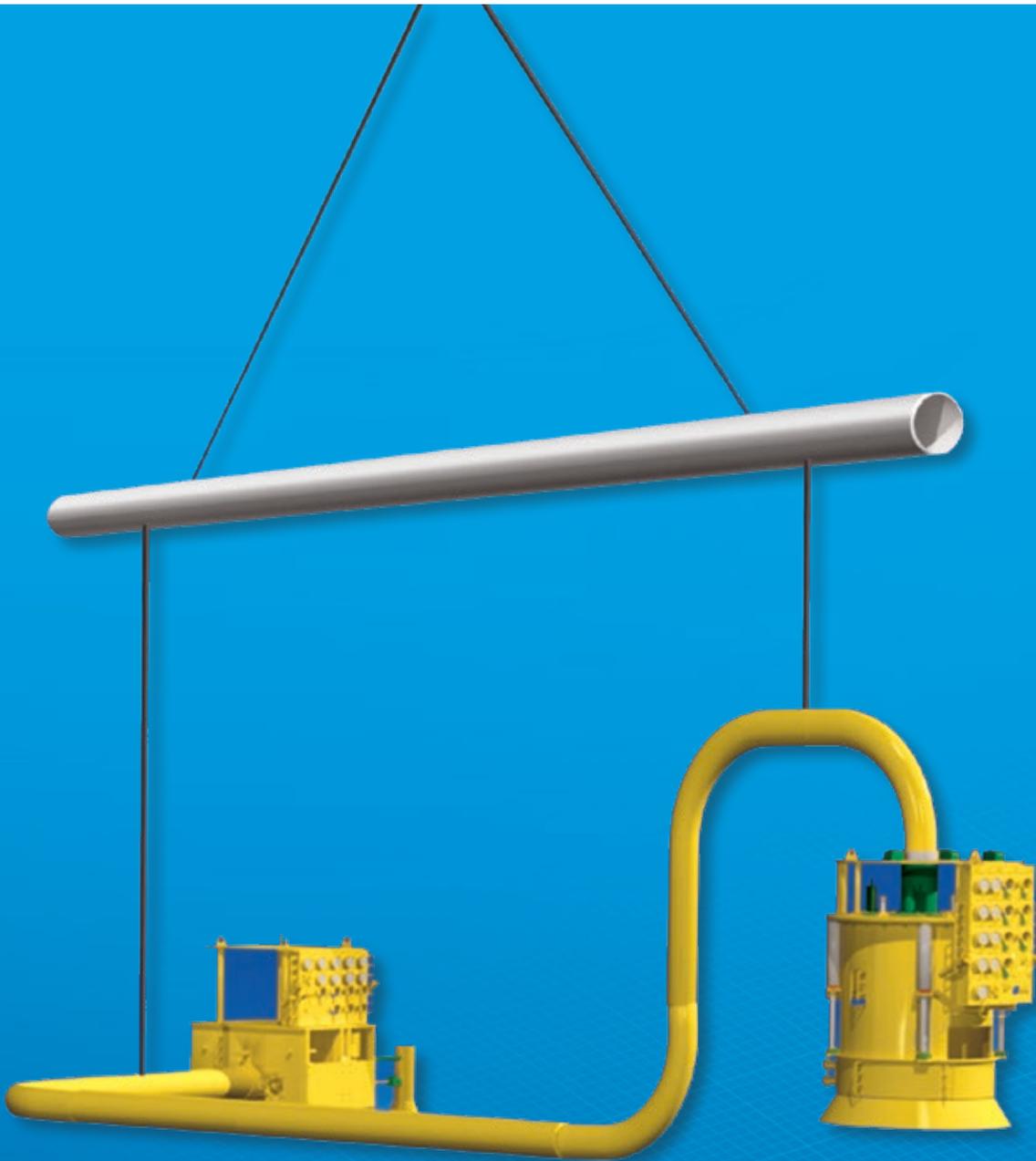




SUBSEA PIPELINE SYSTEMS

# Collet Connector Systems





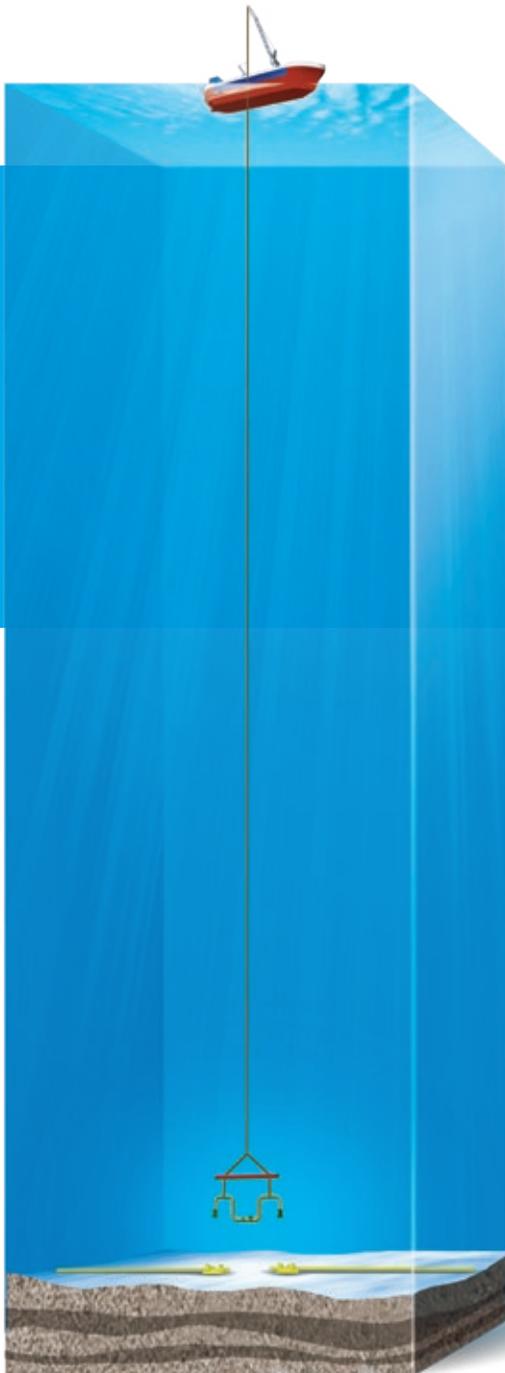
SUBSEA PIPELINE SYSTEMS

# Collet Connector Systems

## Proven Diverless Connections for Deepwater Applications

In deepwater environments and shallow water applications where deploying divers is not practical, collet connector systems are a proven solution for making pipeline and flowline connections. For these applications, operators demand connections that can be installed quickly, efficiently and reliably – with trouble-free sealing even under harsh conditions.

That's why producers around the world turn to Oil States Collet Connector Systems. Our compact, robust, and easy-to-install Collet Connectors deliver industry-leading price, performance and reliability. With connectors in service for more than 20 years and in production areas around the world, they're a solution you can count on.



## A Leader in Deepwater Large Diameter Export Line Collet Connector Systems

With successful deployments at depths up to 7400 ft, Oil States Collet Connectors have been some of the deepest and largest connectors ever installed subsea.



*Vertical Integral Collet Connector Repair Jumper with Wye Fitting & Future Tie-in Hub in-route for deployment in the Gulf of Mexico*

## Why Oil States Collet Connector Systems?

Oil States Collet Connector systems provide everything you need for making fast, reliable ROV-assisted pipeline or flowline connections up to 60" inches in diameter and up to 10,000 psi working pressure.

### Bottom-line Benefits

- A proven, versatile design with standard configurations for almost any application
- Low installed costs
- Fast installation and testing via ROV
- Metal sealing with the highest external pressure rating in the industry
- Outstanding bending/torsional capacity

### Economical to Purchase & Install

Not only do Oil States Collet Connectors cost less than most competitive solutions, their rapid installation also dramatically reduces costly offshore time. And because they are light and compact, they can be installed using smaller, less costly support vessels.

### Robust Sealing & Long Life

The Oil States metal seal was developed specifically for collet connector applications. Its composite metal construction provides a forgiving sealing surface that can accommodate hub imperfections, assuring a gas-tight seal. The seal has an external pressure of 3000 psi above ambient pressure, an important feature for ultra-deepwater applications.

