DRIL-QUIP

RUNNING THE

FLOW-BY STYLE LOCKDOWN SLEEVE

SUGGESTED PROCEDURE

INSIDE OF RISER

Note: Run the Lead Impression Tool before beginning this procedure to determine if the Lockdown Sleeve requires adjustment to compensate for a deviation in the Casing Hanger stack-up within the Wellhead Housing.

Tools Needed for This Operation

- Casing Hanger Lockdown Sleeve, with adequate flowby
- Lockdown Sleeve Running and Retrieving Tool
- Test Sub with Shearable Gate
- Adjustable Parallels and Digital Calipers

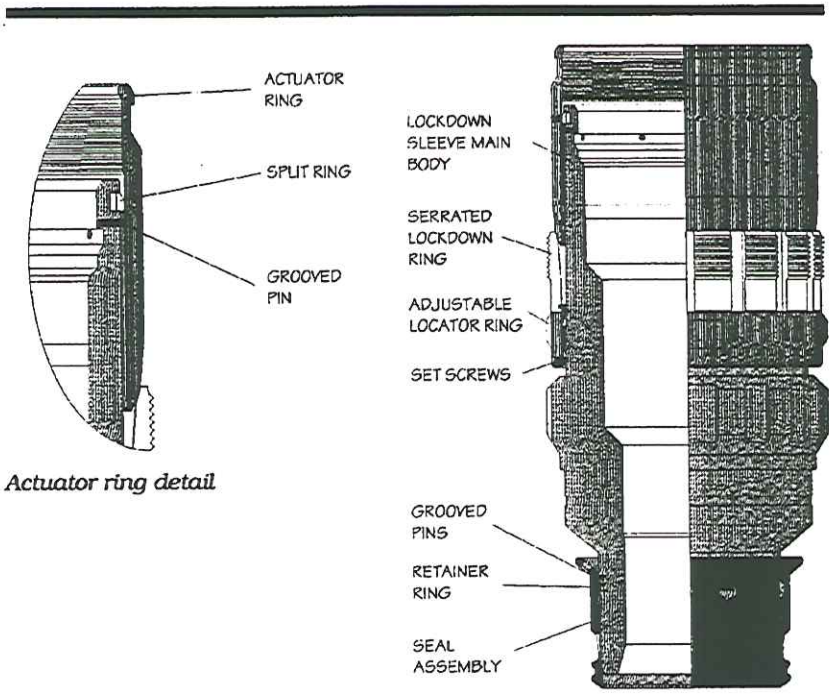
Pre-Operational Procedures

All components of the SS-15 Subsea Wellhead System are carefully inspected at DRIL-QUIP's manufacturing facilities prior to shipping. Pre-operational procedures are suggested to ensure the equipment is not damaged due to shipping and handling, and to ensure all necessary components are available and in good working order when the equipment is used. If any of the following checks are suspect, contact the nearest DRIL-QUIP office.

Lockdown Sleeve

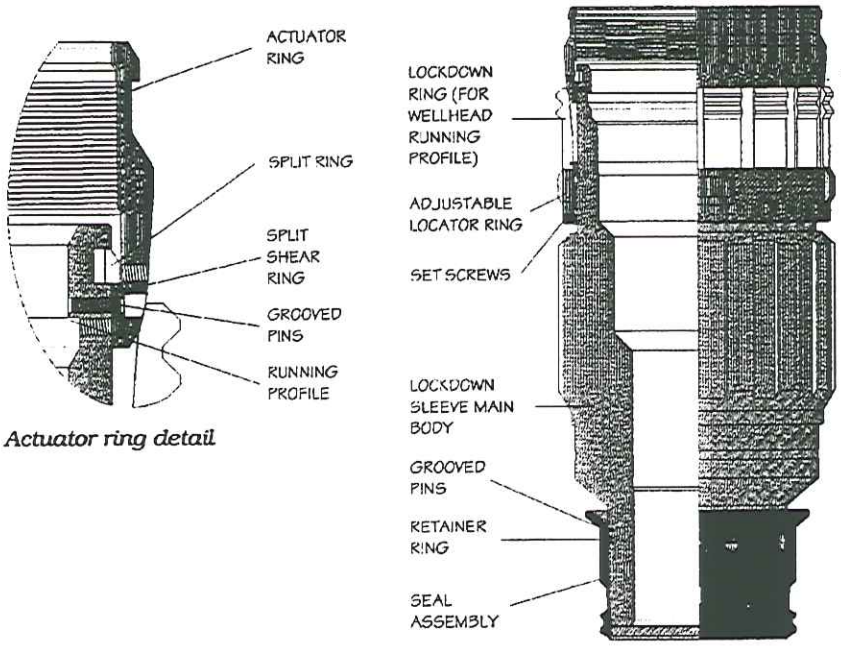
Note: Some Lockdown Sleeves lock into the Wellhead Housing running profile. Other Lockdown Sleeves lock into profiles deeper within the bore of the Wellhead Housing. Ensure the Lockdown Sleeve is appropriate for the Wellhead Housing downhole.

1. Refer to **Figure 1a** and **Figure 1b** for identification of the Lockdown Sleeve components. Record the part number, serial number, and set number of the Lockdown Sleeve for the permanent well file.



Actuator ring detail

Figure 1a. *Typical Lockdown Sleeve for Wellhead deep bore lockdown*



Actuator ring detail

Figure 1b. *Typical Lockdown Sleeve for Wellhead Housing running profile*

2. Remove the upper and lower can protectors from the Lockdown Sleeve. Clean the Lockdown Sleeve if necessary. Do not use a wire brush or sharp tool on the seal area or Seal Assembly of the Lockdown Sleeve.

3. Inspect the actuator ring at the top of the Lockdown Sleeve. The adapter ring of the Lockdown Sleeve Running and Retrieving Tool moves the actuator ring down when hydraulic force is applied from surface. When the actuator ring of the Lockdown Sleeve moves down, the lockdown ring is forced into the lockdown profile of the 18-3/4" Wellhead Housing.

   a. Inspect the thread inside the actuator ring for damage or debris. This thread profile engages the split ring located between the actuator ring and the Lockdown Sleeve main body.

