Pipeline & Gas Journal
September 2000 issue:

Economic Benefits Of Valve Commissioning During Pipeline Construction

The costs associated with block valve replacements from an “in-service” pipeline are rarely taken into consideration when building a new large diameter gas pipeline or adding to an existing pipeline.

The planned life expectancy of most pipeline projects is typically 25 years. As the production fields become depleted, enhanced recovery techniques are introduced as well as new slant hole drilling and 3D seismic techniques. Mature natural gas fields are also being converted to gas storage facilities. These developments have extended the life of the production field many times over. It’s not unusual to have the pipeline remain in service 40-50 years or even longer.

Research has proven that most valve damage occurs at start-up as a result of construction debris, improper hydrostatic testing and cuttings from tie-ins and hot-taps. Sealweld Corporation has developed procedures and techniques that virtually eliminate the problems associated with valve damage during construction.

Existing Construction Techniques
Pipeline construction is typically initiated by first having a design engineering group or outside engineering firm design the new pipeline based on the pipeline operators’ existing written standards for construction practices, materials and safe work procedures. Once the initial design is approved, the materials are tendered for purchase and contracts tendered for construction contractors.

Valves are ordered based on the operators written specification. Then they are manufactured and tested to API and/or other company standards, crated and shipped to the operators specified location. The valves are typically pupped either at the valve factory or at a fabrication yard and welded into assemblies. In some cases, the assemblies are fabricated at the pipeline right-of-way depending on the welding procedure being utilized.

After welding, the valve assemblies and the entire pipeline is hydrostatically tested at 1.5 times the maximum rated working pressure of the pipeline. The pipeline is de-watered, dried and prepared for the introduction of natural gas.
In most cases, individual valves are not seal tested with high-pressure gas until after the pipeline is placed into service.

When valve seat leakage problems are discovered, the operator is faced with a dilemma: do they shut down and drain the pipeline and replace the bad valve or do they leave the valve in place and work around the problem? In most cases, due to delivery commitments and other economic constraints, they elect to leave the valve in place until an outage can be scheduled.

In some cases, the construction contractor may be held responsible for pipeline integrity for the first year or two of operation; the contractor may also be held responsible for any valve replacement costs. This inevitably leads to complications and even litigation in many cases as the contractors look to assign or deflect responsibility. The valve manufacturer can produce written documentation of their factory seal testing to prove that the valve sealed perfectly when manufactured.

Valve Replacement Cost Analysis
Based on studies of valve replacement costs from an assortment of domestic pipeline operators, we can estimate these costs as listed below. You should be able to validate these costs through researching your own records and following these guidelines.

1. New large diameter valve costs—depending on the valve specification, a new valve will cost from $1,200-$2,000 per inch of valve diameter, a 36-inch ball valve ranges from $45,000-$65,000 delivered to the location.

2. Manpower and Equipment—because of the specialized heavy equipment required these costs are also an important consideration. Depending on the location of the valve site, the cost of moving the heavy equipment and housing the manpower can vary greatly, especially if the valve site is in a remote location. Estimates for this range from $200,000-$250,000 per valve site.

3. Cost of Lost Gas—depending on the pipeline configuration and if there are lateral pipelines involved, this cost will have a large impact on the overall valve replacement cost. New practices that help reduce the amount of lost gas include using a portable gas compressor to draw the pipeline pressure down to approximately 150-200 psi with the balance of the gas being flared or vented to atmosphere. In some cases and in the absence of specialized equipment, the entire contents of the pipeline and associated laterals must be blown down and lost to atmosphere. Another significant variable is the size and pressure of the pipeline and cost of the gas being vented which often depends on who owns the gas and the time of year and/or current market conditions. Our estimate for this cost ranges from $50,000-$100,000 per valve site.

4. Lost Revenue for the Pipeline Operator—this is the most significant cost and is not always considered when modeling cost estimates. Depending on the operating jurisdiction, the operator may charge a toll fee for transporting the customer’s gas in the pipeline. If the pipeline goes out of service, the effect is twofold; in the first instance, revenue is not being generated and in the second, the fixed costs for operations are constant. The models that have included this cost in their estimates range from $2.5-$5 million. This value can only be arrived at through a complicated set of calculations based on an analysis of all fixed operating costs, contractual obligations, market conditions and the pipeline design at that specific valve site.

5. In cases where the valve seal damage is discovered before the pipeline is placed into service, valve cut-out and replacement costs typically range from $250,000-$500,000.

With this explanation of the actual combined costs of valve replacement, it is not difficult to understand why an operator or construction contractor would want to take every precaution to ensure valve seal integrity at each phase of pipeline construction.

