CURTISS-WRIGHT

EST Group

Double Block and Bleed Test & Isolation Plug

Novel Isolation Approach Brings Speed, Safety, and Security to Pipeline Valve Replacement

When a pipeline valve needs to be replaced, safety and speed are key considerations. However, when the pipeline cannot be fully drained of its contents and depressurized, these considerations take on a whole new sense of urgency.

This was the case for an oil and gas operator working off the coast of Australia. The operator needed to replace a blowdown valve on a spool filled with hydrocarbons on one of its offshore platforms. They wanted to avoid the conventional process that requires flushing, purging, and then drying the entire spool volume prior to performing the changeout, all of which would add a great deal of time and money to the project.

Further complicating the process, the valve changeout had to be done while ensuring that the spool was completely isolated at all times. There could be no oxygen ingress to the line and no release of hydrocarbons into the atmosphere.

Field-Proven Solution

Curtiss-Wright EST Group proposed a solution that previously proved successful for the operator in other "tie-in" applications, such as installing new flanges into existing pipework: the Double Block and Bleed (DBB) Test & Isolation Plug. The DBB is widely used to isolate and monitor potentially explosive vapors from upstream gases or hydrocarbon fluids in a vessel or pipeline during modifications or repairs requiring hot work.

The plug's dual-cavity port creates a completely air-free, positive pressure barrier between its seals, allowing isolation for welding activities and hydrotesting of new weld connections to be performed with the same isolation tool.

Traditionally, this plug is used to increase the safety for welding activities and gives the operator the ability to hydrotest the new weld between the seals with less than one gallon (3.785 L) of water. This reduces fill times, waste water, and treatment expenses while facilitating testing in remote areas of the facility. The dual port system also allows water to be circulated between the seals for improved cooling during pre- and post-weld procedures.

The standard DBB's seal is pressure rated to 2,250 PsiG (155 BarG), with upstream pressure rated to 10 PsiG (0.7 BarG). Higher pressure ratings can be achieved with special plug designs.

The plug's lightweight, predominantly aluminum construction makes it significantly lighter than other plugs. An 8" Schedule 80 plug, for example, weighs just 36 lbs (16.3 kg) while similarly sized plugs typically weigh in excess of 100 lbs (45.4 kg). This allows operators to avoid the use of cranes or other heavy lifting devices, which are often in high demand during plant turnarounds.

A Novel Installation Approach

While the operator was confident that a standard DBB would effectively isolate the line during the valve changeout, the installation process presented some challenges. The valve would have to be opened to allow the plug to pass through to its set point, which would expose the system to oxygen.

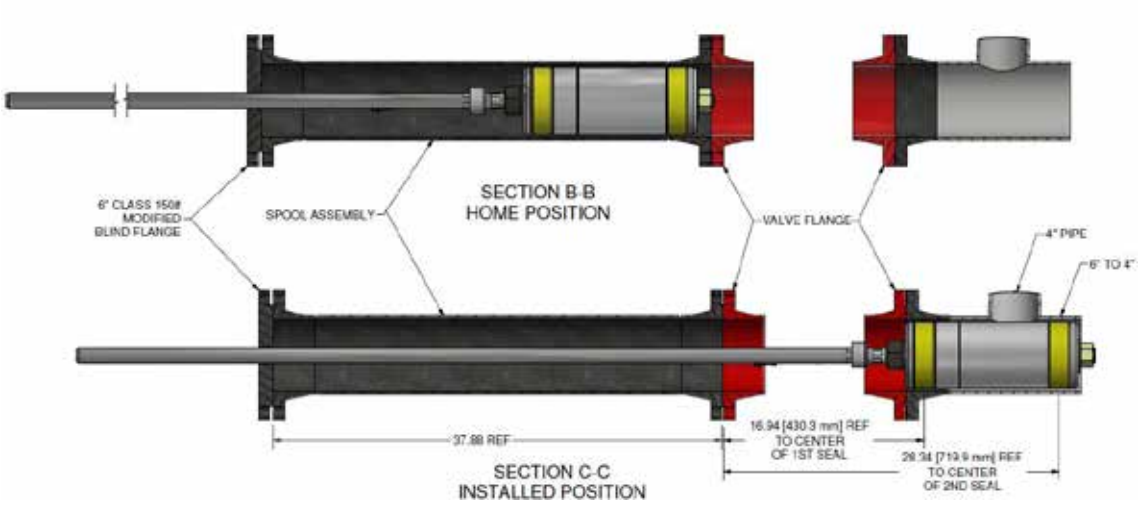

Figure 1 - The DBB housed in the spool assembly prior to deployment (top), and after it has been deployed through the valve and into its setting position by the push rod (bottom).

