

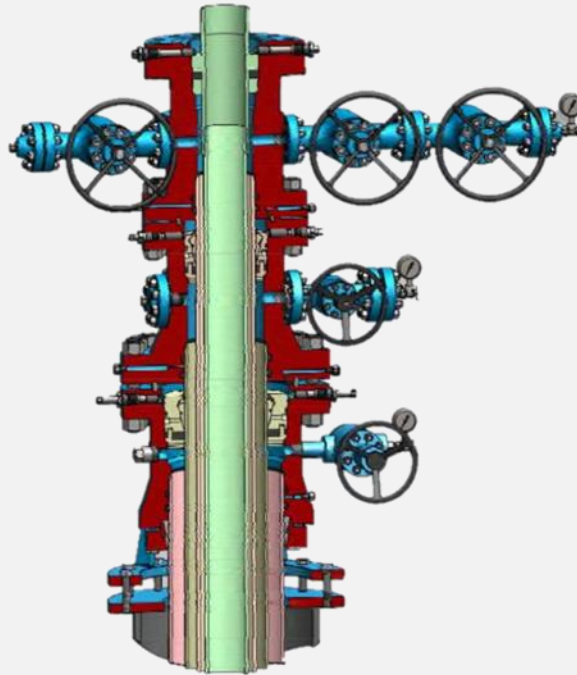
WELL HEADS AND CHRISTMAS TREES COMPONENTS



CONTENT

1	Conventional Wellheads	3
1.1	Standard features	3
1.2	Casing head housings	4
1.3	Casing head spools	4
1.4	Tubing head spools	5
2	Compact wellheads	5
2.1	Standard features	6
3	Dual completions	6
3.1	Dual Tubing Spool	7
3.2	Dual hanger	7
4	Christmas trees	8
4.1	Tees, Crosses, Elbows	8
4.2	Tree Caps & Tubing Head Adapter	9
5	Hangers	9
5.1	Mandrel hangers	9-10
5.2	Slip hangers	10-11
6	Gate & choke valves	11
7	Sealing systems	12
7.1	Elastomer seals	12
7.2	Metal seals	13

1. CONVENTIONAL WELLHEADS



Conventional flanged wellheads for applications that are focused on:

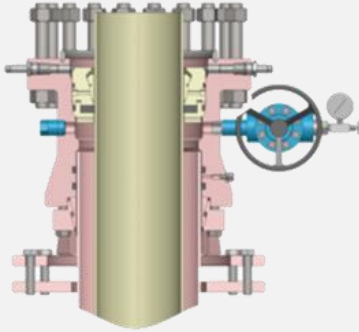
- simplicity of installation
- reliable field proven designs and running tools
- low investment
- standard procedures and parts that are well-known to all rig crews

1.1 Standard Features

- standard flanged API connections
- one stage for each drilling section
- elastomer seals
- automatic slip hanger / simple mandrel hanger
- standard running and testing tools

1.2 Casing head housings

The adapter (usually flanged) between the first casing string and either the BOP stack (during drilling) or the next wellhead stage (after completion), and allowing suspension and sealing of the secondary casing string

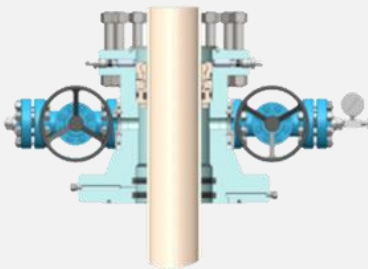


Standard Features

- straight bowl design with a 45° landing shoulder
- accepts automatic and non-automatic sealing casing hanger as well as mandrel type casing hanger
- available with threaded, slip-on weld (optional: shop welded casing pup) or slip-lock bottom connections
- available with line pipe threaded and studded side outlets, studded outlets are threaded for valve removal plugs
- can be provided with lock-down screws for retention of wear bushing
- can be provided with a landing base

1.3 Casing head spools

The adapter (usually flanged) above the Casing Head and either the BOP stack (during drilling) or the next wellhead stage (after completion) and allowing suspension and sealing of another casing string.

