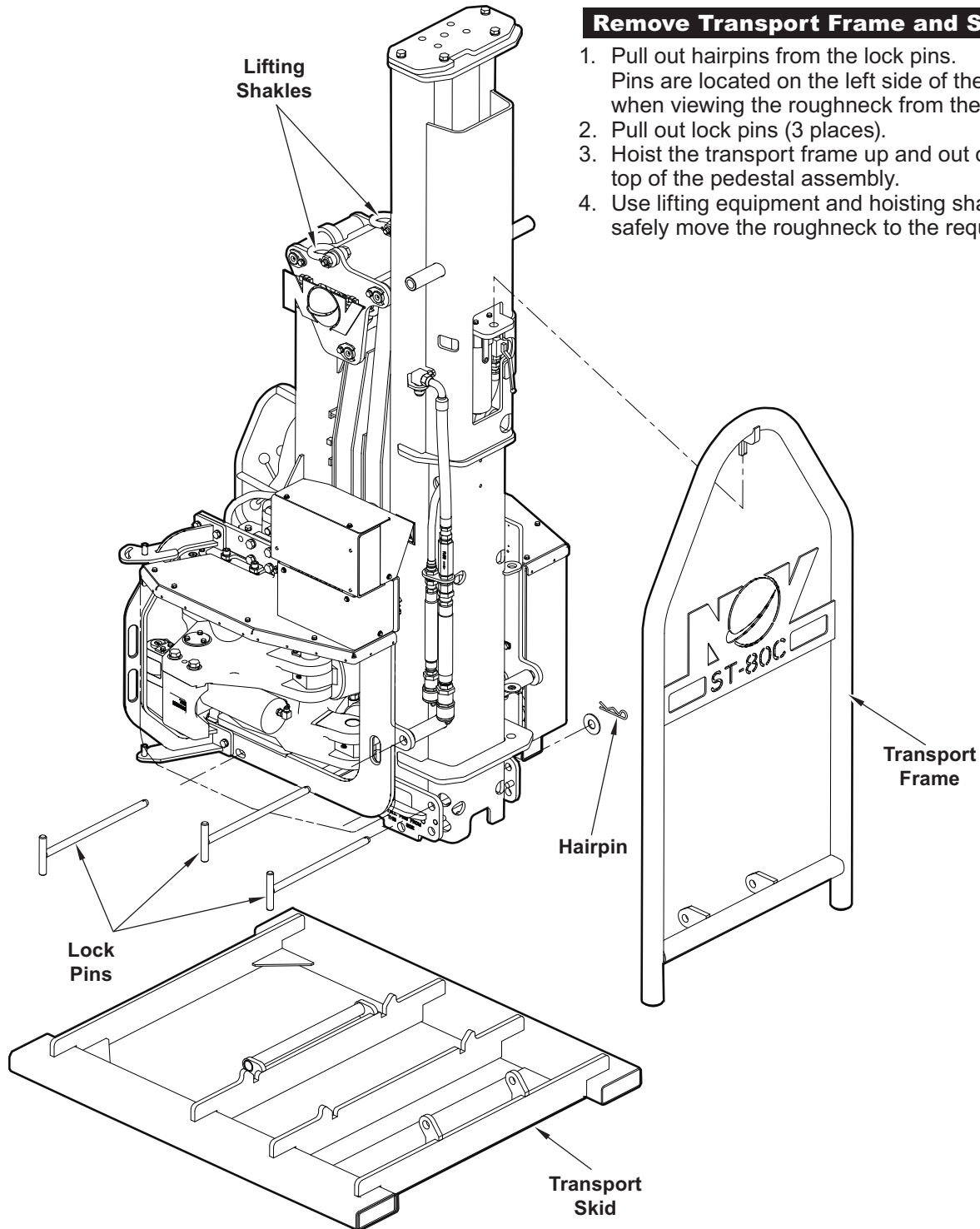


Figure 3-8. Transport Frame and Skid Removal

Installation

Iron Roughneck Installation

For detailed information on installing the Iron Roughneck, refer to the *Technical Drawing Package* for ST-80C Iron Roughneck assembly.

1. With the Iron Roughneck positioned over the rig floor, remove the transport frame and shipping pin. Refer to *Chapter 3, Lifting the Iron Roughneck*.
2. Align the bottom of the pedestal with the floor socket collar and insert the collar pins (2 places.) Refer to Figure 3-9.
3. Disengage lifting device.
4. Remove the shipping/parking lock pins and place them in the pin storage position.



Ensure the pedestal is level and perpendicular to the floor socket collar.

Installation

Iron Roughneck Installation



Ensure the pedestal is level and perpendicular to the floor socket collar.

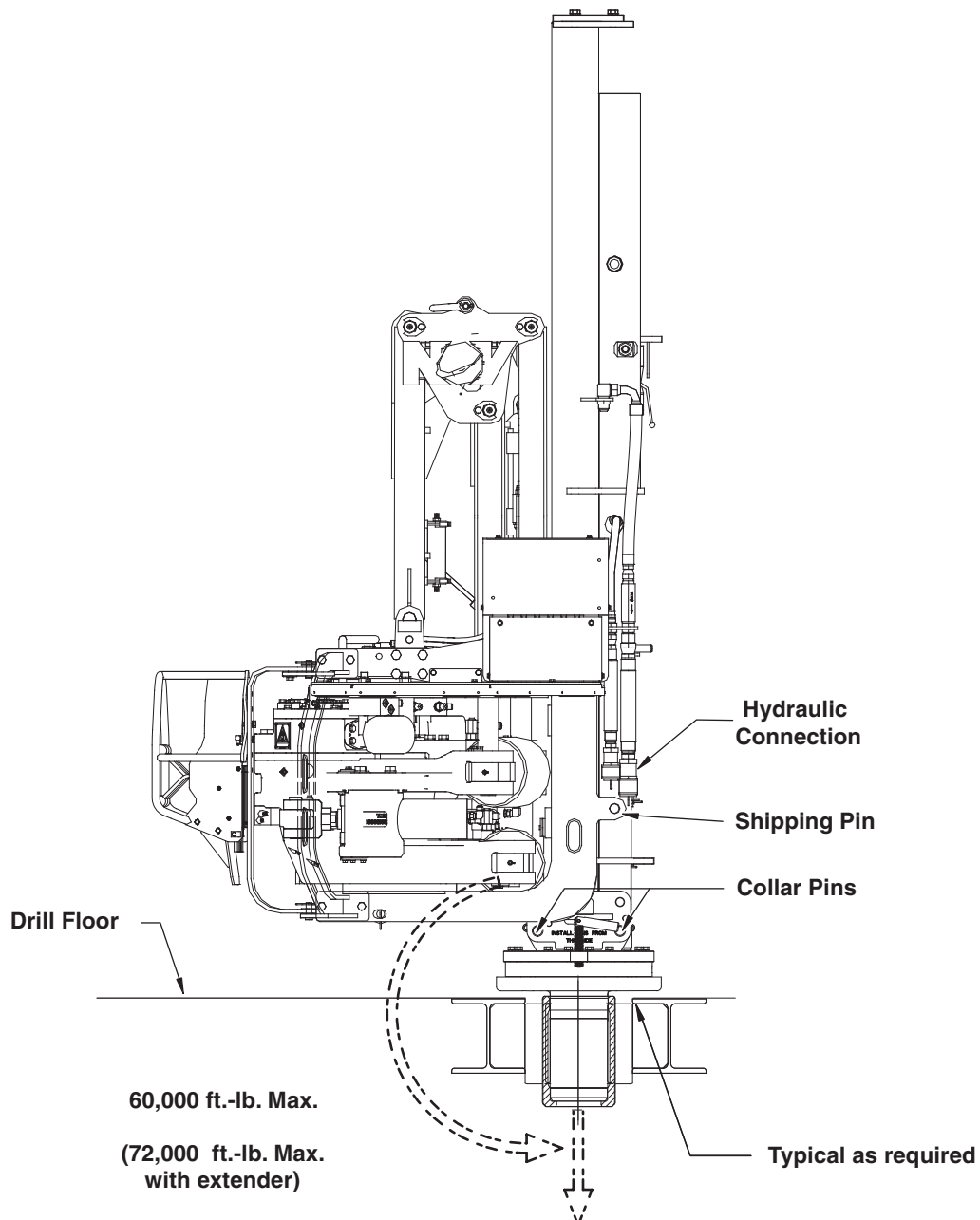


Figure 3-9. Floor Socket Installation and Loading

Installation

Installing the Control Console

The control console attaches to either the front left or right of the Iron Roughneck carriage. Refer to the ST-80C *Technical Drawing Package* for detailed drawings.

The ST-80C controls can be mounted on either side of the carriage. The orientation of the controls can be adjusted to accommodate the best operating angle. The controls can be changed from one side of the ST-80C to the other side using the following procedures.

Positioning the Control Console

Moving the control console

1. Remove the hairpins from the top and bottom of the control console.
2. Remove the screws and lock washers from the top and underside of the carriage assembly.
3. Lift the control console (100 lbs.) from the pin, and give some slack to the cable-tree.
4. Unhook the cable-tree and hook it on the other side of the ST-80C carriage.
5. Lift the control console onto the support pin on the other side of the ST-80C carriage.
6. Orient the control console to achieve the proper working angle and replace the screw, lock washer, and hairpin.

For console operating instructions, refer to *Chapter 4, Operating the ST-80C*.

Installation

Installing the Control Console

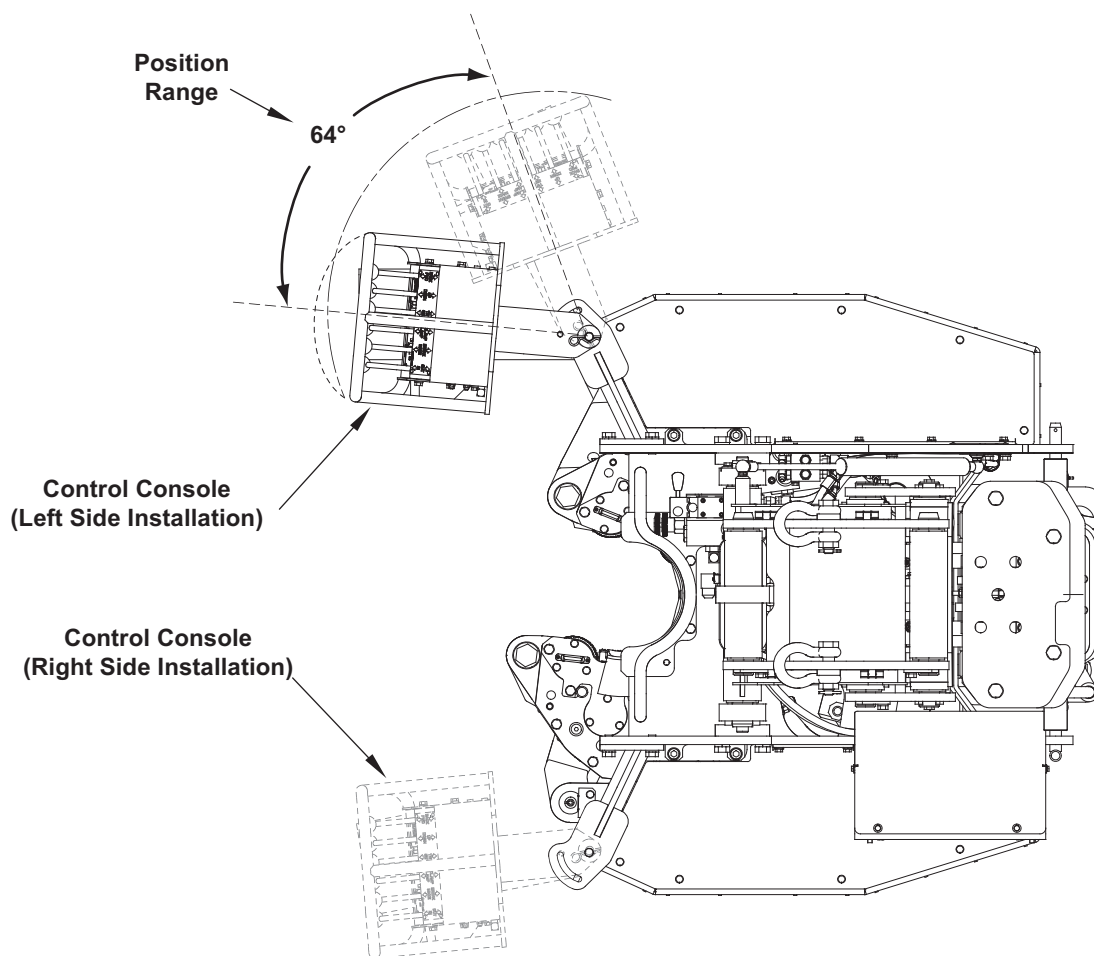


Figure 3-10. Installing the Control Console

Installation

Installing the Service Loops

Refer to the following ST-80C hydraulic system configurations:

- ❑ Customer System Configuration
 - ❑ NOV System Configuration
1. Check that all circuit breakers at the Hydraulic Power Unit (HPU) are OFF.



