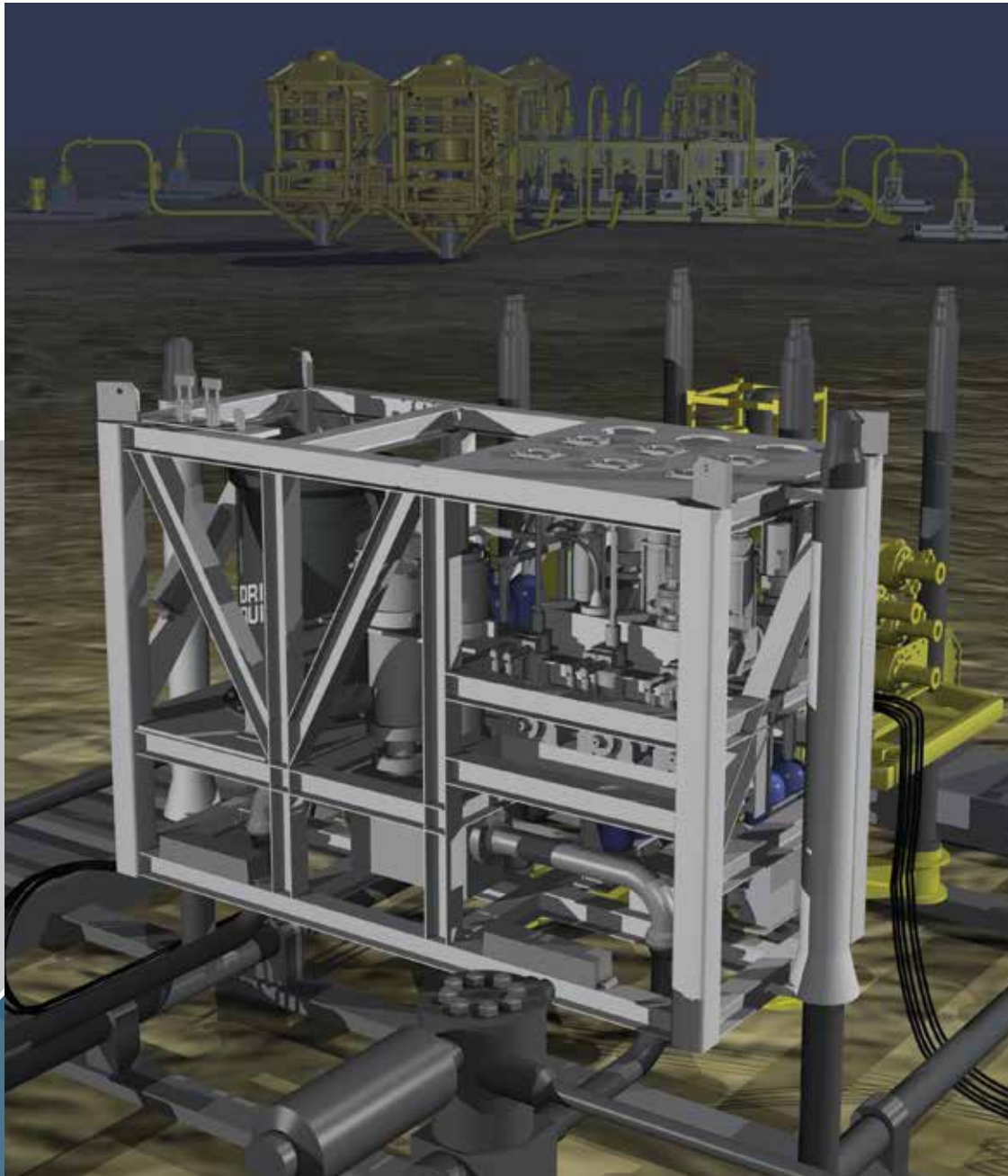




*Setting a Global Standard*



[www.dril-quip.com](http://www.dril-quip.com)

# HIPPS: High Integrity Pressure Protection System

# HIPPS: HIGH INTEGRITY PRESSURE PROTECTION SYSTEM



As deeper reservoirs are drilled and discovered offshore, production costs to develop these wells increase due to higher pressure specifications and requirements. In some cases, these high costs prohibit development of wells, especially if a new flowline is required. An alternative is to tie into existing flowline and pipeline infrastructures, but there are risks involved due to pressure fluctuations between deeper wells and existing lower pressure pipelines. The inclusion of a HIPPS module in the pipeline infrastructure can greatly diminish these risks. A HIPPS module is a safety device that allows high-pressure production wells to safely tie into existing lower pressure-rated pipelines. The HIPPS module includes flowline barrier valves, pressure sensor transmitters and controls

designed to protect against overpressure in pipelines. The module's control system monitors the pressure of fluid flowing through the pipeline to the host platform. Through hardware-encoded logic, the control system automatically closes barrier valves if pressure fluctuations exceed a predetermined value in the flowline. The control system is unique in that it has been specifically designed to operate the HIPPS module autonomously of events and human intervention on the production platform.

