

#1 Halliburton RCD 3000 Rotating Control Device: When drilling scenarios demand precise flow control, Halliburton Rotating Control Devices (RCD) are essential. Halliburton RCD tools fit easily under most drilling rigs without modifications for better manoeuvrability. Operators save rig-up time and reduce the need for onsite inventory by changing stripper elements independent of the bearing assembly. With a full suite of RCD tools for low, intermediate, and high-pressure applications, Halliburton provides safe and efficient containment throughout the process.

The Halliburton suite of RCD tools features stripper elements that can be changed independent of the bearing assembly, saving rig time and reducing onsite inventory at the rig. They are available in rotating head sizes from 7-1/16-inch 3000 psi to 30-inch 2000 psi inlet flange; and weld-on connection sizes in 16, 20, 24, and 40 inches.

Marine Sentry RCD 3000™ rotating control device: The unique remote bearing latch system improves element and bearing changes. The entire bearing assembly can be released and hoisted to the rig floor using the drill pipe. At the rig floor the bearing can be serviced and the elements can be changed. Also available is a dual element configuration that can be deployed through the rotary table.

The Marine Sentry RCD also features real-time wireless monitoring of pressures, temperature, vibration and RPM, giving you predictive indicators of element changes.

Positives:

- The most modern piece of equipment with realtime data, predictive monitoring
- Worldwide presence will cover build, installation and operations site in Brazil.
- Easy release of bearing assembly. Well designed.

Negatives:

- High cost of equipment
- Unknown additional personnel required to operate system, unsure if can buy or supply.





#2 Weatherford International Subsea Rotating Control Device (Marine Series) 7875 DS RCD: Enables transitions between drilling phases with no NPT: Built for rugged marine conditions and virtually any offshore application, SeaShield RCDs help you to protect your personnel, equipment, time, budget, and the environment, even in complex deepwater wells.

- 5,000-psi (34.5-MPa) static pressure ratings.
- Longest-lasting seal life in the industry.
- Nitrogen tested to API 16RCD standards for a gas-tight seal
- Improved differential pressure sensors for enhanced pressure monitoring.
- State-of-the-art latching system that keeps bearing assembly in place to safeguard against variances in wellbore pressure

Positives:

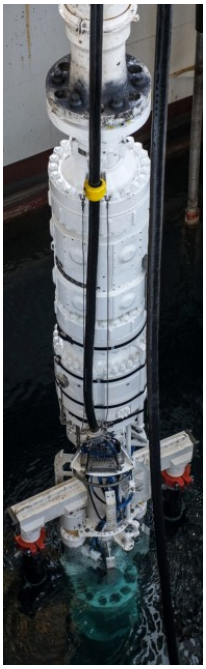
- The strongest presence in Brazil and a partnership with Petrobras with worldwide presence will cover build, installation and operations site in Brazil.
- Will be able to smoothly transition Government approval of MPD systems since both Petrobras and Weatherford already have agreement.
- Largest MPD suppliers in the world with unlimited support.

Negatives:

- Older system, well proven but downtime is regular.
- Previous experience, high cost of equipment
- Numerous additional personnel required to operate system, constant overhead.

- Rig personnel not involved in day-to-day operation

#3 SLB: M-I SWACO supports an extensive fleet of rotating control devices (RCDs) for use in a variety of applications, including annular fluid containment and pressure management in onshore and offshore drilling environments. Across the M-I SWACO RCD portfolio, each system is compatible with both rotary drives and top drives and features seals made of natural rubber, nitrile, butyl, or urethane.
Pressure ratings for the Sealed Rotating System (SRS) and internal seals have been determined through in-house lab testing with a test plug installed. Due to the uncontrolled environment of well drilling operations. Schlumberger does not, under any circumstances, recommend that its RCDs be used as primary blowout prevention equipment. Pressure ratings vary by sealing element material and drill pipe size.