All equipment should be shut down, isolated and tagged "OUT OF SERVICE" before any maintenance procedure is performed. Any unexpected start-up of equipment during operation can cause serious injury or death to personnel and / or damage to the equipment.

2. Locate the hydraulic service loops. Connect the hydraulic supply and return hose from the HPU to the Iron Roughneck.



Exercise extreme caution when performing maintenance on the hydraulic system. Fluid escaping under pressure can cause serious injury or death to personnel and / or damage to equipment.

Installation

Installing the Hydraulic Power Unit (HPU)

Refer to the Hydraulic Schematic included in the ST-80C *Technical Drawing Package* for details.

1. Locate the HPU and isolate incoming power OFF.



All equipment should be shut down, isolated and tagged "Out of Service" before any maintenance procedure is performed. Any unexpected start-up of equipment during operation can cause serious injury or death to personnel and/or damage to the equipment.



Before connecting and/or disconnecting hydraulic connection fittings, the installation in the vicinity is to be cleaned, and all openings closed by caps to ensure that dirt cannot enter the system.



Exercise extreme caution when performing maintenance on the hydraulic system. Fluid escaping under pressure can cause serious injury or death to personnel and/or damage to the equipment.

2. Fill all hydraulic systems to the correct levels with specified hydraulic fluids. For hydraulic fluid specifications, refer to *Chapter 5, Lubricant Specifications*.
3. Locate the HPU service loops. Connect the hydraulic supply and return from the HPU to the Iron Roughneck.

Checkout Procedure

Iron Roughneck Installation Checkout Procedure

- ❑ Ensure that the Iron Roughneck is fully inserted in the socket and column is vertically aligned.
- ❑ Grease all Iron Roughneck grease points.
- ❑ Check that all service loop hydraulic lines are connected.
- ❑ Make sure all hose quick disconnects (QD) are properly engaged.

HPU Installation Checkout Procedure

- ❑ Check the HPU hydraulic service loop. Ensure the hydraulic hoses are properly secured and free from snag hazards, leaks, and crimping.
- ❑ Check the hose quick-disconnect coupling connection between the HPU and the Iron Roughneck to ensure that coupling connections are tightened.
- ❑ Check the fluid level in HPU.
- ❑ Ensure the hydraulic filter, which is located in the rear of the pedestal, is in proper condition.

Controls Installation Checkout Procedure

- ❑ Check the HPU hydraulic service loop. Connect the hydraulic supply (1 hose) and return (1 hose) from the HPU to the Iron Roughneck.

Storing the Iron Roughneck

- ❑ Palletize the Iron Roughneck for indoor storage. A cargo container is appropriate for indoor or outdoor storage.
- ❑ Avoid wide temperature and humidity variations. The ideal environment for storing the Iron Roughneck is clean and dry with an ambient temperature of 60° F (16° C). If high humidity cannot be avoided, National Oilwell Varco recommends storing the Iron Roughneck at 70° F (21° C).
- ❑ All exposed, unpainted metal surfaces are coated with rust preventative at the factory prior to shipment. Coat all unpainted metal surfaces with rust preventative prior to storage or transport.
- ❑ Cover all openings to prevent water or dust from entering. National Oilwell Varco does not recommend using silica or dehydrating agents.
- ❑ When the Iron Roughneck is not being used for more than 3 months, perform the following maintenance:
 1. Clean the Iron Roughneck.
 2. Grease the Iron Roughneck as described in *Chapter 5: Maintenance*.
 3. When transporting the Iron Roughneck, ensure the unit remains vertical and is stable.

Always transport the Iron Roughneck with the transportation skid installed to increase stability.



Never position the Iron Roughneck on its side. This will damage the equipment.

Attach tie-down straps to the two lifting shackles attached on the side of the Iron Roughneck frame. Additional straps can be attached to major structural components of the Iron Roughneck as required.



Never attach straps to, or drape straps across the control assembly or side guards of the Iron Roughneck. These components are not designed or intended to handle transport loads. Using straps in this manner will damage the equipment and create pinch points. Pinch points can cause serious injury to personnel.

Using an Iron Roughneck on Floating Vessels

Floating vessels are subject to wave action and wind, resulting in unpredictable floor motion. Unpredictable floor motion can cause an ST-80C to make sudden and unexpected movements. When this begins to occur, operations should cease and the ST-80C should be secured at well center, mousehole, or standby position. Refer to *Chapter 4, Securing the ST-80C on a Floating Vessel*.

Chapter 4: Operation

Operating the ST-80C

Checking System Pressure

Procedure

1. Attach a pressure gauge to test port LC on the main manifold.
2. Clamp the ST-80C using the clamp lever. It is not necessary to have a pipe in the jaws. Read the pressure on the gauge, while holding the lever in the clamp position. The pressure should be 2,100 psi.
3. Remove the gauge.

Perform the following procedure when the system pressure is not 2,100 psi.

1. Remove the tamper resistant cover from the PRV cartridge.
2. Follow steps 1 through 3 as described above.
3. One person needs to hold the clamp lever in the clamp position.
4. Another person adjusts hex socket on the PRV cartridge. (Clockwise to increase pressure, counterclockwise to decrease pressure.)
5. Remove gauge and replace tamper resistant cover.

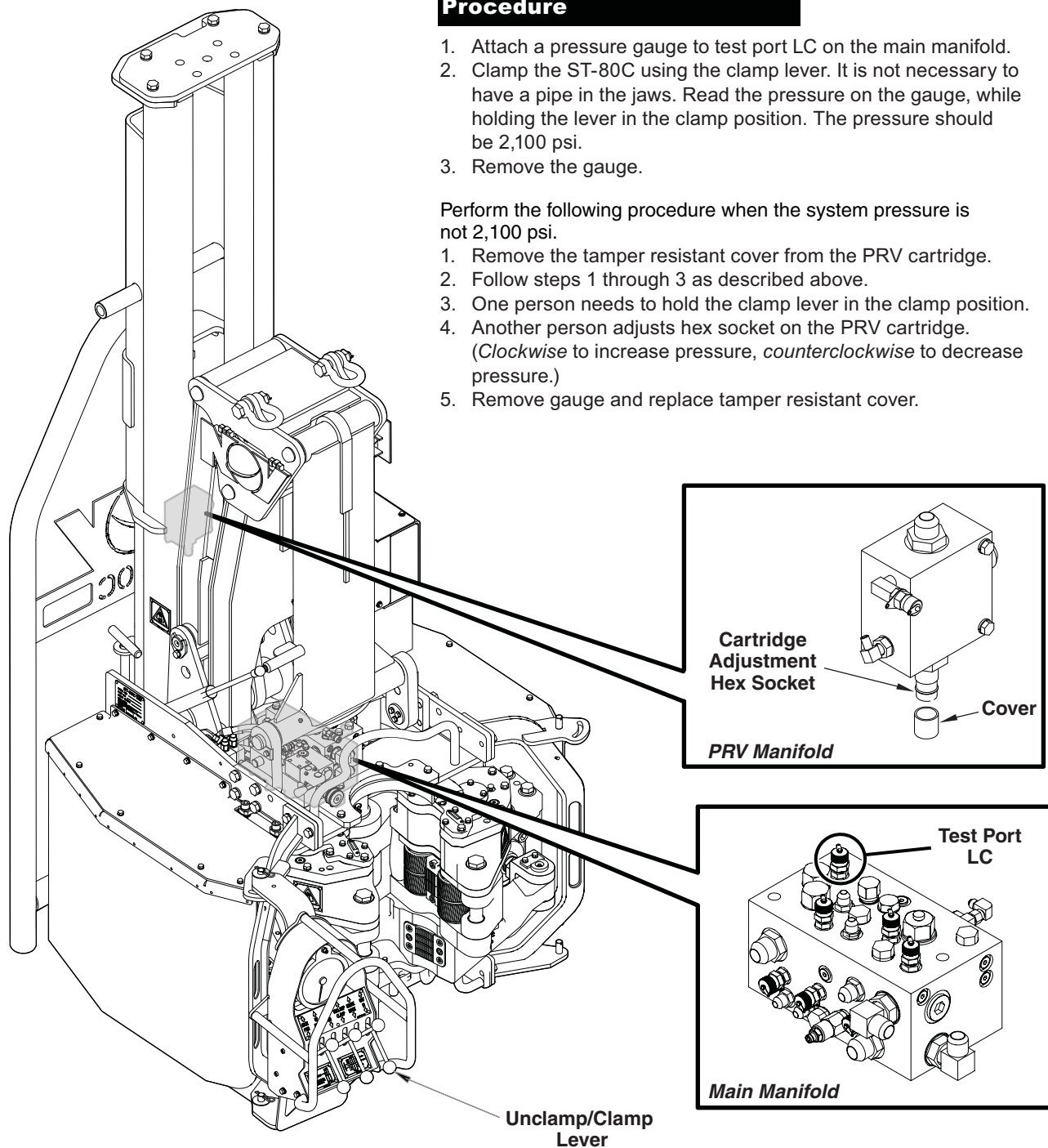
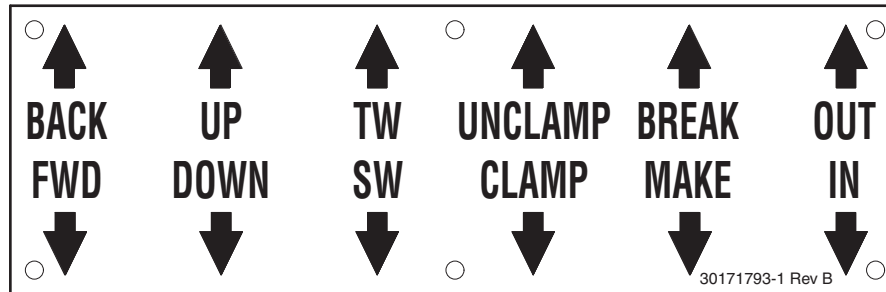


Figure 4-1. Checking System Pressure

Operating the ST-80C Control Console

The operation procedures in this chapter require the use of the control console.



