SS-15® BigBore™ II
Subsea Wellhead System
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The BigBore II Subsea Wellhead System provides a highly flexible and customizable casing program designed to facilitate the drilling of wells that might penetrate shallow water flow zones and/or require several casing strings to accommodate sub-salt or small pore pressure/fracture-gradient differentials.

Dril-QuiP’s SS-15 BigBore II Subsea Wellhead System allows an additional casing string, hanger and seal assembly (typically 18") to pass through the 18 ¾" wellhead with the BOP stack and riser in place. This accommodates drilling and running a large bore diameter casing string through shallow pressurized water sands with complete BOP control and with drilling returns back to the drilling vessel.

**Features**

- Wellhead housing designed for 15,000 psi and 7.0 million lbs of end-load carrying capacity at the bottom internal landing/load shoulders
- High tensile, high bending, high load and high pressure capacity
- Accommodates 27" or 30" mandrel profiles
- Available with internal or external annulus shutoff
- Utilizes two 22" adapters for landing 18" (3,500 psi rated) and 16" (5,000 psi rated) supplemental casing hanger systems
- 5,000 psi rated 18" supplemental casing hanger system available upon request
- 10,000 psi metal-to-metal annulus seal for 16" supplemental casing hanger system available upon request
- Wellhead can pass 18" and 16" casing, casing hangers and testable/retrievable/replaceable seal assemblies inside standard 21" riser and 18 ¾" BOP stack
- Capable of setting five casing strings with BOP stack control
- All casing hangers and seal assemblies are run, set and tested on drill pipe in a single trip
- 18 ¾" seal assembly outer lock ring locks seal assembly and casing hanger down; lock ring on 18" casing hanger locks casing hanger down
- 16" seal assembly contains an outer lock ring or a lockdown feature can be added to the 16" hanger body
- Maximum two million lb preloaded rigid lockdown wellhead assembly
- Large cement return flow-by areas
- Cam-actuated locking system running tools eliminate high torque
- Bit-runnable wear sleeves and wear bushings available
- Optional 32", 28", and 26" supplemental casing hanger systems can be incorporated to accommodate a secondary conductor string requirement
- Alternative casing programs available upon request
- BigBore features available in the SS-15ES Subsea Wellhead System (30" mandrel)
- Field-proven wellhead annulus seals temperature rated for 35° to 250° F
- 18 ¾" annulus seal tested with gas and compliant to API 17D Second Edition
**CONDUCTOR WELLHEAD SYSTEMS**

**CONDUCTOR WELLHEADS**

Drill-Quip’s SS-15 BigBore II Subsea Wellhead Systems can be adapted to include a variety of sizes and types of conductor wellheads. Each conductor wellhead has a dual-grooved running profile for a cam-actuated running tool and a locking profile for the high pressure wellhead housing. All conductor wellheads have large flow-by areas. The wellheads are compatible with a wide range of guide bases (diver-assisted, remote-retrievable, guidelineless, drilling and completion), or can be installed without a guidebase.

**FEATURES**

- Bottom has butt weld preparation
- Cement return ports provide large flow-by returns through guide base
- Extended bore on ID to interface with 18 3/4” wellhead bending reaction ring
- Run with 36” Cam-Actuated Dril-Ahead (CADA) Wellhead Running Tool
- Available in 30” bit drift configuration
- Can be used with ROV ball valves

**CONDUCTOR WELLHEAD RUNNING TOOL**

In BigBoreII operations, the standard Conductor Wellhead Running Tool is generally used as a handling tool to move the Conductor Wellhead and wellhead housing extension from the pipe rack to the rig floor.

**CAM-ACTUATED DRIL-AHEAD (CADA) TOOL**

The Drill-Quip Cam-Actuated Dril-Ahead (CADA) Tool was designed for jetting in large-bore conductor strings and gives the operator the ability to continue drilling out for the next casing string in one trip. This feature saves considerable time in deepwater operations.

