Schlumberger

TRM-5

Tubing-retrievable, surface-controlled subsurface safety valve

APPLICATIONS

- Sweet to moderately corrosive applications
- Temperatures from 40 to 300 degF [4 to 149 degC]
- Pressures to 10,000 psi [68,950 kPa]
- Setting depths to 1,000 ft [305 m]
- Cement-through applications

BENEFITS

- Enhances safety, reliability, and long-term operation by
  - reducing operating friction
  - reducing solids and scale deposition
  - minimizing the number of seals
  - optimizing the flow path and clearance between sliding components

FEATURES

- Simple slickline procedure with or without secondary communication
- Optional materials for polished bores
- Integral self-equalizing mechanism
- All metal-to-metal sealing
- Metal-seal communication and lock-out mechanism
- Design and testing to API and ISO standards

The TRM-5* tubing-retrievable, surface-controlled subsurface safety valve is a general service, self-equalizing, cement-through flapper valve with a premium rod piston and metal-seal body joints.

The compact design, engineered for versatility and reliability, incorporates the best of field-proven Schlumberger technologies. The TRM-5 safety valve features rod piston actuation, metal-to-metal seal body joints, a rugged flapper-closure mechanism, and a minimized number of critical, static, and dynamic seals to ensure maximum reliability. The TRM-5 safety valve can be used in cemented monobore completions, which allows for increased efficiency in economically sensitive completions.

TRM-5 safety valves use a single-rod piston with reliable spring-energized, Teflon-filled sealing elements. The flapper mechanism in the safety valve has full metal-to-metal sealing and meets API and ISO leakage-acceptance criteria.

Modular design accommodates multiple options

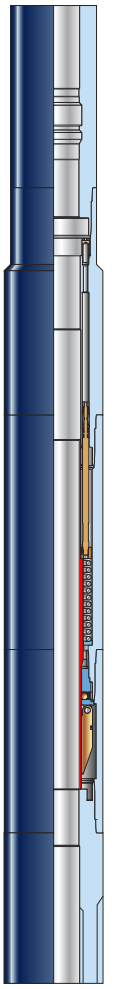
The modular design of the TRM-5 safety valve allows for a maximum number of material and design options, including a wide range of upper nipple profiles, to cost-effectively fit specific applications and operating environments. TRM-5 safety valves are available with working pressure ratings to 10,000 psi [68,950 kPa] and setting depths to 1,000 ft [305 m].

Internal pressure-equalizing feature enhances reliability

The TRM-5 safety valve's side equalizing system is an industry-recognized, proven method of equalizing pressure across the flapper. The ports provide a dedicated flow path for the wellbore fluid. For wear resistance, Schlumberger manufactures the equalizing system components from erosion-resistant materials and coatings. This design has been rigorously tested to ensure reliable operation, whatever the well conditions.

Hydraulic pressure opens valve

The TRM-5 safety valves are normally closed. They are opened by applying hydraulic pressure through a control line that extends from the safety valve through the wellhead to the control panel. Hydraulic



TRM-5 tubing-retrievable, surface-controlled subsurface safety valve.

TRM-5 Safety Valve Specifications

Tubing Size, in [mm]	Max. OD, in [mm]	Min. ID, in [mm]	Working Pressure, psi [kPa]	Max. Temperature Rating, degF [degC]
2.875 [73.0]	5.000 [127.0]	2.312 [58.7]	6,500 [44,818]	40–300 [4–149]
2.875 [73.0]	5.500 [139.7]	2.312 [58.7]	10,000 [68,950]	40–300 [4–149]
3.500 [88.9]	5.500 [139.7]	2.750 [69.9]	6,500 [44,818]	40–300 [4–149]
3.500 [88.9]	5.500 [139.7]	2.812 [71.4]	6,500 [44,818]	40–300 [4–149]
3.500 [88.9]	6.000 [152.4]	2.812 [71.4]	10,000 [68,950]	40–300 [4–149]

pressure applied from the surface control panel moves the rod piston and flow tube down. This downward movement compresses the power spring, moves the flapper off the seat, and continues until the valve is in the fully open position. When the valve is fully open, the flapper and seat system are isolated from production flow, thereby preventing contamination. When the hydraulic control line pressure is released, the power spring lifts the flow tube and rod piston. This upward movement permits the torsion spring on the hinged flapper to move the flapper into the flow stream, close against the flapper seat, and shut off flow from the well.

Lockout operation permanently locks valve open

A lockout mechanism enables a simple slickline procedure to permanently lock out the valve and initiate secondary hydraulic communication. The lockout tool permanently deforms the flow tube in specifically designed areas to prevent the valve from closing, and it permanently locks the safety valve open. If a secondary valve is required, a further slickline operation punctures the piston bore to establish hydraulic communication to the valve ID. A surface-controlled slickline safety valve can then be installed in the TRM-5 safety valve and controlled by using this hydraulic communication.

Pressure-equalizing operation opens valve with pressure below flapper

To open the TRM-5 safety valve with pressure below the flapper, hydraulic pressure is applied to the actuating piston. The pressure causes the flow tube to move downward and open the equalizing port. The wellbore fluid travels through the equalizing port and into the bore of the valve above the flapper. The pressure above the flapper increases until it equals the pressure below the flapper. When the pressure is equalized, the flow tube continues to move down to the fully open position, shielding the closure and equalizing mechanism.

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