Transforming the future with new solutions

Testing the integrity of recoated pipeline is crucial to corrosion prevention. **John Balogh, Meriam, USA,** presents a new-age technology that surpasses existing testing methods.

As the process of recoating a pipeline is crucial to the prevention of corrosion, the process of testing the integrity post-recoat is equally important. In order to be sure that a pipeline is prepared for the rigours of the operation for many years, the integrity of its structure needs to be re-evaluated and deemed suitable to enable future testing. Enter the obligatory hydrostatic pressure test.

Figure 1. Pipeline taken out of ground to conduct tests.

Value in hydrostatic pressure testing

Hydrostatic pressure tests or pipeline integrity tests are performed on a section of pipeline to determine whether or not the pipeline has the required integrity that, if left untested, may cause a rupture and interruption in service, let alone safety concerns. In this case, the test determines whether or not the recoated pipelines have the same integrity that was required prior to the coating process. During this test, a section of the pipeline is typically filled with water to remove air. A positive displacement pump is used to raise the pressure inside the pipe to a predetermined test value.

During the pressurisation of the pipe it is important to measure the volume of the media (water) entering the pipe and plot that versus pressure. This is called a yield plot. The yield plot should be linear in nature. For example, if your pipe pressure is currently 850 psi and you add 10 gallons of water to the pipe, the pressure after the additional water should be 860 psi. Another 10 gallons, another 10 psi (870 psi) and so on.

Figure 2. Pressure test in progress.

Figure 3. This process is truly critical as you can see miles of pipeline above.

This should continue until the Maximum Allowable Operating Pressure (MAOP) is reached.

However, using the same example, if at 850 psi with 10 gallons being added you would expect another 10 psi. In this case only 5 psi is added which gives you 855 psi. Adding, another 10 gallons now only increases the pressure another 3 psi, giving you a pipe pressure of 858 psi. Here, something is wrong. Either there is leak or an area in the pipeline steel is going into the plastic region, known as deformation. This is permanent unlike the elastic region where, once depressurised, the pipe will return to its original size.

After achieving the predetermined pressure, the section of pipe being tested is shut in at test pressure and the pressure is monitored and recorded for signs of pressure decay (leaks). It is necessary to identify whether or not there has been a pressure decay, which would indicate that the pipeline is not ready for future usage. Another factor taken into account during these tests is the temperature. Temperature changes in a closed system affect the pressure in that system; therefore, ambient temperature and the temperature of the pipeline itself are also monitored and recorded. One example that reflects the importance of the temperature being monitored is that you could start seeing the pressure dropping. An operator would be able to determine whether or not a leak exists by looking at the graph, in real time. It would indicate that the temperature of the pipe is getting colder as the sun sets. This triggers the operator to have to add more fluid to keep the pressure within the test limits.

These tests are carried out for several different purposes. They are used during the construction of new pipelines and the reclassification of existing pipelines to higher operating pressures. In the event that a pipeline needs to be repaired, this test is beneficial as it points out what issues exist. Also, going along with the post-corrosion recoating scenario, stress corrosion testing programmes require this type of test. This test is also valuable in the case of pipe damage due to outside factors such as subsidence or landslides.

In the case of recoated pipelines, this process has proven to be very valuable to maintaining the viability of pipelines capable of providing accurate readings for pressure. Unfortunately, the historical method of testing these pipes has a lot of opportunity for error. There are several drawbacks to the way these tests are conducted in fields all over the country. Resources, both physical and time related, can be overused and mismanaged. In some cases, they allow for situations to arise where the accuracy and stability of these tests run the risk of being jeopardised.

Conducting an accurate test using traditional methods

To execute these tests properly, hydraulic dead weight testers, which must be level and clean for correct operation, have to be spun by technicians for accurate data collection. As they are spun, data related to both pressure and temperature are recorded by hand. This requires great focus and patience. The data is recorded through the primitive means of paper and pen documentation. Ironically, the margin for error in testing the pipelines is essentially zero, whereas the probability of error from the handwritten data collection method is common, if not likely. To add to this potential confusion, data is pulled from multiple different documents, but the results must be organised on one data sheet, which in effect could also contribute to error. Add in the necessities of batteries and timers, and you need a checklist of materials to remember to bring before you even head to test the pipeline. These tests typically run 8 - 24 hours and in specific timed intervals, which vary on a case by case basis, a technician is expected to rotate the dead weights throughout the test. The entire time the operators are focused on data collection and would be better served to rely on the test itself for that.

Perhaps the most important function of the entire test is the validity of the data. The purpose of the test is to gather data that reflects the conditions of the pipeline during the test. The issue lies in the existence of data manipulation. Due to the length of these tests, patience can run short, leaving open the possibility of manually entering data to expedite the process. This highlights the need for a more full-proof system that takes manual data entry out of the equation entirely.

Figure 4. Site of a pressure test with exposed pipeline.

Finding an improved solution

As this process is so critical, the means of testing is should be tailored to foster an error free environment, such as Meriam's PIT5000 Digital Deadweight Tester. Considering that so much rides on these pipelines maintaining their structural integrity, Meriam created a patented tool that allows for the test procedure to be completed with the same emphasis on accuracy, but a more realistic, logical approach from a logistics standpoint.

The PIT5000 provides a digital solution, one rooted in the thinking that the concept of saving time is important to the technicians administering the test. Meriam engineers worked in conjunction with the operators conducting these tests to better understand the unmet needs of the current method for pressure testing to help them develop a digital version of the tried and true dead weight testers. Gone are the weights that need to be spun every time data is collected, gone are the charts and pens, which dry out, needed to hand record the results. Gone are the different areas of separately gathered data to combine into one singular data sheet. The PIT5000 eliminates the need to correct the density of the weights; there are no linkages to slip and no pen lines to interpret. All of the test data is collected automatically and better yet found in one place, a plotted pressure and temperature versus time graph, with a yield plot (pressure vs. volume). Data collected features unique rate information to monitor pressurisation/depressurisation and provides user-settable visual alerts which are active during the shut in period. The system guarantees consistency of data, eliminates transcription errors and produces an electronically secure final report. This harkens back to the notion of saving the operator time by reducing the workload. This tool also renders data manipulation impossible. In essence, the PIT5000 alleviates the headaches created by the potential for flaws that the older method presents. It is a one-stop-shop designed to consolidate the procedures and data collecting tasks of pipeline pressure testing. The PIT5000 is also the only system currently available that addresses the needs of today's integrity management requirements.

Conclusion

The future is unpredictable, something that Meriam understands. However, the future can be transformed and Meriam drives the thinking behind that transformation. Forward thinking is what empowers the growth of all industries and the evolution of applying new-age technology to solve existing problems is a direct byproduct of that ideology. That idea is boundless. Efficient and effective processes are what dictate the way we interact and adapt to the changes in the landscape of day to day occurrences. Meriam has simply applied this theory to one of the industries that they know best. Meriam introduced the PIT5000 to better facilitate turning the vital undertaking of pipeline pressure testing after pipe recoating into a seamless operation.