### Designed to Meet Your Needs

Our Collet Connector systems are available in standard sizes up to 28", or we can customize a solution with the size and pressure rating that best suits your application. That means you never have to buy more than you need.

Our connectors can also be used on platform disconnects, moorings and riser anchoring systems – all with fast, remote installation.

### Exceptional Service & Support

Your Oil States engineering team and onsite field technicians will assist at every step of the installation process to ensure fast, reliable and trouble-free deployment.





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## Vertical Alignment & Connection

Vertical connector configurations are typically favored for rigid pipes and jumpers. Vertical configurations have a protective alignment shroud and guide funnel that lands over the male hub connection structure during installation, aligning the hubs. Soft landing cylinders prevent the hubs from contact during jumper landing and provide a controlled vertical connection. The soft landing cylinders also have sufficient vertical lift to facilitate subsea seal change-outs and other interventions.

## Horizontal Alignment & Connection

Horizontal connection configurations are favored where a lower vertical profile is required (in the North Sea, for example), or when flexible pipes or jumpers are deployed.

Horizontal configurations have two downward-facing guide funnels, which engage vertical guide posts on the connection porch. The guide funnels are attached to pull-in cylinders, which provide the force necessary to stroke the horizontal Collet Connector to or from the male hub.

## Control Panel Operation

Both integrated and retrievable configurations incorporate a control panel to facilitate ROV operation. The panel utilizes a single industry-standard, dual-bore dual-port hot stab coupling for all hydraulic functions. The control panel includes depth-compensated, high-visibility pressure gauges for visual confirmation of hydraulic supply. All functions are directly visible or have visible indicators to confirm function operations. The control panel also includes an isolation valve for external testing to verify seal integrity.

All Collet Connectors can be unlatched with an ROV-operable override tool, allowing the connector to be released from the male hub in the event of a hydraulic malfunction.

## Fastest Installation in the Industry

With Oil States Collet Connectors, the entire ROV-assisted connection process<sup>1</sup>, including initiation of the seal test, is usually completed in 30 minutes or less. And only Oil States offers a 7° taper, simplifying installation and release.

<sup>1</sup> Excluding run time.



## Horizontal Running Tool

For horizontal configurations where a non-integral design is optimal, a Horizontal Running Tool controls the installation. The Horizontal Running Tool consists of a hydraulic connector operating assembly, two mechanical lock operators, two pull-in cylinders with guide funnels, a retaining cylinder, and an ROV-operable control panel mounted to a structural frame. The hydraulic connector operating assembly consists of four actuators attached to mounting plates which engage the reaction plate and drive plate to latch and unlatch the collet segments. The mechanical lock operators consist of hydraulic motors with sockets that engage the secondary lock feature. Guide funnels are attached to the pull-in cylinders and engage the Connector Porch guide posts to provide initial alignment and reaction. The pull-in cylinders provide the axial force necessary to stroke the Collet Connector to and from the male hub. They provide sufficient stroke for seal change-out and pipe bore access. The locking cylinder secures the Running Tool to the Collet Connector during deployment.



## Vertical Running Tool

For vertical configurations where a non-integral design is desirable, a Vertical Running Tool controls the installation. The Vertical Running Tool consists of four hydraulic actuators, two mechanical lock operators, four soft-landing cylinders, and an ROV-operable control panel attached to an alignment structure. The alignment structure consists of a downward-facing funnel and sleeve, which engage the male hub connection structure to provide initial alignment of the hubs. The hydraulic actuators engage and react against funnels in the collet connector drive plate and reaction plate to toggle between the latched and unlatched positions. Soft landing cylinders control vertical engagement of the collet connector onto the male hub and provide vertical lift for seal change-outs and pipe bore access.





SUBSEA PIPELINE SYSTEMS

# Collet Connector Systems

## About Oil States Collet Connector Systems

Oil States Collet Connectors are most commonly used for final hook-up of subsea production systems with hard-pipe or flexible pipe jumpers. They are also used for diverless pipeline repair systems and future pipeline tie-in systems.



