



Subsea Drilling Systems



Reliable, cost-effective solutions for offshore drilling...

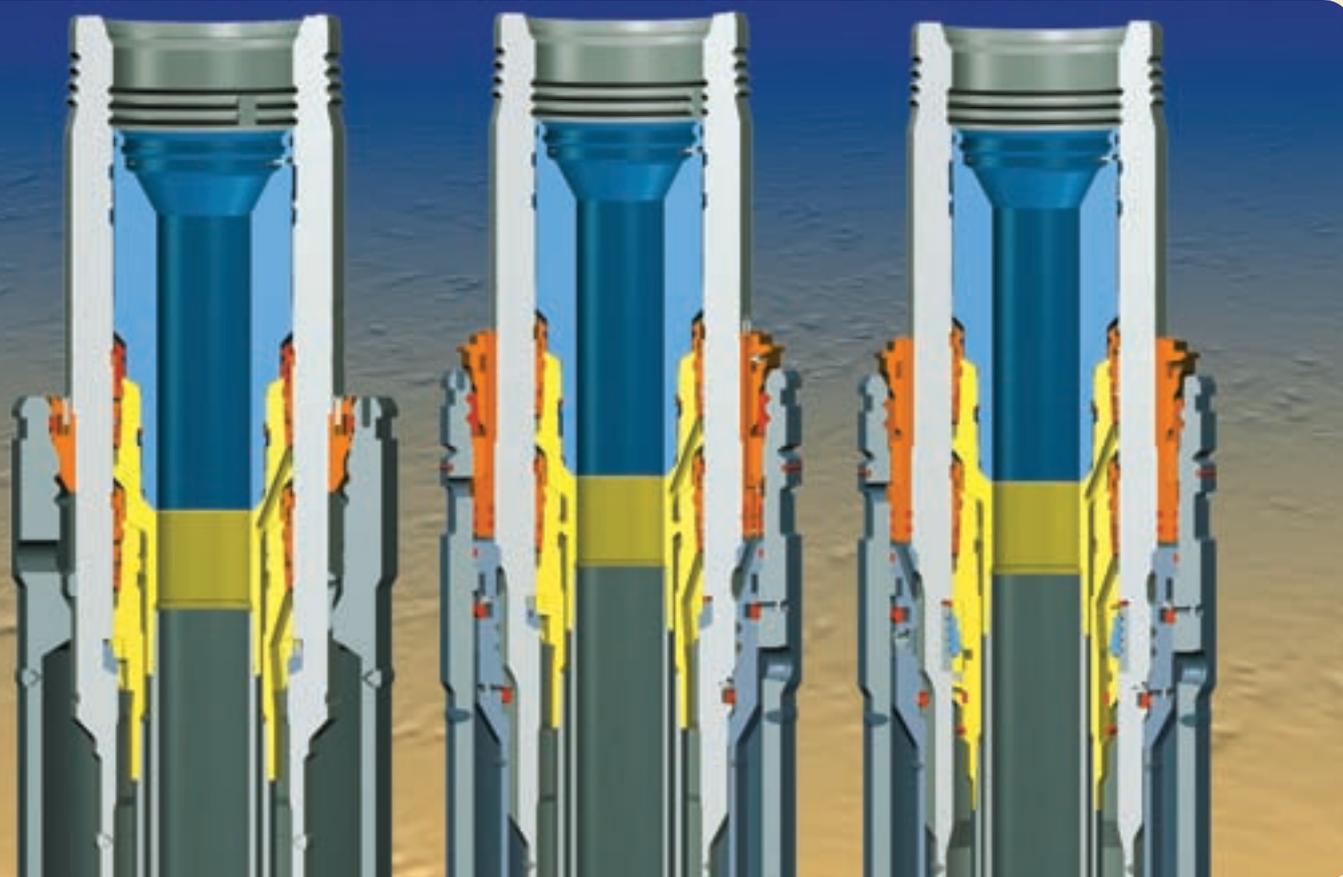
FMC Technologies Subsea Drilling Systems lead the industry with reliable and cost-effective drilling solutions which meet customer demands for Standard, Slimbore and High Capacity drilling applications in water depths from a few hundred feet to more than 10,000 feet. The FMC subsea wellhead family of systems can be configured for a multitude of scenarios, reducing installation time and improving cost effectiveness over competitive designs.