**FEATURES**

- Incorporates all features of the standard Conductor Wellhead Running Tool
- Five right-hand rotations to release from the wellhead
- Low friction-bearing surfaces carry tensile and bending loads, ensuring easy release even under high bending moments
- Ascending/descending rod is used to indicate tool’s lock/unlock status
- Large flow-by area provides ample returns while jetting or turbo drilling
- Large ID passes maximum 10” drill collars
- Stem allows 18” pick-up to restart mud motor
- Spring-loaded shear pins hold CADA tool body in place during drilling ahead operations
- Unlimited water depth rated
- Field-proven performance
Dril-Quip’s 28” Supplemental Casing Hanger System consists of Casing Hanger Adapter, Casing Hanger and Running Tool. The system is available in a variety of sizes and configurations to suit customer requirements.

**Features**

**Casing Hanger Adapter with Annulus Access**

Dril-Quip offers a 36” adapter that provides annulus access while providing a landing shoulder for a 28” supplemental casing hanger system. A bank of ports is located in the adapter above and below the landing point for the 28” supplemental hanger. Pipe plugs and ball valves can be added to provide returns during the jetting and cementing operations, access during the drilling operations, and shutoff after the wellhead and surface casing has been installed.

- Split lock ring can support sinking conductor pipe up to 1.3 million lbs
- Available for 28” or 30” bit drift conductor wellheads

**Casing Hanger**

- Hangs 28” conductor from Supplemental Casing Hanger and Supplemental Casing Hanger adapter
- Split lock ring helps support sinking conductor pipe after 28” hanger landed
- Seals inside the supplemental adapter after landing

**Casing Hanger Running Tool**

- Left-hand make-up and right-hand release
- O-rings seal off inside Supplemental Casing Hanger
- Has port and optional ball valve arrangement to facilitate casing filling during running operation
- Can be configured with check-valve arranged to facilitate pipe fill-up while running.
**18 ¾” Wellhead System**

**18 ¾” Subsea Wellhead**

Drill-Quip’s SS-15 BigBore II Subsea Wellhead is designed for 15,000 psi working pressure and H₂S service. The wellhead has a primary landing shoulder and unique multiple-load profile on the lower ID, which allows all casing weight and pressure loads to be carried at the bottom of the wellhead, with a 7.0 million lb load capacity. The wellhead-restricted ID is 18.510 inches. The wellhead can be provided with a Drill-Quip or customer-specified wellhead connector profile.

**Features**
- Customer-specified wellhead connector profile with corrosion-resistant ring gasket preparation
- Designed and manufactured for 15,000 psi H₂S service
- OD has landing ring and split lock ring for locking into the conductor wellhead and can be preloaded to maximum of 2 million lbs
- Primary load shoulder and multiple load shoulder profile can carry all loads at the bottom of the wellhead for 7.0 million lbs total load capacity
- Provisions for tubing hanger in addition to three casing hangers
- Available with annulus shutoff system
- RLD system transfers bending loads to the conductor pipe
- Temperature range 35°-250° F gas service
- Compliant to API 17D, Second Edition
- Deep bucket support plate lands the top of the wellhead near flush with the rotary table

**Subsea Wellhead Running Tool**

Drill-Quip Wellhead Running Tools have a right-hand make-up, left-hand release, cam-actuated locking design. Ascending/descending indicator rods are used on each tool to determine lock/unlock status. The running tools are unaffected by hydrostatic pressure and have ample exhaust and fill ports.

**Features**
- Cam-actuated mechanism unaffected by water depth
- Removable plugs provide large flow area for water fill-up and air vent
- Used with Rigid Lockdown Tool to run BigBore II Wellhead
- 6 ¾” API regular box up and 4 ½” API IF pin down

This illustration depicts the H-4 locking connection profile. Other profiles are available upon request.
RIGID LOCKDOWN SYSTEM

RIGID LOCKDOWN WELLHEAD
The 18 ¾” Rigid Lockdown Wellhead body incorporates all the field-proven features of Dril-Quip’s standard wellhead. In addition, the Rigid Lockdown Wellhead System incorporates a locking mechanism that preload the 18 ¾” wellhead to the conductor wellhead. This system increases resistance to fatigue applications.

FEATURES
- Bottom of housing has 22” OD buttweld preparation
- Protected seal area and lockdown grooves for a subsea tubing hanger system
- Run, land, preload and lock using Mechanical Rigid Lockdown Running Tool and 18 ¾” Wellhead Running Tool using drill pipe pull

MECHANICAL RIGID LOCKDOWN RUNNING TOOL
The Mechanical Rigid Lockdown Running Tool allows the running, installation and cementing of the 18 ¾” Rigid Lockdown Wellhead System and 22” casing on drill pipe in one trip.

