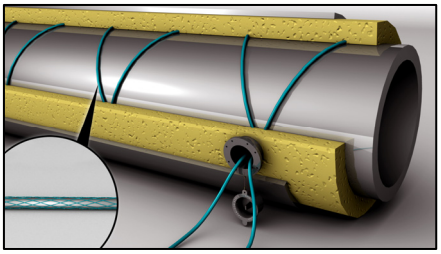
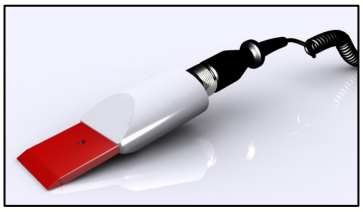
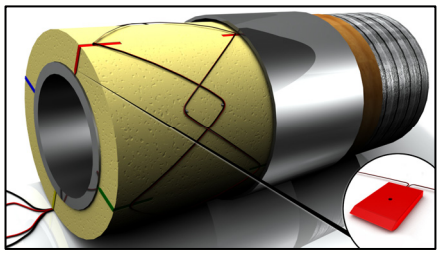
COSASCO®
Corrosion Under Insulation (CUI) Corrosion Sensors

Request A Quote

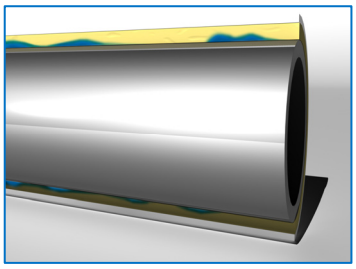






- **Low Cost, easy to install corrosion sensors**
- **Detects corrosion at pipe surface**
- **Three sensor types to choose from**
- **No removal of insulation required (Type 2 & 3)**
- **Reduces inspection and repair costs**
- **Patent applied for Temperature Rating**

  Type 1 – up to 200°C (392°F)
  Type 2 & 3 – up to 85°C (185°F)



Moisture trapped in the insulation can create a corrosion cell on the pipe surface and may be found anywhere around the pipe circumference.

Corrosion Under Insulation (CUI) is recognized as a major corrosion problem, which costs the oil & gas, chemical & petrochemical and food processing industries millions of dollars a year in inspection, repair and replacement costs. CUI can be detrimental to the integrity of an insulated pipeline or vessel if not detected early on, causing leaks leading to possible catastrophic events.

CUI is a form of general and localized corrosion that may occur between the insulation and the outer surface of a thermally insulated and poorly coated pipeline or vessel. CUI can occur under the most common types of thermal insulation eg Rockwool, foam rubber, polyurethane, calcium silicate, and fiberglass. Those insulation materials that have higher adsorption properties of water, oxygen and leachable chlorides are more likely to exacerbate or accelerate the corrosion process. The main cause of CUI is the penetration of water and acids or acid gases like chlorine, through the outer protective seal or cladding to the metal surface where it becomes absorbed by the insulation, causing a corrosion cell adjacent to the pipe wall. Warm temperatures, normally between 30-200°C (32-390°F) along with the ingress of any form of moisture and oxygen, create an environment that may accelerate corrosion. The type and rate of corrosion under insulation will vary depending on certain factors, including insulation type, temperature variance, coating protection, pipe metallurgy and environmental influences eg a severe rain storm or deluge system testing.

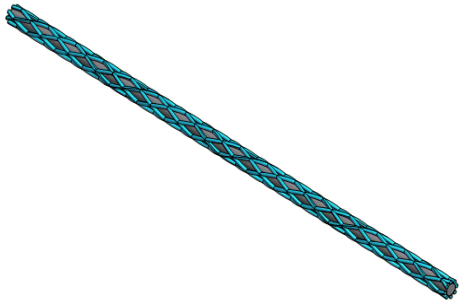
Severe outer pipe wall corrosion due to CUI

As the pipe surface is not normally accessible, the current methods of detecting CUI can be expensive and may require the removal of the insulation and cladding. These include visual inspection, radiography, thermal imaging, moisture detectors, and moisture removal methods (eg. drain plug). These techniques in general, do not give reliable results or a direct indication of corrosion, even if there is moisture present in the insulation.