   Note: When the actuator ring is depressed, the split ring will ratchet into the threads on the ID of the actuator ring and secure the actuator ring down.

   b. Confirm the actuator ring is fully extended. It should measure 3.88" from the top of the actuator ring to the face of the Lockdown Sleeve main body. Refer to **Figure 2a** and **Figure 2b.**

   c. Confirm four grooved pins are installed between the Lockdown Sleeve main body and the split shear ring on the ID of the actuator ring. The four grooved pins are accessed from the main body ID. The grooved pins have a combined shear value of 15,320 lb (equivalent to 920 psi in the Running Tool).

4. Inspect the running profile below the grooved pins. Ensure the lip is continuous and free of damage. This profile accepts the shear pins on the Running Tool Landing Adapter. Repair all gouges which could interfere with shear pin engagement.

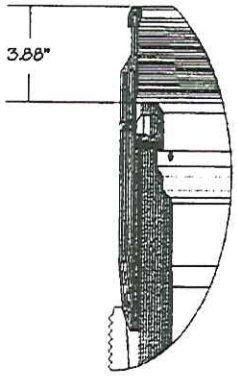


Figure 2a. *Actuator ring in extended position*

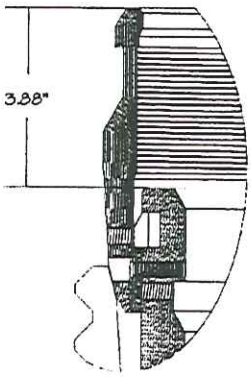


Figure 2b. *Actuator ring in extended position*

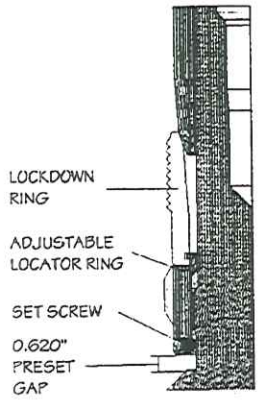


Figure 3a. *Adjustable locator ring factory preset gap*

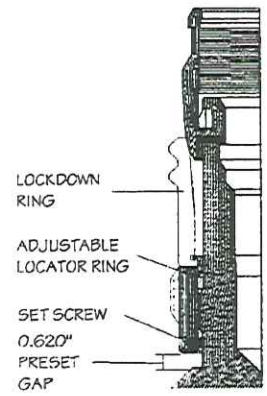


Figure 3b. *Adjustable locator ring factory preset gap*

5. Inspect the lockdown ring for damage that may prevent proper engagement of the lockdown ring with the lockdown profile in the Wellhead Housing. Repair the lockdown ring if necessary. Ensure the maximum OD of the lockdown ring matches the assembly drawing, and that it will drift the bore of the Wellhead Housing.

6. Inspect the adjustable locator ring on the Lockdown Sleeve OD for damage. Verify the adjustable locator ring is secured in place by four socket set screws.

   CAUTION: The Lockdown Sleeve may not properly lock down if adjustable locator ring was moved during shipping or handling. This condition is critical if the Lead Impression Tool run indicated no adjustment of the Lockdown Sleeve is necessary. Verify the factory preset gap is 0.620" (± 0.005").

7. Refer to **Figure 3a** and **Figure 3b**. Measure the gap between the adjustable locator ring and the shoulder of the main body, just below the adjustable locator ring. Use the adjustable parallels and the digital caliper to verify the factory preset gap is 0.620" (± 0.005").

   a. Loosen the set screw on the adjustable parallels. Insert the adjustable parallels into the gap, and slide the adjustable parallels to contact the faces of the main body and the adjustable locator ring. Remove the adjustable parallels and tighten the set screw.

   b. Use the digital caliper to measure the adjustable parallels.

   c. If the preset gap is 0.620" (± 0.005"), record the measurement for the well file.

   d. If the preset gap is not 0.620" (± 0.005"), refer to **Adjusting the Lockdown Sleeve** to adjust the gap within limits. After the gap is set within limits, record the measurement for the well file.

8. If adjustment of the Lockdown Sleeve is necessary to compensate for Casing Hanger stack-up deviation, refer to **Adjusting the Lockdown Sleeve** in this secton.

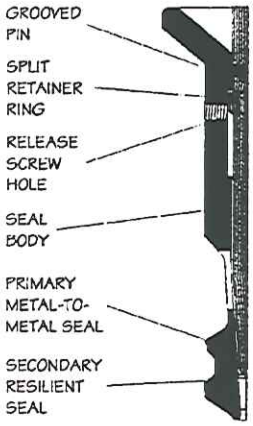


Figure 4a. *detail of a metal-to-metal type Seal Assembly*

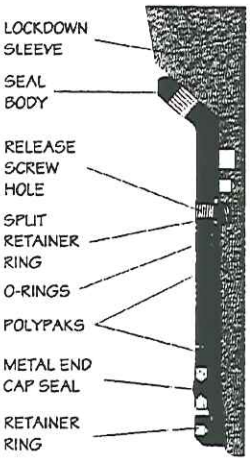


Figure 4b. *detail of a resilient seal type Seal Assembly*

9. Refer to **Figure 4a.** If a metal-to-metal type Seal Assembly is installed, inspect the Seal Assembly as follows.

   a. Inspect the metal sealing lips, above and below the resilient secondary seal, for deformation or scratches. These are the primary OD seals and they require protection. Inspect the resilient secondary seal for damage.

   b. Verify eight grooved pins secure the top of the Seal Assembly approximately 1-1/4" from the main body of the Lockdown Sleeve. These eight pins provide a combined shear valve of 23,520 lb and retain the Seal Assembly in the running position until the Lockdown Sleeve is landed.