The new valve commissioning procedures and techniques that have been developed by Sealweld are proven effective at eliminating the most common reasons for valve seat damage. When the cost of applying these procedures is included into the original purchase price of the valve, the economic benefits to a successful pipeline start-up become obvious.

Case History

Sealweld has been involved in numerous pipeline construction projects in its 30-year history. When the pipeline operator becomes aware of leakage problems, the technicians are often called to the valve site to apply a solution in-line and under pressure.

Through what could be considered a form of reverse engineering, Sealweld engineers have worked these failure experiences back to the original source of the problem and developed what is now referred to as our “New Valve Commissioning Proce-dures” to ensure these known problems are not repeated.
During one such pipeline project, we were awarded a contract to apply our commissioning procedures at the upstream end of the pipeline. On the same pipeline at the downstream end, the construction contractor followed conventional construction techniques.

The natural gas pipeline was a single large diameter high-pressure pipeline that was being expanded to include a parallel or looping line adjacent to the existing pipeline.

In the upstream section of pipeline where we were awarded the contract and allowed to apply our procedures, Sealweld field engineers worked closely with the pipeline operator engineers to modify the valve design specification to include specialty fittings and specific seat sealing design features that best suited their system. Field technicians traveled to the valve factory, to the fabrication yards and to the pipeline right-of-way to apply a protective treatment to all new valves. Multi-skilled valve technicians were also used to install and commission the gas-hydraulic valve actuators.

In the upstream section of pipeline where these procedures were applied, ten 42-inch ball valves and one 36-inch ball valve were installed with gas/hydraulic actuators. All 11 valves sealed perfectly when the high-pressure natural gas was introduced and the system was put into service. Total contract value to perform the commissioning procedures and actuator installation was approximately $75,000.

In the downstream section of pipeline where these procedures were not performed, seven large diameter valves had to be replaced before the pipeline could begin operations.

From these modeling estimates, we can calculate that the costs to replace these seven valves are between $250,000 per valve and $5.4 million per valve, depending on whether the pipeline had been put into service before the valve replacement. Expanded to include all seven valves the cost estimates using our model range from $1.75-$37.8 million. From these experiences, we can successfully demonstrate the economic benefit of utilizing valve commissioning specialists during the construction phase of the project.

Benefits Of Valve Seal
Verification In In-Service Pipelines

Under a separate contract on the same pipeline system the scope of work included performing a preliminary valve evaluation and seat seal testing of all large valves in the upstream end of the pipeline system while it was operating. The objective was to determine if there were any bad or problem leaking valves that could complicate the planned tie-in locations of the new parallel pipeline.

During the initial evaluation phase of the project, our specialized valve technicians were contracted to perform a full-service valve and actuator maintenance to each mainline valve in the upstream section of the system. The scope of work included cleaning, re-lubricating the seat and stem sealant systems, routine gas/hydraulic actuator maintenance including valve stop adjustments, seat leakage testing and measuring for each mainline valve in the existing single pipeline system.

Sealweld specialist valve technicians have also completed similar contracts on large diameter natural gas pipeline systems in foreign and remote pipeline locations. A study of this work allows us to provide an accurate cost comparison for providing these services based on location.

The prices shown are based on the final combined costs to perform a comparable scope of work domestically vs. internationally, taking into consideration the extra cost of training, translation, working and driving along the entire foreign pipeline system. It should be noted that one of the critical variables in preparing any price estimate for working along a long-distance cross country pipeline is the cost of transportation and having to return to the same remote location several times over the duration of the contract.

Stand-by days and their associated costs are also an important variable that must be factored into the calculations. When going into these contracts some of the unknown factors that can affect the construction schedule include:

n Delivery delays of pipe, valves and actuators including manufacturing delays shipping and handling delays, customs clearance and local cartage.

n Labor and manpower disputes including visa & taxation requirements.

n Land access disputes, domestic legal policy regarding land use and access.

n Climate and weather patterns. In some cases construction, takes place over a period of months and/or years. Several different seasons may be experienced. In tropical climates this includes the rainy season, in northern climates the freezing problems associated with cold winter weather resulting in all types of unexpected delays.

The benefits of utilizing an experienced international contractor with the ability and experience to transfer technology to domestic nationals can significantly impact overall manpower costs.

Using these costing models, it is obvious that the cost benefit of utilizing specialized contractors to perform valve commissioning, actuator installation and valve seal verification on existing valves and actuators is extremely cost effective when compared to the cost of valve replacement.
The benefit of having multi-skilled personnel specialized in a variety of valve and actuator related tasks is significant in reducing the total number of personnel required.

These models also demonstrate that over the life expectancy of the pipeline, additional savings can be achieved by instituting a training system for transferring the technology and specialized skills of certified valve technicians from foreign specialists to domestic nationals. ***P&GJ***

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