FEATURES
- Operates in conjunction with the 18 ¾” Housing Running Tool and runs the 18 ¾” wellhead equipped with the rigid lockdown system
- Activates the rigid lockdown mechanism on the 18 ¾” wellhead
- Lockdown is verified with position indicator plate on the OD of the outer sleeve
- Drill pipe overpull at wellhead creates preload between conductor and 18 ¾” wellheads
- Can create a preload up to 2 million lbs
- Unlimited water depth rated – no hydraulics required
Dril-Quip’s Supplemental Casing Hanger Systems provide a means of installing and sealing additional casing strings in the well bore. The SS-15 BigBore II 18” and 16” Supplemental Casing Hanger Systems provides the same weight-set, easy operational features found in all Dril-Quip subsea wellhead systems.

**Features of the 18” Supplemental Casing Hanger System**

**22” x 18” Supplemental Adapter**
- Positive stop load shoulder on adapter assembly captures split lock ring on 18” casing hanger to provide landing seat for the casing hanger
- Allows casing hanger to be set as liner within 22” casing
- Assembly includes centralizing swedge to help align 18” casing hanger, and seal area for 18” seal assembly

**18” Supplemental Casing Hanger**
- Hanger lands out on 22” x 18” supplemental adapter, and split lock ring on casing hanger transfers casing hanger load and pressure end load to adapter
- Hanger locks to supplemental adapter via split lock ring
- Hanger OD has threaded profile to accept 18” seal assembly
- Contains lockdown feature on the casing hanger

**18” Seal Assembly**
- 18” supplemental casing hanger system is rated for 5,000 psi working pressure with 660,000 lbs casing load from above, and 2,500 psi working pressure from below
- Seal assembly provides sealing between casing hanger OD and supplemental adapter
- Gas tested per API 6A Appendix F and API 17D Second Edition
- Single trip with casing hanger and seal assembly running tool lands casing hanger and sets seal
- Seal is weight-set, is pressure tested and secured by left-hand rotation to threads on top of hanger

**18” Casing Hanger Seal Assembly Running Tool (CHSART)**
- CHSART runs supplemental casing hanger with seal assembly and lands hanger in adapter housing in a single trip
- CHSART verifies lockdown ring has snapped into place and also sets and tests the seal to maximum working pressure, with brass indicators to verify the hanger fully lands
FEATURES OF THE 16" SUPPLEMENTAL CASING HANGER SYSTEM

22" x 16" SUPPLEMENTAL ADAPTER
- Installed in predetermined location above 22" x 18" adapter within 22" casing string
- Provides 2-shoulder multiple load profile to interface with casing hanger landing ring
- Provides seal area for 16" metal-to-metal seal assembly
- Allows casing hanger to be set as liner within 22" casing
- Contains lockdown groove for casing hanger and seal assembly

16" SUPPLEMENTAL CASING HANGER
- Hanger lands out on 22" x 16" supplemental adapter, and split load ring transfers casing hanger load and pressure end-load to adapter
- Hanger locks to supplemental adapter via spring-loaded shear pins
- Hanger OD has lock ring groove to lock 16" seal assembly to hanger

16" SEAL ASSEMBLY
- Seal assembly provides weight-set metal-to-metal annulus seal with HNBR elastomeric backup
- 6,500 psi seal is gas tested to API 17D First Edition
- Single trip casing hanger and seal assembly running tool lands casing hanger and sets seal
- Seal assembly has external lock ring feature to lock casing hanger down
- 16" supplemental casing hanger system is also available with 10,000 psi working pressure from above, and 5,000 psi working pressure from below

16" CASING HANGER SEAL ASSEMBLY RUNNING TOOL (CHSART)
- CHSART runs supplemental casing hanger with seal assembly and lands hanger in adapter housing in a single trip
- CHSART installs 16" seal assembly, pressure tests it, and retrieves the seal if it does not test and lock down
In order to facilitate rig operations when running the BigBore II Wellhead System, Dril-Quip has created a set of Wear Sleeves and Selectable Wear Bushings to facilitate time savings on each phase of the drilling operation. These products were developed to protect the metal sealing area inside the wellhead, and are installed when the bottom hole assembly is run, eliminating the need for an extra bore protector or wear bushing trip. The OD of both running tool and stabilizer match the OD of the drill bit (full gauge).