Cosasco offers three low cost methods of monitoring CUI including, Continuous Insulated Braid “corrosion fuse” Wire (Type 1), Inserted “corrosion fuse” probe array (Type 2), and CUI ER Probe (Type 3). These three techniques offer direct corrosion detection and a much lower cost per monitoring point than existing methods and may be customized to meet individual requirements and applications to fit with any plant integrity management program.

COSASCO®

Type 1 – Insulated Braid “Corrosion Fuse” Wire Sensor



Overview

The Insulated Braid Wire Sensor (patent pending) is designed to detect corrosion that has occurred over a relatively large area. A single insulated carbon steel wire of a certain element thickness or multiple wires of varying thickness may be installed. The single wire can be used as a ‘corrosion fuse’ to indicate that an amount of corrosion has occurred. Multiple wires can be used as step measurements, giving an indication of the rate at which corrosion is occurring. The time between the first wire corroding and the second (thicker) wire, and so on can be used to estimate the approximate rate at which the pipe surface is corroding. This method is best used as a part of a preventative maintenance program. This type of sensor is advantageous in determining if corrosion has occurred over a relatively large surface area of pipe anywhere along its length. If installed under a tape coating, it can help determine the integrity of the coating and the corrosion on the pipe surface that may occur due to the coating breakdown.

Operation

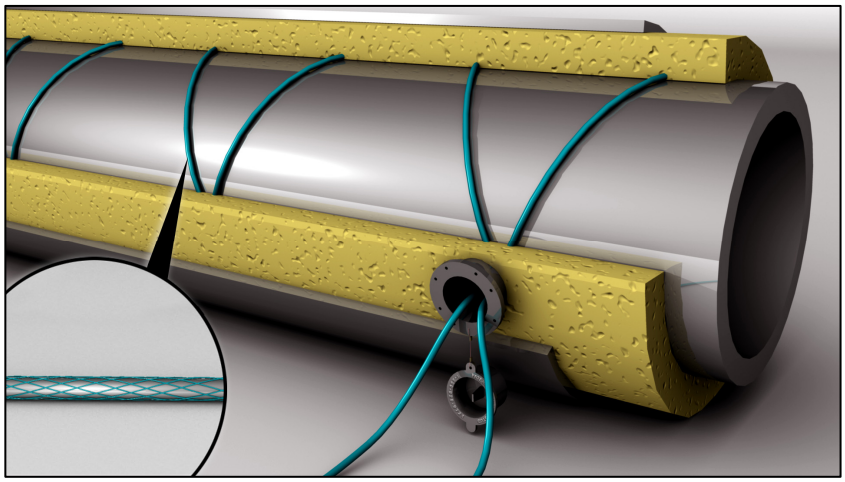
The Insulated Braid Wire Sensor consists of a thin strand of wire, typically carbon steel (or similar material as the pipe or vessel being monitored) with an outer braided insulation. The wire can be wrapped around the pipe as a continuous spiral from one point to another and back as shown in the diagram below. The wire loop circuit will be measured using a simple resistance meter or multimeter from the outside of the insulation and the cable extended to a convenient monitoring point. If an insulating tape or coating is applied on top of the bare pipe and sensor wire then it could be used to detect the effects of a coating breakdown resulting on possible corrosion of the pipe surface.

Installation

The Braided Wire Sensor would typically be fitted at the same time as the initial installation of the insulation or when the insulation has been removed for replacement or pipe repairs. The wire is wrapped around the pipe in a continuous spiral pattern along the selected length of pipe and then spiraled back the in the other direction. A small circular cut is made through the cladding (protective jacket) and insulation and the sensor wires fed through and sealed. Alternatively a gland and plug can be inserted into the insulation and sealed in. Both the lead and termination of the wire will exit through the gland, where the measurement can be taken. When not in use, the plug is replaced and the wire lead and termination are protected and any moisture is sealed out.

