



## D-Tech Rotary Steerable System (RSS)

**QUESTION:** IS THE D-TECH RSS COMPATIBLE WITH ANY MWD/LWD SYSTEM?

**ANSWER:** The D-Tech RSS can be run with any MWD/LWD system, giving customers freedom to assemble their preferred BHA.

**QUESTION:** WHAT MUD MOTORS CAN BE RUN WITH THE D-TECH RSS?

**ANSWER:** The D-Tech RSS is compatible with any mud motor. D-Tech recommends the use of high-torque, even-wall motors to reduce the risk of micro stalls. These motors provide smooth torque and rotary speed delivery for maximized penetration rates.

**QUESTION:** WHAT ARE THE LIMITATIONS ON FLOW RATE (MIN AND MAX)?

**ANSWER:** Minimum and maximum flow rates are dependent on tool size. The D-Tech RSS can be configured for specific flow regimes and mud densities for optimized performance.

- RSS475/4¾-in. tool: flow range 170 to 400 gpm
- RSS675/6-in. tool: flow range 300 to 670 gpm
- RSS900/9-in. tool: flow range 410 to 1,200 gpm

For flow rates outside these specified limits, contact the D-Tech team.

**QUESTION:** WHAT IS THE DOGLEG CAPABILITY OF THE D-TECH RSS? WHAT IS THE MAXIMUM DOGLEG PASSTHROUGH?

**ANSWER:** The D-Tech RSS typically achieves dogleg severities as follows:

- RSS475: 8 degrees/100 ft
- RSS675: 8 degrees/100 ft
- RSS900: 5 degrees/100 ft

The maximum dogleg capability of the D-Tech RSS for any given application is influenced by formation, BHA and/or bit design, run parameter, and stabilizer gauge.

D-Tech advises each customer on the expected performance for any given application and offers optimization suggestions for BHA configurations.

**QUESTION: WHAT ARE THE LCM TOLERANCES FOR THE SYSTEM (SIZE AND QUANTITIES)?****ANSWER:** An innovative filter design allows the D-Tech RSS to provide industry-leading LCM handling capabilities.

The specified maximum LCM concentrations are as follows (medium-sized nut plug):

- RSS475: 30 lb/bbl
- RSS675: 50 lb/bbl
- RSS900: 50 lb/bbl

For other types of LCM, the maximum concentration is subject to material type.

**QUESTION: WHAT ARE THE DIFFERENCES BETWEEN PUSH-THE-BIT AND POINT-THE-BIT ROTARY STEERABLE SYSTEMS? WHAT TYPE OF SYSTEM IS THE D-TECH RSS?****ANSWER:** Both RSS types allow directional control with full, continuous rotation of the drillstring from surface. Using an RSS eliminates the need to alternate between the sliding and rotating required with steerable motor assemblies combined with a bent housing.**Point-the-bit systems**

In a point-the-bit RSS, the bit axis is tilted relative to the drillstring axis. Tilting is commonly achieved by:

- a. deflecting an internal flexible shaft or
- b. using an offset mandrel.

Both methods can use either a fixed or variable offset. The key drawback of point-the-bit RSS is the design complexity required to implement its functionality. It typically requires large, compensated volumes of hydraulic oil, universal joints for torque transmission, and drilling fluid/oil interface seals. This complexity typically leads to limited reliability, high repair cost, and long turnaround times.

Some point-the-bit RSS rely on stabilized nonrotating external housings to maintain the correct orientation of the drill bit axis tilt to the formation (toolface). These RSS suffer from an increased risk of getting stuck in hole, as the non-rotating reference stabilizer is typically unable to transmit torque during reaming operations, allows cuttings settlement, and can hang on ledges created in the wellbore while drilling through different formations and shallow angles.

Point-the-bit RSS that use a fully rotating offset mandrel to provide bit tilt typically require large amounts of electric power to maintain the toolface control to overcome the drilling and formation forces. The high-power electronic systems are prone to reliability issues caused by heat buildup and fluctuations in high current flows.

**Push-the-bit systems**

The D-Tech RSS uses push-the-bit technology. In these types of systems, a controlled side force is applied to the side of the borehole, pushing the drill bit in the opposite direction to achieve the required wellbore trajectory control.

The side force is generated hydraulically by the bit pressure drop defined by the bit nozzles. A small percentage of the overall mud flow through the drillstring is deviated to the hydraulic pistons of the D-Tech RSS. The benefits of this concept are that only a small amount of electric power is required to power the tool electronics and mud control valve. It minimizes internal wear and makes the electronics inherently more reliable.