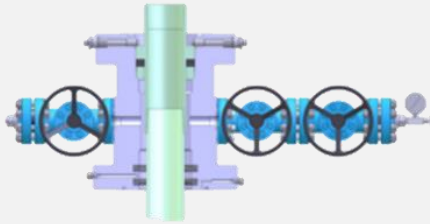


Standard Features

- straight bowl design with a 45° landing shoulder
- accepts automatic and non-automatic sealing casing hanger well as mandrel type casing hanger
- side outlets are studded as standard; studded outlets are threaded for valve removal plugs
- available with plastic energized or self-energizing interference type secondary seals
- can be provided with lock-down screws for retention of wear bushing

1.4 Tubing head spools

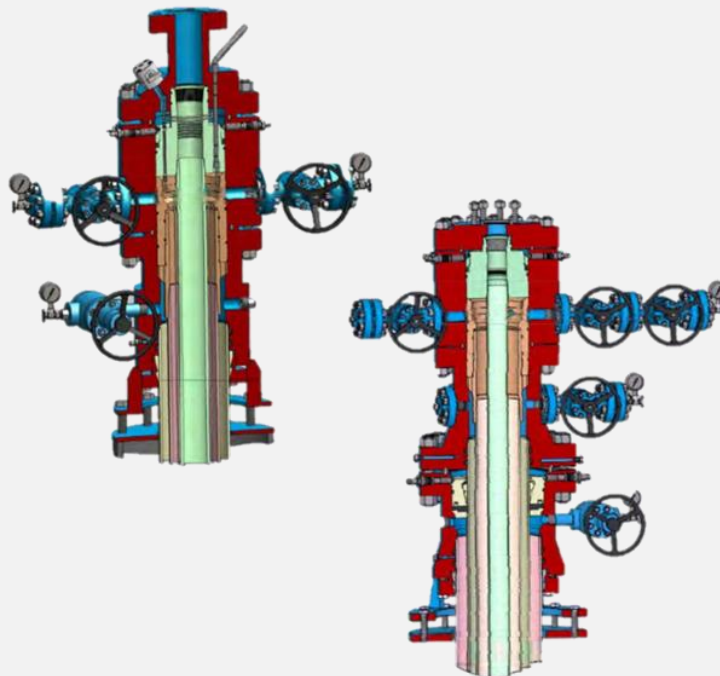
The adapter attached above the casing head/spool and the smallest casing string, used to suspend, and seal the production tubing string.



Standard Features

- straight bowl design with a 45° landing shoulder
- available for single and dual tubing hanger
- side outlets are studded as standard, studded outlets are threaded for valve removal plugs
- have a series of lock-down screws for retention of the tubing hanger
- available with plastic energized or self-energizing interference type secondary seals
- can be supplied with clamp-hub connections as an option

2. COMPACT WELLHEADS



A Compact Wellhead is a multistage cross-over spool for suspension and sealing around multiple strings of casing or tubing, combining several convention stages of casing head spools / tubing spool.

2.1 Standard features

For applications where priorities are set to improved safety, better well control and rig time savings:

- reduces open hole times and maintains well control
- due to hanger installation without removing BOP, reduction of overall BOP nipple down/nipple up times
- the use of mandrel hangers reduces several steps, saves time
- drilling of two or three phases in one go
- maximized safety: no operations underneath the BOP
- reduced number of connections reduce potential leak paths
- additionally, the compact design reduces height and weight
- installation service is recommended

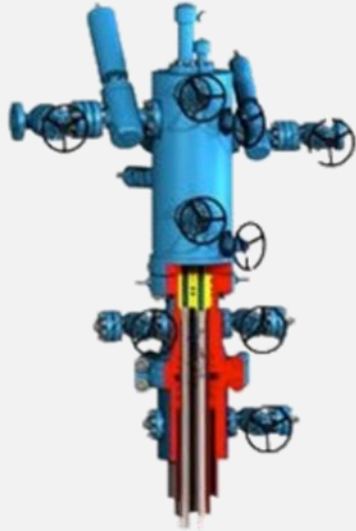
Compact wellheads are available in configurations such as unihead and splitted designs, with two, three or four stages, hub and flange connections, side outlets flanged or threaded, elastomer and metal annulus seals, fluted mandrel hanger.