10. Refer to **Figure 4b.** If a resilient seal type Seal Assembly is installed, inspect the Seal Assembly as follows.

    a. Verify the top of the Seal Assembly is up against the main body of the Lockdown Sleeve. In this position the Seal Assembly is secured to the Lockdown Sleeve by a split retainer ring.

    b. Inspect the end cap seal and the polypak seal on the lower OD of the Seal Assembly. Run a finger over the seals. The seals should be smooth, pliable, and free of cuts or cracks.

    c. Verify the end cap seal retainer ring is made up tightly to the main body of the Seal Assembly.

    d. Replace the seals if necessary. Refer to **Post-Operational Procedures** for instruction on removal and replacement of the metal end cap seal.

11. Cut a hole in the bottom of the lower can protector large enough to stab the Test Sub through when the Running Tool is made up to the Lockdown Sleeve. The hole should not be larger than the ID of the Lockdown Sleeve. Tape over the hole to keep debris out of the Lockdown Sleeve and Seal Assembly IDs.

12. Replace the upper and lower can protectors and store the Lockdown Sleeve as appropriate for operations.

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Adjusting the Lockdown Sleeve

A slip-type connection is used to move the lockdown ring vertically as the adjustable locator ring is rotated.

1. Loosen the four locking set screws at the bottom of the adjustable locator ring.

2. Refer to the Lead Impression Tool run data for the Casing Hanger deviation data.

   a. If the lead impression data shows the Casing Hanger stack-up to be high, subtract the deviation from 0.620". This reduced dimension is the new gap measurement.

   b. If the lead impression data shows the Casing Hanger stack-up to be low, add the deviation to 0.620". This increased dimension is the new gap measurement.

3. Use the adjustable parallels and the digital caliper to adjust the Lockdown Sleeve.

   a. Set the digital caliper to the new gap measurement (± 0.005") and lock the caliper.

   b. Loosen the set screw on the adjustable parallels. Insert the adjustable parallels into the gap of the digital caliper and slide the adjustable parallels to contact the faces of the caliper. Tighten the set screw on the adjustable parallels.

   c. Insert the adjustable parallels into the gap between the adjustable locator ring and the shoulder of the main body. Rotate the adjustable locator ring to contact the top of the adjustable parallels.

4. Use a crisscross pattern to first make up the locking set screws to contact, and then to tighten the set screws. Paint stripe the adjustable locator ring and Lockdown Sleeve main body. Remove the adjustable parallels.

5. Record the final gap measurement for the well file.

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Lockdown Sleeve Running and Retrieving Tool

Note: There are two basic types of the Lockdown Sleeve Running and Retrieving Tool that are run inside of riser. One type of Tool has a fixed landing ring; the other has a moveable landing ring. The recommended running position for the moveable landing ring is shown in **Figure 5**.

1. Refer to **Figure 5** for identification of the Lockdown Sleeve Running and Retrieving Tool (Running Tool) components. Record the part number and serial number of the Running Tool for the permanent well file.

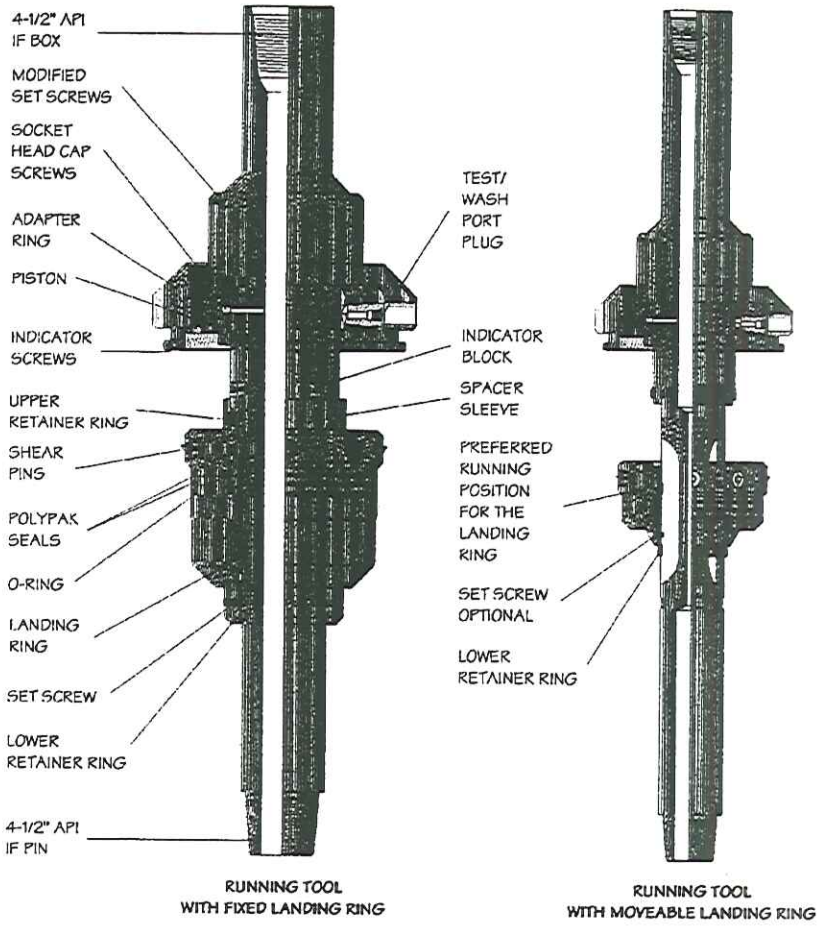

Figure 5. *Typical Lockdown Sleeve Running and Retrieving Tools*

2. Inspect the 4-1/2" IF box and pin for damage. Repair and lubricate the threads if necessary. Re-install the thread protectors.

   CAUTION: When verifying installation of the modified set screws, back off the modified set screws 1/2 turn from their tight position. Failure to do so could result in an improper shearing performance.

3. Confirm six modified set screws are installed in the upper OD of the piston. The set screws must be made up hand-tight and then backed off 1/2-turn. These set screws secure the piston to the main body stem and will shear at approximately 1,150 psi of drill pipe pressure.