### System Components Include:

- Collet Connector
- Collet Actuator and ROV Control Panel
- ROV-operable End Closures and Pig Launchers and Receivers as Required
- Remote Seal Removal/Replacement Tools
- Custom Components as Needed

### System Configurations to suit Virtually Any Field Environment:

- Horizontal Stab with Retrievable Actuator
- Horizontal Stab with Integral Actuator
- Vertical Stab with Retrievable Actuator
- Vertical Stab with Integral Actuator
- Vertical Stab and Hinge-over for First-end Make-up and Pipe Layaway

All are available with either single or multiple bores.

## Choose from Retrievable or Integrated Actuator Configurations

We offer connection systems with built-in, Integral Actuator Systems for environments where maximum installation speed and simplicity are desirable. Customers can also select retrievable configurations, using running tools that can be retrieved and re-used many times over to install collets of varying sizes.

## A Robust Seal Design

The Oil States metal seal offers an exclusive design with composite, stainless steel alloy construction. It features a high-strength core and an outside seal surface that is softer than the hub sealing surfaces, which are inlaid with a corrosion-resistant alloy. The highly durable metal seal has been proven to retain its seal even with significant scratches in the mating surfaces. The high-strength core of the metal seal provides a high external load capacity, allowing for a high external pressure test during connection and preventing leakage into deepwater gas pipelines during blow down.

## The Seal Latching Process

Our Collet Connectors create a leak-tight, externally testable metal seal connection by latching onto a male hub. The latching process compresses a metal seal between the Collet Connector female and male hubs. The hubs are secured by a radial array of collet segments secured by a drive ring, which is stroked axially to toggle the collet segments between the latched and unlatched positions.

In the unlatched position, the collet segments form a funnel which provides the final radial alignment before the female hub nose enters the male hub counter bore. Hydraulic actuators provide the axial force to preload the connection to withstand all internal pressure and external (axial, bending, shear, and torsion) loads.

With the proper preload, the hub faces will not separate, assuring the integrity of the metal seal. The drive ring forms a locking taper via geometry and surface friction of the component interface. Back driving is prevented by a secondary locking mechanism.

## Connector Structures

Three types of connection structures guide the Collet Connectors onto the male hub for safe, accurate alignment:

### Vertical Connection

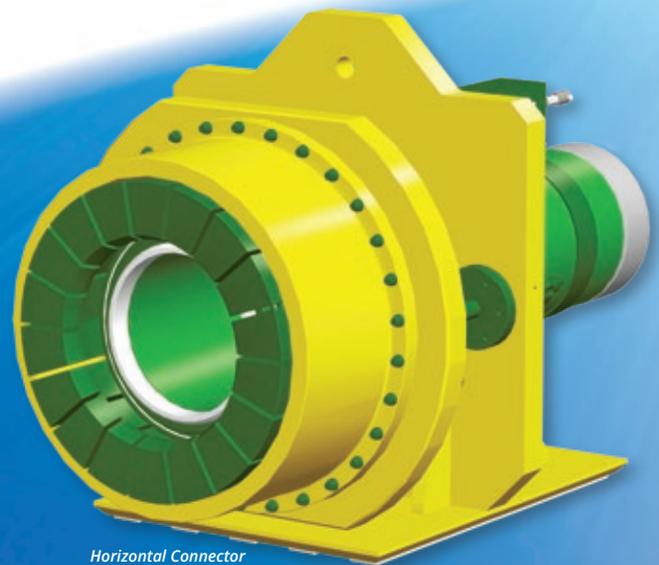
A Vertical Connection System includes an upward-facing male hub fabricated into a Connection Structure. An alignment sleeve engages the Connection Structure during installation, providing initial radial alignment of the hubs. Recessed below the top of the Connection Structure, the male hub and attached piping are protected from vertical and lateral damage. The top face of the Connection Structure provides a landing surface for the soft-land cylinder feet. If additional pull-down force is required, an external groove may be machined to interface with the pull-down cylinder feet. The Connection Structure is typically part of a larger structure, such as a subsea completion guide base, manifold, pipeline termination sled or mid-line tie-in sled.