Detail of Control Panel

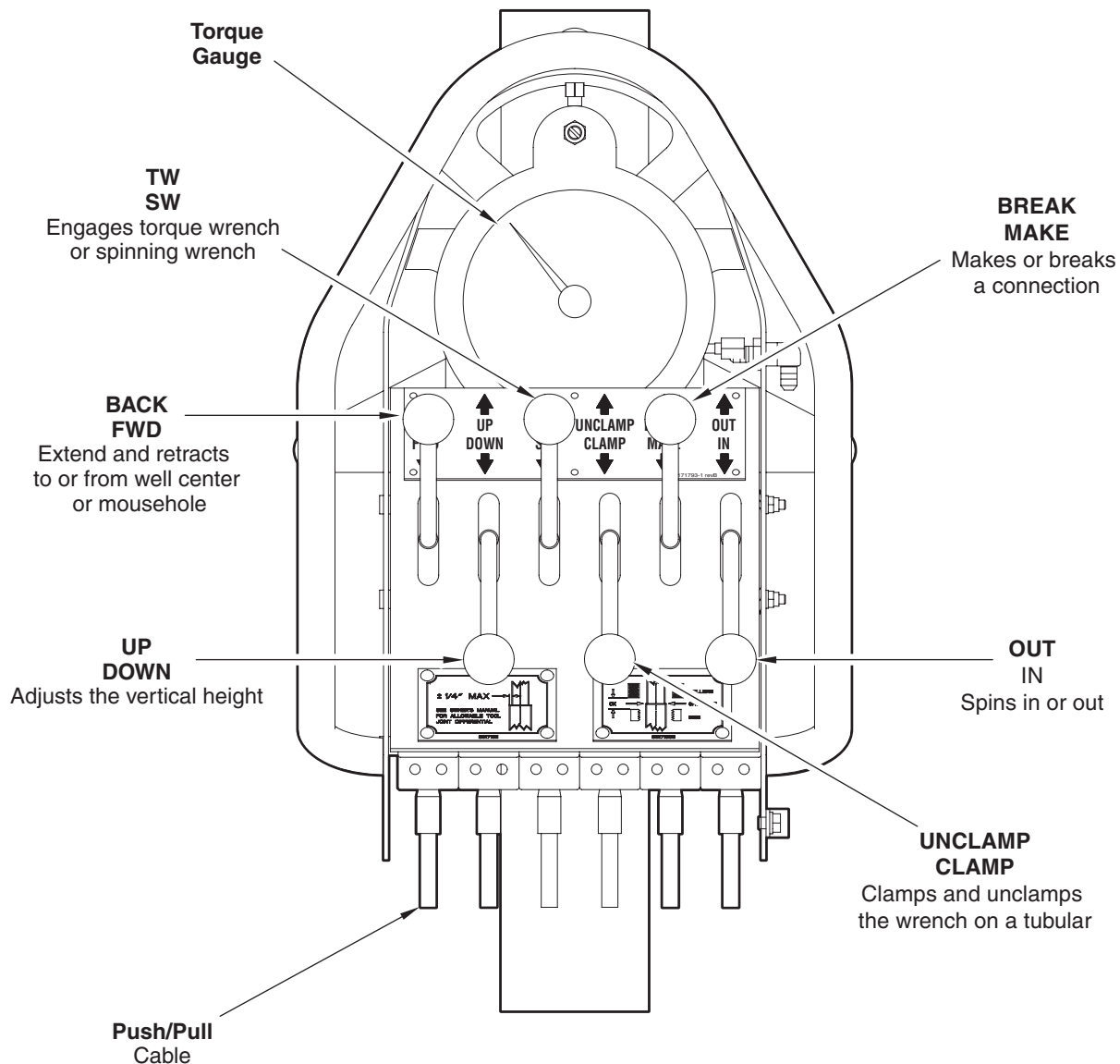


Figure 4-2. Control Console

Operating the ST-80C

Hoist/Lower Kit

The ST-80C Tall model includes a hoist/lower valve that enables the operator to move the Iron Roughneck between the parked/stored and operating positions.

Procedure

1. Retract the ST-80C to the parked position: On the control panel, move the BACK FWD lever to the BACK position,
2. On the left side of the ST-80C, locate the hydraulic hoist /lower valve.



Ensure that there is proper clearance for the ST-80C to be elevated to the stored position.

3. Raise the ST-80C to the parked (fully raised) position: Turn the hoist/lower directional valve handle *counterclockwise*.
4. When the ST-80C is fully raised, install the storage pin in the back of the pedestal.
5. To lower the ST-80C to the standby position: remove the storage pin and turn the directional valve handle *clockwise*.



Whenever hoisting or lowering the iron roughneck, ensure all personnel and equipment are clear of the operating area. Failure to follow this warning may result in injury to personnel and/or damage to equipment.

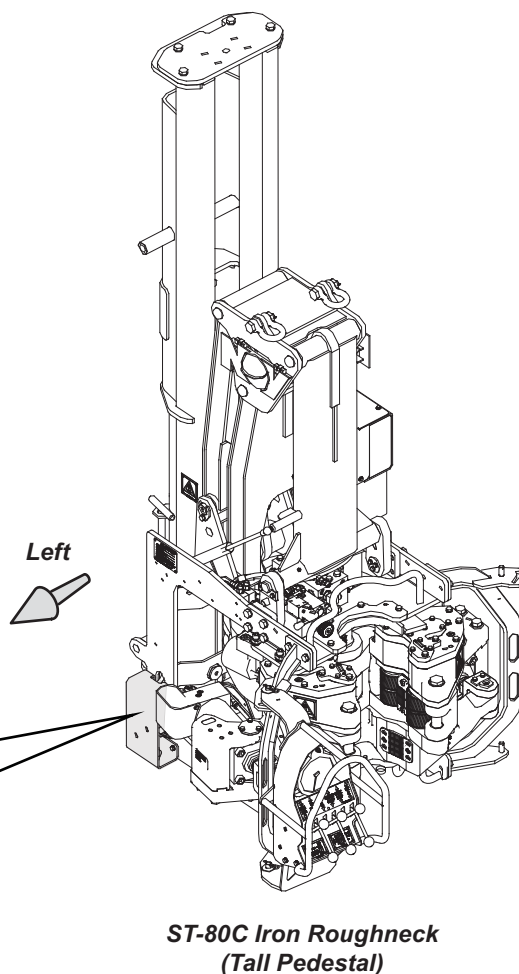
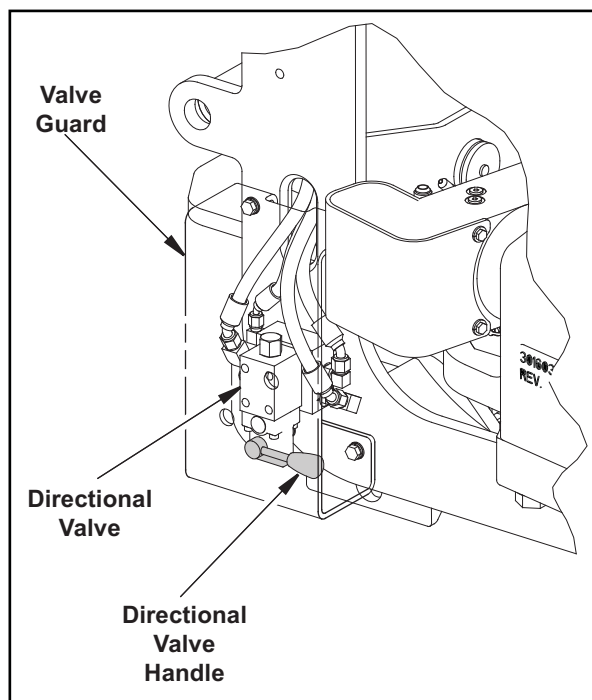


Figure 4-3. Hoist/Lower Kit (ST-80C Tall)

Operating the ST-80C

Positioning ST-80C for Operation



Before operating the ST-80C for the first time, be sure to remove the transport pin and place it in its storage position.



The ST-80C requires adjustment whenever the connection or pipe diameter changes and requires periodic verification per step 5 of adjustment procedure.

Procedure

1. Push the extend/retract lever (on top of the carriage) to the fully retracted position.
2. On the control console, pull forward on the BACK/FWD handle to fully extend the ST-80C.
3. Move the UP/DOWN handle to raise the ST-80C to position the top of the box above the lower dies and below the spin rollers.



Special attention is necessary if hard banding is present. Do not grip on hard banding.

4. Pull the Extend/Retract handle (on top of the carriage) to adjust the ST-80C until the base plate touches the connection diameter. Verify that the base plate is on the connection diameter and not on the taper or pipe. Adjust elevation as necessary, staying within the guidelines of step 3.



Over extension will show contact with the base plate, but will tilt the wrench out of alignment.

5. Verify correct adjustment:
Use the BACK/FWD handle to retract and extend ST-80C, a full stroke. Lightly swing the ST-80C by placing your left hand on top of controls guard, and your right hand on the front of lower left jaw body. Listen and feel for bumping contact against the connection and verify the bubble is within window.



Use the control console levers to perform steps 2, 3, and 5 on this page.

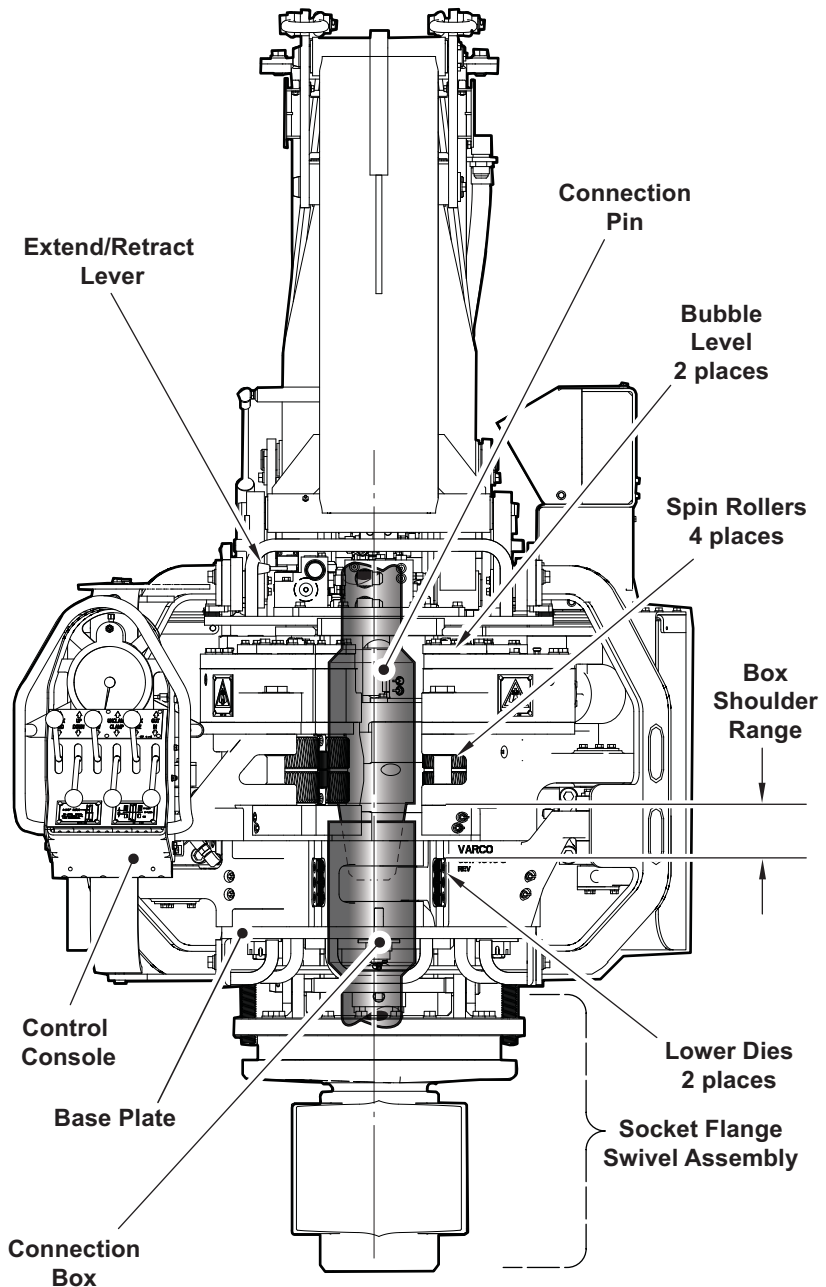


Figure 4-4. Positioning ST-80C

Operating the ST-80C

Making and Breaking Connections

Making Connections

- 1 Use the control panel UNCLAMP/CLAMP lever, to clamp the jaws on the connection, then release the lever.
- 2 Hold the TW/SW lever in the SW position. Wait 1 second before torquing.
- 3 Spin the connection IN.
- 4 Hold the TW/SW lever in the TW position. Wait 1 second before torquing.
- 5 Hold the BREAK/MAKE lever in the MAKE position until the desired torque is achieved.



If the wrench does not reach the desired value in one stroke, repeat.

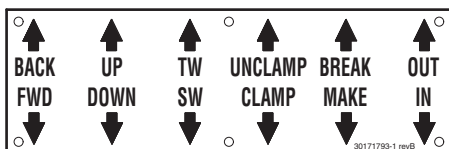
- 6 UNCLAMP the jaws.
- 7 Recycle the torque wrench to BREAK to prepare for the next connection.



