

# CLOCK SPRING®

## Plant and Refinery Case Studies

### External Corrosion

A corrosion cell can find its way to a pipeline not only through the ground, but also by air. Recently, a refinery in southeast Houston, Texas found how corrosive an 'air-borne' drift from a cooling tower can be. An above ground pipeline had corrosion spots spanning over nine hundred feet running parallel to a cooling tower.

A conventional solution to this problem would have encountered serious challenges, such as additional work permits required from various divisions and companies and safety hazards due to the close proximity of process equipment and other product lines which made this project under traditional scenarios an arduous and expensive task. Clock Spring® Snap Wrap composite sleeve reinforcement system was the logical alternative choice as no hot work, down time or line reductions were necessary.



903 units were installed at the rate of approximately 75 feet to 100 feet per day. As a cleaning crew prepped the pipe, three installation crews applied the Clock Spring® Snap Wrap kits by hand spool method since the pipes were within three inches of other hazardous product line. The repairs also included 90 and 45-degree fittings.

Clock Spring® not only provided reinforcement to the damaged areas along the pipe, but also permanent protection from suspension chemicals found in the drift of vapor off the cooling towers. The projected life of the repair exceeds the life of the plant.

### Pipe Support Location Repair

An international gas company has used Clock Spring® within their gas production facility to treat and prevent further corrosion of their pipelines sitting on pipe supports. Clock Spring was used on both low and high-pressure pipelines with corrosion wall loss greater than 30%. The ability to repair without shutdown or welding was of high value to the continued gas production. Their employees are now suitably trained to install Clock Spring as the need arises and will continue to monitor their pipelines for further application and cost savings.



### **Bend Repair**

A company in Pasadena, Texas called Clock Spring to assist with a bend repair for a 6-inch pipe carrying ethylene over a small canal. There were additional pipes running parallel about 5 inches apart. At certain times of year, the pipes become completely submerged in water and therefore experience corrosion issues. Corrosion pits were scattered through the tangents into the bend over a 12-foot arc length.

Clock Spring sent technical representatives to complete the repair. Due to the lack of working space, the hand spool method was used to install units. Approximately 18 units were used to cover the 12-foot arc across both sides of the pipe. Some of the units were cut to fit the bend properly. Roughly 36 units all together were installed within 5 hours. A wax tape was used to mold into the gaps and protect the Clock Spring® units from UV intervention.



Clock Spring® is an example of technology that saves money, improves safety, and helps to protect the environment. The use of Clock Spring® repair technology has been expanding as the old methods give way to some modern thinking. A Clock Spring® repair is the fastest and safest method of making a permanent repair. It reduces the pipeline company costs. It reduces greenhouse gas emissions and benefits the environment. Proactive operators have realized significant cost benefits and significant environmental benefits by utilizing Clock Spring® repair sleeves.

The advantage of a composite repair used in this fashion is obvious. Not only does a Clock Spring® coil serve as an external defect repair for up to 80% wall loss anomalies, it also shields the pipeline from any future corrosion or damage. This is a permanent repair with a 50-year minimum life.

### **Leak Repair**

The Clock Spring® Leak Repair system can be used to repair leaking defects in irregular shapes, bends, fittings, tees and other difficult repair applications. The Leak Stop-02 system, along with the Clock Spring® Snap Wrap repair, will address most maintenance and repair needs for pipes and pipe works operating up to 500 pounds per square inch (psi).



During a scheduled turnaround, multiple through-wall defects were uncovered in a section of process piping. The 8-inch stainless steel schedule 10 pipeline, operating at less than 50 psi, had pinhole defects spanning over 20 feet. A shutdown of a byproducts line out of the unit caused a volumetric increase of corrosive material in the vapor. Corrosive liquids accumulated at elevation changes and fittings across the outlet section.

The product, which operates at less than 100 degrees Fahrenheit, is comprised of 82 percent nitrogen, 6.5 percent acetic acid, 1.9 percent water, 8.3 percent oxygen, 1 percent hydrogen bromide, 0.2 percent methyl acetate and 0.1 percent methanol by volume. Clock Spring Leak Stop-02 repaired over 35 feet of this piping with scattered pinhole leaks. The chemical resistivity was not an issue; the sealing material is inert to most corrosive materials.

Clock Spring can provide data that displays the resistivity of most compounds. The one-man operation took less than two days to complete. Clock Spring not only provided reinforcement to the damaged areas along the pipe, but also permanent protection from any future corrosion. The projected life of the repair exceeds the life of the plant.

### **Leak Repair of Water Line**

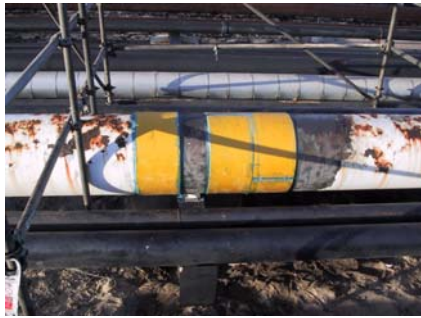
A Clock Spring® customer called for help on an unusual problem. They had a 42-inch diameter, low-pressure, water line that had developed a leak and they could not take the line out of service. After investigating, they found that the line had severe external corrosion along a 12-foot section. They repaired the leak with a compression sleeve but were concerned with the other defects. In fact, as they were cleaning these defects, some of them began to weep slightly.



