

TRIV™ Injection Sleeve w/VOi™ Insert

Dual Barrier Tubing Retrievable SCSSV



Applications:

- Mild to severely corrosive environments
- Injection Wells
- Formations requiring injection rates to 70,000 bpd [11,129 m³]
- Wells requiring injection pressure to 10,000 psi [68,948 kPa]

Benefits:

- Maximizes injection rates
- Prevents uncontrolled well flow
- Eliminates choke size chatter by continually adjusting in response to a flow
- Prevents injection backflow
- Provides dual barrier system
- Eliminate flapper throttling
- Reduces erosion from high rate injection flow
- Eliminates need for external control line

Features:

- Tubing retrievable
- Subsurface controlled
- Wireline retrievable variable orifice choke
- Minimum pressure drop over entire injection rate range
- Erosion resistant materials in flow path
- Proven hard/soft seat flapper seal
- Orifice automatically adjusts in response to flow rate
- Designed in accordance with API 14A
- Metal to metal body joints

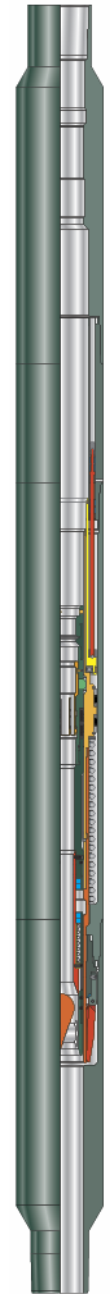
Description:

The Tejas tubing retrievable injection valve, or TRIV™, is a subsurface controlled, injection safety valve that features the patent-pending Tejas VOi™ variable orifice insert. It is designed to prevent injection fluid from flowing back out of the well if the surface control system becomes damaged or malfunctions. The TRIV™ also provides pressure management as the surrounding reservoir wells are produced.

The design of the TRIV™ provides a reliable, extremely versatile system that is virtually maintenance free. Together with the VOi™, the TRIV™ provides full well integrity without the necessity of running a control line to depth. The TRIV™ features metal-to-metal body joints and incorporates our proven curved flapper and hard/soft seat primary seal designs.

The TRIV™ along with the wireline retrievable VOi™ choke system provide a dual-barrier safety system designed to provide a 20-year service life. The valve and insert have unlimited setting depths and are available in a wide variety of material selections that are suitable for both severely corrosive and highly erosive environments associated with water-injection applications.

The TRIV™ and VOi™ combination is designed to allow high flow injection rates without the need for a separate control system. The large-bore geometry combined with our proven curved flapper system provides the most efficient injection safety valve available on the market. The TRIV™ and VOi™ are designed to cover the entire range of injection rates up to 100,000 bpd [15,899 m³/d] and 10,000 psi [68,948 kPa] working pressure. The system is also capable of downhole temperatures ranging from 32 to 325°F [0 to 161°C].