## HIPPS RELIABILITY

DRIL-QUIP's control system for the HIPPS module utilizes fiber optics for communication and incorporates multiple fault tolerant redundancies and highly reliable Safety Integrity Level (SIL) rated field-proven components. SIL is an industry-recognized rating system that establishes required reliability for safety devices, including HIPPS modules. DRIL-QUIP's HIPPS modules are designed to SIL reliability levels of SIL-3 or SIL-4.

## HIPPS DESIGN REQUIREMENTS

DRIL-QUIP's HIPPS module is designed according to the following specifications:

- Protects the pipeline from overpressurization via failsafe close valves that close when pressure exceeds the trip set point as determined by the pipeline design
- HIPPS controls, located subsea, are autonomous and independent of production control systems, including the platform's Production Shutdown and Emergency Shutdown systems
- The HIPPS design, per API-RP-170, provides the capability for full system testing as required to maintain its SIL rating over the life of the HIPPS module
- Redundant electrical power and communications are utilized
- Redundant pressure transmitters (from different manufacturers to minimize common mode failure) automatically close the Production Shutdown Valves when two or more transmitters report overpressurization
- Production Shutdown Valves close on loss of electrical or hydraulic power or loss of communications with the platform
- Production Shutdown Valves start to close within two seconds after overpressure detection; DRIL-QUIP HIPPS valves are designed per API-6A and 17D and are PR-2 tested
- Uses high reliability logic solvers from industry recognized SIS (Safety Instrumented System) manufacturers
- After overpressurization event, Production Shutdown valves will not reopen until pressure transmitters read below the trip set point
- Methanol injection support system is used to mitigate hydrate formation; to provide a fluid source for pressure testing, and to clean piping and pressure sensors



*HIPPS Pressure Transmitters*



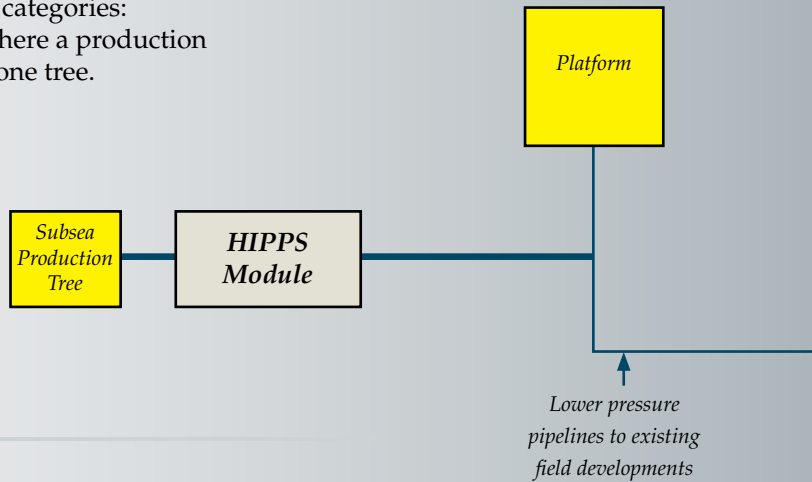
*HIPPS Control Pod/Production Shutdown Valves*

## HIPPS FOR SINGLE OR MULTIPLE TREES

Subsea HIPPS module applications fall into two primary categories: single tree installations, or multiple tree developments where a production manifold is used to commingle the flow from more than one tree.

