PETRONIC

valves and actuators
**Subsea Electric Actuators**

**Benefits**

- **Environmentally Friendly**
  - No leaks, zero discharge

- **Advanced Diagnostic**
  - Continuous monitoring - partial stroking test - torque limiting

- **Reliability**
  - 25 years of operational life - SIL 2 certified in High Demand Mode

- **Safety First**
  - Overall risk mitigation of the plant

- **Project Cost Savings**
  - No hydraulic umbilicals and no HPU

- **Power Efficiency**
  - Avoiding hydraulic pressure drops and providing power consumption optimization

**Petronic Main Features**

**Smart Control Characteristics**
- Start/Stop torque control
- Continuous positioning
- Speed setting and control
- Max output torque limiting device
- Feed-back control position
- Speed control shaping to power consumption optimization

**Interconnections Utilities**
- Serial connection for test bench interface
- Different communication protocols available: Canbus (SILS Level 2 - Fault tolerant), CANopen, MODBUS, TCP/IP, ETHERNET

**Diagnostic Characteristics**
- Continuous voltage and current supply monitoring and control
- Partial stroking test
- Motor high temperature self-protection

**Mechanical Characteristics**
- Nominal torque: 2,700 Nm ISO 13628-8 class 4 (different setting upon request)
- Nominal motor torque: 10 Nm
- Nominal motor speed: 1000 rpm

**Electric Characteristics**
- Nominal voltage 24 VDC (range 12-36 VDC)
- Stand-by power consumption: 16W
- Different output torque on request

**Execution**
- Stand-alone
- Back-up battery

**Environmental Condition**
- Pressure compensated electronic design:
  - 300 bar (tested up to 450 bar) for 12,000 cycles
- Working temperature from -10°C to +65°C
qualification tests PERFORMED

- Functional test - ISO 13628
- Endurance Test (10,000 cycles) - ISO 13628
- Hyperbaric and Endurance Test (12,000 cycles @ 450 bar) - ISO 13628
- Motor Driver Board Test
- Mother Board Test
- Power Board Test
- Controller Board Test
- Electronic-Motor System Test
- Thermal Analysis Test
- PR2 Qualification Test (-10°C to +65°C) API 6A and API 17D
- Environmental Compatibility Test
- Vibration and Shock Test
- Electromagnetic Compatibility Test
- PETRONIC EROV Reliability Analysis

petronic ADAPTABILITY

1. ball valves
2. check valves
3. slab gate valves
4. double expanding gate valves
petronic development approach
API RP 17N / ISO 13628-13
Recommended practice for subsea production system reliability and technical risk management

sizes and performances
TO MEET EVERY REQUIREMENT
Petronic subsea electric actuator is ergonomic, modular designed and fully customizable. Different model sizes are available to meet project specifications and Client’s requirements
petronic

ADVANTAGES

Subsea electric actuation offers several advantages:

- Environmentally friendly
- Overall project cost reduction
- Real-time feedback
- Power efficient
- Pollution emission free
- Certified SIL in accordance with IEC 61508: 2000

sil calculation

AND RELIABILITY ANALYSIS

<table>
<thead>
<tr>
<th>SAFETY INTEGRITY LEVEL</th>
<th>safety integrity levels for high demand mode of operation (IEC 61508-1 table 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>safety integrity level</td>
<td>probability of a dangerous failure per hour</td>
</tr>
<tr>
<td>SIL 4</td>
<td>&gt;= 10^-9 to &lt;10^-8</td>
</tr>
<tr>
<td>SIL 3</td>
<td>&gt;= 10^-8 to &lt;10^-7</td>
</tr>
<tr>
<td>SIL 2</td>
<td>&gt;= 10^-7 to &lt;10^-6</td>
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<tr>
<td>SIL 1</td>
<td>&gt;= 10^-6 to &lt;10^-5</td>
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<tr>
<th>HARDWARE FAULT TOLERANCE</th>
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<tr>
<td>architectural constraints on type A* safety-related subsystems (IEC 61508-2 table 2)</td>
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<tr>
<td>SAFE FAIL FRACTION</td>
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<tr>
<td></td>
</tr>
<tr>
<td>&lt; 60%</td>
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<tr>
<td>60% ÷ 90%</td>
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<tr>
<td>90% ÷ 99%</td>
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<tr>
<td>&gt; 99%</td>
</tr>
</tbody>
</table>

table 3 “safety integrity levels for high demand mode of operation”

table 2 “architectural constraints on type A* safety-related subsystems”
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