Optimax™ Series Tubing-Retrievable Surface-Controlled Subsurface Safety Valve Modesl WSP(E)-5, WSP(E)-7.5, and WSP(E)-10

Shuts in a well to prevent uncontrolled flow

Applications

- Fluid and gas environments
- High-pressure production and injection applications

Features and Benefits

- Curved flapper technology enables a smaller OD, which eases running and accommodates bypass lines.
- The field-proven, nonelastomeric dynamic seal avoids explosive-decompression and fluid-compatibility issues to enhance safety.
- The safety valve contains a premium piston mechanism for demanding gas or high-pressure applications.
- Metal-to-metal premium housing connections are standard.
- Accessories can be deployed on slickline, which avoids complex operational requirements.

Tool Description

The Weatherford Optimax series WSP(E) tubing-retrievable surface-controlled subsurface safety valves are rod-piston, curved-flapper type safety valves. These valves are installed to shut-in wells in the event of uncontrolled flow caused by equipment failure or damage. An integral part of the completion string, each model is controlled by a single hydraulic control line. Control-line pressure keeps the valve in the open position; when pressure is bled off, the valve closes to prevent uncontrolled flow. In the unlikely event the safety valve malfunctions, the Weatherford Optimax WLT lockout tool and Optimax WCT control-line communication tool can be deployed to adapt the valve to accept a Weatherford WIT wireline-insert safety valve, which minimizes disruption to production operations.

Options

An internal through-the-flapper, self-equalizing feature simplifies safety valve operation for improved reliability.

Available Accessories

- Optimax WLT lockout tool
- Optimax WCT control-line communication tool
- Optimax WET exercise tool
- Optimax WIT wireline-insert safety valve

An Optimax tubing-retrievable and surface-controlled safety valve shuts in a well when control-line pressure bleeds off.

Weatherford®

Optimax™ Series Tubing-Retrievable Surface-Controlled Safety Valve

Specifications

Size	5-1/2 in. (139.7 mm)			Large Bore 5-1/2 in. (139.7 mm)	7 in. (177.8 mm)		
Overall length	92 in. (234 cm)			84 in. (213 cm)	99 in. (251 cm)		
Standard sealbore (minimum bore)	4.578 in. (116.281mm)			4.750 in. (120.650 mm)	6.000 and 5.963[a] in. (152.400 and 151.460 mm)		
Weatherford housing threads	6.937 and 5.500 in. (176.200 and 139.700 mm)			7.125 and 5.600 in. (180.975 and 142.240 mm)	8.465 and 7.088 in. (215.011 and 180.035 mm)		
Test pressure	7,500 psi (52 MPa)	11,250 psi (78 MPa)	15,000 psi (103 MPa)	7,500 psi (52 MPa)	7,500 psi (52 MPa)	11,250 psi (78 MPa)	15,000 psi (103 MPa)
Working pressure	5,000 psi (34 MPa)	7,500 psi (52 MPa)	10,000 psi (69 MPa)	5,000 psi (34 MPa)	5,000 psi (34 MPa)	7,500 psi (52 MPa)	10,000 psi (69 MPa)
Maximum OD	7.700 in. (195.580 mm)	7.760 in. (197.104 mm)	8.100 in. (205.740 mm)	7.700 in. (195.580 mm)	9.200 in. (233.680 mm)	9.288 in. (235.915 mm)	9.430 in. (239.522 mm)
Standard nipple profile	Petroline® QN profile[b]						
Control-line connection	Industry-standard metal-seal compression fitting for 1/4-in. (6.35-mm) control line						
Rated working temperature	30° to 300°F (–1° to 149°C)						
Failsafe setting depth	2,000 ft (610 m)						
Operating pressure, full open[c]	2,000 psi (14 MPa)						
Operating pressure, full closed[c]	1,000 psi (7 MPa)						
Dynamic seal system	Proprietary design nonelastomeric rod-piston seal stack, verified in tests to 10,000-psi (69-MPa) gas differential pressure at 300ºF (149ºC)						

[a] Staggered sealbore.
[b] Other manufacturer's profiles available upon request.
[c] Values shown are estimates, subject to verification.
[D] P feature safety valve also contains a non-elastomeric piston stop seal, which isolates the dynamic seals at the full-open and full-closed positions.