For all your drilling needs contact FMC Technologies.

www.fmctechnologies.com/subseadrilling

UWD-15 Subsea Wellhead Systems

FMC's UWD-15 subsea wellhead systems have continuously met customer needs since their introduction in 1991. Today's UWD-15 family advances this long tradition of excellence in a complete range of high pressure and deepwater applications.



Standard

Rigid Lock Stack Down

Large Bore

Modular, Stackable Design

Rated for working pressures up to 15,000 psi, FMC offers UWD-15 subsea wellhead systems for a complete range of shallow and deepwater drilling and production scenarios, including standard, shallow water flow, large bore and rigidized/preloaded operations. These modular designs and multi-task running tools enable many of the same components to be used across the UWD-15 family.

Specialized Tools Reduce Trips, Installation Time

The benefits of FMC's modular subsea wellhead design extend to its industry leading running tools. UWD-15 systems use fewer running and test tools than any competitive subsea drilling system. These multi-function tools provide options for running and retrieving components either individually or in combination with other components, enabling fast, accurate and reliable UWD-15 system installation.



18-3/4" Wellhead Running Tool

Standard UWD-15 System

Designed for drilling and production applications up to 15,000 psi working pressure, the Standard

UWD-15 System features a world-

proven weight-set, metal-to-metal seal design. The Standard System is designed for applications in water depths ranging from a few hundred feet to 6,000 feet. Systems are available with annulus monitoring capabilities and can be supplied with a drill-cutting injection system.



Metal-to-Metal Seals



Stackable Casing Hangers

Rigid Lock Stack Down System

The FMC UWD-15 Rigid Lock Stack Down (RLSD) System is ideal for drilling through formations where unconsolidated shallow water flow exists and an additional casing string is needed to isolate the zone. The RLSD allows for the addition of a 26" casing string without changing standard drilling procedures or components required for running subsequent casing strings. A Rigid Lock Seal Assembly (RLSA) installed between the 36" and 20" casing strings contains any shallow water flow that may be present. The RLSD preloaded system handles the higher bending, fatigue and torsional loads generated by TLP, Spar, DP drill ship and DP semi-submersible applications. The RLSD system, with or without a 26" conductor, is recommended for water depths up to 10,000 feet.

Large Bore Wellhead System

The FMC Large Bore Wellhead System (LBWS) is an extension of the Rigid Lock Stack Down (RLSD) System product line, with additional provision to run two casing strings (18" and 16") which are suspended submudline. The LBWS includes additional trip-saving tools, such as single trip tools for the submudline equipment and bore protectors that are run and retrieved with the drill string, which save the operator additional trips.

The FMC **Large Bore 2M (LB-2M)** Wellhead System is an extension of the UWD-15 Large Bore Wellhead System. The LB-2M System features casing hangers and running tools designed to carry additional casing load at the systems working pressure. The 16" submudline casing hanger, with a two million pounds (2M lbs.) high capacity hanger system has a 10,000 psi working pressure rating. The 2M lbs. high capacity 13-5/8" casing hanger lands inside the high pressure housing and is rated for 15,000 psi working pressure.

