

Stainless steel seals the deal

Beneath the surface, under streets and buildings, an ‘invisible’ infrastructure humbly helps to make modern life more efficient, convenient and safe; pipelines that transport drinking water, gas, oil and waste water to and from buildings and across cities, countries and continents. Burying these pipes underground protects them from most forms of damage, and saves space above ground. However, ageing, corrosion, wear and ground movement pose challenges to their integrity, and can lead to leaks which are difficult to locate, access and fix. A rubber pipe seal, secured in place from inside the pipe with molybdenum-containing stainless steel expansion rings, is a convenient and durable solution.

Traditionally, repairing or replacing a buried pipe involves digging up the ground to access the affected section, often beyond the immediate area of the leak. Such repairs can lead to traffic disruption or interruption of plant and building operations, as well as environmental damage. Additionally, the damaged pipe may lay beneath other pipes or fixtures, meaning it is not directly or easily accessible from the surface. To complicate matters further, the exact location of a leak can be difficult to pinpoint and shutting down the pipe for repair may in itself cause problems, leaving businesses and customers without essential services. A repair system that fixes the pipe from the inside can solve many of these issues, because inspectors and repair personnel can use existing access points without disturbing the surface, and, if necessary, without disrupting services.

An inside job

Internal pipe repair methods including relining, are collectively called ‘trenchless rehabilitation techniques’. They are generally quicker and less costly than open-trench methods, because they avoid or minimize excavation and backfilling; they are also safer and less invasive. Installing a relatively narrow rubber pipe seal, right at the affected area, is one of the most cost-effective and quick methods to repair a localized leak or offset joint. This internal sealing system can be used in any pipeline that is large enough to be accessible by people.

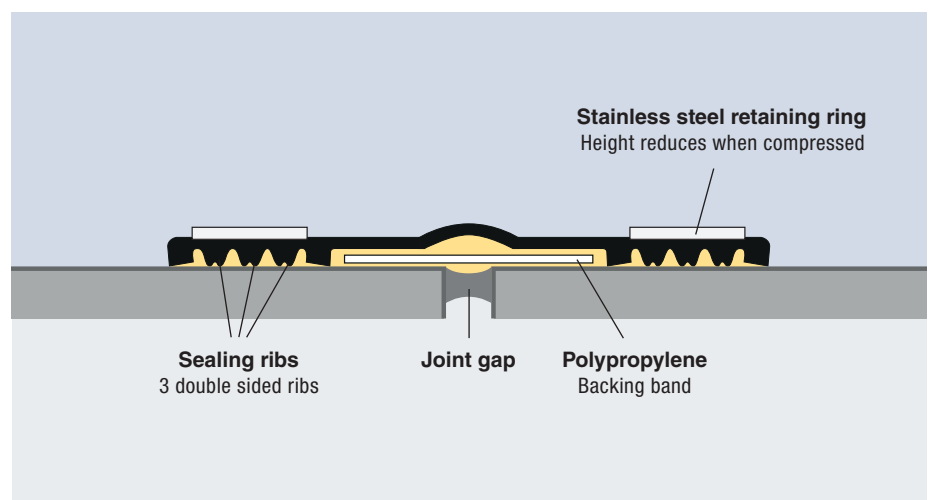
Rather than replacing or repairing the pipe itself, or relining lengths of pipe, the system applies a ‘patch’ locally. The leaking section is first evacuated, so that the repair team can enter the pipe using the nearest access hatch. After they have located the leak, they clean the inside surface of the pipe and prepare it for sealing. Usually between 30 and 50 centimeters wide, the rubber strip is similar to the tube inside a tire, and extends to fit around the entire inner circumference of the pipe. It incorporates sealing ribs at both edges of the strip. The sealing ribs, which face the inside of the pipe, are then themselves held in place with two stainless steel expansion rings, creating the seal.