Applications and Benefits

- Single or multiple, continuous wire detects corrosion over a relatively large area of cover
- Applied to surface of pipe as a continuous spiral or wire loop
- Multiple wire thickness option for determining corrosion rate
- Low cost, easy to install and interrogate
- Applied on new pipelines, field joints, insulated process lines, installed after a repair
- Potential Savings in inspection and associated repair costs
- Requires removal of insulation
- Rated for temperatures up to 200°C (392°F)



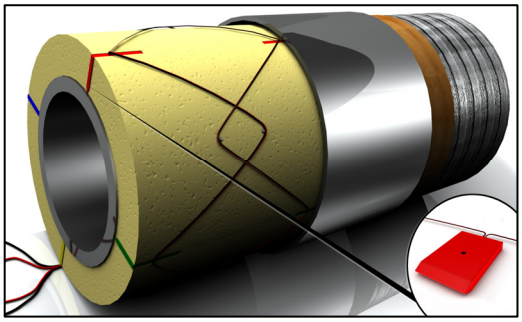
A braided insulation wire is shown installed in a continuous spiral pattern under the insulation

Measurement using simple Multimeter

Type 2 - Inserted “Corrosion Fuse” Probe Array Sensor

Overview

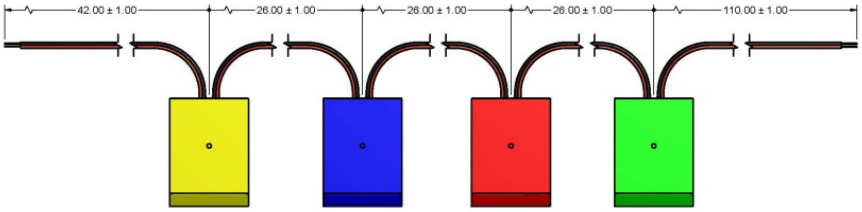
The Inserted Probe Array Sensor (patent pending) acts as a ‘corrosion fuse’ detector that will provide an indication of corrosion occurring at the pipe surface, at known discrete locations. It was originally designed to be installed during the remediation and mitigation of corrosion damage under thermally insulated pipeline field joints. There are two common types of pipeline insulation repair processes. The first requires the old cladding to be removed with the insulation left in place. Insulation tape eg Densyl, is wrapped around the affected area and a new protective cladding is strapped in place. The second involves removing an entire section of insulation from a damaged area. The pipe is repaired and cleaned, and new insulation is installed. Insulating tape, typically Densyl, is then applied and a protective outer cladding is strapped in place. The ‘Corrosion Fuse’ sensor array is designed for installation in either of these remediation process, on pipelines or insulated process

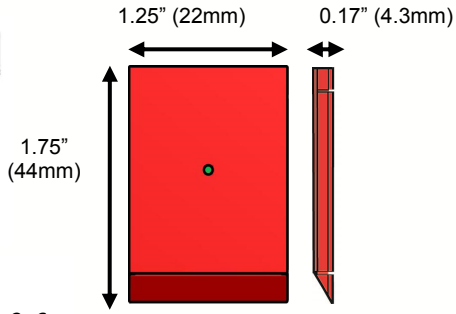


Probes inserted through insulation at 4 clock positions around pipe circumference

Operation

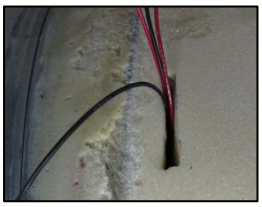
The Type 2 Inserted Probe Array Sensor is a chain of four (or more) discrete probes connected in series by two circuits. Each sensor chain is made up of four molded probe housings, each with two measuring elements and a different companion resistor set. When an element wire corrodes through completely, an open circuit will occur in the sensor circuit which will read the companion resistor value, thus allowing the user to identify which probe or probes in the chain have corroded. Typically the four sensors are installed at the 12, 3, 6, and 9 o’clock positions around the pipe as shown above. The two circuits are fed through the outer cladding and terminated on the outside of the insulation. Measurements are made on the two separate sensor resistance circuits using a standard resistance meter or multimeter.





