Schlumberger

TRM-4 Series Reduced OD Safety Valves

APPLICATION

- Sweet to moderately corrosive environments from 40 degF to 300 degF [4 degC to 149 degC]

BENEFITS

- Optimizes the valve OD.
- Allows fewer potential leak paths.
- Has high hydraulic system pressure rating (15,000-psi [103,421-kPa] piston seals)
- Provides safe, long-term operation.
- Reduces solids and scale-deposition problems.
- Provides a simple slickline lockout procedure, with or without secondary communication.

FEATURES

- Full metal-to-metal sealing Inconel® flapper mechanism
- Unique and reliable curved flapper mechanism
- Static nonelastomeric operating piston seat in full-open position
- Compact design
- Minimum number of seals
- Metal-seal body joints and static operating piston seal in full-closed position
- Optimal geometry and clearance between sliding components
- Metal-seal communication and lockout mechanism

General service, reduced OD, premium rod piston, metal-seal body joints, flapper valve with working pressures to 10,000 psi [68,950 kPa]

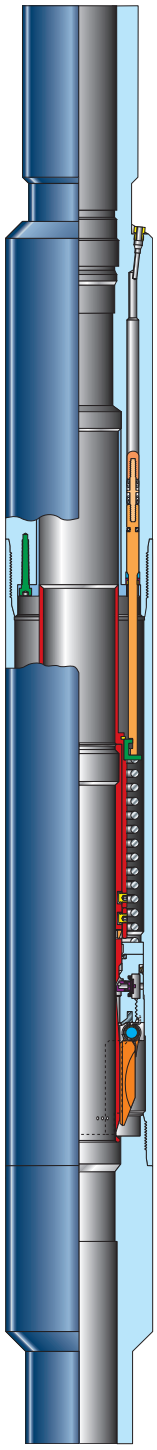
The Camco* TRM-4 reduced OD series tubing-retrievable, surface-controlled, subsurface safety valves are value engineered to provide remarkable versatility and reliability. Their compact design incorporates the best of the unsurpassed, field-proven Schlumberger technologies. The TRM-4 reduced OD series features rod piston actuation; metal-to-metal seal body joints; a rugged flapper-closure mechanism; and a minimum number of critical, static, and dynamic seals to ensure maximum reliability.

All TRM-4 reduced OD valves use a single-rod piston with reliable spring-energized, filled Teflon sealing elements; a static, full-closed, metal-to-metal seal; and a static, fully open seal and centralizing system. For maximum reliability, all TRM-4 reduced OD valves have only two body joints and use proprietary Cam-P* threads to achieve a reliable, metal-to-metal seal. The premium flapper mechanism in the TRM-4 reduced OD valves also has full metal-to-metal sealing plus a secondary soft seat, and it meets a leakage-acceptance criterion that is substantially more stringent than API and ISO specifications.

For optimum valve OD, some sizes of the TRM-4 valve feature the unique Camco curved-flapper design.

The modular design of the TRM-4 reduced OD series allows for a maximum number of material and design options, including a wide range of nipple profiles, to cost effectively fit specific applications and operating environments. TRM-4 reduced OD valves are available with working pressure ratings to 10,000 psi [68,950 kPa] and setting depths to 2,500 ft [762 m]. Other TRM-4 series valves provide deepset capability and many other optional features.

Schlumberger offers a special optional ScaleGard* surface treatment on selected internal surfaces that minimizes solids buildup caused by produced fluids.



TRM-4P-CF safety valve.

TRM-4 Series Reduced OD Safety Valves

INTERNAL EQUALIZING FEATURE

Some reduced OD TRM-4 valves include a fail-safe equalizing system strategically located above the flapper seat. This design minimizes any effect from erosional velocities and prevents the equalizing dart from being dislodged. The ports within the dart provide a dedicated flow path for the wellbore fluid. They also protect the dart-sealing surfaces and eliminate flow-induced damage. For added wear protection, Schlumberger manufactures the equalizing system components from erosion-resistant materials.

PREMIUM PISTON-SEALING SYSTEM

Within the valve's chamber housing, the rod piston consists of a stepped OD and a compliant downstop of a polyetheretherketone polymer. As the operating piston reaches full open, it contacts the static full-open seal and protects the dynamic operating piston from produced fluids. The polymer sealing element provides a compliant sealing surface to avoid incomplete sealing caused by particulate matter. All of the premium piston system components are manufactured from wear-resistant materials for maximum durability.

VALVE OPERATION

The TRM-4 reduced OD 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 pressure applied from the surface control panel pushes the rod piston and the flow tube down. This downward movement compresses the power spring, moves the flapper off seat, and continues until the valve is in the open position. When 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 the 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 in flow from the well.

LOCKOUT OPERATION

A unique lockout mechanism enables a simple slickline procedure to permanently lock the valve open and initiate secondary hydraulic communication. A lockout sleeve located above the flow tube is shifted downward. This downward movement parts the shear plug, engages the lockout rod, and permanently locks the safety valve open while establishing hydraulic communication to the valve ID. A secondary valve can then be installed in the TRM-4 reduced OD valve. A second lockout option in the lower end of the valve allows TRM-4 valves to be locked open without activating secondary hydraulic communication.

EQUALIZING OPERATION

To open the self-equalizing TRM-4PE-CF reduced OD valve with pressure below the flapper, hydraulic pressure is applied to the actuating piston. The pressure causes the flow tube to move downward and push a ported equalizing dart outward. The wellbore fluid travels through the port in the equalizing dart 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 ported equalizing dart moves back to the closed position as the flow tube moves down to the fully open position and shields the closure mechanism.

Engineering Data for TRM-4 Series Reduced OD Safety Valves

Tubing Size† (in [mm])	Valve Type	Max. OD (in [mm])	Nipple Bore (in [mm])	Working Pressure (psi [kPa])	Tensile Strength‡ (lbf [kg])
3.500 [88.9]	TRM-4E	5.000 [127.0]	2.812 [71.4]	10,000 [68,950]	362,000 [164,167.0]
	TRM-4HP	5.507 [139.9]		5,000 [34,475]	
4.500 [114.3]	TRM-4PE-CF-DS	5.905 [150.0]	3.812 [96.8]		296,000 [134,236.0]
	TRM-4PE-CF	6.000 [152.4]			307,000 [139,224.5]
5.500 [139.7]	TRM-4P-CF	7.500 [190.5]	4.562 [115.9]		479,500 [217,453.0]
7.000 [177.8]	TRM-4HP-CF	9.000 [228.6]	6.000 [152.4]	8,500 [58,608]	1,222,000 [554,177.0]
	TRM-4P-CF	9.156 [232.6]	5.875 [149.2]	5,000 [34,475]	778,800 [353,185.8]
		9.250 [235.0]	5.937 [150.8]		885,000 [401,347.5]

† The engineering data provided illustrate the scope of this product offering but are not all inclusive. Additional sizes and pressure ratings are available upon request.

‡ Tensile ratings are given for specific example valves; higher-strength materials affect this value. Tensile ratings shown are exclusive of end connection (EOEC) and at ambient temperature.

www.slb.com/completions

Schlumberger