4. Verify eight socket head cap screws are tightly installed in the piston adapter ring. These cap screws secure the adapter ring to the piston.

5. Verify two 1/2" NPT pipe plugs are installed tightly in the test/wash ports. The test/wash ports are for internal DRIL-QUIP use only.

6. Inspect the three threaded lead indicator screws on the bottom of the adapter ring. The indicator screws are used to verify the adapter ring on the tool made contact with the actuator ring on the Lockdown Sleeve during the lockdown sequence. Refer to **Figure 6.**

   a. Confirm the screws are adjusted to a height of 1/8".

   b. If the screws are deformed, replace the lead indicator screws. Use an "easy out" tool to extract flattened indicator screws.

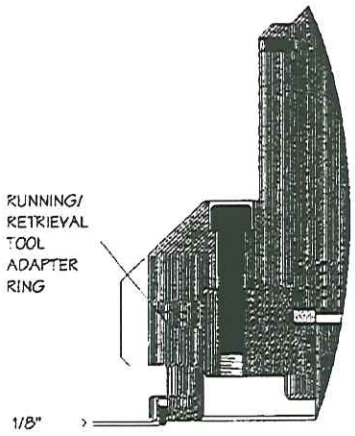

Figure 6. *Indicator screw*

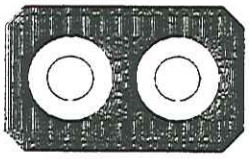

Figure 7. *Serviceable lead indicator block used to determine piston stroke*

7. Refer to **Figure 7.** If three lead indicator blocks are installed on the stem of the Running Tool, remove them. These blocks are used to determine effective piston stroke when the circulation gate is blown with the Running Tool landed out. However, DRIL-QUIP standard operating procedure shears the Running Tool out of the Lockdown Sleeve before blowing the circulation gate.

   Note: While pressuring up to blow the circulation gate, the Running Tool piston is driven down to the upper retainer ring. If the lead indicator blocks are installed, they may be destroyed in the process.

8. Ensure the upper retainer ring is properly installed. If a spacer sleeve is installed on the stem of the Running Tool, ensure it is secured to the stem by the upper retainer ring. The spacer sleeve prevents the piston from damaging the upper retainer ring.

9. Inspect the eight shear pins on the OD of the landing ring. These shear pins represent a combined shear value of 60,000 lb.

   a. Ensure the shear pins are properly installed, tapered side to the bottom, flat surface on top.

   b. Check the springs behind the shear pins by depressing the pins and releasing them. Each shear pin should return to its extended position.

   c. Refer to **Removal, Cleaning, and Installation of Shear Pins** if it is necessary to replace a shear pin.

10. Inspect the polypak seals and O-rings on the landing ring of the Running Tool. Ensure the seals are properly installed in their grooves with no protrusions. The seals should be smooth, pliable, and free of cuts and cracks. Replace the seals if necessary.

11. If the Running Tool has a fixed landing ring, verify the lower retainer ring is threaded up against the landing ring and secured with four socket set screws.

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12. If the Running Tool has a moveable landing ring, verify the landing ring is installed in the recommended position over the flowby slots in the Running Tool stem.

    a. Ensure the lower retainer ring is installed with its 10° chamfer facing the landing ring.

    CAUTION: When verifying installation of the modified set screws, back off the modified set screws 1/2 turn from their tight position. Failure to do so could result in an improper shearing performance.

    b. Use of modified set screws in the landing ring is optional; they may provide for easier makeup of the Running Tool to the Lockdown Sleeve. If modified set screws are used to secure the landing ring to the stem, ensure they are made up hand-tight and then backed off 1/2 turn. These set screws will shear at approximately 30,000 lb of weight down.

    CAUTION: The Retrieval Ring is used only when the Lockdown Sleeve is being retrieved and must be removed from the Running Tool before running the Lockdown Sleeve.

13. Verify the Retrieval Ring is available and serviceable. The Retrieval Ring is shipped separate from the Running Tool.

14. Store the Running Tool as appropriate for operations.

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Lockdown Sleeve Test Sub

CAUTION: The circulation gate must be fully functional regardless of downhole conditions. The Running Tool will not function properly if the Test Sub is run with a sheared circulation gate.

1. Refer to the **Figure 8** for identification of the Lockdown Sleeve Test Sub (Test Sub) components. Record the part number and serial number of the Test Sub for the permanent well file.

2. Inspect the 4-1/2" IF box and pin threads for damage. Repair and grease the threads if necessary. Re-install the thread protectors.

3. Verify the top of the circulation gate is approximately 6-1/4" from the top of the Test Sub.

   a. Remove the eight threaded shear pin retainers.

   b. Ensure the circulation gate is held in place with six grooved pins. These pins shear at approximately 3,450 psi of surface drill pipe pressure and allow the string to be pulled dry.

   c. Re-install the eight threaded shear pin retainers.

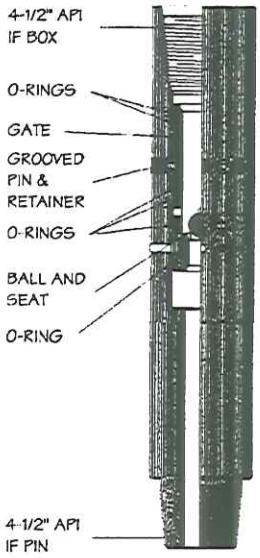

Figure 8. *Lockdown Sleeve Test Sub*

4. Confirm the ball is installed in the circulation gate.

5. Store the Test Sub as appropriate for operations.

Running Procedure

Note: Run the Lead Impression Tool before beginning this procedure to determine if the Lockdown Sleeve requires adjustment to compensate for a deviation in the Casing Hanger stack-up within the Wellhead Housing. Verify the Wear Bushing has been retrieved.

Note: The Lockdown Sleeve is weight-set by the Running Tool. Weight is required below the Running Tool.

