Rapid-dePloy™
Marine Drilling System
As the offshore oil industry ventures into deeper water and greater well depths, the complexity and costs of drilling have increased exponentially. These costs are not measured by equipment price alone. Operational costs, maintenance and repair, and life cycle of the equipment are all part of the equation. Riser systems, with extended periods of use under a variety of conditions, must be rugged and reliable, easy to use and maintain, cost-effective and operationally efficient. Designing a marine drilling system that offers the appropriate balance of technology and economy is a challenge, which Dril-Quip has answered with its RAPID-dePLOY Marine Drilling System. The system, as its name implies, is quickly installed, saving valuable rig time. It is designed for ease of use and maintenance, with field replacement of critical components. This rapid-running, high-strength system is built to last – designed to effortlessly handle ultra-deepwater and extreme drilling conditions today and well into the future.

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Dril-Quip’s RAPID-dePLOY Marine Drilling equipment is designed to meet applicable API specifications and industry standards.
CAPABILITIES

PROJECT MANAGEMENT
Project management capabilities have enabled Dril-Quip to better manage the design, manufacture and delivery of Dril-Quip products on large, integrated projects throughout the world.

The project management techniques utilize time-proven processes, which are defined at the start of a project via a formal Project Execution Plan (PEP). This formalized project management system has proven invaluable for successful management of the resources required to complete projects on time and to the customers’ requirements.

ENGINEERING
Dril-Quip’s technological leadership in the industry is the result of an ongoing commitment to a professional engineering staff with in-depth experience in the design of drilling and production equipment. This experience is supported by state-of-the-art computer systems networked to expedite and optimize the process of modeling, analyzing, modifying and testing each design. These capabilities enable Dril-Quip to consistently provide new and improved products to the oil and gas industry worldwide.

MANUFACTURING
Dril-Quip products are manufactured from selected high-grade forging material. Computer-controlled machine tools are used for dimensional accuracy, precision machining and consistent quality. Each product is inspected, assembled and tested prior to shipment. Computer tracking systems are used to schedule and monitor each customer’s order during the manufacturing process. This attention to detail ensures product quality and on-time delivery.

SERVICE
In order to ensure vital support to the offshore industry, Dril-Quip field service technicians are rigorously trained and tested in the proper use, handling and repair of Dril-Quip products. Only the most qualified and knowledgeable personnel are employed by Dril-Quip for field service. These technicians are then posted at strategically located Dril-Quip facilities throughout the world, readily available to our customers on a 24-hour basis.

TRAINING
The Dril-Quip Training Department offers to the industry training courses in the installation, operation and maintenance of offshore drilling and production equipment. These courses utilize computer-assisted training tools, models and actual equipment to enhance the participants’ knowledge of offshore operations. Dril-Quip’s Training Department offers custom courses tailored toward specific projects and customer requirements.
**FRC™ Flanged Riser Connector**

**Features**

- 6- or 8-bolt configuration suitable for use in exploratory drilling, field development and high-pressure drilling riser for TLP and Spar applications
- The FRC Riser Connector is available in several load and pressure capacities per API specifications
- High-pressure riser is provided with a gas-tight, metal-to-metal seal ring gasket
- Stab sub seal ring has a dual alignment feature for long wear life
- Heavy duty forged bolts are used to make up the connectors; bolts are maintained in the “up” position prior to make-up and auto-engage during make-up, with auto-reset in the “up” position during breakout
- The flat-faced flange design reduces loading on the bolts
- The running tool profile is in the upper flange

**High Strength, Light Weight**

Deil-Quip’s FRC Riser Connector is designed for fast, simple, reliable, trouble-free operation. Special hydraulic wrenches ensure fast make-up and accurate preloading of the FRC Flange Connectors. This quick-running, high-strength coupling is designed for easy maintenance with field replacement of most of its components. This rugged, reliable riser connector delivers maximum uptime.