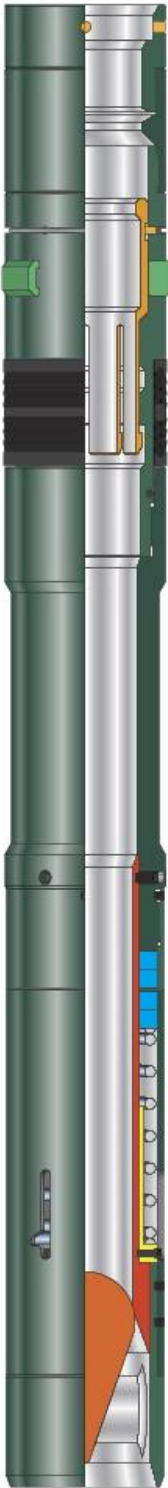
TRIV™
Closed Position



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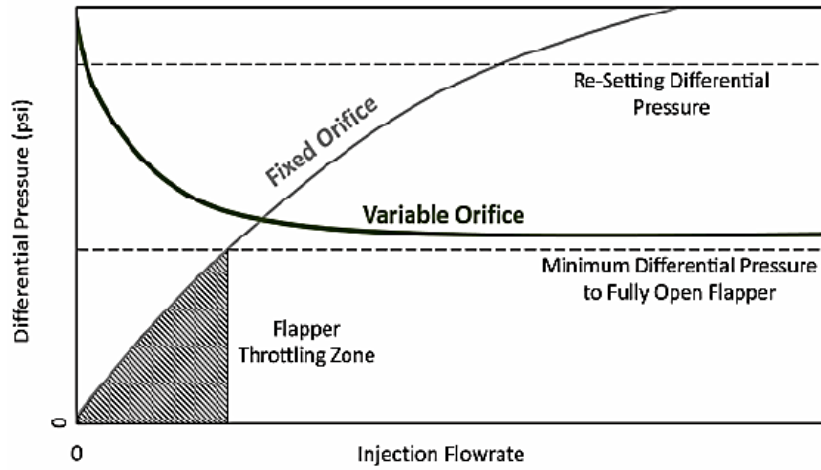
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VOi™ Insert
Closed
Position

Variable vs. Fixed Orifice
Insert Performance



Unlike conventional fixed-orifice injection safety valves, the variable orifice insert provides a constant, low back-pressure during injection regardless of the rate. The VOi™ also incorporates a patent-pending design that ensures the flapper valve in the TRIV™ is completely opened before any fluids are injected into the reservoir. This significantly increases the operational life of the TRIV™ by eliminating the potential for flapper damage and throttling associated with low-flow conditions found in fixed-orifice conventional designs.

The TRIV™ features several internal profiles for contingency operations if needed. The valve offers a wide variety of upper lock profiles for isolation, an upper flow tube exercise profile, and a lower flow tube profile for thru-tubing temporary lock-out. The system is also certified under the American Petroleum Institute (API) Specification 14A-0032.

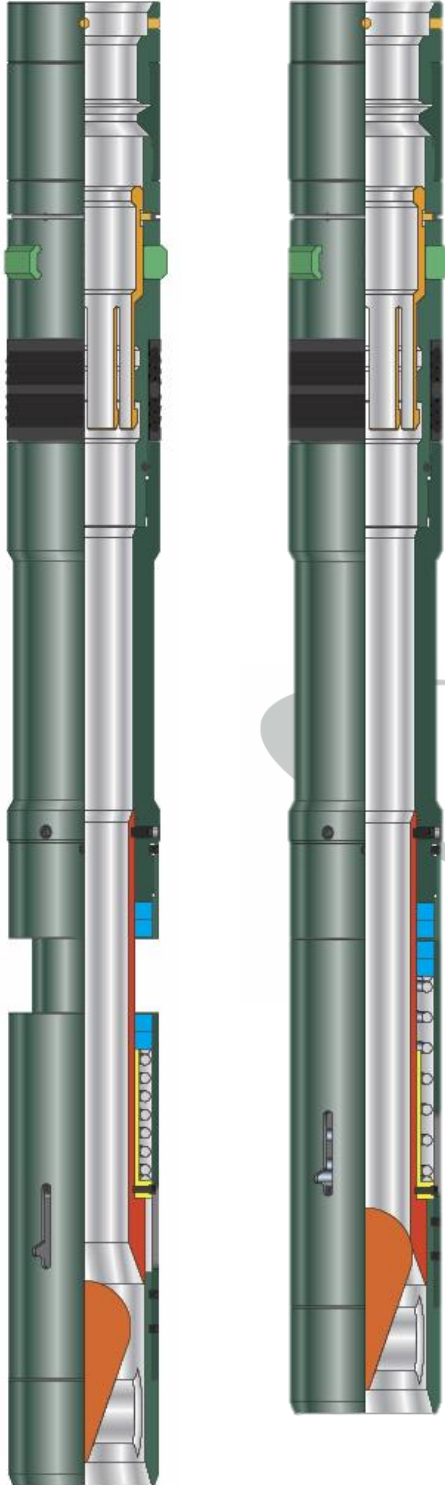
System Operation:

The TRIV™ is a normally-closed valve that opens in response to both pressure and flow differential generated across the VOi™. During installation, the TRIV™ is run with the lower flow tube extended and the flapper temporarily locked-open. The VOi™ is installed with an RJT Lock into the upper flow tube of the TRIV™. During installation, the VOi™ is set to an intermediate running position allowing fluid bypass and lower completion pressure communication. The system of TRIV™ and VOi™ required two injection cycles to become completely operational.