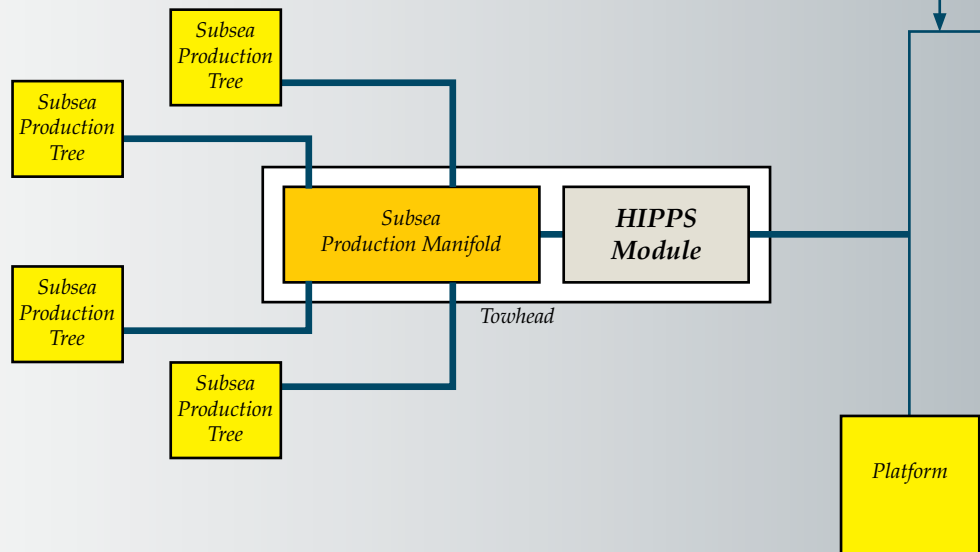
### HIPPS Single Tree Configuration:

3 Pressure Sensors, 2 Production Shutdown Valves, Electro-Hydraulic Control System for HIPPS and single subsea production tree



### HIPPS – Manifold-based:

6 Pressure Sensors, 2 Production Shutdown Valves, Electro-Hydraulic Control System for HIPPS, production manifold and multiple subsea production trees



Towhead housing Subsea Production Manifold and DRIL-QUIP HIPPS destined for installation in the North Sea



DRIL-QUIP Production Manifold



# HIPPS SCOPE OF SUPPLY

## MAIN TOPSIDE EQUIPMENT

- **Master Control Station**– provides the Human-Machine Interface (HMI) for the HIPPS module; DRIL-QUIP’s HMI software is Delta V-based and can easily be linked into the platform’s distributed control system and emergency shutdown systems

The HMI is used to monitor the following:

- Historical events and alarms
- Pressure trends and valve status
- Required pre-programmed reporting

The HMI is used to control the following tasks:

- Pressure test the Pressure Transmitters and Isolation Valves
- Flush and clean Pressure Sensors and piping to mitigate hydrate formation
- **Subsea Power and Communications Unit** – distributes platform electrical power to HIPPS module
- **Subsea Control Unit** – provides the primary electronic logic interface between various HIPPS system components
- **Third Party Unit** – converts raw data from third party Pressure Transmitters to engineering data that may be utilized by the SCU
- **Hydraulic Power Unit** – hydraulic fluid storage and pumps to supply high pressure and low pressure hydraulic fluid to the HIPPS module
- **Umbilical Termination Assembly** – connection point between the topside equipment and the umbilical

## SUBSEA EQUIPMENT

- **Flowline/Umbilical Bundle** – transmits electric power and communications, hydraulic power, and chemicals between topside equipment and HIPPS module and associated production tree(s)
- **Subsea Umbilical Termination Unit** – termination point between the topside umbilical and the subsea equipment



HIPPS HMI Software Display Examples



Installation of HIPPS Control Pod



*HIPPS Production Shutdown Valves*

• **HIPPS Module – a manifold structure that contains the following components:**

- Subsea Control Module (HSCM) and base plate
- Flowline section with two Production Shutdown (hydraulically activated failsafe close) Gate Valves and Pressure Sensor(s)
- Pressure Sensor Header consisting of Process Isolation Valves, Pressure Transmitters, Methanol Isolation Valves and block and bleed valves
- Subsea Accumulator Module (SAM) – provides subsea energy storage

**THE HIPPS SUBSEA CONTROL MODULE (HSCM)**

The HSCM is the control point for all HIPPS module activities. It is interconnected with the topside platform control equipment and all HIPPS valves, sensors and subsea accumulator modules. The HSCM contains a Subsea Electronics Module and failsafe solenoid valves. The HSCM is filled with dielectric fluid, and is compensated for pressure and temperature changes. It can be deployed and retrieved with ROV assistance and/or divers. All power signal electrical connectors are mounted to the top of the HSCM for accessibility by ROV or diver.

**PRODUCTION SHUTDOWN VALVES**

The Production Shutdown Valves are API mono-programmed five-inch 10,000 psi failsafe close bidirectional flow-through gate valves that are designed and tested to meet HIPPS module customer-specified standards. DRIL-QUIP’s gate valves and actuator for HIPPS module applications are designed to operate in up to 3,000 feet of water.