It also allows the control electronics to be fully scalable, meaning the same control unit assembly is used for all tool sizes with only a collar-specific adapter kit.

Together with fast turnaround times between runs, this design allows the D-Tech RSS to offer customers with high asset efficiency and availability.

The ruggedized, fit-for-purpose design is substantially more robust and suitable to handle challenging drilling conditions observed in many high-performance land drilling applications.

Compared to other push-the-bit RSS, the D-Tech RSS does not require mounting holes in the collar housing to control electronics—a frequent source of fatigue cracks seen in other commercial systems, especially when subjected to high levels of stick-slip or high-frequency torque oscillations.

**QUESTION:** WHAT ARE THE THREAD CONNECTIONS ON THE D-TECH RSS?

**ANSWER:** In its standard configuration, the D-Tech RSS uses the following drill bit (lower) connections X upper connections:

- RSS475: 3½-in. Reg box X 3½-in. IF
- RSS675: 4½-in. Reg box X 4½-in. IF
- RSS900: 6 5/8-in. Reg box X 6-in. Reg box

Custom crossover subs to other thread types and custom connection collars are available on request.

**QUESTION:** WHAT IS THE PRESSURE DROP THROUGH THE SYSTEM?

**ANSWER:** A large, open-flow path through the D-Tech RSS results in a minimal overall pressure drop through the system.

**QUESTION:** WHAT IS THE MAXIMUM RPM FOR RUNNING THE D-TECH RSS?

**ANSWER:** The maximum continuous operating rotational speed to achieve maximum steering performance is 330 RPM for the majority of the tool sizes. Contact your D-Tech representative for more information.

**QUESTION:** HOW IS SURFACE TESTING CONDUCTED PRIOR TO RUNNING THE D-TECH SYSTEM IN HOLE?

**ANSWER:** The ease with which the D-Tech tool can be picked up, programmed, and controlled is essential for adding customer value.

The D-Tech RSS is fully programmed prior to deployment. This enables a pick-up-and-go process at the rig site without the need for a high-side or scribing procedure. In normal operating conditions, a D-Tech system BHA can be picked up quicker than a conventional motor BHA.

The system is controlled through an intuitive, easy-to-use software application available for iOS and Android platforms, eliminating the need for expensive surface equipment.

**QUESTION:** HOW FAR ARE DIRECTIONAL SENSORS FROM THE BIT WHEN RUNNING THE D-TECH RSS?

**ANSWER:** D-Tech's rotary steerable tools facilitate pinpoint accuracy using a three-axis accelerometer package coupled with a roll gyro located four feet from the drill bit to continually record inclination.

This inclination measurement is used as the basis of a closed-loop control system to maintain directional control to within a few feet of the target.

**QUESTION:** WHAT IS YOUR CURRENT FLEET UTILIZATION FOR THE D-TECH RSS?

**ANSWER:** The scalable design of the D-Tech RSS uses a single-sized electronics control assembly for every tool size.

Fast tool turnaround time of less than one day provides the D-Tech RSS with outstanding asset efficiency and fleet utilization, which minimizes downtime and maximizes productivity for customers.

**QUESTION:** DESCRIBE THE DOWNLINK PROCESS FOR COMMUNICATING WITH THE D-TECH RSS.

**ANSWER:** The D-Tech RSS uses a simple but robust communication system.

Commands are sent by rig pump flow modulation through 20 to 25% variation in flow. Downlinking is best performed while drilling, saving time. The intuitive D-Tech downlink software can be installed on any laptop, iPhone, or Android device.

**QUESTION:** WHAT DOWNLINK VERIFICATIONS ARE RECEIVED AT THE SURFACE?

**ANSWER:** Downlink verification is done on surface through a WITS interface module that runs the same detection software used in the tool and verifies that the correct downlink command was sent.

Communication with the D-Tech RSS is unidirectional. Survey data provides an indication that the tool received the desired downlink.

**QUESTION:** WHAT CRITERIA DO I USE TO DECIDE MOTOR/BIT COMBINATIONS THAT ARE RUN WITH THE D-TECH RSS?

**ANSWER:** To optimize performance, D-Tech provides guidelines for recommended drill bit and motor combinations.

**QUESTION:** WHAT ARE RIGSITE PERSONNEL REQUIREMENTS FOR RUNNING THE D-TECH RSS?

**ANSWER:** The D-Tech RSS can be run by any qualified directional driller after they complete the recommended minimum training.

The directional driller can be accompanied by a D-Tech drilling specialist as an onsite advisor to improve downhole run performance.

24/7 remote support is also available.