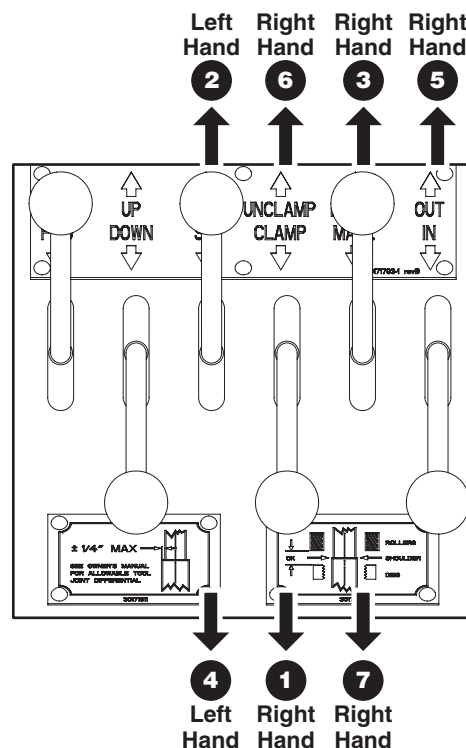
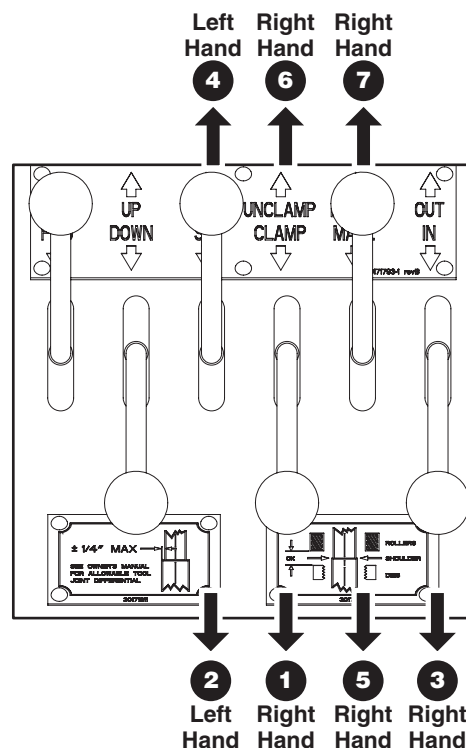
If the wrench does not reach the desired value in one stroke, repeat.

Breaking Connections

- 1 Use the control panel UNCLAMP/CLAMP lever, to clamp the jaws on the connection, then release the lever.
- 2 Hold the TW/SW lever in the TW position. Wait 1 second before torquing.
- 3 Hold the BREAK/MAKE lever in the BREAK position until the connection is broken.
- 4 Hold the TW/SW lever in the SW position. Wait 1 second before spinning.
- 5 Spin the connection OUT.
- 6 UNCLAMP the jaws.
- 7 Recycle the torque wrench to MAKE to prepare for the next connection.



Detail of Control Plaque

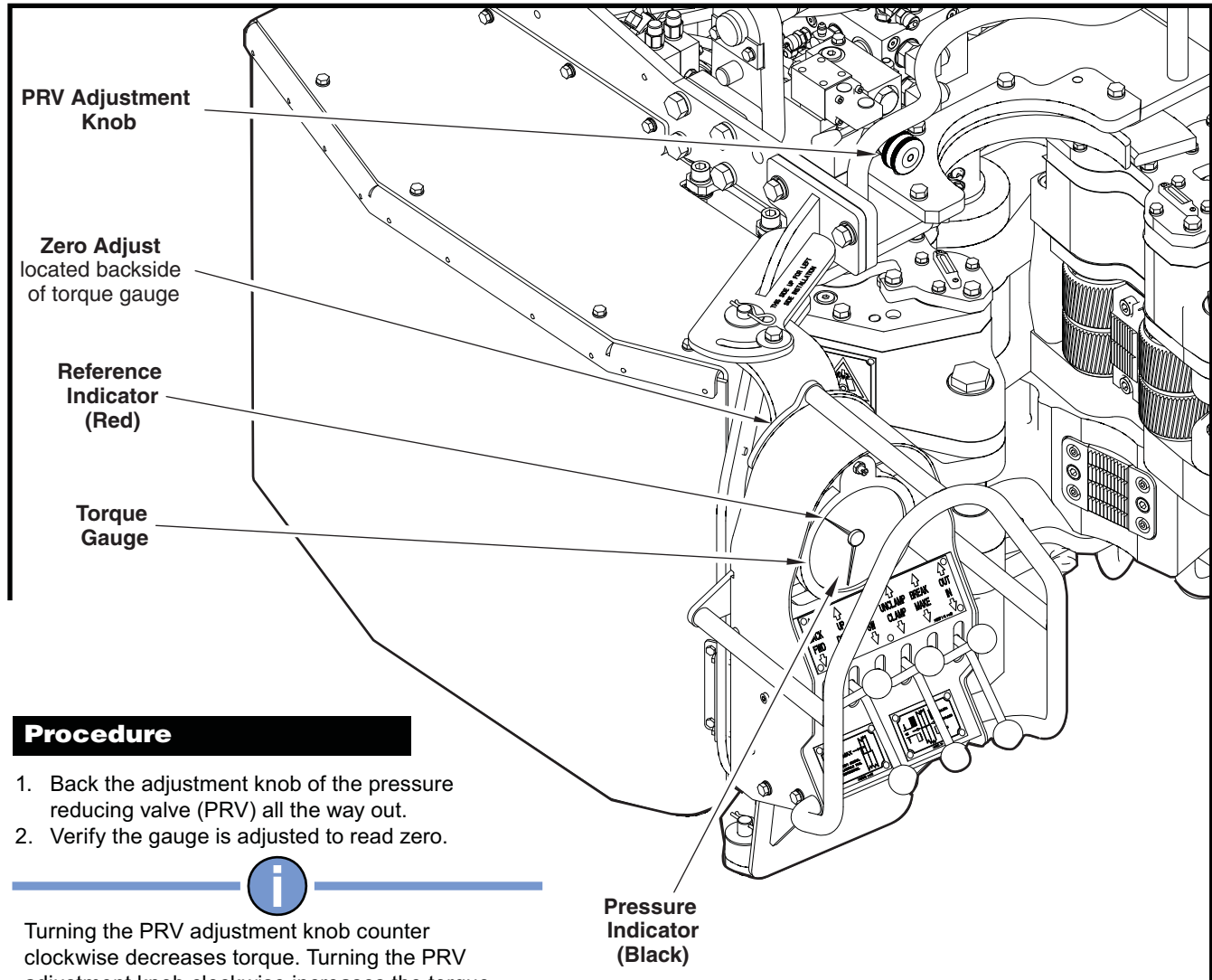


Control Panel Levers

Figure 4-5. Making and Breaking Connections

Operating the ST-80C

Adjusting the Makeup Torque



Procedure

1. Back the adjustment knob of the pressure reducing valve (PRV) all the way out.
2. Verify the gauge is adjusted to read zero.



Turning the PRV adjustment knob counter clockwise decreases torque. Turning the PRV adjustment knob clockwise increases the torque.

3. Cycle jaws to break and clamp onto a tubular.
4. Spin the connection in.
5. Torque the connection.
6. While holding the torque handle, turn the PRV adjustment knob clockwise while watching the torque gauge until the desired torque is achieved.



If torque cylinders reach end of stroke, the gauge reads zero. Recycle jaws and retorque.

7. Position the reference indicator (red needle) on the torque gauge at the desired torque value.



National Oilwell Varco offers an additional gauge kit that can be installed in the driller's cabin (Remote Torque Gage kit, PN 30173445).

Figure 4-6. Adjusting Makeup Torque

Operating the ST-80C

Adjusting Torque Gauge



National Oilwell Varco offers an additional gauge kit that can be installed in the driller's cabin (Remote Torque Gauge kit, (P/N 30173445)).



- Zero out the torque gauge every time you start up the ST-80C, or when the torque setting has changed.
- Return line pressure affects the gauge reading.
- See the *Chapter 6, Troubleshooting* for gauge responsiveness setting.



DO NOT operate the **TORQUE** lever while zeroing the torque gauge dial.

Procedure

1. Rotate the knob on the backside of the gauge to zero out the torque gauge dial.
2. Open the hydraulic shut-off valve handle to allow pressure to the system.
3. Rotate the small knob on the back of the gauge so that it shows zero.

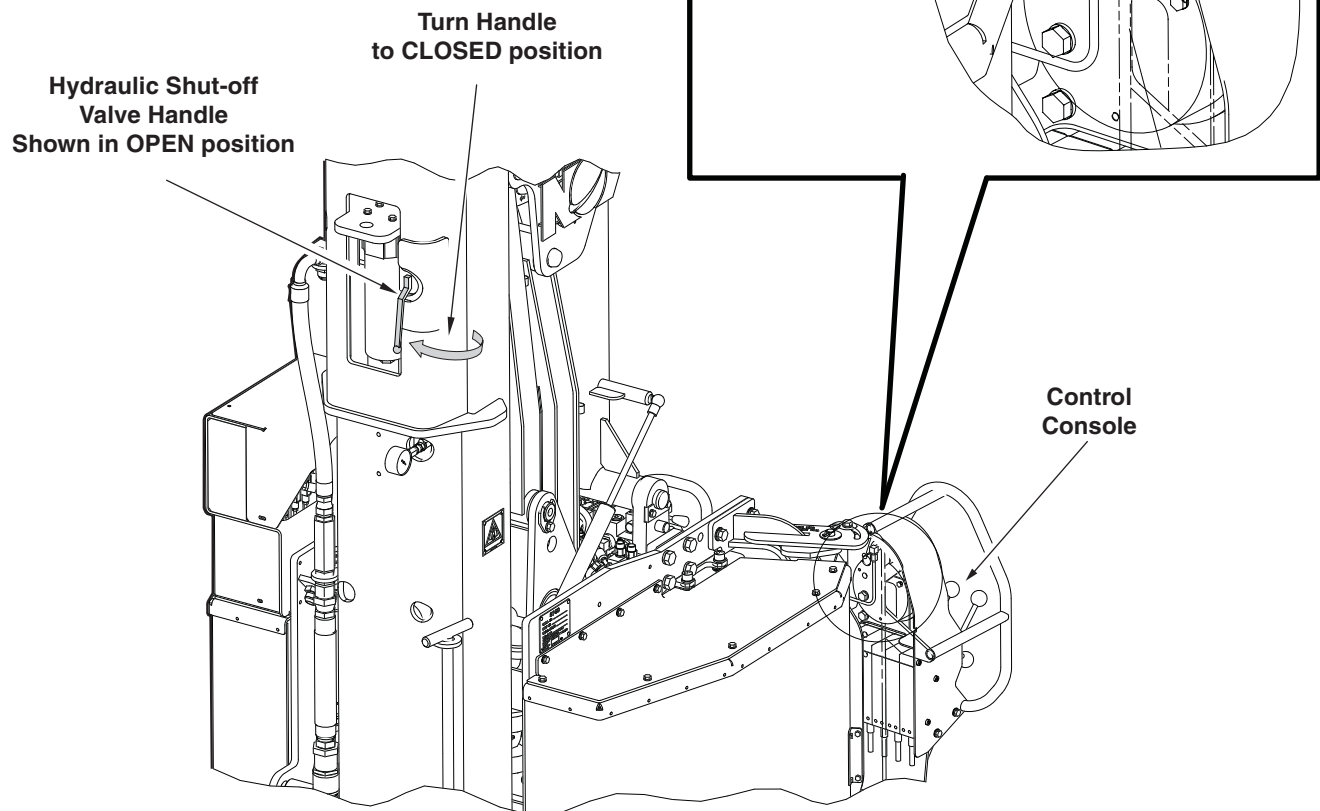


Figure 4-7. Adjusting Torque Gauge

Operating the ST-80C

Securing the ST-80C on a Floating Vessel

When operating an ST-80C on a floating vessel, high waves and wind cause the ST-80C to make sudden and unexpected movements.



Floating vessels are subject to wave action and wind, resulting in unpredictable floor motion. Unpredictable floor motion can cause an ST-80C to make sudden and unexpected movements. When this begins to occur, operations should cease and the ST-80C should be secured at well center, mousehole, or standby position. Refer to procedures in Figure 4-8.

Procedure

1. Stop operation.
2. On the control panel, move the BACK/FWD lever to the BACK position: move the ST-80C to parked position.
3. Turn the base assembly jackscrews (2 places) *clockwise* until they tighten against the base plate to prevent pedestal rotation.



When ST-80C operation can proceed safely, turn the base assembly jackscrews (2 places) counterclockwise to allow pedestal rotation.