3. DUAL COMPLETIONS

Tubing head and Christmas tree for a single well that produces from two separate formation at the same time. It includes a dual tubing hanger to suspend two independent tubing strings for production from two segregated zones, and a dual Christmas tree.

Dual completion tubing heads are designed with the same features as the single equipment but incorporate two alignment pins located 180° apart to ensure proper orientation of dual tubing hangers.

3.1 Dual Tubing Spool



Straight bowl design with a 45° landing shoulder.
 Have a series of lock-down screws for retention of tubing hanger
 Has two alignment pins located 180° apart below the landing shoulder.
 Accepts tubing hanger for single completions by retracting the alignment pins.
 Side outlets are studded as standard; studded outlets are threaded for valve removal plugs.
 Available with plastic energized or self-energized interference type secondary seals.

3.2 Dual Hanger

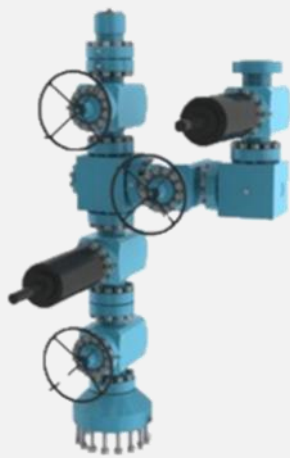


Standard hanger is a split mandrel type hanger where both parts can be run independently.
 Back pressure valve preparation.
 Available with standard API threads or Premium tubing threads
 Elastomer primary and secondary seals
 Control line option

4. CHRISTMAS TREES

Christmas trees can be supplied in various designs, solid blocked versions and stacked with single gate valves.

The below pictures show a comparison between a conventional and a compact tree, both pictures have the same scale. The compact tree has a solid block design, which dramatically reduces the complete tree height. These reductions determine considerable savings in environmental infrastructure e. g. when used offshore.



Conventional tree



Compact tree

4.1 Tees, Crosses, Elbows



Cross: Pressure-containing fitting with (a minimum of) four openings in a plane

Tee: Pressure-containing fitting with three openings in a plane

Elbow: Pressure-containing fitting with two (angled) openings

Crosses, tees, and elbows are provided in sizes from 2 1/16" to 7 1/16" with working pressures from 2000 psi to 15000 psi and trim AA - HH.

All crosses are manufactured by default with studded connections, while other connection methods are available upon request.

4.2 Tree Caps & Tubing Head Adapter

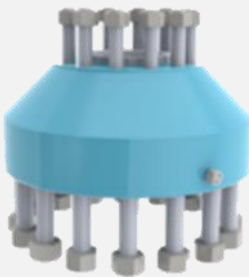


Tree Cap / Top Connector

Uppermost adapter of a Christmas tree which allows full-bore access to the Christmas tree

Tree Caps provide a fast and secure access to the bore of the Christmas tree and are available in all possible bore sizes up to 7 1/16" and trim AA - HH.

Tree caps have a "quick union" design for fast removal and reconnect of the nut. No hammering is required for getting a seal tight fit.



Tubing Head Adapter

Lower adapter of a Christmas tree used to join the tubing head to the lowermost valve of the Christmas tree

Tubing bonnets are available as a transition piece between tubing head and Christmas tree and therefore in all flanged, studded, threaded and clamp connections.

Also, internal controlled bores for extended neck of tubing hanger, test ports and optional feed throughs for control line.