Once the TRIV™ is installed, the first injection cycle “resets” the VOi™ such that when the injection is halted, the VOi™ will be in the fully closed position. The second injection cycle drives upper flow tube and attached “closed” VOi™ into the lower flow tube. Once the upper flow tube and lower flow tube make contact, they become locked together and function as a single assembly. When the second injection cycle is halted, the flow tube assembly will return, and the flapper will close providing lower completion pressure integrity. Both the TRIV™ flapper and the VOi™ are capable of providing full well pressure protection during the operational life of the completion.

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VOi™ Insert
Open
Position

VOi™ Insert
Closed
Position

The VOi™ eliminates the need for expensive orifice change-outs as the well conditions change over time. The low injection back-pressure also increases well injection efficiency as shown in the following graph. The operation of the TRIV™ and VOi™ together fundamentally change the pressure and flow relationships typically associated with fixed-orifice injection safety valves by eliminating damage and decreasing operational back-pressure.

Temporary Lock-out:

The lower flow tube design enables a simple wireline operation for exercise or temporary TRIV™ lock-out. Two separate lock-out tools are available for mechanically or hydraulically manipulating the lower flow tube. Either tool locates on the no-go shoulder in the upper lock profile. A set of lock dogs anchor the tool to the TRIV™ while a second set of shifting dogs address the shifting profile in the lower flow tube. Actuating the lock-out tool shifts the lower flow tube apart from the upper flow tube and moves the flapper out of the bore of the valve.

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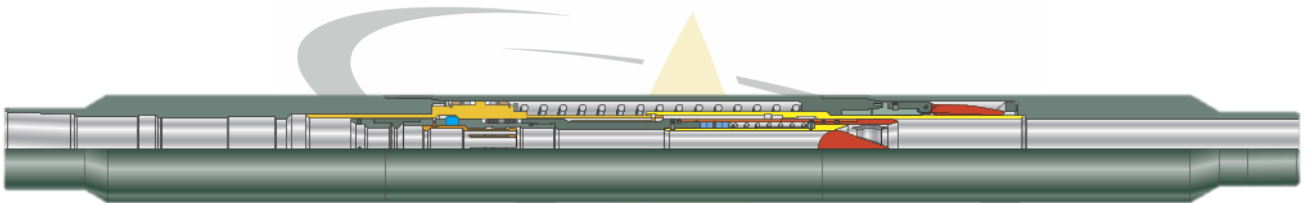
Engineering Data:

Tubing Size in [mm]	Max OD in [mm]	Min ID in [mm]	Working Pressure psi [kPa]	Tensile Strength lbf [kN]	Upper Landing Nipple		VOi Landing Nipple	
					Bore in [mm]	Type	Bore in [mm]	Type
4.500 [114.3]	6.765 [171.8]	3.668 [93.7]	10,000 [68,947]	475,000 [2,113]	3.812 [96.8]	DB	3.688 [93.7]	RJT
5.500 [139.7]	8.010 [203.5]	4.500 [114.3]	10,000 [68,947]	729,000 [3,243]	4.562 [117.5]	DB	4.500 [114.3]	RJT

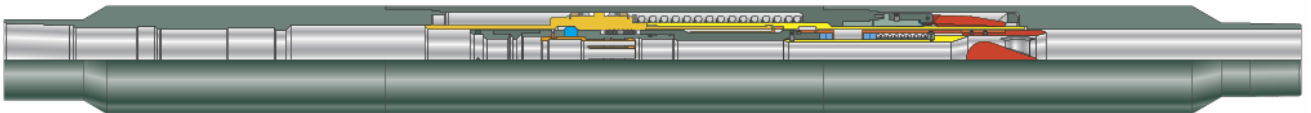
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† The engineering data provided illustrate the scope of this product offering and are not all inclusive. Additional sizes and pressure ratings are available upon request.

Direct request for quotations to: product.sales@tejasre.com



TRIV™ Locked Position



TRIV™ Full Open Position