Installation

The probes may be inserted perpendicular with reference to the pipe, typically in the 12, 3, 6, and 9 o’clock positions. To install the sensors, the outer cladding is removed and each probe is pushed through the insulation with an insertion tool (shown below) until it makes contact with the outer pipe wall. The probe is then sealed in with a waterproof sealant and the cladding is replaced. The circuit wires are fed through the cladding and sealed. However, for applications that require only spot readings or in instances where it is preferred not to remove the cladding, a single sensor may be used or the wires can be run on the outside of the cladding and protected by a tape wrap. In this case a slit hole (22x4.5mm) in the outer cladding will be required.

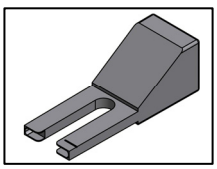


Corrosion probe shown inserted vertically

In the second type of remediation process, where a section of the insulation is removed, the probes are inserted in the same 12, 3, 6, and 9 o’clock positions, but are installed in line with the pipe wall and as close to the pipe surface as possible. There are two elements in the probe, one located near the cable entry and the other near the tip of the probe. The sensor is sealed in and the new insulation is installed. The wires are then exited through the insulation and cladding and the open end wires then inserted into a protective tube.

Applications and Benefits

- 4 probe sensor array with two ‘corrosion fuse’ elements per probe
- Detects corrosion at pipe surface at known discrete positions
- Simple and robust design, Low cost, easy to install and interrogate
- Applied on new pipelines, field joints, insulated process lines, can be installed on existing insulated pipe or as part of a repair
- Potential Savings in inspection and associated repair costs
- Does not require removal of insulation
- Rated for temperatures up to 85°C (185°F)



Insertion Tool

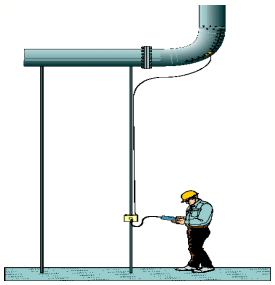
Type 3 - CUI ER Probe Sensor

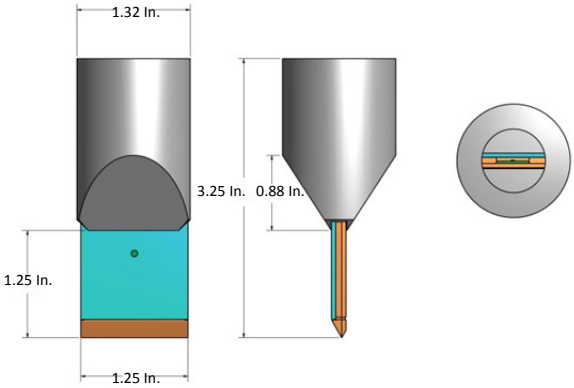
Overview

The CUI ER probe sensor is an individual electrical resistance (ER) probe that provides a measurement of the corrosion rate near the pipe surface. It is useful in determining the underlying cause of corrosion and the ability to measure changes in corrosion conditions, ie the effectiveness of repairs, temperature cycles or environmental changes eg after a severe rain storm or effects of sprinkler/deluge systems.

Operation

The CUI ER Probe is an adaptation of the Type 2 'Corrosion Fuse' sensor but to work like a ER probe. It has the standard probe connector and is measured by any of the portable ER Probe measurement instruments, including the Checkmate, Checkmate Plus, and Mate II. Remote interrogation via extension cable up to 150 ft (50m) is possible.