Optimax™ Series Tubing-Retrievable Surface-Controlled Safety Valve

Standard Metallic Materials

Housing and internal components	9 chrome, 1 moly or 13% minimum chrome; 80,000-psi (552-MPa) minimum yield
Flapper and seat	INCONEL® 718
Piston rod and power spring	MP 35 N
Tubing thread connection	As requested
Design and manufacturing compliance	API Q1 and API 14A
Class of service	API 14A 3S2

INCONEL is a registered trademark of the Special Metals Corporation group of companies.

OptiPkr™ Production Packer

Provides a reliable production tubing-to-casing seal that withstands the most demanding wellbore conditions

Applications

- Conventional, monobore, and stacked completions
- Liner-top isolations
- Subsea environments
- Extended-reach; deviated; and high-pressure, high-temperature (HPHT) wells

Features and Benefits

- Withstands pressures up to 10,000 psi (69 MPa), temperatures up to 350°F (177°C), and achieves a reliable seal by locking the element in place under variable loads and pressure cycling
- Enhances tool reliability by incorporating a patented fold-backup system to provide extrusion protection
- Reduces the risk of premature setting or pin shearing if the packer encounters downhole obstructions
- Includes versatile actuation options, including hydraulic, hydrostatic, or electronic, the latter of which uses a radio-frequency identification (RFID) trigger
- Accommodates monobore completions
- Eliminates mandrel movement while setting, which enables stacked completions
- Offers near-360° casing contact through the patent-pending slip design, which reduces slip-to-casing stress and minimizes internal casing damage
- Minimizes overpull and simplifies removal
- Enables easy removal even after the packer has been placed under extreme loads through its cut-to-release technology
- Contains an antireset mechanism that prevents the slips or element from resetting during retrieval

Tool Description

The Weatherford OptiPkr production packer combines the robust performance of a permanent packer with the flexibility of a retrievable packer into one tool. It provides a reliable seal between the outside of the production tubing and the inside of the casing in demanding wellbore conditions. The packer has a modular design that adapts to most applications and wellbore conditions and enables conversion between hydraulic-, hydrostatic-, and RFID-setting modes. It exceeds the International Organization for Standardization (ISO) 14310 Level V0 standards for load and pressure.

The Weatherford OptiPkr production packer provides a reliable production tubing-to-casing seal that withstands the most demanding wellbore conditions, and it can be retrieved for enhanced operational flexibility.

Weatherford®

OptiPkr™ Production Packer

Specifications

Outside Diameter (OD)		7 in. (177.8 mm)					
Weight		23 to 26 lb/ft (34.2 to 38.7 kg/m)	29 to 32 lb/ft (43.1 to 47.6 kg/m)	32 to 35 lb/ft (47.6 to 52.1 kg/m)	29 to 32 lb/ft (43.1 to 47.6 kg/m)	32 to 35 lb/ft (47.6 to 52.1 kg/m)	35 to 38 (52.1 to 56.6 kg/m)
Minimum ID		6.187 in. (157.10 mm)	5.990 in. (152.10 mm)	5.892 in. (149.60 mm)	5.990 in. (152.10 mm)	5.892 in. (149.60 mm)	5.801 in. (147.35 mm)
Maximum ID		6.466 in. (164.20 mm)	6.293 in. (159.80 mm)	6.208 in. (157.90 mm)	6.293 in. (159.80 mm)	6.208 in. (157.90 mm)	6.123 in. (155.52 mm)
Maximum OD		6.000 in. (152.40 mm)	5.910 in. (150.10 mm)	5.820 in. (147.80 mm)	5.910 in. (150.10 mm)	5.820 in. (147.80 mm)	5.735 in. (145.67 mm)
Standard thread connection		3 1/2-in. VAM® TOP			4 1/2-in. VAM® TOP		3 1/2-in. VAM® TOP
Minimum ID		2.962 in. (75.23 mm)			3.833 in. (97.40 mm)		2.720 in. (69.09 mm)
80-ksi material	Differential pressure rating	10,000 psi (69 MPa)			8,400 psi (58 MPa)		–
	Tensile rating	200,000 lb (890 KN)			178,128 lb (792 KN)		–
95-ksi material	Differential pressure rating	10,000 psi (69 MPa)					15,000 psi (103 MPa)
	Tensile rating	200,000 lb (890 KN)			212,546 lb (945 KN)		212,000 lb (943 KN)
110-ksi material	Differential pressure rating	10,000 psi (69 MPa)					15,000 psi (103 MPa)
	Tensile rating	200,000 lb (890 KN)			212,546 lb (945 KN)		212,000 lb (943 KN)
Element type		HNBR			HNBR	HNBR and AFLAS	AFLAS
Flow-test rating at 80°F (27°C)		–			10 bbl/min (1.6 m^3/min)		–
Flow-test rating at 176°F (79°C)		–					
Temperature range		80 to 350°F (27 to 177°C)					200 to 400°F (93 to 204°C)
ISO 14310-tested		V0					

The above ratings are not combined loading and are for the OptiPkr production packer with a hydraulic module. Consult with an applications engineer for packer ratings with different setting modules.