- Operates below tension ring
- 18¾-in pass-through
- Redundant, reliable design that requires no wear sleeve
- Piston land-and-lock mechanism
- Integrated @balance Speed* sealed rotating system
- Dual sealing element
- Single-trip deployment of the SRS
- API 16RCD monogrammed
- Multiple ways to confirm latching integrity
- Single-interface connection for hydraulic and controls
- Compatible with any riser system
- Submersible
- NACE compliant
- Max Rotating Speed 200 RPM
- Max Pass through 9-1/4” inch
- Static Pressure 2,500 psi
- Sealing Elements: Natural Rubber, Nitrile, Polyurethane, Butyl
- Slim Line annular Blowout Preventer and flow spool, weighs just over 80,000 lb and measures 40-ft long, making it the shortest and lightest available on the market

Positives:

- Largest company in the world with worldwide presence will cover build, installation and operations site in Brazil.
- Good combination of MiSwaco and SLB on valves / choke systems.
- Lightweight and simple to use, single life operation during deployment.
- Worked with Stena to produce their system. So willing to work alongside client.

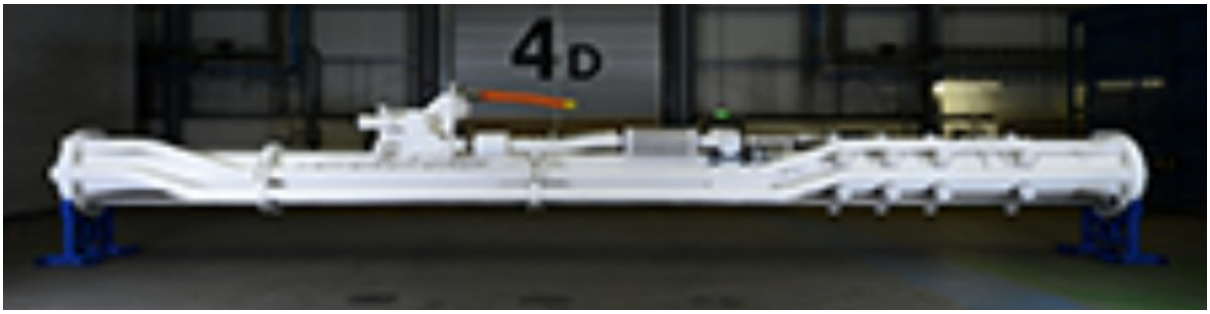
Negatives:

- Pressure ratings in operation unknown, not clear/ambiguous.
- Unknown cost of equipment
- Unknown additional personnel required to operate system, buy or rent personnel overhead.
- Rig personnel not involved in day-to-day operation if operated by SLB/MiSwaco

#4 Oil States: Oil States compact Managed Pressure Drilling (MPD) Riser Integration Joint (RIJ) Has been designed to improve safety and increase operational efficiency.
Hands-free flow line and umbilical stabbing removes the need for man-riding.
Oil States joint is around half the length and up to 1/3rd the weight of conventional RIJ’s, making it easy to handle and fast to rig-up.

Being fitted with twin retrievable stripper packers and bearing assembly, the joint is completely serviceable whilst over well centre. Stripper packers are run and retrieved by drill pipe tool removing the need to pull the RIJ from the string or return to the onshore service centre to replace annular seals.

- Approximately half the length and 1/3rd the weight of conventional Riser Integration Joints.
- Fast rig-up with hands-free flow line and umbilical stabbing.
- Fully serviceable while over the well centre.
- 18-3/4″ through bore with stripper packers and bearing assembly removed.
- Integrated riser gas handling.
- Combined managed pressure drilling and riser gas handling



Positives:

- UK, Singapore and Brazil Operations will cover build, installation and predicted operations site in Brazil.
- Close to Electro Flow Controls in Aberdeen which would be envisaged to manufacture Control System; therefore, integration testing can be conducted prior to sending to rig for installation.
- Stated size of equipment and working parts massively reduced.
- In the same country as control system manufacturer.

Negatives:

- Unsure if the system has been previously manufactured and not a lot of product information, without official approach current status unknown.
- Unknown cost
- Unknown additional personnel required to operate system, unsure if can buy or supply.
- Unknown if dual element.