### Horizontal Connection

A Horizontal Connection System includes a horizontal male hub fabricated into a Connector Porch with two vertical guide posts. Funnels engage the Connector Porch guide posts during installation, providing the alignment and reaction points necessary for pull-in during connection. The Connector Porch is typically a component of a larger fabrication such as a manifold, pipeline termination sled, or mid-line tie-in sled. The Connector Porch may also include a rotational leveling system to compensate for structural or seabed settlement offsets.

### Stab & Hinge-over Connection

A Stab and Hinge-over Connection System includes a Receiver Structure. The Receiver Structure is a vertical inverted pyramid which accepts the Collet Connector male pyramid during installation. The male pyramid is filled with a weighted material such as concrete to assure it hangs vertically. The Receiver Structure is equally robust, allowing all installation and connection loads to be transmitted directly into the base structure through the pyramid. The Receiver Structure is typically a component of a larger fabrication, such as a manifold or termination sled.



## System Accessories

### Male End Closure

A Male End Closure (MEC) provides a pressure cap that creates a blind end for future deployment of a jumper. A MEC installed on a male hub protects the sealing surfaces and pipe bore and allows for hydrostatic pressure testing, flooding of a dry pipeline, and dewatering of a flooded pipeline. The MEC may also be configured to accept a transponder interface for subsea location and jumper fabrication measurements. The MEC includes a vent valve sized to accommodate the necessary testing and flooding/venting requirements. Oil States offers both collet-style and split clamp-style MECs.

### Seal Removal Tool

The Seal Removal Tool is used to perform a subsea seal replacement by disengaging and extracting the metal seal from the female hub seal pocket. The ROV removes the Seal Removal Tool along with the metal seal and secures it for recovery to the surface. The Seal Removal Tool will not damage the male hub or sealing surfaces during operation.

### Seal Installation Tool

The Seal Installation Tool is used to install a new metal seal into the female hub seal pocket. The ROV installs the Seal Installation Tool containing the replacement metal seal onto the exposed male hub. The Seal Installation Tool is manufactured from lightweight materials which will not damage the male hub or sealing surfaces during operation.

## Jumper Fabrication

### Fabrication & Measurement Jig

Fabrication and Measurement Jigs (FMJ) are used to fabricate jumpers using subsea orientation and measurement data. They provide a template for fabrication and hydrostatic testing of jumpers offshore or keyside for confident deployment subsea.

A jumper is fabricated by positioning and precisely adjusting the FMJs to match the locations of the subsea male hubs. The Collet Connectors are installed on the FMJ hubs, and the piping is welded to obtain the desired geometry – resulting in a perfect fit.

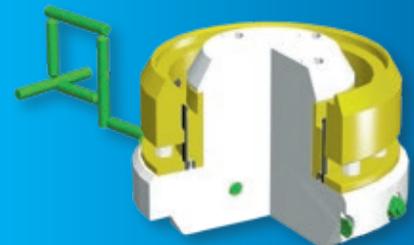
## Jumpers

A jumper is a run of pipe fabricated between two Collet Connectors, which may be connected vertically, horizontally or one in each orientation. Jumper configuration is driven by subsea geometry, installation method and other operational criteria.

Jumpers are typically installed while suspended from a spreader bar. The rigging must be designed to properly support the jumper during installation and allow for disconnection by the ROV subsea. Rigging must also be included for recovery of the Collet Connector running tools after installation of non-integral applications.



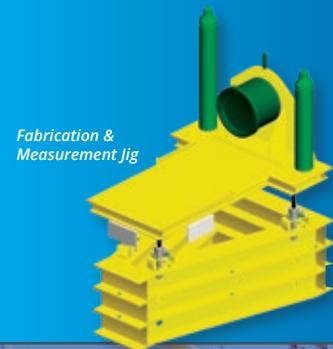
Male End Closure



Seal Removal Tool



Seal Installation Tool



Fabrication & Measurement Jig



## Oil States Subsea Pipeline Systems

Oil States' Houston-based Subsea Pipeline Systems division designs, manufactures and markets proprietary deepwater and shallow water pipeline connectors for subsea pipeline construction, repair and expansion projects.



Oil States Industries Facility | Houston Hobby, Texas USA



Oil States Industries Facility | Houston Ship Channel, Texas USA

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