- To fully set the Seal Assembly: 68,000 lb
- To fully shear the Seal Assembly shear pins: 23,500 lb
- To resist premature shear out of the Running Tool: 60,000 lb
- To achieve a full pre-load on the Lockdown Sleeve and resist pumping the Running Tool out of the hole: 41,100 lb @ 2,500 psi; 49,300 lb @ 3,000 psi; and 57,200 lb @ 3,450 psi (necessary to shear the gate and pull a dry string)
- DRIL-QUIP recommends running 100,000 lb of weight below the Running Tool. Consult the operator to determine the distance from the top of the Wellhead Housing to the cement top in the last casing string. Weight above the Running Tool can be substituted for weight below the Running Tool.

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Run the Lockdown Sleeve

Note: If additional centralization is necessary, the Multi-Purpose Tool, configured with the Wear Bushing Retrieval Adapter and Adapter Sub, can be run a joint above the Running Tool. The joint of drill pipe allows the BOP rams to be closed to pressure test the Lockdown Sleeve. Ensure tool joints will not interfere with BOP ram operation.

1. Place the Running Tool in the rotary or mouse hole. Make up a double joint of drill pipe into the upper box connector of the Running Tool.

2. Verify the ball is installed in the Test Sub and then make up the Test Sub below the Running Tool. Make up a pup joint below the Test Sub and carefully stand the assembly back in the derrick.

   Note: This system will not operate without the ball.

3. Remove the upper protector from the Lockdown Sleeve. Tighten the Allen head screws to secure the lower can protector to the Lockdown Sleeve for protection.

4. Set the Lockdown Sleeve on the rotary table with the lower can protector down.

5. Pick up the Running Tool/Test Sub assembly from the derrick. Stab the Running Tool/Test Sub assembly into the Lockdown Sleeve. The pin of the pup joint below the Test Sub will pass through the hole made in the lower can protector.

6. Set the weight of the Running Tool assembly on the Lockdown Sleeve to ensure the shear pins on the Running Tool properly latch into the Lockdown Sleeve. Pick up on the Running Tool a few feet to confirm the Lockdown Sleeve is latched to the Running Tool.

   Note: If the Running Tool must be released from the Lockdown Sleeve, refer to **Release the Running Tool from the Lockdown Sleeve**, under **Post-Operational Procedures**.

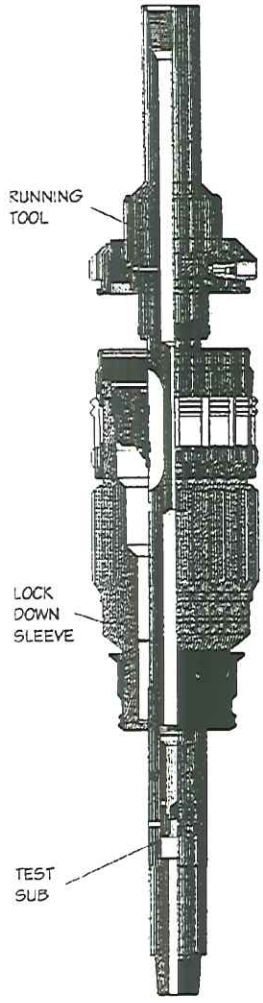

Figure 10. *Lockdown Sleeve running joint, Running Tool with moveable landing ring (can protector not shown)*

7. Refer to **Figure 9** and **Figure 10.** Stand the Running Tool assembly/ Lockdown Sleeve back in the derrick.

8. Run the necessary drill pipe to achieve a minimum air weight of 100,000 lb below the Running Tool.

9. Pick up the Running Tool assembly/Lockdown Sleeve. Make up the assembly to the drill pipe stinger in the rotary.

10. Pick up the entire assembly off the rotary.

    a. Back out the Allen head screws on the lower can protector.

    b. Drop the protector off the Seal Assembly and cut the protector off with a torch. Ensure the protector is far enough below the Seal Assembly so as not to damage the Seal Assembly when using a cutting torch.

11. Remove the slips and rotary bushings. Run the Lockdown Sleeve down hole on drill pipe.

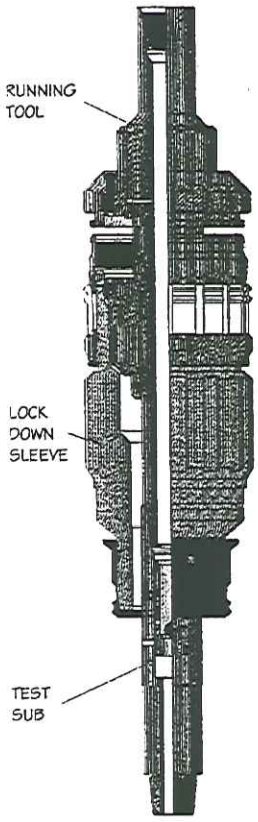

Figure 9. *Lockdown Sleeve running joint, Running Tool with fixed landing ring (can protector not shown)*

Note: Shear pins carry the entire weight of the Lockdown Sleeve while it is run to the Wellhead. The shear pins have a collective shear value of 60,000 lb.

    a. When the Lockdown Sleeve approaches the stack, adjust the motion compensator or blocks to support only the weight of the drill pipe running string.

    b. Run the Lockdown Sleeve slowly through the stack.

12. Land the Lockdown Sleeve on the Casing Hanger. If the Lockdown Sleeve incorporates a metal-to-metal type Seal Assembly, the seal is set and energized by weight.

- As approximately 23,520 lb of drill pipe stinger weight is applied on the Lockdown Sleeve, the grooved pins in the Seal Assembly shear.
- If the Running Tool landing ring was run in the recommended position with set screws installed, drill pipe stinger weight shears the modified set screws in the landing ring at approximately 30,000 lb. The running string will drop approximately 6".
- As the full 100,000 lb of drill pipe stinger weight is applied on the Lockdown Sleeve, the Lockdown Sleeve drops approximately 1-1/4" and the 4° taper on the lower OD of the Lockdown Sleeve energizes the Seal Assembly.