The 3-D illustrations below depict the Wear Sleeve and Selectable Wear Bushing assemblies in the wellhead for:

1. Drilling out for 18” Casing with the 18 ¾” x 17” Wear Sleeve
2. Drilling out for 16” Casing with the 18 ¾” x 16” Wear Sleeve
3. Drilling out for the 1st Position Casing Hanger with the 18 ¾” x 15 ¼” Wear Sleeve
4. Drilling out for the 2nd Position Casing Hanger with the 18 ¾” x 14 ¾” Selectable Wear Bushing
5. Retrieval of Wear Sleeves and Bushings with the Multi-Purpose Tool and Retrieval Adapter
Casing Hangers

The SS-15 BigBore II Subsea Wellhead System 1st Position Casing Hanger incorporates a multiple-shoulder split load ring that supplies the required end-load carrying capacity for a 15,000 psi wellhead system. The 2nd Position Casing Hanger lands on a high-load 40 degree landing shoulder, which transfers weight and pressure loads to the 1st Position Casing Hanger and helps centralize the 2nd Position Casing Hanger in the wellhead. All casing hangers have a large 14 square inch flow-by area and can be locked down to the wellhead if desired.

Features

- 1st Position Casing Hanger rated for 10,000 psi H₂S service; can be configured for 12,500 psi standard service
- 2nd Position Casing Hanger rated for 15,000 psi service
- All Casing Hangers rated for High-Load (HL) capacity
- Casing Hanger OD profiles provide lock ring groove and tapered metal-to-metal sealing area for the seal assembly
- Casing Hangers can be configured to accommodate 14” casing and smaller
The SS-15 Seal Assembly is weight set and provides a metal-to-metal seal between the casing hanger OD and wellhead ID. The seal assembly is made from integral structural steel, with a protected resilient seal backup, which is trapped between the metal seal lips and can never extrude. The seal assembly is radially preloaded on a tapered surface of the casing hanger. Proper energizing of the seal assembly is assured even if formation cuttings or debris are in the cement return areas. DRIL-QUIP’s Seal Assembly has been successfully tested multiple times without the resilient material backup and with gumbo and formation cuttings packed around the casing hanger to demonstrate its true metal-to-metal sealing characteristics. The seal assembly has also been successfully cycle-tested multiple times per API 17D with water and nitrogen gas to 15,000 psi and 250°F.

The same 18 ¾” seal assembly fits all casing hangers 14” and smaller. It is automatically locked to the casing hanger during pressure testing and will properly seal. The 18 ¾” seal assembly can be retrieved, if needed, by straight vertical pull. No torque or left-hand rotation is required to release the seal assembly from the casing hanger. Seal assembly lockdown capacity is 750,000 lbs.

An 18 ¾” Emergency Seal Assembly is available if needed. It uses metal lips and radially squeezed elastomer on the OD and ID, rather than O-rings, and is installed on the casing hanger in the same manner as the standard seal assembly. The emergency seal sets higher in the annulus to utilize a fresh sealing area on the wellhead and the hanger.

DRIL-QUIP’s 18 ¾” Seal Assembly is designed for 15,000 psi working pressure from above and 10,000 psi from below, and H₂S service at 35° to 250° F, per API 17D, 2nd Edition, and API 6A class V.
The 18¾” Casing Hanger Seal Assembly Running Tool used in the BigBore II Subsea Wellhead System is designed to minimize the operations associated with installation of the casing hanger and seal assembly in the wellhead. The Casing Hanger Seal Assembly Running Tool is a single-trip, cam-actuated running tool that runs all casing hangers 14” and smaller, and seal assembly within a given wellhead size.

