STOPPLE® Train Plugging System: Simplified Method for Double Block and Bleed

By Frank Dum and Ray Foster

Abstract:
Double block and bleed is the preferred approach used to maximize safety while performing maintenance on active pipelines or piping systems. In the past, operators have used a number of methods to achieve double block and bleed. What all of these methods have in common is the dual barrier concept, the notion of placing not one but two barriers between a line’s pressurized contents and whatever work—such as cutting or welding—is being performed. In response to increasing industry demand, a simplified method for achieving double block and bleed has been developed by engineers at T.D. Williamson, Inc. The patent-pending STOPPLE® Train plugging system couples proven plugging technology with a reduced need for line intrusions, saving operators both time and expense. The STOPPLE Train system has proven itself in dozens of applications during the past couple of years. This paper offers a look at how double block and bleed can be achieved while still saving time and money.

1. Traditional Methods
Double block and bleed has traditionally been achieved in a number of ways. As shown in Figure 1, two separate valves with a bleed port between them can be used. The combination of a valve and a STOPPLE plugging head with a port between them can also achieve the same effect. In some cases, operators use a STOPPLE plugging head and an isolation plug with a port between them. Many operators simply use two STOPPLE plugging heads and a bleed port. There are also several methods that rely on inflatable bags or bladders.

What all of these methods have in common is that they establish two barriers. Whether those barriers are valves, STOPPLE plugging heads, isolation plugs or combinations thereof, the basic premise remains the same: the second barrier acts as a failsafe for the first. And regardless of the combination of equipment, inclusion of a bleed port between the two barriers provides a means for bleed down and pressure monitoring during operations.

2. The New Method
In response to increasing demand by pipeline and piping system operators for double block and bleed functionality, the engineers at T.D. Williamson, Inc. (TDW) developed the STOPPLE Train plugging system. Based on proven plugging technology pioneered by TDW in the 1950s, this unique, patent pending system relies on not one but two plugging heads. As shown in Figure 2, these two plugging heads are linked together to form a “train” that can serve as a double block. The first plugging head is the trailing plugging head and forms a primary seal. The second plugging head is the leading plugging head and forms a secondary seal. In the unlikely event that the first seal leaks, the second seal is fully capable of holding the line pressure by itself.

Compared with traditional methods, which typically require at least two fittings and taps to achieve double block and bleed, this innovative system requires only one...
standard STOPPLE fitting and one hot tap to achieve the same effect. As shown in Figures 3a through 3d, the linked plugging heads of the STOPPLE Train system can be inserted into a line through just one opening. A single fitting and hot tap thus yields the double block benefit of two standard STOPPLE plugging heads.

A pressure bleed port positioned between the two plugging heads allows the void between the heads to be bled down, creating a zone of zero energy. This port also allows for seal verification and monitoring before and during downstream maintenance operations. If the operator so chooses, this system can also be used without the bleed port to get the safety advantage of redundant seals.

3. System Capabilities

The STOPPLE Train plugging system was designed to handle both low pressure and high pressure environments. Tests have shown that at low pressures, compression between the sealing elements and the pipe inside diameter creates an excellent barrier. The sealing elements do not even need to be energized to seal; at 0.5 psi to 5 psi, the compression fit alone is enough to create positive seals. Once energized, the seals will remain intact until an external force, such as retraction of the plugging heads, breaks it.

The STOPPLE Train system also functions well in high pressure applications. Both plugging heads are rated to 1000 psi (69 bar) at 180°F (82°C), or reduced pressures at temperatures up to 350°F (176°C). They have been tested successfully at 1.5 times this rating. In addition, the pressurized plugging heads have been successfully tested together and independently.

4. Benefits

Because the STOPPLE Train plugging system requires only a single standard STOPPLE fitting and one hot tap, fewer potential leak paths remain on the piping once work is complete. Compared to other methods for achieving double block and bleed, which typically require twice as many line penetrations, this is a major improvement. Fewer fittings also mean less expense. Further savings result from less excavation, fewer pieces of equipment, less welding and a shorter overall job time, meaning less exposure to potential hazards for personnel and less potential system downtime.

The most cost-effective aspect of this new system stems from the fact that it is based on proven plugging technology. Pressure ratings for the STOPPLE Train system follow traditional STOPPLE parameters, and all standard STOPPLE tools apply to the maintenance of the STOPPLE Train plugging heads. Using the STOPPLE Train system requires nearly identical training, operation and maintenance as for all STOPPLE plugging systems, so veteran equipment users generally see very little change (other than a little extra plugging head travel length) from typical plugging operations.