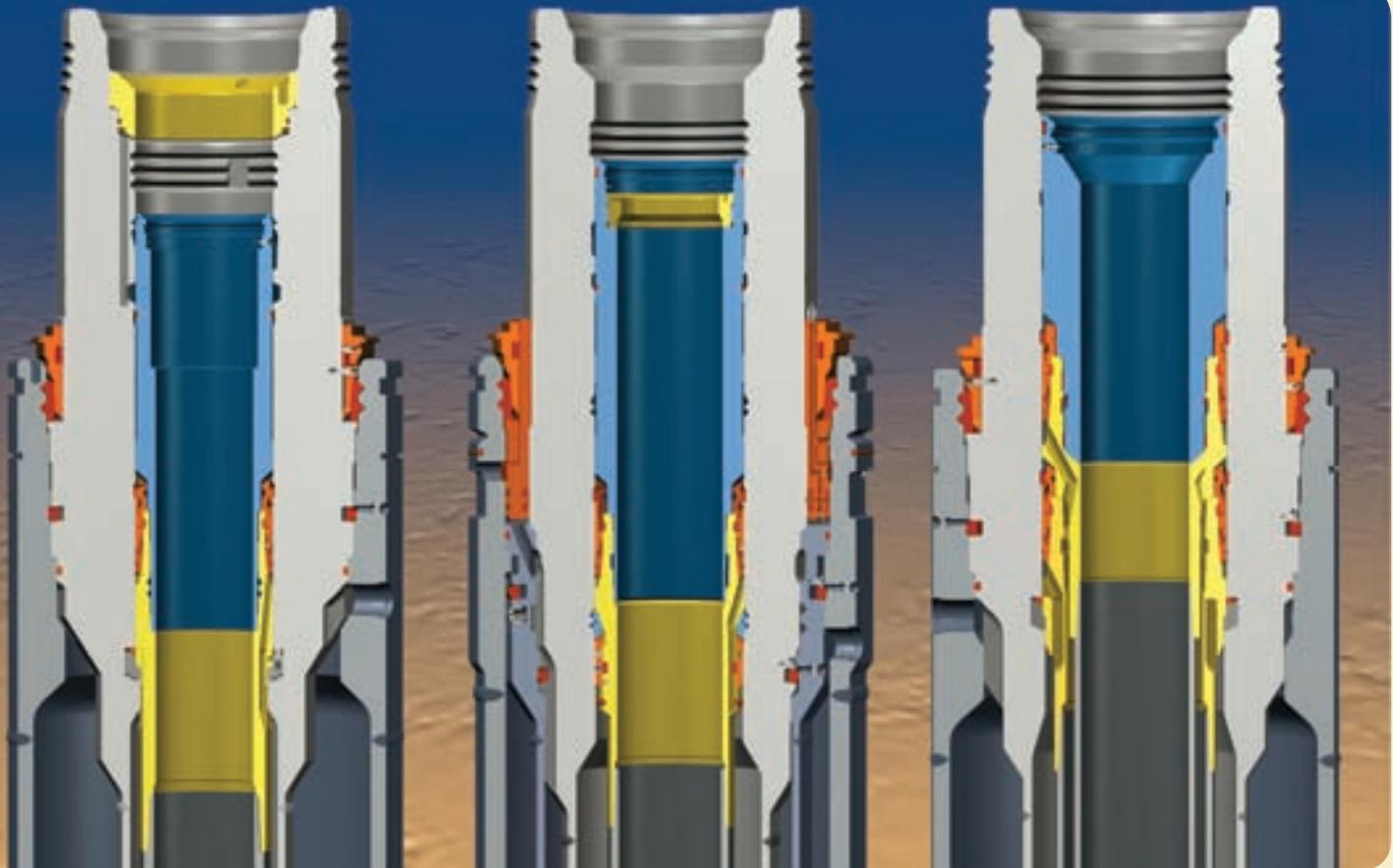
The LB-2M high pressure wellhead housing utilizes the same internal profile as the Standard Large Bore system. This allows FMC to continue to use the same field proven casing hanger and seal technology that is used throughout the UWD-15 Subsea Wellhead family. The fully qualified UWD-15 multi-function running tools and bit run/retrieve wear bushings are fully compatible with the LB-2M system.



