PowerDrive Orbit
Rotary steerable system
The PowerDrive Orbit* rotary steerable system (RSS) is a highly reliable push-the-bit RSS that increases drilling efficiency and enhances trajectory control using a newly developed pad actuation design on any rig type worldwide.

Optimize directional drilling with the PowerDrive RSS family
The Schlumberger PowerDrive* RSS family includes a broad array of directional drilling technologies designed to deliver full rotation that reduces drag, improves rates of penetration (ROP), decreases stick/slip, and achieves superior hole cleaning in a variety of operating scenarios. The fully rotational steering systems improve penetration rates by eliminating stationary components that cause friction and inefficiency.

New Features and Benefits
- New pad design with metal-to-metal sealing to handle corrosive drilling fluids and severe downhole conditions
- Expanded revolution rate limits, supporting up to 150 rev/min from the current limit of 220 rev/min for higher ROP and stick and slip control
- Six-axis continuous inclination and azimuth measurements for better true-vertical-depth (TVD) definition and accurate well positioning
- Dual downlink options to fulfill all commands from surface in any rig type
PowerDrive Orbit RSS

Increases operating window in challenging drilling conditions
With wells becoming increasingly more complex, operators need solutions that go beyond the limits of conventional technology. The PowerDrive Orbit RSS expands the operating envelope of rotary steerable technology with features that deliver greater durability, reliability, and efficiency.

The system includes a newly developed actuation pad designed with metal-to-metal sealing to withstand the most aggressive drilling fluids and challenging hydraulic designs. The pad pushes against the formation to steer the well and provide precise directional control in complex 3D well trajectories.

PowerDrive Orbit system, with its newly developed pad design and self-steering automation, helped improve ROP and drill from 4,085 to 4,704 m while keeping verticality of the well within 0.5 degrees.

Delivers accurate well placement
The durable system also includes new and comprehensive six-axis continuous inclination and azimuth measurements. The multiaxial component allows automatic hold inclination and azimuth capability. The system also features self-steering capabilities making automatic adjustments in a closed-loop system to keep a specific inclination and azimuth. With better automatic trajectory control, hole quality is improved, the tangent is smoother, and tortuosity is minimized. This new feature also allows the most precise kickoff from vertical.

Enhances drilling efficiency
The PowerDrive Orbit RSS is fully compatible with all existing BHA components being used today and complements other tools in the PowerDrive suite of services. The PowerDrive Orbit vortex™ motorized hybrid rotary steerable system (RSS), can perform at speeds up to 350 rev/min while still maintaining directional control and consistent steerability. Performing multiple functions while drilling, the time-saving system has been engineered to drill wells, from shoe to total depth (TD), in a single run.

Example of Time Savings in Sandstone Reservoir

PowerDrive Orbit RSS drilled an 8½-in section in approximately 3 days, 8.8 days faster than the operator’s planned trajectory in the Misoa formation.

PowerDrive Orbit RSS Helps Save 21 Days and Increase Lateral Length by 33%

Middle East operator drills a new record 6¾-in hole 12,690-ft deep in a single run

An operator needed an RSS that could maintain directional control while drilling deep laterals in a field that presented high stick/slip and severe shock levels.

Despite high stick/slip peak values reaching 350 rpm, the PowerDrive Orbit RSS helped overcome severe torque and drilled a record 12,690 ft in a single run, 21 days ahead of schedule.

Example of Time Savings in Sandstone Reservoir

Depth, ft

0 2 4 6 8 10 12 14 16

Time, d

0 2 4 6 8 10 12 14 16

Actual

Planned

8.8 days saved

13,000

13,200

13,400

13,600

13,800

14,000

14,200

13,000

13,200

13,400

13,600

13,800

14,000

14,200

PowerDrive Orbit system has achieved successful runs in conventional and complex environments across the globe, including in the Middle East, United States, Gulf of Mexico, Mexico, Colombia, Venezuela, China, and the North Sea.

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Shell needed a reliable RSS that could sustain HPHT conditions, including measured static temperatures up to 165 degC, while keeping the well vertical.