Weatherford®

OptiPkr™ Production Packer

Specifications

Outside Diameter (OD)		9-5/8 in. (244.5 mm)			10-3/4 in. (273 mm)	
Weight		47 to 53.5 lb/ft (69.9 to 79.6 kg/m)			60.7 to 65.7 lb/ft (90.3 to 97.7 kg/m)	
Minimum ID		8.405 in. (213.50 mm)			9.417 in. (239.20 mm)	
Maximum ID		8.822 in. (224.00 mm)			9.819 in. (249.40 mm)	
Maximum OD		8.310 in. (211.10 mm)			9.345 in. (237.40 mm)	
Standard thread connection		4 1/2-in. VAM® TOP	5 1/2-in. VAM® TOP HC	7-in. VAM® TOP HC	5 1/2-in. VAM® TOP HC	7-in. VAM® TOP HC
Minimum ID		3.894 in. (98.91 mm)	4.650 in. (118.10 mm)	6.060 in. (149.20 mm)	4.750 in. (120.60 mm)	6.060 in. (149.20 mm)
80-ksi material	Differential pressure rating	8,000 psi (55 MPa)		6,700 psi (46 MPa)	6,500 psi (45 MPa)	
	Tensile rating	400,000 lb (1,779 KN)	360,380 lb (1,603 KN)	302,264 lb (1,345 KN)	400,000 lb (1,779 KN)	
95-ksi material	Differential pressure rating	8,000 psi (55 MPa)			6,500 psi (45 MPa)	
	Tensile rating	400,000 lb (1,779 KN)		360,380 lb (1,603 KN)	400,000 lb (1,779 KN)	
110-ksi material	Differential pressure rating	8,000 psi (55 MPa)			6,500 psi (45 MPa)	
	Tensile rating	400,000 lb (1,779 KN)				
Element type		HNBR				
Flow-test rating at 80°F (27°C)		14 bbl/min (2.2 m^3/min)				
Flow-test rating at 176°F (79°C)		10 bbl/min (1.6 m^3/min)				
Temperature range		80 to 350°F (27 to 177°C)				
ISO 14310-tested		V0				

The above ratings are not combined loading and are for the OptiPkr production packer with a hydraulic module. Consult with an applications engineer for packer ratings with different setting modules.

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RFID OptiROSS™ Remotely Operated Sliding Sleeve

Manages flow from individual production zones remotely

Applications

- Managing flow from individual production zones
- Eliminating the need for washpipe, intervention, wires, or control lines
- Highly fractured wells

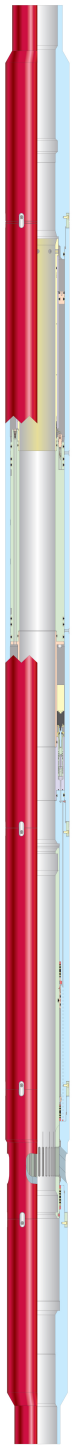
Features and Benefits

- Eliminates the need for washpipe, control lines, intervention, wires, services, or crew
- Facilitates tests of individual compartments and select optimized well profile
- Features selective remote opening and closing through radio-frequency identification (RFID) technology
- Protects seals when opening in over-and-underbalanced applications through controlled equalization
- Minimizes pressure drops
- Provides operational reliability through built-in hydraulic reservoir
- Features a robust, reliable, and simple design
- Reverts to a standard mechanical sliding sleeve at the end of battery life

Tool Description

The Weatherford OptiROSS remotely operated sliding sleeve combines advanced well sliding-sleeve technology with RFID technology to provide an interventionless, control-line-free well management device. The tool provides remote means of managing flow from individual production zones with no limit to the number of sleeves that can be installed in a single monobore completion.

The tool is preprogrammed to operator-specific applications and is opened and closed by circulating RFID tags, frequency-modulated pressure signatures, timers, or a combination of these. The debris-tolerant tool does not rely on any debris-sensitive springs, check valves, nor complex piston arrangements during operation; thus, its reliability is not compromised by the need for precharged or well-sensitive piston chambers.