Super Flowby Drill Ahead Tool

UWD-10 Subsea Wellhead Systems

FMC Technologies presents the UWD-10 Slimbore System, with smaller bore diameters for slender well designs. The UWD-10 system is based on the same world-proven technology as the UWD-15 systems. The Slimbore wellhead allows the use of reduced diameter riser systems for drilling and production applications. This makes it possible for early generation drilling vessels to drill in deeper water and floating production facilities can increase the quantity of production risers tied back to the host platform.



13-5/8" Slimbore

14-3/4" Slimbore

16-3/4" Slimbore

Modular, Stackable Design

The UWD-10 Subsea Wellhead System is designed for a complete range of drilling and production scenarios in shallow or deepwater with subsea or surface BOPs. Designed for drilling and production applications, Slimbore Systems are suitable for H₂S

service and are available with 16-3/4", 14-3/4" and 13-5/8" nominal bore diameters. Each system has a rigidizing mechanism to provide enhanced fatigue resistance. The modular design enable use of many of the same open water tools that are used across both the UWD-20 and UWD-15 product families.

Specialized Tools Save Trips, Time and Money

Based on the design of the industry-leading UWD-15 running tools, UWD-10 Slimbore Systems continue the tradition of providing multi-function running and test tools, plus bit installable/retrievable wear bushings and bore protectors. The UWD-10 tools provide the option of running and retrieving components either individually or in combination, resulting in less required tools than any competitive slimbore subsea drilling system.



14" Single Trip Tool

14-3/4" Slimbore System

The 14-3/4" Slimbore System is designed to use standard UWD-15 RLSD System components whenever possible. This decreases the operator's cost while increasing system reliability and equipment availability. The RLSD is installed between the 36" and 20" casing to contain shallow water flow and create preload for improved fatigue life of the system. The high pressure wellhead housing has two active landing shoulders for casing hangers inside the housing, as well as a 13-3/8" submudline casing hanger and receptacle.



16-3/4" Slimbore System

The 16-3/4" Slimbore System features a passive load shoulder in the high pressure wellhead for landing and stacking the casing hangers. This system builds on the field-proven designs of FMC's weight-set metal-to-metal seal assembly and integral rigid lock mechanism. The integral rigid lock mechanism creates preload between the low pressure and high pressure wellhead housings. This preload provides improved fatigue life,

allowing for higher bending and torsional loads generated by TLP, Spar, DP drill ship and DP semi-submersible applications.



Integral Rigid Lock and Stackable Hanger



11-3/4" Casing Hanger for the 14-3/4" Slimbore system

Active Load Shoulder and Seal with the 11-3/4" Hanger

13-5/8" Slimbore System

The 13-5/8" UWD-10 Slimbore System is uniquely designed to accommodate slender well designs and production with vertical subsea trees, allowing the slimbore tubing hanger to be installed in the wellhead, and alleviating the requirement for a tubing head. The high pressure wellhead housing can be configured with either two casing hangers landing in the wellhead or one casing hanger with one tubing hanger inside the housing.