The FRC Riser Connector incorporates a flat-faced, preloaded flange design that complies with API 16R specifications and is built to an ISO-9001 quality plan. The design incorporates tensile load sharing between the main riser pipe and the choke and kill lines. Load sharing provides the benefit of reducing the riser pipe wall thickness, resulting in a significant weight reduction.
Dril-Quip offers riser joints in a variety of configurations. Slick and buoyant riser joints make up the bulk of the riser string. Each joint will contain up to six auxiliary lines that are secured to the main riser pipe by lightweight urethane retainers spaced along the length of the joint. The mechanical connection between joints is accomplished with Dril-Quip’s FRC Riser Connector. The Rapid-dePloy Riser System is offered pin up or box up with the running profile in the upper connector. The dual alignment stab sub seal ring and the choke and kill line stab subs work together to provide initial and final orientation of the riser joints as they are made up. Horizontal handling of the riser joints is accomplished using Dril-Quip’s special lift tools. Bolts, bolt inserts, seal subs and all seals are field replaceable.

To provide buoyant riser joints, Dril-Quip’s engineers work closely with buoyancy manufacturers to integrate buoyancy modules with our slick riser joints. Each joint is fitted with an upper and lower compact, lightweight thrust collar assembly to maintain the modules in place and transfer the thrust load generated by the buoyancy modules into the riser joint.

**Features**

- **Rapid-dePloy** Riser Joints are available in several working pressure and load-carrying capacities
- The upper pin flange contains a field-replaceable stab sub seal ring fitted with elastomeric seals that provides the sealing between joints
- Choke and kill line stabs engage prior to smaller boost and hydraulic stabs, giving a two-point alignment prior to bolt make-up
- Choke and kill line pin connections are hard-faced for long service life
- The BOP stack control umbilical is clamped to the choke and kill lines as the riser is run
- Installation and vertical handling is accomplished using the riser handling and test tool, which engages the handling profile in the ID of pin end riser flange
- Special hydraulic wrenches ensure fast make-up and accurate preloading of the FRC Flange Connectors
- Hydraulic handling tools are cam-actuated and balanced to facilitate ease of handling and trouble-free operations
The RAPID-dePloy Telescopic Joint is positioned at the top of the riser and attaches to the diverter flex joint. It is designed to give the drilling riser string a place to change length to accommodate the horizontal and vertical motion of the drilling vessel. It includes interfaces for attaching riser tensioners and auxiliary line drape hoses.

Dril-Quip’s RAPID-dePloy Telescopic Joint features a customer-specified stroke, dual packers, riser tension ring dual-bearing housing, water supply port for inner barrel lubrication, auxiliary line drape hose connection interface, and hydraulic connector for locking the inner and outer barrel together for landing and retrieving the BOP stack. The lower shoe on the inner barrel is designed to support entire string weight for emergency retrieval.

**Features**

- Can support the entire riser string and BOP stack without the aid of tensioners
- Incorporates two hydraulically operated packers: an upper primary packer and a lower secondary (backup) packer to provide a seal between the inner and outer barrel
- Dual packers have proprietary split polyurethane sleeves between the packers and the inner barrel for long field life
- Upper packer insert can be replaced while the telescopic joint is in service
- Telescopic joint can pass through the tension ring while the ring is parked on the diverter housing so that auxiliary line drape hoses can be attached to the telescopic joint prior to attaching the tension ring; also allows for space-out verification before landing the BOP stack
- Provides a primary fluid bearing and a secondary bronze bearing for tension ring rotation
- Ratcheting system for small incremental rig rotations used with or without fluid bearing
- Provides the upper termination of the riser system’s auxiliary lines
- Inner barrel remotely locks to the outer barrel for landing and retrieving BOP stack
The Rapid-dePloy Solid Tension Ring (STR) provides for rapid attachment of the rig’s tensioning lines to the riser system at deployment. When not in use, it is locked to the bottom of the diverter housing and its design allows all riser components to pass through it. The STR attaches to the dual-bearing housing on the telescopic joint and houses a rotation mechanism that interfaces with a tooth ring on the telescopic joint to provide positive mechanical rotation of the tension ring.