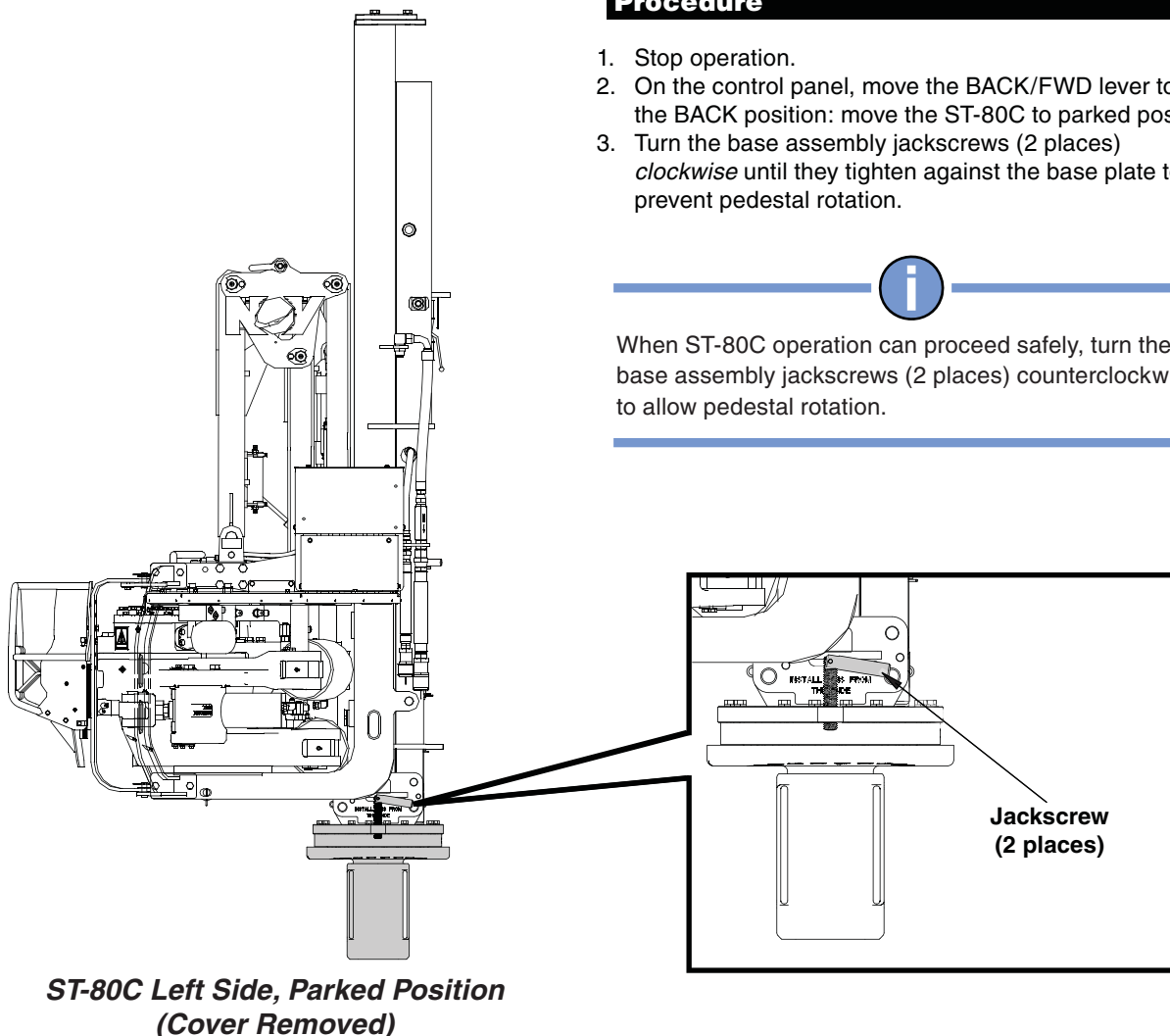


Figure 4-8. High Wind and Wave Precautions

Chapter 5: Maintenance

Lubricant Specifications

Refer to the Recommended Lubricants and Hydraulic Fluids document in the equipment User Manual.



The Lubrication intervals described in this manual are based on lubricant supplier recommendations. Severe conditions such as extreme loads or temperature, corrosive atmosphere, and so on, may require more frequent lubrication.

Inspection and Lubrication

Inspecting Hardware and Fittings

Visually inspect the ST-80C for loose or missing hardware and fittings daily. Make sure all lock safety wire is undamaged and that the safety cable between the 3 guiding pins of the lower jaws is present.

Check the inline pressure filter weekly. Replace as necessary if the indicator is red during operation.

Inspect all hoses for wear or damage. Replace as necessary.



All hoses are clearly labeled. Consult hose kit drawings for proper routing and hose specification and always label when replacing hoses on the ST-80C.

Lubricating the ST-80C

The lubrication intervals described in this manual are based on lubricant supplier recommendations. Severe conditions such as extreme loads or temperature, corrosive atmosphere, etc., may require more frequent lubrication.

Worn bushings, binding parts, rust accumulations, and other abnormal conditions indicate more frequent lubrication is necessary.

Apply grease daily to all grease fittings as shown on the following page.



When greasing the spinner assembly, watch for clean grease extruding from under the spinning wrench rollers. If it becomes difficult to inject grease and no grease extrudes from under the spinner rollers, the grease vent may be missing or clogged. This can jam the spinner rollers. Repair or replace as necessary.



Clean any grease which falls to the floor to prevent personal injury due to slipping.

Inspection and Lubrication

Daily



Each grease fitting is to be greased until clean grease is seen extruding from the related component.



During operation, surfaces may become hot enough to cause bodily injury. To reduce the risk of injury from a hot component, allow the surface to cool before touching.

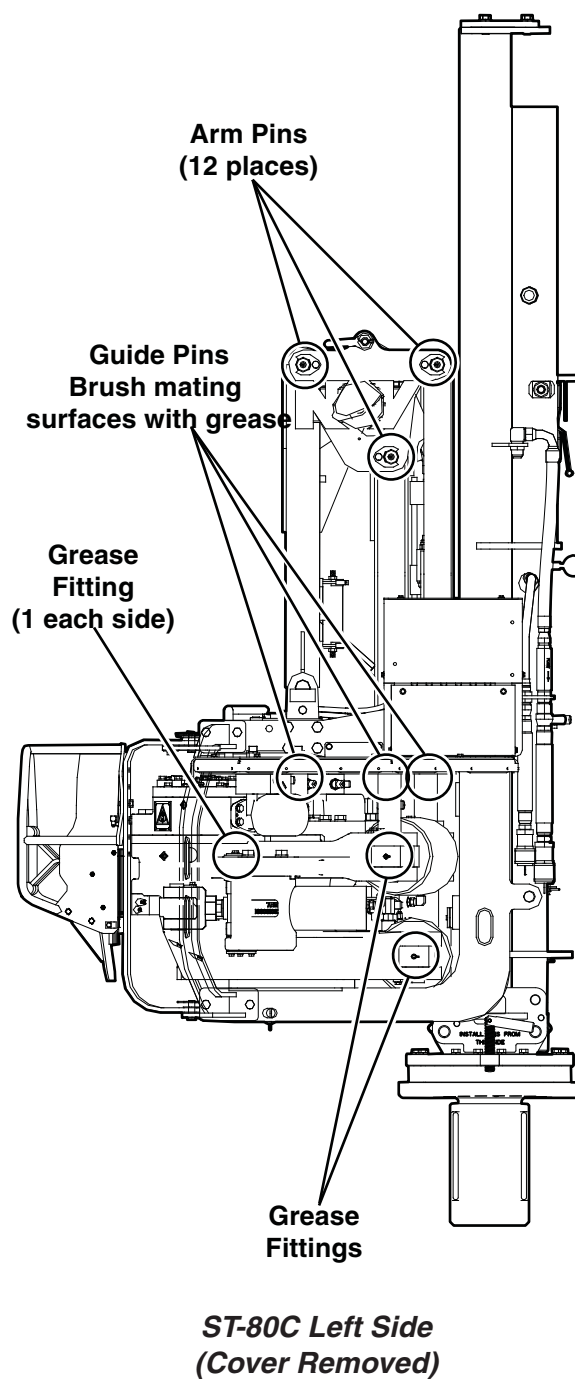
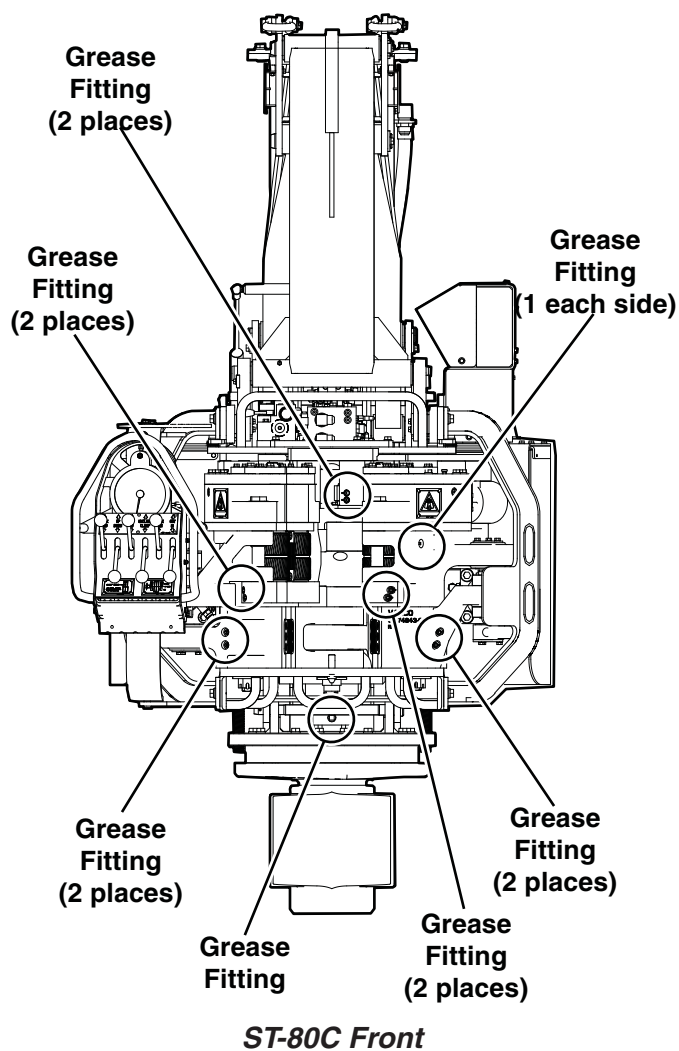