13. Prepare to test the Lockdown Sleeve.

Lockdown Sleeve Test Procedure

Note: The letters preceding the potential leak paths correspond to the troubleshooting chart presented later in this section.

Pre-Test Checks

1. Perform the following pre-test checks of the pressure system before beginning the test procedures to identify potential leak paths during the test. The potential leak paths are:

   a. Test rams

   b. BOP stack connection(s) between the test rams and the Wellhead connector.

   c. Test pump unit.

   d. Choke and kill manifold.

   e. Test line and all the connections from the test pump to the BOP.

   f. BOP stack valve(s) or any other choke/kill inlets

   g. Ring gasket between the Wellhead and the wellhead connector

   h. O-ring seals on the Lockdown Sleeve Running/Retrieving Tool

   i. Seal Assembly

2. Fill the riser with drilling fluid to detect pipe ram leakage.

3. Fill the drill pipe with fluid. Open the drill pipe running string to the atmosphere. Continuous returns through the drill pipe indicate Running Tool seal leakage.

4. Verify the integrity of the pressure system.

   a. Select a set of pipe rams to be used to pressure test the Seal Assembly. Call these rams the test rams.

   b. Select a choke or kill line that enters the BOP stack below the test rams. Call this line the test line. Close the test line valve closest to the BOP stack. Use a test pump unit to pressure up the test line to a minimum of 2,500 psi or the desired BOP stack pressure, whichever pressure is greater.

   c. Note the fluid level in the test unit suction tank and hold the test for one minute. If a pressure drop is noticed: trace the source of the drop, correct the problem, re-test the test line, and hold pressure for one minute.

   d. If a choke or kill line other than the test line enters the BOP stack below the test rams, test the lower line valve at the BOP stack in the manner described in **Sub-step 4b**. If there are no other inlets in the BOP stack below the test rams other than the test line, this step can be omitted.

Test Procedure

CAUTION: Do not exceed 15,000 psi when testing the Seal Assembly.

1. Close the test rams and build pressure up to a minimum of 5,000 psi, or any other value chosen by the operator, for approximately five minutes. Do not exceed a test pressure 15,000 psi.

   Note: If during the Seal Assembly test a pressure drop is experienced, refer to **Table 1** for troubleshooting information. This table can be used to quickly isolate the source of the leak.

2. At the conclusion of this test, bleed the pressure and open the rams. Prepare to lock the Lockdown Sleeve to the Wellhead Housing.

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Table 1. *Lockdown Sleeve Seal Assembly Troubleshooting Chart*

Symptoms	Possible Problem	Suggested Solution
Fluid loss at test pump unit	c. Test Pump Unit	Repair the leak in the Test Pump unit, and test again
Fluid returns in the well bore	a. Test Rams	Open and close the Test Rams, and test again Select new Test Rams, and test again
Fluid returns at the Choke/Kill manifold	d. Valves in the Choke/Kill manifold f. Choke/Kill valves at the BOP	Open and close the Valves, and test again Open and close the Valves, and test again Close the backup C/K valves at the BOP, and test again
Continuous fluid returns through the drill pipe running string	h. O-rings and Lip seals leaking on Running & Retrieval Tool Lock-Down Sleeve Seal Assembly Leaking	Retrieve the Running Tool and Lock-Down Sleeve, pressure up Running Tool, and replace 0-rings and Lip seals. Re-run Assembly and test again Retrieve the Running Tool and Lock-Down Sleeve, inspect Seal Assembly, and replace Seal Assembly if necessary. Re-run Assembly and test again
Fluid noticed through the camera, between the Wellhead and Wellhead connector	g. Wellhead ring gasket	Replace the Wellhead ring gasket, and test again
Fluid noticed through the camera, from the main BOP	b. Ram body/ Wellhead connections	Retrieve the BOP, replace the ring gasket(s), re-run the BOP, and test again
Fluid noticed through the camera, from the test line connections	e. Packing in the Choke/ Kill test line	Retrieve the Riser, replace the packing, re-run the Riser, and test again
No visible fluid loss	i. Seal Assembly	Check the weight on the Running Tool (must be a minimum of 100,000 lb) Pull the Running Tool and Lock-Down Sleeve, run Jet Sub, install new Seal Assembly on Lock-Down Sleeve. Re-run Assembly and test again

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Locking the Lockdown Sleeve

CAUTION: Do not exceed 3,000 psi before proper locking of the Lockdown Sleeve has been verified. The gate in the Test Sub will shear at approximately 3,450 psi and pressure up below the Running Tool.

1. Pressure down the drill pipe to 2,500 psi maximum. At approximately 1,150 psi, the modified set screws in the piston will shear and a momentary pressure fluctuation may be seen on the pressure gauge.

2. When the pressure reaches 2,500 psi, hold this pressure for approximately one to two minutes. The locking sequence may be repeated, if desired, by bleeding the pressure in the drill pipe to 0 psi and re-pressurizing to 2,500 psi for one to two minutes.

   - Pressure extends the piston/adapter ring of the Running Tool.
   - The adapter ring contacts the actuator ring and drives it down behind the lockdown ring.
   - The lockdown ring expands radially and engages the Wellhead Housing lockdown profile.
   - The last Casing Hanger is preloaded 200,000 lb.

3. Bleed off the drill pipe pressure.

4. Pull 30,000 lb over the weight of the entire landing string to verify the Lockdown Sleeve is locked to the Wellhead Housing. Do not exceed 60,000 lb to prevent the Running Tool from prematurely shearing out of the Lockdown Sleeve.

5. Pick straight up on the running string. The Running Tool will shear out of the Lockdown Sleeve with an overpull of approximately 60,000 lb. The 60,000 lb shear out indicates the Lockdown Sleeve is locked to the Wellhead Housing.

