Effective well control with unsurpassed reliability
Isolation Valves

These versatile tools can help you increase wellbore safety, simplify completion operations, and enhance production.

The first FIV* formation isolation valve was developed using established drillstem test (DST) technology to find an answer to an industrywide problem. A Schlumberger customer needed to protect a reservoir from fluid loss and provide a reliable barrier while increasing efficiency and maximizing overall recovery.

Schlumberger engineers developed a valve using concepts and features from DST technology, including the rotating bidirectional sealing ball, nitrogen power source, and J-slot mechanism for counting cycles—all in existence since 1982. These features were repackaged and redesigned from existing testing tools.

The resulting FIV formation isolation valve, released in 1995, resolved the problem, saving the customer days of rig time and money by mitigating risks, preventing damage to the formation, and operating without the need for intervention. Today, the FIV valve is the valve of choice for reliable wellbore isolation that would not be possible with conventional fluid loss technologies.

Schlumberger isolation valves safeguard reservoirs by providing a reliable barrier and containing fluids during completions and workover operations.
VERSATILITY WHERE IT COUNTS

The main purpose of the FIV valve is to isolate the reservoir from the wellbore, but the valve’s versatility can be seen in the broad range of applications in which it can be used, including fluid loss control, underbalanced perforating, well control barrier operations, deepset lubrication, and multizone isolation. Because of the rotating ball and floating seal design, the valve is debris tolerant, making it especially useful in sandface completions.

With its ability to hold pressures from both above and below, the valve can also be used as a downhole lubricator valve and as a way to more safely suspend or temporarily abandon a well. Together, these features enable the well to be sealed and the pressure above or below the ball contained, the production packer set without intervention, and then the valve cycled open remotely.

FIV II formation isolation valve

The FIV II formation isolation valve is the standard version in the family of isolation valves. One of its main benefits is that it can be opened and closed mechanically and opened remotely without intervention.

To operate it mechanically, the operator runs a shifting tool at the end of wash pipe, perforating string, or coiled tubing. When the shifting tool is passed through the valve, the ball either opens or closes with a gas-tight seal, and the shifting tool unlatches from the latch collet of the valve, allowing retrieval.

The Trip Saver® one-time remote-opening feature enables the operator to open the valve without conventional intervention techniques. Cycles of tubing pressure, in a number predetermined by an integral indexing mechanism, are applied against the closed valve. When the indexing mechanism reaches the opening cycle, the Trip Saver feature actuates, opening the valve. This action allows the operator to pressure test the tubing, set and test the packer, and test the tubing hanger before reestablishing communication with the reservoir.

Qualified and tested

The FIV II valve is qualified and tested with gas to a zero-bubble leak rate across the ball. This tight acceptance criterion enables the tool to be used as a barrier for well intervention operations and for long-term well suspension.

Isolation valves are suited for a variety of applications and environments, including subsea completions. The FIV valve can be opened and closed mechanically and opened remotely without intervention. Mechanical operation involves passing a shifting tool through the valve to open or close the ball with a gas-tight seal. Remote operation involves using cycles of tubing pressure to actuate the Trip Saver mechanism, which opens the valve.
Built on a solid foundation

The Schlumberger family of isolation valves, which originated with the FIV valve, has expanded to meet increasing functional requirements. Today, the numerous fit-for-purpose options vary according to the wide range of applications and specific job requirements. The additional valves in the family all use core components of the technology from the original FIV valve, thus building from a strong foundation.

**MFIV II mechanical FIV valve**
The MFIV* II mechanical FIV valve is the basic version of the FIV product but is designed without a Trip Saver feature. It is operated mechanically with a shifting tool and can be opened and closed multiple times. The valve uses the same ball sealing design and latch collet system as those used by the FIV II valve.

**SFIV surface-controlled FIV valve**
As the demand for variations in isolation valves grew, the first new product developed was the SFIV* surface-controlled FIV valve. This valve functions as a lubricator for under-balanced drilling and perforating without killing the well. It sits above the subsurface safety valve and provides a bidirectional barrier above and below the sealing ball. Two options are available—the SFIV N valve, operated from the surface with nitrogen via a single control line, and the SFIV H valve, also operated from the surface but with dual hydraulic control lines.
With its award-winning technology for offshore safety, the versatile FIV valve offers a high level of confidence in formation protection.

**Isolation Valve Types**

<table>
<thead>
<tr>
<th>Barrier Types</th>
<th>Primary Actuation Types</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trip Saver Feature</td>
</tr>
<tr>
<td>FIV II valve</td>
<td></td>
</tr>
<tr>
<td>MFIV II valve</td>
<td></td>
</tr>
<tr>
<td>SFIV valve</td>
<td></td>
</tr>
<tr>
<td>AFIV valve</td>
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</tr>
<tr>
<td>TIVF valve</td>
<td></td>
</tr>
</tbody>
</table>

**AFIV annular-controlled FIV valve**
The next innovation was the AFIV* annular-controlled FIV valve. The AFIV offering is a shrouded version of the FIV II valve, and as with the FIV II valve, it uses the Trip Saver feature, a cycle mandrel, and a latch collet system. It uses a sleeve-type barrier rather than a ball to isolate the tubing from the annulus. This valve is used for selective multizone intelligent completions.