An unlimited number of OptiROSS remotely operated sliding sleeves can be run in a single monobore completion.

Weatherford®

RFID OptiROSS™ Remotely Operated Sliding Sleeve

Specifications*

Size	Maximum OD	Minimum ID	Pressure Rating	Absolute Pressure Rating	Temperature	Minimum Flow Area	Maximum Differential Opening Pressure
3.50 in. (88.9 mm)	5.85 in. (149 mm)	2.81 in. (71.4 mm)	7,500 psi (51.7 MPa)	15,000 psi (103.4 MPa)	39 to 302°F (4 to 150°C)	6.20 in.^{2} (40 cm^2)	1,500 psi (10.3 MPa)
5.50 in. (139.7 mm)	7.75 in. (196.9 mm)	4.31 in. (109.5 mm)		12,500 psi (86.1 MPa)		16.33 in.^{2} (105.4 cm^2)	
5.50 in. (139.7 mm)	8 in. (203.2 mm)	4.56 in. (115.8 mm)		15,000 psi (103.4 MPa)		16.33 in.^{2} (105.4 cm^2)	

* Customer-specific specification variants are available upon request.

Intelligent Completion Packoff Element

Provides zonal isolation in applications that require chemical injection or monitoring below the isolation system

Applications

- Isolating intervals within the well, primarily in intelligent completions, where multiple control lines and I-Wires are fed through
- Monitoring below the isolation system

Features and Benefits

- Reduces possible leak paths and eliminates body movement during setting
- Minimizes seal movement in operation and prevents multiple leak paths
- Optimizes control line bypass while retaining packer through the wellbore
- Minimizes part count and simplifies interchangeability over casing weights
- Contains multiple setting options to adapt to specific wells

Tool Description

The Weatherford intelligent completion packoff element (ICE) is a retrievable and hydraulically set multiple control-line bypass that achieves zonal isolation within intelligent well completions. The one-piece body makes it possible to feed multiple lines through the ICE tool in either workshop or offshore environments. The feedthrough capabilities also enable placing gauges and chemical injection systems below the completion isolation system.

Tested in accordance with the International Organization for Standardization (ISO) 14310, the ICE tool provides multiple setting options. Control-line pressure, a mechanical communication sub, or a radio-frequency identification (RFID) enabled communication sub can set the base packer.

The ICE tool is released into a retracted position using a straight-pull, shear release.

The ICE tool has a one-piece body that reduces leak paths and minimizes body movement during setting.

Weatherford®

Intelligent Completion Packoff Element

Specifications*

Casing Information		Maximum OD	Minimum ID	Connections	Maximum FeedThru	Pressure Rating	Element Material	Temperature	Standard Certificate
Size	Weight								
5.50 in. (139.7 mm)	17 lb/ft (2.35 kg/m)	4.710 in. (119.6 mm)	2.40 in. (61.0 mm)	2-7/8 in. (50.8 mm) Premium	4	3,000 psi* (20.68 MPa)	HNBR	68 to 275°F (20 to 135°C)	ISO 14310-V5
	20 lb/ft (2.76 kg/m)	4.595 in. (116.8 mm)							
6.625 in. (168.3 mm)	32 lb/ft (4.42 kg/m)	5.405 in. (137.4 mm)							
	24 lb/ft (3.31 kg/m)	5.735 in. (145.8 mm)	2.92 in. (74.2 mm)	3-1/2 in. (76.2 mm) Premium	5				
7 in. (177.8 mm)	23 lb/ft (3.17 kg/m)	6.095 in. (154.9 mm)							
	26 lb/ft (3.59 kg/m)								
7.625 in. (193.7 mm)	29.7 lb/ft. (4.11 kg/m)	6.690 in. (169.9 mm)	3.96 in. (100.6 mm)	4-1/2 in. (101.6 mm) Premium	5				
9.625 in. (244.5 mm)	40 lb/ft (5.53 kg/m)	8.540 in. (216.9 mm)	4.56 in. (115.8 mm)	5-1/2 in. (127 mm) Premium	6				
	47 lb/ft (6.9 kg/m)	8.450 in. (214.6 mm)							
	53.5 lb/ft (7.39 kg/m)	8.305 in. (211.1 mm)							

* Results depend on the released version. Customer-specific specification variants are available on request

Optibarrier™ Mechanical Ball Valve

Provides unlimited mechanical opening and closing functionality

Applications

- Sand control
- Isolation of lower-completion system for upper-completion installation or workovers
- Platform for hydraulically setting production packers