**PRESSURE SENSOR HEADER**

The Pressure Sensor Header is a manifold that consists of three pressure transmitters from different manufacturers, three one-inch 10,000 psi actuated isolation valves, a methanol header pressure transmitter, and three methanol isolation valves. All valves incorporate an ROV interface.

**SUBSEA ACCUMULATOR MODULE**

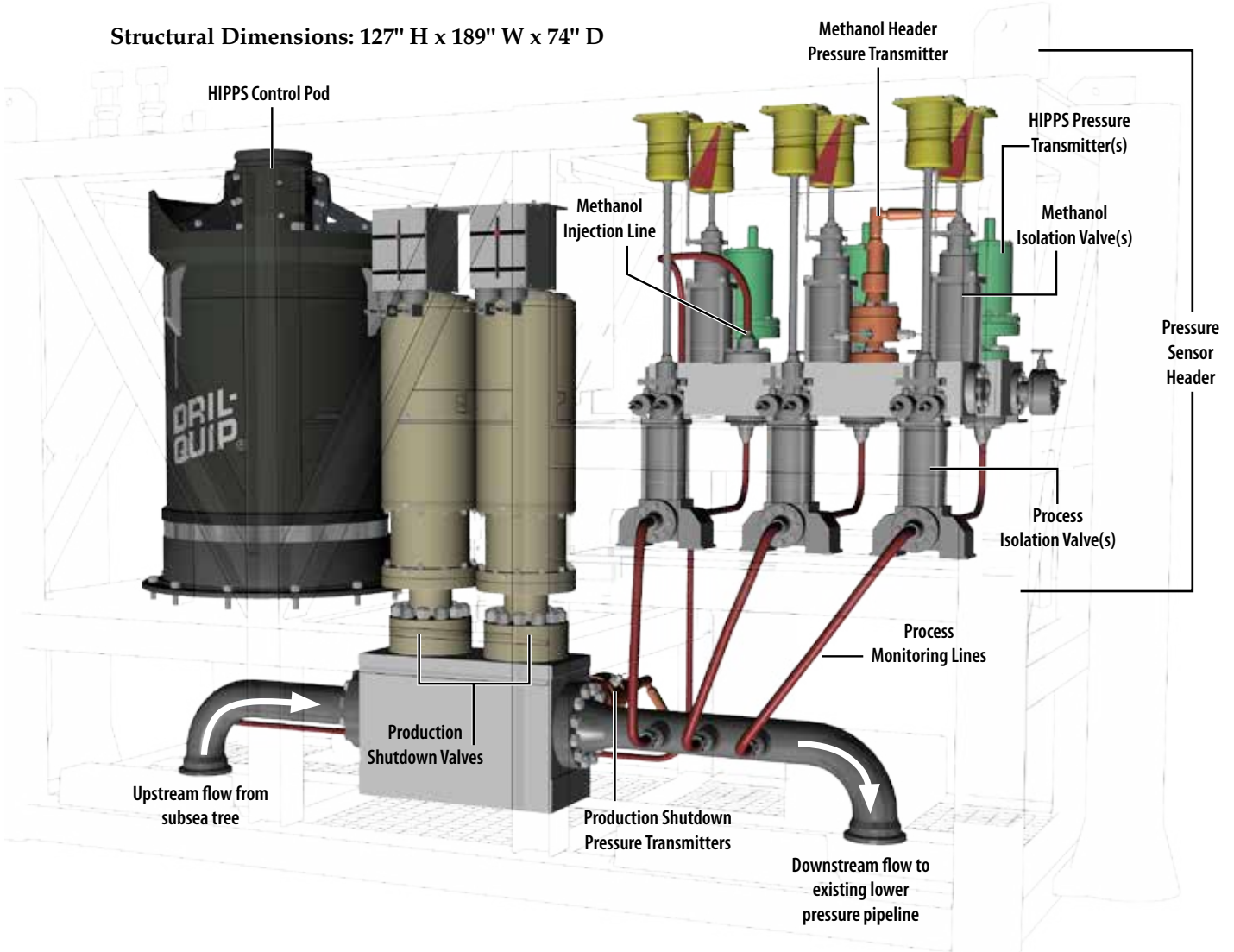
The Subsea Accumulator Module is a precharged accumulator rack that stores hydraulic fluid used to function the Production Shutdown valves on demand.