Figure 5-1. Daily Lubrication

Inspection and Lubrication Weekly

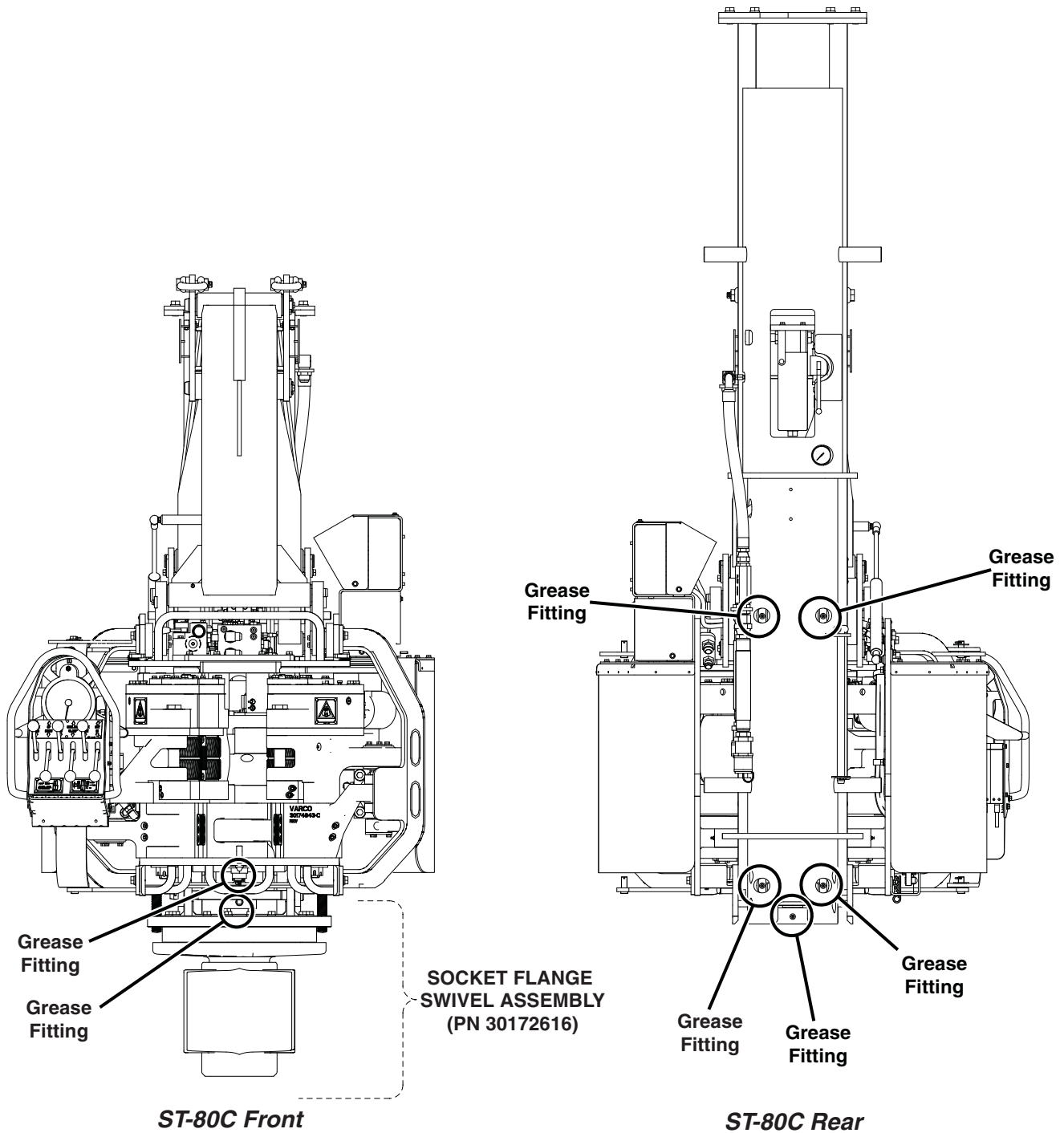
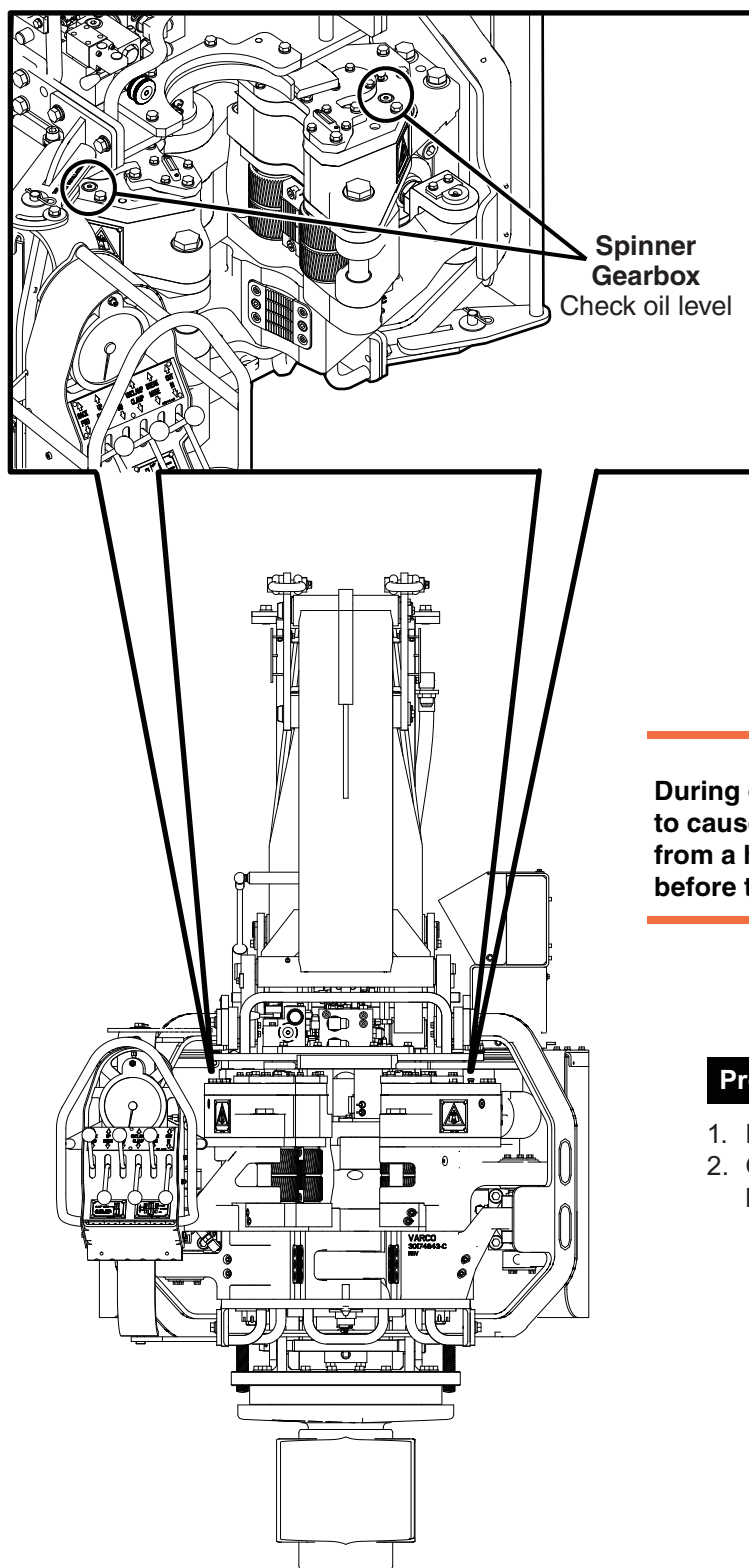


Figure 5-2. Weekly Lubrication

Inspection and Lubrication

Monthly



During operation, surfaces may become hot enough to cause bodily injury. To reduce the risk of injury from a hot component, allow the surface to cool before touching.

Procedure

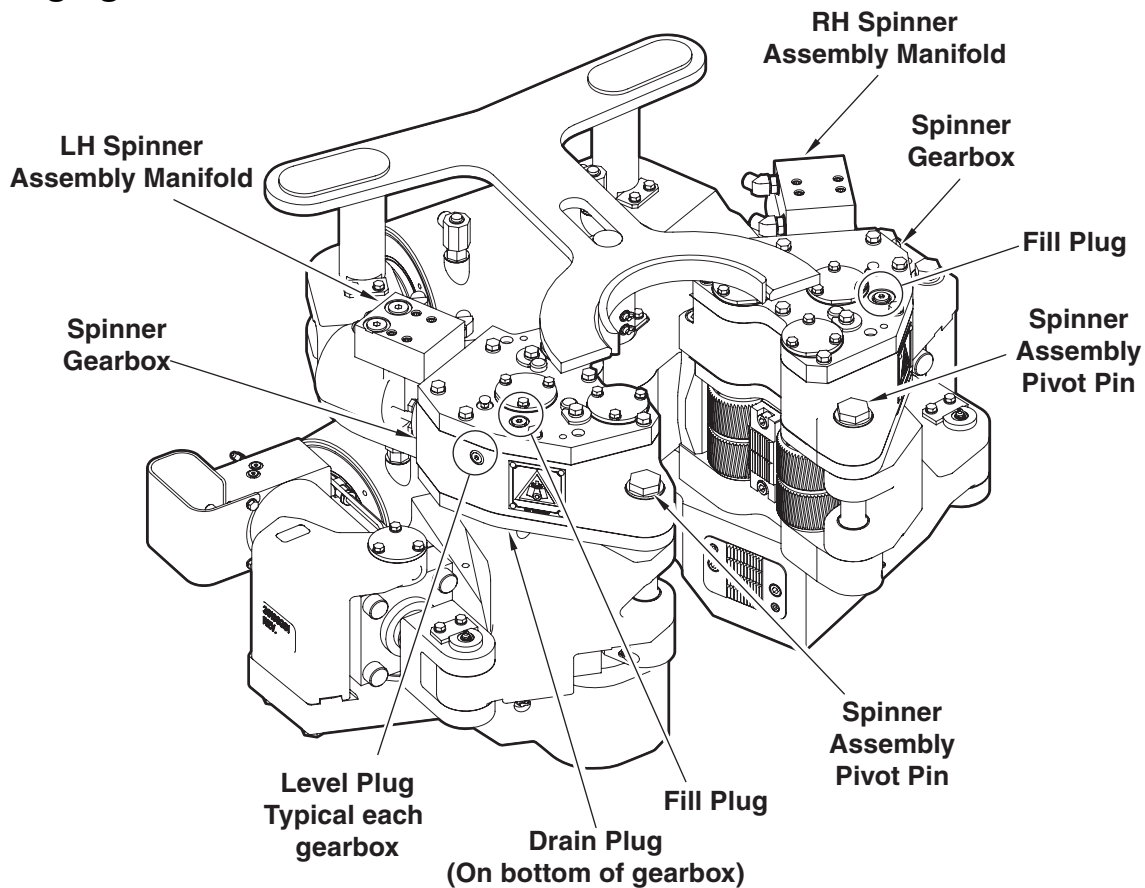
1. Remove the fitting and view the oil level.
2. Oil level should be approximately 2-1/2 inches below the top surface of the top plate.

Figure 5-3. Monthly Lubrication

Inspection and Lubrication

6 Months

Changing Oil



Procedure

Change the oil in the ST-80C spinner gearbox every 6 months.

1. Disconnect the hydraulic hoses from the spinner assembly manifolds and cap fittings.
2. Remove the spinner assembly pivot pin.
3. Lift out the spinner assembly.
4. Remove the fill and level plug.
5. Drain the oil by removing the plug on the bottom of the gearboxes. (Gearboxes must be swung out.) Look for signs of debris or contamination. Report any unusual findings to your local National Oilwell Varco Service Center.
6. Replace the drain plug.
7. Fill the gearboxes with fresh oil through the fill port (approx. 0.5 gallons). For Lubricant information refer to Chapter 5 Maintenance, Lubricant Specifications.
8. Replace the fill and level plug.



During operation, surfaces may become hot enough to cause bodily injury. To reduce the risk of injury from a hot component, allow the surface to cool before touching.

Figure 5-4. Changing Oil

Inspection and Lubrication

MPI Inspections

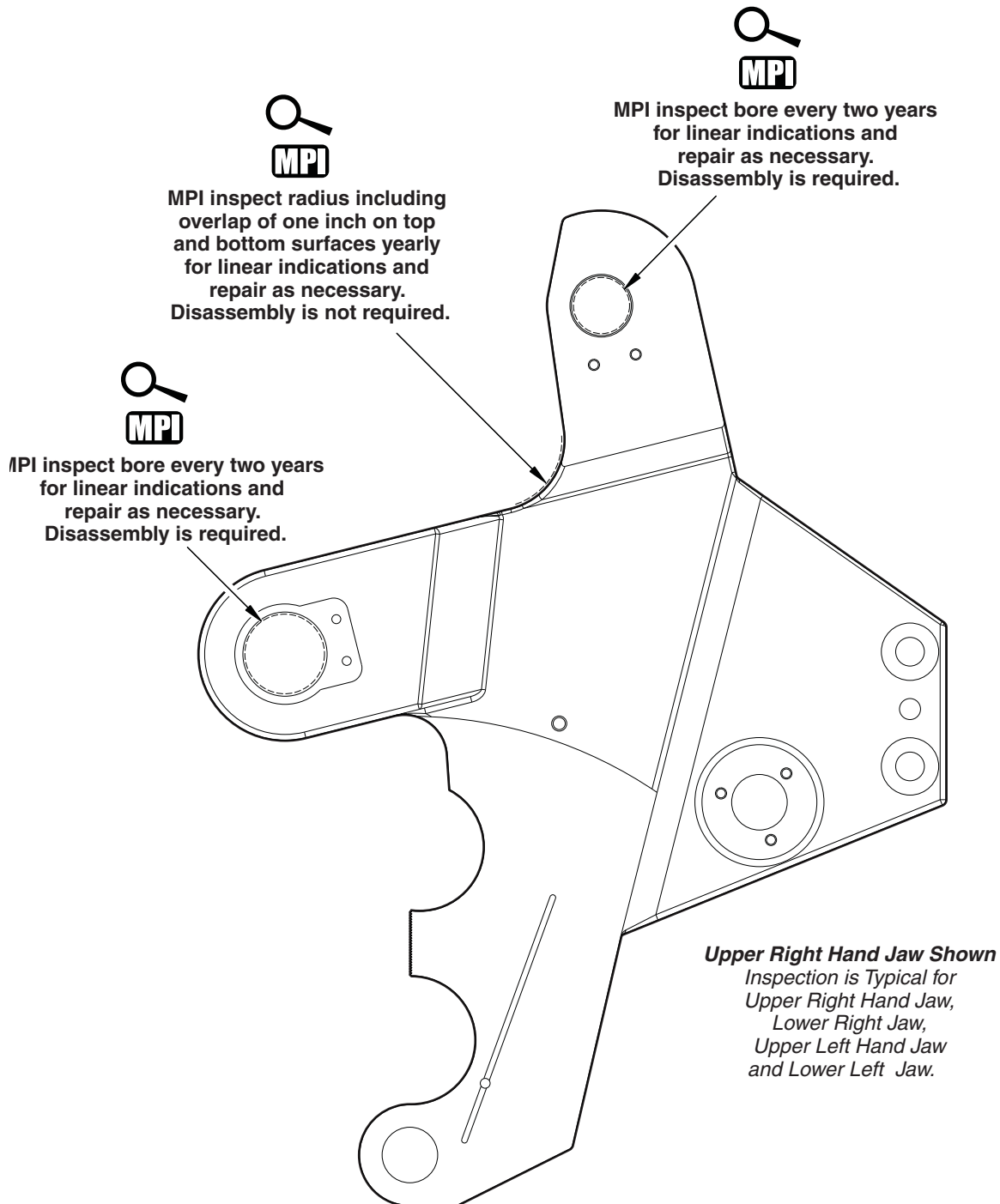


Figure 5-5. Inspect MPI

Disassembly and Assembly

Precautions



Transport hydraulic components to a clean, dust-free service area before disassembling for service.