- Interchangeable between all of Dril-Quip’s wellheads within a given size
- Has 1.5 million lb load-carrying capacity with 2.0 million lb carrying capacity available upon request
- Seal assembly is mounted on the tool when running, providing the maximum amount of flow-by available
- The running tool automatically locks down the seal assembly to the casing hanger during the first pressure test. The seal assembly is retrieved when the running tool is recovered if the seal assembly is not properly locked down
- The running tool seals in the casing hanger to allow a full test of the seal assembly and the BOP stack
- Field-proven performance

**Casing Hanger and Seal Assembly Installation with the Casing Hanger Seal Assembly Running Tool**

- Casing Hanger landed, cementing position
- Seal Assembly landed, not set
- Seal Assembly locked and tested
The Dril-Quip Seal Assembly Running Tool is used to run the standard and emergency seal assemblies. Since the seal assembly is weight set, no rotation is required for installation. The tool automatically tests and locks the seal during installation, and is capable of allowing a full-function BOP stack test. The tool is designed to retrieve the seal assembly if it does not test or cannot get locked to the casing hanger.
BOP ISOLATION TEST TOOLS

BOP ISOLATION TEST TOOL
The BOP Isolation Test Tool is a weight-set tool that allows testing of the BOP stack and the wellhead housing during the drilling operation after removal of the Nominal Bore Protector. The seal element activator sleeve can only be released when the split release ring engages the minimum ID in the wellhead or wear bushing.

FEATURES
- Tests the bottom of a wellhead when the Nominal Bore Protector is removed (requires BigBore II Wellhead Housing Adapter, as shown)
- Tests the wear bushings (after Wellhead Housing Adapter is removed)
- Tests the BOP while isolating the casing hanger and seal assembly from test pressure
- Can be landed on top of a casing hanger with wear bushing removed (seal assembly is isolated from test pressure)
- Seal activation mechanism does not allow premature activation of seal element
- Through-bore tool eliminates possibility of over-pressurizing casing
- Ample flow-by area facilitates running and prevents swabbing when the tool is retrieved
- 4 ½” API IF box up and 4 ½” API IF pin down

SPECIAL BOP TEST TOOL
Dril-Quip’s Special BOP Test Tool allows testing of the BOP stack with the Nominal Bore Protector installed.

FEATURES
- Allows testing on top of the Nominal Bore Protector
- Seal activation mechanism does not allow premature activation of seal element
- Alternative BOP Test Tool capable of running and installing Nominal Bore Protector and test in one trip
- Alternative BOP Test Tool capable of landing on wear sleeves
The Lockdown Sleeve lands on the production casing hanger and locks the casing hanger to the wellhead housing. This prevents oscillations of casing hanger and seal assembly from thermal pipe expansion and annulus pressure.

**Features**

- Profile on upper end of the Lockdown Sleeve is used for attachment of the running tool
- Lockdown mechanism on upper OD of Lockdown Sleeve is activated by the running tool
- Lockdown mechanism is adjustable based on the reading obtained by the lead impression tool and can accommodate a casing hanger landing up to 5/8" high
- Lockdown function operates via actuation sleeve that drives out a lockdown ring into the lockdown groove profile in the 18 3/4" wellhead housing
- Metal-to-metal seal on lower end of Lockdown Sleeve is mechanically trapped in place and is used to seal off the upper bore of the uppermost casing hanger
- Seal has been successfully tested with gas per API 6A PR-2 requirements with zero leakage
- Lockdown Sleeve’s upper ID seal surface is lined with Alloy 625 for corrosion resistance
- Lockdown Sleeve interfaces with the subsea tree’s stab sub to isolate the VX cavity and production hanger pack-off

**Lockdown Sleeve Seat Protector**

The Lockdown Sleeve Seat Protector is a wear bushing device used to prevent damage to the seal area and lockdown mechanism of the lockdown sleeve.

- Run and retrieved with the 18 3/4” Multi-Purpose Tool and lockdown Sleeve Seat Protector running/retrieving adapter
- Seat Protector’s minimum ID matches the minimum ID of the Lockdown Sleeve
- Upper funnel allows for easy guidance of downhole tools.
Dril-Quip’s LS-15 Liner Hanger System is available with all of Dril-Quip’s Wellhead Systems. The LS-15 Liner Hanger products are built to perform under a wide range of conditions, and are ideally suited for long reach, high angle, horizontal and ultra-heavy liner completions. This premium liner hookup incorporates many innovative tool designs, ensuring reliable operation and service in many of today’s most demanding wells.