Tubing Hanger Profile

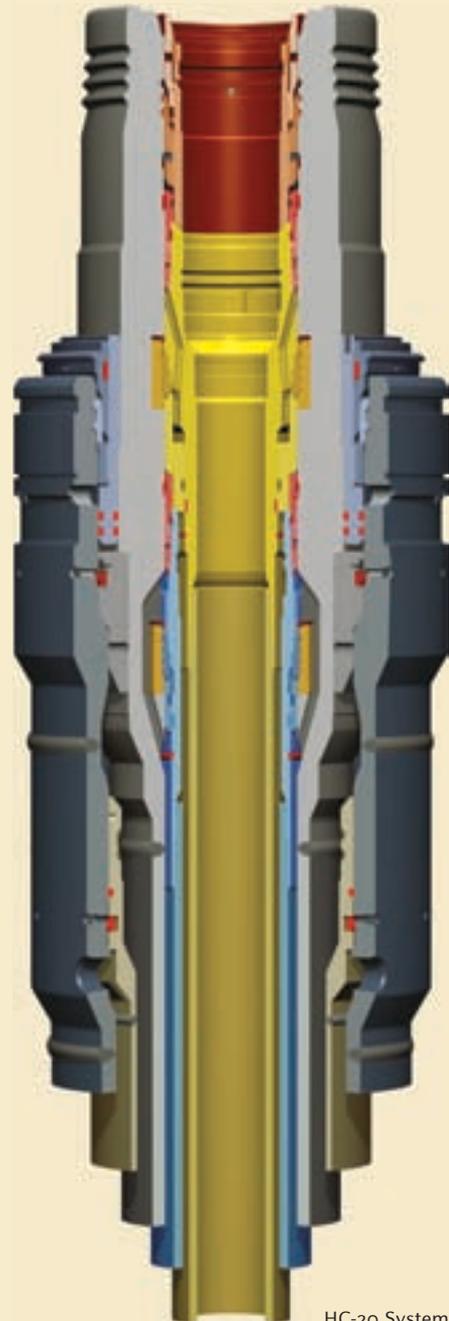


Integral Rigid Lock High Pressure Housing

UWD-HC Subsea Wellhead Systems

FMC's High Capacity Subsea Wellhead Systems are engineered to meet the increasing capacities and pressures in the subsea drilling environment. The FMC UWD-HC family is based on the field proven UWD-15 wellhead systems including the use of fewer running and test tools. FMC's high capacity tools are designed to handle higher capacities while performing multi-functions.

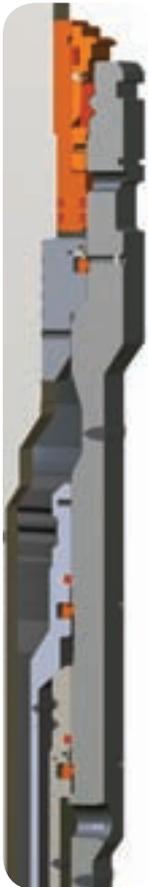
- 4M lbs. Wellhead String Capacity
- 20K Rated Wellhead
- Rated for 350°F Temperature Rating
- 30" or 27" H4 Mandrel
- Super Heavy Duty Rigid Lock Seal Assembly (SHD RLSA)



HC-20 System

HC-20

The FMC 20,000 psi High Capacity Wellhead System (HC-20) has advanced the traditions of excellence by integrating performance features of the field proven UWD-15 wellhead family such as the modular design and weight-set, metal-to-metal seal design. The HC-20 system has an improved wellhead housing design providing for additional casing strings and increased capabilities in high-pressure and deepwater applications.



High Capacity Wellhead Interface with Open Water Casing Strings

FMC's HC-20 wellhead has an increased casing string capacity of 4M lbs. with each active shoulder capable of handling 2M lbs. plus the maximum BOP pressure test load. This extensive capacity permits our customers to drill deeper wells with longer and heavier casing strings. This innovative HC wellhead system, with a 20,000 psi working pressure, allows the 42" x 22" annulus to be completely cemented back to the mudline providing a stronger structural foundation. The design of the HC-20 system also allows the 16" casing hanger to be landed submudline or in the 1st hanger position in the wellhead.

The HC-20 System includes the Super Heavy Duty Rigid Lock Seal Assembly which rigidizes the low pressure housing to the high pressure housing to create a 2.5M lbs. preloaded system. This capacity grants a higher fatigue and torsional resistance to handle the loads generated by TLP, SPAR, DP drill ships and DP semi-submersible vessels in deepwater applications.