5. HANGERS

Casing hangers are available as slip type hangers where four or more slip wedges are supported in a bowl having a 45° landing shoulder. Alternative mandrel type casing hangers have a 45° landing shoulder and are designed to fit into the same casing head spools.

Tubing hangers are threaded mandrel type hangers with 45° load shoulder, extended neck, tonging space and BPV preparation.

Mandrel hangers are available with API threads as well as with premium threads.

5.1 Mandrel Hangers

Cylindrical part used to hang a tubing or a casing string in a tubing / casing head, where the tubular is connected by a female thread to the mandrel

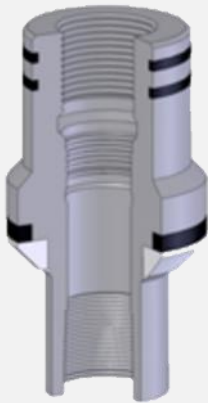
Casing hangers



Standard Features Casing Hangers

- threaded mandrel type hanger, available with standard API threads or premium casing threads
- has a 45° load shoulder and can replace slip hangers in conventional wellhead spools – improves rig time and enhances safety of rig operations
- is a fluted style hanger and allows cement returns up through the riser
- has a lower tonging neck and upper neck with secondary sealing area and lifting thread
- is rated to joint strength of suspended casing

Tubing hangers



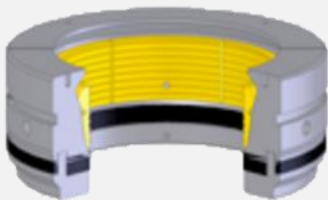
Standard Features Tubing Hangers

- threaded mandrel type hanger, available with standard API threads or premium tubing threads
- has an extended neck which is equipped with interference-type secondary seals
- The compression type primary annulus seal is activated by the tubing weight.
- preparation for backpressure valve as a standard
- available with porting for control and injection lines or preparation for continuous control lines
- also available in both elastomer and metal seal designs

5.2 Slip Hangers

Slip Type Casing Hanger: Cylindrical mechanism used to suspend a casing string in a casing head by gripping the pipe with an arrangement of slips and packing rings.

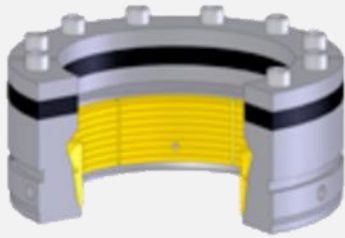
Automatic casing hangers



Standard Features Automatic Casing Hangers

- wrap-around hanger which incorporates pack off, slip bowl and slip wedges
- classified as an API group III hanger
- pack-off is automatically energized by casing weight and seals the annulus below the slips
- can be lowered through blowout preventer
- supports casing weight and seals the annulus before the BOP is removed

Manual casing hangers



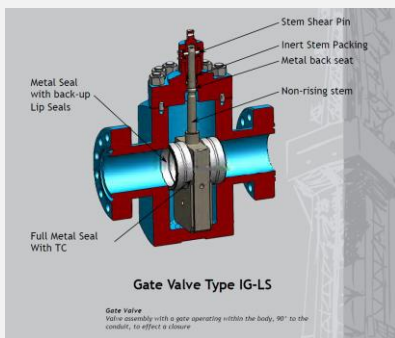
Standard Features Manual Casing Hangers

- wrap-around hanger which incorporates pack off, slip bowl and slips
- classified as a API group III hanger
- has a compression style pack-off above the slips which is energized using cap screws
- can be lowered through blowout preventer
- is used when the annulus seal is required independently from casing load
- isolates test pressure from hanging load

6. GATE & CHOKE VALVES

Gate Valve

A valve with a sliding gate closure mechanism, used to shut-off and seal any flow.



Standard Features

- slab gate with floating seats – bidirectional design
- metal-to-metal seal
- metal backseat sealing – it is possible to change the soft stem seal under pressure
- self-energized stem packing
- full-bore
- non-rising stem
- available with flanged end connections
- available as API 6A, up to PSL 3G
- available up to 7 1/16"
- forged body
- trim AA - HH
- available as manual or automatic version
- in automatic design, a wire cutting version is also available.