**Features**

- Minimizes personnel in the moon pool
- Saves significant time in attaching tension lines to the telescopic joint
- Once system is attached to the wellhead, STR supports all riser loads
- Integral pressurized fluid bearing minimizes friction, allowing drilling vessel and inner barrel rotation relative to outer barrel, assuring correct alignment of the tensioner wires
- Secondary silicon bronze bearing provided for use if rig hydraulics fail
- Positive mechanical rotation (if required) is accomplished hydraulically
- Accepts 8 to 16 tensioner cables, determined by rig-specific tensioning equipment
- Made up to telescopic joint after drilling riser is run and auxiliary line drape hoses are attached, but prior to attaching riser system to subsea wellhead
The Auxiliary Line GN Connection System uses individual GN connectors to attach each drape hose individually to the telescopic joint. The Dril-Quip GN Connectors are fitted with swivel flanges, which mate with the drape hose flanges and are made up to the drape hoses prior to lowering them into position.

**Features**

- The GN connectors have a series of suspension holes used to adjust the balance of the connectors and drape hose for installation
- Tugger lines are used to lower the GN connector and drape hose to the interface on the telescopic joint
- The interface and GN connectors have mating pins and slots used to align and attach the GN connectors to the telescopic joint; a locking pin is inserted to secure them
- There are five auxiliary line goosenecks with provisions for a sixth line, if necessary
- The functions of these lines are choke, kill, mud boost and hydraulic supply

**Installation Steps for the Auxiliary Lines**

1. **Pre-slot engagement**
2. Gooseneck skewed due to hose drape
3. **Initial slot engagement**
4. Gooseneck skewed due to hose drape
5. **Alignment in vertical slot**
6. Box pre-aligned with pin
7. **100% engagement in vertical slot**
8. Box aligned with pin
9. Gooseneck landed
10. Box engaged over pin
11. Bolster holes aligned for retainer pin
**Features**

- Significant savings in running time
- The two-piece hydraulic SR connection system lands and locks to the telescopic joint, providing faster attachment of drape hoses
- The system is secured to the telescopic joint and the parking station with hydraulic latches
- Requires a smaller installation crew and minimizes personnel in moon pool
- Attaches up to six auxiliary lines permanently to the split ring

The Rapid-dePloy Auxiliary Line SR Connection System incorporates a hydraulically latched split ring with preinstalled drape hoses that rapidly attach to the telescopic joint. When not in use, it is stored below the drill floor using an optional parking station. It includes two balanced handling tools for installation and retrieval.
**Rapid-deploy Boost Line Termination Joint**

Del-Quip’s Rapid-deploy Boost Line Termination Joint solves the challenge of maintaining drilling mud velocity inside the riser in deep water. By boosting mud flow velocities from the lower end of the riser, cuttings and heavy particulates can be returned to the surface. Several valve options are available to test the boost line and to prevent backflow into the boost line from the riser. The boost line may also be terminated in the flex joint extensions on the lower marine riser package.
Rapid-deploy Lower Flex Joint Assembly

The Rapid-deploy Lower Flex Joint Assembly is designed to accommodate angular misalignment between the riser and BOP stack. The flex joint assembly can have provisions for wear bushings. The top of the flex joint has an FRC Pin Up Flange Connection. The flex joint provides auxiliary line termination points. This may include the boost line. The auxiliary lines mate to the lower marine riser package flex loops.

Features

- Operating depths up to 12,000 ft
- Angular deflections up to 10 degrees
- Trouble-free operation even in H₂S service
- Easily retrofitted into any subsea BOP stack
- Maintains rigidity under extreme pressure
- Flexing capability reduces stresses in riser and eases reaction forces on the BOP stack
**Rapid-dePloy Hydraulic Riser Spider and Gimbal**

Dril-Quip’s Rapid-dePloy Hydraulic Riser Spider and Gimbal provide a quick, secure and safe method for running Dril-Quip’s Rapid-dePloy Marine Drilling Riser System. Together they serve as the landing point for each joint as the riser is run and are designed to support the entire weight of the drilling riser at the rotary table.