6. After shear out has been verified, pull the Running Tool clear of the BOP Stack.

CAUTION: If there is reason to believe the Lockdown Sleeve is still attached to the Running Tool during retrieval (i.e. no overpull), do not shear the gate in the Test Sub. Attempting to shear the gate will spread open the lock ring in the stack or riser and compromise retrieval. In this situation, it will be necessary to pull a wet string.

7. Pressure down the drill pipe to 4,000 psi maximum. At approximately 3,450 psi, the gate in the Test Sub will shear and a momentary pressure fluctuation may be seen on the pressure gauge. Stop pumping.

   Note: If the lead indicator blocks are installed, the block impressions are destroyed as the Running Tool piston is driven down to the spacer ring by the drill pipe pressure used to blow the circulation gate.

8. Retrieve the running string to the surface. The sheared circulation gate will allow the string to be pulled dry.

9. Examine the lead indicator screws on the Running Tool adapter ring to confirm positive contact with the Lockdown Sleeve actuator ring. The indicator screws should be deformed.

Post-Operational Procedures

Lockdown Sleeve Running and Retrieving Tool

1. Break out the Running Tool and Test Sub from the running string and wash this equipment with fresh water.

2. Remove all sheared modified set screws from the piston of the Running Tool. Slide the piston up to the stop on the center stem of the Running Tool. Install six new set screws through the piston and into the stem of the Running Tool.

3. If the seals need to be replaced, remove the lower retainer ring below the landing ring and slide the landing ring off the center stem.

   a. Replace the seals on the center stem and the landing ring if necessary.

   b. Re-install the landing ring and the lower retainer ring.

   c. Replace the shear pins in the landing ring. Refer to **Removal, Cleaning, and Installation of Shear Pins.**

4. Replace the three lead indicator screws on the Running Tool adapter ring. and the three lead indicator blocks on the Running Tool stem.

5. Restore the Test Sub to running condition.

   a. Remove the Test Sub from the Running Tool.

   b. Re-set the Test Sub gate. Refer to **Re-Setting the Test Sub Gate** for instructions.

c. Make up the Test Sub to the Running Tool. Store the ball in a secure area.

6. Install the thread protectors and store the Running Tool as appropriate for operations.

Removal, Cleaning, and Installation of Shear Pins

1. Use a spanner wrench to unscrew the retainer nut and remove the shear pin assembly.

2. Lightly grease and install a new shear pin assembly according to the layout. Install the shear pin with the tapered side down and the flat side up. Refer to **Figure 11.**

3. Tighten the retainer nut with the spanner wrench. Ensure the retainer nut does not protrude beyond the OD of the tool. If either one or both protrude: remove, clean, and re-install the shear pin assembly to achieve the proper installation.

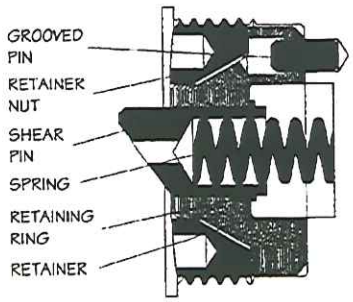

Figure 11. *Detail of a shear pin assembly layout*

4. After installation, check each spring by pressing the shear pin with your finger. The shear pin should return to the extended position.

Note: Excessive grease and/or debris can prevent the retainer nut and retainer from fully seating when the shear pin is installed.

DRIL-QUIP

Release the Running Tool from the Lockdown Sleeve

1. Set the Running Tool/Lockdown Sleeve in the slips at the rotary table.

   a. Remove the eight socket head cap screws that secure the adapter ring to the piston. Remove the adapter ring.

   b. Loosen the four locking set screws at the bottom of the adjustable locator ring. Rotate the adjustable locator ring all the way down.

   Note: Some styles of Lockdown Sleeve do not require the adjustable locator ring to be threaded down to gain access to the shear pin releasing holes.

   c. Refer to **Figure 12.** Align the access holes in the actuator ring with the holes in the split shear ring. Tap in the two grooved pins that secure the actuator ring to the main body of the Lockdown Sleeve.

2. Remove the actuator ring from the Lockdown Sleeve.

   a. Thread twelve 3/8" bolts into the threaded holes in the actuator ring to collapse the split ring securing the actuator ring to the Lockdown Sleeve.

   b. Pick up the actuator ring clear of the main body of the Lockdown Sleeve to gain access to the shear pin releasing holes.

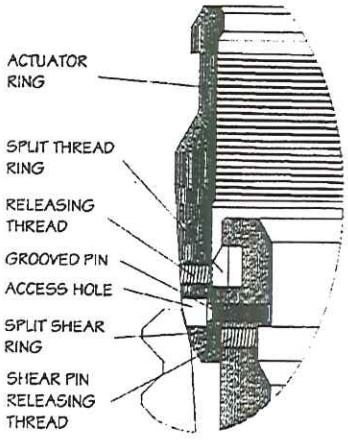

Figure 12. *Releasing detail. Running Tool not shown*

3. Align the shear pin releasing holes with the spring-loaded shear pins on the Landing Adapter. Thread eight 3/8" bolts into the threaded holes in the main body to compress the spring-loaded shear pins. When all spring-loaded shear pins are compressed, the Running Tool is released from the Lockdown Sleeve.

4. Pick up on the block to remove the Running Tool from the Lockdown Sleeve.

   a. Re-install the adapter ring. Re-install the eight socket head cap screws to secure the adapter ring to the piston.

   b. Stand the Running Tool back in the derrick.

5. Lay down the Lockdown Sleeve.

6. Re-install the actuator ring. It should measure 3.88" from the top of the actuator ring to the face of the Lockdown Sleeve main body.

   a. Install four new grooved pins into the ID of the Lockdown Sleeve main body to secure the actuator ring in place.

   b. Reset the gap between the adjustable locator ring and the shoulder of the main body. Tighten the locking set screws to secure the adjustable locator ring in place.