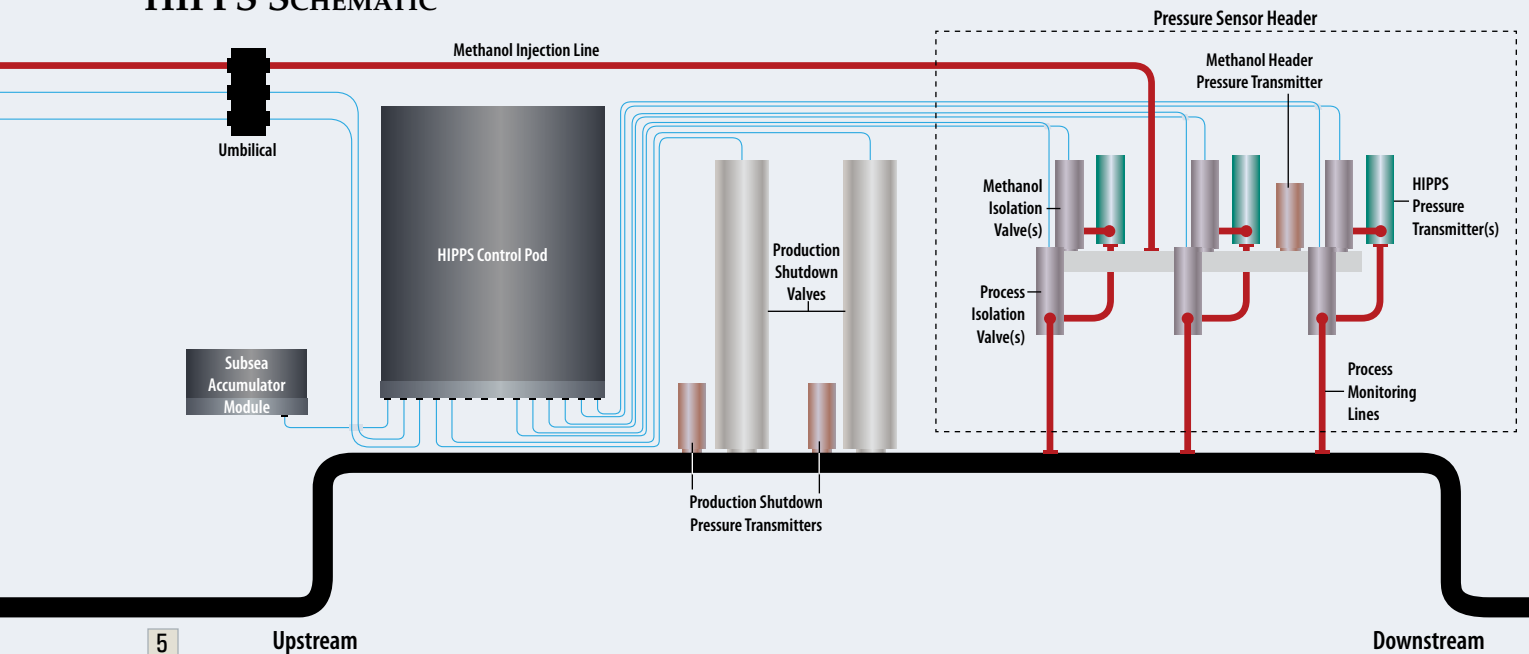
*HIPPS Pressure Sensor Header for production manifold-based application with multiple trees*

# HIPPS COMPONENTS

Structural Dimensions: 127" H x 189" W x 74" D



## HIPPS SCHEMATIC





# THE DRIL-QUIP PRODUCTION CONTROL SYSTEM



DRIL-QUIP also offers Subsea Production Control Systems for subsea trees and production manifolds. DRIL-QUIP's state-of-the-art control system is fiber-optic based and is most suitable for deepwater operations and long offsets of the controlled equipment. DRIL-QUIP offers a variety of Multiplex/Fiber-Optic, Multiplex/Copper and/or hydraulic based production control system configurations.

DRIL-QUIP's fiber-optic based Multiplex Control System supplies real-time access for control and monitoring of over 50 wells. A single control module can operate 36 functions and monitor 32 sensors. MODBUS protocol allows operators to easily link to the platform control system. A flexible design allows DRIL-QUIP engineers to create a system for an operator's application employing standard equipment modules. DRIL-QUIP can package this system for shallow or deepwater applications up to 10,000-ft depths.

