

SAFETY SYSTEMS

OPTIMAX™ SERIES SAFETY VALVES

Providing the highest reliability
record in the industry

DRILLING & FORMATION EVALUATION
WELL CONSTRUCTION
COMPLETION & STIMULATION
PRODUCTION



Weatherford®

THE INDUSTRY'S **MOST RELIABLE VALVES**

Working offshore, the safety of your crew, equipment, and the environment can come down to one piece of equipment—your safety valve. The Optimax safety valve is a reliable, field-proven guard against catastrophic loss of well control. In fact, our safety valves have been deployed more than 7,000 times around the world. With more than 20,000 cumulative years of service, our tubing-retrievable safety valves (TRSVs) have had zero failures attributed to the valve design.

Industry standards are just our starting point. In all Weatherford operations, our most important mission is pursuing the highest possible standards to maximize our quality, health, safety, and environmental performance.

20,000 YEARS
of cumulative service life with
ZERO FAILURES





Safety Valves for any Application

Produced with a simple yet rugged design, premium materials, and an extreme set of performance tests, our comprehensive line of Optimax safety valves provides reliable service for all types of offshore applications and in diverse well conditions. Ranging in size to accommodate 2 3/8- to 7-in. tubing, our safety valves are rated for pressures up to 15,000 psi (103 MPa) and for temperatures up to 350°F (177°C).

We recommend the optimal safety valve to meet the specific needs of your well. We manufacture safety valves in a range of standard materials for most applications. And we also use specialty materials to customize valves for harsh downhole environments.

We continually expand our safety valve portfolio to evolve with operators' needs. Most recently, we added super-slim valves and deep-set valves to our portfolio. Compared to curved-flapper safety valves of an equivalent size, our super-slim curved flappers have a reduced outside diameter (OD). As a result, you can use smaller casing strings to reduce completion costs and still have space for bypass lines. Our deep-set valves provide fail-safe closure at depths greater than 12,000 ft (3,658 m)—without being affected by tubing pressure or relying on the long-term storage of nitrogen.

Testing

All Weatherford safety valves are certified to API 14A and API Q1 specifications. Further, each family of safety valves undergoes our rigorous test program to verify durability and reliability. As a result of our stringent testing, many of our valves have achieved the industry's highest rating, a V1 validation grade per API 14A 12th edition.

All of our TRSVs and wireline-retrievable safety valves (WRSVs) are slam tested at rates beyond industry standards. We tested a 7-in. Optimax TRSV at 460 ft/s (140 m/s), which equates to a flow rate exceeding 480 million scf/d. After the first slam-closure test, the valve produced no measurable leakage. After an additional slam closure, post-slam leak rates were still too low to measure.

Research and Development

Weatherford has two of the largest R&D, testing, and training facilities in the industry. Our Houston Technology & Training Center houses an advanced safety valve engineering lab with three hot cells and two flow loops that simulate downhole conditions. Our manufacturing facility in Bellocq, France, has two vertical test towers, two dedicated safety valve test panels, and a test well.



TUBING-RETRIEVABLE SAFETY VALVES

With no sleeves, plugs, or other mechanisms that can fail, our rod-piston, flapper-type TRSVs are engineered for simplicity and reliability. Actuated by a single control line, hydraulic pressure opens the valve for production or injection. With any loss of pressure caused by equipment failure or damage, the valve automatically reverts to its natural, fail-safe position—firmly closed.

The reliability of our TRSVs is the result of intelligent engineering and unique features. Our engineering team studied past successes and failures of safety valve designs and created an Optimax design that helped to eliminate previous points of failure.

Rod Piston Assembly

Our rod piston systems are lathe-machined for precise tolerances and finish. We have best-in-class piston bores that allow for accurate sealing engagement while making the system more robust. Our meticulous machining is reinforced by advanced non-elastomeric dynamic seals, which mitigate issues with fluid compatibility and explosive decompression. Further, we use unique glide bearings that protect the dynamic seals under eccentric loading for reliable performance over the lifetime of your well.



Rod piston



Rod piston dynamic seal assembly

Hydraulic System

The hydraulic system in Optimax safety valves has only two potential leak paths—the piston seals and the control-line connection. No other secondary communication path is possible. Spring-energized thermoplastic seals and a reinforced fluoropolymer secondary seal system provide exceptional closure. Unique carbon-composite backups and bearings protect the overall system from excess wear. Our piston-stop system provides a static seal in both the fully open and the fully closed positions. Using a primary metal-to-metal seal with a non-elastomeric secondary seal enables dynamic-seal unloading and extends the life of the hydraulic system.