Choke valves

A valve used to restrict and control the flow of fluids to maintain a desired pressure and flow rate.

Standard Features

- Positive and adjustable chokes
- trim AA - HH
- sizes up to 7 1/16"
- It is possible to rebuild an adjustable choke into a positive one and vice versa by using a separately offered conversion kit.

7. SEALING SYSTEMS

Wide range of different seal types for virtually any kind of environment. Various metal and elastomer sealing systems.

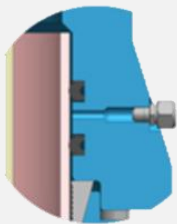
7.1 Elastomer seals



SQ-Seal: Hanger Seal / Casing Seal

The SQ-seals are square or rectangular shaped seals, tough and able to seal machined surfaces as well as rough surfaces. Its large cross-sections provide the ability to compensate also for larger gaps.

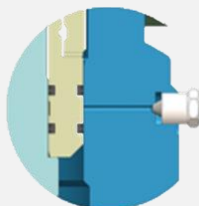
Main applications are primary seals in tubing hangers and casing hangers.



FS-Seal: Casing Seal / Unmachined Surfaces

The FS-seal is able to seal safely under difficult sealing conditions, like rough casing surfaces or large extrusion gaps. The special shaped seal face and the large flexible profile compensate the high API casing tolerances and provide a high sealing contact pressure. It seals bi-directionally and features integral metal anti-extrusion rings.

Main applications are secondary casing seal packings in conventional spools and casing pack-offs in emergency hanger systems.

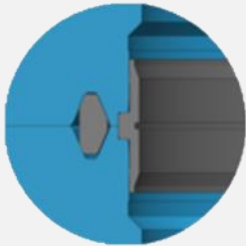


S-Seal: Hanger Seal / Machined Surfaces

These seals are designed for machined surfaces. The S-seals have molded-in metal back-up rings for extrusion prevention. Radiused seal face provides for high interference and easy installation. It is available as ID and OD seal.

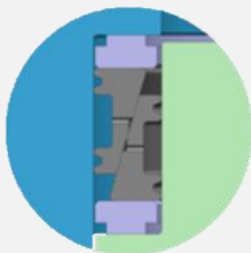
Main applications are annulus seals and hanger neck seals.

7.2 Metal seals



FDS-Seal

The FDS-seal is easily installed without special tools and can also be replaced easily, if necessary. It is a unidirectional pressure energized seal for mid to high pressure and has only small space requirements. Main applications are double barrier flange seals in combination with standard API ring gaskets and mandrel hanger, tubing hanger neck seals.



DWS-Seal

The DWS-seal is an annulus seal which can be installed on machined surfaces and also works on rough casing surfaces. It is a bidirectional pressure energized seal which requires mechanical preloading. It can be pressure tested from the outside.

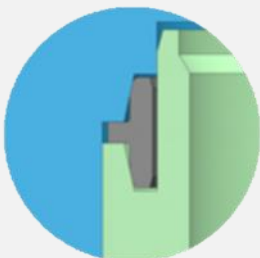
Main applications are secondary casing seals in combination with slip hanger, mandrel hanger, tubing hanger seals, annulus seal assemblies.



MUS-Seal

The MUS-seal is a two-part metal seal, which is intended to seal on machined surfaces like hanger necks. It is a bidirectional pressure energized seal which requires mechanical preloading. It can be pressure tested from the outside.

Main applications are primary and secondary seals on tubing hanger and casing hanger.



MTS-Seal

The advantage of the MTS-seal is the easy installation. It requires less space and less installation loads than API ring gaskets. The MTS-seal automatically centralizes itself during installation and its shoulder works as an end stop.

Main applications are bonnet and hub connection seals, tubing hanger neck seals.