SHD RLSA

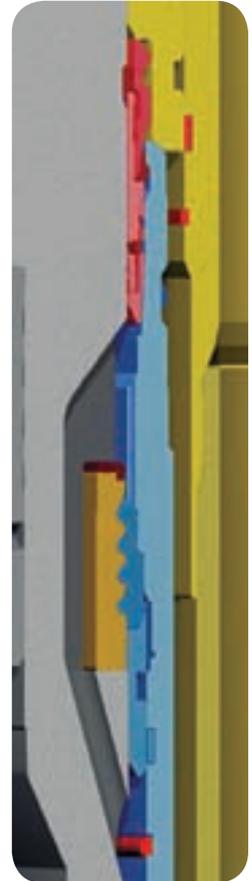
HC-15

Incorporating the same features as the HC-20 system, the HC-15 Systems including the Super Heavy Duty Rigid Lock Mechanism, low pressure housing designed for 42" or 38" conductor pipe, intermediate open water casing strings of 32" or 30" and 28" or 26", and the same metal-to-metal seal assemblies and submudline equipment.

However, the high pressure wellhead housing incorporates the more commonly found connection profile, the H4, instead of the Super Heavy Duty H4 connection. The wellhead is rated to a 4M lbs. string capacity with a 15,000 psi operating pressure.



SHD Rigid Lock Seal Assembly Interface with Low and High Pressure Housing



High Capacity First Hanger Position Active Load Shoulder

Specialty Tools

For Increased Installation Efficiency

Rotary Table Adapter Bushing (RTAB)

- The Rotary Table Adapter Bushing (RTAB) is designed to hang-off a Rigid Lock or Large Bore Wellhead and 22"/20" casing string in the Rotary Table to make-up the Cam Tool and RLSA Running Tool after running the inner string.
- Top of wellhead is low enough to promote a safe working environment that allows the inner string to be made up with the iron roughneck.
- Sets in 49-1/2" Rotary Table Master Bushing



Rotary Table Adapter Bushing

18" & 16" Hang Off Plate

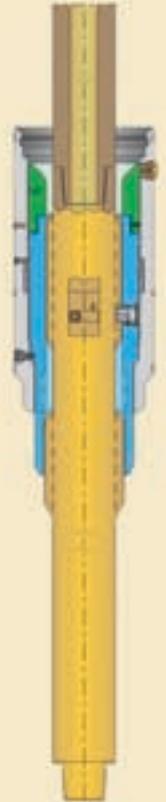
- 18" & 16" Casing Hanger Hang Off Plate (CHHOP) is designed to hang-off LB Submudline hangers in the rotary so the Single Trip Tool can be removed to run inner string.
- The recessed 18"/16" hanger promotes an safe working environment to run the inner string.
- CHHOP is rated to 1M lbs.; the CHHOP used in conjunction with the LB-2M 16" hanger is rated to 2M lbs.



18" & 16" Hang Off Plate

Nested Wear Bushing

- Three part bit retrievable 13" Wear Bushing runs on 10-1/2" stabilizer.
- Centralize drill string during drilling operation to promote wear on replaceable upper body.
- Outer bushing can be either left in or removed from the wellhead during each trip out of wellhead.
- Inner bushing is pulled each trip out of wellhead.
- Spring loaded tool can be used as secondary means of running and retrieving the nested wellhead.



Nested Wear Bushing

Open Water Casing Hanger Measurement Tool, Lockdown Bushing (LDB) and LDB Running and Retrieval Tool

- Designed for running in open water from a work boat to reduce installation cost.
- Increases accuracy of measuring the hanger position within the wellhead.
- Utilizes a ROV to install, the measurement tool and read digital outputs from sensors.
- ROV locks the LDB to the wellhead by stroking an energizing mandrel to engage the load ring to the high pressure housing.
- Tests metal-to-metal seal on LDB.