Flapper and Seat

Both our flat and curved flappers maximize sealing capability, even in debris-laden environments. Our flappers offer a metal-to-metal, flapper-to-seat interface with a resilient secondary soft seat. The unique geometry provides stable, secure sealing during slam closures and high-pressure differentials. Our slimline safety valves with super-slim flappers also give operators the option of using smaller, more economical casing strings to reduce completion costs.

Through-the-Flapper Pressure-Equalizing System

Our technology saves operators time and money when restarting production after a well shut-in. The metal-to-metal, through-the-flapper self-equalizing feature offers tangible benefits to operations. Technicians can safely match pressures above and below a closed flapper, which eliminates the cost of re-routing gas from a nearby well or importing pressurization equipment.



Curved flapper



Flapper hard seat with non-elastomeric soft seat

Control-Line Connection

We use an integral single-ferrule swage connection with the fitting receptacle machined directly into the valve body. This unique design maximizes pressure containment and exceeds the capability of the control-line tubing.



Control-line fitting

WIRELINE-RETRIEVABLE SAFETY VALVES

Though our TRSVs have never failed because of the valve design, faulty or damaged safety valves can cause significant downtime and cost millions of dollars to replace. Our wireline-retrievable safety valves (WRSVs) are an economical solution for damaged safety valves. Deployed on slickline, our WRSVs can land inside a damaged TRSV, effectively bypassing the TRSV to restore production at a fraction of the cost of replacement.

Our surface-controlled, rod-piston-actuated WRSVs feature a unique eccentric valve design that incorporates flat-flapper technology and maintains a large through bore, which yields up to a 30 percent larger flow area and a lower pressure drop than safety valves from other vendors. The flat flapper uses a primary metal-to-metal seal and an elastomeric soft seat for low-pressure seal integrity.

Like our TRSVs, Weatherford WRSVs use our through-the-flapper pressure-equalizing technology and minimize the number of potential hydraulic leak paths.



REAL RESULTS

Pressure bellows safety valve immediately
**SHUT IN PRODUCTION
AND PREVENTED A MAJOR
HYDROCARBON SPILL**
after a barge collided with the wellhead

Surface-controlled safety valves
**ELIMINATED \$50 MILLION
IN WORKOVER EXPENSES**
over a 2-year period for 27 wells with
blocked or damaged control lines

SPECIALIZED SAFETY VALVES AND TOOLS

Our comprehensive selection of safety valves goes beyond the Optimax series of TRSVs and WRSVs. We also offer annular, velocity, and pressure bellows (PB) safety valves; our patented Renaissance® system of intervention-free safety valves; and contingency tools for damaged valves.

Annular Safety Valves—Unlike similar products with complex and failure-prone poppet or sliding-sleeve closure mechanisms, our annular safety valves have the same rugged simplicity as flapper-style systems. With our field-proven rod-piston system and non-elastomeric dynamic seals, our annular safety valves provide a durable, reliable, and long-term safety barrier between the tubing and casing.

Velocity Safety Valves—Installed on slickline, these subsurface-controlled safety valves are set using a predetermined flow rate. Should flow rates surpass the predetermined rate, our velocity valves automatically seal off production regardless of well depth.

PB Safety Valves—Our PB valves are subsurface controlled and set using a predetermined pressure rate. If well control is compromised, a nitrogen-charged bellows system shuts in the well. Because these automatic safety valves work without surface control, they are suitable for bypassing TRSVs with control-line failure.

Renaissance System—Our Renaissance safety valves provide a unique, cost-effective solution for common well problems that previously required expensive repair. Renaissance safety valves can be used in wells with damaged seal bores, for replacing damaged control lines, for retrofitting capillary-injection or high-volume water-injection capabilities, and for retrofitting wells without safety valves.

Contingency Tools—In the unlikely event that an Optimax safety valve malfunctions or if a competitor valve fails, our lockout and communication tools can help restore production to your well. Deployed on slickline, the lockout tool permanently opens a failed TRSV. Next, the communication tool restarts hydraulic operations, which enables the installation of an insert safety valve.





Part of our comprehensive completion solutions, Optimax safety valves suit every well application from the most basic to the extreme. The reliability and robust performance of our tubing-retrievable, wireline-retrievable, and specialty safety valves are the culmination of expert engineering and design, superior materials, and rigorous testing. To learn more about our Optimax safety valves, visit weatherford.com



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