**Features**

- Gimbal’s six bearing elements allow full load distribution and up to six degrees of angular misalignment
- Spider support plates are hydraulically opened and closed
- Set of pins automatically locks plates in the extended (closed) position
- Locking pins will remain locked even with loss of hydraulic pressure
- Locking pins provide a visual indicator that plates are fully closed and locked
- Standard gimbal is designed to fit in a standard 60” diameter rotary table
- Spiders and gimbals are available in several capacities and rotary table sizes
- To ensure that spider is not opened accidentally, the support plate “open” function and the locking pin “unlock” function are plumbed separately
- Four retractable guidance plates position the riser flange in the middle of the spider when closing the plates
- Hydraulic jumper hoses mounted on the spider are for use with hydraulic riser handling tool
- Spider can be used with the rotary table separately
Dril-Quip’s Rapid-dePloy Auto-Fill Valve Joint protects the riser system from collapsing if the fluid inside the riser is lost. The auto-fill valve senses differential pressure between the riser bore and the ocean. If a predetermined differential pressure is exceeded, the valve’s sliding sleeve is opened, flooding the riser with seawater and equalizing the external and internal pressures, thereby preventing catastrophic failure of the riser. An ROV hot stab is provided to reset and close the auto-fill valve. It can also be fitted with a number of options for direct hydraulic override control for both opening and closing the valve.

The auto-fill valve is usually positioned 100 to 150 ft below the surface.
**DX™ Hydraulic Connectors**

Dril-Quip’s DX Hydraulic Wellhead Connector Series is ideally suited for use with a subsea BOP stack and lower marine riser package. The connectors are available in three models: the DX-10, DX-15 and the DXDW-15. These field-proven, trouble-free connectors are designed to provide high bending, high tensile and high pressure capacities.

**Features**

- Trouble-free operation
- Unique latching segments provide uniform load distribution
- Latching segments automatically retract when the connector is unlocked
- Easily retrofitted into any subsea BOP stack connection
- DX Seal Ring with primary metal-to-metal sealing and emergency backup, metal-to-metal sealing profile
- Ring gasket retaining mechanism provides simple, reliable remote gasket installation and removal
- Large lock and unlock porting for quick response
- DX-DW Connectors available for deepwater, higher preload requirements
- Field-proven performance
The Rapid-dePloy Diverter System is designed for rapid installation and provides pressure and flow diversion in the event of a shallow fluid kick. The diverter cartridge and split insert packers are locked and retained with weight-set locking segments. Insert packers can be installed and retrieved similar to split rotary bushings. Running and retrieving tools can be used to test seals, valves and insert packers. An optional annular cartridge with Complete Shut-Off (CSO) is available on request.

**Features**

- Provides field-proven performance and protection from shallow gas
- Minimizes mechanical and hydraulic connections required for installation
- Diverter cartridge assembly and split insert packers are run through rotary table into diverter housing and are weight-set and auto-locking (no dogs to lock or hydraulics)
- Available in all rotary sizes up to 72"
- Permanent housing attached under rotary table eliminates manual connect / reconnect of flowline and fill-up line
- All diverter components positively oriented to assure outlet alignment
- Various-sized diverter elements provide complete BOP protection while drilling or running casing
- Diverter housing has an external latch groove for “parking” solid tension ring
- Equipped with an integral flex joint and riser connection
- Segmented lock rings provide superior distribution of thrust loads for diverter cartridge and packer
- Reliable passive seals on hard-faced sealing surfaces to isolate the diversion line outlets; these seals are automatically energized when the diverter is locked down – no hydraulics are required
- Up to 2,000 psi working pressure systems are available upon request
- Standard 500 psi working pressure allows the use of low-pressure components
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