15K LDB Running and Retrieval Tool

UWD-10 System Comparison

	UWD-10 16-3/4"	UWD-10 14-3/4"	UWD-10 13-5/8"
Casing Size	36"/30" x 20" x 13-3/8" thru 7"	36" x 28"/26" x 20" x 13-3/8" x 11-3/4"	36" x 16" x 10-3/4" x 8-5/8" or tubing hanger
Features	<ul style="list-style-type: none"> • 10K PSI rated wellhead • 3.5M casing weight and pressure load capacity with passive load shoulders • 27" OD H4 mandrel profile connection • Metal-to-Metal annulus seal assemblies in the wellhead • Integral Rigid Lock System rigidizes high pressure housing to the 30" conductor housing with 1.5 M lbs. preload 	<ul style="list-style-type: none"> • 10K PSI rated wellhead • 27" OD H4 mandrel profile connection • 2.45M lbs casing weight and pressure load capacity with each independent active load shoulder • 13-3/8" submudline hanger • Isolation of the 36" x 20" annulus with shallow water flow packoff • Additional optional 28"/26" casing string • RLSA rigidizes the high pressure housing to the 36" conductor housing with 2.0 M lbs. preload 	<ul style="list-style-type: none"> • Identical features with the 16 3/4" slimbore wellhead system except: • 2 stackable casing hangers on passive load shoulders • Wellhead casing weight and pressure load capacity is 3.2M when configured with two casing hangers • Optional configuration of one casing hanger and one tubing hanger landing in the wellhead. • Wellhead casing weight and pressure load capacity is 3.1M when configured with one casing hanger and one tubing hanger.
Application	Wellbore of 16 3/4" that can be used with a surface or subsea BOP	Wellbore of 14 3/4" that can be used in deepwater tiebacks	Wellbore of 13 5/8" that the tubing hanger will be installed in the wellhead

UWD-15 & UWD-HC System Comparison

	UWD-15 Standard	UWD-15 Rigid Lock	UWD-15 Large Bore	HC-20
Casing Size	36"/30" x 20" x 16" x 13-5/8" thru 7"	36" x 28"/26" x 20" x 16" x 13-5/8" thru 7"	36" x 28"/26" x 22" x 18" x 16" x 13-5/8" thru 7"	42/38" x 32"/30" x 28"/26" x 22" x 18" x 16" x 13-5/8" thru 7"
Features	<ul style="list-style-type: none"> • 15K PSI rated wellhead • 7.1M casing weight and pressure load capacity with passive load shoulders • 27" H4 mandrel profile connection • Metal-to-Metal annulus seal assemblies can be used in the wellhead • 16" submudline casing hanger (5K PSI pressure rating, 550K lbs. string capacity) • 13-5/8" casing hanger (15K PSI pressure rating, 1M lbs. string capacity) 	<ul style="list-style-type: none"> • Identical features with the Standard wellhead system except: • Isolation of the 36" x 20" annulus with shallow water flow packoff • Additional optional 28"/26" casing string • RLSA rigidizes the high pressure housing to the 36" conductor housing with 2.0 M lbs. preload 	<ul style="list-style-type: none"> • Identical features with the Rigid Lock wellhead system except: • Active load should for 13-5/8" hanger allows for additional 18" submudline hanger • Independent 18" and 16" submudline hangers • Increased hanger capacity in 16" hanger (6.5K PSI pressure rating, 1M string capacity) • Increased hanger capacity in 13-5/8" hanger (1.5M string capacity) • LB-2M wellhead system allows 2M string capacity for 16 and 13-5/8" hanger 	<ul style="list-style-type: none"> • 4M wellhead string capacity with two independent active load shoulders • 20K wellhead pressure rating • 30" OD Super Heavy Duty H4 Connector • 16" hanger run submudline or in the wellhead • 32"/30" open water casing string • Submudline 16" casing hanger (10K PSI pressure rating, 2M string capacity) • 16" or 13-5/8" casing hanger in wellhead (20K PSI pressure rating, 2M string capacity)
Application	Wells located in a few 100 feet to 6000 feet of water	Wells located in deepwater with dynamically positioned vessels, shallow water flow concerns, or a tie-back	Wells located in deepwater that require an additional casing string (18"); extra casing string capacity in the 16" and 13-5/8"	Wells that are ultra deep, high pressure, and high temperature that require additional casing string capacity

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