**LS-15 System Features**

The LS-15 Liner Hanger System features field-proven technology that incorporates the following:

- High strength, high pressure, high load-carrying capacity
- Metal-to-metal Annulus Packer Seal for high pressure service
- No hydraulic or mechanical devices on the hanger body, minimizing leak paths
- Large slip area and controlled friction minimizes stress in the supporting casing
- All hangers are automatically centralized when C-Ring Slip is set
- Bypass flow area is the same after setting the liner hanger slip as in the running-in position
- Maximizes circulating flow-by areas for efficient cementing operations
- The LS-15 Liner Hanger System can be sized and configured to customer specifications

**LS-15 Packer Seal Features**

- Integral, one-trip metal-to-metal sealing design
- Anti-swab design for faster running speeds and higher circulating rates, and resists mechanical damage while running
- Standard service for many sizes is 10,000 psi at 400°F. Higher pressures are achievable and are only limited by the capacity of the packer mandrel and casing

**Rotational Option**

With the addition of a rotating bearing assembly, the LS-15 Liner Hanger can be rotated with the slips in the set position during the cementing operation. This feature can assist in completing a successful cement job.
The Liner Hanger is run to total depth with the slip in the retracted, running position. The hanger body is then slacked off onto the slip. The sharp teeth on the slip will secure the Liner Hanger to the supporting casing. At light loading, the dull inner slip teeth will not yet grab the cone as it slides behind the slip.

When released from its locked-down running-in position, the slip will spring open and come into contact with the ID of the supporting casing.

As the loading increases and travel progresses, the inner teeth begin to form small shoulders on the Liner Hanger slip cone. As the shoulders increase in size, the downward travel of the Liner Hanger is stopped before loading gets high enough to collapse the Liner Hanger body or burst the supporting casing.

The LS-15 System Incorporates a Unique Hanger Slip Design

Dril-Quip’s proprietary one-piece C-Ring Hang-Off Slip has been developed to greatly reduce the amount of hoop stress placed on the supporting casing by the liner load. Dril-Quip’s circumferential slip design distributes the liner load much more evenly around the casing than conventional multi-slip segment hanger systems. The C-Ring Slip also incorporates a method of controlling the friction between the slip and the hanger body. This “controlled friction” design redirects hoop load into axial load, drastically reducing the collapsing load on the hanger body and burst pressure on the casing. This combination of stress loading permits the LS-15 Liner Hanger System to hang longer and much heavier liners than possible with conventional technology.

One-Piece C-Ring Slip
LS-15 Running Tool

- The system incorporates high torque capacity for drill-down, wash-down applications and rotation during cementing operations.
- The running tool incorporates a port isolation system that eliminates the possibility of prematurely setting the slip, or releasing from the hanger while running into the hole.
- The hydraulics to set the liner hanger slip are built into the running tool, not as part of the hanger system, eliminating the need for a hydraulic port through the body of the liner hanger.
- The running tool is hydraulically released from the liner hanger and also incorporates a unique right-hand hydromechanical secondary release.

Running Procedures

In order to solve many of the problems encountered during liner installation, Dril-Quip has simplified the running procedures of the liner hanger for exceptional ease of use.

1. Trip into hole to liner setting depth.
2. Launch setting ball from cementing manifold, pump ball to seat in running tool.
3. Pressure to 1,000 psi, shift the port isolation sleeve and release liner hanger slip, slack off liner weight onto slip.
4. Pressure to 2,000 psi to release running tool from liner hanger.
5. Reduce drill pipe pressure to 500 psi to accomplish soft release of setting ball. Pick up drill pipe string approximately 4” to check for release of running tool which is confirmed when drill pipe pressure bleeds off.
7. Launch pump-down plug from cementing manifold and displace to liner wiper plug.
8. Pressure to 1,000 psi, release the liner wiper plug from the running tool.
9. Continue fluid displacement and pump the plug set to landing collar.
10. Pick up running tool to release packer setting assembly and slack off weight to set packer seal.
11. Pressure down the annulus to pressure assist setting and testing the packer seal.
12. Pull out of hole with running tool.