#5 NOV Active Control Device (ACD) System; Is the industry's first active, non-rotating sealing device for MPD operations. The ACD seals the wellbore annulus and diverts returns using a novel, actively energized sealing element controlled by our industry-standard annular packer system. The design allows the system to determine the sealing element condition, while an external sealing element control contains high-pressure wellbore fluids even after the sealing element reaches a worn state. The ACD eliminates complex bearing assemblies and high-wear rotary seal components found in conventional passive rotating control devices (RCD) that are the source of many MPD problems. Monitoring and controlling the seal reduces maintenance, extends service life, and enhances safety.



ACD, developed specifically for deepwater service, is a fundamental advance in annular pressure containment that eliminates passive rotating control device (RCD) design deficiencies. The ACD's pioneering

MPD capabilities can dramatically reduce costs, eliminate common operational problems, and improve reliability and safety.
The Compact Riser Gas Handling (RGH) system permanently integrates DSIT and flow spool functions in a single joint to remove connections and reduce weight. The compact RGH may interface with our riser flanges or directly with OEM riser equipment as the client determines. Installation of a riser gas handling system improves safety and kick response options while making the rig MPD ready.
rotating control devices (RCD) with dual, non-rotating API 16RCD seal sleeve elements. The device eliminates the RCDs bearing assembly for a significant reduction in maintenance and operating costs. ACD active seal sleeve elements are controlled by adjusting the annular packer closing pressure. As the seal wears, the closing force is maintained to ensure the wellbore seal.

Positives:

- Worldwide coverage with no boundaries to working for Petrobras in Brazil Operations.
- Very good support service
- Less breakdowns due to new type of system designed by NOV (non-moving parts)
- Possible to supply entire MPD system
- DNV and ABS approved system

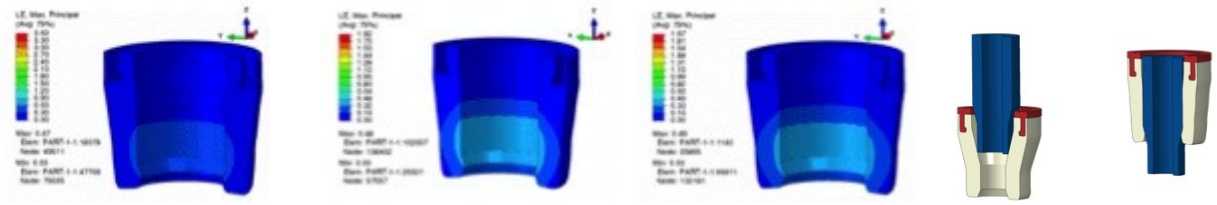
Negatives:

- Unsure downtime is accurate or sales pitch. Current data unknown, need proof.
- Unknown cost, do NOV supply one piece of equipment or only supply entire system
- Unknown additional personnel required to operate system, unsure if can buy or supply.

#6 Regional Marine Engineering Services: RMES Singapore. The RMES MPD/RCD is designed to be a flexible system that can be constructed to suit the customers' requirements.
"THE ADAPTIVE SYSTEM" Available basic configurations are. May be very good for RCD Sealing Elements

- Below tension ring (BTR)
- Below tension ring (BTR)
- Dual Packer Elements
- ID Through Bearing Assembly Ø9-1/4"
- ID Through Bore Protector Ø17-5/8"
- D Through RCD Housing Ø18-3/4"

Advanced Element Simulation: Od Sealing Element:



Positives:

- Cheap alternative based in Singapore close to main office. May be able to supply sealing elements and/or RCD, need further product information.
- High QA/QC control of subsea equipment (good track record).

Negatives:

- Small company no known product information.
- Unknown support services if any outside Singapore.
- Unknown additional personnel required to operate system, unsure if can buy or supply.
- Unknown if dual element.

#7 CCSC Petroleum: No product information: Not recommended, avoid



#8 Aker MPD/MPO System:

Positives:

- Aker Solutions presence in Brazil, previously signed Respol Sinopec Brazil contract.
- Aker MPD system being introduced by Aker/MPO is fully automated and simple to operate, needing few people to run the equipment.

Negatives:

Not a lot known of system, possibly no longer in MPD