Disassembly procedures are performed when replacing damaged components that are causing a tool function to fail. Whenever performing a disassembly, practice preventive maintenance by:

- ❑ Cleaning and inspecting all disassembled parts.
- ❑ Replacing all worn and damaged parts before they can cause another failure.
- ❑ Installing thread protectors on exposed threads.



Torque all fasteners to the limits given in DS 00008 (Design Specification Design Torque Standard) unless an alternative torque value is given in the procedure.

Disassembly and Assembly

Precautions



Release all hydraulic oil pressure before disconnecting hydraulic lines. Hydraulic oil under pressure can penetrate skin and cause serious injury.

Before opening the hydraulic system, thoroughly clean the work area. Maintain system cleanliness by promptly capping all disconnected lines. Dirt is extremely harmful to hydraulic system components and can cause equipment failure and subsequent injury to personnel.

Ensure all hydraulic lines are isolated and the ball valve is closed before any work is performed on the ST-80C.

If air is introduced into the duplex extend cylinder, use extreme caution when extending the platform for the first time. As the load moves over center, the air will compress causing the support arm to extend rapidly. Support unit with tugger and stand to the side until air is purged.



During operation, surfaces may become hot enough to cause bodily injury. To reduce the risk of injury from a hot component, allow the surface to cool before touching.

Disassembly and Assembly

Changing Dies

Procedure

Replacing Upper Dies

1. Clean the area around the dies and remove the two screws holding each die and discard screws.
2. Remove worn die.
3. Clean the backing surfaces with wire brush, inspect and grease lightly.
4. Install new dies and screws, torque to 138-152 ft.-lb.

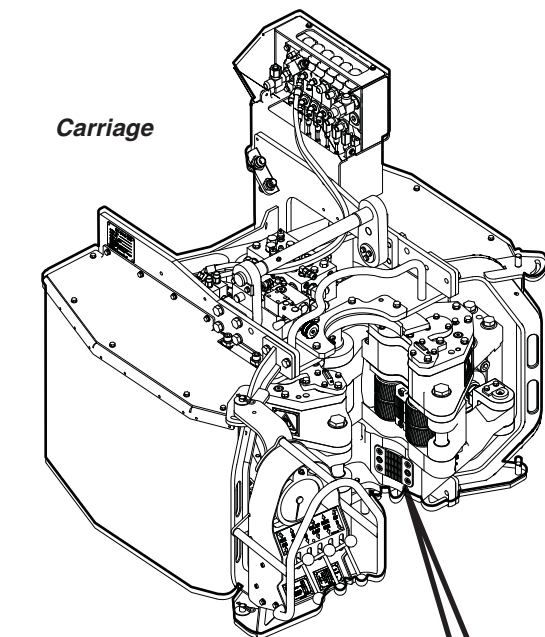
Replacing Lower Dies

1. Remove all main socket head screws (2 per die carrier) and all set screws (4 per die carrier) from both die carriers.
2. Screw handtight 1 socket head screw in each of the 4 corners.
3. Advance each of the 4 socket head screws 1/2 turn at a time in an X pattern until die carrier comes free.

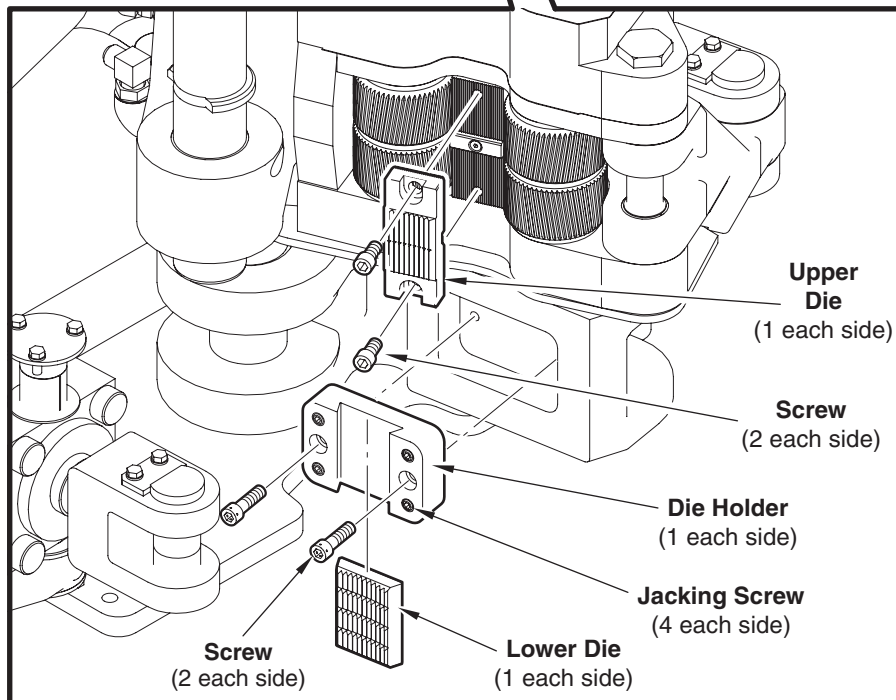


Caution the die can slip out of the die holder once its free of the housing.

4. Remove die and socket head screws from die carrier.
5. Discard the existing screws, set screws, and dies after disassembly.
6. Clean receiving pocket and die holder thoroughly, and liberally apply anti-seize to all mating surfaces before reinstalling them.
7. Install new dies in die carrier and slide die carrier back in pocket.
8. Install new screws and torque to 70-80 ft.-lb.
9. Install and tighten the jacking screws to prevent them from falling out (15-20 ft.-lb.).



Carriage



Upper Die
(1 each side)

Screw
(2 each side)

Die Holder
(1 each side)

Jacking Screw
(4 each side)

Screw
(2 each side)

Lower Die
(1 each side)

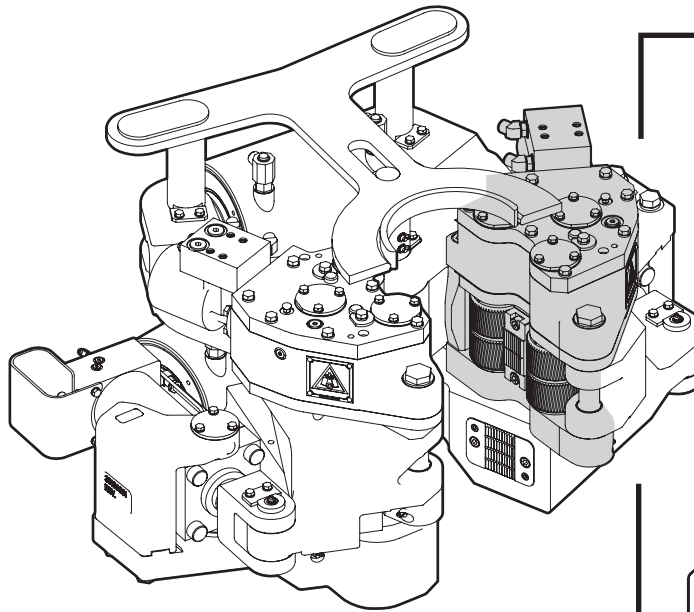


During operation, surfaces may become hot enough to cause bodily injury. To reduce the risk of injury from a hot component, allow the surface to cool before touching.

Figure 5-6. Changing Dies

Disassembly and Assembly

Replacing Spin Rollers and Slide Rings



During operation, surfaces may become hot enough to cause bodily injury. To reduce the risk of injury from a hot component, allow the surface to cool before touching.

Disassembly

1. Disconnect the hydraulic hoses from the spinner assembly manifolds and cap fittings.
2. Remove the spinner assembly pivot pin.
3. Lift out the spinner assembly and place it on a table.
4. Remove the socket head screw from the bottom of the lower assembly.
5. Remove the lower assembly.
6. Slide off rollers, remove keys and upper and lower slide rings.

Assembly

1. Install upper slide rings with grooves.
2. Ensure the shaft keys are in place and slide on new rollers.
3. Install lower slide rings and replace the lower assembly.
4. Replace socket head screw in bottom of lower assembly. Apply anti-seize to entire length and torque to 450-500 ft.-lb.
5. Reassemble the spinner assembly to upper jaws and install spinner assembly pivot pin. Apply anti-seize to the threads of the pin and torque to 350-400 ft.-lb.
6. Attach hydraulic hoses to spinner assembly manifold.
7. Operate the tool and verify SPIN-IN causes all rollers to turn CCW as viewed from above.