Features and Benefits

- The Optibarrier mechanical ball valve can be operated via industry-standard shifting tools for operational flexibility.
- The ball valve has increased differential opening capacity.
- The ball valve has unlimited mechanical opening and closing functionality.
- Initial valve closure is achieved when the washpipe and collet shifting tool are retrieved through the valve.
- The full-bore inside diameter (ID) of the ball valve maximizes production and enhances access to the formation.
- The bidirectional sealing mechanism provides a robust downhole barrier.
- The ball mechanism is rotationally locked to facilitate contingency milling.
- The ball valve can be manufactured in a variety of metallurgies, ranging from basic 4140 to high-nickel premium alloys, to suit specific wellbore conditions and operational needs.
- By exceeding ISO 28781-V1 standards, and having passed extended debris and life-cycle testing, the ball valve demonstrates reliable performance.

Tool Description

The Weatherford Optibarrier mechanical ball valve is a tubing-mounted bidirectional ball valve that controls wellbore flow. It is opened and closed mechanically by using industry-standard shifting tools or a stinger module in the upper-completion system. The ball valve has a modular design that enables compatibility with the other Optibarrier products, including those that are operated mechanically, hydraulically, or remotely using radio-frequency-identification (RFID) technology.

The Optibarrier ball valve exceeds ISO 28781 standards and has undergone extended debris testing as evidence of life-of-well performance capabilities. The ball valve can be manufactured in a variety of metallurgies, from basic 4140 to high nickel premium alloys.

The Weatherford Optibarrier mechanical ball valve can be opened and closed an unlimited numbers of times using common industry shifting tools.

Weatherford®

Optibarrier™ Mechanical Ball Valve

Specifications

Size	Maximum OD	Minimum ID	Maximum Differential Rating Across Ball	Temperature	Connections	Qualification Standard
4.50 in. (114.30 mm)	7.75 in. (196.85 mm)	3.75 in. (95.25 mm)	10,000 psi (68.90 MPa)	39 to 302°F 4 to 150°C)	4-1/2 in. premium	ISO 28781-V1
5.50 in. (216 mm)	8 in. (203.20 mm)	4.63 in. (117.60 mm)	7,500 psi (51.70 MPa)		5-1/2 in. premium	
5.50 in. (216 mm)	8.25 in. (209.55 mm)	4.25 in. (107.95 mm)	10,000 psi (68.90 MPa)		5-1/2 in. premium	

*Maximum differential ratings across ball are metallurgy dependent.

RFID Inflow Control Device

Delivers interventionless inflow management using RFID technology

Applications

- Regulating and managing inflow or outflow profiles across a horizontal wellbore

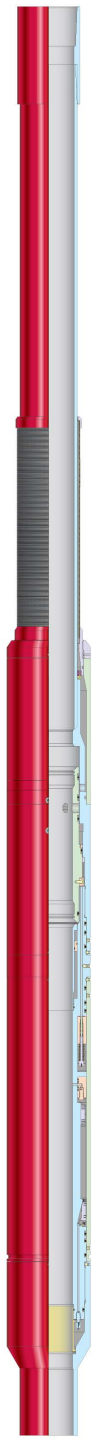
Features and Benefits

- Eliminates the need for washpipe, intervention services, and crew, which alleviates health, safety, and environmental concerns while reducing operating costs
- Eliminates the need for an intermediate completion by running closed, which effectively makes the lower completion a reservoir barrier and fluid loss device
- Increases the percentage of the total hydrocarbon produced
- Improves drainage of unwanted fluids
- Opens remotely using radio-frequency identification (RFID) technology
- Promotes even distribution across the reservoir section
- Facilitates staged startup and toe-to-heel well cleanup
- Provides operational reliability through built-in clean hydraulic reservoir and debris tolerance
- Minimizes nonproductive time because the device is set up according to customer requirements
- Reverts to a standard mechanical sliding sleeve following remote completion operations

Tool Description

The Weatherford RFID inflow control device (ICD) combines the FloReg™ inflow control system with RFID technology to evenly distribute inflow throughout a horizontal wellbore. The ICD, or a series of ICDs, are run closed and then, at depth, sequentially opened with no intervention. This capability eliminates the need for washpipe, intervention services, wires, or control lines, which reduces completion time and risk. The ICD is customizable to customer-specific applications, and it can be opened by either circulating RFID tags, using a frequency modulated pressure signature, timers, or a combination of these.