**TIVF tubing isolation valve with flapper**
The TIVF* tubing isolation valve with flapper was developed to allow autofilling of the tubing, multiple-tubing pressure testing, packer setting, and remote opening. This valve uses the Trip Saver feature but differs from the FIV II valve in that it uses a flapper as the sealing barrier and is run in the closed position. The valve has a modified cycle mandrel that allows it to open a port to a dedicated packer-setting control line during the cycle sequence. Once opened, it provides fullbore access.
High-overbalance completions are becoming more common in the deepwater arena as fields continue to mature and reservoirs deplete. It is increasingly important to find reliable, cost-effective ways to capture an area’s late-life reserves. In the Gulf of Mexico, a well completed with seawater had a 1,500-psi overbalance and experienced a steady fluid-loss rate of 6 bbl/min after a sand control system was installed. This rate was much higher than the recommended rate for setting the fluid-loss devices typically used; thus, conventional fluid-loss devices such as ceramic flappers and fluid-loss drop balls could not be used.

Because a riser fill valve had been installed to prevent evacuation, postponing setting the mechanical fluid-loss device until after the well reached equilibrium was not an option. The operator chose a Schlumberger FIV formation isolation valve because it could be closed at rates of 25 bbl/min, much higher than the operator’s loss rate of 6 bbl/min. The operator completed the well without loss of fluid or the need to spot potentially reservoir-damaging fluid-loss pills. The FIV valve was then successfully opened remotely with the Trip Saver device, which required no additional intervention, and communication with the reservoir was reestablished.

A sound track record of success.
SUCCESFUL INTEGRATED SOLUTION USING MFIV VALVE AND ESP PUMPS IS EXTENDED TO ENTIRE OFFSHORE FIELD

An operator in the Middle East wanted to install ESPs in a particular field to enhance production but needed to avoid formation damage when the ESPs were replaced, typically every few years. A conventional workover requires the fluid in the well to be displaced with kill fluid to establish well control. The damaging kill fluid comes into contact with the formation every time pumps are replaced. Not only does the kill fluid damage the formation, but it also increases operational costs because of the fluid lost to the formation and the time needed to reestablish production.

Schlumberger proposed an integrated solution using MFIV mechanical valve technology with the ESPs to protect the formation during pump replacements. The MFIV valve provided a two-way barrier that isolated the formation and contained the reservoir fluids, providing increased wellbore safety, simplifying completion operations, and enhancing production. Based on the successful results of the initial installation, the operator standardized the completion solution to all its offshore ESP installations.

ISOATION VALVES PROVIDE INNOVATIVE SOLUTION FOR A DEEPWATER PROJECT

An operator in an offshore field development in West Africa needed an efficient, reliable way to isolate a reservoir after performing gravel-pack operations for each well. The Schlumberger FIV valve was installed below the gravel-pack packer, stopping the fluid loss after completion of the gravel pack operations and isolating the reservoir for the installation of the upper completion.

The completion installation had to be started before subsea Christmas trees were delivered. This meant that to meet the required barrier policy, a valve would be needed to provide an additional barrier below the tubing hanger. Schlumberger developed the SFIV surface-controlled valve for the operator. This valve was located above the subsurface safety valve, and the ball seals provided a bidirectional testable barrier. Operated from the surface with dual hydraulic control lines, the valve eliminated the need to intervene after the installation of the Christmas trees. By using the FIV and SFIV valves, the operator successfully gravel packed and isolated the reservoir, installed the upper completion, and suspended the well without waiting for the Christmas trees to be installed. This innovative solution provided flexibility for rig operations and saved the operator approximately 2 rig days in a deepwater environment.

APPLICATIONS
- Fluid-loss control
- Underbalanced perforating
- Well control barrier operation
- Deepset lubricator operation
- Multiple zone isolation

BENEFITS
- Improves well productivity by preventing formation damage
- Reduces time and costs by minimizing interventions
- Saves time and costs by allowing multiple perforating runs without killing the well
- Increases efficiency by enabling batch drilling and completion operations
- Enhances safety during lubrication of long perforating assemblies

FEATURES
- Protects against formation damage
- Provides an efficient, reliable way to isolate the reservoir
- Eliminates fluid losses during completion installations
- Acts as a barrier valve for well control
- Uses tubing pressure cycles for noninterventional one-time opening
- Uses shifting tool for unlimited mechanical opening and closing
- Enables batch drilling and completion operations
Isolating the reservoir to prevent fluid loss protects the well—and your investment. Operators around the world depend on Schlumberger isolation valves. So should you.

**Schlumberger Family of Isolation Valves**

- FIV II Formation Isolation Valve
- MFIV II Mechanical FIV Valve
- SFIV Surface-Controlled FIV Valve
- AFIV Annular-Controlled FIV Valve
- TIVF Tubing Isolation Valve with Flapper