## **BASIC COMPONENTS OF THE PRODUCTION CONTROL SYSTEM:**

- **Master Control Station**
- **Hydraulic Power Unit**
- **Third Party Unit**
- **Topside Umbilical Termination Unit**
- **Umbilical**
- **Subsea Umbilical Termination Unit**
- **Subsea Control Pod**

## **INSTALLATION AND WORKOVER CONTROL (IWOC) SYSTEM**

DRIL-QUIP's IWOC System for deep and ultra-deep installation and workover requirements is designed to the same high-quality standards that are used in DRIL-QUIP's Production Control System.

The IWOC System typically includes a Master Control Station, Hydraulic Power Unit, umbilical(s) stored on a winch-controlled reel, sheaves and junction plates. The IWOC System provides direct control to the tools used to install the tubing hanger, tree and tree cap. The system can be used to install the tree while maintaining necessary control of the Emergency Disconnect Package and Lower Riser Package when applicable.

DRIL-QUIP's IWOC System is available in Direct Hydraulic and Multiplex configurations.



*DRIL-QUIP Subsea Tree with deepwater Control Pod*



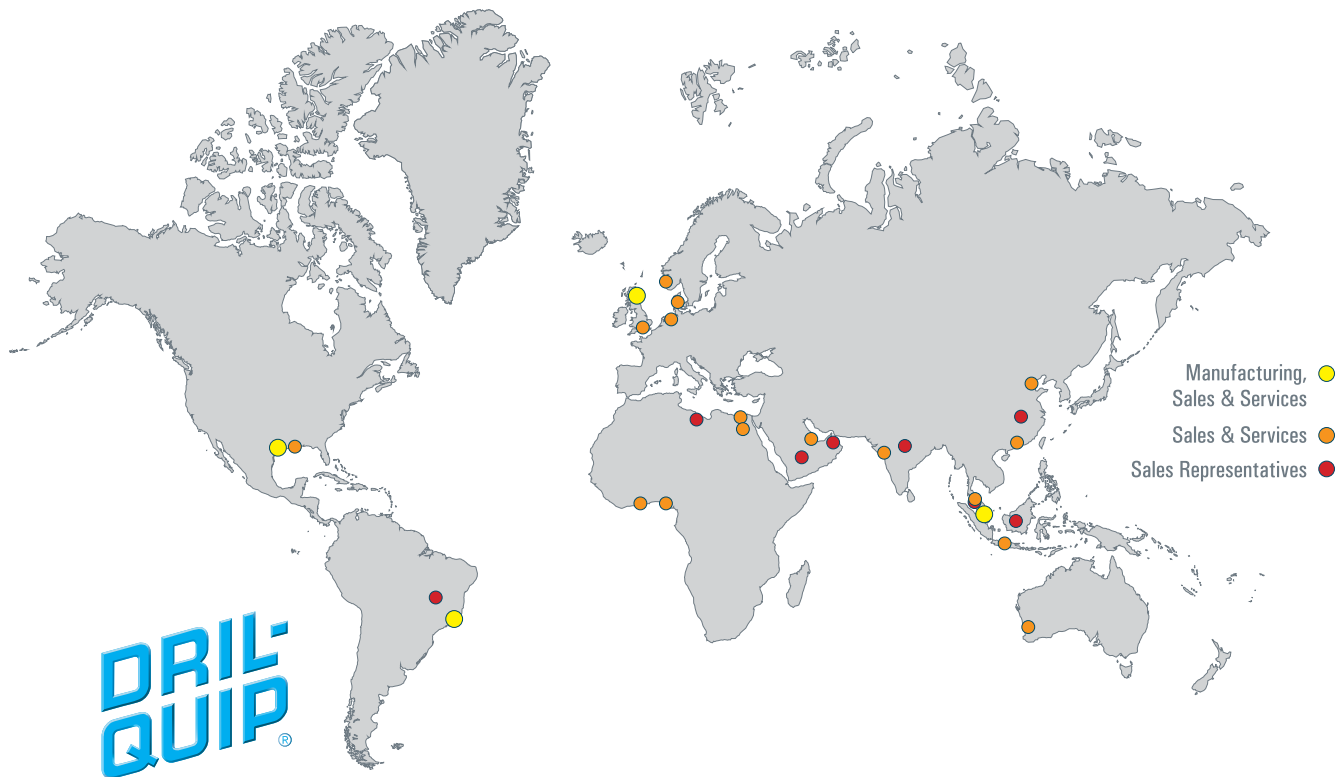
*Master Control Station*



*Hydraulic Power Unit*



*IWOC Hose Reel and Umbilical*



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