5. Line Replacement

Since being introduced, the STOPPLE Train plugging system has proven itself in dozens of field applications. A good example was a project completed in November 2008. A Texas gas pipeline needed to be replaced, and part of the safety requirements included a double block and bleed method of pipeline isolation. To add to the complexity of the job, the pipeline was in close proximity to a very busy street. Because of the need to not interrupt rush hour traffic, the pipeline could only be repaired between the hours of 9 a.m. to 4 p.m. In addition, the customer required minimized intrusion into the piping, as well as reduced fitting, welding and associated costs. In response to these requirements and the call for a double block and bleed capability, a STOPPLE Train plugging system was deployed. On the day of the job, standard pressure tests on the
STOPPLE fittings were carried out and then the hot taps were made. The STOPPLE Train housing was installed, and equalization hoses were installed. Sweeping was conducted to remove potential metal chips that may have been left behind during the hot tapping operations, and then the STOPPLE Train plugging heads were inserted and set. The pipe was bled, and the seals were in place. A hose was run from the bleed port to a safe location in the event that any gas would leak past the primary seal.

With the STOPPLE Train system in place, cold cutting and welding of both sections of the pipe were executed and completed. The STOPPLE Train system was retracted. The housing was unbolted and completion plug inserted and set. The STOPPLE Train plugging system performed according to expectations. Tapping with no flow left some chips in the pipe, but the plugging heads still sealed properly. The project was successfully completed with all the customer’s objectives and requirements fully satisfied.

6. Valve Change Out

The STOPPLE Train plugging system also proved instrumental during a December 2009 valve change out on a 10-inch diesel transmission pipeline that normally transports 1200 barrels per hour. The customer needed to unbolt an existing isolation valve and replace it with a new one. Following successful hydrotesting of equipment, three downstream taps were made: a 2-inch equalization tap, followed by the 10-inch tap required for placement of the STOPPLE Train plugging heads and a _-inch tap for bleed purposes.

Following removal of the tapping machine, the STOPPLE Train system was mounted, and equalization and hydraulic hoses were connected. Product flow was stopped and two valves were closed about a _-mile north of the work area. A small bleed port was opened between the two valves to provide double block and bleed on the upstream side of the work area. The STOPPLE Train plugging heads were inserted and the bleed valve opened to provide double block and bleed on the downstream side of the work area. Once the isolated section was essentially drained, the isolation valve to be replaced was unbolted and the new valve put into position and bolted up.

The upstream valves were then cracked open and air was bled from the line prior to removal of the STOPPLE Train plugging heads. Once the plugging heads were fully retracted, the housing was removed and a completion plug was set in the fitting, followed by a blind flange. The entire project took just two working days, and the customer was pleased with the efficiency of the process.

7. Line Tie-In

A third example of STOPPLE Train system application revolved around a customer’s need to add a new isolation valve while replacing a portion of an existing 8-inch natural gas liquids (NGL) pipeline. In this case, two STOPPLE Train systems were employed, one upstream and one downstream, to seal off 1.3 miles of the pipeline. The customer used pipeline batching pigs to replace the NGL with nitrogen through the region of the pipeline to be replaced. The pigs were launched at intervals sufficient to provide a 1000-foot buffer of nitrogen on each side of the work zone.

The downstream STOPPLE Train plugging heads were set first, followed by the upstream plugging heads. The customer depressurized and bled down the 1.3 miles of nitrogen from the pipeline. Once it was verified that there was no product leak past the secondary seals of the STOPPLE Train plugging heads, the bleed valves were opened to ensure that a good primary seal had also been achieved. It was determined that the line was safe to cut and open.

Both ends of the pipeline were cut within approximately 6 feet of the STOPPLE Train plugging heads. The customer tied in the new line and installed an 8-inch block valve 50 feet downstream from the upstream plugging heads. Once the modifications were complete, the customer closed this new block valve and TDW equalized between each of the STOPPLE Train systems and the valve. Both systems were then retracted and both completion plugs were set. The customer was so pleased with the success of the work that they have ordered two STOPPLE fittings for emergency response preparedness.

8. Conclusion

The STOPPLE Train plugging system has proven to be a safe and cost-effective method for achieving double block and bleed. The initial wave of five plugging head sizes—4-, 6-, 8-, 10- and 12-inch—are all designed for use on Schedule 40 pipe. Additional, larger sizes designed to cover approximately 80% of pipeline market needs are currently in development and testing, with initial in-field use scheduled for later this year.

About the authors

Frank Dum is Market Development Manager for the Line Intervention / Flow Assurance division of T.D. Williamson, Inc. His degrees received include a BS in General Engineering from Oklahoma State University and an MBA from Northeastern Oklahoma State University. Mr. Dum has more than 25 years of experience in the E&P, pipeline and refinery industries.

Ray Foster is TDW’s Country Manager for Indonesia, based in Jakarta. Ray has over 35 years experience in the Oil and Gas industry. He has an MBA in Marketing.