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### Specifications

<table>
<thead>
<tr>
<th>PowerDrive Orbit 475</th>
<th>PowerDrive Orbit 675</th>
<th>PowerDrive Orbit 900</th>
<th>PowerDrive Orbit 900 Large Borehole</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nominal OD (API)</strong></td>
<td>4.75 in</td>
<td>6.75 in</td>
<td>9.625 in</td>
</tr>
<tr>
<td><strong>Hole size</strong></td>
<td>5½ in to 6½ in</td>
<td>8½ in to 8¾ in</td>
<td>12¼ in to 14¾ in</td>
</tr>
<tr>
<td><strong>Overall length</strong></td>
<td>13.5 ft</td>
<td>13.53 ft</td>
<td>14.00 ft</td>
</tr>
<tr>
<td><strong>Max. collar dogleg</strong></td>
<td>30°/100 ft [30°/30 m] sliding, 10°/100 ft [10°/30 m] rotating</td>
<td>16°/100 ft [16°/30 m] sliding, 5°/100 ft [5°/30 m] rotating</td>
<td>8°/100 ft [8°/30 m] sliding, 4°/100 ft [4°/30 m] rotating</td>
</tr>
<tr>
<td><strong>Build rate</strong></td>
<td>0°– 8°/100 ft</td>
<td>0°– 8°/100 ft</td>
<td>0°– 5°/100 ft</td>
</tr>
<tr>
<td><strong>Max. operating torque †</strong></td>
<td>9,000 ft.lbf [12,200 N.m]</td>
<td>16,000 ft.lbf [21,700 N.m]</td>
<td>48,000 ft.lbf [65,000 N.m]</td>
</tr>
<tr>
<td><strong>Max. operating load</strong></td>
<td>340,000 lbf [1,500,000 N]</td>
<td>1,100,000 lbf [4,900,000 N]</td>
<td>1,400,000 lbf [6,200,000 N]</td>
</tr>
<tr>
<td><strong>Max. weight on bit</strong></td>
<td>As recommended by drill bit vendor</td>
<td>As recommended by drill bit vendor</td>
<td>As recommended by drill bit vendor</td>
</tr>
<tr>
<td><strong>Weight of assembly in air</strong></td>
<td>584 lbs</td>
<td>1,276 lbs</td>
<td>2,445 lbs</td>
</tr>
<tr>
<td><strong>Max. lost circulation material</strong></td>
<td>35 lbm/bbl medium nut plug</td>
<td>50 lbm/bbl medium nut plug</td>
<td>50 lbm/bbl medium nut plug</td>
</tr>
<tr>
<td><strong>Lateral vibrations</strong></td>
<td>Shock level 3 (50-gn threshold), 30-min limit</td>
<td>Shock level 3 (50-gn threshold), 30-min limit</td>
<td>Shock level 3 (50-gn threshold), 30-min limit</td>
</tr>
<tr>
<td><strong>Stick/slip</strong></td>
<td>± 100% mean rotational speed, 30-min limit</td>
<td>± 100% mean rotational speed, 30-min limit</td>
<td>± 100% mean rotational speed, 30-min limit</td>
</tr>
<tr>
<td><strong>Max. rotational speed</strong></td>
<td>350 rpm</td>
<td>350 rpm</td>
<td>350 rpm</td>
</tr>
<tr>
<td><strong>Max. hydrostatic pressure</strong></td>
<td>20,000 psi [138 MPa]</td>
<td>20,000 psi [138 MPa]</td>
<td>20,000 psi [138 MPa]</td>
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<tr>
<td></td>
<td>14,500.00</td>
<td>56,000.00</td>
<td>259,000.00</td>
</tr>
<tr>
<td><strong>Mud sand content</strong></td>
<td>1% by volume</td>
<td>1% by volume</td>
<td>1% by volume</td>
</tr>
</tbody>
</table>

### Rotary Connections

- **Collar upper connection**: 3½ IF box, 4½ IF box, 6 Reg box, 7⅝ Reg box
- **Bit box**: 3½ Reg, 4½ Reg, 6 Reg, 7⅝ Reg

### Sensors

- **Bit box to gamma ray**: 5.86 ft [1.79 m], 6.40 ft [1.95 m], 7.16 ft [2.18 m], 7.91 ft [2.43 m]
- **Bit box to inclination**: 6.79 ft [2.07 m], 7.27 ft [2.21 m], 8.49 ft [2.60 m], 9.67 ft [2.95 m]
- **Bit box to azimuth**: 8.10 ft [2.46 m], 8.69 ft [2.65 m], 10.30 ft [3.13 m], 10.97 ft [3.30 m]
- **Inclination accuracy**: 0.11° (at 1 sigma level), 0.11° (at 1 sigma level), 0.11° (at 1 sigma level), 0.11° (at 1 sigma level)
- **Azimuth accuracy**: 1° at 1° latitude, 1° at 1° latitude, 1° at 1° latitude, 1° at 1° latitude
- **Gamma ray accuracy, azimuthal 4-quadrant**: ± 5% (50-s averaging window), ± 5% (50-s averaging window), ± 5% (50-s averaging window), ± 5% (50-s averaging window)
- **Shock detector threshold, radial**: 50 g (50 g max. peak), 50 g (50 g max. peak), 50 g (50 g max. peak), 50 g (50 g max. peak)

†Depending on WOB  ‡Depending on mud weight values  §Optional 350 degF [175 degC] available.

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**Expanding applications with dual downlink communication**

The system offers dual downlink capabilities—the first option allows for downlink activation by a traditional flow change command, and the second is a new collar RPM-based feature that allows direct activation by changing the collar rotation rate.

The flow change command, which is typically used, is less affected by high stick/slip and high torque. The new collar RPM-based command is less affected by the slow reaction from the mud pumps when drilling. This application enables an RSS to be run on any type of rig, including mechanical rigs without a silicon-controlled rectifier, which require fast-reacting manipulation of surface pumps to send the command.
PowerDrive Orbit

With performance focused design, high-speed capabilities, and long durability, the PowerDrive Orbit rotary steerable system improves drilling efficiency and well placement in all conventional and complex environments.