The customer had used Clock Spring® for high pressure pipeline repairs and called to determine if it could be used for this repair. Clock Spring Company, L.P. designed a Leak Stop repair that not only stopped the leak but also protected the pipe from further corrosion. Thirteen 2-wrap Leak Stop units were installed axially along the damaged pipe. The repair was completed quickly without disrupting flow.

### **Leak Repair of Product Line**

In El Segundo, California a pipeline off loading product from a tanker to a nearby tank farm had weeps and needed to be repaired before the next shipment. An unexpected delivery forced this group into an immediate repair mode. An over-night delivery of seven Clock Spring® Snap Wrap units and Clock Spring® Leak Repair Systems was sent to arrive by 10 a.m. the next morning. The leaks were approximately 1/8" in diameter due to external corrosion. The seven repairs were completed by 2 p.m. that same day and the cargo was off loaded the next day.



This application is a great illustration of a company investigating its options and responding quickly and efficiently to an unexpected change. The LS-02 is an excellent product for this particular repair; a line that has been shutdown with pinholes, not considered a DOT line, operating at low pressure, but a valuable asset to the company. A quick and effective installation of the LS-02 removed installation problems associated with temporary clamps; environmental disclosures for leaking pipelines near water, and the delay of shipments to other terminals.

### **Leak Repair on High-Voltage Line**

In another recent application, Clock Spring repaired multiple defects, including two leaks, on a high-voltage 6-inch schedule 40-conduit pipe (see figure 2). The 138 kV cable is insulated by pressurized synthetic oil. The pipeline maintains a pressure of 250 psi to insulate the pipe wall from the high-voltage cables. Clock Spring repaired the leaks and almost 15 feet of defects from third-party damage to the pipe wall and coating.



Though the load on the cable was removed, the operator wanted to maintain positive pressure on the line during the repairs. Both leaks were sealed and wrapped with the composite sleeve while the operator maintained 10 psi and 15 psi. The non-leaking defects were repaired with Snap Wrap with normal oil pressure in the pipe (250 psi).

All components used within the repair are completely traceable, and all aspects of a repair can be supported by detailed engineering analysis, tests and experience. The system is a safe alternative to traditional pipeline repair methods.

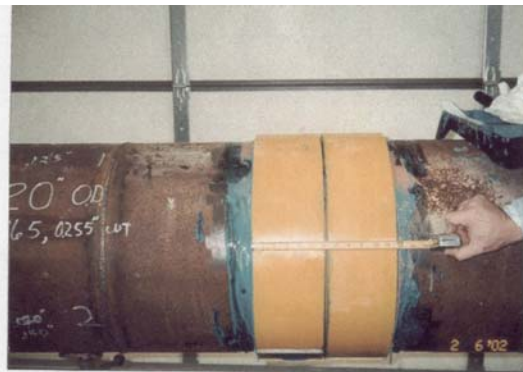
### **Weld Repair**

Clock Spring® composite repair system can be used to reinforce corrosion or other blunt defects that affect the girth weld zone. Defects in the weld zone can be repaired by bridging the weld cap with an additional Clock Spring® unit. Clock Springs are installed on either side of the weld; the space between the units is filled with high compressive strength filler and a third unit installed over the filled gap.

A major pipeline company collaborated with Clock Spring to evaluate the effectiveness of the Clock Spring® repair for reinforcing defects in girth welds. A test protocol and the facilities needed to demonstrate the performance of the composite wrap when used in this repair application was organized.

Three defects were placed in the center weld. These defects were each approximately 6-inches long with a depth of 50% wall. They were separated circumferentially by approximately 10-inches and were made using a power grinder.

The test section was sealed and filled with water. A pump was used to increase the pressure to failure at a rate of approximately 12 psi / minute. The pipe was pressured to 1380 psi (85% yield) and held for 30 minutes. Pressure was increased slowly until failure occurred at 1820 psi (112 %SMYS).



The test spool containing the girth weld defects repaired with Clock Spring® was subjected to hydrostatic pressure until failure occurred.

The failure pressure was 1820 psi, which corresponds to a stress of 72.8 ksi. The failure occurred outside of the repaired area at a small patch of localized corrosion. The failure was a typical "fish mouth" tear, stopping at the installed Clock Spring®.

The volume of the test spool is approximately 37760 cubic inches. At 1.804 cubic inches per ounce of water, the spool contained 17051 ounces of water at the beginning of the test. A total of 1456 ounces of water was added to the test spool during the test (8.5%).



Note the bulging of the pipe outside the repair area.

### **Conclusion**

Composite repairs are a proven and accepted high-pressure pipeline repair technology. Within Clock Spring to date we have completed over 150,000 repairs in over 70 countries worldwide. Defects found in piping can be permanently repaired more safely, quickly and economically by using composite technology than any alternative technique. The areas for application of composite repairs are expanding and now include:

- external and internal defects
  - bend repairs
  - weld repairs
- mechanical damage and third party interference
  - pipe supports
  - mill defects
- high temperatures / sub-zero temperatures
  - structural reinforcement
  - crack arrestors
  - open water repairs

**Simply the smartest pipeline repair decision you can make!**

**Clock Spring Company L.P. • 14107 Interdrive West • Houston, Texas, 77032  
Telephone 281.590.8491 • 800.471.0060 • Fax 281.590.9528**

[www.clockspring.com](http://www.clockspring.com)