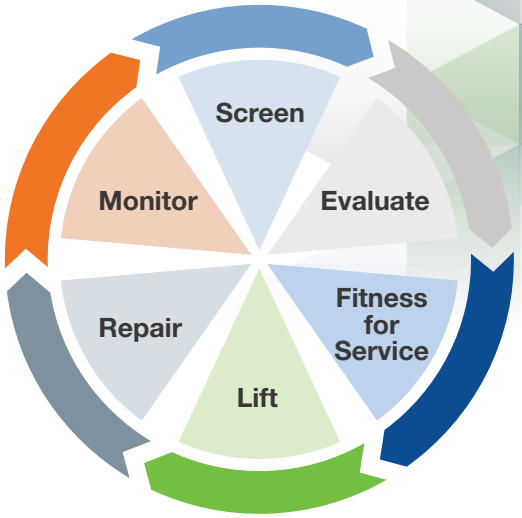
Advanced On-stream Solutions for Touch-point Corrosion Damage

Integrated Solutions Ensure Integrity at Touch Points & Pipe Supports



Touch-point Corrosion (TPC) and Corrosion under pipe supports (CUPS) are damage mechanisms that plague industry. Accelerated external wall loss at these highly localized points presents particular integrity concerns as the damage is:

- Difficult to avoid
- Difficult to detect
- Difficult to measure
- Difficult to remediate

TEAM's integrated touch point corrosion program manages all aspects of the integrity process from screening for damage to permanent repair assuring integrity – every time. TEAM's unique turn-key approach to touchpoint corrosion integrity eliminates the need for operators to deal with multiple contractors, ensuring seamless integrity management of critical assets.

Laser Scanning Visualization and UAV Inspection

TEAM has the capability to rapidly capture geospatial data and create a digital model of the plant or facility. This data allows touch points to be identified, digitally tagged and cataloged. TEAM utilizes advanced drone technology as part of its comprehensive solution set, which allows the operator to quickly carry out visual inspection areas of concern with restricted access without the need to erect expensive scaffolding.

Rope Access – Close Visual Inspection and NDE

Where remote screening has identified potential for damage TEAM can deploy fully certified rope access technicians to gain further insight, TEAM's Technicians are certified in a wide range of NDE methods allowing data to be collected without the need to erect expensive scaffolding unnecessarily. Findings from the rope access work can then inform further decisions, avoiding wasting resources on false positive damage concerns.

TEAM UAS Capabilities

TEAM Rope Access Inspection & Mechanical Services

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Advanced NDE Damage Screening & Sizing

TEAM employs both direct and indirect ultrasonic methods which enable industry leading technicians to identify, assess, and quantify areas of concern related to TPC and CUPS. TEAM's extensive range of NDE techniques allows Level 3 practitioners to deploy the best technology for the application from digital profile radiography, bulk wave UT, M-Skip, guided wave and EMAT.

M-Skip Phased Array utilizes high angle phased array ultrasonic inspection to identify and quantify areas of concern several inches away from the transducer location.

Guided Wave (Long Range) provides a complete volumetric assessment of the piping system under evaluation and can identify and qualify multiple contact points from a single test location.

- Rapid volumetric screening assessment of piping systems to quickly locate areas of concern
- Ability to assess multiple touch points from a single location
- Ability to screen insulated piping systems with limited disturbance to the insulation

EMAT (Short Range) utilizes an EMAT based ultrasonic semi-automated pipe crawler that can provide indirect remaining wall measurements on the pipe system.

- Can accurately measure up to 50% remaining wall
- Ultrasonic wave travels around the circumference of the piping

API 579 Fitness for Service

Should NDE determine that damage is expected, TEAM's advanced engineering group can carry out a first-pass fitness for service assessment to guide next steps, including assessing the risk of lifting the line on-stream to gain access to any damage. TEAM have the capability to carry out fitness-for-service assessments up to to API 579 Level 3 using finite element analysis. This fitness-for-service can be further refined based on any subsequent inspections of the damage.

Engineered On-Stream Line Lifting

Should any damage detected require further assessment using direct methods, or a repair or remediation, TEAM is able to carry out a engineering analysis of the damage line to assess the risk of lifting. If suitable, TEAM can lift the line in a controlled manner to create access for further activities. TEAM's engineered on-stream line lifting solution provides a step change in safety in comparison to lifting using cranes or uncontrolled jacking. TEAM's solution provides the following benefits:

- Lift curvature evaluated using piping stress analysis
- Lift height limited using mechanical stops
- Detailed Risk Assessment and JSA collaboration
- Full lift height mechanically locked, hydraulics depressurized
- Ultra-portable lifting jacks – suitable for manual handling
- Rapid movement of lift points along pipe supports

TEAM Phased Array UT

TEAM Guided Wave Inspection

TEAM EMAT Wall Thickness Evaluation

TEAM Engineered On-Stream Line Lifting

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Remediation & Repair

Where coating breakdown and minor damage is found, TEAM is able to remediate the contact point using a range of advanced coatings and bonded wear plates, eliminating the crevice and preventing further degradation.

Should a fitness-for-service assessment deem a repair is required, TEAM's industry leading composite repair system can be deployed. TEAM controls the full repair process from material selection through design, installation and inspection ensuring compliance with ASME PCC-2 and ISO 24817. Where a composite repair is unsuitable, TEAM's mechanical repair enclosures are installed to restore integrity and ensure reliable operations.

TEAM Advanced Carbon Fiber Composite Repair at Touch Point

Condition Monitoring – Ensuring Ongoing Reliability

A reliability-focused touch point corrosion program is not just a discrete project, on-going monitoring of the plant is required to ensure integrity. TEAM's program includes the option of a range of monitoring techniques from conventional risk-based inspection through to permanently installed guided wave collars that allow real time condition assessment for critical lines.

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