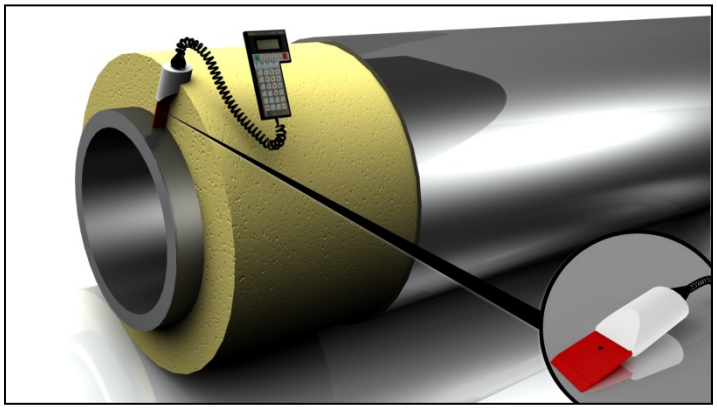


Installation

The installation of the CUI probe does not require removal of the cladding or insulation. A clearance hole, approx. 35mm, is required for insertion of the probe. The probe can be fitted in any orientation around the pipe and then sealed in place using a standard sealastic or silicone to prevent any external water leak path. The probe length can be designed to suit the insulation thickness and allow access to the connector. For remote or inaccessible locations an extension cable can be run to a convenient monitoring point.

Applications and Benefits

- Based on established Electrical Resistance (ER) technique.
- Provides a direct measurement of corrosion vs. metal loss, corrosion rate and trends
- Data used to identify key events causing corrosion eg effect of heavy rain storms, check on insulation repair performance, effects of operating temperature cycling etc.
- Inserted through insulation, Sensor element positioned near surface of pipe
- Low cost, easy to install and interrogate using standard ER corrosion probe instrumentation.
- Applied on new pipelines, field joints, insulated process lines, can be installed on existing insulated pipe or as part of a repair.
- Potential savings in inspection and associated repair costs
- Does Not require removal of insulation
- Rated for temperatures up to 85°C (185°F)



Ordering Information

Insulated Braid “Corrosion Fuse” Wire Sensor

Model	Description
CUIW	Insulated Braid “Corrosion Fuse” Wire Sensor

Code	Element Wire Diameter
.010	0.010” (0.254 mm) diameter
.018	0.018” (0.457 mm) diameter
.025	0.025” (0.635 mm) diameter

Code	Order Length
XXXX	Length in feet (1000 ft. max)

Code	Connector Assembly Wire Termination
0	Standard with plug & receptacle (ground level pipe)
1-L	With Connector Assy Extension Cable (PN: 646015-L) (for overhead pipes)

CUIW — .010 — 50 — 0 ← **Typical Order Number**

Inserted “Corrosion Fuse” Probe Array Sensor

Model	Description
CUI	Inserted “Corrosion Fuse” Probe Array Sensor

Code	Element Wire Diameter
.010	0.010” (0.254 mm) diameter
.018	0.018” (0.457 mm) diameter
.025	0.025” (0.635 mm) diameter

CUI — .010 ← **Typical Order Number**

CUI ER Probe

Model	Description
CUIP	CUI ER Probe Assembly

Code	Wire Diameter
.010	0.010” (0.254 mm) diameter
.018	0.018” (0.457 mm) diameter
.025	0.025” (0.325 mm) diameter

Code	Wire Material*
K03005	Carbon Steel

CUIP — .010 — K03005 ← **Typical Order Number**

***Other material options available. Please contact Cosasco Customer Service.**

Accessories

Insertion Tool (CUI only)	PN: 741022
Hole Starting Tool (CUI and CUIP)	PN: 741021
Checkmate Portable Reader (CUIP only)	PN: Checkmate
Extension Cable (CUIP only)	PN: CBL1-B-B-0-0-LL (LL=Length in feet. Specify length: available in 1 ft increments from 1 to 1500 ft. in a single continuous run).

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CUI-DS rev-
Rev. Date: 05/11/2016