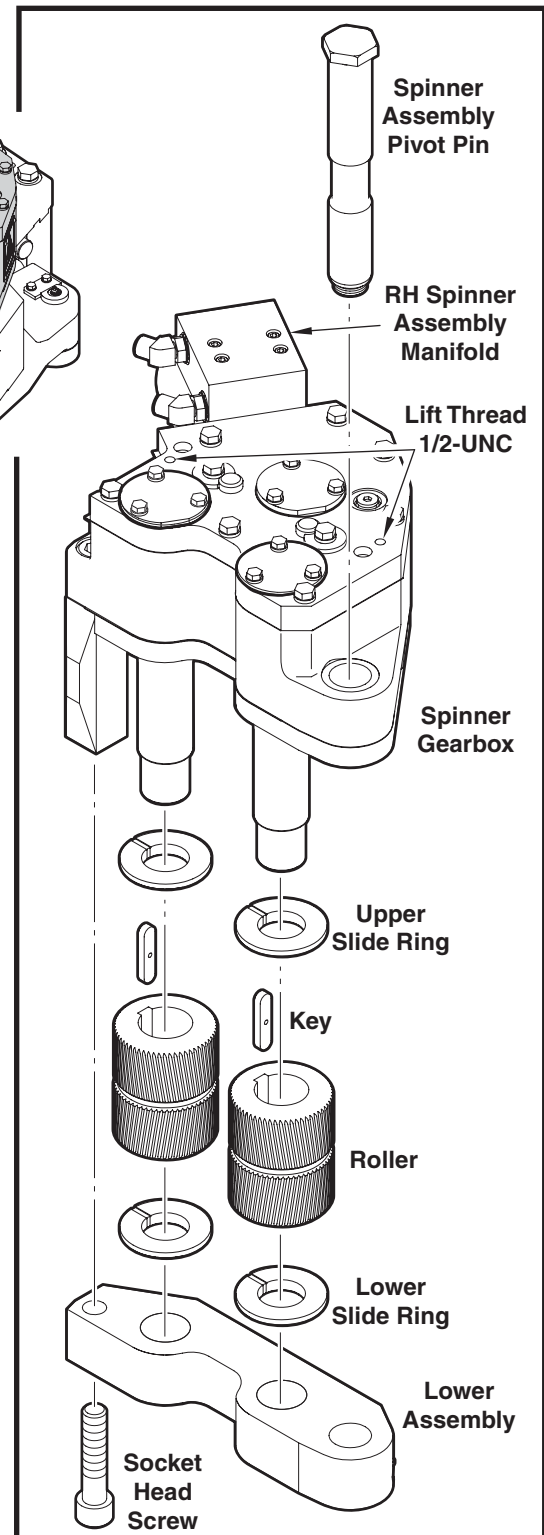
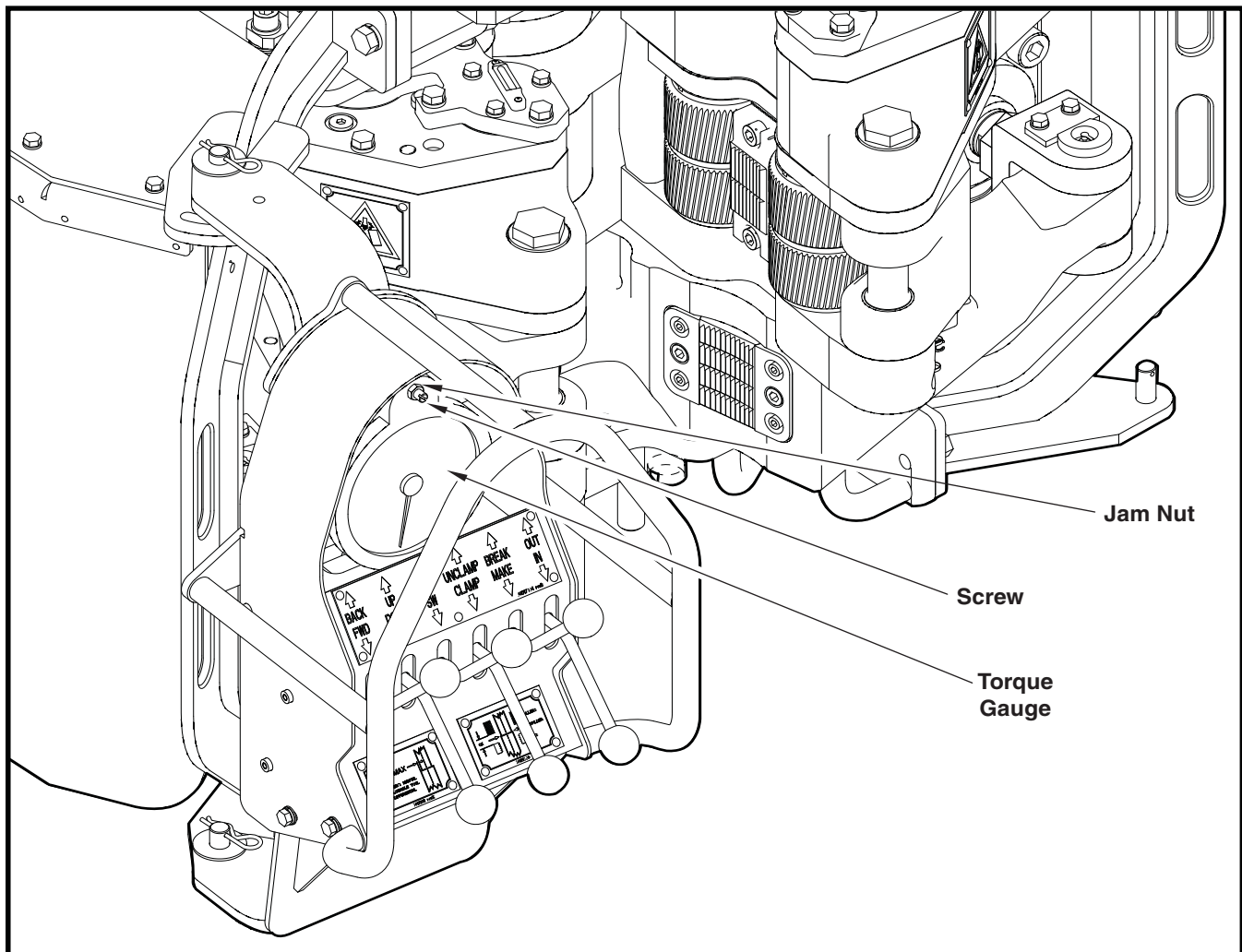


Figure 5-7. Replace Spin Roller and Slide Rings

Adjusting Torque Gauge Responsiveness



If the torque gauge is not responding or is too sensitive, adjust the needle valve on the torque gauge until the gauge reacts with the desired response.



During operation, surfaces may become hot enough to cause bodily injury. To reduce the risk of injury from a hot component, allow the surface to cool before touching.

Procedure

1. Untighten the jam nut.
2. Clamp the jaws on the pipe and operate the lever for making up pipe. (The needle will show activity when pressure is building up.)
3. Rotate the screw with a screwdriver to change responsiveness (CW decreases speed).
4. If necessary repeat step 2 and 3 until the desired speed is acquired.
5. Tighten the jam nut.



Do not screw out set screw all the way. It will lose engagement with counterpart.

Figure 5-8. Adjust Torque Gauge

Chapter 6: Troubleshooting

Troubleshooting the ST-80C

This section describes general troubleshooting methods and provides tables for troubleshooting specific problems or components.



Make sure all hydraulic lines are isolated and the ball valve is closed before any work is performed on the ST-80C.



Whenever hoisting or lowering or operating the Iron Roughneck, ensure all personnel and equipment are clear of the operating area. Failure to follow this warning may result in injury to personnel or damage to equipment.



During operation, surfaces may become hot enough to cause bodily injury. To reduce the risk of injury from a hot component, allow the surface to cool before touching.

When troubleshooting the ST-80C, make sure the hydraulic pressure is between 2,000 and 2,100 psi at the inlet of the manifold. Check the back pressure of the tank line (ensure the pressure does not exceed 30 psi).

1. Ensure that all hoses and QDs are properly connected.
2. Check manifold, fittings, QDs and hoses for leaks or damage.
3. Ensure the tool is lubricated per *Chapter 5, Maintenance*.

The most important things to check after each rig move and before operating the ST-80C are:

1. Ensure that the ST-80C is fully inserted in the socket.
2. Ensure all QDs are fully engaged.
3. Ensure the operating pressures are correct.
4. Verify the condition of the filter.
5. Check all fittings for leaks.
6. Lubricate entire ST-80C and check the condition of the filter per *Chapter 5, Maintenance*.

Troubleshooting the ST-80C

Troubleshooting Tables

Symptom	Probable cause	Remedy
Tool runs slowly.	Hydraulic quick disconnect on supply or return lines not fully shouldered.	Tighten until fully shouldered.
	Power unit not delivering full flow.	Check power supply flow while spin out valve is actuated. Flow should be 40 GPM.
	Power unit return line filter dirty.	Replace filter element of HPU.
	Pressure filter dirty.	Replace filter element of ST-80C.
	Torque pressure set too low.	Increase pressure setting.

Symptom	Probably cause	Remedy
Vertical positioning assembly moves in one direction only or does not move at all.	Power supply not operating, or pressure too low.	Re-establish hydraulic power.
	Lift cylinder damaged or dirty.	Clean or repair cylinder.
	Binding of carriage in pedestal.	Lubricate or replace side rollers.
	Push/Pull cable broken.	Replace cable.
Does not maintain vertical position	Counterbalance valve out of adjustment.	Replace, or adjust counterbalance valve to maintain vertical position.
	Lift cylinder leak.	Replace seals.

Troubleshooting the ST-80C

Troubleshooting Tables

Symptom	Probable cause	Remedy
Torque cylinders do not makeup.	Torque valve set too low.	Increase setting.
	Torque valve or pressure reducing valve stuck closed, dirty, or damaged.	Check valves, clean or replace.
	Torque cylinders already at end of stroke.	Recycle the upper jaw for next bite.
	Torque setting damaged.	Check, clean, or replace.
Torque cylinders do not breakout.	Torque setting pressure reducing valve stuck closed, dirty or damaged.	Check valves, clean or replace.
Torque cylinders drift in makeup direction.	Sticking or worn main operating valve.	Disassemble valve, inspect for contamination or wear, and repair or replace.
Torque cylinders drift in breakout direction.	Excessive back pressure on return line.	Check for restriction in return line. Check hydraulic power supply. Check for other equipment using same tank line.
	Sticking or worn main operating valve.	Disassemble valve, inspect for contamination or wear, and repair or replace.
Torque cylinder don't move or move slowly.	Push/Pull cable broken.	Replace cable.
	Dirty return filter in power supply.	Replace filter element.
Torque gauge does not indicate pressure during makeup	Dirty inlet port or gauge.	Clean inlet port or replace gauge.
	Dump valve stuck open (depressed, pressure does not build up) or set incorrectly.	Adjust full CW test if still no pressure reading, replace, readjust 1/4 turn from full CCW position.
	Torque cylinders reached end of stroke and actuated dump valve.	Reset for additional stroke.
	Gauge damper closed.	Open damper located on top front of gauge (rotate counterclockwise).
	Gauge not adjusted to zero.	Rotate zero adjust knob on back of gauge case. Recheck torque setting.

Symptom	Probable cause	Remedy
	Tank line pressure.	Check and correct.
	Defective gauge.	Replace.

Troubleshooting the ST-80C

Troubleshooting Tables

Symptom	Probable cause	Remedy
Jaws slip on tool joint.	Worn or broken dies.	Replace dies.
	Hydraulic pressure too low.	Make sure the pressure at the manifold is set to 2,000 - 2,100 psi.
Upper torque wrench body lifts while cycling in makeup or breakout mode.	Interference between upper and lower body sets.	Check and remove interference.
Torque wrench clamp cylinders too slow or uneven.	Check valves on manifold contaminated or defective.	Clean, repair, or adjust valves.
	Lack of lubrication.	Lube all grease fittings.
	Push/Pull cable broken.	Replace cable.

Symptom	Probable cause	Remedy
Spinner assemblies do not clamp or unclamp and/or motors do not run.	Flow restricted.	Locate cause or restriction and correct.
	Power supply defective.	Check power supply.
	Push/Pull cable broken.	Replace cable.
Spinner assemblies or motor creep with valve in neutral position.	Leaking or sticky valve.	Return valve to center position manually. If problem persists, inspect valve spool for wear or contamination. Repair or replace.
Motor runs irregularly.	Contaminated motor.	Repair motor or replace.
	Bent shaft.	Repair motor or replace.
Spinner assemblies do not move in unison.	Defective pivot.	Check hinge pins and bores and repair or replace as required.
	Lack of lubrication.	Lube all grease fittings.
	Defective piston/gland.	Repair or replace.
	Restriction in hydraulic line.	Check for pinched, clogged, or otherwise obstructed hydraulic lines. Clear obstruction.

Troubleshooting the ST80C

Troubleshooting Tables

Symptom	Probable cause	Remedy
Spin rollers do not turn with motor running, or have insufficient power.	Sheared drive roller key.	Replace key.
	Nut that keeps bevel gear in place on motor shaft is backed off.	Remove motor, retighten nut and secure nut with lock tab.
	Motor seal blown.	Replace motor seals. Check that motor drain lines are open to tank.
	Flow restricted to motor.	Locate cause of restriction and correct.
	Defective roller bearings.	Replace bearings.
	Defective motor.	Repair motor.
Loss of power, torque.	Motor Drive shaft broken.	Replace Shaft.
	Power supply not operating.	Check power supply pressure gauge for indication. Ensure that supply pressure remains high with operating valve energized.
	Restricted hydraulic lines.	Check for pinched, clogged, or otherwise obstructed hydraulic lines. Clear obstruction.
	Worn cylinder seals.	Replace seals.
Drill pipe or collars rub against spinner housing during spinning.	Spin rollers worn excessively.	Replace spin rollers.
Spin rollers slip.	Insufficient clamping pressure.	Check pressure at manifold set to 2,000-2,100 psi. Check for leaks in clamping lines and replace as required. Replace and check relieving valves in manifold (CB8, CB9 and RV1).
	Defective seal on spin clamp cylinder piston.	Replace seal.
	Slippery connection.	Clean connection.
	Spin rollers worn.	Replace spin rollers.
Spinner motor does not run.	Push/Pull cable broken.	Replace cable.