These specially engineered, stainless steel rings are typically three to five

millimeters thick and are manufactured with a gap. With the help of a hydraulic extender the gap is expanded, pressing the ring against the rubber seal. Once expanded, a stainless steel section is slotted into the gap, locking the ring in the expanded position and maintaining the sealing pressure.

After the seal and stainless steel bands are installed, the seal can be pressure tested to ensure it is sound. Because the elastomer seal is flexible, it will remain in place even if the pipe moves. Movement can arise from external pressure, or from two different pipe diameters being sealed together.

Such internal seals come in contact with a range of substances, including potable water, gas, oil, and sewage. They



Schematic of the sealing system. © Amex



Installation of the internal pipe sealing system. © AMEX

are also used in industrial applications such as cooling water for power stations or process plants. To ensure the seal can stand up to such a wide range of possible liquids without degradation, the expansion ring is usually made of molybdenum-containing stainless steel, a material known for its exceptional resistance to corrosion in a variety of environments.

Stainless steel ensures durable repair

Different grades of stainless steels may be selected, depending on the corrosivity. They typically include Type 316 austenitic stainless steel with 2% molybdenum and, the more corrosion resistant, 2205 duplex stainless steel with 3% molybdenum. The latter is used in more aggressive applications, for example, in waters with higher chloride contents which are encountered in pipelines which are installed undersea or at desalination plants. Proprietary versions of the system are guaranteed to last for fifty years. The oldest examples have been in use for around forty years, but show no sign of degradation to either the seal or the sealing ring.

This internal sealing system was developed to stop leaks and to be more reliable than a spray coating that is not flexible and tends to both crack and degrade over time. It has been used

successfully around the world, and can return pipes to normal service much more quickly than traditional methods. Additionally, these seals do not require completely dry conditions, as some other systems do, and can even be put in place by divers without emptying the pipe.

From distress to success

At the Killingholme power station in the United Kingdom two faulty joints were discovered in one of the 1.8 meter diameter condenser return pipelines. The joints, located below the generator transformer compound, were not accessible from above, and were badly misaligned. Adding to the problem, the station's cooling water is taken directly from an estuary, requiring the replacement seals to have good chloride resistance. An abrasion-resistant rubber seal with 2205 duplex stainless steel compression rings provided an ideal solution for the repair, which took only two days to install. Its low profile does not obstruct the water flow and also eliminates the need for chemical adhesives and their associated hazards. ➤

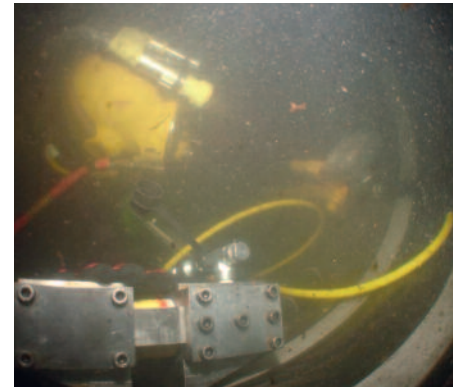


The inside of a large diameter pipe repaired with the sealing system. © AMEX

The rubber seal is able to accommodate substantial joint movement thanks to its flexibility and it has a life expectancy of 50 years or more.

The internal pipe repair system was also used during the extension of the London Underground in the 1990s. During work on the Jubilee Line, a sewer that ran just meters above the new line, was at risk of losing integrity from the vibration of the drilling machines, which threatened to bring work to a halt. Using this inner-pipe system with a Type 316L stainless steel compression ring, the sewer was successfully sealed from the inside, preventing leakage or collapse, and allowing the drilling to continue.

As these and countless other examples show, underground pipes perform crucial,



If necessary, the system can even be installed while the pipe is in operation. © AMEX

but invisible roles. Accessing them externally is very expensive and creates an often disproportionate amount of damage and disruption compared to the size of the area that needs to be repaired.

By accessing the leak from the inside, pipes can be returned to normal service much more quickly. Most importantly, the solution often depends on molybdenum to offer long-lasting, reliable service. (AH)