Working in collaboration with its Australian distributor PipeServ, EST Group developed a customized plug and installation strategy, with the ultimate goal of making plug installation as efficient, seamless, and risk-free as possible, without adding to the operator's maintenance budget. The solution included a custom launching spool assembly that housed a specially designed, hydraulically actuated DBB Test & Isolation Plug (see figure 1).

The launching spool and DBB were designed to safely isolate the valve during changeout through the following installation process. First, the spool assembly was attached to the valve flange. Then, the DBB was inserted into the spool assembly with a lanyard and the chamber was sealed with a flange. Nitrogen gas was introduced between the flange and the DBB plug to displace all oxygen from the system.

With the launching spool closed off and no oxygen present, the valve was then opened to allow passage of the plug. The DBB was pushed out of the launching spool assembly, through the valve and extended into the line with a long push rod to isolate the valve flange while the upstream chamber was pressurized with nitrogen. The assembly was designed to ensure that the DBB would be positioned in the line precisely where it needed to be with a predetermined measurement verification marking on the lanyard.

The position of the plug in the line made the conventional actuation process of mechanically activating the plug by manually torquing the nuts on the shaft of the plug impossible. The system was under pressure and closed off from the atmosphere. This necessitated the special hydraulically actuated plug, which included a hydraulic piston cylinder internal to the DBB. The cylinder was activated by energizing a hydraulic hose that fed to the plug. As the cylinder moved, it compressed the seal material forming a leak-tight seal on the two locations on the pipe wall.

During deployment of the novel DBB plug, the team had to develop a way to not only extend the plug to its setting location and safely bring it back, but also maintain pressure boundaries between the hydraulic hose assembly, connections, fittings, and gauges inside the launching spool assembly and the atmosphere. The solution was to route the hose assembly around the push rod in a spiral. As the plug was moved into position, the assembly extended like an unraveling spring to ensure service to the test plug was maintained while the plug was extended. Once the seals were compressed, the hydraulics were locked and monitored and remained in the system—along with the plug and the rod.

To ensure that the plug was fully engaged with the pipe during the entire process, the team had to continuously monitor the pressure at the plug. The plug was positioned in the line such that the two seals straddled a 4" auxiliary pipe running off the main line. The team pressurized the auxiliary line and monitored it for any drops in pressure, which would indicate that one or both seals was leaking.

With the plug secure, the nitrogen pressure was released, and the launching spool assembly and failed blowdown valve were safely removed. A new valve was securely installed. The launching spool assembly was reinstalled to the new valve flange and the process was reversed to safely remove the special DBB plug. The entire process enabled safe replacement of the blowdown valve while maintaining a nitrogen-rich environment to ensure no hydrocarbons escaped and no oxygen entered the system.

Success Through Collaboration

EST Group needed to operate under a tight timeline to ensure successful execution of this project. Working closely with the operator's team to ensure it met all of their specifications, they were able to develop the hydraulically actuated DBB plug and successfully deliver it within the short window of opportunity.

The plug was flown to the offshore platform by helicopter where the operator's maintenance crew performed the installation successfully. In addition to the operator's crew, a dedicated PipeServ technician was on site during the process to ensure the valve change-out went smoothly. The crew

Figure 2 - The equipment required for the line isolation consisted of just three main components: a hydraulic hose line (top), the spool assembly (middle), and the hydraulically actuated DBB (bottom).

was able to perform the valve replacement in about one day, realizing a significant cost savings in time and labor for the operator, over the four-day schedule originally planned.

Remote technical support and detailed installation instructions provided with the plug were contributing factors to the success of the project as well. Rather than flying an application expert to the site to oversee the process, which would have added significant cost and additional days to the job, the operator's maintenance crew were able to perform the repair easily and efficiently by following the detailed installation steps.

The custom solution not only delivered significantly lower repair costs versus a traditional valve replacement procedure, but the operator was able to keep their crew safe and the integrity of the pipeline and other equipment intact as well. The operator plans to document the success of this project to standardize similar procedures for other valve changing applications.

Curtiss-Wright EST Group offers a full line of test and isolation plugs, and maintains a large inventory ready to ship globally. 24/7 emergency design and manufacturing services are available to custom-build plugs to customers' specific application needs, including construction composition, pressure ratings, size ranges, and seal materials.

For more information, visit cw-estgroup.com. Contact us at EST-Sales@curtisswright.com or +1 215.721.1100 / 800.355.7044 to speak with EST Group's Sales Team today!

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North, Central & South America **EST Group** 2701 Township Line Road Hatfield, PA 19440-1770 USA | +1.215.721.1100 +1.800.355.7044 | est-info@curtisswright.com
Europe / Middle East / Africa **EST Group B.V.** Hoorn 312D 2404 HL Alphen aan den Rijn The Netherlands | +31.172.418841 | est-emea@curtisswright.com
China +86.400.636.5077 | est-china@curtisswright.cn | **Singapore** +65.3158.5052 | est-asia@curtisswright.com