Designed with debris, mud solids, and cement in mind, the device does not rely on debris-sensitive springs, check valves, or complex piston arrangements. Further, reliability is not compromised by the need for any pre-charged or well-sensitive piston chambers.



The ICD uses RFID technology to evenly distribute inflow throughout a horizontal wellbore.

Weatherford®

RFID Inflow Control Device

Specifications*

<table>
<tr><th>Size</th><th>Maximum Outside Diameter (OD)</th><th>Minimum Inside Diameter (ID)</th><th>Pressure Rating</th><th>Absolute Pressure Rating</th><th>Temperature</th></tr>
<tr><td rowspan="3">4.50 in.
(114.3 mm)</td><td rowspan="3">5.625 in.
(142.9 mm)</td><td>2.50 in.
(63.5 mm)</td><td rowspan="6">7,500 psi
(51.7 MPa)</td><td rowspan="2">15,000 psi
(103.4 MPa)</td><td rowspan="6">39 to 302°F
(4 to 150°C)</td></tr>
<tr><td>2.81 in.
(71.4 mm)</td></tr>
<tr><td>3.50 in.
(88.9 mm)</td><td>10,000 psi
(68.9 MPa)</td></tr>
<tr><td rowspan="3">5.50 in.
(139.7 mm)</td><td rowspan="2">7.750 in.
(196.9 mm)</td><td>3.81 in.
(96.8 mm)</td><td rowspan="3">15,000 psi
(103.4 MPa)</td></tr>
<tr><td>4.31 in.
(109.5 mm)</td></tr>
<tr><td>8 in.
(203.2 mm)</td><td>4.56 in.
(115.8 mm)</td></tr>
</table>

* Customer specific specification variants are available on request.

RFID Reservoir Isolation Valve

Isolates the toe of the completion and eliminates the need for a deep-set plug

Applications

- Enhancing circulation path and providing well control and fluid changeout
- Remotely setting hydraulic devices, such as packers, the ROk-ANkOR® openhole whipstock anchor system, and circulating valves
- Remotely delivering injection, production, or intervention operations

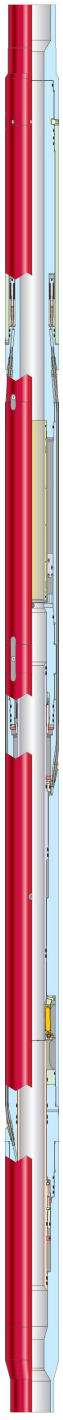
Features and Benefits

- Eliminates the need for intervention services and crew through remote interventionless operation
- Reduces health, safety, and environmental concerns by reducing intervention requirements
- Improves operating costs by eliminating the need for addition completions
- Interfaces with any hydraulic-set device
- Releases any fill and leaves a flush bore when remotely opened through fall-through-flapper technology
- Provides simple, programmable operating logic

Tool Description

The Weatherford RFID-operated reservoir isolation valve (RIV) is an interventionless barrier device that isolates the toe of the completion, which eliminates the need for a deep-set plug and reduces completion time and risk. Qualified according to the International Organization for Standardization (ISO) 28781 V1, the RIV is a cost-effective and safe means of isolating completion systems.

The robustly constructed RIV is designed with debris, mud solids, and cement in mind; the internal operating mechanism is contained with the flow path. The debris-tolerant RIV does not rely on debris-sensitive springs, check valves, or complex piston arrangements. Built on patented fall-through-flapper technology, any debris fill is relieved and released as the flapper opens down into its housing to leave a flush bore. The flapper also provides a bidirectional barrier against which the completion system can be tested and hydraulically set. The tool also features a ceramic flapper option, as applicable. The RIV is run in the open position and is closed by circulating RFID tags via a preprogrammed timer. The RIV can be reopened by a frequency modulated pressure signature.



The Weatherford RFID RIV provides interventionless isolation in the toe of the completion without using a deep-set plug.

Weatherford®

RFID Reservoir Isolation Valve

Specifications*

Size	Maximum OD	Minimum ID	Flapper Pressure Rating	Absolute Pressure Rating	Temperature
4.50 in. (114.3 mm)	5.63 in. (143 mm)	2.50 in. (63.5 mm)	7,500 psi (51.7 MPa)	10,000 psi (69.9 MPa)	39 to 302°F (4 to 150°C)
	6 in. (152.4 mm)	2.25 in. (57.2 mm)	10,000 psi (69.9 MPa)	15,000 psi (103.4 MPa)	

* Customer specific specification variants are available on request.