7. Re-install the upper and lower can protectors. Store the Lockdown Sleeve as appropriate for operations.

Re-Setting the Test Sub Gate

1. Remove the ball from the Test Sub. Store the ball in a secure area.

2. Use an Allen wrench to remove all eight shear pin retainers from the OD of the Test Sub.

3. Knock the gate out of the Test Sub from the pin end. Wash the bore of the Test Sub thoroughly.

4. Remove the O-rings from the gate. Clean the gate and install new O-rings. Verify the groove in the OD of the gate is painted white. The white groove is used as a reference for gate installation. Refer to **Figure 13a**.

5. Inspect the gate seat for scratches, washouts, and proper installation.

   a. If the sealing capability of the seat is questionable, replace the gate.

   b. If the gate seat is not properly installed, knock it out of the gate. Clean the seat and the gate seat face. Apply a thin layer of a thread-locking compound to the gate seat face and re-install the seat. Tap the seat into place within the gate seat. Remove all excess compound from the gate ID and seat ball-sealing face. Refer to **Figure 13b**.

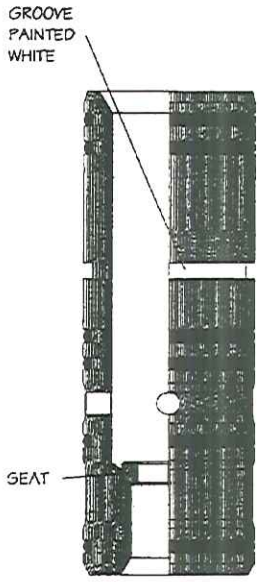

Figure 13a. *Test Sub gate showing a white groove used as a reference for re-assembly*

Note: A quality thread-locking compound such as **Bakerlok®** or equivalent is recommended to secure the seat within the gate seat face. Avoid thread-locking compounds with rapid cure times; there may not be sufficient time to clean excess compound from the seat ball-sealing face.

5. Lubricate the OD of the gate. Re-install the gate into the Test Sub. The top of the gate is indicated by a pair of O-rings.

   a. Tap the gate into the Test Sub until the top of the gate is approximately 6-1/4" from the top of the Test Sub.

   b. Observe the gate through the grooved pin holes in the Test Sub. When the gate is in proper position, the white groove in the OD of the gate will be visible through the grooved pin holes in the Test Sub.

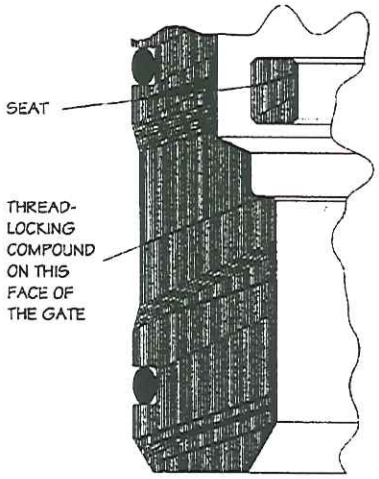

Figure 13b. *Gate seat installation detail*

6. Install six new grooved pins to secure the gate in the running position within the Test Sub. Use an Allen wrench to re-install all eight grooved pin retainers into the OD of the Test Sub.

DRIL-QUIP

Replacing the Lockdown Sleeve Seal Assembly

Metal-to-Metal Type Seal Assembly

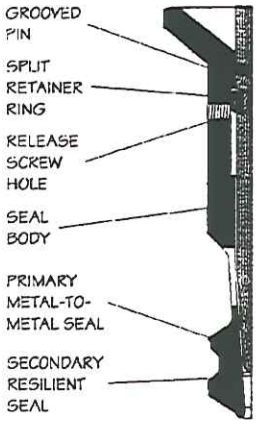

Figure 14. *detail of a metal-to-metal type Seal Assembly*

1. Refer to **Figure 14.** Drill out the eight grooved pins securing the Seal Assembly to the Lockdown Sleeve.
2. Thread bolts into the 3/8" holes to collapse the retainer ring and allow the Seal Assembly to slide off the bottom of the Lockdown Sleeve.
3. Install the new Seal Assembly onto the Lockdown Sleeve. Observe the split retainer ring through the view holes of the Seal Assembly to verify the split retainer ring has engaged the groove in the Seal Assembly ID.
4. Align the grooved pin holes and install eight new grooved pins.
5. Re-install the upper and lower can protectors and store the Lockdown Sleeve until it is needed.

Resilient Seal Type Seal Assembly

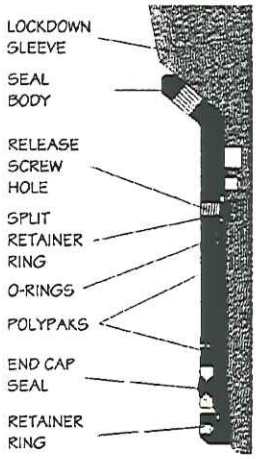

Figure 15. *detail of a resilient seal type Seal Assembly*

1. Refer to **Figure 15.** Thread eight 3/8" bolts into the threaded holes in the Seal Assembly OD to collapse the split retainer ring securing the Seal Assembly to the Lockdown Sleeve.
2. Slide the Seal Assembly off the Lockdown Sleeve. It may be necessary to install four 3/8" jacking bolts into the threaded holes in the upper OD of the Seal Assembly.
3. Slide on the new Seal Assembly. The split retainer ring in the OD of the Lockdown Sleeve will snap into a groove in the ID of the Seal Assembly to secure the Seal Assembly to the Lockdown Sleeve. Observe the split retainer ring through the view holes of the Seal Assembly to verify the split retainer ring has engaged the groove.
4. Re-install the upper and lower can protectors and store the Lockdown Sleeve until it is needed.

DRIL-QUIP

Replacing the Resilient Seal Type Seal Assembly Seals

1. Refer to **Figure 15**. Unscrew and remove the retainer ring.
2. Remove the end cap seal and polypak.
3. Inspect the new polypak and end cap seal. The seals should be smooth, pliable, and free of cuts and cracks.
4. Lubricate and install the new polypak and end cap seal.
5. Thread on the retainer ring.